A BURNING QUESTION? FIRE, LIVELIHOODS AND SUSTAINABILITY IN THE NAVOSA REGION OF THE FIJI ISLANDS

A thesis presented in partial fulfilment of the requirements for the Degree of Doctor of Philosophy in Development Studies at Massey University

Trevor George King

2004

I declare that this thesis is my own work, except for those sections explicitly acknowledged, and that the main content of the thesis has not been previously submitted for a degree at any other university.

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ABSTRACT

The relevance of the sustainable development approach for land conservation in tropical hill regions is often assumed, but is seldom evaluated against local realities. This study analyses the causes of land degradation and unsustainability in the seasonally fire-prone region of Navosa, Viti Levu, Fiji Islands. A complex and multi-layered set of connections exists between livelihood strategies and the environment in this region where fire is used as a tool. Traditional institutions governing land management have been undermined, however, and the sustainability of the *vanua* (or land-people nexus) is threatened.

Despite their reliance on fire, local participants reported uncontrolled burning (caused by a minority of villagers) and deforestation leading to land degradation, lower productivity and damage to fisheries. Degradation was increasing parallel with escalating human and animal populations, despite relatively equitable, resilient and livelihood-enhancing cultural institutions. Non-indigenous models of resource use, imposed by colonial and neocolonial authorities, have exacerbated land degradation and compromised indigenous resource management. Traditional tenure and leadership are impeded, leading to inequities in access to land as populations increase, and leaving local leaders unable to enact conservation. An intrusive market-based economic system encourages increased resource exploitation with little regard for environmental sustainability.

A traditional model of agroarboriculture and indigenous development in the form of still-observable (but largely disused) irrigated terraces suggests the relevance of a sustainable alternative based on indigenous knowledge. To achieve sustainable development in Navosa, the emphasis should be on socio-environmental amelioration rather than on economic development (which exacerbates degradation), and to this end, local participants expressed a desire for particular conservation strategies.

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CONTENTS

ABSTRACT iii

ACKNOWLEDGEMENTS iv

CONTENTS v

TABLES xix

FIGURES xx

PHOTOGRAPHS xxi

CONVENTIONS xxii

GLOSSARY xxiii

CHAPTER ONE 1

INTRODUCTION 1
- PURPOSE 1
- NATURE OF PROBLEM 1
  - Sustainability 3
  - Justification for the Research 4
  - Cultural and Historical Ecology 5
  - Structure 6

CHAPTER TWO 9

THEORIES OF HUMAN-ENVIRONMENT INTERACTION, SUSTAINABILITY

AND DEVELOPMENT 9
INTRODUCTION 9
THE MANAGEMENT OF THIRD WORLD LAND DEGRADATION 9
Human-Environment Interaction 10
A single theory for people and the land? 12
Cultural ecology 13
Historical ecology 13
Political ecology 15
Land Degradation and Society 16
Land degradation and social change 16
Demographic approaches 16
Neoclassical beliefs and sustainability 17
DEVELOPMENT THEORIES 18
Development in the Modern Period 19
From Grand Narratives To Many Narratives 20
Poststructuralism, postmodernism and postcolonialism 20
The local or indigenous subculture of postmodernism 20
Practical alternatives 22
SUSTAINABLE DEVELOPMENT 22
Sustainable Development: Origins and Issues 22
Sustainable development: our common future 23
Pacific islands and sustainable rural development 24
The perspective of universal growth 25
Economic growth theory 25
The political economy of degradation 26
Cultural imperialism and sustainable knowledge 27
Cultural sustainability 27
Power and sustainable development 28
Strategies of sustainable development 29
Land degradation and sustainable development 29
LOCAL ASPECTS TO DEVELOPMENT 31

Livelihoods 31
Participation 34
Participation for development 34
Participation as means to or end of development 35
Empowerment 36
Empowerment and sustainability 37
The difficulties of empowerment 37
Who participates, and why? 37
Indigenous and Local Knowledge 38
Definitions 38
The knowledge interface, hybrids and performance 39
Power 39
Indigenous knowledge 40
The contexts of identity 40
Divisions and conjunctions of identity 41
Indigenous and traditional knowledge 42
Summary of Theoretical Approaches 42

CHAPTER THREE 44

AGRI-CULTURE, PYRO-LIVELIHOODS AND SUSTAINABILITY IN NAVOSA:
PAST TO PRESENT 44
INTRODUCTION, LANDSCAPE AND PLACE 44
Environment and Natural Resources 46
Edaphic features 46
Soils 47
Climate 47
Cyclones 49
Vegetation 50
Navosa in Fiji 51
Context and application 52

LANDSCAPE HISTORY AND WATERSHED CHANGE 53
The Political Ecology of Landscape History 54
The Landscape History of Navosa 55
Land degradation or landscape enhancement? 57
Terracing and pondfields 59
Vuci origins 60
Vuci distribution 61
Vuci decline 62
Swiddening, permanent and other dryland cultivation methods 64
How sustainable are these methods? 66
Permanent cultivation of alluvial flatlands 70
Permanent 'swidden' cultivation 70
Swiddens: evolution and resilience 71
Polycultural gardens, agrodiversity and agroecology 73
Energy and sustainability 75
Carrying capacity 78
FIRE AND LAND DEGRADATION 79
Fire, Land Management, Degradation 79
Watershed or tinderbox: a post-contact landscape 80
The origins of concern 81
Deforestation and fire regulation 81
Plantation fires 82
Fire and grassland 84
The 'Burns' Report 86
Did burning increase over time? 89
Animals, grazing and fire 91
Vetiver grass, tenure, security 93
CULTURE AND SOCIAL ORGANISATION 94
Culture and Custom 95
Culture history 95
Solevu, community, exchange and identity 96

Kerekere, welfare and redistribution 98
Yaqona and *sevusevu* 99
Language 100
Identity, totems, ecology and *vanua* 101
Totems 101
First fruits 105
Vanua 106
Vanua and indigenous land management 107
Social Structure and Community Systems 107
Community 108
Church and religion 108
Kinship groups 109
Leadership 110
Local government 110
Land tenure, use rights and *vanua* 111
Work and labour 114
Land tenure and belongingness 115
Tradition and identity 116
Tradition and politics 117
RURAL DEVELOPMENT 118
Yalavou Beef 118
Highlands Logging 119
Lowland Crop Projects 119
Summary: Fire, Land Management and Sustainability 120

CHAPTER FOUR 122

RESEARCH METHODS 122
INTRODUCTION 122
THE RATIONALE FOR FIELDWORK 122
THE RESEARCH PHILOSOPHY 122

Methodological Variety 124
Context and the Choice of Method 124
Participation: A Context-Oriented Methodology 125
Navosa and participation 127
Participatory method and environment 129
RESEARCH DESIGN 130
Information Needed to Establish the Thesis 130
Texts about the field: secondary (non-field) research 131
Primary (field) research 131
Techniques Used 132
Observation 132
Maps, photos and drawings 133
Interviews 134
Participant enquiry 135
Questionnaires 135
Participatory appraisal techniques 136
Logistics Of Data Collection 138
RESEARCH IN PRACTICE 139
Implementation of Prior Plans 139
Techniques Used and Problems Encountered 143
Observation 143
Interviews 145
Participant enquiry 147
Questionnaires 148
The village household questionnaire 148
The regional village questionnaire 153
Participatory appraisal techniques 154
Participation in Practice 159
Local realities and interaction in research 160
Translation 161
Translator differences 163

Translating the translators 165
Triangulation 167
Empowerment and research 168
Implications of my chosen methods on empowerment 169
Being Reflexive 170
Interaction with participants 173
The effects of preconceptions 175

CHAPTER FIVE 177

VILLAGES AND *VANUA*: RESULTS FROM THE FIELD 177
THE INITIAL SURVEY 177
Introduction 177
Keiyasi 178
Nawairabe 184
Nubuyanitu 190
Draubuta 192
Namoli 193
Nasauvakarua 195
Navatumali 199
Navosa Landscape, Dry Season 200
OTHER VILLAGES, WET SEASON 201
Waibasaga 201
Vatubalavu 202
Sawene 204
Nukuilau 205
HUMAN POPULATION 205
IN-DEPTH EVALUATIONS 210
Nasauvakarua 210
Burning 211
Analysis of results 212

Sociocultural, environmental and livelihood values 217
Environment and sustainability 217
Intra-village differences 220
Household wealth 221
Wild food 221
Nawairabe 222
Analysis of results 222
Burning 222
Sociocultural, environmental and livelihood values 227
Environment and sustainability 227
Repeated burning 229
Intra-village differences 230
Social identity and groups 231
Household wealth 231
Summary 231

CHAPTER SIX 232

VIEWING NAVOSA: FIRE AND LIVELIHOODS FROM NEAR AND FAR 232
NADROGA-NAVOSA: LOCAL, SEMILOCAL AND NONLOCAL VIEWS . . . 232
Navosa: Local Government Services 233
A view from within: the Assistant *Roko* 233
The district officers and rural development 234
The Doctor and health 236
Extension services and middle valley agriculture 237
The Semilocal: Provincial Services 239
Agricultural services 239
The quarterly meeting 239
Yaqona statistics in Nadroga-Navosa 241
The Keiyasi *turaga-ni-koro* and modernisation 241
Distant Views and Nonlocal Perspectives 243

Professional perspectives 243
Education professionals 243
Expert nonlocal attitudes on sustainability 243
Food and nutrition 244
Environment 244
Non-government organisations (NGOs) 245
Government officials 246
Government and the rural development process 246
The Fijian Affairs Board and Duavata 246
Political leadership 250
A TOPICAL VIEW OF NAVOSA 251
Sociocultural Aspects and Livelihoods 251
Local education and development 252
Public media and local communications 253
Traditional ecological knowledge 253
Social and religious change 254
Local culture history 256
Resource Management and Sustainability 256
Resources and land conservation 256
Traditional land use and cultivation 257
Hydroponics 258
Vetiver 258
Pasture and sustainability in Nadroga-Navosa 260
Animal health, pasture 261
The Yalavou beef grazing project 263
Cattle and gardens 265
Forestry 266
Fishing 270
Downstream effects of erosion 270
Drought resilience, crop choice and food security 271
The Livelihood Resources 272

Turmeric 272
Agroforestry trees and plants 273
Vaivai-ni-mocemoce 274
Yams 274
Vitua 275
Dalo 277
Perspectives on Burning, Livelihoods and Degradation 277
Local views 277
Semilocal views 278
Nonlocal views 279
Intensified and sustainable land use 281
THE NAVOSA REGION PARTICIPATORY STUDY 282
Participatory Group Study 282
Analysis of results 282
Burning 282
Sociocultural, livelihood and environmental values 286
Environment and sustainability 287
Wild food 289
Social identity and groups 290
Cultural values and vanua 291
SUMMARY OF RESULTS 292

CHAPTER SEVEN 295

NAVOSA: A SUSTAINABLE *VANUA*? 295
FIRES AND DEGRADATION 295
Reasons for Burning 295
Uncontrolled Burning 300
Excessive Burning, Land Degradation and Pressure on Livelihoods 300
Prevention and afforestation 302
LIVELIHOODS AND FOOD SECURITY 303

The Sustainable Livelihoods Approach 304
Resource categories 306
Natural resources 306
Physical 307
Financial 310
Traditional sociocultural 311
Social and religious 311
Human resources 312
Present Livelihood Strategies 313
Livelihoods and indigenous knowledge 314
Wild Food and Drink Resources 314
Kakana 315
Other Crops and Food Imports 316
Ika and *Manumanu* 317
Recent Changes 319
Livelihood outcomes 319
Well being of self and *vanua* 320
Vulnerability context 320
Shock 320
Stress 322
Transforming institutions and domains 324
THE SOCIOCULTURAL SYSTEM 325
INDIGENOUS LAND MANAGEMENT 329
The History 329
Vuci to *Tavioka* 331
Grassland Management and Burning 333
Food Security 335
Sociocultural Change and Management 336
SUMMARY: IS IT SUSTAINABLE? 338

CHAPTER EIGHT 341

NAVOSA DEVELOPMENT AND SUSTAINABLE LAND MANAGEMENT 341
DEVELOPMENT 341
Tradition, Change and Development 342
Development and Transition 347
Indigenous Development 349
Planned Economic Growth and Modernisation 351
Planned Social and Environmental Amelioration 353
VANUA AND DEVELOPMENT 355
Vanua and Traditional Land Management 355
Vanua and modernisation 357
Vanua and indigenous development 359
Vanua, planned economic growth and modernisation 364
Vanua and socio-environmental amelioration 366
SUSTAINABLE DEVELOPMENT 367
The Challenge to an Orthodoxy 368
Does Poverty Cause Environmental Degradation? 369
Navosa and the poverty line 370
Nanoko 376
Other villages 376
Does Economic Development Alleviate Environmental Degradation? .. 378
Pasture development 380
Yaqona and *dalo* production 381
Pine plantations 383
A Sustainable *Vanua:* Land, Culture and Society 384
Degradation of the commons 384
Sustainable livelihoods 387
Possibilities for Improved Sustainability 387
Summary 388

CHAPTER NINE 391

CONCLUSIONS 391
SUSTAINABILITY 391
Sustainable Development? 393
Looking to the Future 395

REFERENCES 396

APPENDIX ONE 432
QUESTIONNAIRES 432
Navosa Regional Questionnaire 432
Village Household Questionnaire 435

APPENDIX TWO 441
QUESTIONNAIRE TECHNIQUES 441
Regional Questionnaire Techniques 441
Village Household Questionnaire Techniques 450

APPENDIX THREE 456
RESPONSES TO THE QUESTION ON BURNING 456

APPENDIX FOUR 457
PRA TECHNIQUES 457
Village Group Techniques 457
1. Seasonal crop calendar matrix 457
2. Seasonal burning calendar matrix 460
3. Food resource matrix 460
4. Environmental sustainability matrix 462
5. *Vuci* brainstorm 463
6. Vegetation resource matrix 463
7. Gender control in agriculture matrix 464
8. Resource map 465

APPENDIX FIVE 466
INFORMATION SHEET 466

TABLES

TABLE I. Menu of RRA & PRA methods 137
TABLE II. Nasauvakarua population data 209
TABLE III. Nawairabe population data 210
TABLE IV. Reasons why Nasauvakarua land is burned 212
TABLE V. Nasauvakarua values 217
TABLE VI. The main environmental problems 218
TABLE VII. Reasons why Nawairabe land is burned 222
TABLE VIII. Nawairabe values 227
TABLE IX. The main environmental problems 228
TABLE X. Reasons why Navosa land is burned 282
TABLE XI. Navosa values 286
TABLE XII. How does repeated burning affect the land? 288
TABLE XIII. What should be done about land degradation? 289
TABLE XIV. Importance of wild *(ni veikau)* food *(kakana)* and drink *(gunu)* 289
TABLE XV. Relative importance of different social groups 290
TABLE XVI. Importance of *vanua* 291

FIGURES

Map of Fiji showing the main islands xxvi
FIGURE 1. Map of Navosa 45
FIGURE 2. Navosa population 205
FIGURE 3. Nasauvakarua and Nawairabe population 207
FIGURE 4. Nasauvakarua and Nawairabe households 208
FIGURE 5. Nasauvakarua burning calendar, men 214
FIGURE 6. Nasauvakarua burning calendar, women 215
FIGURE 7. Nawairabe burning calendar, men 224
FIGURE 8. Nawairabe burning calendar, women 225
FIGURE 9. Navosa burning 284
FIGURE 10. Navosa values 286
FIGURE 11. Subsistence sources in Navosa 290
FIGURE 12. Livelihood system of Navosa 305

PHOTOGRAPHS

PHOTOGRAPH 1. Using the firewheel 151
PHOTOGRAPH 2. Nasauvakarua farmer, yam hut and dog 175
PHOTOGRAPH 3. Keiyasi village 178
PHOTOGRAPH 4. Fenced *dalo sabe* 180
PHOTOGRAPH 5. Irrigation 182
PHOTOGRAPH 6. *Bitu* aqueduct 185
PHOTOGRAPH 7. Nawairabe hills, dry season 187
PHOTOGRAPH 8. New grass for the animals 188
PHOTOGRAPH 9. New grass 189
PHOTOGRAPH 10. Nasa creek *tabaiwai* 192
PHOTOGRAPH 11. Severe erosion 201
PHOTOGRAPH 12. *Vaivai-ni-mocemoce* 203
PHOTOGRAPH 13. Solikana burning 211
PHOTOGRAPH 14. Soil conservation 259
PHOTOGRAPH 15. Harvesting *vitua* (wild yams) 276
PHOTOGRAPH 16. *Teitei* on colluvial fan 299
PHOTOGRAPH 17. *Tui* Navatusila and Natoka *vuci*. 361
PHOTOGRAPH 18. *Yaqona* and *dalo* in head-of-creek 382
PHOTOGRAPH 19. Burning calendar 459
PHOTOGRAPH 20. Food resource and security matrix 461

CONVENTIONS

ORTHOGRAPHY AND TERMS

The system of spelling adopted in this thesis for Fijian words and names is the standard Fijian orthography (Schütz, 1985). It is limited in some ways: certain details of pronunciation are lacking, for example, the macron which can be used as an emphasis to indicate long vowels. Specific consonants are pronounced as follows:

b is pronounced as *mb* as in *timber*

c is pronounced as *th* as in *mother*

d is pronounced as *nd* as in *tender*

g is pronounced as *ng* as in *singer*

j is pronounced as *ch* as in *church*

q is pronounced as *ng* as in *hunger*

Some of the terms used in this thesis may differ from standard Fijian (Bauan) language in that they reflect the different communalects or dialects used in the Navosa region: see Schütz (1962) for an analysis. In general, when I refer to local phenomena then I prefer to use the local term where it is different from the standard Fijian equivalent, however, many of the terms used by my translators were standard Fijian ones.

GLOSSARY

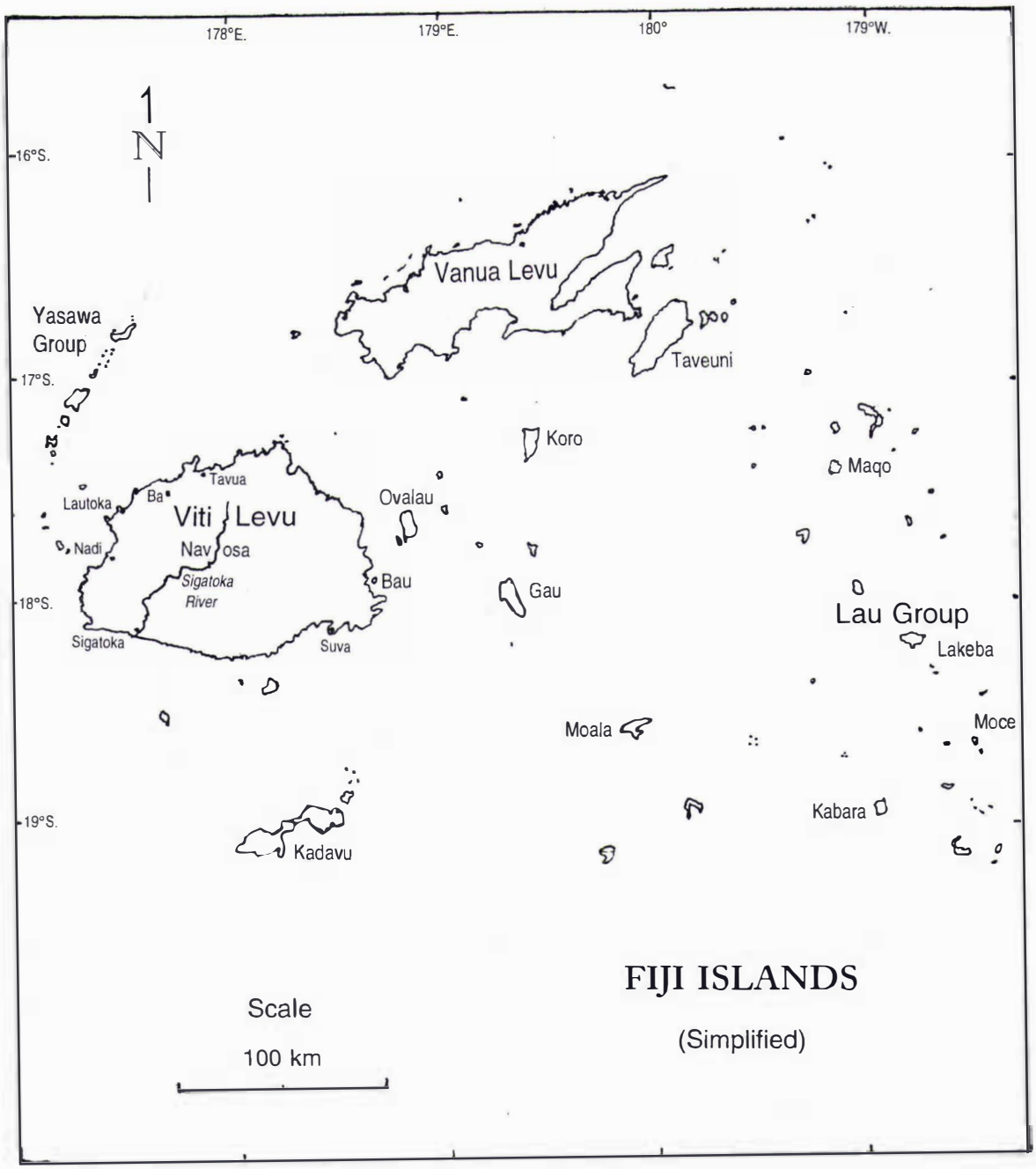
Note: The information on Fijian food plants and trees is available in greater detail in Clarke & Thaman (1993) and Thaman (1990a).

banidakai	*Jatropha curcas,* used to support a living fence.
bele (wata)	*Hibiscus manihot,* shrub-like green vegetable.
beto, bito	(a) Ancestral clan or subclan (Navosa, western Fiji), (b) clan house.
bila	Gardens on alluvial flatland.
bitu	*Schizostachyum glaucifolium,* indigenous common bamboo.
bitu-ni-vavalagi	*Bambusa vulgaris,* introduced large bamboo, less common in Navosa.
BP	Before present.
CDF	Commodity Development Framework, a government agricultural development scheme.
dalo, doko, doxo	*Colocasia esculenta,* taro.
dalo/doko/doxo-ni-tana	*Xanthosoma sagittifolium.*
F.D.	Field data.
F.I.	Field interview/s.
F.O.	Field observation/s.
FSP	Foundation for the Peoples of the South Pacific, an NGO.
gasau	*Miscanthus japonicus,* a very tall native grass, forms dense reed-like thickets.
i sevu	Annual first fruits ceremony.
kari	Turmeric, *Curcuma longa.*
kulu	Breadfruit *(Artocarpus altilis),* also *uto* (Bauan).
kumala	*Ipomoea batatas,* sweet potato.
laulau ni manivosi	*Mauniba, Pennisetum polystachyon,* mission (mongoose) grass.
LDC	Less developed country.

MAF(F)	Ministry of Agriculture and Fisheries (and Forests).
magiti	Food offered for ceremonial distribution.
mahogany	*Swietenia macrophylla.*
malasou, boro	*Solanum americanum,* black nightshade, wild green vegetable.
maqo	Mango *(Mangifera indica).*
masi	Bark-cloth, made from *Broussonetia papyrifera.*
matanitu	Military or governing confederation of *vanua.*
mataqali	Ancestral and landowning clan, subordinate to *yavusa.*
mauniba	*Pennisetum polystachyon, laulau ni manivosi,* mission (mongoose) grass.
MDC	More developed country.
moli, soco	*Citrus sp.: Moli kana (C. grandis,* pomelo, shaddock), *moli Taiti (C. sinensis,* sweet orange), *moli madirini (C. reticlata,* mandarin, tangerine), *moli witwiti (C. microcarpa), moli karokaro (C. hystrix), moli kula, (C. aurantium,* sour orange).
Navosa	Sub-province of Nadroga-Navosa province.
NLC	Native Land Commission.
NGO	Non-Government Organisation.
onolulu	*Piper aduncum (Yaqona-ni-onolulu, Yaqoyaqona, Yaqona* from Honolulu), common shrub on grassland.
pine	Usually *Pinus caribaea (var. hondurensis).*
quwawa	*Psidium guajava,* guava.
Roko	Administrative head of province.
seremaia	Soursop, *Annona muricata.*
sevusevu	Village welcoming ceremony.
solevu	Customary gathering, usually ceremonial.
solesolevaka	Small work group of friends and family.
suki	Fijian tobacco.
SVRDP	Sigatoka Valley Rural Development Project.
tabaiwai	Pondfields growing *dalo,* also *vuci.*

tabua	Whale's tooth, a formal token of exchange.
tavioka	*Manihot esculenta,* cassava.
teitei	Hillside gardens.
tokatoka	Ancestral subclan (mainly eastern Fiji).
turaga	Chief (usually hereditary), elder, respected person; *turaga-ni-matanitu,* governing chief; *turaga-ni-vanua* or *-yavusa* or *-mataqali* or *-tokatoka/beto/bito,* clan chiefs, in decreasing order of inclusiveness.
turaga-ni-koro	Elected administrative head of village; *turaga-ni-yasana,* bureaucratic head of province.
uto	*Carica papaya,* papaya, also *kulu* (Nawairabe), *weleti* (Bauan).
uvi	Cultivated yam, *Dioscorea sp., and others.*
vanua	(a) Nexus of place and people, land, home; (b) regional confederation of *yavusa.*
vaivai	*Leucaena leucocephala,* common agroforestry tree.
vaivai-ni-vavalagi, vaivai-ni-mocemoce	*(Rain tree) Samanea saman,* but also other large Mimosaceae *(Albizzia, sp., etc).* Common large shade and fuelwood tree.
via	*Alocasia macrorrhiza,* giant *dalo,* tuber used in emergencies.
vuci	A wet cultivation *dalo* garden, often terraced and irrigated, also *tabaiwai.*
vitua	Wild yams, often semi-domesticated.
vuvale	Family, household.
Yalavou Project	A large pastoral project adjacent to Navosa in Nadroga.
yaqona	*Piper methysticum, kava,* a beverage with a calming effect.
yavusa	Ancestral clan, largest unit of kinship associated with founding ancestor *(vu).*
yavutu	Ancestral home of clan founder.

Map of Fiji showing the main islands



CHAPTER ONE

INTRODUCTION

PURPOSE

This study set out to explore the issues that were important for sustainable livelihoods in a traditional but developing hill-region context. The Navosa region, an inland area on the large island of Viti Levu, part of the Fiji Islands (see map, p. xxvi), was chosen partly because it is occupied by traditional indigenous communities of cultivator-farmers, and partly because it incorporates a clearly-defined watershed.

The initial enquiry was broad in scope: I intended to study how the people of Navosa managed their land in relation to sustainability and developmental changes. My plan was to be guided by knowledge gained through interaction with local participants. This plan eventuated and it became apparent that participants were most concerned about the uncontrolled fires and excessive burning (and, secondarily, excessive logging) that took place in the hilly savanna-like landscape. Fire (and indigenous land management) became the main, but not exclusive, focus of the study.

The other purpose was to theoretically evaluate the sustainable development approach in the light of the results.

NATURE OF PROBLEM

The analysis was prompted by concerns about resource degradation, sociocultural change and the sustainability of the environment in developing rural areas (DeWalt, 1988). Recent development approaches argue for the salience of environmental and sociocultural aspects (in addition to economics) in development (Overton, 1999a). Special attention is given to the distinctiveness of the local context and the exploration and exposition of the local people's knowledge or realities

(Chambers, 1983; Sillitoe, 1998a), and livelihoods (DFID, 1999; Purdie, 1999).

Environmental degradation and unsustainability are of ongoing concern and are central themes in the development agenda. The now accepted policy cure, sustainable development, invokes the twin goals of economic growth and environmental protection (WCED, 1987). However, substantial evidence of the relevance of sustainable development as a cure for environmental degradation in less developed countries (LDCs) is lacking. The sustainable development approach was built in a top-down manner on the need to deal with large-scale global environmental concerns, rather than being built systematically from the bottom-up based on the knowledge of local and indigenous peoples (Warren, 1993). The different social systems and cultures of small rural groups, with pragmatic connections to their environment, are frequently overlooked in developmental attempts to prevent land degradation. Little is known (at the policy-making level), both about how indigenous or local people manage their land for sustainability, and how developmental changes affect sustainability in developing regions. This thesis attempts to address these lacunae, but remains aware of the wider forces:

> The important question now is not which traditional practices, as practised in the past, are sustainable, but rather which conditions cause people to conserve their resources, and which conditions favour destruction, or overexploitation of local resources. (Schmink, et al., 1992, p. 8).

The participatory field research led not only to a focus on land degradation and the role of fire but also the history of these events. In this context this thesis examines three issues. The first considers how local people (both past and present) used the environment in relation to sustainability. The second issue concerns the impact of nonlocal (or extralocal) development processes on the local context. The third issue is

whether current development in this rural region is sustainable.

Sustainability

How do we serve both local people's livelihoods (an issue involving the economic use of both natural and social resources) and ensure the protection of the environment? This was the original goal of the concept of sustainable development. The aim is:

> to make development sustainable — to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1987, p. 8).

In order to realise this goal, a development strategy that served both basic human needs and environmental concerns was needed. The basic proposition was that by improving the livelihoods of marginalised communities in developing regions, these same communities would be less inclined to degrade their surrounding environment in the search for scarce natural resources. Thus both economic and ecological concerns were merged in a sustainable development strategy.

There are many influencing factors. The very important role of sociocultural forces in small-scale communities was rather belatedly recognised by the policy-makers (Munasinghe and McNeely, 1995). The role of historical forces such as the effects of colonialism or economic ideology have often been influential on the course of development. The world has not so far confronted the impending slow depletion of non-renewable fossil energy resources, predicted to happen this century, (Campbell and Laherrère, 1998; Pimentel, et al., 1973), which provide many of the inputs upon which agricultural development depends.

Land degradation is a key issue for sustainable development. Can it help prevent land degradation, or is sustainable development conceived too broadly to be practical in local contexts?

Justification for the Research

Deforestation, widespread burning, and land degradation in tropical regions (and elsewhere) contributes to global resource depletion, weakening biodiversity, and climate change (Meyer, et al., 1998; Pernetta and Hughes, 1990; Wuebbles and Rosenberg, 1998). Such events not only undermine the global store of natural resources and biodiversity, but also undermine the ability of farmers to produce a sustainable supply of food in the less industrialised countries.

At the local level, the people who work the land for their livelihoods in these changing environments are often considered to be impoverished and compelled to over-exploit the available land resources (Allen and Thomas, 1992; Leonard, 1989; Vosti and Reardon, 1997). But in many such countries the sustainability of attempts at agricultural modernisation have been controversial (DeWalt, 1984; Richards, 1985).

Many of the symptoms of accelerating non-sustainability are apparent in Fiji despite a tradition of sophisticated and sustainable production. The symptoms of concern include agrodeforestation and loss of biodiversity (Clarke and Thaman, 1997), environmental degradation (Watling and Chape, 1992; Watling and Chape, 1993, p. xii), dependency upon increasingly scarce and expensive fossil fuels, health risks from agrichemicals (Thaman, 1984), tenurial conflicts and resource and market dependency (Overton, 1994; Ward, 1995), and social inequity (Clarke and Morrison, 1987; Overton, 1989; Thaman, 1981a; Thaman, 1986).

Due to the demands of the market and increasing populations, land resources and local livelihoods are coming under increasing pressure in many places. As a result, the long-term inter-generational stability of the local human-environment system is threatened.

However, there is a dearth of information about the conditions under

which local cultivator-farmers[1] may be prepared to adopt more sustainable practices. This study strives to understand the factors that underlie trends to unsustainability. It also aspires to provide insights into the conditions by which sustainability can be enhanced.

Cultural and Historical Ecology

Traditional communities have generally persisted because of their ability to practise a sustainable way of life, and their extensive ecological knowledge should be respected (Baines, 1989; Williams and Baines, 1993). They are often better able to accurately assess the true costs and benefits of ecosystem disturbance than a non-local professional. This point was made by an anthropologist in the Fiji Islands in the 1940s:

> The significant problem regarding community welfare and the conservation of resources does not emerge simply as the question of how human health and institutions may be improved, or of how topsoil may be saved, or watersheds, and forest land protected, or organic species preserved from extinction ... the significant problem of community welfare emerges as a matter of using and adapting local beliefs, attitudes, habits and institutions, supplemented where necessary by appropriate new ones, to the end that human groups, through natural eco-cultural processes, may foster the development and maintenance of a balanced, healthy *total* community—plants and animals, as well as human groups. (Thompson, 1949, p. 266).

The recognition of the importance and wisdom of indigenous systems and structures, including knowledge and community practices, is vital in order that indigenous groups can enhance the environmental

[1] Schoeffel (1994, p. 35) argues that it is misleading to describe custom-oriented semi-subsistence Pacific island cultivators as farmers. The community-orientation of these relatively self-sufficient indigenous communities contradicts the economists' notion of farming as a form of profit-making capitalist enterprise. Navosa communities are relatively communal, but individual cultivators may perceive themselves as farmers, using a livelihood rather than economic perspective (F.I., 1998-1999).

sustainability of their land-people nexus, or *vanua* (see p. 106).

Land degradation in Fiji has a long and continuing history composed of both natural and human-induced (anthropogenic) change. For example, tropical cyclones can cause landslips even on well-forested slopes, and some degree of soil erosion is a natural process (Twyford and Wright, 1965). On the other hand anthropogenic fires denude much of the Navosa region during the dry season, and the resulting bared soil allows widespread sheet erosion when rainstorms arrive at the beginning of the wet season. Thus, both natural and anthropogenic processes interact to degrade the land of its potential to support life and livelihoods, but it is the anthropogenic modifications which have caused the most local concern.

Structure of the Thesis

The thesis begins in Chapter two with an outline of relevant theory. An eclectic approach is used which reflects the author's concern for a multifaceted understanding of the human-environment situation, and his desire to understand (and express) local realities through participation. Consequently, a range of theories were selected which have been grouped into three categories: those related to sustainable development, those representing local approaches to development, and those associated with different approaches to the problem of human-induced land degradation.

Chapter three presents a background of knowledge relevant to indigenous land management and the sustainability of resources. The Navosa context is introduced here using a selected analysis of relevant agricultural, arboricultural, livelihood and sociocultural research already conducted in Fiji. Nearly all of this chapter was written after the field research (although some materials were accumulated as a result of secondary research while in Fiji), and thus the contents of this chapter do not significantly presume the findings of my field research.

Chapter four describes the method and process of research. The guidelines of the Participatory Rural Appraisal (PRA) approach were influential here. Contrary to the rest of the thesis, this chapter deliberately includes present-tense expression in an attempt to reflexively reveal at least some aspects of how the research was conducted.

Chapter five presents an outline of the study villages within the Navosa region, with the results of in-depth studies at the villages of Nasauvakarua and Nawairabe. The outline may be broadly described as a 'thick description' (Geertz, 1973) of the landscape and human context. The in-depth studies, by contrast, are relatively detailed. Local knowledge was also shared through interviews, questionnaires and PRA techniques, and that knowledge was presented in the remainder of the results in this chapter and the next.

Chapter six focuses on the perspectival and topical results of the field research, including extralocal views, plus the findings of the Navosa region-wide study involving eighteen villages or settlements.

Chapter seven addresses the issues of sustainability raised by the results. The main focus is fire, the conservation of natural resources and the practice of livelihoods.

Chapter eight considers development in relation to the sustainability findings of the previous chapter and other research. In particular, the analysis focuses on the level of integration between processes of development, land degradation and people-environment relationships. I argue that there are contradictions in the sustainable development ideal in this context. In an attempt to explain why these contradictions are pervasive and repetitive, the findings of the field research are related to wider-scale forces in development.

There is base of socio-economic change which is often overlooked by the agents of development. Instead of a bicameral (economic and environmental) strategy for sustainable development, I argue that only environmental amelioration is needed to enhance sustainable livelihoods

in Navosa.

The conclusion in Chapter nine draws together the information in earlier chapters, places the Navosa situation in a broader context, and suggests some policy options for local sustainable development.

The appendices describe the research techniques in detail.

CHAPTER TWO

THEORIES OF HUMAN-ENVIRONMENT INTERACTION, SUSTAINABILITY AND DEVELOPMENT

INTRODUCTION

The author's attempt to appreciate the diversity of facts, knowledge, values and perspectives in this study necessitated an understanding of an eclectic group of theories, which are the subject of this chapter. Theories were selected that were appropriate to analysing and ordering an array of information involving different geographical, socio-cultural and temporal scales. Some theories (e.g., those relating to the participatory method) were most significant prior to entering the field, but the importance of others (e.g., postcolonial analysis) was realised only after fieldwork was completed. The theories have been organised into three major sections related to: (a) human-environment relations and the management of land degradation, (b) sustainable development, and (c) local aspects to development.

THE MANAGEMENT OF THIRD WORLD LAND DEGRADATION

This sub-section will outline various theories relating to human-environment interaction, followed by a section focused on land degradation.

Human-Environment Interaction

The history of human-environment interaction has been described as a long-term 'ecological transition' involving anthropogenic change where the increased ability of human culture to extract and transfer energy from the environment has led to a broad trend of economic growth (Bennett, 1976). The propensity to increase energy extraction and produce commodities has led to changes in the structure of nature-society relationships that have become the basis of development (DeWalt, 1984; DeWalt, 1988). Thus, the history of human intervention is important to any study of land degradation and management.

What scientific theories are used to study anthropogenic modifications to the environment? There are many specific approaches, but little consensus on overarching models (Balée, 1998a, pp. 2-5; Blaikie and Brookfield, 1987b, pp. 27-48). Three different approaches which are relevant to different aspects of human-induced land degradation in the seasonally-dry tropics are used here. These are cultural ecology, historical ecology and political ecology.

Cultural ecology focuses on culture-environment interactions at the community level (e.g., Netting, 1986/1977; Rappaport, 1968; Steward, 1955). Historical ecology focuses on anthropogenic landscape change over long time periods (e.g., Balée, 1998a; Crumley, 1994c), and political ecology focuses on the influence of broader social, political and economic structures relating to the environment (Blaikie, 1985; Blaikie and Brookfield, 1987b; Thrupp, 1993). All emphasise important aspects of the people-environment nexus, but each has a focus which it tends to privilege. For example, cultural ecology tends to highlight culture rather than landscape history or politics.

The main themes of theoretical difference revolve around the issues of: (a) time and types of evolutionary trend, (b) complexity, and (c) socio-political organisation. The first is discussed immediately below, but complexity and socio-political organisation are discussed later in the

section on historical ecology.

Some theories (e.g., the systemic cultural ecology in Rappaport (1971)) tend to study interactions during one brief time period, and do not attempt to predict change or evolutionary trends. Other theories (e.g., historical ecology (Balée, 1998b), and the evolutionary ecology of White (1959)), attempt to account for change over time. Where humankind as been the subject of (positivist) scientific study, an implicit goal-directed teleological element inherited from evolutionary biology and ecology is often included (e.g., Sahlins, 1960). On the other hand, historical ecology, as the scientific study of the landscape, has tended to focus on geophysical, historical and material processes without attempting to theorise evolutionary trends. The landscape is perceived as interactively changing, but not evolving (Crumley, 1994c, pp. 2-3).

Evolutionary theories are often stage-oriented. For example, human-environment interactions can be organised into a differentially-valued unilinear series of particular social and economic types. For example, the progression from gatherer-hunter, herder, agriculturalist, to industrial societies is a stage theory where the latter is the most 'evolved' and implicitly valued. Evolutionary thinking also differentially values technology in the 'progression' from the 'primitive' hoe, to animal-drawn power, and then to tractors and other examples of fossil-fuel powered mechanisation, concomitant with a trend of increasing energy exploitation (White, 1959).

The tables are turned, however, when the contrasting perspective of energy efficiency (rather than exploitation) is used. The hand hoe has the most energetic efficiency and the tractor the lowest (Clarke, 1977). Therefore, a theory of the evolution of energetic efficiency has as its teleological goal, and its most valued technique, the hoe, thus effectively reversing the direction of stages of tool use. This portrayal reflects how

social values underlie evolutionary stage theories.[2]

A conventional (technocentric, ethnocentric) evolutionary approach was reflected or implied in the literature of many researchers of the early and mid 20th century Fiji (e.g., Watters, 1960, 1969). The implications of evolutionary theory are significant in marginalised (or indigenous, 'primitivised') locales, where local people are implicitly victimised by Eurocentric evolutionary models of change through an ideology where their dignity and autonomy are subverted (Johnston, 1994a).

A single theory for people and the land?

In order to create an overarching theory of human-environment relationships, the reconciliation of interactive and evolutionary approaches is necessary. Unfortunately, the contradiction between a priori environmental and evolutionary, or sociocultural, foci represented at different historical epochs has subverted any attempt:

> The contradiction is this: the first part of the story of the human species is couched in evolutionary and environmental terms, the second [sociocultural] denies environment a meaningful role in human history. (Crumley, 1994b, p. 2).

It is difficult to integrate these contrasting tenets to produce a unified theory of anthropogenic change, thus confounding attempts to produce overarching theories of people-land relationships.

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[2] I believe that teleological theories which give greater value to the most 'evolved', are usually ethnocentric and often imperialist, but not in this example based on energy efficiency.

Cultural ecology

Cultural ecology, viewed broadly, includes various perspectives, but they all prioritise the human uses of and cultural accommodation to various types of environments, in the past and the present. For example, Steward (1955), whose relatively small-scale and multilinear model shares similar territory with the livelihood approach, theorised the ways in which traditional societies adapted to such environmental features as topography, climate and physical resources. In his model, different types of technologies and economics, and levels of population, are expressions of the interplays of a society with its habitat (Merchant, 1990, p. 674). The cultural ecology approach tends to be based around particular events rather than historical processes or political structure (Vayda, 1998).

Historical ecology

Historical ecology ideally focuses on the 'dialogue' between culture and nature rather than on oppositional dichotomies with unidirectional (evolutionary) tendencies (Balée, 1998a, p. 14; IBSRAM, 1991). In the view of historical ecologists, it is historical, and not evolutionary, events which are responsible for the primary changes in relationships between human societies and their immediate environments (Balée, 1998a, p. 13). Using a dialectical approach, historical ecology focuses on the interpenetration of culture and the environment, rather than invoking adaptation (which has unidirectional and evolutionary connotations) (Balée, 1998b, p. 14).

Historical ecology has been described as the study of a series of interactive landscape events, and emphasises the importance of recognising plural or eclectic heterarchies (somewhat similar to Steward's (1955) concept of multilinear change), in lieu of singular hierarchies in the history of people-environment relations (Crumley, 1987; Crumley, 1994a). The perspective where '... we see hierarchy everywhere in nature ...' is criticised (Crumley, 1987, p. 157). The unconscious adoption of

hierarchy-as-order is endemic to what are assumed to be complex societies: thus, 'complexity is often conflated with order, order with hierarchy, and hierarchy with power' (Crumley, 1994a, p. 186). Instead, Crumley, who found a high degree of flexibility and ecological accommodation in the history of a non-hierarchical Celtic society, argues that hierarchical models are inherently no more complex than non-hierarchical (heterarchical) models:

> The dominant paradigm of cultural evolutionary theory ... obscures the dynamic social relations (complex by any definition) among and within many polities ... (Crumley, 1994a, p. 199).

The dynamic aspect of social relations can be revealed by exploring the structural forms of nature and relating these to human situations. This approach is relevant to the Fiji context, where social flux has been considerable at certain times, perhaps associated with environmental change (Nunn, 2003; Nunn and Britton, 2001). In cases where environmental change causes human uncertainty, it is necessary to have flexible economic, social, political and structural systems (plus the full gamut of species diversity) to maintain resilience and sustainability (Glavovic, et al., 2003).

A flexible and heterarchical character is typical of agropastoral societies. Many of them have persevered and maintained their resource base and their resilience through time over a range of environmental settings (on condition of having significant autonomy). In Egypt, one '... long-lived society survived for millennia because of weak connections between central administration and production ...' (Hassan, 1994, p. 178).

Many of these features are apparent in Navosa, which is somewhat remote, traditional, agropastoral and arboricultural, and is less politically hierarchical than eastern Fiji.

Political ecology

Political ecologists argue that many causes of natural and human resource degradation are socio-economic and political rather than ecological or technological (Thrupp, 1993, p. 48). Land degradation has '... social causes, and they must be understood if there are to be social solutions ...' (Blaikie and Brookfield, 1987b, p. xxii). Nature and society are believed to interact dynamically and dialectically (similar to cultural ecology, but differing from historical ecology which has more focus on the landscape), and any given environmental problem has multiple causes, rather than a single cause, but political-economic causes are believed to be particularly important (Blaikie, 1985).

There is an awareness of how the negative effects of degradation are distributed among social groups. Indigenous people are among the economically less privileged people who are often the main victims of degradation (Thrupp, 1993, p. 49). Poverty is believed to both contribute to, and result from, environmental degradation. Poverty is often derived from broader socio-economic inequities and structures tied to uneven development. Recovery must start from an understanding of both the socio-economic and political contexts which circumscribe the degradation dilemma. Population growth (as a causal force) is seldom a focus of recent political ecology, although it is recognised that population pressures may both contribute to, and result from, resource degradation (Blaikie and Brookfield, 1987b, pp. 32-34).

From a political ecology perspective, sustainable development must include social equity and respect for human rights as well as ecological soundness and economic productivity (Thrupp, 1993, p. 50). The intra-generational rights of present generations are considered of urgent importance, and are given greater priority than the rights of future generations. Thus, purely protectionist long-term conservation goals have received less attention from political ecologists (ibid), who tend to presume the relevance of political structure in research (Vayda and

Walters, 1999).

Land Degradation and Society

Land degradation is difficult to study: it usually occurs slowly over a long time period, and is often spatially complex. Studies of land degradation are best practised in an interdisciplinary fashion, involving both the natural and the social sciences (Blaikie and Brookfield, 1987b, p. xvii). Blaikie and Brookfield's (1987b) seminal inquiry is the basis of the following account. Although tropical land degradation has long been acknowledged, and extensively studied, attempts at prevention have only had a limited impact upon the prevailing effects of the exploitation of nature for short-term gain (Dregne, 1984). Why are land users so often unwilling or unable to prevent accelerated degradation?

Land degradation and social change

Part of the problem is a lack of consensus on the overall significance of land degradation in relation to social change, especially when population is added as a factor. The three-way interrelationship between: (a) type of land use, (b) environmental base, and (c) (human) population is very complex, and thus proximate causes are difficult to discriminate.

Demographic approaches

Despite the lack of scientific certainty, there are two main perspectives that have been influential in guiding demographic theories of population and resource use (Jolly and Torrey, 1993). One is associated with the classical economic approach (and the natural science paradigm of Thomas Malthus), which stresses the difficulty of maintaining a steady or increasing standard of living given a finite resource base and an exponentially growing population (Jolly and Torrey, 1993, p. 2). Classical theorists are pessimistic about the repercussions of change, advocate constraints on the use of resources, and tend to support purely protectionist conservation goals.

The second, neoclassical (also cornucopian) approach emphasises the accumulation of both physical and human capital and the substitution of abundant factors for scarce ones (Jolly and Torrey, 1993, p. 2). For example, 'abundant' petroleum gas (transformed into fertiliser) can substitute for soil nutrients in hydroponic glasshouse culture. In response to greater population density, neoclassical theorists suggest that: farmers might reduce their fallows, increase their use of 'substitute' technologies, perhaps build terraces and introduce fertiliser, and implement multiple cropping cycles in order to increase production from a finite area (Boserup, 1965). This approach is optimistic that change can have positive repercussions, although there is a contradiction in that this model encourages the greater use of non-renewable resources such as fossil fuel which reduces long-run sustainability compared to approaches that are more energy efficient (see p. 75).

Neoclassical beliefs and sustainability

Because of the cornucopian confidence in the efficacy of technological substitutes as alternatives for existing natural resources, neoclassical approaches have an implicit tendency to discount the importance of land degradation in agricultural development. This scenario is exemplified by the promotion of soil-less hydroponic growing systems. These systems, although they did not exist in Navosa, were being introduced to students at a secondary school in Navosa (see p. 258).

The neoclassical approach tends to treat land degradation as an exclusively technical issue, a problem to be solved by innovation, akin to the Green Revolution. However, the analogy with the Green Revolution is misplaced. Whereas the technical changes of the Green Revolution (often strongly supported by the state) led to an increase in short-term financial security for a range of farmers, the potential gains of land conservation are usually slow to realise and without immediate financial incentive. Consequently, technical interventions on behalf of land

degradation often have a poor record of adoption and perseverance in many regions (Blaikie and Brookfield, 1987b). Exceptions are when individual farmers are especially environmentally concerned (a minority (F.I., 1998-1999)), or when conservation is vitally necessary for continued production. For example, in steep upland areas of Nepal, prevention techniques were only utilised by local farmers in cases where short-term livelihoods were imperiled by impending landslips and other severe forms of erosion (Blaikie and Brookfield, 1987b, p. 43).

The cost of developing landesque capital (Blaikie and Brookfield, 1987b, p. 9) such as terraces for soil conservation (see p. 59) is usually high and smallholders often lack the resources to carry out such work. The social and technological changes of development, especially where there is a trend of diversification, may also have an effect by creating uncertainty (Scoones, 1996, pp. 7, 9) about the wisdom of investing in relatively permanent landesque capital despite the potential for both enhanced livelihoods and soil conservation. This may be especially true where large-scale externally-induced development has occurred in the past, for example, the Yalavou beef project area adjacent to Navosa. In these places there may be an implicit expectation that similar top-down development projects will occur again in the future (F.I., 1998-1999).

DEVELOPMENT THEORIES

This section begins with a synopsis of development theories as they relate to the history of the exploitation of rural resources, before moving on to a critical analysis of sustainable development.

Development in the Modern Period

Development is associated with the recent period of global history that had the European Enlightenment as its progenitor. The advances of science and technology, fed by the decline of feudalism vis-à-vis the expansion of capitalism and democracy, were reflected in an ideology of mastery over nature (Leiss, 1972). For the first time, explicit encouragement was given to the exploitation of natural resources and their conversion via industry into the commodities of modern civilisation.

After World War II, conditions were ripe for the geographical expansion of the modern world. Resources were perceived to be abundant, and cornucopian notions of unlimited advancement flourished from about 1945 to the 1960s. Economic growth theorists of the 1950s and the early 1960s believed that the right quantity and mixture of saving, investment and foreign aid was all that was necessary to enable developing countries to progress rapidly along a path that had historically been forged by the more developed countries (Todaro, 1994/1977, p. 68). Rostow (1960) argued that a unilinear set of evolutionary stages could predict this process. Modernisation theorists advocated social engineering (McMichael, 1996, p. 3), and structural changes that were believed to be necessary for the transition to a modern society (Toye, 1993/1987).

In the 1970s, discontinuities in the practical consequences of development and modernisation exposed certain contradictions. For example, in the case of trade, unequal dependent relationships, rather than idealised interdependent relationships, were the normal partnership arrangement (Toye, 1993/1987, pp. 32-33). Dependency theorists argued that modernisation theory legitimised foreign aid as an instrument that maintained exploitative neocolonial patterns of international relations, or underdevelopment (Peet, 1980; Rist, 1997, p. 110).

Both modernisation and underdevelopment thinkers focused

primarily on economic progress without considering the long-term issues relating to ecological sustainability, and both assumed development theory to be universally applicable for all developing countries without reference to localised culture and environments.

From Grand Narratives To Many Narratives

Universalism has been challenged by recent developments that emphasise a plurality of smaller units.

Poststructuralism, postmodernism and postcolonialism

The tendency to universalism and diffusionism in the grand narratives of development meta-theories has been challenged by the rise of poststructural thought[3] since the mid 1980s (e.g., Escobar, 1984-1985). Critics, such as Escobar, have attempted to counter hegemonic relationships by deconstructing the power relations in the development discourse of modernisation (Crush, 1995; Escobar, 1995). Critical analyses of the history of development have revealed the spread of the underlying (and hegemonic) world capitalist system (Sklair, 1994). The antidote has been the intentional efforts of a few to ameliorate the negative social effects of this capitalist system (Cowen and Shenton, 1995).

The local or indigenous subculture of postmodernism

Postmodern theorists, whose approach is relativistic, argue that local and indigenous knowledge should be the core of development (Gegeo, 1998), rather than being marginalised or ignored by globally-oriented development theories. According to the relativist perspective, all knowledge is norm-laden: 'facts do not speak for themselves but take on meaning only in specific cultural contexts' (Hunn, 1999, p. 10). The potentially universal and homogenising grand narrative of nonlocal

[3] Although each has distinctive aspects, I believe that both the postmodern and the postcolonial share the poststructural approach.

knowledge and modernisation (part of the 'Global Project' (Esteva and Prakash, 1998, p. 1)), which champions western epistemologies over all others (Banuri, 1990; Gupta, 1998), is contradicted. Instead, the postmodern approaches support a significant role for local knowledge in development (Sillitoe, 1998a; Sillitoe, 1998b; Williams and Baines, 1993).

Postcolonial analysis

The critical evaluation of the discursive and material legacies of colonialism is called postcolonial analysis (McEwan, 2002). Postcolonial theorists have challenged the frequently unacknowledged and unexamined assumptions at the heart of Western disciplines that are insensitive to the meanings, values and practices of other cultures.

The subaltern struggle for power is a central focus of postcolonial studies. Colonial discourses and processes have a tendency to be unconsciously ethnocentric, buried in European culture, and indicative of a dominant Western worldview. Their deconstruction sheds light on the origins of present-day inequities and conflicts (Sylvester, 1999, p. 712).

The history of the Fiji Islands has been the subject of various forms of (sometimes unexplicit) postcolonial analysis at a variety of levels (Clammer, 1998/1973; Durutalo, 1985; France, 1969; Howe, 2000; Qalo, 1993; Tanner, 1996; Thomas, 1994). All had the intention of exposing (different kinds of) hegemonic power relations.

Benefits and difficulties

The ability of poststructural studies to discern dysfunctional aspects of past development that hinder sustainable development is a substantial benefit (Sylvester, 1999). Unfortunately, many poststructural (including postmodern and postcolonial) analyses target the level of meta-narratives, where they tend to involute and engage in abstruse debate with similar others (e.g., Thomas, 1994). Only some texts reflect discourse analysis that engages with the local level (e.g., Durutalo, 1985; Gupta, 1998), and fewer still have engaged with material practice in their critiques (e.g., Esteva, 1998).

Practical alternatives

The general failure of large universal models of development (Burkey, 1993, pp. xvi-xvii) has led to a variety of approaches that focus on the particular rather than the universal. There is an increased recognition that different contexts in development have independent and heterogenous characteristics (as postmodernism reflects). Environmental sustainability, women's issues, culture, local contexts, livelihoods and the role of diverse power relations in development, have all been unsheathed, and form the primary perspective of this thesis.

Increasing environmental degradation has been a major concern. In the late 20th century, environmental problems such as pollution, deforestation, global warming and declining biodiversity caused heightened international concern. The ensuing calls for action to prevent further degradation were then pitched against the prevailing notion of unlimited economic growth, which was perceived to be the main instrument of environmental degradation. Eventually, the calls for sustainability were recognised and incorporated into development theory as the sustainable development approach.

SUSTAINABLE DEVELOPMENT

The following discussion of sustainable development and related concepts studies a broad range of critical issues, especially those related to land degradation in tropical countries.

Sustainable Development: Origins and Issues

The approach of sustainable development was built from two globally-oriented but opposed perspectives: (a) anti-poverty economic development, and (b) the environmental conservation movement. Sustainable development unites these two perspectives based on the premise that the conservation of scarce natural resources is necessary to facilitate continuing economic prosperity.

The Brundtland Report (WCED, 1987b) presents the archetypal statement of this position, summed-up in the following:

> Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1987b, p. 43).

This enduring definition demands the sustainability[4] across generations of need-satisfying resources, and as such is a strong definition. The role of inter-generational, as well as intra-generational resource management is a focus of sustainable development.

Sustainable development: our common future

The Brundtland Report insisted that the environment cannot be isolated from developmental processes: 'there has been a growing realisation ... that it is impossible to separate economic development issues from environment issues' (WCED, 1987b, p. 3). A reciprocal relation was said to be held between development and environment: 'many forms of development erode the environmental resources upon which they must be based, and environmental degradation can undermine economic development' (ibid, p. 3). There were many contradictions within the report, which was still based on economic premises, but its recognition of the important link between poverty and the environment was a turning-point: 'poverty is a major cause and effect of global environmental problems' (WCED, 1987b, p. 3).

As the expression of a global ideal, the sustainable development concept has served a valuable function in integrating previously disparate forces, but the difficulty of implementing (mainly technically-oriented) strategies for sustainable development led to a focus on

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[4] The terms sustainability and sustainable development have somewhat different meanings. In this thesis, the concept of 'sustainability' refers to the perseverance of the environment (including human and economic environments) (Brown, et al., 1987), whereas sustainable development names the attempt to incorporate sustainability with economic development.

underlying structural inequalities (Adams, 2001).

Pacific islands and sustainable rural development

The uneven world distribution and cost of agricultural input commodities and energy resources (World Resources Institute, 2000) is relevant to strategies for sustainable development. The peripheral place of Fiji in the world system suggests it is disadvantaged. Less industrialised nations that are net importers of energy (such as the Pacific island countries) suffer high energy costs and scarcities compared to MDCs because of disadvantages due to a scarcity of endogenous fossil-fuel resources, smallness, remote location and high transport costs (Bayliss-Smith, et al., 1988, p. 276; Burt and Clerk, 1997; Johnston, 1984; Overton, 1993; Overton and Thaman, 1999; Reddy, 1998; Thaman and Ba, 1979). Some of these constraints also effect competitiveness in the global market, especially under a trade-based neoliberal economic regime, thus limiting the possibility of economic development and improved livelihoods (Ward, 1989; Ward, 1993).

Natural hazards can be especially debilitating, particularly tropical cyclones, although long-term threats from global warming are significant (Nunn, 1993). Cyclones periodically cause severe damage to natural and physical resources leading to crippled livelihoods (Clarke, 1992; Crozier, et al., 1981, p. 71; McGregor, 1997; Seru, 1994a). In addition, the psychological effects of storms may diminish interest in long-term development. Other environmental constraints include periodic droughts associated with El Niño weather patterns in the Pacific, which occur about every five years (MFARD & UNDHA, 1994, p. 95), and are particularly stressful in the drier, leeward districts of Fiji. In the past, traditional mitigation and coping mechanisms were employed, but there has been a breakdown in these systems (Carter, et al., 1991), and the corresponding emergence of relief-dependency upon government and international donors. This shift parallels the move from a customary 'culture of sustainability' to a 'culture of exploitation' associated with the

dominant ethos of economic development (Overton, 1993, pp. 165, 169).

The perspective of universal growth

Certain common denominators (or more succinctly, agents of destruction) underpin sustainable development but have not been confronted directly (Adams, 2001). Perhaps the most ubiquitous is the world capitalist system which dispenses capital to enhance the development of industrialism and modernisation (Peet, 1980). The international conferences of the late 20th century (Stockholm, Brundtland, Rio) were all conducted in a manner that implicitly accepted economic growth (Daly, 1995).

Economic growth theory

The economic theory behind capitalist growth and modernisation presumes the universal relevance and homogenous application of economic growth:

> The current search for the cause or causes of economic growth appears to be frequently informed by a commitment to producing objective, scientific, and universal knowledge of economic growth, and this is underpinned by the view that all economies are substantially similar in their components and processes ... (Kenny and Williams, 2001, p. 4).

The argument is circular, however, and ignores the cultural factors that contradict economic growth (Gudeman, 2001; Spate, 1959). Nevertheless, development, at present, is dependent upon capitalism and the destruction of hindrances to growth (Cowen and Shenton, 1996, p. ix). But according to O'Connor (1994): 'there are few expressions as ambiguous as 'sustainable capitalism' ... (p. 152). Thus, the 'grand idea' of sustainable development may be built on nonsustainable foundations, which require critical appraisal.

The political economy of degradation

At the grass-roots level, economic exploitation for surplus value (which is an inseparable part of capitalist economics) is associated with degradation:

> Degradation is thus often encapsulated in a web of surplus-extracting relationships, in feudal systems, in colonial/capitalist economic relationships, and almost wherever there is marked inequality. (Blaikie and Brookfield, 1987b, p. 241).

It may be said that the process of economic development with its ideology of universal growth challenges and subverts any institution or community that imposes constraints on capitalism and growth:

> Development as introduced and promoted by the colonial and postcolonial governments ... is, in principle, modernization, made especially obvious by the emphasis on economic development to the exclusion of other aspects of development (Gegeo, 1998, p. 307).

Thus, the universalist epistemology of capitalism with it's dominant, homogenising and exploitative development ideology exerts coercive effects on non-capitalist communities, which still remain in Navosa and other local or indigenous areas (see Gudeman (2001) for an outline of the processes in these situations).

It may be broadly concluded that an ideology of economic growth tends to escalate the exploitation of resources in the local community context, and this ideology is associated with a particular cultural perspective.

Cultural imperialism and sustainable knowledge

The phenomenon of sustainable development originated from a framework of Western, Eurocentric ideas (Brohman, 1995; Cowen and Shenton, 1995, pp. 41-42; Hettne, 1990, pp. 36-74). Consequently, the concept of sustainable development is associated with organisations that tend to promote practices based on the historical experiences of the temperate regions and their hegemony of over-generalised and universalising knowledge. An adequate appreciation of local contexts in LDCs is usually lacking (Joseph, et al., 1990; Penna and Campbell, 1998).

The potential for conflict between the disjunctive knowledge-realms of MDCs and local contexts is significant, and thus the epistemological differences must be recognised. Those relationships that are incommensurable restrain the implementation of policies for sustainable development in LDC contexts (Sillitoe, et al., 2002). The differences may be so significant that policies cannot be replicated in local contexts in tropical regions (Ram, 1997; Weischet and Caviedes, 1993).

Despite these constraints, most LDCs have been implementing institutional frameworks for environmental policy based on European models, and are supported with funding from MDCs (Amanor, 1994, p. 7; Department of Environment, 1998). This mimicry occurs despite the recognised dislike of European ethnocentric models by indigenous institutions in LDCs (Wiarda, 1983), and is an aspect of cultural imperialism (Gupta, 1998).

Cultural sustainability

What is the relation between sustainable development and local or indigenous culture? If traditional land use was sustainable, and at least partly because the indigenous culture practised a broadly sustainable resource management system (e.g., Overton, 1993, pp. 166-167), would it not be better to aim to uphold this traditional status quo rather than attempt development which may undermine the sociocultural system upon which the system partly depends? The Brundtland report

recognises the paradox:

> It is a terrible irony that as formal development reaches more deeply into rainforests, deserts and other isolated environments, it tends to destroy the only cultures that have proved able to thrive in these environments' (WCED, 1987b, p. 115).

However, although the Brundtland Report recognised that traditional rights should be protected and 'accompanied by positive measures to enhance the well-being of the community in ways appropriate to the group's lifestyle' (ibid, p. 116), development was encouraged to continue (albeit with care and sensitivity) through the advocacy of conventional development goals such as the improvement of nutrition and health systems. It is here that the economic and cultural values of the MDCs have precedence over those of 'vulnerable minorities' (Penna and Campbell, 1998), who are not expected to refuse these developments. In effect, the approach is 'paternal' and 'top-down'.

Power and sustainable development

Vivian (1992) argued that the disempowerment of local communities is the root cause of degradation in LDCs, and the remedy is grass-roots empowerment, discussed later (see pp. 36, 37). But the political and economic directions taken by state leadership are also important in determining the direction of change (Adams, 2001, pp. 250-284; Paarlberg, 2000).

In Fiji, the accumulation of political power in the eastern provinces has led to inequities in the regional distribution of agricultural aid (Durutalo, 1985). The location of power also influences the direction of sectoral aid along class lines (Qalo, 1993). All of these things mitigate against the equitable deployment of strategies to aid sustainability at the local level.

Strategies of sustainable development

Because 'sustainable development is a concept fraught with imprecision and inconsistencies ...' (Overton, 1999a, p. 1), the implementation of strategies for sustainable development has proved more difficult than first envisaged (Overton and Scheyvens, 1999; Redclift and Sage, 1994). The high degree of heterogeneity in local and social contexts is under-determined by the inherent simplicity of the concept of sustainable development. To implement sustainable development, strategies and techniques must be accommodated to each context, leading to a multiplicity of different and diverging approaches. This digression, although necessary for local-level interaction, tends to create distance between the original premise of long-term sustainability and implementation (Overton, 1999a, p. 3). In practice, long-term perspectives tend to be overlooked in favour of short-term approaches (King, 1998).

Land degradation and sustainable development

Land degradation is a key resource issue at the centre of the economics versus environment debate, as the following homily indicates:

> Those who are poor and hungry will often destroy their immediate environment in order to survive: They will cut down forests; their livestock will overgraze grasslands; they will overuse marginal land ... (WCED, 1987b, p. 28).

The Brundtland Report hoped that by improving the livelihoods of marginalised communities, these same communities would be less inclined to over-exploit their resource base, degrade their environment, and thereby compromise the livelihoods of future generations. The Brundtland Report made general claims[5] that economic development will cure both ills: reduce poverty and lessen land degradation. However, evidence that this can occur as a result of specific development

[5] There were an assortment of qualifications for particularly degraded environments.

intervention is meagre. The Machakos case (Tiffen, et al., 1994) is a rare and highly quoted example (World Resources Institute, 2000, pp. 149-158), but is insufficient to answer the vital question about whether economic development encourages local communities in LDCs to protect their environment and resources for future generations. It must first be answered at the places where local livelihoods and the environment interact (the subject of this thesis), but information about the broader context is relevant and follows.

Despite various successes, badly implemented soil conservation programs have increased degradation. Poor terracing, often done without the participation of local people in planning and implementation, can exacerbate erosion, leading to a disenchantment among local people that may be generalised to all conservation projects (Pretty, 1995, p. 93).

There are sceptics who question whether economic change and modernisation can have any positive effect on the rural resource base (Pretty, 1995, pp. 58-93). The widespread cases of over-exploitation and contamination of land by relatively wealthy farmers in MDCs (using agricultural machinery and chemical inputs), have led to environmental degradation including lowered biodiversity and social costs (Conway and Pretty, 1991; Pretty, 1995, pp. 58-93; Shiva, 1991; Weiskel, 1989).

Some of the best farmland is lost to housing and industrialisation in MDCs, thus placing more pressure on peripheral land; and there are potential epidemiological threats to global health arising from distorted ecological relationships and 'planetary overload' (McMichael, 1996, pp. 281-283).

There is optimism that the process of demographic transition, where increasing incomes eventually lead to lower population growth rates and therefore less population pressure on the environment, will eventually be beneficial. However, this process, which may take many generations to run its course, has no effect on existing processes of degradation, and is associated with some of the problems of MDCs outlined above.

LOCAL ASPECTS TO DEVELOPMENT

This section outlines three key concepts of local development, in particular, livelihood systems, participation, and indigenous or local knowledge.

Livelihoods

The importance of livelihoods in development theory has a foundation in the philosophy of Sen (1983). Sen challenges the relatively macro-scale emphasis in development economics on production, aggregate income and supply, and instead, favours an approach where '... we are concerned with what people can or cannot do ...' (ibid, p. 755). His focus is on the '...'entitlements' of people and the 'capabilities' that these entitlements generate' (p. 754). An entitlement is the optional set of 'commodity bundles' that a person can command in a society using the totality of rights and opportunities that he or she faces (p. 754). On the basis of this entitlement, a person can acquire some capabilities, i.e., the ability to do one activity (e.g., be well nourished) or another, and fail to acquire other capabilities (pp. 754-755). Sen emphasises the role of assets and commodities already held by individuals, rather than the things others have but which they lack. Consequently, his approach reflects the importance of micro-scale structures and processes.

Similarly, 'livelihood systems' is an approach which contrasts local, insider perspectives and realities with the centrist economic growth perspective, but is more concerned with the relation between policy and local practice at a slightly larger spatial scale (Chambers and Conway, 1992). The aim is to present 'livelihood security' as an integrating concept in development theory and practice (Chambers, 1988, p. 1; Purdie, 1996; Purdie, 1999; WCED, 1987a). The livelihood systems approach challenges the orthodox basic needs approach, in which a universally-formulated set of presumed needs (water, food, health and

education) were provided inflexibly without recourse to local requirements.

The livelihood approach considers and addresses the diachronic processes of how needs are ordinarily met, and the empowerment of individuals and small groups as they live their daily lives: using and managing resources through an integrative mix of their cultural, social, economic, political and ecological institutions and networks. It recognises the realities for most rural people in developing countries where a continuing daily effort is required to maintain a livelihood in a context of changing ideological and material conditions and aspirations.

Chambers & Conway (1992) defined the concept in the following way:

> A livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living: a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels and in the short and long term. (p. 7-8)

This foundation begins with the micro-scale. The ability to derive a livelihood involves claims to particular resources, such as land, vegetation, and water; the ability to access these in practice, which necessarily involves issues of local, national and international politics; the ability to store specific resources or forms of wealth as a protection against risk (an aspect of the sufficiency of livelihoods); and the ability of individuals to apply their capabilities to carry out necessary activities required to derive a livelihood.

These principles are situated within an encompassing framework of sustainability, such that the activities of a livelihood should not impinge upon the efficacy of other livelihood strategies in other places or times. The dynamic and flexible nature of the set of social, cultural, economic,

political and environmental relationships pertaining to livelihoods are of fundamental importance: the relationships and institutions which determine the nature, efficacy and longevity of livelihood strategies are neither static or universal, but may be evident in some circumstances, places or times and not others (Purdie, 1999, p. 68).

The sustainable livelihoods model has been adapted to articulate with Pacific contexts (especially Melanesia, including Fiji), where traditional culture and agriculture dominate (Cahn, 2003; Purdie, 1999). Earlier development models, without a foundation in livelihoods theory, suffered from project failure because local socio-cultural and institutional resources were not given due importance (Schoeffel, 1996). By contrast, the sustainable livelihoods approach embraces traditional Pacific socio-cultural and institutional systems and treats them as a set of assets or resources for development. These assets are incorporated into a holistic conceptual framework where local livelihood strategies are more central (and influencing structures and processes are more peripheral), than in other, extralocal, livelihood system (or development) models (Cahn, 2003). Also, because Pacific societies are often confronted with 'waves of adversity' as a result of disasters, the concept of resilience has greater significance (Glavovic, et al., 2003). These concepts are illustrated in the sustainable livelihoods diagram (see p. 305), and are explained more comprehensively in chapter seven following articulation with the research context.

How successfully does the livelihood approach integrate with other aspects of sustainable development? Despite the intent to be all-embracing, there are some limitations. The livelihood approach deals with the local environment in primarily utilitarian terms as a source of resources, with few references to broader-scale sustainability issues such as the conservation of threatened species or biodiversity. Another way of saying this is that livelihood systems are defined in anthropocentric terms, in contrast to the ecological approach where the 'livelihoods' (or

welfare) of nonhuman species may be considered as well. Thus, the long-term value of non-economic species and biodiversity can be under-appreciated by the livelihoods approach.

The micro-scale aspect of livelihood systems may direct attention away from 'downstream' environmental issues such as down-river sedimentation, marine destruction or global climate change caused by the cumulation of degrading local land-use practices. Also, the term 'livelihoods', through its conventional meaning, may draw attention away from sustainability.

Nevertheless, the livelihoods concept is important for the way in which it brings neglected local, micro-scale knowledge and practices to the fore, thus allowing engagement using participatory methods.

Participation

The participatory approach in development aims to make 'development from below' a reality through practice (Stöhr and Taylor, 1981).

Participation for development

Theorists espousing the concept of participation promote a strategy where local people become the central agents in the development process, who identify and meet their own needs rather than relying on or succumbing to the views, opinions and needs of exogenous societies. Local people are assumed to be the most knowledgeable experts on sustaining their societies. Decision-making is expected to be practised by the local community, leading to development strategies that correspond more closely with the needs and conditions of the people (Cancian and Armstead, 1992; Chambers and Blackburn, 1996; Rahnema, 1992a).

But participation has remained an elusive concept to define. Like many development terms, it suffers from having many meanings and interpretations, and has been implemented in various ways: some of which are tangential to the concept of effective dialogue and sharing

which is at the semantic base of participation. Community participation can be represented as a continuum: from trifling voluntary contributions (of labour, etc) with only token local influence, to an active process of increasing local or community initiative and control in projects, (Brohman, 1996, p. 252). There have been attempts to reduce participation to its essential elements. The United Nations (1981) distinguishes between coerced participation, induced participation, and spontaneous or bottom-up participation. The first is the least desirable, and the latter is the most desirable because it 'comes closest to the ideal mode of participation as it reflects voluntary and autonomous action on the part of the people to organise and deal with their problems unaided by governments or other external agencies' (United Nations, 1981, p. 8). Similarly, Midgley (1986) contrasts 'pseudo' participation, in which projects are carried out according to prior decisions made by outsiders and 'authentic' participation, in which local people democratically control project decision-making.

Participation as means to or end of development

Participation can be conceived either as a means toward particular, usually externally imposed, goals, such as improved project results; or as an end in itself (Brohman, 1996, pp. 252-253). For example, many development economists view community participation as an advantageous strategy towards achieving the equitable sharing of project benefits (the 'means' to a goal approach). Alternatively, egalitarian participation, conceived as an empowering process, may be viewed as the only end that is needed to ensure the well-being of individuals and communities in the development process (Conyers, 1985, p. 8). The difference is one of strategic and political emphasis and many approaches to participation share aspects of both the goal-directed and means-directed models.

Thus, participation can be defined differently according to the resources and goals of the various actors. The role of power is

important: it is likely that those who control greater social resources will attempt to dominate or mobilise the relatively powerless to serve their own hegemonic ends, rather than empowering the less powerful to increase the capacity of their grass-roots entitlements (Oakley, 1987).

Empowerment

Empowerment has been advocated as an emendation in cases where there is a lack of power and control by people at the grass-roots over their own circumstances.

The problem of empowerment is exhibited in western Fiji:

> A factor contributing to difficulty in all colonisation and development schemes involving indigenous or small-scale groups in a particular region is the fact that the nature and scale of the project are beyond their comprehension. Given their small numbers, dispersed village or galala settlements come to see themselves as powerless to affect the imposed change from outside apart from some form of resistance or flight, neither one a long-term solution (Durutalo, 1985, p. 527).

This situation of undermined identity (or status) has been described as part of the 'postcolonial condition' (Gupta, 1998, p. ix). It is often based on a structure of dependency that manifests as a condition of disempowerment (Durutalo, 1985). Reflecting his structural approach, Durutalo advocated correction in the form of a socialist socio-economic system at the nation-state level (p. 532). By contrast, the empowerment approach attempts to organise and empower at the micro-scale, grass-roots level. The empowerment techniques of education and conscientization (increasing social awareness (Freire, 1972; Freire, 1976/1974)) are believed to be critical for instilling self-confidence and inspiring self-expression among local people, without which effective participatory decision-making and human resource mobilisation is impossible.

Empowerment and sustainability

Empowerment is advocated as a way of enhancing livelihoods and environments by increasing local capacities (Friedmann, 1992). Empowerment and participation both facilitate the expression of local people's rights and responsibilities, and their prerogative for sustaining their land and livelihood systems (Vivian, 1992).

The difficulties of empowerment

The main hindrance to empowerment is that the process is often inimical to the short-term interests of the centralised nation-state and its allied power brokers. Many governments have an ambivalence towards grass-roots empowerment and development work, especially when it involves overtly political activities such as consciousness-raising and popular education.

Who participates, and why?

Not only should we ask how participation or empowerment occurs, but we need to ask: who participates, and for what reasons? Does the research engage with all of the diverse groups that have a stake in the results?

In the past, the primary participants (outside of the researcher/s) in people-oriented field studies were the village leaders and educated villagers. Senior members are often the voice of the household, and consequently they tend to be the main source of knowledge, in lieu of spousal, junior or peripheral members. But local knowledge and perceptions often differ across various classes, especially in livelihood research (Nazarea-Sandoval, 1995). It is necessary to ascertain relevant factors attributable to particular groups in order that significant differences in capabilities are not overlooked. The degree to which individuals participate and the means by which they participate is related to their group allegiances and local responsibilities (Chambers, 1997, pp. 84-87), which are usually hierarchically interrelated (Toren, 1990). Enquiry into the structures and meanings associated with local

sociocultural frameworks is necessary in order to ascertain whether forms of injustice are prevalent. Sustainability cannot be achieved where significant inequalities jeopardise the entitlement to realise capacities.

Indigenous and Local Knowledge

An allusion to the inequality of influence between homogenising global systems and indigenous knowledge has already been made (see p. 27). This section discusses indigeneity and local knowledge in context.

Definitions

Indigenous knowledge is defined as that knowledge associated with a distinctive sociocultural group who have a record of long (and usually first) habitation of a particular place (Heyd, 1995). But a more complex picture is indicated by other factors: indigeneity may be a recapitulation of how specific groups of people were historically and structurally located in relation to the expansion of Europe (Purcell, 1998, p. 258), or when comparisons are made to other, competing groups of people (Béteille, 1998). Indigenous knowledge may also be utilised to promote political claims (Ellen, et al., 2000).

Local knowledge is defined differently. It is associated with social groups living in particular locales. The emphasis tends toward spatial, geographical criteria in lieu of cultural criteria. But social uniqueness is still an important part of local knowledge because local groups identify themselves apart from the surrounding milieu (Raedeke and Rikoon, 1997, p. 153); and culture, because it forms part of local identity and distinctiveness, is still relevant, as exemplified in the Fijian *vanua* concept (Batibasaqa, et al., 1999; Crosby, 1994).

Contrary to the implied fixity and autonomy of early, closed 'knowledge system' approaches (e.g., Brokensha, 1980); the current view of local knowledge acknowledges its relational, open, dynamic and interpenetrating nature, and has been likened to a knowledge community (Raedeke and Rikoon, 1997).

The knowledge interface, hybrids and performance

The situation where many knowledge communities and practices interact with each other and with modern intrusions has been called the knowledge interface (Long, 1989; Long and Villarreal, 1993). This interface must be understood and appropriate intermediatory strategies assembled if we want successful development strategies (Murdoch and Clark, 1994, p. 130). Actors need to be able to find and communicate the relevant mix of indigenous, local and 'Western' knowledge (Jiggins, 1988) in order to oblige the conjunctive, 'intermestic' (international-domestic) coalitions or hybrids (Gupta, 1998, p. 337) at the interface (Long and Villarreal, 1993).

The type of knowledge is crucial. According to Richards (1993, p. 62), it is performance knowledge (e.g., labour efficacy) which is most important, and not technical knowledge, which is often incorrectly generalised as indigenous knowledge (especially by agricultural researchers). Performance is a time-oriented, sequential and flexible practice (most evident with intercropping), that can contradict the combinatorial spatial dimensions used by many researchers to characterise indigenous knowledge systems (Kothari, 2002; Richards, 1993).

Power

Given this epistemological melange, can indigenous or local knowledge still be useful as a strategic framework in sustainable development? Poststructural theorists argue that the role of power must be shifted to centre stage for the concepts of local or indigenous to be efficacious.

In the Pacific, Gegeo (1998) argues '... for historically silent voices to be recognised as legitimate and deserving to be heard' (p. 309). It is the 'silent voices' that are the predominant (and often underestimated) force at the intersection of indigenous knowledge and development.

Indigenous knowledge

In many ways, indigenous knowledge is synonymous with local knowledge, but the terms are used interchangeably depending on need. Indigenous knowledge is used most explicitly when the inhabitants of a (sometimes broader) area share cultural identity and are considered to be the long-standing or original inhabitants of a particular place. For example, Fijians clearly meet the criteria for indigenous status (despite being numerically, politically and militarily dominant in Fiji); but Fijians of Indian descent (Indo-Fijians, called Indians in Fiji), despite being a (large) minority group, and locally dominant in some parts, are not indigenous because they lack both 'first inhabitant' status and globally-perceived ethnic distinctiveness (i.e., there are few Fijians in the world, but many Indians). The role of distinctiveness is important: indigenous peoples are often those threatened with cultural genocide, and their loss may amount to not only a loss of cultural diversity but also of human sustainability (Bodley, 2001; Clarke, 1977; Goodland, 1988; Johnston, 1994b; Thaman, 1982a).

The contexts of identity

The vital role of place and perspective in the definitions of indigenous and local are apparent when they are alternately viewed from home and afar. Because of their ethnic distinctiveness, their status as original inhabitants, and the relatively small size of their historic home, Fijians are considered to be indigenous people. They are also considered to be local people when viewed (etically) from afar. But at home, within the (generic) indigenous Fijian (emic) context, 'Fijian' does not have an especially 'local' connotation, although *vanua*, clans, regions, islands and villages are symbols of locality.

Alternate views are exemplified in Navosa. People from the central hills of Viti Levu are called *kai* Colo (hill people) by other Fijians. This is a clear reference to their locality (Tanner, 1996), although it may include

other connotations.[6] Within *kai* Colo, however, other more specific referents to place and belongingness are used in place of this term.

Thus, 'indigenous' and 'local' are context-laden descriptions which may have little meaning outside of their semiotic arena. This arena is often socially defined, structured and contested: '"indigenousness" is a conjunctural location rather than an essential identity' (Gupta, 1998, p. 18).

Divisions and conjunctions of identity

Fijians identify themselves and others based on birthplace, village, clan relationship, and socio-political status within the Fiji Islands (Capell and Lester, 1941; Ravuvu, 1983; Thomas, 1990; Walter, 1978). Comparisons within the indigenous realm with other Fijian groups are based on important notions of distinctiveness in relation to both material resources (e.g., differential accessibility to state resources) and culture (Durutalo, 1985; Ewins, 1997, p. 432; Tanner, 1996).

The comparative significance of non-indigenous cultural groups is low in Navosa because the indigenous population has both a vast majority and an almost exclusive residence pattern. Indigeneity is more significant where there is an opposing ethnic group (e.g., Fijians of Indian descent) capable of political threat, as in some other regions of Fiji. In these contexts, the concept of *vaka Viti* (the Fijian way) assumes importance as an assertion of difference (Overton, 1993; Overton, 1999b). In Navosa, however, Indo-Fijians (a few lived near Keiyasi) co-existed well with neighbouring Fijians (F.O., 1998-1999), and there was little need for Fijians to assert ethnic difference.

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[6] *Kai Colo* suffer the prejudice of people from sometimes more developed coastal regions who stereotype interior hill people as backward (F.I., 1998-1999; Ravuvu, 1988, pp. 4-6).

Indigenous and traditional knowledges

Is the traditional the same as the indigenous? Cultures change over time, and in different ways in different places, and therefore what constitutes tradition, or the indigenous, may be unclear, changing and contested (Crocombe, 1972; Turner, 1997).

The traditional is often conflated with indigeneity, but Gegeo (1998, p. 290) argues that indigenous knowledge is separate from traditional knowledge, and that indigenous knowledge is the result of the integration of introduced knowledge with traditional knowledge. The result is a definition of indigenous knowledge that incorporates a hybrid character, and is indirectly reflective of its local place of origin.

The degree to which identity is associated with patrilineal norms is relevant. In Fiji, marriage is usually exogamous, resulting in a spatial network of kin relationships that increases fusion at the expense of uniqueness (Thomas, 1991, pp. 194-195)[7], and I would argue, 'indigeneity', or 'Fijianess', at the expense of local distinctiveness.

Summary of Theoretical Approaches

The theories associated with the problem of anthropogenically-caused land degradation differ according to their emphasis on cultural, temporal and socio-political factors. The history of development has reflected an ongoing desire for economic growth, unfortunately at the expense of the environment. Sustainable development is the potential panacea for environmental degradation in rural areas of LDCs. It recognises a need for conservation and institutional change but presumes continuing economic growth. The possibility of implementing sustainable development in the vast and heterogeneous arena of marginalised Third World agricultural contexts is considered, and a lack of commensurability involving ecological, economic and sociocultural

[7] Thomas's research was in the Noikoro *tikina* of Navosa.

structures and processes creates doubt about the applicability of sustainable development in these regions.

The importance of local livelihoods and indigenous knowledge communities is emphasised as a part of efforts to achieve participatory and sustainable development, and there are critical sociocultural (and political) factors which are particularly relevant to development and sustainability.

CHAPTER THREE

AGRI-CULTURE, PYRO-LIVELIHOODS AND SUSTAINABILITY IN NAVOSA: PAST TO PRESENT

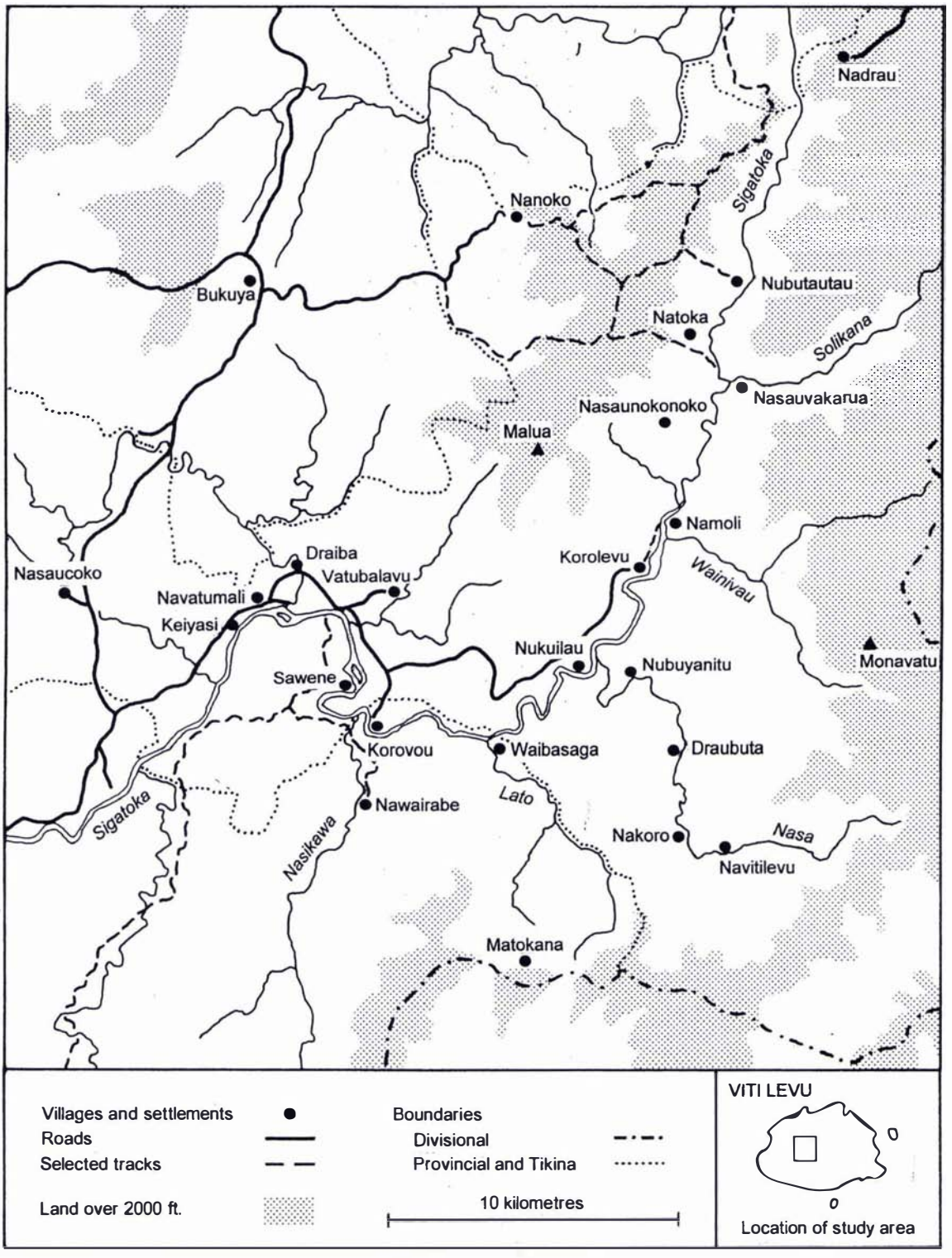
INTRODUCTION, LANDSCAPE AND PLACE

This chapter presents a detailed description of circumstances relating to sustainable land use in the Navosa region of the Fiji Islands. After the following introduction to landscape and place, there are major sections on the history of the landscape, watershed degradation and sustainability, culture and social organization, and rural development.

The Navosa region is in the centre of Viti Levu, the largest of the Fiji islands. The provincial boundaries outline Navosa as the northern and inland half of the province of Nadroga-Navosa centred upon the middle-upper stretches of the Sigatoka River. The area of research, however, can be more properly defined as the Navosa watershed region which includes some villages (e.g., Nawairabe) that lie alongside tributaries of the Sigatoka River that drain into Navosa but are located outside of the provincial boundary (see Figure 1, p. 45).

Culturally, the study includes three *tikina* (traditional culture areas or districts) within Navosa: the Nasikawa, Noikoro and Navatusila *tikinas,* corresponding to *yavusa* (patrilineal clans) of the same name. There are other *tikinas* (e.g., Namataku and Nadrau) within Navosa province, but my research was limited to the most accessible districts (covering most of the area of Navosa). Villages and settlements are widely spread and are often located beside watercourses (in the main valley) or near water sources (on the highland plateau). Many smaller settlements, often unmapped, are located near cultivation areas.

FIGURE 1. Map of Navosa



Environment and Natural Resources

The grassland landscape of Navosa can be described as a savanna, albeit a hilly, even mountainous, savanna. Most of the low hills are of a similar height, although they are relatively dissected, and are circumscribed by high hills on the periphery. Native forest grows in the gullies, on the wetter slopes, and on the highest ridges and plateaux.

Edaphic features

The terrain in Navosa is primarily hilly, although the broad lower reaches of the valleys are less than 100 metres (m) above sea level. The Sigatoka River and its tributaries traverse the region surrounded by flatlands and low broken hills of medium height (about 400 m altitude) in its lower and middle reaches. The bounding high hills, ridges and tablelands reach about 700-1000 m altitude, and form an arc that is transected by the Sigatoka through a gorge in the upper reaches above Namoli. The highest recognised peak is Monavatu at 1130 m altitude, although a higher plateau point of 1309 m (the second highest altitude in Fiji) lies on the boundary of Navosa near the headwaters of the Solikana Creek on the Qalilevu (Nadrau) Plateau north of Monavatu. The hill-sides are relatively stable: there are small landslides or slumps on lower slopes in some areas, especially after damaging cyclones, but land-slips are not as common as those in the Nausori highland area to the west or the furthest reaches of the upper Sigatoka Valley north of Nubutautau (F.I., 1998-1999).

After burning or an extended dry period, hydrophobiscity develops where water runs-off rather than infiltrates the ground. During this period the landscape is vulnerable to severe sheet erosion during heavy first rains (F.O., 1998-1999).

Soils

The alluvial soil of the upper reaches of Sigatoka River and tributaries in Navosa is the Wainibuka Sandy Clay Loam (Twyford and Wright, 1965, pp. 263-264). These soils are very fertile (with very high phosphate levels), except for old terraces that have not been replenished through flooding. They are at least moderately well-drained, and are one of the best agricultural soils in Fiji. They are limited only by flooding.

The Sigatoka Sandy and Clay Loam and Clay (Twyford and Wright, 1965, pp. 264-265) is present in lower reaches around Keiyasi and Sawene, and supports the widest variety of agriculture in Fiji. These soils are also very fertile and are well-drained. The sandy soils frequently flood but the clay types seldom flood, and are slightly less fertile.

There is a mosaic of a large number of other soil types, too numerous to outline, but nearly all associated with hillslopes and of moderate to lesser fertility. They are largely nigrescent soils and steepland humic latosols. Red-yellow podzolics are present in the area of the Lato and Nasa Creeks, and there are some gley soils near the mouth of the Namada River. There are some small to medium areas of impoverished ferruginous latosols (associated with *talasiga* vegetation, see pp. 47, 86) west of Keiyasi, between Draiba and Vatubalavu, opposite Korovou, and near Korolevu. Overall, the soils of Navosa are of medium fertility, with a few areas of low fertility, and several small niches of high fertility.

Climate

Viti Levu has climatic conditions much in common with the other high islands of the Fiji group. Temperatures are warm to hot and equable as a result of the tropical location and maritime conditions (Derrick, 1965). Only some higher altitude inland regions (e.g., the northern hills of Navosa) have cooler conditions, especially in winter, but frosts are virtually unknown. Temperature variation is seasonal, most apparent in coastal regions where the summer is noticeably hot

and humid. The temperatures of the higher inland regions are often moderated in summer by the cooling effect of cloud cover.

Despite the equable temperatures, there is a marked difference in rainfall between the wet windward (southeast) and the dry leeward northwest regions of Viti Levu, caused by orographic conditions associated with hills and mountains. In general, the windward region does not have a significant dry season and has a relatively consistent rainfall year-round. By contrast, the leeward region has a marked dry season of about 3-6 months duration. The windward region rarely suffers from drought, but droughts are relatively common in the leeward region, especially on the west and northwest coasts. Navosa lies in the transitional climatic zone between these two extremes. The pattern of precipitation over the lowlands of Navosa is most similar to the drier leeward region, whereas the Navosa highlands share the heavier rainfall of eastern regions (see below).

The average rainfall recorded at the main stations in the transitional zone (but outside of Navosa) are: (a) Nacocolevu (lower Sigatoka Valley, Nadroga), 1848 mm per annum, and (b) Nadarivatu mountain station, 3587 mm p.a. (Twyford and Wright, 1965, Table XII). Raw data on monthly rainfall during the 1980s and 1990s was obtained from the Fiji Meterological Station for three Navosa sites. Unfortunately, recording was inconsistent, with many missing values (sometimes coinciding with cyclone periods). However, some years had a complete set of 12 monthly values, and only these years were averaged to produce the following figures: (a) Nakoro, 1900 mm p.a. (8 years included), Korolevu, 1714 mm p.a. (11 years), and (c) Nanoko, 2459 mm p.a. (13 years). The figures for Nakoro and Korolevu are both comparable with Nacocolevu: all are valley-bottom locations. The figure for Nanoko reflects its higher elevation on a plateau, intermediate to the extreme height of Nadarivatu.

At Nakoro, on the eastern margin of Navosa, the average dry season was of four months duration. Korolevu, in the middle of Navosa, had an

average dry season of six months duration, with a marked and consistent polarity between wet and dry seasons. It experienced a severe drought in 1980 when no rain fell for six months between May and October. The records from Nanoko indicated a severe drought in 1987 (an El Niño year[8]) when very little rain fell for six months between May and October, and a less severe drought in 1992. Nanoko's dry season (when monthly rainfall was less than 100 mm) was over 5 months on average but rainfall was relatively high. At all three stations the driest month was July and the wettest was January (Nakoro) or March (Korolevu and Nanoko). Fiji experiences drought effects from ENSO events with a periodicity of between two and ten years, although with increasing frequency in recent decades (Sturman and McGowan, 1999, pp. 14-15).

Cyclones

Tropical cyclones of hurricane[9] force are a perennial threat in the Fiji Islands. They occur in the summer months, usually between November and April, although 94 percent of hurricanes have occurred between December and March (Thompson, 1986). An average of one cyclone per year occurred between 1923 and 1985, although there were periods when they were absent for as long as five years. The most severe hurricane-force cyclones are less frequent and occur on average every four years, although three hurricanes have been known to occur in one year (e.g., 1985) (ibid, pp. 7-8). Most of the cyclones approaching Fiji affect some part of Viti Levu. The central path of the hurricane is about 72 km across, and severe damage from the fierce winds is usually

[8] *El Niño* Southern Oscillation (ENSO) events occur every few years in the Pacific. They are a set of oceanic and atmospheric changes which result in anomalous drought conditions in Fiji.

[9] The strength of cyclones is categorised under different systems. Benson (1997) uses an Australian system of five different classes. However, here I have used the three-class system of Thompson (1986), a progression of cyclones, storms and hurricanes (the most severe type).

limited to within this swath (p. 8).

Cyclones cause torrential rainfall: commonly around 200-400 mm in 24 hours, but 900 mm has been recorded (Crozier, et al., 1981, p. 69), leading to flooding. There is often severe damage to crops (especially *tavioka (Manihot esculenta,* cassava), and *yaqona),* forests and infrastructure with significant economic consequences (Benson, 1997; McGregor, 1997), including landslide and erosion damage to watersheds (Crozier, et al., 1981; Terry and Raj, 1999). The damage caused by Hurricane Kina in 1992-1993 included farm machinery being washed away (Seru, 1994a, p. 1), and was estimated to cost $F170 million with 23 deaths (Benson, 1997, p. 25; Fiji Meteorological Service, 1993). A high wood debris load, associated with deforestation from logging, caused the Sigatoka bridge to give way (Seru, 1994a, p. 13).

Vegetation

The vegetation pattern of Navosa is significant to land management. A broad outline is presented here, and details emerge in later discussions of landscape history (see p. 55), and land degradation.

The dominant vegetation in Navosa is grassland, with forest in the gullies. Forest is only predominant in the east, where Navosa abuts the moist Qalilevu (Nadrau) Plateau and the windward part of Viti Levu; and on the southeast-facing windward slopes of the high hills in the centre-north (the Malua and Nanoko heights) and the west of Navosa (the Nausori highlands) (Twyford and Wright, 1965).

The composition of species varies in a niche pattern paralleling edaphic features and does not conform to large-scale typologies (Ash, 1992, Smith, 1979; Twyford & Wright, 1965, pp. 80-86). The dominant grassland and secondary scrub species are *mauniba (laulau ni manivosi,* mission or mongoose grass, *Pennisetum polystachyon), gasau* grass *(Miscanthus japonicus), bitu* (native bamboo, *Schizostachyum glaucifolium),* and *onolulu* (a small shrub, *Piper aduncum)* (F.O., 1998-1999). *Vaivai-ni-mocemoce (Samanea saman),* is a very large (and cyclone-resistant (Ehrhart, 1992))

introduced tree that has become dominant by colonising valley bottoms in the drier parts of the region to the exclusion of other species. The agroforestry tree, *vaivai (Leucaena leucocephala)* is localised in some places. The *quwawa* shrub (guava, *Psidium guajava)* is localised near some villages but is not otherwise dominant. There are many locally useful native forest species, but most of the tracts of valuable commercial indigenous timber trees have already been logged. The once-common *dakua makadre* (Fijian kauri, *Agathis vitiensis)* is now rare. There are some small plantations of introduced *Pinus caribaea* on dry hillsides, and a few isolated specimens of mahogany *(Swietenia macrophylla)* near streambeds (F.O., 1998-1999).

The vegetation history indicates that the once-dominant native species are receding against newly-dominant introduced species (F.O., 1998-1999; Weaver, 1992).

Navosa in Fiji

The specific context of this thesis is the seasonally dry and hilly interior watershed of the Sigatoka River located in the transitional climate zone of central Viti Levu, the largest island of Fiji. This area is characterised by an indigenous village mixed subsistence and market farming system, and is populated almost exclusively by indigenous Fijians (Derrick, 1965; Ward, 1965), of whom some support a movement to promote Navosa as an independent province (Gravelle, 1980).

Other regions of Fiji can have markedly different climates and agricultural systems, and different ethnic groups. The lowlands of Fiji are renowned for supporting a commercial agriculture sector specialising in, for example, sugar, copra, ginger, and many other export crops (Chandra, 1983). There is a windward, south-eastern region surrounding the centre of political power in Eastern Fiji. The windward parts of the high islands such as Viti Levu have moist conditions in all seasons which favour the production of *dalo (Colocasia esculenta), dalo-ni-tana*

(Xanthosoma sagttifolium), vudi (Musa sp., plantain) and *jaina (Musa sp.,* banana) sometimes under a multi-storied arboricultural (Thaman, 1993) and otherwise protective forested landscape (Twyford and Wright, 1965). This region is too wet for swidden fires to get out of control, and uncontrolled burning is not a problem.

In contrast, leeward Viti Levu has a pronounced dry season of from three to five or six months duration (Derrick, 1965). The traditional crop here is *uvi* (yam), and *tavioka* is now the dominant *kakana* ('true food' (Pollock, 1985)), both of which prefer dryish, well-drained conditions. *Dalo, yaqona,* and other moisture-loving crops can be grown only in forested, moist niches, particularly in gullies on the windward mountainous slopes (e.g., the Malua heights south of Nanoko), but also around lowland swamp areas.

Context and application

It is important to discriminate where in Fiji this study is relevant and where it does not apply. It is most relevant to the west-central hill, mountain and valley (Colo) region of Viti Levu, but also has points of relevance (especially landscape and vegetation) to the wider, dry north-western geographical region. It also has relevance to all areas of Fiji where indigenous Fijians are dominant, but most especially to where the concept of *vanua* is understood (Batibasaqa, et al., 1999) and the western indigenous culture area. It has relevance to all areas of Fiji where subsistence agriculture (especially *tavioka* cultivation) is an important means for livelihoods.

This study does not have any close relevance to the wetter windward regions, the coastal strips of the large islands (except the near the mouth of the Sigatoka), or the predominantly coastal small islands of Fiji (e.g., Bayliss-Smith, 1988); or to those places dominated by industrialised agriculture (e.g., the sugar lands); or non-indigenous ethnic groups, although points of relevance do occur.

LANDSCAPE HISTORY AND WATERSHED CHANGE

The Fiji Islands present a multifaceted landscape and seascape (Hau'ofa, 1994) of many different ecological conditions. Correspondingly, there is potential for a range of problems with sustainability in different rural contexts. These include the physical sustainability of atolls and other low islands which may be submerged by rising sea levels (Aalbersberg, et al., 1993; Pernetta and Hughes, 1990), threats to the integrity and biodiversity of forests (Thaman, 2002; Weaver, 1993), the severe erosion of fragile topsoil through cultivation on (especially leased) sloping sugar cane or ginger farms (Clarke and Morrison, 1987; Gawander, 1998a; Seru, 1998b; Spate, 1959, p. 97), and the long-standing concern about land degradation as a result of fire in the savanna-like but hilly grassland areas managed by indigenous Fijians in the *vanua* of Western Fiji.

It is the last of these that is taken up here. The issue of land degradation and especially soil erosion has long been of concern in Fiji as the literature attests (Burns, et al., 1960; Clarke and Morrison, 1987; Cochrane, 1968; Crozier, et al., 1981; Cumberland, 1948/1953; Donald and Ramjan, 1939; Drysdale, 1986; Eyles, 1987; Gawander, 1998a; Haynes, 1989; Hughes, 1985; Jack, 1937; Liedke, 1989; Morrison, 1981; Morrison and Clarke, n.d.; Morrison, et al., 1990; Ramjan, 1947; Ramjan, 1951; Seru, 1994b; Spate, 1959; Terry, 1999; Watling and Chape, 1992; Whitehead, 1958). Most of these reports were critical of the lack of preventative measures against erosion on hill land and affirmed the need for prevention and specialised conservation techniques. However, three decades later, despite the attention of expert specialists, there appears to be little 'awareness of the need to husband soil resources and its fertility' (Watling and Chape, 1992, p. 52). But first it is important to understand the deeper nature of the predicament. It may be a mistake to believe the initial impressions that sustainability is threatened. Perhaps the problem is no problem at all?

The Political Ecology of Landscape History

Is land degradation an actual problem? This question was posed by Fairhead and Leach in an African savanna context where the orthodox view of botanists, agronomists and foresters was that deforestation had occurred (Fairhead and Leach, 1996a; Leach and Mearns, 1996b). Their conclusion was that the '... orthodox evaluations of environmental change, and hence of local land-use practices, are demonstrably false' (Leach and Mearns, 1996a, p. 4). How did they arrive at this conclusion which was opposite to the orthodox view? The most noted case concerns the islands of trees that surrounded Kissidougou savanna villages. These groves were assumed by non-indigenous specialists to be the last remnants of a once extensive forest, and therefore concluded that deforestation had occurred in the distant past that had transformed Kissidougou into savanna. Fairhead and Leach, however, after being alerted by the reports of indigenous elders, eventually came to the opposite conclusion, that the savanna was the natural state, and that the forest islands were actually planted by the village occupants (Fairhead and Leach, 1996a; Fairhead and Leach, 1996b). The indigenous people were, in fact, managing the land well. But the colonial authorities accepted the deforestation view of their officials, partly because the narrative was plausible (Roe, 1991), and concluded that local communities were practising poor land management. This (false) information was then used by the government in an attempt to privatise land tenure, which was inappropriate.

The Landscape History of Navosa

Given that the Navosa landscape looks like a grassland savanna-forest mosaic, albeit hilly, then there is a possibility that the same mistake may be made. There are parallels, for example: Cochrane (1969), a geographer, concluded that the savanna-like vegetation of western Viti Levu was the result of deforestation since settlement, especially following European contact, and particularly during the 'last four decades' (Cochrane, 1968, p. 115). But could it be that the natural state of Navosa was savanna grassland? This question has been asked before (Brookfield and Overton, 1988; Nunn, 1990; Nunn, 1997; Nunn and Britton, 2001).

The prehistoric (and pre-settlement) evidence suggests that 'leeward Fiji may have been characterised by widespread grasslands and fern-lands ...' (Enright and Gosden, 1992, p. 176) during the probably arid period of the glacial maximum up to 9000 BP (Before Present). After this period, forest was believed to have returned to the landscape until at least 4000 BP (Southern, 1986). Prior to human colonisation, there were low rates of sedimentation at the mouth of the Sigatoka Valley from about 7500 to about 1500 years ago (Dickinson, et al., 1998), suggesting a well-protected landscape.

Fiji was first settled about 3600 BP[10] (Frost, 1979; Green, 1963; Kirch, 2000, p. 155; Nunn, 1996; Southern, 1986; Spriggs, 1996), an event which coincided with the beginning of a '... major phase of landscape alteration ...' (Enright and Gosden, 1992, p. 181), and local extinction of avifauna (p. 181). The widespread clearance for swidden agriculture decimated many Pacific island forests by about 2000 BP (Enright and Gosden, 1992; Nunn, 1990):

> The marked reduction in forest area and the proportional increase in grasslands during the thousand years or so of initial settlement ... is undeniable. (Nunn, 1997, p. 7).

[10] Most current estimates are between 3000-4000 BP.

On the Qalilevu Plateau, just northeast of Navosa, deforestation began about 2000 BP (Southern, 1986, p. 148) and continued to about 1000 BP, which coincides with a probable 1600 BP to 700 BP period of increased sedimentation rates at the mouth of the Sigatoka River (Dickinson, et al., 1998, pp. 21-22, 25-26). The sedimentation may well have been caused by '... anthropogenic alteration of the landscape in the upstream drainage basin of the Sigatoka River, chiefly by deforestation as human settlement expanded into the highlands of Viti Levu' (Dickinson, et al., 1998, p. 26). As a result, large areas of fernland-grassland vegetation once again dominated leeward Fiji (Enright and Gosden, 1992, p. 190). This period, the Little Climatic Optimum, was believed to have been associated with increasing aridity, the development of water-conservatory strategies (e.g., irrigated terracing), cooperation between social groups; larger, nucleated settlements, and increasing socio-political complexity (Nunn and Britton, 2001).

Subsequent environmental change has been more controversial, mainly because the evidence has been inferred from relatively general and widely dispersed data. From about 700 BP to 500 BP, increased storminess, precipitation and other climatic disturbances may have increased the level of damage to upland agricultural terracing and tested the resilience of the resource base; and the lower temperatures of the Little Ice Age between 500 BP to 200 BP, associated with resource depletion as a result of lower sea levels, may have encouraged the movement of coastal peoples to fortified inland settlements, thus inciting conflict (Nunn, 2000; Nunn, 2003; Nunn and Britton, 2001). However, local evidence is lacking and the degree to which these events effected Navosa is unknown.

Smaller temporal scale episodic fluctuations also have an influence. Some of the most vivid accounts of fires and deforestation, such as that of Horne (1881) (see p. 80), have coincided with ENSO events (Brookfield and Overton, 1988, pp. 94-95).

The overall conclusion that can be drawn here is that the natural vegetation pattern in Navosa does not conform to one model, but varies from predominantly-grassland to predominantly-forest according to very long term changes in climate. In addition, the short-term (and smaller) episodic fluctuations caused by ENSO events have a tendency to accelerate deforestation and the spread of grassland.

Nevertheless, it is almost certain that at the time of initial settlement, Navosa contained much more forest than it does today, and deforestation has occurred since then. The limited number of native grass species (Ash, 1992, p. 121) supports the view that grassland has not been the climax[11] vegetation of recent history. The more frequent ENSO events of recent decades and the dry season fires in the leeward regions may be advancing deforestation and are hindering reafforestation.

Land degradation or landscape enhancement?

There is speculation that widespread accelerated hillslope erosion was not without intent (Brookfield and Overton, 1988). There are various opinions on the degree to which traditional agriculture was either matched to environmental conditions (Spriggs, c. 1984), or conversely, the environment was modified to provide better growing conditions for important crops (Spriggs, 1997b). With the latter in mind, perhaps landscapes were modified to make them more suitable for agriculture? This is hypothesised as human-induced landscape modification, or enhancement (Spriggs, 1985):

> ... accelerated hillslope erosion and valley infilling, have in most cases not led to ecological disaster but to a greatly expanded potential for agricultural intensification and social stratification. (Spriggs, 1985, p. 409).

[11] The vegetation gradient is that of the approximate present only. It is recognised that the term 'climax' tends to make static and over-simplify one particular ecological gradient when the landscape may be subject to a range of different and fluctuating gradients and climaxes over the very long-term.

The expansion of alluvial lowlands and colluvial fans by accelerated erosion caused by burning and deforestation may have been beneficial for crop growth, especially where depressions could be filled. Landscape enhancement should be able to be predicted from differences in the amounts, and distribution of, fertile colluvial and alluvial soil types (versus non-fertile types) over time, as well as from specific edaphic features. The evidence often used, that from Lakeba island (Best, 1984), is, I believe, compromised. Despite the prevalence of sediments that are fertile (p. 30), much of the most recent colluvium from eroded hillsides *(Chromic luvisols)* is infertile (Best, 1984, p. 27). This suggests that erosion has continued in these places despite the lack of enhancement, and therefore the enhancement hypothesis is redundant in these circumstances. Nevertheless, an enhancement strategy may have been useful in certain environmental niches, especially to in-fill swamps, and in areas where the eroded colluvium or alluvium was particularly fertile.

The question of how swidden agriculture was conducted before the advent of relatively efficient steel tools (Sillitoe, 1979) is important to an understanding of landscape enhancement, but little is known about the use of prehistoric stone tools, found at Sigatoka (Green, 1963). Taking Sillitoe's (1979) Wola data from Papua New Guinea, steel axes cut at least 1.4 times faster than stone axes, although many variables were not included, and an energy comparison was not made. Large trees that could be felled by a steel axe were instead pollarded, ringed and burned by fires when stone axes were used. It is therefore likely that the advantage of fire as an efficient means of land clearance was comparatively more important to Navosa cultivators in the pre-contact stone-tool period, a view which is supported by the aforementioned evidence for increased erosion and sedimentation in the colonisation period. In addition, the preference for relatively soft, friable soil to grow root crops (especially yams) was likely to be higher under a system involving less efficient digging tools, another reason why landscape

enhancement may have been desired.

In summary, the ecological factors of land degradation and climate change were found to be contiguous with the formation of a modified landscape to maintain or enhance agriculture. Landscape enhancement was probably more important prior to the introduction of steel tools.

Terracing and pondfields

It is believed that irrigated terraces were first constructed in Fiji during the Vuda period after 1100 A.D., (Kirch, 2000, p. 158). The construction of terraces was a form of landscape modification and enhancement, and a form of (sustainable) landesque capital (Blaikie and Brookfield, 1987b, p. 9). Irrigated, terraced agriculture was practised in Navosa, sometimes covering steep hillsides with a three-dimensional array of pondfields (named *vuci, tabaiwai,* and other names depending on locality), growing *dalo* (Hashimoto, 1990; Kuhlken, 1994b; Parry, 1987; Parry, 1994; Watling, 1984), and sometimes a little *via* (Sahlins, 1962, p. 43). Another type are the shallow-gradient valley-floor systems comprised of stream-side (or riverside) pondfields often on alluvial *bila.* There were once large numbers of *vuci* of various sizes scattered over the Fijian leeward landscape in suitable niches (Kuhlken, 1994b; Sahlins, 1962, pp. 43-48), but they are now almost entirely disused, although their remains can be still be seen (Hashimoto, 1990; Parry, 1987).

Were these past systems sustainable in terms of land use? Was excessive burning and soil erosion minimised under this system compared to the swiddening alternative? This has not been studied in Fiji, but an irrigated terrace is a permanent fixture that is not burned, except when in fallow. The fallow areas of each terrace were small and well-contained, so burning could be easily controlled. Apart from slumping in the outside terrace walls (Watling, 1984, p. 134), there was little chance of soil erosion. Terraces served to catch any eroded sediment as a result of slumping or sheetwash following tropical storms. The irrigation intake would be closed off under these circumstances.

Nevertheless, an argument has been made that *vuci* were the motive for nearby settlement, thus ensuring that deforestation was maintained by swidden burning in the surrounding area, for example, in the Nasa Creek area near a major forest boundary (Hashimoto, 1990, p. 16). The prehistoric evidence points to swidden agriculture being the first cause of deforestation, although *vuci* may have supported the continuation of settlement in areas of degraded swidden land, which does prevent reafforestation in forest margin areas.

Each set of *vuci* usually belonged to a particular *mataqali* or *beto/bito* (patrilineal clan) but in some cases the organisation was conducted by the village as a whole, or even shared between villages. The leading household of the group usually controlled the head compartment where water enters the system, and other households maintained their own compartments within the system, at least on Gau island (Watling, 1984).

The *vuci* are an example of landesque capital, defined as 'purposive land management designed to secure future production' (Blaikie and Brookfield, 1987b, p. 9). The creation of landesque capital is not believed to be motivated by financial returns, which are often below economic discount rates, but often arise from necessity or coercive relations of production (ibid). In this sense *vuci* represent a form of developmental change with sustainable land management as an important goal.

Vuci origins

Many formative reasons for terracing have been suggested, including land degradation, climate, population expansion, social exchange, and war. As a result of the extensive clearing of forests and erosion after initial colonisation, and consequent land degradation, there may have been a shift from swidden systems to alternative forms of agriculture. Terraces may have been constructed on denuded hillsides and cultivation may have been shifted downstream to augmented alluvial flatlands and pondfields (Brookfield and Overton, 1988; Southern, 1986). According to the climate hypothesis, a period of intense aridity around the time of the

Little Climatic Optimum (700 - 1250 BP, coinciding with the Vuda cultural phase (Green, 1963)), caused a shift from swidden agriculture to irrigated, terraced agriculture (Nunn and Britton, 2001). Population expansion remains a possibility, but the evidence remains opaque. In the lower Sigatoka, prehistoric settlement populations did not outstrip the available resources (Parry, 1987, p. 131), although the quantity of soil resource (rich alluvium) is much greater there than in the upper valley. The importance of creating surplus production for social exchange is relevant, but social exchange may have been enhanced by terracing, so causal significance cannot be determined. The same argument applies to war and the need to establish gardens in defensible locations away from valley bottoms and near settlements. The close association of fortified settlements and terraced gardens is demonstrated (Parry, 1987), but increased surplus production from terracing may have led to larger social exchange transactions, increased competition and social stratification, and hence conflict. But the opposite process, where a state of war caused a need for defensible settlements located on higher ground, and gardens located nearby, is equally possible. The direction of causality is difficult to determine (Parry, 1987, p. 131), and the first causes of terracing remain obscure.

Vuci distribution

Kuhlken visited terracing sites in the upper Sigatoka (including Navosa) in 1992 and 'found all of them abandoned' (p. 162), although he admitted that his search did not extend to smaller operating systems which are usually invisible on aerial photographs.

Hashimoto (1990) studied *vuci* in the Nasa Creek area, and on the Namoli-Korolevu (Nakula) *bila*. Irrigated *dalo* cultivation was practised 'extensively and prosperously' (p. 3) near Draubuta around the Nasa Creek until 1972 when the *vuci* were damaged by Hurricane Bibi, and not repaired. In 1982, only one *vuci* (built in the 1960s) was being maintained by the village of Draubuta on the lowest slope of the

Nakaumata Hill near the old village site of Naduta on the Wainimosi Creek. The Draubuta *vuci* were managed by the whole village, but the Nakula pondfield system on the flat Namoli-Korolevu *bila* belonged to only one *mataqali*, and drew water from the wide Wainivau Creek. Similar to the Nakaumata terraces, it was divided into relatively small ponds so that a continuous supply of *dalo* was available year-round from staggered plantings.

Both of the systems studied by Hashimoto (1990) had been abandoned before my visit in 1998, although the *Nakula* pondfield was maintained until Cyclone Kina in 1992-1993 (F.I., 1998-1999).

Vuci decline

There are many reasons why irrigated terraces ceased production (Hashimoto, 1990; Kuhlken, 1994a; 1994b; Parry, 1987; Sahlins, 1962, p. 49; Twyford, 1958/1963; Watling, 1984). These authors have variously attributed decline to: (a) depopulation following the European introduction of disease, (c) the influence of European and Indo-Fijian cultural and economic values, (d) the replacement of chiefly authority by colonial authority (but contradicted by Sahlins, 1962, p. 46[12]), (h) cessation of war and internecine conflict (but contradicted in Rivers, 1926, p. 283[13]), (e) the imposition of 'tax gardens' and the fixing of land tenure by colonial authorities, (f) the weakening of traditional social solidarity and leadership, (g) increased internal migration, (r) the relocation of settlements downstream away from their *vuci*, (i) the introduction of market cropping, (k) plantation agriculture (e.g., bananas), (l) labour displacement (e.g., sandalwood, *yaqona*, gold), (b) the hard work of terrace construction, (m) new cultigens (e.g., *Xanthosoma*, but especially cassava, *Manihot esculenta*), (n) new cultivars (e.g., dryland *dalo*), (o) the introduction of cattle and the encouragement of extensive

[12] The *turaga-ni-koro* and individual householders managed *vuci* largely without chiefly intervention.

[13] Hocart reported irrigation being the cause of quarrels on Lakeba Island.

grazing leading to the displacement of cultivated gardens, (p) damage to gardens and waterworks by animals, (q) risks associated with drought, floods, and the collapse of retaining walls, and (s) agricultural innovations (e.g., the plough, and other tools that aided dryland cultivation).

A long period of decline in the Fijian population caused by a series of epidemics of introduced disease followed the first contact with Europeans in the early 19th century (McArthur, 1967; McDonald, 1959/1963). The most noted epidemic in Navosa was the measles epidemic of 1875 (with subsequent dysentery & pneumonia) that caused losses estimated at between 20 and 27 percent of the total Fijian population (Derrick, 1955/1959; McArthur, 1967). The decline in the availability of labour as a result of depopulation was likely to have been especially germane, and probably caused severe stress on the *vuci* system.

Many of these reasons are based on past events and circumstances, and reflect larger-scale and historical perspectives that, however, may not be relevant in specific local contexts. What do local farmers say? One study, on the island of Gau, presented one farmer's summary of the advantages and disadvantages of *vuci*. Advantages of *dalo* grown in *tabaiwai* were: (a) better taste and sticky texture (excellent for *vakalolo* (Fijian pudding)), (b) more suckers are produced (depending on cultivar), and (c) weeding is reduced (Watling, 1984). Disadvantages were: (a) the hard preparatory labour, (b) continuous supervision, and (c) the risk from drought, floods, and the occasional irreparable collapse of walls (Watling, 1984, p. 134). Watling's participants reported that the shift to cash crop production (especially *yaqona*, not previously grown for cash) by younger farmers for individual gain was a major cause of the decline of *tabaiwai* at Gau (ibid).

At Moala, advantages were that the *vuci* can be planted and harvested year-round, with the possibility of piecemeal harvesting and immediate replanting. Mature corms can be left growing for up to 12 months

longer if not needed immediately (Sahlins, 1962, pp. 48-49). One plot can be maintained for 2-4 years if the water flow holds, and relatively short fallows of 3-12 months were usual. The main labour requirement was for weeding. Sahlins observed (in 1954-1955) that 'year by year wet taro plots go out of use through sheer neglect' (Sahlins, 1962, p. 49). Decline was estimated as one third of the original area over the previous three or four decades (thus abandonment was gradual). The main reason was that labour was diverted to money-earning copra production, and the introduction of *tavioka* enabled a 'quicker, more efficient means of food production' (ibid, p. 49).

In summary, a mix of social, cultural, environmental and economic influences have caused change in the context and practice of local terracing agroecology. Continued change is possible. For example, terracing systems may be put to use again: (a) if there is a reversal of labour displacement due to the value of wetland *dalo* increasing relative to other crops, or (b) if the productivity of dryland agriculture declines, for example, due to pest infestation or land degradation (which may have happened in the past).

Swiddening, permanent and other dryland cultivation methods

Dryland gardening is usually categorised into two types: swidden and permanent cultivation, although transitional hybrids of these two types are sufficiently common to suggest a semi-permanent category (Padoch, et al., 1998), and houseyard gardens are another type (Clarke, et al., 1999, p. 357). Swidden cultivation is a way of life (Peters and Neuenschwander, 1988) as well as a major means of subsistence for some 300-500 million people, most of whom live in the tropics (Brady, 1996). Swiddening involves about 30 percent of the global arable land area (ibid), and is the most common form of agriculture practised by indigenous Fijians (Barrau, 1959; Frazer, 1964; Perks, 1980; Twyford and Wright, 1965, pp. 174, 212-214). It is characterised by the rotation of fields in a forested, semi-forested or grassland landscape where relatively short periods of

cropping (generally of 1-3 years, but 3-5 years in Fiji (Twyford and Wright, 1965, p. 213)) are alternated with long fallow periods of up to twenty years or more (but often as sort as 6-8 years) (Pelzer, 1958), although there are innumerable variations (Conklin, 1961; Padoch, et al., 1998; Peters and Neuenschwander, 1988, pp. 7-13). Swiddening was the initial agricultural method in Melanesian societies (Brookfield and Hart, 1971, p. 81; Kirch, 1991, p. 120), although Melanesians later preferred to leave established forest intact and utilise previously cultivated land instead (Barrau, 1959, p. 53). Clearing is by means of slash and burn, hoe and burn (Conklin, 1961), or alternatively, burn then slash (Peters and Neuenschwander, 1988, p. 8). It is often described as shifting cultivation, but there is ambiguity: some settlements are permanent and a fixed number of fields are rotated around them (similar to modern mixed farming), but in other places habitations or entire settlements are shifted to a new area when fields become unproductive (true shifting cultivation, but now rare in Melanesia (Barrau, 1959, p. 53)). Thus my preference for the term swidden which means 'burned clearing', which appears to be the least contradictory for western Fiji, although it is exogenous.[14]

Nearly all swidden societies use fire as a tool to clear land for cultivation[15] (Bartlett, 1957; Brookfield and Allen, 1991; Peters and Neuenschwander, 1988; Pyne, 1993). Conklin (1957) attempted to classify shifting cultivation into types according to a range of agronomic and ecological criteria. The factors that he considered to be important were: the principal crop types (root crops, grains, or tree crops), crop associations and successions, crop-fallow time ratios, dispersal of

[14] Swidden is an Old English dialect term (Ekwall, 1955). Note that the equivalent Fijian terminology generally omits the burning aspect, e.g., *qele ni teitei* (garden land (Ravuvu, 1983, p. 71)), presumably because burning is taken for granted.

[15] It should be noted that burning was not practised in some continually wet places, where an alternative slash-mulch system was practised, e.g., for *dalo* cultivation (Conklin, 1961, pp. 27-28). Also see Clarke (1971, pp. 68-69).

swiddens, presence of livestock, specific tools and techniques including special means of treating the soil, vegetation cover of land cleared, climate conditions, soil conditions, and topography. He noted the great amount of intercropping that occurred, and how any analysis of the productive efficiency of the swidden system should include all crops and all activities, and not just that of the main crop (in this case, dryland rice) (p. 152). Swidden agriculture is generally associated with low population densities and extensive rather than intensive use of labour (Pelzer, 1958; Watters, 1960b). In some regions, fields can be located long distances from the village, often with a two-tier arrangement where distant fields are cropped on a long-fallow basis and those near the village are cropped almost continuously (with additional inputs) (Nye and Greenland, 1960, p. 131). Abandoned, 'fallow' fields are usually not completely abandoned but serve as a reservoir for a diverse array of livelihood resources for many years (Posey, 1985). Social, economic, and political criteria are also important, and Conklin (1961) eventually included these in a broader and much more detailed classification that emphasised the diversity of local forms and practices that came under the umbrella of shifting or swidden agriculture (see also Brookfield, 1994; Watters, 1960; Conklin, 1957; Nye, 1960).

How sustainable are these methods?

How sustainable is swidden farming? There is a general consensus that societies with low population densities using swidden farming techniques with long crop-fallow ratios are relatively sustainable from a livelihood perspective given a stable and conducive environment[16] (Nye and Greenland, 1960, pp. 127) and experienced management[17] (Vosti

[16] Changing environmental circumstances, as in the Sigatoka watershed during the Little Climatic Optimum, may have undermined stability in Navosa (see p. 56).

[17] New immigrant settlers are often inexperienced, and suffer hardship in the learning phase (Vosti and Witcover, 1996, pp. 29-30), compared with experienced cultivators who have acquired human resources (indigenous knowledge) about how to manage natural resources.

and Witcover, 1996). They are usually associated with multi-layered polycultural systems (see p. 73), and are relatively versatile and self-sufficient in that they avoid the need for high levels of external inputs and subsequent dependency upon fossil-fuel energy and external infrastructure (Reijntjes, et al., 1992, p. 7). Soil nutrient levels are often well-maintained under extensive long-fallow cultivation (Barrau, 1959; Cassidy and Pahalad, 1953; Nye and Greenland, 1960, p. 127), and according to Twyford and Wright (1965, p. 214), one of the beneficial features of swiddening in Fiji was that soil erosion was not significantly increased (*talasiga* excepted (see pp. 47, 86), and compared to sloping sugar cane fields). Thus, sustainable livelihoods could be maintained.

Records of Navosa swidden practice are rare, but the following describes the most rugged part of Navosa:

> The Navatusila side [east side of the Sigatoka River, north of the Solikana junction] consists of stony hill-sides, bare and irregularly eroded into steep hills and sharp valleys with a small number of pockets that are cultivated and then allowed to have long fallows (Sukuna, 1952, p. i).

Thus, the Navatusila people recognised that only long fallows were feasible in that area, and practised accordingly.

There is a local division between *tavioka* places and *yaqona* places (Hashimoto, 1990). Most, but not all, Navosa villages have both types (Keiyasi, Draiba and Vatubalavu are exceptions) (F.I., 1998-1999). *Tavioka* tolerates drought and infertility, and is planted in the open on a variety of slopes and well-drained soil types, that are often relatively close to habitations (either village or remote hill residences). The degree of fallowing can vary from long-fallow to no fallow (i.e., permanent cultivation). Hashimoto's (1990) description is from Draubuta village:

> The 45 cassava gardens (46% of the total gardens) are found mainly in sunny and drier places on gravel terraces along streams and on slopes running from the lower forest zones to

the grasslands. (Hashimoto, 1990, p. 12).

There is a large degree of interplanting in *tavioka* places, combining the former mainly with plantains, coconuts, pineapples, sugar cane, bananas and yams (and rarely: *dalo, dalo-ni-tana* and *yaqona).*

By contrast, *yaqona* places 'are located in the forest zones on the higher slopes of the mountains ...' (Hashimoto, 1990, p. 12). This is because *yaqona* and *dalo* require moist, rich conditions, black soil for best growth, and *yaqona* requires shelter from the wind and excellent drainage (F.I., 1998-1999). The *yaqona* gardens were interplanted with mainly *yaqona, dalo, dalo-ni-tana, vudi, jaina,* sugar cane and a little *tavioka,* and were located 2-4 hours on horseback from Draubuta. In addition, there were a few exclusive *dalo* gardens, a sugar cane garden and gardens with other crops (Hashimoto, 1990, p. 12). There were a total of 97 gardens for this one village with an average of 5.7 crop species in each garden and an average area of 0.57 ha.

Thus, In both *tavioka* and *yaqona* places interplanting with other crops has been the norm. In other places, mulching and 'planting on the triangle' had been practised (Harwood, 1950). In some areas, dryland terraces were constructed on steep hillsides with the aid of 'bamboo palisades' to hold yam gardens (Parham, 1937, p. 16).

From an environmentalist perspective, biodiversity may be reduced and modified by swidden farming, but it does not seriously decline as in other forms of farming (de Jong, 1997; Harwood, 1996). Geertz, for example, considered swiddening to have conservation value because '... the swidden plot is not a "field" at all ... but a miniaturized tropical [and harvestable] forest' (Geertz, 1963, p. 25). The tropical swidden preserved the biodiversity of the forest, protected and shaded the soil and plants within it, and largely maintained the forests' role as a energy and nutrient storehouse (pp. 15-25). In sum, it 'maintains the general structure of the pre-existing natural ecosystem' (p. 16), and thus, under pristine conditions (and interpreted through the lens of 'thick

description', Geertz, 1973), swiddening is a sustainable system. Since then, ecologists have measured changes in biodiversity due to swiddening (Fujisaka, et al., 1998b; Fujisaka, et al., 2000) that have given some support to Geertz's view. These (detailed) studies found that biodiversity was: highest in primary forest, moderately high in swidden fallows, but low in pastures (Fujisaka, et al., 1998b). The introduction of new species in swidden partially compensates for those that are eliminated. The practice of burning vegetation for swiddening also contributes to global warming, but is much less significant than the effluence from the use of fossil fuels (Tinker, et al., 1996). Burning and deforestation cause large losses of carbon to the atmosphere (Fujisaka, et al., 1998a), but the carbon stocks of swidden areas begin to accumulate again with the regeneration of vegetation. Thus, carbon levels fluctuate according to relatively fast tropical episodes of deforestation and regeneration (Kotto-Same, et al., 1997; Zhang, et al., 2002).

The issue of the long-term sustainability of the resource base under conditions of increasing population and resource exploitation is less certain (Brown and Schreckenberg, 1998; Clarke, 1976). There are changes as access to markets and other factors encourage permanent settlement, population densities increase, cultivatable areas decline in abundance, closer crop-fallow ratios increase weed infestation (Seavoy, 1973) and reduce crop yields (Nye and Greenland, 1960), and burning is more frequent. The area of fallow forest is reduced, leading to replacement by grass, and more land is exposed to the possibility of erosion and degradation (Nye and Greenland, 1960, p. 127). The introduction of the plough in place of the cultivation-stick or hoe can result in severe erosion on steep slopes (Pelzer, 1958, pp. 127-128). All of these things reduce the resilience of the system and its sustainability.

Permanent cultivation of alluvial flatlands

Permanent dryland cultivation is strongly associated with the cropping of alluvial flats *(bila)* in Fiji, especially in the lower Sigatoka Valley and the coastal regions (Chandra, 1972; Twyford and Wright, 1965, pp. 214-215), but there is a lack of comprehensive information for Navosa. Chandra's (Chandra, 1978a; 1978b; 1979a) studies of agriculture in the Sigatoka Valley extended upstream to some sites near Keiyasi, Durumoli, Draiba, and Natogotogo on the southern margin of Navosa. There are localised areas of very fertile alluvial flats of various sizes (Belshaw, 1964b; Hashimoto, 1990; Woodward, et al., c. 1986), which are usually cropped in the winter months with low levels of external inputs (Chandra, 1972). The average size of *bila* farms is 1.4 ha along the river (Woodward, et al., c. 1986). The main crops planted by Fijians included: *tavioka,* maize, *kumala* (sweet potatoes), pumpkin, peanuts, watermelon, and *suki* (Fijian tobacco). Other crops include peppers, eggplants, plantains, bananas, potatoes, other vegetables, *dalo* and yams (Belshaw, 1964b; Chandra, 1979a; Department of Agriculture, 1997). Rice was planted for subsistence use by a few Indo-Fijian families at Durumoli near Keiyasi. Unlike swidden systems, these dryfield gardens generally have an open canopy with less species and crop segregation is the rule (Clarke, et al., 1999). Fallow times are short, and often equal to or shorter than cultivation times. Tillage is done by plough, either animal-drawn or tractor-drawn, and the whole field is cultivated.

Permanent 'swidden' cultivation.

Another form of dryland cultivation is practised where long-fallow swiddens were once preferred, but now permanent cropping takes place. This type is most commonly found on sloping land near permanent settlements and is sometimes called a short-fallow system although sometimes there is no fallow period at all (Clarke, et al., 1999). This type is increasingly common in Fiji, especially where *tavioka* is grown. Various methods of weed control are used, either sporadic burning of the low

vegetation (among existing crops) or the use of herbicide.

Because a long-fallow swidden is the most rewarding form of cropping system in most tropical hill situations, the presence of this type may indicate a changing pattern of agricultural land use (Clarke, et al., 1999, p. 356). Although production is less than a long-fallow swidden under traditional, low-input conditions; the advantage of having a cultivation area close to habitation and market transport may be compensation. Low yields, especially of *tavioka*, may be tolerated because of the convenience and the low labour inputs required, or alternatively, the conditions of higher weed growth and lower fertility may be compensated by the use of external inputs such as herbicide and fertiliser.

In many situations, these gardens are mixed with traditional swiddens in a complex and unstable pattern, and their existence (if identified) is evidence of a gradual process of long-term change towards permanent cultivation systems. This process can be easily overlooked when the differences are not discerned and only more stereotypical types of cultivation are perceived (Padoch, et al., 1998).

Swiddens: evolution and resilience

Watters (1960), who conducted research on indigenous Fijian agriculture, attempted to classify swidden agriculture. His first typology names eight ways in which swiddening is combined with other 'economic' types such as the gathering and hunting of wild foods, pastoralism, and permanent cultivation. This classification was framed to elucidate a theory of (Eurocentric) cultural evolution (ibid, p. 66), which was then a focus of intellectual endeavour also pursued by others (Birdsell, 1957, pp. 398-400; Sahlins and Service, 1960; White, 1959). These theories of cumulative change reflected the historical course of the development of temperate-climate European civilisation (e.g. agriculture: see Boserup, 1965, pp. 16-17). The trend began with origins that were found in kinship-based gathering and hunting societies, developed

through an intermediate stage of pastoralism, towards completion that manifested in a society based on property relations and permanent agriculture (White, 1959, pp. 281-302). The theory was unidirectional and teleological in that the trend of evolution was towards the circumstances of current European civilisation. Any trend that suggests a reversal of direction, such as a return to swidden agriculture following a stage of terrace agriculture, falsifies the theory. Watters found that this evolutionary approach was often incommensurate with the data from living cultures, and was therefore insufficient for a positivist explanation (Watters, 1960b, p. 66). Instead, he believed that diffusion was the best theory to account for change (ibid), but in many cases of swidden agriculture, diffusion appeared to have been halted:

> Consequently shifting cultivators had reached a stage of "ecological climax" beyond which little cultural evolution could occur until the whole ecosystem was disturbed. (Watters, 1960b, 95).

Thus, Watters implicitly recognised that swidden cultivation was the most efficient way to utilise natural resources for a livelihood in these tropical contexts. They had achieved a self-perpetuating (sustainable) system based on 'a common set of environmental conditions' (Watters, 1960b, p. 95). But Watters was perturbed that swidden societies were in a static equilibrium, and wishing change to occur, he believed that it was necessary for them to be penetrated by European society (p. 95). Watters later writings, mainly based on research in rural Fiji, were all focused on how to modernise 'unchanging' swidden society, but without regard for sustainability (Watters, 1960a; Watters, 1965; Watters, 1969a; Watters, 1969b).

Polycultural gardens, agrodiversity and agroecology

Most Fijian villages can obtain food from a large diversity of wild and cultivated plant and tree crops, sometimes planted as village or houseyard gardens (Thaman, 1990b). The term polycultural (Harwood, 1950) is a useful description for both crop biodiversity (Oldfield and Alcorn, 1987) and the agrodiversity of soil management practices (Reij, et al., 1996). The agrodiversity concept is also closely associated with the management of land, water and biota as a whole (Brookfield and Padoch, 1994, p. 9; Brookfield and Stocking, 1999), which includes both crop biodiversity and the diversity of soil and water management strategies. Indigenous methods of soil conservation are locally valuable but often overlooked (Ayers, 1995). Other forms of diversity such as insect and soil biodiversity should not be ignored (Pimentel, et al., 1992). Brookfield and Stocking (1999) suggest that agrodiversity can be divided into four main elements: (a) biophysical diversity (natural environment), (b) management diversity, (c) agro-biodiversity, and (d) organisational diversity (socio-economic aspects); which they argue are basic to understanding the interaction between natural biological diversity and human land use (p. 79). To some extent these categories overlap with the concept of livelihood diversity (Ellis, 2000).

The high degree of biodiversity in indigenous cropping and livestock farming aids the resilience and sustainability of the system by spreading risk (e.g., from pests), increasing tolerance to shock and stress and enhancing food security (Brookfield and Padoch, 1994; Netting and Stone, 1996; Thaman and Clarke, 1993; Thrupp, 1998). Agrodiversity helps food security when environmental conditions are highly variable as under shock or stress conditions associated with cyclones or droughts (Brookfield and Padoch, 1994, pp. 41-42). Wellbeing is enhanced with greater variety in the diet (Jansen, et al., 1990; Parkinson, et al., 1992; Pollock, 1992, pp. 53-55; Thaman, 1981b), and nutrition and health are assisted by the wider source of nutrients, medicines and vitamins

(Strathy, 1995; Thaman and Clarke, 1993). A high degree of dietary satisfaction may enhance the value and sustainability of the local culture in the face of increasing dependency upon imported foods (Pollock, 1993; Thaman, 1979; Thaman, 1982a).

The importance of polycultural gardens is often underestimated, partly because they are difficult to detect on the landscape (Brookfield and Padoch, 1994, pp. 7-8). Because they serve as a repository of a variety of indigenous knowledge and practice, they also serve to sustain the heterogeneity of cultures by their complexity and importance to local livelihoods and wellbeing (Clarke, 1995; Siwatibau, 1984; Thaman, 1988a; Thaman, et al., 1979). The three-way interrelationship between indigenous knowledge, polycultural livelihoods and environment is often sustainable (Alcorn, 1995; Clad, 1988; Croll and Parkin, 1992; DeWalt, 1994; Thaman, 1988a; Thaman, et al., 1979).

It would be a mistake to claim that indigenous knowledge was always linked to conservationist practices, however, because unsound environmental management has occurred (Baines, 1989; Clarke, 1990; Clarke, 1994; Thaman, 1986; Bahn and Flenley, 1992). In addition, caring behaviour in relation to the wider environment could be lacking, as indicated in situations where individual household decisions were privileged over the group, or households were in competition (Rutz, 1977).

Farmers choose different land management strategies according to the resources available to them and the variety of risks and uncertainties which must be overcome (Clarke, 1994; Scoones, 1996). Experimentation and the selective use of information is a characteristic of many farmers in many places (Brookfield and Stocking, 1999, p. 40; Richards, 1985). As a result, there is a diversity of techniques and strategies in land management (Clarke and Thaman, 1993; Wilken, 1987), including complex crop-management skills (Richards, 1989) and marketing arrangements (Netting and Stone, 1996). Thus, in any one place,

indigenous knowledge tends to change over time, reflecting environmental, cultural, market, or other changes (Brookfield and Padoch, 1994, p. 39; Richards, 1993). This can be viewed as both a strength and a weakness. It is a strength when the knowledge base maintains its relevance to context and sustainability. It is a weakness when knowledge associated with sustainable practices is replaced by knowledge associated with unsustainable practices.

Despite the reservations about practices in some situations, agrodiversity provides a foundation upon which indigenous soil and water conservation can be enhanced (Alcorn, 1995; Amanor, 1994, p. 230; Clarke, 1978; Clarke, 1990; Tengberg, et al., 1998).

Energy and sustainability

> If the goal of the Fijians is maximising calories per cost of input, then they seem to be doing this admirably well ... (Chandra, et al., 1974, p. 37).

This was the conclusion of research conducted on the energy efficiency of food crop production of Fijians farming on alluvial *bila* in the Sigatoka Valley (Chandra, 1979b; 1979c; 1981; Chandra and De Boer, 1976; Chandra, et al., 1974; Chandra, et al., 1976). High levels of efficiency were gained because root crops are biologically efficient energy storage systems (Coursey and Haynes, 1970), and the energy inputs were low. The efficiency ratio (in kilojoules, edible production/energy input[18]) of crops varied from 66 (Fijian farms, yams) to 2 (Indo-Fijian farms, cauliflowers). The highest efficiency rankings of Fijian farms were: 66 (yams), 60 (sweet potatoes), 52 (cassava), 39 (maize), 24 (bananas), 21 (*dalo*, dryland), 19 (irish potato), 17 (rice & passion-fruit), 15 (peanuts), 14 (watermelon & eggplant). Fijian farms had

[18] E_i = kJ produced by edible portion of crop i / kJ expendable energy used in crop i.

much higher efficiency ratios than Indo-Fijian farms which used more energy in inputs (Chandra, 1981, p. 15). Caution is needed in interpretation, because these figures are relevant to mid-valley *bila* agriculture only. *Dalo*, for example, is not well suited to relatively dry, humus-lacking *bila*, but yams are. In a wet site, with a different tillage technique, the ranking for *dalo* is likely to improve, as much as four times if inputs are held constant and it is grown under irrigated conditions (Kirch, 1994, p. 92). Chandra's figures are similar to the ratio (20:1) reported for crop production in a Maring society studied by Rappaport in New Guinea (Bayliss-Smith, 1982, p. 34; Rappaport, 1968, p. 52; Rappaport, 1971). Any of these figures are far more favourable than those for industrialised agriculture in developed countries (e.g., Japan, 0.41:1 (the lowest), and New Zealand, 0.62:1 (Conforti, 1997, p. 235)); which consume much larger amounts of nonrenewable fossil fuels (Clarke, 1978; Conforti and Giampietro, 1997), and therefore compromise long-term global sustainability (Biesiot and Mulder, 1994; Campbell and Laherrère, 1998).

Some qualifications are in order. First, the measurement of energy variables is often methodologically difficult and imprecise (Ellen, 1982, pp. 113-117). Second, there is contention about what inputs are either internal or external to the cropping system, for example, there is energy released (to both the atmosphere and returned as nutrient-laden ash) in the burned forest resource of swidden systems (Norman, 1978). Should the nutrient be taken into account as a fertiliser input? Should this be measured as just the amount in the nutrient, or the total amount of energy released by the inferno? How should this be distributed when the life of the swidden may vary from a few to many years? Fires are not the only contentious externality. What of landscape enhancement? Should the extra fertility gained from deposition as a result of erosion be included? These questions raise the existence of different hierarchical levels at which energy efficiency can be assessed, for example, the

household, societal or global ecological levels (Giampietro and Pimentel, 1991).

Those who wish to include environmental externalities in a more holistic system may argue for the environmental costing of the inferno or enhancement (Barbier and Burgess, 1997; Pearce, et al., 1990, pp. 97-100). However, the limitations of available data together with a lack of support from policy-makers make natural resource accounting difficult (Zohir, 1996, p. 28). In addition, wider issues of local versus global environmental history, consumption, equity and political ecology will intrude in the calculations (Adams, 2001, pp. 250-284). For example, consider the use of nitrogen fertiliser in industrialised agriculture (Smil, 1997). It is associated with the over-exploitation of fossil reserves and environmental pollution, and the increase in its consumption is expected to continue (Kawashima, et al., 1997). If the long-run external economic and environmental costs associated with the use of nitrogen fertiliser are taken into account, then it is likely that the energy efficiency ratios of industrialised agriculture will be even more precarious.

The importance of energy efficiency is that development can only be sustained indefinitely, ceteris paribus, if its energy budget is balanced, that is, if its inputs at least equal the outputs (Giampietro and Pimentel, 1992; Hall and Hall, 1993). By contrast, under the present capitalist system there are large incentives for people to exploit resources rapidly by consuming more inputs than producing food outputs and disregarding long-term sustainability (Hall and Hall, 1993). In the context of global political ecology, this has led to demands for a stable, equitable, steady-state society which will control over-exploitation (Daly, 1995; Giampietro and Pimentel, 1991; Goldsmith, 1972). In the context of Navosa, entry into this system carries a risk to livelihoods involving dependency upon external fossil fuel energy (Pollock, 1993; Rutz, 1977; Thaman, 1982a; Thaman, 1984). There is a danger that reliance on external sources of energy will lower the resilience of the local livelihood

system, and leave it under-equipped to maintain production in the face of shocks (Conway and Barbier, 1990, p. 11).

Carrying capacity and intensification

Both the concept of sustainability and the concept of carrying capacity share much in common. Different rural environments have varying levels of resources which can support different levels of population. In any given environment, increasing population tends to lead to greater levels of resource extraction which may endanger the sustainability of the resource, as Malthus forewarned in *An Essay on the Principle of Population*. When this happens, it is said that the carrying capacity of the system has been exceeded. The carrying capacity is a calculated judgement about the number of people that a given environment can support without generating land degradation (Street, 1969, p. 104). The carrying capacity, however, can be raised by using more intensive agronomic techniques (Brookfield, 1972), which may be forced by an increase in population density (Boserup, 1965). Agricultural intensification can maintain high and sustainable levels of production and human population, exemplified by some East Asian rice farming systems (Bray, 1994), and also the traditional Pacific *vuci* systems (Kuhlken, 1994b).

The calculation of carrying capacity of (especially polycultural) swidden cultivation is desirable in order to stabilise policy-making (Roe, 1995, p. 1066), but is fraught with many variables that are difficult to measure and that fluctuate over time (Brush, 1975). Using a model based on systems ecology, some analysts have suggested the simple option of fixing the maximum carrying capacity as that level of population that is homeostatically supported by the existing (usually long) crop-fallow ratio in a traditional swidden society (e.g., Conklin, 1957, p. 146). The societies whose practices fit this model are almost certainly sustainable, but few of these extensive systems remain. Most swidden societies are shortening their crop-fallow ratios (and therefore exceeding traditional

carrying capacities) under pressure of population increase associated with modernisation. These societies are no longer closed systems in homeostatic balance with their environment, but can be characterised as partially open systems that rely on external inputs to maintain their rate of change and increase their carrying capacity. Although carrying capacity is increased, sustainability declines because of higher risk and lower resilience.

FIRE AND LAND DEGRADATION

Fire is the almost indispensable tool of the swidden agriculturalist in tropical forest regions around the world (Bartlett, 1956; Bartlett, 1957). Fire can be used for diverse purposes as an ecological tool, as an economic instrument for livelihoods, and as a weapon (Masipiqueña, et al., 2000, p. 189).

In the case of Fiji, wildfire is most significant in leeward northwestern regions such as Navosa, which have pronounced dry seasons (Derrick, 1965, pp. 103-110) and ecological characteristics which make fire very difficult to control. By contrast, swidden fire is easily managed in the windward region of south-eastern Fiji where a year-round moist climate prevails.

Fire, Land Management, Degradation

Land degradation following uncontrolled fires has been and still is a ubiquitous and controversial phenomenon round the world (Crutzen and Goldammer, 1993; Goldammer, 1990). In Navosa, the deforestation and degradation caused by fire has also been controversial, as follows.

Watershed or tinderbox: a post-contact landscape

At the time of the first European observers, the southwest leeward landscape of Viti Levu was described from a visiting ship as:

> ... low shores with patches of brown, barren land ; then succeed narrow vales, beyond which rise hills, whose wooded tops are in fine contrast with the bold bare front at their base. Behind these are the highest mountains in the group, bleak and sterile, ... (Williams, 1982/1858, p. 8).

The implication to be drawn is that deforestation, if it occurred, had already occurred. The evidence suggests that:

> The major creation of grasslands has origins more in the prehistoric record and in the activities of the earliest settlers of the islands, rather than the inhabitants during the past millennium. (Brookfield and Overton, 1988, p. 96).

Widespread forest clearance using fire had led to the creation of grasslands in Navosa (see p. 56). Nevertheless, degradation was not confined to the past:

> Unfortunately these fires are still occurring, and only last dry season they laid waste to a great part of the province of Navosa. (Horne, 1881, p. 134) ... By burning the grass off the ground the soil is laid bare, and the surface is cracked and crumbled into dust by the heat of the sun. From the steepness of the ground in some places, the first heavy rain carries off the loose surface soil to a depth of several inches. (Horne, 1881, p. 133).

This account implies that grassland fires (probably uncontrolled) were associated with unsustainable land management. Horne was an English botanist, experienced in tropical conditions, who conducted a scientific survey of the vegetation of Viti Levu during 1877-1878 for Governor Gordon of Fiji (Smith, 1979, pp. 49-52).

The origins of concern

One year earlier, Gordon, in Navosa during his military campaign in the dry season of 1876, frequently made note of the conflagrations (Gordon, 1879; Gordon, 1901). For example: '...heavy fires all over the country. I wish those who make them could see what destruction they are causing [sic]' (Gordon, 1901, p. 88). His notes reflect a belief in his own superiority and an absence of reflexivity with regard to local knowledge, but they were typical of a colonial leader. From his statements, he seemed to believe that both his Fijian soldiers and the Colo people (his enemy at the time) were oblivious to fire which he perceived to have no other purpose but destruction. Fire was a cause of discomfort to him, but there is no indication that he enquired about the cause of fire. His trip was arduous, '... but that is nothing to the vexation which the universal fires, springing up everywhere, cause me.' (p. 97). It was apparent that Gordon had a keen aesthetic appreciation of scenery based on green vegetation and clear air. While near Navatumali, 'the Goths [sic] had set fire to the reeds close by, spoiling the pretty junction of the rivers' (p. 96), and, 'the only thing that disturbed my enjoyment of the glorious day and delicious air was the prevalence of smoke everywhere, and fires all over the country' (p. 98). He comes to the conclusion: '... verily this is a land wasted by fire' (p. 110), and had occasion to '... lecture on the iniquity of careless fire-raising', after leaving Navosa on his return to Nadroga (p. 619).

Deforestation and fire regulation

Thus, there was early colonial concern about the role of fire with regard to land degradation, and Gordon set about trying to control fire. In Fijian Regulation No. 1 of 1878 (applicable to indigenous Fijians only), Gordon commanded that a firebreak 'two fathoms wide' (3.6 m) should be cleared around a place intended for burning, and three days notice given to the *turaga-ni-koro* (village headman), who would arrange for an inspection and subsequent permission and supervision for the fire

(Government of Fiji, 1883, p. 32). In addition, an ordinance (targeting non Fijians, and with similar content) was enacted in 1878 'for the better prevention by accidents by fire' (Legislative Council, 1878).

The colonial government attempted to enforce fire prevention (sometimes using draconian techniques). Fire wardens were employed and *turaga-ni-koro* had the authority to punish offenders (with up to six months jail). Apparently, these methods were partially successful (F.I., 1998-1999), unlike a parallel context in Madagascar where local farmers, using fire as an agro-pastoral tool, rebelled against draconian colonial impositions and carried-on burning regardless (Kull, 2002. p. 60). The advent of Fijian independence (in 1970), however, caused a general relaxation of control. The fire regulations were associated with the colonial regime and Fijians wanted independence from colonialism. Fire wardens were no longer employed (responsibility was passed to the police) and the ability of *turaga-ni-koro* to enforce the fire prevention laws was undermined. A decree in 1969, on the verge of independence (Government of Fiji, 1985a), prohibited the unauthorised burning of vegetation over a large part of the leeward region (including Navosa) in the dry season from 1 July to 31 December of any year. This law, and other fire prevention laws (which are essentially unchanged from their colonial origins (Government of Fiji, 1985b)), are ignored and not policed.

Plantation fires

No records of Navosa grassland wildfires have been kept, but there are good records of forest fires in plantations further to the west. In most years a portion of the pine plantations managed by Fiji Pine Limited (FPL) to the west of Navosa are destroyed by fire damage. For example, 8,566 ha were destroyed over the 10 year period between 1987-1997 (Were, 1997, p. 9) out of the total of 43,201 hectares held in 1997 (Fiji Pine Limited, 1997). In addition, many areas are burned but not destroyed. For example, there were no plantations completely

destroyed in 1992 but firecrews fought 156 plantation fires which burned 2,905 hectares, fought 56 wildfires near pine plantation boundaries, and undertook 952 control burns over 1,642 hectares (Fiji Pine Limited, 1992).

The worst years, 1987, 1988 and 1994, were years exacerbated by El Niño climatic events and government elections (1987 was also a coup year) (Were, 1997, p. 9). The causes of fire in FPL plantations between 1995 and October 1997 were: (a) arson (51%), (b) spillover (from adjacent farms, 39%), (c) grazing (7%), (d) relights (poor workmanship of FPL employees, 2%), and (e) lightning (1%). The cause of the high arson rate involved conflict with landowner communities. Issues included low returns, loss of alternative means of income, lack of employment prospects for community members, drying-up of community water supplies and other resource degradation, social equity issues, and party politics. In order to lower the rate of loss, prescribed burning for fuel reduction is being experimented with, and attempts were being made to increase benefits to landowners.

Fires are also associated with the sugar industry. The rate of burning of sugar cane fields has increased steadily from a rate of 19 percent in 1968 to an average of 62 percent in 1997 (Fiji Sugar Corporation, 1998). Over 95 percent of cane burning is deliberately started by the farmer. The residual 5 percent is attributed to either lightning (1%), carelessness or neighbourly sabotage (Davies, 1998, p. 4). Cane fires sometimes spread to grasslands, forest and pine plantations thus contributing to the increased prevalence of wildfires.

It is apparent from this information that El Niño drought effects, political and livelihood concerns figure relatively highly in the cause of plantation fires, and that local farmers commonly light fires to serve their own interests. What was the situation in the Navosa grasslands?

Fire and grassland

According to prehistoric evidence, the impact of human occupation on Navosa quickly became evident in the form of large-scale burning and deforestation which led to the spread of grasslands (Dickinson, et al., 1998; Southern, 1986) (see p. 56). It was the burning of these grasslands that Governor Gordon, and other commentators, objected to.

An important question, answered only imprecisely by the literature, was the nature of the grassland. *Mauniba (Pennisetum polystachyon*, also called *laulau ni manivosi*, mission or mongoose grass), now dominates the grasslands of Navosa. It was first introduced into Fiji in 1920 (Wright, 1920), is generally unpalatable to stock, and is now regarded by many as a weed species. But what grasses existed prior to the introduction of *mauniba?* According to Parham (1955, p. 10), it is normal to find only one dominant species of grass in any region of Fiji, and the common native grass in Navosa is *gasau (Miscanthus floridulus)*, commonly referred to by Europeans as a reed, probably because it is very tall with thick, straight stems and grows in dense stands.[19] *Gasau* is a grass of forest margins (ibid, p. 11). Lemon grasses *(Cymbopogon sp.)* were also present up to 1925 (Twyford and Wright, 1965, p. 195). Additional information comes from Horne, who travelled through Navosa making observations:

> The village of na Moali [sic, Namoli?] lies in the region between the wet and the dry parts of Viti Levu. Open grass-covered hills,[20] which are interspersed park-like with clumps of forest, are characteristic of this locality. (Horne, 1881, pp 39-40).

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[19] *Gasau* is properly a grass. I object to the use of the term 'reed' on the grounds that reeds are commonly associated in other countries with wet, poor soil. *Gasau* commonly grows on well-drained soils of medium to high fertility.

[20] Because Horne distinguishes grass from 'reeds' on several occasions, then the 'grass-covered hills' may be composed of grasses other than 'reeds', for example, lemon grass (see p. 84). But because Horne's descriptions of distant views are general rather than particular, I doubt that he is making this distinction here.

In addition, 'the gasau grass or reed ... is by far the most abundant, covering whole sides of hills ...' (p. 69), and 'bamboos, ... are numerous' (p. 69).

Today, however, *mauniba,* which is pyrophytic, has supplanted *gasau* as the dominant grass in Navosa and covers large areas of poor to medium fertility land:

> This aggressive grass community ... has been established by frequent firing and is maintained as an induced, exotic, pyric, disclimax vegetation community by continued firing .... (Cochrane, 1968, p. 114).

Because it is pyrophytic, it resists and even encourages repeated burning, which causes greater erosion resulting in lower soil fertility, and lessens the chance of encroachment of fertility-preferring species such as *gasau* or *bitu* (native bamboo, *Schizostachyum glaucifolium)* which provide better ground cover. In addition:

> The infiltration capacity of soils supporting induced savanna vegetation *[mauniba]* is much less than that of similar soils in areas still under bush cover, so that surface runoff is high. Stripping of top soil by sheetwash not only renders the hill slopes less valuable for future agricultural, pastoral or other economic activities, but also results in siltation of streams and increases the flood hazard ... (Cochrane, 1968, p. 114).

There is a vegetation gradient observed generally in Nadroga-Navosa and Ba provinces, a simplified outline of which is presented here (for more detail see Cochrane, 1969). The current vegetation climax is, for the most part (with the possible exception of *talasiga* areas, see below[21]), native forest. Where forest is burned repeatedly, it tends to be replaced by *gasau* (higher slopes) or *bitu* (lower slopes). If *gasau* is burned

[21] It is uncertain whether the *talasiga* lands are naturally impoverished, or created as the result of repeated burning over generations (Ash, 1992, p. 121). But under current circumstances, it is certain that burning is advancing degradation (Cochrane, 1969).

repeatedly (sometimes as little as twice (Cochrane, 1969, p. 130)), it is replaced by *mauniba*, and repeated firing of *mauniba* on poor soils may lead to the most impoverished *talasiga* vegetation dominated by bracken ferns, although this is often confined to spurs in Nadroga and Navosa.

Cochrane (1968) believed that Fijians (in the dry Ba province) exerted 'a small local effect upon the landscape' (p. 115):

> Fires used by Fijian villagers to prepare plots for shifting agriculture are usually small and localised. When the plots are abandoned they are rapidly invaded by species from the flanking bush and the process of regeneration is relatively rapid. (Cochrane, 1968, p. 115).

Nevertheless, the important opinion of the Commission of Enquiry into Natural Resources, the 'Burns Report' (Burns, et al., 1960), some of which was subsequently incorporated into government policy (Legislative Council, 1960), was ambivalent, and curious.

The 'Burns' Report

The (colonial era) Burns Report, in concert with the Spate Report (Spate, 1959), represented the first major post-war enquiry into the potential for the exploitation of natural resources in Fiji. The authors of this report had the benefit of many sources of information (including 612 memoranda from the public — 295 from Fijians, and oral evidence from 79 Fijians),[22] but the visit to Fiji by the main authors was very brief. On a three-day trip around the coast, they passed through Sigatoka (it is unlikely that they visited Navosa), and surveyed the region from the air on one day in the dry season month of July.

Under the heading *Grass burning and talasiga*, they were aware of the 'severe and extensive damage caused by fires which annually sweep across the drier areas' (p. 76), but they were more concerned with the

[22] Unfortunately, details on the location and social position of the informants was not mentioned.

soil erosion of cultivated areas:

> Many witnesses were at pains to emphasize the serious damage which grass fires annually cause to both soil and property particularly in the dry areas; some mentioned the evils of uncontrolled grazing and overstocking; but all too few appeared to take the same lively interest in the disastrous effects of soil erosion when caused by the careless and improper use of cultivated land. (Burns, et al., 1960, p. 73).

They linked the view of their informants with the Fijian Regulations which prohibited and regulated the burning of grass (p. 73), thus implying that their informants were merely reflecting official attitudes (i.e., the regulations about fires), rather than reporting issues such as erosion: '... matters concerning the conservation of cultivated land are conspicuous by their complete absence' (p.73). The lack of local reporting of concern about erosion is an important finding; but the authors of the Burns Report disregarded their local informants' knowledge in favour of their own extralocal opinion when they decided to pursue the latter against the former. About the same time as the Burns Report visit, the foremost Fijian soil conservation specialist had described repeated burning as '... the greatest single cause of soil erosion in Fiji' (Whitehead, 1958, p. 7). Why should the Burns Report contradict this view by arguing that degradation in the form of soil erosion from *cultivated* land is the main problem, especially when their informants (in written memoranda) appear to be saying that controlling the destruction of land by fire is most important? After all, denudation by fire was the main technique used in clearing the land for cultivation.

What lies behind the dismissal of local views by the Burns Report? First, because of their brief visit, they could not have observed seasonal events, such as the severe erosion that might occur in November or December from sloping grassland bared to the elements as a result of fire. Second, they associate grass with pasture for grazing animals, and

have a stereotypical (temperate-climate) belief that this is beneficial for soil conservation:

> A suitable and well-managed pasture is not only the best antidote against soil erosion, but is also a soil improver (Burns, et al., 1960, p. 75).

It is now well-known that natural forest is the best soil cover to prevent erosion, so their first statement is ill-founded. Forest regrowth (or agroforestry techniques) are almost always preferred to grassland as the best methods to restore fertility in tropical swidden fallows on sloping land (see p. 67), so the second statement is highly contentious. They do offer a qualification to the effect that indiscriminate burning of pastureland is bad, but their overall perspective is similar to that of a pastoral advisor who wishes to promote rangeland grazing on the hills:

> Grass burning as such, therefore, should not necessarily be condemned in a cursory manner; if properly and carefully used at the right time of the year it can be a "valuable implement" in the hands of a competent farmer, but uncontrolled it is a serious menace. One of the best and quickest ways, of course, of reducing the annual fires which sweep across much of the unoccupied range-land is to encourage an expansion of farming and ranching in these areas. (Burns, et al., 1960, p. 77).

They discuss the introduction of *mauniba* in Fiji in 1920, which was tested at Nasinu agricultural station and released in 1922 (Twyford and Wright, 1965, p. 195). Instead of being beneficial, they recognised that it 'had done much to aggravate both range fires and soil erosion' (Burns, et al., 1960, p. 76).

> However, as the question of grass burning is a very complicated matter and when *properly used* can, in certain cases, be of great assistance to the management of grassland ... (Burns, et al., 1960, p. 76).

They continue in this vein and it becomes apparent that they view fire as a necessary tool for the establishment of pasture. They defend the spread of *mauniba* (which is palatable to grazing animals only in its very young stages (Parham, 1955, p. 104)) as a soil-improving nurse crop to establish the better quality *Nadi* blue grass *(Dichanthium caricosum),* and also as a replacement for bracken fern on *talasiga* land. This argument is flawed, however, partly because it assumes that repeated burning will decrease after replacement by *mauniba.* The reverse has occurred (Cochrane, 1969, p. 123). They also seem to believe that *mauniba* improves *(talasiga)* soil, but the predisposition to increased burning will destroy any possible benefits here. Their arguments throughout suggest that they are aware they are disregarding the complaints of their local informants. Their focus on erosion caused by cultivation, albeit understandable in the case of sloping sugar cane and ginger farms, disregards the importance of erosion caused by excessive burning on land covered by *mauniba* grass. Thus, despite the local resources at their disposal, and the strong local discourse against the spread of *mauniba* and fire as causal agents of land degradation, they concluded by promoting a rangeland model of land use that became government policy (Legislative Council, 1960, p. 2), without fully articulating with local concerns, and without a proper evaluation of its appropriateness in local conditions.

Did burning increase over time?

Another important question is the degree to which Navosa burning either increased or decreased over time, especially in the 20th century. Unfortunately, there are no records that quantify burning, and an interpretation must be made from written records, oral histories and aerial photographs.

A difficulty with written and oral accounts is that what is being reported may have different meanings. Several different factors can be weighed differently by different people to describe excessive burning.

These include the frequency of local fires (sometimes more than once per annum), the season in which they occur, the areal extent of the burn, the type of vegetation that is destroyed, how spectacular the blaze appears (Burns, et al., 1960, p. 76), the amount to which it is uncontrolled, the degree to which immediate damage is caused to local resources (e.g., crop gardens), the degree to which fires degrade land over time, and how they effect livelihoods.

Aerial photographs were available from 1950, and have been made periodically since then (often after cyclone damage). The general pattern of vegetation between 1950 and 1994 appeared to have changed little (see p. 287). However, the lack of resolution in the 1950 photographs made detailed comparisons very difficult.

There were many unspecified complaints that the amount of burning was increasing, as reported in most of the literature, through the mid twentieth century, and especially after *mauniba* became established (Burns, et al., 1960; Cochrane, 1968; Cochrane, 1969). However, it cannot be ascertained from the evidence available whether increased burning was a fact, or merely a continuing general complaint similar to those of the past (e.g., Gordon, Horne, see above). Again the Burns Report opined that:

> With the rapid spread of the tall [sic] Mission Grass over the last 20 or 30 years the fires themselves may appear more "spectacular" and so give the appearance of being worse. (Burns, et al., 1960, p. 76).

Unfortunately, this explanation is incorrect in most of the Navosa context. Grasses such as *gasau* and *bitu* are much taller than *mauniba,* and a *bitu* fire is far more spectacular (and noisy) than a *mauniba* one (F.O., 1998-1999). Their argument may be relevant, however, in cases where *talasiga* fernland was invaded by *mauniba.*

One factor often overlooked was the increasing population in the period after about 1920. The tragedies of the late 19th century had

decimated population levels, and it can be expected that burning was less in this time, especially with grazing animals not yet common. After 1920, the population began to recover, and other things being equal, more people will light more fires. The introduction of livestock and the development of grazing techniques may also have encouraged fires over a larger area.

Animals, grazing and fire

The Fijian villager usually keeps a few animals, which absorb labour, but this labour is spread throughout the year. 'The animals provide meat for home consumption, insurance against unexpected cash demands and difficult times and for social and religious obligations' (Tubunakawai, 1986, p. 109).

Pigs *(vorei, vuaka, Sus scrofa)*, either domesticated or wild, have existed in Fiji at least after 1774 (Twyford and Wright, 1965, p. 194), but are believed to have arrived with earlier Lapita settlers, along with the dog *(tui, koli)* and the fowl *(toa)* (Green, 1963, pp. 240, 244-245; Kirch, 2000, p. 111). Wild pigs are relatively common in the forested *(veikau)* interior. Goats *(me)* are less common in Navosa than other more densely populated areas, but horses and cattle are common. Horses *(ose)* are the main form of transport. Cattle *(bulamakau, bulaka)* were present in Fiji after 1857, and later introduced to Navosa and other dry areas. But, '... to provide succulent feed during the dry season, the practice of burning the *rangeland* [emphasis added] was adopted ...' (Twyford and Wright, 1965, p. 194), probably by European graziers (F.I., 1998-1999). However, '... while this resulted, in some areas, in temporary enhanced pasture values, it has always been accompanied by loss of soil material' (ibid):

> In areas where the soil had only a weak regenerative mechanism, continual burning resulted in severe soil deterioration (as well as erosion) and often only talasiga vegetation (fern) became the only plant life the soils could support. (Twyford and Wright, 1965, p. 194).

As early as 1920, a survey of pastoral areas confirmed that 'pastures were overstocked,' and 'that the only successful graziers were those with areas of river flat invaded by *para* grass' *(Brachiaria mutica)* (ibid, also Rainey, 1920a, 1920b). Thus, early on, cattle were recognised as profound agents with regard to the sustainability of grassland and soil resources on sloping land by agricultural experts.

The first census of livestock was in 1901 (Colony of Fiji, 1901). There were no figures for Colo districts, but neighbouring Nadroga had: (a) 292 cattle, (b) 12 horses, (c) 483 goats, and (d) 93 pigs, which almost certainly indicates that the density of grazing animals in Navosa was extremely low at that time, and the relative importance of wild pigs was probably much higher. By 1920, there were 6,500 cattle and 1000 horses in the combined Nadroga and Colo West provinces (Rainey, 1920b). In 1933, European and Indo-Fijian farmers were lighting fires to improve grazing (Sykes, 1933, p. 7), but this practice was not attributed to Fijian communities, which suggests that grazing animals were relatively uncommon around Fijian villages. By contrast, Fijians were lighting fires '... to stimulate the growth of wild yams and keep wild pigs away from their gardens ...' (Sykes, 1933, p. 7). By 1968, the cattle population for the whole of Nadroga-Navosa was 13,975 including 4,734 bullocks (Legislative Council, 1969, p. 47), with 6,822 horses (p. 49). The cattle population of the combined Ruwailevu and Navosa 'new' *tikinas* within Nadroga-Navosa province (listed as 'all others' in the census table) was 4,597 including 1,068 working bullocks. Unfortunately the 1991 agricultural census lacked the finer details of the 1968 census, but the general increase in the number of grazing animals is great. By 1991, the Nadroga-Navosa cattle population had increased approximately four-fold to 55,286 animals including 11,300 bullocks (Ministry of Primary Industries and Co-operatives, 1992, p. 112). However, the number of horses had increased less than two-fold to 11,245 horses (p. 118). Unfortunately, separate figures for Navosa could not be obtained, but as

Navosa is perhaps the best pastoral area of Nadroga-Navosa as a whole (especially for horses (Rainey, 1920b)), the figures are likely to be analogous except that a lesser percentage of bullocks and a higher percentage of horses might be expected. It is apparent that the cattle population was increasing drastically, and faster than the increase in human population (see p. 205).

The Navosa goat population appeared to be increasing but insufficient census data was available to make worthwhile inferences about the rate of increase. It is opportune here to criticise the availability of local, within-*tikina* agricultural census data.

The increase in the number of grazing animals was causing an impact on the village environment. The burning of lands close to a village for grazing was alienating that land from potential use in growing crops. As a result, villagers were forced to either cultivate on shorter fallows or move further afield for cropping (Cochrane, 1968, p. 115).

Some improvement in stocking capacity arrived with the introduction of *vaivai (Leucaena leucocephala)*. This small leguminous tree was introduced before 1867 and serves as a useful agroforestry fodder tree in dry conditions in some localities (Partridge and Ranacou, 1973; Partridge and Ranacou, 1974; F.O., 1998-1999).

Vetiver grass, tenure, security and conservation

Vetiver grass has been used for at least 200 years in Tamil Nadu, India, as a hedge plant to aid soil conservation (Warren, 1991, p. 22), and was introduced to Fiji about the beginning of the 20th century. During the Fijian colonial period, there was a very active, and internationally-known, vetiver grass *(Vetiveria zizanioides)* conservation program targeting sugar cane fields. Unfortunately, vetiver only exists as remnants today (Gawander, 1998b). Why did this system deteriorate? One explanation is the low level of commitment of tenant farmers under low-security socio-economic and tenurial circumstances. Many

tenant sugar cane farmers view their future livelihood with uncertainty (Overton, et al., 1999, p. 176).

Vetiver is still being promoted, but in the much smaller and fragmentary areal context of commercial vegetable farms on sloping land (F.I., 1998-1999; F.O., 1998-1999). On these farms, damage by soil erosion has an almost immediate effect on livelihoods, and conservation is supported.

In Navosa however, direct state-promoted intervention is rare and land management tends to reflect the tenurially secure but usually short-term ambitions of indigenous farmers working with a neocolonial bureaucratic system that occasionally competes with, and occasionally hybridises with, traditional leadership arrangements (Belshaw, 1964b; Lasaqa, 1984).

CULTURE AND SOCIAL ORGANISATION

Unlike many other minority cultures in the world system, traditional[23] Fijian culture has preserved much of its distinctiveness in the face of developmental changes (Bainimarama, 1991), partly due to the continuation of indigenous Fijian political power (Lawson, 1997; Norton, 2000; Scheyvens, 1999, pp. 58-59), the continued importance of kin networks (Toren, 1999b, p. 27; Turner, 1987), and the flexibility of the local action-orientated view of culture (Toren, 1988). In this broad sense, Fijian culture and its social structures have proved to be sustainable. It is recognised that traditional cultures usually persevered by maintaining a sympathetic interpenetration (or accommodation) with their environment, in this case the *vanua* or land-people nexus, based on maintaining their livelihoods in the face of shocks and stress (Clarke,

[23] I use the term 'traditional' as a heuristic descriptor, but recognise that societies are in continual change and tradition is always relative to present time, whenever that may be. Sahlins (2000, p. 49) asserts that Pacific societies were neotraditional by the time of the first anthropological studies, that is, their traditional stage had past. His view reflects an evolutionary stage theory.

1977; Clarke, 1990; Sahlins, 1957; Thompson, 1949a; Thompson, 1949b). In general, the traditional Fijian society and its polycultural livelihood system have persevered, but increasing stress is occurring as rising populations and enlarged commodity-consumption patterns consume more local resources (Clarke, 1991; Thaman, 1981a; Thaman, 1986; Thaman, 1989).

Culture and Custom

Much is distinctive about the culture of Navosa, but this (selective) account will focus on those aspects of culture that are believed to be related to the sustainable use of resources.[24]

Culture history

The earliest recorded inhabitants of Fiji were named the 'Lapita people' after their distinctive style of pottery (Green, 1963). Pottery is still produced by local artisans at some villages in Fiji (Geraghty, 1996; Palmer, 1966/1971; Rossitto, 1992), including the remote village of Nakoro in Navosa (Palmer and Shaw, 1968), and at other Navosa villages in the past (Geraghty, 1996. p. 422; Palmer and Shaw, 1968, p. 86). Pottery-making in Fiji is the almost exclusive preserve of women, who once produced many types for different purposes, including cooking pots (Geraghty, 1996). Unfortunately, the craft has declined since the nineteenth century.[25] Locally-made *kuro* (pots) were important as exchange items at community *solevu* (large gatherings), especially marriages (Palmer and Shaw, 1968, pp. 86-87).

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[24] It should be noted that Fijian culture is very complex, has changed over time and from place to place. This description is that of a relative outsider. Detailed explanations of the Fijian ethos in practice from an insider perspective are in Ravuvu (1987) and Nayacakalou (1975).

[25] Food was steamed rather than boiled in earthenware pots, and thus nutrition and taste have been lost since non-earthenware pots were adopted (F.I., 1998-1999).

Solevu, community, exchange and identity

Solevu means 'large gathering',[26] but they can vary in size from relatively small to very large community events. There is variation: each district, or village, in Fiji has its unique cultural traditions, and the process of each gathering will vary accordingly. In general, *solevu* are associated with large feasts *(magiti),* recreation (song, dance, humour & courtship), meetings, and an exchange ceremony (Belshaw, 1964b, pp 126-153; Hashimoto, 1984, pp. 27-29). These events are customarily held in relation to the circumstances of birth, marriage and death (Thomas, 1991, pp. 192-193), but can also be organised for large cooperative projects such as building, and on religious or political occasions (Belshaw, 1964b; Turner, 1987). *Solevu* involve *tovo vakavanua* (customary ways), and thus are a central expression of traditional Fijian culture (Hashimoto, 1984; Turner, 1987). They serve to heal social differences and disputes, create solidarity, and redistribute resources (Hashimoto, 1984; Rutz, 1978). The contributions to *solevu* were once dependent upon what could be sourced from the local environment (e.g., yams, *dalo),* or obtained by barter from others (e.g., *kuro* (pots), *masima* (salt blocks), *tabua* (decorated teeth of the sperm whale), *ibe* (mats, *Pandanus sp.)* and *masi* (barkcloth)).[27] It is not well documented but it is likely that the opportunity to exchange local Navosa produce (e.g, *yaqona, masi)* for nonlocal items (e.g., *kuro, masima)* was much more important in the past (Palmer and Shaw, 1968, pp. 86-87), and *solevu* provided an excellent opportunity for barter to take place. Thus, the *solevu* served many functions. Today, exchange items (including *tabua)* can be accumulated beforehand by purchase through a money transaction (Thomas, 1991, p.

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[26] Hashimoto (1984, p. 28) interpreted the term to mean the gift exchange ritual and farewell ceremony component of a longer *veiqaravi* or *magiti* (feasting) event at Viwa, eastern Fiji. In Matailobau (Colo East), weddings and funerals were only clearly underway when women have given their mats (Turner, 1986, p. 230). Navosa people refer to the whole event as *solevu.*

[27] *Masi* is made from the inner bark of *Broussonetia papyrifera.* Further details on these ritual exchange items is in Toganivalu (1917) and Tatawaqa (1913).

192). This has led to a few changes. For example, *masi* is rarely produced now, but it was once made at Nasauvakarua village in Navatusila district, and then taken to Nanoko village (one or two days walk away) where it was printed (Roth, 1934). Other exchange items include bundles of *kakana* (usually *tavioka, dalo),* 20L drums of kerosene, *masima, ibe, yaqona* and *tabua.* Large quantities of *kakana,* kerosene, *masima* and *ibe* are usually exchanged (Thomas, 1992c, p. 214), although there are seasonal and regional variations (e.g., *kuro* were prominent when Nakoro people were participating (Thomas, 1992c, p. 214)). Several cattle, pigs, or both are contributed for slaughter and consumption during the *solevu* (Belshaw, 1964b, p. 135). Culture, exchange and community solidarity intermingle closely during a *solevu:* 'all sorts of things were exchanged: *tambua, yanggona, imbe* [sic], pigs, sermons, handshakes, daily services, cheers, traditional dances, good wishes, etc.' (Hashimoto, 1984, p. 28).

Despite the changes of modernisation, the ritual of *solevu* has not been threatened, but appears to have grown stronger, at least in the scale of contributions (Spate, 1959, pp. 25-26): although this may be illusory when compared to increases in per capita money income (Rutz, 1978, p. 800). In addition to the local social, economic, and cultural reasons for holding *solevu* (Thomas, 1991, p. 190), the *solevu* may also represent Fijian solidarity and identity against that of politically competing ethnic groups (Hashimoto, 1984, p. 28), and other outsiders (Thomas, 1992c, pp. 223-224). However, Norton (1993a) argues that 'the cultural elements of identity derive their character and reinforcement more in the dialogue between different contexts of action among Fijians, than in a disdainful opposition to other groups' (p. 748).

Kerekere, welfare and redistribution

The everyday Fijian practice of soliciting things (*kerekere*, deemed illegal by colonial authorities) has attracted much administrative and scholarly attention (Sahlins, 1957, pp. 203-213; Spate, 1959; Thompson, 1972/1940, p. 85; Toren, 1999b, p. 35). Colonial authorities tried to eliminate *kerekere* because they believed it would inhibit productivity and economic growth (Spate, 1959), despite arguments to the opposite effect (Sahlins, 1993, p. 862), and particular mores or rules about its appropriate use (Sahlins, 1962, p. 204). *Kerekere* has various social functions (Sahlins, 1957, pp. 203-213), including being a means by which a resource-poor person could obtain the use of physical resources to aid their livelihood: thus allowing the redistribution of wealth and enhancing community welfare (Sahlins, 1962, p. 205; Thompson, 1972/1940, pp. 84-85). Reciprocity, exchange and status are involved:

> Under the soliciting system a man loses face if he refuses to give up property solicited by a relative. However, the recipient is under obligation to the donor, who has the right to retaliate by soliciting something of greater value from him at some future time. (Thompson, 1972/1940, p. 85).

If someone makes a request that is satisfied, but cannot reciprocate later, their status within the community is affected (Ravuvu, 1987, p. 250), despite the sustenance to their material well-being. *Kerekere* does not differ in principle from other types of exchange such as the *solevu*, in that 'the ... principle of gift exchange emphasises communal industry and group prestige rather than individual enterprise' (Thompson, 1972/1940, p. 86). In effect, together with *solevu*, *kerekere* serves to materially sustain the community.

Yaqona and sevusevu

Any visitor to a Fijian village is welcomed by way of a *sevusevu* ceremony involving the drinking of a preparation from the roots (or lower stems) of the *yaqona* plant *(Piper methysticum).*

> The *yaqona* ceremony and the *sevusevu* — or presentation of the roots of the plant — are the central rituals of Fijian social life. (Toren, 1999a, p. 33).

The *yaqona* beverage (also *kava,* grog) is alkaloid-rich and induces relaxation and a mild trance-like state, among other effects (Lebot, et al., 1997; Lester, 1941; Lester, 1942; Tokalau, 1990). *'Yaqona*-drinking is today the prime ritual manifestation of the traditional social order, where chiefs and elders are paid tribute ...' (Toren, 1999a. p. 37), and symbiotically, others learn to embody local history (Toren, 1990; Toren, 1999b). In a similar way to ceremonial drinking in other societies (Dove, 1988), the ritual of drinking *yaqona* serves to maintain identity, create social solidarity and maintain important livelihood networks in a process of socio-economic integration. Thus, the ritual of *gunu yaqona* (*yaqona*-drinking) is central to cultural sustainability.

However, in addition to being a gift and tribute, *yaqona* is also a commodity which earns a financial return, and money lessens the need for socio-economic integration (Dove, 1988, p. 172). Thus, there is a tension between the (unifying) traditional and the (divisive) financial role of *yaqona.* The Fijian strategy is to keep the two realms of *yaqona* as far apart as possible. When money is involved, drinking *yaqona* together is called *gunu sede* (*gunu lavo* in Navosa) (drinking cash) (Toren, 1999a, p. 38). The long-term effect of this division is questionable, however. High market prices may stimulate the production of yaqona for income, thus eventually weakening its traditional role.

Language

Identity is also closely allied to the use of vernacular language. The language of Fiji has been sustained over time, especially the regional variant of *Bau* (a very small, but very powerful island), which is now the standard language of Fiji taught in schools, although Hindi and English are also commonly spoken and taught. There is a major language division between eastern Fijian and western Fijian (Navosa is largely western), and in addition, there are many communalects or dialects. The Navosa region has about four communalects, although they overlap on many features (Schütz, 1962, pp. 28, 37, 64, 66, 155). The Nasikawa, Noikoro, and Navatusila districts tend to share unique communalects but the pattern of differences does not follow district boundaries and individual villages may have unique terms. Because of clan exogamy, children are usually exposed to the different dialects of each parent (Schütz, 1962, p. 4), and thus there is considerable knowledge and flexibility in the use of local dialects and Bauan (standard Fijian). However, visiting Fijians who only speak Bauan are unable to understand the local communalect without local help (Palmer and Shaw, 1968, p. 81).

There was a strong local pride among three Nakoro potters who insisted that local terms be used in preference to Bauan (ibid, p. 81). This demonstrates that cultural identity is closely associated with a way of doing things, in this case making *kuro* (a distinctively local occupation), rather than being an abstract notion.

Identity, totems, ecology and *vanua*

The people of the interior of Fiji have been known as the *kai* Colo, or mountain people. Their oral history is unclear, and has been undermined by the adoption of Christianity and other social changes (France, 1966). There are no written histories apart from fragments of their war exploits (e.g., Sukuna, 1952), genealogical history (e.g., Brewster, 1920a), and many observations made by early Europeans (Brewster, 1920b; Brewster, 1922; de Marzan, 1987; Graeffe, et al., 1986/1868; Small, 1909; Tischner, et al., 1984; Webb, 1890). Nevertheless, totemic relations between people and various plants or animals have been recorded, especially in *kai* Colo regions.

Totems

In the 19th century, totemic relations between particular plants or animals, and clans, were relatively important to the interior highland cultures of Viti Levu (Roth, 1973/1953, p. 56). The beliefs and practices were described by early administrators and anthropologists, who tried (usually unsuccessfully) to fit the facts to an evolutionary theory based on the development of stages of social organisation (Rivers, 1908, p. 133; Schmidt, 1908). It was believed that each totemic entity had an important spiritual value, and each clan or subclan had a *tabu* (sacred power) relation to their own particular entities.

For example, the *ganivatu* (hawk, *Falco peregrinus)* was the *tabu* animal of the Navatusila *(yavusa)* people of Navosa (Rivers, 1908, p. 134). One of their divisions, the 'Hamarama' [sic] (Namarama, Thomson, 1958, p. 65), were prohibited from eating 'the fowl', and the Vadrasiga *mataqali* should not eat the *cogi* (pigeon). The Nareba clan [sic] (later consigned as a Noikoro *yavusa* by the NLC (ibid, p. 82), but holding land in Navatusila (NLC cadastral map) through chiefly marriage (F.I., 1998-1999)), should not eat the *reba* bird (in this case, notice the connection between the name of the clan and the animal). Three subclans *(tokatoka):* the Ivisi [sic., Visi], Nanoko, and Iasawa [sic., Yasawa] were prohibited from eating the

tui (koli, dog). According to Rivers, the sub-groups believed in their descent from the *tabu* animal (the *ganivatu).* The neighbouring Nadrau people, also of Navosa, but divided politically from the Navatusila, had as their *tabu* totem the *qiliyago,* a small black bird with a long beak. Other totem animals of other clans included the *dravidravi* (aquatic creature), *dabea* (large eel), prawn, *vevewa (lulu,* owl), *tuitui* (bird), kingfisher, snake and lizard. Insects, being *manumanu* (animal), can also be totems (Capell, 1941/1953, p. 60). Many of these are important food items in other places.

Regarding plants, the Nadrau people were not allowed to eat yams during the two months beginning with the new moon in January (the two months called *uluvatu* and *vunagumu)* under fear of becoming ill (Rivers, 1908, p. 136). The Nadrau people stated that this prohibition was universal throughout Fiji in former times. One group were prohibited from eating the *damuni* (curved purple yam). The Nasalia branch of Nadrau should not eat the *via,* or the *soaga* (native banana).

According to Rivers, there were three main features of totemism. They were: belief in descent from the totem, prohibition of the totem as an article of food, and a connection with a particular unit of social organisation (p. 134). Rivers's teachers stated these restrictions were largely a thing of the past (p. 136).

According to other early researchers, there was a division between principal and secondary totems where the principal totems were two-fold, consisting of both an animal and a tree or plant, and the secondary totems were mainly food plant cultivars (e.g., *uvi, dalo, jaina)* that were only partially prohibited from local use (de Marzan, 1987; Schmidt, 1908). The clan is occasionally named after one of the principal totems, especially the tree (de Marzan, 1987, p. 32). For example, the vunaqumu clan (the *vu* of Tabaivunaqumu of Nasauvakarua) have the *qumu (Acacia richii)* as their tree totem (ibid, p. 36).

Unfortunately, this distinction between principal and secondary

totems is not taken up in the later account of Capell and Lester (1941/1953), who seemed to be more influenced by eastern custom. These authors are criticised by Thomas (in de Marzan, 1987, p. 30) for a lack of discrimination regarding western Fijian practices, which Thomas believes are distinct in that 'identifications of social groups in totemic terms seems only to have occurred in the west' (ibid, p. 30).

Aspects of totemism that Schmidt summarised included: (a) a large number of plant totems (not noted by Rivers), (b) ceremonies for procurement of an abundance of crops, (c) the localisation of totems, and (d) that visitors are obliged to observe the totems of the district of their hosts (Schmidt, 1908, p. 152).

However, by the year 1941, due to the introduction of Christianity, 'many Fijians are vague or ignorant as to one or more of their totems' (Capell, 1941/1953, p. 59). Nevertheless, 'the people are essentially totemic ...' (Capell, 1941/1953, p. 59). According to these authors, the totems *(i cavuti)* are usually a linked trilogy of *ika*, tree and *manumanu* (animal, bird or insect), which apply to all members of a *yavusa*, and are generally inherited partilineally (except in the Dreketi Valley, Vanua Levu), and thus may be connected to the founding *vu* (ancestor) or the *kalou-vou* (god). By 1941, the *tabu* on the killing or eating of the totem was seldom observed, at least in many of the areas that Capell and Lester had visited (including Namosi in the east, but not Navosa) (p. 60). There were diverging practices. In some places, highly desired totems (e.g., the *yavato* larvae) were esteemed as chiefly food, but in others, totems such as the *vevewa* (owl) were set free (after being decorated with ribbons) if caught. It was usual for there to be a prohibition against voicing the name of a totem, especially where the tree totem is preeminent (as in the relatively treeless Ra province), and especially with regard to visitors, who could be violently punished by the special actions of women (pp. 60-61).

Today, food totems become the centre of attention when related, but

opposite (perhaps cross-cousin), kin groups or individuals meet (Ravuvu, 1983, pp. 34-37). It is usual in these circumstances for the visitor to abstain from the food of the host. This practice is confined to certain regions. Thus, it is apparent that a diversity of totemic structures and practices existed, which all served to promote local difference and identity, and reinforce the strong local sense of place that exists (or existed) in Fijian society (Turner, 1988). The account of de Marzan (1987) is probably most correct for Navosa, and the interpretation of Capell and Lester (1941/1953) is less persuasive.

The complexity of totemic relations in *kai* Colo suggests that the past relations between plants, animals and people were relatively close compared to today, and were probably similar to those in the southern Lau group where Thompson found evidence of what may be interpreted as a sustainable cultural ecology (Thompson, 1949a; Thompson, 1949b). Likewise, the evidence of simpler forms of totemic relations, and their connection with chiefly power in the eastern coastal regions, suggests that early Fijian informants from these regions were less concerned with the environment than *kai* Colo informants.

Unfortunately, there is virtually no discussion, at least in the literature mentioned, about whether the choice of totems was related to ecological scarcity, or perhaps alternatively, to cultural value. There are circumstances where a link is possible. The tree totems in relatively barren Ra, and the lone *nginga* (sic., probably *qiqia)* tree of Kabara (Thompson, 1938, p. 183), suggest that a cultural ecology of totems may be possible. Totems can be powerful symbols of local identity as reflected in the stories in the aforementioned literature, but only the work of Laura Thompson in the Lau Islands is associated with cultural ecology during this period (Thompson, 1938; Thompson, 1949a; Thompson, 1949b; Thompson, 1972/1940).

First fruits

An annual *i sevu* or first fruits ceremony sometimes takes place in traditional Fijian communities (Sahlins, 1962; Turner, 1984), organised by the village priest. In one case, the first yams of the season are symbolically gifted by the community to an ancestral deity, in the person of a chief or elder. Afterwards, the chief reciprocated by serving the yams to the community at a feast (Turner, 1984, p. 141). The ceremony (usually in April) coincided with the yam harvest, and was intended to propitiate future prosperity in both gardens and forest life (yams grow in both domains). According to Turner (1984, p. 133), the 'first fruits' ceremony exhibits the '... basic tenet of Fijian culture that ceremonial exchange is, in and of itself, a life enhancing activity'. Chiefs are expected to show caring and protective behaviour (Norton, 1999, p. 24), and the gift to the chief must be reciprocated in the form of aid when needed. The chief's economic role is not to exploit, but organise peoples labour instead (Sahlins, 1962, p. 348).

The chief once had the right of *lala* (especially in eastern Fiji), where labour (or other service) could be demanded by the chief for purposes of protection or sustenance (Kamikamica, 1997). Today, however, the state has supplanted the hereditary chief in many of these roles and the service of *lala* has fallen into disuse, especially for those chiefs who live away from their people. Although many chiefs have lost the power to organise in the traditional manner (Harwood, 1950), alternative paths are possible if they: enter the state bureaucratic system (Nayacakalou, 1975; Nayacakalou, 1978), become a leader in electoral politics (Thomson, 1999), or gain influence through other means (Thomas, 1992a, p. 84).

The bureaucratic system is locally represented by the elected village *turaga-ni-koro* who organises the day to day running of the village. Each *turaga-ni-koro* participates in a *tikina* council, and representatives of each *tikina* participate in a provincial council chaired by the provincial *Roko* (executive chairman) and his deputies (Assistant *Rokos*). In some cases,

these positions are held by hereditary chiefs, who bring their own *sau* or *mana* (sacred power (Hocart, 1914; Ravuvu, 1983, p. 86; Williksen-Bakker, 1990, p. 241)) to the position. These leaders will, ceteris paribus, command greater respect and abeyance (among their own people) than others, resulting in leadership hierarchies that can be very complex amalgams of the traditional and the modern. Certain high-ranking (*yavusa* or above) hereditary chiefs (prefixed *Tui*) can take a position on the *Bose Levu Vakaturaga* (Great Council of Chiefs).

Development consultants of the post World War II economic growth and modernisation period criticised the leadership system for being a bulwark against change (Spate, 1959), but is change necessary for sustainability?

Vanua

Vanua is a concept that is difficult to translate across languages from Fijian to English, and is usually translated to mean 'land', but more correctly it refers to the environment in its totality, including both natural and human aspects (Batibasaqa, et al., 1999, p. 101; Lasaqa, 1984, p. 22; Milner, 1973, p. xxvii; Ravuvu, 1983, p. 70; Williksen-Bakker, 1990):

> The Fijian term, vanua, has physical, social, and cultural dimensions which are interrelated. It does not mean only the land area one is identified with, and the vegetation, animal life, and other objects on it, but it also includes the social and cultural system—the people, their traditions and customs, beliefs and values, and the various other institutions established for the sake of achieving harmony, solidarity and prosperity within a particular social context. (Ravuvu, 1983, p. 70).

The meaning of *vanua* is thus an integrating and identity-enhancing, local phenomenon. The emotion of attachment and identification that it engenders can serve to promote environmental action on the behalf of the *vanua*.

Vanua and indigenous land management

A person does not just identify with a vanua, but is an inseparable and integral part of the *vanua,* a nexus of land and people:

> The Fijian speaks of his land as *na qua vanua.* Not only my land, but the land to which I belong, of which I am an integral part, the land which is part of me and feeds me. The men are the land. (Lasaqa, 1984, p. 22; based on Milner, 1973, p. xxvii).

A strong sense of attachment does not necessarily translate into wise environmental practice, however, and caution is needed. A study of environmental change on Easter Island in the eastern Pacific suggested that indigenous communities over-exploited their environment to their own detriment (Bahn and Flenley, 1992). The inclusive ethos of holism associated with the *vanua* concept has a little-mentioned weakness in that it can succour the neglect of particulars, epitomised by the shortcomings of *Gestalt* psychology which prioritised the whole as greater than the sum of its parts (Apao, 1986, p. 98). By analogy, land degradation may be overlooked if the *vanua* at large is prospering. On the other hand, any decline in the *vanua* as a whole may be considered especially threatening, provoking attempts at amelioration.

Social Structure and Community Systems

The Navosa social system can be divided into community, religious, kinship and leadership aspects.

Community

Fijian communities are organised into *koro* (villages) which are the centre of community life (Nayacakalou, 1978; Ravuvu, 1983; Watters, 1969a). The villages tend to be viewed as permanent, but the evidence of many old disused village sites attests to their semi-permanent character (Parry, 1987, Fig 6A, 6B). The fissioning and creation of new villages continues to occur, although not as readily as in the past (France, 1969, p. 13).

Villages may contain only one ancestral kin group, but they commonly contain two or more different ancestral groups (Spate, 1959, Appendix II), which can be related in very complex ways (Nayacakalou, 1975; Nayacakalou, 1978, pp. 78-80). It is not uncommon for particular ancestral groups to reside in villages and cultivate land for which they have no formal title (according to the NLC), although their traditional use-rights can be very strong.

Church and religion

The *lotu* (christian churches) have a central role in village life (Nayacakalou, 1975; Nayacakalou, 1978; Ravuvu, 1983), which extends to agricultural life (Marseu, 1984). Church activities can be integrated with other, more prosaic, community activities (Ravuvu, 1983, p. 98). The ethical relationship between the church and the *vanua* is strong (Marseu, 1984, pp. 104-106), and the church tends to support the ethos of sharing in Fijian custom:

> Anyone who wants too much, strives too much, is too ambitious and hoards for individual and personal use and enhancement, who is stingy and hardly shares with others, or is aggressive rather than humble, is likely to be punished by God. (Ravuvu, 1983, p. 99).

The Methodist church is dominant, but Catholic and Seventh Day Adventist churches are central in some villages. A variety of pentecostal and charismatic sects have also become established in recent decades.

There appears to be little explicit religious concern with sustainability per se, but the promotion of the *vanua* concept is important (Batibasaqa, et al., 1999, p. 102).

Kinship groups

The social segmentation of Navosa society revolves around a hierarchy of patrilineal kin groups, who have descended from a common ancestor, the *vu*. The first ancestral group was called the *yavusa* (named after the house mound, *yavu*, of the settlement, *yavutu*, of the ancestor) (Ravuvu, 1983; Roth, 1973/1953, p. 54). As groups became more populous over time, they subdivided, and smaller segments that were subservient to the *yavusa* formed. They are named differently in different regions (France, 1969, p. 142), but the Bauan term *mataqali* has been standardised (usually referred to as a clan equivalent[28]). In turn, as these grew larger, a further subdivision added another layer called *beto* or *bito* (in Navosa, Roth, 1973/1953, p. 59), or *tokatoka* (the standard Bauan sept or subclan equivalent). There is some confusion about the subdivision status of *beto* and *bito*, which may be the Navosa equivalent to the Bauan *mataqali* rather than the *tokatoka* (Roth, 1973/1953, p. 59). There were many variations in local clan terminology and relationships (Ravuvu, 1987; Roth, 1973/1953), but these were homogenised by the actions of the Native Land Commission (NLC) for the purposes of land titling. Lastly the *vuvale*, or family household, is the smallest unit, and the one most identified with by individuals (F.I., 1998-1999).

Yavusa can sometimes merge rather than subdivide. An agglomeration of territorially-related *yavusa* under a *turaga-ni-vanua* (chief of *vanua)* is called a *vanua* (Ravuvu, 1983, p. 76); and a confederation of *vanua*, usually for military or state political purposes (and often fluctuating in composition), is called a *matanitu* (Nayacakalou, 1975, pp. 36-38).

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[28] Ravuvu (1983, p. 77) has a different model where *yavusa* equals clan and *mataqali* is the subclan. The difference is not important outside of taxonomy.

Leadership

Each of these units has hereditary leadership in the form of a chief *(turaga),* and their affiliated *matanivanua* (master of ceremony) (Nayacakalou, 1978; Ravuvu, 1987; Roth, 1973/1953, p. 60). In the past, leadership positions existed for *sauturaga* (deputy chief), *bete* (priests), *bati (bainivanua,* defenders of the land, warriors), *matanisau* (craftspersons) *qonedau* (fisher); and in the southern Lau Islands of Fiji there were *vaka vanua,* translated as the 'chief of crops' (Thompson, 1972/1940, p. 99) or the 'crop custodian' (Thompson, 1949b, p. 260). The duty of this latter position was to impose *tabu* (prohibitions) on each of the crops as necessary to ensure the sustainability of the resources. This personage was once important throughout southern Lau, but by 1940, the position was functioning only on the island of Moce. The *vaka vanua* also supervised the preservation of foods such as breadfruit, which were then required for survival during periods of stress or shock (ibid, p. 100). The *qolidau* (or *dau ni qoli,* the master fisher) supervised the fisheries, and was believed to be effective at conserving the fish resource. For example, when the *qolidau* position became defunct on Kabara Island, the fish resource dwindled (p. 100). Today, these subsidiary and specialised forms of class and resource leadership function only occasionally.

Local government

Nadroga-Navosa is a province, of which Navosa is the inland sub-province, which in turn contains sub-provincial districts called *tikina.* There has been a return to the system of 'old' *tikinas* that follow the boundaries of *vanua* units (Ward, 1965, p. xvi), and the 'new' *tikinas* (of which Navosa sub-province was one) are now defunct (ibid, p. xx). The old *tikinas* were re-established in 1996, and the first *tikina* council meetings occurred in 1997. The *tikinas* of Nadrau, Navatusila, Noikoro and Namataku make up Navosa. The study includes the adjoining *tikina* of Nasikawa (which is part of Nadroga province), because it's watershed drains into Navosa. *Tikinas* have one representative on the *tikina* council

except for those that have more than 10 villages which are allowed two representatives.

Land tenure, use rights and *vanua*

Land tenure in Fiji is a mixture of traditional and the modern (Crocombe, 1995; France, 1969; Ward, 1995). The modern system safeguards the inalienability of ancestral land, a policy established by early colonial government and enacted through the Native Land Commission (NLC). It is a system of formalised and fixed land boundaries and titles based on the claims of ancestral groups approximating the *mataqali* level (France, 1969; Thomson, 1958; Thomson, 1959). However, the rigidity of the NLC tenure system has restricted the expansion of agriculture (Overton, 1987a; Overton, 1992; Overton, 1994). This system tends to be supported by high chiefs, a few of whom benefit inequitably from rental income gained through the formalised lease system of the Native Lands Trust Board (NLTB) (although most benefit only modestly (Norton, 1999, p. 25)). Those high chiefs who live an urban life find it relatively difficult to live up to popular expectations for caring and protective behaviour towards their village and *vanua* (Norton, 1999, p. 24).

The traditional *(vakavanua)* system of land tenure is more flexible (paradoxically, it is illegal). The Fijian notion of *vakavanua* (translated as custom, or the way of the land (Overton, 1999b, p. 180)), holds a valued place in traditional Fijian identity. It is characterised by informal and flexible arrangements about the use of land that flux depending upon social needs and relations, environmental circumstances, and the need for mobility (e.g., swidden agriculture) (Eaton, 1988; Overton, 1987a; Ward, 1995). If one *mataqali* has surplus land, it may be requested (through *kerekere)* by an individual or another group for their use. Although traditional ancestral groups have a strong emotional attachment to their *yavutu* at specific places and areas, they did not claim to own the land (at least in the past), contrary to the European system.

For various reasons (e.g., agriculture, help during war, judicious marriage (Crocombe, 1989, p. 21)), many patrilineal clans occupy and use land of neighbouring, or even distant, clans, leading to a very complex and interdependent set of relationships between ancestral groups and land use.

Today, the land tenure system is a heterogenous mixture where both these systems function to varying degrees, although with the fresh challenge that there is an emerging level of awareness about the monetary value of land — exemplified by the recent conflicts surrounding the reparation for land taken by the government for state purposes.

How does tenure affect sustainability? The most well-known issue involving sustainability relates to issues of security of tenure in relation to leased land. Short leasehold periods have been associated with an insecurity of tenure and a lack of investment in maintaining the resource base. This situation is associated with the very severe degradation of sloping land in the Fiji sugar belt:

> I have seen some of the classic areas of erosion in India, Australia, and New Caledonia, but I do not think I have anywhere seen sheet erosion of such intensity as in parts of the hinterland of Nadi and Lautoka. (Spate, 1959, p. 97).

Fortunately, this situation is less marked in Navosa, partly because the soils are more stable, and partly because the people have security of tenure. But the security of tenure in Navosa is not related to individual private ownership of a land title, because local cultivators are immersed in a communal social system with land titles held by *mataqali*. Instead, they have the security of customary use, and because of the inalienability of land, may actually have greater security than a smallholder with privately owned land.

Although the village social system is a communal one, the rights of individual householders to cultivate land are individual rather than

communal (Rutz, 1977):

> An extraordinary point about the Fijian in agriculture is that it is the one activity in which he is and was an individualist. (Parham, 1937, p. 17).

An individual's inherited and historical tenure over particular areas is respected by others in the village, but competition occurs over the use of favoured locations. There are traditional rules for the control and transfer of fallow *(veimada,* in Waimaro) land. It is the normal concern of local cultivators to preserve a knowledge of their previously cultivated swiddens, and attempt to maintain a claim on their fallow lands. Householders have greatest rights to their recently cultivated plots, but the longer they leave their fallow lands, the less right they have to them (Rutz, 1977, p. 167). Where land is short, as in the village of Wainawaqa in Namosi, competition occurs for the best lands, and if the fallow is left too long, another cultivator may claim it as being *vanua vou* (new lands for cultivation). All land falls into one of these three classes (already cultivated, fallow & new lands).

Thus, if a village has only a fixed and limited amount of cultivatable land, the fallow period will shorten and the security of tenure will decrease with increasing population over time, perhaps leading to overexploitation and degradation. The advantage of the traditional *vakavanua* Fijian tenurial system is that additional land elsewhere may be requested (by *kerekere)* to accommodate an increasing demand for land (Overton, 1994).

Work and labour

The large work effort involved in preparing for *solevu*, and the associated removal of labour from money earning activities, was a focus of criticism from proponents of economic modernisation (e.g., Spate, 1959; Rakoto, 1973). *Solevu* and other communal demands were regarded as an impediment by the agents of modernisation, who reflected colonial, and unusually individualistic Fijian, values.

It is paradoxical, however, that the particular form of communalism in the present Fijian village society may owe much to colonial intervention[29] (France, 1969, pp. 127-128; Ravuvu, 1998). Knapman (1987, pp. 46-47) summarises other arguments to this effect dating from Thomson (1908, p. 65). There is evidence that the Native Regulations of 1877 (Government of Fiji, 1883), were developed by colonial forces in an attempt to tame the *kai* Colo after their uprising in 1876. Various cultural changes were enforced, and the leadership was rigidly restructured in order to protect the government (and the top level of the Fijian leadership) from instability (France, 1969; Heath, 1974, p. 86; Lal, 1992, p. 15).

The later anti-communal view of the critics, however, was not supported by the commissioned ethnographic research that followed in the Sigatoka Valley. Belshaw (1964b, pp. 126-153) concluded that most of these criticisms were unjustified:

> So far I have shown that ceremonies, despite their complexity and scale, are not as demanding as might appear at first sight, are not wasteful, do not dissipate resources, and are flexible in their impact upon individuals. (Belshaw, 1964b, p. 152).

His conclusion was that ceremonies were neutral with regard to

[29] It is recognised that Fijians lived in villages prior to cession, especially during periods of warfare, and were to a degree, communal (Parry, 1987). The distinction refers to the invention of a particular type of 'engineered' communalism defined by the ideology and regulatory force of the combined colonial and chiefly leadership of the time.

economic growth (p. 152). The findings of Rutz (1978), from research in the Namosi region of eastern Fiji, were somewhat different. Rutz's research was similar to Belshaw's but with greater detail on the synchronic use and distribution of capital and labour. He found that, contra Belshaw, ceremonial expenditure often falls unevenly on a few participants and constitutes a burden to them despite the support of kin. Over time, however, when the effects of community reciprocity and the social 'welfare function' (welfare costs borne by the community rather than the state) are included, then 'ceremonial exchange is intrinsically neither inhibitory nor facilitative of economic development' (Rutz, 1978, p. 805).

Land tenure and belongingness

In the case of Nasauvakarua, the land surrounding the village on the south side of the river belongs to Nareba, a Noikoro *mataqali* (fixed by the NLC, but the outcome of a customary marriage exchange of Navatusila land and a chief's daughter). But this Noikoro *mataqali* has no clan representation in the village. The other land adjacent to the village (to the north, west, and southeast of the river), belongs to three *mataqali* of Navatusila *yavusa.* One of these clans was represented by three households in the village. The remainder of the village (30 households) belonged to three equally dominant *beto* or *mataqali* (Emalu, Nakurukuruvakatini and Tabaivunaqumu, 10 households each), and Nakorovatu (1 household). The clan representation in Nasauvakarua was primarily composed of 'immigrant' clans from elsewhere, specifically villages of Wainimala to the east, who obtained residence in Navatusila as a result of help given to Navatusila during war, originally residing at Namaururu and Nabukuniqa upstream from Nasauvakarua on the Solikana Creek. These old (now overgrown) villages, located opposite each other in a landscape of rugged beauty, were reported as once having 20 and 35 houses respectively (F.I., 1998-1999). The *yavu* are still visible (F.O., 1998-1999).

The case of Nawairabe was different. The village has two dominant 'landowning' *mataqali*, Buroko and Nasikawa (18 & 10 households respectively), both belonging to the Nasikawa *yavusa*, and several minor 'immigrant' *bito* or *mataqali*. Nawairabe was originally the seat of the Nasikawa *vanua* (now located in the roadhead, Korovou). The village is located on a small block of crown land, and described as village reserve. The large areas of hilly land to the southwest (now part of the Yalavou Project) and especially the southeast belong to Nasikawa. Buroko has a block including downstream *bila* to the west of the Nasikawa Creek. Some of the other important *bila* downstream from the village belong to Noi Nabau, a *mataqali* of Namataku *vanua* centred on Sawene to the west.

The relationship between *vuvale*, their *mataqali*, and their land is thus complex, but in many cases the attachment to vanua, and the use of agricultural land, was relatively independent of *mataqali* boundaries as fixed by the NLC. A flexible land tenure system allows for resources to be matched to need, but the rigid NLC system imposes a restriction on flexibility and thus jeopardises sustainable land use.

Tradition and identity

According to Brewster, an early European visitor to Navosa, *yaqona*, *tabua* and *vuaka* were the most important cultural symbols (at least to men) (Brewster, 1922, pp. 17-24). More recently, *yaqona* and *tabua* are described as being most important for cultural identity (Bainimarama, 1991). These objects, although central to the Fijian way of life, may be less important than what they symbolically represent:

> The Fijians are concerned above all with practices, while Europeans take objects as markers. (Thomas, 1997, p. 176).

Thus, what, or how something, is done; is more important to a Fijian than the accumulation of material objects, which make poor indicators of social change. For example, objects such as tin roofs (often viewed by outsiders as evidence of development) do not indicate significantly

greater value in the indigenous system. As Thomas elucidates, Korolevu shares a feature with many other Navosa villages where the *were levu* (chiefs house, the best house in the village) is in traditional thatched style, rather than the more modern tin-roof style.

Instead of the object indicating value, relationships hold pride of place:

> The key concepts are to do with sharing and hospitality, and respect. Nearly every casual visitor to a Fijian village will be told that the crucial feature of the Fijian way of life is embodied in one's willingness to share. (Thomas, 1997, p. 173).

Tradition and politics

Today, Fijian culture ranges from the most traditional to less traditional depending on (especially geographical) context. Navosa, along with other interior places, and the small, outer islands of Fiji, are considered traditional areas; in contrast to the coastal, and especially urban areas, which are significantly less traditional. What defines tradition? This question has been the subject of intense debate in the literature, especially in relation to whether change is endogenous or exogenous, and the degree to which colonial-period authorities manipulated tradition (Carrier, 1992; Jolly, 1992; Jolly and Thomas, 1992; Keesing, 1989; Linnekin, 1990; Linnekin and Poyer, 1990; Norton, 1993a; Sahlins, 1993; Thomas, 1992b; 1992d; Thomas, 1993; Turner, 1997).

These issues may seem of little relevance to relatively independent Navosa. Nevertheless, the historic role of the Fijian chiefdom and the colonial government which together organised the national Fijian social and political structure in order to preserve customary ways (and political power) in the face of change is undeniable (France, 1968; France, 1969). The traditions that were enshrined were not only pre-European customs,

but included those that were partly created by the colonial government to facilitate the practice of government (ibid).

RURAL DEVELOPMENT

The central hinterland of Navosa has been free of large development projects except for relatively small scale interventions such as social forestry plantations, water reservoirs and pipelines, and the construction of large buildings in a few villages. The introduction of new species for grazing purposes has had ubiquitous effects throughout Navosa, and on the southern margins, various agricultural projects have led to a patchwork of local changes. The commercial logging of the forests on the periphery has, until recently, been carried out in a highly unsustainable manner, with few apparent benefits outside of the construction of various buildings.

There were many developments related to livelihoods, and the most obvious (but not necessarily the most significant) are outlined below. There are many smaller (e.g., agronomic, educational) aspects of development that are less visible but which may be more effectual.

Yalavou Beef

The Yalavou Rural Development Project (Stage 1), which began in 1978, encompassed the hilly eastern bank grasslands of the lower Sigatoka Valley from Korotogo near the sea almost to Sawene (G.P. McGowan & Associates, 1976). The Yalavou I project was very large and situated mainly in Nadroga, and thus only affected Navosa on the southern margins near Nawairabe and Sawene. A few Nawairabe householders were either Yalavou farmers or had been Yalavou farmers (F.I., 1998-1999). The project, although described as an integrated project, was based on beef farming.

A large-scale Yalavou II project had been planned that encompassed much of the Navosa area from the mid-valley at Nawairabe to the

upper-valley beyond Namoli (Woodward, et al., c. 1986), and initial planning was underway for a Yalavou III in the western hills of the Sigatoka, but planning for both was abandoned after the 1987 military coup. After the coup, following the withdrawal of Australian support, the Yalavou I scheme foundered and many farmers returned to their villages and traditional livelihoods. A few farmers still continue with the advantage of government support and the use of lands that other farmers had forsaken.

Highlands Logging

The hillslopes on the northern margins of Navosa between Bukuya and Nanoko were logged by clearfelling in the latter half of the 20th century (1970s-1980s). Few recorded details were made available about this event, but the ecological and social impact was reported to be large and negative (F.I., 1998-1999), and is discussed in Chapter 8 (see p. 365).

Lowland Crop Projects

The recent Sigatoka Valley Rural Development Project (SVRDP), and previous crop-horticulture projects, have affected the lowland villages of Draiba, Sawene, Keiyasi and Nasaucoko (and nearby settlements), which have substantial areas of *bila* (alluvial flatland) on the southern margin of Navosa. The influence has been mainly in the form of technical changes and the provision of advice and subsidies for agricultural inputs. However, other factors such as the poor quality of the road and the cost of transport tend to reduce the incentive to produce for market, especially when prices are low, despite a significant level of farming entrepreneurship (Belshaw, 1964b).

Summary: Fire, Land Management and Sustainability

Although the Navosa landscape probably looks similar today compared to the period after initial settlement, there have been many changes in land use. Initial swiddening and the opportunistic use of wetlands and rivers was supplemented by a sophisticated system of irrigated terrace agriculture perhaps about 1000 years ago. Following European contact, introduced diseases led to a period of severe human depopulation, and colonial administration compelled the relocation of habitations away from the landesque capital of irrigated terraces, which have gradually been abandoned. The invasion of *mauniba* during the colonial period has led to a grassland landscape with a very low pastoral and biodiversity value, and a propensity to burn during the dry season. The burning destroys protective vegetation and exposes the soil to heavy rainfall at the transition from the dry to the wet season, leading to severe erosion and the impoverishment of previously fertile soils.

Traditional swiddening is still carried out but with shorter fallows and new crops as people and livestock become more numerous. The rigid NLC system of land tenure has so far had limited impact on actual practice in Navosa, but threatens to constrain sustainability in the future. The capitalist market commodity system is increasing its penetration, but the indigenous social and economic exchange system still predominates, aided by the situation where important cash crops are also traditional subsistence crops, and by the policy of government which has accentuated the preservation of the traditional sector.

The management of land is based on indigenous knowledge and is intimately related to livelihoods, but changing circumstances (such as increasing populations, greater individualism and market commodification), is disrupting the postcolonial leadership and admitting sociocultural and environmental degradation.

Past efforts at development have done little to countermand this trend, and instead often reinforce socio-cultural inequities and

environmental degradation, thus reducing sustainability.

CHAPTER FOUR

RESEARCH METHODS

INTRODUCTION

This chapter focuses on the rationale for fieldwork, my research philosophy, the specific context for the research, the research techniques used, and how the research went in practice. The style of writing is sometimes in the first person in order that my positionality and praxis as a researcher is more clearly revealed.

THE RATIONALE FOR FIELDWORK

There has been a lack of comprehensive field research on rural sustainability in LDCs, including Fiji. This research aimed to study and analyze one local region so that salient features of that place were available to both the host communities and as a contribution to the general body of knowledge on livelihoods and sustainability.

THE RESEARCH PHILOSOPHY

The research was to be relatively context-driven with regard to both natural and social contexts. Indigenous knowledge was respected and given a priority to inform, and traditional scientific research techniques, despite their importance in epistemology, were considered relative to issues of reflexivity (Twyman, et al., 1999). The intention was to 'problematise' the natural, cultural, and historical reality of the context following an interactive model that affords respect to local communities (Freire, 1970, pp. 18, 21; Freire, 1976/1974, p. ix).

At the core of my epistemology is a preference for an eclectic science, critically aware, with a special focus on the need to be culturally sensitive and interactive with the special conditions of the local context.

An eclectic approach acknowledges a plurality of phenomena but searches for central themes among diversity. Science in these circumstances aims for verity by using rigorous, but contextually sensitive, guidelines that allow for consistent ways of evaluating new knowledge. A critical intellectual model of evaluation is used in an attempt to discern truths that apply generally. The epistemic values of veracity, objectivity (reliability) and perspicacity (generalisability) outlined by Stewart (1998) are held by the researcher, although I was prepared to qualify objectivity against issues of subjectivity (Okely, 1996, pp. 27-44) and generalisability against the representation of distinctiveness and the specific needs associated with the local or indigenous context.

The research does not explicitly use either a social or a natural science model (although social techniques figured prominently) and both qualitative and quantitative techniques were used.

The division in science between qualitative and quantitative research is considered to be mistaken by this researcher: who has a view that this distinction is a polarising and constraining one without methodological justification. The emphasis on qualitative-quantitative distinctiveness rather than upon qualitative-quantitative complementarity, by virtue of methodological reduction, can lead to research that is inappropriately matched to the research context by virtue of its inherent lack of flexibility. Most research involves both meanings and quantities whether it be a humanistic discipline (relative quantities or occurrences of events are important) or the physical sciences (where numbers without attached meanings are absurd). In this research both the qualities and the quantities of things are considered dialectically but the appropriate reductive (interpretive and numerical) techniques will be used where necessary. One of these focuses on variations in verbal-literal meaning and the other on quantitative variables but both are necessary together to produce scientific data.

Methodological Variety

The multifaceted nature of the research required a range of methods in order to gather data. The choice of these methods was determined both by the context (both natural and social) and by the particular knowledge and skills of the researcher. I collected data from both local and nonlocal participants with reference to relevant local and nonlocal institutional forms.

In order to gain background knowledge a review was conducted of literature and documents held in libraries, archives, government departments and other sources outside of and within Fiji. A survey of maps, drawings, and photographs provided valuable information on various aspects of land use in the Navosa region. The knowledge held by various participants was acquired by asking questions either in discussion or through interviews.

Observation (of the landscape, vegetation, events and people) was an important aspect of field research, especially because the region was largely new to me. Discussions and interviews with both individuals and groups were conducted, and various field-specific verbal-visual techniques based on Participatory Rural Appraisal (PRA) methods were used. Some of these were created in the field by me to match the specific research needs of the local context.

Context and the Choice of Method

Conventional development research and practice has tended to show little consideration for the views and aspirations of the local people upon whom development impinges. Many researchers, following Western scientific traditions, have adopted either the positivist scientific method of hypothesis-testing, or alternatively, have used ethnographic methods involving the interpretation of local meanings, both of which have often been based on centrist cultural-ideological perspectives where the people of developing areas have been given little say in the goals or

the method of the research. Typically, a researcher following a hypothesis-testing model will choose her or his hypothesis at their (usually nonlocal) institution prior to arrival in the field, or alternatively, a meaning-oriented researcher may attempt to interpret an 'exotic' culture according to the terms of a universally-oriented social scientific theory. In contrast, an opposite approach is to allow the local people to dictate all dimensions of a researcher's activity in the field.

This research attempts to strike a balance. Although I arrived in the field with certain broad preconceptions about where and what I was going to research and how I was going to do it, I believed that it was important to incorporate aspects of the local context and be guided by the problems that the local people reported. I also intended to use methods that are more interactive and less alienating for a range of local people. The outcome was expected to be more consistent with local aims and realities.

Participation: A Context-Oriented Methodology

My research strategy was to incorporate the principles of a participatory approach that concentrated on local contexts, perspectives and action, rather than their extralocal counterparts. Conventional methods reflect a system of top-down power relations in global affairs that prescribe or precipitate change regardless of the local peoples' own contexts, strategies and goals. Because local peoples' knowledge and initiatives are often undermined in the process, local people have become disempowered and dependent upon central forces for their community goals and strategies (Burkey, 1993, pp. 59-60). In order to reverse, or at least ameliorate, this process of subjugation, an increased level of direction by the local people is desired so that local self-esteem and autonomy will be enhanced during the research process.

In practice, there are a variety of approaches to participatory research which may be reduced to five characteristics: (a) participation by the

people being studied, (b) inclusion of local or indigenous knowledge (c) recognition of power relations and local empowerment, (d) consciousness-raising and education, and (e) political action (Cancian and Armstead, 1992). Some research only attempts the first of these criteria, and is considered to be, if at all, barely participatory because it does not include the other factors. This approach is reduced by Oakley (1987) to a non-emancipatory *mobilisation* model in a dichotomy where the opposite is an emancipatory *empowerment* model which emphasises the consciousness-raising, empowering, and political role of researchers (Cancian and Armstead, 1992), who should not be 'scientifically neutral' but instead promote emancipatory change with the research subjects for a more just society (Lather, 1986).

Inherent in the criteria for empowerment are several logical (but not necessarily methodologically constraining) contradictions. For example, empowerment demands a prominent pedagogical and leadership role from the (often extralocal) researcher, which is contrary to the participatory emphasis on self-reliance and the expanded role of the voice of the local people. This contradiction can undermine the participatory emphasis on the value and role of local or indigenous knowledge and leadership: which has the potential to destabilise local systems of knowledge and leadership structures.

Empowerment can also have relative effects: what is empowering in one context may disempower in another, or what may be empowering to one person or group may disempower others. For example, an attempt to empower less privileged classes such as marginalised poor households within a village may serve to disempower their socially central, traditional leadership: which can have a number of repercussions, including a decline in the status of indigenous knowledge and leadership structures.

Thus, the object of empowerment and its subject (whether individual, minority group, village, clan, region, country) must be carefully

considered with respect to dialectical effects. The role of indigenous knowledge should be emphasised as part of the empowerment process in order that local knowledge can be validated against the intrusions of outside hegemonies.

It is apparent from the foregoing that political forces are consistently at work throughout development situations. In some contexts the role of alternative political action may be necessary. In other less-threatened contexts (such as Navosa), it may be more important to preserve local or indigenous knowledge, and empowerment may be directed to enhance the status of local culture and the quality of livelihoods rather than countering overt political forces.

Thus, participation has been variously construed to facilitate, catalyse, assimilate, and even suppress the initiative of rural people, depending on the players and the context (Rocheleau, 1994, pp 7-8). It has similarities with the concept of sustainable development: it has internal contradictions and can be interpreted variously, but it's general challenge to nonlocal directions in research is inescapable.

Navosa and participation

The major goal was to study and record local knowledge and practices relating to sustainability. For this reason, I wanted to remain as invisible in the everyday lives of the people as possible so that a relatively uncontaminated understanding of existing circumstances was obtained. Based on the model of a humanistic social and ecological science, I attempted to understand local histories, and social or ecological systems through the participant-observer-enquirer-recorder-analyst role. My positioning was similar to that of the ethnographic 'participant-observer' (despite reservations about the appropriateness of this description, presented later). In this role I did not attempt to engage with the local population as an agent of emancipatory change, but rather as an information-gatherer and evaluator who was willing to empower by interactively sharing the results of the research process with

his participant community. I expected the research process itself to be mildly empowering to the local people, primarily by validating local knowledge.

A distinction has been made in participatory research between *extractive* and *interactive* approaches (Rocheleau, 1994, p. 7). A purely extractive approach occurs when local contributions of work, knowledge, and other resources are extracted without significant interaction with 'participants' of the development process (Rocheleau, 1994, p. 7). The extractive approach is essentially disempowering to local people, and is typical of the mobilisation model, which aims to extract data in an attempt to enhance an externally-derived blueprint.

By contrast, the interactive approach can be empowering, and occurs when outsiders are welcomed into and take part in local community strategies and goals for development (Rocheleau, 1994). My approach attempts to be interactive with local realities and goals by incorporating locally chosen problems and parameters. But, inevitably, there are aspects of this research that are extractive because they serve nonlocal goals. My personal goal to use the data to achieve a higher academic degree is one example. Other data, for example, local history, may be controversial when published in the public arena because it can be both viewed as extractive or interactive depending upon the use to which it is put by whom (see Dove, 1999, pp. 241-242, for an example from the Vietnam war). If the data reflects on vexatious power relations then such data is a sensitive issue to be distributed with caution (Turner, 1997, p. 346).

Thus, all participatory research is a blend of interactive and extractive approaches, and it is the degree to which the ideal of being interactive is achieved that is important. I accepted the fact that any participant-analyst in a local society is a change agent by virtue of their extraordinary visibility, their distinctive actions, and their presumed status. In addition, the verbal conduct of the researcher will be

influential. For example, the particular questions that are asked will indicate to the local people what the researcher considers to be important. The social rendition of this process of enquiry may be influential in unpredicted ways. Not only may it cause changes in the local setting, but it may also change the data that the researcher collects. To give an example, the particular expectations of interviewees may interfere with the collection of data. This has been called the *demand characteristics* of social research (Orne, 1962). In these cases, subjects try to predict what will please the researcher and answer accordingly. In a situation of field research, such effects, assuming they are present, are difficult to control: but can be minimised by astute questionnaire construction, the researcher taking a critical, reflective and accommodating stance during the research proceedings, and triangulation (cross-checking) with others over the period of questionnaire administration.

With acknowledgement of all these factors, my particular approach was intended to represent and be sensitive to the local context (people and environment) and includes an emphasis whereby local participants: (a) help to formulate the topics of the research, (b) help with the data collection and (c) receive localised help from the researcher, and (d) receive feedback on the results of the research.

Participatory method and environment

The method of participatory research is basically a social process involving the utilitarian description of local environments. It is less appropriate as a method for conducting detailed natural science research into relatively non-utilitarian issues such as the degree of biodiversity; or the differential degree of erosion across localities; or numbers of rare or little-known species, although it can help with these. When the participatory method is used to ascertain the state of the environment it is done through the perceptions of local peoples, whose reports usually (although not always) reflect their immediate preoccupation with

resources and livelihoods. As a result, the participatory model is relatively anthropocentric (human-centred) rather than ecocentric in its orientation.

It may not be the leading model for those concerned primarily with the welfare and conservation of, for example, pristine tropical forest. The more purely environmental aspects of sustainability are sometimes best learned as a result of observation and the techniques of the physical and natural sciences following a more ecocentric model. The context in Navosa includes some areas of pristine forest (including some about to be logged) of which little is known in a scientific sense. Because the goals and resources of my research precluded any in-depth research in this area, I used a mixture of some relatively non-participatory techniques (observation, photographs, maps & manuscripts) and participatory research techniques to ascertain their role in sustainability. This approach was followed for the study of other aspects of the physical environment such as grasslands and waterways.

RESEARCH DESIGN

Information Needed to Establish the Thesis

The research involved both primary and secondary data collection. Primary data was collected both from rural Navosa and from government officials and others in urban centres such as Suva (the capital) and Lautoka (the administrative centre of the Western Division). However, secondary (background) data was almost exclusively only available in the nonlocal urban centres.

Texts about the field: secondary (non-field) research

Secondary information pertaining to the research context was often diachronic (through time), and was obtained predominantly from books, reports, and articles held in libraries and archives in New Zealand and Fiji. On some occasions material had to be purchased or was discovered in the field. This information was used for a literature review covering the themes of resource issues, agriculture, development, culture, history and sustainability.

Other important secondary information sources included maps, photographs (especially aerial photographs), diagrams and statistical data (e.g., census information): nearly all of which were obtained from government sources in Suva. Finally, elements of the Fijian language and Navosa dialects were learned from a language teacher in Suva in an attempt to understand some of the local language.

Primary (field) research

In addition to the information held by nonlocals in the urban centres, I was most concerned to obtain information from rural areas that reflected indigenous or local knowledge about aspects of sustainability. The primary data was collected in either of two main ways: personal observation or via communication with people. The method of observation resulted in largely synchronic (contemporary) data collected in correspondence with my own perceptions and particular need for knowledge of local physical features that relate to sustainability. Other knowledge was learned through enquiry, interviews, answers to questionnaires, and PRA techniques.

Techniques Used

A multidisciplinary knowledge is needed in order to study the topic of sustainability. Thus, several different research techniques were used according to the needs of the thesis, the needs of the context, and my own particular skills.

The general techniques for observation and interviewing were learned beforehand. Partially because the research involved a context-driven philosophy, and partially because the context was initially unfamiliar, many of the specific techniques were not developed until after my arrival in the field.

Observation

The technique of observation is unique in that it is practised nearly continually and often involuntarily by the researcher in all waking hours. It is also often considered to be independent of dialogue, although observation may also be directed by dialogue in various ways. It is the predominant way in which the researcher learns about the environmental context of the research. It can be focused to discern particular features of, for example, the landscape or village life. Finally, observation, in that it relies on our normally relatively veridical visual senses, is considered to be perceptually representative and what is seen is believed to be consensual in most ordinary situations (Gibson, 1979).

Observation by itself has drawbacks: it leaves the researcher as an outside observer and it is (unless practised over many seasons, and then it is time-consuming) a relatively synchronic approach which does not take account of long-term changes. Observation is affected by familiarity and novelty which direct our attention. Familiar things tend to be overlooked and novel things are often noticed immediately. Thus, there are likely to be differences between the local people and the researcher over what is considered worth observing. For the researcher many aspects of the whole context were novel and interesting. For the local people the researcher is likely to be the only novel and perhaps

interesting thing.

Maps, photos and drawings

Maps are vital not only to navigate but also to gauge environmental features, topography, vegetation, waterways, land use, settlement patterns, roads and tracks, and other things. Most important, they enable the conception of a mental picture of the whole region, which aids the understanding of relationships between it's components. The most useful map was a (1:250,000) topographic map of Viti Levu but more detailed (1:50,000) topographic maps of the local region were also very helpful. Other maps obtained included those describing ownership boundaries, aspects of climate, population distribution, soils, land classification and use, land slope, forest functions, and physical or cultural features.

There was a scarcity of recent (non-aerial) photographs taken of Navosa. Nevertheless, aerial photographs were available in the Fiji Lands Department from about 1950 to 1994: these were very useful as data, and were used to ascertain topography, vegetation type, degree of seasonal burning, land use and settlement patterns among other things.

I intended to take photographs in the field in order to record environmental and sociocultural features. I planned to use a Polaroid camera to take and return photographs of participants in situ, and to experiment with a technique involving participants photographing their own important features, for example, during a transect walk.

The main disadvantages of photography are that: (a) the images collected tend to depict a small, very selective, and relatively passive representation of the research context, (b) they tend to be limited to one time period, (c) they usually convey only the photographer's (the outsider's) view of reality vis-à-vis the photographed peoples' reality, and (d) the readily perceived (but analytically simple) nature of photographs can dominate the more considered and critical value of textual analysis.

Diagrams were useful when they were created as a result of PRA techniques, and can represent local views relatively subjectively.

Interviews

Interviews were necessary in order to obtain an in-depth understanding of local knowledge, livelihoods, culture and socio-ecological structures. Plans were made to interview research participants with a relatively informal approach that reflected my desire for the research to be as context-driven as possible. I had already learned from previous experience that Fijian custom and etiquette was different from New Zealand European customs, and that a relatively relaxed, opportunist, conversational and circuitous strategy was often necessary to obtain information.

Introductions, especially from influential leaders of their region, were anticipated as especially important in the process of building up trust prior to interviews, and information about the nature of the research was prepared for explanation to participants. It was envisioned that most of the interviews would be recorded in written form but audio taped interviews were also expected. A requirement for translators (and transcribers) was expected in many rural situations.

The main disadvantages of interviewing are that: (a) the knowledge shared is often restricted in its topical breadth, (b) the process is time-consuming (especially with translators), and (c) the answers shared are subject to the perspectival, communication and personal foibles of interviewees, interviewers and translators.

I planned to conduct group interviews: where consensus decision-making between participants was expected to provide greater validity and make better use of time.

Participant enquiry

The most informal 'interviews' or meetings are simply enquiries and discussions with local people following something previously mentioned or observed in the daily round of conversations and observations. This was often how the most essential data on social, cultural, livelihood and ecological factors was ascertained, and is more accurately described here as participant-enquiry rather than the coinciding conventional term known as participant-observation. The point of difference is that the term participant-observation does not accurately describe a technique that is both visual and verbal in its process and predominantly verbal in its representation via the written word. The participant-enquiry process involves enquiry, listening, sharing, analysis and recording (mainly verbal techniques), as well as observation (a visual technique). Thus, I prefer to use the term participant-enquiry, in order to emphasise the central role of enquiry (rather than (relatively objective) observation) in the research process. By using the term participant-enquiry, I am using a narrower definition than explained by the (relatively generic) participant-observation approach (DeWalt, et al., 1998, p. 259). Because strict observation can be a rather detached, one-way and extractive technique, and can be contrary to the ideals of participation, I have made it explicit by considering it separately.

Questionnaires

Questionnaires were used but were not planned until after entering the field. The advantage of administering a questionnaire is that detailed mundane data about household composition (census data), agricultural practice, food security, trade, land use, livelihoods, values and attitudes can be obtained across a sample of a population of people that includes representatives from a full range of social strata. The questionnaire facilitated the collection of a wide range of information, and it also allowed greater control of extraneous contaminating factors across different participants. Questionnaires can also be replicated which

facilitates the comparison of data across a range of similar contexts. However, it is necessary to plan questionnaires carefully for a variety of reasons, for example, so that answers to the first questions in a series do not predict the answers to later questions in the same series (Dillman, 1978, pp. 79-159).

The main disadvantages are that questionnaires: (a) are relatively more extractive and less interactive for eliciting information, (b) can be time-consuming and difficult to schedule for both the interviewee and the interviewer, (c) can be taxing for the interviewee because of the high persistence of mental effort required and their sometimes mundane nature, and (d) the knowledge shared is often restricted in its topical depth.

Participatory appraisal techniques

The systematic use of Rapid Rural Appraisal (RRA) (Rocheleau, et al., 1989) and Participatory Rural Appraisal (PRA) (Chambers, 1994a; Chambers, 1997, pp. 102-129) techniques were planned. The particular techniques used were chosen according to research and context demands. The RRA and PRA techniques are distinctive by their endeavour to maintain a participatory (and in the case of PRA: empowering) approach whilst quickly agglomerating a variety of data that can be triangulated or cross-checked with other data to provide internal verification (Burgess, 1984, pp.143-165). These techniques ask the participants to create their own visual drawings, maps, photographs or tabulated information often in concert with others in the form of a group exercise. The procedure was expected to be popular because it can allow the participants to express their own realities and needs in a relatively open-ended and creative but consensual way. The questions asked were about social, cultural, economic, and environmental resources.

There are a large range of PRA techniques, for example: social maps, resource maps, matrix scoring, transect lines and walks, time lines, trend

and change analysis, seasonal calendars, household rankings, individual farm sketches, photographic ranking, developmental priority rankings, semi-structured interviews, case studies, analysis of difference, direct observation, and immediate report writing (Chambers, 1997, pp. 116-119; Purdie, 1996, pp. 98-111). The basic techniques used are outlined in Table I.

TABLE I. Menu of RRA & PRA methods.

METHOD	PROCEDURE	RATIONALE
Secondary Sources	Search for books, maps, articles, reports, aerial photographs, satellite images	Provides basis from which to start
Open-ended and semi-structured Interviews	Mental or written checklist of points, but open-ended and non-confrontational	Allows the follow-up of the unexpected, and the ability to cross check information
Key informants	Seeking out "experts" in the community to provide key information	Provides in-depth information on particular aspects of local life
Focus groups	Using groups of people to focus on a particular aspect of local life to determine a consensus of opinion	Allows for a broader analysis of local knowledge and the reality of local life
Do-it-yourself	Ask to be taught how particular tasks are carried out within the local area	Provides a deeper understanding of local activities and capabilities
Participatory mapping and modelling	Local people design maps and make models of the local community and the environment	Provides valuable information on local communities and resources, and allows local people to assess their own situation.
Transect walks	Local people walking through an area and noting, drawing and discussing local features, resources, and problems	Provides additional information of local environment and community problems and potentials
Timelines and trend and change analysis	Construct chronologies of local events, resource availability and use using local informants	Allows the analysis of change over time, and indicates what local people consider to be important historical events.
Seasonal calendars	Construct seasonal calendars showing key seasons, months, and cyclical events	Elicits information on cyclical processes within a local area, e.g., crop rotations, planting, harvesting, rainfall.
Matrix scoring and ranking	Uses seed or other materials to indicate the relative importance of resources, social groupings, assets, soils, crops, and differences in wealth, etc.	Indicates differences between people and relative importance of local resources, facilities and problems

Source: Abridged from pp. 959-961 of: Chambers, R. (1994a). The origin and practice of participatory rural appraisal. *World Development, 22*, 953-969.

The particular techniques used were chosen only after I had a knowledge of the local context: some techniques proved to be more efficacious than others depending upon context. These techniques are described in Appendices 2 and 4.

Logistics Of Data Collection

It was anticipated that a minimum of six months continuous research from the start of the dry season was needed in order to cover most of the seasonal effects in the region.

Prior to departure from New Zealand, a key teacher who was locally respected in Navosa helped with information about the research location and with background information. This teacher also provided a letter introducing me to the local people. Preparations were made for financial, bureaucratic, technical and other needs and procedures. Letters, information sheets and consent forms were prepared to help introduce myself, inform participants about the research, and obtain consent.

A broadly conceived and flexible research plan was prepared before leaving New Zealand that specified likely questions, resource and logistical details as well as a framework of time and travel: including a plan to visit the Navosa region as soon as possible after arrival.

The order in which various phases of the research were done was influenced strongly by the season and the likely weather at different places among other things. For example, I chose to research at Nasauvakarua first before Nawairabe because of the potential difficulties at Nasauvakarua associated with rising river levels at the start of the wet season.

RESEARCH IN PRACTICE

How well did fieldwork follow the initial plans, and what problems were encountered? What new techniques were devised to aid fieldwork? What was my experience like, and how did it affect local peoples? This section addresses these questions.

Implementation of Prior Plans

The research was relatively unplanned to allow for flexible interaction with the relatively unknown context. Nevertheless, the field research still demanded a substantial level of (especially financial, social and logistical) planning and organisation in order to be successful. What was least planned was the topic chosen and the specific techniques to be used. During preparations, I had learned about general methods such as survey research (Dixon and Leach, 1984), and ethnographic and case study techniques used by previous researchers (e.g., Belshaw, 1964b; Watters, 1969). I had a broad but inexperienced knowledge of PRA techniques which I was hoping to use, but was unsure of how or when they would be applicable.

Upon arrival in Fiji, I gathered additional basic information and materials (maps, notebooks & camera film) and prepared to enter the field. I was aware from my study of Fijian history that relationships between the remote Navosa region and the Fijian Government were potentially strained. Because the trust of the local peoples was essential to my research, I chose to delay my approach for permission and help through the official channels. Instead, I contacted relatives of my key teacher who hosted me and helped me plan an initial excursion into the Navosa area. A young man from this family guided me on this tour where my goal was to problematise and attempt to discern salient features of the local context, and ascertain the place/s where further in-depth research should be conducted.

My tentative plan to follow-up Hashimoto's (1990) study of

traditional irrigated agriculture was not realised because the Draubuta leadership was unwilling, the only time this occurred in Navosa. But it was also the only situation where I brought an additional agenda (outside of what was on the information sheet), to the local context.

The most interesting feature of land use in the Navosa region was the interrelation between the sociocultural system, pastoral farming, agroarboriculture, cultivation, hunting, and fire. The possibility of land degradation was apparent following my observation of recently burned hills bared of vegetation. With these features in mind, I travelled to Suva and began secondary research and interviews. It soon became apparent from the historical record that fire had been a ubiquitous phenomenon in the history of Navosa but there was no detailed research on the subject, so I decided to make fire a central topic of my research.

I interviewed a range of experts from government agencies, universities, museums, NGOs, and some urban-based individuals from Navosa including *turaga* (chiefs). Only a very few of these were known to me before departure from New Zealand. This phase of the research was largely a matter of systematically following the leads given by others. Because the number of leads multiplied over time, and some interviews were difficult to arrange at suitable times, this work took longer than expected. It was a matter of serendipity that I met a young visitor from Israel who was asking to do volunteer work for environmental groups in Fiji. Although I had not previously considered the use of an assistant, she agreed to accompany me to Navosa and was with me for the Nasauvakarua fieldwork as an assistant.

After this phase I planned to return to Navosa (after gaining formal permission from both traditional and bureaucratic leaders) and visit the places (Nasauvakarua and Nawairabe) I had selected for in-depth fieldwork. The process of selecting these places was a reasoned one influenced partly by my key teacher and his kin connections. I planned to do research at two or more villages to accommodate differences

between hill farming and flatland farming. Nasauvakarua was ideal for the first because it lacked road access, was relatively remote and traditional, located near forest margins, and the hill farmers practised swiddening using hand tools. Nawairabe was an ideal foil because it had road access, a transitional socio-cultural system, was distant from forest margins, practised mainly *bila* agriculture using animal-drawn implements; and shared a similar size and population with Nasauvakarua. A study of a 'tractor-powered' village (e.g., Sawene), was considered, but limited resources eliminated the possibility. Based on my previous visit, I felt that I had a good chance that these villages would consent to my research, which proved true.

It was fortuitous that a Professor from the University of the South Pacific (USP) was taking a group of geography students to the Navatumali-Keiyasi area of Navosa about this time. I joined them on their field-trips which was rewarding for the information I learned about the physical, livelihood and cultural context.

The eight weeks in Nasauvakarua were a process of intense cultural adjustment, problematisation and the development of techniques to obtain the information I needed on land use and sustainable agricultural development. I was glad to have the company of my volunteer research assistant whose sociability and help allowed me to concentrate on framing questions, developing techniques, and writing a questionnaire relatively free of the demands of village social life. The experience and strategies that I developed there encouraged me to extend the research to a multi-village study across the Navosa region. This new phase of the research was not previously contemplated.

Instead of travelling to Nawairabe I embarked on this regional phase immediately while the memory of dry season burning among the participants was still fresh and before the rains of the wet season made travel especially difficult and dangerous. Nevertheless, heavy rain did occur in this phase and some of the river crossings (on foot) were

precarious. Travel was either via motor vehicles (between Sigatoka River villages, and in the Western Navosa area) or by foot (the remainder). On one or two occasions packhorses were used. The option of travelling by horse was avoided because of my allergies, the reduced flexibility, and the increased danger (some of the tracks traversed precipitous hillsides where a fall could be fatal).

After this 'tour' of the eastern Navosa villages I had planned for in-depth research at Nawairabe, but sadly the *Tui* Nasikawa died. The *Tui* Nasikawa was the highest ranking *turaga* for the Nasikawa district of which Nawairabe was a part. Because research was not possible there for several weeks due to the funeral process, I returned to the coastal region where I researched (and ran an errand for Nasauvakarua) in Western Division centres such as Lautoka, Ba and Tavua. I also visited Suva again. I returned to Nawairabe several weeks later than planned: I spent three weeks there in the wet season and repeated the methods I had used at Nasauvakarua. I was now nearing the end of my fieldwork but the western and northern Navosa part of the regional study remained, and it was necessary to visit Nasauvakarua again while returning from the northwest. After leaving Nasauvakarua, I was held up at Namoli village by serious flooding of the Sigatoka River which was nevertheless rewarding (as unpredictable events often were), in this case for the observation of erosion processes at work.

That account describes in temporal order the sequence of events that the research took. The process was one of exploring opportunities as they arose and working around constraints in a flexible manner always in cooperation with the local people, who hosted my visits in their homes.

Techniques Used and Problems Encountered

Of the techniques chosen, observation, participant enquiry and interviews were the most used and the most essential to understand the context. Questionnaires and PRA techniques were also used: they were invaluable in learning about intra-village and intra-region variations on specific themes.

Observation

Much of the enquiry was conceived in response to my observations of features of land use, especially the dramatic baring of the soil following burning and the exposure of grass roots as a result of sheet erosion following heavy rain. Observation provides the details and evidence of the heterogeneity of land use that maps and photographs cannot supply: for example, the agri-arboricultural or agroforestry systems that were obscured by secondary forest. In this case close inspection was needed as an uninformed tourist would be very unlikely to identify them. Observations of separate environmental features can be combined to form proximate interpretations based on their degree of interdependence (Stocking and Abel, 1981). For example, the relation between the colour and depth of soil, the degree of slope, and the type of vegetation usually gives a good indication of the degree of land degradation (assuming the observer has adequate local knowledge of these features).

Observation was a crucial technique in an attempt to understand sociocultural events and their relation to the ecological context.

Maps, photos and drawings

Maps were valuable in obtaining geographic information, and also for ascertaining and cross-checking local features. One particular map (Fig 6A from Parry, 1987) that showed old settlement sites and other historical features was of interest to and shown to the local people. This map was a good catalyst to discussion about the local history. Other maps aroused little interest from local people.

Because there were a variety of maps available relating to land use that represented a historical series, I decided to collect these and use them as raw data in order to exhibit perspectival changes over time.

The trial technique of giving the camera to local participants to record local features was abandoned after a short trial because the participants were unfamiliar with the use of cameras and lacked the necessary photography skills. Consequently, the process of learning how to use the camera interfered with the ability to take relevant photographs because the participant tended to stand in one place and take photographs of objects which were distant, and it was then difficult to determine which of the objects in the resulting photograph were important to the participant.

The cost of film, bulkiness, low definition and low-light limitations of the Polaroid camera proved impractical in the field and it was not used. Instead, photographs of local people were largely recorded on relatively inexpensive print film using a 35mm camera. This method proved practical because photographs were able to be returned to the people following local processing when return journeys to the field were made.

Interviews

I found that participants generally welcomed the chance to be interviewed even though they often led busy lives. Most of the interviews were not arranged beforehand but were conducted upon the first meeting with the participants in whatever place they were, but some were arranged via my translators (especially in the villages) or over the phone in urban areas. A translator was necessary where the interviewee did not speak English well. This was typical in the villages where many interviews took place in an opportunist and leisurely manner but were typically slow because of in situ translation. Each interview started with personal introductions, and then an exposition of the purposes of the research as written on the Information sheet which I carried with me. After consent was obtained, I asked questions according to the knowledge held by the interviewee, my needs for information, the nature of the dialogic interaction in the interview (the type of power and personal interrelationship/s), and the context of the interview. As much as possible I tried to engage the interviewee informally in a cordial discussion rather than confronting the interviewee directly with a series of questions: which can be considered offensive in Fiji, and can be inefficient because the interviewee sometimes does not immediately understand the question and needs to hear the context. In many of the interviews the questions I was most interested in were asked at appropriate points during these discussions: this technique has the advantage that the interviewee has the opportunity to understand the question more easily because they comprehend the context of my questioning more clearly. In the case of sensitive issues I tried to maintain the cooperation of the participant by approaching the topic in a roundabout way and usually near the end of the interview.

Some interviews were held around the *yaqona* bowl, in which case information would be more quickly and openly forthcoming but only for a limited time before the soporific effects of the *yaqona* beverage led

to languor. The *yaqona* sessions were nearly always relatively public situations (usually with several participants) and as such they were good occasions to assimilate community perspectives (both for the researcher and for the young people of the community). The community view was usually expounded by the highest-ranking person present while those less in rank obliged by listening at this time. However, sometimes it was apparent that the highest-ranking person held idiosyncratic views that were not representative of the group, and on occasion there was open argument about issues within the group. By contrast, individual interviews allowed for the expression of personal experience and the garnering of more particular and technical information. However, there was not a clear division between one-to-one interviews and group interviews because many 'individual' interviews were conducted with other people present and coming and going from the household or the office. This was an unavoidable aspect of research, especially in the villages, and another reason why formally structured questioning would have been incompatible. New arrivals to the interview situation sometimes changed, or added, to the direction or the depth of the interview, and flexibility was necessary. Interviews could be interrupted by the arrival of a visitor, or an unforseen event (e.g., the pursuing of a errant wild pig through the village) or an urgent request for the knowledge or labour of the interviewee, and consequently some interviews were continued at a later time. The best place for private one-to-one interviews was away from the village in the gardens and forested land where participants were more relaxed and prepared to speak in detail, especially about agricultural matters.

Preparations had been made to record interviews via audio tape, but the device was never used, primarily because I believed it would intrude negatively into the relationship of trust I had with participants.

Participant enquiry

This was primarily an opportunist activity. I judged the time to make enquiries according to the prevailing context and situation. Many enquiries about features of the land and the people were conducted with my translator-guide whilst travelling (usually by foot) through the landscape and visiting villages. Much useful information was gained in this way but the demands upon my translators to satisfy my requests for information were quite large, and there were times when I felt that my requests had exceeded what they were prepared to offer me in terms of effort or of their own knowledge and status. The process of translation was taxing for them, many of my questions may have seemed naive to them, and their social status incorporated limits upon what they could comment on regardless of what they knew: these things placed a limit upon the number and type of questions I could ask directly of them.

In the villages I requested information from leaders and experts in particular fields. I recognised that social status or position predicted much of what a person was able to say on any matter. Thus, only certain questions could be asked of certain people, and the presence or absence of particular others in the enquiry situation (similar to interviews) often influenced what information was given. Similar to interviews, there were only certain times when people were available to participate: (a) many villagers work strenuously in certain hours (usually early morning and late afternoons and evenings depending on the season), and (b) many villagers reside out of the village during the week at their distant cash crop gardens or are away from the village at *solevu* (ceremonial gatherings), church events, or visiting relatives or doing business in the towns and elsewhere. Thus, it is often necessary to go where the people are: which can be very difficult in the Navosa region where (foot) travel is very strenuous and a high level of fitness is required.

Questionnaires

There were two different research phases in which questionnaires were used: the within-village household studies and within-region village studies. Each required a different method and a different questionnaire although some questions were replicated from the study of households to the study of villages.

The first phase involved in-depth studies at the two villages previously chosen to be compared: Nasauvakarua (where I stayed 8-9 weeks) and Nawairabe (where I stayed 3-4 weeks). The research techniques were developed primarily at Nasauvakarua where each of the households was evaluated separately in the questionnaire (the respondent was usually either the head of household or spouse).

The second phase involved questioning separate female and male groups of participants in each of 18 different villages or settlements in a regional study. I managed to visit one village per day in a tour lasting about three weeks at the beginning of the wet season.

The village household questionnaire

It was not initially planned, but while in Nasauvakarua I realised that a questionnaire would be a quick and effective way of obtaining detailed information representative of the whole village and not just the village experts that had been interviewed. In particular, I wanted to broaden the base of my data collection away from that of my relatively privileged host household. Due to the customary constraints associated with being a visitor and resident in a particular household, and my place in the network of power relationships associated with the host, it was difficult to interview members of other households who were not allied to this household. The questionnaire was a device which enabled me to visit and obtain the contributions of other households. Subsequently, I administered a questionnaire, through a translator, to every household in this village, and for Nawairabe also (each had 34 households). The questionnaire interviews were usually conducted within homes within

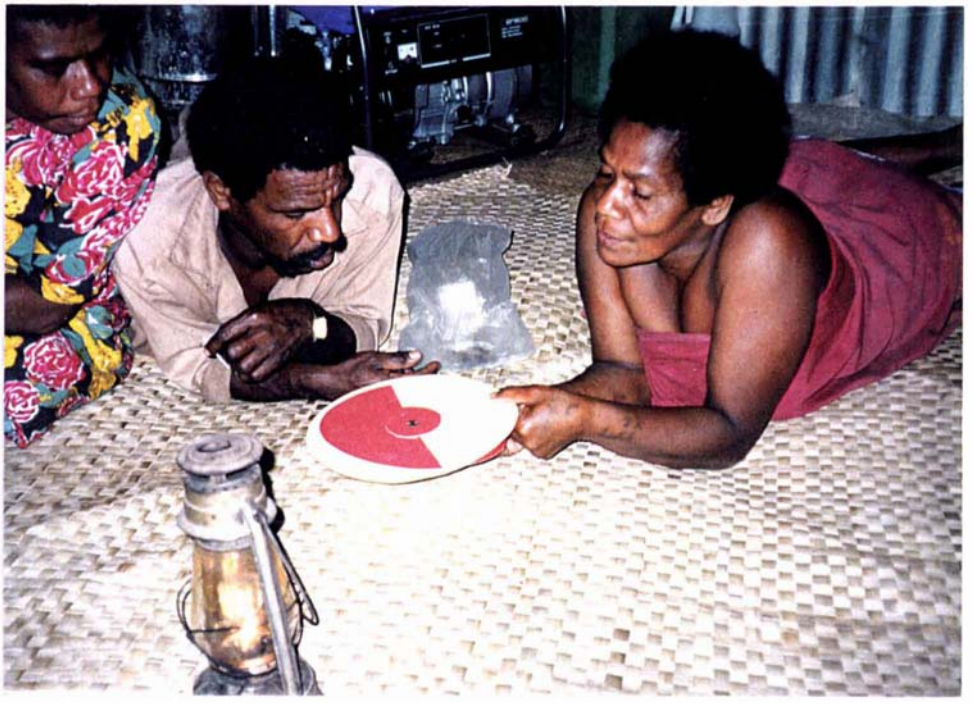
the villages, but some of the interviews were conducted outside on the *rara* (village green), or in a few cases, in relatively remote farm settlements or in other distant locations (wherever the participants happened to be located). The bulk of the interviews were conducted in the homes of the particular householders concerned, but some of the interviewees' arranged their household interview at the home of the host where I was staying at the time. Ideally, however, my policy was to conduct the interview within the household concerned (to minimise data contamination). The selection criteria for the paired villages, described beforehand (see p. 141), included that they be of similar size and population but it was a coincidence that each contained the same number of households.

In order that the questions would be contextually relevant, I selected the questions and wrote the questionnaire at the first village I resided at (Nasauvakarua). It was handwritten over several pages of a large A4 size notepad. Most of the questions were census-type in format but some questions incorporated new features in the way of visual techniques using cards, tokens and a movable pie-chart for some questions (see Appendix 2). These techniques were developed by adapting known PRA and social research card-sort techniques to the requirements of the context. One of these is, to my knowledge, an innovative technique that combines open-questioning with token scoring of chosen cards (see Appendix 2). My translator helped with the initial formulation of the questions, and later my volunteer assistant and some participants (especially the *Turaga ni koro)* helped with refinements. We gathered special materials for the visual techniques: (a) *vesi* seeds (used as tokens) were gathered from the ground underneath nearby groves of *vesi* trees and stored in plastic bags: I employed a young boy to help with this task. The purchase of extra supplies of coloured cardboard, paper pins, coloured felt-tip pens and other items necessitated a journey to the major town of Ba. The translator was asked to make a copy of the

questionnaire in a locally understandable dialect of Fijian language so that other translators in other villages could cross-check and translate for their own linguistic contexts. I did not use a trial run for this questionnaire because of time constraints and because I felt that it would place excessive demands on the labour of the participants which may have compounded to the detriment of later aspects of the research. Instead, the first few cases of questionnaire administration with individual households (hereafter called data contributions) were analysed for effectiveness, and some questions were added or changed slightly, especially the new techniques.

An example was the question which asked about the percentage of uncontrolled burning. Initially I resisted asking this question as I knew that most of the local participants did not understand the (verbal) percentage concept, and I did not want to embarrass them and create difficulties for my translator (and myself) by asking the question in an orthodox verbal manner. I discounted the use of fractions by virtue of their inaccuracy. While I struggled to work out a way of getting this crucial information it was lacking from the initial data contributions. I was despairing to the point of discounting the question's importance and had almost given up the attempt, but my assistant helped by frequently prompting me about why I was not asking this question, and after a period I recalled a demonstration of the use of the movable pie chart technique and I decided to experiment with this approach. At this point we journeyed to the town of Ba for the extra materials. Fortunately, my assistant knew how to make the device which was constructed quickly from two sheets of cardboard and a paper pin. The resulting device, like all the visual techniques used in the questionnaire, exceeded my expectations with the speed, accuracy and enthusiasm with which the participants used it, and it was then incorporated as an

important part of all field research.



PHOTOGRAPH 1. Using the firewheel.

As a result of the additions and changes to the questionnaire format, some of the data contributions had to be updated by returning to some of the households at a later date. Only the additional or changed questions were asked on these relatively short and unproblematic repeat visits. This partly participatory process of questionnaire construction allowed early oversights to be corrected and the questionnaire improved, and I felt that the benefits far outweighed any detractions from not maintaining a rigidly consistent format. In addition, at the second village (Nawairabe) where the context was slightly different, other (relatively small) changes were made: (a) in the way of additional detail to answers to existing questions (suggested by the participants), and (b) a very small number of new questions were added, taking care that they were placed so that they would not confound the most important questions and any comparisons with the first village. The bulk of the questionnaires were

administered over a period of about two weeks, with the remaining contributions from a few isolated households being collected when opportunities arose later.

Some answers to questions (especially Part H, questions 1 and 2, see Appendix 1) were noticed to change in accordance with village events. This effect detracted from inter-household comparisons for the open questions concerned, but conversely added information to the cumulative village data and lent emphasis to the changing seasonal and event-related nature of answers to some questions. This effect shows how a reductive technique can help by informing on context with the use of a flexible multi-level approach to method.

The questionnaire also lent itself to impromptu interviews: sometimes the participant volunteered additional information which was followed up in interview style by me either immediately or at the end of the questionnaire. Sometimes I enquired for additional information in response to a novel answer or in recognition of the knowledge or eloquence of the participant, and likewise an interview followed. These interviews tended to be brief unless arranged for a later time because of the enervating nature of the questionnaire process. The time to administer the questionnaire ranged from about 45 minutes to 75 minutes. It involved 66 questions and thus required considerable effort to complete: which all households did do. The census-style questions were generally considered to be tedious. The most difficult questions for the participants were Part H, questions 1 and 2 (see Appendix 1): these open questions about the environment demanded considerable thought. Participants commented that they liked the visual-style techniques and found them the most enjoyable to do.

The regional village questionnaire

As a result of the success of the household data contributions in Nasauvakarua together with the contextual knowledge that I had accumulated by this time, I decided to extend some of the questions to a new phase involving other villages in the Navosa region. This new 'participatory questionnaire' was comprised of a much smaller set of questions and involved village groups across the region rather than households within a village. I eliminated the household census-type questions used in the village questionnaire but converged on key land use, resource and social issues using mainly PRA-style visual techniques. There were five questions initially but this was expanded to seven when I became aware of the desirability of two new questions (see Appendix 1). Two data contributions occurred at each village or settlement: one from a men's group and the other from a women's group.

Upon our arrival in a village we asked the *turaga ni koro* to call nearby people to form two separate groups of six or more people. The requested minimum of six people was usually realised but there was a considerable variability in the numbers of participants that gathered ranging from 12 or more down to just three or four people. I was pliant if there were only three to five people available, and the data contribution went ahead.

It was aspired to alternate the gender of the first participating group in an attempt to control for inter-group confounding of the gender variable. This occurred when some members of the yet-to-participate second group observed the opposite-gender first group in action and followed their example. This contamination was not widespread but occurred at a small minority of villages where the women's group tended to model their answers on the men's group. It was normal for the village *turaga ni koro* (male in all cases) to gather a men's group first (only 4 villages out of 18 were women-first). My request for 'women-first' contradicted custom, and I did not challenge the order of events

when my preferred arrangement did not materialise.

Each group was asked to discuss each question among themselves and achieve a consensus result. The groups were usually comprised of adults but this was not a requirement: in one village young men were very active in discussion before producing the desired consensual result. Sometimes only one person manipulated the tokens (*vesi* seeds) but at other times more than one person helped manoeuvre the tokens. Consensus appeared to be achieved more often than not but I was required to be pliant when circumstances beyond my control (such as the presence of a highly-ranked and alert chief) prevented this from occurring.

Participatory appraisal techniques

Various visually-oriented participatory appraisal techniques were developed in situ following Participatory Rural Appraisal (PRA) and the earlier Rapid Rural Appraisal (RRA) models of rural research (Chambers, 1994a). I had participated in a PRA training workshop before entering the field and thus had a small amount of experience with some techniques. My previous experience with the use of card-sorting techniques as an undergraduate assistant in social psychological research also helped (Oliver and Vaughan, 1991).

PRA practice: timing, process and context

The techniques were in two sets. The first set was developed for use within the individual household questionnaire and later extended to the regional village questionnaire as mentioned previously: this was the most innovative aspect of the research and combined visually-oriented card-sorting, pie-chart and token-manipulating techniques. The incorporation of these techniques within the questionnaire format was unorthodox but proved to be highly successful: the techniques were participant-friendly, easy to use, and high quality data was gathered. The second set was more closely modelled on typical PRA procedure and was conducted separately from the questionnaire in the form of two

separate groups of all-female and all-male villagers: the techniques that were developed included seasonal event calendar matrices, resource matrices, environmental problem matrices, gender and control matrices, brainstorms, and resource maps (see Appendix 4 and the results section).

In the characteristic PRA scenario the evaluations are undertaken shortly after arrival in a village by a team of researcher-facilitators (Kronen, 1997). The novelty of the occasion ensures that many curious local people will end up being participants in the ensuing evaluation exercises which have been largely planned beforehand. In this research, however, my first priority was to better understand the local context before designing the appropriate PRA techniques. The putative advantages of this approach were that the PRA exercise could be more participatory with regard to the match between the method and local knowledge, especially in this case where I had little prior knowledge of the local context. This proved to be successful: for example, the researcher devised the *Seasonal burning calendar matrix* (a technique involving a tabular and temporal representation of local fires, see Appendix 4) as a response to local concerns about excessive burning, and the focus upon particular variables within the resource matrices and the gender and control exercises were dependent upon a knowledge of locally-important natural and social resources. This focusing of the general to the more particular in the use of the PRA techniques facilitated a more meaningful interaction with the local people: who benefited by learning through dialogue and observation in addition to contributing more detail to the study.

There were disadvantages, however. Once the novelty of my presence in the village faded it was more difficult to organise and especially maintain a large group of people to do the planned exercises. Reasons include: (a) most people were very preoccupied with their livelihood arrangements and their gardens, (b) many villagers were resident at their distant *yaqona* gardens during week days and possibly only available on

Sundays or Mondays or at the time of the village council meeting once a month, (c) *solevu*, church and other customary gatherings had precedence, (d) the research lacked the promise of immediate gain to their livelihoods, and (e) some people felt that they had already contributed a lot through participation in the questionnaires. This last reason was partly an artefact of postponement at Nasauvakarua where I had planned the timing of the PRA group exercises to precede the beginning of the round of questionnaires. The date chosen was for the day of the *Bose ni koro* (village council meeting) which is ideally held on the first Monday of the month but in this case the date (19 October) was in the third week. This date was four weeks after my arrival in Nasauvakarua. However, because a *solevu* was being held nearby that required Nasauvakarua participation, the *Bose ni koro*, and thus the PRA exercise, was postponed. Eventually it occurred on the 27th October immediately after the *Bose ni koro* that day, and about half way through the two week period of questionnaire research.

The timing of this exercise, both because of my length of time in the village, and the contiguity with the *Bose ni koro*, affected the procedure. First, the villager's familiarity with me and the research affected the novelty of the research, and thus fewer people were enthused when the PRA took place. Second, the *Bose ni koro* attracted the elders and leaders of the village and thus, following Fijian custom, the more peripheral members of the community were obliged to remain in abeyance to the senior members who were present. Those who were in conflict with this leadership may have avoided the meeting. Thus, the results of the PRA exercise could include a bias towards the views of those who held power in the community over those who were marginalised.

I could do nothing about the reduced novelty, but an attempt was made to minimise the potential for 'leadership bias' by manipulating the sequence of the evaluations. For example, I chose to do the women's group first (against custom) partly because there was a lack of younger

men present at the time and partly because there were more women present. According to custom the senior men are those most responsible for and entitled to offer community information: however, the lack of younger men may have jeopardised the PRA exercise because some techniques (especially the resource map) required relatively educated and dexterous participants. Also, by doing the women's evaluation first, I hoped to minimise the stronger voice of the male leadership influencing subsequent evaluations. The men's group was accomplished the next day after more younger men were requested: in this exercise the senior men observed (and sometimes contributed) from a background position.

My plan was to continue with additional techniques on subsequent days, but the declining enthusiasm together with the need for the participants to attend to their work activities curtailed this venture.

Techniques and application

The techniques that were generated (described in Appendix 4 and illustrated in the results section) were similar in that most of the comparisons were carried out on large sheets of newsprint on floors within buildings. I considered the use of outdoor locations and alternative more natural materials but the hot sun (or rain) and hard ground conditions prevented this: it was the norm for local people to retire indoors (except for football games) during midday periods, and the use of felt-tip pens and paper allowed for better detail and easy recording. Some (especially senior) participants were unfamiliar with these materials but the more educated younger participants used these materials without difficulty. The resource map was an exception as it proved difficult to find people who had the ability to draw maps on paper. The covered floors prevented the use of other techniques that did not use paper materials. This set of PRA techniques and variables were conducted consecutively within a half day participatory exercise with either all-female or all-male participant groups at Nasauvakarua and Nawairabe villages on separate occasions. Usually the opposite gender

group exercise was conducted the following day. An interval of nine-ten weeks occurred between the exercise at Nasauvakarua and at Nawairabe, and nearly identical techniques (allowing for some slight changes due to technical improvements) were used at both villages. The category variables, however, were partially context driven: they were altered to fit the local village context although there were many similarities and opportunities for comparison between villages.

The opportunity was taken to replicate some of the visual-oriented questions from the regional village questionnaire by incorporating them into this exercise. This was a valuable aid to cross-check the data, and in one instance allowed me to correct an anomalous village group data figure.

Anomalies

In some evaluations responses occurred which were believed to be anomalous. For example, at one village group exercise early in the study I recorded a low and unusual score off the firewheel for the question on uncontrolled burning. While earnestly deliberating, the participants had suddenly adjusted and handed the firewheel back abruptly, and I was surprised to see the low score. My volunteer assistant (who was in a position to observe the whole group interaction) informed me later that she had observed a (senior) participant impose his own judgment by fiat over that of the other participants: who were obliged according to custom to report the senior participant's opinion regardless of their own opinions. Later I queried my translator privately about this. His response was noncommittal and parallel to that of the other participants in the exercise. In this village, despite his status as my translator, he was not able to publicly (research was viewed as public domain) comment upon the judgment of those senior to him. Without his support I was not able to repeat the exercise, which would be possible only in special circumstances where the senior participant's authority was not undermined.

Nevertheless, there was an opportunity for cross-checking and rectification. Because the questionnaire for this village incorporated this same question, I could validly choose to cross-check the average of the scores of all the relevant householders and compare this with the group score. When this was done it was shown that the group score had indeed been anomalous: made clear when the participant returned a similarly low and anomalous score for the same question in the questionnaire. This approach also demonstrates the value of triangulation (cross-checking) across methods and the team approach.

There were four or five other anomalous events which I noted: there were two other direct fiat events involving senior men, one case of indirect chiefly influence and two cases of tiredness and inaccuracy following the consumption of large amounts of *yaqona* (one of these also involved a fiat). Only men were involved in anomalous cases. There were 35 evaluations which included a regional total of approximately 215 questions: of these it is estimated that approximately 10 questions were affected by anomalous actions so the overall degree of recorded anomalous responses (0.04%) was quite small.

Participation in Practice

Participatory research was previously described as a process of being interactive with local realities and goals and incorporating local parameters in contrast to the conventional method of conducting research to extract information according to the needs and goals of nonlocal institutions. In addition, participation is expected to be relatively empowering for local people. The degree to which participation was successful is discussed here.

Local realities and interaction in research

The initial objectives of the research were centred on the issue of sustainability and its relation to the use of natural resources in the local agri-cultural system. After the initial tour of exploration and interaction with local participants in Navosa, my efforts began to reflect the expression of community concern about excessive burning of the land and subsequent erosion. Thus, the goal of the research changed from a relatively broad and abstract conceptualisation to a more explicit and tangible focus as a result of local participation.

Several aspects of the research reflected, in various degrees, an interactive (rather than extractive) approach. For example: (a) as far as possible local language terms were used for description, (b) I resided in local homes, ate local food, and participated in local events, (c) contributions were made to local institutions and livelihoods with gifts (*yaqona*, locally-grown *suki*, photographs) and money, (d) questionnaires were formulated in situ using context-relevant local categories chosen after interaction with local participants and translators, (e) PRA plans and techniques were designed and prepared following dialogue with local participants and translators, (f) community experts acted as key teachers, (g) an approach of 'do-it-yourself' (a PRA technique: engaging oneself in what the participants were doing in lieu of merely observing), was sometimes used, and (h) a written report and other information was returned to the local people. Other tools were less interactive and more extractive: (i) transect walks with participants provided information on the local context (although often participants used this opportunity to seek my advice about related, especially technical, matters), (j) local seasonal calendars were constructed, and (k) local participants matrix scored various participant-chosen but researcher-framed resource categories (although participants sometimes learned from each other here).

It was apparent that in many group situations, younger and less

knowledgeable members of the community were indirectly learning knowledge that was expressed by the community experts. The impression was that this opportunity was relatively unique (which indicates that the pedagogy of indigenous knowledge was normally obstructed), and possibly valuable to younger villagers, although the validity of this inference was not checked thoroughly. The practice of research, therefore, while not completely interactive, may have had the indirect effect of supporting indigenous knowledge.

Translation

At the beginning, I considered the possibility of engaging an expert nonlocal translator who was familiar with the local communalects or dialects (see Geraghty (1983, pp. 17-19) regarding the communalect-dialect distinction). Such a person, if they were available and affordable, would have been more accurate and efficient in the translation process. However, after engaging locally resident farmers as translators, it was found that local status and knowledge were very important, and that nonlocal translators would have been unsuitable given the nature of this research.

I used three local men at different times in the role of principal translator: the first was an initial guide, the second at mainly at Nasauvakarua, and the third mainly at Nawairabe. The two village translators were both local to their respective villages of Nasauvakarua and Nawairabe. There were others who did translation on occasion: all except two were locally resident and all except one were men. Both outsiders were involved in translation only for short periods: one was from neighbouring Nadroga rather than Navosa but still had local connections, and the other was a woman schoolteacher from Suva who was staying with relatives in the local Namoli village: she assisted my first principal translator on occasion.

In an initial effort to produce a gender-balanced approach, I made a tentative agreement to use a young woman translator in order to

facilitate interviews with women at Nasauvakarua. However, this novel arrangement was abandoned because of potential controversy and the difficulties it would have caused: the necessary but unorthodox closeness between an unmarried woman and myself would have led to romantic and destructive rumours and damaged reputations. Also, it would have been a challenge to the sexual politics of the village: it was particularly a challenge to my regular male translator who would have been offended that another person and (perhaps) that a (similar-age) woman had usurped his role despite an explanation that a particularly gender-sensitive approach was needed in this specific micro-context. This issue of power was a sensitive one in a place where a person's status is often dependent upon hierarchy and their ritual role (Toren, 1990; Turner, 1986). I deferred to local custom where: 'women serve men; men guide women; men speak on behalf of women at important functions' (Turner, 1986, p. 1).

I decided beforehand to use more than one translator to allow for a better matching of translators with varying local contexts and to cross-check the efficacy of translators: this information was shared with the translators. The disadvantage of this approach was the possibility of inconsistency of interpretation between translators. In order to guard against varying translations, the initial translator was instructed to write out his interpretation of the questionnaire in the Fijian language. Thus, subsequent translators could read both the English and the Fijian language versions in order to maintain the consistency of meaning.

The age and education of translators varied. The first translator was also my guide on the exploratory tour of Navosa: he was a young farmer from Keiyasi with fourth form education, and a relative of a Fijian man already known to me. He was a quiet, polite and thinking man who served to introduce the region and its people. Much of the journey covered new territory and was a learning experience for him. However, his lack of advanced education told in the level of translation

he could give, and this prevented his use later when more detailed translation was needed.

The second translator was chosen with the help of the Assistant *Roko* based at Navatumali. He was the next choice after the first man chosen proved to be unavailable. This second translator worked closely with me at Nasauvakarua where many of the research techniques were developed. This translator was born in Nasauvakarua but lived with his aged grandmother at the neighbouring Namoli village. He was an intelligent young man with sixth form education.

The third translator was chosen after discussion with the Assistant *Roko* at Navatumali: he was a young man from Navatumali. However, this man elected not to continue after arrival at Nawairabe (possibly because he was a friend of the first translator and did not want to offend him by taking his place), and instead an arrangement was made with a respected mature man, a *turaga-ni-bito* (chief of subclan) to be the translator.

Each of these translators did an effective job and there was a consistency of translation between translators. However, each had a different personality and perspective that was noticeable in the results of translation in particular situations.

Translator differences

The main difference between the different translators used at Nasauvakarua and Nawairabe was their age and status: one man was young and without the status of maturity, whereas the other man was mature, tertiary educated, and had relatively high status in the village. Both were intelligent but each had advantages and disadvantages. The advantage of the young man was his slight marginality to the village, his relatively neutral social position, his lack of strong opinions, and his recent education. He was raised in the study village but currently lived in a neighbouring village. However, his inexperience was a disadvantage: he lacked the detailed knowledge of local cultural matters held by seniors.

The other translator, by contrast, held a *turaga-ni-bito* (chief of a subclan) position and was a 'kingmaker' to the *vanua.* Parallel with his maturity, this translator had a more established and central position in local society. His knowledge and experience was advantageous to understanding local culture and social structures, and his authority was helpful in certain circumstances. However, the disadvantage was that his beliefs and opinions were well known in the village, and thus there was the possibility that interviewees would slant their discourse in ways to please or otherwise influence the translator. I detected some evidence that this was occurring, but only on the topic of burning. The translator actively campaigned against excessive burning on village lands. Thus, it is possible that some of the responses to the questions involving fires had been influenced by his views. This argument appeared to be affirmed by the above-average percentage score for uncontrolled burning in his home village, compared to other villages. However, there is a difficulty in determining the degree to which he, as a leader, was either expressing idiosyncratic views or properly expressing an already-held community view, in response to circumstances of local severity. In Fijian society it is often only the *turaga* who are allowed to speak with forthright opinions, and following the Fijian custom of *veidokai* (polite respectfulness) (Ravuvu, 1983, p. 104), it is generally impolite to challenge these views, for example, by analysing their origin. Triangulation was helpful, but it was difficult to ascertain the extent of translator influence by comparing responses between villages because each village has different circumstances. Nevertheless, some degree of contiguity is expected when different villages with different translators are compared. My analysis suggests that the degree of translator influence was not excessive and that it was limited to a small subset of questions.

Another problem arose in the questionnaire administration: translators sometimes developed a tendency to prompt expected answers

by hinting, thus imposing their own interpretation during the process. This was especially the case when there was an urgency to complete the session and the participant was slow in responding to questions. I was obliged to correct this tendency by instructing the translator to allow sufficient time for the response to questions in the questionnaire.

On rare occasions the translators overlooked relevant responses. For example, one (popular) reason for burning is to cultivate the wild green vegetable, *malasou (Solanum americanum,* black nightshade). This was disregarded by the translator as being too minor when first encountered, however, I recognised the word and observed the enquiring look from the participant who had offered it. A short discussion resolved the matter so that *malasou* was included as a valid reason thereafter.

These aforesaid situations are evidence of the problems associated with the use of translators who are also necessarily local interpreters. It was found that the translation process was never totally free of interpreter influence, yet despite this, many aspects of potential bias could be detected and guarded against.

Translating the translators

The translators were instructed to use local communalect or dialect terms in preference to standard Fijian ones and to share with me the details where two or more terms had the same meaning. However, the translators, although local, sometimes used the standard Fijian terms which are taught in the Fijian education system. It was undetermined to what degree the local variants have been replaced by standard Fijian in common usage, but it appeared that the generally younger and more educated translators used more standard Fijian than the village seniors did. A comparison of some of the terms that I recorded with the vernacular ones in Schütz (1962) reveals that, although many vernacular terms were given, some of the terms given to me were standard Fijian ones where local variants either still exist or once existed. The relevant villages that Schütz analysed included Nubutautau, Korolevu, Vunatoto,

Draiba and Keiyasi. The standard was elicited during research (instead of the vernacular) in cases such as: burn *(káma, yági;* standard, then local in parentheses), drink *(gunúva, sòmía),* road or path *(sála, cà lévu),* and village *(kóro, rá:rá:).* Other terms, however, matched their vernacular as in Schütz. My lack of knowledge of the Fijian language also constrained translation. It was a struggle to understand the pronunciation and the appropriate spelling of many terms: which may have influenced the translators towards an efficiency of effort by using standard Fijian rather than persisting with vernacular variants (with their unusual pronunciation and spelling). It is apparent from studying Schütz's (1962) translations that this was sometimes the case. I failed to understand that, for example, the vernacular spelling and pronunciation of the term fish was *íxa* and not the standard *ika.* A reason for this may be that the translators did not know how to spell the vernacular *íxa* (there is a lack of literature with vernacular spelling) despite being familiar with *ika.* In these cases, then, the standard was used and I remained unaware of the distinction despite enquiries for further explanation. This was the main disadvantage of local translators: because of their lack of professional training they were sometimes unable to explain, and especially write, variations in language. This led to occasions when I struggled without sufficient help to comprehend and write a (probably local dialect) pronunciation.

The case above also indicates how the lack of colloquial written material in vernacular regions encourages the hegemony of standard Fijian.

On the whole translators generally relished their role and the accompanying chance to further their language skills and knowledge — they were the first guides to the local context and important repositories of information.

Triangulation

The validation of recorded information by cross-checking was an ongoing process: the technical term used by PRA researchers is triangulation (Chambers, 1997, p. 157; Mukherjee, 1995, p. 38). Data that has been subject to this form of validation will be more reliable (Webb, et al., 1966, pp. 3, 181). Triangulation can be likened to a process of informal and flexible hypothesis-testing where the 'hypothesis' concerned must be able to survive a series of complementary methods of testing (Burgess, 1984, p. 144).

The use of the term 'hypothesis' is somewhat analogical and should be treated with caution. From my field experience, the 'hypothesis' itself was usually conceived in terms of a concept and a question following a spontaneous opportunity during dialogue with a participant: on most occasions it was constructed in a manner where I did not have time to reflect on whether I was using deductive or inductive thought in formulating the question.

The process of triangulation can be subdivided into: (a) data triangulation, (b) investigator triangulation, (c) theory triangulation, and (d) methodological triangulation (Burgess, 1984, p. 145). In turn, data triangulation can be subdivided into: (a) time triangulation, (b) space triangulation, and (c) person triangulation (ibid).

This research incorporates methodological triangulation, all aspects of data triangulation, a degree of theory triangulation and a form of investigator triangulation. Regarding the latter, although there was predominantly only one investigator (myself) rather than two or more, there was some degree of triangulation with my volunteer assistant and especially my translators. Methodological triangulation occurred across the various tools previously discussed: particularly the comparison between questionnaires and PRA. Regarding data triangulation, time triangulation was somewhat limited over the months (not years or decades) of the research but historical data was collected as a substitute.

Space triangulation occurred between villages intra-regionally. Person triangulation occurred for participants and the researcher across individual interviews, household questionnaires, group interviews, PRA group evaluations and larger *solevu* events.

Triangulation has been evident in some examples already used to explain other phenomena, for example, for the analysis of anomalous scores during the use of the firewheel (see p. 158).

Empowerment and research

This research did not aim to empower the community as a first priority (cf. Scheyvens, 1995). Nevertheless, I endeavoured to maintain a mode of interaction that ameliorated disempowerment vis-à-vis encouraging empowerment when possible.

Empowerment of villagers may have been facilitated by: (a) the researcher seeking advice from and permission from local leaders, (b) the researcher being willing to listen and record the knowledge and opinions of the participants, (c) the researcher adopting local ways of living, (d) the researcher showing respect for local norms and the opinions of local people, (e) the researcher taking care to ensure that women and socially marginal households could contribute, and (f) providing an arena where participants can learn from other participants, especially the younger learning traditional ways from the older. My experience was that most of these factors tended to ameliorate disempowerment and promote empowerment in most situations in this context. The last point, the sharing of local perspectives and practices as a counterpoint to receiving nonlocal forms, appeared most significant.

Implications of my chosen methods on empowerment

It is difficult to ascertain, without specific research, whether different methods are more or less empowering, and here I rely on my subjective judgements made in the field. Most of the Navosa villages, although proud of their culture, are increasingly valuing nonlocal norms and practices in lieu of their own as extralocal infrastructure gradually penetrates. Senior members of the communities generally welcomed my respect for traditional ways. However, the opinion of younger people was more difficult to discern partly because of the cultural more where younger members of the community defer their voice to that of their elders. Nevertheless, my enquiries about traditional knowledge and social structures stimulated dialogue. For example, it was apparent that certain questions (particularly the questionnaire enquiries regarding subclan, clan and totems) caused much deliberation, perhaps because these social categories were the basis of a group and personal identity that had been partly lost. Many (especially younger) participants had a less than optimal understanding of these traditional structures and mores and my enquiries caused a certain 'revisionism' (re-learning of neglected local knowledge). This information was undoubtably edifying and empowering for many of the younger people whose knowledge of traditional local ways has faltered out of abeyance to their education via the hegemonic national school curricula.

The visual-verbal PRA tools used both in the questionnaire and the group exercises were particularly effective partly because less knowledgeable participants learned from those who were more knowledgeable. During the questionnaires various family members and others listened, and sometimes contributed, to the process thus extending and reinforcing the knowledge shared during the enquiry.

Being Reflexive

The concept of reflexivity refers to a researcher's awareness of their own place and role (positionality) in an epistemological and political praxis (which includes participants), both local and distant. Reflexivity reflects a concern about how the researcher's presence disturbs or alters the local way of life, and vice versa, and further, how the results of that research (and the group's way of life) is both presented in, and engaged in praxis with, the wider world.

The analysis of reflexivity has a close association with the use of interpretive methods (Whitaker, 1996). The controversial role of ethnography during the Vietnam war (when political neutrality was compromised), was a significant anthropological stimulus for reflexive analysis. Scholte (1969) suggested that anthropologists:

> must always note 'reflexively' how the political assymetries their activities presupposed were connected, in the process of ethnography, to the epistemological privileges of 'objectivity' and 'neutrality' they also claimed (Whitaker, 1996, p. 471).

The analysis of reflexivity aims to make explicit the researcher's own gendered, ethnic, national, political, financial and professional position which is inextricably at play while interpreting and recording in the field, and it necessitates a greater understanding of the structure of the hegemonic power relations that surround and inform the researcher (Rabinow, 1977).

One type of reflexive analysis, albeit distantly-positioned and post hoc, is exhibited by a postcolonial deconstruction of the formalised Fijian framework of land ownership (Clammer, 1998/1973). The focus is on hegemonic power relations and the political consequences that developed as a result of the homogenising interpretations of particular British social anthropologists of the 19th century.

In practice, politics and ways of knowing have many levels and dimensions: actual situations in the field involve a complex array of knowledge, positions and politics (Twyman, et al., 1999). In contrast to a statist position of idealised political neutrality and universal epistemologies, the research situation can be treated as a dialectic where both parties create new awareness of each others unique position by their reciprocal dialogue (Freire, 1976/1974, p. 45) in combination with an ethic of empowerment. The participatory emphasis on empowerment, despite it's logical contradictions, thus complements a reflexive approach in a praxis-oriented model. In dialectical combination, the role of empowerment is to create change and the role of reflexivity is to ensure that equity is established and maintained in the process.

The applied PRA model, although lacking an explicit concern for reflexivity, relies on participatory techniques that suggest a partially reflexive orientation. For example, the concept of reversal (from etic to emic) of frames, modes, relations, and power in the PRA situation (Chambers, 1994b), suggests a prescriptive attempt to utilise reflexive ideas, but usually without fully engaging in reflexive praxis to the extent of analysing the researcher's positionality as part of the evaluation. In addition, although these (synchronic) PRA techniques problematise the cultural and power dynamics between researcher and researched, they tend to overlook the wider diachronic and political context.

Reflexivity in practice

In the cross-cultural situation an ability to learn about, understand, and be sympathetic to the local ways is requisite. Self-awareness is a necessary part of this process but is not an end in itself, indeed, in my experience it was hard not to be self-aware. It is the dialectic of self-awareness and other-awareness in action (or positionality) in the local milieu that matters. The following is an outline of some of my experiences in this regard.

The circumstance of being either the only, or one of two, non-

indigenous persons in the village exacerbated my sense of distinctiveness, at least in a superficial sense. At Nasauvakarua I had the opportunity to discuss my interpretation of events with my volunteer assistant, but this opportunity was used rather rarely because: (a) the demands of research activities were time-consuming and took precedence, and (b) opportunities for private discussion away from others was limited (although we were both guests in the same house, local mores made sacrosanct any discussion involving the host's household), (c) our relationship was not a verbose one, and (d) my assistant was not trained in the complexities of reflexive research.

My main avenue of reflecting upon fieldwork was done: (a) through observation and the use of maps and other local secondary materials, (b) through dialogue with my translators or other local people, and (c) by writing my thoughts in a journal. This latter method allowed me to both immediately reflect on and look for insights into the phenomena I was writing about, and make a record for later analysis.

I explored the surrounding terrain widely in order to observe and understand the local environment. This approach helped me perceive local culture and society in its environmental (and broader social) context, particularly with regard to food and resource issues. By taking this approach, I was in a more objective position to understand my reflexive position in the village. However, attention to these broader, more objective aspects allowed less time to learn about and reflect on the subjective aspects of local culture.

Dialogue is important for reflexive understanding, especially when it challenges preconceptions, as the following vignette reflecting on the value of bamboo exemplifies. *Bitu* (bamboo) is a common plant in the hills of Navosa where it forms large groves in gullies at the base of hills. In northern New Zealand, from where the author originates, (non-indigenous) bamboo groves are perceived as a serious noxious weed infestation of pasture and indigenous vegetation. My first reaction upon

seeing these bamboo groves was to assume that the *bitu* was a spreading, exotic weed (as in New Zealand) that was replacing the native forest. I asked my young guide if it was degrading the local environment. His reply was negative, but the author was somewhat sceptical and repeated the question until an abrupt reply from my guide indicated that this line of questioning was naive and irritating. It was probably insulting to my guide who was having his integrity questioned. This rebuff was embarrassing to me, and I was forced to reflect both on my method of questioning and the nature of the particular information concerned. Later, I came to realise that *bitu* was not an exotic weed but a valuable indigenous plant co-existing with other indigenous vegetation and with many livelihood functions in the local context. *Bitu* had a meaning in Navosa that was opposite to that of the region of my origins. I eventually re-framed my perspective in these local terms to appreciate the advantages of *bitu*. This example illustrates the value of a critical perspective and cultural sensitivity in learning to understand the physical environment.

The value of recording information in a journal, in addition to its permanence, is that it enables the author to reflect on and analyse the information in the process of writing it or shortly after it has been written. It sometimes stimulates further questioning, for example, when the author realises that inadequate or incomplete information has been obtained on a subject, or that related themes are important and should be explored, or that the topic should be cross-checked with other data.

Interaction with participants

The support of my part-local Fijian teacher was crucial for opening doorways in the region to facilitate the research. Because of this teacher's support and influence, the participants cooperated with the research despite the intensity of their everyday priorities.

Because of my emphasis on a grass-roots model, I chose not to allay myself within the confines of a chiefly village which proffered greater

convenience and offered potential participants with a higher degree of education. Instead, for the in-depth studies, I chose specific villages according to various ecological and social reasons. The English language was not well understood, especially among senior members of the communities, and translation was essential. There was insufficient time for me to learn the Fijian language and discern the local dialects although key terms were learned and used. This lack of linguistic understanding had a pronounced effect: in one way it simplified matters because only a small part of everyday banter and dialogue was able to be understood. Without the distraction of everyday talk and gossip I was more able to focus on planning and recording the research. On the other hand, by learning predominantly through translation many nuances of local culture were not able to be fully understood: thus limiting my understanding of what people consider to be important in their everyday lives. This 'everyday knowledge' would have been helpful in order to more quickly ascertain local perspectives.

The everyday constraints were lessened somewhat during interviews: we were often seated intimately within the small houses which usually only comprised one room. Thus, I was able to observe and make notes on my surroundings, and during the interview it was relatively easy to observe the helpful features of facial expression and body language and any departures from the regular dialogue.

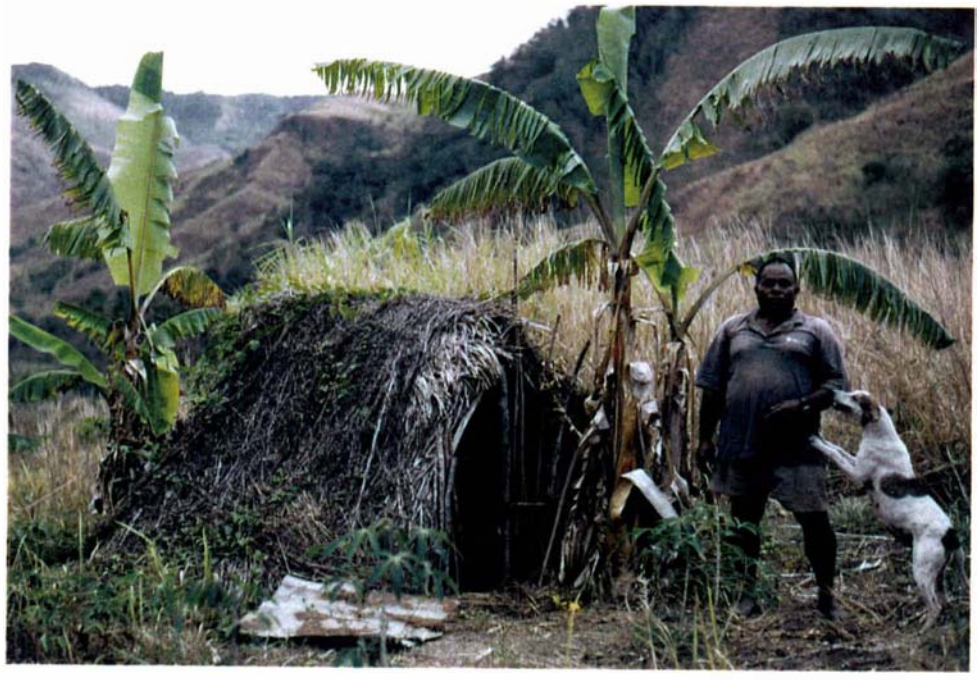
Many interviews began with the offer of a cup of tea and food which it was polite to accept. *Yaqona* was also frequently offered which I was obliged to accept, and drinking up to three cups of *yaqona* in separate rounds had little effect on concentration. Sometimes the participants drank *yaqona* during the interviews, which usually helped the social interaction. However, those who had drunk large quantities of *yaqona* were unable to engage in worthwhile dialogue, especially through a translator.

Overall, the interaction with the participants was a professional one.

Although I participated in the customary ways and the everyday banter of joking phrases, everyone knew that my presence would be of limited duration, and my participation with the local people reflected this.

The effects of preconceptions

The task of research operates within certain assumptions. The verbal translation process has a constraint in that there is a threshold beyond which the recording of less-important information becomes limited and realities obscured. Observation data can help when complemented by triangulation to help overcome this problem as indicated in the previous example involving bamboo (see p. 172), but can also confound. The following photograph showing a farmer-cultivator alongside a hut with his apparent friend the dog.



PHOTOGRAPH 2. Nasauvakarua farmer, yam hut and dog

In New Zealand the hut would be interpreted as a dog kennel, but it was a yam hut. This photograph was posed: it was not normal in

Navosa for local people to succour their dogs. Subsequent questioning revealed that the yam hut belonged to the participant's neighbour contradicting my first assumption that it belonged to the participant. Thus, several false assumptions could be made from this photograph.

Generally speaking I made a point of challenging my own assumptions, and sometimes asked myself, 'could this be explained in another way?' Or, if I was in the position of a local person, how would they perceive this? In this way my own preconceptions were challenged and altered closer to the local reality. Nevertheless, a lot of what is written in my journal represents my own interests and basic preconceptions about my role as a researcher. Because this is important, I have attempted here to expose what some of my preconceptions were.

CHAPTER FIVE

VILLAGES AND *VANUA*: RESULTS FROM THE FIELD

This chapter portrays the Navosa landscape and livelihood system through a descriptive analysis of villages and their adjoining lands as observed during 1998-1999, starting with an initial survey that was conducted along participatory lines. Additional information from research conducted later in the study has been incorporated (especially in relation to burning and land degradation). A section on human population in Navosa incorporates census and field data. In-depth studies were made at Nasauvakarua and Nawairabe villages at a later time, and the results are presented at the end of this chapter.

THE INITIAL SURVEY

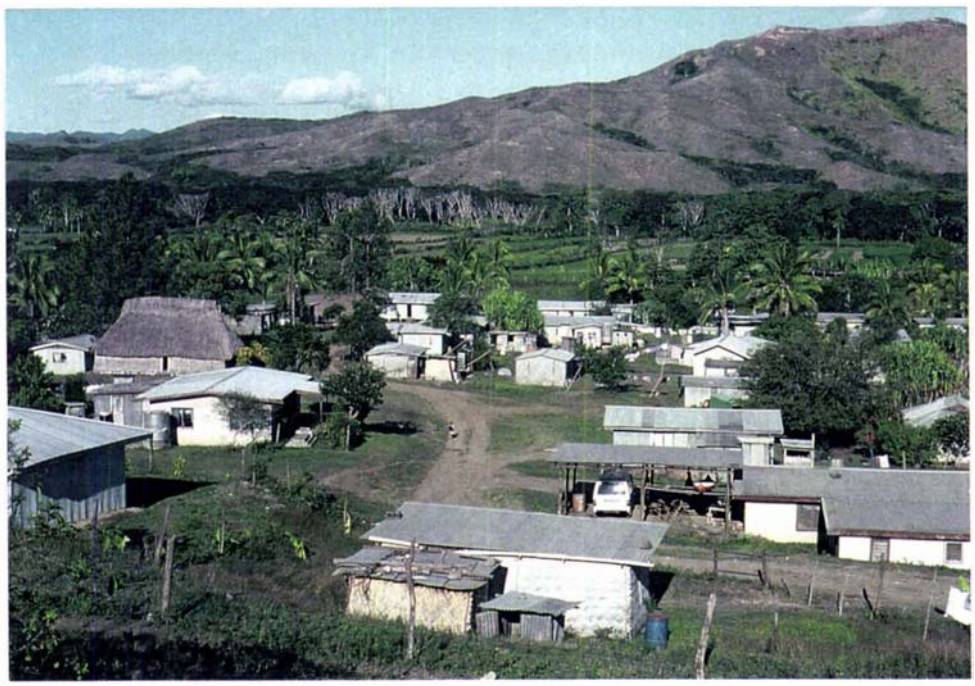
The initial survey occurred during the month of June and covered six villages and the landscape between them. It was on this tour that the geography, culture and key local issues were perceived for the first time. The characteristics of each village and its context will be described followed by a summary of the region as a whole.

Introduction

The initial survey was an attempt to discern the key features and problems that related to agricultural development and environmental sustainability in the Navosa watershed. The previous wet season had been unusual in that the summer of 1997-1998 coincided with an El Niño event, and there had been drought conditions. The landscape was already arid in June, the normal start of the dry season. The survey was conducted with a guide, usually walking between villages.

Keiyasi

Keiyasi village (approximately 30 metres in altitude) is located on the western bank of the Sigatoka River approximately 45 km inland and upriver from the coastal town of Sigatoka. Most houses were of sawn timber and iron construction in Keiyasi, except the large traditional *bures* of the village leaders. Groves of large *vaivai-ni-mocemoce (Samanea saman)* trees were common near the village.



PHOTOGRAPH 3. Keiyasi village. Leader's *bure* on left, riverside *bila* beyond, grassed hills in distance.

Access is via the poorly paved Sigatoka Valley road which is nevertheless open almost all year round: the journey usually takes about two hours. Most of the villagers are farmers who have agricultural plots located next to the river on rich alluvial soil *(bila)*. Commercial crops being grown included tobacco, watermelons, maize, pumpkin, *kumala* (sweet potato), eggplant, chili, *pinati/vinati* (peanut), *bele* and other vegetables in addition to the ubiquitous *tavioka* (cassava, *Manihot*

esculenta), which is also the dominant subsistence food.

There was one (noisy) generator supplying electricity to one family in the village. It was apparent that this was a village experiencing considerable change with modernisation views being expressed alongside a traditional way of life. A village leader wanted his sons to obtain paid employment rather than continue a traditional cultivator's lifestyle (F.I., 1998-1999). He had witnessed the success of cooperative organisations while visiting New Zealand, and desired the same for Keiyasi. Thus, he was critical of the lack of government action in organising the marketing of local export crops, which he believed was the main constraint to development in Keiyasi. He complained that the rough road surface damaged some crops (e.g., papaya) in transit making marketing more difficult, and he wanted a tractor and plough to overcome the difficulty in obtaining sufficient labour. Despite his exposure to other cultures, this farmer was happy with his life in Keiyasi and did not wish to be anywhere else.

Dalo was not commonly grown near Keiyasi, but there was a small spring-fed *sabe* (swamp *vuci)* in a small gully set in pasture land on the

eastern side of the river.

PHOTOGRAPH 4. Fenced *dalo sabe*, farmer and horse in background.

Floods occur every two, five or seven years following cyclones, when as much as 'three feet' of alluvium had been deposited (following Cyclone Kina) (F.I., 1998-1999). Floods occurred in 1964 (the largest), 1970, 1978 and 1993, and government relief supplies are needed for subsistence after floods.

Most farms are fenced, often using *banidakai* (*Jatropha curcas*, living fence) bushes planted as posts and two or three strands of barbed wire. Bullocks and *siriyera* (plough), *kurikiria* (row cultivator), and *yara* (harrow) were used for cultivating the very rich soil. NPK fertiliser (cost $5.00 per 2 kg bag) was sometimes used in small quantities to help the growth of pumpkin and watermelon.

Gramoxone (paraquat) was used to control weeds around *tavioka*. Orthene (acephate, an insecticide), was used to control insects on watermelon. At least one farmer believed that it helped to control

downy mildew (a fungus) also (F.I., 1998-1999).

Meleni, (watermelons), once a popular crop here, were now increasingly infected with a virus and difficult to grow, but at least one farmer blamed the (Taiwanese) seed (F.I., 1998-1999). The local agricultural advisor believed that the virus problem began with the introduction of aphids, perhaps allied with the introduction of (virus-invested) Indian tobacco, tomatoes or wild amaranthus. The infestation is now chronic, but some farmers are experimenting with virus-resistant varieties.

A *pinati* (peanut) crop growing nearby (on sandy soil) was showing the effects of stem-boring caterpillars which kill young shoots. The senior farmer was unaware that his crop was suffering from an insect pest, and he was pleasantly surprised when I located the larvae and showed him the cause of the problem. Apparently the crop was new to him, and it was apparent from his behaviour (he did not venture into the field to investigate individual plants with me), that he was either not familiar with the practice of locating and identifying pests that were causing crop failure, or regarded such work as an inefficient practice.

Agricultural chemicals were generally used at low levels and without much knowledge of safety issues and cause and effect. I learned from the local agricultural technical officer that the fungicides Benlate and Mencozib were often used in an attempt to control peanut stem-borer insects, when insecticides were needed.

The (locally well-liked) Agricultural Officer's view was that many farmers lacked sufficient knowledge about pests and their control, and had a poor understanding of how to use agrichemicals: 'they just spray' (F.I., 1998-1999). He believed that a lack of education was the problem, and that the errors would only be eliminated when a more educated generation matured. On another farm, I asked a local Indo-Fijian leasehold farmer about which agrichemicals were most harmful. He considered that Roundup (glyphosate) was more harmful than

Gramoxone (paraquat), because the former itched after contact with his skin whereas the latter did not (F.I., 1998-1999). This is contrary to scientific fact about toxicity levels, and goes in the face of the well-known very high suicide rates among pregnant, unmarried Indo-Fijian girls who drink Gramoxone. Protective gear was seldom used because he 'cannot afford the gear'. This farmer noticed, however, that spray drift from these herbicides (used on maize and rice) damaged other vegetables, especially peanuts.

This farmer's first need was for better seeds, especially better brands. His second priority was an irrigation pump with a sprinkler system. At present he uses a forty-four gallon drum mounted on a bullock-drawn sledge to take water from the river to his farm. The drum must be filled and emptied manually.

PHOTOGRAPH 5. Irrigation. Pump in foreground, bullock-drawn sled and drum in background.

The sledge is also used to transport produce across the wide and flat river bed in the dry season when levels are low, as it was then.

The Fijian owner of the leaseholder's farm was concerned about getting water for his livestock animals in the dry season. The animal access to the river was now blocked because he had leased his *bila* to be cultivated by the tenant. Despite this cost, both owner and tenant appeared to cooperate well together. The owner lacked both the knowledge and the money needed to install a pump-based watering system for his livestock. He was also concerned about the theft of livestock, especially goats, and wanted better fences to help control animals and prevent theft.

My host family maintained a goatshed to protect their goats from marauding dogs at night. The boys, and occasionally the girls, collected firewood here (the female head of household had a paid job), but women are the usual fuelwood-gatherers in most villages. Men sometimes transported the firewood using a horse & sled. Considerable travel was necessary to obtain the best fuelwood *(quwawa),* although there was no shortage. *Quwawa* is preferred because it emits little smoke, burns hotter and lasts longer. Fuelwood collection is not considered onerous and is often enjoyed (F.I., 1998-1999).

In Keiyasi, there was one diesel-powered irrigation pump with a irrigation system owned by one family. It was reported that each family wants their own pump but cannot afford it. Similar to many other villages, there was a village community work day on Monday that was led by the *turaga-ni-koro.*

When interviewed later on the eighth of September, the senior *Turaga* from Keiyasi considered the river to be at its lowest level ever, and another senior man reported that it was the worst drought that he could remember.

Nawairabe

Nawairabe (about 60 m in altitude) is sited alongside the Nasikawa river and surrounded by hills. Most of the gardens were permanently situated on flat alluvial soil of *bila* adjacent to the river, and were cropped repeatedly with the whole field being cultivated.

The main crops were *tavioka, sila* (maize), and *vinati,* with lesser areas in *meleni* and *uvi* (yams). Watermelon is now grown less frequently, despite high prices, because horses and cattle damage the crop. The residents were proud of their sweet-tasting *moli taiti* (oranges), which are produced from the trees originally planted by one particular (Fijian) man. Produce is either sledged out with bullocks or, for lesser quantities (e.g., one sack), carried on a horse. There were some relatively small areas of *kasi verara* (hillside) swidden *teitei* (gardens) on the eastern side of the village growing mainly *tavioka* with little interplanting. *Vitua* (wild yams) were relatively plentiful (compared to Keiyasi), and were harvested between October and January, often during fuelwood collections.

Natural resources such as *vitua,* pigs, and fish were reported to be greater in the 1930s than now, and there was more gully vegetation (especially trees) in the past because of the strict constraints on burning during the colonial period. *Yaqona* and *dalo* were grown by the *turaga-ni-koro* and a few others in the *veikau* (forest) about 6.5 km away (a 1½ hr steep uphill walk).

There were a pair of small streamside *tabaiwai (vuci,* irrigated pondfields) among trees on the western side of the Nasikawa Creek opposite the village. A traditional bamboo aqueduct (made from *bitu-ni-vavalagi)* supplied spring water. Each *tabaiwai* contained about 120-130

partly mature plants and was operated by a single household.

PHOTOGRAPH 6. *Bitu* aqueduct used for conducting water to *tabaiwai*.

Cattle and horses graze in the gullies under the shade of trees, and sometimes roam the lower slopes at cooler times such as in the early morning or late evening. Bullocks were usually kept tethered near the village, where they were trained. Mature pigs and goats were generally kept penned, but the village chief's goats were grazing freely on new post-fire *mauniba* (mission grass) shoots on the steep slopes above the village. Piglets, *tui* (dogs), *toa* (poultry) and *ga* (ducks) were allowed to roam around the village. *Tui* are necessary for hunting pigs, but are regarded as a pest around the village where they try to scavenge food. The river was clear (in June) and river fish were served at some meals. *Ibe (yo, voivoi, Pandanus sp.)* mats were being made by women.

A large new Methodist church and a new chief's house (financed from the logging of *mataqali* land) were being built on a bulldozed terrace above the main village. However, it was discovered during

subsequent research that the leadership of that *mataqali*, and the distribution of the revenue was being contested (F.I., 1998-1999). One reason was that most people in Nawairabe were not Methodists. Seventy one percent of households supported other denominations, and further, in some 'Methodist' households it was only the head of the household who was a Methodist. Inherited leaders were also pitted against educated equivalents, resulting in two leadership factions. Those who had organised the existing logging arrangement were uneducated, and another faction, led by an educated adult from (but not resident in) the village, had opposed the deal and was leading a court case against it. Nevertheless, many villagers appreciated the benefits of logging roads which allowed easier access.

Many of the hills to the south of Nawairabe showed signs of recent fires. The steep slopes, largely covered in *mauniba*, had been burned bare of vegetation to encourage new grass shoots. It was apparent that most of the fires had originated near the base of these steep hills and burned upslope to the crest, where they usually stopped. In more gently rolling

terrain, however, the fires may continue and burn much larger areas.

PHOTOGRAPH 7. Nawairabe hills, dry season. In the foreground are recently burned slopes showing damage to the secondary forest in the gully. In the background is a typical pattern of forest in the gullies, *bitu* (bamboo) and *gasau* on the lower slopes, and *mauniba* (mission grass) on the higher slopes and ridges.

Secondary forest occupied the gullies between these steep hills with *bitu* (bamboo) and *gasau* occupying the lower slopes. In the places where fire did not reach, the forest was regenerating. A few goats were grazing on

new mission grass shoots.

PHOTOGRAPH 8. New grass for the animals. Goats grazing on new *mauniba* (mission grass) shoots after burning, dry season, Nawairabe hills. Unburned vegetation in background corner.

An inspection of the burned areas showed that the soil was laid bare between the stumps of *mauniba* and thus vulnerable to erosion if heavy

rain fell.

PHOTOGRAPH 9. New grass. *Mauniba* (mission grass) after burning, dry season, Nawairabe hills. New shoots are edible, soil is vulnerable to erosion.

Areas that had several months regrowth after previous burning were covered by a thick, impenetrable (and unpalatable) sward of *mauniba*. Apart from a horse and foot track that connected Nawairabe with Matokana village, there were no other animal tracks on the slopes, suggesting that only light ruminants such as goats grazed the area, or alternatively, that erosion was so heavy as to remove all signs of heavier ruminants. Despite the steepness, there were few landslips.

Local farmers prefer to keep livestock rather than plant forest trees

(F.I., 1998-1999), nevertheless, there was a small, new *Pinus caribaea* plantation close to the village. The steepness of much of the terrain behind Nawairabe, however, makes plantation forestry difficult because cutting and extracting logs is difficult, and the steep slopes are more vulnerable to uncontrolled fires in the dry season. The exploitation of forests was not new, however. *Dakua (Agathis vitiensis)* gum (called *makedre)* was extracted in the 1930s. Most of the large *dakua* trees in the hinterland of Nasikawa were destroyed by fire used to extract the gum (F.I., 1998-1999).

The *quwawa* shrub was common on open land and was highly valued by local participants. In addition to being the best fuelwood, it has other, mainly culinary and medicinal uses. Children are particularly fond of the fruits, which are also used to fatten cattle. The plants are controlled by burning (perhaps every 2-3 years), which also makes harvesting the *quwawa* fuelwood easier: the above-ground parts of the plant are killed but the trunk and branches remain intact and are then suitable for harvesting and used as fuelwood. New sprouts quickly emerge from the roots following fire. Wild *quwawa* fruit is harvested by Nawairabe villagers during March and April and sold to the South Pacific Cannery which collects the fruit in a large truck and transports it to the factory at Sigatoka. Sometimes, however, cyclones and floods during the wet season obstruct the transport (which must ford the river), making this opportunity to earn money somewhat unreliable.

Nubuyanitu

Nubuyanitu (about 110 m in altitude) is a village built on the North side of the lower reaches of the Nasa Creek, an eastern-side tributary of the Sigatoka River. The village is dominated by a large new church built with the help of overseas Seventh-Day Adventist church aid and houses built from relatively costly materials. The Seventh-Day Adventist religion is notable for an abstentionist policy regarding the use of recreational

drugs. Nevertheless, we were greeted in the usual manner with *yaqona* during the *sevusevu* and the use of *suki* was observed among the men. *Yaqona* was drying on mats in the sun. The leaders in this village were very interested in development aid, probably because they had already successfully benefited from previous aid.

The *turaga-ni-koro* maintained a very lush agro-arboricultural *teitei* located midway up a very steep, forested valley near the village. This garden is not burned because of the presence of *yaqona* (one plant was 10 years old and others were more than five years old). There was an elaborate interplanting across different stories of vegetation from root crops to tall trees. Species observed included: banana, papaya, sugar cane, plantain, tomato, *tavioka*, pineapple, *ibe, dalo, dalo-ni-tana, uvi,* mandarin, *maqo, niu,* and breadfruit. Despite the steepness, there were few landslips and minimal erosion: the only areas of disturbed ground subject to erosion were small areas of up to one metre in diameter where *yaqona* plants had been harvested. These sites were relatively high on the slope so any eroded sediment was most likely to be trapped by the heavy undergrowth downslope. These ex-*yaqona* sites were subsequently planted with *tavioka.* Near the lower periphery *tavioka* and pineapple were interplanted in a more open area that had been burned. Cattle rarely ventured onto these steep slopes and tended to stay near the valley bottoms.

This *teitei* was a contrast to the surrounding hills which were mainly savanna-like and burned periodically. Most of the other village agriculture was practised in fenced *bila* around the Nasa Creek.

Draubuta

The remnants of once-cultivated irrigated terraces (*vuci*, or *tabaiwai* according to Parry (1987, Figure 6B)), were apparent close to the Nasa Creek and the ruined Nabokotini village site en route to Draubuta village further up the valley. These terraces, and others, are marked in Parry (1987, Fig 6B (map insert)) and Hashimoto (1990, p. 4), but are unknown by many in Fiji.[30] Another set of terraces, further up the valley between Draubuta and Nakoro villages, were visited at a later date in the wet season, and are pictured below.

PHOTOGRAPH 10. Nasa creek *tabaiwai (vuci)*, wet season. The grass clothing the previously burned hills is *mauniba*

I had hoped to follow-up the previous research of Hashimoto (1990) on irrigated terrace agriculture near Draubuta village (about 160 m in altitude). Unfortunately, this was not possible, as already discussed (see

[30] My (young farmer) guide from Keiyasi was unaware that *tabaiwai* existed before he observed them.

p. 139).

There were a small number of isolated homesteads located between the villages. The rivers and creeks were all crystal clear during this drought period.

Namoli

Namoli village (about 120 m in altitude) is at the end of the (fine-weather) road and over a causeway across the Sigatoka River, and was a centre of development activity (a housing project was being implemented). Part of the village was destroyed by flooding as a result of Cyclone Kina in 1993, and a reconstruction program involving new houses on higher ground had begun (eleven were already partly completed). It was aided by AIDAB (the Australian Government Aid Agency), in concert with remittances due to Namoli from (selective) logging operations in the nearby indigenous forest on the Qalilevu Plateau to the east. However, the village leaders protested that the government was withholding the funds that were needed to enable the continued employment of the builders, thus frustrating the progress of development (F.I., 1998-1999).

I was able to visit the logging operation. *Kauvula (Endospermum macrophyllum), soronavulu* (probably *Dysoxylum sp.)* and *togotogo* (probably *Bischofia javanica)* logs were ready for transport. Various wild food plants were growing in the forest. They included *vitua,* the fruit salad plant, *Musa sp.,* and *moli kana* (pumelo, shaddock) trees. Later inspection of aerial photographs revealed that this part of the forest was close to an abandoned mountain village with the remnants of a very large area of overgrown *vuci* nearby in the vicinity of the Navunidakua Creek. This historic feature, now nearly invisible, and many others found north of Namoli, were outside the area covered in Parry (1987).

The selective logging process was causing relatively discrete damage to the forest in the form of bulldozer tracks, but the penetration of the

forest by these tracks may in future allow access to the area for crops such as *yaqona*, and could thus lead to further deforestation. The poor soil may be a deterrent, however.

On the other side of the Sigatoka Valley in the hills to the west of Namoli a logging road had been constructed to extract pine logs from a village plantation, but a dispute between Namoli and the logging company had caused logging to be halted.

Yaqona is the main crop at Namoli, grown in sheltered, fertile and moist places in the high, western Malua-Nanoko hills. The chief's son praised the new varieties of (rainfed) *dalo* that were introduced via the Agriculture Department, but objected to the burning of grassland because it encouraged less beneficial forms of grass on the slopes (F.I., 1998-1999). The large, introduced *vaivai-ni-mocemoce* (or *vaivai-ni-vavalagi)* trees were considered a nuisance because they dry-up watercourses, whereas native trees do not.

Despite being a progressive village, tradition was considered to be strong in Namoli (F.I., 1998-1999), where the chief *(Ratu* Oliva) was highly respected despite his rank being less than some others. The *Ratu* and his son live in traditional *bures,* and about half the houses are of the traditional thatched *bure* type. Catholicism, the only religion here, is strong.

Ratu Oliva makes the point that 'people are adaptable in Namoli, and it is the good life', a view shared by a young Caucasian schoolboy who preferred to live in Namoli rather than with his wealthy parents overseas because 'village life is fun' (F.I., 1998-1999). However, some leaders felt that the youth were too village-oriented, and the chief's son felt that the younger generation were lazy compared to his generation, and were less prepared to travel to the high hills to work as he had done.

The *Turaga* supported a ban on burning for new grass, and there are strict rules in place for how burning is to be done when clearing land for *teitei.* This involves cutting the whole area including a firebreak.

Consequently, the results from the question on burning (see p. 282, and Appendix 1) were different from other villages. The score for burning new grass was extremely low, and, unusually, carelessness and accidental burning were given as reasons but also scored low (the evaluation was unusual in than it was conducted under the *Turaga's* supervision). Nevertheless, the percentage of uncontrolled burning was recorded as a slightly above average 80 percent, which suggests either: (a) that other reasons for lighting fires led to uncontrolled burning, (b) or that people from other villages (who were travelling through) were being careless, or (c) that the *Turaga's* policies were not being followed by Namoli villagers.

According to Namoli leaders, the main agricultural need was for mechanisation to till the *bila*. The second most important farming need was a new irrigation pipeline (or a bulldozed canal) to replace the canal and *vuci* system destroyed by Cyclone Kina. This latter option could enhance agricultural sustainability, and a pipeline may also serve to improve the potable water supply, which had a limited supply in the drought.

Nasauvakarua

Nasauvakarua village (about 190 m in altitude) is very picturesque with many traditional *bures* built on stone platforms as well as houses made from sawn-timber framing and corrugated iron roofing. The village had hosted groups of foreign 'adventure tourists' on rare occasions.

There is no immediate road access to the village which is located on an alluvial terrace on the south side of the Solikana Creek, an eastern headwater tributary of the Sigatoka. Rising river levels during the wet season can make Nasauvakarua inaccessible from the west or south, although there is a long, rugged forest track going east over the Qalilevu (Nadrau) Plateau to Namosi.

The environment was unpolluted apart from some noxious waste

near the village. Expended torch batteries are cast on the riverside in the village creating a potential for contamination. Plastic packaging was often dealt with in a similar manner: it was clear that the people were not practised in safely disposing of these commodities.

There is one (Catholic) church in the village (with a permanent catechist), and five *mataqali*. There is a lot of respect for the *vanua* concept, although the response to my inquiry seemed tinged with sadness as if for something being lost (F.I., 1998-1999).

Both horses and cattle are highly valued in Nasauvakarua. Horses are very important for transport, especially en route to the high altitude *yaqona* and *dalo* plantations, and are treated affectionately. They are kept for their lifespan, but can be exchanged or sold. They are also used, along with two bullocks, to extract building timbers from the surrounding forest remnants, a job done solely with human labour in the past. Non-local building materials are brought to the village with human labour, however, which partially explains the popularity of traditional buildings here. One new *bure* had recently been completed and two more were currently being built (using only local materials).

A logging operation on the more distant Nadrau escarpment is planned but the village leadership knows few details, mainly because it is being organised through the *yavusa* leadership in Nubutautau nearby (F.I., 1998-1999). On my first visit to Nasauvakarua I observed one electric generator supplying, on rare occasions, lighting to some houses at the northern end of the village. A few households sell a small variety and quantity of grocery items and food from their homes.

There is a pessimistic view here about the usefulness of overseas aid. They believe that any such money 'will get lost in the government' (perhaps reflecting the Namoli experience).

Despite the recent drought, they said 'there is always food here' (F.I., 1998-1999). But because of the drought, the supply of greens such as *wata (bele)* was limited. This caused some local concern as even the

malasou green vegetable was in short supply. The men usually go pig-hunting (often up the Solikana Valley) with their dogs, using steel lances or cane knives, on Saturdays.

Juvenile *doxo (doko, dalo)* was nursed in a small plot on the riverside on the east side of the village, and protected from horses by a post and rail fence. It is transplanted to the hill gardens later at the start of the wet season. The gardens contained a variety of food plants and trees, sometimes on flat areas but often on very steep (sometimes 35°) and rugged terrain. *Tavioka* was dominant, and pineapples, papaya, *dalo-ni-tana, uvi, jaina, via,* sugar cane, and *duruka (Saccharum edule)* were among other food plants seen. *Tavioka* was hand-planted in hills of five plants predominantly on slopes, and also on level areas near the river, and harvested by hand. The pattern of cultivation tended to be piecemeal, with the ground cultivated only in the vicinity of individual hillocks for most crops, although some plots were tilled and mounded into beds for *uvi. Dalo* was planted near water sources, and many other cultivation techniques were utilised, apparently adapted to different environmental niches. *Yaqona* was prolific in a moist niche near the Rogorua Creek (a tributary of the Solikana), but most of the Nasauvakarua *yaqona* is located near Nanoko on Nubutautau land closer to the roadhead.

Common food trees included the *maqo* (also valued for shade), which was planted around the outer periphery of the village. Several varieties of citrus, and breadfruit, were planted around the inner periphery of the village. *Niu* (coconuts) were planted within the village. *Vaivai (Leucaena)* was common on the cropping areas, and *vaivai-ni-mocemoce* near the village, where the branches were cut and used for fuelwood.

A recently-emigrated participant reported that the *tikina buli* (colonial-era district headman, a Nubutautau *turaga-ni-mataqali,* but the *buli* title now carries little power) was urging people to avoid burning the grassland, and promoting the planting of trees at public meetings (F.I., 1998-1999). Tree planting was believed to benefit animals with shade

and was expected to have a minimal effect on the grazing area. This participant also reported that burning was deliberate rather than accidental in Nasauvakarua. *Gasau* is burned in certain places up the Solikana Valley to help grow *dalo* and *uvi*.

Animals, which are branded, stay localised in the same place, so fences are not needed except near the village, although cattle go higher on the hills during cooler weather (F.I., 1998-1999). Women like raising pigs and poultry (partly because they can keep the proceeds) whereas men raise horses and cattle. Pigs are popular, partly because they can be exchanged for garden plots. The skins of *tavioka* tubers are the main food for domestic pigs, but the *Bose ni koro* (village council) had recently banned domestic pigs from the village because they attract wild pigs which cause damage to gardens.

The radio-telephone (R-T) system, and the water supply were both broken during my visit, and these were the main issues for Nasauvakarua women according to the expatriate resident (F.I., 1998-1999).

The Solikana Creek became polluted with red soil while the tunnel associated with the (hydro-electric) Monasavu Dam was being built in the 1980s. As a result there was a village request for a piped water supply, which was built by the Public Works Department about 1991-1992, with the help of the villagers (F.I., 1998-1999). At that time, (unspecified) researchers also offered to build a mini-hydro scheme to Nasauvakarua for water and electricity. The water supply was not functioning because it was never repaired after being broken by Cyclone Kina in 1992-1993. It appeared that inappropriate piping had been used: the steel and plastic piping was of the rigid type which is very easily damaged when cyclones strike. By contrast, an alternative flexible alkathene (polythene) pipe that is less easily damaged and easier to repair would have been more suitable.

After the pipe broke, the Nasauvakarua people gave up hope that the

hydro scheme would be realised (F.I., 1998-1999). They do not know how arrangements can be made to repair the pipes, and they do not have the technical ability to repair the pipes themselves. Thus, in Nasauvakarua people use the river as their water supply except when the river is flooded when they collect rain water. Although the collection of water for consumption and cooking is an inconvenience, the washing of clothes is more easily carried out in the river than in the village, and only those women villagers most distant from the river would be helped by the restoration of the water supply.

In the days after my return to Navatumali and Keiyasi (around 25 June) I witnessed many fires burning in the hills between Keiyasi and Sawene, mainly on the western flanks of the Sawene hills that face Keiyasi.

Navatumali

Navatumali was the government station located on high ground near the Sigatoka River and about a kilometre from Keiyasi. A secondary school (among other services) was located there. There was an area of burned young *quwawa* of a low height (about knee-height) on the roadside near the Navosa Central School. I enquired and was given differing views about why the *quwawa* was burned. A *Turaga* from Waibasaga who was passing through Navatumali at the time suggested that the burned road verges were necessary to prevent horses and cattle 'cutting themselves' and 'getting tangled' on the *quwawa* bushes. By contrast, the headmaster was of the view that most nearby fires were arson on the part of the children. This situation reflects how attitudes to burning differed according to each participant's local role and perspective, a finding which is not unique to Navosa (Masipiqueña, et al., 2000).

In another example, a Navatumali policeman suggested that because the season for harvesting *vitua* was normally finished by September, and

because the weather was too dry for a good flush of young shoots from burned *mauniba*, the burning in September of grass-covered hills was 'casual'. According to him, casual burning resulted from acts of carelessness associated with thrown cigarettes while hunting pigs, but the cause was controversial: another participant believed that cigarettes were insufficient to start fires.

Navosa Landscape, Dry Season

The most important factors that impressed me on this preliminary tour was: (a) the prevalence of fire in the environment and the potential for degradation, (b) the knowledgable, adaptable, practical and efficient way in which the indigenous people used a variety of resources and practised their livelihoods, and (c) the disturbing manner in which new influences were having an impact upon the local culture-environment nexus and jeopardising the *vanua*.

The agricultural type was a mixture of many forms: subsistence and cash cropping, pastoral 'farming', arboriculture, horticulture and silviculture. Although pastoral animals were ubiquitous, in many instances little monetary gain was made from them, and their value was more closely related to non-monetary cultural and social needs (Tubunakawai, 1986). In many places agri-arboriculture was a good description for a type of diverse, mixed crop and tree farming with the accent on understorey interplanting and food trees. The silvicultural pine plantations are distinctive examples of an introduced, non-interplanted, monocultural form of land management, especially when compared to the varied usefulness of the remnants of indigenous forests.

OTHER VILLAGES, WET SEASON

The remainder of the villages were visited later in the period of research, many in the wet season.

Waibasaga

The degree of hillside erosion in the Navosa region is apparent in the following photograph which was taken south of Waibasaga (about 60 m in altitude) after heavy rain that occurred throughout Navosa between 12 and 17 November. The roots of the *mauniba* are laid bare which indicates that a substantial depth of the surface soil was lost to sheet erosion on this flat site on a steep hillside.

PHOTOGRAPH 11. Severe erosion. Exposed roots of *mauniba* on a hillside following heavy rain on 17 November near Waibasaga.

Despite the severity of hillside erosion, the local emphasis was on controlling erosion near riverbanks and tracks. *Gasau-ni-vavalagi* (elephant grass) was especially useful for this purpose, and was also used as a

thatch.

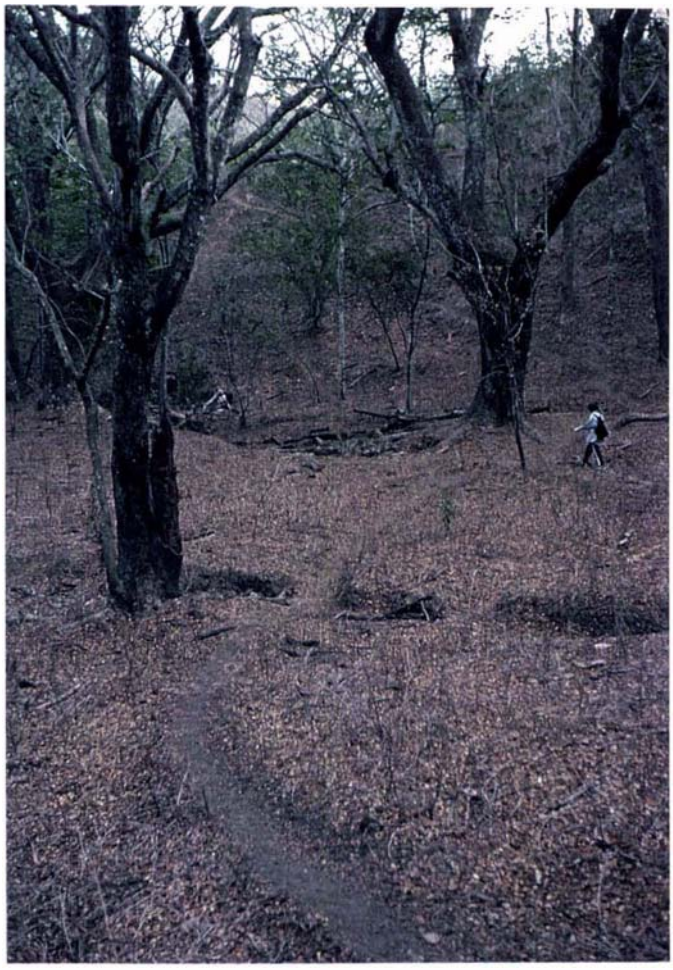
The hillside behind the village gardens was burned for new shoots for the animals in the dry season. The *Turaga* pointed out that new grass partly served to keep the animals (horses, cattle & goats) near the village so that they were accessible, described as a common practice in many villages. In an average year, the growth of new shoots also relieves animal pressure on the nearby gardens, which were poorly fenced. However, this year was different: the drought had slowed the emergence of the shoots and cattle had broached the fences and damaged the gardens. The *turaga-ni-koro* reported that the river reached the lowest level (on 8 September) that he had witnessed. The drought eased on 12 November with the arrival of the first heavy rains of the wet season.

Waibasaga has a set of hot springs, which had not altered their flow despite the drought. A development idea was introduced when a visiting professor, speaking publicly in the community hall in the company of local people, suggested that the site would be suitable for ecotourism. The village is traditional, but as far as is known, there has been no action on this idea yet, probably because crop returns were high and villagers may have had little to gain.

Vatubalavu

Large *vaivai-ni-mocemoce* trees are now the dominant vegetation in the usually dry gullies between low hills in the area around Vatubalavu (about 50 m in altitude) and Waibasaga. The *turaga-ni-koro* complained that *vaivai-ni-mocemoce*, which had been introduced by a New Zealander who was farming here about 1950, caused soil erosion. The indigenous gully vegetation has largely been supplanted here, perhaps due to excessive burning. *Vaivai-ni-mocemoce* trees provide shade, a relatively light fuelwood (and for a short time, edible pods), but are poor at protecting the soil from heavy rainfall. This is because the trees almost eliminate lower-growing ground-cover species (see photograph) and thus

expose the soil to heavy rain and sheetwash.



PHOTOGRAPH 12. *Vaivai-ni-mocemoce* near Vatubalavu in the dry season. The meagre ground-cover under the open canopy of *vaivai-ni-mocemoce* suggests less biodiversity and is an erosion risk.

Many of the trees, especially those situated in drier areas, had poor leaf canopies during the transition period from the dry season to the wet season when heavy rain could penetrate and cause erosion. *Vaivai-ni-mocemoce* also lowers the diversity of vegetation in the gully, and probably reduces the level of animal forage. It was observed that there were signs of severe gully erosion around the roots of the *vaivai-ni-mocemoce* trees in groves where the groundcover was negligible. In comparison, gullies dominated by *bitu* or indigenous forest had a dense

layer of ground cover and the potential for erosion appeared much less. The *turaga-ni-koro* was positive about the effect of pines, which did not cause soil erosion. Mahogany trees, planted by the New Zealander, had once grown well here before they were harvested. Some similar (very large) mahogany trees were growing on alluvial soil alongside the river at Nawairabe.

This village has a lack of land: the *turaga-ni-koro* mentioned that there was no place for the young people to plant crops. They sometimes sow *Nadi* blue grass seed for pasture after burning in this village, a practice learned from overseas experience in New Zealand. Unlike horses and cattle, goats do not habitually return to the grazing paddock near the village, and therefore burning for new grass was practised near the village to ensure that their goats did not stray.

Sawene

Sawene village (about 40 m altitude) was unusual in that it owned (four) tractors that were used for most of the tillage, in lieu of draught animals or human labour. This village was also unusual in that (newly-built) flush toilets were encountered here. Similar to Namoli, the chiefly *bure* was of a high standard, and there was respect for the chief, but nearly all houses were the of tin-roof style.

At Sawene it was reported again that *vaivai-ni-mocemoce* was 'a bad tree because it makes the soil infertile and causes soil erosion near the river' (F.I., 1998-1999). The increasing shallowness of the river and decline in the number of fish was again reported (but they added that it had been 30 years since the river got noticeably worse), and blame was attributed to careless burning for this.

The *turaga-ni-koro* complained about the decline in respect for the chiefs since independence in 1970, and was concerned about the increased poaching of fish (sometimes at night), and a lack of discipline among his villagers.

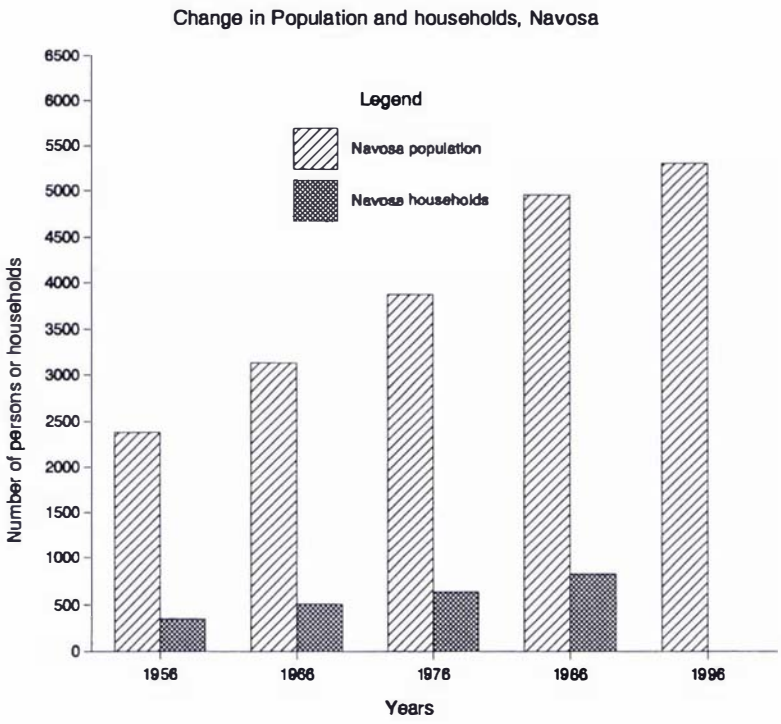
Nukuilau

Nukuilau (about 75 m altitude) was the home village of the Assistant *Roko* of Nadroga-Navosa. There was a village rule that outlawed burning, except for clearing land for *teitei*. Uncontrolled burning was an above-average 85 percent here, which probably reflects both the special need for prohibition and a failure to achieve control. Carelessness was blamed on insufficient thought about the long-term consequences by PRA participants (F.D., 1998-1999).

HUMAN POPULATION

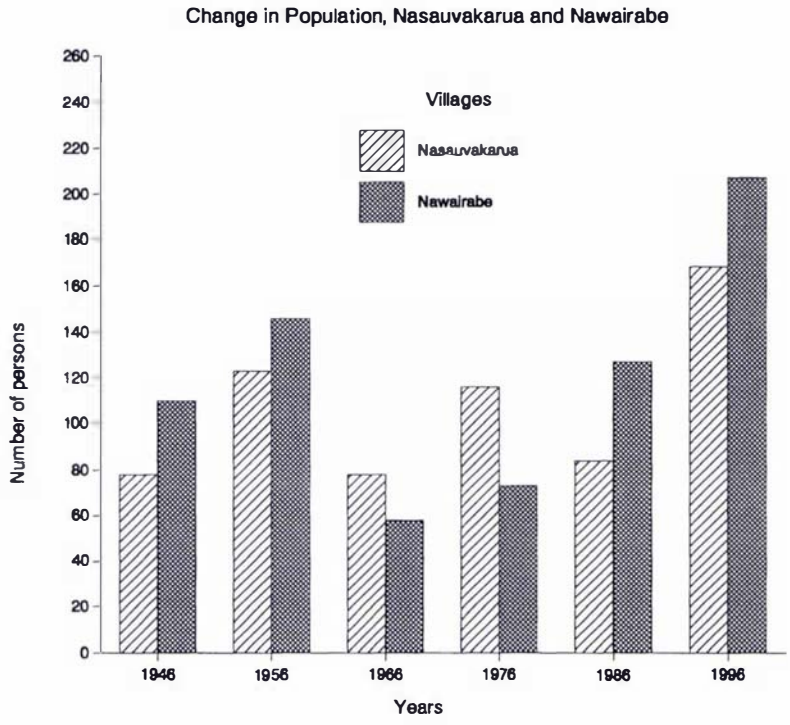
The population has been increasing in Navosa at a consistent rate over recent decades (Figure 2), and in 1996 the total was 5,319 persons (Bureau of Statistics, 1998, p. 18).

FIGURE 2. Navosa population (census results).



There has been a 0.7 percent increase in the Navosa population between 1986 and 1996. This was similar to the 0.8 percent increase for Fiji as a whole, but lower than the 1.8 percent increase for the Fijian ethnic group over the same period. The number of households was increasing at a slightly greater rate than the population for Navosa as a whole: the number of persons per household decreased from 6.71 persons per household (p/hh) in 1956 to 5.96 p/hh in 1986 following a consistent trend. Given the increase in population, this suggests that the family unit is becoming more fragmented over time. In addition, many *vuvale* in some villages have a second residence near their hill *teitei*, which is not recorded by the census system, and because the second residence can serve to disperse the household unit, fragmentation is probably greater than suggested by the census data, although it is unknown whether this is changing over time. At these villages, houses were sometimes vacant, especially during weekdays and school terms. Because census collection is focused on villages or settlements, it may neglect developments that are occurring in the hinterland, where much of the *yaqona* and *dalo* production takes place.

FIGURE 3. Nasauvakarua and Nawairabe population (census & research results).



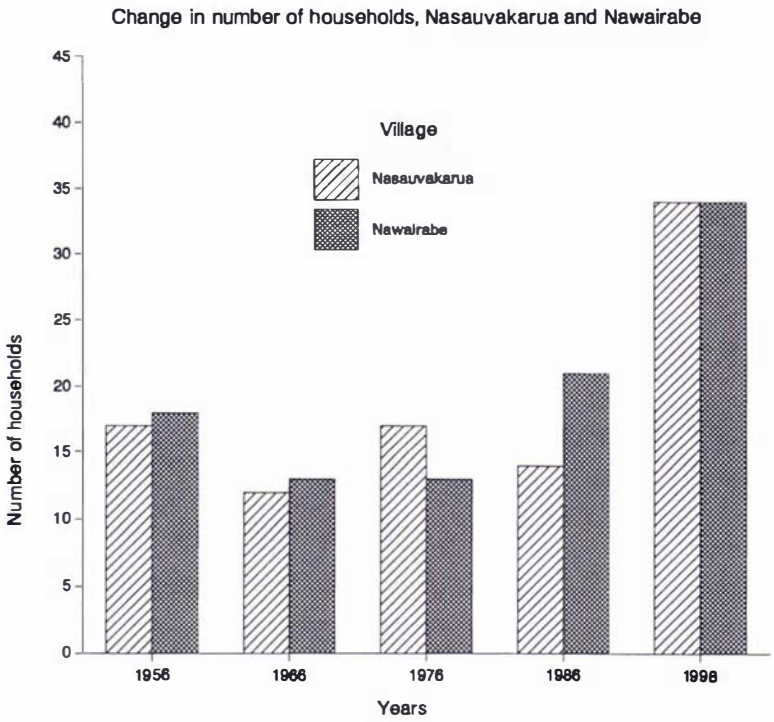
The 1998 population of Nasauvakarua (168 persons) and Nawairabe (207 persons) was recorded from household interviews, and compared with census numbers as in Figure 3. The figure for Nasauvakarua was exactly twice the census figure of 1986, a 100 percent increase in 12 years, although there is doubt about the accuracy of the census figures. According to the census Economic Activity Table (other data was unavailable), the population of Nasauvakarua in 1996 was 97 persons, a conspicuous difference from my 1998 total.[31] Is it possible that the population has doubled in two years? Because the equivalent 1996 data for Nawairabe population was acceptably close (201 persons) to the 1998 data, I am led to question the accuracy of the 1996 figures for

[31] Could my data have been inaccurate? I interviewed each and every household using a translator who was the son of a Nasauvakarua householder. The only possibility for inaccuracy was where more than one household claimed an individual as their own, but I do not believe that any discrepancies here would lead to a major difference. The validity of the method of my data collection is strengthened by the figures obtained at Nawairabe which were not discrepant with the 1996 census.

Nasauvakarua. Census-takers sometimes fail to record villagers away from home or in transit, and it is possible that this is what happened in 1986 and 1996. I conclude that the 1998 figures are correct and that a substantial increase in population is occurring.

The graph shows a population recession around the 1966 to 1976 period. The local cause is unknown, but the national labour market was buoyant during this period, thus facilitating out-migration from villages (Peet, 1980, p. 105). It contracted sharply after the mid-1970s (Chung, 1988, pp. 119-120).

FIGURE 4. Nasauvakarua and Nawairabe households (census & research results).



There were an identical number of 34 households at both Nasauvakarua and Nawairabe villages in 1998, which represents a large increase over previous census figures for both villages, and especially Nasauvakarua (Figure 4). The presence of new houses (*bure*-style) was readily apparent at Nasauvakarua, and the building of new *bures*, both at the village and in *yaqona* gardens, was ongoing during the 1998 dry

season. Although more variable, and despite a lack of 1996 census figures, these results support the general trend for Navosa (Figure 2). The causes of house construction may include: the recent high *yaqona* and *dalo* prices, the recent overnight hosting of groups of adventure tourists at Nasauvakarua, and the proceeds from logging at Nawairabe. They reflect ongoing development.

Age group comparisons (see Table II and Table III) reflect the predominance of the population in the younger age groups. There were few members temporarily absent from village households which suggested that internal migration (Sofer, 1993; Ward, 1961) was insignificant for these villages, especially Nasauvakarua, at least at the time of year that research was conducted. The higher figures for Nawairabe are expected given its relative closeness to transport and population centres.

TABLE II. Nasauvakarua population data.

Age Group	Female	Male	Total	Average per household
Absent[32]	2	0	2	
0-6	15	19	34	1.0
7-15	15	21	36	1.1
16-29	25	23	48	1.4
30-54	18	16	34	1.0
55-	8	8	16	0.5
All	81	87	168	4.9

[32] Persons absent from the village were not included in totals.

TABLE III. Nawairabe population data.

Age Group	Female	Male	Total	Average per household
Absent	3	4	7	
0-6	27	14	41	1.2
7-15	21	33	54	1.6
16-29	23	27	50	1.5
30-54	25	26	51	1.5
55-	4	7	11	0.3
All	100	107	207	6.1

IN-DEPTH EVALUATIONS

The villages of Nasauvakarua and Nawairabe were studied in-depth: the results are presented here. Nasauvakarua is relatively remote and traditional, and Nawairabe reflected a greater number of extralocal influences, but there are many similarities.

Nasauvakarua

In-depth research was conducted in Nasauvakarua for a period of eight and one-half weeks from 15th September through to 8th November. This coincided with the early summer period at the end of the dry season when the *maqo* began to ripen. Because of the late arrival of the wet season rains this period was largely dry and day temperatures were very high. The wet season brings humidity, but also cloud cover which reduces temperatures in the hills.

Some of the villagers were engaged in building: the *bure* poles and framing had already been erected from locally-sourced timber trees, and thatch material *(mauniba* and *gasau)* was being harvested from the opposite hillside and brought down to the village by two pack-horses or carried on people's backs to thatch the roofs.

Burning

Isolated incidents of burning were still occurring helped by the continuing dry and hot weather although most of the regularly burned areas had already been burned.

PHOTOGRAPH 13. Solikana burning. Looking east up the Solikana valley from above Nasauvakarua in September showing a mosaic of recent burning of *mauniba* grassland, for new grass in the distance, but mainly for other reasons near the *teitei* of the Rogorua Valley in the middle-right. The forest of the Qalilevu Plateau is on the skyline. A sloping *tavioka teitei* is on the left among indigenous vegetation with *gasau* on the upper slopes. The foreground vegetation is mainly *mauniba* interspersed with *maqo, quwawa* and *onolulu.*

The pattern of grassland burning resulted from fires being lit near the base of slopes whereupon the fires moved uphill, sometimes with a broad front (if the area had not been burned for over a year or two), or sometimes in a narrow, snaking band if previous burning or cleared gardens had limited the fuel available. Fires can move sideways and downhill: this was observed on a very steep slope among a (fuel-laden) *bitu* stand in very high temperatures where the fire burned fiercely. There is no danger to villages because (a) they are generally located in valleys

where fires do not go, (b) their surrounding open spaces are kept free of potential fuel and (c) wind strengths are rarely high in the dry season. Also, because the fires occur regularly, the land seldom has time to accumulate sufficient fuel to produce the fierce fires that are a danger to human life. The broken topography of much of the landscape also affords places (gullies, waterways, etc) where people can protect themselves. One participant suggested that some people light fires following the belief that fires will bring rain, although this reason was not verified by others.

Analysis of results

The results are presented in the following tables. For the numerical data, only raw scores and relative percentages are presented although the number of cases was about ideal for statistical analysis to be reliable in many cases.[33]

TABLE IV. Reasons why Nasauvakarua land is burned (relative percentages based on averaged scores of interviewee's).

New grass	Wild yams	Clearing land	Repel wild pigs	Pig hunting	*Malasou*	Fuelwood
19.5	23.8	35.4	12.4	2.3	5.4	1.3

The main reasons given for lighting fires on the land were (a) clearing land for *teitei* (35.4%), (b) new grass for the animals (19.5%), and (c) finding and harvesting wild yams (23.8%). Another important reason was to repel wild pigs from *teitei* areas (12.4%), and less important reasons were to grow the 'wild' green vegetable, *malasou* (5.4%), hunt wild pigs (2.3%), and to prepare (kill) the *quwawa* shrubs ready for harvesting as fuelwood (1.3%). A gender comparison showed little difference between genders except that men reported hunting pigs

[33] I am sceptical of the importance placed on the attainment, or not, of statistical significance based on the arbitrary decision to use a particular level of degrees of freedom for the null hypothesis. I believe that in many disciplines the attainment or non-attainment of statistical significance leads to a 'fetishism of the null hypothesis' that obscures the more meaningful characteristics of the raw data.

whereas women did not, and women reported harvesting fuelwood whereas men did not.

The average percentage of uncontrolled burning (68%) was slightly lower than usual suggesting that slightly more control on burning was present in this village compared to the regional average. Nevertheless, it also indicates that much more land is burned than a livelihood requires. Although there are strict laws requiring the preparation of firebreaks, these are generally disregarded. One reason for this is the immense effort needed to cut firebreaks on steep hillsides under very hot conditions (at least in early summer) which is beyond the physical stamina of most people.

The men's group drew up a burning calendar and matrix (next page).

FIGURE 5. Nasauvakarua burning calendar, men (28 Oct 1998).

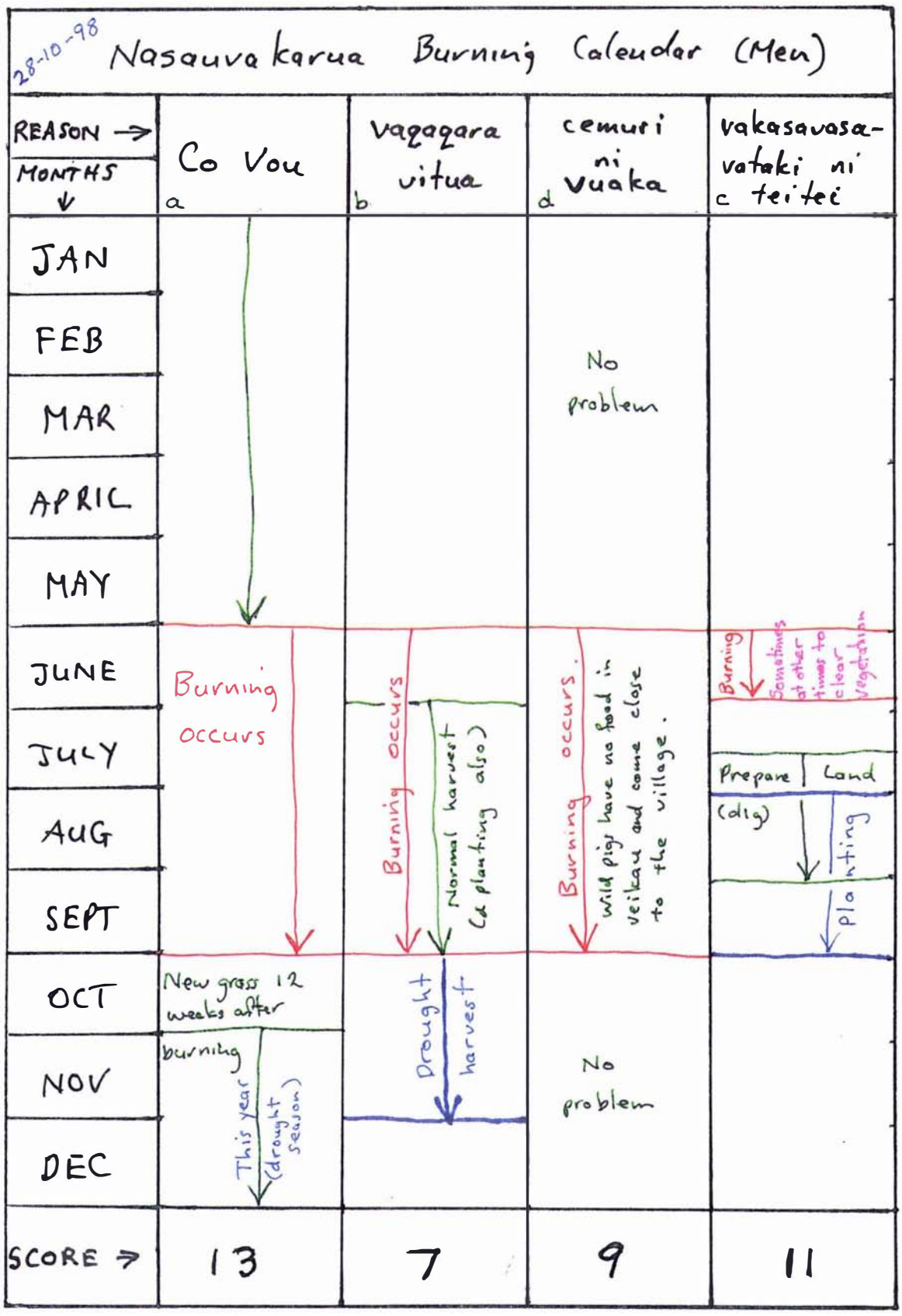
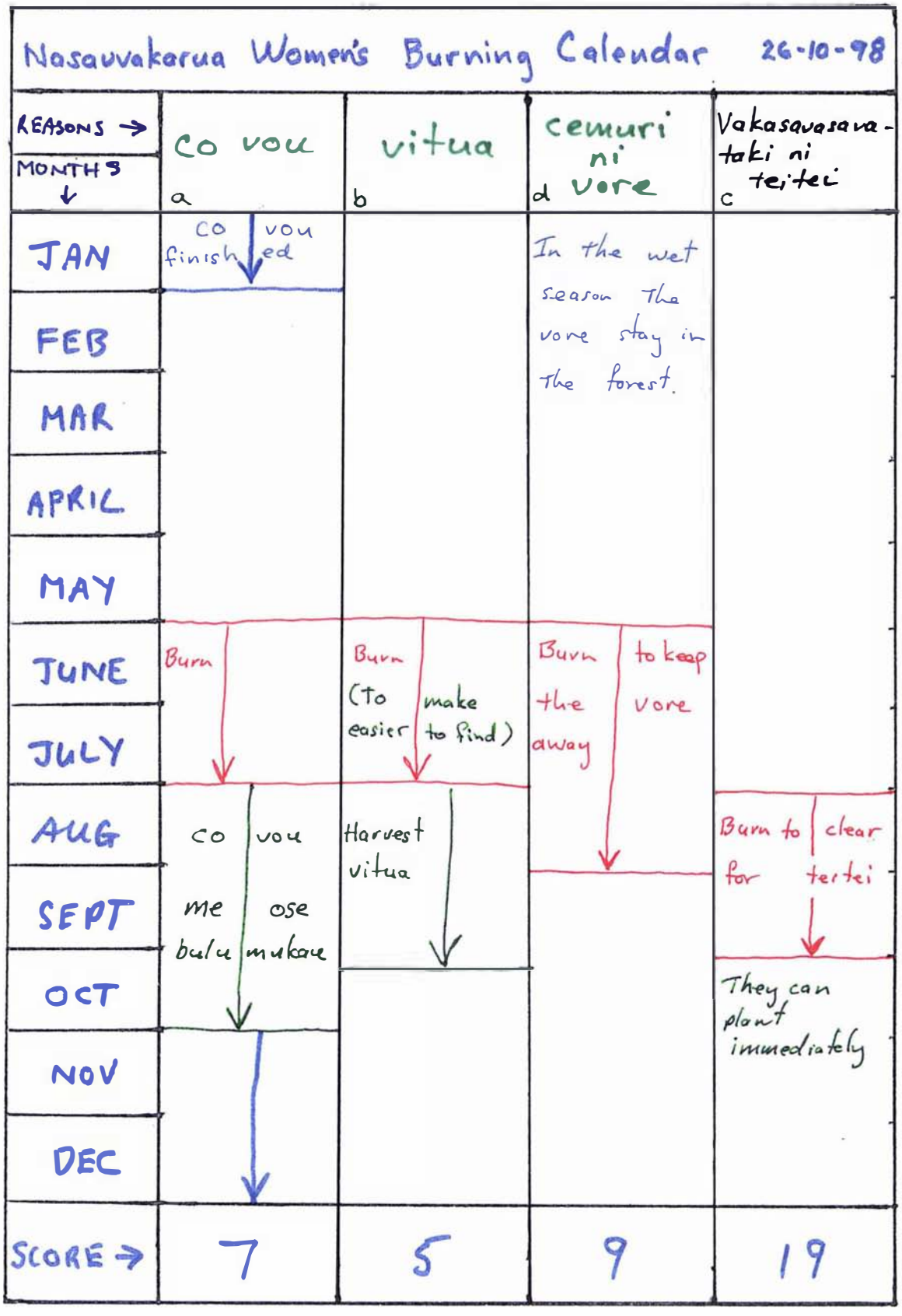


FIGURE 6. Nasauvakarua burning calendar, women (26 Oct 1998).



The calendar indicated that burning began at the start of the dry season in June and continued until the end of September in a normal year (1998 was exceptional with late burning still occurring). New shoots from *mauniba* are expected for 12 weeks after the end of burning. Harvesting *vitua* begins one month after the beginning of burning in June and usually continues until the end of September, although in 1998 it was expected to continue until the end of November. During the drought season wild pigs suffer from a dearth of food in the *veikau* and descend close to village *teitei* usually from June to the end of September. Clearing land for *teitei* usually occurs during June, although sometimes it occurs at other times to clear vegetation. It is dug from mid-July until the end of August, and it is planted from the beginning of August until the end of September. The men's group scored these categories differently from the questionnaire average, rating new grass and repelling wild pigs higher, and wild yams lower than usual (see Figure 5).

The women's calendar was similar but they differed on the burning period compared to the men, suggesting shorter periods ending before the end of August except for clearing garden land. New grass was similar but they specified in addition that new grass finished at the end of January. *Vitua* was similar, mentioning that it made *vitua* easier to find. Repelling wild pigs was similar. However, they gave notably different results for clearing land suggesting that burning took place both over a longer period and later in the year (August-September). They mentioned that they plant immediately after burning which is the case with *tavioka,* but not with, for example, yams, which require a longer soil preparation. This suggests that the women and men were each thinking about different crops. The women gave more typical importance scores with clearing land much the highest, but also rating repelling wild pigs highly (see Figure 6).

Sociocultural, environmental and livelihood values

As part of the interview process, participants were asked to discriminate between various sociocultural, environmental, and livelihood values and show how important each was. In Nasauvakarua, *kakana* or garden food rated the most important (24.8%), followed by environment (sustaining for future generations, 17.2%), church (16.9%), money (16.8%), customary ways (13.5%), and animals (10.9%), as in the following table.

TABLE V. Nasauvakarua values: sociocultural, environmental and livelihood (relative percentages based on averaged scores of interviewee's).

Kakana (food, garden)	*Lavo* (money)	*Tovo vakavanua, solevu*	*Lotu* (church)	Environment	*Manumanu* (animals)
24.8	16.8	13.5	16.9	17.2	10.9

The exceptional importance of *kakana* (compared to the regional average) may reflect the relatively isolated and subsistence-dependent location of the village. Another interpretation is that the score was affected by the drought as it differs from the Navosa average (scored mainly after the drought) by the importance placed on *kakana*, although if this was the case, then the importance of animals should also have been high. Nevertheless, the scores reflect the importance of all of these categories and show that concern about future generations is a part, but not a dominant part, of key sociocultural, livelihood and environment values.

Environment and sustainability

I examined a series of aerial photographs (1951, 1978, 1990, 1994) of the Nasauvakarua area. There were no major changes in vegetation patterns between forest and grassland during these years but minor changes were observed. Evidence of *vuci* was most apparent in the 1951 photographs, declining thereafter. Deforestation at the head of the Rogorua Creek area was at a peak in 1978, recovering thereafter. Deforestation has occurred after about 1990 on some steep gully slopes

on the south side of the Solikana east of the village where *tavioka* is now planted. Flood damage and watercourse alterations are apparent on the post-Cyclone Kina (1994) photographs, including the damage to the creek mouth (after a major slip in the gully behind) just upstream and opposite the village in the Nalele area. The photographs show that the hillslopes above this gully had been subject to continual burning. Overall, however, the pattern and relative areas of grassland versus forest is remarkably similar from 1951 to 1994. The housing pattern changed little from 1951 to 1978 when nearly all houses were thatched *bures* (except for one large iron-roofed building, probably the church, in 1978). In 1990 an increased number of houses (several with iron-roofs), and the radio-telephone building became evident. The very few outlying *bures* near village *teitei* seemed unchanged from 1951 to 1994. In 1994, the Raralevu clan hamlet up-creek at Vanuakula was visible for the first time.

What are the main environmental problems that will concern future generations? Although some had a quick understanding, many participants struggled with this unfamiliar question. After thought, they produced the questionnaire responses which are summarised below.

TABLE VI. The main environmental problems that effect future generations in Nasauvakarua (relative percentages of sorted answers).

Excessive logging	Excessive burning	Soil erosion	Stock control	Fish depletion	Rubbish disposal
46.6	18.8	5.3	23.3	4.5	1.5

Excessive logging was the main concern (46.6%). This category summarises several answers that had more to do with excessive local tree-felling: (near village, near river, at Rogorua-Solikana junction, head-of-creek areas, steepland) by villagers than the efforts of large-scale logging operations (reported near Natoka, 5.3%). People complained that excessive tree-felling was drying-up the land near the village, causing soil erosion near village, causing riverbank erosion, and causing

sedimentation. Stock control figured highly (23.3%) and aspects of this category frequently caused frustration. There were problems with keeping animals away from the river upstream (18%), animals breaking through fences and entering *teitei* (or people breaking down the fence to let animals in), poaching by people from other villages, and animals dying in the river. The other significant category was excessive burning (18.8%) associated with careless burning. Soil erosion (5.3%) was occurring on hills in the wet season and fish depletion was a problem (4.5%) made more severe by poaching associated with people from other villages. Finally, problems with rubbish disposal (1.5%) were caused by excessive rubbish lying around the village and the lack of a promised new village rubbish hole.

This question was also asked with separate female and male groups at Nasauvakarua using the same technique but in a PRA village situation. The results for men at Nasauvakarua were similar to the interview results. Local logging, animals polluting the river upstream, and stock control rated higher than careless burning. The women's group was similar, specifying that cutting too many trees near the river, and cutting too many trees near the village (so that *yaqona* cannot be grown there), as logging problems that collectively rated highest. Burning carelessly was the next most important, followed by too many animals upstream that pollute the river.

The impression gained was that this question was something not usually thought about by the average villager, but was the domain of deep thinkers, village elders and clan leaders.

Intra-village differences

The main reason households were blamed for damaging the environment was through burning carelessly (50.7%), although breaking down fences (17.7%) also figured highly. Leaving animals upstream (6.5%) was the only other reason above one percent.

Households were rated for damaging the environment by other households, where a lower rating is best. Seven households were blamed at rates above five percent for damaging the environment (the highest was 9.8%). Twenty-one households rated below three percent and 11 households were below one percent blame. This evidence shows that within a village, certain households had a reputation for causing specific environmental damage, and indirectly it shows that villagers were aware of these problems.

By contrast, some households were known to care best for the environment, and this was rated by households against reasons why. The ratings are converted to relative percentages. Reasons given for why some households cared best for the environment were: (a) some households showed leadership and taught others not to damage the environment (51.1% of reasons), (b) some did not burn carelessly (19.7% of reasons), (c) some taught not to burn carelessly (4.8%), and taking care of the environment (4.8%). It was notable that village leaders (elders and clan leaders) dominated the highest household ratings. Two leaders rated 12.7 percent and six others rated over six percent credit for caring for the environment. There was a more marked difference between those who rated higher and those who rated lower (17 below 1% credit) compared to the damage question before.

Household wealth

This was a difficult question to ask and obtain reliable data about. Although I was in a position to ask of the level of income in households during interviews, I did not do so because I believed that this question: (a) would be time-consuming, (b) would not be answered sincerely in all cases, and (b) could lead to suspicion of my intentions. The householders may have been concerned about how information about income could be used by taxation officials (cf. Thomas, 1997, p. 181) or police. It was considered rude to ask about differences in wealth between households. The cultural and church ethos emphasised sharing and mutual assistance and the corollary was that differences in wealth were either denied or not available to be collected, or downplayed. Nevertheless, data was collected from one leader who was willing to show differences but its reliability could not be checked. According to his evaluation, the most wealthy households were those headed by adult men of the most productive age group rather than the village leaders (who were often elders). Overall, the differences between households were relatively small and suggested an egalitarian community, especially in Nasauvakarua. Bank accounts were held by 56 percent of households.

Wild food

The question about the relative importance of wild food (*kakana ni veikau*, forest food) and drink (*gunu ni veikau*, forest drink) was presented to only a small trial sample of Nasauvakarua villagers. Although wild food did not supersede *kakana* for importance, the relatively high figure indicated that *vitua* and other wild foods are highly valued. The cultural importance of *yaqona* and cultivated fruit was reflected in the high score for *gunu*, and the slightly lesser but still substantial score for *gunu ni veikau* indicated that vegetables, fruit and medicine obtained from the wild were an important part of the Nasauvakarua diet and pharmacopoeia. Overall, the relatively equal spread of the results suggested that locally-obtained subsistence food, drink and medicine

were comparatively important for livelihoods.

Nawairabe

The in-depth research in the village of Nawairabe occurred in the December-January period during the wet season. The landscape of low hills was now a vivid green as the new shoots of *mauniba* were well-established, a marked contrast from my visit in the dry season. Nawairabe is similar to Nasauvakarua in that it is situated alongside a river, but is different in other ways. It has large areas of fertile *bila* (alluvial flatland gardens) where *tavioka*, maize, peanuts, watermelon, *kumala*, and pumpkin are grown, but few *yaqona* sites. Animal-drawn implements are the norm here whereas in Nasauvakarua the spade was still dominant for tillage. The topography is less rugged and it is closer to the centres of development in the middle of the Sigatoka Valley (although road access is difficult in the wet season). Nearly all houses are made of a sawn timber and corrugated iron construction. At one time it was a chiefly village, although the Nasikawa seat is now at Korovou (a roadhead). Whereas Nasauvakarua has an identity as a Catholic village, there are several religions in Nawairabe, and Nawairabe identity is relatively fragmented. The ritualised aspects of traditional culture are less influential here and it is more transitional than Nasauvakarua.

Analysis of results

Burning

TABLE VII. Reasons why Nawairabe land is burned (relative percentages based on averaged scores of interviewee's).

New grass	Wild yams	Clearing land	Hunt pigs	*Malasou*	Careless -ness	Clearing tracks	Turmeric	Pines	Fuel-wood
23.9	20.9	31.5	7.4	4.7	1.2	1.2	0.9	5.8	2.6

The main reasons given for lighting fires on the land were similar to

Nasauvakarua: (a) clearing land for *teitei* (31.5%), (b) new grass for the animals (23.9%), and (c) finding and harvesting wild yams (20.9%). The need to repel wild pigs was not present but other reasons were evident. They were: hunting wild pigs (7.4%), clearing land for planting pine trees (5.8%), *malasou* (4.7%), harvesting *quwawa* fuelwood (2.6%), clearing tracks (1.2%), carelessness (1.2%), and harvesting turmeric (0.9%).

A gender comparison showed greater differences compared to Nasauvakarua. Men reported burning for clearing tracks whereas women did not, and men scored hunting pigs, and preparing for planting pines much higher than women. Women reported harvesting fuelwood whereas men did not, and scored *malasou* and harvesting *quwawa* fuelwood much higher than men.

The above-average percentage of uncontrolled burning (78%) suggests that this issue is particularly salient in Nawairabe.

The men's group burning calendar and importance matrix follows (Figure 7).

FIGURE 7. Nawairabe burning calendar, men (9 Jan 1999).

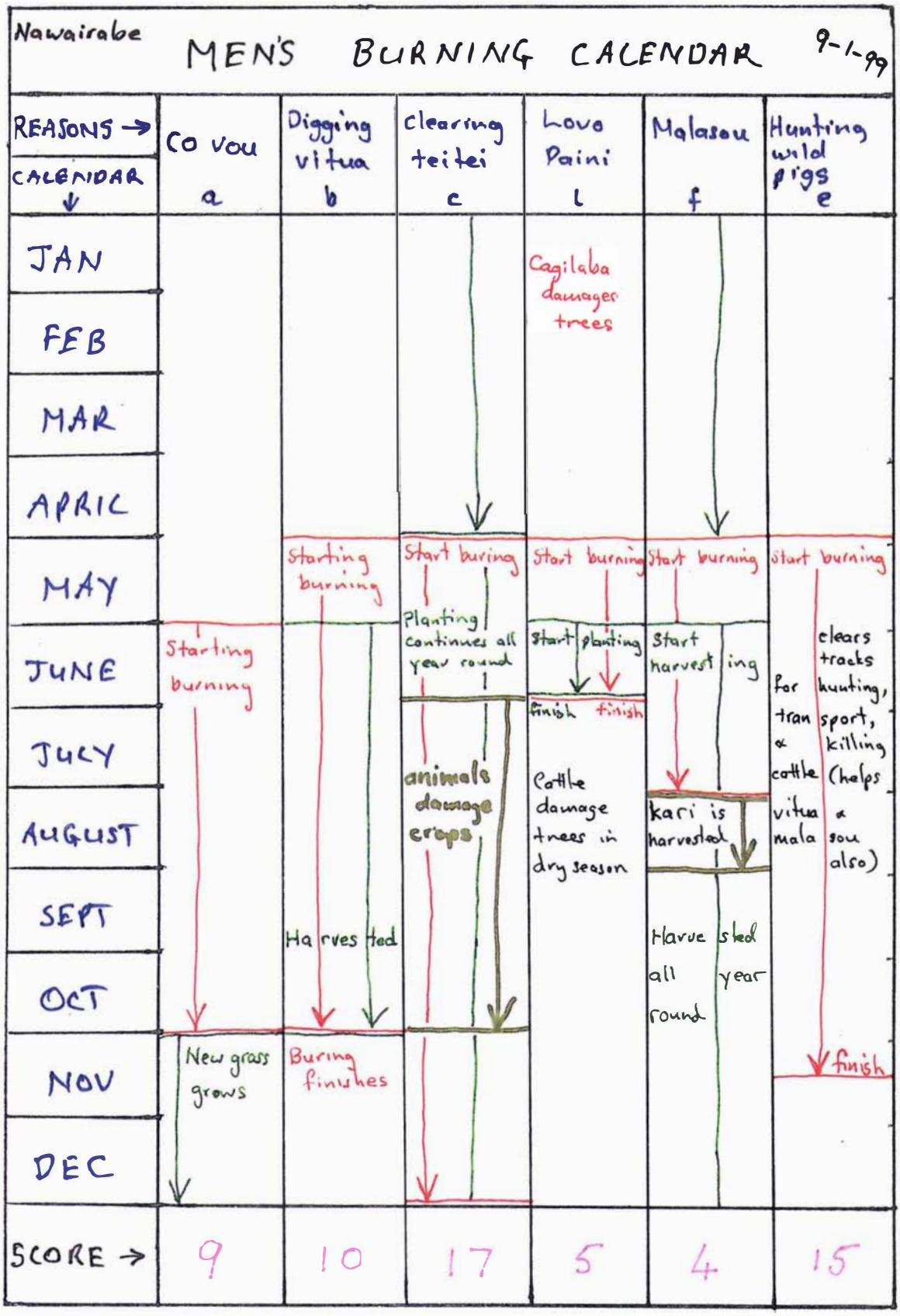
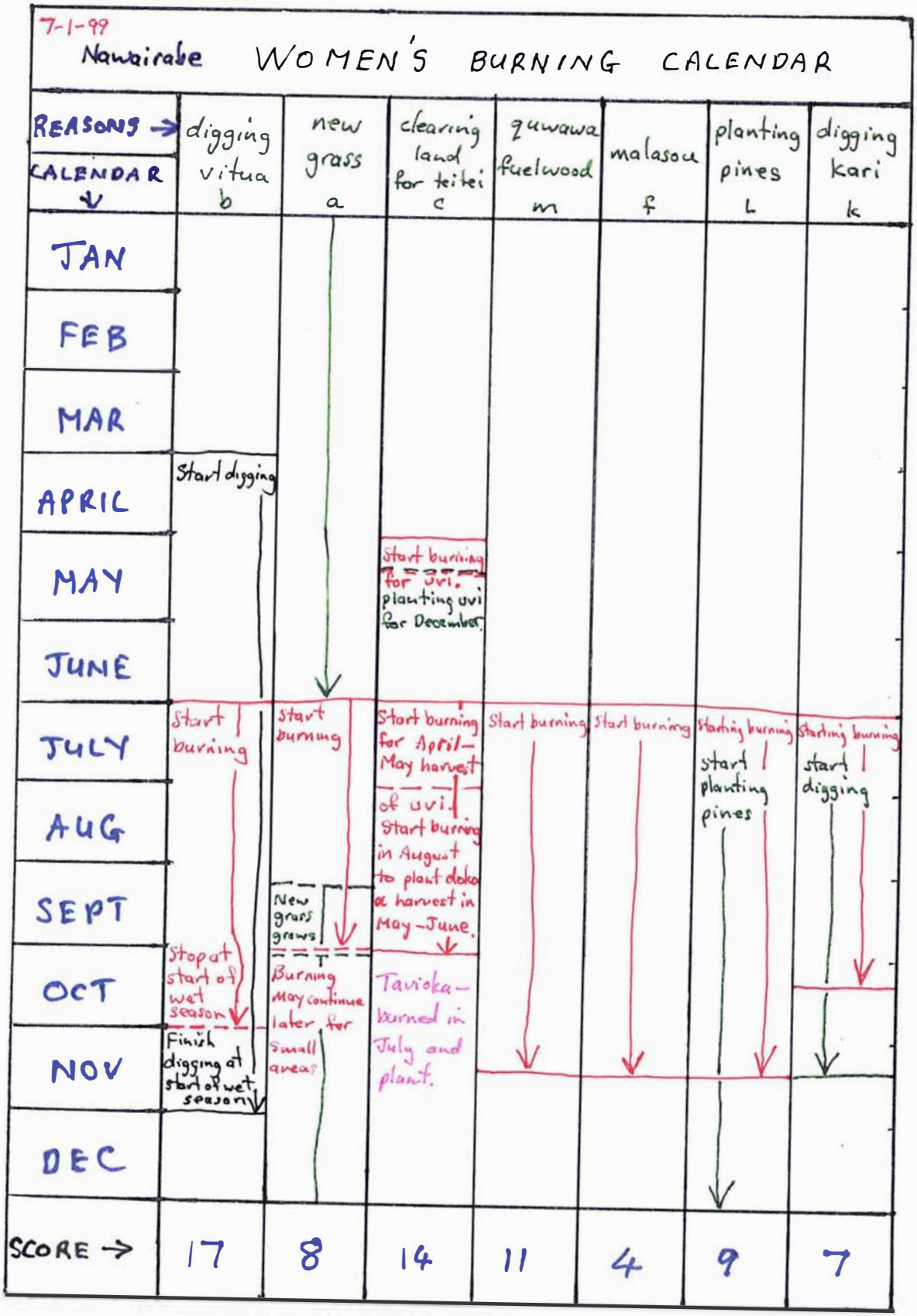


FIGURE 8. Nawairabe burning calendar, women (7 Jan 1999).



This calendar indicates that burning began at the start of May and normally continued until the end of October. This is a more extended period compared to Nasauvakarua. New shoots from *mauniba* are expected by the beginning of November. Again, harvesting *vitua* begins one month after the beginning of burning and usually continues until the end of October. Clearing land for *teitei* begins in May and finishes at the end of December: planting continues all year round. Animals damage crops in the dry months from July to October. Burning for planting pines occurs from May and actual planting is in June. Forests are damaged by cyclones during the cyclone season, and by cattle in the dry season. Burning for *malasou* starts in May and continues until the end of July. Harvesting begins in June and continues year-round. During July, *kari* (turmeric) is harvested. Burning land to hunt wild pigs begins in May and finishes at the end of October: the main purpose is to clear tracks for hunting, transport, and killing cattle, but the burning also helps for harvesting *vitua* and *malasou*. The men's group showed a typical pattern of scoring for importance with the exception that the score for hunting pigs was relatively high compared to the questionnaire average. This was probably because a leading member of the group was involved in hunting activity.

In the women's calendar and matrix (Figure 8), the burning was reported as starting at the beginning of July, except for clearing land for gardens which started in May. There was additional detail regarding the timing of new grass: a flush of new grass grows during September although burning may continue later for smaller areas. The digging of *vitua* finished at the start of the wet season after burning finished at the end of October. Clearing land for *teitei* occurred over a longer period. At the beginning of May, early burning was conducted for the planting of an early crop of *uvi* two weeks later (harvested in December). Burning started for the main crop of *uvi* in July (harvested April-May the following year), and burning for *doko (dalo)* began in August through

September for a May-June harvest the following year. Burning for the planting of *tavioka* took place in July. Burning for *quwawa* fuelwood, *malasou* and planting pines took place from July to the middle of November. Pines were planted from July to December. Burning for *kari* (turmeric) took place from July to the middle of October: digging turmeric began in July and continued to the middle of November. The women scored *vitua* as the most important reason for burning, followed by clearing land. Fuelwood (not mentioned by the men) also scored relatively high and conversely hunting pigs was not mentioned.

Sociocultural, environmental and livelihood values

TABLE VIII. Nawairabe values: sociocultural, environmental and livelihood (relative percentages).

Kakana	*Lavo* (money)	*Tovo vakavanua, solevu*	*Lotu* (church)	Environment	*Manumanu* (animals)
16.9	14.1	13.8	27.9	14.2	13.1

The comparison of values reflected the importance of church (27.9%) in Nawairabe people's lives. The other values were similarly important although *kakana* (16.9%) was a little more important than the others. Compared to Nasauvakarua, kakana was less important, and church was more important.

Environment and sustainability

A series of aerial photographs (1951, 1978, 1990, 1994) of the Nawairabe area were inspected. There were no major changes in vegetation patterns between forest and grassland during these years. The road was absent on the 1951 and 1978 photographs, and the 1994 photograph shows the damage to and re-alignment of watercourses after Cyclone Kina. The field patterns on the *bila* changed over the years. In 1951 the number of *bila* fields was far less, and most were close to the village. A large *vuci* with eleven terraces is apparent on one tributary to the east of the village, and small *vuci* and old village remnants are apparent upstream. From 1978, there were many more *bila* fields in

place of forest down-river. From 1990, there were an increased number of *bila* fields in place of forest up-river. The number of *kasi verara teitei* near the village was low and appeared to have increased little over the years. The housing pattern in the village changed substantially between 1951 and 1990. The number of houses, which were all *bures*, was less in 1951. However, many were large *bures*, and the *turaga-ni-vanua's bure* (now demolished) stood above the village. There were many more houses in 1978, and a few iron-roofed houses appeared to have replaced the largest *bures*. The chief's *bure* no longer stood. In 1990, there was a preponderance of relatively closely-packed iron-roofed houses and the number of *bures* (which seemed to be smaller in size) was quite small. In 1978 there was one outlying house on the track half-way to Korovou and in 1990 there were two houses on this site which was now close to the road which had been built.

Overall, again, the pattern and relative areas of grassland versus forest on the hills is remarkably similar from 1951 to 1994 despite evidence indicating a substantial population increase and increased flatland agriculture which had replaced forest margins on the Nasikawa Creek.

What are the main environmental problems that will concern future generations?

TABLE IX. The main environmental problems that effect future generations in Nawairabe (relative percentages of sorted answers).

Excessive logging	Excessive burning	Soil erosion	Stock control	Fish depletion	Rubbish disposal	Adverse climate	Soil infertility
11.1	46.7	17.8	0	2.2	0	11.1	11.1

Excessive burning (46.7%), and the associated soil erosion in the wet season (17.8%) were by far the most important environmental problems in Nawairabe. The problem of soil infertility (11.1%) was also associated with excessive burning. Excessive logging (11.1%) rated less than at Nasauvakarua, and was primarily attributed to the up-river logging

concession at Natukale which caused pollution and downstream sedimentation. The adverse effects of climate events (drought, cyclones & flood damage) and especially their unpredictable nature, were a cause for complaint (11.1%). The use of *duva* and other fish-suffocants was blamed for the depletion of fish (2.2%).

This question was also asked using the same technique but with village PRA gender groups. The results at Nawairabe covered a broader range of issues. For men, burning carelessly rated the highest, but fish poison in the river, cutting too much timber, and stray animals that damaged *teitei* and wild crops *(vitua, sarau* and *kwale)* figured more prominently. The women's results were very different: by far the highest ratings were given against the use of fish poison *(duva* & Hi-Tech chemical). Animals that caused damage to fences and plants, and careless burning were of secondary importance. It was unascertained, but sometimes a rogue result like this was caused by a recent local occurrence of a problem that aroused frustration. The same effect was noticed at Nasauvakarua during questionnaire administration (which took place over several weeks) with regard to an incident of poaching, which was suddenly reported as an environmental problem, but which ceased to be reported again after a few days.

Repeated burning

How does repeated burning affect the land? This question was asked of a few households. In order of importance, repeated burning led to: (a) greater infertility of the land, (b) soil erosion, (c) damage to *vanua* or trees, (d) drying-up of the land, (e) more difficulty in growing crops, (f) damage to the river with less fish, (g) pasture deterioration, and (h) less food for the animals.

Intra-village differences

The dominant and only reason households were blamed for damaging the environment was through burning carelessly, either generally (94.4%), to find wild pigs (2.2%), while hunting (2.2%), or for goats (1.1%).

As in Nasauvakarua, households were rated for damaging the environment. Three households were blamed by other households at a rate of above 10 percent for damaging the environment (the highest was 20%). Another three were over five percent, twenty-three households were below two percent and 14 households scored were not blamed at all (0%). This evidence shows that within Nawairabe, there was a marked level of blame against certain households for careless burning, and this was considerably more distinct than in Nasauvakarua.

By contrast, there were households that were known to care best for the environment. In Nawairabe, most credit was given to those that did not burn at all (53.3%). Similarly, those that did not burn carelessly were credited 24.3 percent. Other reasons included: being a good or nice person (6.5%), teaching not to burn carelessly (5.6%), those that preserved the environment for future generations (4.7%), liking farming and keeping farm clean (1.9%), respecting what the *turaga-ni-koro* says (1.9%), not hunting (0.9%), and lastly, taking care of the environment (0.9% credit). It was conspicuous that the household of my translator (a village leader, outspoken against burning) dominated the ratings (21.5% of credit). Only one other, (who did not burn, the son of the *turaga-ni-koro)* rated above 10 percent, and two others rated over five percent. By contrast, 22 rated below two percent credit. Thus, again there was a marked difference between those who scored higher and those who scored lower compared to Nasauvakarua. The high credit rating given to the household of my translator suggests that my translator's well-known views have been influential in the outcome of the evaluations related to burning.

Social identity and groups

The relative importance of five locally important social and cultural groups was investigated at a few households. The pattern showed the *lotu* (church) to be most important, closely followed by the *vuvale* (household), with the *mataqali* (clan), *bito* (subclan) and *koro* (village) approximately equal at a level that was less important to householders.

Household wealth

As at Nasauvakarua, this was a difficult question to ask and obtain useful data about. Nevertheless, satisfactory data was collected. Again, only small differences in wealth were apparent: indicating a very egalitarian community. The most wealthy households were those headed by adult men of the most productive age group. Bank accounts were held by 29 percent of households in Nawairabe and the average for both Nasauvakarua and Nawairabe together was 43 percent.

Summary

Various local agricultural strategies related to sustainability have been described, together with examples of anthropogenically-caused processes of land degradation. Local people in Nasauvakarua and Nawairabe burn the land for various livelihood reasons (which were compared). But they were also concerned about excessive uncontrolled burning and local deforestation. Wild foods were important for livelihoods, and human population has been increasing in a consistent manner throughout Navosa. Many of these results provide background data for the next chapter, and are related to the broader-scale issues of sustainability and development discussed in subsequent chapters.

CHAPTER SIX

VIEWING NAVOSA: FIRE AND LIVELIHOODS FROM NEAR AND FAR

This chapter presents the results of the remainder of primary research including local (Navosa), semilocal (mainly in Nadroga), and nonlocal research (mainly in Suva, the Fijian capital). It is presented in different sections according to both participant and topic so that the broad range of human and environmental factors in sustainable development are covered. Finally, the results of the participatory Navosa watershed study involving eighteen villages and settlements are presented.

Much of the information was sourced through field interviews, and where possible, particular voices have been made explicit by using quotes from the interviews. Many individuals who were interviewed have been cited in an anonymous way, but some, especially those holding important positions, have been identified. The main focus of questioning, following the initial survey, was on burning, livelihoods and the state of the environment.

NADROGA-NAVOSA: LOCAL, SEMILOCAL AND NONLOCAL VIEWS

This section expresses the contributions of various participants, most of whom were located outside of Navosa and who lacked local knowledge, but who sometimes had specialised knowledge that was relevant. Some nonlocal participants had local knowledge, and vice versa: they have been placed according to perspective.

It starts with contributions from bureaucratic and service leaders who were based at the local Navatumali Government Station on the southern margins of Navosa, and at other less local centres further from Navosa.

Navosa: Local Government Services

The sub-provincial leadership was located at Navatumali, which serves as a centre for bureaucracy, district development, agricultural services, education (primary and secondary), health (medical clinic), law and order (police), and the (rarely open) postal service. There is one shop.

A view from within: the Assistant *Roko*

The Assistant *Roko* was the indigenous bureaucratic leader for the Navosa sub-province of the Nadroga-Navosa province, and represents the Fijian Affairs Board on local matters. As such, he shares a leadership role in the region, parallel with the *turaga-ni-yavusa, turaga-ni-vanua* (inherited leaders, some attain membership to the Great Council of Chiefs), district officers and politicians. He was the official representative of the government in Navosa, and is subordinate to the *Roko (turaga-ni-yasana)* for the Nadroga-Navosa province based in Sigatoka. The next paragraph expresses his knowledge and views.

The Assistant *Roko* originates from Nukuilau village. He was concerned about erosion and sees it as a problem. Excessive burning and damage from logging were the two main causes, but he could not remember anyone being charged for a fire offence because 'policing is too difficult' (F.I., 1998-1999). He favoured the return of the old regulations and the use of fire officers (including the *turaga-ni-koro,* as in the colonial period) to help police fires. He also wanted to be able to maintain and police the selective logging policy of the government, in light of the degradation of the past. The Nanoko-Bukuya area was logged in a large operation between 1960 and 1980 by the Pacific Lumber Company. There were once many crop niches in that area, but the land is now barren because it was not replanted after logging. Replanting is desired but the replanting cost is now high, the money is unavailable, and there is a new 'problem of animals'. The lack of fencing has become the greatest hindrance to reafforestation. There is a lack of

local action on fencing and afforestation because 'the people believe that they have to be paid for it' by the government. Nearly every household now has ten animals, mainly for customary use, for example, marriages. To prepare for marriage, individuals are obliged to spend heavily to build up stocks of cattle, and purchase horses, etc. More fencing is needed to control animals within larger pasture areas, rather than the usual practice of fencing to exclude animals from relatively small garden areas. During the period when a farmer is saving to purchase fence-wire, they will live on '*tavioka* and soup' (F.I., 1998-1999).

The district officers and rural development

Rural development was the responsibility of the District Officer at Navatumali, who originated from eastern Fiji (F.I., 1998-1999). He supervised developments in roading, water supply, health, agriculture, telephone communication, and village housing (e.g., at Namoli). Ideally, he saw it as the responsibility of the village people to identify and present the projects they wanted, and then the District Officer would help them prioritise their needs. But 'some of the villages have to be advised' about their development. At the time, the greatest priority was being given to upgrading the logging road for Nakoro village. Piped water supplies are the next priority: he has overseen the implementation of potable water installations in each village in his time. In each case, the local community contributes one-third of the cost in advance, and then the Rural Water Supply Department is engaged to survey and implement the project. Maintenance becomes the sole responsibility of the village.

The district officer also reported smaller developments. At Nakoro, the people had requested 20 toilet bowls, which the government will provide on condition that the village people build the concrete slabs, purchase the cisterns, and install them (F.I., 1998-1999). Nakoro had also requested a telephone for which the village must contribute $1000 cash and a building which costs another $1000. The government will then

contribute the $2500 radio-telephone set.

In Navosa, the development hierarchy starts with the village level, then goes to the *tikina* (district) level, then the Development Committee (and for large projects over $100,000), to the Government. In the case of small projects only the *tikina* council need be involved and the District Officer directs action. The District Officer works together with the *Roko* at development and *tikina* meetings.

The District Officer at Tavua (who was responsible for Navatusila district) was instituting a new survey in Nasauvakarua to replace the broken water system (F.I., 1998-1999). His opinion was that Nasauvakarua had few problems, except for the lack of road accessibility: 'people at Nasauvakarua have it good, land fertility is good at Nasauvakarua, transport is the only problem'. He visits the Navatusila district (specifically, the chiefly village of Nubutautau) about every three months. There had been a project to build a large water reservoir at Nubutautau, but it had not been sealed correctly, and was unusable in 1998. The District Office is responsible for the road from the Solikana junction up the Natoka Hill: a surveyor from the Department of Works and Development has suggested that this road be realigned but there are no funds available yet.

The Navatumali District Officer's view was that people who burned were only thinking of the next three or four days, and did not consider the long-term damage, or how 'burning will make the drought worse' (F.I., 1998-1999). 'They burn for pigs, so that they can see the pig run'. When the pig is trapped in a patch of vegetation, they burn the bush to flush it out. Yam areas are burned so that it is easy to walk and find the yam: 'it is just because they are lazy'. 'They should be taught what will be the effect of burning.' Despite the above, he added: 'burning is mainly the result of carelessness'. His advice was that an awareness and training program was needed at village level.

The Navatumali District Officer held the view that the water supply

was threatened at some villages because of the lack of (especially native) trees, but was not aware that *vaivai-ni-mocemoce* caused any problem (F.I., 1998-1999). His view was that erosion was a problem, and will get worse, but farmers were largely unconcerned because of 'a lack of knowledge'. The District Officer was unsure about how burning affected pasture, but he had similar views to the Assistant *Roko* on the lack of appropriate fencing and the desirability of afforestation (although burning was a constraint). District pounds are located at Keiyasi, Korovou and Nukuilau, and any animal that is not fenced-in or roped can be impounded by law.

The Doctor and health

The Indo-Fijian Navatumali medical doctor had noticed 'increasing cases of malnutrition in the region', and a 'family-planning problem' associated with an increasing population (F.I., 1998-1999). He believed the causes were based on a variety of political, economic, cultural, demographic and climatic (drought) factors that were 'multi-factorial' and very complex. There are protein deficiencies in some families as a result of nutritional ignorance: 'these families eat only cassava and tea.' The doctor did not report how widespread these problems were, but his report of a trend reflects a context of considerable social change occurring in the relatively developed circumstances near to this clinic.

Another participant reported that three out of fifty-five Keiyasi households (0.05%) had malnutrition problems caused by excessive *yaqona*-drinking and laziness (leading to insufficient subsistence cropping), despite an abundance of land (F.I., 1998-1999).

Extension services and middle valley agriculture

The Navatumali Agricultural Station was staffed by three officers with different responsibilities. The Head Officer was an Agricultural Technical Officer who concentrated on 'upper'[34] Sigatoka Valley crop advice and management, mainly in the Keiyasi-Draiba area. Another Extension Officer led an 'upper' valley (Keiyasi-Draiba, Nawairabe, and northern Yalavou) livestock and pastoral development program, and the third agricultural officer was a Fieldman who travelled fairly widely in the 'upper' valley and promoted agricultural intensification and modernisation in the wider Navosa territory. The following information is from interviews.

The management of the agricultural station was accepted by approximately 70 percent of crop farmers (in the Keiyasi-Draiba area), who use the station to acquire supplies (F.I., 1998-1999). Granulated urea and superphosphate fertiliser, imported from New Zealand, was stocked. The prices were $42.00 and $32.00 respectively for a 40kg sack.

The Fiji Agriculture Department had decided to upgrade the Keiyasi sled track which traverses many of the *bila* farms alongside the flood-prone west bank south of Keiyasi. However, the local Agricultural Officer was critical of this plan, not because floods might destroy the road, but because the government tended to 'spoon-feed' farmers, and thus farmers did not develop their own individual or collective interests in order to help themselves. But paradoxically, he felt that the 'Agriculture Station must force change upon the farmers in order to make them more progressive' (F.I., 1998-1999).

The proposed new road was also considered to be unsuitable by the local *turaga-ni-koro,* on the grounds that sleds will wear quickly on gravel. He wanted the new road to be made with flat surface so that sleds

[34] Fiji MAF has three areal designations for the west bank of the Sigatoka River: lower, middle, and upper valley. The MAF 'upper' valley corresponds to the geographical middle valley. The designation reflects the low priority placed on true upper valley agriculture by government agencies.

cannot dislodge the loose and less-abrasive gravel to the side of the road.

There had been few changes to local agriculture according to the local agricultural Fieldman (who was responsible for the Navosa villages). Because there is an increasing amount of repeated cropping and less fallowing, he promotes the increased use of fertilisers (especially 13-13-13 NPK). However the Fieldman emphasised that soil tests, especially for pH values, are needed: 'the soil is different in every farm'. A government package is offered but it is expensive and farmers are reluctant to take up fertilisers because they don't understand the new technology. Instead, farmers want a new piece of land every year to grow crops and maintain fertility. 'Every year they are moving' and after five years they come back to the fallow area. Instead, 'we should be planting in one area', even in the hills, because the population is increasing (F.I., 1998-1999). Intensification should occur and planting should take place repeatedly in one place 'like in New Zealand'.

Nevertheless, traditional methods were useful in some places. At Vatubalavu they were planting *tavioka* on steep slopes because the population was increasing. In order to combat erosion, they had revived their forefathers' method of staggering the arrangement of *tavioka* hills on the slopes (F.I., 1998-1999; F.O., 1998-1999).

According to the Fieldman, irrigation was not needed in the high hills because there was sufficient rainfall, and cabbage could be grown there in the 'off-season'. But irrigation was needed in Nadroga because it was drier, although irrigation pipes tended to be damaged by logs, trees, and other debris during flooding in the middle valley. Some fertility arrives from deposition during flooding but deposition is uneven — in some places the soil is raised and in others the soil is removed (F.I., 1998-1999).

The Semilocal: Provincial Services

Various government and provincial services were based in the province of Nadroga, which differed from Navosa in that there was a higher edaphic contrast between large areas of rich alluvial *bila* and grassed hills; and there was less native forest.

Agricultural services

The Fiji MAF operated the Sigatoka Research Station at Nacocolevu in the lower valley, which was also a base for Nadroga-Navosa extension services.

The quarterly meeting

I witnessed a quarterly meeting of the Nadroga-Navosa Agriculture Extension Service on 24 June 1998 which was by coincidence held at Navatumali during my time there. The discussion involved various topics mainly related to agricultural production in the Sigatoka Valley. Production reports occupied the most time. Targets were not being met, partly because of the drought.

A directive, received from the Head Office of the Agriculture Department, was presented. It involved a research plan associated with an overseas aid project for vegetable production (lettuce, asparagus, watermelons, capsicum). It was to be based at Nacocolevu Research Station and involved farmer participants in the Sigatoka Valley. The criteria were that participants: (a) must be commercial farmers (rather than semi-commercial), (b) must have irrigation, (c) must be innovative, (d) should be grouped together (e.g., involved in an irrigation group), (e) should be in the 'lower' valley (no reason given but close to Nacocolevu Research Station), (f) should focus on small demonstration plots to minimise risk, and (g) have flood irrigation rather than sprinklers. The advisors, however, were sceptical if not scathing: (a) about the crop choice, (b) the choice of the 'lower' valley which was least appropriate climatically for these crops, and (c) about the uneven distribution of

these resources, which was especially repugnant to 'upper' valley representatives, and to my guide who was a young local farmer. The issue of uneven distribution of development resources (between the 'lower', 'mid' and 'upper' valley) was keenly understood by the various participants at the meeting. It was apparent also that there was a lack of two-way understanding between the Head Office at Koronivia and the Nadroga-Navosa Regional Agricultural Station who felt themselves to be the pawns of top-down directives from Koronivia.

The local Fijian Fieldman (who was also a school manager) proposed that projects aimed at practical education in agricultural technology should be provided for local (Keiyasi-Draiba) young men. This proposal, probably seen as an education issue outside their sector, did not gain strong support among the advisors.

The Acting Senior Agricultural Officer gave a pep talk at the start of and near the close of the meeting. The message was simple and direct: farmers wanted change and more money in their pockets. In the opening address he emphasised that 'we are change agents', and during the close he used phrases including: 'fill up their pockets', and 'they want change, they want money ...' (F.O., 1998-1999).

At the end of the meeting, I was given an opportunity to ask questions. Were they familiar with the concept of sustainability? The term was neither in policy nor was it a significant ideology (F.I., 1998-1999), and was new to most of the advisors. Only two (one livestock advisor, and the coastal 'vetiver' advisor) of the thirteen advisors present were familiar with it. The Navatumali livestock advisor was concerned about sustainability himself, but considered that local people have 'no notion of future sustainability' although their 'traditional methods may have been sustainable' (F.I., 1998-1999).

Yaqona statistics in Nadroga-Navosa

It was estimated from the 1997 report (Department of Agriculture, 1997), that 30.9 ha of *yaqona* were grown by 70 farmers in the 'upper' valley of Nadroga-Navosa. My interpretation of Hashimoto's (1990) data (37 *yaqona* gardens averaging 1.4 acres each, see p. 68) suggests that there may be up to 21 ha of (interplanted) *yaqona* grown at Draubuta any one time, from only one village. My data from Nasauvakarua and Nawairabe indicated that 11.18 ha was grown by 38 farmers in these two villages alone, and Nawairabe contributed only 0.32 ha from 6 farmers to this total because it was not in a prime *'yaqona* area'. Some large villages such as Nanoko, and others such as Matokana that have good *yaqona* sites can be expected to produce more *yaqona* than Nasauvakarua. There are many villages and settlements, especially those near forest margin and head-of-creek areas, that have *yaqona* sites similar to Nasauvakarua. This data suggests that the figures for *yaqona* in the report were incomplete, which contrasts with the emphasis placed on the accurate recording of *bila* cash crops, which were more central to the advisors territory. An explanation is that the Agriculture Department regarded most of Navosa as off-limits. The consequence is that the considerable contributions of Navosa farmers to the national economy are made invisible.

The Keiyasi *turaga-ni-koro* and modernisation

The Keiyasi *turaga-ni-koro* had a six hectare riverside farm which was irrigated with a high-volume diesel-driven pump, unfortunately broken down at the time. His main problem was animal damage to his crops reflecting insecure fencing (F.I., 1998-1999). The second most important problem was flooding, which is also a danger to irrigation systems. His farm had flooded in 1991, 1993 and 1995 (about every two-three years). The theft of produce was his third most serious problem.

There was a lack of local demand by farmers for irrigation, which the *turaga-ni-koro* attributed to a lack of access to bullocks or implements to cultivate. Other farmers did not have the money for the seed and

fertiliser package. There were other factors. A tobacco scheme had recently been abandoned by the buyer, negatively affecting livelihoods. Because this left farmers short of cash to purchase inputs, the irrigation scheme was also affected. In effect, only the larger farms could afford irrigation. But some Keiyasi farmers were slow to adopt irrigation because they did not know how to grow the new crops, and were unused to paying high prices for hard-to-get new seeds.

He argues that many local Fijian farmers had developed a dependent mentality as a result of 'spoon-feeding' from project-initiated handouts in the past, and new techniques are not attempted because they wait to be supervised. Ideally, farmers need further agricultural education, especially agricultural science courses at the school, and a specialist teacher is needed to serve this need.

In summary, it is apparent that there is not a well-organised path for local farmers to voice their needs, except via the *turaga-ni-koro,* who clearly has a modernisation approach. However, in Keiyasi, there was little opportunity for the *turaga-ni-koro* to influence MAF agricultural development policy, which instead was based on a top-down approach reflecting a modernisation ideology and practice.

Excessive burning is the main long-term problem around Keiyasi. Logging started in the 1950s and 1960s and there are 50 percent less trees than twenty years ago (F.I., 1998-1999). Nawairabe also had less burning and many more trees then. The main reason for burning in the area is the accidental spread of cooking fires prepared to cook pigs, and the secondary reason was for new grass. However, another local farmer said that the sole reason for burning was for new grass.

Distant Views and Nonlocal Perspectives

Interviews were conducted away from Navosa and Nadroga with nonlocal laypeople, teachers, environmental activists, NGO staff, officials and politicians, and some local people who had migrated out of Navosa.

Professional perspectives

Although there were notable exceptions, the common perspective among (usually urban) professionals was that local people were unthinking and ignorant exploiters of their environment.

Education professionals

The view that local people live in the relatively immediate present rather than concerning themselves about the future was common, especially among visiting professionals. Many professionals that I met pointed out the lack of scientific biological or ecological knowledge of local people: they 'live day to day' and 'don't think about the future' (F.I., 1998-1999), thus implying that local people cannot be relied upon to maintain sustainability because of a lack of scientific knowledge about the environment and a lack of concern for the future. There was virtually no mention of institutional or leadership failings. A few educationalists had a deeper and more knowledgeable perspective on Fijian culture and sustainability, and were a valuable reservoir of knowledge.

Expert nonlocal attitudes on sustainability

According to a visiting scientist from overseas, who had been living in Fiji for more than a year, there is a local Nadroga attitude of optimism and accommodation where 'nothing is a problem' (perhaps reflecting a resilient past), which obscures concern about long-term changes in the environment. In his view, a local ethos of 'living in the present' was misplaced and more consideration should be given to future generations.

Food and nutrition

The National Food and Nutrition Committee (NFNC), based in Suva, promotes the growing of subsistence foods and green vegetable crops. Despite a traditional heritage of good nutrition, the increasing dependence of Fijians upon imported foods was causing an increased level of malnutrition (NFNDP, 1982, p. i). Part of the problem was that the subsistence needs of some households were being compromised to the commercial sale of food crops. In Tailevu (an eastern region with many poor soils), and elsewhere, it was found that some households were selling *dalo* (which has high nutritional value) in preference to consuming it (F.I., 1998-1999), resulting in malnutrition from inadequate substitutes (FAO, 1982, pp. 11-12; Manning and Thaman, 1980, p. 49).

Environment

A draft Sustainable Development Bill was about to be considered by the government (F.I., 1998-1999). Unfortunately, this policy document did not focus on land degradation: it was mainly oriented to urban concerns such as preventing pollution by establishing safe waste disposal facilities (Department of Environment, 1998). The issue of rural soil erosion and land degradation was only addressed in broad terms — through a proposed National Resource Management Unit. The bill was a highly compartmentalised, and therefore of limited use for land conservation. For example, there was a lack of proposed action on excessive burning, and fire control was viewed as a forestry issue, instead of being treated as an integral people, livelihoods and landscape *(vanua)* issue. Also lacking was any provision to address the agricultural dimensions of sustainability. The title of this document was also misleading in that it was more about urban environmental protection than sustainable rural development. It was also an overly long and strenuously legal document that was not appropriate for the Fiji context, where the Department of the Environment lacked the power to confront larger-scale environmental issues.

Land and agriculture

Land and agricultural officers based in Suva emphasised the diverse range of agricultural issues and problems in different regions in Fiji. For example, wind erosion can be a problem in some coastal areas but is insignificant elsewhere. The moral was that 'circumstance dictates actions' (F.I., 1998-1999), which is interpreted as indicating the necessity for local responsibility and decision-making.

Non-government organisations (NGOs)

The Lautoka-based Foundation for the Peoples of the South Pacific (FSP, also the *Kana* Project) was indisputably the most active NGO in local participatory development, and the only one active in the Navosa area. Its main focus was on health in rural areas, especially the Western Division. It had been involved in the implementation off several small-scale health projects in Navosa, especially at schools. For example, the Nasikawa District School at Korovou had benefited from the installation of a water tank to provide potable water.

The South Pacific Action Committee for the Environment (SPACHEE) had no involvement with Navosa whatsoever, but it did maintain a well-stocked and very useful library in Suva, and served as a resource centre for environmentalists and others interested in sustainability.

The World Wild Fund for Nature (WWF) also has offices in Suva, and like SPACHEE, had no input into Navosa. It had a point of relevance in that it was concerned about the potentially spreading habit of mahogany in the wetter regions of Fiji. A problem for conservators had been the lack of research on the ecology of native species.

Government officials

In general, government officials were helpful with practical information, but they tended to avoid comment on politically sensitive issues such as large agricultural development projects, where benefits were often inequitably distributed in a way that favoured the dominant political forces located outside of Navosa (F.I., 1998-1999).

A typical public-service view of local development is that the people 'take for granted that the government will continue to spoon-feed them', and that villager's 'wait for development to occur' (F.I., 1998-1999).

Government and the rural development process

The development process in Fiji was frequently the subject of criticism, and was viewed as in need of overhaul (F.I., 1998-1999). Development agencies were criticised for their poor communication with local people and a lack of understanding of local peoples' needs. The 'targeted' groups were often not able to clearly outline their needs, perhaps because of a lack of consensus (or need). There was poor communication and logistic inefficiency in relations between the administrative bureaucracies, especially with regard to the cumbersome funding process, and the resulting delays compromised success. In particular, the powerful Ministry of Finance frequently delayed or redirected development funds against the wishes of the intended recipients (F.I., 1998-1999).

The Fijian Affairs Board and Duavata

The Fijian Affairs Board (FAB), in co-ordination with the Ministry of the Environment, had been indirectly focusing on environmental concerns and the sustainable use of resources through a project group, Duavata. The details in the following paragraphs were mainly obtained from the project leader in the FAB (F.I., 1998-1999), and from a FAB document (Duavata Group, 1997). The Duavata Project was initiated in response to the recommendations of the Cole Report on provincial administration over a decade earlier (Cole, et al., 1984). The holistic

meaning of *duavata* is unity, but it also means 'to unite or harmonize the family', and also refers to 'the act of working together for community or other betterment' (F.I., 1998-1999). The goal was to promote unity among the social groups that make up Fijian society. It aimed to overcome the divisions and conflict within village leadership that made development planning and management difficult. One of these involved confusion over the different leadership roles of traditional hereditary chiefs and elected bureaucratic leaders in villages. The FAB believed that many leaders lacked a clear understanding of their role in village society and were working at cross-purposes. Consequently, the workshops aimed to increase mutual understanding among leaders by educating them about their proper responsibilities and roles in managing the village-*vanua* system.

Each *tikina* was visited by a team of two Duavata leaders from the FAB. Although the FAB leader was a woman, workshop leaders were all men, because women were unavailable to work the continuous five-week work periods. Some *tikina* in Nadroga had already been visited, and plans were being made to conduct the first workshops in Navosa, at Namataku and Navatusila *tikinas* (coinciding with the time of in-depth research).

The initiative aimed to improve the welfare of the people by: (a) training them to acquire skills in self-determination so that they can be equipped to tackle any development of their choice and not rely on outside help, (b) reinforce the value of village customs and life to youth, (c) emphasise the preeminence of *vanua* and the role of cooperation among leaders towards achieving *vanua* aims, (d) clarifying leadership roles and duty, (e) reinforcing the value of moral conduct and education towards nurturing good citizens, (f) encouraging the preservation of heritage, forests, fishing grounds, and indigenous culture, and (g) increasing the understanding of the structure of relationships between the people, the NLTB, the NLC, and other government departments

(where documents concerning native interests are kept and preserved) (Duavata Group, 1997).

During the workshop, management techniques (e.g., time management, problem-solving and brainstorming) were introduced. These techniques were accommodated within a Fijian unity perspective, in contrast to the European system, as follows. The five-day workshops were participatory (everyone was invited, but the *tikina* council was required to be there), and included an overview of problems, brainstorming, and the explication of church, government and *vanua* perspectives. The issues of food security, income generation and spiritual belief were discussed. The emphasis of the Duavata team was on helping local villagers to solve their own problems. Nevertheless, certain guidelines were promoted which involved social change. 'Under the old system' members of the chiefly family were often served first in appointments and dominated committee proceedings (described as 'the chiefly family' rule, perhaps more prevalent in eastern Fiji). Various *turaga* and *turaga-ni-koro* met at focus groups and deliberated among their peers in order to clarify their own roles and responsibilities. The Duavata strategy encouraged the allocation of decision-making roles to people with skills, leadership ability and commitment (this challenges recent custom where decision-making formally lies with inherited leaders). Paradoxically, the example suggested was of a carpenter's clan leader taking responsibility for construction work in lieu of the chiefly family (in accordance with pre-cession custom) (F.I., 1998-1999). Because it was believed that the bureaucratically-dominated provincial development committees take too much control and responsibility (Belshaw (1964b) had a similar view), chiefly leadership was encouraged to engage in development initiatives.

One day of the workshop was spent on the sustainable use of natural resources, and the intellectual protection of cultural resources. The norm is that resources were taken for granted: 'Fijian people are only aware of

their natural resources when they don't have them any more'. Thus, local people need to learn about how to practice sustainability in order to conserve their resources. Leaders of the priestly clan *(bete)* once saw themselves as protectors of the environment, but many of today's *bete* do not know their role, because their fathers have not passed the knowledge to them. According to the (eastern) leader, the failure to transmit traditional knowledge to the younger generation is most apparent in the Western Division (including Navosa), partly because children are commonly absent from their elders' villages during school terms. In addition, some western Fijians only partially accept the (eastern) traditional chiefly way (and the associated political hegemony (Durutalo, 1985)), and are reluctant to accept 'traditional' roles. Instead, many adults prefer to be individuals rather than play a role that involves subservience to the chief. For example, some *matanivanua* avoid the role of chief's spokesperson, and similar attitudes compromise the traditional *bete,* fisherman, or carpenter roles, thus leading to a relatively fragmented system of leadership. The Duavata leadership hoped that chiefs would play their 'proper' role, and become model leaders. The nonchiefly community would then be obliged to follow (F.I., 1998-1999).

The Duavata group encouraged local communities to plant more crops (similar to the early colonial Fijian Regulations), because they believed that a lack of productivity had occurred since the demise of the strict colonial regulations (with their threats of punishment) in 1967. The colonial regulations, among other demands, had enforced the planting of proscribed amounts of various crops (Government of Fiji, 1883). This strategy was also an indirect attempt to deflect excessive *yaqona* drinking in villages, and was the reason behind the emphasis on time management.

A plan of action (including financial aspects) was drawn up at the conclusion of the workshop. Workshops were receiving positive feedback at the time, but the leadership warned that *duavata* should be a

continuing development effort, rather than a single event.

The Duavata initiative reflects the view of the government about what is lacking with regard to development aspirations in Fijian society. It also demonstrates how environmental, social, cultural, and political forms are integral to, and have a profound influence on the direction of any strategy for sustainable development in the Fiji context. In particular, it reveals the importance of local institutions in this process.

Political leadership

The *turaga-ni-vanua* for the Noikoro district in central Navosa was also a nationally-known parliamentary politician known for her outspokenness. She was distinguished by a tertiary education in Australia and a chiefly perspective. Despite other demands, she managed to visit Navosa and especially her home in Korolevu village about every five weeks, despite some ill-health, to maintain her links with the vanua and church (F.I., 1998-1999). However, there were clear differences in lifestyle and priorities between this urban-based *turaga* and the rural villager-farmers she represented.

She had a sound understanding of environmental matters and had suspended a logging operation near the village of Nakoro because non-selective methods were being used (F.I., 1998-1999). She was also backing a 'Noikoro Forest Conservation Area Proposal' which was being considered by the government (NLTB, 1996). This document aimed to conserve a 4,094 ha part of the now unpopulated Wainivau Creek catchment including the high peak of Monavatu. The proposal included the establishment of a National Park, the development of ecotourist facilities, and an allowance for the local harvesting of non-timber forest products. The area is remote and contains the remnants of abandoned villages and large agricultural terraces. Progress on the project was slow at the time of the interview.

The *Turaga* and her husband were concerned about the increasing numbers of young people who wanted to farm and build at Korolevu,

and subsequent pressure on resources, and the increased difficulty in sustaining an income than before (F.I., 1998-1999). The development at Namoli had created demand for housing development at Korolevu. She would prefer to distribute any aid for housing in the form of loans, but Fijians generally view an unsecured loan as a windfall, unless it was part of a traditional ceremonial exchange.

Some of the farmers at Korolevu had asked for help to develop the *vuci* land across the river (shared with Namoli). However, other members of the community grew cash crops there and were against the proposal, creating a stalemate. Younger men were moving back to the village from elsewhere and there was now a shortage of cultivatable land near Korolevu. The Noikoro *tikina* was the third-largest district in Fiji, but most of the land near Korolevu is relatively infertile low to medium rolling hill country covered in *mauniba*, and some *talasiga*. Despite the prevalence of regularly-burned grassland in their domain, this leader and her husband were not aware of the legal situation with regard to fires.

A TOPICAL VIEW OF NAVOSA

This section covers various topics related to the resource-centred concerns that emerged during participatory research.

Sociocultural Aspects and Livelihoods

The contextual relations between the sociocultural system, livelihoods and the environment is the focus here.

Local education and development

Primary education was available locally from schools at Nanoko, Nukuilau, Korovou, and Navatumali. Children from all other villages either board at the school, or more often, board with relatives in the nearest village during the term of 14 weeks (with 3 weekends leave at home) (F.I., 1998-1999). Secondary education from Forms 1-6 was available from the Navosa Central College at Navatumali (19 teachers, 322 pupils, 63 boarders) and the Navatusila District School at Nanoko. Many children from the Catholic villages of Namoli and Nasauvakarua attended the (Catholic) Bemana Junior Secondary School further down the valley. The Sigatoka Methodist School at Sigatoka taught Form 7. There was a considerable burden on families to pay the various school fees and miscellaneous charges, and the lower enrolments for fifth form and higher reflect added costs. Children from chiefly or religious families sometimes send their children further afield for education, to Sigatoka or elsewhere.

The curricula at the Navosa Central College did not contain any local history, and instead, only history from other countries was taught (F.I., 1998-1999). There were no materials in the school library relating to local events or history, and the nearest public library was in the main centre of Lautoka. Agricultural science is taught in Form three and Form four at the Navosa Central College. Projects can include commercial vegetable and poultry farming. However, there was 'no allowance in the curriculum for the development of traditional farming techniques' (F.I., 1998-1999), except for the practical work of hostel boarders who work after school three times per week planting *tavioka, dalo, bele,* and *jaina;* to be harvested, cooked and consumed later as a contribution towards boarding costs. The basics of soil erosion were covered at fifth form level, and environmental awareness was included in basic science, agricultural science, biology and geography classes; but the local problem of burning was not emphasised, partly because textbooks were

developed in Suva where burning was not a problem. When asked, none of the pupils knew the meaning of the term sustainability.

Public media and local communications

Television reception is obtained at Navatumali but in most of Navosa reception is poor and television is not received, although VCR videos are played on television sets owned by some higher-income households with the aid of petrol or diesel-powered generators (F.O., 1998-1999). The recent high market prices for *yaqona* have enabled many households to purchase generators, VCRs and monitors for use in their villages, but their operation is often limited by a lack of or inability to afford fuel. My period at Nasauvakarua coincided with the purchase of two new sets of electricity generators by clan leaders, and the first television monitors and video players. The first of these attracted a large audience to watch a video of a boxing match with a local (Korolevu) champion. Radio reception is possible and battery-powered, hand-held radios are put to use occasionally, especially for football matches and political broadcasts, depending on village policy and whether batteries can be afforded or are available. The printed media are virtually absent from Navosa, although old Fiji Times newspapers are in demand for use as cigarette paper.

Traditional ecological knowledge

It was reported that there was a current trend of educational failure where the younger generation were failing to learn, or were not being taught, the traditional ecological knowledge of their parent generation, thus exacerbating over-exploitation (F.I., 1998-1999). For example, young villagers are digging and selling *vitua* without replanting the head of the yam to ensure its reproduction — a traditional technique that senior village harvesters practice. In another case, the subsistence supply of green lemons *(moli)*, needed by senior villagers, was sold to the market by younger people. In these cases, the demand for money can threaten the sustainability of natural resources, the unity of social and customary institutions, and food security.

There was another trend where emigration from villages compromised what was described as the 'social function' of tradition (F.I., 1998-1999). The typical hill cultivator has traditional obligations that entail various social, cultural and religious responsibilities, which were intimately related to group and personal identity. But the 'psychological' base of this partly-religious identity was being jeopardised by (modern) economic culture (F.I., 1998-1999).

An important facet of local culture was the traditional conception of time-management which included a balanced arrangement of work to leisure hours in accordance with community norms (F.I., 1998-1999). Most traditional villages were egalitarian with little variation in wealth between villages. Fijian conceptions of wealth were much broader and less money-oriented than *vavalagi* (European) versions. Fijians recognised *tabua, masi, ibe, uvi, dalo, tavioka,* cattle, goats, horses, pigs, land, forest trees, tractors and the quality of housing as wealth (F.I., 1998-1999). This list reflects the mixture of customary and modern notions of wealth present in village Fiji today. Money was not mentioned as a measure of wealth, although its significance was apparent in participatory appraisal (see p. 286).

Social and religious change

Significant social change was occurring throughout Fiji, especially in the more developed regions, according to a senior agricultural officer in Suva (F.I., 1998-1999). In coastal regions of Viti Levu, Fijians are becoming more possessive, and exclude those who lack the security of land. People are more money-conscious and are less accommodating as hosts than they used to be. Villagers are becoming more concerned with their personal and family identity rather than identifying with their community. The increased concern with household security within each village (houses are usually locked when nobody is present), reflects these changes. There is an increased level of segregation between the different generations within villages, for example, young men are increasingly

questioned and scolded for mild antisocial behaviour. In the Officer's view, these trends of increasing individualism are leading to 'a tragedy of the commons' where common resources are overexploited by individuals for individual gain. These changes directly contradict the nineteen- and twentieth-century emphasis upon communal sentiment in Fijian ethos, religion and politics, where individual gain was said to be anathema (F.I., 1998-1999).

This same officer reported that 'women are a very strong influence on the process of change' (F.I., 1998-1999). Part of the reason for this is that a woman, especially a chiefly woman, brings the different ideas and practices of her affinal village to her new village after she marries and enters the patrilocal focused household. Men generally stay in their own village when they marry and thus are not expected to be change agents, although some young men bring new ideas from outside work experiences. The newly married woman gains status by bringing new (or different) skills (e.g., an esteemed weaving style) to a village where this skill is lacking. Traditionally wives were given their own gardens in their husband's village and they gardened separately, but today husbands and wives are encouraged to garden together as a family unit. In Navosa, women do more agricultural and fishing activity compared to the women from the eastern Lau island group whose main priority is weaving. The *ibe* (mats) can be sold at the Sigatoka market in addition to being exchanged at *solevu* and used in the house.

Local cultivators don't plan for the long-term, instead 'they plan for tommorrows food' and basic household needs, according to the same senior agricultural officer (F.I., 1998-1999). Nevertheless, it was also said they do plan their crops as any farmer must, and organise into work groups *(solesolevaka)* for doing tasks. *Solesolevaka* often work across, rather than within, *mataqali* boundaries, and these groups are important for growing (and drinking) *yaqona*, planting yams, playing rugby, hunting, fishing, church, resource gathering (e.g., fuelwood), weaving, marketing

and village protocol, among other activities. It is common for there to be four to five farmers who cooperate in these groups by, for example, exchanging planting materials and sharing labour.

Women congregate exclusively in gathering and fishing groups, and more formally, in church and womens interest groups.

Local culture history

The importance of social and religious history on the people of the Navosa was significant, in particular, the killing of the Reverend Thomas Baker in 1867 (Derrick, 1950, p. 165; F.I., 1998-1999). As a result, the region is still somewhat afflicted with an aura of the demonic, especially to outsiders. It was apparent that many government officers viewed Navosa as an 'out-of-bounds' area: one where many were afraid to tread. Nevertheless, the people of Navosa were friendly and inquisitive, but tactful with regard to their own personal information. The strong group identity served to ameliorate 'personal weaknesses' (perhaps individualism) among the villagers in this relatively traditional region (F.I., 1998-1999). Consequently, local community development initiatives have a chance of being successful here.

Resource Management and Sustainability

The details about how resources are used and managed, and possibilities for local amelioration are discussed here.

Resources and land conservation

This section describes the ways particular natural resources are used for livelihoods, and their relation to sustainability.

Traditional land use and cultivation

One particular Suva-based government officer had local experience, and contributed rarely-mentioned information about traditional practices (Seru, 1998a). Compared to the present, old people used food more seasonally: there were periods of exclusion for certain foods which helped maintain food security, and the seasonal attributes of some trees and vegetation (e.g., breadfruit and yams) were used as indicators for particular activities.

Old people burned differently: they effected a more controlled and careful approach compared to today. Burning was not practised where *uvi, dalo, vudi, dalo-ni-tana, bele* and *yaqona* were grown. These crops require soils high in organic-matter and fires destroy this attribute. A three-year cutting and composting cycle was often used in the past to grow *dalo*. Mulches were used with organic-matter to preserve moisture (F.I., 1998-1999).

Tavioka tolerates a wider range of conditions and requires less care than the aforementioned crops. As a result, the utilisation of *tavioka* has led to a relatively careless and less sustainable way of farming. *Tavioka* has another drawback: it begins to lose its starch content after the stem is broken during cyclones, and it becomes useless as an emergency fresh food (except for the first few days) during the post-cyclone period (F.I., 1998-1999).

In the past, the rotation cycles of swidden agriculture were based on a cultivation period of five years in one plot with a 20-30 year fallow. However, rapidly increasing human population is creating irreversible changes. Although commercial agriculture for export did not begin until 1960, many villages are now crowded and lack good land. The high prices received for *dalo* as an export crop has led some growers to exclude others from their land in an effort to grow more for export. Thus, those with less land are now suffering more (F.I., 1998-1999).

Hydroponics

The method of growing vegetables in soil-less hydroponic systems was being taught at the Navosa Central College (F.I., 1998-1999). Perhaps because I was perceived as an expert from a more developed country, I was expected to be knowledgeable (and perhaps promote) this new technology during a guest lecture. However, in my view, these innovative ideas (which are of marginal relevance in Navosa where capital and resources are lacking), can have a negative effect in that they can implicitly discount the significance of land degradation by promoting an (unrealistic) alternative to traditional ways and the necessity for soil conservation.

Vetiver grass

Vetiver grass had been planted on the contour to prevent erosion on erodible slopes on two model farms in the Vunatovau-Nadroumai area of Cuvu *tikina* of Nadroga. One farmer was growing tomatoes on a small but very steep *teitei* off the crest of a ridge with several rows of vetiver planted along the contour (F.O., 1998-1999). On another farm, contoured rows of pineapple and vegetables grew on a moderate but

highly erodible slope alongside rows of vetiver in rolling terrain.

PHOTOGRAPH 14. Soil conservation. Nadroga pineapple-vegetable farm with vetiver grass in foreground.

Vetiver grass can also be used as thatch on *bures*. According to the agricultural officers, vetiver was not believed to be necessary on *yaqona* gardens because the *yaqona* or *dalo* plants themselves serve to control erosion (F.I., 1998-1999). Vetiver was once common on cane farms, but it is now only seen occasionally, often as a poorly-maintained remnant of old plantings, and there had been few recent plantings.

The Senior Land Use Officer (Western Division), in Lautoka, considered that vetiver grass was now in decline because farmers were not teaching their sons about the benefits of vetiver (F.I., 1998-1999). Consequently, vetiver bunds were destroyed by the use of bulldozers and other heavy machinery. Part of the reason was that vetiver-planting was once made compulsory (a colonial edict), and planting was enforced, rather than being decided by participatory means. Thus, it was not a part of farmer values (local knowledge or performance), and had not

been passed on. Thus, lack of knowledge about the benefits is the main hindrance to furthering the use of vetiver grass (F.I., 1998-1999). The model farm approach (at Tilialevu, near Sigatoka) was the preferred method for promoting vetiver grass.

Pasture and sustainability in Nadroga-Navosa

According to the head livestock researcher at Nacocolevu, overgrazing is a normal condition, despite the ideal stocking rate of 0.5 cattle beasts/ha (F.I., 1998-1999). Weed infestation is a problem in addition to soil erosion, watershed pollution and sedimentation. Weeds (especially the woody type) are controlled by burning, ideally every 3-4 years. Clumps of *mauniba* become unpalatable with age but respond to burning (F.I., 1998-1999). When ungrazed, *mauniba* covers and protects the soil, but the soil is exposed between clumps after burning. Severe erosion can result if heavy rains fall on the unprotected soil at the time after *mauniba* is burned, and he believes that this is an increasing problem (F.I., 1998-1999).

Other reasons that the livestock researcher gave for burning were: (a) to stimulate fresh growth, (b) to maintain a clean look, and (c) to facilitate wild-pig hunting. When a pig is chased into a valley, it is common practice for hunters to burn the ridges either side so that the quarry will be exposed and easier to track outside of the valley. But the livestock researcher was unaware that burning was practised to harvest wild yams (common in Navosa but not in Nadroga), and thus his knowledge about the Navosa context was limited.

Several large pastoral projects were initiated in the 1960s and 1970s (including Yalavou) (F.I., 1998-1999). Packages of superphosphate were used to establish legumes by improving the phosphate and potassium content of soils. The stocking rate was improved from 0·25 to 1·25 beasts/ha in some places. Following the legumes, *Nadi* Blue grass (NBG, *Dichanthium caricosum),* which establishes easily, was introduced with a new goal of 2 beasts/ha. The procedure involved conducting a burn after

the first rain of the wet season, and then sowing legumes (usually from horseback), with NBG following later. NBG is a creeping grass which helps to prevent excessive weed growth and erosion and is resistant to fire. However, NBG has detractions: it is susceptible to rust in the wet season, it grows very slowly during flowering in the dry season, and it tends to die-out following severe droughts. Also, after it is established, controlling weeds by burning becomes difficult (it inhibits the spread of fire) (F.I., 1998-1999). The pastoral researcher believed that NBG-based pastures supported a more sustainable system than *mauniba* equivalents.

Other alternative grasses require cultivation for establishment (and often fertiliser), and thus can only be used on slopes below 15°, and are too costly to establish and maintain. Experiments have been conducted by burning steepland and sowing with new seeds among the *mauniba*, but fertiliser was required, and this was not currently cost-effective. Despite his knowledge of small grasses, he did not know much about *bitu* in the hills (F.I., 1998-1999). Signal grass (*Brachiaria decumbens*, but possibly *B. humidicola*), was being planted for pasture in the Sigatoka Valley. This grass, growing at Nacocolevu, spreads rapidly via stolons in moist conditions on fertile soil (F.O., 1998-1999).

Animal health, pasture, livelihoods and custom

The Animal Health and Pasture Division (AHP) of MAF has a truck to collect livestock and transport them to either Nasinu or Vuda for slaughter. Ten to fifteen animals (cattle or goats) are necessary for an economic load, but this was hypothetical because the truck had broken down and was last used more than six months earlier. Farmers might ordinarily use this service to obtain a higher farmgate price than other alternatives, however, they must wait two weeks or more for a cheque to be returned for payment, perhaps via the livestock officer (F.I., 1998-1999). This is not attractive to farmers because many do not have bank accounts, and the communication system (either to Navatumali, or Suva) is poor.

Instead, a middleman with a seven tonne truck (taking 12 animals) can be contacted via local means and will pay cash-in-hand, after travelling up the valley as far as Nukuilau. An average of about five animals are collected by middlemen each week. Animals are sold to pay for school fees, especially at the start of term, and to provide for church contributions, especially the major annual church gatherings or conferences, such as the one held in Suva during August.

Pigs *(vorei, vuaka)* are necessary at many ceremonial gatherings, especially major church celebrations, and are usually preferred over cattle (but in Nasuvakarua, where wild pigs were plentiful, cattle were more highly regarded). *Vorei* are sometimes sold to kin within local communities, at a price of between $100 and $400 (for a very large pig). The request to purchase must be made in-person, and with a contribution of one kilogram of *yaqona;* in which case, the 'owner' will be obliged to sell (F.I., 1998-1999).

The percentage of animals sold for cash rather than used for subsistence or ceremonial reasons was approximately seventy percent according to a livestock advisor with local experience (F.I., 1998-1999), although this figure probably represents 'livestock' areas such as Yalavou, and may be much less in many villages. In Nasauvakarua, there was an average of 9.2 cattle and 4.5 goats in each household (plus 4.2 horses and 0.4 domesticated pigs); and in 1998, each household contributed 3.94 cattle (and no other animals) to *solevu* (F.D., 1998-1999). Thus, 43 percent of the total cattle herd were contributed during 1998 for *solevu* (some may have been exchanges involving live animals). That amount seems unsustainable (cattle take two-three years to reach maturity), and leaves none for sale. It may have reflected a year of low productivity and fertility (due to drought) and high demand, but also, if live animals were exchanged under reciprocal arrangements, or sold outside the village, then each household can expect to request live animals in return, or be able to purchase replacements, sometime in the future.

The figures at Nawairabe were an average of 15.5 cattle and three goats per household, with an average of 5.32 cattle (and 0.12 pigs) contributed to *solevu* from each household (F.D., 1998-1999). Thus, an average of 21 percent of cattle were contributed. Because Nawairabe contained Yalavou farmers (see below), total cattle numbers were high and many were sold.

Goats *(me)* have free-range near Nawairabe (they are not penned at night). They tend to be herded towards rocky areas where they are safer from marauding dogs (F.I., 1998-1999). The recurring occupation by goats at these 'camp sites' results in erosion-scars, but the relatively low numbers of goats means that damage is not widespread yet in Navosa. Because goat meat is not customary for Fijians, goats provide a reliable cash return when sold to Indo-Fijians for perhaps $3.50 per kilo or approximately $60-$100 each. By contrast, cattle were retained to fulfil obligations at *solevu* or *magiti*.

The Yalavou beef grazing project

The development of the Yalavou project on the hilly savanna-like east side of the Sigatoka River was based on an extralocal (Australian) model. It was eventually considered a failure and has been criticised as being inappropriate for the region (F.I., 1998-1999).

Individual Fijians were selected to settle away from their villages on pastoral blocks under a development program. Peceli, son of the chief at Nawairabe, has a Yalavou block near Nawairabe village (F.I., 1998-1999). He has ten experimental sheep and 120 cattle. His Yalavou lease of 129 ha is administered through the NLTB but because two similar lessors have forgone their properties, he effectively has the use of about 200 ha.

Cattle were originally introduced as a ranch-style operation in the region (before Yalavou), and at that time were grazed widely on the hills using more management than at present (F.I., 1998-1999). One such 'ranching centre' was Matokana village, which still maintains many animals in the hilly region between Nawairabe and Matokana. The main

grazing grass is *Nadi* Blue Grass which can persist on flat ridge-tops and in bottom areas but tends to die-out on the slopes where *mauniba* is the dominant grass.

Different experts gave different reasons about why farmers abandoned their Yalavou farms, perhaps reflecting their own position, perspective or sentiments. A former Minister of Agriculture that I interviewed, an expatriate European who helped initiate the project, believed simply that a lack of management was the problem. Agricultural advisors gave other reasons (F.I., 1998-1999). According to one, farmers left Yalavou and returned to their villages because their farm blocks were unsuitable for growing crops. Flat land was scarce, and because the 'Yalavou' streams stopped flowing in the dry season, there was no opportunity for irrigated cropping. One man pointed out that Fijian people like to fish, and live, by the river. At Yalavou, they were estranged from this lifestyle, and thus later, when hopes did not materialise, they became unsatisfied and returned to their villages. Another reason why many returned to their villages was that they did not like the feeling of being isolated and living alone. There were other less personal reasons: (a) stock numbers were not maintained partly due to demands for customary obligation and theft, (b) the support from advisory staff faded after the 1987 coup which eroded many farmers' confidence, (c) many of the farmers had very little schooling which limited their ability to understand new technologies and manage finances, (d) farmers lacked motivation because they were usually selected (by MAF and *mataqali* leaders) rather than being true volunteers, and (e) there were problems with financial continuity because there was only one source of income on the farms (most Fijians have several crops and a spread of income). Soils were generally very good for pasture but drought was common on areas set aside for crops.

According to one advisor, the key problem was that the individuals selected as farmers were not highly motivated and proficient for their

role (but it is possible that there was a lack of willing individuals). The general conclusion was that the project was overly ambitious in several ways (F.I., 1998-1999).

Today MAF concentrates on one focal-point farm at Yalavou, with research focused on stock breeding. The most common breed was Santa Gertrudis which had adapted very well to the environment. An artificial insemination program aimed at crossbreeding the Charolais and Brahmin breeds was underway.

Some plantations of pine trees were planted but these held no immediate advantages to livelihoods. Agroforestry using widely spaced pine trees is a possibility on flat and ridge-top sites (F.I., 1998-1999). However, planting pines on slopes apparently causes too much shading for productive pasture.

Cattle and gardens

The Navatumali-based Fieldman, and many others, reported that controlling cattle was a major difficulty. The fences are often broached and cattle damage crops (F.I., 1998-1999). Cattle are sometimes tethered to prevent damage, but not as frequently as in the past when cattle tethering was compulsory. Cattle were also responsible for the discontinuation of *vuci* because the loss of vegetation and pugging led to the drying-up of the land. The Fieldman reported that 'cattle spoil the gardens and everything', and are responsible for the lack of water (F.I., 1998-1999). *Yaqona* was once grown in Navatumali and other parts of the river valley, but this crop is now absent because cattle destroy the vegetation used for shading the *yaqona* crop.

The headmaster of the Navosa Central College proffered similar views. The increase in livestock farming at Navatumali was causing havoc: 'we can no longer control the animals roaming around' ... 'cows can open gates, cattle are now pulling *tavioka* out of the ground and eating the roots' (F.I., 1998-1999). Goats created destruction in the hills, and pigs were occasionally breaking out of pens and damaging crops.

The lack of good fencing was the most significant problem, and the drought caused both an increase in the level of stock pressure (F.I., 1998-1999), and the weakening of living fences (F.O., 1998-1999).

Wild pigs are declining in number because young men 'hunt continuously', according to the headmaster. In his opinion, burning did not aid pig hunting, but may sometimes result from the hunters' frustration at not finding pigs. His view was that educational awareness was needed to counteract these issues.

Forestry

Officers of the Forestry Division of MAF were interviewed in Suva. Forest development can begin if the landowners approach the Forestry Division (via the FAB) for help (F.I., 1998-1999), although the main focus was on establishing mahogany and sandalwood on wetter sites. The Forestry Section can arrange for its research division to do an on-site survey, free to the landowner.

The establishment of indigenous species was not a priority, partly because little was known about their propagation and growth characteristics. Because of a lack of knowledge about when indigenous species flowered and seeded, the availability of seed was poor. Other reasons for their low priority were their usually slow growth rate, and uncertainty about the eventual value of their timber in the case of quick-growing species such as *kauvula.*

Each year during Arbor week in February or March MAF offers nursery trees free for planting, but outside of this time, nursery trees cost money. The Divisional Officers supervise planting. The nationwide Commodity Development Fund (CDF) scheme could only be exploited for the establishment of mahogany plantations if they were above 100 ha. This Forestry Officer's view was that local people do have a concern for the future (F.I., 1998-1999), and that money was not a major hindrance because local people were able to save for other things (such as ceremonies and school fees). She acknowledged that the reciprocity of

social affairs was very important in village life, but did not view this as a major hindrance.

The Forestry Division was planning a series of Community Resource Management Workshops in villages, but this initiative had been delayed while the Duavata workshops (see p. 246) were being implemented. The philosophy was based on a holistic approach and involved drawing the links between erosion, land degradation and the damage to coastal resources from sedimentation. They aimed to remedy excessive burning and 'poor land management' (F.I., 1998-1999). Their advice will be to use contour ploughing, minimise burning, and use 'resource replacement' (afforestation). On steep land, indigenous species and restorative practices will be recommended rather than the plantation model. Agroforestry may be considered where appropriate.

The local forest rangers were based in Sigatoka town. Their view was that existing natural vegetation should be conserved to prevent land degradation, especially on steep slopes. Land over 30° slope is classified for protection and cannot be used for plantations (F.I., 1998-1999). The ranger's views are presented in the next few paragraphs.

Despite the recognition that natural vegetation was best for steep slopes, the Senior Ranger believed that 'the present generation is not thinking of their children' when plantation forests were not planted. His reasoning was that it was possible to obtain a sustainable monetary income from planting pine on dry western slopes and mahogany on the higher, wetter eastern slopes, but local people were not interested. His view was that a lack of education, 'the day to day worldview', and a lack of money was behind their lack of interest, rather than better alternatives. The ranger gave other details as in the following.

Most of the commercially valuable timber had already been logged from indigenous forests in the region. The remaining blocks being logged were: (a) Nawairabe (where 50% of its large concession had already gone), (b) Nakoro, which has a small block left, and (c) Namoli,

which was logging its medium-sized block, and (d) Draubuta, which had a medium-sized block. The logging companies sometimes break regulations during harvesting, and this had caused logging to be curtailed at Nakoro. After logging, creepers grow rapidly, and one particular creeper introduced to the coastal area in 1986 is spreading inland and becoming a major pest.

Mahogany is not a recommended species for most of Navosa, but is being planted in the wetter already-logged areas of neighbouring Serua to the east, and can be planted on the higher eastern-facing slopes of eastern Navosa although none was planned. It returns a high value when harvested, protects the soil well while growing, and was capable of providing a long-term sustainable indigenous timber supply.

Nevertheless, mahogany has been established as a quick-growing replacement for slower-growing native species in biodiversity-rich forests on regenerating sites. Mahogany will probably lower the biodiversity of such forests (Watling, 1998). An alternative strategy is preferable where mahogany is planted on degraded, marginal low-biodiversity sites that may benefit from increased biodiversity under the protection of quick-growing mahogany.

Pine trees provide employment, and have performed satisfactorily, although the revenue is relatively low. *Pinus caribaea* grows well in dry areas, and at medium-high altitudes and is harvested at 15-20 years. Logging practice is controlled by the environmental criteria in the National Code of Logging Practice (Ministry of Forests, 1990). Private contractors do the harvesting. Because native trees are hard to establish, only pine trees were planted in Navosa.

Fires cause serious damage to young pine trees up to 7 or 8 years old, and older trees can also be damaged under certain circumstances. However, damage is minimised if there is an annual controlled burn. Some plantations were frequently damaged by fire, and have been abandoned as productive enterprises. Others were suspected of being

burned intentionally (e.g., at Nubuyanitu) because one or more graziers preferred pasture. The preferred management technique (often not followed) is to close a newly planted area for three years. Thereafter, the understorey is grazed (an agroforestry approach) in order to prevent fire damage.

The smaller community forestry plantations are usually about 0.4–1.0 ha. They were promoted by the Department of Forestry Extension Services (now defunct), before the responsibility was taken over by the Fiji Pine Company. School planting programs have also begun, the first at Nokonoko in the lower valley.

Other experts were more concerned with biodiversity (Watling, 1998). Watling's environmentalist contribution follows. He was positive about the role of *Pinus* species, which usually replaced grassland rather than native forest. Pines were effective as year-round ground cover and grew better on a second cycle, and were not deemed to be a biodiversity threat because of their non-spreading habit. Although *pinus caribaea* does not support undergrowth, pines planted on ridges allowed the regrowth of other species in adjacent gullies which were protected from periodic fire by the surrounding plantations. But it was reported that pines tended to extract moisture from soils, and so are unsuitable when planted near water sources or garden areas where they tend to dry up the supply of moisture. The village water supplies at two upland villages in the *Nadarivatu* area had been ruined in this way. Another participant reported that coastal pine plantations were being burned to relieve the soil of excessive acidity caused by pine needles, as well as to prevent the drying up of watercourses (F.I., 1998-1999).

Fishing

Fish are the most consistently utilised source of protein for Navosa villagers (F.D., 1998-1999). But the Assistant *Roko* was concerned about erosion which had caused sedimentation of the Sigatoka River, which was now shallower with fewer deep holes than in the past, thus limiting the size of fish (F.I., 1998-1999). Another senior participant reported that, compared to the past, there were fewer and smaller fish in the river at Keiyasi — because of frequent netting. The headmaster of the Navosa Central College affirmed that fishing was now harder because the river is over-fished (F.I., 1998-1999). The following comments are his views. *Duva* was commonly used — despite the severe punishment if caught (1 year in prison); and tobacco, which is more damaging than *duva*, is also used to stun fish, and now the fish are fewer and smaller. At one time it was necessary to swim across the river, and river sharks came up as far as Nawairabe. Sedimentation had caused the river to become shallow over the last 30 years, and although Cyclone Kina deposited sediment on the floodplain in 1992-1993, it was not the cause of the river sedimentation at Navatumali. In his view, the cause of the sedimentation has probably been logging, burning, and an increase in agricultural production.

Downstream effects of erosion

One participant (a mature tertiary student), reported that Korotogo Bay near the mouth of the Sigatoka River became brown for the first time after Cyclone Kina in 1992-1993, and that erosion has got worse over his lifespan (F.I., 1998-1999).

Drought resilience, crop choice and food security

Drought stress severely affected coastal Nadroga in 1998, but Navosa was less affected. Why was this so?

The coastal Nadroga region, which also includes the lower Sigatoka River valley, is primarily a sugar growing region where livelihoods are based on income from cash crops. The higher incomes earned by predominantly Indo-Fijian sugar cane farmers is reflected in the degree of mechanisation: many sugar cane farmers have tractors. Indo-Fijian farmers plant rice as a subsistence crop in the beginning of the wet season, but the drought during the previous 1997-1998 'wet' season had caused the widespread failure of the rice crop (F.I., 1998-1999). In addition, the projected sugar harvest was expected to be poor, and thus many sugar-farming families were suffering from both a lack of food and cash. In contrast, most Fijians in the region grew *tavioka* as their primary subsistence crop (also a cash crop), which is relatively hardy under drought conditions. Although their cash income was also affected, their subsistence base was more secure. Thus, there was a clear advantage to the group that grew *tavioka*, which was a more resilient and sustainable crop under drought conditions, although in normal years the higher risk of growing rice could be more rewarding.

Compared to the considerable anxiety about famine in the coastal sugar regions of Nadroga, Nadi and Ba; there appeared to be relatively little concern about food security in Navosa which was also suffering drought (F.I., 1998-1999). This comparison must be qualified, however, by differences in climate, environment and growing conditions between regions. Navosa also has greater wild food resources. Nevertheless, it appeared that the different crop strategies between indigenous and non-indigenous cultivators was significant in relation to the resilience and sustainability of food security and livelihood systems under those particular drought conditions.

An analogous comparison of crop choices can be made within the

Sigatoka Valley between the upper valley and the lower valley. The major crop planted in the upper valley *(tavioka)* serves well for food security as well as providing cash. In the lower valley, however, there was a tendency to grow cash-only crops (e.g., sugar, tobacco), at the expense of food security.

The Livelihood Resources

The role of livelihoods in reasons why local participants light fires was significant. This section describes some livelihood resources that were significant, and their role in the Navosa environment, especially the fire ecology. Most of the data comes from interviews, but other sources have also been used to compile the information.

Turmeric

Turmeric *(kari)* was originally introduced by immigrants from India and it now proliferates on open grasslands, partly because it survives burning, and partly because the seeds are spread by birds and animals (F.I., 1998-1999). Where scrub growth is a hindrance, the land may be burned so that access to the rhizomes is made easier (F.O., 1998-1999). This is a similar technique to that for harvesting *vitua,* except that *vitua* is associated with dense *gasau* and native forest where *kari* cannot grow. After harvesting, the rhizomes are boiled in 44 gallon drums and then dried. The price paid for the product was only marginally attractive to local harvester-producers: fresh rhizomes realised 0.25 c per kg, and the boiled and dried product earned from 0.50 c to $1.20 c per kg.

A higher price of $2.50/kg was being paid for (boiled and dried) 'organic' turmeric by one Japanese entrepreneur who had a collection and drying factory on the Queens Highway coastal road in Nadroga. The turmeric was harvested from the wild by Keiyasi and Draiba people, among others (F.I., 1998-1999). He exported seven tonnes per week but believed that demand was sufficient to export 52.5 tonnes per week to Japan where the organic product was consumed as a speciality health

food with a cult following — that realised a substantially higher price than 'non-organic' product sold to the spice and dye trade.

The exporter bought turmeric on the conditions that: (a) fertiliser was not used during plant growth, and (b) a tuber was left in the ground after harvest to ensure continuity of supply and sustainability (F.I., 1998-1999).

Agroforestry trees and plants

Agroforestry trees included *Leucaena, Gliricidia* (which has edible leaves), *Albizzia, Secola* and *Calliandra.* All of these pod-bearing and legume-leaved trees are locally called *vaivai.* The 'small *vaivai*' (either *Gliricidia* or *Leucaena),* were favoured for animal fodder. *Leucaena leucocephala* was common and used in gardens for shade, fertility and to provide 'living support' for yam vines.

Bitu was frequently reported by local participants as being beneficial for soil and water conservation, building and flooring, and as a beneficial cover crop that can be burned for planting *tavioka.* It is shallow-rooted and easily destroyed by fire, but the introduced large *bitu-ni-vavalagi,* used for poles, is harder to destroy.

One important expert (with Nadroga experience) criticised *bitu* because he believed it replaced forest and lowered biodiversity, whereas the larger clumping bamboo *(bitu-ni-vavalagi),* which does not form dense groves, allowed biodiversity (Watling, 1998). *Bitu,* however, was less common in Nadroga compared to Navosa. My observations in Navosa suggested that *bitu* was extremely effective as an erosion-preventing ground cover, and possessed many other livelihood benefits, which far outweighed any loss of biodiversity. In the hills around Nawairabe, *bitu* may have enhanced the fertility of land in the transitional buffer zone next to native forest, rather than being a replacement for forest. A *bitu* fire was observed on a steep slope on a very hot evening at Nasauvakarua, and although spectacular, it did not invade the nearby gully forest, and died out quickly at the forest margins (F.O., 1998-1999).

Part of the reason for the lack of forest damage is that fires tend to burn more aggressively uphill, and forest is usually downhill from *bitu*.

Vaivai-ni-mocemoce

In the view of the Western Division Land Use Officer, the large *vaivai-ni-mocemoce* tree was a beneficial tree because it prevented soil erosion (compared to open grassland) and increased soil fertility (F.I., 1998-1999). However, in hilly Navosa, *vaivai-ni-mocemoce* grows in gullies and does not replace open grassland. Instead, it replaces indigenous forest. *Vaivai-ni-mocemoce* has spread rapidly: the first tree was introduced to Navatumali about forty years ago, and now many large trees grow there (F.I., 1998-1999). Animals spread the seeds by eating the black-coloured pods which contain a sweet pulp, and it is very quick-growing. The local Fieldman described it as a pest: '*vaivai* is a big weed' (F.I., 1998-1999). Crops such as *dalo* and cassava cannot grow under it, and *vaivai-ni-mocemoce* 'softens' (loosens, makes erodible) the soil. Also, '*vaivai* pulls all the water' (i.e, it drys up water sources) (F.I., 1998-1999). Erosion occurs because there is no grass under *vaivai-ni-mocemoce*. By contrast, the '*maqo* tree can hold the soil structure'. The timber of *vaivai-ni-mocemoce* is classified by the experts as non-durable and worthless but has been used for local houses (where it lasts at least 10 years).

In the (experienced) Fieldman's view, forestry plantations and farming 'never go together' (F.I., 1998-1999).

Yams

Cultivated yam *(uvi)* gardens are admired for their customary and aesthetically beautiful qualities, but cultivation is labour-intensive. Yams are grown in hill villages such as Nasauvakarua and Nanoko, and sold to places such as Navatumali lower in the valley (F.I., 1998-1999). Cultivated yams, which are supported by poles, can be damaged by cyclones. Wild yams, by contrast, serve the same function of providing food, but require far less labour (F.I., 1998-1999).

Vitua

Vitua (wild yams) often occur among trees near the base of hills, or are associated with *bitu* or *gasau* in similar locations. *Vitua* are relatively cyclone-proof because their very long vines can withstand movement in the high branches of trees, and the surrounding vegetation prevents crucial damage near the base. They also resist aridity thus making them very resilient against drought, but they prefer moderately 'soft' (local terminology) soil to form large tubers (F.I., 1998-1999). In the past, every household had hundreds of *uvi* and *vitua*, often trained with *bitu* poles leaning against (e.g., *maqo)* trees which act as supports for the vine (a hybrid of wild regeneration and cultivated technique) (F.I., 1998-1999). There were many similar variations on yam-growing technique, often using semi-domesticated hybrid techniques where natural regeneration and human modification were combined (F.O., 1998-1999). For example, *vaivai* can be planted to support yam vines, or *'vitua'* may be intentionally planted under existing trees *(Leucaena* was popular in Navosa (F.O., 1998-1999)). These techniques exemplify traditional intercropping.

Vitua (wild yams) are located for harvest by two methods. The first is by sighting their foliage among the crown of trees and then tracing the vine to the ground where the root can be found. But if harvesting is left too late then the mature stem of the vine disintegrates at its joints and the tubers cannot be found (F.I., 1998-1999). The second method is used for particular species or cultivars annually in spring after the first rains. The tubers are located when their new shoots show above ground. These shoots are much easier to locate where the ground has been

cleared by fire (F.O., 1998-1999).

PHOTOGRAPH 15. Harvesting *vitua* (wild yams) from an area of burned *gasau* grass. Notice that the remaining vegetation provides better ground cover than burned *mauniba*.

The most palatable starch of yams is located in the lower part of the yam distinct from the small head of the yam which is the least palatable. The head is usually removed and replanted on site, following local mores (F.O., 1998-1999). However, today, many young harvesters sell the *vitua* for cash with the head still attached, and consequently, there is a decline in yam fertility and abundance (reported at Nawairabe and some other locations) (F.I., 1998-1999). Thus, the sustainability of this valuable resource is threatened.

Dalo

Dalo has already been discussed in relation to irrigated terrace agriculture, and only a few points are added here. *Dalo* is the chiefly, special-occasion food, that serves to enhance prestige when it is shared with others (F.I., 1998-1999). Although the farmgate price was high, *dalo* was only occasionally sold in Navosa because of its customary importance, especially to satisfy kin and community requests and obligations (F.I., 1998-1999). Customary requests for *dalo* made it a less attractive crop to those individuals (rare in Navosa) who were not intimately involved in the village exchange economy (F.I., 1998-1999).

Perspectives on Burning, Livelihoods and Degradation

Many agricultural advisors acknowledged that soil erosion was a problem in some localities where steep land with inadequate ground cover was susceptible to high rainfall. It became apparent that there was a divide between rural (mainly local), provincial (semilocal), and urban (nonlocal, mainly Suva), perceptions about the causes of burning in Navosa. These three perspectives (local, semilocal and nonlocal) are presented below.

Local views

Interviews conducted at Navatumali are presented here. Other, more detailed, information is located in the in-depth and participant study sections.

According to the headmaster of the NCC, the level of burning had increased to a level not experienced before. They 'burn for the hell of it!', and 'they burn for wild ginger (turmeric)' (F.I., 1998-1999). Policing was severe in colonial times 'and burning was completely out before 1970'. Previously, control had been more effective when the *buli* and the *turaga-ni-koro* were backed up by *ofica-ni-yasana* (Officers of the province), who were very powerful. However, today 'the backup forces are not there any more', and 'the *turaga-ni-koro* gives up due to lack of support'.

Wildfires are an immediate problem when they burn gardens, especially *yaqona* gardens. The owner of the *yaqona* will demand compensation, but usually the person or persons responsible for the wildfire cannot be determined.

Semilocal views

The semilocal perspective usually had a local focus and was often authoritative, but in many cases it was based on experience in neighbouring Nadroga province rather than in Navosa, which had a significantly different landscape.

The Senior Forest Ranger at Sigatoka town had a relatively detailed view of (non-forest) burning: (a) 'they burn so that the animals can have small shoots to eat in the dry season', (b) some like to see a fire burning (arson), (c) carelessness, e.g., as a result of a thrown cigarette, (d) to access yams in river gullies and other lower areas between April and October (a minor reason), and (e) to clear walking tracks. But he did not mention clearing land for gardens.

From an environmentalist perspective, fire was a problem because it destroys biodiversity (Watling, 1998). The 'lower-middle' Sigatoka landscape was a transitional landscape where the common *gasau* and scrub vegetation represents an ecological stage of transition between grassland and forest. Watling (1998), who had experience as a landowner and hunter in Nadroga, had observed vegetation change on Viti Levu over the period of his lifetime, and for twenty years in the Sigatoka region. During this period grass has given way to regenerating *gasau* and scrub in protected areas, and he believes the scrub will be replaced by forest in another 20 years, aided by *yaqona-ni-Onolulu (onolulu, Piper aduncum). Onolulu* has been a new introduction since about 1940, and this bush has spread rapidly (seeds are spread by *beka* (bats, who eat the fruits). It is regarded as an invasive weed in the drier mountainous areas of Western Viti Levu (e.g., at Koroyanitu). Nevertheless, *onolulu* aids the regeneration of endemic species by sheltering them in their juvenile

stages.[35] *Quwawa* will quickly outgrow grass if not burned. *Gasau* will also quickly outgrow low grasses but is very flammable when fire enters. In these circumstances a *gasau* fire will damage nearby trees whereas a low grass fire tends to leave them intact.

In Watling's view, burning in Nadroga was primarily intended to provide access for hunters to hunting territory, rather than to facilitate the event of hunting any particular prey. He maintained that 90 percent of fires in the 'mid-lower' Sigatoka Valley area of Nadroga were for this reason which included 'hunting' for *vitua*. The Nadroga region (of which Yalavou is part) is different from Navosa in that there is less native forest and few *teitei* on the relatively dry and low grass-covered hills.

Watling believed that the first priority in conservation was to stabilise the use of fire. However, he warned that there must be very good livelihood reasons to encourage people to stop firing the land. When this was done, then trees and other vegetation could be established with confidence. Research is needed first to evaluate which species can maintain or enhance biodiversity, although he believed that many of the currently-popular tree species were possibilities.

Nonlocal views

A visiting agricultural scientist from overseas, who had been in the Sigatoka Valley for some months managing an Integrated Pest Management project, considered that fires in the 'lower' or 'mid' valley region were the result of carelessness rather than being intentional burns, and were quite unwarranted (F.I., 1998-1999).

Mauniba (mission grass) was viewed positively by the pasture advisors, in contrast to the conclusions of Cochrane (1968) (see p. 85). The advisors defended *mauniba* in the following way (F.I., 1998-1999). Because *mauniba* produced a thick canopy of vegetative cover, it was considered to be effective at minimising soil erosion (they did not

[35] In another interview, a local youth reported that hunting *beka* is relatively easy when the animals are feasting on seasonal *onolulu* fruits near ground level (F.I., 1998-1999).

mention the risk of erosion from bared soil after fire). *Mauniba* was said to prefer black soil types and did not grow well on unsuitable soil types. In contrast to cane and ginger land where the disturbed soil is bared after harvest, less soil is lost under *mauniba*. The necessity for fire was also explained. In a normal year, *mauniba* leaves die in August and seedlings emerge after rainfall during October to December. However, if it was unburned, a thick mulch of dead leaves prevented the growth of seedlings, and the access of grazing animals to the young shoots is hindered.

The most authoritative expert, a Fijian research officer, viewed burning as both a management tool and a cultural more (Seru, 1998a). The latter is indicated because Fijians 'like to burn'. This Officer suggested several factors that local people either overlooked or were unable to express. As a management tool, fire is used for clearing the land, enriching the soil, and controlling pests and diseases. Pests that are controlled include insects (e.g., snails and slugs), and diseases such as anthracnose, which is a pest of yams. Burning also controls yam rot, mildew on *tavioka* and other crops, and army worms (killed by the heat of fire). No other advisor mentioned these agronomic issues.

Other interviews, however, evinced a variety of opinions on the causes of burning, that in many cases reflected the professional position and responsibilities held by the particular advisor. The case of Yalavou is an example. An advisor who held a relatively senior position at Yalavou believed that grassland fires were generally the result of carelessness, rather than for pig-hunting — for which fires were not helpful in his opinion (F.I., 1998-1999). His view was that hunters did not need to burn to contain, locate or flush-out pigs. But another advisor, with hunting experience, expressed a different view (F.I., 1998-1999). Again, most burning as aimless, but sometimes fires were used to flush pigs from cover to a place where hunters were waiting. In his view, most people, especially the younger generation, tended to regard the *mauniba*-

covered Yalavou hills as unimportant wasteland (because they lacked a practical use), and therefore, they cared little about potential degradation through burning. At least one other advisor reported cases where fires were used to flush pigs.

Intensified and sustainable land use

According to a specialist officer in the agriculture department land use division, old and sustainable practices can be renewed. *Vuci* can be re-established (F.I., 1998-1999). The technology is simple and feasible, but labour requirements are fairly high. Once established, however, normal maintenance was not arduous. Following the initial planting, *dalo* side-shoots can be replanted as necessary to sustain the garden, and the technical aspects were not constraining. A bulldozer could be utilised to reduce the labour of terrace construction, and *bitu-ni-vavalagi* was still available to make aqueducts (F.I., 1998-1999).

However, a teacher with experience at Namoli village, perhaps the most ambitious of the Navosa villages, suggested that laziness among the young men is a problem, and this may compromise any reconstruction of the *vuci* (F.I., 1998-1999). Even village women are tending to rely on cash from *yaqona* and are neglecting to harvest wild fruits, although *vitua* are still collected (F.I., 1998-1999).

Another advisor reported that because fencing was a problem, cattle had damaged both *tabaiwai* terraces and the plantings on the island of Moala. The senior advisor cautioned that the idea of planting *dalo* in *vuci* was especially popular during periods of drought (as at the time of interviews), but that the practice may not be sustained during wetter climatic conditions depending on circumstances.

The Koronivia Research Station had breeding programs for dryland *dalo* (80 varieties), and *tavioka* (25 varieties), but irrigated varieties lack priority and only three wetland varieties of *dalo* were grown for use in *poi* (puddings). Instead the focus is on dryland varieties with export potential. Of special interest in marginal dryland areas such as Navosa

was one new variety with striped stems which was particularly resistant to drought.

THE NAVOSA REGION PARTICIPATORY STUDY

Eighteen villages or settlements were visited (mainly in Navatusila, Noikoro, Nasikawa, and Namataku *tikinas),* and in each place separate local female and male participant groups were organised by the *turaga-ni-koro* to share their knowledge of local conditions.

Participatory Group Study

The techniques that were developed earlier at Nasauvakarua were replicated (with some modifications) for use in the group studies, and the results are presented in the following tables. The results are representative of most of the Sigatoka-Navosa watershed region, but not all the subprovincial villages were visited: either because they were in another watershed, or were relatively inaccessible. The Nadroga province villages of Nawairabe and Korovou are included because they are within the Sigatoka-Navosa watershed area.

Analysis of results

The results of each section of the study are presented consecutively.

Burning

The reasons for burning were obtained with the same method used

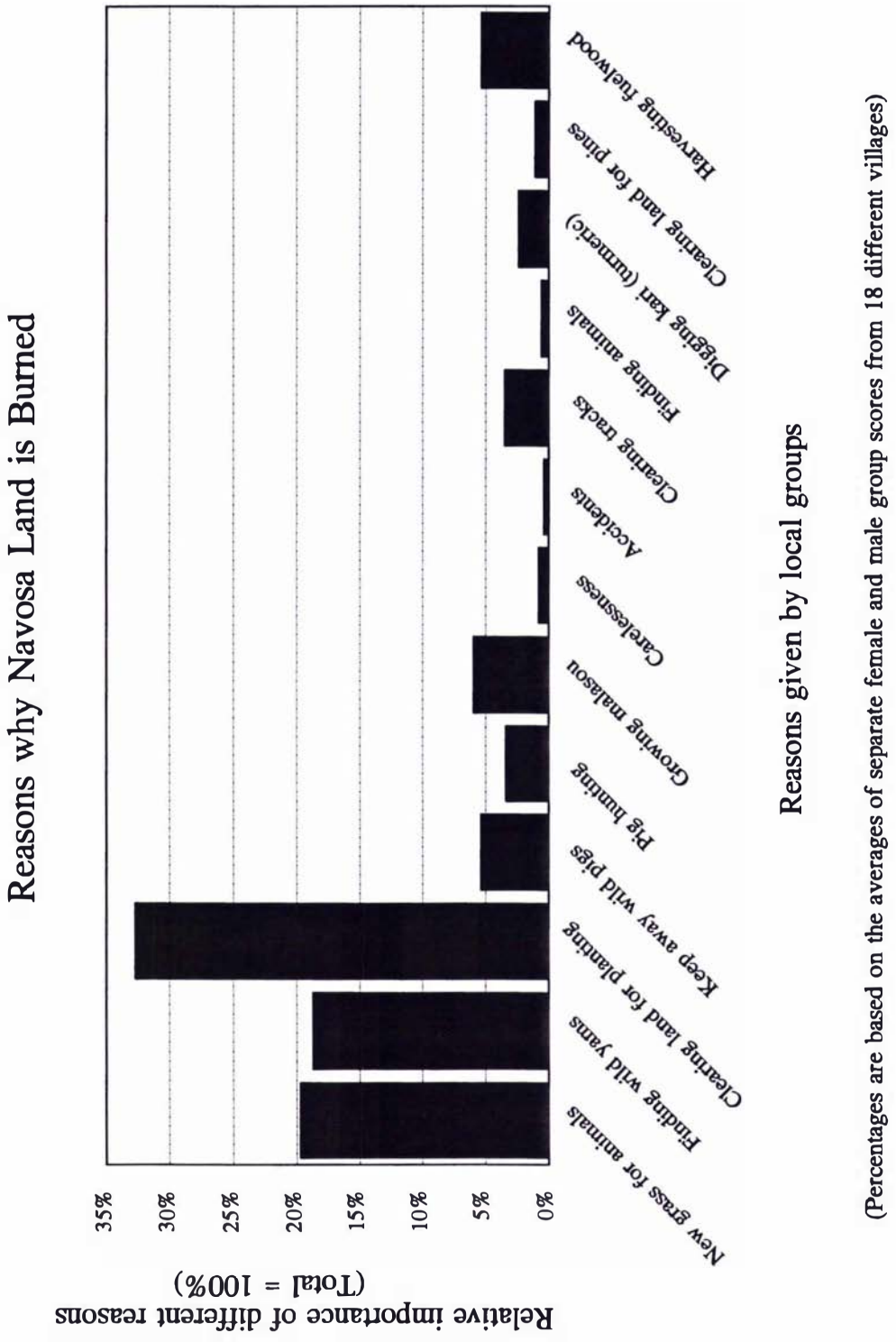
at Nasauvakarua and Nawairabe, and are presented below.

TABLE X. Reasons why Navosa land is burned (relative percentages based on averaged female and male village group scores).

New grass	Wild yams	Clearing land	Repel wild pigs	Pig hunting	*Malasou*	Careless-ness
19.7	18.7	32.7	5.4	3.4	6.0	0.8
Accidents	Clearing tracks	Finding animals	Turmeric	Pines	Fuelwood	
0.4	3.5	0.6	2.4	1.1	5.4	

The main reasons given for lighting fires on the land were (a) clearing land for *teitei* (32.7%), (b) new grass for the animals (19.7%), and (c) finding (and harvesting) wild yams (18.7%). The lesser reasons were: to grow the 'wild' green vegetable, *malasou* (6.0%), repel wild pigs from garden areas (5.4%), harvest *quwawa* fuelwood (5.4%), clear tracks for people and animals (3.5%), hunt wild pigs (3.4%), dig *kari* (turmeric) (2.4%), clear land for planting pines (1.1%), carelessness (0.8%) and accidents (0.4%) (Figure 9).

FIGURE 9. Navosa burning.



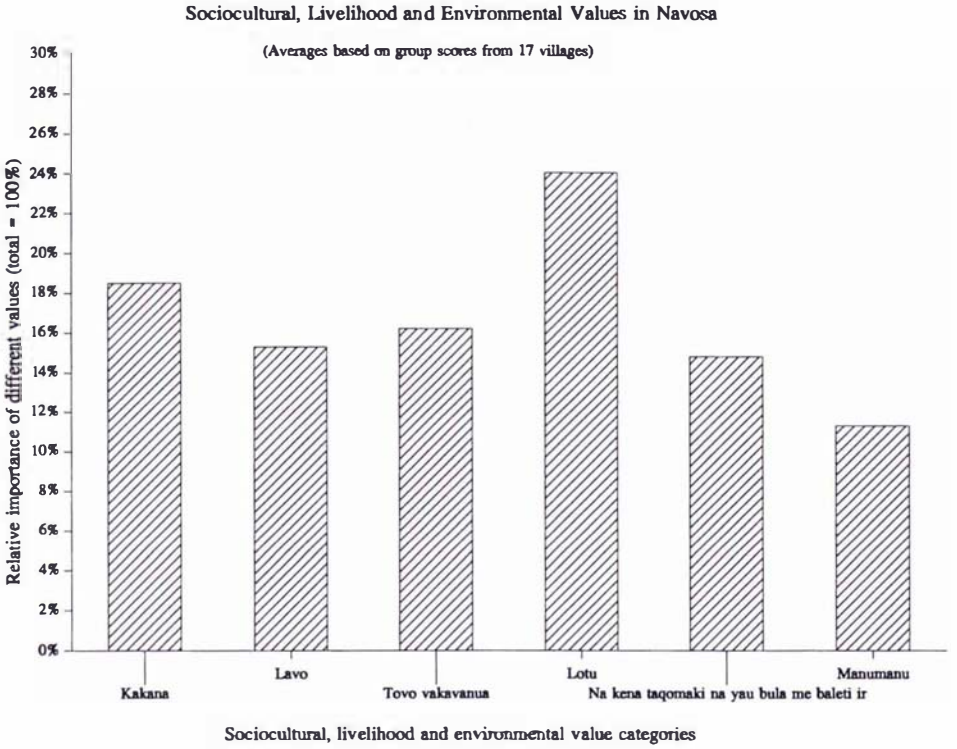
A gender comparison showed a general similarity with the following exceptions: (a) men (22.5%) scored new grass higher than women (17.5%), (b) men (6.5%) reported hunting pigs whereas the women rarely did (0.7%), (c) women (8.0%) scored *malasou* much higher than men (3.6%), (d) women (3.3%) scored digging *kari* (harvesting turmeric) higher than men (1.5%), and (e) women (7.8%) scored harvesting *quwawa* fuelwood much higher than men (3.3%). Overall, the less-frequently stated reasons were more important for women than men, but the strong consistency between women and men of reporting clearing land for gardens and harvesting *vitua* (and to a lesser degree, new grass) supports the universal importance of these reasons.

The average percentage of uncontrolled burning (71%) was confidently reported with small band of variation. This suggests that the people were not only well aware of the degree of uncontrolled burning but also found the amount unsatisfactory, and certainly more than livelihoods require. The difference between genders was negligible (women, 71.4%; men, 70.6%). These results show that people tend to light fires for particular reasons, but these fires often get out of control and burn a larger area (typically 71% larger) than required.

The results do not suggest that carelessness or accidents are significant causes of fire, but a qualification is necessary because it is likely that those people who caused excessive burning by their carelessness or because they were arsonists would not be the responsible individuals who participated in the evaluations. Thus, it is probable that the importance of carelessness as a reason for why fires are started is underestimated. The degree to which it was underestimated could not be ascertained, but from interviews, carelessness was a greater problem in open grassland areas where *teitei* were absent (e.g., in Yalavou).

Sociocultural, livelihood and environmental values

FIGURE 10. Navosa values: sociocultural, livelihood and environmental.



As part of the evaluation, participants were asked to discriminate between various sociocultural, livelihood and environmental values and show how important each was. In the Navosa region, *lotu* (church) rated the most important (24.0%), followed by *kakana* (18.5%), *tovo vakavanua* (customary ways, 16.2%), *lavo* (money, 15.3%), environment (sustaining for future generations, 14.8%), and *manumanu* (animals, 11.3%), as in

Table XI and Figure 10.

TABLE XI. Navosa values: sociocultural, environmental and livelihood (relative percentages of averaged female and male village group scores).

Kakana (true food)	*Lavo* (money)	*Tovo vakavanua, solevu*	*Lotu* (church)	Environment	*Manumanu* (animals)
18.5	15.3	16.2	24.0	14.8	11.3

The importance of the church is apparent. The remainder of the scores were relatively similar (although *kakana* was slightly higher) reflecting the importance of all of these categories, and showing that concern about the environment and future generations is a part, although a very relative part, of key sociocultural, livelihood and environment values. Gender differences were small: men (17.5%) scored customary ways slightly higher than women (14.8%), and women (19.7%) scored *kakana* slightly higher than men (17.4%).

Environment and sustainability

A series of aerial photographs (1951, 1978, 1990, 1994) of the Navosa region were inspected. There were no major changes in vegetation patterns between forest and grassland during these years. Photographs showed *vuci* (and old village or fortification sites), especially on tributaries of the Lato Creek, the Nasa Creek, the Wainivau Creek, the Solikana Creek, and on some smaller tributaries of the Sigatoka (especially from Nukuilau north to Nubutautau). As at Nawairabe, most changes appeared close to waterways. In 1951, the Waibasaga site is overgrown with forest but evidence of nearby *vuci* show that it was then an abandoned village (since re-established). In 1990 the *vuci* is overgrown and no longer visible from the air but other areas near the river are now cultivated in lieu of forest. This pattern of abandoning irrigated terrace cultivation (often on steep hillslopes with poor soil) for *bila* or more fertile slopes is apparent throughout the region.

In 1990 and 1994 in the eastern Waibasaga hinterland, and in the hinterland west of Nukuilau and Korolevu, and in the hinterland east of

Draubuta and Nakoro, and generally throughout the whole Lato Creek and Nasa Creek region in Nasikawa and Noikoro *tikinas*, numerous small erosion scars are visible in gullies and near crests of the relatively low grass-covered hills on the aerial photographs. This is an ominous sign, because erosion has so far not been officially considered a serious threat over most of Navosa.

What are the main environmental problems that will concern future generations? This question was asked at Nasauvakarua and Nawairabe but was not asked during the regional evaluation because it proved too time-consuming. Instead, the author decided to focus on burning, and asked: how does repeated burning affect the land? (Table XII).

TABLE XII. How does repeated burning affect the land? (relative percentages based on sorted answers from female and male village groups).

Makes land infertile	Soil erosion	Dries-up land	Harder to grow crops, less cropland	Damages *vanua*; trees, *vitua*, wildlife	Less food for animals	River damaged; less *ura*, *duna*, *ika*	Pasture deterio-ration
25.2	27.8	14.8	7.8	16.5	4.3	1.7	1.7

The answers were sorted and in order of importance were: (a) causes soil erosion (27.8%, especially on the hills), (b) makes land infertile (25.2%, especially on the hills), (c) damages *vanua*, trees, *vitua* and wildlife (16.5%, where 10.4% was difficulty growing native trees), (d) dries up land (14.8%, where 6.1% was at the head of creeks), (e) more difficulty in growing crops (7.8%), (f) less food for animals, (4.3%), damage to the river with less fish (1.7%, especially prawns & eels), and (g) pasture deterioration (1.7%). There were some gender differences: (a) men (31.%) reported soil erosion more often than women did (24.1%), (b) men (19.7%) reported damage to *vanua* and native trees more often than women (13%), (c) women (13%) reported that it was harder to grow crops far more often than men did (3.3%). This suggests that men are more concerned about the loss of trees (a resource for building), and women are more concerned about the greater difficulty of growing

tavioka (typically on hillsides).

What should be done about land degradation? This question was asked at about half of the villages (Table XIII).

TABLE XIII. What should be done about land degradation? (relative percentages based on sorted answers from 7 female and 7 male village groups).

Irrigation	Fertiliser	Stop careless burning	Plant new grasses	Pine & mahogany trees	Agroforestry trees
2.9	2.9	28.6	11.4	48.6	5.7

The cessation of careless burning was important (28.6%), but planting forest trees (48.6%) was the most common answer (either pine, 28.6%, or mahogany, 20%). New grasses (11.4%, esp *Nadi* blue grass, 5.7%) also figured along with agroforestry trees (5.7%, coconut & velvet trees), irrigation (2.9%) and fertiliser (2.9%).

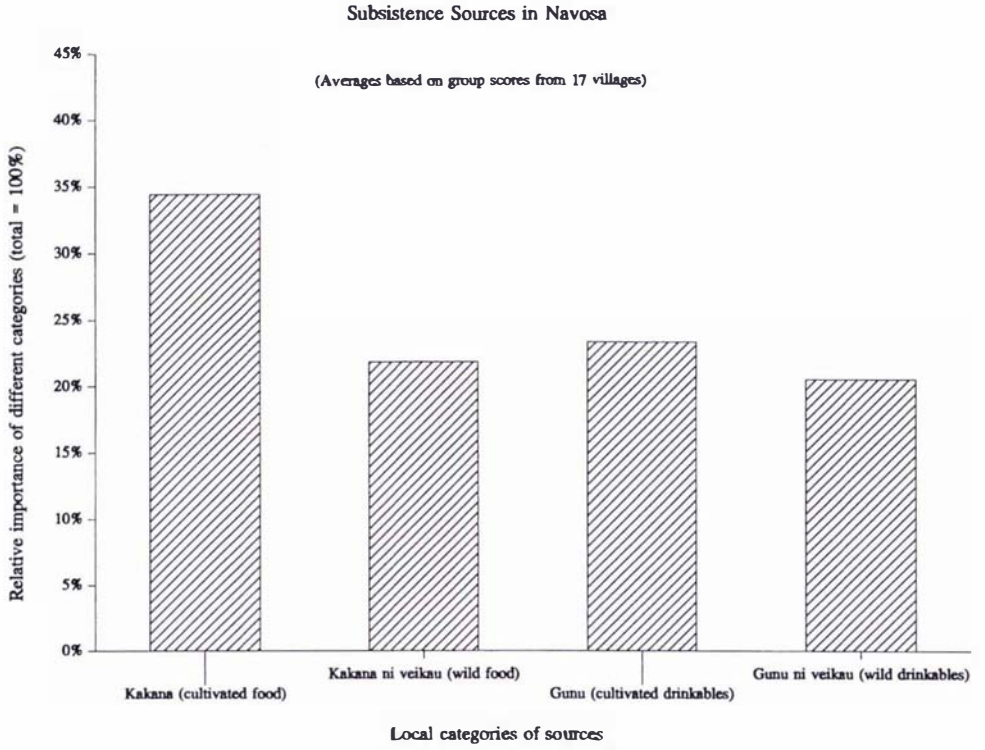
Wild food

The rankings of cultivated and wild food and drink sources indicated that wild foods and drinks (and medicines) were all important for livelihoods but *kakana* had special value (Table XIV and Figure 11). There was little difference between women's and men's scores.

TABLE XIV. Importance of wild *(ni veikau)* food *(kakana)* and drink *(gunu)*; (relative percentages of averaged female and male village group scores).

Kakana	*Kakana ni veikau*	*Gunu*	*Gunu ni veikau*
34.4	21.8	23.3	20.5

FIGURE 11. Subsistence sources in Navosa.



Overall, the relatively equal spread of the results suggests that the importance of subsistence food, drink and medicine obtained wild from the local environment is very important to local livelihoods.

Social identity and groups

The relative importance of various local social and cultural groups was investigated (Table XV). Only eight villages were asked to contribute here.

TABLE XV. Relative importance of different social groups (relative percentages of averaged 8 female and 8 male village group scores).

Mataqali (clan)	*Beto, bito, tokatoka* (subclan)	*Koro* (village)	*Lotu* (church)	*Vuvale* (household)
14.9	17.1	14.6	24.9	28.5

The household (28.5%) and church (24.9%) rated substantially above other groups, of which the subclan (17.1%) was the most important. The

clan (14.9%) and village (14.6%) groups; which are the largest, most impersonal and most inclusive, rated the lowest. Overall, the ratings suggested that each group was important, but that the smaller and more intimate groups were most important. There was little difference between genders.

Cultural values and vanua

A group of statements representing various local cultural perspectives on *vanua* were presented at eight villages and participants were asked to discriminate them and rate them for importance. Unlike the question asking about environmental problems for future generations, this question was readily understood and quickly answered.

TABLE XVI. Importance of *vanua* (relative percentages of averaged 8 female and 8 male village group scores).

Vanua questions	English translation	Score
solevu, kerekere	A distinctive economic ethic of reciprocity and mutual assistance	13.8
Veilomani vaka veiwekani	A sense of kinship with fellow beings	24.2
Vakarokoroko taka/doka na yau bula	A reverence for creation as a whole	14.4
Na kena taqomaki na yau bula me baleti ira na noda kawa	A sense of commitment to safeguard all natural resources for future generations	18.4
Lewe ni vanua, gonedau, mataisau, Turaga ni vanua	A sense of responsibility and stewardship for the way the gifts of nature are used	14.5
Na tabu kei na mana ni vanua	A sacred regard for the whole of nature and its responsibilities as being gifts from God	14.8

The results (Table XVI) suggest that the importance of kinship ranks highest (24.2%) although safeguarding natural resources is also important (18.4%) among these cultural and religious values. Again, all of the

statements scored well suggesting that all of these propositions were important. There was little difference between genders except that men scored slightly higher for safeguarding natural resources for future generations (20.0%) compared to women (16.9%).

SUMMARY OF RESULTS

The results show that officers of the government and other nonlocal experts frequently had stereotypical, but often inaccurate, views about the causes of burning and land degradation in the Navosa rural area. Part of this was due to the lack of local research, scientific knowledge, and education on the subject. Officers had a tendency to present information based on their own experience, perspective, home region, area of expertise, or job description. A very few, usually with local experience, were able to offer deeper insights than those obtained from local people themselves by virtue of their mix of local and scientific knowledge.

Conversely, local people had an intimate knowledge of why fires were started, their relation to livelihoods, and the amount of unnecessary burning. Many of the reasons for burning were necessary from a livelihood perspective, but uncontrolled and excessive burning was causing both short-term and long-term harm to many local livelihoods (although some livelihoods benefited from burning). The question of which reasons represented necessary practices, and which were unnecessary for the maintenance of livelihoods was a geographically multifaceted, socially and culturally complex and politically vexatious issue on which it was difficult to get a concordance of data. It is possible (but not made explicit) that those firing the land perceive (or assume) several advantages to lighting a fire in any one place. The lack of community control suggests that many other members of the community perceived advantages from the actions of those who light fires. The same multifaceted difficulty occurred in

relation to which reasons led to the most uncontrolled burning and environmental damage, although the argument, based on the amount of land burned, implicating new grass for the animals as the most destructive reason, was persuasive. Nevertheless, there was a clear consensus among villagers, and especially village leaders, that careless and excessive burning should stop. In many places, leaders were concerned about erosion and the growing infertility of the land which was affecting crop production. There were many reports that animal stock numbers were becoming excessive, and the lack of good stock control was leading to damaged crop gardens.

The common, introduced, large tree, *vaivai-ni-mocemoce*, was blamed for drying up the land and causing erosion. Many erosion scars are appearing (after cyclones) on the relatively low grass-covered hills of the Nasikawa and Noikoro districts. Villagers' believed that afforestation was needed to prevent degradation, but in many locales, attempts at afforestation will fail unless burning can be being controlled.

Villagers had a clear awareness of which particular households (and which individuals) caused the most damage in the local village area. Conversely, those who attempted to protect the environment were also well-known. However, local leaders (the *turaga-ni-koro* and inherited *turaga)* were relatively powerless to halt burning. Offenders (if they were known) were not punished, and the local police were too remote to be useful in this regard.

The concept of sustaining local resources for future generations was understood much more readily if presented within a local cultural-religious framework. It was apparent that only some people thought deeply about conserving resources for future generations, and participants in general found it difficult to decide which were the main environmental problems that might effect future generations. The orthodox view is that this issue was the domain of leaders, who were expected to manage the *vanua* and its environment, and to instruct it's

people on the appropriate actions. However, leaders often complained that they did not have the resources and were powerless to effect change, and that the people did not listen to them.

Finally, it was apparent that environmental conservation was being inhibited by the lack of understanding between the differing perspectives of local and nonlocal institutions. This was reflected in many sectors but the lack of a local component in environmental education was particularly relevant.

CHAPTER SEVEN

NAVOSA: A SUSTAINABLE *VANUA*?

In this chapter I will address the question: how sustainable is the *vanua* in Navosa? The main sustainability issue was reported to be land degradation, especially declining fertility, as a result of excessive burning. Another prominent issue that featured was environmental damage as a result of logging. These events have caused degradation, not only to the landscape, but to the whole land-people nexus that is called the *vanua*, and especially threaten food security. The first cause of land degradation was commonly attributed to uncontrolled fires.

FIRES AND DEGRADATION

The question which has been often overlooked, or to which the answers have often been assumed from experience elsewhere, is why the land is burned.

Reasons for Burning

The three main reasons given for burning were: clearing land for gardens, new grass for the animals, and harvesting wild yams. These reasons were the only ones consistently rated high by all villages. Clearing land for gardens was easily the most important reason, although not a reason that requires large areas to be burned. Its high rating reflects the importance of growing crops as the main means of livelihood and food security.

The role of *tavioka* as the main food crop is implicated in burning. Although *tavioka* requires good shelter, it demands exposure to light and is therefore grown in the open after the fire clearance of taller vegetation (F.I., 1998-1999; F.O., 1998-1999). It can grow on relatively poor soils and on very steep hillside sites in a rotation after more fertility-demanding crops such as *uvi* or *dalo*. Thus, it does not require the

clearance of primary forest (for higher fertility) to grow under a swidden system, and is often grown in the same place for several years on fertile sites. In addition, it is sometimes replanted without fallow: a mound may be replanted in the same day as the mature tubers are harvested from the same place (F.O., 1998-1999). This method was often used near villages as part of the 'kitchen garden', and can serve to minimise burning (fallow times are eliminated or shortened), although at the expense of soil fertility. Fires are still used in these areas to clear weeds and regenerating vegetation (although herbicide is now used occasionally), and to prepare new plots ready for use, but because of the short fallow cycles, limited regrowth and the small amount of fuel, fires are often of low intensity. This is particularly so where the low vegetation has been killed by herbicide. Fires that spread through herbicide-killed vegetation, often in *tavioka* crop gardens, burn very close to the ground, destroying weeds, but offering few other benefits.

By contrast, some other important crops (e.g., *yaqona, dalo-ni-tana, vitua)* are often grown under or among the shade and protection of semi-permanent secondary forest or in lush agri-arboriculture systems that are seldom burned (F.O., 1998-1999). In these places, the fallow cycle for *yaqona* can be as long as thirty years or more (F.I., 1998-1999). Fire is generally very well-controlled in the vicinity of these gardens, which tend to be in wetter and less fire-prone sites at higher altitudes (F.O., 1998-1999). Nevertheless, in dry years, they can be destroyed by fire (F.I., 1998-1999). They persist, however, because local fire management is effective in these niches, helped by their high value to the *vanua.*

The second main reason for burning was new grass for the animals. Although it scored much less than the first reason for importance, the amount of land burned for this reason was the greatest, and the type of vegetation burned *(mauniba),* was the most specific. An almost exclusive sward of *mauniba* occupies much of the grassland in Nasikawa, Noikoro,

and Navatusila *tikinas*. The growth of tender young shoots of *mauniba* occurs in the weeks after the inedible and smothering mass of older and dying leaves is burned. Regrowth of shoots occurs spontaneously after burning, but rainfall hastens growth. These tender young leaves serve as forage for the animals during the middle and later stages of the dry season in the season of dearth. During the wet season the grass grows very rapidly and quickly becomes inedible again although at this stage it provides good protection for the soil. Thus the season of forage from the shoots of *mauniba* is a relatively short period of a few weeks, but large areas are burned for this reason. Given that the population of animals is increasing in Navosa then it is logical to expect, ceteris paribus, that the already large area burned for this reason will increase in future.

The third main reason given was for harvesting wild yams *(vitua)*. The act of burning to find wild yams made finding and harvesting them much easier. *Vitua* often grow in fertile areas of very tall (head-height), robust and dense *gasau* grass on the lower (occasionally colluvial) slopes of hills. This sward is very difficult to penetrate. Thus finding the new vine stems, and digging the *vitua,* is very hard labour unless the sward is burned beforehand. By contrast, after burning, the newly sprouted tendrils are easily located, and digging is relatively easy on the cleared terrain. *Vitua* must be sufficiently mature from several years growth before they are large enough to be harvested. Thus, burning the same place for *vitua* each year is not necessary, although it is usual that there is a range of differently-aged plants. Thus, some areas are burned frequently and only the more mature and larger tubers harvested.

There were many minor reasons of which some were general, and others specific to certain areas in Navosa. Government officers and outsiders generally gave simple and stereotypical answers about why land was burned, and these reasons were frequently inaccurate. For example, government officers and outsiders (including neighbouring

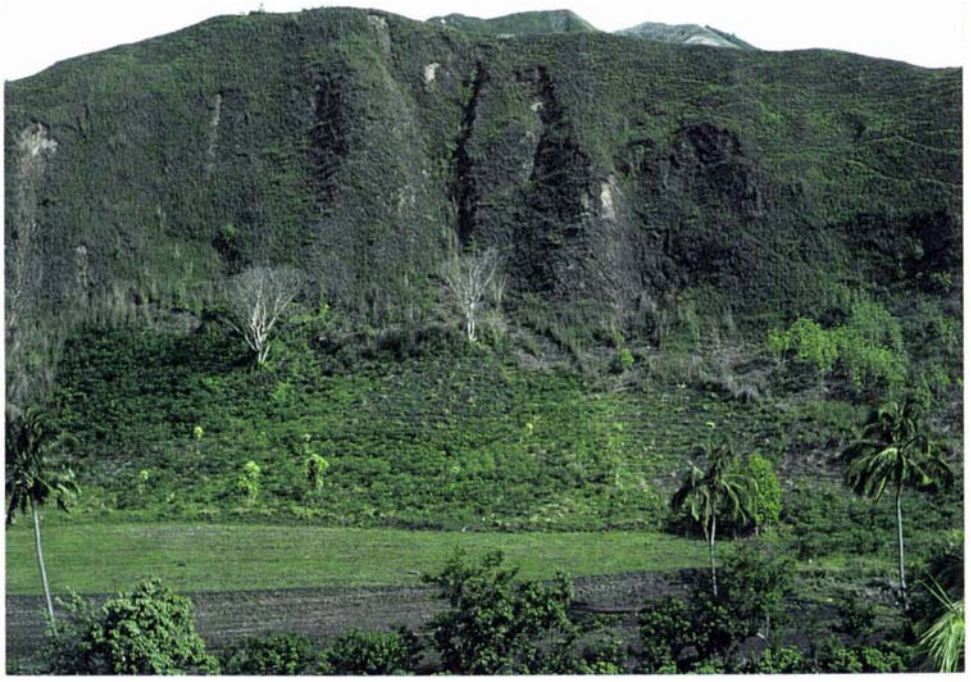
Nadroga people) frequently mentioned hunting pigs as a main cause of fires, but this reason was relatively minor in Navosa, and was superseded in importance by the need to burn adjacent land to repel pigs from garden areas in villages near densely forested areas. The local participants gave more detail, for example, clearing tracks is a reason that probably aids pig hunting but its prime importance is to improve access and transport for people and animals (especially horses) between villages.

The minor but general importance of *malasou* as a reason for burning was never mentioned by anyone but villagers, especially village women. The firing of areas of *quwawa* to kill the shrub for use as fuelwood also reflects the differences between official and local views. Officially, *quwawa* is perceived as a noxious weed of 'pasture' (often, *mauniba)* land, but the plant has many valuable uses, especially as high quality fuelwood, for the local people. The fact that it burns hot and clean is beneficial for the health of those around cooking hearths. Only *kailo* (unidentified, 2 species, either white or black) was reported as a better fuelwood (at Nawairabe).

Burning for landscape enhancement?

Is the land burned to encourage erosion and sedimentation in order to enhance the fertility and agricultural potential of the landscape? None of the participants reported this as a specific reason. But the following photograph is suggestive: it shows crops (mainly *tavioka)* on a colluvial fan below a very steep face that is regularly burned. The flat area is

alluvial *bila* adjacent to the Nasa Creek.



PHOTOGRAPH 16. *Teitei* on colluvial fan alongside Nasa Creek, Draubuta. *Bila* in foreground. Wet season.

Is the escarpment intentionally burned to increase colluvial sedimentation? Interviews were not available, but in my view, probably not. It is highly unlikely that *teitei* fires in the dry season could be prevented from burning the escarpment, and its combustion was probably unintentional, but the result rewarding in the very long-term. Other observations throughout Navosa suggested that steep hillsides were often preferred to colluvial areas for (especially *tavioka)* gardens (F.O., 1998-1999), and this example was an exception. The important factor is soil fertility, and in general, farmers plant on the most fertile areas even if the slope is very steep (sometimes 35° — 40° (F.D., 1998-1999)), compared to a more gentle but less fertile colluvial slope (F.I., 1998-1999). One explanation for this effect, assuming constant soil type, is that erosion increases towards the lower end of a constant slope, however, this is usually counteracted by the deposition of sediment from

upslope (Wezel, et al., 2002, pp. 120-121). Other, more likely, explanations are that lower slopes are either of a less fertile soil type (Twyford and Wright, 1965, p. 212), or are cropped more frequently, thus lessening their fertility (Wezel, et al., 2002, p. 121). The best indicator of fertility was the type of vegetation: *gasau, bitu* or secondary forest were all good indicators of fertility. The poorest soil here was almost exclusively dominated by *mauniba*. Fortunately, there were only limited occurrences of the infertile mixed fernland-grassland (*dravuisiga* or *talasiga,* sunburned land) in Navosa (see pp. 47, 86). The impoverished *talasiga* areas are characterised by a lack of indigenous villages (Twyford and Wright, 1965, p. 214).

Uncontrolled Burning

Carelessness and accidents were seldom given as reasons for burning, but when asked about the degree of uncontrolled burning (attributed to either carelessness or accidents), Navosa people gave an amount that averaged to seventy one percent (of all the land that was burned). The speed and confidence with which the figure was reported suggested that local people were well aware of the situation, and that it concerned them. This result suggests that most of the damage was caused by fires that were started for specific reasons, rather than being started from carelessness; and that then burn much greater areas than needed because of a lack of control.

Excessive Burning, Land Degradation and Pressure on Livelihoods

Today, the human and animal population in Navosa is increasing to the extent that increased pressure on resources is occurring. In particular, increasing numbers of people are accumulating greater numbers of animals which exploit and consume more of the natural resources, especially near waterways and in the forested gullies. The grazing of cattle, goats and horses is now leading to increased pressure

in the season of dearth to burn *mauniba* grassland for new grass shoots, and sporadic late fires often continue until the transition to the wet season, and leave the ground bare at this time. Late burning is sometimes done to clear small garden areas, and there is also late burning in some (smaller) areas to harvest *vitua* to be sold at the market (F.D., 1998-1999).

The transition period from the dry to the wet season is when the bared hillsides are exceptionally vulnerable to severe soil erosion from heavy rain and storms. Severe erosion did occur in late 1998 while the researcher was in the region (F.O., 1998-1999). Further, any cyclones that arrive early in the wet season will bring rainstorms that will be particularly damaging. The large amount of erosion that occurred appeared to contradict Twyford and Wright's (1965, p. 214) report that erosion was not of significance in traditional sloping swidden areas. However, there may be no contradiction if it is accepted most of the erosion was from grasslands, and that the erosion-prone grasslands are separate from swidden. My observation was that erosion occurred wherever the land was bared to the heavy rain that fell during this transitional season in the mixed grassland-swidden landscape, and that large areas of grassland suffered erosion (F.O., 1998-1999).

There was a consensus of local leaders and participants complaining about damage to crops from animals, excessive burning and the declining fertility of (especially hillside) areas of cultivation. The prevalence of burning limited the adoption of post and wire fencing, which is usually only constructed around garden areas. Burning is practised more carefully near fenced areas, particularly in *yaqona* plantations where farmers are very careful.

There were few complaints about a lack of food but a common complaint concerned the increased difficulty of growing crops in the traditional way of shifting agriculture, especially near the village. In addition, there was concern about the ability to feed the animals in the

season of dearth.

Prevention and afforestation

The main weaknesses in prevention were: (a) a lack of contextually-relevant education about the effects of excessive burning on the environment, (b) a lack of a means of communication by which leader's and others could have their views and sanctions against burning heard, discussed and disseminated to all at the village level, and (c) a lack of any power of enforcement.

An important factor that worked against enforcement and prevention was that it was difficult to locate blame for uncontrolled burning in areas of broken terrain where there is a considerable movement of people, some of whom are travelling through from other villages. The official enforcing agency, the police, were ineffective because they were too remote from the local situation.

The villages that had a single and respected leader were more effective in prevention since the leader's opinion was heard universally. Many villages, however, do not have a simple hierarchy of leadership (there could be several clans), or their leader or leaders were uninterested in conservation. Where there was more than one leader, the conservation efforts of only one leader would be severely compromised.

Some villages have *tabu* or policies related to burning, although their effect seemed to be moderate at best. There was more respect for the *tabu* placed by socially powerful and locally-based traditional leaders. It was apparent that the most respected leaders were locally-based (although not necessarily of the highest ranks). Higher-ranking leaders who lived outside the *vanua* were given respect for their title, but often lacked a full understanding of the means of livelihoods, and their role was more formal in local affairs.

The excessive burning makes the practice of afforestation difficult. In many areas, young trees are likely to be killed by fire before they reach the relatively resistant mature stages. This problem is unfortunately most

serious where afforestation would be of the most benefit and least hindrance, for example, on the low hills of the Nasikawa and Noikoro tikinas.

LIVELIHOODS AND FOOD SECURITY

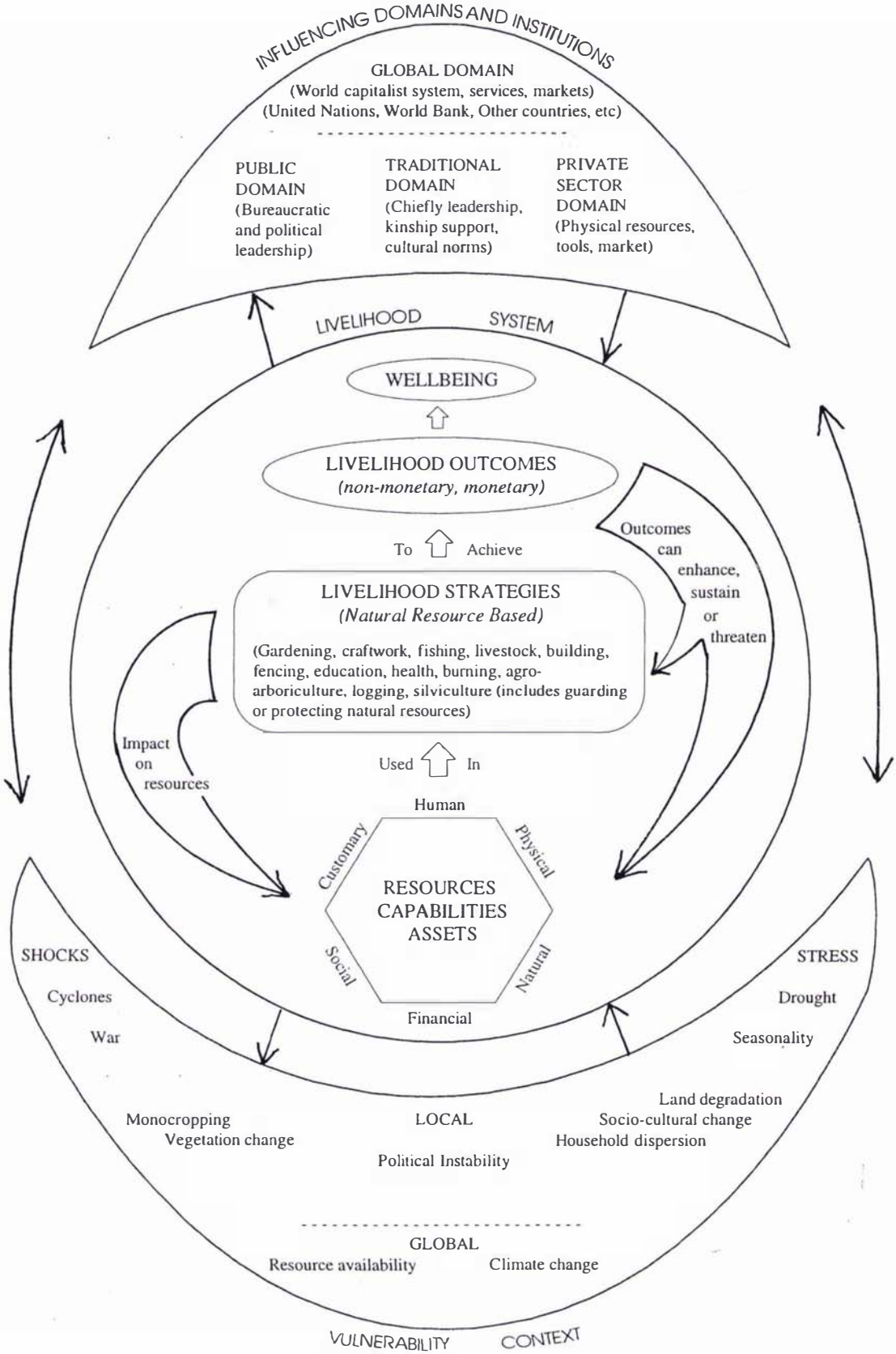
What is a sustainable livelihood? A sustainable livelihood in Navosa must foster individual and *vanua* well-being through the wise use of resources and an infrastructure of culturally acceptable living through periods of stress (e.g., drought, isolation) and shock (e.g., an incinerated *yaqona teitei,* or a cyclone disaster), without degrading the environment and the ability of future generations to make their own livelihoods (Chambers and Conway, 1992). There must not only be a continuum of sufficient resources and resilience to live without poverty within the local nexus but global resources should be conserved as well (Pretty, 1995).

This all-encompassing definition is an ideal. The contradictions between utilitarian and conservationist goals are negotiated within this framework. Individual wellbeing is determined by the status of entitlements, and the resultant capabilities (Sen, 1983, pp. 754–756), which I argue (contra Sen, p. 755), are broadly utilitarian in their ends. Explaining further, a capability, among other things, is the potential to satisfy one or many desires, and is therefore the potential to achieve the maximum individual reward possible (utilitarianism). *Vanua* wellbeing is less utilitarian, and more concerned with the maintenance of the extant system, human and nonhuman (Batibasaqa, et al., 1999).

The Sustainable Livelihoods Approach

First, the existing system will be analysed in terms of the resource categories of the sustainable livelihood approach, followed by an analysis of: the livelihood strategies, the livelihood outcomes, the vulnerability context, and lastly, the domains and institutions that influence local livelihoods. This framework is adapted from similar models (Cahn, 2003; Chambers and Conway, 1992; DFID, 1999; Ellis, 2000; Scoones, 1998), outlined previously (see p. 33). It emphasises the managed resilience of local systems that ameliorate 'waves of adversity' through the maintenance of proven social and cultural resources, namely, customary and communal cultural systems (Glavovic, et al., 2003), and is illustrated overleaf.

FIGURE 12. Livelihood system of Navosa.



Resource categories

The resource categories have been divided into: physical, natural, human, financial, religious, and traditional sociocultural aspects. They have been selected for their explanatory usefulness in the Navosa context. Each is not exclusive but overlaps with others in various ways.

Natural resources

Navosa is generally well-endowed with natural resources despite being mistakenly appraised by government agents as a relatively unproductive region. The land is dissected by relatively unpolluted rivers that flow all year round. The rainfall is usually adequate in most seasons for the growth of a range of rainfed tropical crops. A diversity of food, some in abundant quantity, can be obtained from the wild in many places in most seasons of the year. There are usually sufficient (although fragmented and diverse) areas of good soil types to support food-crop cultivation, and in some niches, high-return commercial cropping (often in relatively invisible agri-arboriculture environments). Some villages have good access to the house-building, tool-making, craft-making and medicine resources of the indigenous and secondary forest areas, despite the declining area of unexploited indigenous rainforest. Most of the natural resources that are consumed are renewable, although increasing use of non-renewable resources is occurring.

Nevertheless, due to deforestation and poor soil conditions, certain village areas lack the normal range of resources, and will be vulnerable to adversity before others. In particular, the declining fertility of the hillslopes that are used to grow crops is causing concern about food security and the ability to earn a cash income. Cultivators must go further from the village in some areas to grow their crops. Many traditional house-building materials (especially post and pole timbers, and vines) are scarce and access to them is declining further, and most villages now have poor access to traditional medicines from the

indigenous forest. The lack of these resources forces people to purchase materials and medicines using cash.

There is also concern about the declining size and quantity of fish obtained from the Sigatoka River (and its tributaries) which now has an increased amount of sediment and lacks the deep holes that existed as little as thirty years ago (F.I., 1998-1999). The importance of this resource is significant: Each Nasauvakarua household harvested a combined average of 217 fish, prawns and eels per year. The equivalent figure for Nawairabe was 244 fish, prawns and eels per year.

Physical resources

The infrastructural resources of Navosa are somewhat limited. The roading system is based on one central valley, and one highland road, which serve about half the villages. The quality of the surface deteriorates and the roads may become impassable after heavy rain.

Piped water supplies have been installed in most villages, but in at least one case, the local people had not learned the technical skills necessary for maintenance.

The communication system is poor, especially for the dissemination of printed matter. Newspapers are not distributed. A mail system is unreliable and not well used. Most messages travel by word of mouth or are couriered by friends or relatives who are travelling to the market towns. Radio telephone sets are located in some villages but repairs to those that break down may take months or years to effect. Electricity is rare and only available from generator sets. Although television reception is usually not possible, radio reception with battery-power is often available.

Another type of infrastructure is that of landesque capital (Blaikie and Brookfield, 1987b, pp. 9-10). The classic example of landesque capital is the *vuci*. Although they are now mainly disused, these once-irrigated *vuci* or *tabaiwai* terraces are a form of capital asset. A large amount of labour was involved in the initial construction of these

sometimes prodigious flights of terraces, but once constructed, they were relatively easy to maintain, despite the need for consistent maintenance and occasional repairs (Watling, 1984). Small, functioning systems were observed in Navosa at Natoka and Nawairabe, and at Navala in the Ba River watershed, rather similar to the small systems described by Sahlins (1962, pp. 43-49) on Moala island. Because most of the terraces still exist and could be rehabilitated, they remain as a form of unused capital. Today, however, terraces (and their water supply corridor), would need to be securely fenced, thus requiring an additional input of landesque capital.

Fences are a crucial form of landesque capital. Many farmers, especially those on *bila*, rely on fences to protect their gardens, and the building of fences is a highly important and major outlay, which young farmers must fund themselves.

The tools used for farming tend to be simple. All adults owned a cane knife which was used to cut fuelwood and *tavioka* stems, kill wild pigs, and for many other things. Some men used a long, pointed and unbarbed steel rod to spear wild pigs. Thin and pointed steel rods, together with rubber slings and goggles, were used to spear fish. Fish traps were often constructed from indigenous materials. Many villagers, especially those in the hinterland, use slightly tapered long-bladed spades as their tillage and harvesting tool, especially when working on steep slopes. The long blades were useful for digging *vitua.* On more gentle slopes, and downstream villages, either bullock or horse-drawn ploughs, harrows and row cultivators were used for tillage and other tasks such as hauling fuelwood on a sled. Tractors, often rented, were used in only two or three villages at the downriver entrance to Navosa.

Cooking was generally done over open fires in cook-houses adjacent to the sleeping house of each household. Although kerosene primuses and gas cookers with fuel were available, most cooks preferred to cook over wood. In one or two isolated cases gas cookers were utilised, but only in the early morning for a quick meal before work. Generally, good quality woodfuel was available which did not smoke badly. Every household used kerosene to fuel lamps for lighting: most were the robust, low-pressure tilly-lamp type, but high-pressure Coleman lamps were sometimes used. The introduction of diesel or petrol-powered electrical generators was beginning to occur in some villages, where they were used occasionally for lighting (in a few adjoining houses), or used to run VCR and TV monitor sets.

Some non-government institutions helped with the provision of physical resources. Womens groups helped with the provision of materials and skills for the development of womens crafts and human resources. NGO's were not strongly active in Navosa, but the FSP Kana Project based at Lautoka had helped with a variety of initiatives, for

example, workshops promoting the importance of indigenous resources and medicines, and especially improvements to physical resources such as local school facilities.

Financial resources

Salaried individuals with regular incomes were largely confined to the government station at Navatumali, schools and health posts. There were no social security payments directed towards Navosa to the author's knowledge except for war pensions to a few retired servicemen. The *turaga-ni-koro* of each village was paid a very small salary, and village radio operators, where they existed, also received a very small salary. Rental income from the lease of land arranged by the NLTB (a relatively small area compared to neighbouring Nadroga and other Western provinces) was a source of income for a few hereditary *turaga*. The amount distributed among the rest of the community was unknown but believed to be very small.

The importance of financial resources in the form of individual savings was relatively low in Navosa. Many people did not have bank accounts. Most people wanted money, but only to pay for tools, materials (physical resources), commodities (including customary exchange items) and services (especially schooling) as needed, and there was no expressed interest in saving money for investment. Loans, especially from the government, were seen as gifts unless part of the traditional exchange system, when there were obligations to return the favour at some time in the future.

The traditional exchange system provides social security (and may have a beneficial environmental effect), and still dominates the economic system of Navosa, where the notion of capital is estranged from economic life. That is, people use money to accumulate 'capital' in the form of physical resources (animals, tools, implements, houses), but this 'capital' is not used as a means of controlling production to accumulate profits.

Traditional sociocultural resources

The traditional system of culture and social relations and the traditional economic system of reciprocal exchange and redistribution are pervasive in Navosa life, and profoundly influence how livelihoods are gained. The system of kinship relations and obligations is fundamental to ensuring the social and material welfare for each person in the culture. *Tovo vakavanua* (the customary way) is still the dominant economic system in several ways. It is at the centre of the flexible land tenure arrangements still prevalent in Navosa. It defines what foods are appropriate to grow and eat, and the form of many other aspects of material life. It ensures the provision of social welfare via exchange and redistribution. It underlies indigenous social institutions and leadership structures. It is at the centre of social recreation. It helps define identity. In effect, tradition is at the core of what is distinctive about Navosa, and indigenous Fijian livelihoods.

Social and religious resources

The predominance of religious belief, and the role that religion has in exchange systems, suggests this category. Although churches have been very influential in social life since the 19th century and adopt aspects of traditional culture in their process, the people differentiate the church from customary ways. The church organisations often function with horizontal linkages among the volunteers and usually have strong connections with the village structure and leadership, although this connection can be confounded in villages with several churches. In Fiji, the churches provide not only a centre for moral teaching and spiritual identity but also tend to promote human caring and sharing (including exchange and redistribution) among villagers. They thus lend support to social unity. Local church groups sometimes help with the organisation of labour groups, in exchange for cash, to help householders with large tasks. They provide the moral basis to Fijian communal life, and it's distinctive livelihood system. In some cases at least, religion is a strong

supporter of the *vanua* concept.

Schools can function as a social resource in the few villages where they are present. Other social resources were available, but their influence was relatively sporadic. The women's groups were perhaps the most important, but their influence was often in a material way rather than a specifically social way. Other influences included the government Duavata initiative and the FSP Kana projects.

Human resources

There was a great variety and depth of local or indigenous knowledge and capabilities that people had about how to procure a livelihood in specific local conditions. There were particular people who were regarded as having specialist skills in various areas of local production including: indigenous medicine, knowledge about trees and timber qualities, housebuilding, horses, cattle, goats, *vitua*, *uvi*, poultry, weaving mats, agroforestry, and other practical skills. In addition, small work groups *(solesolevaka)* made up of a few cooperating households (often grouped across kin boundaries), are vital to livelihoods for the sharing of labour and skills on an everyday basis.

The value of labour is very important in Navosa because every household in all except the administrative villages relies on the physical labour of it's members for the production of livelihoods. It was noticeable that those households with persons whose labour was strong and active were more productive and able to offer greater food security than other households, which were sometimes dependent upon redistribution from the more productive households.

Public education is designed to raise the level of human resources across Fiji as a whole. However, there is a difficult question about how one measures the quality of a human resource in Navosa. There are differing external and local criteria about what is relevant. In particular, does the learning from formal education lead to higher levels of human resources in a region where local agricultural and craft skills are crucial

for most people's livelihood? Are schoolchildren implicitly taught to value external knowledge over local knowledge?

The distribution of schools is quite inequitable in Navosa. Some villages have adjacent schools as part of the community, but most villages lack schools and children must be educated outside of the home village under a boarding arrangement. It was suggested that this situation has an effect on the level of local indigenous knowledge of boarding children. It also removes the value of children (e.g., caregiving of preschool children) from the home village for long periods of the year.

Access to health services is also inequitable. Some villages have much easier access to official health services than others, and some villages have better indigenous medicine services than others. How can we compare the value of indigenous medicine and official health services? Both are used in Navosa. Overall, this aspect of human capital is difficult to measure but the official services are distributed inequitably.

Present Livelihood Strategies

Nearly all of the livelihood strategies in Navosa are based on natural resources. The exceptions are the employed officers of government institutions, mainly at Navatumali and at schools, and wage income earned outside the region by a relatively small number of migratory household members. The major livelihood strategies are the production of food crops (especially root crops) and *yaqona*, although the sale of animals, marijuana and craftwork (especially *ibe*, mats) earns reward. The exploitation of wild food sources is very important. Income from other employment is relatively low in Navosa. Younger persons may spasmodically bring back money earned from outside jobs, but many of the Navosa youth lack the education and affiliations to obtain paying jobs. The remoteness of Navosa hinders possibilities for employment, for example, in the mainly coastal tourism sector.

Livelihoods and indigenous knowledge

Indigenous knowledge is the basis by which the current system is organised for both subsistence and commercial livelihoods, although the input of agricultural knowledge via extension officers and other influences has lead to some changes over time. New crop cultivars, plants and technologies are sometimes accepted into the local system where they prove advantageous to livelihoods, but in the main, traditional knowledge, proven through time, has persevered.

The existing basis of livelihoods in Navosa involves both the traditional exploitation of wild food resources (some are saleable) and the cultivation (with low external inputs and high energy efficiency, Chandra, 1979b; Chandra, et al., 1974) of subsistence root crops (*kakana*, often saleable). Other foods, such as fish, vegetables and meat (described as relishes), are also saleable. *Yaqona*, the traditional ritual, and now recreational drink, is in high commercial demand and is the main cash crop in areas where suitable conditions are available. Small plots of marijuana are sometimes grown but carry high risk and cause social conflict.

The resources for traditional housing can be procured from the natural environment, where they are still available, or obtained via exchange or purchase. Alternatively, cash must be earned and used to purchase modern building materials.

Wild Food and Drink Resources

The studied comparison of cultivated versus wild (*ni veikau*, from the forest) food and drink reflects the substantial importance given to wild sources. Wild food and drink resources include yams, pigs, *beka*, prawns, fish, eels, papaya, *maqo*, fern leaves, watercress, *malasou*, amaranth leaves, and turmeric (all mentioned as important in PRA results (F.D., 1998-1999)). Children relish *quwawa* fruits but they were not mentioned by adults as food (although valuable for other reasons) (F.I., 1998-1999).

In addition, wild indigenous fruits such as *kavika (Syzygium malaccense), dawa (Pometia pinnata)* and *wi (Spondias dulcis),* and the nut, *ivi (Inocarpus fagifer),* are consumed in season (Thaman, 1990a). Some domesticated resources, for example, fruit such as breadfruit, *moli* and *seremaia (Annona muricata);* have spread to the wild and add to the wild resource base.

It was apparent that there were groves of trees around or near villages and gardens in Navosa (like Kissidougou (Fairhead and Leach, 1996a)), that were either preserved for planted for utilitarian purposes. The effect is more spread between villages and remote gardens, and not as marked as the 'islands of trees' in Kissidougou (except for the distinctive groves of old *maqo* trees dominating old village sites), but the necessity for maintaining useful trees and plants nearby is the same. Many of these trees and plants are domesticated, rather than wild, but the boundary between the two is blurred.

Kakana

The cultivation of root crops *(kakana,* true food), a traditional practice learned from forbears, is the basis of Navosa food security and livelihoods. These crops can be relied upon to provide a consistent and culturally acceptable food supply (and cash when needed) in all but extreme climatic stress and shock circumstances.

Uvi and *dalo* have been very important throughout the culture history of Navosa with *uvi* being the most esteemed (ceremonial) crop in the past. *Dalo* is not grown by all households because it requires consistently moist conditions which are lacking in some areas. Likewise, *uvi* is not grown if there is insufficient labour and good soil. These crops, especially *uvi,* require relatively high labour inputs.

In the mid 20th century the less labour-intensive *tavioka* came to the fore as the dominant root crop (Thaman and Thomas, 1982; Thaman and Thomas, 1985), and is grown by everyone, although *uvi* and *dalo* are preferred for *magiti.* In the hill areas where *yaqona* grows, *tavioka* is

mainly used for subsistence, but on the down-river alluvial *bila*, *tavioka* is an important commercial crop (as well as for subsistence).

The present highly energy-efficient method of growing *kakana* not only lowers risk for the household, but is also ecologically benign on a global scale because of the relatively low input of fossil-fuel needed (Biesiot and Mulder, 1994; DeWalt, 1984). These low-input technologies are associated with long-term sustainability (Altieri, 1995/1987, p. 371). The conclusion is that the continued cultivation of these crops in this way is a very sustainable practice for local communities and enhances well-being.

Other Crops and Food Imports

In addition to the major crops there was a wide variety of food and drink crops grown, and many of the lesser crops were important following cyclones partly because they were grown in sheltered agro-arboriculture sites that escape the most severe damage. Especially important agro-arboricultural plants are *yaqona*, *dalo-ni-tana*, *vitua* and other yams, plantains, bananas, and breadfruit (F.D., 1998-1999). The *vaivai (Leucaena leucocephala)* tree provides an especially favourable environment for agro-arboricultural plots, and *vaivai* leaves were harvested and fed to goats. *Kumala* is grown in the open similar to *tavioka*. Tree crops such as *niu* (coconut), *maqo*, and *moli* were very important, and their importance may be underestimated in the study because they are typically valued by children more than the adults.

Other produce included craft items such as woven mats and pots. *Ibe* (mats) were woven from *Pandanus sp. (yo, voivoi)* by women in most villages, and exchanged at *solevu* or market (and sometimes sold there). This aspect of livelihoods is easily underestimated, but mats are necessary for floor coverings and are quite valuable, and serve as a renewable physical resource.

Pots were made only at Nakoro village (in Navosa) by a very small

group of women. Pots were exchanged or purchased and transported on horses to other villages where they were exchanged with distant kin at *solevu*. Most were probably taken out of the province, as very few pots were seen in village cookhouses. Alternatively, because they were very fragile, pots may have a short life, although well-kept examples lasted well. The practice appeared to be declining and was threatened because younger women were reluctant to take up the craft in Nakoro.

Substitutes for *kakana* such as flour, rice and sugar are present in all households, and serve well following storms.

Ika and Manumanu

Ika (fish), *ura* (prawns) and *duna* (eels) are all highly esteemed and generally available traditional protein relishes, although not culturally valued as 'first foods' like *kakana* (Pollock, 1986). There are many species, of which the local people have a very good knowledge (Thaman, 1990a, pp. 63-65). I observed three *ura sa* (large prawns, *Macrobrachium sp.*), three *duna* (eels, *Anguilla sp.*) and 17 fish of up to 25 cm in length, evenly divided between *ikadroka (Kuhlia rupestris), drava* (probably *Kuhlia marginata),* and *sawene* species, being caught on a day's fishing trip up the rugged Solikana Creek. The eels were caught in rock crevices in the headwaters, and many of the fish were speared around large rocks among rapids. Other species are *moce, ura vuse* (small prawns), *ura bati* (large prawns with very large pincers), *beli (Gobiidae sp.), babani, sasali* (eel, *Archirophichthys kamperi),* and further downstream in the Sigatoka River, *maleya (tilapia, Oreochromis mossambica)* and *isireli* fish. Changes in species composition has occurred as new species have been introduced (e.g., *tilapia).* There was a consensus that there were deeper pools in the creeks and rivers and many more fish in the period before 1951, and especially before 1940 (F.I., 1998-1999). The introduction of diving goggles around 1950 led to a noticeable decline in abundance, and the use of illicit stunning and suffocating agents (e.g., *duva (Derris sp.)* and modern

chemicals) to harvest fish is an increasing problem.

Beka (bats) are hunted and consumed in season, especially by boys and young men. Pigs are hunted from the wild (each Saturday in Nasauvakarua), and often part of the kill was cooked and consumed away from the village. One senior participant in Nasauvakarua indicated that wild pigs were increasing where they had once been scarce in the dense *veikau* of the Qalilevu Plateau (now being logged), although they are common around forest margins and relatively open areas. They have been used as a food source for much longer than cattle. However, at Nubutautau which has a relatively favourable, open environment for wild pigs, offerings of *vorei* at *solevu* have declined in inverse relationship to the increase in contributions of cattle (Martin, 1968, pp. 111-113).

Cattle are now the important food at *solevu* in Navosa, despite being a relatively recent introduction from the 19th century, and nearly all households keep them under low-maintenance free-range conditions. At Nubutautau, the giving of cattle at *solevu* was rare in the 1950s, but was usual in the 1960s, and loans from the Navatusila Credit Union were being used to purchase cattle for ceremonial use (Martin, 1968, p. 113).

Goats are also of relatively recent introduction but require greater management: they are typically raised by Fijians and sold for money to the Indo-Fijians, with the exception of a few which are consumed non-ceremonially by some households. The location of the goats can be managed by the placement of salt licks, where the goats usually spend the night. These places have been denuded of vegetation, but are small in area. The effect of the browsing of goats on the differential regeneration of plant species and biodiversity in Fiji is unknown (Hussain, 1983; Payne, 1952).

Poultry are raised around the village and are occasionally eaten as household food, usually on family occasions.

Recent Changes

Cash is earned from the sale of crops, but the local culture places a strong emphasis on reciprocal sharing and collective welfare, especially at the family, church and village level, at the expense of individual monetary gain. There was a remarkable equality in household wealth, but those households which had leaders in the most productive age-group tended to be better-off (although they were obliged to share among less productive kin).

The penetration by capitalist systems was relatively weak in Navosa, but noticeable. Bank accounts were held by 43 percent of households in Nasauvakarua and Nawairabe despite the inaccessibility of banking services. Most people do not accumulate the cash they earn but use it to satisfy relatively short-term demands, needs and wants. Cash is used to purchase items needed for customary social purposes.

Livelihood outcomes

The outcomes of the livelihood strategies can be coarsely divided into the need to satisfy food security, exchange obligations, and obtain money. An interpretation of the answers to a comparative evaluation of Navosa values suggests that each of these was of similar importance, although the first of these *(kakana)* scored highest, followed by exchange obligations *(tovo vakavanua)*, and then money *(lavo)* (see p. 286). Other categories can be added to these three, however, because the people often think in terms of the physical resources they would like (e.g., a horse, cattle, building materials), rather than something abstract like money. Thus, the importance of animals can at least be added to the above three categories, especially the necessity of cattle for *magiti* at *solevu*, and horses as transport across the sometimes rugged terrain. This was tested in the evaluation of values where an animal category *(manumanu)* scored lower than the other categories but was still relatively important.

The role of the church was important, and contributions were made

in the form of either money or labour time or *magiti* gifts, on different occasions. If contributions to the church (sometimes for redistribution, and sometimes outside the village) are regarded as an exchange obligation then the importance of exchange would become greater, but the proportional importance of these factors was not determined.

Well being of self and *vanua*

The usually implicit but ultimate goal of livelihoods is to ensure well-being. Well-being thus becomes the yardstick for how sustainability is to be measured. But what is the object of well-being? In Navosa, well-being is not defined in terms of the individual self, but is defined relatively collectively (people, institutions and environment: the *vanua*). The results from the study on Navosa values gives credence to this perspective.

Vulnerability context

Livelihoods are vulnerable to the sudden shock of tropical cyclones (see p. 49), and to slower-acting stresses on the *vanua* system which can be manifested from widely divergent physical, spatial, and structural causes, but compared to some other regions of Fiji (e.g., atolls), Navosa has a relatively resilient edaphic system (F.O., 1998-1999).

The vulnerability context is described here under the two categories of (sudden) shocks and (gradual) stress. They represent opposite poles based on the rapidity of their onset.

Shock

Serious epidemics of disease, and war, last experienced in the late 19th century, created sufficient social and economic shock to seriously threaten the resilience of the system and produce a decline in livelihoods.

Cyclonic storms and hurricanes occasionally strike and cause widespread destruction. Cyclone Kina in 1992-1993 was the most recent devastating cyclone in Navosa, but other, less destructive, cyclones have occurred since then. The consequences, as in the case of Cyclone Kina,

can be catastrophic, not only on the means of livelihood but also on the mind of the people whose lives are put under threat by these events. Both the main subsistence crop *(tavioka)* and the main cash crop *(yaqona)* are fragile and vulnerable to storms, especially *tavioka* because it is usually grown in the open on less-sheltered sites. *Yaqona* is also highly vulnerable to wind damage (McGregor, 1997, p. 5), but is usually grown in sheltered sites in Navosa.

There has been a gradual breakdown in traditional mitigation and coping systems, and local communities have increasingly resorted to the government for relief assistance in the aftermath of disasters (Benson, 1997; Thaman, 1982a; Thaman and Clarke, 1983). Severe natural disasters also constitute a shock to the Fiji economy at large, resulting in substantial declines in Gross Domestic Product (GDP) that necessitate recovery strategies (Benson, 1997).

Resilience is maintained by:

1. Preserving forest and other protective land cover. The protection of the *vanua* vegetation also serves to protect the wild food supply which is an aid after disasters.
2. Maintaining the fertility of the land, which encourages protective ground cover.
3. Maintaining the hillside niches of sheltered agroforestry gardens which support a variety of food crops and *yaqona.*
4. Maintaining food preservation techniques.
5. Having a reservoir of *kumala* plants. *Kumala* cuttings, if available, are distributed by the government following cyclones and are esteemed for their ability to produce quickly before the main *kakana* crops have recovered.
6. Maintaining stores of rice, flour, sugar and oil which are often the mainstay after cyclones, and are often distributed by aid programs at these times (after a delay).

The local food resources that were rated by Nasauvakarua and

Nawairabe participants as particularly important after a *cagilaba* (cyclone) were: *dalo-ni-tana, kumala, dalo, vitua (plus kwale and sarau,* all wild yams), *uvi, niu, jaina/jieke, vudi, bote (Colocasia* leaves), *vorei, vinati* (peanuts), and *via (Alocasia)* (F.D., 1998-1999). These resources have been placed in approximate order of importance, but variations between gender groups and the two villages were substantial and often subject to local opportunity. The importance of *yo (voivoi, Pandanus sp.,* to repair storm-damaged bures) was also mentioned.

Stress

Stress can originate from many causes. Some of these are:

1. Normal seasonal fluctuations involving climatic, agronomic, market, labour movement and health conditions.
2. Periodic drought, which does not completely destroy livelihoods but does lower agricultural production in Navosa.
3. Land degradation due to excessive burning and declining soil fertility, which limits productivity and the potential for diversification.
4. Technological change can generate (as well as alleviate) stress. The introduction of *mauniba,* cattle, the use of animal-drawn implements on slopes has led to stress. The introduction of agrichemicals and vehicles (e.g., via serious accidents) can create stress on human health, as does the demand to participate in the market economy.
5. The risks associated with market price fluctuations. Market prices can vary both for the value of produce sold and the cost of commodities purchased. Low prices for produce strain the ability to produce money and meet obligations through exchange at *solevu.* High prices for purchased commodities limit the ability to purchase livelihood-enhancing food and physical resources.
6. The risks associated with availability. Imported items may not be available regularly (due to political, economic or freight issues), thus creating risk with regard to dependence on these items.
7. National political factors. Navosa has suffered at times compared to

more politically privileged regions because of a lack of influence in government and the lack of economic patronage.

8. Social stereotypes. Navosa people, especially those from Navatusila *tikina*, suffer social indignities from people of other regions as a result of being perceived in terms of controversial past events and being the menacing oppositional force in historic conflicts.

9. Demographic changes. Increasing population and age-related demographic changes place stress on the livelihood system. The phenomenon of circular mobility that is present in other parts of Fiji is limited here (see also Sofer, 1987, p. 10).

10. Global climate change can stress the livelihood system.

11. In the long-term, any dependency on nonrenewable and globally-sourced resources such as fossil fuels will add stress to livelihoods when increasing scarcity raises input costs and lowers availability.

Perhaps because of insufficient experience, wider knowledge, or the gradualness of change, many of these processes were not mentioned by local participants, who tend to report only the most recent and memorable events which are causing loss or inconvenience, such as abnormal seasonal events or sudden agronomic, market or environmental changes. For example, the losses caused by wayward animals which damage gardens are sudden events, but these events are strongly related to particular seasonal, cultural-demographic (and sometimes, social) stresses (F.D., 1998-1999). Some participants, who had longer experience, or who thought deeper than others, commented upon factors such as periodic climate change, long-term vegetation and land degradation or politico-economic inequities.

Transforming institutions and domains

These are the entities which have a (usually larger-scale) leadership and transfiguring role with regard to livelihoods.

In the Pacific, three distinct livelihood domains or spheres can be claimed: (a) the government domain, (b) the private sector domain, and (c) the traditional domain (Hooper, 1993). In Navosa, the traditional domain is dominant: the other domains are marginal but both have slowly increasing influence.

There are a variety of transforming institutions (which, vice versa, may sometimes resist change). They include: education, health, church, womens groups, bureaucratic leadership, chiefly leadership, MAF, forestry and other government agencies, NGOs, media, national and international market forces, and national and international political influences. Some of these (e.g., church, village leadership, education and health) have relatively close household links, and others are situated at a distance.

Some institutions have relatively horizontal power interrelationships with householders, and others have relatively vertical interrelationships, and many have both. For example, church organisations have vertical power structures and close ties to large international organisations: but many emphasise horizontal sharing relationships among church members at the village level.

Some are explicit about creating change, for example, the government Duavata workshops clearly intended to enhance local social resources with the aim of facilitating development through institutional enhancement. Nevertheless, it is uncertain whether they have more effect than other institutions which create change by their continuing presence rather than any explicit goal to create change (e.g., market forces, schooling, district health nurses).

THE SOCIOCULTURAL SYSTEM

Social life in Navosa, at first glance, revolves around the villages where nearly all people live a way of life that is broadly similar to the way that their ancestors were believed to have lived. However, other places are important too. All villagers are cultivators, and their means of livelihood is gained from their hill *teitei* or flatland *bila* which can be close to the village, or commonly, many hours travelling from the village. Many households have a second house which is located in these distant gardens, and cultivators often prefer these places to the more formal village and its obligations. Many spend two or more weeks in their hill gardens, especially when extra work is necessary, and perhaps return to the villages on Sunday and Monday for church and the village workaday contributions. The *turaga-ni-koro* at Nasauvakarua managed his hill farm at Natoka (2 hours away) in addition to being the village leader for which he was paid a token amount by the government. Nearly all *turaga-ni-koro* were in a similar position.

The *vuvale* (household) was the most important social group. The household was the centre of livelihood creation and family identity. Associated with the household were small work groups *(solesolevaka)* whose membership was often unconnected to clan affiliation: these were very important for livelihoods. The church was also very important, but mainly for spiritual and collective identity and guidance, rather than livelihoods. The church was not usually associated with specific messages about caring for the environment, but a church message to this effect could be influential, alongside a broader message about caring for *vanua*. The subclan and clan groups were considered by adults as being rather less important than the aforementioned household and church groups. Because legal land ownership is invested in the *mataqali*, this suggests that participants do not rate legal land ownership as being very important to them. However, the traditional inherited use-rights associated with the cultivation of particular local areas (often

unconnected to clan ownership) are extremely important and inalienable under customary rules. The subclan was considered more important than the clan, which gives credence to those views which argue that the subclan should be the basis of legal land ownership instead of the clan, although again, in much of Navosa use-rights would take priority. The composition of *solesolevaka* (work groups) may be important to livelihood security: this can be the subject of further research. The *koro* (village) was valued slightly less than the other more intimate groups, perhaps because it was associated more with social regulation and control than the other groups.

The social and religious history of the region was important. The Colo region is regarded as a bastion of traditionalism and to some people from other regions of Fiji it is an area to be feared, not only because of it's geographic remoteness and relative impenetrability, but also for an aura of the demonic resulting from history, in particular, the Thomas Baker incident (Small, 1909). In addition, shamanic powers were said to be held by certain leaders in other parts of Navatusila. The prejudice of others in 'Christian Fiji' stills casts a cloud over the Colo region: local children are initially teased and later disparaged by those from other regions in relation to their social history (F.I., 1998-1999). This abuse has effected local ambition, for example, only one person (very recently) from Nasauvakarua village has achieved a tertiary education.

Navosa is comprised of several language dialects (or communalects (Pawley and Sayaba, 1971)) which sometimes vary from village to village in patterns that do not correspond to formal *(tikina)* boundaries. There was a tendency for youth to adopt the standard Fijian (Bauan) way of speaking taught at school, rather than their local dialects. Because schoolchildren usually lived away from their home villages during school terms, the acquisition of local knowledge was impeded for young people, who typically did know not their totems or clan affiliations.

Because of the education system, local knowledge tends to be undermined by the hegemony of standard Fijian and as a result some in Navosa feel that they are backward to those living elsewhere, although material standards are similar. There was little support for the recognition of the distinctive local history (partly due to the aforementioned events) and pride in local identity suffers as a result.

Social change is occurring in the region following the trend established elsewhere in Fiji: people are now more possessive and money-conscious, and less accommodating as hosts than in the past. Villagers are becoming more concerned with their personal and family identity rather than identifying with the community. Nearly all houses are locked when the residents are away. There is increasing segregation between generations within villages. The position of village leaders is less powerful than in the past, and leaders now find it more difficult to assert control. The combination of increasing individualism and the breakdown of the institutions and leadership which control resources is leading to a degradation of the *vanua* as individuals overexploit the previously shared common resources for gain, and this situation will worsen in future decades unless changes are made.

The lifestyle is foremost a physically hard-working one associated with primary production for the household and the need for a livelihood, but social activities play an important role. Popular recreation includes socialising around *yaqona,* playing rugby football, and travelling to visit relatives, attend church gatherings or *solevu.* Customary practices, especially *solevu* associated with weddings and deaths are very important, and serve to redistribute resources in addition to being eagerly anticipated (especially by the youth) as social recreation and a chance to meet others. They also reinforce local values and identity in that each village or clan tends to have certain distinctive aspects of culture that are respected by visiting groups.

How are these values and practices related to sustainability? In some

cases they relate relatively directly to household land use practice, and in other cases they are integrated with a social system which as a whole has proven itself to be sustainable in the local context. These will be dealt with separately.

Household sustainability

The flexible aspect of land tenure that was still active in Navosa allows households that need more land to request it through a traditional system from other households, or landowning subclans or clans that have a surplus. The groups that are approached in this way are obliged to share their land, which is formalised with the presentation of a *tabua* and gifts. In this way, excessive pressure on land is avoided by a redistribution of the resource to those most in need. Unfortunately, the changes associated with the legal fixation of land claims through the NLC to specific *mataqali* is frustrating this system in some areas, although in Navosa the traditional system is still effective. The increasing level of possessiveness in Fijian social life also threatens this system.

The collective emphasis on sharing within villages and the church offers a necessary and effective bulwark for those households under stress or who have been the victims of disaster.

A negative aspect of culture on the sustainability of the *vanua* is the need to keep cattle for use at *magiti* during *solevu*. In other parts of Fiji pigs are traditional and the preferred *magiti* at *solevu* but in Navosa cattle are the esteemed *magiti* food despite the availability of pigs which can be obtained, usually fairly reliably, from the wild near many villages. The increasing number of cattle is putting stress on the land during periods of drought.

Another negative aspect of custom is the traditional firing of the land to find wild yams. Where *vitua* grow in tall, dense stands of *gasau* then the task of finding them is much easier if the *gasau* is burned beforehand. The firing exposes and provides access to the *vitua* growing over lower hillside areas of medium extent where the cutting of a

firebreak would be extremely arduous. Lacking a firebreak, the fires tend to spread further uphill and further afield than is necessary.

INDIGENOUS LAND MANAGEMENT

The traditional practices of land management in Navosa have maintained a sustainable system until now, although an increasing population together with greater exploitation of the land raise questions about future sustainability. Perhaps the strategies of the past can be useful in the future?

The History

In traditional Navosa culture, overall land management was the responsibility of local leaders who could impose restrictions on resource use and who could enforce punishment for any who broke the (sometimes ritualised) rules, despite a relatively egalitarian tradition compared to eastern Fiji (F.I., 1998-1999).

In addition, there are symbolic aspects of traditional culture, of which some vestiges survive, that serve to prevent excessive degradation of the land-people system or *vanua*. Most of these serve to reinforce local cooperation, sharing, and identity, but some serve to protect the environment also. The system of totems and corresponding food *tabu*, which serve to reinforce local identity and respect for *vanua*, has some relevance here. Some beliefs and legends, for example, the stories surrounding the mythical *veli* creature (similar to those in Seemann (1973/1862, pp. 204-205)) and recorded at Nasauvakarua, may help protect locally important forest niches by deflecting any disturbance to the *veli's* habitat.

The strong cultural ethos surrounding the production of local food crops also serves to reinforce care of the land (Pollock, 1992, p. 235), as part of a self-reliant cultural system that is focused on maintaining food security and livelihood resilience.

Leadership was similarly powerful, even brutal, in the colonial era although control was less locally-based (Ravuvu, 1991, pp. 17-41). Nevertheless, local *buli* and *turaga-ni-koro* were feared and able to assert their will, and fire officers were employed (F.I., 1998-1999). Early in this period many villages were relocated away from protective hill and upstream sites down to more accessible, but more flood-prone, riverside sites in the valleys. In some cases, villages were separated from their supporting *vuci*. The main reason given for the discontinuation of the *vuci* at Nasauvakarua was that the villages had been moved away towards roads and closer to market access (F.I., 1998-1999). The people from Nasikawa old village (in the headwaters of the Nasikawa Creek), had moved downstream to a new site at Nubutolu (because there was more land there (F.I., 1998-1999)), until flood destroyed the village in 1933. Consequently, Nubutolu was relocated downstream onto the nearly flat site of its former main *vuci*,[36] and renamed Nawairabe (F.I., 1998-1999). The flood had probably deposited soft alluvium and enhanced the fertility of the *bila* downstream from Nawairabe village making the loss of the *vuci* feasible. This relocation, and the advent of *tavioka* from the 1940s (becoming popular in the 1960s), probably encouraged more burning as increased swiddening substituted for the loss of *vuci*. There were greater numbers of *vitua*, pigs and fish available during the 1930s compared to the present, and strict regulations and policing led to the clearing of gardens before burning, and fewer fires encouraged more forest in the gullies. At that time there were no cattle and few horses so fences were not needed. Prior to the opening of the first regional school in Nawairabe during 1936, the norm was to eat two meals per day. However, three meals per day became the adopted practice after the establishment of the school. The introduction of the plow was associated with the replacement of *vuci*, although this was not until after 1950 (F.I.,

[36] This site was not discovered by Parry's aerial photograph analysis (Parry, 1987, Fig. 6B).

1998-1999). From about 1960 increased burning led to declining fertility and the replacement of traditional crops by the less nutrient-demanding *tavioka.* The last major *vuci* were damaged by cattle trampling the waterworks, and they were abandoned between 1960 and 1965, the period when cattle began to be a general problem. Cattle were considered to be the main reason that *vuci* were abandoned. Other reasons were: (a) that gully erosion caused waterways to fall in height, and (b) careless burning destroyed forest at the head of creek areas and creeks dried up. Pigs were not a problem at Nawairabe because the *veikau* was remote from the village. *Mauniba* was reported to have arrived as late as the 1960s and spread very quickly following the burning of areas of *gasau.* The school moved to Korovou in 1961.

Vuci to Tavioka: Changes in Tillage

The destruction of hillforts throughout Navosa (Parry, 1987, p. 51), and the movement of villages downstream, together with other factors, precipitated the general decline of *vuci,* and the loss of a very sustainable cultivation system. High intensity cropping using only human labour on large irrigated *dalo* terraces was still extant in the 1930s but had largely ceased by the 1950s in Navosa (F.I., 1998-1999). The large set of *vuci* pondfields on the riverbank flats between Namoli and Korolevu (see Hashimoto, 1990) were an exception: they continued until the destruction of the feeder canal by Cyclone Kina in 1993. There were only a few small *tabaiwai* in use in 1998 (observed at Natoka and Nawairabe). There were about 300 *dalo* in the combined (60 m^2) *tabaiwai* at Natoka (fed with polythene pipe), and about 250 in the two small (17.5 m^2) Nawairabe *tabaiwai* (fed with a *bitu-ni-vavalagi* aquaduct).

One of the large disused hillside terrace systems at Nasauvakarua was studied. It belonged to *mataqali* Kurukuruvakatini, was built on heavy soil, and had a cultivatable terrace area of approximately 4000 m^2, where each terrace was approximately 4 m wide (F.D., 1998-1999). These

disused systems are still visible on aerial photographs, and it appeared to be an average-sized system. There are several others of similar size in the region. Swamp *vuci* were more common but did not cover a large area. They were located near springs in head of creek areas (e.g., at Nasaunokonoko), and also in small isolated swamps, (e.g., near Keiyasi). The *vuci* system was relatively sustainable for both food security and environmental preservation, but required an initially high labour input, especially compared to *tavioka*, although only a very compact amount of land was required. The expansion of *tavioka* cultivation and the proliferation of cattle (which damaged catchments, terraces and water transport devices) were described as the main causes of *vuci* abandonment, although climate and other reasons were reported to have played a part (F.I., 1998-1999). At Nasauvakarua, it appeared that the erosion of the Rogorua Creek down to bedrock may have allowed the stream to go underground through its bottom section from just below a major canal intake (F.O., 1998-1999). It is possible, I suggest, that underground infiltration may have affected stream flows at the intake of the (still visible) canal that fed the Emalu *vuci*. This reason has not been previously reported. The local elders reported that a drying climate, together with cyclone damage to intakes, caused the abandonment of *vuci* in the middle of the 20th century. The climate was moist (a *drakito* period) from 1917 to about 1940. Trees behind the village were cut down in the 1930s to plant crops and supply house posts. *Yaqona* was grown behind the village on the south side until 1947, when the area became too dry as a result of local deforestation. *Vuci* started declining from the 1940s when it got too dry. *Tavioka* arrived at this time and the last *vuci* was abandoned in 1952 following a cyclone. Because the terraces are still physically sound, my view is that the cyclone damage was to the intakes rather than the terraces themselves. This suggests that erosion associated with terracing was negligible.

The abandonment of *vuci* cultivation reflects a change from an

irrigated high intensity production system to a system of less intensity although still high production (*tavioka* produces well). The use of spades has facilitated *tavioka* cultivation on unterraced rainfed slopes in a system that requires relatively low labour input but is still energy-efficient. Frequently, *tavioka* is harvested and planted again in one operation and it's ability to grow on relatively poor soils ensures very sustainable production.

There are signs that intensification is increasing again with the introduction of animal-drawn tillage techniques in hilly areas that were previously only tilled with human labour, and the introduction of tractors on the lower valley margins of Navosa. These advanced tillage techniques, especially those using animal-drawn implements, are sometimes used to prepare land for root crops on steep slopes. The land is considerably more vulnerable to soil erosion under this tillage regime compared to irrigated terracing or dryland tillage using spades. At present, tractors are only used on flat alluvial *bila* around Sawene and Draiba.

Grassland Management and Burning

The most significant changes have been the introduction of *mauniba* (in 1920) and cattle (in the 19th century). The introduction of the fire-prone *mauniba*, with it's ability to colonise and dominate grassland, has caused dramatic changes in the ecology of Navosa. It can only be utilised for grazing for a few weeks after being burned. But, for this reason it is fired frequently leading to soil erosion and land degradation. It is indicative of the fallibility of modern agricultural knowledge that one of the reasons given for its introduction was to protect the soil from erosion.

If one considers the amount of land burned, the demand for young shoots from *mauniba* feature prominently. Whereas only small to medium sized areas are required to be cleared for cultivation and finding

wild yams, large areas are burned for new shoots for the animals, especially cattle. This occurs in the season of dearth (the dry season), especially near villages. Horses, which are highly valued for transport in Navosa, and goats (for cash), also figure highly in the need for grazing.

Cattle are valued for cultural reasons, and are usually only killed for *magiti* and eaten at *solevu*. They are sometimes exchanged with, or sold to, other householders for these purposes and only infrequently are they sold for cash to a middleman. As the human population is increasing, the demand for and population of cattle is increasing. All young men are now expected to build up a herd of animals, and nearly all households have cattle, although numbers per household are usually quite low (with some exceptions) and are just sufficient to cover *magiti* needs. A minimum of labour and inputs is expended in maintaining the herd. Cattle graze, and cause damage, in the shade of the indigenous gully vegetation during the heat of the day. Goats, which range widely in the day but which stay in one place at night (causing very localised erosion), have so far not caused widespread concern in Navosa (partly because dogs predate upon and control goat populations). However, increasing demand for cash may lead to an increased goat population in the future. The same scenario is likely for the Barbados Black-Belly sheep that MAF is introducing to other parts of Fiji, but which may become established in Navosa in time. The number of horses is also significant but they are more often grazed in a controlled manner close to the village.

The Animal and Pasture Division of MAF has a project focusing on pasture improvement and intensification, but the farmers associated with this project have land with relatively moderate terrain, are few in number, and are located near the advisory centre at Navatumali (especially near Yalavou). As the Yalavou experience has indicated, there are many difficulties with cattle-raising for profit in Navosa. The prevalence of poor soil, drought and fire makes fencing and pasture

management difficult. The intensification of cattle production is likely to cause further environmental degradation, and also very significant conflict with fishing resources and the practice of cultivation which are the main sources of livelihoods. For example, land taken for pastoral use is placing pressure on subsistence agriculture, especially when animals damage cultivations. Spriggs (1997a, pp. 266-267) has reported that this type of pressure eventually leads to land being taken out of the subsistence cycle leading to a loss of local sustainability.

The excessive burning is causing soil erosion and infertility on hillslopes where *tavioka* and other crops are grown, and in a few villages in Navosa (especially Vatubalavu and Nanoko), there is an increasing shortage of cultivatable land. There was an attempt to control excessive burning by several village leaders, largely through edict, but today this strategy has little effect on actual practice.

Food Security

Food security is seldom threatened in Navosa except in those places short of good land. There was a reliance on subsistence food crops, especially *tavioka,* although there was sufficient cash available from the sale of produce to purchase flour, rice, sugar and vegetable oil which were present in all households (F.D., 1998-1999). The subsistence root crops *(kakana)* and the wild yams *(vitua)* provide sustenance through drought (although there is a reduction in availability and green vegetables are scarce), and it is only in the shock periods after cyclones that food security is seriously challenged.

In the past it was common to use techniques of shelter and preservation to guard against famine after cyclones, but today there is a reliance on government-distributed food aid in these circumstances. The cyclone period corresponds to a season when *vitua* are actively growing and are not palatable, and they are rarely harvested at this time. The stems of *tavioka* often break during high winds, and except for a short

period immediately after the damage, they cannot be consumed until the plant has recovered some months later. Nevertheless, the crops which grow in well-sheltered agro-arboriculture gullies often survive cyclones and support food security. *Kumala* is often planted immediately after cyclones, especially on *bila*, because it grows quickly and can provide a harvest in about two or three months.

Does excessive burning effect food security? The change in vegetation from forest to *mauniba* has decreased the amount of land available for wild food and crops. The effect is less where burning is confined to existing grassland, however, fires occasionally intrude into regenerating shrub or forested areas and damage crops. There was a common complaint about declining fertility with regard to slopes where *tavioka* is grown near the villages. Thus, *tavioka*, despite its tolerance of poor soil, was becoming less productive, necessitating larger areas to be planted. Other, more fertility-demanding crops were becoming harder to grow, and cultivators were forced to travel further from the village to seek fertile areas.

Although the situation is tolerable at present in most villages, it was predicted by some leaders that the issue of increasing pressure on local resources will become serious in about twenty years (F.I., 1998-1999). Villages such as Vatubalavu and Nanoko are already experiencing difficulties with food security, and other villages were reporting a shortage of cultivatable land.

Sociocultural Change and Management

The region has been recognised for the strong connection between its people and the land, or *vanua*. The traditional social and cultural system, which is still relatively strong, emphasises sharing and exchange rather than the individual accumulation of fixed assets. However, today, social and economic change is reducing the bonds between people and their *vanua* (Batibasaqa, et al., 1999, pp. 103-104). Traditional leadership

has been significantly compromised by outside forces (Ravuvu, 1988, p. 173), and by colonial intervention (Ravuvu, 1991, pp. 1-41). Modern beliefs and the commodity individualism associated with capitalist economic processes are undermining traditional forms of sharing, social identity and environmental control (F.I., 1998-1999).

There have been changes in the cultural ecology of Navosa, particularly the introduction of cattle and goats. Recent practice favours the raising of cattle for traditional cultural purposes, and the raising of goats for monetary income. The extensive *vanua* land in Navosa is particularly threatened by these changes. An individual can advance her or his status by the prestation of cattle at *solevu* or by earning money from the sale of goats grazed on common *vanua* land. At present there is little structural constraint, apart from the approbation of other householders, about doing so. As a result there is an increasing amount of conflict with regard to damage caused by animals on both cultivated and wild food resources.

Wild yams are increasingly harvested by younger villagers and sold for cash at local markets without taking care to cut off and replant the small reproductive head of the yam. Cattle also damage *vitua* by eating the foliage, damaging the vine, and trampling the base of the plant in the valleys where *vitua* grows. As a result there were reports that *vitua* and other wild yams are declining in abundance.

The degree of indigenous knowledge was declining and the traditional means of identity including knowledge of totems, clans and local history were being marginalised in the face of the schooling system. This process was exacerbated by the situation where most students were educated away from their village and were without the influence of parents and elders for long periods.

SUMMARY: IS IT SUSTAINABLE?

The local *vanua* has proven itself to be a sustainable system until the present, but can this be maintained in the future? According to the reports of local participants, there are increasing problems with land degradation as a result of excessive burning and logging. There is an increasing population of people and animals. Sedimentation is increasing in waterways and fish stocks are declining. Economic and sociocultural changes threaten a previously harmonious people-environment nexus and common areas are beginning to be being overexploited. Local leadership has been undermined and now lacks the power to promote and enforce environmental rehabilitation. In some places food security is declining, and for some households, livelihoods are harder to maintain. All of these factors, although occurring very slowly, indicate that sustainability will be threatened in the future, and in some cases is already threatened.

But first, what is sustainability? More specifically, what entities is it important to sustain in Navosa? What is the indigenous view on sustainability and does it differ from the global view? Given my emphasis on local views, the last question will be addressed first.

It was apparent that local people, especially those that did not have an advanced education or hold leadership positions, were primarily concerned with their day to day livelihoods (perhaps thinking a week in advance about planned activities) and had little or no knowledge about wider environmental issues outside Navosa. In general, life in the *vanua* was good, they perceived few threats to its continuance, and they seldom questioned whether it sustainable. They did not have a rational theoretical concept of 'sustainability', but they did understand the importance of maintaining the *vanua* perceived through a cultural-religious ethical framework. They were keenly aware of local environmental disturbances and many were concerned about trends towards degradation. The things that they complained about involved

threats to their livelihoods (erosion and declining soil fertility) and disturbances to the resource-laden local forested areas, especially near habitated areas such as the village. Thus, local knowledge is fine-grained and embedded in the indigenous cultural ecology of livelihoods, but 'environmental degradation' as a general concept was not usually something they thought about (F.I., 1998-1999). A similar finding was found among African herders who had a comprehensive interactive knowledge of and concern about of the relation between herds and vegetation, but showed little interest in changes in vegetation climaxes outside their role as pasture (Bollig and Schulte, 1999, pp. 511-512). In comparison, there is a greater diversity of interactive knowledge in Navosa, reflecting the greater variation in livelihood resources. These findings support theoretical approaches in ethnoecology that argue for typologies based on practical local, indigenous criteria rather than those that privilege formal classification systems (Bulmer, 1974; Hunn, 1982). In general, indigenous knowledge was very important in Navosa, especially in the more traditional villages.

Those with advanced education, especially leaders, were often vocal about land degradation and tried to prevent it by edict, but had little power to enforce change.

For the local people questions about sustainability primarily concerned the maintenance of the natural resource base, although aesthetic concerns were mentioned. There was little direct mention of financial sustainability, although some villages were interested in increased development. With regard to sociocultural sustainability, the loss of leadership power (an institutional issue) and some traditional customs was regretted by elders and seen as a bulwark to environmental rehabilitation.

There are some issues that local people did not report that had an environmental impact. A few factors were beneficial. They did not report some livelihood benefits of burning such as the destruction of

agricultural pests, nor did they tend to explicitly recognise the value of traditional and egalitarian aspects of their socio-cultural system that enhance sustainability.

However, many were deleterious. They did not report any concern about the downstream or coastal effects of erosion and sedimentation occurring in their region (Asquith, et al., 1994; Dickinson, et al., 1998, p. 26; Haynes, 1989; Morrison, et al., 1990), or of pollution from their village contaminating the river downstream, despite being concerned about pollution from the up-river end of their village effecting the down-river end. They did not report any explicit concern about health or environmental dangers from the use of agrichemicals (although little was used in Navosa). There was no mention of the atmosphere-polluting and climate-modifying effects of gases from large-scale fires. These lacunae reflect the lack of a wider environmental knowledge (many of the adults had no schooling). These things, however, are of concern to environmental scientists and others concerned with larger-scale environmental processes that effect regional and global sustainability.

Thus, sustainability from a Navosa perspective is focused on local phenomena. They think locally, and wish to act locally, but their struggle to act in concert on pressing local environmental issues is compromised by institutional dilemmas and lack of government support.

Can the land degradation be reversed? This question is addressed in the next chapter involving sustainable development.

CHAPTER EIGHT

NAVOSA DEVELOPMENT AND SUSTAINABLE LAND MANAGEMENT

This chapter begins by outlining the structure and main aspects of development in Navosa. Traditional change is considered as a form of development, but is contrasted with the model of economic growth and modernisation. Current processes of indigenous development are contrasted with extralocally-planned development. The chapter then focuses on two main questions: how is the *vanua* effected by development, and is sustainable development possible?

DEVELOPMENT

Development can be defined as a process of economic and social change where extralocal forces and processes such as the diffusion of the international capitalist market system, modernist ideologies, and new technologies interact with local or indigenous systems. There can be negative repercussions. For example, nonlocal agents seeking large profits have a tendency to exploit the weaknesses of local communities and extract local resources, for example, timber, frequently degrading the resource base, and leaving a residue of social conflict in the community (Brookfield, et al., 1995; Routley and Routley, 1977; Scheyvens and Cassells, 1999, pp. 116-119; Scheyvens and Lagisa, 1998). But there can also be slower-acting transformations that are not immediately destructive: local innovators can appropriate and modify new ideas and techniques to create 'hybrids' that suit their own relatively small-scale livelihood interests (Amanor, 1994, pp. 206-216; Chambers, et al., 1989; Reijntjes, et al., 1992, p. 36), or increase production of rewarding local commodities when new markets appear (Richards, 1985). Development can also occur in a manner that is strongly consistent with endogenous (or indigenous) practice (Haverkort, et al., 2003; Richards, 1985).

Tradition, Change and Development

Traditional change has often been contrasted with development, especially in the modernisation literature. The term development is usually reserved for large-scale processes associated with economic growth and social amelioration that originated in Europe in the 19th century (Cowen and Shenton, 1995). But some of the prehistoric changes in Navosa were marked, and it is suggested that indigenous development may be an appropriate description for them. In this case, rather than arguing against the development concept, I argue that the concept of development should be broadened to include local and indigenous dimensions of development.

Changes in Navosa have included initial deforestation for swidden agriculture (Brookfield and Overton, 1988; Southern, 1986), innovations or adaptations of dryland and irrigated cultivation systems, especially terraced *dalo* cropping in *tabaiwai* or *vuci* (Kuhlken, 1994b; Parry, 1994), new crops and cultivars (Barrau, 1960; Brookfield and Hart, 1971, pp. 83-84; Yen, 1968), and the introduction of steel tools on first contact with European society (Derrick, 1950).

Many of these factors are discussed later (see p. 355), but the development of *vuci* has been at the centre of a debate about prehistoric agricultural intensification and social organisation, and is given particular attention here. The large *vuci* in Navosa are an adaptation incorporating both sociocultural and environmental influences. They are clearly an edaphic modification of a hillside environment involving deforestation and reconstruction involving displacement (but little removal) of soil through the application of human labour to grow domestic crops. On the other hand, they are ecologically adapted to climate, a specific source of water, soil type, and crop type. They are also socially adapted to cultural needs, the availability of labour, and institutional type.

The ecology of Navosa shifting agriculture can be explained similarly. The use of fire, and digging techniques, to deforest and cultivate dryland

swidden plots is an obvious modification of the environment, but other aspects such as the allowance for environmental renewal through fallowing and revegetation, non-intervention in the water supply, minimal human impact on edaphic forms and soils, and relatively efficient and nonpolluting grass-roots livelihoods and social institutions suggest a high degree of ecological accommodation, especially when compared with modern industrial agriculture.

Agricultural intensification and social organisation

Do the changes associated with the construction of terraces suggest agricultural intensification and disintensification (Brookfield, 1972; Brookfield, 2001; Spriggs, 1981), or merely innovation (Brookfield, 1984), and how are they related to systematic development? Despite the visible edaphic signs of widespread technological change (which indicate innovation), it is very difficult to infer social and demographic changes (as intensification requires) from physical evidence (Leach, 1999; Spriggs, 1990, p. 174). Nevertheless, the presence of innovation is often regarded as key evidence of development (Belshaw, 1964b, p. 113).

Vuci techniques are believed to have been developed independently in the Pacific, rather than having being learned from a centre of diffusion outside Oceania (Kirch, 2000, pp. 158-160), and thus they may be an innovative indigenous development. Changes associated with irrigated terracing include: (a) new technology, (b) an increase in landesque capital, (c) an intensification of the agricultural system leading to higher production, and (d) an increase in wealth in terms of an increased amount of exchange commodity. Unirrigated terraces, similar but involving less landesque capital, were also constructed to grow yams.

Kuhlken (1994b), who studied the distribution of terracing in Viti Levu, comes to the conclusion that cultural, rather than environmental, reasons predicated the distribution of irrigated *dalo* cultivation (p. 106). Despite the majority of terracing occurring in the seasonally dry leeward regions of Viti Levu (p. 165), he claimed that the absence of terracing

over much of western Viti Levu indicated a lack of cultural preference in these areas. However, examination of his maps suggests that terracing is closely associated with the more hilly or mountainous regions and the availability of running water that could be diverted for irrigation in the dry season: made more salient because of his inability to discern small streamside terraces obscured by gully vegetation from aerial photographs. The combination of these two conditions is scarce over much of the rest of western Viti Levu including the fertile lower valleys of the major rivers where yams could be more easily grown. He did not attempt to correlate terrace sites with soil type and water-retention ability: free-draining soils are not suitable for ponding, but impoverished clay soils are not suitable either (Hashimoto, 1990, p. 7; but see Williams, 1982/1858, p. 61). By contrast, my analysis is that the location of terrace sites is strongly associated with available environmental niches. The cultivation of *dalo* was almost certainly highly desired from a cultural and livelihood perspective (Pollock, 1985), but the environmental conditions over most of the leeward region were the limiting factor, a finding concomitant with the theory that environmental limits constrain the perseverance of culture (Meggers, 1954).

Larger *vuci* systems required disciplined social organisation and relatively sophisticated engineering, but it seems that a highly hierarchical leadership structure was not necessary, except when long canals and aqueducts crossed territorial boundaries (Spriggs, 1990, p. 178), or perhaps when several clans collectively operated very large *vuci*. Social groups that are normally in conflict can cooperate when it is in their interests to do so, as when under environmental stress.[37]

Early claims that the irrigated 'hydraulic societies' of the Pacific were associated with increased socio-political complexity have been

[37] The *tabaiwai* that are in use today are small and require little organisation outside of one household. One clan was involved with the large Nakula pondfield that ceased operation in 1993 (Hashimoto, 1990).

contradicted:

> The most hierarchically structured and hegemonic Polynesian polities are usually associated, not with the irrigation-dominated production zones, ... but with the intensive dryland sectors. (Kirch, 1994, p. 10).

This division parallels the situation in Viti Levu where dryland agriculture is largely associated with the relatively top-down and complex polity of the windward southeastern region, and irrigation was largely confined in the less stratified polities of the leeward northwestern region (Kuhlken, 1994b). The social structure of early Navosa society was believed to be relatively egalitarian:

> 'Nowhere else in Fiji did I come across chiefs so little removed from their "kaisi" [kaisî] (serfs) as in Vosa [Vôsa, Navôsâ]' (brackets and parentheses in original) (Kleinschmidt, et al., 1984/1879, p. 149).

A Colo chief's position was relatively tenuous with his own people, and his decisions were subject to consent from a council of elders (Thomson, 1908, p. 59). This situation remains broadly unchanged. Navosa was a relatively egalitarian society (F.O., 1998-1999), despite the surge in chiefly power after European contact (Thomson, 1908, pp. 56-65). Chiefly authority declined after the British asserted their hegemony, however (Ravuvu, 1991, pp. 17-41; Thomson, 1908, p. 62), and for local chiefs it has declined further, especially after independence (F.I., 1998-1999; Ravuvu, 1988, p. 170). Nevertheless, it is likely that increased production from *vuci* systems provided an opportunity for chiefs to advance their status and power through their increased ability to give at exchange ceremonies.

The slow process of building *vuci*, however, was perhaps less persuasive than the once popular chiefly strategy of welcoming fugitive outsiders to settle on unused clan land. This strategy aided the chief

because it ensured a grateful group of loyal subordinates who were prepared to offer him much greater personal allegiance than his own clan group and kin (Thomson, 1908, p. 59). The people of Nasauvakarua are said to been given residence in Navatusila at Namaururu and Nabukuniqa under this arrangement (F.I., 1998-1999). Because it was the kin who were more likely to be involved with extant *vuci* production, it was probably in the political interests of a chief to implement this other strategy (especially at times of war), rather than focus on increased *vuci* production. Following the colonial fixing of boundaries and land titling by the NLC, it is now far more difficult or impossible for a chief to exercise a *vakavanua* (customary) strategy and provide a new home for landless *vuvale*, thus constraining social equity, and sustainability.

How were traditional settlements arranged? In the later stages of prehistory, settlements tended to agglomerate around defensible sites close to resources, and fortifications were necessary for protection against war attack during war (Parry, 1987, pp. 118-119). Thus, a higher degree of collective organisation was necessary to build infrastructure. Nevertheless, the socio-political units were relatively small and independent, and followed topographical boundaries:

> The landscape was compartmentalized and this feature is reflected in the settlement pattern, the diversity of communalects and the polity (Parry, 1987, p. 124).

Thus, intensification probably happened relatively gradually, and in a palimpsest succession, although some events, for example, the adoption of metal tools, created rapid change. Metal objects and tools were eagerly adopted upon European contact (Derrick, 1950, p. 41). The indigenous people quickly recognised the technological superiority of iron over existing tool materials and strove to acquire these new commodities (axes, knives, nails, etc), for livelihood and exchange purposes, resulting in fierce competition between coastal Fijian polities for trade objects (Derrick, 1950, p. 43). The demand for the new tools is

evidence of how traditional society was willing to adopt innovations, and thus further their indigenous development.

During the mid 20th century, it was observed that instead of being conservative, '... they [Sigatoka Valley Fijians] have been selective and adaptive in developing a new society and culture which appeals deeply to them ...' (Belshaw, 1964b, p. 118). Thus, Fijian society was developing in its own way, by interacting with and incorporating Western elements as served their needs.

Development and Transition

What is the overall impact of development, interpreted broadly as human intervention, in Navosa? Following the initial fire and devegetation due to human occupation, the easiest to discern and most enduring development for the *vanua* has been the introduction and persistence of new biological species, plant and animal, which have substantially and perhaps permanently altered the vegetation environment and the agricultural system (Ash, 1992, p. 117). The changes in vegetation follow the course of ecological imperialism (Crosby, 1986), a process whereby domesticated plants and animals are transported by colonists from their place of origin to their 'new' lands where they spread and sometimes dominate the new territory. This process is clearly aimed at reproducing the livelihood and cultural system of their origin in their new place of residence, and it has been repeatedly practised by each wave of new colonising cultures in Fiji. Some of these new species have had a destructive impact (the colonial administration was especially culpable), but some have added to the livelihoods of local people (Thaman, 1990a), and must be considered as part of development.

The edaphic environment has also been changed, but in a less diverse manner than that of vegetation. The changes in land fertility are less visible, but can be perceived by the type of vegetation that is supported

(Twyford and Wright, 1965). Where excessive burning has taken place, there has been a trend to lowered soil fertility and a 'degraded' vegetation pattern (Cochrane, 1969).

In the lower Sigatoka Valley (of neighbouring Nadroga), commercial crops are grown according to market demand with a relatively intensive use of physical resources. The farmers here, especially the Indo-Fijian tenant farmers, are hoping to produce and accumulate a substantial profit from their capital, rather than have that gain contribute towards a traditional exchange and redistribution system. Market individualism characterises their approach (Brown and Lauder, 2001). Various socio-cultural changes (e.g., the beginnings of a class society and a move away from a subsistence mode of production), have already been documented for this type of development situation (Overton, 1990; Ravuvu, 1988). In the present context, changes include increased individualism and the expression of personal desire and ambition, the fragmentation of social institutions, and the loss of diversity of local languages and cultural practices in favour of the consumption of global and nationalist ideas and commodities (F.I., 1998-1999). The overall situation is broadly consistent with world-wide economic trends to capitalist accumulation, increasing class division, and the commodification of resources (Sklair, 1994). These processes are associated with the cumulative deterioration of the physical environment and the maldistribution of wealth (McMichael, 1996, pp. 288-292), which lead to diminished sustainability. Nevertheless, the power of the traditional Fijian domain hinders the transition to the capitalist model (Lasaqa, 1984, p. 204).

Indigenous Development

In present-day Navosa, the external context of capitalist market relations and institutions has become stronger, but the local sociocultural and livelihood system is still dominated by a traditional kinship-based community exchange and redistribution system (F.O., 1998-1999). The conjunction of these two systems reflects a situation of indigenous or endogenous change and development (Haverkort, et al., 2003; Richards, 1985) based on indigenous knowledge (Gegeo, 1998) or performance (Richards, 1993).

The capability of a Navosa householder to control the means of production is bounded by a set of livelihood resources and forms of capital that are governed by environmental and cultural influences (Belshaw, 1964a). The profit motive is still nascent in this society of subsistence affluence (Fisk, 1972). Similar to other swidden societies (Dove, 1984), there is a tendency to focus on consumption rather than production. Thus, capitalist accumulation and market individualism have not been important, but other community-oriented forms of commodification (e.g., Dove, 1988; Toren, 1999) do occur.

Various changes are occurring but the basic kinship and exchange system still functions to maintain a strongly egalitarian society where basic needs are well-met in most places without significant government input (F.D., 1998-1999). In the sense of individual welfare, recent economic growth in Navosa has been very positive, but environmental threats are increasing.

Recent developments include the selective logging of the last few areas of high-value indigenous timber (one conservation area was being retained (NLTB, 1996)). The structure of logging operations exemplified nonlocal capitalist development, but when remittances are used to enhance community facilities (as in the case of Namoli village), a degree of indigenous development is reflected. Nevertheless, there were serious conflicts, especially when the distribution of the proceeds of logging

were disputed, as in the case of Nawairabe (F.I., 1998-1999). In these cases, the integrity of the indigenous system of community development was seen to be threatened.

The introduction or intensification of money-earning crops and associated agricultural techniques is evident together with slight changes in the mode of production. Indigenous development is indicated where changes take hybrid forms and are assimilated to aid the local community. The case where a flexible polythene pipe (a new technique) was used to convey water to irrigate a *vuci* is a good example. The incorporation of nonlocal textile materials (e.g., woollen strands) by women into traditional *ibe* (mats) to enhance their value is another. These products can be used for both community ceremony and market sale.

In agriculture, there are many examples where local resources and introduced techniques have been merged to produce an indigenous 'hybrid'. Most visible are the fences which are constructed with steel wire supported by a dense row of small native trees (grown from cuttings) as 'living posts'. The use of living *vaivai (Leucaena)* to support yam vines, among other purposes, is a common agro-arboricultural interplanting technique. The use of fire to prepare the land for planting pines, or harvesting *quwawa,* can be included here, despite potential degradation. In remote communities, animal-drawn implements and bullocks have been purchased to cultivate garden areas where only spades were used before (especially for yams and *dalo,* both used traditionally). Areas of *vaivai-ni-mocemoce (samanea saman)* were being ringbarked by burning for clearance and cultivation on river *bila* near Sawene where tractors were available for the removal of stumps and cultivation. Farmers were incorporating the newer varieties of *dalo* and *tavioka* into their cropping cycles.

Some new techniques could be destructive, however. Gramoxone was being increasingly used to kill weeds on *tavioka* plots (which allowed

extended cropping periods), but safety precautions were either unknown or unheeded, and the risk of poisoning was high.

Planned Economic Growth and Modernisation

The government has promoted regional growth through the provision of infrastructure, especially the provision and improvement of roads, and education and extension services. The building of roads encourages human mobility and the transport of a greater diversity and better quality of produce to markets for sale, and conversely, allows easier access to the external agents of development (Chung, 1988; Ward, 1982). The Sigatoka to Keiyasi road was completed about 1956, according to Belshaw (1964b), 'and by all accounts it created a revolution in the way of life of the Fijian villagers' (ibid, p. 261). The new road may have been partially responsible for the boom in independent innovation that impressed Belshaw during his research two years later. But the initial advantages provided by a new road may not persist at the same level once the temporary boon associated with construction wears-off, as Chung (1988) documented elsewhere in Fiji. In recent decades, road improvement has been very gradual: a road has been constructed to Namoli from Korolevu (with the help of international aid), and a logging road has been extended down the Natoka Hill to the Sigatoka River near Nasauvakarua. The upgrading of a logging road up the Nasa Creek to Nakoro was to be started in the near future.

The large development schemes of previous decades often did not achieve their goals (e.g., Taukei, 1993). The cooperative credit schemes of the 1950s and 1960s (Belshaw, 1964b; Martin, 1968) have largely ceased, although the Karomatovu Cooperative was reported to still be functioning at the very remote Matokana village. In the 1960s, a large development project called the Land Development Authority (LDA) was implemented in the Keiyasi-Draiba *bila* area (F.I., 1998-1999). Overseas

aid was introduced and bulldozers cleared land for farming. A 'Valley Industrial Cooperative' and bank branches were established at Navatumali, but they no longer exist (F.I., 1998-1999).

There have been no new credit initiatives (outside of private banking), mainly because there was little provision for credit under conditions of customary land title, with the proviso that existing lending institutions (e.g., the Fiji Development Bank) have conventional European capitalist-oriented lending policies that are incompatible with the Fijian land tenure system (Sharma, 1984). I will add that these policies suffer from a lack of needed innovation appropriate to indigenous or local conditions. They are also inequitable in that they tend to serve the already wealthy (Sharma, 1984). For example, the 1997-2000 Commodity Development Framework (CDF) agricultural development scheme (MAFF & ALTA, 1996; MAFFA, 1996), which aimed to develop agriculture throughout Fiji from an 'enterprise development-year 1996 to a fully-fledged agro-industry base-year 2000 [sic]' (MAFF & ALTA, 1996). This program had only a marginal effect in Nadroga and Navosa by 1998, partly because the support (through subsidies on production) was inequitably distributed to well-connected farmers in politically favoured regions (F.I., 1998-1999). Navosa receives aid (including sacks of rice and perhaps *kumala* cuttings) after cyclones, but quantities are limited.

There have been few notable projects since the coup of 1987. One reason has been that the neoliberal structural readjustment policies in the 1990s have limited the ability of the government to supply credit and manipulate the national economy.

Another is that the benefits accruing from government policy have tended to bypass Navosa in favour of other regions, especially the eastern islands, through the influence of politically powerful patrons and a development process dominated by migration, remittances, aid and bureaucracy (Bayliss-Smith, et al., 1988, p. 165). Navosa was not a

privileged territory, largely because of the eastern power hegemony (Durutalo, 1985), but also because the most publicly known advocate for Navosa, the *Tui* Noikoro, is a leader in the parliamentary opposition.

These inequities are part of an underlying large-scale core-periphery structure which tends to work against decentralisation and preserve the resource-exploitative and monopolistic position of the capitalist core (e.g., in the politically powerful eastern region), in relation to the village mode of production in the periphery (e.g., Navosa), thus maintaining the existing polarised economic pattern and uneven development (Narayan, 1984; Sofer, 1988).

The local agricultural extension service was primarily utilised by farmers in the vicinity of Navatumali, and was little used by the bulk of the farmers who cultivated in the greater part in Navosa, thus suggesting an analog of the core-periphery structure within Navosa itself. The role of education is very significant in raising expectations for material progress and modernisation (Watson-Gegeo and Gegeo, 1992), but context-specific agricultural education, especially for young adults, is lacking.

Overall, planned development in the last decade has mainly been limited to basic services. Perhaps the most significant effect has been the introduction of modern ideologies through schooling, although an improved roading system was escalating development in some communities.

Planned Social and Environmental Amelioration

Social and environmental amelioration rectifies the destructive effects of economic development and modernisation on sociocultural and environmental systems, and enhances sustainability (Overton, 1993). Many NGOs (e.g., the Kana Project) are involved in ameliorative work. Amelioration is a goal in environmental education, afforestation and restorative agriculture (e.g., agro-arboriculture or agroforestry).

But there have been few persistent social and environmental ameliorative initiatives in Navosa. Those that have occurred have tended to rely on workshops (e.g., Duavata), which are relatively non-persistent in their application. The indigenous knowledge of *vanua* and the use of wild plant resources has been promoted through workshops, sometimes by NGOs (e.g., the Kana Project), but a long-term plan to prevent land degradation was lacking.

By contrast, there have been few constraints (except for new environmental protection guidelines (Ministry of Forests, 1990)) upon the process of logging of the remaining high-value forests. Despite the improved guidelines, some logging companies still break the regulations occasionally (F.I., 1998-1999).

There was a lack of action about protecting the environment, partly because the centralised Fijian bureaucratic system was not responsive to the concerns of the vanua leadership in Navosa, and the local level of bureaucracy in Navosa had little power and few resources to effect change. Responsibility for land management in Navosa is spread over several (traditional and bureaucratic) institutions, and consequently any local impetus for change tends to become dispersed both because of the lack of a clear channel through which land degradation could be addressed and amelioration enacted, and a lack of resources with which to effect change (F.I., 1998-1999).

Many local leaders did not attempt to encourage amelioration because they believed that they would be unable to induce any significant change, although those leaders who were attempting to create change were highly regarded (F.I., 1998-1999). The lack of resources at the village, *tikina* and provincial levels limited the formation of initiatives to organise beneficial development (Lasaqa, 1984, pp. 207-208). Thus, the existing institutions are largely ineffective with regard to environmental conservation and development. Perhaps most important, there was little locally-oriented environmental education except that introduced by a

minority of concerned teachers. There is a clear need for initiatives by the government to improve context-relevant environmental education.

VANUA AND DEVELOPMENT

How is the Navosa *vanua* affected by development? In particular, has the environment been made more or less sustainable by development over time? In this section the impact of development on sustainability will be evaluated, starting with a baseline of traditional practices.

Vanua and Traditional Land Management

The indigenous use of fire has been a conspicuous aspect of the Navosa environment, and has been used to manage the *vanua* in order to sustain livelihoods.

In Navosa, the important techniques of using fire to clear vegetation for gardens and finding wild yams are traditional strategies, and the use of burned areas to control animal movement has a foundation in traditional practice (F.D., 1998-1999). However, the continuity of this practice between the past and present is clouded. The specific evidence that is needed to comment upon the degree of burning and its relation to changing population levels over long time periods is lacking. What is known is that some of the current reasons for lighting fires (e.g., new grass for animals, *quwawa* for fuelwood, *malasou*, clearing for pines, harvesting *kari*) were not present in earlier times. It is possible that there were a lesser number of reasons (and fire-starting tools), to justify starting fires. However, there were some former reasons that have lapsed, such as the need to clear vegetation around villages to enhance security during war. A lack of evidence, however, hinders any attempt to compare the degree of uncontrolled burning over time.

Based on his data from the lower Sigatoka, Parry calculated that 9,000 to 11,000 persons were estimated to occupy the middle and upper Sigatoka Valley in the mid to late 1870s (Parry, 1987, p. 53). This figure

is qualified because Parry's analysis of settlements did not extend to the hinterland of Navosa where many villages were located prior to cession. During 1998, I was informed about and able to visit several *vuci* and disused villages that were outside the range of his maps, in both riverside and mountain environments.

Despite high population densities in a few riverside locations, Parry concluded that the level of population in the alluvial *bila* region of the lower Sigatoka Valley did not reach a level that threatened the capacity of the agricultural system (p. 131). This situation does not transfer to Navosa, however, because the upper Sigatoka valley has much less *bila* (and other differences). Instead, large-scale flights of *vuci*, and associated aqueducts and canals on hill-slopes to grow *dalo*, were constructed in Navosa.

Terraced agriculture was believed to have begun about 1100 A.D., which coincided with the middle of the Little Climatic Optimum (LCO., approx. A.D. 750-1300) (Nunn and Britton, 2001). It is possible that increasing aridity during the LCO jeopardised the hillside cultivation of the preferred dry season crop, the yam, and forced the large-scale construction of irrigated *dalo* terraces in order to ensure a sustainable food supply. My view is that this argument best explains prehistoric agricultural change in Navosa. Spriggs (1981) argues similarly for the general Pacific context. I observed the effects of a El Niño drought in 1998 which caused dryland dalo to be physiologically distressed (F.O., 1998-1999). The seasonal planting of yams and the transplanting of *dalo* were delayed by several weeks. Other crops such as *tavioka, jaina* and *vudi* were also growing poorly.

Because *tavioka* was not introduced until the 19th century, and *kumala* was also a relatively late introduction, prehistoric societies, especially if populous, were likely to have been forced to rely on the seasonal availability of *vitua* and breadfruit or the less palatable *via kana (alocasia macrorrhiza), yaka (pueraria thunbergiana/lobata,* now regarded as a weed at

Nasauvakarua), and other minor food plants to avoid famine (Massal and Barrau, 1956). The promise of a sustainable supply of *dalo* from irrigated terraces must have been very attractive under these circumstances (Spriggs, 1990, pp. 176-177), as was indicated in 1998 when the leaders of some villages (e.g., Korolevu, Namoli, Nawairabe, and the women of Nasauvakarua) either discussed among themselves, or expressed their interest in the possibility of resurrecting their *vuci* in order to improve the sustainability of their agriculture.

Indigenous development can also be described as resulting from a process of opportunistic or interpenetrating interaction with the environment (Steward, 1955). Initially, some technological changes may appear relatively small (e.g., the introduction of fishing goggles, or *mauniba),* but they eventually stimulate great changes. Fishing goggles and modern chemical paralysing agents have noticeably increased the level of exploitation of local fish, and thus improved local nutrition and livelihoods, and probably human population, but fish stocks are now under threat, and may not be sustainable in the long-term (F.I., 1998-1999). The wide-ranging effects of *mauniba* are also salient (see p. 85). Although popularly described as traditional and conservative, Fijian society in the Sigatoka region has in fact been developing by adopting new livelihood techniques and gradually changing over time.

Vanua and modernisation

Development and modernisation has been steadily progressing in the urban centres, the tourist areas, and the more developed rural areas of Fiji throughout the late 20th century (Chandra, 1983, pp. 22-24; Knapman, 1985; Knapman, 1987). The rise of capitalism and the adoption of social, cultural and technological innovation has been a characteristic in these areas (Peet, 1980).

Watters (1969) described mid 20th-century Fiji as a dual economy society (traditional rural, and modern urban). On the one hand, traditional rural society was institutionally bound to remain 'stagnant';

and on the other there was a growing industrialised urban centre — leading to a dual economy system.

What is the situation in Navosa? The willingness of innovators to adopt modern techniques is well demonstrated by the case studies in Belshaw's (1964b) study of economic development in Nadroga-Navosa. However, there are strong constraints to the adoption and spread of innovation. Belshaw summarises:

> It seems clear from many of the examples of enterprise ... that many are prepared to act, but that the terms of action are exceedingly onerous in that they imply forms of behaviour, insecurities, and supporting institutions which are outside the habitual frames of reference of the Fijians. (Belshaw, 1964b, p. 272)

Belshaw believed that (traditional) Fijian society itself was not predisposed to economic development: 'one will not be able to speak of an [Nadroga-Navosa] economic system which generates economic growth from its internal characteristics' (ibid, p. 272). According to Belshaw, the entrenched Fijian cultural, institutional, and government structure impedes the socio-economic progression to development, a situation that has not changed (Lawson, 1997; Watters, 1969).

Despite the possibility of structural impediments, local changes are occurring which include an increasing awareness of the value of money and a correspondingly greater degree of self-centred, or *vuvale*-centred, behaviour at the expense of community and larger-group togetherness and cooperation. However, the customary traditional exchange system still persists because of its ability to maintain cultural and social identity, enhance resilience, and safeguard the livelihoods of all villagers. Local communities thus serve as a bulwark after the shock of cyclones and other disasters, and are the basis of individual welfare and sustainability. Thus, local people have only partially accommodated the individualist market-oriented capitalist system, and Navosa is still considered a

traditional area, by virtue of its broad perseverance with customary *vanua* practices. An average of only 43 percent of households in Nasauvakarua and Nawairabe have bank accounts (see p. 231), and the combined importance of church and customary ways outweighs the importance of money (see p. 286). Therefore, in Navosa, it is safe to accept that capitalist development, although stimulating many changes (Belshaw, 1964a), has not become a dominating structural force in the local economic system. Part of the reason is external: urban industrialism has entered a period of stagnation and unemployment, and the growth in the tourism sector has had little impact in Navosa (F.I., 1998-1999).

Vanua and indigenous development

Because the instances of innovation in Navosa were mainly focused on improving livelihoods (without specific regard for capitalist accumulation), they are best described as examples of indigenous development. Indigenous development is usually not obvious to the outsider. Instead of being a highly visible project event, indigenous development occurs spontaneously and relatively invisibly through local innovation in the way of gradual changes to livelihood and conservation systems (Johnson, 1972). It may also have unpredictable outcomes:

> Even when culture change is strongly directed towards particular goals, very unexpected processes and effects are usually encountered. (Steward, 1977, p. 312).

An example is the adoption of *tavioka* which was initially used as food for pigs (F.I., 1998-1999). *Tavioka* eventually became accepted as *kakana* (true food), and together with other factors (e.g., introduction of cattle) caused a wide-ranging systematic change to the agricultural system in the post-war decades, and displaced yams or *dalo* as the central everyday food (Thaman, 1982b).

Some farmers are innovators and were adopting new techniques to save labour, enhance diversity, and improve their livelihoods (F.I.,

1998-1999). The persons most associated with innovation appeared to be mature (but not senior) adults aged about thirty years of age. Young adults lacked the status to challenge traditional ways, and senior adults were usually happy with existing methods.

New crops and trees had been introduced, and there was usually a keen interest in them if it was believed that they may produce a substantial benefit. Nearly all of their important crops and arboricultural trees, as throughout most of the Pacific, are domesticated introductions (Seemann, 1862; Seemann, 1973/1862, p. 380). The spread of *vaivai (Leucaena leucophylla)* and *tavioka* are conspicuous and fairly recent examples, but there are a great many others which were introduced in the 19th and early 20th century and have gradually achieved popularity (Clarke and Thaman, 1993, pp. 63-84; Thaman, 1990a).

New varieties of *kakana* crops had been adopted, adding diversity to the existing range of cultivars, and the comments from farmers about new dryland *dalo* cultivars were especially favourable (F.I., 1998-1999). Some had an increased drought resistance which aided resilience during dry periods. However, there were no new wetland *dalo* cultivars outside of two traditional varieties. New cultivars of *tavioka* had been widely adopted and had extended the agronomic potential and consumer appeal of this crop, and there were a substantial number of different species and cultivars, and ways of growing, *uvi* and *vitua.*

The most noteworthy example of an innovation that improves the function of a traditional method was the use of 32 mm polythene hose to supply water from a spring to a pool with diversion channels to irrigate a small set of three *vuci* (60 m^2) growing wetland *dalo* (approx. 300 plants) on a 10° — 20° slope with heavy soil near the *Tui* Navatusila's house at Natoka. This technique was not seen elsewhere, but ensured that his *tabaiwai* remained productive through twelve months of the year despite the trampling of animals which curb the use of traditional canals and aqueducts. Two cultivars of traditional wetland

dalo (lewa ni vuya and vudra), which are preferred for taste over dryland varieties (F.I., 1998-1999; Watling, 1984, p. 122), were used. An equivalent area of *vuci* was in fallow.

PHOTOGRAPH 17. *Tui* Navatusila and Natoka *vuci*. Irrigation: the polythene pipe in the left-bottom corner has carried water from a spring. This technique is novel in Navosa, although reported elsewhere (Watling, 1984).

Given that this system belonged to the *turaga-ni-yavusa* of Navatusila, and *vuci dalo* was valued higher because of its taste, texture and perhaps sacredness (Kuhlken, 1994b, pp. 368-370), was it a method reserved for chiefly classes only? The evidence does not allow a clear conclusion: although *dalo* was considered a chiefly food (F.I., 1998-1999), and a chief's ceremonial obligations are higher than others, nearly all householders grow (dryland) *dalo*, sell it, and use it for prestation. Certain dryland cultivars are grown for prestation purposes rather than for sale. The other *tabaiwai* at Nawairabe belonged to a householder who was not a chief, and when the large size of prehistoric terraces is considered, it seems unlikely that the *tabaiwai* technique was confined to

chiefly classes. After studying the two existing systems, my view is that the technique represents: (a) an efficient and opportunistic use of a select environmental niche and resource, and (b) a valuing of customary ways (which gains social reward, especially for a chief).

The adoption of Gramoxone herbicide for weed control is spreading, although still not common (an average of 9% of households in Nasauvakarua and Nawairabe used it, and only 16% used any chemical at all (F.I., 1998-1999)). There is an increased use of animal-drawn (either bullock or horse) ploughs, often where they have been never used before as in Nasauvakarua. Bullocks are increasingly being purchased to pull the plough (there is now an average of 0.9 bullocks per household in Nasauvakarua and Nawairabe). Gas stoves are becoming more common (an average of 10 kg of bottled gas used per household per annum), although they are still used infrequently and by only a few households. Electricity generator sets (powered by diesel or petrol) were now being purchased more frequently (Nasauvakarua clans purchased another two in addition to the one already existing during my time there). VCR sets were also purchased, and perhaps the first videos were shown.

Other examples of indigenous development include the technique of vertical staggering of the planting of *tavioka* on steep hillsides to prevent erosion, and the many different types of interplanting using non-traditional crops (F.O., 1998-1999). A very common practice is the relatively open-ground interplanting of pineapples with *tavioka*, but the multi-layered approaches of agro-arboriculture gardens are considerably more complex, and differ from garden to garden in the same area (Clarke and Thaman, 1993; F.O., 1998-1999; Thaman, 1988a). It is common to have several different combinations of crop plants and trees interplanted together (F.O., 1998-1999). The areal quantity and importance of these agroforestry gardens is commonly underestimated because they are usually shrouded by the upper-storey of their canopy of secondary forest when viewed from a distance (F.O., 1998-1999).

The adoption of cattle as an important component of exchange at *solevu* is another example of indigenous development. In this case, the innovation closely parallels traditional practice but with the substitution of cattle for pigs at feasts. Pigs were used in the early 1960s for *solevu* at Nubutautau (Martin, 1968, p. 111), but by 1967 cattle were frequently being used (ibid, pp. 112-113). Only cattle were slaughtered for a Nubutautau *solevu* in 1998 (F.O., 1998-1999).

Many new plants have been adopted for different purposes. *Gasau-ni-vavalagi* (elephant grass) is valued for its ability to protect the banks of rivers and creeks. *Moli* (citrus) and other introduced fruit trees are popular and have been planted widely throughout Navosa following their introduction often by a single local innovator, who is sometimes remembered.

The various forms of *vaivai* are usually popular *(vaivai-ni-mocemoce* is an occasional exception) and are put to many uses. The introduction of *Leucaena leucocephala* has been very positive and has been strongly taken up by local farmers who use the fast-growing trees to support *vitua* vines as well as for shade and to improve fertility in agroforestry niches. According to belief, one man introduced this species to the local community. Similar species such as *Gliricidia* are also finding acceptance, partly because of their multiple functions.

Many of these agricultural innovations are a 'hybrid' mixture of indigenous and introduced knowledge, tools or practices. In Navosa, new trees or crop plants, new cultivars, agrichemicals, and new techniques have been introduced from outside, and are then readily accepted for experimentation, and adopted, or modified for local use by innovative farmers.

The reverse situation, where the indigenous knowledge surrounding the use of local plants is extracted for agricultural or pharmaceutical exploitation by industrialised core countries only occurs rarely. However, when it does occur, for example, in the case of *yaqona,* the effect of

industrialisation may have profound effects on indigenous livelihoods. In the short term, *yaqona* prices have risen due to extra demand, but *yaqona* cultivars are now being grown outside of their indigenous region and there is a danger that the market may become flooded by *yaqona* exports from other geographical regions and nations, and thus diminish rewards for indigenous producers (Johnston, 1997; Peteru, 1995).

Vanua, planned economic growth and modernisation

Navosa has been transformed by large-scale logging (Durutalo, 1985; Qalo, 1993), credit and financial management schemes (Martin, 1968), community-scale afforestation (Drysdale, 1988; Qalo, 1993), and major agricultural development projects (near the southern margin) from the 1950s through to the coup of 1987 (e.g., G.P. McGowan & Associates, 1976; Hawaiian Agronomics International, 1984). Since then, there have been no major development initiatives (F.I., 1998-1999). A very large-scale development plan (Yalavou II; Woodward, McKillop & Baker, c. 1986) had been in preparation for much of Navosa, but this was abandoned after the 1987 coup before implementation began. The 1987 military coup had both external and internal economic effects. Overseas backers such as Australia and New Zealand withheld aid funds (Lal, 1992, p. 284), and there was a national economic downturn, especially in tourism (Knapman, 1988). As a result, large projects such as Yalavou were either abandoned or downsized (F.I., 1998-1999). The coup led to a ethnic polarisation in the Fijian electoral system which is strongly correlated with geographical divisions between east and west (Lawson, 1996, p. 75). Because the Fijian government was based around an eastern chiefly hegemony (Lawson, 1997) which has tended to serve its own regional interests (Sofer, 1988), the western regions (and especially the interior districts) have not been treated equitably (Durutalo, 2000). This was despite the general strategy of a Fijian-dominated government (and military) to favour Fijian interests over other ethnic groups (Lal, 1992, p. 316). Coincidentally, the 1990s heralded the arrival of neoliberal

economic development and structural adjustment policies with a concomitant reduction in the role of government (and consequently, investment) (Prasad, 2000, pp. 168-169), together with a theoretical and policy shift towards subregional or local approaches to development that reflected 'less government' and more indigenous or civil input (ADB, 1997; Brohman, 1996; Chambers, 1997; Ghai and Vivian, 1992; Warren, et al., 1989). Part of the reason for this shift was the recognition that large regional agricultural projects were often not succeeding (Overton, 1987b).

Nevertheless, the process of modernisation continues through infrastructural and sociocultural influences such as new roads, agricultural extension, the education system, media and other modernising influences.

The large-scale and nonselective logging of the forested slopes of the northern Navosa boundary (in the Nanoko-Bukuya area) provided little or no lasting benefit for livelihoods (F.I., 1998-1999). Instead, the roadhead village of Nanoko is now considered the first village to have entered a cycle of poverty in Navosa. There were complaints of good *yaqona* sites being destroyed, head of creek areas drying-up, and of pervasive land degradation on these once-luxuriant slopes. Nanoko village has an exceptionally large population which is partly due to high fertility, and partly due to migration from other villages in the past. Logging was largely extractive with no follow-on benefits. At the time of research, selective logging was occurring near Namoli and Nawairabe. In the case of Namoli, where leadership was respected, proceeds had helped build a road and new houses were being built on a flood-free terrace above the old village. In the case of Nawairabe, a large new Methodist church and a house for the village chief on a terrace above the old village had been partly completed at the time of research, but there were acrimonious disputes about the distribution of proceeds. Most community members in Nawairabe belong to churches other than the

Methodist church (F.D., 1998-1999).

The common feature of the use of logging proceeds was the construction of new buildings. Once logging ceased, no further benefits could be expected, unless the deforested areas were replanted with high-value timber trees. This was occurring in other, higher rainfall, regions where mahogany was being planted after the logging of indigenous forest. This may occur on the higher-rainfall Nawairabe concession, but the discontent regarding the use of irregular proceeds suggests that commercial forestry has questionable value for the average villager's livelihood.

Vanua and socio-environmental amelioration

The history of ameliorative environmentalism started perhaps with the introduction of *mauniba* in Navosa in the early 20th century. This fodder grass was sometimes thought of as a ground cover that would help prevent erosion, and it was reported to have spread throughout Navosa very quickly. The process by which it acts instead to escalate erosion has been discussed previously (see p. 85).

The introduction and promotion of vetiver grass on the sugar cane farms of neighbouring Nadroga and Ba provinces during the colonial years has not spread to Navosa. Vetiver is very rarely seen despite the frequent use of steep slopes for cropping in Navosa. It is uncertain that vetiver grass would be particularly effective at preventing soil erosion on such very steep slopes where the rows would have to be closely spaced. Usually such slopes do not erode severely because of the surrounding and cover vegetation, but erosion can be severe if seasonally heavy rain strikes recently cultivated ground.

The introduction of other grasses (e.g., *Nadi* blue grass) has been beneficial to pasture farmers, but many of these grasses have not competed strongly against *mauniba*, especially in drought conditions.

The most recent and visible introductions are the community woodlots of *Pinus* species planted on agriculturally nonproductive land

near villages in Navosa. Most are between one half and two hectares in size, much smaller than the large industrialised plantations managed by Fiji Pine in the west. The intention was to provide a local timber resource that could also be sold if needed, however, their role in livelihoods is precarious because most woodlots are too small in size and too remote in location to be financially valuable as a timber resource. The quality of the wood is relatively low, but it is accepted locally for use in house framing and for other non-durable purposes.

The protection of indigenous forest through conservation areas has not been broached in Navosa until recently. A large area has now been proposed as a conservation park (NLTB, 1996). This initiative could be described as indigenous development because it was initiated by the *turaga-ni-vanua* of Noikoro *tikina,* although the strong national political profile of this Australian-educated leader and other input suggests a relatively global approach. This conservation initiative is likely to enhance long-term sustainability.

SUSTAINABLE DEVELOPMENT

> In essence, sustainable development is a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations. (WCED, 1987, p. 46)

This view from Brundtland Report is characteristic of the concept of sustainable development. It reflects a concern about maintaining the resource base in order to serve human needs, and as such, is an amalgamation of previously opposed economic and environmental concerns, but controversially, with a pronounced utilitarian emphasis on serving human desires rather than conserving species or biodiversity.

Thus, sustainable development could be viewed as merely a reflection of the course of the already developed European model of development through modernisation, destruction (Leiss, 1972; Weiskel, 1989), and ad hoc environmental remediation, but with the added ambition of preventing excessive environmental degradation. In other words, sustainable development is a planned and controlled form of development where environmental limits are not exceeded during the process (WCED, 1987, p. 45).

This goal is clearly ambitious because it is attempting to achieve something that already developed societies did not achieve immediately, that is, economic development with concomitant environmental conservation (Herring, 1990; Johnston, 1996/1989). Is this goal attainable under Third World contexts and realities? Or is the concept of sustainable development a Eurocentric ideal that is impractical under Third World realities?

The Challenge to an Orthodoxy

The project of sustainable development, as originally put forward by Brundtland, et al. (WCED, 1987) uncomfortably straddled what was then a deep ideological divide between the backers of economic modernisation and the proponents of socio-environmental amelioration. According to the Brundtland Report, both economic development and environmental conservation should occur together to tackle both poverty and environmental degradation (ibid, pp. 46, 49, 51, 57, 129, 335, 349, 364-365). A qualification is needed to the effect that the Brundtland Report, which was based on economic assumptions, is a pastiche of ambiguous views that can be interpreted to allow for exceptions (e.g., pp. 133-134).

Although the sustainable development ideal has some relevance in planned contexts, my view is that it is an ambitious and unrealistic strategy where the process of economic development is already

significant and largely unplanned. It assumes that all development can be strategically controlled, but much development is unplanned and follows the worldwide diffusion of capitalism (Cowen and Shenton, 1995). Therefore, the Brundtland Report model may be logically inconsistent under conditions where the process of capitalist development is stronger than ameliorative forces. For sustainable development to occur, it is necessary to articulate with the process of economic development, which is already growth-enhancing, and therefore sustainable development will primarily be an ameliorative practice. In Navosa, despite custom, economic development continues to exert coercive pressure. What is required is the balancing role of ameliorating socio-environmental action. Sustainability is required, but sustainable development as suggested by the economic program of the Brundtland Report is inappropriate.

The Brundtland Report, and similar approaches to sustainable development, have two major assumptions. The first is that poverty is a major cause of environmental degradation (pp. 28, 364), and the second is that economic development alleviates degradation through reducing poverty (pp. 1, 51). How do they fare?

Does Poverty Cause Environmental Degradation?

According to the Brundtland Report, poverty causes environmental degradation:

> Those who are poor and hungry will often destroy their immediate environment in order to survive: They will cut down forests; their livestock will overgraze grasslands; they will overuse marginal land .... (WCED, 1987, p. 28)

This process does occur, but it is often the case that environmental degradation is caused by excessive resource exploitation that is caused by factors other than poverty, for example, social inequalities (Barkin,

2000). Thus, the above statement may be overly simplistic and possibly quite wrong in many Third World rural contexts, and indeed, the reverse may be true. To illustrate, consider the following: gatherer-hunter groups may be considered the poorest social groups by the income standards of the already developed world. However, based on the ratio of leisure to work, they have been considered as the 'original affluent society' (Sahlins, 1972), and are generally credited as having caused the least environmental degradation (Simmons, 1991, p. 25). By contrast, the deforestation of temperate regions has caused the largest percentage areal loss of forest (Goudie, 2000, p. 52), and the most developed countries have the highest rates of natural resource extraction and pollution, and effect on the biosphere, and yet they represent the least poor. In this example, the reverse is true, wealth causes environmental degradation because economic development leads to higher extraction of natural resources and environmental degradation. Navosa is regarded as a poor region of Fiji: does this argument apply there, and what other factors are important?

Navosa and the poverty line

Although Navosa is considered to be relatively poor by people from other Fijian regions (F.I., 1998-1999), and according to the standards of world development (UNDP, 1997, p. 24), the resource base was considered to be moderately well-endowed by local experts (F.I., 1998-1999). According to the Fiji Poverty Report, the weekly income of F$149.59 for households in Nadroga-Navosa was the second lowest, primarily because of the lack of earnings from business and paid employment (UNDP, 1997, p. 24). The report also argued that intra-village income variation between households was high, contradicting the commonly-held view of communal egalitarianism in rural Fijian villages (p. 23), and my own findings (F.D., 1998-1999). It is not possible to evaluate the published figures in depth, but I am sceptical about the accuracy of rural household income figures, especially when only cash is

involved and many households do not have bank accounts. The level of income at which taxation began was well-known, and my interpretation was that many householders would present only the financial information that favoured them (Rutz, 1978, p. 796). The wide variation could also be due to sincere versus insincere presentations of income level, or the way in which ceremonial or obligation costs and benefits were calculated, and thus the validity of these figures is questionable (see p. 221).

Instead, many indigenous Fijian villagers may enjoy an economy of subsistence affluence (Fisk, 1972, p. 24). According to this perspective, values other than those associated with 'economic man' and development criteria affect economic decisions. For example, the avoidance of drudgery incurred in work (Chayanov, 1986/1966), and the preference for leisure are significant satisfactions, especially in an environment where manual work is very strenuous (as in early summer).[38] The satisfaction and increase in status when traditional obligations are fulfilled also suggests affluence, but these factors cannot be easily measured in money terms (Fisk, 1972). According to Fisk, most Fijians in traditional agriculture can produce, using their own land and labour, a 'fairly comfortable level of living' (p. 24), from the cost of three to four hours of male[39] labour per day on average. It appeared that most Navosa men worked longer hours than this on an ordinary working day (and the work was usually very strenuous), but there were some men who do less work, some seasons when weather prevents work, and some days when they are engaged in travel or leisure. Women worked longer, and more consistently on everyday cooking and

[38] It cannot be assumed that subsistence affluence was a traditional prehistoric phenomenon. Colchester (1984) argues that the affluent lifestyle was created through the introduction of steel tools which made swidden agriculture easier, although the effect of steel tools on *vuci* agriculture may have been less. Fire may have been more important as a clearance tool before European contact.

[39] Because women work in gardens, and work longer hours than men, this figure is misleading, in effect, the women are subsidising the men in their subsistence affluence.

household tasks than most men did (a man could have this role in some circumstances), and also worked in gardens, especially in household *tavioka* and *uvi* production and the harvesting of green vegetables and collection of some wild foods, although there was variation between households and villages in gender roles (F.I., 1998-1999). The other work roles of women were similar to those outlined in the literature for Fiji in general (Schoeffel and Kikau, 1980; Slatter, 1984; Sofield, 1985). In sum, most Navosa households would not be described as poor but would fit the model of subsistence affluence with the addition of some modern gains as a result of commercialisation. Most households were able to obtain a satisfactory income from agriculture and other means in a manner similar to or better than other interior villages throughout Fiji. The high prices being obtained for *yaqona* and *dalo*, and the new items purchased suggested that most Navosa householders were not poor. It was not rational for village Fijians to pursue other options under those circumstances, although an increase in population may lead to change (Fisk, 1972, p. 32).

Nevertheless, against the view of subsistence affluence, the Fiji Poverty Report (UNDP, 1997) asserts that a 'poverty line' can be discerned based on certain levels of household income, and that 22 percent of rural Fijian households were poor (p. 39). This is a judgement based on economic criteria made from general data. A general criticism of 'poverty line' approaches is that they ignore variations in the availability of non-monetised livelihood resources. In effect, they focus only on financial resources or assets, and largely ignore the non-monetary (especially the customary, social, and environmental) aspects of livelihood resources (which are strong in Navosa), as the basis of the ability to create livelihood strategies and further wellbeing. The effect of the poverty line is to standardise a certain income level as an indicator of wealth, and the lack of that income stream as poverty, regardless of the abundance of other livelihood resources available to a householder.

This process is another form of cultural hegemony or imperialism (Rahnema, 1992b). Nevertheless, in certain contexts, particularly peripheral urban situations in Fiji (Walsh, 1978), non-monetary livelihood resources are limited and poverty can be real. The question of how poverty is measured is important, and here I argue that greater emphasis needs to be placed upon non-monetary livelihood resources in an exchange economy, which are the basis of livelihood security and sustainability in Navosa.

There are other ways to approach poverty. Laderchi, Saith and Stewart (2003) claim four approaches to poverty: monetary, capability, social exclusion and participatory. The Poverty Report is a monetary approach, based on a shortfall of income (alternatively, consumption) from a theorised poverty line (ibid, p. 247). In contrast, the participatory approach avoids the axiomatic approach involving the external imposition of a poverty line, and asks the local people themselves to participate in decisions about what is poverty, and its magnitude (p. 260). This is the approach I prefer because it articulates with indigenous realities. The capability approach, although a sophisticated compromise, is difficult to measure, and the social exclusion approach suffers because of the difficulty in defining the criteria of exclusion.

The inappropriateness of these two methods is indicated by the Nasauvakarua case. Because Nasauvakarua is remotely located, it is excluded from easy access to education and health services, which would suggest that: (a) their capabilities were limited, and (b) that they suffered social exclusion. But of all the villages, the Nasauvakarua people were most happy with their lot, not desiring much in the way of development change (F.I., 1998-1999).

Thus, in Navosa, I did not feel confident that surveys of income or expenditure would reflect the degree of wealth or poverty there, and did not attempt such a measure, partly because previous attempts had obtained discrepant results (Cleveland, 1991), and partly because it was

culturally insensitive to enquire directly about household financial status. Indirect techniques led to the conclusion that there was little difference in wealth between households, and sharing between households overcame the differences that did exist (F.I., 1998-1999).

The type and level of nutrition, and general health, I believe, may be a better indicator of poverty in the Navosa context than monetised values (Manning and Thaman, 1980; Thaman, 1979), and may represent the security of livelihoods more accurately. The level of carbohydrate consumption was always adequate, even during drought. Leafy greens were nearly always available, except during drought, and a good variety of fruit in abundance was consumed in most seasons. The only reservations concern the level of protein consumption, which following Fijian cultural norms, was relatively low in the Sigatoka Valley (Cleveland, 1991; NFNC, 1996). Similar patterns were observed in Navosa (F.O., 1998-1999), although household fresh fish consumption is considerable: each Nasauvakarua and Nawairabe household consumed an average of 231 small fish *(ika, ura* and *duna)* p.a., (F.D., 1998-1999). The popularity of the dominant *kakana* in Navosa, *tavioka,* which contains very little protein, may add to the concern (Thaman and Thomas, 1980). A protein analysis may indicate which Fijian households are most susceptible to poverty (Cleveland, 1991; Manning and Thaman, 1980; NFNC, 1995; NFNC, 1996).

The levels of household consumption did not indicate cause for immediate concern: all households consumed fresh fish, prawns, eels, and poultry; and tinned mackerel and tuna, in similar quantities (especially in Nasauvakarua) (F.D., 1998-1999). Wild pigs are frequently hunted (especially in Nasauvakarua), but are often consumed in the field and only part of the kill may be brought back to the household. Bats are a seasonal food. Cattle are usually only eaten at ceremonial occasions. My analysis of various data, including an interview with the District Nurse (F.I., 1998-1999), led me to conclude that nutritional poverty in

Nasauvakarua and Nawairabe was insignificant if not entirely absent (F.O., 1998-1999).

The ability of Nasauvakarua villagers to construct their houses at virtually no monetary cost, thereby allowing alternative uses of funds, is not taken into account in the national report. The notion that as many as 22 percent of villagers were poor, as the poverty report suggests, may violate the self-esteem of a sometimes proud minority regional group (F.I., 1998-1999). Thus, the report itself could be hegemonic.

Returning to sustainable development, it is apparent that land degradation cannot be attributed to poverty. In Navosa, there has been a history of burning of the forest and grasslands leading to land degradation since early occupation, but until recently the system has been credited as sustainable. Now, however, the reports indicate that there are trends to unsustainability despite the increase in per capita incomes, another refutation of the link between poverty and environmental degradation. As a result of the inroads of infrastructural development, especially the construction of roads, increased levels of commercial activity and exploitation of natural resources are occurring. The greater exploitation of resources, especially from logging but also for generalised agricultural production, has been placing increasing pressure on land to the extent that some practices are now viewed as destructive by local people. There are also demographic changes: the population has been steadily increasing in Navosa (Figure 2). The stagnant urban economy, and the high prices for *yaqona* and *dalo,* were encouraging young people to stay in rural areas and practice cultivation as a livelihood (F.I., 1998-1999). The rural cattle population was increasing in parallel fashion, thus exacerbating land degradation and resulting in a decline of the health of waterways.

Of all Navosa villages, Nanoko was the only one associated with poverty (F.I., 1998-1999), and thus requires special mention.

Nanoko

Nanoko is located at a roadhead and is the largest village in Navosa (pop. approx. 500). Population growth has been high, and it was one of the first villages to be closely involved with development as a result of the nearby logging operations of the Pacific Lumber Company in the 1960s and 1970s. Because it experienced early economic development, it should be wealthier than surrounding villages. However, the reverse was the case: it was the only village in Navosa that was reported to have entered a cycle of poverty (F.I., 1998-1999). Livelihoods were not secure and health problems were rife due to contaminated drinking water, although a new dam for water supply was in the process of being constructed. The logging operation, which was almost completely extractive, involved clearfelling and largescale deforestation, and had destroyed many head of creek areas and forest niches where valuable *yaqona* and *dalo* were once grown, and there was no reafforestation. Thus, Nanoko was the only village in Navosa where fuelwood was difficult to obtain. As a result, the livelihood system in Nanoko was under stress in 1998. In summary, extractive economic development together with a rapidly increased population had led to lowered resilience and a stressed livelihood system in Nanoko.

Other villages

Another village that was said to be close to entering a poverty trap was Vatubalavu. Vatubalavu lacked yaqona sites and had only a limited amount of *bila* (once used for banana production), and was forced to improvise other means of income. It was a spiritual centre that had benefited from church aid, and large church gatherings were sometimes held there.

Certain other villages had experienced planned development. Cooperative projects were centred in Draiba during the 1950s (Belshaw, 1964b, pp. 54-57). In the 1980s, a large squash project was initiated, but it lasted only one year (F.I., 1998-1999). New tractors, loans, and other

inputs were supplied, but none remain. The cooperative store was running in 1989, and this building, together with other dilapidated western-style buildings, gave Draiba a run-down impression in 1998. Although the village was located among rich agricultural land, it appeared no wealthier than other villages.

Sawene also has a history of development and similarly fertile land (Belshaw, 1964b). Despite being of more traditional appearance than Draiba, it was relatively mechanised and tractors were typically used for tillage. It was the only village (apart from Navatumali & Keiyasi) that I came across that had (newly constructed) flush toilets. In some ways this village had similarities with Namoli, where a respected traditional leader and an innovative *turaga-ni-koro* were leaders of change. In both cases, these villages were viewed as both upholders of tradition and leaders in innovation. The apparent contradiction mattered little in fact. On the one hand, the village chief upheld traditional culture (and was highly respected for this), but he was also prepared to accept material change (usually carried out through the leadership of the *turaga-ni-koro).* In both villages leadership was uncontested, the traditional chiefly *bure* was well-built and the *sevusevu* ritual was conducted in a reverent and formal manner. Vatubalavu, Sawene and Draiba, plus Keiyasi, and partly, Nawairabe, were not *'yaqona'* villages but relied on the production of *tavioka,* maize and other crops from their alluvial *bila* flatlands for a income, which although consistent, was not booming like *yaqona* prices.

Keiyasi was reported to be expanding its cultivation area on alluvial *bila* and was viewed as a developing village. Its roadhead location and rich soils gave an advantage, although it lacked *yaqona* sites. Farmers in the Keiyasi-Draiba area had bought eleven two-tonne trucks in recent years, and this was viewed as evidence of economic development, especially by eastern-bank villagers (e.g., at Nawairabe) who complained that the west bank villages (e.g., Keiyasi, Draiba) were getting most of the development aid (F.I., 1998-1999). Sawene was on the east bank but

had fair access across the river to the west bank road. Overall, because of rich soils, there were no major problems with resource sustainability in this area.

This was not the case at Nanoko, where economic development, especially logging, had led to degradation and a decline in livelihood resources and subsequent poverty. Thus, inappropriate development hastens the arrival of poverty rather than poverty being the cause. There was no strong evidence from other parts of Navosa that poverty causes environmental degradation, although there is evidence that increasing populations are reducing the resilience of the *vanua*. Thus, in the case of Navosa, poverty is not a significant cause of environmental degradation. Instead, the evidence suggests that increasing populations of well-fed communities are causing environmental degradation, which nevertheless, may lead to poverty in the long-term. Given the hazard expressed in the Nanoko example, it is germane to ask if economic development can alleviate environmental degradation.

Does Economic Development Alleviate Environmental Degradation?

Can economic development alleviate environmental degradation in Navosa? The sustainable development model suggests that economic development will reduce poverty and therefore alleviate pressure on scarce natural resources and minimise environmental degradation:

> Growth must be revived in developing countries because that is where the links between economic growth, the alleviation of poverty, and environmental conditions operate most directly. (WCED, 1987, p. 51)

I have suggested above that poverty is not a significant factor in the Navosa situation, viewed broadly. Nevertheless, land degradation continues to occur and is worsening. The implication is that the sustainable development model may be inappropriate in Navosa.

However, it may still be relevant if planned economic development can directly alleviate land degradation. But so far there have been no signs that an improved per capita income, which is occurring generally across Navosa (UNDP, 1997, p. 43; UNDP, 1999, p. 16), has alleviated environmental degradation, and instead degradation appears to be worsening.

Other indicators of development have also increased. The Human Development Index for Fiji shows that: (a) life expectancy at birth, (b) adult literacy, (c) the gross domestic product per capita have all increased substantially since the 1980s (UNDP, 1999, p 16). Although these national figures do not specifically portray local Navosa conditions, they do suggest that the broader national economic and social environment was growth-enhancing. The current economic state of Navosa appeared strong with burgeoning prices for some main crops and native timbers, and major commodities being bought and introduced to communities for the first time. The strong subsistence base and the kin-based redistribution system ensured sustainable livelihoods and healthy people. The high prices for *yaqona* and *dalo* (and lack of urban employment) were stemming migration to urban areas, and young adults were returning to grow these crops. The Navosa population has been steadily increasing (see p. 205). The population data collected from Nasauvakarua and Nawairabe during 1998 revealed a dramatic increase over the 1986 census figures where the number of households and the total population is approximately doubled (population is exactly doubled in Nasauvakarua) in both cases since 1986.[40] Thus, economic change is suggested by all the indicators.

Various logging operations, canal-building near Monasavu, and agricultural development on the alluvial lowlands have all had localised effects on the watershed. The effects of logging have been especially

[40] The interpretation of this data should be cautious, however, because census data sometimes lacked accuracy.

deleterious, especially to downstream livelihoods and the river ecology. Participants at Navatumali, Nasauvakarua and Nawairabe all reported the negative effects of large-scale logging operations upstream: village water supplies, the quality of bathing, and fishing were all affected, often for several weeks at a time, creating serious inconvenience (F.I., 1998-1999).

The only example of a planned project effecting the Navosa watershed in recent years has been the Yalavou I pastoral project, which abuts the southern margins of Navosa near Nawairabe village and affects the Nasikawa Creek watershed which drains into Navosa. It is discussed in more detail.

Pasture development

Although conceived as a major project, the effect of the Yalavou pastoral development project on local livelihoods has been minimal. There have been benefits, inequitably distributed, for the few Yalavou farmers who remain, partly because they have taken over the neighbouring blocks which were abandoned. One farmer at Nawairabe has benefited in this way (F.I., 1998-1999). The Yalavou-built east-bank road has improved access to Sawene and Nawairabe in some seasons. The predicted change in vegetation cover from *mauniba* to better pasture species has not eventuated on a large scale. Fires still raze the hills in the dry season.

Sixteen volunteer farmers near Navatumali were involved in a livestock grazing project on two hectare blocks of gently contoured lowlands. *Nadi* blue grass and other 'non-combustible' grasses had been sown or planted for pasture improvement. One of these new grasses, said to be signal grass, which grows strongly once established, was being planted with enthusiasm on some sites up the Nasikawa Creek valley (e.g., at Natukalevu) on Yalavou blocks on advice from the extension officers. I believe the suitability of this grass is questionable, based on the manner of it's growth at the Nacocolevu research station (F.O., 1998-1999). It spreads vigorously via stolons in fertile and moist

conditions, and although good for grazing, it may become invasive and be difficult to control in gardens, adding risk and cost to the most important means of livelihood in the region, especially on *bila*. On enquiry, the local advisors discounted the risk associated with the destructive aspect of the grass (it had not grown well on poorer sites near Nacocolevu) (F.I., 1998-1999), but to some extent, the plantings were locally experimental. Caution should be exercised because another experimental grass, *mauniba*, quickly spread to change the whole grassland landscape and ecology in the 1920s.

Species introductions such as these are based on a specialised technocentric approach (Amanor, 1994, p. 7). As a consequence they carry risks (Scoones, 1996) of higher costs and thus less resilience in other parts of the whole-farm agroecosystem (Norgaard, 1984), which is often discounted by the self-interest of over-specialised extension services (Chambers, 1993). There is a need for a more 'whole-farm' approach to agricultural extension, as advocated by Thaman (1988b).

In summary, pasture development has not effected the vegetation cover of Navosa to any appreciable extent since the introduction of *mauniba* in the 1920s, but there is a risk that new introductions could negatively affect the more important cultivated areas and reduce livelihood sustainability.

Yaqona and dalo production

The production of *yaqona* may be a good example of sustainable development where the development of an indigenous crop helps the environment. *Yaqona* is planted on steep slopes that are normally stable but can be erosion-prone when under stress. *Yaqona* is harvested on average only about every four years. During the intervening years, low ground cover and the *yaqona* canopy prevent erosion. *Yaqona* is sometimes planted under the light shade of *vaivai* and other protective trees, and intercropped, especially on drier sites. It is only when individual bushes are uprooted during harvesting, especially during the

dry to wet season transition period, that the soil is disturbed and erosion is possible. Because the general area is uncultivated, the risk is confined to the site where the hillocks were disturbed.

Because *yaqona* needs moist fertile sites and shelter from wind, the preferred garden areas for *yaqona* are head of creek areas and confined sites cut among moist native forest. Thus, there is a strong incentive to maintain soil fertility and conserve forest as protection for *yaqona*.

There is also an incentive to preserve forested headwaters for the production of *dalo*, which also demands moist sites.

PHOTOGRAPH 18. *Yaqona* and *dalo* in head-of-creek area at Nasaunokonoko.

In other cases, however, *dalo* is planted on cultivated areas after the soil has been loosened with animal-drawn implements. On steeper sites, severe erosion may occur as a result of adoption of this method. At present the number of sites cultivated in this manner and under threat of erosion was not large but the technique seems to be spreading with the introduction of plough tillage in hilly areas and may cause

significant erosion in the future. In this example, development, as the increased use of more sophisticated technology, is leading to increased erosion, the reverse of conservation. The use of vetiver or contoured agroforestry techniques on these sites is likely to be necessary for sustainability.

Pine plantations

The establishment of plantations of predominantly *Pinus caribaea* has been a feature of development in Navosa. Planting was requested and cooperatively carried out by local communities following the promotion of community forestry by the Forest Service. They are the first plantations in Navosa and thus are an experimental form of land use. They are best described as a hybrid of indigenous and planned development involving both economic and ameliorative purposes. They are not a strong example of economic development because they produce low earnings, and their introduction may reflect political ends (Peluso, 1992; Qalo, 1993). Most of these plantations are of a relatively small size, and the economics of harvesting them for sale is marginal. Nevertheless, these plantations are an example of development that is generally regarded as having an ameliorative benefit in Navosa because they protect the soil and serve to prevent erosion, and are partially fire resistant when mature. The fire resistance is important because it reduces the danger to the community of a large-scale forest fire.

They have some ecological drawbacks. In some cases (in other nearby regions) pine plantations have degraded head-of-creek and garden areas, and affected water supplies by drying-up the water source, a side-effect of high evaporation rates (Waterloo, et al., 1999). This has been avoided in Navosa where the relatively small plantations have been sited on ridges and slopes below the sensitive head of creek areas.

The nitrogen dynamics of soils occupied by *Pinus caribaea* are relatively slow (Smith, et al., 1998, p. 203), and when soils are of low fertility, there is a risk of nutrient depletion in future rotations (Kadeba,

1994). In addition, there are qualified reports of surface soil toxicity associated with polyphenol compounds from fallen pine needles (Gosz, 1984), and a decline in other soil nutrients (Cornforth, 1970; Evans, 1992, p. 345).

Thus, *Pinus caribaea* is not suitable for interplanting with garden crops, and may take land out of the swidden cropping cycle. There is a need for research on alternative dry climate species that produce quality timber and integrate better with cropping.

In some circumstances community-based forestry plantations have been captured by elites, leading to local inequalities (Klooster, 1999). This was not reported to be common in Navosa (F.I., 1998-1999). It was observed, however, that in situations where *Pinus caribaea* proved to be a hindrance to local livelihoods, plantations were destroyed, either by logging, or especially in their early years, by fire (already a common occurrence, F.O., 1998-1999; Were, 1997).

Thus, apart from *yaqona* cultivation and afforestation, most forms of economic development have not lessened the degradation of the environment, and in many cases have served to hasten land degradation.

A Sustainable Vanua: Land, Culture and Society

The common land and waterways of Navosa are the basis of the *vanua*. How sustainably does the local cultural system articulate with the land?

Degradation of the commons

In Navosa, increasing populations of animals and people are putting increasing pressure on natural resources, especially forest and grazing resources. These particular resources are associated with the commons (Blaikie and Brookfield, 1987a), or clan territory (Ward, 1995). Unlike house foundations, garden areas, or certain trees planted by an individual, which have clear and relatively inalienable associations with particular households, the commons is shared by all members of the

village, and may have external or contested 'ownership'.[41] In old Fiji, '... land as land had no value. Its value arose only from its potential produce' (Thomson, 1908, p. 364). This description, changed to present tense, is still true in traditional areas as Navosa, especially evident in Nasauvakarua.

Most of the commons land surrounding villages is subject to controlled-access, under the management of the village council. The council decides where animals are to be grazed, and where and when the rivers and creeks can be fished, and articulates agreements with neighbouring villages. These are practices that can be easily observed, and policed as necessary. However, one response to heightened demand for resources is to burn more land, for example, for grazing or *vitua*. The occurrence and degree of burning is very difficult to control, and a small minority of villagers burn excessively (F.D., 1998-1999; F.I., 1998-1999). In these situations, the community lands may be under threat. The condition of high population growth rates (different from high population density) appears to be present which can exacerbate this trend (Paarlberg, 2000, p. 175). One knowledgeable local resource expert, reflecting Hardin's (1968) allegory, deemed the management of natural resources in Navosa as increasingly akin to a 'tragedy of the commons' (F.I., 1998-1999). Caution is needed, however. Hardin's allegory is effective in inciting concern about a troubling situation, but 'one of the greatest tragedies of recent times has been the degree to which Hardin's 'tragedy of the commons' has been accepted' (Young, 1992, p. 97). It is commonly misinterpreted to describe common property regimes, rather than open-access situations. As a result, simplistic and destructive recommendations have been made for the conversion of local common property regimes to private or state management regimes (Young, 1992,

[41] Because individual households have inalienable use rights to *teitei* and other resources of the land, and land title cannot be sold, titled ownership is unimportant from a cultivators perspective, but very important to those high-ranking chiefly classes who receive rents from the land.

p. 97). Hardin's analogy describes an uncontrolled open-access situation, which is most appropriate to certain oceanic fishing contexts (Berkes, 1989), but not to communally-controlled grazing situations where the possibility of exclusion (by communal management) applies (Feeny, et al., 1990).

At the local level, the actual process of the degradation of the commons can be outlined in this way: the penetration of the commercial economy reduces linkages and solidarity within traditional family units, with the result that social transactions are increasingly practised as contractual rather than cooperative events. As a result, communal institutions are undermined and are replaced by an emerging class structure. Under these circumstances, the weakening of traditional communal institutions leads to a reduction in the effectiveness of management at the local level (Abel, et al., 1985; Blaikie and Brookfield, 1987b, p. 195). This reasoning closely describes the gradual process of change that is currently occurring in Navosa, as described in the previous chapter, which leads to reduced resilience and sustainability in the *vanua*. This process is more apparent at Nawairabe, adjacent to the Yalavou project, than at Nasauvakarua, but there are many difficulties in trying to compare different cases (Agrawal, 2001). The large number of factors involved (Agrawal suggests 35), has so far prevented the construction of an empirically-based theory of common property, which makes prediction haphazard, but Agrawal (2001) believes that progress is being made. A better understanding of the causal factors involved in the degradation of common property resources could provide important insights into how degradation can be prevented.

Sustainable livelihoods

Navosa is a place where livelihood security has been beneficent in the past, and has not been seriously questioned until now. The *vanua* has always provided (F.I., 1998-1999). However, increasing populations and greater human exploitation are leading to land and waterway degradation, which is lowering the resilience of the *vanua*, which in turn is a threat to the sustainability of existing livelihoods, as discussed in the previous chapter. This process is predicted to become worse in the coming decades, especially in the hill regions (F.I., 1998-1999).

Possibilities for Improved Sustainability

What are the possibilities for improving sustainability in Navosa? A reduction in the amount of burning is an essential first step to improving the resilience and sustainability of the *vanua*. Reduced burning and longer fallowing times would allow the better regeneration of vegetation necessary to enhance soil fertility (Nye and Greenland, 1960), and allow the regeneration of plant and tree species important to local livelihoods. The control of fires would also allow the development of agro-arboriculture, agroforestry and plantations in areas not presently forested. The control of burning would also allow the construction and maintenance of better quality fences, which would reduce the amount of garden destruction caused by domestic and feral animals. All of this would help prevent erosion and serve to maintain or improve waterways and fisheries.

An agricultural technique that may become feasible with population increase and further intensification is irrigation, especially when combined with terracing, as in the past. There is scope for the introduction of new techniques for water transport such as those involving flexible and robust alkathene (polythene) pipe. The traditional techniques of canals and timber aqueducts are generally no longer practical (except in small, well-fenced, cases) because of the danger of

damage by animals.

Most importantly, there needs to be comprehensive research on how the structure and function of the existing customary and bureaucratic common property institutions can be improved to meet the new challenge of land degradation, and policies should be developed to address the current failings in these institutions.

Summary

Economic development per se has not led to environmental conservation in Navosa, and instead, the evidence suggests that ongoing economic development is leading to the deterioration of the environment as more people exploit the land along existing patterns to a greater degree. In particular, the extractive logging of native forest has had a negative impact on the *vanua* by destroying the natural resources on which livelihoods depend and inciting social division. The demand for nonlocal commodities and services, and increasing population levels, are exacerbating land degradation, and there is a lack of planned environmental amelioration to compensate for the increased exploitation of resources.

I have argued that local indigenous development, as practised in the past and the present, features significantly in Navosa, and may be the least destructive form of development. *Vuci,* first developed many centuries ago, represent an innovative and sustainable form of development based on landesque capital that still exists. This method of production is still favoured in certain contexts, especially during drought and when *dalo* prices are high, and some Navosa villages requested help to re-establish their *vuci* systems.

Although structural changes have been made at crucial political junctures in the past, there has been little overt change to social and leadership institutions since the time of independence in 1970. Local institutions have gradually been undermined by a process of increased

liberalisation following cultural change since independence (F.I., 1998-1999). Village elders often commented on post-independence social liberalisation in negative terms, and blamed the trend towards greater leniency for the increase in land degradation. In their experience, land management had become more difficult as social organisation had become more liberal.

The role of planned development has been spasmodic and relatively insignificant. Education has been encouraging modernisation and ideological change, although without insufficient attention to environmental conservation. Programs for social and environmental amelioration have been mostly absent in the last decade.

Thus, the ability of the *vanua* leadership to control and manage their land has declined. There has been a parallel trend, but in the opposite direction, towards laissez fairre attitudes by some villagers who treat the commons as an open resource without regard for sustainability. Together, these changes interact to reinforce the recent trend towards greater land degradation caused by the exploitative and destructive aspects of economic development and modernisation.

The Brundtland policy for sustainable development (WCED, 1987) would not be appropriate in Navosa. Instead, it would almost certainly exacerbate the existing imbalance of economic development over the environment, and be counterproductive by damaging important common property institutions. Instead, environmental amelioration is required to balance the destructive effects of economic development.

Indigenous development, however, reflecting an inherent degree of environmental and livelihood concern associated with *vanua* (Batibasaqa, et al., 1999; Crosby, 2002), can serve as a foundation for environmental amelioration in an effort to help protect valuable sensitive environmental zones with conservation (Jolly, 1992; Overton, 1999b; Raine, 1998; Weaver, 1996).

In the short-term, wise development strategies aimed at reducing

land degradation and enhancing the existing social and environmental resources would be welcome at most villages. Education for sustainable land use is needed. Leadership institutions and governance of the environment need urgent attention. If economic growth is to be sustainable, then strategies for social and environmental amelioration must be implemented to ensure that livelihoods can be maintained for future generations.

CHAPTER NINE

CONCLUSIONS

SUSTAINABILITY

Sustainable development involves environmental, economic (livelihood) and sociocultural aspects. What has been found in Navosa is that the environment has been degraded by a range of different factors, including those initially associated with extralocal cultural demand and exploitation, such as the creation of rangeland and the extraction of commercially valuable native timber. The environment was also being stressed by the livelihood strategies of increasing, and increasingly commodified, local populations, leading to an escalating and increasingly unsustainable exploitation of resources. A rise in the animal population, especially cattle, is exacerbating the need to fire the land to produce young shoots for fodder. Excessive uncontrolled burning at the end of the dry season is leading to unprotected soil and severe erosion occurs when heavy rain falls at the beginning of the wet season. The removal of trees and logging exacerbates erosion. The sustainability of aquatic resources (fish, prawns and eels) in creeks and rivers is becoming threatened. Navosa people express general consternation about the burning practices which negatively affect their livelihoods. The fire regulations are ineffectual. A minority of householders in each village are known to be associated with excessive burning.

Changes to the social structure since independence (e.g., increasing orientation to markets) have negatively effected the village leadership. The resources made available to local *turaga* (chiefs) have declined and they can no longer maintain the strict control they once had. The shift in the responsibility for policing of fires from *turaga* and fire wardens to the police has had a negative impact, with virtually no prosecutions for damaging conflagrations, and virtually no constraining effect. In Navosa,

the police are unsuitable for this function partly because: (a) they are not quickly accessible (enforcement needs to be locally-available near villages), (b) some of their other duties conflict with the maintenance of good communications with the *turaga-ni-koro* and other leaders, and (c) they are understaffed. The role of education is crucial also. Local knowledge is represented inadequately in the national curricula. Very little is taught to the children about conservation of the unique local environment. Part of the problem is that the curricula is commonly developed in the moist climate of the eastern centres such as Suva where the issue of uncontrolled fires is not important. The curricula needs to have a local conservation component. In general, the concerns of Navosa have not been adequately attended by the Suva-based institutional system which is politically dominated by indigenous leaders representing eastern Fiji.

On the other hand, the local cultural system has remained relatively stable and sustainable (despite the decline of the natural resource base), partly because the historic and involuted socio-political structure (which has been selectively maintained by chiefly self-interest), favours the continuation of traditional indigenous identity. Aspects of the traditional system that favour sustainability include: indigenous agronomic knowledge and practice, an illegal but flexible and locally-based *(vakavanua)* land tenure system that works in parallel with the official NLTB system, and an emphasis on community sharing in Navosa villages through ritual means: especially *tovo vakavanua (solevu, kerekere)*, village work parties, and also some religious institutions.

Thus, my view is that Navosa has maintained a sound system of cultural sustainability despite a hegemonic, rigid and inadequate social structure, partly because of its beneficent base of natural resources and relatively low populations. However, increasing human and animal populations, and especially increasing commodification, are now beginning to stress the base of natural resources, and sustainability is

threatened.

Sustainable Development?

How can sustainable development be of value in this context? First, an attempt has been made to show that it is important to understand the role of social and environmental change in the past and during the present. The development history in Navosa has involved a set of changes where both agricultural intensification, disintensification, and induced degradation has occurred. The evidence indicates that the first settlers practised a mixture of swidden agriculture together with the opportunistic use of particular ecological niches such as wetlands. Later, irrigated, terraced agriculture became common, and was practised on a large scale in the hinterland of Navosa. This method involved the construction of landesque capital (terraces and waterworks), which ensured that a sustainable supply of *dalo* could be produced in most seasons in particular locations, with a minimum of disruption to the local environment.

The arrival of British colonialism led to many changes, some of which were based on attempts to enforce political control over Navosa, and some to serve colonial needs. All exhibited a British colonial strategy of attempting to reproduce the characteristics of Britain or its colonies in Fiji under a policy of diffusion. Some have had a large impact on Navosa: the resettlement of villages away from the hinterland, the introduction of *mauniba* (mission grass), the introduction of cattle and horses, large-scale logging, and the increasing impact of a capitalist market economy. Some of these changes have been destructive, in the whole (e.g. *mauniba)* or in parts (e.g., logging) to the local *vanua* and have inconvenienced many people, and have undermined environmental resilience and hence sustainability.

Although no longer under colonial duress, the process of Fijian development still often functions as a process of imbibing (through

diffusion) the model of high energy consumption 'developed' regions (where, paradoxically, the energy infrastructure is less efficient).

There is a tendency for agents of overseas development to promote their external model of development without adequately listening to the concerns of local people, or understanding the local context. Because they do not articulate adequately with the local context, they tend to view the project field as a 'blank slate' upon which they can impress their knowledge. As a result they frequently overlook the historical evidence that there is an indigenous development process already occurring. Their efforts at development frequently clash, rather than articulate, with indigenous development, and their efforts fail. This has been the outcome of many large-scale Navosa development projects of the past.

The neocolonial government continues with a process of economic growth and modernisation, now in neoliberal dress. But the system shows evidence of a palimpsest of discretionary class influence. For reasons of ethnic politics, and to ensure the continuity of indigenous tradition (and their own interests), the Fijian leadership continues to protect village communities from unrestrained interaction with the neoliberal market system. By doing so, the leadership has served to maintain some aspects of custom that enhance (particularly cultural) sustainability. But it has also failed to improve the effectiveness of local leadership institutions. It has also ignored (over decades) repeated expressions of concern about the decline in the resilience, productivity and sustainability of the natural resource base in specific areas. In order to improve the sustainability of the resource base, the institution of local leadership needs to be revitalised, together with a strategy of participatory education and awareness for the better management of what are now becoming, in many places, fragile lands and fragile *vanua*.

Looking to the Future

For development to be sustainable in Navosa it must encourage socio-environmental amelioration to offset the degradation associated with economic development, and to this end, local participants expressed their desire for particular conservation strategies. These included better control of fire, more and improved fencing, and afforestation. The latter is desired in specific places, but the existing dryland plantation species integrate poorly with indigenous cropping, and research is needed to find species that will sustainably enhance both livelihoods and the environment.

Livelihood alternatives that preserve the environment may help. Agroforestry, or more correctly, agro-arboriculture systems are already used to effect in Navosa, and their beneficial effects should be promoted. The revegetation of degraded land with fire-resistant forest species that integrate well with village crop systems is highly desirable, as is the development of improved fencing systems.

A possibility for the future is suggested by the model of 'progressing with the past' (Clarke, 1977; Clarke, 1978; Overton, 1993), in particular the development of irrigated terracing systems which once existed in Navosa. This approach is relevant given that landesque capital (old terraces) already exist and that population levels are intensifying. The incorporation of new technologies has already proven effective in the innovative local development of 'hybrid' irrigated terraces, which have overcome some of the limitations of traditional systems in a changed environment.

Ultimately, however, the best development is that which sustains the already existing resources, and to this end, a reduction in the excessive uncontrolled burning of the vanua is the first priority.

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APPENDIX ONE

QUESTIONNAIRES

1. Navosa Regional Questionnaire

1. Why is the land burned? (or, what are the reasons for burning the land?). (List as many reasons as possible, then show how important each is by scoring the cards with the *vesi* seeds).

2. What part of the land that gets burned is because of carelessness or accident? (Show this on the device).

3. What is most important for you in [your village]?
   a *Kakana* (cultivated food)
   b *Lavo* (money)
   c *Tovo vakavanua, solevu* (customary ways)
   d *Lotu* (church)
   e *Na kena taqomaki na yau bula me baleti ira na noda kawa* (safeguarding natural resources for future generations)
   f *Manumanu* (animals)

   (Score the cards with the *vesi* seeds).

4a. How does repeated burning affect the land?

4b. What should be done about land degradation?

5. Which is the most important?

K *Kakana* (cultivated food)

KV *Kakana ni veikau* (wild food)

G *Gunu* (drinkables)

GV *Gunu ni veikau* (wild drinkables)

(Score the cards with the *vesi* seeds).

6. Which is the most important to you?

V *Mataqali* (clan)

W *Tokatoka, beto/bito* (subclan)

X *Koro* (village)

Y *Lotu* (church)

Z *Vuvale* (household)

(Score the cards with the *vesi* seeds).

7. Show how important each category (card) is?

a *Solevu, kerekere* (a distinctive economic ethic of reciprocity and mutual assistance)

b *Veilomani vaka veiwekani* (a sense of kinship with fellow beings)

c *Vakarokoroko taka/doka na yau bula* (a reverence for creation as a whole)

d *Na kena taqomaki na yau bula me baleti ira na noda kawa* (a sense of commitment to safeguard all natural resources for future generations)

e *Lewe ni vanua, gonedau, mataisau, turaga ni vanua* (a sense of responsibility and stewardship for the way the gifts of nature are used)

f *Na tabu kei na mana ni vanua* (a sacred regard for the whole of nature and its responsibilities as being gifts from god)

(Score the cards with the *vesi* seeds).

2. Village Household Questionnaire

(i). Record interview number, name of *vuvale* (household), gender of main participant, date, time, and notes.

PART A. CENSUS

1. How many persons in the *vuvale* (household)?
2. How many elderly (over 55) females and males?
3. How many adults (30-54) females and males?
4. How many young adults (16-29) females and males?
5. How many schoolchildren (7-15) females and males?
6. How many young children (0-6) females and males?
7. How many people are temporarily absent?
8. What is your *mataqali* (clan)?
9. What is your *tokatoka/beto/bito* (subclan)?
10. Are you from [Nasauvakarua/Nawairabe], or another village?
11. Does anyone in the household have a bank account (No or Yes)?
12. What religious group do you belong to?

PART B. AGRICULTURAL CENSUS

1. How many *ose* (horses) does the household have?
2. How many *bulumakau* (cattle) does the household have?
3. How many bullocks does the household have?
4. How many *vuaka/vorei* (pigs) does the household have?
5. How many *toa* (poultry) does the household have?
6. How many *me* (goats) does the household have?
7. How many *vuaka/vorei* (wild pigs) does the household catch each year?
8. How many *ixa* (fish) (including *ura* (prawns) and *duna* (eels)) does the household catch each year?
9. How many *vitua* (wild yams) does the household collect each year?

10. How many bags of *kari* (turmeric) does the household collect each year?
11. Are there other wild foods collected?
12. How many *teitei* (including *bila)* (gardens) does the household have?
14. Are any fertilisers used? If yes, what are they, how much is used each year, and for what crops?
13. List the area of each *teitei/bila* (gardens) with the crops that are grown on each *teitei/bila.*
15. Does the household keep *tui* (dogs) for hunting *vorei* (pigs)? If yes, how many?
16. Are there any chemicals used with the *teitei/bila* (gardens)? If yes, what are they, how much is used each year, for what crops, and what protection is used?
17. How many *beka* (bats) does the household collect each year?
18. Are there any times when not enough people are available to help with the *teitei* (gardens)? If yes, how many extra persons are needed, when, and for what purpose?

PART C. FOOD SECURITY

1. Name the important *kakana* (cultivated food) that your household grows and uses?
2. How many square chain (or trees) of each do you plant each year? (Cross-check with Question B13).
3. Name the important *gunu (gunuvi,* drinkables) that your household uses?
4. How many square chain (or number of trees/plants) of each do you plant each year?
5. What are the best foods after a *cagilaba* (cyclone)?
6. What are the best foods during a drought?
7. Are there things that could be done to help in times of drought?

8. How much *tavioka* (cassava) is harvested for the *vuvale* (household) each week?

PART D. IMPORTED FOOD ITEMS

1. How many kilograms of flour does the household buy each year?
2. How many kilograms of rice does the household buy each year?
3. How many kilograms of sugar does the household buy each year?
4. How many kilograms of dahl does the household buy each year?
5. How many kilograms of salt does the household buy each year?
6. How many litres of cooking oil does the household buy each year?
7. How many tins of canned fish does the household buy each year? (mackerel or tuna?)
8. How many tins of canned beef does the household buy each year?
9. How many drums of kerosene does the household buy each year? How much is used for cooking?
10. How many kilograms of gas does the household buy each year?
11. What other important items are bought, and how much of each?

PART E. FIRE

1. Why is the land burned? (or, what are the reasons for burning the land?).

   (List as many reasons as possible, then score the cards with the *vesi* seeds).

PART F. SOCIOCULTURAL, ENVIRONMENTAL AND LIVELIHOOD VALUES

1. What is most important for you in [Nasauvakarua/Nawairabe]?
   a *Kakana* (cultivated food)
   b *Lavo* (money)
   c *Tovo vakavanua, solevu* (customary ways)
   d *Lotu* (church)
   e *Na kena taqomaki na yau bula me baleti ira na noda* (safeguarding natural resources for future generations)
   f *Manumanu* (animals)

   (Score the cards with the *vesi* seeds).

PART G. CULTURAL ECOLOGY

1. How many *solevu* (customary gatherings) does the household attend each year?
2. How many of the *vuvale* (household) animals are killed for *solevu* (customary gatherings) each year? Which animals are used?
3. List the totems of your *mataqali?* Mention any differences between *tako/lavo* (generation groups) or *tokatoka.*

PART H. ENVIRONMENT

1. What are the main *vei ka bula* (environmental) problems that concern future generations? (List as many reasons as possible).
2. How do you care for the *vei ka bula* (environment) for future generations? (List as many reasons as possible).
3. Which *vuvale* (households) in [Nasauvakarua/Nawairabe] care best for the *vei ka bula* (environment), and why? (Select the cards, and explain why each household is chosen).
4. Which *vuvale* (households) in [Nasauvakarua/Nawairabe] damage the *vei ka bula* (environment) the most, and why? (Select the cards, and explain why each household is chosen)

5. There are *vuvale* (households) for these *mataqali* in [Nasauvakarua/Nawairabe]. Which care best for the *vei ka bula* (environment)? (Score the cards with the *vesi* seeds).
6. What part of the land that gets burned is because of carelessness or accident? (Show this on the device).
7. How does repeated burning affect the land?
8. What should be done about land degradation?

PART I. WEALTH

1. These are *mataqali* (clans) in [Nasauvakarua/Nawairabe]. Which are the most wealthy? (Score the cards with the *vesi* seeds).

PART K. SOCIAL-POLITICAL GROUPS

1. Which is the most important to you?
   - V *Mataqali* (clan)
   - W *Tokatoka, beto/bito* (subclan)
   - X *Koro* (village)
   - Y *Lotu* (church)
   - Z *Vuvale* (household)

(Score the cards with the *vesi* seeds).

PART J. VANUA

1. Show how important each category is?
   - a *Solevu, kerekere* (a distinctive economic ethic of reciprocity and mutual assistance).
   - b *Veilomani vaka veiwekani* (a sense of kinship with fellow beings).
   - c *Vakarokoroko taka/doka na yau bula* (a reverence for creation as a whole).
   - d *Na kena taqomaki na yau bula me baleti ira na noda kawa* (a sense of commitment to safeguard all natural resources for future generations).

e *Lewe ni vanua, gonedau, mataisau, Turaga ni vanua* (a sense of responsibility and stewardship for the way the gifts of nature are used).

f *Na tabu kei na mana ni vanua* (a sacred regard for the whole of nature and its responsibilities as being gifts from God).

(Score the cards with the *vesi* seeds).

PART L. FOOD SOURCE

1. Which is the most important?

K *Kakana* (cultivated food)

KV *Kakana ni veikau* (wild food)

G *Gunu* (cultivated drinkables)

GV *Gunu ni veikau* (wild drinkables)

(Score the cards with the *vesi* seeds).

APPENDIX TWO

QUESTIONNAIRE TECHNIQUES

1. Regional Questionnaire Techniques

Question One

Why is the land burned? (or, what are the reasons for burning the land?). (List as many reasons as possible, then show how important each is by scoring the cards with the vesi seeds).

This question was always presented as an open question. As answers were received, they were written down in Fijian language using large print with a black medium felt-tip pen on cards (size 105 x 100mm) cut from orange-coloured cardboard. In the top-right corner of each card I wrote a small letter (a, b, c, etc) using a ball-point pen to identify each card for recording purposes.

Normally each participant would give 3 to 7 reasons for why the land was burned: the reasons given are in Appendix Three (see p. 456). After the last reason was given, the (3-7) cards representing each reason given were placed in a horizontal row on the ground in front of the participants in order that they could score the cards for importance. Tokens (*vesi* tree seeds) were then placed between the participants and the line of cards according to the following criteria. Ten (10) tokens were given for each card chosen. For example, if there were 3 cards then 30 seeds were placed; if there were 7 cards placed then 70 seeds were placed. *Vesi* tree seeds are of typical leguminous shape, approximately 2-2.5 cm in diameter and brown-coloured. For speed and efficiency I used different-coloured small plastic bags already prepared and labelled to contain 30, 40, or 50 seeds. I added seeds from another bag if I needed 60 or 70 seeds. The bags were emptied in a heap in front of the participants.

The participants were then asked to show how important each reason was by scoring the cards with the *vesi* seeds. The participants would move the seeds from the heap and distribute them in groups in front of each card. They would put more seeds in front of the important reasons and less seeds in front of the lesser reasons.

When finished, each group of seeds was counted and I recorded the score with the code number from the adjacent card (a, b, c, etc) in my notebook as they were called out by the person counting. Often the participants and myself would help count the seeds in addition to the translator.

Finally I would check for discrepancies by totalling all of the scores in my notebook which should amount to the number of seeds given. This is important because sometimes the seeds would be lost (e.g., under the mat), or miscounted, leading to a discrepancy between the number given and the number counted. For example, in this case the sum should be fifty:

a	5
b	10
c	7
d	13
e	15
Total	50.

After the initial evaluations, most of the participant's answers to the open questioning will match previous reasons represented on the set of cards already held, which are simply reused as needed. New cards will be made only occasionally when a new reason is given. I made 13 cards in response to various answers at different villages. Sometimes a reason is given which is close to a card already held. In these cases further discussion would clarify whether a new card should be made or whether the reason was not different enough to warrant a new card. The criteria I used was that if the reason was subordinate to another more general

reason already represented by a card, then I did not allow it, but made notes for my journal. If, however, the reason stood by itself then I would make another card.

From the cumulated figures a score of the importance of each reason can be obtained and numerical averages worked out at a later date.

The main advantages of this novel technique are: (a) open questioning allows for local participant-driven, context-driven and novel answers, and (b) a quantitative relation between categories is obtained which is an improvement on the ranking methods most often used.

Question Two

What part of the land that gets burned is because of carelessness or accident? (Show this on the device).

Note that this (closed) question was not intended to measure the total amount of land that was burned, but measures the percentage of burned land that was the result of carelessness or accidents. It was considered that 'carelessness' and 'accident' had different meanings in the local context and so care was taken to include both terms in questioning. The difference between controlled and uncontrolled burning is another related although more general concept. Although the answers can be interpreted in these terms, the question was not asked in terms of controlled or uncontrolled burning because the question would be less in the vernacular, less specific, and would involve the use of a negative in the term 'uncontrolled'. Negative terms invite censure and have been avoided.

In order to ascertain the proportion of burned land that was the result of carelessness or accidents a device (termed a firewheel) based on the principle of a movable pie chart was invented and constructed from two different coloured pieces of cardboard and a paper pin bought at a local town. This visual device was designed to overcome the circumstance where most of the participants were unfamiliar with the concept of percentages in verbal terms. Marks and numbers representing

percentages were discretely placed around the circumference of the device to enable the researchers to interpret and record a quantitative score from this device, but the proportions that the participants worked with were indicated and given by the ratio of red cardboard showing against the yellow cardboard background.

The participants were shown how to use the device by rotating the foremost sheet of cardboard against the background piece. The translator demonstrated how the participants could use the range from none (0%) to all (100%) by rotating the device from one extreme to the other and finally presenting the device to the participants set at 50 percent. The participants adjusted the device to answer the question. Tests showed that the initial setting did not effect the participants' scoring if the device was fully explained in this way.

After the participants had completed the task, the percentage estimate was read from the rim of the device and recorded in a notebook. The scores were later averaged across participant groups to obtain region-wide scores.

Question Three

What is the most important for you in [your village]?

a *Kakana* (cultivated food)

b *Lavo* (money)

c *Tovo vakavanua, solevu* (customary ways)

d *Lotu* (church)

e *Na kena taqomaki na yau bula me baleti ira noda kawa*
(Safeguarding natural resources for future generations)

f *Manumanu* (animals)

This (closed) question compared categories chosen to represent some sociocultural, livelihood and environmental values that interested the researcher. The particular categories were chosen (by the researcher) after dialogue with the local translator in order to ascertain the important local features. The main purpose was to evaluate the potential

for sustainability across generations by comparing this concept with other locally important livelihood categories.

The categories were written down in Fijian language using large print with a blue medium felt-tip pen on six cards (size 105 x 100mm) cut from pink-coloured cardboard. In the top-right corner of each card I wrote a small letter (a, b, c, d, e, or f) using a ball-point pen to identify each card for recording purposes.

The six cards representing each category were placed in a horizontal row on the ground in front of the participants in order that the participants could score the cards for importance.

Sixty *vesi* seeds (emptied from the plastic bag used to carry them) were then placed in a heap between the participants and the line of cards.

The participants were then asked to show how important each category was by scoring the cards with the *vesi* seeds. The participants would move the seeds from the heap and distribute them in groups in front of each card. They would put more seeds in front of the important categories and less seeds in front of the lessor categories.

The remainder of the procedure is the same as for question one.

Question Four

How does repeated burning affect the land?

This was an open question that invited discussion. However, participants usually gave answers in single sentence form without much discussion. These answers were recorded in a notebook in qualitative form.

Certain common themes were central to this collection. As a result the researcher has post hoc coded and categorised the data into common themes that can be compared quantitatively. These results are available from the researcher on asking.

Question Five

Which is the most important?

a *Kakana* (cultivated food)

b *Kakana ni veikau* (wild food)

c *Gunu* (drinkables)

d *Gunu ni veikau* (wild drinkables)

This (closed) question compares the importance of local subsistence livelihood categories. It was expected that these categories will relate to variations in local resource availability determined by reference to other data. The explicit relation between resource availability and resource use or importance was not tested here.

These categories were chosen by the researcher after dialogue with the local translator and local experts. They reflect the region's relatively traditional cultural knowledge. An alternative framework, introduced with the English language, is becoming more prevalent, especially at the government centre of Navatumali. The traditional categories were generally, but not unequivocally, understood, and clarification by the translator was necessary with a few participants. For example, questions were asked by participants about certain resources which crossed semantic margins (rather like the categorisation of tomato is debated in Anglo cultures), and the translator gave advice about how they were to be categorised.

The categories were written down in Fijian language using large print with a green large felt-tip pen on four cards (size 150 x 105mm) cut from yellow-coloured cardboard.

The four cards representing each category were placed in a horizontal row on the ground in front of the participants in order that the participants could score the cards for importance.

Forty *vesi* seeds (emptied from the plastic bag used to carry them) were then placed in a heap between the participants and the line of cards.

The participants were then asked to show how important each category was by scoring the cards with the *vesi* seeds. The participants would move the seeds from the heap and distribute them in groups in front of each card. They would put more seeds in front of the important categories and less seeds in front of the lessor categories.

When finished, each group of seeds was counted and I recorded the score directly against the four book codes (K, KNV, G, GNV) for the different categories in my notebook as they were called out by the person counting. Often the participants, and myself, would help count the seeds.

The remainder of the procedure is the same as for question one.

Question Six

Which is the most important to you?

V	*Mataqali*	(clan)
W	*Tokatoka, beto/bito*	(subclan)
X	*Koro*	(village)
Y	*Lotu*	(church)
Z	*Vuvale*	(household)

This (closed) question compares the importance of some local social group categories. The particular categories were chosen by the researcher following their historical and cultural importance, with advice from the translator. The aim was to find out the relative importance of these social groups among the participants.

The categories were written down in Fijian language using large print with a black medium felt-tip pen on five cards (size 150 x 105mm) cut from plain cream-coloured cardboard. In the top-right corner of each card I wrote a small letter (V, W, X, Y, or Z) using a ball-point pen to identify each card for recording purposes.

The five cards representing each category were placed in a horizontal row on the ground in front of the participants in order that the participants could score the cards for importance.

Fifty *vesi* seeds (emptied from the plastic bag used to carry them) were then placed in a heap between the participants and the line of cards.

The participants were then asked to show how important each category was by scoring the cards with the *vesi* seeds. The participants would move the seeds from the heap and distribute them in groups in front of each card. They would put more seeds in front of the important categories and less seeds in front of the lessor categories.

The remainder of the procedure is the same as for question one.

Question Seven

Show how important each category (card) is?

a *Solevu, kerekere* (a distinctive economic ethic of reciprocity and mutual assistance)

b *Veilomani vaka veiwekani* (a sense of kinship with fellow beings)

c *Vakarokoroko taka/doka na yau bula* (a reverence for creation as a whole)

d *Na kena taqomaki na yau bula me baleti ira na noda kawa* (a sense of commitment to safeguard all natural resources for future generations)

e *Lewe ni vanua, gonedau, mataisau, Turaga ni vanua* (a sense of responsibility and stewardship for the way the gifts of nature are used)

f *Na tabu kei na mana ni vanua* (a sacred regard for the whole of nature and its responsibilities as being gifts from God).

This (closed) question compared certain philosophical (or ideological) and cultural value categories associated with the Fijian concept of *vanua* (Batibasaqa, et al., 1999). The main concern was to compare the various aspects for importance, and particularly to evaluate the importance of the category that represented the potential for safeguarding natural resources for future generations.

The categories were written down in Fijian language using large print with a green medium felt-tip pen on six cards (size 150 x 105mm) cut from yellow-coloured cardboard. In the top-right corner of each card I

wrote a small letter (a, b, c, d, e, or f) using a ball-point pen to identify each card for recording purposes.

The six cards representing each category were placed in a horizontal row on the ground in front of the participants in order that the participants could score the cards for importance.

Sixty *vesi* seeds (emptied from the plastic bag used to carry them) were then placed in a heap between the participants and the line of cards.

The participants were then asked to show how important each category was by scoring the cards with the *vesi* seeds. The participants would move the seeds from the heap and distribute them in groups in front of each card. They would put more seeds in front of the important categories and less seeds in front of the lessor categories.

The remainder of the procedure is the same as for question one.

2. Village Household Questionnaire Techniques

Prologue

The name of the *vuvale* (household), gender of the main participant, date, time, and notes were recorded on the opening page of the questionnaire notebook with a unique number for identifying each interview.

Part A. Census

There were twelve closed questions in this section that asked about household population and composition, social, geographical and religious group identity, and financial development.

Part B. Agricultural census

Eighteen questions were asked about various agricultural activities that relate to sustainable development. Many of these questions were closed but there were some open questions and some semi-structured secondary questions

Part C. Food security

There were eight questions involving both closed and open responses that concerned subsistence cropping and sustainability. Question two requires special mention because the answers were cross-checked with the data from part B, question 13. Any inconsistencies were discussed and corrections were made to the data from both questions.

Part D. Bought food items

Ten closed questions and one open question were asked about items bought for food and cooking fuel.

Part E. Fire

This question and its technique was identical to that of question one in the regional questionnaire (see p. 441) except that it was generally conducted in a family household situation and sometimes with only one participant.

Part F. Sociocultural, livelihood and environmental values

This question and its technique was identical with question three of the regional questionnaire with the same provisos as those for Part E.

Part G. Cultural ecology

Three mainly closed questions were asked about customary ways and local totems.

Part H. Environment

Eight questions were asked using various techniques.

Questions One, Two, Seven and Eight

Questions 1, 2, 7 and 8 were conventional open questions.

Questions Three and Four

Questions 3 and 4 incorporated both closed and open responses to a question integrated with a selection technique using cards that were intended to discover differences between households regarding environmental practices. These two questions were designed as a pair that complemented each other in order to: (a) minimise resistance to the possibly contentious question four, and (b) for additional veracity. Thirty-four (one for each household) white-coloured cards made from light cardboard of size 7 x 7.5 cm were prepared beforehand. Each household's name was written with a medium black felt-tip pen on both sides of one card with a small identification number written in ball-point pen in the upper right hand corner. All names were single words. Some of the households were identified by the name of the person who was the head of the household rather than by the name of their house (or *yavu*, ancestral foundation).

The cards were randomly shuffled and placed adjacent to each other on the ground in a group in front of the (usually single) participant. The participant was then asked to respond to question three: *which vuvale (households) in [Nasauvakarua/Nawairabe] care best for the vei ka bula (environment)?* In order to answer, the participant was asked to choose from the cards arrayed in front of her or him. When the participant picked up a card, they were then asked to explain *why* they had chosen that household. The number of the card was recorded in by the researcher along with the reason given by the participant. The same process was repeated for other cards that were selected by the participant until the participant/s indicated that they had finished. Each selection was recorded in the notebook in the order given.

Question four was similar. All of the cards were collected from the ground, randomly shuffled, and re-distributed on the ground. They were then asked question four: *which vuvale (households) in [Nasauvakarua/Nawairabe] damage the vei ka bula (environment) the most, and why?* The remainder of the process is the same as for question three above.

Question Five

Question five was a closed question integrated with a scoring task which was intended to ascertain if there were any differences between *mataqali* with regard to care for the environment. A set of cards was made from light cardboard with each card representing one *mataqali* in the village. Nasauvakarua had 4 blue-coloured cards of 10 x 15 cm size and Nawairabe had 9 yellow-coloured cards of 8 x 13 cm size matching the number of *mataqali* in each village. The cards were smaller for Nawairabe to ensure that their greater number could be located in front of each participant, and the colour difference was to allow for easier identification by the researcher. The name of each *mataqali* was written on the card with a medium felt-tip pen (red for Nasauvakarua, blue for Nawairabe) and small letters (A, B, C, etc) identifying each card for

recording purposes were written with a ball-point pen in the upper right-hand corner of each card. Tokens (*vesi* tree seeds, brown-coloured with leguminous shape, approx. dia. 2-2.5 cm) were prepared and stored in a labelled small plastic bag. Ten tokens were given for each card in the set: for example, 40 seeds were used for 4 cards, and 90 seeds for 9 cards.

At the time of the evaluation the cards were shuffled randomly and placed in a horizontal row on the ground in front of the participant/s in order that the participant could score the cards. The tokens were emptied from the small plastic bag used to carry them in a heap between the participants and the line of cards. Next, the participant/s were asked question five: *There are vuvale (households) for these mataqali in [Nasauvakarua/Nawairabe].*[42] Which care best for the *vei ka bula* (environment)? The participants were then asked to show which *mataqali* cared best by scoring the cards with the *vesi* seeds. The participants would move the seeds from the heap and distribute them in groups in front of each card. They would put more seeds in front of the favoured cards and less seeds in front of the less favoured cards. When finished, each group of seeds was counted and I recorded the score with the code number from the adjacent card (A, B, C, etc) in my notebook as they were called out by the person counting. Often the participants and myself would help count the seeds in addition to the translator. Finally I would check for discrepancies by totalling all of the scores in my notebook which should amount to the number of seeds given. This was important because sometimes the seeds would be lost (e.g., under the mat), or miscounted, leading to a discrepancy between the number given and the number counted. For example, in this case the sum should be forty:

[42] This phrasing allows for the existence of other *mataqali* whose presence was very marginal. In the case of Nasauvakarua another *mataqali* in addition to those mentioned was discovered at a late stage. It was represented by only one young man.

a 5
b 12
c 8
d 15
Total 40.

From the cumulated figures a score for each *mataqali* in the village can be obtained (discounting each participants own-*mataqali* scores) and numerical comparisons worked out at a later date.

Question Six

Question six and its technique was identical to that of question two in the regional questionnaire (see p. 443) except that it was generally conducted in a family household situation (sometimes with only one participant) and the scores were later averaged across households rather than participant groups to obtain village rather than regional scores.

Part I. Wealth

There was one closed question: *These are mataqali (clans) in [Nasauvakarua/Nawairabe].* Which are the most wealthy? The procedure generally follows that of question five of part H (see pp. 446, 452).

Part K. Social-political groups

The one closed question and its technique were identical to that asked for question six of the regional questionnaire (see p. 447) except that it was generally conducted in a family household situation (sometimes with only one participant) and the scores were later averaged across households rather than participant groups to obtain village rather than regional scores.

Part J. Vanua

The one closed question and its technique were identical to that asked for question seven of the regional questionnaire (see p. 448) except that it was generally conducted in a family household situation (sometimes with only one participant) and the scores were later averaged across households rather than participant groups to obtain village rather than regional scores.

Part L. Food source

The one closed question and its technique were identical to that asked for question five of the regional questionnaire (see pp. 446, 452) except that it was generally conducted in a family household situation (sometimes with only one participant) and the scores were later averaged across households rather than participant groups to obtain village rather than regional scores.

APPENDIX THREE

RESPONSES TO THE QUESTION ON BURNING

The reasons given by participants in question one of the Regional questionnaire and Part E of the Individual village questionnaire were represented by cards with the following Fijian words written on them. Alongside are the translators' interpretations:

a.	*Co vou*	(new grass for animals)
b.	*Vaqaqara vitua*	(finding wild yams)
c.	*Vakasavasavataki ni teitei*	(clearing land for planting)
d.	*Cemuri ni vuaka*	(repel wild pigs)
e.	*Vanua ni vakasasa vuaka*	(pig hunting)
f.	*Malasou*	(growing *malasou)*
g.	*Vakamakama vakavei talia*	(carelessness)
h.	*Kamavakacalaka*	(accidents)
i.	*Gau ni sala*	(clearing tracks)
j.	*Vanua ni vaqaqara manumanu*	(finding animals)
k.	*Keli kari*	(digging *kari* (turmeric))
l.	*Lovo paini*	(clearing land for pines)
m.	*Quwawa quto*	(harvesting *quwawa* fuelwood).

APPENDIX FOUR

PRA TECHNIQUES

The PRA techniques that were used within questionnaires with householders have been described separately in Appendix Two. Other PRA techniques were conducted in the conventional manner within group situations and are described here.

Village Group Techniques

Nearly identical techniques were used at both Nasauvakarua and Nawairabe villages but some of the research variables (here called categories) were changed to fit differences in context between Nasauvakarua to Nawairabe. The materials used were simple: predominantly large sheets of newsprint 84 cm in width cut to length from a roll bought from a newspaper printery in Suva and medium felt tip pens of different colours. Ten cm x 10 cm cards were cut from same coloured cardboard and some were inscribed upon ready for selection to represent resource categories.

1. Seasonal crop calendar matrix

In order to evaluate the calendar of seasonal cropping a paper and pen calendar incorporating blank variable and data fields was designed and prepared beforehand. At the time of the evaluation this sheet was spread in front of the participants on the ground. In order to select the crop categories the participants were first asked to rank their most important crops from among a choice of prepared cards representing all of the major and many minor crops. Novel crops were allowed for and upon suggestion a new card was prepared with the name of the crop inscribed. The selected cards were then placed in rank order in the place allocated for them at the head of the newspaper sheet and appropriate dividing columns drawn down the page with felt-tip pens. The calendar

was then described to the participants who were then asked various questions (in a semi-structured format) relating to the seasonality of cropping (e.g., time to clear, prepare, plant, weed, protect and harvest) for each crop in succession. As the information was received from the translator or directly from participants it was written down on the calendar by either the researcher or the translator in the appropriate places adjacent to the calendar months indicated.

The final task was to score each of the categories for importance. This was done using a technique developed earlier in the questionnaire process which was combined here with the calendar task. The technique is similar to that of question one of the regional questionnaire or Part E of the household questionnaire (see Appendices for details) in that the categories were chosen following open questioning and scored with *vesi* seed tokens but in this case there was a lag between the initial selection of the categories (as above) and the scoring procedure while the calendar information was gathered. The question was: *which of these crops are the most important?* To facilitate the correspondence between the chosen categories and the scoring boxes the category cards were moved from the top of the sheet to a position just above the scoring boxes. The *vesi* seeds were distributed and placed by the participants in the boxes

prepared at the bottom of the calendar sheet. The following photograph (of the similar burning calendar) illustrates these features.

PHOTOGRAPH 19. Burning calendar.

The seeds were counted and the scores were written in the scoring boxes using the felt-tip pens. The category labels were copied from the cards to the equivalent boxes at the head of the sheet. The name of the village, gender and the date were recorded on the sheet. Thus, the data and all of the relevant information was recorded on the calendar sheet/s which were kept by the researcher. These sheets were transcribed by the researcher after leaving the field and are presented in the results section.

2. Seasonal burning calendar matrix

This calendar was designed and prepared in a similar manner to the seasonal cropping calendar but the categories and the questions asked were different. The categories were established in the same manner as those for question one of the regional questionnaire or Part E of the household questionnaire (see Appendices) in response to the same open question: *why is the land burned?* Answers were written on separate cards each of which was placed at the head of a column on the calendar sheet. In the researcher's case he was able to use the same cards which had previously been prepared during the questionnaire because the answers were among those already collected (see Appendix 3). Thereafter, various semi-structured questions relating to the reasons for, timing and effects of burning were asked for each category (answer) similar to the process for the crop calendar.

The remainder of the process was done in an equivalent manner to the crop calendar.

3. Food resource matrix

A matrix was designed and prepared beforehand using similar materials to the seasonal calendars. Questions rather than calendar months were on the y axis and horizontal rows were drawn completely

across the sheet. Many more columns were drawn to cover for a greater number of resource categories (see photograph).

PHOTOGRAPH 20. Food resource and security matrix. Cards for individual resources are on the right-bottom of the photograph at the head of the sheet. Large matrices such as this are useful for a broad comparison of variables, but do not allow accurate numerical comparisons.

Forty-four cards representing a wide range of cultivated and wild food resources were prepared for selection similar to the seasonal calendar resource cards. In the case of Nawairabe three separate and smaller matrix sheets were drawn rather than the single very large one used at Nasauvakarua.

The selection of resources was divided into four components: *kakana* (true food), *gunuvi* (drink), *manumanu* (animals) and *kana ni vanua* (wild foods). These four domains match important local resource divisions (basic starch foods, liquid or potential-liquids (includes fruits and green vegetables), food from animals, and wild foods). The resources for each domain were selected by the participants from the cards available, plus any novel resources mentioned (new cards were made for these). The selected cards were placed in the boxes at the head of the columns on the matrix sheet. The exercise was explained to the participants who were then asked to compare and score each resource category against the questions written in the left margin with *vesi* seed tokens. Each question was dealt with successively. Finally, the participants were asked to compare and score the questions themselves for importance: a vertical column of cells was left next to the written questions for this purpose, and the participants scored these similarly with *vesi* card tokens.

The recording of all the information was done in the same manner as for the seasonal calendars.

4. Environmental sustainability matrix

The environment evaluation was done in a manner similar to question one of the regional questionnaire and Part E of the household questionnaire. Participants were asked the open question: *what are the main problems for protecting the vei ka bula (environment) for future generations?* Answers were written down in separate rows on a matrix sheet prepared for the purpose (see results). The participants were then asked to score the different answers for importance. *Vesi* seed tokens were distributed by the participants into boxes left for the purpose down the right side margin of the matrix sheet. The remainder of the process is the same as that as for the seasonal calendar except that no cards were involved.

5. *Vuci* brainstorm

A local example of an extant *vuci* system (irrigated *doxo/dalo* terraces) was described to the participants, who when then asked the following question: *do they think that a vuci is a good idea for their own village?* If the answer was affirmative then the following additional questions were asked: *why has no person made a vuci here?*, and *what would be required for someone to make a vuci here?* The answers to this structured question were recorded in a notebook.

6. Vegetation resource matrix

A matrix was designed and prepared beforehand using similar materials to the food resource matrix described earlier. Twenty-six cards representing a cross-section of different types of non-cultivated natural vegetation resources were prepared for selection in a similar manner to the food resource cards.

Care was taken to include a wide variety of vegetation types in order to encourage participants to think broadly and across seasons before making their selections. The resource categories were selected by the participants from the cards available, plus any novel resources mentioned (new cards were made for these). Some regionally important resources were made mandatory by the researcher, and others were (only occasionally) prompted to the participants by the researcher if they were overlooked (perhaps because they were out of season): the participants usually affirmed these categories in the selection. The selected cards were placed in the boxes at the head of the columns on the matrix sheet. The exercise was explained to the participants who were then asked to compare and score each resource category against the questions written in the left margin with *vesi* seed tokens. Each question was dealt with successively. Finally, the participants were asked to compare and score the questions themselves for importance: a vertical column of cells was left next to the written questions for this purpose, and the participants scored these similarly with *vesi* card tokens.

The recording of all the information was done in the same manner as for the seasonal calendars.

7. Gender control in agriculture matrix

This matrix was prepared with similar materials to the food and vegetation resource matrices but was designed to accommodate different techniques. Eight questions relating to the gender division of control in agriculture were written in boxes on the left margin of each row on the matrix sheet. The columns were allocated to the important food crops and other cultivated resources: including *yaqona* and *yo (Pandanus sp.,* for mats). Cards were selected used in the same manner as for the food and vegetation resource matrices (*yaqona* and *yo,* representing important non-food crops, were mandatory).

Each question was asked consecutively and either/and responses for each resource category were shown by the use of one *vesi* seed token (to indicate female) and/or one 1.5-2.0 cm diameter river stone (to indicate male) in each cell. If only female was important, then one *vesi* seed was used. If only male was important, then one stone was used. If both female and male were important then one *vesi* seed and one stone were used together.

Another two questions at the bottom of each sheet were related to labour effort and were framed differently to require quantitative answers: they were scored with *vesi* seed tokens similar to the food and vegetation resource matrices.

The recording of the information was done in a similar manner as for the resource calendars except that for the gender questions each *vesi* seed was recorded with a letter F and each stone was recorded with a letter M in the cell concerned. A legend that described the gendered meanings of the *vesi* seeds and stones was added to the sheet.

8. Resource map

Participants were asked to draw a map illustrating the location of important resources and associated features for their local village region. The materials used included blank sheets of newsprint paper and felt-tip pens. After the map was completed, a question was asked: *what are the main problems with resources?* The answers were written on a corner of the map. All the information, including village, gender group, and date were recorded on the map which was kept by the researcher.

APPENDIX FIVE

INFORMATION SHEET
(printed on Massey University letterhead paper)

Sigatoka-Navosa Sustainability Study

INFORMATION SHEET 1

1. Who are the researcher and his supervisor?

The study is being conducted by Trevor King from the School of Global Studies, Massey University, New Zealand. Trevor is here to study sustainable agricultural development, and is supervised by Professor John Overton, the Head of Department of the Institute of Development Studies, School of Global Studies.

2. Where can they be contacted?

The researcher and his supervisor can be contacted using the addresses and telephone numbers listed at the end of this information sheet.

3. What is the study about?

The reason I am here is to study the different ways that people have collected wild food, gardened, and grown crops, so that I can find out which ways are best for preserving the land and the people for the future. I am interviewing people and expect to be around the Navosa area for about 6 months.

A summary of the results of the study (in your language) will be made available to you if you want. Please let me know now, or contact me later, so that I can send you a copy after the study is finished.

4. What will be asked of me?

I am conducting interviews and meetings with people when they are free to do so. Nobody is obliged to take part and anyone can decline to take part. If you agree to take part, I will try my best to arrange interviews and meetings at times that are suitable.

The interviews can be quite long. You can request that they be completed at a later time, or be abandoned.

I may decide to make notes as you talk. If this is so, I will ask for your permission to do so.

5. Anonymity and confidentiality

Any information you give will be in complete confidence to me, and will be used only for the purposes of research. My translators and transcribers will also maintain your confidence, and they have signed an agreement with me to support this.

I will make sure that any notes I make are anonymous (unless it is your request to be named) and kept under safe custody, but please note that the information I record may be used in my thesis and other publications. Please be sure to let me know about anything that you have said that you do not want published.

I respect the rights to specific information owned by different social groups and villages in the area of research. I will ask for consent before disseminating information owned by any such group.

6. The rights of the participant(s):

- You have the right to decline to take part in this study.
- You have the right to refuse to answer any particular questions.
- You have the right to withdraw from the study at any time
- You have the right to ask any questions about the study at any time

- You have the right to provide information on the understanding that your name will not be used unless you give permission to the researcher.
- You have the right to be given access to a summary of the findings of the study when it is concluded.

Addresses and Telephone Numbers

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