Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.
Sustainable Land Use on the East Coast -
A case study of land use change in the
Upper-Hikuwai Catchment

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

Peter Zwart
1996
Abstract

This thesis explores the principles of sustainability and applies them to the issue of land use on severely erosion-prone hill country in the East Coast region of the North Island of New Zealand. Sustainability is found to require a biophysical bottom line, implying a need for planning to establish threshold levels of protection for particular classes of land. The study uses a locally developed system of land classification which takes into account the physical causes and remedies of soil erosion as the basis for such a plan. This sets the biophysical bottom line to which land use and management must seek to conform, but above which, remain flexible, according to other societal objectives such as equity or efficiency. The history of land use change, and the policy response to the issue is reviewed for the region, and compared with this plan. The plan is then applied to one catchment subject to severe soil erosion, and where changes in land use are in process and the changes assessed and compared with the attitudes of the landowners and the context in which they have made their decisions. It was found that considerable progress had been made recently towards greater compliance with this plan and toward a pattern of land use more diverse and more consistent with the varying physical capacity of the area. This has been particularly facilitated by assistance from central and local government between 1988 and 1993. The study concludes, however, by highlighting the degree of favour shown to forestry interests over those of farming interests in current method of public support for erosion control. The study anticipates the eventual blanket afforestation of the catchment under this scheme.
Acknowledgments

No research is ever a product of the labours of one person. It rests on the cooperation, support and encouragement of a host of people.

My gratitude goes firstly to the people of Tokomaru Bay and the Upper-Hikuwai Catchment who so willingly shared their experiences and choices with me. Their generosity and interest were perhaps the most important element and the highlight of the study.

Essential too, was the immense support received from Bob Miller, Trevor Freeman, Paul Williams and staff of the Conservation Division of the Gisborne District Council. Their assistance, advice and generous supply of information and planning documents provided the foundation to my work.

I owe much to my Heads of Department, Croz Walsh, Brian Panter and John Overton who have all fostered the development of a vibrant and enquiring environment at the Institute of Development Studies. Each have provided much needed direction at crucial stages of this work.

To Anton Meister who supervised this project from its inception, belongs the credit for wading through ponderous drafts and distilling from them the crux of an argument.

To my flatmates in Palmerston North and Wellington, to all the past and present staff and students of Development Studies, and to my colleagues at Caritas Aotearoa New Zealand, who all gave freely and generously the moral support and caffeine needed to see this project to its conclusion, I offer my sincerest gratitude.

Finally and most importantly to my family who, throughout their own trials of recent years, have been unceasing in their steady support for my efforts and who, as always, have bolstered my efforts with regular parcels of greatly welcomed Gisborne fruit and vegetables.
Table of Contents

Acknowledgments
Table of Contents
List of Tables
List of Figures

CHAPTER ONE
Introduction

1.1 Introduction
1.2 The Case Study Approach
1.3 Direction and Layout

CHAPTER TWO
Natural Resource Allocation and Sustainability

2.1 Introduction
2.2 Resource Allocation
2.2.1 The Market as Resource Allocator
2.2.2 Economic Efficiency
2.2.3 Limitations of the Market
2.2.4 Environmental Values
2.2.5 Dynamic Efficiency
2.3 Efficiency versus Optimality
2.3.1 Optimal Scale
2.3.2 Thresholds
2.3.3 Economic Growth and Limits
2.3.4 The Entropic Debate
2.3.5 Ideological Diversity
2.4 Emerging Themes
2.4.1 Sustainable Development
2.4.2 Our Common Future
2.4.3 Environmental Efficiency
2.4.4 Economic Efficiency and Equity
2.4.5 Sustainable Development - a Unifying Concept?
2.4.6 Sustainability as an Environmental Ethic
2.4.7 Biophysical Sustainability
2.5 Sustainability in New Zealand
2.5.1 Primacy of Biophysical Sustainability
2.5.2 The Hierarchy of Considerations in the RMA
2.5.3 Sustainable Land Management
2.5.4 Sustainable Agriculture
2.6 Conclusion

CHAPTER THREE
Sustainable Land Management on New Zealand Pastoral Hill Country

3.1 Introduction
3.2 Biophysical Sustainability and Soil Erosion
3.2.1 Land Degradation
3.2.2 Land Classification
3.2.3 Land Use Categories
3.3 Methods of Erosion Control
3.3.1 Effectiveness of Erosion Control Measures
3.3.2 Pinus Radiata
3.3.3 Indigenous Forest
3.3.4 On-Farm Soil Conservation
3.3.5 Towards Biophysically Sustainable Land Use
3.4 The Economics of Land as Property
3.4.1 The Property Rights of Shifting Ground
3.4.2 The Shifting Ground of Property Rights
3.5 Land Use Change
3.5.1 Risk Aversion
3.5.2 Personal Attitudes
3.5.3 Context of Land Management Decisions
3.6 Micro-Economic Context
3.6.1 Land Tenure
3.6.2 Categories of Land Managers
3.6.3 The Economic Unit
3.6.4 Capital Constraints
3.7 Macro-Economic and Policy Context
3.7.1 Pastoral Development Policy
3.7.2 Forestry versus Farming
3.7.3 Agricultural Productivity and Efficiency
3.7.4 The Current Role of Policy
3.8 Social and Cultural Context
3.9 Conclusion

CHAPTER FOUR
Soil Erosion and Land Use Change on the East Coast
4.1 Introduction
4.2 Pastoral Hill Country in the East Coast Region
4.2.1 Physiography of the Region
4.2.2 Climate
4.3 Land Use and Vegetation
4.3.1 Pre-European Vegetation and Land use
4.3.2 The Establishment Of Pastoral Farming
4.3.3 Land Alienation
4.3.4 Forest Clearance
4.3.5 Impact of Land Use on Vegetation and Ecology
4.3.6 Erosion Severity Acknowledged
4.3.7 Establishment of Catchment Boards
4.4 Forestry for Erosion Control
4.4.1 Plantings at Mangatu
4.4.2 The East Coast Project
4.4.3 Revised Land Classification
4.4.5 The East Coast Planning Study
4.5 Afforestation Reviewed
4.5.1 Progress of the East Coast Project
4.5.2 The Cyclone Bola Agricultural Assistance Package
4.5.3 Officials Committee Report
4.5.4 The East Coast Project Conservation Forestry Scheme
4.5.5 The FARM Partnership Scheme
4.5.6 Revival of the East Coast Project
4.5.7 Shrubland
4.5.8 Special Purpose Species
4.7 On-Farm Soil Conservation
4.7.1 Progress of On-farm Soil Conservation Work
4.7.2 Reduction and Removal of Subsidies
4.7.3 District Council Policy on Soil Erosion
4.8 Conclusion - A Changing Framework for Analysis
4.8.1 Equity
4.8.2 Summary

CHAPTER FIVE
Summary of Soil Erosion and Land Use Change on the East Coast
5.1 Introduction
5.2 Pastoral Hill Country in the East Coast Region
5.2.1 Physiography of the Region
5.2.2 Climate
5.3 Land Use and Vegetation
5.3.1 Pre-European Vegetation and Land use
5.3.2 The Establishment Of Pastoral Farming
5.3.3 Land Alienation
5.3.4 Forest Clearance
5.3.5 Impact of Land Use on Vegetation and Ecology
5.3.6 Erosion Severity Acknowledged
5.3.7 Establishment of Catchment Boards
5.4 Forestry for Erosion Control
5.4.1 Plantings at Mangatu
5.4.2 The East Coast Project
5.4.3 Revised Land Classification
5.4.5 The East Coast Planning Study
5.5 Afforestation Reviewed
5.5.1 Progress of the East Coast Project
5.5.2 The Cyclone Bola Agricultural Assistance Package
5.5.3 Officials Committee Report
5.5.4 The East Coast Project Conservation Forestry Scheme
5.5.5 The FARM Partnership Scheme
5.5.6 Revival of the East Coast Project
5.5.7 Shrubland
5.5.8 Special Purpose Species
5.7 On-Farm Soil Conservation
5.7.1 Progress of On-farm Soil Conservation Work
5.7.2 Reduction and Removal of Subsidies
5.7.3 District Council Policy on Soil Erosion
5.8 Conclusion - A Changing Framework for Analysis
5.8.1 Equity
5.8.2 Summary
### CHAPTER FIVE

**Methodology**

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1 Introduction</td>
<td>145</td>
</tr>
<tr>
<td>5.2 Choice of Catchment Area</td>
<td>145</td>
</tr>
<tr>
<td>5.3 The Upper-Hikuwai Catchment</td>
<td>146</td>
</tr>
<tr>
<td>5.3.1 Catchment Boundary</td>
<td>147</td>
</tr>
<tr>
<td>5.3.2 Land Use and Vegetation</td>
<td>147</td>
</tr>
<tr>
<td>5.3.3 Land Classification</td>
<td>150</td>
</tr>
<tr>
<td>5.3.4 Categories of Land-Managers</td>
<td>152</td>
</tr>
<tr>
<td>5.4 Fieldwork</td>
<td>152</td>
</tr>
<tr>
<td>5.4.1 Preparation</td>
<td>153</td>
</tr>
<tr>
<td>5.4.2 Questionnaire</td>
<td>153</td>
</tr>
<tr>
<td>5.4.3 Interviews and Data Collection</td>
<td>154</td>
</tr>
<tr>
<td>5.4.4 Analysis</td>
<td>155</td>
</tr>
</tbody>
</table>

### CHAPTER SIX

**Land Use Change in the Upper-Hikuwai Catchment**

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1 Introduction</td>
<td>159</td>
</tr>
<tr>
<td>6.2 Land Ownership in the Catchment</td>
<td>160</td>
</tr>
<tr>
<td>6.2.1 Maori Land</td>
<td>162</td>
</tr>
<tr>
<td>6.2.2 Publicly-Owned Land</td>
<td>163</td>
</tr>
<tr>
<td>6.2.3 Forestry Holdings</td>
<td>165</td>
</tr>
<tr>
<td>6.2.4 Family Farms</td>
<td>166</td>
</tr>
<tr>
<td>6.2.5 Leasehold Land</td>
<td>166</td>
</tr>
<tr>
<td>6.2.6 Land Ownership and Land Use Categories</td>
<td>168</td>
</tr>
<tr>
<td>6.3 Land Use and Vegetation Change by Land Use Categories</td>
<td>171</td>
</tr>
<tr>
<td>6.3.1 Forestry</td>
<td>171</td>
</tr>
<tr>
<td>6.3.2 Conservation Forestry Scheme</td>
<td>174</td>
</tr>
<tr>
<td>6.3.3 Forestry Rights for Best Land Exchange</td>
<td>177</td>
</tr>
<tr>
<td>6.3.4 Source of Afforestation</td>
<td>179</td>
</tr>
<tr>
<td>6.3.5 Future Afforestation</td>
<td>181</td>
</tr>
<tr>
<td>6.3.6 Pasture</td>
<td>182</td>
</tr>
<tr>
<td>6.3.7 On-Farm Conservation Works</td>
<td>185</td>
</tr>
<tr>
<td>6.3.8 Shrubland</td>
<td>191</td>
</tr>
<tr>
<td>6.3.9 Native Forest</td>
<td>194</td>
</tr>
<tr>
<td>6.4 Attitudes of Respondents</td>
<td>198</td>
</tr>
<tr>
<td>6.4.1 Attitudes to Farming and to the Region</td>
<td>198</td>
</tr>
<tr>
<td>6.4.2 Perception of Severity of Erosion</td>
<td>200</td>
</tr>
<tr>
<td>6.4.3 Attitudes to Forestry</td>
<td>201</td>
</tr>
<tr>
<td>6.4.4 Effect of Cyclone Bola</td>
<td>202</td>
</tr>
<tr>
<td>6.4.5 Effects of Forestry on Land Use Decisions</td>
<td>202</td>
</tr>
<tr>
<td>6.3.6 Land Retirement</td>
<td>204</td>
</tr>
<tr>
<td>6.4.7 Property Rights</td>
<td>205</td>
</tr>
<tr>
<td>6.5 Additional Significant Changes in the Catchment</td>
<td>205</td>
</tr>
<tr>
<td>6.5.1 Stocking rate</td>
<td>205</td>
</tr>
<tr>
<td>6.5.2 Employment</td>
<td>206</td>
</tr>
<tr>
<td>6.5.3 Growth in Contiguous Area of Forestry</td>
<td>207</td>
</tr>
<tr>
<td>6.5.4 Ownership Changes</td>
<td>207</td>
</tr>
</tbody>
</table>

### CHAPTER SEVEN

**Conclusion**

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.1 Introduction and Comments on the Study</td>
<td>209</td>
</tr>
<tr>
<td>7.2 Sustainable Development and Sustainable Land Use</td>
<td>210</td>
</tr>
<tr>
<td>7.3 Sustainable Land Use and Erosion Prone Pastoral Hill Country</td>
<td>211</td>
</tr>
<tr>
<td>7.4 Sustainable Land Use Pattern in the Upper-Hikuwai Catchment</td>
<td>212</td>
</tr>
<tr>
<td>7.5 Land Use Change in the Upper-Hikuwai Catchment</td>
<td>213</td>
</tr>
<tr>
<td>7.6 Public Involvement in Promoting Sustainable Land Use</td>
<td>214</td>
</tr>
</tbody>
</table>
Appendix I
Summary of Land Use Capability Unit Classifications ............................................. 223

Appendix II
Questionnaire for Landholders in the Study Area ................................................... 224

Appendix III
Summary of Erosion Control Research on Pastoral Hill Country ............................. 240

Appendix IV
Land Use Categories for Properties in the Upper-Hikuwai Catchment .................... 250

Appendix V
LUC Breakdown by Land Use and Vegetation for Properties in the Upper-Hikuwai Catchment .......................................................... 251

Appendix VI
Detailed LUC Breakdown for Land Exchanges ....................................................... 256

Appendix VII
Annual Afforestation by Property and LUC in the Upper-Hikuwai Catchment ......... 258

Appendix VIII
LUC Breakdown of Pasture Remaining on Properties in the Upper-Hikuwai Catchment which have Land Requiring Afforestation ..................... 260

Bibliography .............................................................................................................. 263
List of Tables

Table 2.1 - Potential for North Island Pasture to Revert to Natural Vegetation 55
Table 3.1 - Land Use Categories 68
Table 4.1 - Land Cover Type in the Gisborne District in 1992. 104
Table 4.2 - Recommendations of the Taylor Report. 113
Table 4.3 - Land Use Categories by Area of the Region 118
Table 4.4 - Forestry Established by 1987 121
Table 4.5 - Land Cover by Land Use Category Area for 1987 121
Table 4.6 - Gross Area of Exotic Forest by Land Use Category 128
Table 4.7 - Estimated Extent of On-Farm Soil Conservation Works in 1987 137
Table 5.1 - Predominant Vegetation Types (over 40% of area) 148
Table 5.2 - Subdominant Vegetation (less than 40% of area) 148
Table 5.3 - Erosion Severity. 149
Table 5.4 - Prevalence of Forms of Erosion. 150
Table 5.5 - Comparison between LUC Areas for District and Study Area. 151
Table 6.1 - Summary of Separate Enterprises in the Catchment. 161
Table 6.2 - Tenure of Maori Land in the Catchment 162
Table 6.3 - Tenure of Non-Maori Land. 164
Table 6.4 - Leasehold Land in the Catchment. 167
Table 6.5 - Land Ownership by LUC in 1980 168
Table 6.6 - Land Ownership by LUC in 1993 168
Table 6.7 - Comparative LUC Breakdown of Farmed and Leased Maori Land 170
Table 6.8 - LUC Breakdown on Maori and Non-Maori Leasehold Land 170
Table 6.9 - Afforestation under the 95% Scheme by Property and LUC Areas 175
Table 6.10 - Land Afforested by LUC Areas and Agent of Afforestation. 179
Table 6.11 - Area in Pasture by Land Use Category - 1980 - 1997 182
Table 6.12 - Pasture with Extensive On-Farm Conservation Works 186
Table 6.13 - Pasture without On-Farm Conservation Works 186
Table 6.14 - Properties with Significant Areas of Dominant Scrub 192
Table 6.15 - Pasture with Extensive Scrub Cover 193
Table 6.16 - Breakdown of Native Forest by Property and LUC 195
List of Figures

Figure 2.1 - Economic Output and Environmental Efficiency 44
Figure 3.1 - Adjustment of Mean Hillslope Soil Depths following Deforestation 65
Figure 4.1 - Erosion Severity in the East Cape and the North Island 110
Figure 4.2 - The Blue Line dividing the Critical Headwaters from the Pastoral Foreland, with Existing Vegetation for 1967 114
Figure 4.3 - Map of East Coast Project Conservation Forestry Scheme 127
Figure 4.4 - Existing Area of Exotic Forest in the Region by Period of Establishment 129
Figure 5.1 - Proportion of LUC Areas for Region and Catchment 151
Figure 6.1 - Location of the Upper-Hikuwai Catchment 159
Figure 6.2 - Establishment of Exotic Forest in the Study Area 173