Rural Livelihoods and Natural Resource Sustainability:

A case study of two Communities on Chiloé Island

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Alan Bannister

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❖ ABSTRACT

This research examines the relationship between livelihood strategies of rural communities in Chile and local environmental sustainability. It determines livelihood options adopted by local communities and identifies their impact on the surrounding environment. Two case studies are presented using the sustainable livelihood approach as a framework to describe the livelihood strategies of two rural communities in Chiloé Island. Environmental sustainability is investigated using elements and concepts of the FESLM (Framework for Evaluating Sustainable Land Management) approach and of agroecosystem analysis. Both communities were selected because of their location close to extensive areas of native forests. One community is relatively isolated, has a "Huilliche" ethnic tradition, with a predominance of subsistence activities; the other is closer to markets and their livelihoods are primarily derived from farming-forestry systems. Data for the study was collected from in-depth semi-structured interviews and key informant interviews with local leaders, relevant local government staff, NGOs, and community members.

For the examined cases, results suggest that rural subsistence communities are highly diversified, using their resources in a non-sustainable way; generating livelihood strategies that fail to improve their social, economic and environmental conditions. Low productivity soils, steep slopes, and depleted fragile forest ecosystems create a complex natural resource base. The main causes for the community economic problems are the lack of road networks and markets to sell products to. Organisations in charge of development interventions are aware of the situation but find it difficult to start a sustainable development process, mostly due to a lack of human capital in the communities, notably education, organisational skills, and technology adoption.

Future development interventions should tackle the issues that constrain development in these communities, consider rural communities' context-specific characteristics, value local culture and tradition, facilitate to build social and human capital, ensure integrated management of natural resources, and assist with markets for existing and value-added products produced by local households.

KEY WORDS

Sustainable rural development, livelihood strategies, environmental sustainability, Chile, SLA (sustainable livelihood approach)

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❖ ABBREVIATIONS

AIFBN	= Forest Engineers Association for the Chilean Native Forests
CONADI	= National Corporation of Indigenous Development (ChileGovt)
CONAF	= National Corporation of Forestry (Chile Govt)
CONAMA	= National Commission for the Environment (Chile Govt)
CORFO	= Corporation of Productive Promotion (Chile Govt)
DFID	= Department for International Development (UK)
FAO	= Food and Agriculture Organisation of the United Nations
FESLM	= Framework for Evaluating Sustainable Land Management
GEF	= Global Environmental Facility
GTZ	= German Corporation for Technical Collaboration
IFAD	= International Fund for Agricultural Development (UN)
INDAP	= National Institute of Agricultural Development (Chile Govt)
INE	= National Institute of Statistics (Chile Govt)
INRM	= Integrated Natural Resource Management
MIDEPLAN	= Ministry of Development and Planning (Chile Govt)
PCE	= Parliamentary Commissioner for the Environment (NZ Govt)
PRODEMU	= Women's Development Program (Chile Govt)
PRODESAL	= Local Development Programme (INDAP and Rural Council)
UNDP	= United Nations Development Programme
SLA	= Sustainable Livelihood Approach
WCED	= World Commission on Environment and Development

❖ TABLE OF CONTENTS

❖ LIST OF FIGURES

❖ LIST OF TABLES

❖ CHAPTER 1. INTRODUCTION

This chapter presents a succinct overview of background information about Chile and the area of study that leads to the definition of the research problem to be analysed in this thesis. The research question is defined and the research objectives outlined. Finally the thesis organisation, with the description of each chapter is presented.

1.1 RESEARCH BACKGROUND

Sustainable development is a major concept underpinning current government policies, development projects, and conservation initiatives in Chile. Sustainable development encompasses the economic, social and environmental aspects of development in one concept, and as such is the basis for controversy and complexity in implementation.

Internationally, poverty is concentrated in rural areas (IFAD, 2001), and a dependence on natural resources is a dominant characteristic of these areas (Wiggins, 2001). In other words poverty, rural communities, and natural resources endure within the rural context of low income countries. The relation between rural poor communities and natural resources has been regarded as a downward spiral. This relation, its determinants and outcomes, is the key element in this research. The relation between rural communities and their natural resource endowment is analysed in the context of a Latin-American Island, in the southern regions of Chile.

1.1.1 Current development issues in Chile

- **Positive aspects of Chile's development**

Economic development

Chile's structural adjustment and trade liberalisation process has been very successful in terms of economic indicators. Chile is recognised as one of the most stable countries in Latin America. It is identified as an example of high economic growth, openness of markets (ranked 11th of 155 world countries (Emol, 2005)), and for the implementation of successful poverty alleviation programmes during the last three decades. For the period of 1990-2000 the economy of the country grew at an annual average of 6.3 % (MIDEPLAN, 2000). The GDP per capita for 2003 was US$

9,820 (UNDP, 2004). Based on GDP per capita, the World Bank, ranks Chile in 73rd place among approximately 150 world economies, and categorises the country as an "upper middle income country" (World Bank, 2002).

Increasing wealth

During the period 1988-1998 the combination of growth and directed social programmes reduced poverty incidence in the country by 50%. Poverty in Chile has declined in incidence, depth and severity (World Bank, 2001). In 1990, 38.6 % of the Chilean population was living in poverty, compared to 20.6 % in 2000. Extreme poverty at the country level fell from 12.9 % in 1990 to 5.7 % in 2000 (MIDEPLAN, 2000).

Social development

The total population of the country at the last census (2002) was 15,116,435 inhabitants. The Chilean population grew during the decade 1982-1992 at 1.6 %, decreasing in the next decade (1992-2002) to 1.2 % (INE, 2003). The Human Development Index published by the United Nations Development Programme identifies Chile as a country with a "high human development index" (0.839 ; ranked 43). Life expectancy in Chile is 76 years and 95.7 % of adults are literate (UNDP, 2004).

Environmental development

In terms of environmental indicators Chile is starting a process of modernisation of their environmental legislation. In the early 1990s there were only six government staff working on environment issues, and there were no comprehensive environmental laws, regulations or procedures. INDAP (agricultural agency) and CONAF (forestry agency) were the two established state agencies in charge of managing natural resources. By the year 2000 a central environment agency (CONAMA) was created, with 350 staff, environmental units in several ministries, and a solid environmental impact assessment system (World Bank, 2003). Currently, 18.9 % of the surface of the country is protected under the Chilean National Park System; 21 of the 91 known mammal species are endangered; freshwater reserves reach 61,007 m^3 per capita, compared to 32,905 m^3 of Latin-America; and CO_2 emissions per capita are 4.1 metric tons compared to the 2.6 metric tons average of Latin-American countries (World Bank, 2002b).

- **Trade-offs of the current development**

Wealth Inequity

Wealth inequity is a major issue that is affecting the country. One of the reasons for this phenomenon is the low impact of the trickledown effect of the economy. The Gini coefficient[1] remains almost the same comparing 1987 (0.546) and 1998 (0.546) (World Bank, 2001), so that the overall picture shows no improvement of the income distribution. In 1998, 20% of the richer households received 57.3 % of the national income, and 20% of the poorer households took only 3.7 % of the country's income (MIDEPLAN, 2000).

Rural urban divide

An evident rural-urban divide exists in Chile in terms of the disproportionate distribution of wealth, opportunities (e.g., access to capital, education, work), and investment in urban areas. The rural population of Chile continues to decline. In 1907, the rural population of Chile was 57 %, in 1952 40%, in 1990 18.5 %, and in the year 2000 it was 14.1%. This demonstrates the continuous decrease in rural population in Chile (INE, 2003; MIDEPLAN, 2000).

When analysing poverty differences between rural and urban areas, in 1990 38.4% of the urban population was poor[2]. This decreased to 20.1% by the year 2000. Rural areas in contrast, experienced a slower decline of population living in poverty conditions from 39.5% in 1990 to 23.8% in 2000 (MIDEPLAN, 2000).

Natural resource depletion

The positive trends in economic, social, and environmental indicators contrast with other negative outcomes of the Chilean development process. Depletion of the natural resources, such as the reduction of native forested areas, erosion, and air/water pollution are affecting large areas of the country. One of the reasons for this situation is that the country relies on natural resources for its growth, exporting copper, timber and agricultural products (fruits and wine). Another reason is the lack

[1] The Gini coefficient quantifies the degree of income inequality of a particular income distribution. It lies between 0 and 1. Gini coefficients close to zero reflect more equal distribution while a coefficient close to one means inequality.

[2] Poverty levels used in this research are based on MIDEPLAN, 2002. These are the official poverty indicators used by the Chilean government and are the same used by the World Bank. Urban poverty line based on monthly per-capita income: US$ 72; Rural poverty line US$ 49. Urban extreme poverty line: US$ 36; rural extreme poverty line US$ 29.

of awareness among the general public about the environmental problems of the country.

In terms of native forests, which are the main resource available in the area of study, the expansion of the agricultural frontier in the 19th and 20th centuries, and during the last 30 years, the massive growth of industrial plantations (*Pinus radiata*), have greatly reduced the cover of native forests (Armesto, 2001).

As Armesto (2001) suggests for the Chilean context, economic policies have stimulated the transfer of public land to large international holdings seeking rapid exploitation of timber resources, leaving local communities excluded from the use of resources, changing radically the original landscape, degrading the ecosystems, and generating the loss of a wide range of natural resources traditionally valued by local communities.

1.1.2 Chiloé Island

As Chile continues on the economic path of development, Chiloé, an island in the southwest of Chile, has fallen behind in this development process. While the island has the resources and potential to develop in terms of intensive agriculture, forestry, tourism and the salmon industry, it is only the latter that has shown any promise.

Over the last decade, the conversion of native forest to farmland, the decrease in the productivity of agricultural land and the depletion of marine resources have collectively impacted on the rural communities dependent on those resources. The local rural context of these communities is characterised by out-migration of young people to nonfarm activities, market isolation, and few diversification opportunities. In response to these factors these rural communities are changing their livelihood strategies with resultant consequences for the sustainable use of the natural resources in the region.

Special characteristics of Chiloé are: 44% of the population live in rural areas, compared with the national average of 14.1 % (INE, 2003); 80% of the farms are smaller than 30 ha; the level of industrialisation and private business is low (with the exception of the salmon industry); and most of the people undertake low input and natural resource-based activities (sheep farming, forestry, local handicrafts, sea-food collection, and small-scale tourism initiatives).

1.2 RESEARCH PROBLEM

The positive economic development process in Chile has generated profound changes in rural communities including Chiloé Island. While the market revolution in Chile of the 80s produced the fastest growth in GDP in Latin America, the gains have not spread to all areas, in particular the isolated rural areas. For these areas the low prices for traditional agricultural products (potatoes, wool, and sheep meat), the less developed markets for native forest products (timber and firewood), the decrease in natural resource availability with native forests being converted to farmland and the declining productivity of agricultural land through overuse have led to situations of relatively low development and poverty. The communities in these areas have few livelihood diversification opportunities to improve their well-being. These factors are changing the livelihood strategies of rural communities and their traditional relation of dependence on the surrounding environment. Given these trends and the local vulnerability context, there is a need for better understanding for developing strategies for sustainable rural development initiatives.

This research aims to describe the local livelihoods of two rural communities in Chiloé Island (Chile), identify the main factors that influence sustainability of rural livelihoods and the surrounding environment, and suggest policies for future development initiatives in the area.

1.3 RESEARCH STRUCTURE

1.3.1 Research Question

- How can the sustainability of rural communities and the local natural resources in Chiloé Island be enhanced?

1.3.2 Research Objectives

Objective 1

- To identify the key factors influencing sustainability of the rural livelihoods and natural resources. This objective included three subobjectives:
    - describe local livelihoods,
    - assess the level of dependency on natural resources,
    - determine the sustainability of local livelihoods and natural resource use pattern.

Objective 2

- To determine relevant strategies that would help to improve the livelihoods of the local communities in a sustainable manner.

1.4 THESIS ORGANISATION

This thesis is organised in seven chapters. The introductory chapter gives the general outline of the research. It states the research problem, the main question, and the research objectives.

Chapter two includes the literature review covering theoretical foundations of environmental sustainability, rural livelihoods, and the environmental-rural community relation. Practical implications for sustainable rural development strategies are described, finishing with analytical tools that describe the Sustainable Livelihood Approach (SLA) and the concepts behind the sustainability analysis.

Chapter three establishes the methodological approach of this research, covering the theoretical framework, data requirements, the analytical tools used in the data collection, data management and analysis.

Chapter four describes the background of the area of study, aiming to create a deeper understanding of the context in which this research was carried out. This chapter constitutes the case description that precedes the results chapter.

Chapter five presents the results obtained from the analysis of the data collected in Chile during the field work. A description of the local livelihoods is outlined using the sustainable livelihood framework, and the sustainability analysis for the current livelihood strategies is presented.

Chapter six presents the discussion of the results, linking them with the theory. The main factors influencing the sustainability of rural livelihoods and natural resources are described and policy implications are suggested.

Finally, chapter seven establishes the major conclusions from this research as they relate to the research question.

❖ CHAPTER 2. LITERATURE REVIEW

The aims of this research are to analyse the relation between rural communities and local environmental sustainability, the factors influencing the outcomes from this relation, and to suggest policy recommendations that could generate a sustainable rural development process in the most southern regions of Chile.

Traditionally, rural communities are highly dependent on the available natural resources of their influence area. This generates a close relation between rural communities, local environmental dynamics, and the institutional-organisational context that rural communities are facing.

In this chapter, a first section summarises the general development context that rural areas are facing in the global, national and local context. It also includes a discussion of the most important shifts in development practice relating to sustainable rural development. A second section introduces the factors that directly influence the sustainability of a rural community and its livelihoods in social and economic terms. Next, environmental aspects are introduced; basic ecosystemic concepts to manage the natural resources are presented and factors influencing sustainability of natural resources are described. After this introduction, important aspects dealing with the relation between natural resources sustainability and rural communities are established in an integrated analysis. The second section finishes by presenting the outcomes in terms of *strategies* as a result of the socioeconomic and environmental factors that were exposed before. In the third section, theoretical and analytical concepts of approaches and frameworks that have been used by other researchers while investigating rural livelihoods and sustainability of rural areas and natural resources are presented.

2.1 SUSTAINABLE DEVELOPMENT

True sustainability requires that we recognize the reality of the ecological limits to material growth (Rees, 1990).

Rural communities in developing countries are not exempted from the modernisation process that currently influences the world. This process includes globalisation of the markets and information, reduction of international prices, industrialisation of the

production towards lower costs and economies of scale (large-scale economic organisation), urbanisation, and concentration of the wealth in fewer hands (Ellis, 2000).

Poverty and environmental problems remain waiting for the implementation of solutions worldwide. In rural areas the fixed supply of land suitable for agriculture and food production, the increasing numbers of people competing for the same land area, and the widespread process of land degradation accelerated by human activities, are the main aspects that FAO (1993) stresses about the relation between poverty-population and environmental concerns. The global population is expected to grow to about 8 billion by 2025 (World Bank, 2001b). Human pressure on resources to achieve higher levels of productivity and meet market exigencies is increasing rapidly with the industrialisation of the developing countries. This situation, plus the widespread modernisation development model will create important ecological, economical and social costs for future generations. As Blaschke (1991) suggests, future generations may have to bear the cost of present day activities which seek short-term economic gain. The capacity of the earth is limited, so that the sustainability of the chosen development model will be a defining issue of the twenty-first century.

Sustainable development has been regarded as an alternative development model which is aimed at equilibrating the trade-offs between environment, social, and economic factors. There is widespread agreement that sustainability should be the basis of a new development theory (United Nations, 1992). The most widespread definition for *sustainable development* comes from the Brundtland report (WCED, 1987, p. 8) and is as follows:

> *Development which meets the needs of the present without compromising the ability of future generations to meet their own goals*.

Sustainability is about the equilibrium of the use, needs and special characteristics of three main factors: environment, economics, and society; all of them important in their own dimension. The aim is to reach an equilibrium in which all three factors can express their potential on a long-term basis, without decreasing their future capability to recover from shock and stress (resilience) produced by unsustainable human economic activity, or natural disasters. All of the three main factors must hand over some of their internal expectations to benefit the common equilibrium. For example, humans should use the environment responsibly; that means avoiding resource depletion. Exploitation of natural resources must not be seen as only business and

market profit, and society must live according to its surrounding ecosystem possibilities.

Figure 2.1 illustrates a system (e.g. community-region-nation) with strong sustainability in terms of natural resources, in which the environment constrains society and economy. In this model human society is totally immersed in the environment. The economy is a subset of society, because it exists only in the social context. Human cultural values can change, their expectations can rise or fall, the economy can expand or contract, but in no case is it possible to exceed the capacity of the earth to absorb the effects of human activities (PCE, 2002).

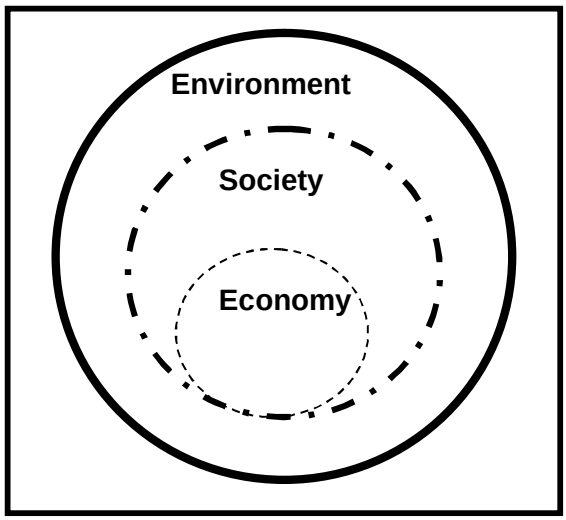

FIGURE 2.1. Sustainability of a system is basically constrained by the natural systems. In this case the economy is presented as a subset of the society.
(Source: PCE, 2002.)

There is a need to adapt the actual models of development to more environmentally and socially sound models. Some initiatives are beginning to be applied and there is international pressure to incorporate these elements into government programmes in the following years (certification schemes, carbon taxes, etc.). Real sustainable development needs to find equilibrium between the human-centred emphasis of the current development and the eco-centred development that green movements propose. Blaschke et al., (1991, p. 182) states: "*ecological sustainability and human economic development may often be incompatible*".

Ecological economics incorporates ecological concepts into the economic model. It aims to reorganise the markets to allow the expression of the hidden costs and externalities that development and economic growth generate. It states that a healthy

economy needs a healthy ecology (Costanza, 1997). The two concepts are interdependent and it is not possible to isolate them. The incorporation of elements of ecological economics into the current development model would involve a recovery of the recognition that nature supports our lives and livelihood and is the primary source of sustenance (Shiva, 1992).

Finally, it is central to consider the different levels of sustainability. There are global considerations, and local ones. What is sustainable in one area may not be so in another, and what was sustainable at one time may no longer be sustainable (FAO, 1993). Sustainability is a dynamic concept, subject to boundaries, timeframes and local conditions.

The sustainable development theory has influenced the practice of rural development in low income countries, generating a paradigm shift which integrates ecological as well as economic criteria.

2.1.1 Sustainable rural development

Rural development has been concerned for decades with agriculture, development of small farms, nonfarm economy, and rural livelihoods, but also with wider issues such as health, education, participation, and social protection (Ashley, 2001). As discussed before, usually in low income countries economic criteria rule the decision making process, and environment and social issues are less important. Shepherd (1998) states that in the context of low income countries, sustainable development has not been promoted.

Sustainable rural development can be attained by encouraging the use of local labour, adapting indigenous technologies, and creating participative small productive units that can work and sell collaboratively, developing holistic responses to social needs of rural communities, and empowering people towards finding their own solutions.

Currently, rural development initiatives are delivered in the form of projects and programmes. Shepherd (1998) establishes that the generation of a rural development project reflects the broader framework in which rural development should be applied. At present, there is a dominance of aid and aid-like processes in rural development, creating a project-based culture, based on objectives and cost-effectiveness. New perspectives on rural development include: participation, holistic point of view, and process approach versus blueprints. Sustainable rural

development should be managed in initial stages by governmental agencies and NGOs, as a multisectoral activity, with targeted state intervention, and by creating partnership with the civil society (Ashley, 2001). During the past decade *sector-wide approaches*[1] have been successful in health and education, but rural development is not a sector as defined, and it involves a series of other activities such as agriculture, off-farm economies, and local culture among others.

A rural development project should operate under three principles: *territorialism*, focus on space and people reaching their own local goals, (as the opposite to the goal of increasing, for example, the GDP for the country); *cultural pluralism*, (which refers to the fact that different communities in the same society have different codes of behaviour and value systems, which reinforce the separate ethnic identity rather than attempting to generalise in a common national culture); and finally, the *ecological sustainability* concept that will be described later in this review.

Key elements for achieving sustainable development are presented here (Shepherd, 1998):

Sustainable agriculture: the literature refers to this concept as an increase in productivity through intensification substituting chemicals for organic inputs. However, other views are more concerned with the relation of the agricultural systems with the surrounding environment, moving away from chemicals, aiming for organic farming and creating agro-ecological systems based on species diversity (Ellis, 2000). Another less radical approach to sustainable agriculture is the “best practices principles approach” that include changes in the ways of production towards more environmentally responsible alternatives (i.e. use of legumes in crop rotations, cover crops, catch crops, green manure, reduction of tillage, and synchronisation of fertilisation with demand). In poor countries the shift to sustainable agriculture is an economic as well as an environmental necessity. The high cost of production of the green revolution technology creates a necessary change to more sustainable options of agriculture. Cleaner and low input alternatives are much appreciated in Western developed societies because of their environmental and health concerns. Ashley (2001) establishes, for a low income country context, that agricultural growth and higher productivity have a positive relationship with poverty reduction. So it can be considered that supporting sustainable agricultural practices

[1] A sector-wide approach promotes the ownership of the development process by the local government, funding ministries or programmes at the governmental level. It is opposite to project-level funding. For more information see Farrington (2001).

can be a key element in developing rural areas. That means, for example, the use of local technology, lower inputs, smaller scale, lower capital per worker ratio, integrated pest management, and slow release fertilisers, among other context specific characteristics.

The presence of sustainable local institutions: There is a need to consider the necessary change in the basic strategies of who is directing the process. Institutions should change to be local (i.e., aim at decentralisation) and encourage participation among the community (Shepherd, 1998). Through empowerment local institutions can create sustainable livelihoods and increase the educational levels of the rural population. Empowerment is related to education, which finally influences rural people's cultural values, know-how, sense for life, and self-reliance (Schumacher, 1973). Education is also an important component of environmental conservation (Hollander, 2003).

Gender perspectives are another key element to be incorporated into rural sustainable development initiatives. This element considers that all members of a community should be treated equally. It incorporates the issues of human rights into development. Values like autonomy, dignity, peace, equity, freedom, justice, and quality of the natural environment have gained a place as development objectives and are part of the sustainable development concept. In terms of development initiatives it incorporates the change from "who benefits" from the project, to "with what contributes"; meaning by this, a change from paternalistic approaches to participative approaches, focussing especially on the differences between men and women.

Figure 2.2 illustrates a summary of the elements described before, all of them involved in achieving Sustainable rural development. The three main components of rural sustainability are included: Rural communities (social), natural resources (environment), and local economy (economy); generating the baseline for applied field solutions such as sustainable agriculture, social participation, and the involvement of the state and private sector in a common project. There are development values that should be respected (e.g., autonomy, dignity, peace, equity, freedom, and justice) and three broad operating principles close the sustainability cycle: territorial approach, respect for local culture and values, and a special concern about the environment's sustainability.

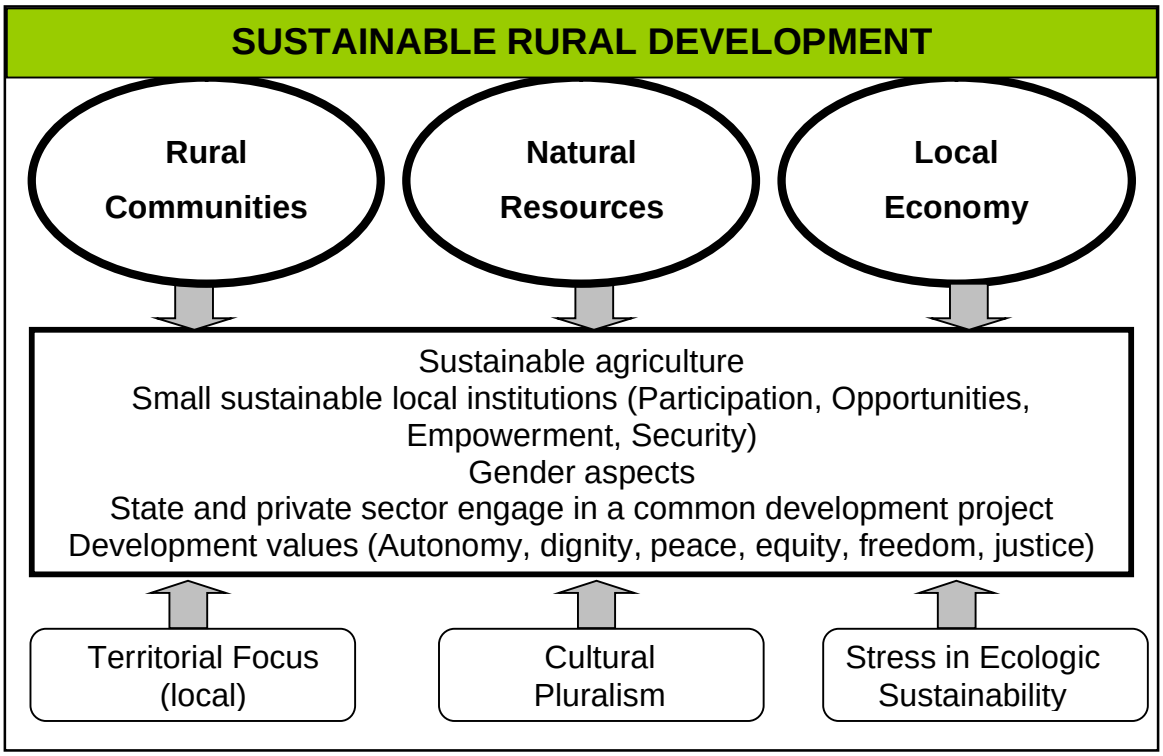

FIGURE 2.2. Summary of the main aspects involved in the new paradigm of sustainable rural development.

2.2 RURAL COMMUNITIES AND NATURAL RESOURCES

The last section focused on the broader context faced by rural communities in low income countries, expressed by modernisation and an economic oriented development process. In that section, the concept of sustainable development was introduced as an alternative to the current development process.

This section will describe the sustainability of rural communities and the surrounding environment in terms of the three main components of sustainability (i.e., social, economic, and environmental). First, social and economic aspects of sustainability are analysed separately, considering the factors that affect or enhance sustainability of rural communities. Secondly, the natural resource component is analyzed and the main factors necessary to achieve sustainability of human managed ecosystems are presented. Thirdly, the links between socioeconomic and environmental aspects are described, incorporating empirical and case study evidence. Finally, different strategies at the organisational and household levels are presented as a result of the adaptation of the different stakeholders to the described factors that are affecting the sustainability of rural communities and natural resources.

2.2.1 Rural communities and the socioeconomic factors enhancing their sustainability

This review is about rural environments and families that live in countryside areas, their dependence on natural resources and ways to achieve sustainability. In this section the socioeconomic aspects of the rural communities will be described. First, the definition of *rural area* is presented; second, the concept of *rural livelihood* is introduced as an approach to integrate all the aspects of rural communities' sustainability; and finally, different factors that affect rural communities in social and economic terms are described.

- **Rural areas, communities, and livelihoods**

Rural Areas

Rural areas constitute the space where *human settlement and infrastructure occupy only small patches of the landscape, most of which is dominated by fields and pastures, woods and forests, water, mountain and desert* (Ashley, 2001). Rural people usually live in farmsteads or settlements of 5 to 10,000 persons, depending on the different countries (IFAD, 2001). Other authors characterise rural areas in terms of places where people spend most of their time working on farms, places where land is relatively cheap and abundant, places with high transaction costs associated with long distance and poor infrastructure (Binswanger & Deininger, 1997; cited in Ashley, 2001). Natural capital is one of the key elements of rural areas, and the immobility of the natural resources generates several activities that are exclusive to these areas such as farming, forestry, fishing, and mining (Wiggins, 2001). In the Chilean context rural areas are considered as villages with a population of fewer than 1,000 inhabitants, or between 1,001 and 2,000 inhabitants where 50% of the economically productive population carries out activities derived from the natural resources (secondary or tertiary activities) (MIDEPLAN, 2000).

Rural communities and households

While older views see rural communities as static and relatively homogenous entities, new approaches of social theory view communities as diverse groups of people, with different identities, stressing important differences in terms of gender, caste, wealth, age, and origins. Communities are composed of people who actively monitor, interpret, and shape the world around them (Leach, 1999). For this research *communities* are *groups of households that share a common territory, have similar historical background, and define themselves as a community*.

A *household* is conventionally conceived as *the social group which resides in the same place, shares same meals, and makes joint or coordinated decisions over resource allocation and income pooling* (Ellis, 2000, p. 18).

Rural livelihoods

The introduction of the concept of *rural livelihood* at this stage is important because of its significance in terms of integrating the concepts of community and sustainability. The definition of Sustainable Livelihoods comes from Chambers (1992, p. 7):

> *"A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living: a livelihood is sustainable in which can cope with and recover from stress and shocks and maintain or enhanced its capabilities and assets both now and in the future…"*

Hussein (1998, p. 3) adds an environmental consideration to the end of that definition to stress this often neglected factor *"...while not undermining the natural resource base."*

The livelihood analysis was developed through the 1980s and 1990s by authors such as Chambers and Conway and finds its roots in the famine analysis of the 1980s by Sen and Swift (all cited in Ellis, 2001). The Livelihood approach has become a useful tool for rural development analysis (Ashley, 2001). Scoones (1998) states that the concept of *sustainable livelihoods* is gaining importance in rural development initiatives, poverty reduction and environmental management.

The livelihood analysis identifies the assets available for rural communities, includes the context that surrounds the rural area, integrates the analysis in a holistic manner, and aims for sustainability of the economic, social and natural resources. The interesting considerations of this view are that livelihoods refer to more than only income and wealth. Other factors such as quality of life and society, security, and dignity are also considered (Shepherd, 1998). Rural livelihoods are constructed from a set or a portfolio of resources and activities (Hussein, 1998).

Rural livelihood analysis must be conducted from the perspective of rural people. In that sense it stresses a holistic analysis of the livelihood strategies to support people's capacity to act and produce (Gilman, 2000). Rural people have the capacity to exercise choice. Due to the actual pattern of change in the rural areas, there is a

need to understand the diversity of rural areas and the complexity of livelihood strategies.

At the community level, for a livelihood to be sustainable requires that the livelihood strategy selected by each household should not affect the options of others in the community to make their living (Gilman, 2000).

In summary, rural livelihood sustainability is influenced by economic, social and environmental factors. Social aspects and economic factors are related, especially during the last century where the economy has taken an important and ruling position in low income countries. These socioeconomic factors are part of the specific context for each community and will lead to certain choices of livelihood strategies, which will be analysed in section 2.2.4.

- **Economic factors influencing sustainability of rural communities**

Economic sustainability refers to *an activity that over the long term has an income or return from the investments equal to or greater than the cost of inputs, in the local currency* (Parliamentary Commissioner for the Environment, 1991; cited in Blaschke, 1991). Economic aspects are very relevant in the daily lives of rural communities. The economic performance of one household will be finally the most common indicator to show if a certain household lives in poverty conditions or not.

Rural poverty

This research is focused on poor rural communities, aiming to describe the livelihood strategies of the less developed farmers of Chiloé Island. As in many parts of the world the rural areas of Chile present deep poverty problems and several environmental concerns.

Poverty measured by the income generation capacities of a household is an important economic factor in rural household sustainability. Three-quarters of the world's extreme poverty is located in rural areas and 50 % of the poor depend on agriculture products (IFAD, 2001). Conway (1997) points out that the majority of rural poor live in areas that are ecologically vulnerable, resource poor, highly heterogeneous and risk prone. Rural poor are often located in environmentally degraded areas (through pollution, erosion, overexploitation of land and natural resources), or areas that are climate restrictive, for example dry regions, wetlands and mountains. Conway (1997) gives the mountainous areas of Latin-America or South-Asia as example. Natural resources degradation has produced a deep change

in the stability of rural communities through countryside to city migration, general high poverty rates, and loss of cultural values. Food safety, malnutrition, illiteracy, powerlessness, low self-esteem, and social inequity are social concerns today and are still a very big problem for the poor people in developing countries around the world.

Poor farmers make little use of credit, sell their products in local markets, and their livelihood is mostly for subsistence (Shepherd, 1998). Low income countries are forced generally to adopt structural adjustment policies, very focused on growth, reduction of the size of the state and its expenditure, shift to the private sector, increase of exports and decrease of imports, and encouraging exploitation of natural resources to pay debts. This external context affects the rural poor, increasing the rural-urban migration, with consequent redistributive problems, and increasing poverty, among others.

The World development report (World Bank, 2001b) adopts a multidimensional definition of poverty, and incorporates three important elements: *Opportunity* referring to growth, with markets working better for the poor and how to expand the assets for the poor; *Empowerment*, about making state institutions responsive to poor people and building social capital; and finally *Security*, meaning the risk managing strategies to reduce the vulnerability context (Ashley, 2001). The 1997 UNDP Human Development Report (United Nations, 1997) establishes that the core elements to eradicate poverty are: *empowerment*, *pro-poor growth*, *improved management of globalisation*, an *active state*, *gender equity*, and *building on assets of the poor*.

As described, the livelihood analysis adopts a multidimensional context of poverty. It is a useful analytic structure that helps in understanding the reality of the poor and the complexity of the rural life. These elements (e.g.: opportunities, empowerment, security, pro-poor growth, assets for the poor) should be considered in the analysis of the livelihood strategies of rural communities with the intention of generating better policies for the future. By generating a better environment for the households, and aiming to improve the livelihood strategies through the development of individual, family and community capacities, poverty can be eradicated (Gilman, 2000).

Size of the farm

This research is focused on rural communities composed of small subsistence farmers. The size of a productive unit has been a matter of debate. Several authors agree that small farms are able to create sustainable livelihoods in rural areas. Ellis (2001) establishes that at a local level an emphasis on small farms can address

growth and equity issues. Schumacher (1973) suggests that small independent units, using local labour, local and intermediate technologies, with low capital per worker can create more well-being than can mega-corporations and big economic structures. The concentration of wealth in fewer hands leads to the creation of dual rural economies: on the one side the rich commercial farms, and on the other the small peasant communities (Ellis, 2001).

On the other hand, Ashley (2001) presents evidence in the case of Mexico and Brazil questioning the future ability of small farmers to enhance their productivity and efficiency in order to compete with large-scale agriculture. However, IFAD (2001) states that productivity of small farms is at least twice that of the largest ones in Colombia, Brazil and India. They use employment more intensively, and practise double cropping and intercropping using a mixture of valuable crops. Schumacher (1973) states the importance of the small size initiatives and that small economies are viable. He incorporates the idea that not all the evaluation should be economic, stressing also qualitative concepts about the importance of land and work for the rural people.

Certainly the case for small farms fails if we adopt an approach based on the use of high level technology and the need of high levels of knowledge to manage the farm. The general idea of the “smallness” concept is to change these technologies for appropriate ones, more adapted to the local conditions and to the preferences of the peasant communities.

Rural growth

Ellis (2000) establishes that small farm growth is a prerequisite for nonfarm growth in other areas of a country. Increased agricultural outputs generate the increase of labour intensive nonfarm activities, known as the “rural growth linkages” (Ellis, 2000, p. 22). Rural growth reduces poverty both in rural and urban areas, but urban growth does not alleviate poverty in rural areas (Dart & Ravallion, 1996; cited in Ashley, 2001).

Migration and population trends

Migration of rural people to urban areas is a result of an increase in the rural population, but is also due to the impossibility of surviving and making a living (in economic terms) in the farming areas. This is related to the *opportunities* to generate sustainable livelihoods in rural areas.

Analysing data between 1970 and 1999 and projecting them to the 2020 for India, Kenya and Brazil, Ashley (2001) concludes that during this period the rural population will continue to grow in absolute terms, but will decline in relative terms (compared to the urban population). Population densities are rising and poverty remains high, with more than 75% of the world's poor living in rural areas (IFAD, 2001; Wiggins, 2001). The Chilean case is similar to these other low income countries. In 1990 of the total population, 18.5% was rural, and in the year 2000, the proportion of rural inhabitants decreased to 14.1%. This demonstrates the continuous decrease in rural population in Chile (MIDEPLAN, 1998). Connectivity, infrastructure and services have improved, but agricultural commodity prices have decreased, pushing hundreds of rural inhabitants to the cities.

Infrastructure access

Connectedness (physical capital) as described in the last point has improved in many low income countries, with better provision of roads, electricity and telephone lines. Physical capital generates better information access, health services, and education opportunities. However, it also exposes rural communities to other changes such as conflict spreading (political, territorial) in some rural areas, dependence on markets, decline of the agriculture sector in relative terms as part of the economy, low prices for commodities, migration, rapid technological change, and rapid development of the rural nonfarm economy (Ashley, 2001).

Access to credit and subsidies

For noncapitalised smallholders, access to credit is one of the most limiting variables. Microcredit can come from formal or informal sources. Informal sources can not be dismissed, because they are of great importance to the rural inhabitants and are easily reached. For example, in Pakistan almost 70% of the credits obtained by smallholders come from informal sources (Manig, 1990). In this case, money lenders, who charge excessive interest, are not an important part of the informal market, as lending from relatives comprises 58% of all the informal lending. Manig (1990) concludes that informal credit can be as efficient as subsidised formal credit schemes in terms of equity and distribution of the resources in rural areas. Pretes (2002) suggests that there is a high inequity in the actual credit schemes used in low income countries. Rural banking services must satisfy a complete range of services, to cover the demands of all the stakeholders, allowing people to obtain credit and also start up grants. In the Chilean case, small rural farmers can have access to subsidised credit that the Agricultural Development National Institute (INDAP) delivers. This credit

helps farmers adopt technological packages, fertiliser, improve farm infrastructure, and in some cases form community managed microenterprises. In 2003 INDAP released more than 3 million US dollars in credits to the small beneficiaries of the Chilean rural areas (INDAP, 2003).

Subsides are not well perceived within the new free trade market world. International market agreements do not allow governments to deliver direct subsidies to agriculture and other areas of the economy. However, grants are important to get new businesses or microenterprises started (Pretes, 2002). In Chile, indirect subsidies or benefits are still being used in agriculture, for example, for soil recuperation (fertilisers, new farm land opening, foresting), and technical assistance. For the small farmers there is a complete set of subsidies and benefits administered by INDAP. These subsidies cover irrigation projects, livestock projects and technical assistance. Rural and urban councils can deliver special grants for people with major social problems.

- **Social factors influencing sustainability of Rural Communities**

Social sustainability involves a multiple criteria definition which includes quality of life, social peace, a strong civil society, participation, the degree of incidence of different forms of poverty and exclusion, distributional equity, justice and human rights, cultural identity and diversity, the maintenance of social capital, and the effectiveness of social institutions (Glaser, 2004, p. 366). The relative importance of each of these criteria depends on the local specific social, economic and environmental context.

Sustainable social values

Social values are a key factor in achieving social sustainability. Social values can be influenced by external cultural interferences such as globalisation, migration of new people into the area, presence of foreign tourism, and television, among others. Social sustainable values are equity, justice and liberation. Unjust societies or communities are not sustainable. For example, injustices can take the form of division of society by race or class, gender discrimination, basic human rights, and inequalities in health and education, among others.

Participation and empowerment seem to be the most common prerequisites for bringing about justice and social equity. Participation refers to people's identifying their own needs and taking part in the development process. Empowerment goes one step further, stating that development should occur by providing the means by

which poor and marginalised groups can change their own lives for the better (Friedmann, 1992; cited in Maiava, 2003).

Culture and traditions

The maintenance of the local culture and traditions is part of the social values of a community. As rural communities evolve, grow, and are exposed to modernisation, they begin to lose some of their traditional cultural background. However, it must be considered that culture is a process, not a state, and it evolves over time (Crocombe, 1972; Latukefu, 1976; cited in Cahn, 2002)

A study done by Cahn (2002) on the current livelihood and cultural changes in the Pacific Islands shows that rural livelihood exists in the context of culture and tradition. These two elements impact on livelihood in terms of access to - and the control over - the resources; choice and success of the elected living strategy, priorities for livelihood outcomes; and finally, the incentives that the people respond to. On the other hand, traditional livelihoods are affected by external influences (i.e., national context, markets, and new cultures) which in turn generate a cultural change among the community, and as a result, new ways of living develop. That means that culture and traditions change in a dynamic process influenced by external forces, changing again the livelihood strategies. This process is exposed in figure 2.3 and is applicable to most of the different cultures of the world.

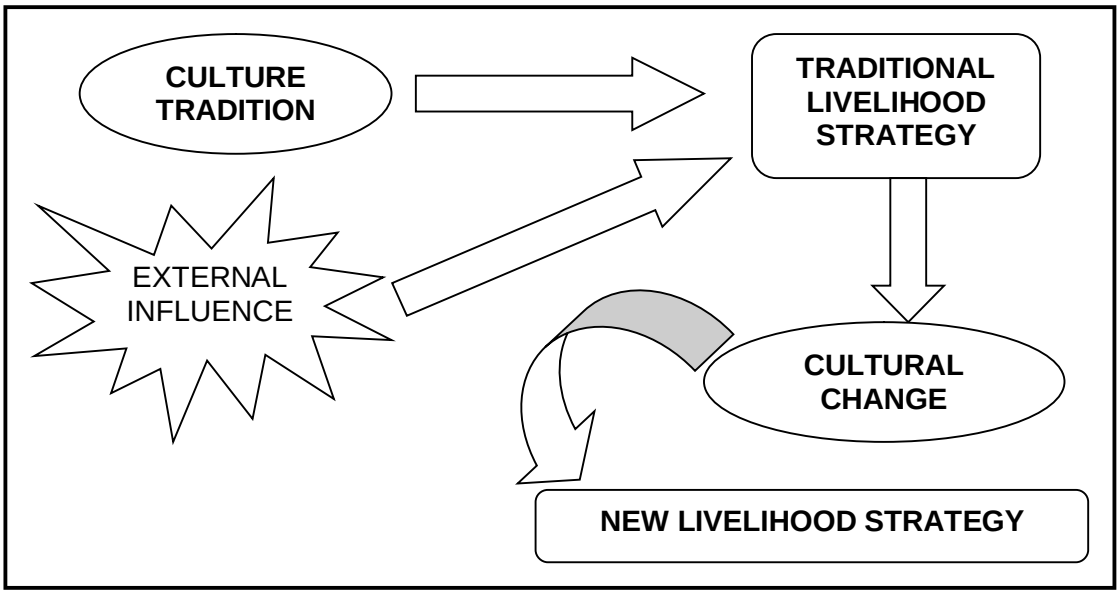

FIGURE 2.3. Dynamic process of livelihood and cultural change
(Source: Cahn, 2002).

The benefit of using a holistic livelihood approach is that all the aspects affecting a certain community are considered. For example, many projects in the Pacific islands have failed because institutional and sociocultural issues were not considered. Such sociocultural aspects are obligations inside the community that are collective rather than individually motivated, antagonistic feelings towards individual economic gain, commitment to ceremonies and gift giving, sharing and distribution of food and money patterns, influence of church, power and status of individuals and gender issues. Given those sociocultural realities it can be concluded that these island communities do not fit the dominant economic model and a alternative model for development is called for.

Distribution of assets

Distribution of assets is an important factor, especially in the rural areas, where redistribution of - or access to - assets such as land, water, and labour are key determinants in reducing poverty or increasing social and economic sustainability (Rahman, 2001). Labour is the main asset that rural poor have. The capacity to sell labour is related to the health and skills of the household member. This asset combined with other assets (natural resources) can create a viable livelihood (Ellis, 2000).

Within communities, different households compete for the control of the assets. This situation creates an uneven distribution of resources. The competition and different access opportunities of community household and the differential impacts of the environmental degradation among household should be recognised before implementing sustainable rural development initiatives (Gilman, 2000).

As Ellis (2000) suggests, an unequal distribution of resources is generated as rural poor are dispossessed of their assets or obliged to sell or migrate. The rural rich concentrate more land and resources, increasing the inequalities.

Social protection is related to the vulnerability context of the rural community. Households normally turn to community support systems in case of shocks and stresses. Poor people respond to stresses by adopting either *ex-ante* risk management strategies or *ex-post* coping strategies. If less developed social networks are established, the vulnerability of the household increases, finally affecting the livelihood sustainability of rural households.

Education is the greatest resource for poor communities (Schumacher, 1973). Transmission of values, respect for life, and technical know-how are key elements for social sustainability. Ashley (2001) showed for India, Kenya, and Brazil that in general terms “human capabilities” such as literacy are increasing social capital in rural areas of low income countries.

Increased education among rural communities leads to increased ***health***, due to more awareness and better sources of information. Health is another aspect that Ashley (2001) suggests has shown some improvement during the last decades in low income countries. This is reflected in decreased infant mortality, and better access to health services and sanitation.

Group sustainability, in terms of the local organisational capacities, is a key element of social sustainability in rural areas. For the success of a local organisation (e.g., productive groups, and community boards) there are several elements that define their sustainability. People must find personal benefits in a project, as well as community or group benefits. Cheating and opportunism in productive oriented community groups and community boards must be reduced, flexible and simple management must be encouraged, trust must be built, and quality leaders must sacrifice part of their time for the group. Some rules must be created and the ability to punish must exist.

However, groups and cooperatives are not always the solution to a particular productive or organisational problem. Due to a lack of planning, organisational skills, or initial external support and advice productive groups often do not succeed after a particular project or subsidy. External consultants are key element to securing group sustainability as they have to prepare rural people with the necessary organisational skills. As Lyon (2003) suggests, group sustainability takes time to develop, and needs training, and an equilibrated rate of external supervision. Most of the aid development programmes encourage the formation of groups as the main aspect to participation in the projects. If the group is not well prepared for a communal and participatory activity, the project’s chance of failure increases.

2.2.2 Natural Resources factors enhancing Sustainability

The concept of the environment as a separate entity is a human invention and has profound effect in our relation with the environment (Rees, 1990).

For Ellis (2000), *environment* means *the land, water, and vegetation that are utilized by the rural communities to provide means of survival*. In this research the concept of "natural resources" instead of "environment" has been used, aiming to stress the "human utilization component" of the environment. Therefore, natural resources are: forest resources (native and introduced), agricultural resources (including access to land (quantity of land), soil (quality of land), pastures, horticultural facilities (greenhouse, veggie garden), and livestock), marine resources, mineral resources, and water, all of them available for the rural community. Natural resources are an integral part of the local ecosystem, in the same way that the ecosystems are part of the general environment.

The sustainability of natural resources is based on ecological theories and incorporates social interactions that aim to manage an ecosystem. Human intervention can affect the state of the ecosystem in a negative or positive way. The direction of the change that human interactions create depends on the ecosystem's characteristics, the type of intervention, and the expected outcome. It is not easy to establish limits, boundaries and harvest quotas to human intervention in the natural ecosystems, or to recognise the finite nature of the resources (Blaschke, 1991).

The maintenance of the essential ecosystem processes is a key element in the ecosystem sustainability (Blaschke, 1991; Chapin 1996), as will be established in the analysis that follows. The aim of this section is to provide some understanding of the key elements about the structure of the ecosystems in order that they might be managed in a sustainable way.

- **Ecosystem sustainability**

A *sustainable ecosystem* is *one which, over the normal cycle of disturbance events, maintains its characteristic diversity of major functional groups, productivity, and rates of biochemical cycling* (Chapin, 1996). This definition includes all the stages of succession: disturbance, colonisation, and successional development (Holling, 1986; cited in Chapin, 1996). It involves the use of components of an ecosystem that allows the perpetuation of the character and natural processes of that ecosystem (Blaschke, 1991).

Ecological theory is based on the notions of equilibrium, balance, harmony and functional order. Key concepts include gradual, linear change, homeostatic regulations and stable equilibrium points or cycles; concepts grounded in the "balance of nature" (Leach, 1999). The equilibrium assumptions are included in several theories such as: vegetation succession, population modelling, ecosystem functioning, and species area relationships. There is an implicit idea of linear transition to a stable and natural climax. Since the 1970s nonequilibrium theories have emerged creating what is known as the "new ecology". These theories differentiate from the former ecology theories by: firstly, having an understanding of the variability in time and space, resulting in dynamic modelling of the ecosystems; secondly, working with hierarchies and scale relationships in ecosystem analysis; and finally, by recognising the importance of history for current dynamics. The aim in using the historical emphasis is to consider the human effects in the environment, analysing the relationships between environmental and social change.

Ecosystem sustainability is of growing concern to ecologists who study the cumulative global impact of environmental change. It is important also for social scientists or development practitioners who attempt to develop policies to sustain production of food, goods, and services in the increasing human population. Many ecosystems already show long-term changes due intense human use, as for example desertification, eutrofication, and loss of organic soil.

Rural communities should practise the principle of *environmental care*; which is defined as *a process by which local communities organise themselves with varying degrees of outside support so as to apply their skills and knowledge to the care of natural resources and environment while satisfying livelihood needs* (Pretty & Guijt, 1992; cited in Leach, 1999).

- **Natural resources sustainability components**

Hierarchies

Conway (1987), Blaschke (1991), and Kelly (1997) establish the importance of considering that ecosystems are hierarchical systems. Only appropriated levels of hierarchies should be compared. For example, a farm can be sustainable within the farm boundaries, but may not be sustainable at other levels, such as in the macroeconomic context. The hierarchies in a natural system can be conceived as, organism-population-community-ecosystem-biome-biosphere, or in the case of an agricultural system, field-farm-village-region-nation (Conway, 1985).

Temporal scales

Attention should be given to temporal and spatial scales. Sustainability is not an infinite condition. Every system has a timeframe for its sustainability. Normally, societies consider scales that are relevant to direct human management, related to the long-term yield of commodities for human consumption. Human scales are not relevant for unmanaged ecosystems such as National Parks and Reserves. Few ecosystems are sustainable longer than a few tens of thousands of years, because over that period all the elements (climate, soil, and species) change significantly. Hence sustainability is relevant in terms of the dominant species: decades to centuries (FAO, 1993; Chapin, 1996).

Predicting Natural Resource Sustainability

An important feature related to ecosystem sustainability is that sustainability is a prediction, based on today's fitness of the system. For example, the use of the concept of maximum sustainable yield for wildlife or fisheries needs knowledge and research about the system and its condition. This happens because every system has a certain succession in its life-span. This succession is a result of the changing climatic conditions and other internal developmental changes. It is necessary to distinguish changes due normal life-span limits and changes that cut short the life-span of the system. Human activity can introduce shortcuts to the life-span of a certain system (Constanza, 1997).

Interactive Controls of the Ecosystem

The sustainability of an ecosystem is characterised by a set of four interactive controls that govern and control the ecosystem processes (Chapin, 1996). The interactive controls determine the structure and productivity of ecosystems. Human management of the natural resources introduces changes in these controls with a possibility of an unsustainable result. These interactive controls must oscillate within stable bounds for the ecosystem to remain sustainable. The Interactive controls are:

Climate governs the structure, productivity and biogeochemistry of ecosystems. Climatic changes generating glacial and interglacial cycles have generated strong ecosystem changes (Davis, 1981; cited in Chapin, 1996). Microclimatic aspects such as water and temperature are governed by vegetation structures and their productivity. Latitude, solar input, land-ocean interactions and topography determine the climate patterns that affect and also determine one ecosystem. Changes in the ecosystem can affect climate, demonstrating the close interaction between them. For

example, the conversion of forest to pastures might lead to drier climate patterns that affect the forest regeneration, creating a new state in the ecosystem.

Soil Resource supply determines the maximum productivity and structural diversity of vegetation. Change in soil resources is the most widespread mechanism by which human activity has altered ecosystem sustainability. Erosion, fertilisers, and runoff to aquatic systems are some examples.

Major functional organisms: Functional groups in an ecosystem are groups of species that have similar effects on the ecosystem processes. Functional groups are, for example, herbivorous animals, evergreen trees, and mosses. They have, as a group of organisms, important effects on the ecosystem process (Chapin, 1996). Climate, soil and disturbance affect the species type that dominates the ecosystem. Elimination or introduction of species in an ecosystem can change the shape of it definitively through changes in resources or in the disturbance regime.

Disturbance Regime: fire, wind, insect outbreaks, hurricanes, and floods are landscape scale disturbances that are critical to sustaining natural structure. Climate is much related to the disturbance regime, and how often this situation occurs. On the other hand the disturbance events such as flooding affect the soil resource with new material. Human activity also causes severe stress to the ecosystems, such as dam building, fires, urbanisation, and the opening up of new land for farming.

To maintain natural ecosystems in their current state or manage them in a sustainable manner, there is a need of maintaining the interactive controls. This occurs with a series of negative and positive feedback that constrain the possible changes in these controls.

Feedback mechanisms of the Ecosystems

Natural ecosystems are a complex network of interacting positive and negative feedbacks (De Angelis et al., 1986; cited in Chapin, 1996). Conway (1987) citing several authors, stresses the importance of the feedback control mechanisms and communication networks of the ecosystems.

Negative and positive feedbacks control the successions in the ecosystems. Negative feedbacks provide resistance to natural and anthropogenic changes in the interactive controls of the ecosystem. This feedback maintains the potential for regeneration after the perturbation. Positive feedbacks amplify the original change and push the ecosystem to a new state. For example, after a disturbance there is an increase of plant biomass (positive feedback) due to more light and better soil. At a

certain level, negative feedbacks constrain the growth in biomass because less light penetrates the canopy and there is more competition for the resources (Chapin, 1996).

In managed ecosystems, the management practices are determine the degree of sustainability of the system. Understanding, maintaining and encouraging the interactive controls and the negative feedbacks are key principles to be applied in managing ecosystems if sustainability is to be achieved.

Conservation practices[2]

In normal circumstances rural communities do not farm in ways that cause a decline in yields for the future (Ellis, 2000). Economic factors play an important role in the conservation strategies that farmers can apply in their activities. If the future income streams are heavily discounted compared with current income, current production and extraction of resources are a priority. Also, if the opportunity cost of labour is high (due to livelihood stress, insecure land tenure, low returns), less work is directed to conservation, such as terrace building, fertilisation, rotations, tree planting, and generally better agricultural practices. If stress increases (e.g., market prices for products decrease, labour shortage), conservation practices are neglected. Then this results in households facing the choice between conservation and survival. With the increase of population in rural areas, initial degradation could occur (i.e., as more firewood is needed), but in some cases that does not happen. If people are too poor to invest, degradation occurs. In cases where the cost of land relative to labour increases, farmers can change their methods of production, invest in the land and use it more intensively (Gilman, 2000).

- **Factors that influence natural resource sustainability**

As discussed, natural resource sustainability is greatly influenced by the different ***management strategies*** that communities entitled to use the resources apply to a specific ecosystem. Management strategies are considered as the different livelihood strategies adopted by the rural communities related to the use of their available resources. These livelihood strategies can take into account different *levels of technology* that can affect the ecosystem in different forms. These levels of technology lead to the adoption or rejection of certain *conservation practices* which

[2] The concept of conservation practices does not refer only to purely preservation strategies (e.g., national parks, or avoiding the utilisation of natural resources due to conservation purposes); it is referred to as any practice aiming at sustainable management of natural resources.

are key elements to achieving natural resource sustainability. Mog (2004) establishes a list of conservation strategies as indicators of sustainability. It includes: contour line ploughing, crop rotation, tree plantation, and regular fallowing.

Natural resource sustainability is much influenced by the adoption of the appropriate *temporal scale* and the suitable *hierarchy level*, depending on the general characteristic of the local resources. Therefore a basic *knowledge* of the local natural resource is important. This information allows the community to manage and enhance the local conditions through the controls and feedbacks of the ecosystem in which the communities live, ensuring at the end, a sustainable use of them. As Armesto (2001, p. 866) states for the Chilean context: "the traditional knowledge reveals a much broader perception of the forested resources". Armesto (2001) argues that current external forest managers do not recognise the richness of this knowledge, and that this cultural background has important implications for the development of alternative practices for managing the forests. For Mog (2004), local capabilities, skills, and knowledge are key factors for the sustainability of local initiatives.

Ecological theory is changing the view of the ecosystem from an equilibrated, linear path of the ecosystems towards a climax state, for a view of ecology that stresses spatial and temporal variability, dynamic and nonequilibrium processes, and historical disturbance events. This results in a *new approach to landscape* (landscape as a set of natural resources): a landscape that is transforming, not simply degrading; an ecosystem that is emerging as product of social and ecological history, not simply changing the product of deterministic patterns of environmental change (Leach, 1999).

2.2.3 Natural Resource and Rural Livelihoods Sustainability

What is required is to bring community and environment back into harmony: "policies that bring human numbers and life-styles into balance with nature's capacity" (IUCN / WWF / UNEP, 1991; cited by Leach, 1999)

After analysing the key elements that influence natural resource sustainability (last section) and the livelihood concept as an integrating concept of a rural community's sustainability (section 2.2.1), the relation between them is presented in this section. Poverty, as described in prior sections, has been declared to be one of the main reasons for environmental degradation. However, there are different explanations

that scholars give to describe the relation between rural communities and their natural resource endowment.

- **The rural community - natural resource relation**

Rural areas take in the two elements on which this research focuses: rural communities and natural resources. In developing countries this equation is normally made up by *poor* rural communities and *degraded* natural resource endowment. Farrington (2001) recognises that poverty reduction, along with environmental sustainability, is a priority of agencies concerning rural development. As stated in the preceding section, a common (and most of the times wrong) image held by urban-based development professionals about natural resource sustainability is one of harmony, equilibrium, and balance between natural resources and rural livelihoods.

Views regarding the relation between livelihoods and natural resources

Population is one of the main areas of concern in terms of the availability of natural resources. The relation between population and resource availability is generally conceived as a simple, linear relation, affected only by factors such as the level of technology (Leach, 1999). This view establishes that population growth is generating resource overexploitation, leading to generalised poverty and further environmental degradation, which leads to an inexorable “downward spiral” (ibid, p. 229).

However, there are several more reasons for natural resource degradation besides population growth (Malthusian way of thinking). For example, a community that has certain levels of technology to manage their resources in equilibrium can be affected by a breakdown of traditional authority, commercialization, modernity, social change and new aspirations, immigrations of new people, and state policies.

Conway (1987) incorporates in the concept of agroecosystem the relationship between humans’ use of the resources and ecological aspects of sustainability. For him, an ecosystem looked at, from the point of view of the social value and what it achieves, has a clear definition: it is a function of goods and services produced by the ecosystem (or agroecosystem), their relationship to human needs and happiness and their allocation among the human population (Conway, 1987, p. 5). It must be considered that the social sustainability of the ecosystem has a time dimension. Humans seek increased benefits in the short term, but also security over the longer term. The long- or short-term perspective over the resources adopted by a household will depend on their overall well-being. People struggling to survive will have no other option than to apply a short-term perspective of their surrounding natural resources.

The role of rural communities in natural resource conservation or degradation

During the 1980s to the mid-1990s the state of the environment in developing countries led environmentalist and policy makers to state that poor communities were the reason for environmental depletion. As population increased farm sizes reduced, more people migrated to urban areas, and increased the pressure over marginal areas (Ellis, 2000). This migration to more fragile areas forced people to overuse environmental resources. The degradation of these resources further impoverished them. Desperation and the lack of alternatives lead to the consumption of the capital that is the basis of future survival. Poverty is the real enemy of the environment, and in Hollander's words: "poor people are its victims" (Hollander, 2003, p. 2,). Impoverished people plunder their resources, contaminate and overcrowd their environment. Rural poor do so, not because they want to, but because they need to survive.

However, poor communities are not the only cause that can lead to environmental degradation. There are other components that also affect the environment in rural areas of low income countries. The nonpoor, for example, commercial companies or even the state agencies cause major environmental damage. Sometimes, privileged groups force poor to migrate onto marginal lands, and because they are unable to afford conservation and regeneration measures, their land practices cause further damage to the environment (Gilman, 2000). Timber concessions, road access to pristine forests, and political issues can change the dynamics of the interaction of people with local environment, leading to unsustainable development (Ellis, 2000).

Current thinking about the relationship between the environment and rural communities sees communities as diverse structures, meaning by that, the inclusion of gender perspectives into the analysis; with a dynamic view of the ecosystem, that faces a strong variability in time and space, with hierarchies and scale relationships, and with an important historical component that includes social and environmental events that transform the landscape (Leach, 1999).

Environmentally sustainable behaviours can be found naturally in several indigenous communities that have been living for several hundreds of years in a subsistence way. This environmental awareness is found also in high income countries, as wealth and years of modernisation allow people to re-value the conservation of the environment (Hollander, 2003). The main issue is to consider countries and people living between these two stages: the low income countries and their struggle to become developed to Western standards.

- **Different factors influencing the relation between rural community-natural resources**

Different perspectives on environmental problems

Environmental problems of high income countries are relatively different from those of low income countries (Hollander, 2003). Environmentalists of the first world are concerned about biodiversity loss, climate change, and nuclear residues. Local environmental problems for the rural poor of low income countries are, for example, *hunger* - caused by poverty itself - wars or government incompetence, *contaminated water supplies*, causing diseases and mortality; *diseases*, which could be easily eradicated with modern medicine; *scarcity*, caused by insufficient supplies of resources or by overexploitation as part of the constant struggle for survival; *lack of education and social inequality*, resulting in high birth rates, and difficulties in escaping from poverty. These problems are caused by poverty, and are related to environment degradation. Eradicating poverty is the key element in achieving environmental sustainability (Hollander, 2003).

Fragility of the natural resource endowment

Livelihood choices vary among areas with low natural resource endowment and areas with relatively high natural resource endowment. This is related to the level of risk that these households face. Fragile areas are commonly subject to natural hazards (e.g. floods, drought, winds), having a high risk relative to the income (or economic productivity) that these areas can generate. However, if things go wrong in these areas the absolute income loss is much less.

Richer areas have lower natural hazard risk, but the potential size of the loss is greater. If the stress comes it can create a huge impact, and this is an important factor in the selection of livelihood strategies (Scoones, 1998). The variation in resource type along different agroecosystems and along the resources accessed by the household has important implications in terms of the vulnerability context that rural households face in relation to the natural resource endowment and the fragility of their ecosystem.

Availability of Land

Access to land determines the availability that rural communities have to natural resources. It refers to quantity of land (i.e., area) and the quality of it (i.e., productive soil, timber, water availability).

Access to land is crucial for rural communities as it defines their natural resource endowment and gives the basis for establishing sustainable livelihoods. What people can do on their properties depends on what resources they are able to access. Land access is influenced by the external context set up by a government (i.e., property rights regulations) and by local institutions at the community level (e.g., customary rights over the resources).

The traditional perspective of natural resource conservation aims to create protected areas, which exclude rural people from the resources. National Parks and reserves are good examples of restricted access to natural resources. Natural Parks are a common alternative to ensure environmental conservation. Conservation biology is based on the relation between species biodiversity and the geographical area within which the endangered ecosystem is situated. This generates a vision of natural parks for conservation, without people's using the resources, creating an exclusionary approach, affecting local communities in their access to natural resources (Leach, 1999). Current world views and the ecological assumptions of nature's equilibrium generate this situation where conservation and development remain separated, almost in opposition. In developing countries, in the most primitive areas, nature, people and markets can coexist in subsistence farming schemes and rural indigenous communities. As the country grows towards modernisation, the community is placed out of nature (e.g., increase of urbanisation); nature turns to monocultivars, and the market rules the management of the natural resources. Consequently, the West is often seen as setting nature apart from development, and the wilderness is conceived of as free from humans. That means that people living in national parks or protected areas must be relocated, instead of allowing a community-based management of these areas. The current conservation ideal needs strong financial support, and this reinforces the importance of the income and growth of a country. Richer countries can locate more budgets to conservation and protection of nature (Carruthers, 2001).

On the other hand, there are participatory approaches that aim to achieve integrated development, encouraging land access and conservation of the resources. In the South African context, Leach (1999) shows how "integrated conservation and development projects" are encouraging rural people's participation, involving them in the decision-making process. Before the project, access to land and resources was a widespread conflict, affecting the interactions between social and ecological dynamics. Different people derived livelihoods from different sources, both within and outside the reserve. Control over the resources was mediated by formal and informal

institutional arrangements, adversely affecting some rural dwellers and benefiting others. The project succeeded in providing an understanding of these complex institutional relationships by making the conflict and complementarities of the resource use explicit, creating better access to land for the communities.

Another interesting case is Ghana's forestry sector, which has a long history of exclusionary approaches to forest management. Traditionally, in these areas of savannah and forest ecosystems, rural communities establish crops, use the forests and collect nontimber products. Under the Western perspective of conservation there were serious concerns about the depletion of the forest by rural communities. After a closer analysis it was demonstrated how different is the effect of land owners on the resources, compared to the use that recent immigrants make of the area. Land owners frequently enhance forests and carry out conservation practices, while insecure land tenancy contributes to soil degradation and savannization. Effective interventions, and the securing of land access, were implemented thanks to consideration of these social and institutional differences (Leach, 1999).

Property rights in resource use

Property regimes (e.g., private property, communal property, state land) (Gibbs, 1989) refer to *the endowments and entitlements that households have over the land and natural resources*.

Endowments refer to *the rights and resources that social actors have*, for example (land, labour, skills). *Entitlements*, means *the legitimate effective command over alternative commodity bundles* (Leach, 1999) that include exchange of capabilities and human rights, and economic, social, cultural and political rights, recognised by other communities (Gilman, 2000). As will be described later, the degree of specialisation or diversification by households may relate to the resource endowments available and the level of risk associated with alternative options (Scoones, 1998).

With improved access and control over different assets (natural, social, human, physical and financial capital), the poor are better able to meet basic needs and to create different livelihood options. A common problem for rural poor is the access to owning land. Land ownership is important to begin developing better conditions for the rural households. After that, education, health, adaptation of traditional and new productive techniques to the local context, and a better resource endowment give the basic conditions for an improvement of the sustainability of the households and the surrounding environment (Carruthers, 2001).

Property rights are a key element in analysing the relation between rural communities and natural resource sustainability. They describe the access and rights that rural communities have over land and natural resources. Displaced poor people tend to move to areas were no property institutions are operative, using the resources in an open access mode, where the collective effect of each individual effort to survive results in overall unsustainability (Ellis, 2000). The extractive activities have a short-term perspective because of the nonbelonging feeling to the land, reducing any intention to carry out conservation practices. Private property regimes are not always the preferred solution as they may cause greater conflict, and several management problems at the governmental level. As Ellis (2000) suggests for the African context, private property also misinterprets the role of customary rights in allowing flexible access to critical resources. In other areas private property can avoid over-utilisation of land and natural resources due to a private incentive to conserve resources. Common property regimes have been playing an important role in the livelihoods of landless rural poor, providing access to resources that otherwise they would not be able to access. Effective access to land and natural resources increases the opportunities and options to create sustainable livelihoods.

Location factors

The closer to urban areas the community is established, the more access they have to financial, physical, human and even to social capital (Wiggins, 2001). This is one of the main reasons why more poverty is concentrated in rural areas. Farm land, forests, water bodies, mineral deposits are immobile natural resources. This immobility of the resources is what primarily defines the rural economic role.

Villages that have been isolated by high transport costs present diverse livelihoods, producing not only food and fibre from agriculture, but also clothing, housing, tools, implements, furniture, and energy. When transport cost decrease, imports from the urban areas arrive and displace local manufacture and services. Farming intensifies and concentrates in the immobile natural resources since the costs of reaching the markets reduces. This situation increases the pressure on the natural resources available for the community. Village economies become more specialised and less diverse as economic growth and technical advance takes place. Rural villages end up providing only basic daily services (e.g., horticulture, fresh milk, firewood, and recreation areas), because of a reduction of travel times and transaction costs with urban areas (Wiggins, 2001).

Wiggins (2001) establishes three main categories of rural communities, first, the peri-urban communities from where people can commute daily to the main urban centres, marked by intense interactions between rural and urban, specialized on high-value farming; secondly, the countryside communities, in which the main issue is how to create jobs and welfare for the rural communities, specialising in arable farming (intensive or extensive depending on the resource endowment), livestock, tourism, crafts, among others; and finally, the remote rural areas, where subsistence farming is common, producing only few high-value products, depending on subsidies, waiting for better connectedness.

Ellis (2000) describes a case study of three villages in rural Tanzania. Using qualitative and quantitative methods, he analyses the livelihood strategies of three villages, one in a very remote location, a second one in a middle location, and the last one closer to the main highway in the Kilimanjaro region. Focus group discussion gave an insight into the intricate relationships between the reductions in the price of coffee and the change of the livelihood strategies to intensification and diversification to dairy and other farm-based activities. Asset and activity analysis shows that higher income households are concentrated in the least remote village, and that low income households, marked by low educational level, poor access to land, less cattle owning, and poorer houses, are located in the most remote area. For the remote village it was believed by governmental agencies that coffee was the main source of income in the villages, but results showed this not to be true. The most remote village was associated with higher reliance on farming (73 % versus a 53 % in the least remote). Nonfarm income was more important for the higher income households. In this case, the importance of remittances was shown to be similar in all the income groups. Another unexpected result was that the livelihood activities were less diverse in the least remote village. The subsistence share (value of self-produced food in the household income) reached 26 % in the less remote village, and 31 % in the remote village. High income groups, as expected, have lower reliance on subsistence production. Finally, education, land and access to electricity were described as critical differences between the three villages. This exercise demonstrated that after a holistic analysis of the livelihood strategies, institutional arrangements, and vulnerability context of rural communities; intra-village relations can be understood, creating a much better baseline for policy implementation (Ellis, 2000).

Other studies conducted in the South-Asian and Sub-Saharan Africa context suggest that farming activities, on average, tend to correspond to only 40 - 60 % of the

livelihood strategies chosen by the household (Ellis, 2000). Remittances, transfers of money, wages, and salaries obtained in nonfarm activities have a significant impact on rural livelihoods. The results of this research indicate that livelihood activities were less diverse in the least remote village, showing the effects of its location in relation to urban areas and markets.

Hierarchies and Sustainability

Sustainability of rural livelihoods is not the same as sustainability of the related particular ecosystem. There is some overlap between them, but it must be considered that the sustainability of a lower order subcomponent (ecosystem) of a larger system (livelihoods) is neither a necessary nor a sufficient condition for the sustainability of the larger system. The livelihood system is able to make substitutions to ensure its own sustainability (Ellis, 2000).

2.2.4 Outcomes: Strategies adopted by different stakeholders

After analysing social, economic and environmental factors that affect the sustainability of rural communities and their natural resource endowment, it is possible to recognise different strategies that are adopted by different stakeholders (at different scales) as a result of this context (i.e., global, national, and local). These strategies refer at the organisational level to development options for the rural areas, and at the local level to the livelihood strategies adopted by the households due to the influence of the external, social, economic, and environmental factors that have already been described.

- **Organisational level: development options aiming at the creation of a sustainable relation between natural resources and rural communities**

There are win-win options to the suggested environmental-poverty trap, which can build better institutions and partnerships with rural communities creating more robust livelihoods and healthier environments. The options to be presented pursue three main goals: reduced poverty, better social equity, and enhanced natural resource protection. Firstly, the development implications at a broader national level are presented; secondly, options for the local level are presented, through community-based natural resource management alternatives and integrated natural resource management options.

As discussed earlier, the current development process has come under question, especially due its negative environmental impacts and social deterioration (Shepherd, 1998). Only by reaching equilibrium between economic factors (income), environmental security, and social welfare, is it possible to improve the condition of the poor inhabitants on a long-term basis and secure the ability of the earth to sustain the future generations. To reverse the current trend, the new rural development paradigm proposes small competitive farms and enterprises which will work cooperatively, development of local and indigenous technology, and finally institutions to support them. It is not an antigrowth paradigm; it is about quality of growth, better distribution and stronger environmental concern. It also questions who is directing the process of growth. The idea is to include and involve rural poor in these processes (Shepherd, 1998).

Development options at the national level

In terms of development options, local government could take several different approaches that influence how rural communities relate to local natural resources.

Traditional development approaches are based on two alternative perspectives that local governments can take in developing countries: either to reduce poverty at the expenses of the environment, or to protect the environment at the expense of the poor people (Gilman, 2000). The first approach finds development solutions in the short-term exhaustion of the natural resources to alleviate poverty, while the other encourages the protection of the environment by excluding rural communities from the use of the resources. As discussed earlier, neither of these two options aims at the creation of sustainable livelihoods or the preservation of the environment.

However, a third approach can be proposed; an approach in which local environments cannot be effectively protected unless poverty itself is addressed (Ellis, 2000). Development options that aim to reduce poverty to protect the environment include: economic growth that includes the poor, a labour-intensive pattern of growth, generation of alternative livelihoods to rural people (e.g., diversification), and changes to property regimes, especially regularising the ownership.

This third approach aims to create sustainable livelihoods. A focus on livelihoods offers a holistic approach to development that can be used as a planning tool and policy formulation basis to ensure a sustainable relation between the environment and rural communities. The idea is that the livelihood view helps in finding sustainable rural livelihoods outcomes, through a holistic analysis of the structure, assets, activity portfolio, vulnerabilities, and context of rural households.

The DFID (2001) guidance sheets on the use of the livelihood approach include several case studies analysing the added value of using this approach in project management and policy application. For example in Ethiopia, adopting a livelihood approach has changed the definition of the problem. The shift from a resource perspective to the people's perspective has provided deeper insights into the nature of water insecurity. The livelihood perspective provided insights about the relations between water and food security, understanding patterns of water use, and how water is combined with other assets to generate income. As a result of this analysis, policy makers know that targeted water supply interventions coordinated and sequenced with food security/asset rebuilding efforts are essential to overcome a severe drought. Another example, this time in Mozambique, is an infrastructure project aiming to construct roads to increase connectivity. With the adoption of a livelihood perspective the project changed to answering the following questions: which stakeholders are more affected by the road? and how does the road affect their livelihoods? In some cases roads benefitted bigger companies, increased the risk of land tenure among rural communities and had greater environmental impact (DFID, 2001). In East Africa, livelihood impact assessment was carried out for a conservation project, based on the incorporation of butterfly farming into the household's activities. While economic assessment - the traditional tool to evaluate projects - showed positive project outputs, the livelihood assessment showed mixed results. Some households incorporated the butterfly farming as a full-time income generating activity, but for the majority of the households it was only a minor activity as part of a broader portfolio of activities. In this case for only a minor part of the households the butterfly project was an economic alternative, which gave contrasting results when compared to the cost-benefit analysis. The holistic perspective adopted in livelihood analysis resulted in a deeper understanding of - and a greater insight into - the factors affecting people's livelihood choices (DFID, 2001). This informed policy makers and they were able to understand local communities in an integrated way, enabling them to generate better development interventions in the future.

At the country level, the sustainable livelihood perspective incorporates a cross-sectorial and a multidisciplinary approach to the analysis of rural communities, which is useful for the planning of programmes and projects at the country or regional level. A country level approach is based on four main steps, all of them applied in an integrated and interactive way (Gilman, 2000):

- firstly, make a participatory assessment of risks, assets, entitlements and indigenous knowledge found in the local community. It is important to define the main adaptive and coping strategies used by the community;
- secondly, carry out an analysis of the macro, micro, and sectoral policies; plus the governance arrangements that affect people's livelihood;
- thirdly, determine the main potential contributions of modern science and technology to indigenous knowledge systems in order to improve local livelihoods (i.e., enabling strategies);
- finally, implement microfinance strategy, with a supportive macro economic strategy, and the encouragement of investment.

These elements have been used by UNDP and other international agencies in their country-level planning. Pasteur (2001) shows two successful applications of the livelihood concept in large state-level watershed projects in India, and other projects in Pakistan, Ethiopia, and Zambia. The framework was a useful tool in the design phase, with the key elements of the framework (e.g. policy links, access to capital, incorporating poor people to project cycle) being central to the project. A common language could be provided, and a consistent baseline of principles could be adopted (Pasteur, 2001).

Community-based natural resource management options

Community-based natural resource management alternatives (CBNRM) are successful options to achieve environmental conservation and sustainable livelihoods (Ellis, 2000). However, the resources should have special characteristics such as dispersed resources, high cost if managed by few people, slow growing, difficult to monitor, difficult to measure, technically complex, and have low intensification possibilities (Gibbs, 1989; Ostrom, 1990). Collective action creates lower cost of management and creates cohesion among the people, with successful results (Gilman, 2000).

In CBNRM there is a need to define clear boundaries for the extension of the resource to be managed; identify the users, have a sanction system and conflict resolution mechanisms, and have recognition of the community rights system by the government or the external authorities, with these remaining over time, and being transmitted between generations (Gibbs, 1989; Ostrom, 1990).

Traditional indigenous people who rely on their local natural resources, establish commonly a sustainable mode of production, ensuring the conservation of their environment. This cultural pattern provides protection for the environment and a much stronger sustainability compared to communities that do not have this traditional practice. These kinds of social controls have been developed in many communities explicitly to regulate resource use. Related to this topic there is also a traditional environmental knowledge, transmitted from one generation to other.

There are good examples of this knowledge worldwide: the religious protection of animals and trees in India, the prohibition of cutting the Baobabs in Africa to allow the animal harvest, the Brazilian case where soil deficiencies in the Amazonian basin are compensated by using local resources (Vivian, 1992), ancient irrigation schemes in Spain or the Philippines, forest management in Japan, and the mountain grazing schemes in Switzerland that date from the year 1224 (Ostrom, 1990). This traditional knowledge is the rule rather than the exception among traditional indigenous communities. These management schemes need well-defined and explicit rules governing resource use, avoiding over-exploitation. The resources are open to the members of the community, but when one resource begins to fail, there are management systems that regulate access. It is usual that communities manage common territory, so everybody can usufruct from these common resource systems. Common property has been traditionally misunderstood. But there is a big difference between “common property regimes” where in essence a property is held jointly, and “open access systems” which have no restriction in resource use, leading to degradation of the ecosystems (Vivian, 1992).

For the Chilean context Armesto (2001), AIFBN (2003) and Aqueveque (2003), suggest the creation of communal forests or extractives reserves, which allow the sustainable management of native forests in a context of small land size. This approach is based on the integration of the productive systems of several community members. It reduces the management costs, allows the biological reproduction of the native forests, and creates rotations that ensure the economic and environmental sustainability of silvicultural practices. These alternatives consider also the alternative use of the resources incorporating tourism and nontimber products.

In summary, community-based natural resource management options are a sustainable alternative in many rural areas where the resources and the local communities have special characteristics as do those described earlier.

Integrated Natural Resource Management

Integrated natural resource management (INRM) is a *conscious process of incorporating the multiple aspects of natural resource use into a system of sustainable management to meet the goals of resource users, managers and other stakeholders* (Sayer, 2004, p. 4). The main characteristics of this approach are the acknowledgement of the complexity of the natural resource systems, the encouragement of active research, consideration of the effects at higher and lower scales, the use of models to understand the local context, allowance for a learning and adaptation process, and a stressing of the breakdown of the barriers between science and resource users.

INRM shares similar objectives to those of the 'integrated rural development' projects of the 1960s and 1970s, it differs from it in the focus on a top down approach and Western-science led focus of the old approach. Integrative approaches can be more expensive in the short term (compared to sector-wide approaches), however in the long term they yield sustainable management systems, stronger institutions and a better natural resource base.

- **Community level: livelihood strategies as a result of the local context**

Rural communities still tend to differentiate themselves from others according to their historically primary activity (Hussein, 1998)

As described earlier in this review, the livelihoods concept is a useful tool with which to analyse rural communities, as it incorporates sustainability as a main aspect to consider. In this subsection the concept of livelihoods is used to analyse the livelihood strategies that households adopt as a result of the social, economical and environmental context. Livelihood strategies are seen as outcomes of the social and economic context in which a rural community is living, and of the natural resources that are available to the small farmers.

Rural poor communities rely on the environment for their livelihood. Their survival strategies are affected by the way others around them use environmental resources, and by their own practices. Natural resources are exhaustible and degradable, implying that if population has to grow in both numbers and consumptive habits, improved management techniques for environment resources are needed (Gilman, 2000).

As was suggest earlier, it is not true that poor people are intrinsically degrading their natural resources. It is common to find rural communities carrying out conservation measures, but on the other hand it is also not always true that small farmers are good custodians of the environment (Ellis, 2000). That means that every context is different and needs to be analysed separately.

Livelihood strategies

As a response to the social, economic, and environmental context, and the several factors that influence a rural community, small farmers choose a management option on the basis of the resource portfolio they are able to access. This is known as a *livelihood strategy*. Gilman (2000) states that strategies are realised through the activities, assets and entitlements by which each household or individual makes a living.

Livelihood adaptive strategies commonly adopted in developing countries are: *diversification, migration,* and *agricultural intensification* or *extensification*, each of them depending on the different assets and the context within which the household is living (Hussein, 1998; Scoones, 1998). For many researchers the boundaries separating livelihood strategies are by no means clear. These three main strategies are interlinked and altogether generate the formation of one household's livelihood strategy (Hussein, 1998).

Strategies differentiate from activities or substrategies by their timeframe. Among the activities or substrategies that can be identified, it is possible to find: C*oping activities*, short-term response to a specific shock (e.g., drought, bad harvest); *Adaptive activities*: long-term change in behaviour patterns as a result of a shock or stress (Gilman, 2000); and *Enabling activities,* that create well-being, allow empowerment within the household and facilitate a better future for the household.

The chosen strategy, plus the set of activities or sub-strategies used by the household have an impact on the assets of the household, because livelihood strategies are directly derived from the assets availability. After a shock, the assets can be regenerated, depleted, or transferred. Three basic stages (coping path) can be identified in the pattern of the household in its coping or failure to cope. First the household uses risk minimisation strategies (e.g., savings, investments, accumulation of assets and diversification of income). The second stage involves the disaccummulation of previous investments, asking for loans and new credit. Some productive assets must be disposed of making the recovery after the stress more difficult. If the adverse conditions persist households may have no other choice but to

sell all their remaining assets, subsist on food collection, or migrate to urban areas for relief (Von Braun, 1992).

Not only do local factors, such as those described earlier, affect livelihoods. External context factors such those described in previous sections influence the different alternatives chosen by the households. Population growth, change in terms of trade, economic re-structuring and world trends are stated as some of the most common reasons in the African context (Hussein, 1998).

Different strategies provide flexibility for the household in terms of income, and an extra source of cash. It is significant to note that an increased number of livelihood strategies do not imply that the livelihood is more sustainable (Hussein, 1998). It could be an involuntary act of desperation leading to lower quality of life, making the household more vulnerable and facing irreversible loss of their capital. But practices and adaptive strategies may be positive, functional and sustainable, leading to sustainable livelihoods.

Description of Livelihood strategies

Diversification

Livelihood diversification refers to *attempts by individuals and households to construct a diverse portfolio of activities and assets in order to survive and to improve their standard of living* (Ellis, 2000). This diversification strategy differs by the degree of freedom of choice (diversify or not), and the reversibility of the outcome (Hussein, 1998). Five main diversification alternatives can be identified: first, accumulation of resources to create buffers for stressful times; second, spreading of activities over time to reduce risk; third, changing of activities to reduce the covariance among different sources of stress; fourth, management of risk through various forms of insurance or consumption smoothing, to reduce the effect of stress; and finally, the overall resilience of the system can be enhanced to reduce the impact of shocks (Scoones, 1998).

Multifunctional households generally are much diversified, including both on- and off-farm activities (Ellis, 2000). The diversification process refers mainly to the diversification of the household economies to generate different sources of income. It requires a broader, complementary approach to long-term structural transformations of the household (Wiggins, 2001). Households can diversify their livelihoods for accumulation and reinvestment, or could diversify for coping with temporary adversity (Scoones, 1998).

The first step identified by Hussein (1998) in the diversification of rural livelihoods refers to the change in the composition of the agricultural products that the family produces. This implies less investment as a first stage, restructuring the production as for example, integrating livestock and crops, or slowly increasing the fertility of the land. The second step is towards a nonagricultural diversification, nonagricultural activities, nonagricultural employment, and the process known as de-agrarianisation (Bryceson, 1996; cited in Hussein, 1998).

Income diversification has been associated with better-off households. However, poor farmers usually diversify to survive and pay expenses. Diversification of the livelihood strategies is constrained by lack of education, distance from markets, low wealth status, and small household size. Many of the livelihood diversification strategies are gender specific. Cultural constraints sometimes close some opportunities to women (Hussein, 1998).

Diversification has also an effect on the sustainability of the livelihoods, increasing the general resilience of the livelihood strategies. In terms of biological diversification, multiple crops permit complementarities between species, increase of nutrient formation, nutrient uptake and better reproduction. Compared to monocrop production systems, it also reduces the risk in case of pest attack, frost, or other natural events (Ellis, 2000). On the other hand, because of the increased number of activities, diverse livelihood systems offer greater protection against erosion and other catastrophes than do those which are not diversified.

Migration

Migration can be voluntary or involuntary, and has effects on the reinvestment ability of the household or effects on the consumption pattern of the family (because of the arrival of people from other places) (Scoones, 1998). The reasons behind this alternative are, for example, the credit alleviation through migrant remittances, or a rational allocation of total household labour to maximise the household utility, or as a result of poor agro-climatic conditions (Hussein, 1998). Migration can be beneficial in terms of the social sustainability of the household, but may result in the abandonment of labour intensive forms of soil conservation (terracing), affecting the environmental sustainability. However, some studies show that earnings of nonfarm activities return to the farm in the form of investment in the medium and long term (Ellis, 2000).

Agricultural Extensification

This refers to the inclusion of more land under cultivation. This alternative normally encompasses higher access to natural capital (land) and probably more access to financial capital because of an increase in the cost of management or livestock (Scoones, 1998).

Agricultural Intensification

This strategy refers to the increased average inputs of labour or capital on smallholdings, either on cultivated land or on grazing systems. The purpose of this strategy is to increase the value of output per hectare (Tiffen, 1994; Carswell, 1997; cited in Hussein, 1988). Agricultural intensification is mainly affected by the market proximity and the access to capital. In places like Africa farmers prefer to diversify rather than to intensify their agricultural production. Agricultural intensification can be capital-led (external inputs and policies) or labour-led (based on own labour or social resources) (Scoones, 1998).

2.3 ANALYTICAL APPROACH FOR ANALYSING SUSTAINABILITY IN RURAL AREAS

After the review of the relation between rural communities and natural resources, in which the global and local contexts were considered, it is important to describe analytical approaches that have been used to evaluate the sustainability of rural communities and natural resources. The sustainable livelihoods approach merges social perspectives and economic criteria with environmental sustainability considerations. Sustainability considerations will be analysed introducing indicators and concepts used in the agroecosystem analysis and the sustainable land use management framework. These elements give the baseline on which to introduce the methodological chapter, which includes specific considerations of these analytical approaches, such as frameworks and indicators, and describes how these three approaches will be merged and used together to answer the research questions.

2.3.1 Sustainable Livelihoods Approach (SLA)

- **General aspects of SLA**

The sustainable livelihood approach (SLA) is a people-centred approach that is holistic and dynamic, viewing rural livelihoods in a vulnerability context (i.e., shocks

and trends); and is built on strengths rather than on problems and needs. It includes micro- and macro-links between the household's livelihoods, institutions, organisational structures, and policy environment. The assets of the community are divided into human capital (education, skills), social networks or cultural capital, physical capital (basic infrastructure), financial capital and the natural resources (land, water, wildlife) present in the ecosystem. Finally, the livelihood strategy selected by the household achieves an outcome (e.g., more income, increased wellbeing, reduced vulnerability, food security and sustainable use of natural resources) (DFID, 2001; Thompson, 2001).

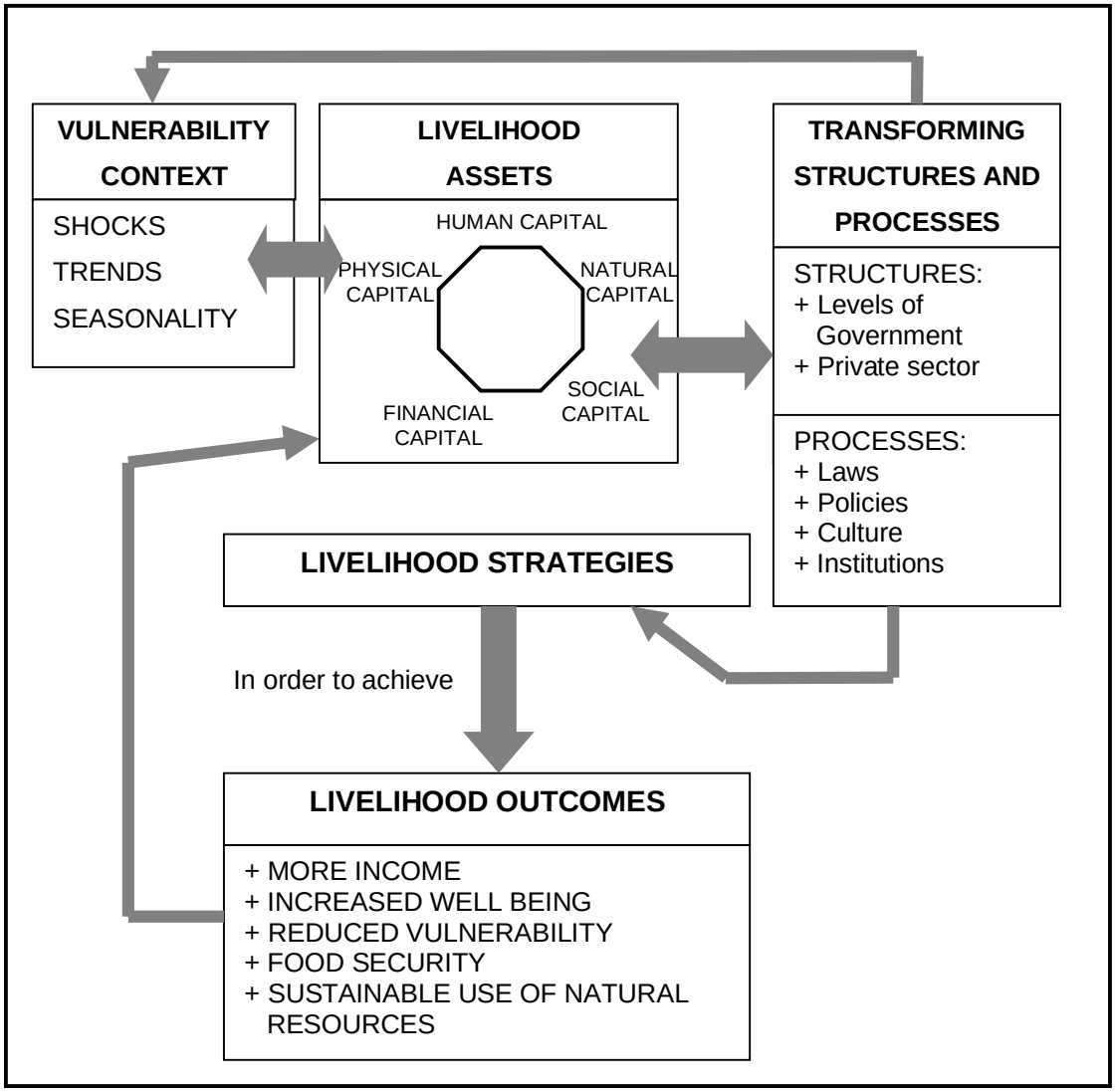

FIGURE 2.4. Sustainable Livelihood Framework.

(DFID, 2001)

The SLA integrates these elements into a framework (Figure 2.4). This framework can be used for identifying where constraints or opportunities lie - for developing

policy, or improving livelihoods of rural communities (Maiava, 2003). Given a particular *context* (policy setting, history, agro-ecology, socioeconomic conditions), there are certain combinations of *livelihood resources* (assets) resulting in the ability of the household to follow a combination of *livelihood strategies* with certain *outcomes*. There are *institutional processes* that will affect the ability to reach the expected outcomes (Scoones, 1998).

The SLA is based on a certain organisational, institutional and social environment. It stresses the participatory way to identify the forces acting in a certain system, determining their assets and local strategies and what are the outcomes that the community want to achieve, and what needs to be done to achieve these outcomes.
It summarises many important concepts of poverty alleviation and social sustainability such as participatory approach, community action, institutions development, work at multiple levels and multidisciplinary teamwork. Successful implementation of this approach requires extensive commitment from the different stakeholders and real intentions to make the changes to reach better levels of equity, stability and sustainability.

For Gilman (2000) and DFID (2001) sustainability of livelihoods is a function of how men and women utilise assets portfolios on both a short- and a long-term basis. *Sustainable Livelihoods* implies the *ability to cope* with and recover from shocks; *economic efficiency* and the use of minimal inputs to generate a given amount of outputs; *social equity*, creating opportunities for all the community members, but without affecting other groups of society; *ecological integrity* ensuring that the livelihood activities do not degrade the local resources; and *no dependence* upon external support (if there is then the support must be economically and institutionally sustainable).

- **Main components of the SLA framework**

Assets

The livelihoods are analysed first from the point of view of the *assets*. This is a different approach from the need analysis, and is basically focused on the recognition of everyone's inherent potential. This potential can derive from social networks, access to physical resources, or influence over institutions. Focusing on the assets allows a connected view of the livelihoods with the surrounding factors, rather than isolated units facing social problems and poverty (Gilman, 2000). The poor compete with each other and with nonpoor for the control of the assets. Within the households

women and children often have the least access to productive assets. The set of assets that a rural community can access can be divided into five major categories (Scoones, 1998; DFID, 2001):

Natural Capital: corresponds to the natural stocks (e.g., soil, water, air, genetic resources) and environmental services (e.g., hydrological cycle, pollution sinks, etc.) from which resources flow and services useful for the livelihoods are derived.

Financial Capital: the capital base, for example: cash, credit/debt, and savings- among others- which are essential for the household.

Human Capital: skills, knowledge, ability to labour, good health and physical capability.

Social Capital: social resources such as networks, social claims, social relations, affiliations, associations; all aspects upon which people draw when pursuing different livelihood strategies.

Physical Capital: basic infrastructure and goods needed to support livelihoods (e.g., affordable transport, secure shelter and buildings, water supply and sanitation, clean and affordable energy, access to information).

Vulnerability Context

The vulnerability context frames the external environment in which people live. It includes critical trends, shocks and seasonality, over which they have limited or no control. The vulnerability context is not always negative, but it must be considered that poor people are influenced greatly by these three stresses (DFID, 2001):

Shocks, destroy assets directly (e.g., floods, storms, civil wars); force people to abandon land as part of the strategies.

Trends are more predictable and more benign. They influence economic rates of return, and also: population trends, resource trend, governance, and technological trends.

Seasonality generates price changes, new employment arises, food becomes more or less available, and health issues are more or less common.

Transforming Structures and Processes

Within the livelihood framework, transforming structures and processes are the institutions, organisations, policies and legislation that shape livelihoods. It includes

the access to capital, decision-making bodies, the terms of exchange between different types of capital, and the returns on any given livelihood strategy (DFID, 2001):

Structure includes the organisations, both public and private. They set and implement policies and laws, deliver services, purchase, and trade.

Processes determine the way in which structures operate and interact. Culture, power relations, institutions are part of the transforming processes of importance to livelihoods.

Institutions are regularised practices or patterns of behaviour structured by rules and norms of society which have persistent and widespread use. Institutions can be formal or informal and subject to multiple interpretations by different actors (Scoones, 1998). Institutional processes must be understood to allow the identification of barriers and opportunities.

Livelihood outcomes

The achievement or output of a livelihood strategy is a livelihood outcome. The concepts of sustainability and achievement-orientation are integral parts of the livelihood outcomes. Outcomes can include among others: more income, increased well-being, reduced vulnerability, improved food security, more sustainable use of natural resources (DFID, 2001).

- **Positives and negatives aspect of SLA**

Some of the strengths of this approach are that the sustainable livelihood approach views the sustainability of natural resources as an integral component of rural livelihood. As an integrative analysis this approach can help to focus and target development interventions, when they are supported by a well managed administrative procedure. In a global perspective the SLA is an alternative framework to introduce changes to the current development model without creating revolutionary changes in the way economies and societies are organised.

This approach is focused on strengths rather than on negative aspects of livelihoods. For example, instead of trying to minimise the negative impact of a livelihood strategy, it seeks to maximise the positive contribution made by the natural environment to people's livelihood outcomes. The SLA approach is complementary to participatory development (participation is an important component of the SLA), to sector-wide approaches (which can be enriched and integrated by the livelihoods

analysis) and to 'integrated rural development' (recognising the errors and without falling into the traps of the 1970s) (DFID, 2001).

To ensure sustainable livelihoods in the rural areas, development strategies, policies, programmes or projects can use diverse types of technologies and several specific practices, but these different alternatives must share three common elements: the use of locally adapted resource-conserving technologies, coordinated actions at the local level, and supportive external institutions (Elliot, 1999).

Some critics of the use of this framework state that it has limited practical application because of the complexities of an integral analysis of the rural areas. The SLA is a complex holistic approach, and it can be easily adapted to a top down approach. Although the SLA is designed to work across sectors, in reality, government institutions are operating on a sectorial basis. Other critics suggest that culture, traditions, and gender are not intrinsically incorporated (Scoones, 1998; Cahn, 2002; Maiava, 2003). However, if a special focus on gender or culture is wanted, it could be incorporated into the framework by the researcher.

2.3.2 Natural resources sustainability – analytical tools

Little work has been done on measuring methods of sustainability at the farm level that take into consideration the environmental and economic trade-offs (Pacini, 2003). Predicting environmental impacts (and hence the sustainability of a certain system) is a common practice; however it is complex and uncertain, reinforcing the subjectivity element of assessing sustainability. Sustainability assessment operates by prediction rather than direct evaluation of impacts (Rigby, 2001). Prediction must be based on a deep understanding of the local processes. Sustainability cannot be measured directly; assessment of sustainability can be made on the performance and direction of the processes that control the functions of a given system at a specific location (Dumansky & Smyth, 1993; cited in FAO, 1993). Decisions must be made about the relative weighting given to different dimensions of sustainability (Rigby, 2001). Pacini (2003) emphasises the need for a systems approach to any strategy that aims to address sustainability of rural areas and their related activities.

A process oriented criteria is what Mog (2004) suggests for the evaluation of sustainability in rural areas. This process is characterised by encouraging participation of local people, building strong local institutions, applying research to the local context by adapting local technology, and providing options, while being aware of heterogeneity and diversity and understanding local knowledge.

Considering these complex elements of the analysis of sustainability, two complementary approaches are used, giving the baseline for defining the indicators to evaluate sustainability of rural livelihoods and natural resources.

- **Main ecosystemic indicators to evaluate sustainability**

Environment sustainability of livelihood strategies in the rural context can be considered by looking at the sustainability of the agroecosystem (Ellis, 2000). This is a useful tool of analysis because of its systemic view of the ecosystem. It allows consideration of socioeconomic goals of the people who are using the resources and also the ecosystem properties, establishing boundaries, and ensuring environmental sustainability. These elements are perfectly coincident with the multiple elements that have been analysed in this review in terms of the factors that affect the sustainability of rural communities and their available natural resources.

Agroecosystems are *ecological systems modified by human beings to produce agricultural products, forest products, fibre, and food among others* (Conway, 1987). The goal of an agroecosystem is to produce increased social value (Conway, 1985; Blaschke, 1991; Kelly, 1997). The general idea is to address the interface of ecological processes and human populations. Human are seen as agents of change, and they are also affected by these changes (Blaschke, 1991). Generally these are complex systems where humans interact with ecosystem factors (Conway, 1987). The interactions range from the micro- (e.g., farm level) to the global-scale.

A sustainable farming system can be characterised by three major components (Kelly, 1987): *Ecological Integrity*, minimising the impacts of production on both the farm and off-farm environment; *Financial viability* in the short and long run; and *Social and cultural acceptability*. These components should reach individually the sustainability status to allow the whole system to be sustainable. The biophysical aspects should include the minimum use of nonrenewable resources, and the prevention - or mitigation - of the environmental impact. The financial component includes the meeting of daily consumption requirements, achievement of the family goals and objectives, meeting of debt obligations, withstanding of climatic or economical crisis, and avoiding a decrease in the real value of the farm. Social and cultural aspects include: satisfaction of family social needs and goals, avoiding the degradation of community services and cohesion, and fulfilling of obligations to future generations. These components impose constraints on the system, which can be

mitigated to some degree by technological development, institutions, policies, and changing attitudes and beliefs (Kelly, 1997).

Properties of the Agroecosystems[3]

For natural populations, communities and ecosystems it is possible to define a similar set of system properties (Conway, 1987; Kelly, 1997):

Productivity is defined as *the output of value per unit of resource input*. The basic resource inputs are land, labour, and capital. Some sources of energy are included under land (solar energy) or under capital (fossil fuel energy). Technology inputs such as fertiliser and pesticides are part of capital. Efficiency between different systems can be measured comparing these combinations of inputs and outputs.

Stability is referred to as *the constancy of productivity in the face of small disturbance forces arising from the normal fluctuations and cycles in the surrounding environment*. It can be expressed as the coefficient of variation of productivity (Conway, 1994).

Resilience is defined *as the ability of an agroecosystem to maintain productivity when subject to a major disturbing force*. The disturbance can be caused by an intensive stress, and this can occur frequently, in continuous form, or can be relatively small and predictable, but with a large accumulative effect. After the shock the ecosystem could be unaffected, may fall in productivity and then return to the trend, or settle to a new stability state with lower productivity. Resilience can be measured using inertia (resistance), elasticity, or amplitude. It determines the persistence of the agroecosystem's productivity under known or possible conditions. Inputs affect resilience, helping to maintain certain systems, as for example crops need the use of periodic fertiliser. On the other hand, the regular use of pesticides can be the reason for a larger shock because of the resistance that pesticides can generate after prolonged use, which can lead to a major pest attack.

Relating resilience to the livelihood strategies, it can be said that diversification of the household livelihood contributes to greater resilience (Ellis, 2000). Stability and Resilience are a continuum, measured by risk and uncertainty. They depend in the flexibility of the system (Kelly, 1997). Stability refers to system variables and resilience refers to system parameters. Resilience is a broader concept than stability.

[3] Annexe one presents a detailed description of the agroecosystem framework.

Equitability refers *to the distribution of the productivity of the agroecosystem among the human beneficiaries*. It is often considered as the evenness of distribution among human beneficiaries according to need. This analysis must be carried out in the context of the sociopolitical aspect of the system. It is necessary to define acceptable levels of wealth and property accumulation, of pollution, of minimum resource stocks to be maintained or of other externalities to constrain the system outcomes.

Rural communities depend on natural resources for their survival. Livelihoods and the agroecological system of the household are linked and face the same stresses and shocks. Taking elements of the agroecosystem analysis, *sustainable livelihoods* can be defined *as those that can cope with stress and shocks, and displays resilience when faced with adverse events* (Ellis, 2000). The sustainability of a livelihoods system is the product of the levels of the four different system properties. The product of these properties is not a simple arithmetic addition or multiplication because people in each place and at each period of time weight the properties differently (Conway, 1994). Technologies and innovations can help to reduce the trade-offs between the system properties.

Framework for sustainable land management (FESLM)[4]

The FESLM approach to the analysis of sustainability in rural areas is based on the concept of sustainable land management. Rigby (2001) identifies this framework as one of the few existing tools aiming to evaluate sustainability at the farm level. It combines technologies, policies and activities to integrate socioeconomic principles with environmental concerns. *Sustainability* in this context is understood as a *measure of the extent to which a form of land use is expected to meet the requirements of productivity, security, protection viability and acceptability*.

It aims to maintain or enhance production and services (Productivity), reduce the level of risk (Security), protect the potential of natural resources and prevent degradation of soil and water quality (Protection), be economically viable (Viability), and socially acceptable (Acceptability) (FAO, 1993). These five objectives are the primarily requirements of sustainability. Trade-offs between objectives can occur, but all five must be incorporated if the assessment of sustainability is to be sound. The FESLM is based on the land use capability of a given area. This approach is very useful in the context of environmental sustainability as it considers the natural capabilities of the local recourses to sustain a certain activity.

[4] Annexe two presents a detailed description of the FESLM framework.

Figure 2.5 summarises the sustainability properties highlighted as key elements for analysing sustainability of rural livelihoods and natural resources. The FESLM framework and the agroecosystem analysis are similar in their theoretical conceptions and show several complementarities.

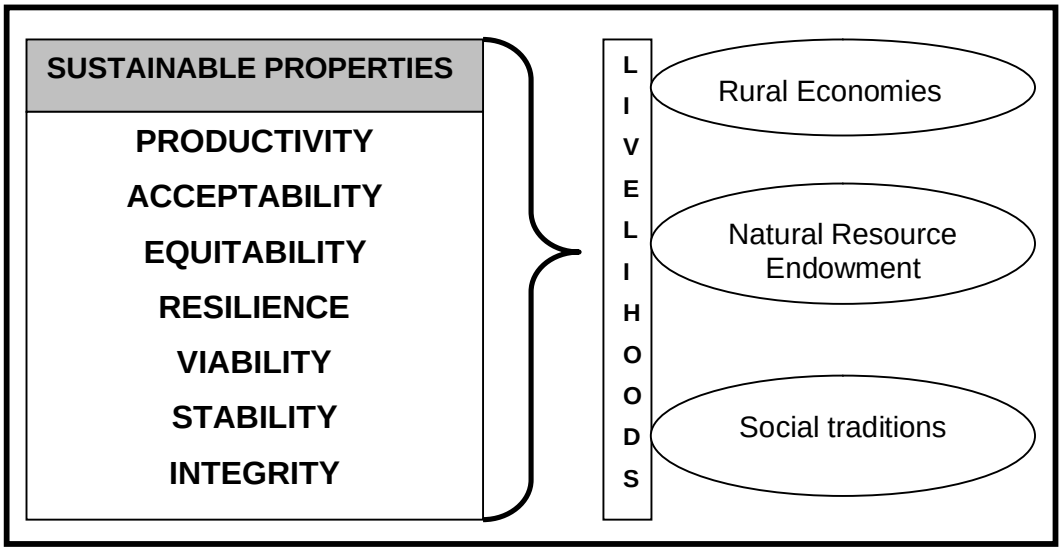

FIGURE 2.5. Sustainability properties for the evaluation of rural livelihoods and natural resources.

2.4 CONCLUSIONS

The literature supports the view that rural communities in low income countries are often poor, have low agricultural productivity, and suffer natural resource depletion. As an alternative development option to the current development trend, sustainable development has been in the development discussion since the late 1980s. It has been difficult to apply the concepts of sustainability to the development arena, mainly because of the trade-offs between the economic, environmental, and social aspects.

Rural communities live in close relation with natural resources, and are exposed every day to decisions that incorporate elements of the economic, social and environment dimension. Their selected livelihood strategies reflect these decisions, which are influenced by factors that are externally generated (e.g., national government policies), and other factors which depend on the local context.

- **Rural context and natural resources**

Most of the problems in rural areas are influenced by the local, regional, national and global contexts. All these factors influence the rural household, and it is not possible to isolate the factors that affect the current situation of rural poor households and the available natural resource endowment. Accordingly, the literature suggests integrative and holistic analysis of the rural areas if sustainability has to be achieved.

At the global level, the economic aspects of the current development model, such as growth, consumption, and free-trade, are being promoted as integral parts of the modernisation process of the world. Developed countries have strong environmental movements, with general public awareness of the current environmental problems, and allocation of resources to improve the environmental standards of their countries. In developing countries, social and environmental aspects take commonly a secondary place, the expectation being that increased economic growth will create increased social wealth. The current economic model has created strong inequities within developing countries. The sustainable development model establishes that the economy should be seen as a subsector constrained by the natural environment capabilities.

At the national and regional level, urbanisation and rural off-farm income are rising in importance as countries grow and develop. Rural areas and their productive activities are relatively losing their importance in the national economy, and poverty remains as a persistent problem in rural areas.

Locally, rural communities have been always related to the local natural resources. They create livelihood strategies according to the access they have to the resources and other local context-specific conditions, such as cultural values and traditions, markets, institutional arrangements, and supporting organisations.

- **Development towards natural resource and rural community sustainability**

There is a need for a holistic and integrated approach to the current issues that affect the sustainability of rural areas. Some authors stress the need for profound changes in the values and goals of humanity to achieve sustainable development (Schumacher, 1973). There are limited chances for indefinite growth in economic terms without establishing some boundaries and limits to environmental exploitation and economic growth (Rees, 1990; Blaschke, 1991; Shiva, 1992; Carruthers, 2001). Attacking rural poverty requires improving poor people’s ability to derive their

sustenance from natural resources (Gilman, 2000). Currently, different disciplines have developed successful alternatives trying to incorporate environmental concerns into the development process. For example some of the best known and documented are:

- economy: ecological economics, which incorporates externalities and ecological services to reflect the real value of goods and services;
- trade: international certification for products, aiming to incorporate social and environmental issues into trade;
- property regimes: experiences with community-based natural resource management, re-establishing the role of common property;
- natural resource management: the concept of integrated natural resource management;
- development in practice: the use of the livelihood analysis in rural areas as a holistic integrative policy tool, aiming at sustainability as one of the livelihood outcomes.

- **Rural poor livelihoods and natural resources**

Natural resources availability is decreasing for rural communities, as land becomes scarce, forests are replaced by agricultural land, agricultural land is eroded, and agricultural products lose their value in the markets. Productivity, stability, resilience and the equitability of the natural resources available for rural communities are in question.

Explaining the environmental problem in terms of migration of poor people to resource poor areas due to overpopulation is quite simplistic. As the analysis suggests poverty remains as the central unresolved issue that is affecting the environment. On the other hand, several other factors affect the relation between the rural poor and the environment: the global and national context, cultural beliefs, and customary institutions among others.

Economic aspects are important to consider in the way they affect how rural communities establish conservation strategies on their land. If the future income streams are heavily discounted compared with current income, and if the opportunity cost of labour is high, conservation strategies are neglected.

In normal circumstances rural communities do not farm in ways that cause a decline in yields for the future. Improved access to the natural capital (e.g., land, forests, water) is a key element in achieving a sustainable relation between livelihoods and environment. Finally, working towards an improvement in the livelihood conditions of rural communities is a determinant for environment enhancement.

- **Social, economic, and environmental factors influencing rural sustainability**

The literature identifies economic, social and environmental factors that affect the sustainability of rural livelihoods. There are five main economic factors: (i) rural poverty; (ii) size of farm; (iii) market opportunities; (iv) credit; and (v) subsidies.

Similarly, there are several social factors affecting the sustainability of rural livelihoods: (i) culture and traditions; (ii) distribution of the resources, which determines social equitability; (iii) social protection, related to the reliance on other members of the community for support; (iv) group sustainability; and (v) education and health.

There are a number of factors that influence the management of natural resources. These factors may include: (i) the basic knowledge communities have about their available resources, (ii) their technological level, (iii) the temporal perspective they apply to the use of natural resources, and (iv) conservation practices such as terrace building, fertilisation, rotations, and tree planting

- **Factors influencing the rural livelihoods and natural resource relation**

Factors that influence the relationship between natural resources and their use by rural households may include:

(i) access to natural resources, such as productive land, forests, and marine areas to collect sea-food, and is a key element in the sustainability of the rural communities, as it defines the availability of different sources of natural and economic capital,
(ii) property rights and land tenure, which determine land access and entitlements over the resources,
(iii) location of the community relative to more developed areas, which also influences rural livelihoods and their dependence on natural resources.

- **Practical frameworks for evaluating sustainability**

Based on the literature, it can be concluded that the Sustainable Livelihood Approach (SLA) (Scoones, 1998; Ashley, 2001; DFID, 2001) is a useful integrative tool for defining the local context and the current livelihoods of rural communities. The livelihood analysis can create the necessary baseline for a sustainability analysis using indicators based on the agroecosystem analysis (Conway, 1985; Kelly 1997) and the FESLM (Framework for Evaluating Sustainable Land Management) (FAO, 1993). Properties of agroecosystems and land use theory that are important to the analysis of the sustainability of livelihood and natural resources include productivity, acceptability, equitability, resilience, viability, stability and integrity.

Environmental concerns and rural livelihoods are the focus of the analysis in this research. The state of the natural capital available for the communities, the sustainable or unsustainable pattern of use of the natural capital will be assessed, and livelihood strategies will be analysed in relation to environmental, social and economic aspects.

❖ CHAPTER 3. RESEARCH METHODOLOGY

The research methodology is described in this chapter. Section one describes the case study approach used in this research project. The case selection is outlined in section two and includes details on selection criteria, units of analysis, sampling method, and sample size. Section three describes the data collection methods: the research instruments characterised by semistructured in-depth interviews at the key informant and household level, and the theoretical guiding framework of the research is presented. Finally, the data analysis techniques used in this research are presented in section four.

3.1 CASE STUDY RESEARCH

The research question this investigation aimed to answer is: “how can the sustainability of rural communities and the local natural resources in Chiloé Island be enhanced?”

Following Yin’s (1994) suggestions about how to determine the appropriate research strategy, three main conditions were taken into consideration: first, the type of research question; second, the amount of control an investigator has over the actual behavioural events; and third, the degree of focus on contemporary as opposed to historical events (Yin, 1994, p. iv).

This research is focused on answering a “how” question. As Yin (1994) states, this kind of question is seeking explanations and can be answered by either an experiment or a case study design. Secondly, regarding the control over the researched events, Yin (1994) suggests that an experimental design is a useful method when control over the events is required. However, this research is focused on local people’s views about the sustainability of local livelihoods and natural resources, and the researcher has no control over the researched events, which makes the case study the strategy to be followed. Finally, in this research it is impossible to divorce the context from the subjects analysed. The case study design gives space to the necessary context considerations to allow the achievement of the research objectives. The exposed reasons, plus the requirements of a deep understanding of the relations between local livelihoods and natural resources management make a survey design the least desirable option for this research.

This section describes the core elements of a multiple case study design, the implications in terms of generalisation in case studies, and the main aspects about the validity and reliability of this research.

3.1.1 Multiple Case Study

- **Case study design**

A case study allows an investigation to retain the holistic and meaningful characteristics of real-life events, when boundaries between phenomenon and context are not clearly evident (Yin, 1994).

Case study design can consider single or multiple case studies. A major limitation of a single case study design is that it can be compared only to theory, whereas a multiple case study design allows comparison between cases and also to theory (Yin, 1994). In this research a multiple case study design was chosen to allow comparisons between cases, which aimed to create more robust results if compared to single case studies. Because of time limitation two cases only are considered.

This research is classified as an *embedded multiple case study*, as it considers two communities, with the analysis of several household units in each community. Attention in this research is given to the units of the community, the households. Each case study focused on answering the research question. Each case study is context specific and provides a holistic analytical description of the communities (Bouma, 2000).

Figure 3.1 presents a summary of the research process based on a multiple case study. It indicates that the initial step must consist of a theory development stage, followed by the selection of the cases and the establishment of the specific data to be collected. Each case study consists of a whole study, from which conclusions are obtained. The individual cases should show how and why a particular proposition was, or was not, demonstrated. Across cases, the report should show why certain cases were predicted to have certain results (Yin, 1994).

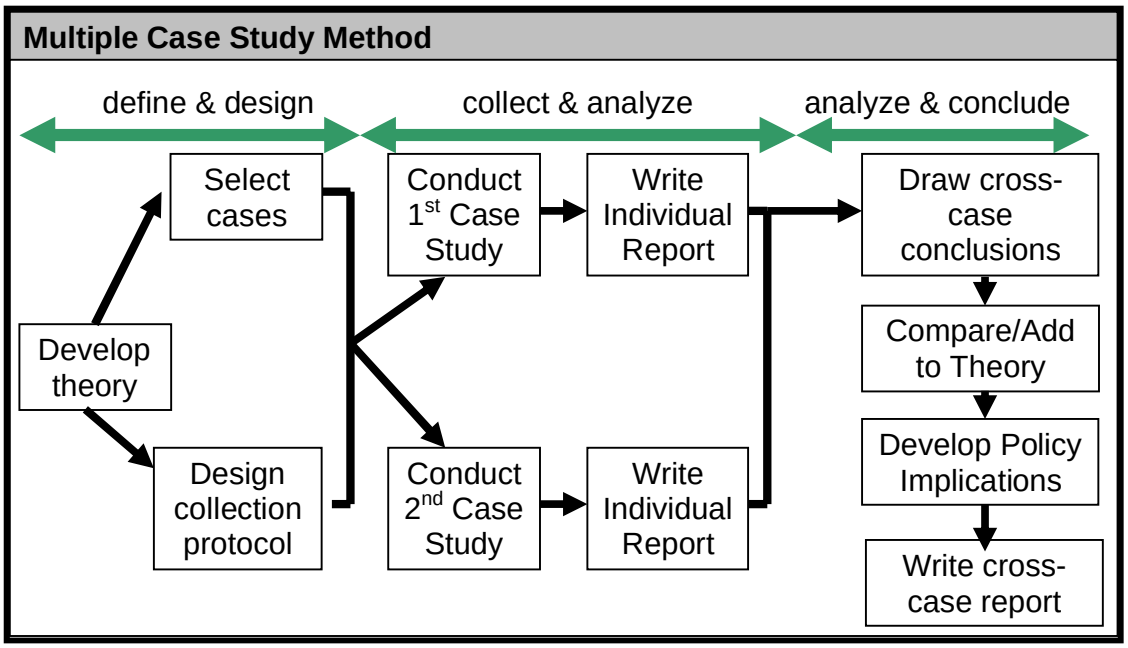

FIGURE 3.1. Multiple case studies.

(Source: Yin, 1994)

- **Case Study generalisation**

Case studies can be generalised and compared against theory and not against populations. This is known as “analytic generalisation” and contrasts with “statistical generalisation”. Analytic generalisation is based on the development of a theoretical body which can be used as a template against which to compare the empirical results of the case studies (Patton, 2002).

The development of a rich theoretical framework is essential for case replication. This framework needs to establish the conditions under which a particular phenomenon is likely to be found. This theoretical body becomes a vehicle to generalise to new cases. If the empirical cases do not work as predicted, the researcher has two options: first, s/he can suggest new elements to be added to theory, or second, theory can be modified (Yin, 1994).

For this research the theoretical framework was developed in chapter two. As presented in that chapter, the theoretical framework is focused on the relation between natural resources and rural livelihoods (i.e., at the community and household level). With this design, generalisation is limited to the two case communities of Chiloé Island amongst whom interviews were conducted and to theory (Yin, 1994).

- **Validity of the Case Study**

The correct operational measures for the concepts to be studied are considered in terms of construct validity (Yin, 1994; Patton, 2002). Multiple sources of evidence were used in this research, ensuring the validity of the results. This aimed to avoid the possible “subjectivity” and bias in the elaboration of the case study.

The multiple sources of data in this research included an extensive review of the existent literature about natural resources and their relation with rural livelihoods, secondary data and studies about the area of study, and primary data collected at the field level from key informants and rural households.

- **Reliability of this Research**

Reliability is concerned with the possibility of repeating the operations of this study, such as the data collection procedures, with similar results (Yin, 1994). This was obtained by describing the necessary procedures that were carried out to select the case communities and to gather and analyse the data.

These procedures are specified in this chapter, and follow the theory about case study research. Data collection of this research is structured around a theoretical framework presented in Figure 3.3, which gave the data requirements to answer the research question, the necessary indicators, and was used as a guiding tool to the data analysis. This sequence of steps allowed a methodical flow from the literature (theory), to the chosen methodology, followed by the data collection and data analysis and finally the presentation of the results following the same structure.

3.2 CASE SELECTION

This section defines units of analysis, establishes the case selection criteria, the sampling method, and sample size.

- **Unit of analysis**

The selection of the unit of analysis is related to the way the initial research questions have been defined (Yin, 1994). This research investigates two rural communities, each of them constituting one case study. The household is the embedded unit of analysis and the community represents the larger unit (i.e., case study) that sets up the context for specific rural livelihoods and natural resource management alternatives.

Two ***communities*** were selected based on ecological and geographical characteristics. Within the community different ***households*** were interviewed. The household is the most appropriate social unit for investigating livelihoods (Ellis, 2000). Different households within the community can have different livelihood strategies, and different relations with the environment. *Household* is defined as *the social group which resides in the same place, shares meals, and makes coordinated decisions over resource allocation* (Ellis, 2000).

- **Case selection criteria**

Two of the main selection criteria used in this research are based on the research question, while establishing that the case communities should be *rural* and carrying out *livelihoods based on natural resources*. The third selection criterion relates to theory, aiming to compare the *effects of location* on the sustainability of rural livelihoods and local natural resources of the case study analysis. The two case studies were selected aiming to create theoretical replications (Yin, 1994). Each case study was selected not as a sampling unit, but rather as a whole new element to be investigated. If the two cases support the same theory, literal replication could be claimed. Differences between the cases can be expected, if the explanations of these differences were predicted by the theoretical body (theoretical replication). As suggested by Ellis (2000) and Wiggins (2001) locational issues are considered in this research, aiming to analyse the differences that rural areas face in terms of their location relative to the main urban centres. As Wiggins (2001) suggests, there are important differences in the current development patterns and future possibilities that rural areas face taking in consideration their location. For this research a community that is closer to the markets and a remote rural community were selected, aiming to compare the livelihood strategies of each and their relation to environmental sustainability.

In summary, the main criteria used for selecting the case communities were:

- case community should be rural,
- case communities carrying out livelihoods based on natural resources,
- both communities close to extensive areas of native forest, as native forests are the prevalent ecosystem in Chiloé Island,
- location in relation to urban areas. One isolated community and one community closer to urban areas. This criterion is related to the intention of generating theoretical replications.

Case community selection

With the help of key informants (i.e., Local NGOs, Local Council) and the researcher's personal knowledge of the area, the two communities were selected based on the selection criteria. The selected communities are:

- Rahue - La Montaña: an isolated community situated on the western side of the coastal ranges of Chiloé Island, carrying out subsistence agriculture, and with *Huilliche* ethnic tradition.

- Quiao: closer to markets, situated on the eastern side of the coastal ranges, carrying out agriculture, diversified to tourism and other productive activities, and has not a specific ethnic affiliation.

Figure 3.2 illustrates the area of study. The two communities selected are shown in their relative position to the urban area of Chonchi City. Rahue – La Montaña community on the west side and Quiao community on the east side of the coastal ranges. These two communities were selected considering their geographical and ecological characteristics. Rahue, on the western side of the forested coastal ranges, facing more isolated conditions, and subsistence agriculture; and another, Quiao in the eastern side of the ranges; facing a farm and market oriented livelihood strategy. Both communities are close to extensive native forested areas.

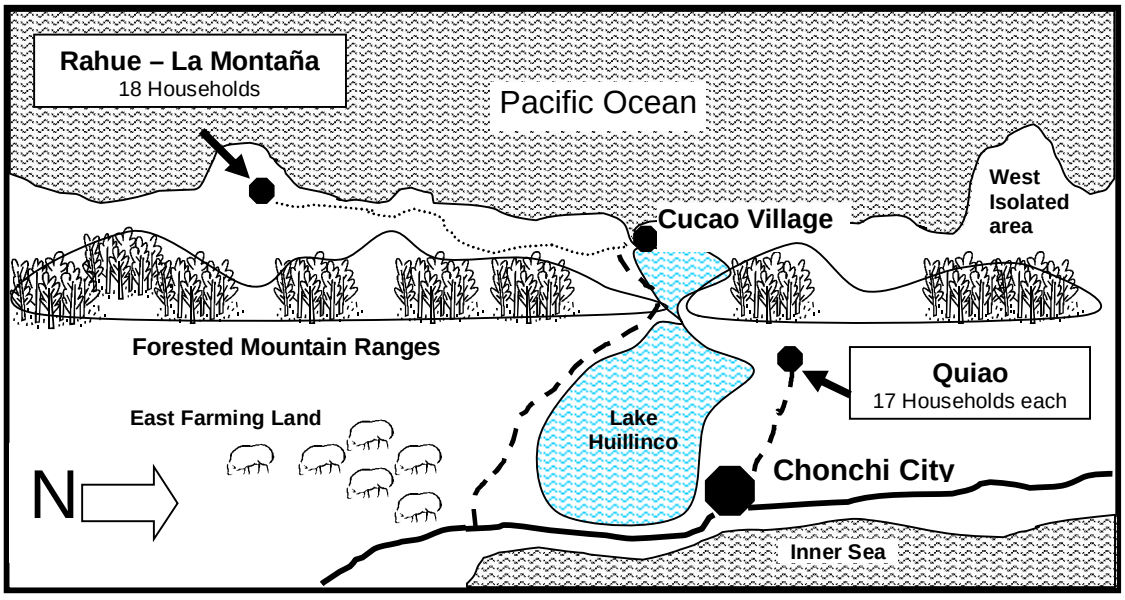

FIGURE 3.2. Area of study: location and size of the case communities in the Chonchi Council area of Chiloé Island, Chile.

- **Sampling methodology**

Within the selected case communities a sample of households and key informants were interviewed. To select the key informants and the households among the community the following procedures were carried out.

Key informant sampling

Key informants are people who are particularly knowledgeable about the inquiry setting. Their insights can prove particularly useful in helping to understand what is happening and why (Patton, 2002). Key informants in the present research were selected according to the type of information they manage and have access to, and were determined by the purpose of the enquiry. The purpose was to identify a wide range of different opinions in several fields that affect the researched topic (Woodhouse, 1998).

Sample size

A total of 13 key informants were interviewed completing the total number of external organisations working in the study area. Key informants in this research were chosen at three levels: governmental level, civil sector, and local level.

At the governmental level: CONAF, the forestry agency, INDAP, the agricultural extension agency, and the local council (three informants) were interviewed. These three governmental organisations are the most important ones implementing development programmes among the case communities.

Among the civil sector four NGOs were interviewed: BMCh, CET, CONTODOS, and the Federation of Indigenous Communities. These organisations summarise the complete sample of NGOs working in the area of study.

Finally, at the local level the community board leader and the indigenous board leader of Rahue la Montaña were interviewed. In Quiao, the tourism group leader and the handicrafts leader were interviewed. The selection of these key informants at the local level was based on their willingness to participate in this research. They were important in mapping all the community households which was the basis for the sampling techniques used within the community.

Community household sampling

The “snowball technique” (Bouma, 2000; Patton, 2002) was selected as the sampling procedure that best applies to the objectives of the study, the time limitations, and the chosen data collection methods (i.e., key informants and household semi structured

in-depth interviews). This is a nonrandom sampling procedure. The focus is to locate information-rich subjects among the community members to allow a broad coverage of the different livelihood strategies carried out within the community.

This sampling procedure consists in gathering information by approaching the community and interviewing those who are available. In this case, key informants were approached such as the local community board leader and the indigenous board leader. They were asked at the end of the interview: “Who does something different from you? Who has an essentially agricultural or forest-based livelihood? Who is more related to the marine resources?” In that way, key informants nominated other households that they know, based on the productive activities they undertake. After interviewing this second group of households, they nominated others based on households that are similar to theirs and those that are different from theirs.

The sample grows as a “snowball”, with each layer of informants providing contact and information about the next one. This provided a broad cross-section sample of the households within the community. The chain of recommended informants would typically diverge initially, as many sources are recommended, to finally converge as a few key names are mentioned over and over (Patton, 2002).

Sample size

In case study research there are no strict rules about the sample size. It depends on the objectives and kind of information that the researcher wants to gather, it also depends on what information is really useful, what will have credibility and what can be done (Patton, 2002). The validity and meaningfulness of the case study refers more to the information richness of the cases selected and the observational and analytical capabilities of the researcher than to the sample size. Lincoln and Guba (1985; cited in Patton, 2002) recommend sampling to “the point of redundancy”. This means that the interviews should continue until the data no longer add new insights about the topic that is studied.

The minimum sample number for this research was planned to consider reasonable coverage of the studied communities. Before the beginning of the data collection this number was still flexible and dependent on the results of the key informant interviews and the quality of the collected data.

The initial sampling procedure at the field level was started with the aim of following the snowball technique, however due to the sufficient time availability in the field and

good coordination with the community activities, a high percentage of the community households were finally interviewed.

At the time this research was carried out in Rahue La Montaña only 18 households were permanently living in the area. Of the community 16 households were finally interviewed. Twelve of the interviewed families were living in the area and four of the interviewed families were living in Cucao Village, but working every day on their farms in the Rahue – La Montaña area. In this case, only two households were not interviewed as they were not present in the area at the time of research for illness and work reasons.

In Quiao thirteen households of the seventeen inhabited farms were interviewed. Families that work part time on the farm but live in urban areas and get most of their income from the city were out of the scope of this research, as the intention was to interview only rural households. In the case of Quiao, four households that were living in the community were not interviewed. One of them was not keen to participate, and in the case of the other three, recommendations and descriptions of other households were listened to (following the snowball technique basics) and it was decided that these households were very similar to other households of the area and were unlikely to provide new or significantly different information.

3.3 DATA COLLECTION METHODS

This section describes the selected data collection instruments and presents the theoretical framework that was used to guide the data collection.

3.3.1 Data collection instruments

The data collection methods used in this research were selected in line with the objectives of this research: to analyse the sustainability of current livelihood strategies and natural resources of two rural communities in Chiloé Island. Different sources of both qualitative and quantitative data were used to achieve the research objectives.

- **Sources and type of data**

The data collection process carried out in Chiloé Island provided primary as well as secondary data:

Primary data were collected to create a rich picture of current livelihood strategies and analyse the dependence and management strategies of the natural resources. The primary data of this research were obtained from local people at the household level. Two kinds of information can be identified from people: *knowledge* that is not available elsewhere (i.e. specially their own views of reality), and *perceptions* of individuals in their capacity as users of resources, and how these are manifest in their decision-making patterns (Woodhouse, 1998).

These primary data were obtained from the household semi-structured interviews and related to livelihood strategies and natural resource management. Key informants added information about the organisational level, especially about the external context (i.e., organisations' influence, markets, environmental issues) of the two communities.

Secondary data gathered during the field work helped to describe historical year trends and the context of the current situation in the rural areas of Chiloé Island. Secondary data collected in Chile were also used to establish comparisons with other studies in the area, and to complete the case description. The cross-checking of data was useful in terms of increasing the validity and confidence of the results (Brock, 1999). Secondary data were obtained in the Chiloé local library (other theses about the area of study (Oyarzun, 2000; Griott, 2004), the Local Encyclopaedia (Fundacion Estrella del Mar, 2001), and general books about Chiloé (Agraria, 1990)), the project data base of BMCh (GEF, 1994), research carried out by CET, studies about forested areas supplied by CONAF (CONAF, 1999), agricultural and rural credit data provided by INDAP and PRODESAL, and research carried out by the AUSTRAL University in Chiloé Island (Armesto, 1996 & 2001; Aqueveque, 2003; Echeverria, 2004).

The data collected for the case studies included qualitative data as well as quantitative data. ***Quantitative descriptive data*** about income portfolio, educational level, access to assets, and dependence on external aid or development programmes were colleted; together with a set of ***qualitative data*** covering seasonability calendars, resource maps, expectations, trends and processes, and sustainability perceptions.

The nature of the information to be gathered in this research required mainly qualitative in-depth data collection, which preserves the richness of the context and captures perceptions of people about their livelihoods and local sustainability. This

can be achieved best using semistructured in-depth interviews, which allow greater depth and flexibility in the process (Patton, 2002).

- **Semistructured interviews**

Semistructured interviews were chosen considering the fact that there is a need to gather detailed and in-depth information about the relations of the livelihood strategies of the households and the surrounding environment, covering sustainability issues that are better explained and discussed with the household members in a face-to-face interview.

Semistructured interviews were used as the main instrument to collect the data in this research. A sequence of “key informant interviews” and “household interviews” was used.

Key Informant Interviews

First, from the key informant interviews the necessary information to give a general overview of local livelihoods, the main environmental problems, and supporting organisations and policies was gained. Key informants provided an initial indication as to the main issues influencing the rural communities and characteristics of the households. The key informant interviews aimed to identify the main issues concerning the rural households and their livelihoods. Key informants contributed information about specific elements of the current development processes that rural livelihoods are currently dealing with (i.e., governmental aid, NGO projects, price trends, alternatives to current livelihoods, etc.). Key informant interviews at the local level also provided information on the distribution of the households within the community. This information assisted in the sampling of the communities and ensured that households were not left out.

The main topics covered during the interviews are shown in the following tables for each respondent level. Annex five includes the interview guides used during the interviews with the key informants.

Household interviews

Secondly, at the household level a semistructured interview covered data regarding the income portfolio of the household, access to assets, vulnerability context and sustainability indicators. In-depth semistructured interviews were used to increase the understanding of the relations and trade-offs of the livelihood strategies at the local households level. A semistructured in-depth interview was applied to the

households of both communities. The semistructured interview was aimed at achieving an in-depth understanding of the household livelihood strategies, and an analysis of the institutional, organisational, environmental, and vulnerability context in which this household was living.

The interview followed an interview guide with the inclusion of graphic tools that come from participatory approaches (e.g., PRA, RRA). These participatory tools were used at the household level to facilitate interaction with the household members during the interview. They also established an interesting discussion point from where questions and new elements of the livelihood strategies and natural resource management arose.

The participatory tools that were used at the household level were:

- *resource map*: showed the different kinds of natural resources and productive systems available for the household,
- *seasonal diagram*: showed the changes in the production during a year,
- *historical matrix*: used to identify the main trends regarding the availability and management of natural resources.

The full household interview guide is presented in Annex six, where the details of the interview guide, the suggested questions (used as guiding assistance), the participatory tool guidelines, and the objectives of each question are specified. The interviews were focused on gathering data regarding: income portfolio, assets access, vulnerability context, processes and structures, and sustainability indicators.

In the Rahue – La Montaña case, before collecting the data, the researcher made a presentation in the monthly community meeting about the goals of this research, the expectations about it, and the possible results of it. In that way households were aware of the researcher in the area and prepared to be interviewed. In the Quiao case, three weeks before starting the data collection previous conversations with local farmers were carried out, aiming to explain details about this research and the need to interview them. This allowed the household to be prepared and allocate some time during the day for the interviews.

- **Data Management**

The household and key informant semistructured interviews were taped, with the written consent of the interviewed person. Annex seven shows the information sheet used during the field work on Chiloé Island.

All the data were stored in tapes and analysed from the tapes. After the conclusion of the research process data were stored properly according to the ethical procedures of Massey University. Annex eight shows the approval of this research by the Human Ethics Committee of Massey University.

3.3.2 Guiding theoretical framework for the evaluation of sustainability of rural livelihoods and natural resources on Chiloé Island.

This section presents the theoretical framework used to guide the data collection. The framework was developed from the literature about rural livelihoods and natural resource sustainability. This framework guided the data collection phase in the field, as the indicators and data requirements came from it. It was also used for the data analysis as a tool to organise the data in logical and representative categories, and finally it was used to arrange the presentation of the data in the results and discussion chapters.

The selected frameworks (i.e., SLA, Agroecosystem, sustainability analysis) used in this research are tools to help identify the key factors influencing sustainability of the rural livelihoods and natural resources in two rural communities on Chiloé Island. These frameworks also helped the researcher to finally identify how the sustainability of rural communities and local natural resources on Chiloé Island could be enhanced. The theoretical framework (Figure 3.3 and 3.4) is composed in three stages:

- **First stage: livelihood analysis**

The first step was an analytical description of the current livelihood strategies (Figure 3.3, first page). From the literature review it was determined that the SLA (Sustainable Livelihood Approach) includes an holistic and current analytical framework to integrate the concept around the livelihood strategies of rural communities.

As described, the aim of this research is to identify how to enhance the sustainability of rural communities and the local natural resources on Chiloé Island. If the level of sustainability has to be established, the literature suggests that a rich base line is needed. The first step establishes a complete in-depth description or diagnosis of the case communities. The livelihood analysis generated this basic knowledge about the communities. This analysis included the assets access of the household: physical capital, financial capital, human capital, social capital, and natural capital. The

vulnerability context was also analysed, in terms of the shocks, trends and seasonality that affect the local households. The processes and structures are also considered in terms of the external context that influences local livelihoods and natural resource management.

This livelihood analysis led to an in-depth description of the context of rural communities of Chiloé, and to a definition of the livelihood strategies of the case communities which are related to the livelihood outcomes. Linking the SLA framework and the agroecosystem theory, it can be said that the livelihood strategies represent the objectives for the agroecosystem. Following concepts of the agroecosystem analysis (Conway, 1985) the local livelihoods and their outcomes were defined by the farmland available for the household and the surrounding context established by the livelihood analysis. The key functional relationships that are considered in this research are:

- *space*: the land from where the resources for the household livelihood strategies come,
- *time*: current livelihood strategies, their context, historical data, and trends,
- *flows*: reflected by the trends and the shocks of the livelihood analysis and other stability and resilience indicators,
- *decisions*: included in terms of the current livelihood strategies.

The framework connects the livelihood strategies of rural communities (SLA framework) with the surrounding natural resources (Agroecosystem analysis), which leads to the sustainability analysis.

- **Second stage: sustainability analysis**

The second stage involved an analysis of the livelihood strategies from a sustainability perspective, aiming to evaluate whether or not they are environmentally sustainable (Figure 3.3, second page). The sustainability assessment of these livelihood strategies included elements and concepts of the FESLM approach and the agroecosystem analysis. The first step (SLA analysis) gives the baseline and necessary knowledge for the sustainability analysis.

This second step involves a sustainability analysis, as shown in the second part of figure 3.3. The livelihood strategy was analysed in terms of its economic, social, and environmental characteristics. The analysed systems properties such as: *productivity*, *stability*, *resilience*, *viability*, *acceptability*, *equitability*, and *integrity* were explored to fulfil the requirements of a sustainable analysis. Figure 3.3 shows

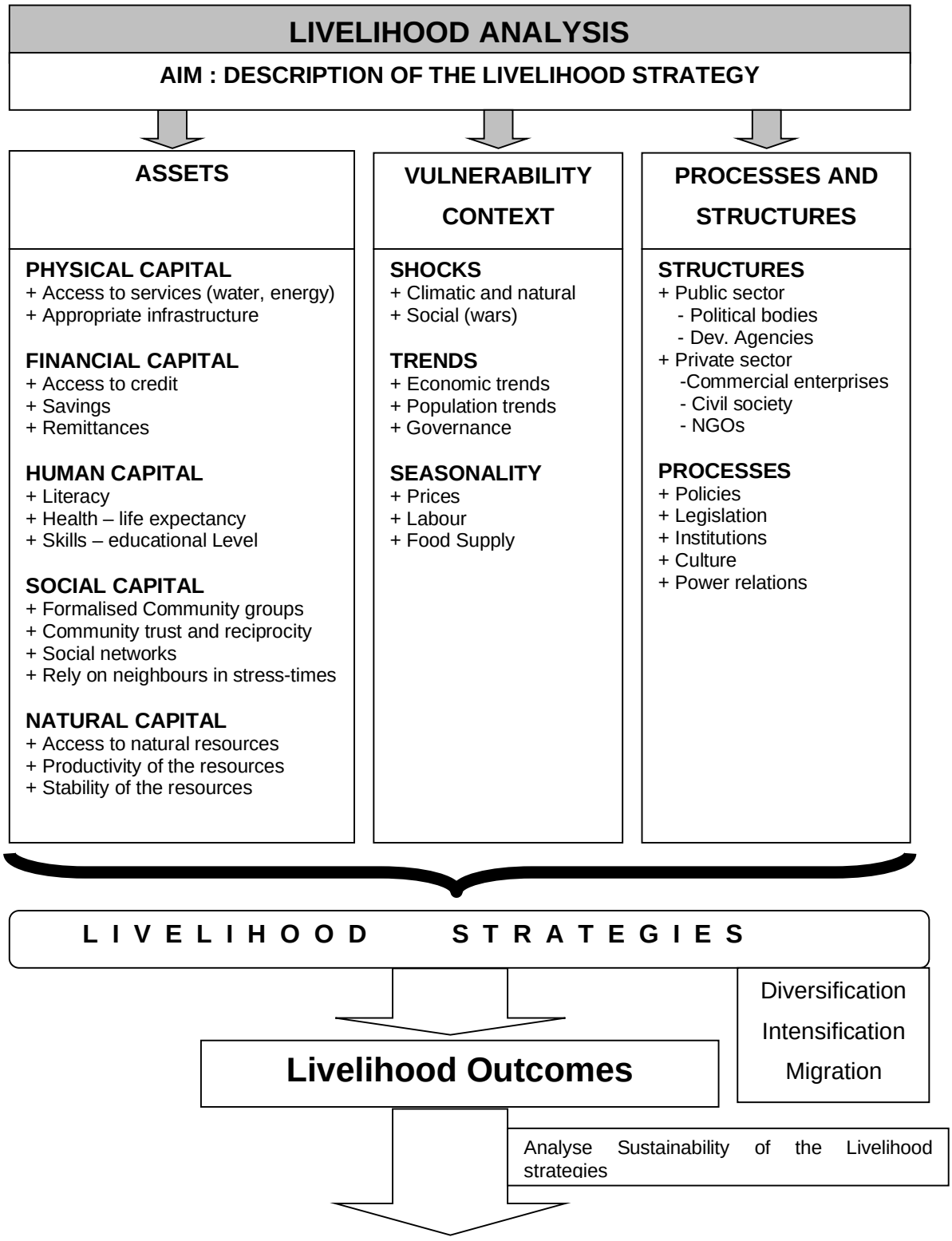

FIGURE 3.3. Theoretical framework for the data collection.

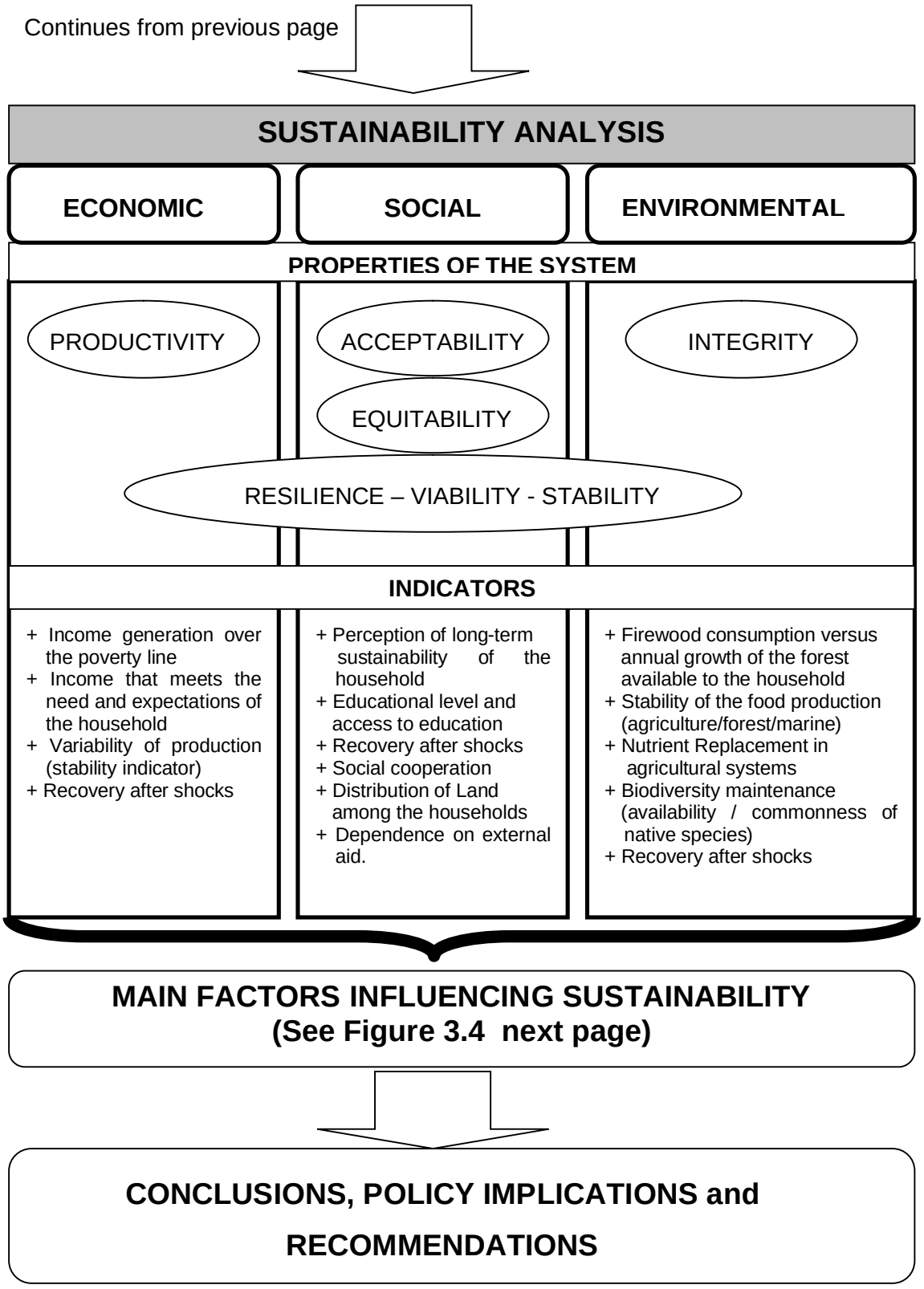

FIGURE 3.3. Theoretical framework for the data collection (continuation).

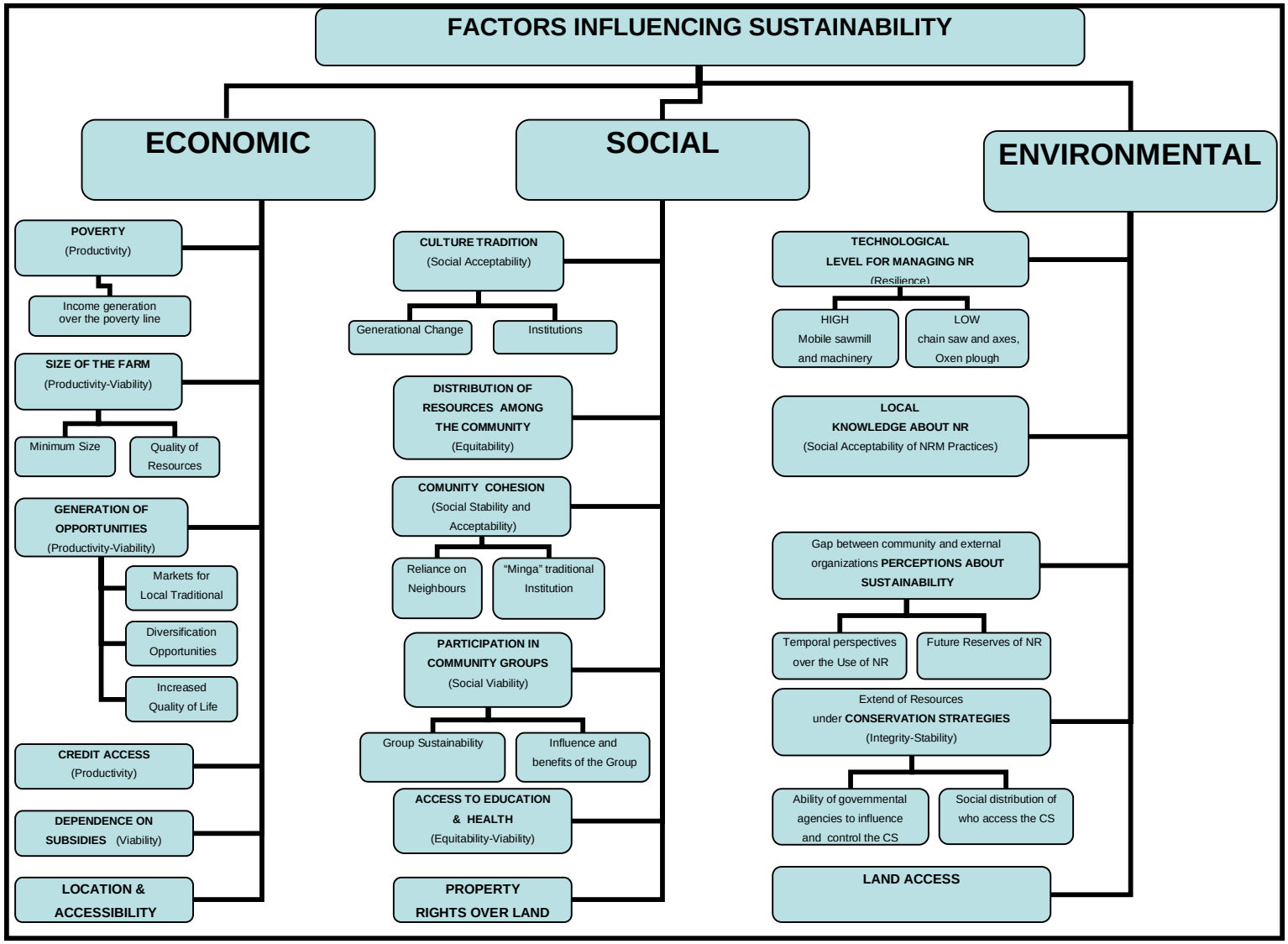

FIGURE 3.4. Main factors influencing sustainability of Rural Areas on Chiloé Island

the indicators for the economic, social and environmental sustainability which were used in this research.

Temporal and perceptual considerations

As discussed in chapter two, sustainability analysis has a temporal perspective, which it is important to define. In addition, the quality and source of the data should be considered, to understand which perspective this research is reflecting (i.e., governmental level or community level).

The research was carried out on a single field visit to the case communities over a period of two months during June and July 2004. Therefore, results of this research illustrate the current factors influencing sustainability of the local rural livelihoods and natural resource management practices. However, they include temporal analysis of trends in the use of natural resources, such as natural resource availability (quality and quantity) and quality of life increase during the last 50 years.

In general terms, the research results present a picture of what is happening in the case communities during the year 2004, with a special focus on their livelihood strategies, natural resource management, and some of the trends over the last decade in education and generational change, quality of life, and natural resource quality.

The sustainability analysis was based mainly on predictions about the future of the households. As one of the aims of this research is to capture the views and perceptions of local people, these predictions come from the household members about their economic, social and environmental future. However, other questions included current quantitative indicators about productivity, stability and acceptability of the livelihood strategies and the use of conservation strategies.

- **Third stage: main factors influencing sustainability**

The literature identifies a complete range of factors influencing the sustainability of rural livelihoods and natural resources, and Figure 3.4 outlines the most relevant factors identified for this research, based on the literature. The sustainability indicators presented before (stage two, Figure 3.3) were used to measure and analyse the relative importance of each of these factors in the case areas. Figure 3.4 illustrates the factors influencing sustainability of rural areas organised regarding their economic, social, and environmental implications:

Economic factors include: poverty levels (income generation over the poverty line), size of the farm (quantity and quality of the resources); generation of opportunities (related to markets, diversification opportunities and quality of life); credit access (financial capital); and dependence on subsidies. Location in relation to urban centres and road accessibility to the resources are key factors related to the economic possibilities of the rural communities.

Social factors consist of the influence of culture and traditions and how modern culture is changing current livelihood strategies; the distribution of resources among the community, which has social equitability implications; community cohesion in terms of social stability and acceptability, measured by the maintenance of traditional institutions; participation in community groups, related to empowerment and participation in the decision-making process; and access to health and education as basic needs of the community. Property rights are seen as part of the socially constructed institutions and have several implications in terms of access to resources. Property rights influence the access to credit and subsidies, they generate social equitability, and secure the land access possibilities of a household, which finally determines the natural resource access.

Environmental factors include the level of technology that rural communities use in the management of natural resources, which influences the high or low impact that livelihood strategies have on the environment. Another factor influencing local sustainability is the local knowledge that communities have about their natural endowment, which is influenced by the information they access, and which generates certain practices at the field level. A third factor is the perceptions about sustainability that local communities have, which influence the long or short perspective over the use of the resources. Furthermore the application of conservation strategies at the farm level, which influences the ecological integrity and stability of the natural resources, is also regarded as an environmental factor. Finally, land access is the main factor that determines the household access to natural capital and productive opportunities.

The analysis and presentation of the results was based on Figure 3.3 and 3.4, which are based on the indicators used to collect data, and also include what the literature suggests of factors that influence sustainability in rural areas.

- **Policy implications**

After having analysed the main factors that influence the sustainability of rural livelihoods and natural resources in the study area, suggestions were made about how projects and programmes that stress environmental sustainability of rural livelihoods could be implemented.

- **Indicators and data requirements**

The theoretical framework presented comprises a wide set of indicators that have been used by other researchers (Conway 1985; FAO, 1993; Scoones, 1998; Ellis, 2000; DFID, 2001; Rigby, 2001; Pacini, 2003; Mog, 2004) for the livelihood analysis and the sustainability assessment of rural areas. These indicators are described in Annex three.

Based on this research's theoretical framework and the special characteristics of the study area (e.g., natural resource endowment, agricultural and forestry products, traditional livelihood activities, and local culture), the data requirements and the related indicators used in this research are presented in Annex four.

3.4 DATA ANALYSIS

This section presents the main considerations followed in the data analysis process carried out in this research. The data analysis techniques used in this research followed the guidelines for the construction of case studies and qualitative techniques of data analysis.

3.4.1 Case study data analysis

As stated before, this is a multiple case study with embedded units of analysis. Embedded research design must be carefully analysed, not focusing only on the subunits (households), but returning also to the larger unit of analysis (community) (Yin, 1994).

Several qualitative techniques were used to analyse the data in this research. There is no exact formula for how to transform data into findings (Patton, 2002). Data analysis consists in examining, categorising, tabulating and testing the evidence to address the initial propositions of this research. There is a need to attend to all the

evidence, avoid any interpretation of the data (bias), and consider any possible alternative explanation.

Following Yin (1994) and Patton (2002) suggestions about how to construct a case study; the process of this research was based on a four step process:

- **Assembly and first stages of analysis of the raw case data**

This stage consists in organising all the information collected about the communities and the context on Chiloé Island. In terms of primary data, one household interview and one key informant interview were fully transcribed from Spanish to English. The interview was read once and the information was organised into several topics. The rest of the interviews were listened to and transcribed in a summarised way (bullet points, conserving important quotations and references) waiting for further analysis.

The qualitative process of data analysis involved in this research includes an *inductive phase*, where patterns, themes and categories were sought in the data, followed by deductive *analysis* where data are confirmed and compared to an existing framework or theory (Patton, 2002). Inductive analysis was started by defining key concepts, phrases, terms, and practices that are special to the case studies. In this research this process was done following the theoretical framework (Figure 3.3 and 3.4) that was used to guide the data collection and analysis process.

After the first transcriptions of interviews, the aim was to develop a manageable classification or coding scheme for the data. Patton (2002) suggests content analysis, which involves identifying, coding, categorising, classifying and labelling the primary patterns of data. Dey (1993; cited in Gray, 2003) proposes an iterative cyclical process of describing, classifying and connecting. The last stage, connecting, aims to find cause and effect relations. This process may be undertaken several times before completing the case report.

Specific analytic techniques suggested by Yin (1994) indicate pattern matching as the most preferable technique to use in case studies. This technique, applied correctly, deals with the internal and external validity issues of case study research. Pattern matching refers to a descriptive finding (Patton 2002), for example: “all interviewed households recognise the use of fertilisers for the potatoes crop”. Patterns can be found by looking for “recurring regularities”.

Pattern matching is based on several pieces of information from the same case that are related to some theoretical proposition. Dependent and independent variables are used and compared against the theory (Yin, 1994).

Once local patterns and concepts have been discovered, the researcher can create categories from which s/he can construct typologies and further elucidate their findings (Patton, 2002). Classification is the process of identifying and defining categories relevant to the research focus and placing them in logical hierarchy (Gray, 2003). Categories must be meaningful in terms of their internal homogeneity, and must be clearly defined with specified boundaries (external heterogeneity) (Patton, 2002).

In the present research notes were taken from the transcripts, covering the main themes of each interview. Patterns, trends, and categories suggested by the literature (and that were established in the theoretical framework (Figure 3.3 and 3.4)) were compared with the findings. New categories and different patterns that emerged from the analysis were included in the framework. Listening to the tapes for a second time was a necessary practice to search for new patterns and categories.

- **Construct a case record**

At this stage data must be condensed, organised, classified and edited into a manageable and accessible file. For this research the sorted data were classified using the theoretical framework presented in section 3.3.2 (Figure 3.3 and 3.4) and the results of the analysis of the two fully transcribed interviews. This created a matrix where each bit of data of each interview was allocated to a corresponding category. Special attention was given to finding new categories and different pieces of data that could add new elements to the theoretical framework. This generated a list of categories with several quotations and data that came from each interview. This was done for each of the two communities and for the set of key informant interviews. For each community the matrix was then separated into several topics and relations between factors influencing sustainability, with the correspondent data from each interview allocated under the respective category.

Quantitative descriptive data were tabulated and helped the descriptive process and the creation of some descriptive figures. This type of data included categories such as: farm area, family members, size of herd, area of forest, and area of paddocks.

- **Write a final case study narrative**

The goal of this stage is a descriptive picture of the community, making all information accessible to the reader to understand the case in all its uniqueness. The case narrative will be presented thematically, including all the contextual considerations necessary to understand the case.

The data were presented using several steps. First, the case description was presented (chapter 4), aiming to introduce the reader to the Chiloé Island context and to important facts that are common to both communities. Secondly, the case of Rahue – La Montaña was presented following the structure theoretical framework of this research and aiming to answer the question and the objectives of this research. Thirdly, the case of Quiao community was presented following the same structure.

A *rich description methodology* (Patton, 2002) was used to describe the livelihood strategies of rural households in two communities in Chiloé Island. The purpose of the description is to illustrate the phenomena of interest, provide an overview of the raw data, and highlight their relevant aspects, maintaining the holism of the data (Gray, 2003). This descriptive analysis allows the reader to understand the context and draw his/her own interpretations about meanings and significance (Patton, 2002).

- **Cross-case conclusions**

The results from both communities are analysed and compared. The aim of cross-case analysis is to identify processes and outcomes across the cases and understand how they qualify by the local context (Gray, 2003). This final process gives more strength to the conclusions. Cross-case analysis based on theoretical replications is a powerful form of analysis. The cases were chosen to produce different results on the basis of distinctions between their theoretically important characteristics (in this case location) (Gray, 2003). The theoretical framework can be reinforced if the case studies support the theory, or new elements can be added to the theory if there are new findings or alternative results (Patton, 2002).

In this research, after analysing both cases, cross-case conclusions were obtained. Theses were used mainly to explain location differences and main factors influencing local livelihoods and natural resource sustainability. In this section the analysis steps out of the unique context of each community aiming to analyse and describe common factors influencing the sustainability of local livelihoods and natural resources.

❖ CHAPTER 4. BACKGROUND DESCRIPTION TO THE CASES

This chapter presents the background information to the area of study. This description aims to help the reader to understand the context of the area of study, it is an important part of the case description, which allows a better understanding of the results at the community level (chapter 5). The information presented in this chapter was obtained from both primary and secondary data.

The first section describes the general context of the study area, starting at the provincial level (Chiloé Island). Then the case community level is presented, finishing with a description of the natural resources and livelihood strategies of the case-communities.

4.1 CHILOÉ ISLAND CONTEXT

4.1.1 General facts about Chiloé Island

- **The 10th region**

Chiloé Island is geopolitically one of the five provinces of the 10th region of Chile. The 10th region is called the "Lakes Region" and contains 7 % of the national population (i.e., 1,061,735 inhabitants) (CONAMA, 2003). It is one of the regions with the highest proportion of rural inhabitants in the country (31.5 %) (INE, 2003).

In terms of poverty indicators, for the year 2000 24.7 % of this region's population lived in poverty. This region has higher levels of poverty than the national average of 20.6 %. When urban-rural poverty data are analysed it is interesting to discover that urban areas of the 10th region have more urban poor as a proportion (27.5 %) than the national urban poor average of 20.1 %. However, rural areas of the Lakes region have lower rural poverty (19.3 %) compared to the national average (23.8 %) (MIDEPLAN, 2000).

- **Chiloé Island province**

The land area of Chiloé Island corresponds to only 1.2 % of the total surface area of Chile. However, Chiloé is the second largest island of South America and presents interesting biodiversity, pristine natural areas, and special cultural characteristics (GEF, 1994). Its 9,136 km^2 are covered mainly by native forests (66.9 %), with

pastures and scrub making up 27.4 % of the total (CONAF, 1999). Most of the population of Chiloé Island live close to forests, pastures and the sea.

The land is predominantly privately owned and the Chiloé National Park constitutes the only important area of state-owned land on the Archipelago. The land area of Chiloé is highly subdivided as the majority of the land holdings on the Island are small farms. Of the total number of 22,103 farms, 48 % of the properties are smaller than 8 ha and 39.4 % of the farms are between 8 ha and 32 ha. Almost 88 % of the farms (i.e., 19,901 farms) are smaller than 32 ha (*Gobernación Provincial de Chiloé*, 2004).

The Island population is 154,766 inhabitants, representing 1.02 % of the national population (census year 2002). The proportion of rural inhabitants in the Chiloé province is 44 % representing the largest proportion of rural inhabitants in the 10th region (INE, 2003).

- **Area of study: the Chonchi Council**

The area of study is located in the Chonchi Municipality, one of the 10 municipalities of Chiloé province. The Chonchi area is 1,362 km^2, on which 12,572 people live. It is the area with the highest percentage of rural inhabitants in the province (64%). The population density is 9.2 inhabitants per km^2, compared to the 16.9 inhabitants per km^2 average of the whole island (INE, 2003).

Figure 4.1 illustrates the general location of Chiloé Island in Chile. The Island is located between latitude 41°50 S and 43°50 S approximately. Chiloé is the northern end of a major region known as “Western Patagonia” which embraces parts of Argentina and Chile down to Cape Horn. The locations of the two selected case communities in the western ranges of Chiloé Island are illustrated.

4.1.2 Future development opportunities of Chiloé Island

Chiloé Island has the potential to develop in terms of intensive agriculture, forestry, and tourism. The country is immersed in a modernisation process that spreads from the centre of the country. The 10th region has been part of that process, and currently Chiloé is the next territory of the region to be developed as part of the economical-industrial development process of the country (Armesto, 2001). However, due to its isolation, rural population, and small farming systems this economic development has been slow.

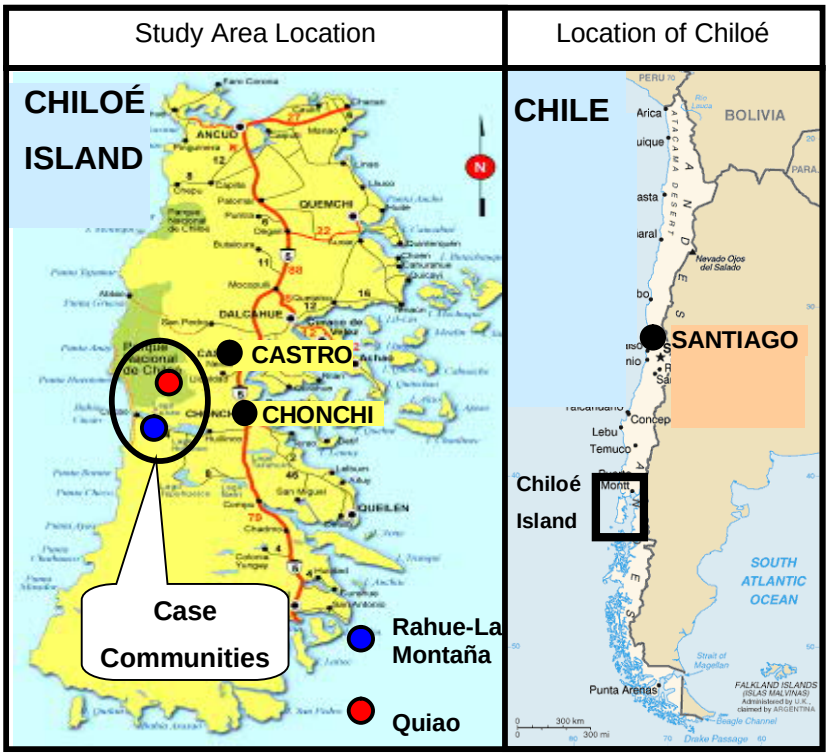

FIGURE 4.1. Location of the area of study in Chile.

In the agricultural sector of Chiloé, milk production has been identified by governmental development agencies as the key area to be developed (INDAP and Provincial Government). The local cooperative, CHILOLAC, has a processing plant (15 million litres per year) running - however - at only 40% of its capacity. Its strategic plan is to encourage more small farmers into the dairy industry, and to generate products with added value to then access foreign markets (*Gobernación Provincial de Chiloé*, 2004). However, culturally milk production is not part of the local household activities and several key informants in this research question the applicability of this proposal to Chiloé.

The forestry sector could be the primary economic driver for the island as forests constitutes the principal available resource. Research and sustainable management alternatives for native forests are currently being implemented in an attempt to create a shift away from the exploitative traditional practices that have been carried out during the past decades. The forestry sector has the greatest management challenges on the Island and native forests are the most visibly degraded natural resource of Chiloé.

Tourism is an important enterprise for Chiloé. This island is visited traditionally by 70,000 Chilean tourists every year. Foreign tourists are increasing their visits to the Island due to its special features. Chiloé Island has a distinctive rich traditional mythology, unique sea-food, 16 wooden churches of the 1800s that were declared Human Heritage sites by UNESCO, stilt houses surrounded by farmland and native forests, beautiful fiords, and more than 40 minor islands which compose the magic landscapes of the Chiloé Archipelago. However, the tourism sector is poorly developed, with requirements for improved tourist infrastructure, better supply of products, and a change from a cheap destination to a well developed, organised, and unique tourist destination. At the end of 2004, a well known Chilean entrepreneur bought almost 115,000 ha in the south of the Island with the intention of creating a conservation park (Emol, 2005). This is equivalent to 15 % of the surface of the island, and will have a profound impact on the economy, the tourism activity, and future prospects for the Island.

The salmon industry is the only major productive sector that has grown and been developed on the island. This is product of the good quality of the waters (i.e.: temperature and oxygenation), the proximity of both the sea and fresh water lakes (both important in the productive cycle of the salmon), and the relatively cheap labour. The salmon and trout farming industry in Chiloé and Aysen[1] generate a net production valued for the year 2004 at almost US$ 1,200 million, making Chile the second largest world producer of salmon and trout after Norway (Salmon Chile, 2004). This has generated hundreds of jobs, strong immigration to the main cities (as the factories are normally in the cities), and a general economic boom on the island.

4.2 THE CONTEXT OF THE RURAL AREAS OF CHILOÉ

4.2.1 Historical context

Archaeological findings near Puerto Montt date human settlement in the area as far back as 12,000 years ago. *Chonos*, *Cuncos*, and *Huilliches* (people of the south) were the first settlers of the Island. Theories about the settlement of the island vary. Some explain the origins of the indigenous communities as being the result of migration from the Pacific islands, while others suggest that the settlers migrated

[1] Aysen is the next region (11th region) to the south of the Lakes region and has a strong isolated condition, characterised by the presence of mountains, fiords, and islands as the main geographical features.

from the mainland of Chile. The pre-Hispanic indigenous inhabitants were sailors and by using canoes they navigated between the islands and fiords of western Patagonia.

Chiloé Island was discovered by the Spanish in 1540 when Alonso de Camargo sailed through the northern coasts of Chiloé. In 1567 Martin Ruiz de Gamboa was the first Spaniard who occupied the island for the Spanish Crown. The territory remained under Spanish control until 1826 when Chilean troops took over the Island which then became part of the newly formed Chilean Republic. Chiloé was the last South-American territory under Spanish control. Since then the *Chilote*, the mix between Huilliche and Spanish/Chilean colonizers has been the predominant population.

Modern Chiloé has seen moments of glory. In 1912 the railway between the two main cities Ancud and Castro was inaugurated, reducing the travel time from several days to only one. During the 1920s the extraction of highly valued timber (*Alerce* and *Cipres* species) created fortunes. Castro City was for many years a tax-free port, increasing the well-being of the locals. With the 1960 earthquake the railway was severely damaged and was replaced by a new road which is still used today. During the late 1970s the salmon farming industry started to grow and became, during the 1990s, the main economic activity of the island.

4.2.2 Institutional context

Chiloé Island has a unique set of traditions and culture compared to the rest of Chile, due to its geographically isolated location, its history, and its ethnic composition. The rural inhabitants of Chiloé face relatively hard conditions and a severe climate. They are engaged in a constant battle with the natural environment to survive. This section describes the institutional characteristics of Chiloé.

Social and economic institutions in Chiloé are determined by several factors including: the geographical closeness of households (closer households work together and share the labour), access between households (the more difficult the access to a household is, the less cooperation it receives), strength of family ties (very important because relatives are a main source of support), and quantity and quality of friends (*compadrazco*) which also determines access to support and help.

- **Community institution**

In Chiloé, traditionally three public institutions generally define a community: the chapel, the cemetery, and the rural school (Agraria, 1990). During the last decade, other institutions have been incorporated, such as the community house and in some cases the first aid establishment. People may live close to, or far away from, these buildings, but their existence and the people's participation in the activities related to these institutions create a sense of belonging in the community.

- **Community leaders**

Traditional leaders of the community are the teacher and the priest. Their opinions are generally highly respected and taken into consideration in the community decision-making process. Since 1990, contact by the community with outsiders has increased with new influences coming from agricultural extension officers and rural council workers (social assistant and productive development consultant). This has generated new types of leadership for the new organisations that were created in the rural communities. The status of the community board president and the indigenous board president gained importance within the community. Normally these leaders are elected by votes at a community gathering. From their different perspectives both the community board president and the indigenous leader, called "*lonko*", have influence over the community.

Different groups based around community and productive activities have different leaders. These groups have different interests, productive motivations, and gathering reasons. However, because of the small size of the community, the local people who participate in the groups are always the same. This means that all the groups basically include the same people. Sources of conflict between the groups affect the relations between neighbours and can create long-term problems among the community.

- **Labour institutions**

The provision of labour within the communities is organised in a number of different ways, some voluntary, others with the aim of earning money. This way of organising labour creates helping networks (social protection) among the communities. Most of them are still in place on Chiloé:

Voluntary labour institutions

Voluntary community work is a common tradition among rural households in Chiloé Island. These voluntary institutions include:

- Request *(súplica)* of some working tools, for example a pair of oxen. The household that asks for the favour returns it in the form of working days equivalent to the magnitude of the request.

- Exchange of days (*días cambiados*) between households; in cases where one household needs extra labour for sowing potatoes, sheep shearing, or another productive activity, the household returns the same quantity of working days to the household which helped.

- Community work (*mingas*): Every *minga* starts with a request of an exchange of working days. The *minga* is collective work, without any payment, where several families take part in one day or more of work for the benefit of one household. Examples of mingas are: potato harvest, house construction, moving a house to another place, and forest clearing. The reward for the helping farmers is basically the food (breakfast, lunch, and a final sheep barbeque (*asado*)) prepared by the household women.

As the people who participate in *mingas* are always the same (i.e., neighbours and relatives) networks of help and support are created, and social ties and neighbourhood relations increase, adding to the security of the household (Oyarzun, 2000). This was found in the literature about Chiloé, and was also found among the case-communities. The presence or absence of these voluntary institutions is an indicator of social cohesion and maintenance of the local traditions.

Money-oriented labour institutions

Working agreements aimed at the generation of cash, food, or an increase in farm productivity also have special characteristics in this area:

- Working Team (*cuadrilla*): this is another interesting way of organising work in rural areas of Chiloé. It consists of collective work in groups of three to four people where the different activities related to the specific work are divided. Examples of work in *cuadrillas* are: gold mining, timber extraction, and opening up of new pastoral land. The benefits of the production or the selling of the products is divided in similar portions.

- Half & half deal (*medieria*): this agreement is, for example, between a household that has not enough pastures to feed their sheep and a landowner who does not have time to work his land. By using *medieria* one household can access more land and after the end of the season share with the land owners the products of this exchange; for example, the lambs.

- **Property rights**

The current small-farm situation of Chiloé originates from the pre-Spanish period where the domestic indigenous system was characterised by small pieces of land allocated to each family and the household made a living from the available natural resources on their land. In 1829, the recently formed Chilean government (1810) required that all land used by indigenous and nonindigenous people be measured and valued, giving rights over the land to all small farmers of Chiloé. The unused land was left in state ownership. The problem with this process was that only the cleared land was measured, leaving out of the household's allocation the forest that was an integral part of their livelihood system. This problem still remains as a major constraint for the rural households in Chiloé (Oyarzun, 2000).

Currently, most of the land in Chiloé is under private ownership. State owned land remains only in the coastal ranges of western Chiloé. Rural communities respect property rights of other members of the community and keep to their own land. However, a special situation occurs with state owned land. Landless rural households are able to access state owned land. They can clear the land for agriculture and after five years of occupation they are able to claim the land as their own and obtain legal rights over the land (*Bienes Nacionales*, 2004). It is a long process for the rural household, which normally needs external support and money, due to the high cost of surveying the land and the legal costs.

A process of redistribution of land has begun over the last decade. As Armesto (2001, p. 870) suggests: "the history of land tenure by indigenous people can be summarized as a gradual process of seizure of their land by the Chilean government and private investors". Large land owners are buying land from smaller farmers, to increase their area of productive land and to intensify production. On the other hand, people not from the Island are buying land for tourism and conservation purposes, generating "conservation" areas. This land for conservation reduces the availability of natural resources for the local communities. Local communities lose their sources of firewood, timber, and pastures.

Small farmers are tempted to sell their land, or part of it, and are beginning to lose their connection to farming activities. Factors influencing householders' decisions about their land include the increasing importance of the non-farm industry in Chiloé (salmon farming), the reduction of the economic importance of the rural areas and their products among the local and national markets (e.g., low prices for potatoes, sheep, and garlic), the greater comfort found in urban areas, and the migration of young people to the urban centres.

4.2.3 Vulnerability context

The case communities' vulnerability to major shocks is low. The likelihood of wars, famine, and political struggle is very low in the current context of Chiloé. The only possible future major natural shock could be an earthquake-tsunami causing damage to the provincial infrastructure.

The climate creates difficult conditions during winter: pasture growth rates and the vegetable production from gardens is low. Households prepare food supplies for the winter and in many cases save money from the selling of summer livestock for purchasing food in the winter. All households in this research agreed that during winter they face the most difficult conditions.

Water access is a key factor contributing to the vulnerability of the households. People rely on natural springs for their water supply. They transport water in buckets for use in the house, to irrigate the vegetable garden, and during summer to supply the livestock in the paddocks. However, it rains a lot in the area (see section 4.3.1 for climate data), occasionally during summer some weeks of dry weather can create a difficult situation for the households, when available water is insufficient for household demands. With the introduction of green-houses for horticultural production the water dependency has increased.

The natural disturbance regime (i.e., fire, wind, rains, drought, volcanic eruptions) is characterised by two extremes: drought or too much rain. Floods are not common as the watersheds can cope with large amounts of rain, however, persistent rain can cause a decrease in agricultural production and make work in the forests difficult. In terms of natural resources, human intervention is the major source of disturbance on Chiloé Island. Some examples are: burning, forest clearance on high slopes, cultivation on slopes, and the overexploitation of native resources (mussels, flora and fauna).

Economic trends have affected rural households. The decrease in the price of traditional products that communities sell to the national markets (potatoes, livestock, and wool) has impacted on the household income. The increased dependence on cash is also generating problems among the households and there is a major push to find nonfarm work. The economic development of Chile has created inequities among members of the community, and people with traditional livelihoods are more dependent on the wealthier members of the community for off-farm work, or are forced to look within the local industry for nonfarm work. Oyarzun (2000) in her research in the same area of study, calls this situation as an “unequal economic relation”, in which the people who have financial resources are the beneficiaries of this process.

4.2.4 Organisational Context

There are several organisations working to support local communities and their livelihood options, giving incentives to rural groups, and influencing the context in which natural resources are managed. There are six provincial organisations implementing rural development projects in the research area:

- INDAP, the agricultural extension agency, with a budget for the Chonchi area of US$ 1,238,000 (year 2003), carries out soil fertility programmes, livestock improvement, irrigation, and credit allocation;
- CONAF, the governmental corporation of forestry is mostly dedicated to forestry control duties (application of forest management schemes, illegal cut, and fire control), but has one programme promoting sustainable use of forests;
- Bosque Modelo Chiloé (BMCh) is a foundation aiming to preserve the biodiversity of Chiloé’s forest and encourages the sustainable management of native forests. It has established a fund, which communities can access for their environmental projects. It has also created an environmental education centre, and a micro-credit scheme;
- CET, an agricultural NGO that works in the conservation of native potatoes and extension of sustainable agriculture;
- The Federation of Indigenous Communities, which aims to support the rights and claims of indigenous communities;
- CONTODOS foundation, which works towards the democratisation of the information and empowerment of traditional indigenous communities;

At the local level, the Chonchi rural council is the elected local government, and is the closest organisation to the communities, acting as the connection between state policies and the local people. The council is in charge of education, health, social housing, infrastructure, urban and rural development, and has a yearly budget of approximately US$ 800,000 (year 2003).

Different roles of the organisations

In terms of natural resource management CONAF and INDAP are the main organisations promoting, supporting, and influencing small farmers. CONAF enforces legislation controlling the use of fire, the harvesting plans and the clearing of forested areas. Their aim is to avoid extensive degradation of the forests due to uncontrolled fires and unsustainable exploitative management.

Forest management schemes (*planes de manejo*) are the legal tool to be used to control the commercial exploitation of the forests. These schemes require a harvesting plan carried out by a forest engineer who calculates sustainable rates of forest utilisation. If small farmers want to have a forest management scheme, they need to have the money to pay for it and they need legal titles to the farm. This excludes some small farmers from the management scheme as it is too expensive. Additionally, not all of them have legal rights over the land, and not all small farmers plan to exploit the forest for commercial reasons to justify such an expense.

The new legislation controlling the management of the forests has changed the current local practices. Burning is no longer an option, fire permits, logging permits, and forest management schemes are necessary. However, the forestry agency has limited capacity to enforce these laws.

In many cases, small farmers are taking more care in their forest management practices. The main reason small farmers are not using fire is because the amount of forest is decreasing, and they do not want to waste useful timber or firewood in a fire. CONAF has started projects at the provincial level involving small farmers in sustainable management plans for the native forests (*El Canelo* Group). Also it has worked with other local NGOs in certification schemes for firewood, and has moved forward in a participatory approach for the management of the national park incorporating local communities in the national park management board.

On the other hand, the clearing of forests for pastures has in many cases been subsidised by INDAP, generating new pastures with introduced species of grass and increased soil fertility through application of fertilisers. Since 2003, INDAP has

ceased funding forestry clearings and has focused their resources on soil regeneration and new pastures establishment over natural pastures. INDAP plays a crucial role in credit allocation in rural areas. This subsidised government credit scheme has been much criticised because of the high indebtedness of small farmers in some areas of the country. On Chiloé it is common practice for small farmers to gain small amounts of credit annually, primarily to fund potato crop establishment, fertilisers and building and infrastructure maintenance.

Local NGOs play an important role in implementing projects which involve development areas that the government level is not able to cover. For example: BMCh is encouraging participation of communities in local initiatives, and aims to increase environmental awareness through education and environmentally friendly projects. The Federation of Indigenous Communities and CONTODOS foundation aim to assist the Huilliche indigenous communities, to re-value their traditional knowledge, and to ease the integration of both worlds - the indigenous and the modern Western culture.

At the community level, traditional organisations consist of the community board, the indigenous board, the religious group, the school's parents' group, and the sporting club. Also, depending on the type of productive activity they are involved with, small farmers organise themselves in agricultural extension groups, tourism groups, marmalade groups, handicrafts groups, horticulture groups, among others. The organisational skills of each group depend on the educational level of the members, and their level of motivation, but also on the advice and time allocated by the groups' initiators (e.g., INDAP, Council, NGOs).

External organisations can influence the adoption of conservation strategies among the communities. Data showed that, for example, fertiliser use (i.e., replacement of nutrients) is credit dependent; pasture establishment is mostly done if a subsidy is available, erosion control is carried out only if externally induced, and the management of native forests in a sustainable way is still under research in some experimental farms with the support of CONAF and German Technical Cooperation (GTZ).

As can be seen, all these organisations are implementing sector-based initiatives (e.g., agriculture, forest, and environment) in the rural areas of Chonchi. INDAP and the Chonchi Council have large budgets, are traditionally seen by local communities as paternalistic organisations (because of their aid delivery and subsidies), and in

many cases are creating community dependency through their actions. On the other hand, the local NGOs (BMCh, CET, CONTODOS) apply current development thinking and aim to empower people and create a sustainable development process. Even though this support and extension is available for the rural communities, the general diagnosis of the area, and as it will be discussed in the following chapters, is that rural communities fail to create sustainable livelihoods and preserve their natural resources for the future generations.

4.3 NATURAL RESOURCES AND RURAL LIVELIHOODS IN CHILOÉ ISLAND

This section describes the general context of the natural resource endowment of Chiloé, the main environmental concerns of the area, and concludes with an overview of the local livelihoods and their dependence on the surrounding natural resources.

4.3.1 Natural resource endowment of Chiloé Island

As described in chapter two the interactive controls of an ecosystem are: climate, soils, the major functional organisms, and the disturbance regime. The disturbance regime has been incorporated in this analysis in prior sections about the vulnerability context and in the management practices of the rural households. In this section the first three elements of the interactive controls which define an ecosystem will be described for the area of study.

- **Climate**

The climate of Chiloé can be described as a rainy-temperate-maritime climate (using Köppen Classification, cited in INE, 2003), characterised by no dry seasons, no frosts due the maritime influence, and an annual rainfall of 2,341 mm (INE, 2003). The annual average temperatures is 10.7 °C, while the average maximum temperature varies between 17.8 °C and 19.4°C and the minimum average temperature ranges between 3.2 °C and 4.7 °C (Agraria, 1990).

South-westerly winds during summer and northerly winds during winter are very strong in the occidental areas of the ranges (where Rahue - La Montaña community is located). The eastern area of the island, where Quiao community is located, is more sheltered from the high winds and precipitation.

- **Soils and geomorphology**

The western ranges of Chiloé Island are characterised by mountains that reach 900 metres' elevation. This area consists of metamorphic soils derived from marine terraces. To the east, the Island is characterised by mainly hill land that has an alluvial-glacial origin.

The soils of Chiloé Island are derived from volcanic ashes (*trumaos*), evolving in conditions of high humidity, varying from very deep to very thin soils. The organic matter is very high and reaches levels of 20 % to 35 %. Natural fertility of Chiloé's soil is low. The main limitation of these soils is their acidity, the retention of P, and the slopes that are a constant topographic feature of the Island. Considering the land use capacity of the soils in Chiloé, 65 % is class VII to VIII (forestry use), and 30 % is class IV and V (limited agricultural use) (Agraria, 1990; Venegas, 2000).

- **Forests**

The most important natural resource of Chiloé is native forest. Forests cover the coastal mountain ranges, and several areas of the hill lands of the east coast of Chiloé. The island is home to many endemic and endangered fauna species of rare or limited distribution (GEF, 1994), mainly concentrated in the western coastal mountain ranges of *Pirulil* and *Piuché*. The forests are mainly evergreen forest type (*siempre-verde*); a type of cold-rain forest composed of a mix of over 23 different tree species such as Tineo (*Weinmannia trichosperma*), Tepa (*Laurelia philipiana*), Roble de Chiloé (*Nothofagus nitida*), Mañio de hojas largas (*Podocarpus saligna*), and Luma (*Amomyrtus luma*). Smaller trees and scrub also are part of this forest type such as Canelo (*Drimys winteri*), Meli (*Amomyrtus meli*), Arrayan (*Luma apiculata*), and Quila (*Chusquea quila*). Ferns and moss also take part in this intricate natural arrangement: Pangue (*Gunnera chilensis*) and Costilla de Vaca (*Blechnum chilense*). This forest type is very dependent on the annual rainfall which varies between 2000 mm (lower areas) and 6000 mm (top of the ranges).

The southern areas of the Island contain another distinctive forest type. It is the "Cipres de las Guaitecas" (*Pilgerodendrum uvifera*), that on northern slopes is associated with "Alerce" (*Fitzroya cupressoides*). Both trees are of great value for their high quality timber and were cut in this area until depletion. Some patches of *Alerce* are preserved in the national park of Chiloé, and as a protected species it is forbidden to cut it.

In very humid areas such as rivers, lakes, and soils with bad drainage, the “Tepu” (*Tepualia stipularis*) is a very common species. The *Tepu* is important for local inhabitants because of its good quality as firewood (Agraria, 1990).

- **Native fauna**

The native fauna of Chiloé Island is composed of several species of mammals, such as those of the *Mustelidae* familiy (water cats): Nutria o Huillin (*Lutra provocax*), Chungungo (*Lutra felina*); one example of the Marsupial order: Monito del monte (*Dromiciops australis gliroides*); one endemic specie of fox: Zorro Chilote (*Dusycion fulvipes*); and the smallest deer in the world, called locally Pudú (*Pudu pudu*), endangered by farmers’ dogs and the loss of their habitat. Birds are an important part of the forests and seashore areas, with more than 50 species living on the island.

- **Agriculture**

Pastures managed by small farmers are mostly natural pastures. Natural pastures include species like Siete Venas (*Plantago lanceolata*), pasto del chancho (*Hypochoeris radicata*), Vinagrillo (*Rumex acetosella*), Chepica (*Agrostis tenuis*), Pasto Miel (*Holcus lanatus*), and Alfalfa Chilota (*Lotus uliginosus*) (Agraria, 1990). Exotic pasture establishment and use of fertiliser are expensive and rare practices for small farmers. Pastures are used mainly for sheep and beef production, with some dairy production in the centre-north of the island.

Potato is the main staple food of rural communities, and the annual harvest is a key factor in their food security. Potatoes are endemic to Chiloé with almost 1000 varieties recorded at the arrival of the Spanish colonisers. Today as a way to differentiate them from the commercial potato crop, they are called “native potatoes”. Native Potatoes were a traditional crop on the Island, but were lost during the last 200 years. Since the late 1980s, CET is reintroducing the native potatoes among the local communities and creating a genetic storage of over 200 varieties of Chiloé’s *solanum tuberosum*.

Food production for household consumption is part of the local livelihood strategy, and includes potatoes crops, the traditional vegetable garden (e.g., peas, garlic, and cabbage) and the green-house products (e.g., tomatoes, lettuces, and cucumber); and minor livestock: poultry and pigs.

Chiloé is regarded as an ideal place to establish organic agriculture programmes, due to the low use of pesticides and chemical fertilisers by the rural farming

communities. However, as national markets become closer through improved accessibility, and new agricultural technology is introduced, a shift away from traditional low input agriculture to an agriculture that is slowly increasing the use of pesticides and fertilisers is taking place. Small farmers and extension agents aim to increase productivity, introduce new products, and encourage cooperation between farmers.

- **Marine resources**

The east coast of Chiloé faces the calm waters of the inner sea that lies between the main Island and the continent. Several fiords allow a rich availability of species. A significant part of local inhabitants' diets is dependent on marine resources. They obtain from the sea abalone, seaweed and different type of shellfish (*erizo*, *almeja*, *chorito*) and fish (salmon and *robalo*). This area of the island has seen the establishment of a salmon and mussel industry in the last two decades.

The west coast of Chiloé is rough and open to the Pacific Ocean. In this area the marine resources are gathered from the shore because the seas are too difficult and risky to be sailed by small boats. The main products of this area are sea weed, abalone, shell fish, and fish (*corvina* and *robalo*) all of them caught from the beach or the nearby rocks.

Aquaculture has grown on the island, as a result of the privileged conditions of the waters of Chiloé (i.e., temperature and cleanness). Salmon and Trout are now part of the natural environment as millions of young fish have been released accidentally to the sea, lakes and streams. Local communities have incorporated these two introduced species into their diet.

4.3.2 Main environmental concerns for Chiloé Island

Several key informants recognised that native forests are the most endangered resource on Chiloé Island. This is illustrated by the decrease in the quantity and quality of the forests (availability of timber), the decrease of the forested area (shift of the forested border to the ranges), the difficulties of management of the *Siempre Verde* forest type which leads to unsustainable management, the lack of research about the native forests and the low availability of forestry extension agents. In addition, firewood is problematic (main source of household energy in the Island), including the fact that there is very little control over the cutting of firewood, the

burning of wet logs (i.e., energy inefficiency), low insulation of the houses (i.e., loss of heat), and the low quality and efficiency of traditional fireplaces.

As a consequence of the management practices and the land use options adopted by rural communities, forests have been greatly reduced and fragmented[2] over the past 50 years (Armesto, 2001). Native forests are converted to pastoral land in low productivity areas, a process which is followed by erosion and a further decline in productivity.

A study carried out by Echeverria (2004) on Chiloé Island, using GIS technology illustrates how in 25 years the native forests have been decreasing in the northern areas of the Island. As Figure 4.2 illustrates, native forest cover varied from 52 % in 1976, to 45 % in 1985, and reduced to 40 % in 1999. Scrubland, as a type of degraded forest, has maintained its presence in the area, while agricultural land is becoming the main land use. Agricultural land increased from 9 % in 1976 to 26 % of the total area in 1999.

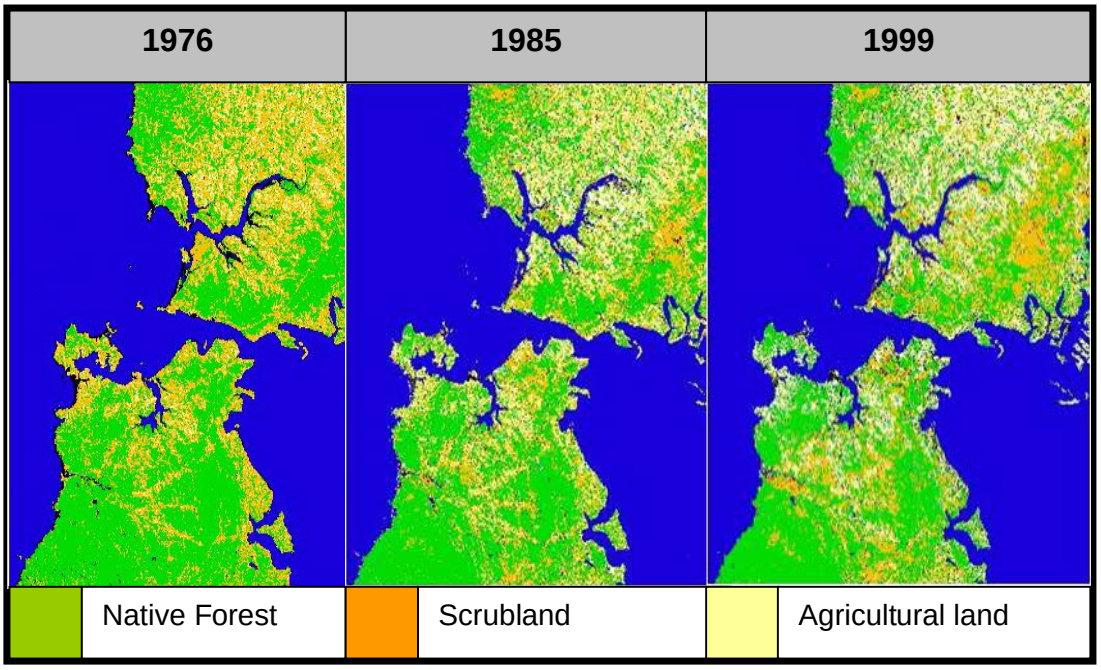

FIGURE 4.2. Land cover change in Chiloé island

(Source: Echeverria, 2004)

[2] Fragmentation of forests refers to the loss of continuity of the forested land, which reduces the resilience and sustainability of the resource: from a homogenous area, change towards a heterogeneous area.

The study results of Echeverria (2004) reflect a widespread situation in Chiloé Island and support the findings and comments of key informants and rural households in the area of study. The fragmentation of the forests has negative impacts in terms of the isolation of the ecosystems, reduced forested cover, and the degradation effect that the agricultural-forest transition creates.

Another study carried out further south of the area of study found similar results (Griott, 2004). Using LANDSAT satellite images, Griott found that a territory of almost 10,000 ha suffered major alterations in terms of its native forest cover. In the period 1986-1993, 592 ha were altered; while in the period 1993-2000, 745 ha were altered by human and natural causes. This created an annual alteration rate of 0.85 % of the forested surface for the period 1986-1993, and 1.07 % for the period 1993-2000.

Other environmental concerns relate to the agricultural activity, loss of native fauna, and garbage disposal such as those presented in the following list:

- erosion of farmland through cultivation on high slopes,
- lack of nutrient replacement in pastures,
- loss of native fauna and their habitats,
- difficulties for rural households in managing the increasing amounts of domestic rubbish such as: non recyclable packages, plastic bottles, and batteries,
- plastic and polystyrene contamination of lake and sea borders caused by the salmon farming industry.

These environmental issues are caused by human intervention in the area. In the Chiloé context, high-scale industrial activities are not well developed. The salmon industry is the only mayor commercial activity carried out on the island, followed by the milk industry in the northern area of the island, and one major mill in the area of Castro city. Compared to the continental area of the region, these industries are small sized enterprises.

Additionally, the high percentage of rural population and the presence of the small farm as the main productive unit of the island, mean that rural communities are the main users of natural resources. The population of Chiloé grew by 18.3% during 1992 - 2002 (INE, 2003), increasing the pressure on the native forest area and creating a need to increase agricultural inputs and efficiency.

4.3.3 Livelihoods in rural Chiloé and their relation with natural resources

Rural communities on Chiloé access a relatively rich natural endowment, where water, firewood, timber, productive soils, and natural pastures are available. Over the years, they have established a diversified livelihood strategy. Most of the land is privately owned in small parcels that include forested and pastoral areas, and are usually located near the sea. This creates a strong agriculture-forest-marine livelihood tradition among the rural communities. The livelihood of Chiloé's rural population includes forestry activities (e.g., firewood and timber), subsistence agriculture (i.e., production for own consumption), livestock production (e.g., beef and sheep), sea-food collection, fishing, gold mining, and off-farm work in the growing salmon farming industry.

The livelihood system of Chiloé rural households has its origin in the pre-Hispanic era, characterised by all the factors of production (i.e., land, labour, technology) controlled and created by the small farmer. The labour is divided between the family members aiming to ensure that the basic needs of the household are met. Traditional methods of production are such that households' productive resources are not degraded. Allocation of part of the production to social and traditional activities is also important (Oyarzun, 2000). However, during the last two decades traditional activities have been changing because of the influences brought by modernisation.

Currently, production of food for household consumption is a wide spread practice in rural households of Chiloé Island. This increases the food security of the family. Potato is the main staple food and each family will sow at least ¼ ha every year for household consumption. Pigs, poultry and the vegetable garden (e.g., garlic, onions, herbs, and other vegetables) are also part of the subsistence production of the household.

Each family needs a cash monthly income to buy some goods that they are not able to produce, such as sugar, green tea (*mate*), flour, cooking oil, butter, and candles. Depending on the access they have to land and natural resources (quality of the pastures, quality of the forests, number of livestock), and the amount of labour they can allocate to the farm, a household will be able to earn the necessary money from the farm. If not, household members are pushed to find jobs on other farms, or in nonfarm activities such as those related to the salmon industry. Migration will be normally the last chosen strategy, as it means to abandoning the farm activities.

Sources of income for the families come from the natural resources that they are entitled to use. Despite forest being the major resource available, agriculture is the key activity of the farmers on Chiloé Island. As described, part of the agricultural production is destined for household consumption, however; in many cases the surplus production is sent to the local markets. Cattle and sheep, and in some cases potatoes, are the traditional products that have well developed markets on the Island. Wool handicrafts (e.g., carpets, jackets, socks, huts, dolls) and baskets made from vegetable fibres are in many cases an extra source of income for the households.
Beef primarily and then sheep are the principal form of savings and investment for the rural household. The availability of increased numbers of livestock reduces the vulnerability of the household and creates generally a better standard of living. Cattle breeding is heavily dependent on pasture production, which has resulted in increasingly more forested land being converted to pastures.

Native forests have been a constant element in the landscape, and the basis for historical struggles for rural inhabitants as they try to open up and maintain agricultural land for pastures using traditional low input techniques. Rural inhabitants have a close traditional and cultural relationship with the surrounding forest, using the timber for houses, fences, and boat construction. Alternative uses for the forests include handicrafts and natural colouring for wool textile production. However, firewood remains as the main use of the forests.

Firewood is the main energy source for all Chiloé households. The firewood oven is the traditional place in the house where the family meets after the day of labour, where people have their food, where the family receives their friends, and where people rest and drink *mate* (a type of South American green tea). The cultural importance of firewood leads to high consumption of this energy source at the provincial level (i.e., one million cubic metres used every year), and this level of use is the most severe threat to the sustainability of the native forests (GEF, 1994).

Forests take a secondary place for the rural households in terms of cash income generation. However, they are of great importance as a source of firewood for the family group. If a household has access to forest they are able to secure the availability of firewood for the year. This is a great contribution for the household economy as they do not need to pay for heating and cooking energy. They need only to allocate labour to the firewood collection process.

Marine resources are important for Chiloé livelihoods, as the inner sea allows the establishment of a sea shore culture. Coastal communities increase their food security collecting sea food and fish. Some of these communities adopt a sea-shore collection tradition, while others use boats and diving equipment. Mussel and salmon farming are fast growing industries that over the last decade have become the major source of off-farm income opportunities for rural households. Marine resources were traditionally openly accessed by local communities for sea-food collection, fishing, and sea-weed harvesting. However, new policies of sea-border use have given rights of use to the salmon and mussel industry, limiting access by local people. The presence in recent years of a paralysing toxin in the sea-food that the communities have traditionally collected is changing the cultural patterns of rural communities in relation to the sea resources.

Management and transformation of natural resources

As described, the main focus of small farmers is on agricultural production, because it contributes more to the households' food supplies, and livestock are an important source of security. As the main ecosystems present in the island are forests, there is a constant opening up of new pastoral land. The traditional practices adopted by rural farmers as they transform the forested areas into agricultural land are as follows: first, burning the area *(rozar*); second, with the help of a pair of oxen, they remove the roots of the trees (*deschampe*); third, they sow potatoes in this new fertile land (*siembra*); and finally, after the potato harvest they let the natural pastures grow to support sheep farming. The following year they will open up a new area of land for the annual potato sowing. The newly opened land is more fertile, and this results in better harvests. The rate of opening land for household needs varies between 0.5 ha to 1 ha per year. This includes the control of the regrowth of the forests. If the household has an already fixed area of agricultural land, the traditional rotation is: one year potatoes, four to five years pastures, and then return to potatoes in the sixth year.

Native forests are managed using exploitative "mining type" practices. Research on the sustainable use of the native forests has been done for several less complex forest types in Chile. However, the evergreen forests of Chiloé are the least known Chilean forest type in terms of productive management. Over the last century the forests have been "utilised" for firewood and the extraction of the best timber trees (*floreo*), and have not yet been "managed" in silvicultural terms (Donoso, 1996).

Relation to the natural resources

Rural households use the word “clean” (*limpio*) as referring to pastoral land and “dirty” (*sucio*) as referring to forest. This gives interesting indications about the relative usefulness of the natural resources for the communities and about the relationship that rural communities establish with their surrounding forests. Many small farmers stated that it is hard work maintaining pastures “clean” of forest. This is an indication of the high resilience of the native forests, and the natural process towards a forested environment.

Small farmers value the land without forest more than the forested land, as pastures allow the establishment of livestock and are free of the hassle and hard work of clearing the forests for agricultural production. This pattern has been changing over the last few years as people from the “continent” are buying lifestyle blocks and holiday spots. The outsiders appreciate the forests more for their aesthetic value.

Comparing the different perspectives between the indigenous people (*Huilliche*) and the small farmers (*Chilotes*) of Chiloé, Oyarzun (2000, p. 9) suggests that the *Huilliche* indigenous communities have a relationship with the natural resources characterised by “a belonging to them” rather than “a possession of them”. This suggests a clear difference from the *Chilote* communities. However, in this research the two communities do not show a very different approach in terms of the management of the natural resources. In general, both communities relate to the natural resources as the source of food, cash, savings, and survival. This suggests that the traditional indigenous perspective is probably more related to a spiritual sense of belonging to the land, rather than to a particular way of managing natural resources.

Research carried out in the area of study, show that the traditional knowledge (*Huilliche tradition*) of the native forests promotes a philosophy that respects the value of diversity and views the forests as providers of multiple resources (Armesto, 2001). On Chiloé Island 95 % of the local plants have known uses for the *Huilliche* communities, illustrating the value placed on the native flora.

4.3.4 The typical productive unit in Chiloé Island

Figure 4.3 shows a typical case of the traditional arrangement that small farmers establish in order to manage the available natural resources and to secure their food supplies during the year. The quantity and quality of resources (land, forest,

pastures, and water) can vary between households, however all households follow this arrangement to a greater extent.

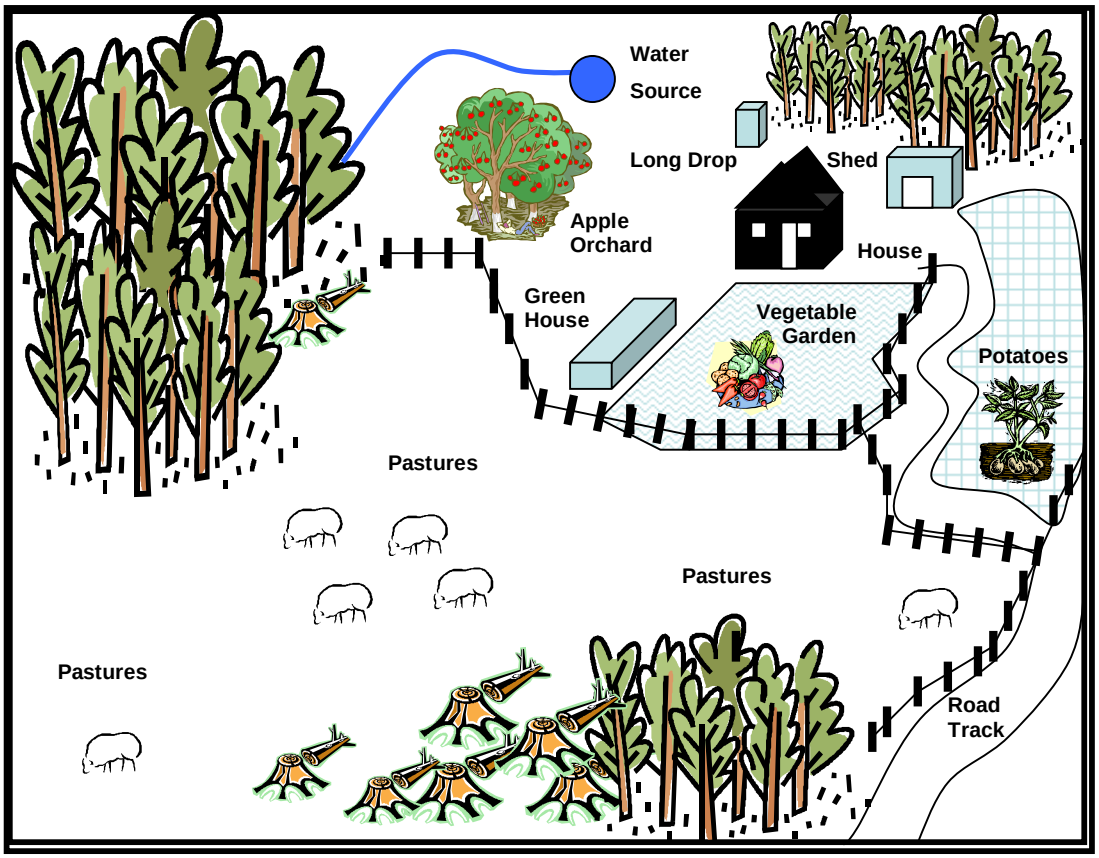

FIGURE 4.4. Resource Map of a Chiloé small farm.

Figure 4.5 shows some of the most common products produced by rural households in the rural communities of Chiloé. Photographs one and two show horticultural activity in Quiao community (lettuces and silver beet); photograph number three represents the importance of minor livestock (poultry and pigs) for the food security of the family; photograph number four shows the sheep types common in Chiloé (e.g., Suffolk, Corridale and a mixed breed called "*criolla"*) used on most of the Chiloé pastures; photographs five and six represent the products obtained from the forests: timber for construction and fences, and firewood. Picture number seven illustrates the native potatoes, which are endemic to Chiloé, and are considered a product with interesting economic potential for the households. Finally, picture eight shows the local wool handicrafts. In this case, a carpet is woven using the traditional "*telar* ".

FIGURE 4.5. Some of the products produced in the case communities.

❖ CHAPTER 5. RESULTS

This chapter presents an analytical description of the current sustainability of the local livelihoods and the natural resource use pattern of two rural communities on Chiloé Island. The first section describes the results for the first case study, the Rahue – La Montaña Community. The second section illustrates the main findings for the Quiao Community and the third section compares the results of both communities in a cross-case analysis. This chapter finishes with an assessment of the sustainability of rural livelihoods and natural resources based on the data collected in this research and indicators suggested by the literature.

5.1 RAHUE - LA MONTAÑA COMMUNITY

5.1.1 General data about Rahue - La Montaña Community

- **Location, accessibility and physical infrastructure**

Rahue - La Montaña is located 45 km to the east of Chonchi City, on the west coast of Chiloé Island. The Rahue - La Montaña community is divided into two areas, the northern and better serviced by roads La Montaña sector, and the Rahue sector which lies further south and has difficult road access.

Rahue – La Montaña community traditionally has been an isolated place, carrying out subsistence agriculture and sea-gathering activities. The climate is severe, an the land faces strong south-westerly winds and the community is exposed to the rough seas of the Pacific. A road connecting the community with the nearby Cucao Village was built in 1999. This road was a great improvement in connectivity for the community, increasing the ability to connect to Cucao village and Chonchi City. However, 62 % of the households still do not have vehicular access to their farms. Electricity is supplied to the houses through individual and collective windmills. There are no sanitation services, and water is mostly carried in buckets to the houses and outside toilets. The community comprises 18 households which have influence over an area of 1200 ha.

Figure 5.1 shows views of the landscape, the isolated condition, and the families of the Rahue - La Montaña community. The landscape is characterised by the combination of forested areas and pastures, hills, and proximity to the sea. The families live in wooden houses with corrugated iron or *alerce* shingles. This

community is located in a mainly forested area. Small farmers clear new pastoral land using low technology tools and, in some cases, fire.

La Montaña sector

Native forests clearings for pasture development

Local family

Rahue sector

FIGURE 5.1. Photographs of Rahue-La Montaña Community

- **Organisational Context**

Local organisations include the community board, the indigenous board, the "Local Development programme" (PRODESAL) agricultural group, and the sports (soccer) club. The community board has been for a long time the most important local organisation in which nearly all the community members take part (only one household does not participate). It is a legally established organisation which decides the development priorities of the community and represents the community in the council and provincial government.

External organisations influence the community through projects and aid delivery. The Chonchi council, through its productive development office, is the external organisation that has the closest relationship with the community. Through the council, different infrastructure projects, such as roads, bridges, and wind energy have been put in place. This has been done with funds from the local council, the regional government, and the Japanese embassy in Chile.

Agricultural extension is delivered through a joint venture between INDAP and the Chonchi Council. This programme is called PRODESAL and works with the community in a productive area of the community's choice. In this case, Rahue community has chosen to work on sheep production and horticulture.
In terms of credit access, 75% of the households are clients of INDAP. This governmental agency is also the source of subsidies and other benefits that rural households are able to obtain (i.e., irrigation, livestock development, and degraded soil recovery).

A new indigenous community board was created during 2001, thanks to the intervention of the Federation of Indigenous Communities and CONADI. One of the principal tasks of the board has been to try to allocate state owned land to the community. This action generated a revival of the indigenous feeling of the Rahue - La Montaña people, in part due to their indigenous family background, but also because of the possible benefits to be achieved.

5.1.2 Rahue- La Montaña community's natural resources

- **Dependency on natural resources**

The territory is covered by extensive areas of forest, in which people have cleared land for agriculture since the 1940s. In 1944, an extensive fire affected all the forested area of the southwest coast of Chiloé. During the 1960s and 1970s, a

logging company cut vast amounts of *Cipres de las Guaitecas* and sold the timber to the national markets. At the same time a large beef production station was operating in the area, which was abandoned after the exhaustion of the "*Cipres*" supply and the decline of the livestock market price. After that period of prosperity, local people remained in the place. They started subsistence agriculture activities, with no capital to continue logging the other valuable species of the forests (*Nothofagus sp* and *Podocarpus sp*).

Currently, native forests are used only for the collection of firewood for household consumption. Timber (better quality forest) is available for 56 % of the households. However, they are not able to access it due to the lack of roads, and the land tenure irregularities that prevent them from obtaining legal permission to cut the resource.

In terms of agriculture, sheep and cattle are the traditional sources of income and saving for the Rahue-La Montaña community. New agricultural land is opened up every year, mainly for livestock production. All the households of the community practise some level of livestock farming. Sheep are common to all (average size of the herd, 18), but only the better-off households have cattle. The average size of a cattle herd is 4, with 38 % of the households having no cattle. Only three households sell between eight and ten calves each year, and this activity is their main income source.

Marine resources are important for this community, which accesses a rich endowment of sea weed, fish, and mussels. During the 1970s, after a period of high mussel extraction (200-300 kg per day per collector) and the probable presence of the brown-algae disease (*marea café*), mussel populations were nearly eliminated. However, during the last 5 years they have made a slow recovery. The current rate of extraction ranges from 15 to 50 kg per day per collector, with no more than eight working days a month due to the tidal variations. This gives 25 % of the Rahue households the chance to generate monthly income principally from this resource. Fishing is not important as an income generating activity, but it contributes to the household food security during summer. Seaweed collection is a future alternative, when new roads make the beaches more accessible.

The area has a long history of gold production. Since the 1940s, many people have come in a gold-rush to the area, with almost 1000 people dedicated fulltime to the activity. The earthquake of 1960 and the exhaustion of the resource finally brought an end to this period. Currently, in one month, people are able to collect at the most,

10 gr. of gold. Only three households integrate gold mining as a main source of income, and one household acts as a seller of the gold in the local markets.

- **Availability of natural resources for the community**

Community views about the current and future state of natural resources differ from those that of key informants and other sources of data. Key informants and governmental studies give a pessimistic view of the future sustainability of natural resources if the current trends continue over the next decades. However, the local community has a positive view of their natural resource endowment even though they agree that the quantity and quality of the resources has decreased over recent decades.

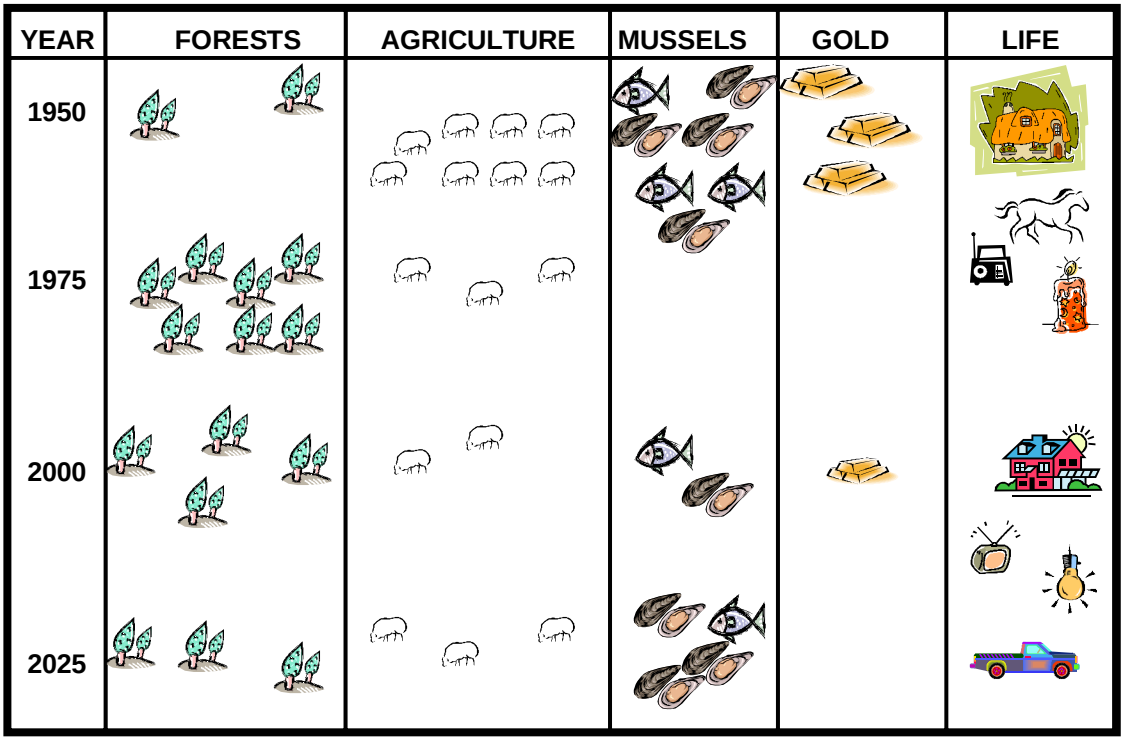

FIGURE 5.2. Historical Matrix showing trends in the availability of natural resources and evolution of the quality of life as identified by the Rahue-La Montaña community.

Figure 5.2 illustrates, using a historical matrix, the perceptions of the community about the historical availability of natural resources. Agriculture was the principal resource for the communities during the 1950s, and extensive forests were cleared for the valuable *Cipres* timber and for livestock production. In the Rahue sector of the community during the 1970s and 1980s agriculture reduced in size through the abandonment of the *Quilan* station (located south of Rahue) and the emigration of some inhabitants of the Rahue sector to the nearby village of Cucao or Chonchi City.

This allowed the forests to re-grow in neglected pastoral land. On the other hand, during the late 1970s and 1980s La Montaña sector saw the arrival of new immigrants and relatives of the first settlers to the area. This increased pressure on the forests and new areas of pastoral land were cleared. In general, the community's future prospects of the forestry-agricultural sector are positive, with expectations of being able to manage and utilise the forest (i.e., Timber extraction and firewood) and maintenance of livestock production at the current rates.

Marine resources have drastically reduced as also has the availability of these resources for the community. However, several households agree that populations are recovering in part for natural reasons and due to regulations on the size of sea food harvested.

Gold resources are in general decreasing as part of the livelihoods, as each day it is more difficult to find gold in the beaches. The future perspectives are negative, with almost no participation in this activity for local livelihoods envisaged for the future.

It is interesting to see that in general natural resources have been decreasing for the community; however, the quality of life of the community has increased. In the words of an older community member: "*I wore my first pair of shoes when I was 14; my son was born with twelve pairs of shoes. Now people have more access to services and goods."* People access electricity through windmills, have better houses, and some of them have TVs. Some of the households expect to have a car in the future, avoiding long horse rides to the village of Cucao. Only one household in Rahue-La Montaña has a car.

5.1.3 Livelihoods in Rahue - La Montaña

- **Livelihood strategies**

It can be generalised for this community that diversification is the main strategy adopted by the households. Rural households have diversified into several productive activities; however the productivity of the activities is not high. This low general productivity (characterised by a subsistence level of production) can be explained by the difficult access that households have to forests (no roads), their isolation from the main markets (unable to sell agricultural products), and the low level of access of the households to financial capital (that could allow them to increase technology levels).

The reasons to diversify to several subsistence activities are: first, to increase food security; second, to maximise the use of the available natural resources on their farms (forests and pastures) using very low technological levels; and third, the need for a cash income.

Because of the isolated context in which households live, four households have moved to the nearby village of Cucao searching for more comfort and better infrastructure. However, they still work every day on their farms and need to walk or ride the two hours that separate the village from the Rahue-La Montaña community.

Within the diversified livelihood strategy several productive activities can be recognised. Production for household consumption is an integral part of each household. Only surplus production is sold to the local markets. The different productive activities identified in Rahue - La Montaña are: Horticulture (potatoes, garlic, basic vegetable garden or green-house), Livestock (sheep, cattle and pasture management), Forestry (firewood production, timber, fences, clearing for pastures). Off-farm activities that are natural resource dependent are: mussel collection, fishing, work on other farms and gold production. Non-farm activities (e.g., work in the salmon industry) for the households of Rahue are not so common due to the isolation of the community in relation to the main salmon industry centres.

- **Main sources of cash income**

Figure 5.3 illustrates the main sources of cash income for the community. Fifty percent (50 %) of the households have to undertake off-farm[1] activities (including gold and mussels), highlighting the difficulty householders have in getting adequate income from on-farm[2] agricultural production. Five households rely on mussels and gold production for their income, and three on non-farm[3] wages outside the community. Twenty-five percent (25 %) of the households rely on social subsidies[4] (disability or pensions) as the main source of income. Only 19 % of the households are dedicated to on-farm activities. The primarily activity for them is to sell livestock. Normally they have greater land areas and more working capital, enabling them to live exclusively from their farm activities.

[1] **Off-farm activities**: work or labour carried out outside the available land of the household. It includes natural resource dependent activities and nonfarm activities.
[2] **On-Farm activities**: all the productive and subsistence activities carried out in the land available for the household.
[3] **Nonfarm activities**: reflects the activities not related to natural resources and carried out in the local industry or in the urban areas.
[4] **Social subsidies** refers to households that rely as main income in governmental social benefits.

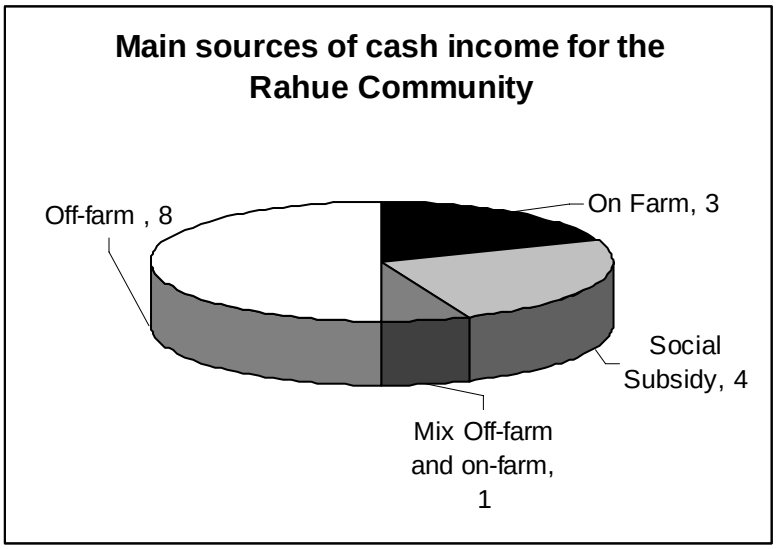

FIGURE 5.3. Main sources of income in Rahue - La Montaña Community

TABLE 5.1. Seasonal activity calendar for Rahue - La Montaña Community

	AUTUMN	WINTER	SPRING	SUMMER
HORTI-CULTURE **- Garlic** **- Potatoes** **- GreenHouse**	Sow---------- --------	- - - - - - - - - - - Preparing ----------	---------- Sow---------- ----------	---------Harvest ---------Harvest ----------
LIVESTOCK **- Sheep** **- Cattle** **- Pasture**	----- - - - - - - - - - - - - - - - - - - -	- ----------	- - - - - - - - - - - - - - - - - - ------ ----------	Lambs---------- ----------
FORESTRY **- Firewood** **-Timber** **- Clearings**	- - - - - - - - - - - --------	- - - - - - - ----------	---------- ----------	---------- ---------- ----------
MUSSEL	- - - - - - - - -	- - - - - - - - - - -	- - - - - - ----------	----------
FISHING **- *Robalo*** **- *Corvina***	---------- - - - 	- - - - - - - - - - - 	- - - - - ---------- ----------	---------- -------
GOLD	- - - - - - - - - -	- - - - - - - - - -	- - - - - - - - - -	----------
OFF-FARM WORK	----------	----------	- - - -	
GENERAL FARM WORK LOAD				
Legend	- - - Low Activity - - - - Medium Activity --------- High Activity			

- **Household activities through the year**

For the households of Rahue - La Montaña Community, Table 5.1 shows the variation and diversity of livelihood activities through the year. In summer there is a concentration of farm activities and households must allocate time to most of them. On the other hand, winter represents the hardest time of the year for the local households. During winter agricultural production is almost nonexistent, the rough sea makes it impossible to collect mussels and fish, and there are bad conditions for gold production on the beaches. Several households send young members to try to find temporary work on other farms or in the salmon industry during winter, while the others just survive with the surplus from the summer production.

5.1.4 Factors influencing sustainability of Rahue- La Montaña

- **Economic Factors**

Poverty

Poverty affects 50 % of the households, which means that half of the households of Rahue – La Montaña live on less than US$ 49 per capita a month. Half of these poor families live under the extreme poverty line (US$ 29 per capita per month) (poverty line used in MIDEPLAN, 2002). Seven of the eight households that are considered not poor still have per capita incomes lower that the Chilean minimum wage (US$ 185 per month). For Rahue-La Montaña, the economic productivity of the livelihood strategies is clearly not fulfilling households' expectations.

Size of the Farm [5]

Seventy-five percent (75 %)[6] of the interviewed households have as primary land[7], a farm smaller than 18 ha, with an average for this group of 7 ha (they range from 2 ha to 18 ha). A farm size smaller than 10 ha makes living in this area quite difficult in terms of economic productivity and viability. However, considering the secondary[8]

[5] Farm definition: whenever "farm" is mentioned in this research it reflects the sum of the three main sources of land, primary, secondary and tertiary.

[6] In this research the households were divided in two groups relative to their farm size to facilitate comparison and avoid distortion of the averages because of the high variability of the farm sizes. GROUP ONE= 75 % of the smallest land holdings; and GROUP TWO= 25 % of the largest land holdings.

[7] **Primary Land**: where the household lives and has their principal production.

[8] **Secondary Land**: a second farm or piece of land where the households access extra forest or pastures.

and tertiary[9] sources of land the average land size increases to 41 ha (they range from 12 to 78 ha).

The group of large land owners (25 % of the households) have an average primary land size of 41 ha (range from 18 to 80 ha). Considering other sources of land, they increase their available area to 70 ha on average (range from 60 to 97 ha).

Small farms need to increase output per ha to survive, but opening up land from forestry for livestock (thus affecting the forest resource without proper management) and increasing the stocking rate, leads to erosion due to cultivation on the slopes. Considering the local conditions (low fertility soils, low productivity of pastures, slopes, and climate), a landholding that is smaller than 10 ha presents major difficulties for the creation of a sustainable livelihood.

Generation of Opportunities

Market opportunities for traditional agricultural products do not benefit the Rahue - La Montaña community, as the low prices paid for potatoes and sheep, plus the high transport costs impede their sale to the nearby Chonchi City. This situation affects the current economic productivity of the households, reducing their long-term viability.

Forestry has still plenty of opportunities to be developed as a livelihood alternative. Timber remains available for future management, but households are aware that it is essential to conserve firewood reserves. As each household accesses small areas of forest; implementing a forest management scheme would be difficult and expensive. If the community could get together, native forests could be managed as one unit, which may help to ensure the sustainability of the forest rotation.

Tourism is a major opportunity for the area, because of its closeness to the Chiloé National Park. Some of the attractions of the area include: fossil stones, an indigenous cemetery, a sea lion colony, coastal scenery, Rahue river, and the southern beaches of *Quilan*, *Checo* and *Catiao*. Tourism gives added value to traditional practices and the scenic value of the forests, creating a greater environmental awareness among local people.

[9] **Tertiary Land**: a third source of land where the household access extra resources, generally through family arrangements.

Credit

Credit is available at subsidised rates for all households of the community through INDAP. More than 60 % of the households access INDAP Credit. BMCh has established a microcredit scheme (*Fondo Esperanza*). This programme is in its starting phase and it is used only by one household. Informal sources of credit are not very common among the interviewed households (only 12.5 % of the households are using informal sources of credit); and three households do not use credit (19 %).
The use of credit has a beneficial impact on the replacement of nutrients in the soil, as 75% of the households use credit to pay for the fertilisers for growing potatoes. The other common use for the credit is infrastructure maintenance (i.e., fences, shed, house).

Credit in this community has a positive impact on the households and is a productive tool that allows the small farmers to increase their financial capital during the year. The repayment rate for the INDAP Chonchi Area is one of the highest in the country, which indicates that farmers are able to cope with the cost of the credit. However, key informants suggest that credit should be allocated for use only in productive activities. On the other hand, small farmers generally utilise part of the credit for general household expenses such as food, school fees, and social commitments. This is an example of the different perspectives between the beneficiaries of a project and the development organisations.

Subsidies

Social Subsidies are an important source of income for 25 % of the households, enabling households to decrease their productive activities on the farm. This kind of subsidy benefits households with older or disabled people, allowing them to stay on the farm.
Productive subsidies are allocated by INDAP and the Chonchi Council and are a key factor in the viability of new businesses or microenterprises. These subsidies help a group of small farmers to establish basic infrastructure or buy machinery. In the Rahue - La Montaña case, subsidies have been mostly used for clearing new land for pastures and to buy machinery and tools such as oxen-ploughs, wheelbarrows, and shovels.

Location and Accessibility of the resources

Location is a factor that affects this community in terms of isolation and high transport costs to the local markets. It defines most of the other factors influencing sustainability (i.e., poverty, opportunities, community cohesion, access to health and

education, technology level, and the use of conservation strategies). It is the source of constraints (agricultural marketing opportunities), however, it is also the source of opportunities (tourism).

Lack of access to the natural resources, both physical (which is related to road access), and legal (which is related to property rights) prevents small farmers from utilising their resources commercially. However, this situation is currently protecting the resource, and creates an opportunity to start a sustainable development process in the community.

- **Social Factors**

Property Rights

Considering the primary land, only 58 % (i.e., seven households) of the smaller land owners[10] have legal titles which secure property rights to the land. The remaining 42 % of these small landowners have family rights to the land. If secondary and tertiary land is considered for this group, the ownership is mostly family (66 %) or state owned (25 %). All the major land owners have legal property rights over their land.

Legal rights over land are a key factor, as having these rights enables people to access forest management schemes, subsidies, and credit through INDAP and CONAF. The lack of titles over the land excludes people from these benefits and increases the vulnerability context of the household.

Distribution of the Resources among the community

The distribution of land and resources among the community members has social equitability implications. Small farmers are currently concerned about the concentration of wealth and governmental benefits held by some of the bigger land owners. This creates divisions among the community and could produce future sources of conflict.

Community cohesion

Community cohesion is a key element in this isolated community. Because of the climatic and geographical difficulties people rely more on their neighbours. As described in section 4.2.2, in Chiloé several traditional social institutions are in place,

[10] In this research households were divided into two groups relative to their farm size to facilitate comparison and avoid distortion of the averages because of the high variability of the farm sizes. GROUP ONE= 75% of the smallest land holdings; and GROUP TWO= 25% of the largest land holdings.

which encourage community work and the creation of safety nets among the community.

In Rahue-La Montaña 75 % of the households agree that in the community there is high cohesion. This is measured in terms of the practice of *mingas* for the potato sowing and harvest, clearing of forests, and other farm work. Sources of conflict are growing in the area, as the indigenous community board of Rahue - La Montaña, supported by the Federation of Indigenous Communities, is claiming 400 ha of state land to be distributed among the community in the future. This new land opportunity is creating major conflict between indigenous and nonindigenous people within the community, as this represents a major opportunity for the Rahue community to access quality forests (timber) and secure property rights over the land.

Participation in groups

Most of the households (81 %) participate in all the community groups. Reasons for this include their isolation and the need to learn about new opportunities and be up-to-date with new information and incoming benefits. For the household members it is important to have firsthand news and not to lose any possible benefit that comes from the external organisations. Participation in the community groups is important as a source of social viability in terms of the empowerment and participation possibilities in the decision-making process of the community.

Women within the community take a secondary role in terms of participation, and they carry out diverse farm and household activities. Normally it is the men who participate in the community groups.

Access to Education and Health

Rahue-La Montaña households, because of their isolation, need to send their children to the boarding school in the nearby village of Cucao. The village is a two to three hours walk / horse ride from the community. This isolated context and the priorities towards farm work mean that people leave school early. Most of the small farmers of the community have incomplete basic education, which allows them to read and write in a basic way, but not to comprehend thoroughly more complex ideas or readings. Health services are available in Cucao Village, and the closest hospital is in Castro City.

People in the community agree that it is really difficult to live far away from these basic services. The need for more comfort and infrastructure has seen some households move to Cucao in recent years (25 % of the households). However, they still go to their farms every day, or go to the mussel collection activities.

Culture and tradition

All the households of the community agree that their culture has changed over the decades. Children are more educated, have access to more material well-being, and probably will abandon the farm. The young people are losing the agricultural traditions and are more used to the urban life.

People are motivated now by money. They need to migrate temporarily to find new mussel spots or to find work in nonfarm jobs. Institutions like the *minga,* and the *cuadrilla* are beginning to lose their importance.

Environmental concerns are now part of the local conversation and people are aware of the concepts related to degradation, management of forests, and minimum capture sizes for mussels. Tourism is also an external influence which brings new ways of behaviour, fashion, and contact with new cultural elements for the community.

- **Environmental Factors**

Pressure on the natural resources due to land access constraints

This factor is closely related to the farm size. The amount of land (i.e., farm size) that each household is accessing at present defines their financial viability and stability, and their ability to maintain the ecological integrity of the resources. The quality and quantity of the resources define the pressure on the resources to reach a certain level of well-being (e.g., livelihood outcomes), and depend on the management practices that households apply over their available resources.

Land access is a very relevant topic for the community, because of the current small farm size that some household have, the unresolved property rights issues of other households, and the future indigenous land access possibility.

Total land access in this community is relatively acceptable with only three households having not enough land from which to subsist. They need to look for income from other sources such as mussel or gold production.

Conservation strategies

Conservation strategies adopted by the community members are few. Replacement of nutrients through the use of fertilisers on the potato crop would be the most important one. Rotation from potato to pasture, returning to potatoes approximately five or six years later allows a recycling of fertility around the farm. However, the cultivation on high slopes, the levels of production (e.g., high stocking rate relative to the low productivity of the natural pastures, clearings to establish the annual potato crop), and other current practices are degrading farm resources.

Forests are not managed in silvicultural terms, and only the best trees are cut (*floreo*) for timber. Firewood is obtained from the farm without any management strategy. Only two households have forest management schemes (enforced by CONAF) and participate in the provincial *Canelo* group whose aim is the sustainable management of native forest.

Mussel extraction is mostly managed as an open access resource. Restriction is established only regarding the size of the animal, but not in terms of quantity of mussels collected from the beaches. Community outsiders access the beaches and compete with the local community for the resources, resulting in an unsustainable rate of extraction.

In terms of management of the residues and household garbage, the interviewed households show high levels of recycling of organic material (as food for pigs and poultry), paper and cardboard (for the fireplace), and plastic containers and bags are normally reused. The difficulties of transporting large amounts of external inputs (agricultural products) and the tradition of buying in bulk shops reduces the number of envelopes and plastic bags among the community. However, there is an increasing concern about the accumulation of plastic, batteries, and bottles on the farms, without having options to dispose of this material properly.

As is clear from the analysis, the adoption of conservation strategies is almost nonexistent, which means that current management practices are not sustainable. Ecological integrity and stability are affected by the lack of sustainable natural resource management techniques. The only factor that protects and preserves the current natural resource endowment is the low access to financial capital which defines the low technology levels of the households.

Technological level

The level of technology used by the community is low, which means that the rate of their impact on the natural resources, especially the native forest, is slower than in other communities of the Island.

Traditionally rural households use axes and chain-saws to clear forests. Oxen are important while removing roots from the soil. Machinery is nonexistent, and oxen or horses are used when ploughing is necessary for the annual potato planting. Human labour remains as the most important resource and most of the productive development depends on manpower and team work. The low level of technology and the management practices of local households do not sustain improvements in the long term, as they do in communities with higher levels of technology. Households need to work constantly to maintain their agricultural area free of scrub. If pastures are left unmanaged for some years, native forests are able to re-grow to adult size in a period of 15 to 20 years, illustrating the high resilience of the forests in Chiloé Island.

Natural resource management knowledge

Local inhabitants know "*el monte*" (the ranges) and their forest very well. The close relationship with - and dependence on - natural resources has created a strong management tradition among the small farmers which is transmitted from generation to generation. There is traditional knowledge about medicinal uses for the plants, they know each tree of their farm, and they have several nontimber uses for the forests (e.g., wool dye, basket making, rope making, fences, etc.). However, there are other natural resource management practices that have been degrading the resources (e.g.: cultivation in favour of the slope; *"floreo"* of the best timber). These practices that have deep roots in the local knowledge could be changed with education and more information.

Household members are open to learning and adopting new information and knowledge. They recognise the need for information aiming to create new opportunities for them and ensure a sustainable relationship with the natural resources. Key informants suggest that the strong traditional knowledge of rural communities is very difficult to change and that it is a time-consuming process to incorporate new practices among the local communities.

Community views on sustainability

As described earlier Rahue - La Montaña households have a generally positive view of their future resource availability. Several households express awareness about the need to increase sustainable practices in the area. As one woman of La Montaña states: "*You cannot destroy and deplete the forests, because after you, your grandchildren will come*."

However, other households recognise that economic pressure requires them to cut the forests for more pastoral land or to sell timber. As one household head said: "*Ecology is not a priority, if I could, I would decimate all the forests*".

5.2 QUIAO COMMUNITY

5.2.1 General facts about Quiao Community

- **Location, accessibility and physical infrastructure**

Quiao community is 15 km west of Chonchi City. It is situated on the east side of the coastal range. This location provides Quiao with a benign climate (i.e., less rain, more protection from westerly winds), connection to the local markets, and good infrastructure - such as a rural school, chapel, health station, and cemetery. Public transport connects the community three times a week with Chonchi City. All the households have access to the road network and 50% of them are connected to the electricity supply. Sanitation services are not available; however 77 % of the households have access to water inside the houses. Toilets are still outside the houses. The community is formed by 17 households which have influence over an approximate area of 2200 ha.

Figure 5.4 illustrates the general geographical and landscape context of Quiao Community. One of the houses of the families that were interviewed is shown along with two women who are using a traditional technique to manufacture a carpet. Households in Quiao have good pastures due to fertiliser use and the introduction of improved pasture seeds which allows them to conserve summer pasture in the form of hay for the winter.

- **Organisational Context**

Quiao has a long tradition of local organisations. The main reason for this organisational development is the historical connection of the community with development organisations, both governmental and NGOs.

Local organisations include the community board, the sports club, the Catholic religious group, and the productive groups that work in connection with development agencies. There is no indigenous group in the area, as the local people do not feel a connection to indigenous values.

The external organisations influencing the community are several. The Chonchi council works on infrastructure development (roads, electricity, and water projects), is in charge of the local school, and has generated an agricultural productive group through the PRODESAL programme and the council office of productive development. PRODESAL is focused on horticultural development and livestock improvement.

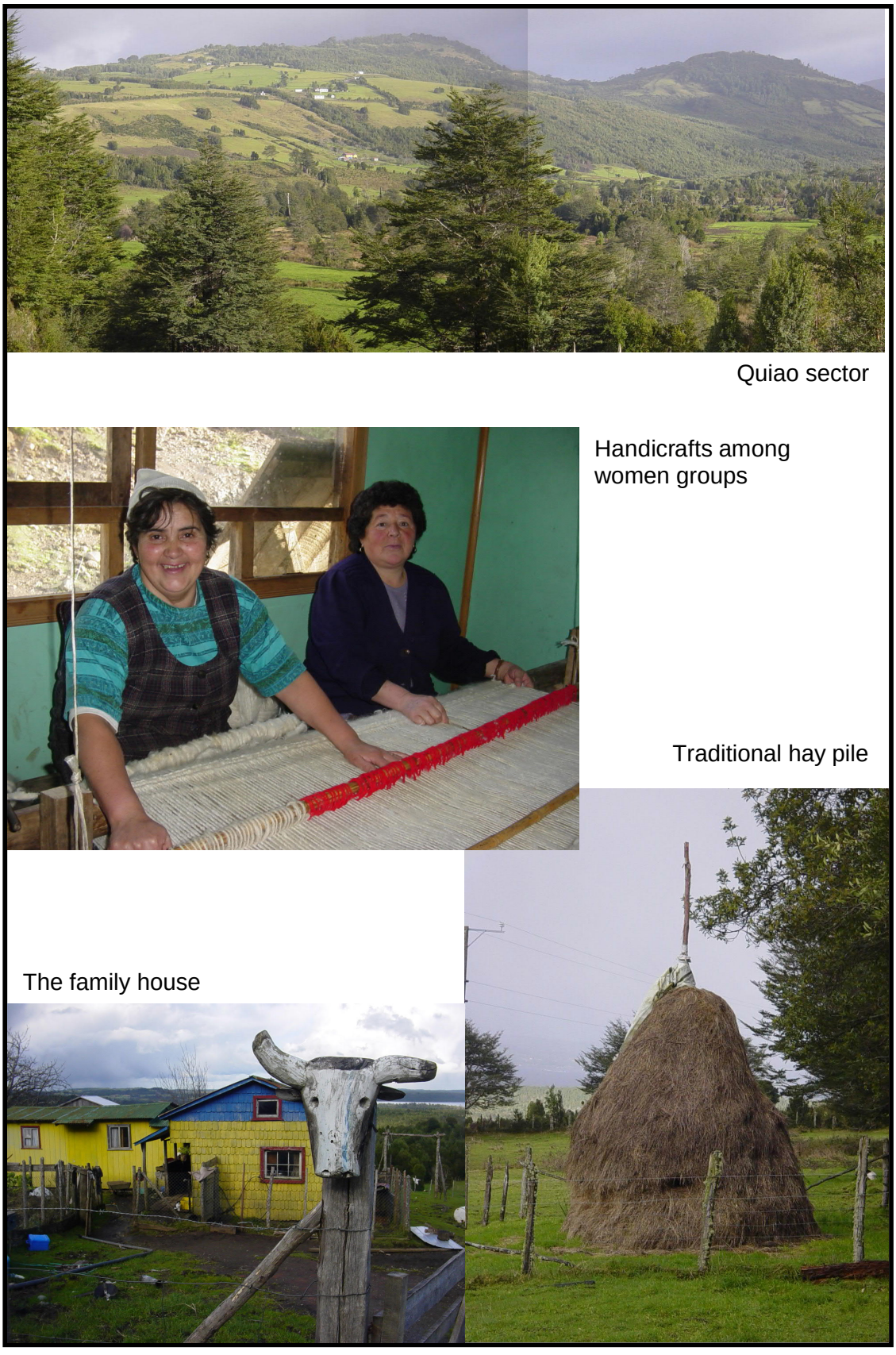

FIGURE 5.4. Photographs of Quiao Community

The handicrafts group of the community was in the beginning supported by BMCh foundation, in a second stage by PRODEMU (Women's development programme), and currently by the council through the productive fund.

The marmalade group was created by CET, and continues with the support of the council and BMCh. This group has taken part in several provincial markets and sells a portion of its production in the national market.

The re-introduction and re-valuing of native potatoes among the community is the work of CET. Native potatoes are a very valuable product and have good markets in the gourmet restaurants on the continent. The price of one kg of native potatoes can be ten times higher than that of the normal potatoes.

The tourism group was created by BMCh and now works independently, carrying out horse rides, trekking, camping, and selling traditional food for the tourists who come from Castro City.

5.2.2 Quiao Community's natural resources

- **Dependency on the natural resources**

Quiao is not near the sea (12 km to the east). Between the 1940s and the 1980s people from Rahue, Cucao, and other west coast settlements came to Quiao by boat (through the nearby Huillinco Lake) and bartered sea-food for potatoes and wheat. Wheat was an important crop 20 years ago; however, it is currently not produced because of the reduction in fertility of the soils, the low price paid for the grain, and principally due to the ease with which flour can be bought in the city.

Currently, the production of potatoes for household consumption, and of vegetables and sheep for festivities are still key elements for each household. Three households in the community specialise in the production of native potatoes, a high valued product, which they sell to restaurants nationally. Livestock is important for the community as there are three households that specialise in livestock production. The average size of the cattle herd in Quiao is seven and the average size of a sheep herd is 18. Horticulture is winning important space as a commercial activity, while families establish green-houses and sell lettuces and silver beet in Chonchi City and to the catering enterprise that serves the rural schools.

Forests are present in the area, as the community borders the Chiloé National Park. Four households sell firewood and one sells labour to the nearby sawmill. Forest management schemes are used by those selling firewood or timber. The rest of the

households cut trees for their own firewood consumption and state that they have good firewood reserves for the future. However, the general trend identified by local farmers in this research shows that forests have been decreasing since the 1960s, with current difficulties in finding good quality timber. Fruits obtained from the native forests and local shrubs are used by a group of households (4 households) for the production of marmalade and traditional spirits. Households collect the fruit from their farms [11] in different seasons of the year. Natural dye is obtained from the forests and vegetable garden products and is used to colour the wool handicrafts.

- **Availability of natural resources for the community**

The perceptions among Quiao community's households reflect their connection to the markets and the influence of the external context (i.e., organisations, markets, and information access). As Figure 5.5 illustrates, almost all the households agree that during the 1950s the situation in terms of natural resource productivity was better than now, with more timber available, production of wheat, selling of potatoes,

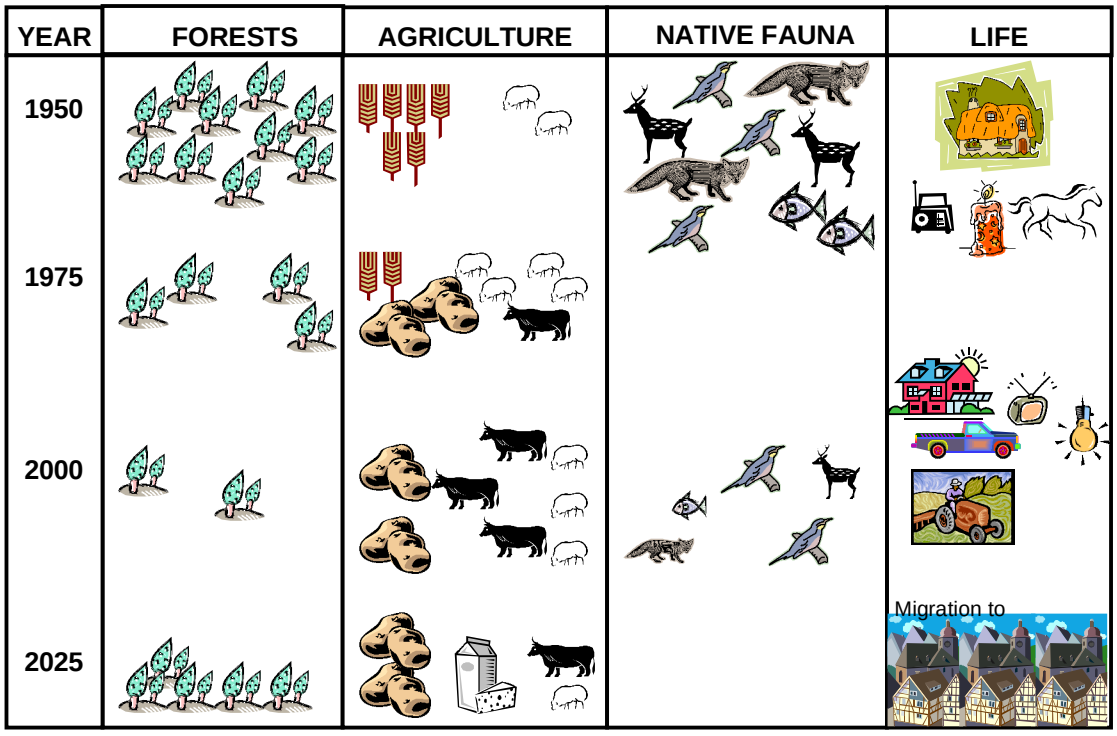

FIGURE 5.5. Historical Matrix showing trends in the availability of natural resources and evolution of the quality of life as identified by the Quiao community.

[11] Farm refers to all the available land for the household (i.e., primary, secondary and tertiary land)

acceptable production for household consumption, and lots of work was available at the farm level. During the 1970s and 1980s agricultural production declined, due to the loss of soil fertility; the forest was less accessible and timber scarce, and the need to use more fertiliser for the pastures increased the cost of production. Currently, the agricultural sector is facing difficult times; however cattle, native potatoes, and sheep allow the wealthier households to make a living from their farms.

Current trends are a decline in forest availability, and reduction of habitats for native animals. However, in contrast local households have a positive view about agricultural production and tourism. In terms of quality of life, they agree that during the last fifty years their quality of life has improved significantly. People can reach Chonchi city in 30 minutes compared to the one day of horse riding two decades ago. Houses are better built, electricity is available for some households, and there is much more external support compared to the past.

Migration to the nearby urban centres is a common response to the reduced productivity of the farms. As one of the Quiao women states: "*Agriculture and forests are losing their value, everybody will end up living in the cities, and you can see it now… no young people are living here."*

5.2.3 Livelihoods in Quiao

- **Livelihood strategies in Quiao**

Livelihood strategies in Quiao are diverse and farm oriented (84 % of the households practice agriculture and forestry), but intensification of production of higher value products such as cattle and native potatoes is ocurring. Small farmers in this area fertilise their paddocks and establish pastures with exotic species. Cattle farming specialisation is common among the better-off households. Cattle are used as an investment strategy and for selling at the local meat market. Households have diversified to other farm activities, such as wool handicrafts, marmalade production from forest fruits, horticulture, and tourism. These activities are a result of external aid programmes, and have been influenced by NGOs, such as BMCh and CET. The formation of groups to carry out these activities in the community has been externally encouraged, with the active involvement and participation of women.

- **Main sources of cash income**

Figure 5.6 illustrates how on-farm[12] activities (livestock and firewood) - which includes handicrafts, tourism and marmalade production - are the most important activities, and are carried out by 46 % of the Quiao households. The second category in importance is a mixed strategy[13] in which one household member works in off-farm activities, and the farm is still maintained as a productive unit (31 % of the households). Finally, only two households (15 %) need to leave the farm activities aside to concentrate on off-farm[14] activities such as the salmon industry (non-farm [15]activity) or selling their labour to another farm. This happens as they do not have access to enough productive land. Social subsidies[16] are the major source of income for only one household.

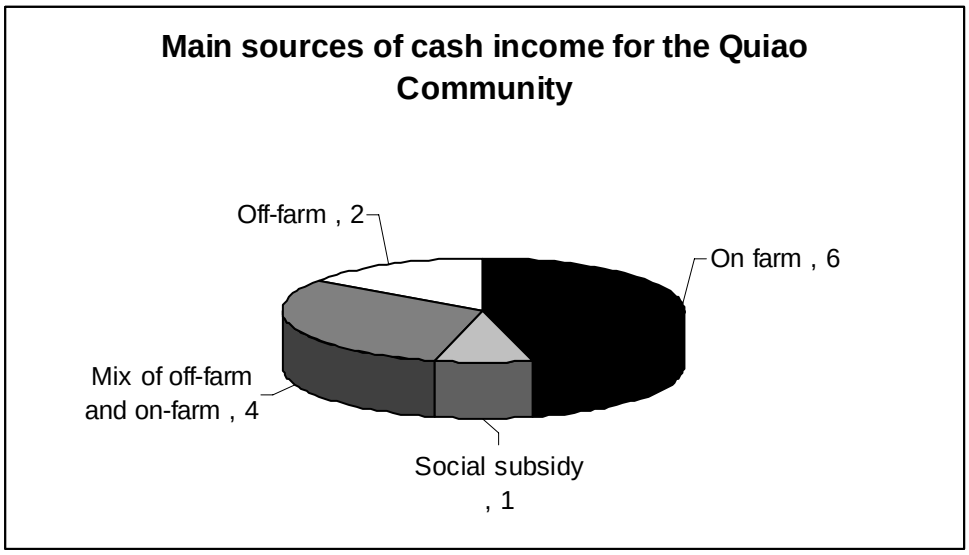

FIGURE 5.6. Main sources of income in Quiao

- **Household activities through the year**

Quiao community as described has a rich farming environment, with small farmers fertilizing their pastures, sowing oats during winter, growing cattle for the local markets, and several productive groups that generate extra income for the households (handicrafts, tourism, marmalade).

[12] **On-Farm activities**: all the productive and subsistence activities carried out on the land
[13] **Mixed Strategy**: characterised by on-farm and off-farm activities
[14] **Off-farm activities**: work or labour carried out outside the available land of the household. It includes natural resource dependent activities and nonfarm activities
[15] **Nonfarm activities**: reflects the activities not related to natural resources and carried out in the local industry or in the urban areas
[16] **Social subsidies**: refers to households that rely for their main income on governmental social benefits

Table 5.2 shows the seasonal activity calendar for the Quiao community. Tourism shows an extreme seasonability and is concentrated during summer. The marmalade and traditional fruit spirits production is spread out during spring and summer depending on the fruit availability. Handicrafts are made year round, but several households concentrate production during winter as the weather does not allow outside activities.

TABLE 5.2. Seasonal activity calendar for Quiao community.

	AUTUMN	WINTER	SPRING	SUMMER
HORTI-CULTURE **- Garlic** **- Potatoes** **- Oats** **- Greenhouse** **- Vegetables**	Sow---------- Harvest ---------- - - - - - - - - - - - -	- - - - - - - - - - - ---------- - - - - - - ---------	---------- Sow---------- ---------- - - - - ----------	---------Harvest ---------- -------- ---------- ---------- - -
LIVESTOCK **- Sheep** **- Cattle** **- Pasture**	----- - - - - - - - - - - - - - - - - -	- ----------	- - - - - - - - - - - Calves---------- ----------	Lambs---------- ----------
FORESTRY **- Firewood** **-Timber** **- Clearings**	- - - - - - - - - - - -------	- - - - - -	---------- ----------	---------- ---------- ----------
HANDI-CRAFTS	- - - ----------	----------	- - - - - - - - - -	- - - - - - - - -
TOURISM				----------
MARMALADE	- - - - - - - - - Berries		- - - - - - - - - - - Michay-Nalca	---------- Cauchao-Mora
OFF-FARM WORK NEED	- - - ----------	----------	- - - - - - - - - -	- - - -
GENERAL FARM WORK LOAD				
Legend	- - - Low Activity - - - - Medium Activity --------- High Activity			

5.2.4 Factors influencing sustainability of Quiao

- **Economic Factors**

Poverty

Field data show that poverty remains low in Quiao, with only 22 % of the households under the poverty line[17]. Households are able to generate relatively adequate

[17] Poverty line based on monthly per capita income: US$ 49 (MIDEPLAN, 2002)

monthly cash incomes as they access off-farm working opportunities; they sell valuable products, such as cattle and native potatoes, and have diversified towards handicrafts, horticulture, marmalades and tourism.

Size of the Farms

The 75 % of Quiao households[18] with the smallest land holdings have an average primary land[19] farm size of 11 ha (range from 1.48 to 18 ha). Considering the secondary[20] and tertiary[21] sources of land the average land size for this group increases to 36 ha (range from 2 to 84 ha).

The group of larger land owners (25 % of the households) have an average primary land size of 36 ha. Taking into account other sources of land, they increase the area to 84 ha on average (range from 71 to 98 ha).

As shown in the poverty levels of Quiao, the farm size and the available natural resources secure a subsistence level of agriculture (viability and productivity) and in several cases allow the intensification of some productive systems such as cattle and native potatoes.

Generation of Opportunities

Generation of opportunities in Quiao has a strong relationship with the location of the community. Quiao is closer to the markets, has received during the last 15 years development extension, and has a sheltered climate (see section 4.3). Hard working households are able to generate a productive, viable and socially acceptable livelihood based on farm activities. Some constraints are the lack of access to sea resources, distance from tourist routes, and restricted soils for agriculture. Tourism has been regarded as a major opportunity for this community, however, there is a lack of marketing in the national markets of the activities offered within the community. The construction of a track connecting Quiao with the national park in Cucao will increase the tourism flow through the area.

[18] In this research the households were divided into two groups relative to their farm size to facilitate comparison and avoid distortion of the averages due to the high variability of the farm sizes. GROUP ONE= 75 % of the smallest land holdings; and GROUP TWO= 25 % of the largest land holdings.

[19] **Primary Land**: where the household lives and has their principal production.

[20] **Secondary Land**: a second farm or piece of land where the households access extra forest or pastures.

[21] **Tertiary Land**: a third source of land where the household accesses extra resources, generally through family arrangements

Credit

Most of the households (76 %) are clients of the INDAP credit scheme. They utilise the credit for pasture and crop (oats) establishment, potato fertilisers, livestock, and general infrastructure. Credit allocation constitutes a great support for the local households, influencing the productivity of the farm as it enables the establishment of improved pastures and the implementation of better management practices among the community as it encourages the adoption of new technology.

Repayment rates in Quiao are good (the repayment rate for the INDAP Chonchi area is one of the highest in the country), with many households having access to automatic credit. This type of credit does not need a productive reason and can be used by the household for different purposes. However, some key informants of this research criticised this type of credit as it is not specifically targeted at agricultural or for forestry productive use. Small farmers of this community are happy with the flexible credit scheme of INDAP as they generally utilise part of the credit for general household expenses such as food, school fees, and social commitments. This is an example of the different perspectives between the beneficiaries of a project and the development organisations.

Subsidies

Social subsidies allocated by the local council are important for the support of families, but do not constitute the main cash income source for any households. Only three households receive social subsidies.

Productive subsidies allocated by INDAP include: irrigation, pasture establishment, livestock improvement (e.g., shed and genetic). Subsidies were important for starting businesses in the area, such as the marmalade group (cooking and package room), the tourism group (traditional reception shed called *fogon*, look - out point, camping ground), horticultural micro-enterprise households (green-house), and the handicrafts group (working capital and sewing machine).

The high amount of resources that have been allocated in rural areas during the last decade increased the dependence on this kind of governmental support by this rural community. As a Quiao community member says: "*People get used to help and are waiting for external support…. I don't like when they come and deliver things for free, we need tools for work, not free things.*"

Location and accessibility of the resources

As discussed, location determines several of the other factors influencing sustainability in this community. Resources are accessible for this community as a better road network connects the numerous tracks that go into the ranges, making forests more available for human utilisation. Market opportunities for agricultural and forestry products are also benefited by the location of the community. However, the closeness to the urban centres means that as the people are more used to cash transactions, traditional values are being lost more rapidly, and there is an increasing pressure on the natural resources within the area of this community.

- **Social factors**

Property rights

Land tenure is not an issue in this community. Eighty-four percent (84 %) of the households of the group of smallest land owners of Quiao are owners of their primary land. The other 16 % have family rights over the land. Considering secondary and tertiary land the ownership is mostly by family rights (78 %). In this community only one household occupies state owned land as a secondary source of land. The group of the larger land holders have all legal property rights over their land.

Distribution of the resources among the community

Social equitability is beginning to be an issue among the community as outsiders are buying land for cottages, lifestyle blocks, or for productive use. This has exposed the community to well-off families from the “continent” and they begin to compare the local conditions to the outside conditions, realising their relatively poor financial situation.

One larger land owner is buying land and has created a farm of more than 300 ha. For the Chiloé context this is an enormous piece of land in the hands of one person. Local people have the perception that this is an unfair situation.

Community cohesion

Community cohesion is a factor that has decreased during the last decade for most of the households (91%). The traditional *minga* (community work to help one household) is no longer common. If additional labour has to be sought, it must be paid. This affects the stability of the community and can create sources of vulnerability as households without cash resources lack help to carry out their traditional farm activities.

Participation in groups

The participation in groups shows mixed results. Most of the households participate in the community board, however not all of them take part in the PRODESAL group. The specific production groups (tourism, marmalade, and handicrafts) are in charge of smaller groups, with strong leaders and these groups are not easily open to new members. These groups have been relatively successful in selling their products and are well known at the provincial level. However, several sources of conflict are affecting the internal group sustainability, reducing the long-term viability of the initiatives.

Women among the community have high levels of involvement. They take part in all productive groups of the community and are central in the development of new ideas among the community.

Access to Education and Health

A health station is shared with the nearby *Los Petanes* community, allowing the community to have first aid assistance close to their homes. If the health situation is critical, from the station an ambulance can be called, and the ill person can be taken to Chonchi or Castro.

A rural school is based in the community allowing children to complete the first six years of the eight years of basic school. The remaining school period (i.e., 7th, 8th and the four years of secondary school) must be finished in Chonchi City. Some decades ago the local school had 45 students but now it has fewer than 10 children. This shows the current trend of families with young children who prefer to move to the city for better infrastructure and opportunities.

Culture and tradition

Because of their relative closeness to the urban area of Chonchi the community members are greatly influenced by the mainstream culture of the country. Migration to urban areas is regarded as a major problem as the children are educated and look for better opportunities in the urban areas of the Island. This reduces the opportunities to allocate labour to farm activities, and increases vulnerability in terms of who will stay on the farm after the actual heads of the households pass away. As a mother of Quiao states: "*Kids are not anymore for the farm. After the studies they find a new life in the cities…*" and another women continues : "*kids are weaker, they want modern things"*; while finishing with the comment of a Quiao man: "*My son said to me: Life in the farm is a sacrifice…however he is interested in starting a business with horticulture."*

- **Environmental Factors**

Pressure over the natural resources due to land access constraints

Land access in Quiao defines the opportunities that a household has to carry out agricultural or forestry activities. Land access and labour are determinants of the economic productive capacity of the household and influence the pressure over the natural resources that a household has to apply to make a living from the farm. Analysing the whole community, the majority of the households access farms bigger than 20 ha, which is enough for securing the basic needs of the households. Only two households access very small farms (i.e., 2 ha and 3.48 ha), representing the poorer households of the community.

The relatively good road and track access that the community has to their forest resources and their closeness to the firewood markets create extra pressure on the resources and are causing a gradual degradation of the forest in the area.

Conservation strategies

Quiao has a good economic endowment; the community is focused on agriculture and forestry, and has systematic external development influence. This allows the establishment of some conservation strategies within the natural resource management practices of the community.

Forest resources in this community are more accessible, with lower transport costs to reach the local firewood and timber markets. This increases the risk of irresponsible utilisation of this resource. However, people who sell timber or firewood commercially are aware of legislation and comply with forest management schemes. The main problem is the illegal selling of firewood which comes from farms that, because of their difficult access, are difficult for CONAF to monitor. Quality timber is scarce and as there are no other valuable products to sell, firewood remains the main product obtained from the forests. Quiao supplies firewood to Chonchi and Castro City (provincial capital). Chonchi Council and CONAF are applying an extension programme that encourages the sustainable management of the native forests. Two households in this area participate in the group, as they have enough forested area and have a different attitude towards the future (i.e., hard-working and long-term perspective).

In terms of agricultural production, Quiao has at least some level of natural pasture improvement and replacement of nutrients. Cultivation following contour lines has not been yet made popular, but the *barbecho* (i.e.: leaving the ploughed soil without a cover during some months, which causes erosion) has been almost completely halted.

In terms of management of the household and farm residues, the Quiao households show some levels of recycling of organic material (as food for pigs and poultry) and paper and cardboard (for the fireplace). Plastic containers and bags are normally reused for the selling of horticultural products. However, the relative ease of buying groceries and other products in the nearby cities means for Quiao increased amounts of rubbish without proper management.

Technological level

The Quiao community uses relatively modern technology in their management practices. In agricultural terms the use of tractors is common, making it easier to establish pastures and carry out commercial activity (e.g., higher cattle stocking rates, increased surface of potato crop).

In terms of the forestry sector, one saw-mill exists in the area, and there is a mobile saw mill available through the *Canelo* group. Chain saws and axes continue to be used, as well as oxen to pull the logs through the muddy tracks.

This level of technology and the location near to the markets increases the pressure on the natural resources, affecting the ecological integrity of the activities carried out by the households. Resilience of the forest is also affected by more intensive management as it reduces the ability of the forest to recover from human intervention.

Natural resource management knowledge

This area has been inhabited since the beginning of the 1900s so that the accumulation of traditional knowledge is deep-rooted among the community. As presented before, some of the traditional knowledge within the area of study is highly valuable (e.g., medicinal use of flora, alternative uses for the forests, growing seasons, terrace cultivation, among others); but some of the local knowledge relates to unsustainable natural resource practices, such as forest management, pasture management, and cultivation on slopes.

The influence of external organisations and the general economic development of the country have generated profound changes as has been detailed before (e.g., concentration of land in fewer hands, natural resource depletion, conservation strategies and programmes, and a lack of young labour to work on the farms, among others). This cultural change and external influence also change how natural resources are managed, changing finally the local knowledge about the resources. Additionally, if young people become less interested in the farm activities and native forests, ancient knowledge that has been transmitted from generation to generation will be lost.

Community views on sustainability

There is awareness among the community about the need to start to reforest areas of their land to secure firewood supplies. In general, people establish limits to the exploitation of the forests, avoiding the use of fires, and using forest management schemes.

Households that are able to intensify their production towards cattle and native potatoes have a better lifestyle. However, this is a result of an attitude towards work that differs from the traditional subsistence concept of the *Chilote* communities.

The perception of the future sustainability of their livelihoods is strongly related to the links with, and opportunities of, the urban areas and non-farm work. The loss of interest in the farm activities and nonfarm work dependence reduces the local pressure on the resources, but results in the migration of young people to urban areas. These young people are the future managers of the family farms, and if they do not return to the farm, the family will lose their connection to the rural area.

5.3 CROSS-CASE ANALYSIS

This section compares the results of the analysis of both communities, focusing on understanding the reasons for their differences, and comparing the main factors that are affecting sustainability in the rural context of Rahue – La Montaña and Quiao communities, and determining the sustainability of the local livelihoods and natural resource use pattern.

5.3.1 Comparison of the resource endowment of the two communities

As described, both communities face a similarly rich natural resource endowment, where forests, natural pastures, water and firewood are available for the households. That means that in terms of ***natural capital*** they face similar conditions. Both communities live close to the ranges so that they need to use slopes to cultivate potatoes and breed livestock. The topographic condition of the area makes access to the forested resource difficult for both communities.

Table 5.3 shows the composition of the herds for both communities. There are few differences in terms of average herd size because in both communities livestock is a source of savings or used as an investment strategy. However, in Quiao livestock plays a more important role as a cash income generating activity as it lies closer to local markets. Forestry is also more developed in Quiao, with households managing a sawmill and selling firewood and timber to the nearby urban areas. In the case of Rahue poor access (lack of roads) militates against this activity.

Access to ***physical capital*** (roads, electricity, and water inside the houses) is better in Quiao. Also, Quiao has access to local schools, and to a basic health service. This better physical infrastructural context allows a better quality of life for the Quiao households.

Financial capital is available for all the households through the INDAP credit scheme. In both communities only the more impoverished households are not able to access the credit (i.e., three households in each community), due to the high cost to re-pay the debt. Subsidies and social assistance from the Chonchi council are also available for the communities and reduce the vulnerability context of the households in case of a stress or shock. Other sources of financial support are: INDAP for productive oriented subsidies and BMCH for environmental oriented projects through

their annual participatory fund. In general terms the Quiao community has better access to financial capital as they have secure property rights (which give them access to credit schemes and subsidies), access more information, carry out well established and recognisable agricultural activities, have diversified to attractive new productive areas, and have fewer of their population in poverty.

TABLE 5.3. Comparative analysis of some descriptive indicators of the case communities.

A) General comparative indicators of the case communties

INDICATOR	RAHUE HOUSEHOLDS	QUIAO HOUSEHOLDS
General Location	Isolated	Close to markets
Livelihood Strategy	Diversified, dependent on off-farm activities	Diversified, towards farm-based intensification
Access to Physical Capital		
Road	62%	100%
Electricity	Windmills (basic supply)	50% connected to network
Water access	100% Outside the houses	77% Inside the houses
Access to Livestock		
Sheep (average herd)	18	18
Cattle (average herd)	4	7

B) Land Access and property rights among the case communities

INDICATOR	RAHUE HOUSEHOLDS		QUIAO HOUSEHOLDS	
Access to Land	**75 % smaller farms**	**25% bigger farms**	**75 % smaller farms**	**25% bigger farms**
Primary Land (average size)	7 ha	41 ha	11 ha	36 ha
Total farm size	41 ha	70 ha	36 ha	84 ha
Land Tenure				
Own	58 %	100%	84%	100%
Family	17 %		16%	
State	25 %			

Social capital was described in the community cohesion section. Rahue shows higher levels of community cohesion, while Quiao shows more sources of internal conflict. Social capital is related to maintenance of the culture and traditions of the community and the social acceptability of the current process of development.

Human Capital in both communities is low, as most of the households' heads have incomplete basic education. When they compare the educational levels of their parents with those of their children, they agree that the current trend is towards an increase of the educational level of their children. However, Quiao has been longer in contact with external organisations which have increased its capacity to relate to the external context, understand new projects and programmes, create their own initiatives, and be better prepared for new challenges.

5.3.2 Livelihood strategies in Rahue and Quiao

As shown in Table 5.3, livelihood strategies in both cases are diversified; however Quiao shows a trend towards on-farm intensification, while Rahue must rely on off-farm activities as a main livelihood strategy.

Comparing both communities and their livelihood strategies it can be concluded that all households produce food for their own consumption (e.g., sheep, pigs, poultry, vegetable garden, and potatoes) aiming to satisfy their basic needs. In addition, all households rely to some extent on cash income and need to diversify to cash-generating activities. In Rahue, these activities include mussel collection, gold production and - in a minor way - cattle production. In Quiao cash-generating activities are principally farm-based and include native potato production, sheep and beef farming, and on a minor scale, tourism, marmalade, and handicrafts production. Off-farm activities in Quiao include temporary migration to urban areas and nonfarm labour.

Both communities are dependent on their natural resource endowment. In the Rahue case the dependence is mostly on off-farm natural resources (marine products and gold). In Quiao the dependence is mostly on on-farm production (cattle, sheep, potatoes), however, due to their higher need for income they need also to rely to some extent on non-farm jobs in the nearby salmon industry.

Figure 5.7 illustrates the comparison between the cash income sources between both communities, showing the relative difficulties for Rahue - La Montaña households in generating adequate income from on-farm agricultural production. Rahue - La Montaña depends on off-farm activities for cash generation. However, there is a difference between Rahue and Quiao in this aspect. Off-farm activities in Rahue are mainly based on the available natural resources, such as: mussel collection, gold production, and work on other farms. On the other hand, off-farm

activities in Quiao are related to the salmon industry which has a net washing plant near Quiao. On-farm activities, as described, are a major source of income for Quiao households.

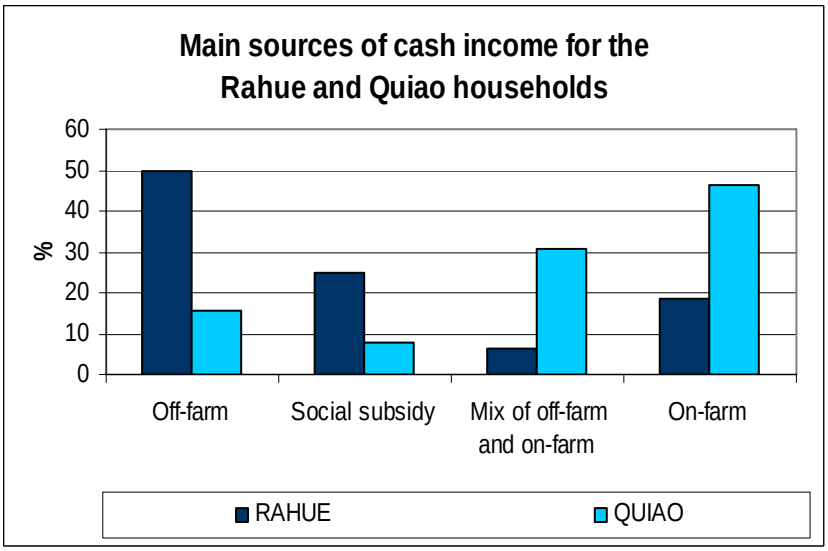

FIGURE 5.7. Main sources of income for the households in Quiao and Rahue.

5.3.3 Natural resource management in the case communities

- **Traditional techniques**

Both communities use the same traditional techniques to manage the natural resources. It is not possible to distinguish any difference in management due to ethnic differences. While the Rahue-La Montaña community has *Huilliche* influence, Quiao comes from what is known as the *Chilote* ethnic tradition. The relation with the forests, the traditional crops, and the agricultural rotations they use are similar.

However, when compared to the whole of Chile, the case communities present interesting characteristics that result in different livelihood outcomes from those expected in more "developed" areas of the country. This could be understood as a difference between the Chiloé farmers (i.e., *Chilote* and *Huilliche*) and the *Chilean* (i.e., mainland Chile) farmers due to ethnic distinctions. The traditional natural resource management practices of rural households in Chiloé aim to satisfy the household's basic needs, trying to generate adequate surplus to allow moderate levels of comfort (e.g., electricity, TV, washing machine), but they do not reach high levels of consumption or well-being. The *chilote* tradition encourages heads of households to be independent in terms of labour and time management (there is an important time allocation to social activities) and if possible they prefer temporary

work over long-term contracts. This allows them to maintain their farms and traditional livelihood options without joining the labour market. As discussed before, this traditional lifestyle option is changing among young people.

The differences in terms of natural resource management among the communities come from the different opportunities that the communities have. Climate, location, low technology, and lack of financial capital play against Rahue, while Quiao is more developed due to more external intervention, enhanced human capital, a longer process of cultivation of the land, and the use of more technology.

These differences affect the natural resources as more technology and closeness to the urban areas has led to increased productivity of the farms, reduced the resilience of the forests, and - in the Quiao case - affected the ecological integrity of the agroecosystem.

The current techniques used for the management of natural resources could be improved through the application of simple conservation practices and changing deep-rooted unsustainable practices. These conservation strategies include cultivation following contour lines fertilisation of pastures, adequate silvicultural management of the native forests, creation of community forests to allow economic and ecologically sound management of native forests, and creation of a marine reserve to allow the exclusive use of the marine resources by the community members.

- **Recycling and Reusing among the communities**

Traditionally rural communities in Chiloé such as those interviewed in this research have high rates of recycling and reuse of the subproducts of their livelihood activities. Food left over and all organic matter that comes from the house provides food for the pigs and poultry which are part of the household production for family consumption. Paper and cardboard are used and burned in the oven and there is low production of residues from their agricultural and forestry activities as the system applied here has low application of external inputs.

Modern life has introduced plastic bags, plastic containers and other materials that are not biodegradable. The isolation of Rahue means that the level of garbage is low, as the possibilities of transporting in large amounts of goods are less. Plastic bags and plastic bottles are reused in the form of bags for selling horticultural products to tourists, flowerpots, water containers for the minor livestock, or to store different elements in the shed. In Quiao there are more facilities to go and shop in town (three

times a week) and many relatives from the Quiao inhabitants live in Chonchi. This closeness to the urban area has generated larger levels of garbage and people have started to bury plastic containers, bags and tins.

5.3.3 Main factors affecting sustainability

A comparison of the main factors affecting the sustainability of the livelihoods of the case communities and their available natural resources are presented in the following section.

- **External context**

The organisational context influences both case communities. In general terms organisations and external agents are much respected. The state (rural council, INDAP) is seen as an agent of aid and solutions. During the last 15 years a "project culture" has been growing in the area. As an old man of Rahue states: "*We are waiting for them to help us."*

In terms of natural resource management, INDAP (source of credit and agricultural subsidies) and CONAF (forest control) influence the communities depending on the goals of the programmes and subsidies they have in place.

Quiao receives the input of local NGOs who have been working for a long time in the area. The outcomes of these interventions are the re-introduction of native potato crops, the tourism group, the marmalade group, and the handicrafts group. In Quiao some members expect future support from the external agencies, some think that the organisations are still far away from their needs, and some agree that organisations are very close to them. It is interesting to discover that community members are aware of the "wrongs" of the aid delivery models applied in Chiloé. They think that in many cases communities are utilised by the external organisations as justification for projects and to show results. This makes them more sensitive to external ideas and more responsive if they do not like the proposals or mistrust the external consultant.

In Rahue the influence of external organisations on the community activities is more recent. The Chonchi Council and INDAP are implementing agricultural extension programmes in the area. The community in this case expect external support for the local activities, new development projects, and better delivery of information. However the major concerns of the community are still basic: property rights over their land and access to water.

- **The role of women in the community**

Because of their longer period of exposure to external organisations, there is a high involvement of women in Quiao productive groups. As a key informant suggests: "*If you work with women, you work in the long term. The levels of responsibility are higher, they have long-term views, there is another kind of energy in them, and they have a better management of frustrations."* In Quiao women are income generators for the households, a situation not commonly found in Rahue.

The role of women in Rahue is secondary, normally working in the houses and in charge of the vegetable garden and minor livestock. There are intentions among some women of the community to form a handicrafts group and a tourism group; however, there has not been a consensus among the community about the topic. In Rahue the indigenous board is led by a woman who has created a new opportunity for participation of women in the leadership of the community.

- **Location related to poverty levels and diversification opportunities**

As described in prior sections location was one of the main selection criteria of these two communities. With this theoretical replication it was expected that different results would be found in the communities. The location of the case communities is certainly a factor in the differing poverty levels and the degree of diversification of the households.

Rahue is an isolated community in the context of Chiloé Island. Field data show that poverty affects 50% of the households in Rahue, with half of these poor families under the extreme poverty line. Rahue's isolated condition determines the lack of opportunities and the harder living conditions of the community. In Quiao, poverty is also present but to a lesser extent, with only 22 % of the households under the poverty line. In general, Quiao households are able to generate better monthly cash incomes and have developed better agricultural-forestry working opportunities.

Rahue's isolation means that people rely more on the production of their own food and goods, as they are unable to access the local and national markets to buy or sell their products. This leads to diversification as the main strategy adopted by the community. For Rahue only gold and mussels, which are highly valued by the markets, represent a relatively reliable source of natural resource-based income. In Rahue, because of its isolation, the lack of road access to the forests and the low level of technology used by the small farmers (use of axes, chain-saws, and oxen),

mean that the native forests are better protected from unsustainable use and large-scale exploitation.

On the other hand, Quiao is closer to markets and this is clearly influencing livelihood strategies. This community has diversified to agricultural and forestry products, and shows the first signs of specialisation towards on-farm added value products. People from Quiao have oriented their activities to products such as native potatoes and tourism, two new successful markets for the province. However, this closeness to markets increases the pressure on the natural resources representing a negative impact for the community. The sale of firewood to local markets is resulting in rapid reduction of the forest resource, affecting the ecological integrity of this practice.

- **Land access, farm size and property rights**

Land access determines the farm size available for a household. This defines the financial viability and stability of the household, and the maintenance of the ecological integrity of the farm because of the pressure that the household applies to the resources in aiming to satisfy their basic needs.

Legal rights over the land are a key factor that enables local households to access the benefits and credit from governmental agencies. Legal title over land leads people to take a long-term perspective over the use of the resources, reduces the vulnerability context of the household, and incorporates the use of conservation strategies to the management of natural resources (if there is extra availability of financial capital and labour).

In Rahue, property rights to land are still not clear and land access is still an issue for the local households. The possibility of obtaining state land through the indigenous board generates discussion and ambitions for more access to land between the rural households. This situation means that the land access factor is relevant in this community if any future development initiative has to be implemented.

On the other hand, in Quiao property rights have not been an issue for a very long time. Every household knows which land and natural resource it is able to access. People's ownership over the land reduces household vulnerability, and leads to longer-term planning in the use of the resources. In summary, considering land access, farm size, and property rights Quiao community is more able to create stable and sustainable livelihoods.

- **Vulnerability context: migration and equitability issues**

The vulnerability context in both communities is different. Quiao - as described - has better infrastructure, better access to markets, and a better quality of life. This means that Quiao's vulnerabilities are related to the external context, in terms of availability of off-farm and nonfarm work and prices of agricultural products (e.g., sheep, cattle, and potatoes).

On the other hand, the vulnerability context in Rahue is related to basic factors such as: property rights, water availability during summer, and lack of roads. The relatively poorer infrastructure (i.e., lack of school and health station), along with the muddy roads and tracks, hard winters, and isolation from the urban areas leaves rural households exposed to more risks, which reduces their quality of life.

Migration has an effect on both communities, also influencing their vulnerability. However, causes of migration seem to be different in both communities. In Quiao, access to education for young people has resulted in greater human capital, but there is also an increased migration of young people to urban areas looking for off-farm work opportunities. This reduces the opportunities for households to allocate labour to farm activities and social institutions like the *mingas.* As discussed earlier, migration increases households' vulnerability in terms of who will stay on the farm after the current head of the house passes away.

In Rahue, the situation is different; temporary migration occurs because of the difficult productive conditions of the area. Some households choose to work in non-farm activities for periods; however they continue working their farms, during the weekend or through family arrangements. At least one quarter of the Rahue households have chosen to live in the nearby village of Cucao (school, health post, electricity, grocery shop, and telephone) and walk or ride the two hours to their farms every day.

Social equitability is an important issue in Chile and also in Chiloé Island. At the community level the distribution of land among the community members has social equity implications. Small farmers in Rahue are currently concerned about the concentration of wealth and governmental assistance with some of the larger-land owners. In the case of Quiao, lifestyle blocks sold to people from northern regions of the country (e.g., Santiago), and the accumulation of land to some larger-land owners is generating concerns about the viability of the small farmers in the area.

- **Community Cohesion**

It is interesting to discover that even though Quiao is richer and more developed than Rahue, and has profitable community initiatives in place (marmalade group, handicrafts, and tourism) it has lower levels of community cohesion.

As a comparison between the case communities, Figure 5.8 illustrates the better access that Quiao has to physical capital (e.g., road infrastructure, water), economic capital (credit), and access to primary land (i.e., where they live) with their own property. However, social capital, reflected in community cohesion, is lower for Quiao.

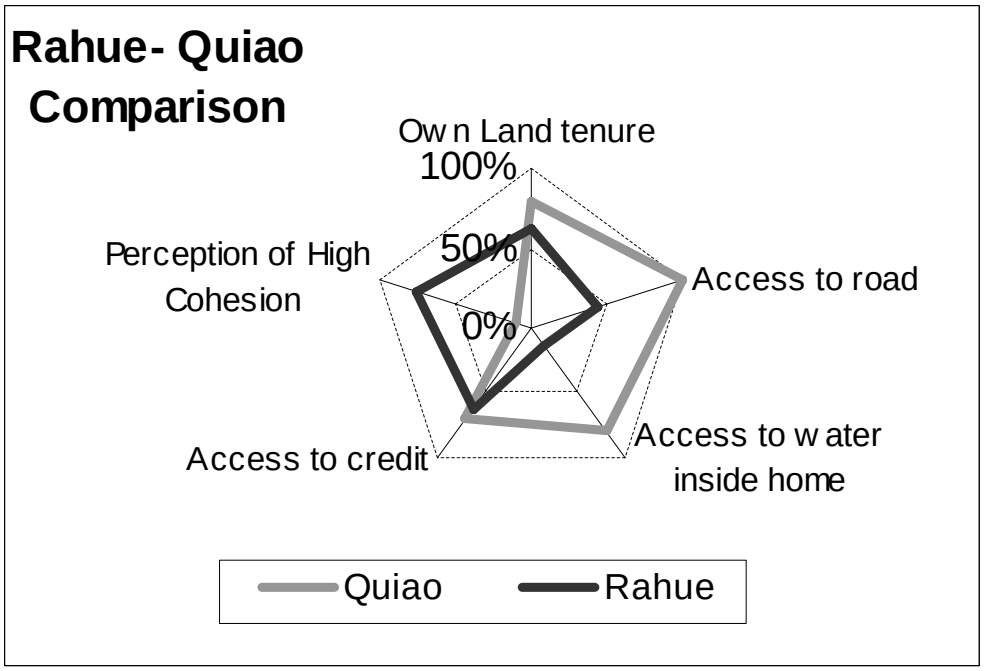

FIGURE 5.8. Quiao and Rahue compared in access aspects to different sources of capital

Most of the households in Quiao (91 %) consider that the community cohesion is low to medium. In Quiao the sources of conflict between neighbours come from unfinished development projects, money matters inside the group, and participation issues (who helps and who does not) at the community level. This shows a potential lack of a group-education in the implementation of the projects that created these groups, which is a key element to increasing group sustainability. On the other hand, the traditional *minga* is no longer common. If work has to be done, it must be paid for. In Rahue, because of its isolation and rough conditions, people rely more on their neighbours. Almost 90 % of the interviewed households in Rahue - La Montaña practice *mingas* every year for the potato planting and harvest.

- **Conservation practices and their determinants**

Conservation practices such as the fertilising of pastures occur more in Quiao than in Rahue – La Montaña. Small farmers in Quiao fertilise their paddocks and establish pastures with exotic species. In most of the households of both rural communities the use of fertilisers is credit dependent. In Rahue 75 % of the fertilising of the potatoes is done via INDAP credit. In both communities, if households have access to credit they are able to fertilise. Erosion control is not a common practice and it was influenced only in one household by an external consultant, with successful results.

In both communities, other conservation practices are absent for a mixture of factors. One is the economic factor (e.g., lack of alternatives and poverty levels). Poor rural households, like those interviewed in this research, are too poor to invest in, or allocate valuable working time to, these practices. A second important factor identified in this research is the lack of information. There are several practices that could be implemented without major cost to the farmer, which could result in better management of the forests, pastures and potato crops than their current traditional practices.

Among the communities there is a general knowledge about the importance of preserving the resources for the next generations. Sustainable use of natural resources is instilled through the local conversation of rural households of Quiao and Rahue - La Montaña. This happens in part due to the efforts of local NGOs and government programmes related to this topic, but also because small farmers realise that natural resources are scarce. However, the difficult livelihood conditions exposed in this analysis, the lack of research and information, and the few practical and successful examples of sustainable development in the area indicate that the gap between the theory and the practice is still large.

5.4 SUSTAINABILITY OF RURAL LIVELIHOODS AND NATURAL RESOURCE USE PATTERN

As described in this research, rural livelihoods in the case communities depend on natural resources for their subsistence and generation of cash income. The sustainability of their livelihood strategies and natural resources have been the key element throughout this research. In this section the different perspectives about sustainability between the interviewed community and the key informants are

discussed. It includes a final assessment of the sustainability of the rural livelihoods and natural resources after an overall analysis of the current livelihood strategies adopted in the study area and the natural resource pattern.

5.4.1 Perception of sustainability

- **Community level**

The view of the communities regarding the future of their natural resources is very positive. For example, almost every household thinks that their firewood reserves will last for at least five to ten years and that the livestock activity will improve in productivity.

However, in both communities there is a consensus that the trend during the last decades has been towards the depletion of the resources. First, the agricultural land has lost productivity (there is a need for more fertiliser); second, timber is difficult to find and firewood has reduced in quality and quantity; third, mussels and gold are almost depleted; fourth, in economic terms it is difficult to earn cash from the farm and compared to the whole country's levels of wealth they feel that they are poor; and finally in social terms, the community cohesion is deteriorating and traditions (social institutions) are being lost.

It is interesting to discover that although rural households are aware of the fragility and vulnerability of the current situation, the general perception of the community is positive when discussing the future.

- **Key informant level**

Key informants' assessment in the area of study coincides with the picture described above. At the organisational level, key informants are aware that the small farm units of Chiloé need to improve their economic productivity through environmentally sustainable practices if social sustainability is to be achieved.

For some key informants the small farmer of Chiloé will never get out of the "poverty trap", and whatever money is allocated to them (i.e., through subsidies or projects) is "lost money". It is true that some small farmers will always carry out subsistence agriculture-forestry and will be always dependent on social subsidies and external help. However, there is a majority of households that have the potential to adapt their livelihood strategies to more productive and environmentally responsible activities, such as tourism, handicrafts, native potatoes, horticulture, and organic agriculture. They need adequate support information and links to the markets. This is already

happening in Quiao, where some households have acceptable levels of wealth based on natural resource-dependent activities. For this group of households, key informants recognise a chance for a better future. They are conscious that there is a need to change the current development process of the Island and allocate more resources to activities that could add value to the local production. They consider that through participation and associative initiatives rural communities can generate sustainable livelihoods.

5.4.2 Sustainability indicators for the case communities

Based on the data collected in the 43 interviews, field notes, and secondary data about the area of study, it can be concluded that under the current development context, the available natural resources, the conditions of the markets for agricultural-forestry-marine products, and current livelihood strategies, most of the rural households of the study area fail to create sustainable livelihoods and preserve their natural resources for future generations.

This assessment is based on the sustainability indicators suggested by the literature (Conway, 1987; FAO, 1993; Kelly, 1997; Rigby, 200; Mog, 2004) which where used in this research.

- ***Economic productivity*** is not fulfilled in Rahue, and only partially in Quiao;
- ***Financial viability*** of the current livelihood strategies of Rahue is in question because of the poverty levels shown in the area, however residents show some optimism in Quiao as new diversification opportunities are put in place;
- ***Social and cultural acceptability*** among the Rahue community is still satisfactory, however in Quiao there are several sources of conflict among productive groups;
- ***Equitability*** is an issue for the small farmers in both communities as larger land owners concentrate benefits and wealth;
- ***Resilience*** of the native forest is in danger as small farmers increase their technological level and their capacity to impact resources.
- All these elements generate the fact that the ***ecological integrity*** is under severe threat in both communities because of the current livelihood strategies and the influence of the external context.

❖ CHAPTER 6. DISCUSSION

The discussion chapter presents a final analysis of the research findings compared to the theory about sustainable rural livelihoods and sustainable natural resource management.

This chapter begins with a discussion of the main factors influencing sustainability in rural areas at the community level, continues with the main aspects of the external context (i.e., national level and local organisations) that influences the rural areas; and finishes with suggestions of the relevant policy implications that could enhance the sustainability of rural livelihoods and natural resources in rural areas of Chiloé Island.

6.1 LOCAL FACTORS INFLUENCING SUSTAINABILITY

This research highlighted that location, land access and conservation strategies are the main factors at the local level influencing the sustainability of local livelihoods and natural resources. These three factors are related to each other, and determined by other minor factors as will be discussed in this section.

6.1.1 Location

Location as a key factor that influences the development opportunities of rural areas (Wiggins, 2001) is strongly supported by this research. As in other low income countries (Ellis, 2000; Wiggins, 2001), the Chiloé community located closer to the urban centre was at a higher stage of development compared to the more isolated rural community. The stage of development was evident in terms of quality of life, vulnerabilities, educational opportunities, food security and wealth all of which is in agreement with the literature (Ellis, 2000; Wiggins, 2001).

The characteristics of the isolated community on Chiloé Island reflect those of similar communities in Africa (Ellis, 2000). These characteristics include: low income, reliance on subsidies, low educational level, poor access to land, and small livestock herds. The results of the present research for the least remote community are also similar to those found by Ellis in his study in the African context. The least remote community of the present research has higher income households if compared to the isolated community. These high income households decrease their subsistence agricultural production as a share of the total production if compared to the poorer

households. However, wealthy households maintain a diversified livelihood strategy securing their food with some level of household production, such as: potatoes, livestock, and vegetable gardens. This result showed that food security and satisfaction of basic needs from the farm activities are common for both wealthy and poor households in both case communities.

In terms of diversification of the livelihood strategies the results of this research were similar to what the literature suggests (Wiggins, 2001). In this research the most isolated community is a diversified community in terms of products and activities so as to ensure their subsistence production and basic needs. Isolation means people rely more on the production of their own food and goods. Isolated poor rural communities face high institutional and transaction costs, and have little choice but to sell through exploitative private traders (Rahman, 2001). Concurrent with this finding, the isolated case community on Chiloé Island faces long distances to markets and high transport costs. They rely on external traders to sell their products for lower prices than communities closer to the markets.

On the other hand, the case community closer to the markets showed the first signs of specialization as described by Wiggins (2001, p. 434) in relation to what he call the “countryside communities” or the least remote community for this research. This case community is directing its activities towards high value products for the external markets.

Similar to Wiggins’ (2001) findings in other low income countries, closeness to markets increases the pressure on the natural resources of the rural areas. In the least remote case community there is a high demand for firewood from the urban areas due to the relatively high availability of forests. However, the selling of firewood to local markets is resulting in rapid reduction of the forest resource, affecting the ecological integrity of the native forests. In the case of the isolated community, its isolated condition has meant the conservation of the natural resources. This research adds new elements that were not described in the reviewed literature: the conservation of the natural resources in the most isolated community occurs at the expense of economic productivity and social acceptability of the current livelihood strategies. This is reflected in the poverty levels of Rahue and in the recognition by the households of their constant struggle to subsist in the current conditions.

Community cohesion

Wiggin’s (2001) showed that there is likely to be that better social capital is found in rural communities that are closer to urban areas. This research found that social

capital measured through community cohesion, decreases as the rural community increases its general development state. In the case communities, this is likely to be because of location and the well-being of the community, factors which have a consequence on the maintenance of the traditional institutions such as community work and exchange of work between households. Households in the isolated community, due to their isolation, need to rely more on neighbours, relatives, and friends; increasing the need for functional social networks. In the least remote community, people pay in cash for labour and the households work independently.

An interesting finding that comes from this research and is contrary to what theory suggests, is that the presence of productive community groups within the community has led to new sources of decreased community cohesion. These groups are a source of conflict among the community due to the lack of organisational skills amongst the household members. Lyon (2003) highlighted that the sustainability of productive groups takes time to develop and needs well planned initial external supervision and support. In the least remote community of this research internal conflicts between group members are common, showing a potential lack of preparation among the community members to carry out commercial and associative-based activities. This may indicate that in this particular case community the creation of these productive groups by external agents lacked sufficient support, supervision, and organisational skills development as is suggested by Lyon (2003).

Factors related to location

The results of this research agree with those of most of the reviewed literature in terms of location as a main factor influencing the development state and sustainability of a rural community. As Conway (1997) and IFAD (2001) suggest, location is a determinant of the poverty levels of the community; as Mog (2004) establishes, it influences the access to information. All these related factors were found to be relevant in the context of the case communities of the present research and influencing the current cultural change of the rural communities of the area of study.

Related to Cahn's (2002) suggestions about culture and traditions changing as communities develop towards new ways of living and increased wellbeing, it was found in these case communities that as communities develop economically, they lose traditional institutions (e.g., *mingas*) and an important generational change is recognisable. Young people migrate towards urban areas and farm activities are less valued.

In summary, this research highlighted that location for both case communities is a key factor influencing the sustainability of the rural livelihoods and natural resources. Location influences the poverty condition, access to information, culture, community cohesion, diversification opportunities, pressure on the natural resources, and the general development state of the community. The results of this research and the literature suggest that an isolated location may affect a community negatively, but it is likely to be that if the isolated community finds a supportive external organisations, gets the necessary information, and a proper link to the local markets it may increase the future opportunities of the rural households and secure sustainable management of the natural resources endowment.

6.1.2 Land Access

A second major factor identified by this research that influences the ability of rural households to generate sustainable livelihoods and manage the natural resources with a long-term perspective is land access. Property rights and physical accessibility were the key elements highlighted by this research as the main differences between the rural communities in terms of their ability to access land and natural resources.

Property rights over the land have both practical as well as social implications. In the context of the case study communities, property rights (legal entitlement to use the land) are required to participate in, and gain the benefits of, government, such as subsidised credit schemes, production incentives, and forest management schemes. In terms of securing land access, the results of this research are similar to what Leach (1999) identifies for the African context. Secure property rights reduce the sources of conflict with neighbours, as everybody knows which land belongs to whom.

Additionally, Leach (1999) states that insecure land tenancy has implications for people's perspectives on the natural resources, as ownership of the resources tends to result in a longer-term view of the resources and the application of conservation strategies to secure the sustainable use of the resources. The results of this research support this view with the two rural communities trying to preserve natural resources on their own farms. This last point has implications in terms of social behaviour, and the results of this research agree with what Ellis (2000) states in terms of property rights. He established that secure property rights increases the sense of belonging to the area, which increases household security.

Physical accessibility was established by this research as a main factor that determines land access, as a household can have the entitlements to use the land, but due to the lack of roads or tracks it may not be able to reach the resources. The findings of Wiggins (2001) suggest that in communities with better accessibility, natural resources are more available to rural communities as also are sources of raw materials and products for the urban areas. This is the case of the less remote community of this research where the increased availability of roads and tracks allowed easy access to natural resources. The contrary was the case for the more isolated community in the present research where the difficult access maintained native forest resources due to the lack of roads. This research agrees with what is found in the literature (Wiggins, 2001) in that physical accessibility as a determinant of land access is linked to location. This is likely to be because communities closer to urban areas have better access to roads and transport.

Farm size debate

This research showed that legal property rights and physical accessibility to the land define the total area of land a household has access to for their livelihood strategies. The farm size and the quality of the resources of the farm are determinants of the economic productivity and viability of the household.

Several authors (Ellis, 2000; IFAD, 2001; Rahman, 2001) suggest that small farms are efficient, employment intensive and economically viable units. Agreeing with these authors, this research highlighted several households within the less remote community that are able to create sustainable livelihoods and fulfil their economic and social expectations, while maintaining their available natural resources. However this occurred only in certain circumstances, such as those which characterised the less remote community. On the contrary, results of the present research showed that many rural households of both communities are not able to generate sustainable livelihoods and maintain the natural resource endowment. This agrees with Ashley's (2001) suggestions when she questions the ability of small farmers to be efficient. In terms of size of the farm, the present research highlighted that small farms are not always able to generate sustainable productive units, but if the necessary conditions are present, they do. These conditions include for example: adequate access to land, secure property rights, improved social capital, information access, and rural infrastructure.

The results of this research agree with Rahman's (2001) proposition that poverty reduction in rural areas should in the first stage develop small farms. However, the results do not support Rahman's (2001) further explanation of the development process of rural areas, as he states that the agricultural production of small farms should be focused in an earlier stage on staple food and in a later stage on commercial crops and the nonfarm sector. The more isolated community in this research is in Rahman's early stage of the process of reducing poverty levels, carrying out subsistence production. Results of the present research suggest that for the isolated community the diversification process is likely to be more successful if the small farmers incorporate traditional crops with high value in local markets rather than staple food and primary products that have proven unsuccessful over the years. For instance, in the less remote community households have diversified their productions towards high value products and have been able to reduce their poverty levels.

This research showed that in the debate about the most appropriate farm size it is necessary to consider cultural aspects of the communities under question, contrasting these with the economic considerations of most of the cities which feature in the literature (Ashley, 2001; Rahman, 2001). Chiloé Island's rural communities present a unique culture and tradition where the small farm productive unit is a core aspect of local livelihoods. Many interviewed householders do not want to establish high input/output productions systems or create micro-enterprises. These results contrast with the view of key informants of this research about the need to intensify production and incorporate small farmers into the export-led economy of the rest of the country. Small farmers interviewed in this research value their independence, the freedom to decide what to do on their farms, their own time management, and the daily contact with their land and natural resources.

Distributive effects of land access

In the researched communities, small farms are the main productive unit which has a positive effect in terms of the distribution of land among the population as all rural farmers have access to a certain piece of land.

Leach (1999) and Carruthers (2001) illustrated cases of exclusionary approaches to the management of natural resources in low income countries, highlighting the unsustainable effect they had on local livelihoods. The results of this research suggest similar conclusions, as for example in the management of the local national park whereby the surrounding community was banned from using the resources or

from sharing the benefits of the park. However, since 2002 one of the case communities has been participating in the benefits of the national park through the tourism group, which is a new productive activity for the households, contributes to the achievement of sustainable livelihoods, and ensures the revaluing of the native forests for their tourism value. Rahman (2001) suggests that the redistribution of assets is the key to reducing rural poverty. In the present research, the redistribution of the benefits of the national park to the community has been a key element in the better future outlook of the less remote community. However this research highlighted one factor not considered in the reviewed literature, which is how the increased access to different sources of capital is affecting community cohesion and the traditional culture of the community.

The case of the isolated community is different, as its people are currently not able to access extensive areas of state-owned land. The prospects of accessing almost 4000 ha of state land in the next few years has generated new sources of conflict within the community as it is not clear how the land will be distributed. Following Rahman's (2001) findings, it is likely to happen that a redistribution of state land among this isolated community will increase households' opportunities to create sustainable livelihoods.

Sources of land and productive potential of the land

Leach (1999) stressed the importance of property rights among the communities as a way to access land. This research suggests that households try to secure land access in different ways. Among the case communities land access secured by family or friendship arrangements is just as important as access secured by recognised legal property rights. Open access to the state forests and beaches to collect gold is also used by the case communities, but contribute to their livelihoods in only a minor way.

Households of the case communities that have a total farm size that is not able to sustain their basic needs increase the pressure on the natural resources on their farm to try to generate an economical return in the short term, leading to resource depletion. After the depletion of the resources they are forced to look for work in off-farm activities or to migrate to the urban areas.

Agrarian change

Ellis (2000) suggests that the current agrarian trend is characterised by competition, uneven technological change, and privatisation, all factors which lead to the

increasing differentiation of peasant communities and the emergence of distinct social classes among the rural communities. Supporting Ellis (2000), this research shows that among the case communities, outsiders usually wealthier, buying land from poorer small farmers. In both communities, larger land owners concentrate land in extensive productive units, increasing the social differences within the community. Furthermore, lifestyle blocks are also a common trend in Chiloé, increasing the loss of the land to rural households. This phenomenon of an "inverse land reform" as some key informants called it, contrasts to Rahman's (2001) positive land reforms, which are characterized by the creation of equally-sized small farms that promote employment, efficiency, and growth. Small farmers of both case communities consider this trend to be against the traditional arrangement of the rural areas of Chiloé.

Additionally, and similarly to what Ellis (2000) described for rural areas in other developing countries (i.e.: African context), the arrival of new people and the better economic situation of some households are generating differences among the communities and the equitable distribution of the resources. Leach (1999) found in Ghana that outsiders to the community used resources in unsustainable ways. In a similar way among the case communities, recent immigrants including those that come to the beaches of the more isolated community deplete the mussel population; and if they access forested areas, they cut forest without establishing any conservation strategy.

Land access as illustrated in this section shows several links to other factors such as property rights, sources of land, farm size, road access and current agrarian change. The results of the present research suggest that these factors influence the sustainability of the local livelihoods, and need to be considered in the special and unique context (i.e.: geographical, social, and cultural) of each rural community to be able to implement development initiatives that aim to achieve sustainable livelihoods and sustainable management of natural resources.

6.1.3 Use of conservation strategies

The literature (Mog, 2004) highlighted the importance of the adoption of conservation strategies if natural resource sustainability has to be achieved. Among the case communities of this research, conservation strategies are not well developed and have a low rate of adoption. This fact supports the final assessment of the current

unsustainable trend in the management of the natural resources, suggested by both the key informants and the householders interviewed in this research.

Furthermore, Ellis (2000) established that in normal circumstances rural communities do not farm in ways that cause a decline in yields. Additionally, Gilman (2000) suggests that if people are too poor to invest, degradation occurs. Hollander (2003) follows the same argument in the case of other developing countries, by saying that communities do not degrade their natural resources because they want to, but only because they need to in order to generate a living from them. The results of this research agree with these three authors as they establish the fact that rural households within the case communities overuse their resources only as a solution to economic stress. In the case of the isolated rural community, due to their poverty condition, they carry out subsistence agriculture with limited focus on conservation strategies and it is their lack of access to natural resources rather than the conservation strategies that is conserving the resources.

This research found similar results to those of Conway (1997) when he describes that rural poor communities often live in ecologically vulnerable areas. The study area presents marginal soils, high slopes, and a complex native forest type, making any sustainable natural resource management attempt very difficult for householders with low financial capacity. Accordingly, among the case communities, the adoption of conservation strategies in these ecologically vulnerable areas is dependent on several aspects such as the access to information, technological level, and local knowledge as is discussed below.

Local knowledge and educational level

Armesto (2001) in case studies of the Chilean context highlights the richness of the traditional knowledge that rural communities have about natural resources. The results of this research agree in part with this finding. On the one hand there is a rich traditional knowledge that can be beneficially adapted to current productive techniques, adding value to the final product and also creating socially sound productive systems. However, on the other hand, there are deep rooted productive traditions among the case communities regarding the management of forests, pastures, and potato crops, which increase the difficulties of introducing new practices that incorporate sustainable management of the resources. The economic pressure on the households has been a factor that causes these unsustainable practices to have more impact on the resources due to higher extraction rates in forests and high stocking rates in agriculture.

The results of this research agree with those of several authors (Schumacher, 1973; Armesto, 2001; Ashley 2001) when they suggest the importance of the educational level among the communities in terms of skills, opportunity generation, self-reliance, and environmental awareness. In the case communities the low educational level is an important factor which complicates the adoption and understanding of new practices. Moreover, traditional knowledge and education are related to the access and management of information among the rural communities.

Access to information

Lack of information and economic factors such as those identified by Ellis (2000) and Gilman (2000) in the literature are likely to be the main reasons for the lack of conservation strategies in the study area. The results suggest that there is a need to improve the access to information for both communities to increase the use of appropriate practices and technology that are culturally acceptable to the communities and will enhance the sustainability of the natural resources on which they depend. These results are similar to those of Rahman (2001) when he recognises that the availability of information on technological options for the rural poor is an important element in the future benefits that communities can obtain from the development process.

Levels of technology

The reviewed literature does not touch specifically on the topic of levels of technology and the impacts of technology on rural environments. The results of this research suggest that the level of technology in a community influences the level of exploitation of natural resources and hence the need for conservation strategies. In general, among the case communities, due to the lack of financial capital rural households have access to only low levels of technology. This is especially the case in the isolated community where the low level of technology reduces the impact of the livelihood strategies on the natural resources and maintains the resilience of the native forests. Hence, this result reinforces Wiggins (2001) description of the effects of location on natural resources. The isolated condition of the case community means that the disturbances caused by human intervention are currently low compared to a high technology scenario where the extraction rate of the resources (especially forests) could have a greater impact. Furthermore, the results show a similar development process to that established by Wiggins (2001) for rural areas, in which it is possible to suggest that the trend in the rural areas of developing countries is towards an increase on the pressure on the natural resources with increasing

levels of technology. Finally, it is possible to suggest, after analysing the data, that an important factor for rural communities to consider is to adopt technologies that are ecologically responsible and socially acceptable; and management strategies that aim for the sustainable use of the natural resources. As the results show, the adoption of these technologies and conservation strategies can be credit and subsidy led.

Credit Access

This research showed that conservation strategies are very dependent on the availability of credit. Nutrient replacement, potato crop fertiliser use, and pasture improvement are all done with the assistance of credit in the Chiloé communities. The use of credit in the study area contrasts with what is generally found in the literature. Shepherd (1998) stated that rural poor farmers in developing countries make little use of credit, while Manig (1990), for the Pakistani context, identified the importance of informal sources of credit. Contrastingly, among the case communities formal credit is easily available at subsidised rates, making it a valuable tool for rural households. Availability of formal credit is not a problem in the area of study and informal sources of credit are less common.

However, several key informants in this research suggested that the problem of credit in the area is in relation to how households spend the money. Credit schemes are delivered to be used in agricultural or forestry activities. Nevertheless, several households use the credit for nonproductive activities. This difference between the expectations and use of the credit between the lending organisation and the rural households is an interesting finding of this research. Rural households appreciate the easy delivery of credit in the study area; however, results suggest that small farmers need financial support without a specific productive use, which is contrary to the suggestions of the lending organisation.

In addition, rural households repay their loans with income generated from activities not related to the activities for which the credit was gained. From the organisational perspective this can be a questionable practice as rural households do not use credit for productive proposes and they do not repay it using the results of productive activities; however, this research highlighted that from the household’s perspective credit is an important source of financial capital and economic support during the year for productive activities, conservation strategies, and other nonfarm related activities, and after analysing the repayment rates, it is likely to be that rural households are able to cope well with the cost of the credit.

External incentives for rural households

This research explored the implications of external incentives in the adoption of certain natural resources related practices among the case communities of Chiloé. The results were similar to those found by Pretes (2002) when he established that grants are important to launch productive systems and to start initiatives that can include the use of sustainable alternatives of production. In the area of study productive oriented subsidies are related to conservation strategies such as soil recovery programmes of the governmental agricultural agency or the household community group for sustainable management of native forests. These successful experiences are basically influenced through subsidies and external support.

Environmentally responsible natural resources practices among the communities find their roots in their traditional knowledge about the local environment. These practices also are influenced by the external context through credit allocation and governmental incentives. The use of deep-rooted unsustainable practices has been growing owing to the economic pressure that small farmers face to generate a monthly cash income from the farm.

6.2 EXTERNAL CONTEXT INFLUENCING SUSTAINABILITY

In this section the influence of the external context at the national and local levels, over the sustainability of the current livelihood strategies and natural resources of the case communities of Chiloé Island are discussed.

6.2.1 National context

As the literature suggests (MIDEPLAN, 2000; World Bank, 2001) Chile is developing unevenly, with most of the economic and social development happening in the major urban centres. Additionally, Ellis (2000) recognises that the current economic scenario in low income countries (i.e., structural adjustment, modernisation) results in a de-agrarianisation process with adverse effects on the viability of agriculturally based livelihoods. Rural areas are left behind in the modernisation process, and remain isolated from the prosperity in the urban and industrial centres. This research highlighted the fact that Chiloé Island is one of the few areas of Chile where the small farm is still the most common productive unit, and represents an example of small rural communities carrying out subsistence activities with limited participation in - and

dependence on - external economic development. As was outlined in previous chapters this condition of economic and social isolation has maintained rural communities in relative poverty and with low educational levels, which is resulting in practices that are adversely affecting the sustainability of natural resources.

In terms of environmental concerns, Hollander (2003) states that affluence and economic growth are pre-requisites for environmental care. The results of this research agree with Hollander's suggestions; however, affluence is a common characteristic of high income countries, which can allocate the resources and have the necessary social awareness to deal with environmental issues. In contrast, in low income countries practical problems arise, where the concept of sustainable development as stated by the WECD (1987) is difficult and too expensive to be applied. Low income countries aim to grow in economic terms to reach affluence levels comparable to those of the high income countries. This process creates several trade- offs for social and environmental factors as was shown in this research.

In summary, the results of this research highlighted that the benefits of the current development process for the rural communities of Chiloé Island are still under question. It must be recognised that rural areas such as the area of study have improved their quality of life, access to roads, health, and education over the last decade; however, in comparative terms rural areas are still excluded from the benefits of the modernisation process of the country.

6.2.2 Local context

- **Effects of the national context on local communities**

The results of this research illustrate the difficult conditions that rural communities face on Chiloé Island. Under the current development path followed by the country it is difficult for the small farm unit arrangement of Chiloé to endure the pressures of the market economy, which influences the natural resource utilisation the current trend for migration and low prices paid for farm products.

In cultural terms, this research highlighted a generational change that is currently happening among the rural communities of the area of study. Access to television, radio, and newspapers, the contact with outsiders through development assistance and tourism, and especially the higher education of the new generations have influenced the traditional culture, establishing new patterns of behaviour and habits

among the communities. There is a need for a monthly cash income, people want to access more goods and services, food habits and dress codes have changed. As Cahn (2002) suggests, this phenomenon is normal and is part of the evolution of the communities. Culture is a process, not a state, and evolves over time. However, there are several concerns about the direction of the current cultural change, as stated by several key informants, household members, and Oyarzun (2000).

This research described how some traditional agricultural products of Chiloé have decreased in importance within the local livelihood activities due to low prices and the ease of buying products in urban areas that come from northern areas of the country. In terms of forest production, the highly valued forest products are currently protected due to their degraded state of conservation. This has led small farmers to diversify towards other products, such as horticultural products and livestock. The low economic return of the farm unit, plus the cultural change cause people to look to the cities as the source of income, comfort, and better infrastructure. Working as a labourer in nonfarm industry, or finding a job in the urban areas is seen by young rural people as their way to move from the sacrificed live of the farm, and a definitive way to start sharing the benefits of the modern live.

In a research carried out in the same area of study, Oyarzun (2000) found many families that work in the local industry and derive income from wages, while still living in the rural areas. Similarly to what Oyarzun (2000) establishes, this research highlighted that wages give families more power to buy goods and increase their standard of living while they decrease dependence on farm activities. Meanwhile, the household loses interest in the farm and decreases the allocation of labour to the farm. Young people are more attracted to the urban areas as the education in local rural schools has a strong bias favouring an urban-based culture. When they reach working age, they migrate to an urban area, which means that the population of the rural areas becomes older.

This research illustrates how rural areas of Chiloé are losing their importance and participation in the Island economy. This situation contrasts with what the literature suggests as approaches towards sustainable rural development. When Shepherd (1998) describes his approach to sustainable rural development, he establishes that it can be attained by encouraging local labour, adapting indigenous technologies, and creating participative small productive units that can work and sell collaboratively. Additionally, Ellis (2000) suggests that small farms' growth is a prerequisite for non-farm growth in other areas of the country. Rural growth reduces poverty in both rural

and urban areas, but urban growth does not alleviate poverty in rural areas. Ashley (2001) agrees with this posture as she states that agricultural growth and higher productivity in rural areas have a positive relationship with poverty reduction. The results of this research support the latter authors by suggesting that the adaptation of the sustainable rural development theory to the Chiloé Island context would mean to integrate the silvicultural and agricultural activities of the rural households, adapting the traditional practices, while incorporating conservation strategies, and boosting markets for the local production which would increase rural growth.

- **Organisational context in the case communities**

The sustainable livelihood approach (DFID, 2001) illustrates the importance of the organisational context among the livelihoods of rural communities in developing countries. The results of this research attribute similar importance to the organisational context, by highlighting the importance and the influence that the government and civil organisations can have in the development process of the rural communities.

Government organisations in the area of study follow the strategies established at the central government level. The agricultural agency plans to incorporate new territories (the 10th region), and new actors (small and medium farmers) into the export led economy of the country (meat and milk sector). This is a centralised top-down approach that has not involved any consideration of the local culture or the carrying out of any participatory approach to establish the proposal, and has left aside some other interesting productive opportunities of the area. This proposal contrasts with the recommendations of several authors (Mog, 2004; Sayer, 2004; Shepherd, 1998) that encourage participatory approaches to implement these kinds of programmes.

Sayer's (2004) suggestions about integrative approaches to management of natural resources find interesting applications in the context of Chiloé Island. As the results suggest, the local natural resource endowment is characterised by agriculture, forestry and marine resources which small farmers manage in one integrated system. Considering that fact, the agricultural and forestry agency should reconsider the objectives and goals of its programmes as they sometimes do not target the needs of the farmers to manage their farms in an integrated way.

In the case communities context, and also as Shepherd (1998) and Hussein (1998) suggest, development agencies, both governmental and NGOs, create a project-based culture generating dependence on their actions. Rural communities in the area

of study wait for the next project to arrive and see what benefits they can get from it. This creates a dependence on external support, decreases the empowerment opportunities for the communities, and affects the capabilities and participation skills of the rural communities.

Finally, considering the organisational context and its influence over the case communities there are interesting experiences that aim the diversification towards products of added value and the generation of sustainable livelihoods. It is likely to be that these experiences do not reach the majority of the Chiloé rural households, but establish a baseline that shows sustainable alternatives for rural development.

6.3 IMPLICATIONS FOR POLICY

This section involves information for policy formulation, program and project generation that suggest relevant strategies that would help to improve the livelihoods of the local communities in a sustainable manner and aim integrated management of natural resources.

6.3.1 Achieving sustainable rural development

As Shepherd (1998), Ashley (2001) and Sayer (2004) suggest, rural communities and their households should be approached by development agencies as an integral unit. Social factors (health, education, group organisation education), economic factors (need to fulfil basic needs, market access), and environmental factors (in the case of this research as an agricultural-forestry-marine unit) must be considered. As the literature suggests the holistic and integrative approach of livelihood analysis has proven a useful tool in several rural contexts around the world (Gilman, 2000; Pasteur, 2001; DFID, 2001).

This research illustrated how a number of programmes and projects have influenced the study area over the years. These projects focused intervention in one area of the local livelihood, for example agriculture, forestry, or housing. These sector-based approaches are likely to fail if other basic issues and needs of the communities have not been solved previously. Projects would be more successful if they took into consideration basic elements such as land tenure problems, water access, and group organisation development, rather than starting immediately aiming to develop products and introducing agricultural and forestry technical advice.

Taking into consideration elements of the literature figure 6.1 highlights the basic elements that are likely to be prioritised if sustainable livelihoods and long-term development are to be achieved in the area of study. First, as shown by this research and also by case studies carried out by and Scoones (1998), Leach (1999), and Carruthers (2001) land access is a main determinant of the ability of a rural household to create sustainable livelihoods. Furthermore as illustrated by Ellis (2000) and also found relevant in these case communities, the certain ownership of the land creates long-term perspectives over the use of the resources and reduces the vulnerability context of the household.

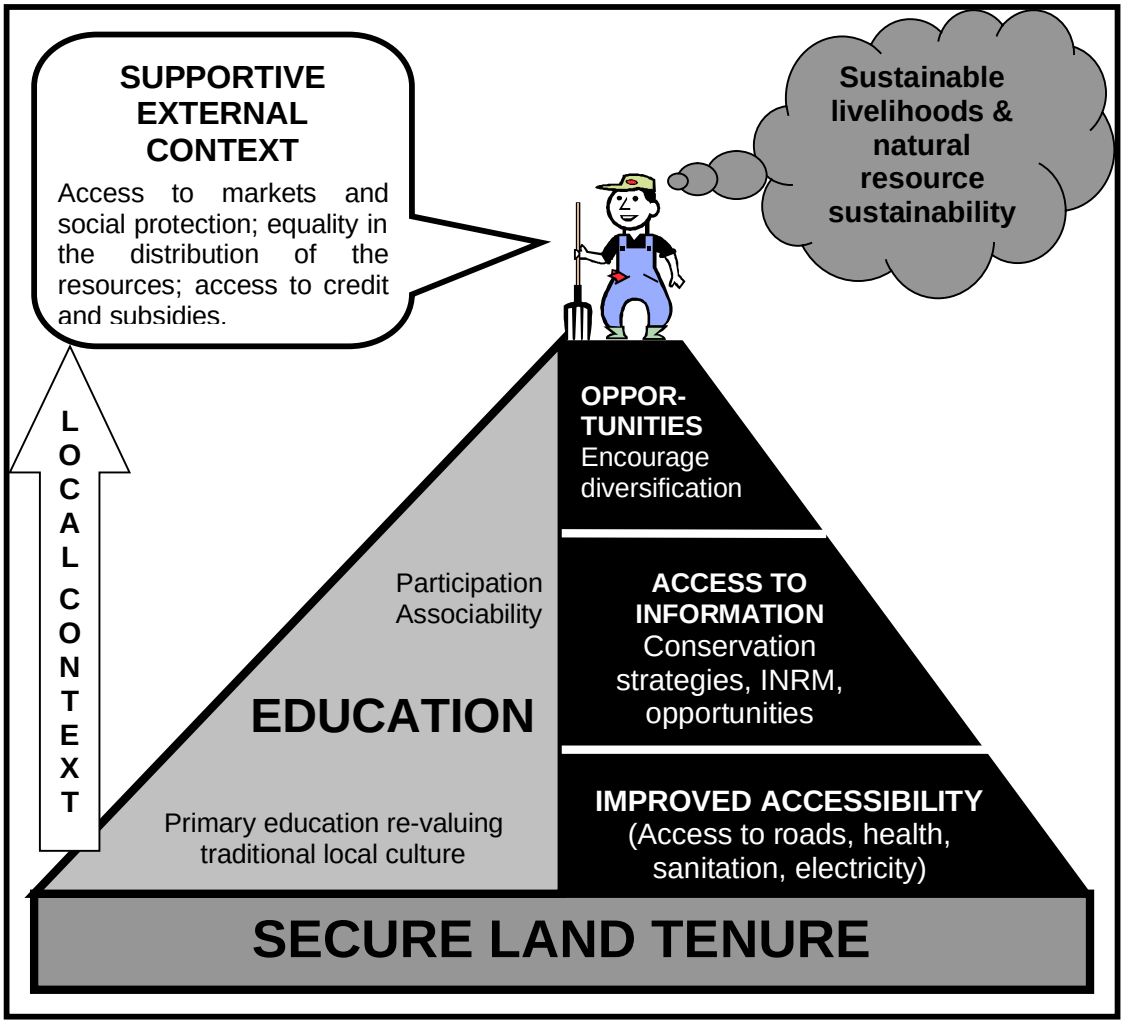

FIGURE 6.1. Basic elements to consider, in the context of Chiloé Island, towards the achievement of sustainable livelihoods and natural resource sustainability.

A second step for policy makers is to secure the accessibility of the community and the resources through improving the road infrastructure, and creating more rural infrastructure such as schools, health stations, sanitation, and electricity access.

Farrington (2001, p. 541) calls this process: “small town development”, which means the improvement of rural infrastructure to increase the quality of life of rural communities, avoiding, for example, the migration trend that is happening currently in Chiloé.

On the other side of the figure 6.1 education has been highlighted by this research and other authors in the Chilean context (Armesto, 2001) as a main factor that should be improved in the rural areas if better environmental and social standards are to be achieved. A higher educational level leads to higher human capital, expressed by a better understanding of the market opportunities, improved associative capabilities (as Lyon (2003) also described), and - as Hollander (2003) suggested - environmental awareness. Education has a strong link to information and the access to new sources of information. As Lyon (2003) suggests, and as was also found in this research, community groups are likely to be more successful if development agencies spend enough time preparing small farmers for associative activities, avoiding future sources of conflict.

The external context should be supportive to the rural areas in terms of legislation, redistribution of wealth from the urban areas (as Rahman (2001) suggests), credit access, and subsidy delivery. A key element highlighted by this research and similarly to Wiggins’ (2001) findings is the need to incorporate the market aspects among the implemented development interventions. If, for example, agricultural productive projects have secure markets for the products, the economic sustainability of the development initiative can be ensured, which is a basic step for the creation of social and environmental long-term sustainability. As this research showed for the isolated community the link between rural communities and the market is missing, and is still not strong enough in the least remote community.

In summary, key elements for policy highlighted in this research are the need to differentiate the special context and cultural characteristics of rural communities before implementing development programmes and projects. A second important element for policy is established by Mog (2004) when he pronounces the need to consider a *process of development* within the rural area, which is particularly relevant considering Sayer’s (2004) suggestion about the need for integrated management of natural resources. It is likely that the livelihood strategies and natural resources of the case communities incorporate several opportunities for the people to create sustainable livelihoods and preserve their natural resources if these concepts are implemented.

6.3.2 Policy for enhancing rural livelihoods and natural resources on Chiloé Island

Finally, a selection of strategies that are likely to improve the livelihoods of the local rural communities of the area of study and enhance the sustainability of the natural resources of Chiloé Island are suggested. These proposals are based on current literature about natural resource management and rural livelihoods, and based on the results of this research which takes into consideration the specific context of the case communities studied.

Rural development initiatives aiming to create sustainable livelihoods and natural resources on Chiloé Island should take into consideration the following recommendations:

- Find a solution to the land tenure problems where they apply, securing access to natural resources.
- Incorporate external field consultants who are aware of the complexity of the rural communities (institutional arrangements enabling natural resource access, diversity of the livelihood strategies, local people's perspectives of the problems). Similarly to what Sayer (2004) suggests, external development agents need to spend enough time in the field to create integral solutions through learning from people's perspectives, vulnerabilities, and strengths.
- Work on group organisation skills (i.e., leadership, group responsibility, value of the common benefit, etc.) of rural communities, as basic elements for future development.
- Similarly to Mog's (2004) and Armesto's (2001) suggestions, this research found that participation and empowerment of rural communities must be encouraged, generating solutions that come from the communities themselves, with the incorporation of external advice and expertise in a learning and adaptive process.
- As Farrington (2001) and Rahman (2001) propose, the results of this research suggest promoting the production of goods and services that have secure markets. The economic return is a major factor ensuring the sustainability of livelihood option. Developing markets for forest products (timber and nontimber use) is a key factor to increasing the value of native forests for rural

households. There is a need for more research about possible uses of timber, commercial rotations length, and management strategies.

- Armesto (2001) suggests that there is a need for government policies to support local development, and government incentives for the sustainable use of native forests. Armesto (1996) states that native forests in Chile were left aside from the general productive development of the country, and in many cases degraded through the wrong use of governmental subsidies that encouraged the plantation of exotic species such as *Eucalyptus globulus* and *Pinus radiata.*

- Communal forests or extractive reserves (Armesto, 2001; AIFBN, 2003), have been suggested as good alternatives in cases where the forested surface is divided among many users. This is the case of Chiloé Island. The small size of the forested land accessed by the rural households increases the management difficulties, and to be economically and biologically sustainable there is a need to manage greater surfaces.

- As described in this research, firewood is traditionally the main source of energy of the Island and the current main use of the native forests. Firewood is a renewable source of energy and, if well managed, can have positive impacts on the local economy, preserve the local traditions, and would not impact negatively on the forests. Alternatives suggested by key informants of this research include:

    - firewood certification through forest management schemes,
    - dry wood availability: selling dry wood is important as it increases the energetic value of the wood, and reduces the air pollution,
    - insulation of houses: is a key factor in the efficient use of the resource,
    - double combustion ovens: is also a factor in the efficient use of firewood, while it reduces the emissions of smoke and pollution to the air.

- Agriculture has the opportunity to produce “green” products because of the isolated context of the Island which is characterised by the use of a low quantity of chemical fertilisers and pesticides. The use of principles of “best practices in agriculture” and sustainable agriculture (as suggested by Ellis, 2000), or

organic agriculture are real opportunities for the economic future of the island, as well as the environmental sustainability of the management practices. These principles can add value to the local production, be closer to the traditional practices they use, and will not affect in a negative way the local livelihood strategies.

- Rural communities that live close to marine resources (e.g., mussel beaches, shellfish areas, fishing spots, etc.) should have rights to use the resources in an exclusive way, finishing with the current open access situation. In this way marine resources can be sustainably managed and populations can improve their conservation state.

❖ CHAPTER 7. SUMMARY AND CONCLUSIONS

7.1 SUMMARY

In this section the aim and objectives are summarised, the selected methodological approach is reviewed and the main descriptive findings about the local rural livelihoods and the sustainability of the current natural resource management practices are summarised.

- **Aim and objectives**

The aim of this research was to understand how to enhance the sustainability of rural livelihoods and the local natural resources on Chiloé Island. In order to answer the research question two main objectives were achieved: first, the key factors influencing sustainability of the rural livelihoods and natural resources were determined, and second, the relevant strategies that would help to improve the livelihoods of the local people and the management strategies of the natural resources were identified.

The first objective included three subobjectives that were achieved after the analysis of the data: (i) the description of the local livelihoods, which was obtained following the guidelines of the sustainable livelihood approach; (ii) the assessment of the level of dependency on natural resources, which was acquired after analysing the main activities and sources of income of the rural households; and (iii) the determination of the sustainability of current livelihoods and natural resources, which was achieved based on sustainability indicators obtained from the agroecosystem analysis, the framework for evaluating sustainable land management, and other research carried out in this field by other authors.

- **Methodology**

An embedded multiple case study design was used in this research. Two rural communities were selected for the study. The selection was based on key informants and prior knowledge of the area. Location, rural conditions, closeness to native forested areas, and dependence on natural resources were part of the criteria of selection. The communities are located in the Chonchi Municipality on the main Island of Chiloé, close to the Chiloé National Park, sharing an extensive area of native forests, and are part of the same geographical catchment.

Each community constituted a case study, and taped in-depth semistructured interviews were used to collect data in each community. Sixteen interviews in the isolated Rahue - La Montaña community and thirteen interviews in the less remote Quiao community were carried among the local households.

The literature suggests that households are the most appropriate social unit for investigating livelihoods. Households were sampled using the snowball technique for locating information-rich informants after interviewing key informants and other households. Thirteen key informants were interviewed at the governmental level, civil sector, and community level adding information about the external context of the case communities.

Assessment of the research methodology

In this research a case study design was selected using qualitative analysis techniques, because of the requirements of in-depth information for the livelihood analysis. The main aim was to investigate factors that influence the complex sustainability context of the rural areas and natural resource management. The findings reinforce the usefulness of the case study design, as they show the importance of the local context, the significance of the specific cultural and traditional institutions in each community, and the several connections between the factors that influence sustainability in rural areas. These are all findings that in a survey design would have been difficult to accomplish.

The selected methodological design presents limitations in terms of generalisation. Case studies can be generalised and compared against theory, but not against populations. With the selected design, generalisation is limited to the interviewed communities of Chiloé Island; however the theoretical framework becomes a vehicle for generalising to new cases (Yin, 1994).

As research project aiming at a holistic and integrated analysis of two rural communities and their relation with the natural resource endowment, the use of the livelihood approach as a guiding tool for the data collection proved to be beneficial. It provided a rich framework within which to describe the rural communities and determine their level of dependence on the natural resources. This was used as a baseline for further sustainability analysis.

In terms of the assessment of the sustainability in rural areas, the selected methodology was properly chosen to maximise the time and budget that were available for this research. In that sense, the present research focused on *household*

views about sustainability of the livelihood strategies and the natural resource endowment. However, research aiming an in-depth sustainability analysis of natural resources would need extensive field-work time and research based on thresholds and quantitative indicators.

Interviews were designed to cover several aspects aiming to gather data at the household level, stressing the capturing of the perspective of the local communities about their livelihoods and their natural resource endowment. This allowed a rich study of the local perspectives about sustainability. Additionally, data input from key informants was important to generate information about the local organisational context and the natural resource condition of the area.

The sampling methodology started as a snowball sampling technique; however it ended by covering the majority of the community households. The snowball sampling proved to be useful at the first stages of the data collection process, allowing a better overview of the different households within the community. In later stages of the data collection, because of the small size of the community it was reasonable to cover a wide range of households aiming to increase the validity and accuracy of the results. Male and female household heads were interviewed, rich and poor households were considered, and the less participative and more disadvantaged members of the community were taken into consideration. This allowed a broad range of responses.

In qualitative research the researcher becomes deeply involved in his/her task. In this case the researcher has known the area of study since 1992, has worked with the communities before (through the local council and local NGOs), speaks the same language, and was aware of the culture and traditions of the communities. This generated a better understanding of the local context and conditions, and enabled him to be attentive to search and find for new elements, factors, and insights that were included in this research.

- **Rural livelihoods and natural resource sustainability**

This research highlighted the fact that small farmers of Chiloé Island utilise forests, agricultural, and marine resources using low levels of technology, low inputs of capital, high inputs of household labour, and using limited or no specific conservation practices. Chiloé Island communities are similar to other poor communities in low income countries who are reliant on natural resources, in that their current situation is difficult in terms of financial viability, agroecosystem productivity, the ecological integrity of their practices, and the stability of their livelihood strategies.

Contrasting with this negative assessment of the current situation in rural areas, this research highlighted the fact, that from the small farmers' point of view, they are generally aware of the fragility of the surrounding natural resources, and they have a positive outlook for future livelihood alternatives, such as sustainable native forest management and tourism.

- **Dependency on natural resources**

Both case communities depend on natural resources for their livelihoods. The natural resilience of Chiloé's rural areas is tied up with the forests. Native forests, as sources of firewood and construction material for fences and housing, are an integral element of the livelihood strategies of rural communities. However, several factors affect the sustainable use of native forests: first, the small areas of forests that households access make any attempt at silvicultural management economically and biologically unsustainable; second, the difficult location of forests makes the resource expensive to transport; third, the market for native timber is not well developed; and finally, the organisation context (legislation, governmental agencies) does not encourage the sustainable management of native forests for the benefit of the small farmer.

All households practise a certain level of agricultural production for their own use. Agricultural products such as potatoes (main staple food), minor livestock (pigs and poultry), sheep (meat and wool), and the vegetable garden contribute to great extent to the household's food security. Livestock (cattle and sheep) are seen as a source of investment and saving, reducing the vulnerability of the households. In terms of economic productivity, traditional agricultural products face low prices and their relative isolation from the markets generates difficulties for the households. Small farmers who have improved pasture management, have better access to financial capital, and have a hard working disposition, are able raise cattle and sheep with positive economic return.

Marine resources are important for the communities of Chiloé Island as mussel and shell-fish are important parts of the diet. For the communities close to the sea, see-weed gathering, mussel collection and gold mining are significant parts of their livelihood strategies.

7.2 CONCLUSIONS

The current modernisation process being experienced by low income countries has affected traditional livelihood strategies of rural areas, generating an urban-biased development and a dependence on cash income. Traditional culture and traditional livelihood strategies in rural areas of Chiloé Island are continuously changing and influencing the sustainability of local livelihoods and natural resources. New generations are undervaluing farm life, making them move away from rural areas, and look for a better future in the cities.

Local livelihood strategies and natural resource management practices currently used in rural households of Chiloé Island are unsustainable, affecting the financial viability and stability of the rural households, decreasing farm productivity, and affecting the ecological integrity of the natural resource endowment.

The sustainability of rural livelihoods is closely linked to the sustainability of natural resources. Economic, social, and environmental factors are strongly linked in rural areas, which means that development initiatives in rural areas should apply a holistic and integrative approach to achieve livelihood and natural resource sustainability.

In order to enhance the sustainability of rural livelihoods and natural resources alternative development options need to be considered. These options include several trade-offs between economic, social, and environmental factors. One of the key elements to be considered aiming to implement these options is that each rural community is different and is immersed in a special context.

The specific context of each rural community determines relevant factors that need to be considered if sustainability of livelihoods and natural resources has to be achieved. These context-specific factors resolve on different development options for each rural community. These factors include:

(i) **location** which determines the diversification opportunities, access to markets, access to information, access to educational facilities, infrastructure, and the relative pressure on natural resources.

(ii) **secure land access** which ensures ownership of the natural resources (which allows a long-term perspective over the resources), reduces households' financial vulnerability, and has social equitability implications for the rural community.

(iii) **culture, traditions, and local institutions** must be considered as context-specific factors that appear to be determinants of how small farmers in rural areas respond to policy and development initiatives.

If sustainability of natural resources and local livelihoods on Chiloé Island are to be enhanced, the economic situation of households needs to be able to be improved through better access to the markets, increasing the diversification opportunities for the households, and adding value to the local production based on natural resources, rather than degrading the natural resource endowment.

Social and human capital expressed by community cohesion and education are relevant to the achievement of sustainable livelihoods, and in addition, they influence perspectives on the management of natural resources.

Natural resource sustainability is influenced by the management strategies that rural households adopt to generate a living from the available resources upon which they are dependent. Management of natural resources is greatly influenced by the traditional knowledge communities have about the resources.

Rural communities support the idea of an active involvement in projects and programmes aiming to increase the participation and ownership by the communities of these initiatives.

7.3 FURTHER RESEARCH

Further research aiming to enhance the sustainability of rural areas and the local natural resources should integrate at the practical level the management of natural resources and livelihood strategies of rural communities. Field-level alternatives should be investigated in more detail, considering specific context and cultural factors within the rural community. Further research should devote extra attention to the influence that local institutions have over rural livelihoods' outcomes and natural resource management practices.

Considering the context of the case communities, most of the traditional practices of rural households on Chiloé Island could be adapted towards sustainable management practices by incorporating simple conservation strategies. There is a strong need to understand how forests can be managed incorporating sustainable practices and creating markets for forest products. This process needs to include rural farmers, encouraging participation, and increasing the ownership of the alternative solutions by the rural households. The current challenge is set up for the governmental extension agents, local NGOs, and research centres: to ensure that locally applied research, development projects, and programmes create further positive impact, by integrating the various elements described in this research, incorporating environmental concerns at the practical level while targeting solutions that create sustainable rural development.

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ANNEXES

ANNEX 1. AGROECOSYSTEM ANALYSIS

This annexe present details about the agroecosystem framework. The basic concepts as explained in chapter two and three of this approach were used in this research.

The aim of this approach is to create a process to relate the sustainability vision and goals for the farm, with the opportunities and constraints provided by the human, capital and biophysical resources of the farm and the wider community (Conway, 1985; Kelly, 1997).

The Analysis can be diagrammed in a serial of steps that are exposed in figure A. The steps are:

Objective/Vision: The first step is to establish the priorities that can lead to improve stability of productivity (income for farmers, or biodiversity for natural systems). It is considered by Kelly (1997) as a sustainability vision, as a statement of what is desired without a reference to how the result will be obtained.

System Definition: system boundaries and hierarchies should be identified. One household could be dependent more than only on their land; some members could have their income coming from far away sources. This can also be done in a form of an inventory of resources available to the system, including land use capabilities, constraints, and main hierarchies of the system.

Pattern Analysis: Four patterns can reveal key functional relationships that determine system properties. Space, time and flows are relevant for both human and natural aspects of the system. Decisions reflect the management alternatives or strategies chosen by the people. The concordance of each pattern with aspects of the SLA framework is established in the following list:

- *Space* is revealed better by maps and transects showing geographical aspects. This is similar to the assets component (natural capital) of the SLA.
- *Time* is expressed well by simple graphs like for example seasonal map showing crop calendars relating different parameters such as labour peaks, prices etc. Time is also considered in the timeframe of the SLA.

- *Flows* showing transformations of energy, materials, money, and information, all of these expressed in flow-diagrams for the major causes and effects and for the presence of stabilising or destabilising feedback loops. This pattern can be and included in the trend and shock analysis of the SLA.

- *Decisions* can range from national to individual, expressed by decisions trees revealing goals and constraints and through spheres of influence identifying critical decision makers. The opportunities identified before can be related to long and short term goals for the system. The decisions are reflected in the Livelihood strategies present in the SLA.

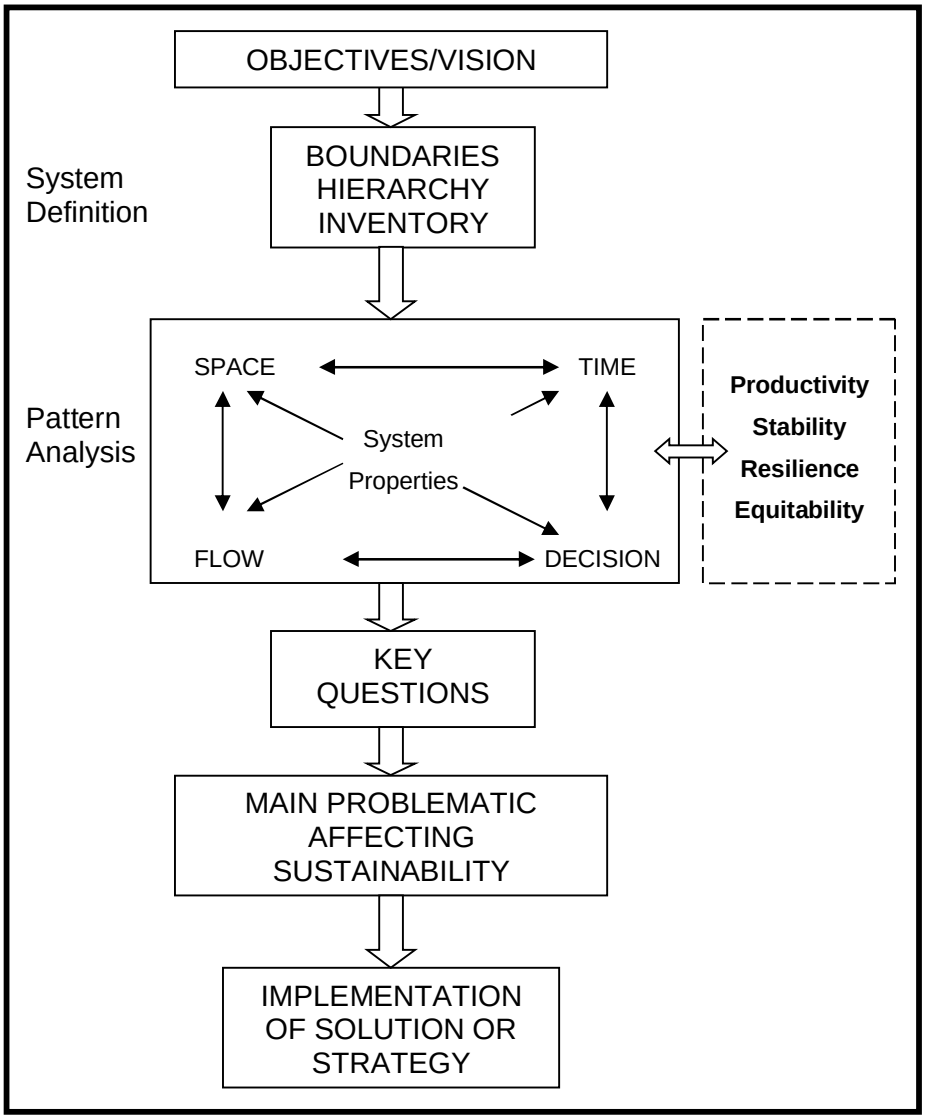


FIGURE A. Basic steps of the procedure for the agroecosystem analysis.
(Source: Conway, 1985; and Kelly, 1997)

System Properties: the properties of the system should guide the form of pattern of analysis. The system properties indicators are presented in annexe 3 (TABLE A), showing productivity, stability, resilience, equitability and their related factors that are determining the agroecosystem. Not all the potential sustainability indicators are relevant for all the situations.

Key Questions: reveal the main problematic of the agroecosystem, gaps in research, and new hypothesis. This also will identify the main management options for achieving sustainability.

Strategy and final assessment of sustainability using this approach must be context specific, holistic, considering historic trends and future projections. A sustainable agroecosystem must be productive, stable, resilient and equitable in each of the biophysical, financial and socio-cultural environments.

ANNEX 2. FESLM

This annexe presents a detailed figure of the framework for evaluation of sustainable land management, of which concepts and indicators were used in this research.

Figure B shows the process of the FESLM approach. It can be divided in two main stages, one that answers “What” is to be evaluated (called: “Purpose”), and a second stage which defines the process of analysis and “How” the evaluation is done.

Purpose:
Objective and Mean define a specific land use, or in case of this research could be understand as a livelihood strategy.

- The *objective* identifies the land use system to be evaluated in terms of it purpose, location and the time of period for sustainability.
- *Means* refers to the management practices to be employed to attain the objective. This includes practices such as crop rotation, low or high input systems, high capital or labour systems, use of chemicals, etc. If the use is unsustainable, some of the practice or management aspects could be changed.

Analysis:

- *Evaluation factors* identify the qualities, attributes, processes controlling interests or constraints which affect sustainability. It is important to consider the Relevance, Stability and Predictability of each of the factor considered in the analysis. Table A show a summary of factors to evaluate physical, biological, economic and social aspects.

- *Diagnostic criteria* refer to the causes, effects and observations, and identify how the selected evaluation factors impact on sustainability. The procedure goes as follows: firstly with the observation of present evidence; secondly with research of historical evidence; thirdly with a spatial comparison with other geographical evidence; and finally modelling theoretical projections. Stability for the evaluation factors is evaluated in all of the steps. The criteria need an understanding of the causes and effects to interpret factor relationships and interactions that determine stability and the direction of change. There are also useful to provide predictions on the future status.

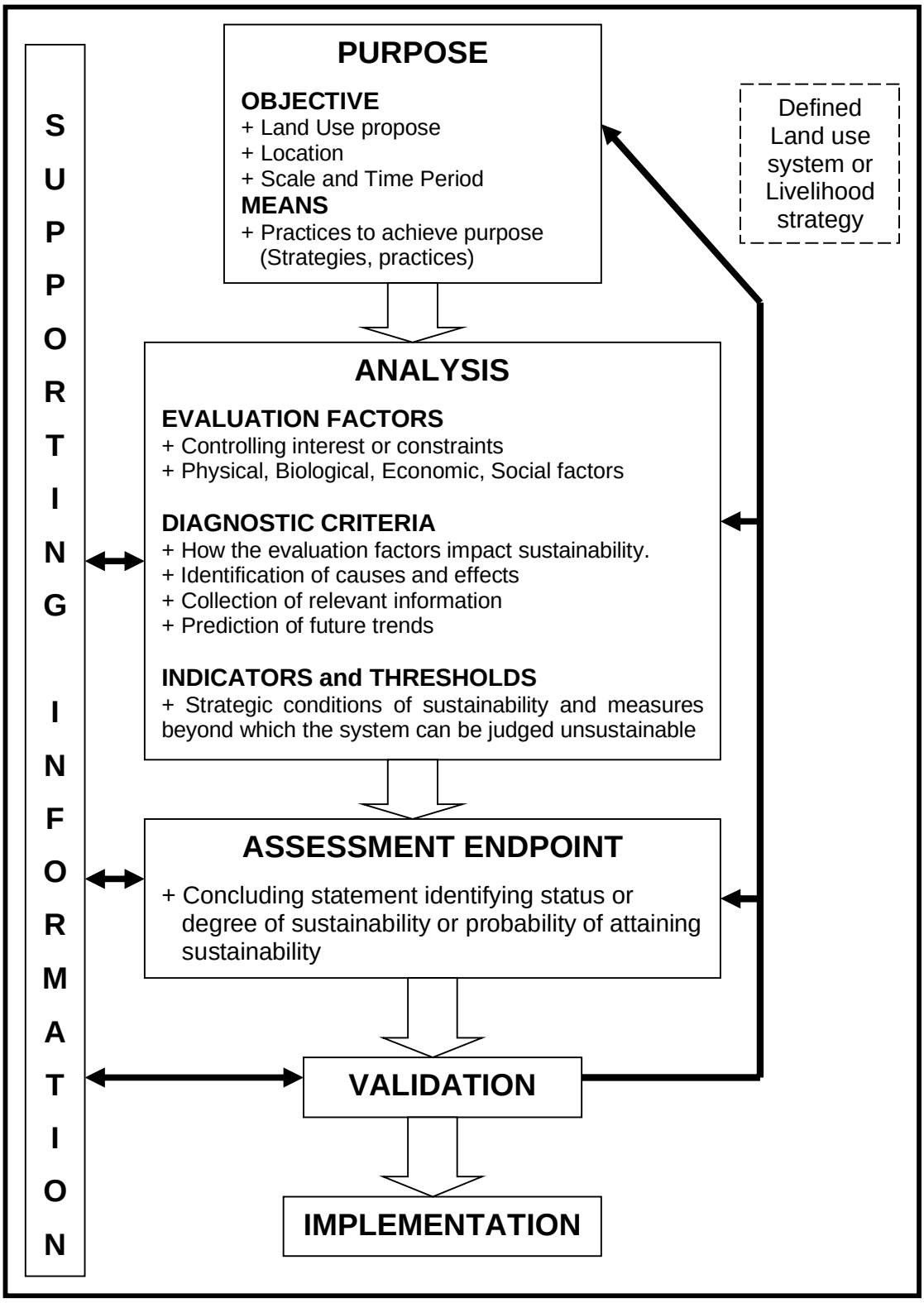


FIGURE B. FESLM: Framework for evaluation of sustainable land management.

(Source: FAO, 1993).

- *Indicators and thresholds* identify measurable or observable attributes which reveal the future status or condition of the evaluation factors. Evaluation Factors that affect more the sustainability of the system are selected and a threshold is established. This will give a certain idea of the sustainability or un-sustainability of the system

Assessment Endpoint:

A projection for the system is established after the latter analysis. The timeframe must consider global trends and possible effects of these factors (climatic change, population, AIDS, etc). The criteria for evaluation are compared against the thresholds for each indicator. If the status of one indicator falls bellows a certain threshold, the system is unsustainable. Care must be taken in judging the *reliability* and the *significance* of each factor. After individual analysis of each factor, the system can be classified. The confidence of the classes of sustainability and the timeframes that they involve are difficult to evaluate. Class placements should not exceed what is reasonable in terms of data reliability (FAO, 1993).

ANNEX 3. RESEARCH INDICATORS

This annex presents the specific indicators that the literature identifies for the use while applying the sustainable livelihood approach and indicators for the sustainability analysis based on the agroecosystem analysis and the FESLM.

❖ Sustainable livelihood indicators

The theoretical concepts and elements of the livelihood analysis were introduced in the second chapter (section 2.3.1). The sustainable livelihood framework was used to describe the current state of two rural communities in Chiloé Island. A complete set of data: income portfolios, assets, the vulnerability context, and processes and structures that affect or benefit the livelihood strategies adopted was collected, analyzed, and finally discussed. The SLA provides a way of organizing the analysis by identifying the main components and encouraging critical thinking about the links between the factors (Ellis, 2000). The SLA framework can be used as a checklist of issues to explore, aiming to show the important connections and relations.

Data collection issues

A full range of quantitative and qualitative information needs to be recollected for the analysis of the sustainable livelihoods. Several authors establish that a large budget research should be not always necessary (Scoones 1998; Ellis, 2000). However, Scoones (1998) is more pessimistic by stating that even a major field effort may be insufficient to uncover all the aspects of sustainable livelihoods at a given site. The solution to this dilemma is to identify the major tradeoffs between for example: types of assets (capital), livelihood strategies and sustainable livelihood outcomes; for different groups of people, considering scales and site conditions. Scoones (1998), Brock (1999), and Ellis (2000) agree that the concept of “optimal ignorance” should be applied; that means a conscious avoiding of irrelevant information that is superfluous to the needs of the project. The focus should be only in what is really necessary to collect, only useful data; which reflects the objectives and focus of the research. Priority areas and main concern can be established with key interviews, focusing the following analysis in the particular problems and constraints of the community. Irrelevant information is left aside.

SLA – Relevant indicators and application

Rural livelihoods can be studied using descriptive quantitative data (main activities, income portfolio, seasonal calendars, environmental indicators, etc) and also in depth qualitative data (social relations and cohesion, relations between culture/traditions and natural resources, etc). At a practical level this framework means (Elliot, 1999):

- Analysis of people's livelihood and how they change over time.
- Special focus in the household and the life-cycle within it.
- Full involvement of people and their views. Peoples priorities first.
- Focus on the impact of policies on people and the dimensions they define.
- Stressing the importance of influencing these policies and promoting an agenda for the poor.
- Works to support people to achieve their own livelihood goals.
- A dynamic tool, which stresses a learning process approach.
- Sustainability through self help (people must have interest, participation must be voluntary, except in the case of very impoverished people, where some inducement or subsidy can be used)

The outcomes of the livelihood strategies can be assessed based in five key elements that the sustainable livelihood approach encompasses (Scoones, 1998):

Creation of Working Days: ability of the livelihood strategy to create gainful employment for a certain portion of the year. This is related to income generation, productivity and the recognition that the employment is worthwhile. It is suggested that 200 days a year can be used as a minimum.

Poverty Reduction: Poverty levels are key criteria to the assessment of livelihoods. Poverty Lines or consumption levels can be used as indicators. Inequality can be measured by Gini Coefficient.

Well-being and capabilities: capabilities by Sen (1984, 1987; cited by Scoones 1998) are "what people can do or be with their entitlements", a concept that encompasses more than only material concerns of food intake or income. Well-being is related by Chambers' (1997) views as self-diagnostic criteria by the poor people of the relevant indicators.

Livelihood adaptation, vulnerability, and resilience: it refers to the ability of the livelihood to recover from stresses. Those who are unable to cope (short term), or to adapt (long term strategies) are more vulnerable and unlikely to achieve sustainable livelihoods.

Natural Resource base sustainability: Rural livelihoods are dependent at least to some extent in natural resources. The depletion of natural resources must be avoided. Natural resource sustainability can be measured linking indicators of resource depletion and accumulation (e.g. soil fertility, vegetation cover) to both the temporal dynamics of system resilience (e.g. the ability to recover from disturbances) and the livelihood needs (e.g. assessment of whether natural resource change results in 'effectively permanent declines in useful products or services').

Some of these indicators need precise quantitative techniques and other more broad and diffuse qualitative assessment.

❖ Sustainability Analysis

This research combines the analysis of socio-economic aspects of rural livelihoods and natural resource management in rural areas. The sustainability analysis aims to assess, using adequate indicators, the sustainability of rural livelihoods and natural resources.

Sustainability analysis needs a strong baseline study to reach the expected results (Blaschke, 1991). The analysis of rural livelihoods in Chiloé Island using the sustainable livelihood approach as a guiding framework will give this strong baseline for the sustainability analysis.

The results obtained from the livelihood analysis (i.e. current livelihood strategies of the rural communities in Chiloé) will be analyzed using socio-economic data and several additional environmental indicators, to assess the sustainability of these livelihood strategies and the natural resources available for the communities.

- **Sustainability Indicators**

Different approaches to sustainability indicators

A simple definition of an indicator is a measure of something in which one has an interest, but which is difficult to monitor exactly (Rigby, 2001). Many authors assigned a quantitative role to indicators, however several other authors regard qualitative indicators as valid tools. Rigby (2001) suggest there are few published examples of farm-level indicators of sustainability.

The selected indicators used in this research were obtained from the agroecosystem analysis and the FESLM framework. These indicators are related to the sustainability properties described in chapter two (section 2.3.2, summarized in figure number 7). The sustainability properties are the key element in the analysis of sustainability in this research.

In terms of indicators for sustainability analysis the literature suggest different perspectives. One is based on indicators and thresholds (FAO, 1993; Pacini *et al*, 2003), and others use indicators but based on predictions (Conway, 1985). The first perspective is used in the FESLM analysis and it is based on a set of indicators, criteria and thresholds. ***Indicators*** reflect the environmental status or change in condition (ea. erosion per ha); ***Criteria*** are standards or rules (models, tests, measures) that govern the judgements on environmental conditions (ea. water quality); ***Thresholds*** correspond to the levels beyond a system undergoes significant change; in other words points at certain stimuli or shock provoke a response.

The second perspective is based on the creation of different indexes, based on local conditions rather than in impacts, evaluating sustainability based in future prediction (Conway, 1985; Rigby *et al*, 2001; Engel *et al*, 2003). This research will be based on this approach, due the time limitations, budget restrictions, availability of secondary data, and the need to interpret the local perspectives of sustainability.

Relevant Indicators

Based on the agrosystem approach, the FESLM framework, and taking the Sustainable Livelihood Approach (SLA) as source of the baseline information on the rural communities, relevant indicators for evaluating sustainability of rural communities are proposed.

Table A defines possible indicators for the different properties of the ecosystem. These indicators are the base of the sustainability analysis of the ecosystem. Linkages between these properties are complex and can involve significant trade-offs between them. For example a rural development project can generate great productivity at expenses of resilience and equitability, or too much emphasis in equitability may inhibit productivity. In this table, Rigby *et al* (2001) identifies some interesting indicators that could be applied to the rural context in Chile and to the qualitative nature of this research.

Maximizing one or other these properties (productivity, resilience, stability, equitability) generates different trade-offs in an agroecosystem, reflecting different priorities. These can be seen as an agroecosystem strategy (Conway, 1987; Kelly, 1997) or in the case of this research a livelihood strategy. This analysis involves value judgement and qualitative assessment. In most cases to reach sustainability, there is a need of productive systems and management practices that generate systems with high quality properties and where the trade-offs are minimized (Conway, 1994; Kelly, 1997).

Table B shows another set of indicators organized under physical, biological, economic and social perspectives. These indicators can also be used to evaluate sustainability of Rural Livelihood strategies, however these indicators are context dependent and not all of them are useful in the context of Chiloé Island.

The data requirement section (section 3.2) describes the selected indicators that were used in the data collection of this research.

TABLE A. Properties of the Agroecosystem and possible Indicators (Source: Conway, 1987; Kelly, 1997; and Rigby, 2001)

PROPERTY OF THE AGROECOSYSTEM	**INDICATOR**
PRODUCTIVITY	+ Yield per hectare (harvest history) + Total Production of goods per household + Employment generation + Enhance farmer's quality of live (Rigby, 2001) + Meets social needs for food. (Rigby, 2001) + Generation of Aesthetic value (social, psychological and spiritual wellbeing) + Fertility (soil test, balance of nutrients) + Maximize use of natural biological processes + Minimize off-farm inputs (non renewable sources) + Maintaining Biodiversity and Environmental quality + Accessibility to markets, roads, credit + Use of technology (Fertilizers)
STABILITY	+ Variation in productivity (time series) + Integration of crops + Crop rotation + Irrigation + Increase of farmers self reliance
RESILIENCE	+ Protection from the shock (how much shock generates a decrease in productivity) + Likelihood of severe shocks + Salinity + Erosion + Declining market demand + Indebtedness + Flood, earthquake + Financial : debt to asset; debt to income ratio
EQUITABILITY	+ Distribution of the total production + Gini coefficient + Lorenz Curve + Village cooperation + Communal Organizations

TABLE B. Evaluation Factors for the FESLM analysis (Source: FAO,1993; and Kelly 1997)

FACTOR	FACTOR GROUP	INDICATOR
PHYSICAL	Topography; Climate; Pest and diseases; Erosion; Soil degradation	*Referring to quality of the factors*
BIOLOGICAL	PRODUCTIVE BIOTA (Crops, livestock, timber trees) BENEFICIAL BIOTA (Positive contribution to sustainability) DESTRUCTIVE BIOTA (weeds, pathogens, pests)	Yield (kg, tons, m^3); Biomass per area; Area occupied (cover) Yield (kg, tons, m^3); Biomass per area; Area occupied (cover) Intensity; Number per area; Biomass per area
	DIVERSITY (Biodiversity and system complexity have a role in sustainability)	Frequency; Abundance
	SPATIAL AND TEMPORAL RELATIONSHIPS (Description in time and space of the interactive influences)	Structure of the system; Seasonality ;Trends; Oscillations
	OFF-SITE EFFECTS (There are highly interactive capabilities in the organisms that have off-site influences)	Nutrient transfer; Movements of pest / animals
ECONOMIC	RESOURCES (Assets of the household, access to resources) + Land + Labour + Capital + Knowledge + Efficiency	 Farm size Availability, Seasonability Return, Options Literacy rates, Access Land/labour, Capital/labour
	ECONOMIC ENVIRONMENT (Factors external to the household environment. They are 'given' for a particular area) + Production Costs + Product Price + Credit + Markets + Population	 Levels, stability Levels, stability Availability, types, Interest rate. Infrastructure, access, Distance Level, Migration, Change
	ATTITUDES (Household members and their decision making process) + Objectives + Risk aversion + Expectations	 Utility, Risk reduction, Safety, Planning. Coefficients of absolute/relative/partial risk aversion Yield/price expectations

	COMPLEX QUALITIES (Composite factors defining system performance) + Income + Profitability + Consumption + Poverty Indices	Household Income; Income per head; Off farm Income Net farm income; Gross margin/ha; Net Returns/ha Total Consumption; Proportion spend in food % of total consumption on Food and nutritional Adequacy
SOCIAL	MACRO-SOCIAL, ECONOMIC, POLITICAL FACTORS	Social Justice; Equity; Participation; Democratic Institutions
	POLICY ENVIRONMENT: (Legal fiscal and Regulatory Framework)	Appropriate Incentives; Control Structures; Promotion of Sustainability
	PHYSICAL and STRATEGIC NEEDS	Opportunities; Distribution of wealth
	RESOURCE AVAILABILITY (To population overall needs)	Existence of Mechanism to reduce pressure on and use systems
	CONFLICTS (Over resources use)	Extent of conflict; Conflict resolution mechanism; Social participation in decision making.
	ACCESS TO RESOURCES (And the Output of production)	Equity of Land tenure; Access to credit; Gender Equity
	COST OF SUSTAINABLE BEHAVIOUR (through social investment)	Existence of Transfer and compensatory mechanism
	LOCAL AFFORDABILITY of SUSTAINABLE BEHAVIOUR	Labour Requirements, material and other costs within those immediately affected
	SECURITY AND LEVEL OF RISK	Risk reduction; Increase of opportunities
	ATTITUDE CHANGES (Knowledge, beliefs, values)	Investment in environmental education; Communication
	SOCIO-CULTURAL ASPECTS	Local Participation; Fitness with local knowledge, values, beliefs

ANNEX 4. DATA REQUIREMENTS AND INDICATORS USED IN THIS RESEARCH

Different kinds of data are required to carry out the livelihood analysis and to analyze the sustainability of the rural livelihoods. Based on the theoretical framework presented in the methodological chapter, and the suggestion made by the literature and that were presented in annexe 3, this section includes a detailed list of indicators and data that were used in this research. It has been obtained from the research of several authors (Conway, 1985; FAO, 1993; Kelly, 1997; Ellis, 2000; DFID, 2001; Cahn, 2002; Lev-Wiesel, 2003).

❖ Livelihood Analysis

The livelihood analysis aims to describe the current livelihoods strategies and their context, as established in the SLA Framework presented in figure 2.4 (section 2.3.1). The indicators listed here were used to describe the livelihood strategies adopted by the households.

- ***Income Portfolio:***

Percentage of income that derives from each of the following activities:

Natural Resource Based

- Subsistence production (as contribution to income)
- Livestock Income
- Marine Products
- Forest Based
- Farm/Agricultural Income
- Handicrafts sales

Non Farm

- Wages
- Rental Income
- Remittances
- Other Income

- ***Assets access:***

Physical Capital	Water (access to clean water)
	Energy (connected to supply)
	Roads (public transport, road quality)
	Infrastructure (heath-post, schools)
Natural Capital	Productive Land (Own, tenant, illegal),
	Forests (own property, open access)
	Sea Border (access to it)
Social Capital	: Community Groups (participation in groups, sense of belonging, solidarity)
	Social networks (community support, communal work)
Human Capital	: Literacy, (educational level)
	Health (disabilities, ability to work)
	Skills (studies, special training)
Financial Capital	: Credit (access and availability)
	Savings (access)
	Remittances (access)

- ***Vulnerability Context:***

Main shocks, trends, and seasonability factors that affect the household during the year are considered in this section. Historical trends and perception about the future were also researched in this set of data.

Shocks	: Climatic and Natural; Social
Trends	: Economic Changes, Population, Governance.
Seasonability	: Agriculture Prices, labour, Food supply

- ***Processes and Structures:***

The community was asked about the main organisations, governmental agencies, programs, projects and laws that affect or benefit the household. The organisations and governmental agencies were asked how they collaborate with rural communities.

Structures	: Public sector: political bodies, state bodies
	Private Sector: Civil society, NGOs, Commercial enterprises.
Processes	: Policies, Legislation, Institutions, Culture, Power Relations.

All these indicators generated data for the analysis of livelihoods of the rural communities in Chiloé. After defining the mayor characteristics of the different livelihood strategies used in Chiloé, a sustainability analysis was carried out.

❖ Sustainability analysis

The main components of the sustainability analysis are the system properties of a rural livelihood as were described in chapter two: productivity, stability, resilience, equitability, viability, acceptability, and ecological integrity.

The main indicators to assess sustainability of Agroecosystems and their related livelihoods are given by literature such as Conway (1985), FAO (1993), Kelly (1997), Hussein (1998), Pacini (2003), and Rigby (2001). Some examples used in this research are:

- The inability to replace lost nutrients is commonly the problem in many farming systems in developing countries where production is primarily for subsistence (Kelly, 1997; Rigby et al., 2001).
- The dependence on external support for livelihood diversification and enhancement is unsustainable (Hussein, 1998)
- Rigby et al., (2001) identifies interesting indicators from the literature: Soil erosion control and awareness; enhancement of the quality of live of the farmers (perceptions), improvement of equity; meeting of social needs; minimal input of off-farm resources
- Principal environmental threats in rural areas regarding sustainability (Pacini et al., 2003): Nutrient loses, soil erosion, biodiversity loss.

The sustainability analysis was divided in the three main dimension of sustainability: economic, social, and environmental factors. The indicators used in this research to analyse each of this components are listed:

- ***Economic aspects***
  - Income Generation over the poverty line (Productivity,Viability)
  - Livelihood strategies that fulfils the needs and expectations of the household (Economic Acceptability)
  - Variability of the production (Economic Stability)
  - Economic Recovery after shocks (Resilience)

- ***Social aspects***
  - Perception of long term sustainability of the household livelihood strategy. (Social Acceptability)
  - Improvement over the future of educational level. (Viability-Productivity)
  - Employment creation (Viability-Productivity)
  - Social recovery after shocks (Resilience)
  - Distribution of Land among the households (Equitability)
  - Dependence on external aid (Viability).
  - Sense of community belonging, solidarity (Lev-Wiesel, 2003) (Acceptability)

- ***Environmental aspects***
  - Energy consumption (firewood) balance. Comparison between what is available and what is consumed. (Integrity)
  - Stability of the food production. (Food security) (Stability)
  - Replacement of nutrients in agricultural land. (Integrity- Resilience)
  - Use of forest management schemes (Viability)
  - Soil Erosion (Integrity)
  - Pollution (water, air, visual garbage) (Stability-Integrity)
  - Environmental recovery after shocks (Resilience)
  - Biodiversity maintenance (availability/commonness of native and endangered species) (Productivity- Integrity)

ANNEX 5. KEY INFORMANT INTERVIEW GUIDES

This annexe presents the research instruments with the complete interview guides that were used during the field work among the two rural communities in Chiloé Island.

Key Informant Interviews

CONAF
INDAP
CHONCHI LOCAL COUNCIL
BMCH, CET, CONTODOS
COMMUNITY LEADERS

KEY INFORMANT INTERVIEWS

1. CONAF

Organisational Level: Governmental Agency

❖ Description of the Institution

CONAF (National Forestry Corporation): CONAF has the responsibility to protect the forests and manage the national parks. With communities living in forested areas, they work in programs of sustainable management of forests. CONAF is in charge of controlling the forest extraction and approve extraction schemes.

❖ Interview Guide

- ***Purpose of the Interview***
  - Background description of the community from the forest perspective for the case description.
  - Identification of the main environmental concerns to be considered in the latter sustainability analysis.
  - Identification of the main current programs, projects that the agency is running in the area, and their impacts on the community and forests.
  - Identify possible future strategies for sustainable development.
  - Gain access to secondary data about:
    - State of the forest resources
    - Ownership of forest (effects of Private Enterprises and Local communities)
    - Use of Forest management schemes

- ***Possible Questions and objectives of the question***

QUESTION	OBJECTIVE
What are the main trends that you see that affect or benefit the rural households in your area? In terms of: Increasing/decreasing poverty Educational level increasing. Productivity , prices, market possibilities Long term development and diversification	General background Information of the community and their trends. SLA Vulnerability context , assets access
What are the main Environmental concerns/threats in the area?	Background information Sustainability Analysis SLA Vulnerability context and secondary data gathering.
What are the trends in the use of the forest resource in Chiloé Island? In terms of: Increasing or decreasing of surface? Availability for the rural communities? Quality of the resource.	Background information SLA Vulnerability context and secondary data.
Describe the main projects, policies, programs that target rural communities.	Projects of CONAF in the area. SLA Processes and Structures
In your opinion what are the effects of this programs ……over the communities? …….over the forests?	Impacts of these projects SLA Processes and Structures and Future Policy implications
Do you know how many rural households are using forest management schemes?	Use of Forest management schemes. Sustainability Analysis and secondary data gathering.
What is the area of native forest under private/state management in the Chonchi municipality?	Ownership over the resources. SLA Natural Capital assets access and secondary data.
Could you explain the impact over the forests that rural communities have, compare to the private enterprises?	Analysis of impact of rural communities over the forest Sustainability Analysis and secondary data gathering.
Do you want to add something else, regarding the topics we covered today?	

2. INDAP

Organisational Level: Governmental Agency

❖ Description of the Institution

INDAP is the National Institute for Agriculture development. They run several programs that benefit the rural communities. For example they have micro-credit schemes, technical support at various levels, and grants for small farmers.

❖ Interview Guide

- ***Purpose of the Interview***
  - Background description of the community from the Agricultural perspective for the case description.
  - Identification of the main environmental concerns to be considered in the latter sustainability analysis.
  - Identification of the main current programs, projects that the agency is running in the area, and their impacts on the community and agricultural development
  - Identify possible future strategies for sustainable development.
  - Gain access to secondary data about:

    Mayor Agricultural Products, markets, etc

    Impacts of the Agriculture over the Native Natural Resources

- ***Possible Questions and objectives of the question***

QUESTION	OBJECTIVE
What are the main trends that you see that affect or benefit the rural households in your area? In terms of: Increasing/decreasing poverty Educational level increasing. Productivity , prices, market possibilities Long term development and diversification	Background Information SLA Vulnerability context and secondary data.
What are the trends in the use of the Agricultural resource in Chiloé Island? In terms of: Productivity , prices, market possibilities Long term development and diversification	Background Information SLA Vulnerability context and secondary data.
What are the main Environmental concerns/threats in the area?	Background information Sustainability Analysis SLA Vulnerability context and secondary data
Describe the main projects, policies, programs that target rural communities.	Main Programs of INDAP in the area. SLA Processes and Structures
In your opinion what are the effects of this programs? …..over the community? …..over the natural resources?	Impacts of these programs SLA Processes and Structures and Future Policy implications
What is the coverage of these programs?	Extension of the impacts of INDAP SLA Processes and Structures
What would you are the possible alternative strategies for rural households?	Future Policy Formulation SLA Trends
Do you want to add something else, regarding the topics we covered today?	

3. CHONCHI MUNICIPALITY

Organisational Level: Governmental level (elected local authority)

❖ Description of the Institution

The communities involved under this research are part of the area of the Chonchi council. The person in charge of department of Rural Development of the council will be interviewed.

❖ Interview Guide

- ***Purpose of the Interview***
  - Background description of the community from the different perspectives:
    - o Agricultural Development
    - o Forestry
    - o Social aspects
    - o Development of infrastructure/markets
  - Identification of the main environmental concerns to be considered in the latter sustainability analysis.
  - Identification of the main current programs, projects that the council is running in the area, and their impacts on the community and natural resources
  - Identify possible future strategies for sustainable development.
  - Check semi-structured interviews in terms of:
    - o Income ranges (poverty level, min income, etc)
    - o Tape record of the interviews?
  - Gain access to secondary data about:

    Social Condition of the communities (descriptive data from council surveys)

- ***Possible Questions and objectives of the question***

QUESTION	OBJECTIVE
What are the main trends that you see that affect or benefit the rural households in your area? In terms of: Agricultural/Forestry/Marine Resources Availability Infrastructure access (physical capital) Increasing/decreasing poverty Educational level increasing (Social aspects) Productivity , prices, market possibilities Long term development and diversification	Background information for case analysis. SLA Vulnerability context , assets access
What are the main Environmental concerns/threats in the area?	Background information Sustainability Analysis SLA Vulnerability context and secondary data gathering.
Describe the main projects, policies, programs that target rural communities.	Main interaction of the council with the communities SLA Processes and Structures
In your opinion what are the effects of this programs? …..over the community? …..over the natural resources?	Impacts of programs SLA Processes and Structures and Future Policy implications
What is the coverage of these programs?	Extension of the impacts SLA Processes and Structures
Can you supply this research with secondary data about: Social status of the researched communities Income Main Activities that they realize	Secondary Data for triangulation and description
What would you are the possible alternative strategies for rural households?	SLA Trends Policy Implications
Do you want to add something else, regarding the topics we covered today?	

4. CET, BMCH and CONTODOS

Organisational Level: Civil Society Organisations

❖ Description of the Institution

NGOs and foundations like CET (Centre for Studies and Technology) and BMCh (Model Forest Chiloe); are working in relation to the agricultural development, forestry diversification and supporting the rural communities with projects and grants to start small business or enterprises.

❖ Interview Guide

- ***Purpose of the Interview***
  - Background description of the community from the different perspectives:
    - Agricultural Development (CET)
    - Forestry (BMCH)
  - Identification of the main environmental concerns to be considered in the latter sustainability analysis.
  - Identification of the main current programs, projects that the council is running in the area, and their impacts on the community and natural resources
  - Identify possible future strategies for sustainable development.
  - Check semi-structured interviews in terms of:
    - Income ranges (poverty level, min income, etc)
    - Tape record of the interviews?
    - Structure of the household interview
    - Check some sustainability indicators
  - Gain access to secondary data about:
    - Studies about Natural resources condition in the area.
    - Effects of development process over the Natural Resources.
    - Studies of the use and effect of local communities over the Natural resources (Forest, agricultural land, marine resources, water)

- ***Possible Questions and objectives of the question***

QUESTION	OBJECTIVE
What are the main trends that you see that affect or benefit the rural households in your area? In terms of: Agricultural/Forestry/Marine Res. Availability Infrastructure access (physical capital) Increasing/decreasing poverty Educational level increasing (Social aspects) Productivity , prices, market possibilities Long term development and diversification	Background information for case analysis. SLA Vulnerability context , assets access
What are the main Environmental concerns/threats in the area?	Background information for case analysis. Sustainability Analysis SLA Vulnerability context and secondary data gathering.
Describe the main projects, policies, programs that target rural communities.	Main project running in the area. SLA Processes and Structures
In your opinion what are the effects of this programs? …..over the community? …..over the natural resources?	Effects of these projects. SLA Processes and Structures and Future Policy implications
Could you explain the impact over the Natural resources (forests-agriculture-salmon industry) that rural communities have, compare to the private enterprises?	Analysis of impact of rural communities over the forest Sustainability Analysis and secondary data gathering.
Can you supply this research with secondary data about: + Natural resources condition/availability in the area. + Effects of development process over the Natural Resources + Studies of the use and effect of local communities over the Natural resources (Forest, agricultural land, marine resources, water)	Secondary Data for triangulation and description
What would you are the possible alternative strategies for rural households?	Future diversification related to environmental concerns SLA Trends, Policy Implications
Do you want to add something else, regarding the topics we covered today?	

5. COMMUNITY KEY INFORMANTS

Organisational Level: Community Level

❖ Selected Informants

At the community level several key informants will be interviewed. In each community each of these leaders will be interviewed. This interview will be a key element in the snow ball sampling technique used in this research.

- Community board leader
- Teacher of the community school
- Agricultural development group leader
- Other possible group leaders
- Indigenous leader
- Tourism group leader,
- Handicrafts group leader,

❖ Interview Guide

- ***Purpose of the Interview:***

- Explain the objectives of this research to the community leaders, and organize a communitarian explanation and presentation of this research. Doing that, households will be aware of the presence of the researcher in the area.
- Background information important to the case description and analysis of its characteristics.
- Checking some of the concepts and assumptions before carrying out the household interview. Discover new aspects not included in the main interview to the households and that could be investigated further.
- Create a community view in terms of (expressed in the social map):
- Natural Resources present in the area (forest, marine, agricultural land, water)
- Numbers (sampling purposes)
- Identification of the main activities of the households to assist sampling.
- Identification of the main environmental concerns from the community perspective.
- Create a Historical analysis of the availability (surface coverage) of Forests, agricultural land, sea resources (quantity) for the community.
- Identify possible future strategies for sustainable development from the perspective of the community.

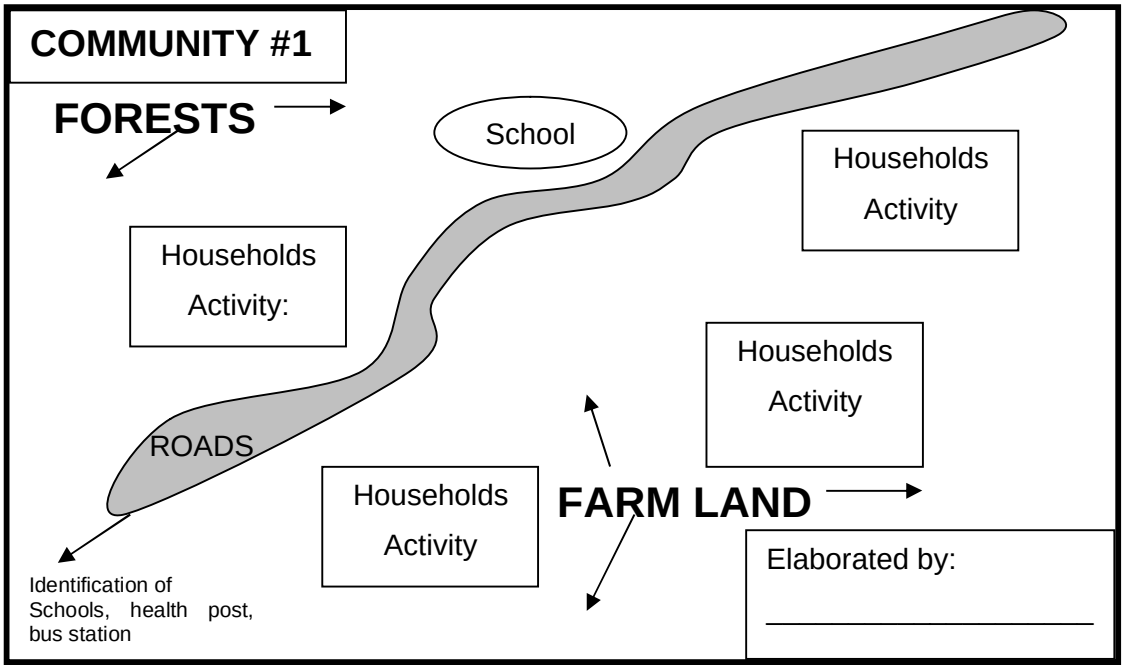
- ***Social Map***

Objectives:

This exercise will help in sampling process, Identify number of household and locations; give them a number for further identification; identify locations of: Schools, Community gathering House, Health Post, Electric Lines, sources of water, major landmarks; analyze major natural resources available to the community; and finally identify main activities in each sector or household

Data to be mapped:

- Draw a map with the geographical features of the community.
  (Hills, natural boundaries, roads, rivers)
- Identify different Natural resources present in the area.
  (Discuss in broader terms access to own land, sea border, forests)
  [SLA Access to NR]
- Identification of all the community households in the map.
- Identify main activities of each Household [SLA Analysis, SAMPLING]
  Example: Agriculture (Vegetables, potatoes, garlic, Livestock)
  Forestry
  Marine products collecting or Fishing
  Handicrafts, Tourism, off farm work, others
- Identify closest Health Post, Markets, Schools, Bus station available for the community.



- ***Natural Resources Historical Matrix:***

Objectives

Explore and represent temporal dimension of people's reality. The main aim of this activity will be to discover the changes in the natural resource over the last decades. Identify some of the causes for those changes.

Data to be included:

Forest coverage, agricultural land, availability of marine resources and native fauna will be plotted in the following table. The community leader decide which factors to include and the time ranges to be used. Social aspects such as population (# houses) and wellbeing of the houses will be also covered to have an insight for example of the possible decrease of NR availability versus the increase/decrease of social well-being among community members.

Indicator / Decade	Forest (coverage of forested land)	Agriculture (coverage of agricultural land)	Marine Resources (availability)	Social development (# houses and wellbeing)
1950				
1970				
1990				
2010				

Further Questions/Discussion based on the Historical Matrix

What are some of the reasons for these changes in the last decades? (Possible use of a TIMELINE)

Shocks (Floods, drought, wind, earthquake)?
Agricultural prizes?
Rural and urban migration? [SLA Vulnerability context]

What are the main current Environmental concerns in the area if they are at all?

Forests
Agriculture
Marine resources depletion
Others
No concerns [Sustainability Analysis SLA Vulnerability context]

❖ **Possible in depth questions**

QUESTION	OBJECTIVE
What are the key elements involved in the environment sustainability in your community? Access to Natural Resources Impacts of agriculture/forestry Poverty Low opportunities Others	Sustainability analysis, main concerns
Describe how many different community groups are working in your community related to the use of natural resources?	Background information about social capital. SLA social capital assets access
Which are the organizations (governmental or civil) that have been supporting the community? Rural Council BMCH INDAP CONADI Others	Institutions taking part of the development process in this community. SLA Processes and Structures
In your opinion what are the effects of this organizations and their programs? …..over the community? …..over the natural resources?	Effects of this programs/projects SLA Processes and Structures
What would you are the possible alternative strategies for the households in the future?	SLA Trends, Policy Implications for sustainable development
What would you like to see in the future regarding programs or policies that benefit your community?	Policy Implications for sustainable development
What is your view about the future of your community?	Background information for the Sustainability analysis and case description
Based on the main activities of the households, described in the social map, can you tell me who would be a good example of each type to interview?	Sampling process
Do you want to add something else, regarding the topics we covered today?	

ANNEX 6. HOUSEHOLD LEVEL INTERVIEW GUIDES

This annexe presents the research instruments with the complete interview guides that were used during the field work among the two rural communities in Chiloé Island.

SEMI STRUCTURED INTERVIEWS

Based on the snowball sampling method, households will be selected considering the opinions and suggestion of the key informants. The key informant interviews will help to identify a range of different livelihood strategies among the two communities. Semi structured interviews will be carried out until the answers are repeated several times.

1. PURPOSE OF THE INTERVIEW

- To gain an understanding of the relation between the livelihood strategies of the household and the environmental sustainability of the natural resources available to them:
    - To what extent are the livelihoods based on the natural resources?
    - Are these livelihood strategies environmentally sustainable?
    - Determine the main factors that have increase or diminished the dependence of the rural communities on their surrounding environment?
- Analyze the natural resources access using a resource map.
- Determine the activities of the household using a flow diagram (Diversification, income, expenditure (costs), time spend in each).
- Determine the influence of external institutions on the livelihoods and the impacts on the environment sustainability (SLA: Processes and structures).
- Determine the main shocks and trends that affect the household in terms of the management of natural resources.
- Analyze the sustainability of the natural resource use checking sustainability indicators.

2. INTRODUCTION TO THE HOUSEHOLD

- Presentations
- Explanation of Topic of this research
- Explanation of the Confidentiality and related research Ethics
- Signature of the Consent

3. RESOURCE MAP

❖ OBJECTIVES:

The resource map focus on natural resources, showing geographical features of the household land. This map reflects how people view their own locality in terms of natural resources (Kumar, 2002).

❖ DATA TO BE MAPPED:

Drawing of a map of the property including the following elements:

Topography, rivers

Buildings: House, Sheds, green-house

Determining main Land Use types:

- o Surface
- o Production: Crops, Livestock, timber, firewood, others

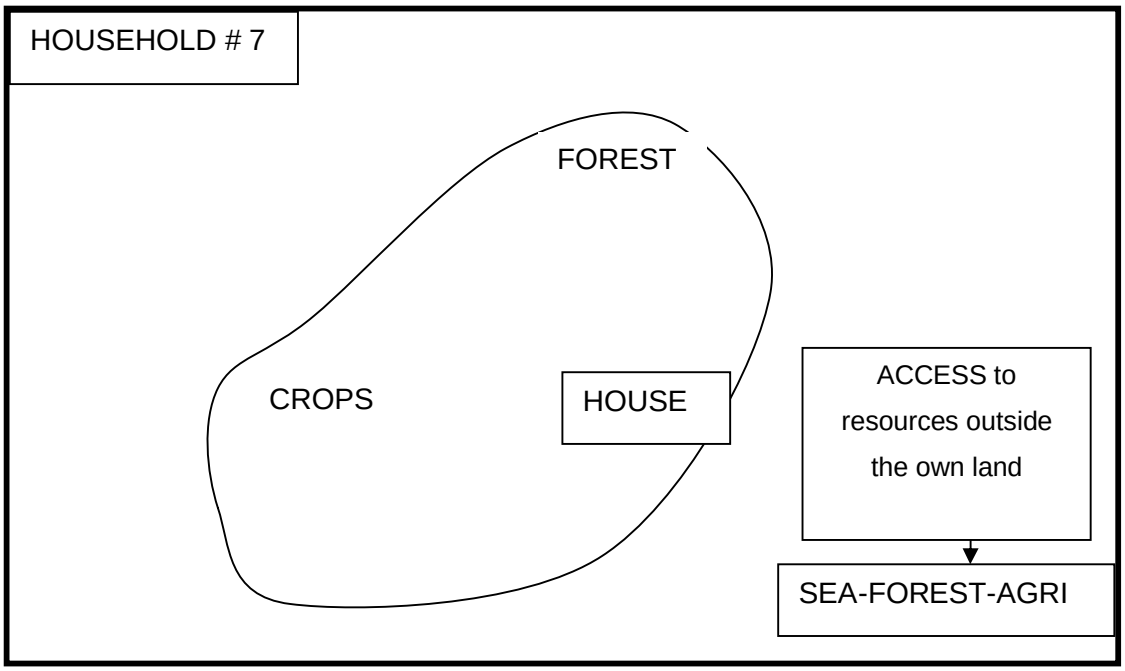
Access to resources outside their land

- o Marine areas,
- o forest,
- o other agricultural land

Access and distance to Health post, School, Road, Electricity, water, sanitation.

Discussion of Environmental Problems: Erosion, Forest depletion, low productivity.

Discuss Property rights regime (Own, tenant, family, partnership, without right)



4. SEASONAL ANALYSIS

❖ OBJECTIVES

This exercise presents a “picture” of the current set of activities that the household carries out during the year. It includes income determination and time consumption in each activity. Major item of expenditure, shocks and main reason of scarcity are covered in relation to this exercise.

The use of either the Flow diagram or the seasonal analysis will be checked with the key informants, to select the most appropriate tool for the local context. The seasonal calendar aims a temporal analysis across annual cycles of the household (Kumar, 2002). The unit of analysis are months or seasons. The outcome can be triangulate against secondary data, in order to verify the information that was generated.

❖ DATA TO BE GATHERED:

- Determining what other activities they realize during the year:
  - Livestock
  - Crops: Potatoes, Garlic, Greenhouse
  - Forests: Fire wood, timber
  - Marine Products gathering
  - Handicrafts
  - Tourism

- Off farm work
- Rental Income
- Remittances
- Others

- If they have access to resources outside their own land, determine:
  - What they gather, produce, etc
  - How often they access to them (Main months in which this activity is concentrated)
- Determine the extent of production/activities in terms of:
  - Time (workload) (how much time spend in each activity)
  - Income (year) (% for each activity and ask for the total amount of income)
- Determine origin of the income:
  - own farm,
  - outside gathering,
  - wages
  - Off farm income.
  - Others _____
- If the household receives external help (grants, project money) determine the importance and impact of it.
- Access to credit
  - Which Institution (INDAP, Relatives etc)
  - Use
  - Amount of money
- Inputs of Firewood and use of Forest management Schemes (FMS)
  - Own Production (FMS?)
  - Buy to local supplier (FMS?)

  [Sustainability analysis]
- Inputs of fertilizer to replace loss nutrients from the soil?
  [Sustainability analysis]
- Determine main expenditure:
  - Food
  - Agricultural supplies
  - Education
  - Others _____

- What is the destiny of the products that you generate?
    - Subsistence (self consumption)
    - Selling if surplus
    - Selling most to markets
    - No own production, only off farm wages.
- Determine periods of scarcity during the year? (scarcity of food, farm or off-farm work) [Sustainability analysis; Stability of production]

- What are the main shocks that affect your livelihoods during the year?
    - Low productivity of agricultural land,
    - Low availability of NR
    - Drought-Rains-Floods- Winds
    - Time availability (Clashes between activities)
    - Other _____
- Determine if the household has changed the activities because of this stresses.
- Have you sell your assets because of these shocks?
- Determine income range? (Check with Key Informants)
    - Under 16.000 (poverty line)
    - 16.000 - 120.000 (minimum wage)
    - 120.000 – 300.000
    - Over 300.000

ACTIVITY SEASONAL ANALYSIS for Rural Households in Chiloé Island.

Months / Criteria	JUN	JUL	AGO	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY
MAIN ACTIVITIES Potatoes Tourism Livestock Off farm Gathering												
WORK LOAD Potatoes Tourism Livestock Off farm												
INCOME (valued $) Potatoes Tourism Livestock Off farm												
Dependence on Natural Resources												
EXPENDITURE												

Destiny of the production (Own-markets-trade)												
Firewood												
Fertilizer												
Periods of scarcity												
Major shocks												
Wages, Remittances, Grants												
Credit access Use, Institution, Amount												

5. IN-DEPTH QUESTIONS GUIDE

❖ OBJECTIVES

Some extra questions will be asked to cover some data that is not considered in the first two PRA exercises. Indicators to establish the sustainability of the environment in the areas under management of the community will be asked.

❖ DATA TO BE GATHERED:

QUESTION	OBJECTIVE
INCOME PORTFOLIO	
Considering your household history, which combination of activities (strategies) have you use during the last decade? (Explain user friendly) ☐ Diversification (eg:Change from Sheep+Potatoes to Sheep+ potatoes+tourism+greenhouse) ☐ Intensification/Extensification (increase production of the same activity) ☐ Migration ☐ No changes , stay the same	Livelihood strategy definition
How do you see the future, are you thinking about changing your activities? ☐ Diversification: other agricultural products, or work off-farm, Tourism, etc? ☐ Intensification ☐ Migration ☐ No changes , stay the same	Livelihood strategy definition
SLA - ASSETS ACCESS	
In which community groups do you participate? Examples : Agriculture Development group Handicrafts group, Community Board Indigenous Community, Tourism Group Other or None What benefit do you get from this? (Friends, income, information, new skills)	Social Capital Social sustainability

In what kind of activities do you rely in your neighbours for help? (communal work, potatoes harvesting, etc)	Social Capital Social sustainability
Talking about your Kids and their education, in what way do you think that they are more aware about the state of the surrounding environment?	Human Capital Sustainability Analysis (Viability- Prod)
Had this situation change compared to your parents?	Human capital, trend related to relation to the environment
In terms of your dreams and expectations are you able to save for the future?	Sustainability analysis (Resilience)
PROCESSES AND STRUCTURES	
How are Institutions like INDAP, CONAF, BMCH affecting or facilitating you the way you use your available natural resources (agriculture, forests, marine)? Explore about Credit access for specific activities, grants that encourage specific attitudes, technical bias to certain activities)	Structures (Public and private institutions)
Is your household part of the Indigenous group of the community? ☐ YES ☐ NO	Culture
SUSTAINABILITY ANALYSIS	
Can you explain if during the last years you have seen more income for your households and opportunities in the area?	Social Aspects (Viability- Productivity) Test Livelihood sustainability
Considering the availability of natural resources; In which way do these elements allow you to recover better/worst from shocks and difficult economic moments? (Explore if they rely on NR in scarcity moments, selling parts of them, generating a economic recover)	Economic aspects (resilience)

In which way do you see differences among the community in terms of access to natural resources? (Analysis of each important element: Forest, Agricultural land, Land, marine resources?)	Social Aspects (Equitability)
What managements do you have to avoid soil erosion?	Environment aspects (Agriculture) (integrity)

HISTORICAL MATRIX	

Do you think that the availability of natural resources (forest, agricultural land, marine resources) has been decreasing in the last decade? [Environment aspects (Availability) Sustainability analysis]

In which way do you see that?
How does that affect you?
What could you done to change that?
Is that important to you?

Indicator / Decade	**Forest (coverage of forested land)**	**Agriculture (coverage of agricultural land)**	**Marine Resources (availability)**	**Others**
1950				
1970				
1990				
2010				

ANNEX 7. INFORMATION SHEET FOR PARTICIPANTS

Massey University

INFORMATION SHEET FOR PARTICIPANTS

20 December 2003

Research Project Title:

Rural livelihood strategies and natural resource sustainability

My name is Alan Bannister Hepp, I was born in Chile, my undergraduate degree is in Agricultural Studies, and I am currently a postgraduate student at Massey University. As part of my Masters Degree in Rural Development, I would like to invite you to participate in the research I am conducting about the local livelihoods in Chiloé Island and their relation with the local environment. Please read this document carefully before deciding to participate in this study.

As the local availability of natural resources is decreasing for the rural inhabitants; this research aims to describe the local livelihoods, determine the sustainability of the local resource use pattern, and identify the main factors that affect livelihoods and the surrounding environment. The main outcomes of this research will be a description of local livelihood strategies of the selected communities, a discussion of the main factors affecting the sustainability of the community and their surrounding environment, and a suggestion of the main issues are to consider for future policy formulation and program/project implementation.

Your community has been selected to be one of the case studies of this research. The selection criteria for choosing your community were that it is a subsistence rural community, close to extensive areas of native forest, with low input-output production. As part of this community you have been selected as a possible candidate to participate in this research. Your participation is voluntary. If you agree to participate, two in depth interviews, and one survey will be carried out with your collaboration. The place and time for the interviews will be discussed later, to match your convenience.

The interview will cover aspects of your daily livelihood strategy, the surrounding environment, and your relation and dependence to the natural resources. The survey

will cover aspects as income, consumption patterns and educational level. If you fell uncomfortable with some of the questions you can decline to answer them.
The collected data will be stored and analysed at Massey University in New Zealand, under restricted access. Only I and my two supervisors will have access to it. At the end of the project all the interview sheets and other related material will be disposed properly.

You have the following rights during this research, considering Massey University Research Policy:

- decline to participate;
- decline to answer any particular question;
- withdraw from the study;
- ask any questions about the study at any time during participation;
- provide information on the understanding that your name will not be used unless you give permission to the researcher;
- be given access to a summary of the project findings when it is concluded.

Data of this research that can be published later, will not link you directly with this research and the confidentiality statement will be respected. Please complete the consent form before starting your participation in this research. If you have any questions or doubts about this project, please contact me. My contact details are: alanbannister@entelchile.net ; phone 064-06-3569585.

This project has been reviewed and approved by the Massey University Human Ethics Committee, PN Protocol NO/NO *(insert protocol number).* If you have any concerns about the conduct of this research, please contact Professor Sylvia V Rumball, Chair, Massey University Campus Human Ethics Committee: Palmerston North, telephone 06 350 5249, email S.V.Rumball@massey.ac.nz.

Best regards,

Alan Bannister Hepp

Massey University
Palmerston North

ANNEX 8. ETHICAL APPROVAL OF THIS RESEARCH

Massey University

OFFICE OF THE ASSISTANT
TO THE VICE-CHANCELLOR
(ETHICS & EQUITY)
Private Bag 11 222
Palmerston North
New Zealand
T 64 6 350 5573
F 64 6 350 5622
humanethics@massey.ac.nz
www.massey.ac.nz

5 March 2004

Alan Bannister
246 College Street
PALMERSTON NORTH

Dear Alan

Re: The Role of Livelihood Strategies in Environmental Sustainability

Thank you for the Low Risk Notification that was received on 2 March 2004.

You may proceed with your research without approval from a Campus Human Ethics Committee. You are reminded that this delegated authority for approval is based on trust that the Screening Questionnaire to Determine the Approval Procedure has been accurately filled out. The delegated authority is valid for three years. Please notify me if situations subsequently occur which cause you to reconsider your initial ethical analysis.

Please ensure that the following statement is used on all public documents, and in particular on Information Sheets:

"This project has been reviewed, judged to be low risk, and approved (*note to applicant: include the process below that is most appropriate to practice within your Department, School or Institute*)
by the researcher
by the researcher and supervisor
by peer review *(if you followed that process)*
by other appropriate process *(outline the process appropriately)*
under delegated authority from the Massey University Human Ethics Committee. If you have any concerns about the conduct of this research, please contact Professor Sylvia Rumball, Assistant to the Vice-Chancellor (Ethics & Equity), telephone 06 350 5249, email humanethics@massey.ac.nz".

Please note that if a sponsoring organisation, funding authority, or a journal in which you wish to publish requires evidence of Committee approval (with an approval number), you will have to provide a full application to a Campus Human Ethics Committee.

Yours sincerely

Sylvia Rumball

Professor Sylvia V Rumball, Chair
Assistant to the Vice-Chancellor (Ethics & Equity)

cc Dr Ganesh Rauniyar
Institute of Natural Resources, PN435