DIVERSITY AT STAKE

A Farmers' Perspective
on Biodiversity and Conservation
in Western Mexico

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Prologue

> '[…] *The Cat only grinned when it saw Alice. It looked good-natured, she thought: still it had very long claws and great many teeth, so she felt that it ought to be treated with respect. 'Cheshire-Puss,' she began, rather timidly, as she did not at all know whether it would like the name, however, it only grinned a little wider. 'Come, it's pleased so far,' thought Alice, and she went on. 'Would you tell me, please, which way I ought to go from here?' 'That depends a good deal on where you want to get to,' said the Cat. 'I don't much care where ------,' said Alice. 'Then it doesn't matter which way you go,' said the Cat. '------ so long as I get somewhere,' Alice added as an explanation. 'Oh, you're sure to do that', said the Cat, 'if you only walk long enough.' Alice felt that this could not be denied* […]*'*
> (Carroll 1982: p. 56/67).

The following pages are the result of a research journey that began in 1993. During that journey, at times I somewhat felt like Alice cited above during one of her adventures in Wonderland. Similar to Alice, I had found my way into a wonderland, which in my case was Rural Sociology. I still remember my first encounter with Jan Douwe van der Ploeg in 1993, when I wanted 'to do something' on farming styles. I also wanted to combine rural sociological theory with the field that I was trained in, i.e. forestry. Over the past years, finding an appropriate balance between rural sociology and forestry has challenged me. Then, I also decided to go to Mexico, which at that time was known to me only through stories told by Mexican students at Wageningen University.

Conducting the research, as well as writing this book, was always enjoyable, in part because for a long time I was involved in more activities than just this research and because the time horizon could be extended as needed. A deadline did not emerge until I began writing this last version in October 2001. Even though time appeared to be on my side, it somewhat took me by surprise and the deadline was more difficult to meet than I had expected. Some nine years have passed since I embarked on what has turned out to be a long research journey. This book tells the story of where I have come so far.

Similar to Alice, I also met a 'cat' whom I could ask for directions. In fact, many 'cats' were met along the way: some grinning, some groaning, and some yawning to the topic of this book. Here I would like to acknowledge those persons who have made important contributions in one way or another.

At the risk of sounding cliché, I must say that it is most difficult to sufficiently acknowledge the farmers in Cuzalapa, many of whom have become my friends. The ways in which they maintain a livelihood and their knowledge of the natural environment are impressive. If this book gives the reader even just a remote understanding of their everyday lives, it will give me a lot of satisfaction. Special thanks go to Rosa, Luis, Manuel, Lino, Imelda, Pedro, Lolo, Eva, Dolores, Benito and Noe for making life so pleasant during my fieldwork.

I am very glad that Jan Douwe van der Ploeg and Freerk Wiersum agreed to become my guides through the scientific wonderland I chose to wander in. Both have made important contributions that substantially improved the quality of this book. Thank you, Jan Douwe, for your inspiring guidance and your support at crucial moments. Thank you, Freerk, for your thoroughness. Henk de Haan, Gemma van der Haar, Hielke van der Meulen, Claudia Ortiz, Dirk Roep, and Marian Stuiver deserve special mention for their comments on earlier versions of this book, especially Chapter 1.

I would like to acknowledge my colleagues in Mexico, at the Department of Ecology and Natural Resources and at the South Coast University Centre of the University of Guadalajara. Thanks are also due to the personnel of the Directorship of the Sierra de Manantlán Biosphere Reserve (DRBSM) of the Ministry of Environment and Natural Resources (SEMARNAT). Maaike Bader, Annette van den Bosch, Liliana Castañeda and Angela Merino are thanked for their share in the fieldwork. Saskia Kreutzer, Nancy Forster, Guadalupe Ortiz, Fernando Partida, and Jaime Morales are thanked for contributing to the development of the ideas underlying this book. Claudia Ortiz is thanked for counseling me regarding the almost Machiavellian enigma called Mexican bureaucacry.

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Peter Gerritsen

1 Co-Production, Farming Styles and Resource Diversity[1]

1.1 Origin of the Research

This book is about farmers and biodiversity conservation. More specifically, it aims at understanding the farmers' role in natural resource management within the context of protected areas.[2] It aims at doing so by combining rural sociological and community forestry theory. This first chapter presents a conceptual framework.

The research underlying this book took place in the Sierra de Manantlán biosphere reserve in Western Mexico, which I will refer to also as 'the RBSM' (according to its Spanish abbreviation) or 'the Reserve' in this and the following chapters.[3,4] The Reserve was established in 1987. I have been working in the Sierra de Manantlán since 1993; since August 1995, specifically as lecturer-researcher of the Department of Ecology and Natural Resources–IMECBIO (DERN-IMECBIO, according to its Spanish abbreviation), which is part of the South Coast University Centre of the University of Guadalajara. Since 1985, DERN-IMECBIO, the original promoter of the RBSM, has been actively promoting biodiversity conservation through research and education, and by stimulating popular participation and a favourable policy environment for conservation activities (Jardel 1992a). In other words, it has been operating as an active change agent in the region. Since the end of 1994, it has done so in close collaboration with the Directorship of the Sierra de Manantlán Biosphere Reserve (DRBSM, according to its Spanish abbreviation) of the Mexican Ministry of Environment and Natural Resources (SEMARNAT, according to its Spanish abbreviation). I also actively participated in the collaborative work of DERN-IMECBIO and DRBSM as change agents.

My interest in conducting this research emerged from some of the difficulties I experienced over the years in promoting the RBSM project amongst farmers. Some of these problems were caused by the apparent lack of interest of farmers in conservation, or the different conflicts that conservation caused. Other problems involved the many obstacles at formal institutional level, or the difficult economic situation for farmers. All of these factors influence the success of conservation activities in the Reserve. The research also emerged from my professional interest in how farmers manage natural resources. More specifically, my interest lies in understanding natural resource management from an integral perspective, i.e. by relating agricultural, cattle-breeding and forestry activities instead of only looking separately at each one of them.

Evolution of the Fieldwork

Fieldwork took place in the indigenous community of Cuzalapa, which will be referred to in this text simply as 'Cuzalapa'. It was in Cuzalapa that I first became familiar with the issues of biodiversity, conservation and protected areas after my arrival in the Sierra de Manantlán in 1993. Cuzalapa is also where I have spent most of my working time during the past nine years. My work there (and in other communities) has consisted of both rural development and research activities.

I performed fieldwork for this research study in the period July 1993 to August 1998. I conducted the research in different ways, depending on the possibilities I had to spend time in the field. During the period July 1993-August 1994, I had the possibility to live full time in the field. From September 1994 until December 1997, fieldwork took place much less regularly and long stays in Cuzalapa were not possible. This was due to a shift in my work from research to rural development activities, which covered several communities in the Reserve. The rural development activities were mostly institutional commitments with DRBSM and SEMARNAT on issues related to the management of the RBSM. Finally, from January 1998 onwards, research became once again a central focus in my daily professional activities.

Roughly speaking, the fieldwork and its results represent a period that coincides with the governmental term of President Zedillo (1994-2000). Since President Fox and his cabinet began leading Mexico in 2000, changes in environmental policies have been made. These changes have already had an impact on the RBSM project; new (political) winds are also blowing in the Sierra de Manantlán. They will, however, not be discussed in this book.

Actor in the RBSM Project

The above description makes it clear that I have been 'one of the players' in the conservation project that supports the Reserve. In fact, I have played a number of different roles (i.e. extension officer, extension co-ordinator and lecturer-researcher). The following pages thus represent a vision that might best be described as coming 'from within'. At the same time, by conducting the research that underlies this book, I also pretend to be a 'detached' observer (insofar as this is possible). As such, this may give rise to some ethical and methodological questions from the reader, which I want to comment on in this section.

It is certainly true that I have been working in the Reserve in two separate capacities, i.e. as a social scientist and as a promoter of the RBSM. It is also true that these two roles are not entirely compatible. In my view, social science has by definition a responsibility to critically view all phenomena that involve human beings. In contrast, promoting specific projects, such as the RBSM, entails a certain conviction and compromise that may hinder critical self-assessments. I fully acknowledge that I could not always separate these two roles, especially during my first years in the Sierra de Manantlán.

Regarding my own position as both social scientist and RBSM promoter, I would like to state that I am glad to be part of DERN-IMECBIO. I admire the commitment and endurance of many of my colleagues in believing in a more sustainable society, while daily practice is filled with many obstacles. I recognise that my double role led to some confusing situations, especially for those colleagues who expected my unconditional support for the RBSM project. It also created some dilemmas for me in writing this book.

Notwithstanding the foregoing, I regard a critical assessment of the RBSM project to be of importance at this stage, as I believe that while the project's ecological dimension has quite a solid basis, its social science component still needs consolidation. With this book, I would like to make a constructive contribution to such an assessment. I hope that the point of view described in the following pages will inspire the reader. I also hope that it will create new spaces for discussions.

To clarify my own position regarding conservation: I consider myself to be an environmentalist, and I also recognise the need for biodiversity conservation. But, I tend to lean towards the needs of farmers rather than those of conservation. I have some moral reasons for this viewpoint, which are related to an individual's right to a basic livelihood and a certain level of self-determination, amongst others. I also believe that, in the end, conservation is more about farmers than about nature. I think that many more possibilities of achieving conservation with the participation of farmers exist than are now recognised. I hope to explore this idea satisfactorily in the following chapters.

The duration of the research has made it possible to overcome some of the methodological question marks that could be placed on this research. Fieldwork conducted over such a long period and such intensive involvement in a region inevitably lead to good insight. At the same time, I do not believe that I would have been able to write the contents of the following chapters without having been involved in the RBSM project as I was.

1.2 Overview of the Biodiversity Debate

Nature, environment, biodiversity, and sustainable development: these are all concepts that have become increasingly important in scientific and societal discussions. They have gained much importance, especially since the seventies, as never before in human history have we been confronted with such a mass extinction of plants and animals on a global scale (WCED 1987; Wilson 1985, 1989; IUCN *et al.* 1991; Primack 1993). Current estimations warn that (more than) 30,000 species are lost annually (of which the majority consists of micro-species that are found in tropical forests and have not yet been described by science), representing an extinction rate that is 120,000 times higher than before humans walked the earth (Myers 1993). Although no consensus exists on the actual number of species lost (Wilson 1988), (natural) scientists do agree that we are currently witnessing what can be called a *biological diversity crisis* (Wilson 1985).

Four factors contribute to today's concern for the world's biological diversity. Firstly, current threats to biological diversity have reached an unprecedented level: never before have so many plant and animal species been threatened by extinction. Secondly, these threats are expanding at an astonishing speed, due to the demands of a rapidly increasing world population, as well as continued advances in technology development. This is further aggravated by the unequal distribution of the world's wealth and the crushing poverty in many countries that have an abundance of species. Thirdly, many of the current threats are of a synergistic nature: several independent factors, combined actively or even in multiple and mutually reinforcing ways make the situation worse. Finally, it is now also realised that the depletion of biological diversity will probably have negative consequences for mankind, since humans are substantially dependent on the natural environment (Primack 1993).

As a consequence of the above, the importance of *biodiversity conservation* is now recognised at the global level (WCED 1987; Wilson 1988; IUCN *et al.* 1991). In its broadest sense, biodiversity is referred to by biologists as the 'variety of life', although it usually is defined at three levels: the genetic, the species and the ecosystem level. Preservation of diversity at all three levels is seen as necessary for the continued survival of species and natural communities. It is also considered important for the well being of humans (Wilson 1988; Primack 1993). As such, this conceptualisation of living nature's diversity has been the main guideline in conservation.[5]

Within the whole spectrum of conservation activities, *protected areas* play a prominent role, particularly in rural areas. Although different categories (or types) of protected areas exist, generally speaking they refer to regions that are under special management regimes, as the biodiversity they contain is considered to be of an often unique quality and in direct need of preservation.[6] They receive special attention because ecological conservation principles have obtained an important place in the debate on sustainable development. Although protected areas have been important for safeguarding species and ecosystem survival (Gregg 1991; Wells *et al.* 1992), biodiversity depletion and natural resource degradation have not yet been halted (Wells *et al.* 1992; Pimbert and Pretty 1995).

In many countries, often long before protected areas were established, *local people* have inhabited these regions. More often than not, the establishment of protected areas has had negative impacts on the residents.[7] In the worst cases, local populations have been evicted from the areas, while the most usual policy practice has been to restrict natural resource use and management. In all cases of protected area establishment, local people's livelihoods have been influenced in one way or another (Dasmann 1991; Wells *et al.* 1992; Ghimire and Pimbert 1997).

Much progress has been made in the evolution of the protected area concept and local people's involvement, and today most conservationists will agree that biodiversity conservation 'stands or falls with development'. With the latter, reference is made to the importance of actively involving local people in the management of protected areas. It is, however, also generally recognised that the relationship between protected area managers and local people remains problematic (Wells *et al.* 1992; Pimbert and

Pretty 1995; Ghimire and Pimbert 1997). Why is it then apparently so difficult to involve local people in the management of protected areas? I will explore the answers to this question in the following section.

Local People and Protected Areas

According to several authors (such as Wells *et al.* 1992, Kamstra 1994, Pimbert and Pretty 1995; Ghimire and Pimbert 1997), recognition of the importance of local people's involvement has existed more on a rhetorical than a practical or operational level. For example, Kamstra explains that

> '[...] *although the policies and guidelines concerning local participation have changed, activities in the field have not necessarily reflected this'* (Kamstra 1994:11).[8]

Moreover:

> '[...] *the way in which people are involved and the objectives of participation are hardly being specified'* (*ibid*.:35),

indicating the lack of proper definitions at planning level. Thus, although the importance of local people's involvement is being recognised, it lacks proper operation at planning and, subsequently, field level. This can be explained partly by looking at the dominant paradigm in conservation. Conservation science is based on the Cartesian paradigm (also known as positivism or rationalism), and one of its central premises is that knowledge about the world can be summarised in the form of universal, i.e. time- and context-free generalisations or laws (Pimbert and Pretty 1995; cf. Kuhn 1996). Consequently:

> '[...] *it is this that has determined the basic values and assumptions of conservation professionals. This has been fundamentally reductionistic, with specialist disciplines prevailing. This has produced a mode of working that has systematically missed the complexity of ecological and social relationships at the local level'* (Pimbert and Pretty 1995:13).

The current impasse cannot be attributed only to difficulties at planning or conceptual level. There are also a number of (related) practical problems related to protected area management. To begin with, it is mostly professionals belonging to the natural sciences and generally few social scientists that are involved in conservation activities. Moreover, as Pimbert and Pretty (1995) state:

> '[...] *policy and technical measures that combine protected area management with socio-economic development in surrounding 'buffer' zones* [i.e. those parts of a protected area where sustainable land-use is sought] *have often tended to be top-down, centralised, under-funded, and of an ad hoc and short term nature'* (*ibid*.:5).[9]

Many would argue that daily practice in protected areas is much more complex than I have described until now and I fully agree with them.[10] Indeed, I have not (yet) addressed the issue of socio-economic and political processes that influence natural resource management and conservation activities. This will be touched upon in the next sections, and dealt with more extensively in the empirical chapters of this study. However, the above introduction did make it clear that there are a number of conceptual and practical problems that are placing biodiversity conservation at stake. Or, as Pimbert and Pretty (1995) put it by linking conservation to poverty alleviation: the

> '[...] *lack of livelihood security ultimately undermines conservation objectives as poverty and rates of environmental degradation intensify in areas surrounding parks and natural reserves'* (*ibid.*:6).

Following the foregoing argumentation, one could easily opt for strictly protected areas that exclude any form of human presence. There are practitioners and policymakers who support this idea, but

> '[...] *the present network of protected areas safeguards only a limited proportion of species at risk, and* [...] *most such areas will prove incapable of preserving more than a modicum of their species in the long run'* (Myers 1993:78).

Besides, due to the ethical, conceptual and practical difficulties: '[...] *this challenge is barely considered scientifically, let alone operationally'* (Myers 1996:42). Thus, new ways have to be looked for to overcome the current impasse in the management of protected areas. In this book, I will do so by looking at the man-nature interface. Following van der Ploeg (1997: endnote 14), I will use the term 'man' as a metaphor for society. In the following chapters I will also refer to that part of society that directly depends on and interacts with nature, i.e. farmers.[11] Furthermore, I will limit the following discussions to 'living' nature, thus, not or hardly taking into account 'dead' nature (*ibid.*). I will present a first overview of the farmer-living nature interface in the next section.

Relationships between Farmers and Living Nature

Many relationships between farmers and living nature can be identified in the different countrysides of the world. Extensive literature reveals that the world's countryside is characterised by a great diversity in farming and natural resource use and management (see for example Ruthenberg 1980; de Janvry 1981; van der Ploeg 1991).

The relationships between farmers and living nature have developed throughout history and, generally speaking, are complex and highly variable. Besides, most of the biological richness in today's world exists in places where farmers have lived for many generations, using their environment in a more or less sustainable manner (Oldfield and Alcorn 1991; Primack 1993; Colchester 1994; Pimbert and Pretty 1995; Nigh and Rodríguez 1995). Thus, the biodiversity of the tropics, but also of the temperate regions, has co-existed with human societies for thousands of years.

In several places humans have not substantially damaged the natural resources in their surroundings (Oldfield and Alcorn 1991; Gómez-Pompa and Kaus 1992; Ellen and Fukui 1996; van der Ploeg 1997). In other places, the mixture and relative densities of plants and animals in many ecosystems reflect the activities of people in the same area, such as selective hunting of certain game animals, fishing, and planting or cultivating of useful plants (Posey 1985, 1999; Ellen and Fukui 1996; Wiersum 1997a). The transformations of nature have taken place not only for subsistence, but also commercial purposes (Wiersum 1997a; Bolhuis and van der Ploeg 1988).

Farmers' use and management of natural resources as described above has resulted in so-called *'domesticated'* (Chase 1989) or *'cultural'* landscapes (Phillips 1995). With both terms reference is made to the transformation of original natural resources of rural landscapes into resource enriched and useful environments (Wiersum 1997a; van der Ploeg 1999). In such cultural landscapes, new forms of biodiversity may be created at landscape, species and genetic level (Fairhead and Leach 1996; see also Berkes *et al.* 2000). Thus, farmers and living nature cannot be understood separately. In a more general way, Quiroz states this quite eloquently: '[...] *cultural diversity and biological diversity are two sides of the same coin. Living diversity in nature corresponds to a living diversity of cultures'* (Quiroz 1994:12; see also Dasmann 1991; Oldfield and Alcorn 1991; Posey 1999).

In several cases, farmers have established customary arrangements with regard to land and natural resources for ensuring the sustainability of biodiversity (Wiersum 1997a; Pimbert and Pretty 1995; Colchester 1994; Primack 1993). Generally speaking, these arrangements are historical and situationally dynamic rather than static, and often they have evolved in response to changing conditions. However, many authors indicate that natural resource management by farmers should not be romanticised (Oldfield and Alcorn 1991; Agrawal 1995; Nigh and Rodríguez 1995; Wiersum 1997a). As Nigh and Rodríguez (1995) state:

> '[...] *the knowledge of the environment* [...], *in itself,* [does] *not guarantee conservation or a sustainable resource use.* [...] *The indigenous peoples are not conservationists by nature. Certain aspects of the indigenous behaviour are very destructive for the ecosystems. The use of natural resources is a social institution that originated under specific historical circumstances. Besides, in certain circumstances, when an indigenous community does not succeed in establishing a sustainable equilibrium with the environment, it can fail. It is necessary to evaluate the social resources of the indigenous peoples and specify their determining conditions, in order to reach a stable human ecology'* (*ibid.*:74/75, own translation).

Problem Statement of this Research

Until now, I have made it clear that there is growing concern amongst scientists and politicians all over the world about the accelerated loss of biodiversity. This concern, which has received major attention since the 1970s, has led to the development of new policy measures such as the creation of conservation areas managed by professionals. Recently, the involvement of farmers in the management of protected areas has obtained more importance. Examples from all over the world show that farmers have inhabited many of the world's protected areas. Often, they have also influenced its biodiversity. But, the managers of protected areas have not yet fully succeeded in grasping the exact nature of the farmers-living nature link. Consequently, they have not yet succeeded in fully incorporating this link into the management schemes of protected areas.

With this book and the underlying research, I want contribute to the debate on biodiversity conservation. This debate takes place in both scientific and societal settings. Here, my endeavour will take place in the scientific arena. My interest lies in exploring two notions that dominate this debate: biodiversity and conservation. I will do so by applying a research perspective that focuses on the perceptions and actions of farmers regarding natural resources and biodiversity. I will discuss this perspective in the next section.

1.3 Research Perspective Underlying this Book

As stated earlier, biodiversity and conservation will be studied in this book from *a farmers' perspective*.[12] Farmers have a direct and, above all, active relationship with living nature through farming and, thus, with biodiversity (van der Ploeg 1993, 1999; Kessy 1998). In many tropical countries, such as Mexico, farming does not only include crop cultivation, or animal husbandry practices for obtaining a livelihood, but also various types of extraction from areas with human-influenced vegetation (i.e. secondary vegetation and forests) (Padoch and Vayda 1983; McDowell and Hildebrand 1986; Hildebrand 1986). In other words, farming in the tropics is often a multi-activity enterprise (Ellen 1993), involving the use and management of a variety of man-made and more or less natural environments. Natural resource management in the sense of consciously conserving and manipulating secondary vegetation and forests thus forms an integral part of farming activities (Wiersum 1997a, 1997b). A number of general features further characterise farmers and farming in tropical countries. Firstly, farmers derive their livelihoods mainly from agriculture (Ellis 1993), even though a diverse portfolio of activities is employed in order to improve living standards (Ellis 1998). Secondly, many farmers are only partially integrated into markets, and in many regions one can identify a number of non-commodity mechanisms for mobilising resources that are limited on the farm. Thirdly, farming is mainly performed through family labour. Finally, the importance of family labour indicates that the farm household represents both a production and consumption unit (Ellis 1993; Zoomers 1998).

My interest in the perspective of farmers originates from my experience in the Sierra de Manantlán biosphere reserve. I believe that a lot has yet to be learned regarding the conservation potential that is embedded in the practice of farming and natural resource management in this region. Therefore, the following chapters represent a scientific exploration into the relationships between farmers and biodiversity in the study area. For this exploration, I will make use of an *actor-oriented approach*. Moreover, I will also use the concepts of *co-production* and *endogenous development* to explain the farmer-living nature link from an actor-oriented perspective. I will discuss these premises of my research perspective in the following.

Actor-Oriented Approach

Several actor-oriented perspectives can be distinguished in science (Long and Long 1992; Long and van der Ploeg 1994). In this research, I will use the farming style approach developed at Wageningen University. Farming styles focus primarily on farmers and farming.[13] Other actors obtain relevance in their interactions with farmers and farming practice (van der Ploeg 1994). Thus, the farming style approach perfectly relates to the farmers' perspective I mentioned earlier.

Actor-oriented perspectives depart from the everyday life experiences and understandings of social actors. In other words, an actor-oriented approach:

> '[...] *entails recognising the 'multiple realities' and diverse social practices of various actors, and requires working out methodologically how to get grips with these different and often incompatible social worlds'* (Long and Long 1992:5).

One of the basic tenets of actor-oriented approaches is the idea that actors possess *agency* to realise the fulfilment of their objectives embedded in specific projects. Agency refers to:

> '[...] *the capacity attributed to the individual actor to process social experience and to devise ways of coping with life even under the most extreme forms of coercion. Within the limits of information, uncertainty and the other constraints* (e.g. physical, normative or politico-economic) that exist, social actors are 'knowledgeable' and 'capable'' (*ibid.*:22/23).

The notion of agency is constituted according to the specific cultural context of an actor. It affects the management of interpersonal relations and the kinds of control that actors can pursue vis-à-vis each other. It also implies that the actor exercises some form of power, which can take place in many different forms (*ibid.*; Scott 1985). Agency (and power) depends upon a network of (other) actors who become partially enrolled in the projects and practices of a specific actor (Long and Long 1992).

Related to the notion of agency is the concept of *structure as a duality*. Structure, understood as the set of rules and resources that direct social life, has meaning only when it is directly related to the notion of agency. It determines the possibilities and limitations of actors, but, at the same time, it is reproduced and transformed through the actors' actions. The structural properties of social systems then: '[...] *are both medium and outcome of the practices they recursively organise'* (Giddens 1984:25). They are also: '[...] *both constraining and enabling'* (*ibid.*:25). Consequently, dualities, such as: 'macro-micro', 'external-internal', 'endogenous-exogenous', or the frequently heard 'global-local', can have different meanings and can thus be understood only in localised contexts (*ibid.* Long and Long 1992).

Co-Production

Following van der Ploeg (1997), I will henceforth refer to the reciprocal relationships between man and nature with the term co-production.[14] More specifically, I propose to consider co-production as the on-going interaction and mutual transformation process of farmers and living nature. Co-production influences the characteristics of farming and natural resource management and of living nature; and it is also influenced by it (Roep 2000).

One can assume that co-production does not exist *sui-generis*, as farmers have developed many ways to relate to living nature. In other words, there is not one, but many ways in which co-production takes place. Furthermore, the characteristics of co-production are highly differential, although theoretically clear limits can be distinguished. Theoretically, co-production is bounded, on the one hand, by 'pure' living nature (the so-called 'wilderness areas') and, on the other hand, by society *sensu strictu* (to be understood as the fully urbanised setting), being the two extremes of the more general man-nature continuum. In the former, nature is left 'untouched', while in the latter nature has been transformed completely, or it has disappeared. It may be clear that: *'*[...] *the rural* [area]*, then, is the locus where the co-production of man and nature is located'* (van der Ploeg 1997:41/42).

One can also assume that both farmers and living nature are malleable, i.e. they can be changed or influenced in one way or another. On the one hand, farmers and living nature both can impose 'their own rules'. Indeed, farmers change living nature through farming practice. Due to the underlying temporal and spatial organisation of natural and social cycles on the farm, the whole range of farming activities and natural resource use and management practices has different effects on living nature (Mendras 1970, van der Ploeg 1987). On the other hand, living nature 'influences' farmers' actions through the specific characteristics of natural resources, including the (temporal and spatial) accessibility of desired goods and services (*ibid.*; Wiersum 1997a). In this way, cultural landscapes are co-produced, as farmers transform living nature. In the same way, farmer populations' cultural patterns are also co-produced, due to living nature's specific characteristics. Often, the process of co-production has led to a particular biodiversity, as well as unique ways of farming and managing natural resources (van der Ploeg 1999).

Until now, I have described co-production in relation to farming and natural resource management in general terms. To a great extent, this book has to do with farmers' use and management of natural resources and biodiversity. Therefore, I propose to further consider co-production as the on-going interaction and mutual transformation process between farmers and living nature, which, under certain conditions, can also lead to the transformation of diversity in both farming practice and biological resources. Whether this is true or not, and whether the transformation of diversity is an unintended consequence or an actively pursued goal, will be the object of a critical discussion throughout the empirical chapters.

Endogenous Development

To fully understand co-production from a farmers' perspective, I will also make use of the concept of *endogenous rural development*. Endogenous rural development patterns refer to development processes that are based on farmers' insights, knowledge and technology, and which are dependent on local resources controlled by the farmers (van der Ploeg 1991). They also relate to farmers' capacity to reallocate extra income within the local setting itself (Broekhuizen and van der Ploeg 1995). Endogenous rural development can be understood as a relatively *'autonomous growth capacity'* of rural areas under specific local production relations (van der Ploeg 2001: pers. comm.).

Research by van der Ploeg and his colleagues on growth capacities of endogenous development has been very much related to the agricultural production process. Commodisation and technology development also had a central place in their investigations (van der Ploeg 1992; Broekhuizen and van der Ploeg 1995). However, endogenous growth potential also applies to living nature, biodiversity and co-production. As stated before, farmers have co-produced living nature in many different and specific ways. This has resulted in a particular set of natural resources, which, in turn, are embedded in specific cultural landscapes. This, in turn, has also further shaped farming diversity. Thus, biological and farming diversity can both be considered features of an endogenous growth potential.

Nowadays, very few agrarian systems depend completely on local resources, capacities and skills. As a consequence of globalisation, many farmers have incorporated, to different degrees, new elements in farming practice (van der Ploeg 1991, 1992; Toledo 1995).[15] Amongst others effects, this has led to a (partial) restructuring of the practice of farming as a whole (van der Ploeg 1987, 1990). New rules have also been defined that influence the ways in which farmers co-produce living nature (Wiersum 1997b, 1999). Consequently, the endogenous growth capacity in general and the nature of co-production in particular have changed.

A Final Comment

By looking at co-production as a feature of endogenous rural development, one is not looking at 'remnants of the past' or at 'impoverished farmers and degraded landscapes'. These and similar images are often heard and used to justify exogenous conservation schemes such as protected areas (see Peluso 1996; DuPuis and Vandergeest 1996; Ghimire and Pimbert 1997). On the contrary, several studies have indicated how endogenous development may result in environmental conservation or even recovery of formerly degraded landscapes (see, for example, Fairhead and Leach 1994, 1996; Gómez-Pompa 1998; Posey 1999; Berkes *et al.* 2000). Moreover, and it is for this reason that I want to emphasise the importance of strengthening co-production as a quality of endogenous rural development. Exogenous models for conservation, such as protected areas, have not prevented depletion of biological diversity. Nor have they succeeded in fully involving farmers in conservation activities. Therefore, an endogenous viewpoint may substantially enhance our understanding of the interests, capacities and skills of farmers in relation to natural resource management. I stated that rural endogenous development processes contain an autonomous growth potential, which can be set free under a reorganisation of local production relations. This growth potential may very well include new ways of ensuring biodiversity conservation. This search for new ways is also one of the challenges that underlie this book.

1.4 Research Objective and Questions

The main objective of this book is to provide a better understanding of biological richness in farmer-inhabited regions by looking at natural resource use and management by farmers. Consequently, the main question posed in this book is:

> *How do farmers relate to biological diversity in general and in the study area in particular, i.e. the indigenous community of Cuzalapa in the Sierra de Manantlán biosphere reserve in Western Mexico?*

I will start this analysis by focussing on the concepts of co-production and endogenous development. I will argue that farming practice is shaped within and through a process of co-production and that it can include an endogenous potential for conservation. I also state that co-production should not be conceptualised as a uniform, but rather as a differential process. Furthermore, I will use the theoretical notion of farming styles for partially conceptualising co-production. Therefore, the first specific research question is:

> *Can the outcome of co-production be understood by looking at possible farming styles in general and in the indigenous community of Cuzalapa in particular?*

Co-production does not only influence farming practice, but it also shapes living nature. Therefore, the second specific research question that I pose in this book is:

> *What are the effects of co-production on biological diversity in general, and in the indigenous community of Cuzalapa in particular?*

Co-production is often embedded in local institutional arrangements for natural resource management. Many of these arrangements, however, have come under pressure due to local and external factors. As a consequence, in some cases degradation of natural resources has taken place, including the accompanying institutional arrangements. In other cases, farmers have developed adaptive strategies (Wiersum 1997a), establishing new relations with the socio-political, technical and ecological context they are confronted with (van der Ploeg 1992). Moreover, these changes can be understood only from a historical perspective. This leads to the third specific research question:

> *Which social factors influence the process of co-production in general and in the indigenous community of Cuzalapa in particular?*

Finally, as I mentioned above, protected areas have played an important role within the whole spectrum of conservation activities in rural areas. The understanding of co-production and endogenous development in relation to the management of biosphere reserves, however, still remains relatively unclear. Therefore, the fourth specific research question will be:

> *What are the implications of looking at co-production and endogenous development for the management of (populated) protected areas in general and for the management of the Sierra de Manantlán biosphere reserve in particular?*

1.5 Conceptualising Farmers in Co-Production

In this section, I will develop the initial part of a conceptual framework that explains the effects of co-production on biodiversity. Here the focus lies on the role of farmers in the process of co-production.

Locality and Heterogeneity

Actor-oriented researchers assume that farming and natural resource management result from the purposeful, both knowledgeable and capable, actions of farmers. In this way, the farm and the natural resources that it contains obtain their specific characteristics. These characteristics refer to the type of activities realised, tools used, genetic material used, farm organisation (including farm layout and specific rotation schemes), type and characteristics of biodiversity on the farm, specific management practices applied to the available natural resources, ties with other farmers and with institutions, etc. Thus, theoretically, farming as a whole constructs its own *locality*.

I propose to define locality as a specific 'social space', i.e. the social context in which farmers' actions acquire and reinforce specificity. I also propose to use the term in referring to a specific 'material' or 'natural space', i.e. the natural context in which natural resources are actively moulded and remoulded by farmers to better meet their needs and in which particular (often unique) ecological entities (i.e. species and ecosystems, including genetic diversity) can emerge. Specificity thus is obtained due to particular socio-political, economic and cultural conditions, as well as a specific biological diversity in the countryside. In other words, it is one of the outcomes of co-production (van der Ploeg 1992, 1997a).

Locality does not refer so much to a geographical notion, although geography undoubtedly plays a part. Essentially it refers to the way in which farmers shape farming practice under given conditions of co-production. Theoretically, under different conditions of co-production, different *heterogeneous agricultural patterns* will emerge. However, under similar conditions of co-production, heterogeneous agricultural patterns might also emerge (van der Ploeg 1992).[16]

The *labour process approach* can be a useful instrument for analysing the patterns of farming and natural resource management. Basically, an analysis of the labour process focusses on three issues. Firstly, it looks at the way in which the labour process is structured. Secondly, it analyses the (localised) set of social and natural conditions in which it is embedded. Finally, attention is given to the social mechanisms through which the specificity of the labour process is reproduced (van der Ploeg 1992). Locality and heterogeneity in farming practice and natural resource management thus result from the way in which the labour process is structured under certain locally specific circumstances. This locally specific structuring of the labour process can be understood by looking at farming styles (see below).

Farming and natural resource management consist of a wide spectrum of tasks and decisions that have to be organised in a coherent way. This organisation is related to the dimensions of time and space, and it includes the management of different social and natural cycles. This specific organisation of time and space is reflected for example in agricultural calendars and a specific farm layout (Mendras 1970; van der Ploeg 1987). Van der Ploeg (1991) speaks of *the co-ordination of domains* as a way to clarify the complex relationships and specificity of farming and natural resource management, as realised through co-production. Generally speaking, van der Ploeg (1987) describes a domain as: '[...] *that specific context in which a given state of the art is seen by the actor as a product of his own operations*' (*ibid.*:325). Hence, a domain is the place where agency is manifested and materialised. The domains of farming that van der Ploeg distinguishes refer to production, reproduction, family and community, and to economic and institutional relations. They can be understood as the different types of activities in farming practice as a whole (van der Ploeg 1990).

Modernisation processes have reshaped the labour process. In some cases, this has led to standardisation and uniformity in the practice of farming and natural resource management (van der Ploeg 1987, 1994). Hence, in these cases, locality and heterogeneity in farming and natural resource management (and thus co-production) have affected (van der Ploeg 1987). Changes and transformations can occur in the social as well as the natural space. Van der Ploeg (1992) specifies the possible fields in which this can take place:

> '[...] *farming as a social practice became increasingly disengaged from:*
> 1. *Nature and ecology*
> 2. *The once integrated and autonomous structure of the labour process*
> 3. *The quality of the labour force*
> 4. *A specific social organisation of time and space*
> 5. *Its links with the elaboration of specific qualities as contained in specific end products*
> 6. *The family as the organising principle in farming'* (*ibid.*: 25).

Farming Styles

The theoretical notion of farming style refers to the different ways in which farms are managed in order to deal with given technical, political, socio-economic and ecological conditions (van der Ploeg 1990). A farming style comprises specific and adequate responses of farmers to local conditions, the reproduction of these responses, and the production relations that are implied. Thus, farming styles reveal the heterogeneity in farming and natural resource management.

Farming styles can be considered specific orderings of co-production (Roep 2000). Theoretically, under different conditions of co-production different farming styles will emerge. However, under similar conditions of co-production, different farming styles might also emerge. (van der Ploeg 1992). Similarly, a specific cultural landscape can be co-produced, as farmers mould and remould the different parts of their natural environment to better suit their needs and aspirations.

Like the notion of locality, farming style is not to be understood as developing only in geographical isolation. Van der Ploeg mentions travelling, storytelling, communication and interchange of experiences with farmers of other regions as some of the ways in which, in former times, social specificity was reproduced and enlarged (*ibid.*). Here, I can also add seed exchange, the introduction of new cattle races or exotic tree species, as some of the ways in which material specificity can be enhanced or transformed.

Through modernisation processes, many farming styles have become more dependent on external resources, which have to be mobilised through markets and institutions. Until now, this shift appears to have taken place primarily in agriculture in industrialised countries, and even there only partially. In other cases, modernisation processes have led to new responses by farmers intended to counter the centralising and homogenising implications of modernisation. In the latter situations, a process of *re-localisation* can be observed (*ibid.*).

For farming and natural resource management as a socio-material process, the process of re-localisation involves a reconstitution of social and natural relationships, which can take place to different degrees (Roep 2000). It also requires new forms of knowledge in order to cope with the changed realities. Where this re-localisation process has taken place, locality and heterogeneity in farming and natural resource management constitute the possible range of strategic responses to the new situations confronting farmers. It is in these contexts that transformations in the process of co-production can take place, as re-localisation involves the constitution of new relations of social and natural farm assets (van der Ploeg 1999, Roep 2000).[17] In other words, the restructuring of farming practice can involve a transformation of the living nature on which farmers depend. This transformation is reflected in a changed or transformed diversity in the cultural landscape caused by the remoulding of natural resources by farmers. This, in turn opens up new possibilities for the farm enterprise. It also creates new conditions for the process of co-production.

A specific farming rationality underlies farming styles, which van der Ploeg calls *calculus*. The calculus represents a specific social arrangement of legitimate and valid objectives and means, enabling farmers to give significance to their labour and to direct the development of their farms (van der Ploeg 1991). In other words:

> '[...] *a calculus,* [...], *makes it possible to operationalize general goals into the daily reality and complexity of the labour process.* [...] *A calculus, or farming logic, is here conceived of as the practical discourse that farmers follow in the organisation of their labour. A certain way of working is then 'logical'* [...]*, because it appears as the concrete embodiment of what is strived for'* (van der Ploeg 1990:31).

As farms entail a number of natural resources, the logic underlying their use and management can be considered part of the calculus. In turn, the cultural landscape, including the diversity in natural resources, can be considered the co-produced material outcome of this logic.

Analytically speaking, a calculus consists of several interrelated parts. Farmers' objectives can be seen as its central feature, as they are embedded in both the farmers' image of the ideal situation and the farmers' weighing of the possibilities and limitations for achieving this situation. As a result, farmers follow a strategic course of action to achieve these objectives. The way in which this is done depends on both the social and natural assets a farmer can count on, including those that can be mobilised through markets. Finally, a calculus is not static, but can change over time.

Finally, empirical research has indicated the relational nature of farming styles, i.e. the way farmers identify themselves and their farming and natural resource management practice in contrast to other farmers. Often, farming styles are symbolised by specific wordings, derived from 'local' language and knowledge, i.e. the so-called folk concepts (see, for example, Roep *et al.* 1991; de Bruin *et al.* 1991).[18]

Interregional and Intraregional Farming Styles

The farming style approach was originally developed by the Dutch sociologist Hofstee; while it has been further developed by the Dutch sociologist van der Ploeg and his research group (Hofstee 1985; van der Ploeg 1994). Hofstee originally defined a farming style as:

> '[...] *the complex, but integrated set of notions, knowledge elements, experiences, etc., held by a group of farmers in a specific region, that describes the way in which farming practice ought to be realised*' (Hofstee 1985:227, own translation).

His definition addresses heterogeneity, above all, as a cultural repertoire. In other words, it refers to the way farming and natural resource management ought to be organised, according to a specific farmer community.

Hofstee also emphasised the regional character of farming styles, by which he meant that farming styles are localised, above all, within the social and biophysical limits of the farm enterprise and the community. Co-production then can be seen as a 'regionalised' and endogenous process, in which farm development mainly builds on the resources that are locally available, i.e. on the farm and in the community. Therefore, I will refer to Hofstee's conceptualisation as *interregional*, or simply *regional farming style*.[19]

Farming styles have increasingly been influenced by external institutions. The different areas composed by the markets, as well as the relations between farms and (multiple) institutions have increasingly started to influence decision-making on farm development (van der Ploeg 1994). These institutions are often located outside the local settings, in which farming styles originally developed. Consequently, the influences of the wider socio-political context have become a factor that has to be taken into account to properly understand the development of farming styles and the process of co-production. Even more so since Hofstee did not specifically address them.

Considering the above, it now can be argued that farming styles have become the reflection of farmer responses to new and changed conditions and that they have reconstituted (part of) their regional nature due to a processes of re-localisation. A farming style then can be described as:

> '[...] *a socially created form of farm organisation and farm development, which from a comparative point of view distinguishes itself from other styles by specific contours,*

specific dynamics, specific relations with markets and external institutions, as well as a specific set of technical-productive outcomes and interrelations. A farming style corresponds to a specific set of socially valid objectives toward which farming is oriented, with specific means, as well as to a specific rationality which combines objectives and means' (van der Ploeg 1991:44, own translation).

Van der Ploeg thus includes exogenous factors in his explanation of the nature and development of farming styles. I will refer to his conceptualisation as *intraregional*, or simply *farming styles*.

The transformation of interregional into intraregional farming styles is the outcome of re-defined relationships between farmers, the wider political-economic context and the biological diversity that surrounds them in the countryside, i.e. co-production. Although the nature of farming styles (and thus co-production) can change over time, three core elements can be distinguished: 1) a specific unity of farming discourse and practice (i.e. a specific unity of mental and manual labour); 2) a specific structuring of the labour process and of the organisation of time and space as concrete dimensions of the farm; and 3) specific connections between economic, social, political, ecological and technological 'dimensions' (van der Ploeg 1994).

1.6 Conceptualising Living Nature in Co-production

In the foregoing section, an initial conceptualisation of co-production was presented by discussing the farming style approach. In this section, attention shifts to living nature.

The Social Construction of Living Nature

Very generally, living nature can be understood as 'what is out there', i.e. the world surrounding human beings. Indeed, many natural attributes surround farmers, such as trees, crops, animals, land, soils, forests, air, etc. Theoretically, living nature thus can be considered a biophysical entity, which allows farmers to produce, harvest, gather, or hunt, as well as to smell, taste, touch, hear, or feel (Ingold 1996; Ellen 1996). In other words, it permits farmers to co-produce.

The way, in which co-production takes place depends on the farmers' understanding of living nature. It also depends on the biological characteristics of living nature. The farmers´ understanding is related to the specific cultural notions contained in his or her perceptions of living nature. Furthermore, it can be related to living nature as a whole; but, more commonly, it is related to parts of it (Ellen 1996). Theoretically, living nature can thus be seen as a *social construction.*[20] With the latter, I propose to make reference to the specific social definition that farmers (but also other actors) have of living nature, and which applies to those parts of living nature that are given meaning within their 'intentional worlds' (Ingold 1996), i.e. as part of their world view and culture. These meaningful parts are those parts that are eaten, cut, enjoyed, worshipped, ploughed, sown, moulded, remoulded, etc. Numerous studies have shown that farmers have their own ways of conceptualising and understanding living nature (see, amongst others, Conklin 1957; Posey 1985; Ellen and Fukui 1996; Blaikie and Jeanrenaud 1997; Kessy 1998; Posey 1999). Furthermore, the social definition of living nature of farmers (and other actors) includes a valorisation and categorisation, which are related to the cognitive patterns of farmers, that allow farmers to come to grips with living nature in particular (Ingold 1996).[21] The farmers' social definition of living nature can be manifested physically in tools and other artefacts, as well as in a specific method of farming and natural resource management. In other words, reference is made here to farming styles.

Natural Resources

Commonly, the parts of living nature that are used and managed by farmers are called *natural resources*. Generally, the term refers to a given set of plant and animal species, ecosystems and inherent ecological processes from which a number of products and environmental services can be obtained (Slocombe 1999). Here, I propose to define the term in a broader sense, as it is now recognised that natural resources are also important for the fulfilment of cultural, emotional, or spiritual needs (Posey 1999).

Natural resources are in essence those attributes of the biophysical environment that are valued by man (Rolston 1994). Values attributed to living nature can be both utilitarian and intrinsic. *Use values* are placed on products and services that are consumed or used directly, while *exchange values* are attributed when commodity circuits are passed before consumption or use. Furthermore, *option values* can be distinguished, when values are attributed to natural resources for future use. Option values attributed to resources often imply the protection or setting-aside of these resources for a certain period (Blaikie and Jeanrenaud 1997; Rolston 1994). Many will argue that (living) nature possess values for itself, the so-called *intrinsic values.* Often, the need for protection and conservation is then stressed (Rolston 1994). Defined in this way, intrinsic values have no direct connection to the processes of co-production, except for the argument that taking a moral responsibility towards living nature might contribute to the well being of both man and living nature. This contribution is generally placed upon future generations (Blaikie and Jeanrenaud 1997). However, intrinsic values can also be defined differently. They can refer to the inherent quality of a product or service that can be obtained from living nature. Then, intrinsic values are directly related to the process of co-production (van der Ploeg 2001: pers. comm.).

The use and management of natural resources can be considered a dynamic phenomenon, due to the values that underlie them. As values can change over time, the use and management of natural resources, or parts of it, can also change (in importance) over time. These changes can also have a spatial dimension, in addition to the temporal dimension. Furthermore, it is within socially constructed nature that conflicts and dilemmas over natural resource management and conservation are located. They arise because actors attribute different and often contested values to living nature as a whole (Wells *et al.* 1992; Fairhead and Leach 1994; Ghimire and Pimbert 1997; Kessy 1998). In order words, conflicts between actors are often found in *differential value constructions* regarding living nature as a whole.

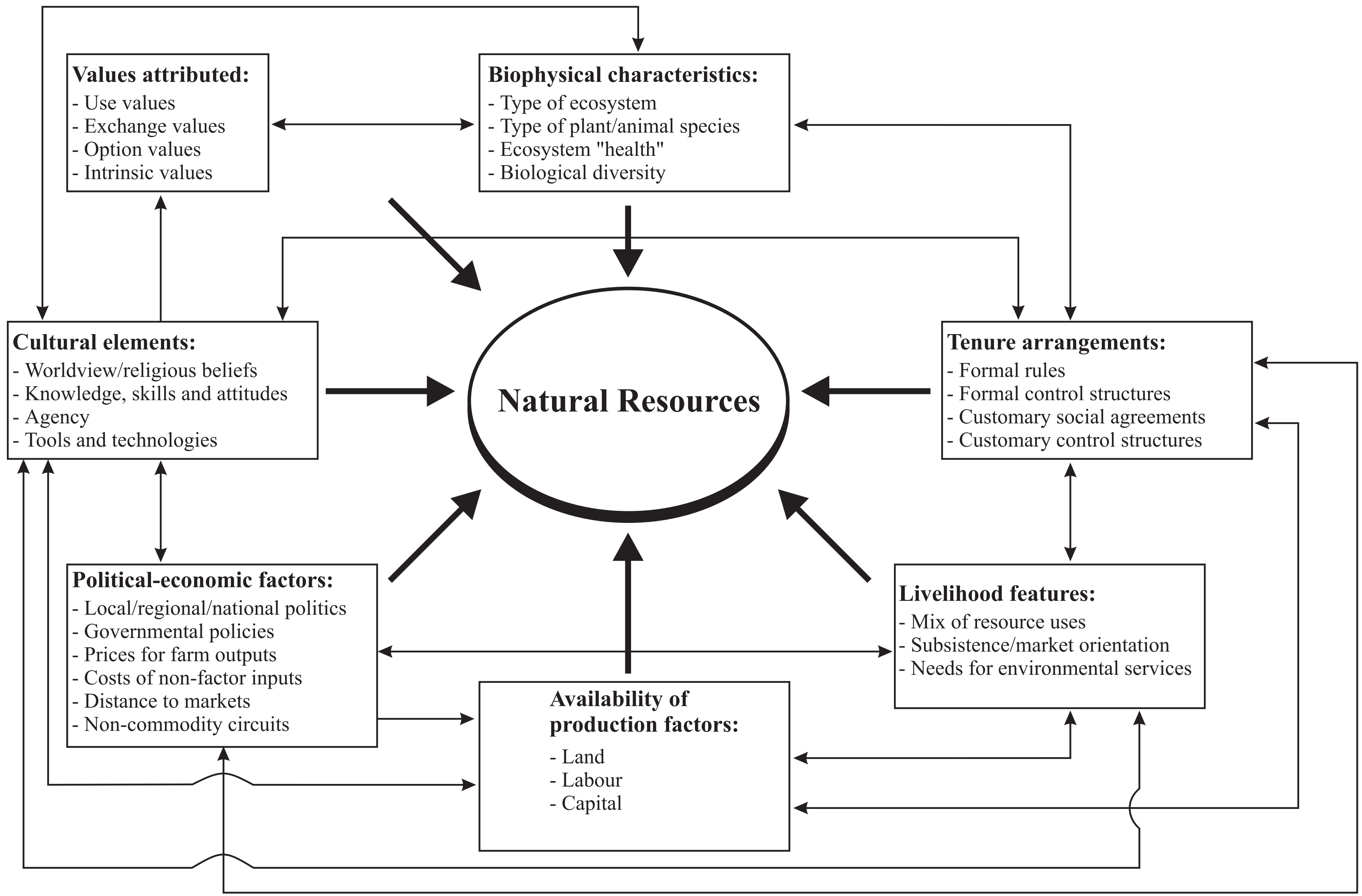
It is important to emphasise that natural resources are not only part of a farmer's social definition in the sense of a valorisation and categorisation. Natural resources are also integral parts of farms, which are actively produced and reproduced by farmers, although this can take place to different degrees. Within and through the process of co-production, natural resources are created, maintained or remoulded on the farm in order to meet farmers' goals (van der Ploeg 1999). Often, different time horizons underlie the transformation processes, due to the different social and natural cycles that have to be organised and managed by farmers (Mendras 1970). This, in turn, leads to specific spatial arrangements on the farm and in the cultural landscape (van der Ploeg 1987); a specific layout of the farm, or patchiness in the cultural landscape is the outcome (see also Berkes *et al.* 2000). The organisation and management of different social and natural cycles further indicates that farmers also actively influence (ecological) succession processes (Mendras 1970, van der Ploeg 1987, 1999; see also Berkes *et al.* 2000). Through this conscious manipulation, existing resources can be further specified and moulded, while new resources may be created. This may offer new possibilities for co-production, as I mentioned earlier.[22]

Natural Resources as Multi-dimensional Entities

In the foregoing section, I focussed on the values attributed to natural resources. But one can distinguish a wide range of other factors that also influence farmers' opportunities and limitations for using and managing natural resources (van der Ploeg 1990; von Benda-Beckmann 1991; Wiersum 1997a). These factors are the following:

- *Cultural elements*, i.e. worldview and religious beliefs that define not only taboos or religious restrictions (Posey 1999), but also relations with nature; knowledge and skills of household members in relation to natural resources and their use and management; agency, i.e. the ability to activate networks and enrol other actors in one's project.
- *Political-economic factors*, i.e. regional and national politics, governmental policies; prices of farm outputs determining future investment levels on farms: costs of non-factor inputs, like chemical fertiliser and pesticides, used to obtain or promote a certain product or transform a natural resource; distance to markets, the existence of non-commodity mechanisms for mobilising resources, etc. (van der Ploeg 1990, 1991).
- *Availability of production factors*, comprising: the quality and quantity of land, labour and capital (van der Ploeg 1990), and including also the distance to overcome to reach natural resources.
- *Biophysical characteristics*, i.e. types of ecosystems; ecosystem 'health'; existing plant and animal species; biological diversity (Primack 1993).
- *Tenure arrangements*, i.e. formal rules and control structures; customary social agreements and control structures; incentives, etc. (von Benda-Beckmann and van der Velde 1992; Wiersum 1997a).
- *Livelihood features*, such as: the mix of resource uses, farmers' orientation towards subsistence or markets, and the needs for environmental services.

Figure 1.1 The multi-dimensional character of natural resources



Values attributed:
- Use values
- Exchange values
- Option values
- Intrinsic values
Biophysical characteristics:
- Type of ecosystem
- Type of plant/animal species
- Ecosystem "health"
- Biological diversity
Cultural elements:
- Worldview/religious beliefs
- Knowledge, skills and attitudes
- Agency
- Tools and technologies
Natural Resources
Tenure arrangements:
- Formal rules
- Formal control structures
- Customary social agreements
- Customary control structures
Political-economic factors:
- Local/regional/national politics
- Governmental policies
- Prices for farm outputs
- Costs of non-factor inputs
- Distance to markets
- Non-commodity circuits
Livelihood features:
- Mix of resource uses
- Subsistence/market orientation
- Needs for environmental services
Availability of production factors:
- Land
- Labour
- Capital

The factors mentioned above determine the attribution of values to natural resources and their translation into concrete action, i.e. a specific resource use and management. The outcome of this translation is a set of specific uses and management practices. Many of these factors are also related to each other, as Figure 1.1 illustrates. Therefore, I propose to consider natural resources as multi-dimensional, with which I refer to the existence of multiple factors that influence its use and management.

Many of the factors listed in Figure 1.1 will have to be negotiated for by farmers. As such, they are partially determined at the interface of different social forces and with other actors. Often, *competition* or *struggles over natural resources* take place between different groups of farmers, or between farmers and external stakeholders (Peluso 1996; Blaikie and Brookfield 1987; Long and Long 1992; Long and van der Ploeg 1994). These struggles can also take place in different forms, depending on the tenure status of a resource. Here, I will explain this by making a distinction that is based on the property rights to natural resources, which can be either individual or communal (von Benda-Beckmann 1991; von Benda Beckmann and van der Velde 1992). Making this distinction is relevant for those (tropical) countries (such as Mexico), where important common property exists.

Regarding individual property, competition is related to farmers' access to land and natural resources as a whole. In the context of communal property, competition should be understood as the possibilities to obtain products or environmental services from common resources. At community level, customary rules and regulations, as well as control structures, are often present, which can equilibrate most competitions or struggles. Formal law can further regulate natural resource use and management (Wiersum 1997a, 1997b). However, actors can manipulate informal and formal rules and regulations, in order to secure their own access or prevent other actors' access to natural resources. Outside agencies, such as governmental agencies, conservationists or non-governmental agencies can also have interests in the community's natural resources. On both the individual and communal level, social struggles take place not only in practice, but also through rhetoric. On a practical level, struggles have to do with the appropriation of resources and the obtaining of power in order to fulfil one's needs or aspirations. With rhetorical struggles, I refer the actors' ability to actively alter discourse, or influence the discourse of others. In other words, use and exchange values attributed to natural resources are being transformed in interface situations in order to get access to or prevent other actors from accessing natural resources (Peluso 1996; Long and Long 1992).

Professional Understanding of Farmer's Use and Management of Natural Resources

In many tropical countries, there has for a long time been a lot of misunderstanding about farmers' use and management of natural resources, especially forests. It was not until the early eighties that a more profound understanding was obtained (Arnold 1990; Wells *et al.* 1992; Wiersum 1997a). Since that time, professionals have become aware that farmers depend on natural resources to satisfy their basic, cultural and religious needs (Arnold 1990; Posey 1999; Wiersum 1999). The role of environmental services in farming practice has also been recognised (Arnold 1990). Furthermore, it has become clear that natural resources provide shelter for all kinds of animals that have been used for a wide range of socio-cultural purposes, or that fulfil important ecological functions in farming practice (Redford *et al.* 1995). Finally, much insight has also been gained into the local institutional arrangements for natural resource use and management (Wiersum 1997a, 1997b).

1.7 The Co-production of Natural Resource Diversity

In the foregoing section I presented a conceptualisation for understanding the role of farmers and living nature in the process of co-production. But I did not yet discuss how to understand the effects of co-production on biodiversity. In this section, I will specifically address this theme.

From Biodiversity to Resource Diversity

Diversity in biological resources is most commonly described by using the biodiversity concept. As stated in the beginning of this chapter, biodiversity is a concept from natural science that describes the biological diversity that can be distinguished at genetic, species and ecosystem level. As I also stated earlier, the biodiversity concept has become the leading principle in conservation in general and in the management of species and ecosystems in protected areas in particular (Primack 1993).

The biodiversity concept makes perfect sense to natural scientists and politicians, but might be meaningless to other actors, such as farmers. This can be explained by looking at the values attributed and the social definitions of living nature and its diversity. It can also be explained by looking at the social processes that determine the composition and distribution of the living nature's diversity.

Scientists and politicians generally attribute intrinsic and option values to living nature. The values that are attributed by farmers to living nature are dominated by instrumental values, even though they also attribute intrinsic and option values. Furthermore, the social definition of living nature of natural scientists and politicians does not necessarily coincide with that of farmers. I already argued this before. In response to the values that they attribute to living nature and their social definition, farmers have often actively maintained biological diversity in their land-use systems (Conklin 1957; Posey 1985; Ellen and Fukui 1996; Kessy 1998; Posey 1999). More specifically, the natural resources that are present in these land-use systems, and which represent a specific biodiversity, have been often consciously conserved and managed by farmers (Slocombe 1999). These resources have also further been moulded and remoulded through and within the process of co-production (van der Ploeg 1999). However, the concept of biodiversity is still mainly considered as a purely biological phenomenon. Consequently, this concept cannot be used very easily to gain insights into the social processes underlying the multiple manifestations of biological diversity in human-influenced environments, nor into the processes of transformation of biological diversity from more natural to more anthropogenic ecosystems (Wiersum and Gonzalez 2000).

Instead of a natural science-based interpretation of biological diversity, it can now be argued that an alternative conceptualisation is required for fully understanding biological diversity, such as in protected areas inhabited by farmers. This alternative concept should make it possible to address farmers' valuation and social definition of living nature (including its diversity) and the social processes that play a role in its constitution and transformation. Here, I propose to call this concept *(natural) resource diversity*, to represent the diversity in natural resources that is distinguished, created and maintained within and through the process of co-production. Within this process, farmers play a strategic role.

The concept of resource diversity can be understood as the sociological counterpart of the concept of biodiversity. Theoretically, different levels of resource diversity can be distinguished, similar to the biodiversity concept. It can be used in reference to the level of individual species, land-use unit level, or landscape level. These levels, however, only make sense when they are part of farmers' social definition of living nature. Furthermore, as resource diversity refers to the consciously valued, and, consequently, conserved, moulded or remoulded components of living nature, it should be interpreted as an inherently dynamic concept. Because, obviously, natural resource values are not static but dynamic, as I stated before, and the constellation of resource diversity will change in response to social transformations.

Notably when considering tropical environments, it has been suggested that the process of co-production has resulted in several specific patterns of resource use, i.e. hunting and gathering, pastoralism, shifting cultivation, permanent cultivation or mixed farming. In reality, however, farmers are normally engaged in a combination of several farming and natural resource use activities (Padoch and Vayda 1983). As a result of the multiple farming and resource use and management activities of many (tropical) households, their natural environment often consists of various actively created or maintained landscape units that represent and, at the same time, contain a specific resource diversity. Some of these units can consist of natural ecosystems from which native species are extracted, while other units consist of agro-ecosystems in which a combination of native species and domesticated species are present. Often, the distinction between the more natural ecosystems and agro-ecosystems is not discrete, but gradual (Wiersum 1997a, 1997b).[23]

Farming Styles and Resource Diversity

Resource diversity is one of the outcomes of the process of co-production. Its characteristics depend not only on the values attributed to living nature by farmers, but also on the management practices that they employ. Both value attribution and the application of management practices are influenced by local ecological, economic, socio-political and technological conditions. It also depends on the transformations of social and natural resources as responses to changed conditions. In other words, it can be assumed that a direct relation exists between resource diversity and farming styles.

Within farming styles, natural resources are created, used and managed in relation to the overall development of the farm, i.e. farmers' goals and their translation into the specific context of the farm. One can thus assume the existence of *style-specific resource diversities*. The characteristics of style-specific resource diversity depend on farmer's objectives regarding the specific set of natural resources that are distinguished and actively moulded and remoulded on the farm and in the landscape. It also depends on the ecological characteristics of these resources. Differences within farming styles might exist, due to the multi-dimensionality of natural resources. In other words, resource diversity is related to specific farm conditions.

The characteristics of style-specific resource diversity can change over time, because of ecological and technological changes, the introduction of new (institutional) norms and principles, or the creation of new organisational structures. Furthermore, it can be influenced through the reconstitution of social networks, transforming ideologies or changing access to production factors and non-factor inputs (Wiersum 1999; Long and Long 1992). Farmers play a strategic role in the reshaping of resources under changed conditions. The outcome of such remoulded resource diversity can be considered the starting point for a new process of co-production, which can include new possibilities for farming practice and biological diversity.

Resource diversity as part of farming styles is reflected in heterogeneous and location-specific land-use patterns. Its characteristics are actively created, maintained or transformed within a farming style at both the farm and the landscape level. At farm level, various privately owned landscape niches can be co-produced, consisting of natural resources that are used and managed in a specific way. At landscape level, one can identify communal land-use zones with the presence of different user groups. Often, private and communal property co-exist.

The use and management of communal resources can be very complex, as different farmers may place different demands on them. Besides, farmers can have either *de jure* or *de facto* control and management responsibility over different natural resources, or production processes. In many tropical regions, control over natural resources does not necessarily have to coincide with the management responsibility (Rocheleau 1987). Furthermore, different tenure arrangements can also exist and style-specific resource diversity can exist within a situation of legal pluralism (von Benda-Beckmann 1991), generally increasing the complexity of norms and regulations regarding use and management.

At both farm and community level, the process of co-production can result in new possibilities, but also limitations for farming practice. Natural resources can be further transformed to better meet the needs and aspirations of farmers. These transformations involve farmers' organisation of natural and social cycles, as well as the dimensions of time and space. I already described this before. Natural resource transformations can further lead to an increase in resource diversity, as well as a decrease. Moreover, theoretically, the same resource diversity can also be maintained. The outcome of these transformations sets the conditions for a new process of co-production, as explained earlier. Figure 1.2 illustrates this schematically.

Figure 1.2 The dynamic co-production of resource diversity

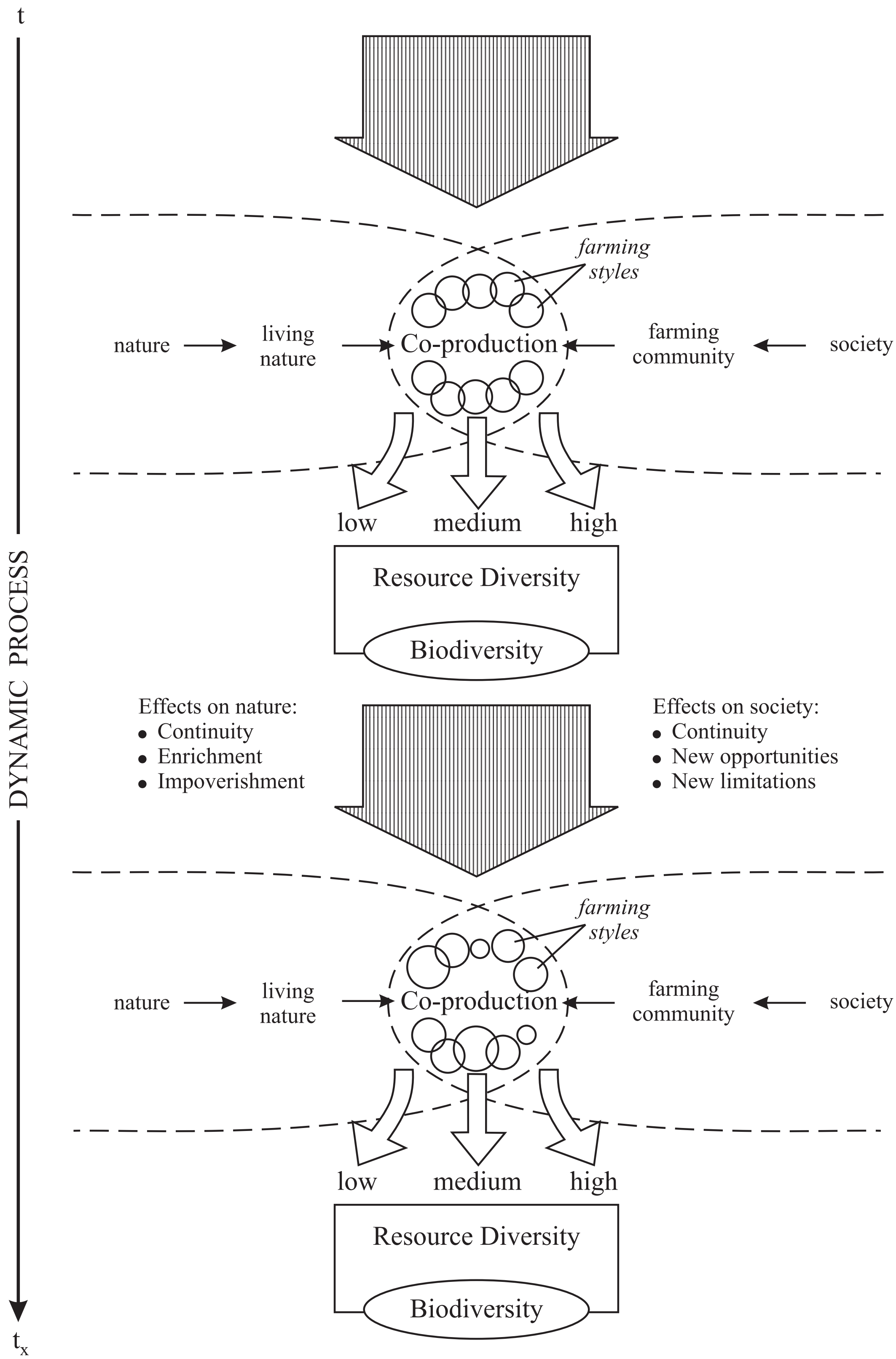


Figure 1.2 also shows that biodiversity can be understood as directly related to resource diversity, as it is embedded in the different natural resources that it composes. It may be clear that any kind of transformation of resource diversity can also have an effect on biodiversity.

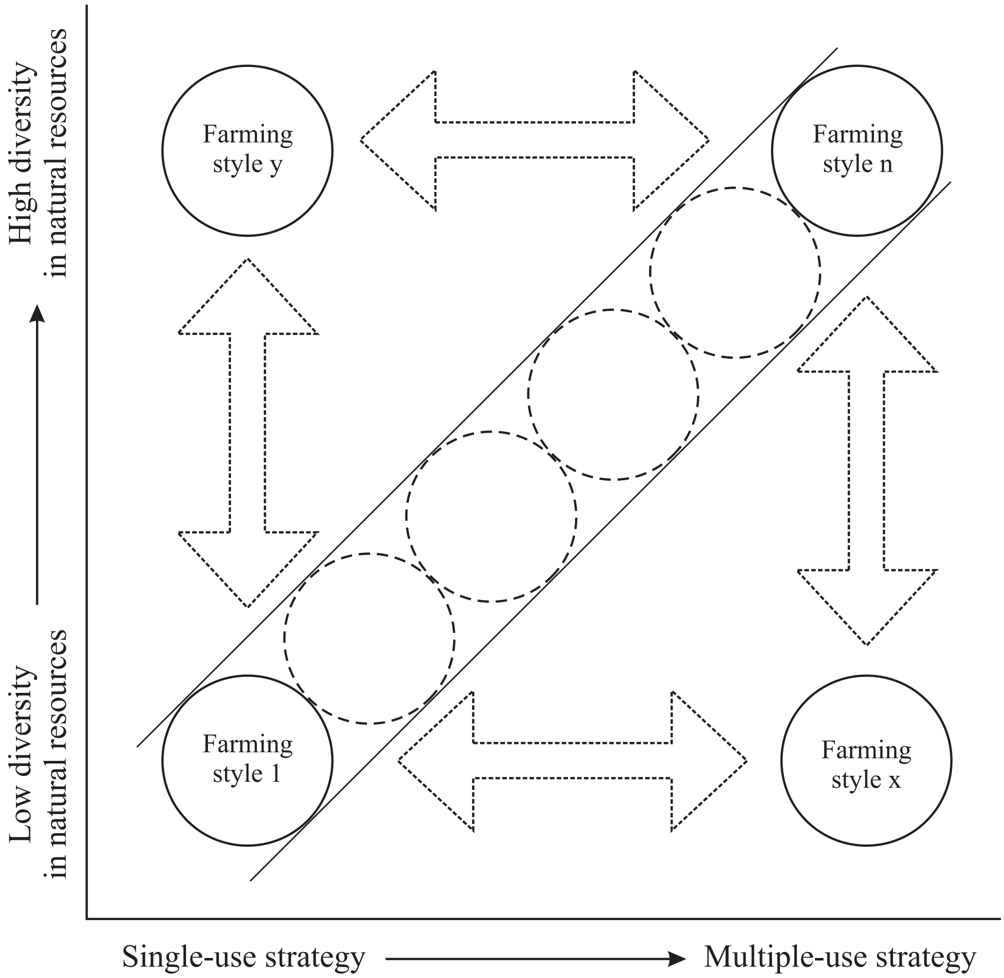
Farm Development Patterns and Resource Diversity

The relation between farming styles and resource diversity can be further understood by looking at farm development patterns. Farm development patterns are related to farming styles, as they can be considered the translation of the underlying notions and ideas of farming styles into specific farming practice. Theoretically, farming styles can be oriented either towards specialisation or diversification, i.e. farmers can follow a single-use or a multiple-use strategy. Many transitional situations are also possible (Toledo 1995; Van der Ploeg 1990).

A relatively wide range of resource use and management activities takes place within those farming styles that follow a multiple-use strategy. This diversification is due to the attribution of many different values to living nature. Under a situation of diversification, it might be assumed that resource diversity is high. Resource diversity may be further enriched, because of possible new insights into living nature that emerge from the process of co-production, or through changing ecological, economic or socio-political conditions that favour it. It can also involve the stimulation of certain ecological processes that can lead to new or improved species or genes, as, for example, is the case for certain local maize varieties (see, for example, Louette *et al.* 1997b). Resource diversity can be considered low within farming styles that are oriented towards a single-use strategy. As the emphasis of this type of farming lies on specialisation, relatively few values are attributed to living nature. Existing natural resources can also be transformed to meet the (specialised) needs and aspirations of farmers. This can also imply the (gradual) transformation of habitats in order to obtain a totally different product or service. In other words, a decrease in resource diversity might occur.

The patterns for the development of resource diversity described above can be considered as normatively defined development patterns for farming styles. In Figure 1.3, a schematic representation is given of the discussed patterns in relation to resource diversity. It also indicates two other possible relationships between farmer strategies and resource diversity that (theoretically) might exist. On the one hand, farming styles could be distinguished that maintain high resource diversity, even though farm development is characterised by specialisation. On the other hand, farming styles might also exist that maintain a strategy of diversification, but with low resource diversity. The existence of these and possible other development patterns of farming styles in the study area will be part of a critical discussion of the empirical evidence.

Figure 1.3 Normatively defined development patterns for farming styles in relation to resource diversity



1.8 Research Process

As discussed in the introduction to this chapter, the research situation was been somewhat complex, as I was a secondary stakeholder in the RBSM. For the Cuzalapa farmers, I was always ‘one of those working for the Reserve’, making the establishment of proper rapport more difficult with those actors who have different interests in the natural resources of Cuzalapa (and the Sierra de Manantlán). The actors with other interests are the group of farmers that controls the local government of Cuzalapa, and the municipality authority of Cuautitlán (to which Cuzalapa belongs).

Although always friendly, generally farmers of the Sierra de Manantlán are somewhat suspicious regarding outside interventions, due to a history of broken promises and conflicts (Rojas *et al.* 1996). Consequently, they do not always give exact answers, above all, when one starts asking about their properties. Therefore, quantitative data have to be taken with some caution. For this reason I also opted for a more qualitative approach. Only the data presented in Chapter 4 are more quantitative, as they were collected amongst a small number of families willing to share information and with which a very good rapport could be established.

Although Cuzalapa was a relatively difficult research area, the fieldwork became easier over time, probably due to my improved command of the Spanish language. The duration of the research made it possible to get to know many families better. Little by little, interviews could be interlocked more readily with the farmers' day to day lives. Although some attention will be given to the position of women in Cuzalapa, it was difficult to interview them due to the socio-cultural ideas on gender in Mexico, especially in more remote and rural areas such as the Sierra de Manantlán.

Research Methodology, Steps and Methods

During the fieldwork, a relatively straightforward methodology was followed, using a limited number of research methods. Fieldwork centred on different themes that have been investigated more or less one after the other. Besides, four basic steps can be distinguished that have been followed:

- *Review of secondary information* on specific research topics in order to obtain a general overview, including historical archives, maps and digitised images (see Bernard 1988).
- *Discussion with key informants* in the study area on specific research topics in order to obtain a preliminary qualitative understanding. The key informants were Cuzalapa farmers who have a broad overview of the different aspects of natural resource management in Cuzalapa, or who have extensive knowledge on specific themes. Use was made of informal and semi-structured interviews, and interview data were complemented by participant observations, field observations, mapping and the so-called 'transect walks' (see Bernard 1998; Geilfus 1997).
- *Corroboration of preliminary results* through discussions with a wider group of farmers. Use was made of informal and semi-structured interviews, complemented by participant observations, field observations, mapping and transect walks (see Bernard 1988; Geilfus 1997).
- *Gathering of quantitative data* in order to elaborate on the qualitative results. Use was made of two methods. On the one hand, a database was constructed of 166 farmers for whom basic data was collected in the period 1993-1998. Note that even though this database was maintained and actualised over the extensive period mentioned, data are not complete for all farmers. On the other hand, two surveys were conducted. In 1994, a survey was conducted to obtain basic data on farmers' agricultural, cattle-breeding and forestry activities (see also Gerritsen 1995). In 1998, another survey was conducted to obtain data on migration patterns of Cuzalapa farmers. The sample size of both surveys consisted of 10-15% of the total farmer population in Cuzalapa. Furthermore, the latter survey consisted of relatively few questions and its results were complemented by informal interviews (see Gerritsen 1998a).

Finally, due to the size of Cuzalapa territory and the lack of motorised transportation in the first year, fieldwork was done mostly in five settlements of Cuzalapa that are located relatively close to one another (i.e. at a walking distance of 45 minutes to one hour). Occasional visits were made to the other more remote localities (i.e. at a walking distance of more than one hour) in order to corroborate findings obtained in the settlements that were more frequently visited.

1.9 The Structure of this Book

In this first chapter, I presented the theoretical framework of this study. Chapters 2 to 7 present the results of the fieldwork. I will link the theoretical suppositions with my empirical findings in Chapter 8. Table 1.1 gives an overview of the content of the whole book, organised by chapter and using key words. Each chapter is described briefly below.

Chapter 2 presents a general description of the study area, i.e. Cuzalapa and the RBSM. It also describes the process of co-production, which includes a historical dimension. *Chapters 3* and *4* take a closer look at farming diversity in Cuzalapa. *Chapter 3* describes the regional farming style in Cuzalapa, including the farmer differentiation that is present in the 1990s. Farming dynamics are also described. The chapter concludes with a discussion of the transformations that have taken place in Cuzalapa since the 1970s. *Chapter 4* presents seven case studies of Cuzalapa farmers, which are analysed from an economic perspective. This chapter gives insight into the livelihood strategies of Cuzalapa farmers. *Chapters 5* and *6* focus on Cuzalapa farmers' resource diversity. *Chapter 5* contains a general description of resource diversity, which is made at landscape level, while *Chapter 6* describes the use and management of Cuzalapa resource diversity by its farmers. The relation between resource diversity and the regional farming style is also described, as well as the transformations that have taken place in resource diversity since the 1970s.

Chapter 7 presents an analysis of the wider institutional context regarding natural resource use and management in Cuzalapa, focussing special attention on the Sierra de Manantlán biosphere reserve, and its impact on resource diversity. *Chapter 8* and the *Epilogue* attempt to link theory, empirical findings and policy practice. *Chapter 8* discusses the overall results of this research and offers some theoretical and practical considerations for strengthening endogenous potentials for conservation. Finally, the *Epilogue* presents a number of policy recommendations.

Table 1.1 Overview of the content of the book

General theme	*Part of book*	*Key words*
Theoretical Framework	Chapter 1	1: Biodiversity, protected areas, biosphere reserves, local people, actor-oriented approach, co-production, endogenous development, farming styles, resource diversity, research methodology
Study Area	Chapter 2	2: Sierra de Manantlán, biodiversity, agrarian communities, forestry, agriculture, cattle-breeding, land reform, history, land tenure
Farmers' perspective on biodiversity and conservation	Chapter 3 to 6	3: Regional farming style, competence value axis, differentiation, resource mobilisation, transformation processes 4: Peasant economics, competence value axis, craftsmanship, transformation processes 5: Farmers' perception of natural resources, resource diversity 6: Natural resource use and management, resource diversity transformations
Policy perspective on biodiversity and conservation	Chapter 7	7: Conservation, institutions, government, biosphere reserve, management programme, formal law, customary agreements, resource access insecurity
Discussion and conclusion	Chapter 8 and Epilogue	8: Co-production, farming styles, resource diversity, protected areas, endogenous development, endogenous potential for biodiversity conservation, platforms for natural resource management, participation, science and scientists, rural sociology, combination of social and natural science Ep.: Policy recommendations

Notes

1 Parts of this Chapter, in combination with parts of the following chapters are published as Gerritsen (1999, 2000, 2001b), Gerritsen and Morales (2001), and Gerritsen *et al.* (2002a, 2002b).

2 Protected areas fall under a special regime for natural resource management. These areas are characterised by a high and exceptional biodiversity, or the presence of endangered plant and animal species. Conserving biodiversity is the main aim of these areas (IUCN *et al.* 1991).

3 Biosphere reserves are a special management category of protected areas. These protected areas are established on land that is already owned by farmers. Land-use regulations are enacted, which, however, do not change existing ownership of land. Although biosphere reserve managers actively seek farmer participation in conservation activities, the established zoning regulations also change the farmers' rights to use and manage natural resources (Batisse 1986; Pimbert and Pretty 1995).

4 Annex 1 presents a glossary of the Mexican terms that are most frequently used in this book.

5 However, the issue of biodiversity loss and, above all, its impact upon evolution, is still '*almost entirely a black hole of enquiry'* (Myers 1996:38), and *'clouded with much uncertainty'* (Myers 1993:75). It very much resembles an '*iceberg'* (Guyer and Richards 1996:1), of which one sees only the top: one imagines, but can never be totally sure, of all that must be under water. Regarding the same discussion on our 'knowledgeability' (Long and Long 1992) of biodiversity, Myers (1996) holds a very controversial viewpoint. He argues that the key issue of biodiversity conservation might not be so much the preservation of diversity, but the safeguarding of evolution's capacity to generate (new) species. This, in turn, would shed a whole new light on biodiversity, its depletion, and conservation.

6 Thus, a precautionary principle underlies protected area management (Myers 1993).

7 From now onwards, protected areas mentioned in the text will refer to populated ones, unless otherwise indicated.

8 The putting in practice of participation takes place in many different ways, but I will not go into the concept of participation (except for in Chapter 7). For a very comprehensive overview and discussion, see Chambers (1983; 1997), or Pretty (1995).

9 Some of these problems (such as the top-down and centralised approach) are a direct outcome of the dominant (conservation) paradigm. Others (such as funding or the ad-hoc and short-term nature of actions) are related more to political willingness and capabilities of putting new policies into practice.

10 See Wells *et al.* (1992), Pimbert and Pretty (1995), Borrini Feyerabend (1996) and Ghimire and Pimbert (1997) for a general discussion.

11 It goes without saying that farmers are equally affected and conditioned by the larger society to which they belong (van der Ploeg 1997, endnote 14).

12 I understand farmers to be those people who are involved in agricultural and cattle-breeding activities on semi-permanent or permanent fields. They can also be involved in forest use for domestic and commercial purposes. Thus, this book will not focus on other users of natural resources, such as traditional hunter-gatherers or nomadic pastoralists (Padoch and Vayda 1983).

13 In this book, this approach includes natural resource management (understood in the broad sense).

14 The concept of co-production originates from the sociological school of *social constructivism*. The term co-evolution is also frequently used. It has been applied to agriculture by rural sociologists at Wageningen University in the Netherlands (see Van der Ploeg 1997, 1999; Wiskerke 1997; Roep 2000). In this research, I heavily draw from the Wageningen School of Rural Sociology, i.e. the work of van der Ploeg and his colleagues.

15 Thus, endogenous development is a relational concept, which only fully demonstrates its meaning when contrasted with its exogenous counterpart (Broekhuizen and van der Ploeg 1995).

16 As it also relates to the characteristics of natural resources, *heterogeneous patterns of natural resource management* can also emerge, which can be further reflected in a corresponding biodiversity in the cultural landscape.

17 Under normal conditions of co-production, transformations in farming and natural resources also take place, but it may be assumed that these transformations take place more slowly and more gradually (van der Ploeg 1990, 1999).

18 Situations may occur in which farming styles are not always very clearly distinguished by farmers on a discursive level. Differences can also exist between farmers' discourse and practice, due to the possibilities that exist for farmers to put general notions and ideas into practice. Furthermore, different actors can have diverging views of the same event (Whatmore 1994). Thus, methodological difficulties can then emerge. In these situations, Giddens' notions of *discursive* and *practical consciousness* can be helpful, referring to two levels on which actors are knowledgeable of their social and natural surrounding. The discursive consciousness relates to 'that which can be put into words', i.e. farmers' ability to assign responsibility for, or to cite the reasons for his or her actions. The practical consciousness alludes to the tacit knowledge of actors that is skilfully applied in the course of their actions, but which is not formulated discursively. By following these notions, clarity can be brought into situations where farmers do not clearly distinguish farming styles, or where they have not developed an (explicit) discourse to explain their situation (Munters *et al.* 1991; Giddens 1984).

19 I define 'regional' as a specific social space in which farmers' actions take place, and around which relatively clear geographical boundaries can be distinguished. In Mexico, where the fieldwork took place, this often coincides with the territory of an agrarian community.

20 Insight is needed into both biophysical and socially constructed nature to fully understand co-production. Until now, living nature as a biophysical entity has been the object of study of mainly natural scientists, while living nature as a social construction falls within the domain of mainly social scientists (Ingold 1996). Insight into one makes more sense when accompanied by an understanding of the other. Due to the scope of this book, emphasis lies on the socially constructed living nature.

21 Depending on their cultural backgrounds, actors can have different understandings of nature, i.e. different social definitions.

22 It is also in this way that farmers co-produce a dynamic working unity for meeting their needs and aspirations that is characterised by a specific socio-material constellation (Roep 2000).

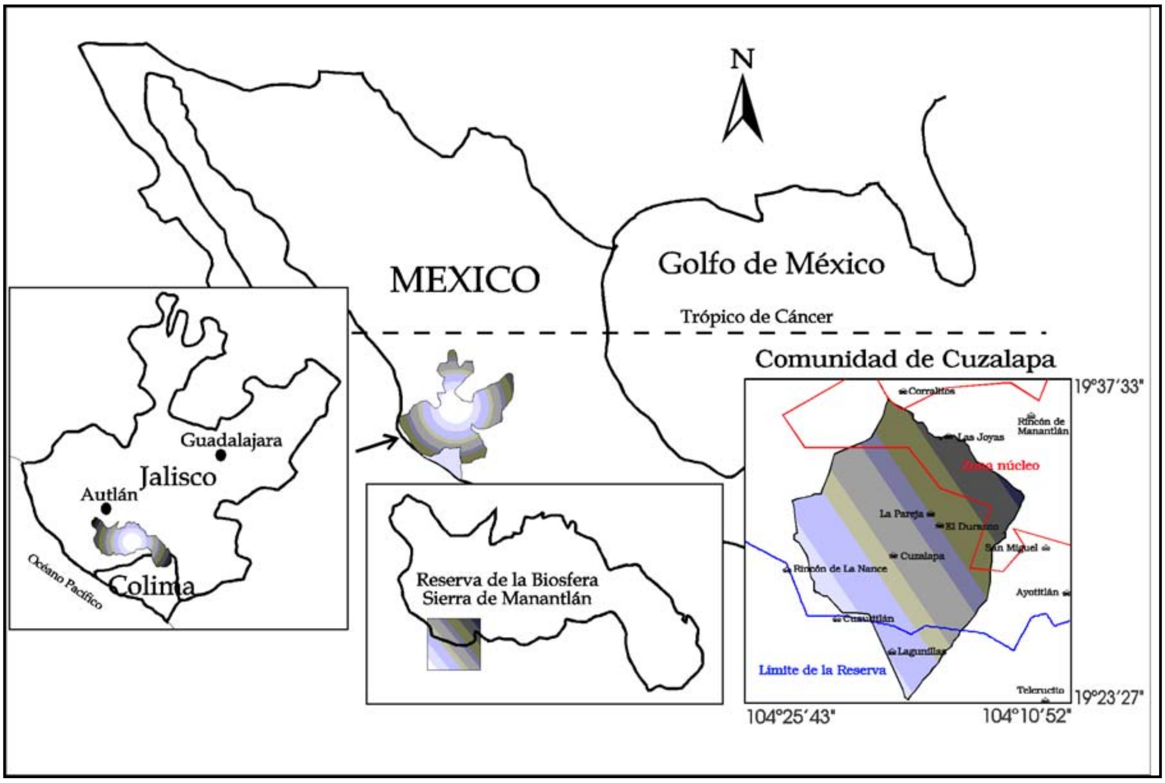
23 For instance, many indigenous forest management types bear witness to human creativity in creating a variety of forest land-use systems in a continuum from native to anthropogenic forests with many systems displaying characteristics, which are intermediate between native forests and pure tree plantations (Wiersum 1997a, 1997b).

2 The Contested Lands of Manantlán[1]

2.1 Introduction

The fieldwork for this study took place in the indigenous community of Cuzalapa, as stated in Chapter 1. Cuzalapa is one of the communities located on the southern slopes of the Sierra de Manantlán biosphere reserve. The RBSM is situated in the south-western part of the state of Jalisco and the northern part of the state of Colima in Western Mexico (Figure 2.1).

Figure 2.1 Location of Cuzalapa and the RBSM (SIIR-SM 1998)



In this chapter, I will first give a general description of the Sierra de Manantlán biosphere reserve to provide the reader with a basic understanding of the Reserve. Then, I will give a general description of Cuzalapa, including a historical dimension. Both descriptions will provide a basis for understanding the remaining chapters of this book.

2.2 The Sierra de Manantlán Biosphere Reserve

The RBSM comprises a mountainous area of 139,577 hectares that ranges in altitude from 400 to 2,860 metres above sea level. The region is characterised by a very high diversity in plant and animal species (Table 2.1). Thirteen vegetation types can be found within its limits, including cloud forest, which is very rich in species (IMECBIO 2000b). The biological diversity of the RBSM contains great potential for agricultural, but, above all for forestry, medicinal and nutritional purposes (Benz *et al.* 1994; IMECBIO 2000b). In 1960, the Mexican writer Agustín Yáñez already referred to the coastal region of Jalisco as '*la tierra pródiga'* (the rich and abundant land) (Yáñez 1992), due to its great richness and potential for exploitation. He also already described the contested nature of the natural resources of the region.

Table 2.1 Biological diversity in the RBSM (IMECBIO 2000b)

Class	*Number of species*	*Endemic species (%)*
Vascular plants	±2900	±50
Mammals	110	20
Birds	336	11
Reptiles and amphibians	85	15
Fishes	16	25

Various studies suggest that the biological diversity in the Sierra de Manantlán is not only the result of ecological conditions, but also of agricultural and cattle-breeding practices (Jardel 1991, 1992a, 1992b; Graf 1992; Brockmann and González 1994; Benz *et al.* 1994; Gerritsen 1995; Bussink 1995; Rojas *et al.* 1996; Louette *et al.* 1997a, 1997b). Notably, the biodiversity 'flagship' species, *Zea diploperennis* (see below), is not a wilderness species, but a species that results from human-influenced conditions (see Gerritsen *et al.* 2001). Human-influenced conditions date back to pre-Hispanic times (Laitner-Benz 1992; Laitner-Benz and Benz 1994).

Creation of the Reserve

The Sierra de Manantlán was decreed a *biosphere reserve* in 1987 and it was incorporated in the Man and Biosphere (MAB) network of biosphere reserves of UNESCO in 1988. Biosphere reserves emerged in the 1970s and are based on an integrated approach to conservation in which development, research and educational goals are pursued in addition to conservation objectives (Batisse 1986). During its early years, the approach:

> '[...] *seemed heretical for many conservationists: it attempted to include and not exclude the human beings in conservation, and experiment with land and natural resource management forms that could harmonise nature protection with its rational use, in order to satisfy the needs of the people*' (Jardel *et al.* 1997:1, own translation).

Nowadays, this integrated approach has become a common scheme for conservation. In 1997, for example, 324 biosphere reserves could be found in 82 countries (*ibid.*); most of them located in developing countries (WCMC 1992).

The establishment of the Sierra de Manantlán as a protected area is attributable to its biological richness, its forestry potential, its watersheds, and, hence, the importance of conserving the Sierra's natural resources for mankind as a whole. It obtained the status of biosphere reserve because the area falls within the territory of a considerable number of agrarian communities.[2] The RBSM is now considered to be one of North America's most important protected areas in terms of the biological diversity it contains (Jardel 1992a; Jardel *et al.* 1996).

The discovery of *milpilla* (Zea diploperennis), a wild endemic 'relative' of corn with potential for genetic maize improvement, in the late 1970s, led to the idea to establish a protected area in the Sierra de Manantlán (Jardel 1992a). The struggle over natural resources between some farmer groups and private logging companies coincided with the University of Guadalajara's interest to create a protected area, establishing the social basis needed for the final creation of the Reserve in 1987 (Graf *et al.* 1995; Jardel *et al.* 1996). Since that time, the Reserve's management strategy for achieving conservation has evolved from a one-species approach into an ecosystem approach; the whole mountain range and its watersheds are now considered as an integral conservation unit. The establishment of the Sierra de Manantlán as a protected area has been an important factor in stopping unsustainable commercial logging activities. However, like many other biosphere reserves (Jardel *et al.* 1997; Ghimire and Pimbert 1997), the Reserve is still confronted with numerous environmental and socio-political problems, which threaten the objectives of biodiversity conservation and sustainable development (Jardel 1992a).

The importance of the socio-economic and political aspects of the Reserve's management has been recognised since the beginning. For those promoting the RBSM, it has always been clear that, apart from their historical rights, the involvement of the rural population is crucial for the project to be successful (Jardel *et al.* 1996). Nevertheless, farmer participation has not yet fully obtained its rightful place within the Reserve's management. Although much progress has been made, this issue still challenges the managers of the RBSM (IMECBIO 2000b; Gerritsen *et al.* 2000b; Kreutzer 1998a; Gerritsen 1997a, 1998b).[3]

Agrarian Communities within the RBSM

The agrarian communities of the Sierra de Manantlán represent a socio-economic and political landscape that is as diverse and complex as the biological diversity the area contains. The RBSM has 8,860 inhabitants, but some 21,533 live adjacent to it, all of whom depend partially on its resources and have influence on the Reserve's management. Of the total population within the Reserve, 97 per cent live in the valleys and lower slopes, i.e. below 1500 metres above sea level. Of all the land within the RBSM, 1 per cent is owned by the government, 39 per cent is private property, while the rest belongs to *ejidos* (farmer communities established during the Mexican Revolution) and *comunidades indígenas* (indigenous communities of the *Nahua* ethnic group).[4] As the RBSM's creation in 1987 did not change the existing land tenure regime, it currently falls within the territory of 32 agrarian communities and 80 private land-owners, all within the boundaries of seven municipalities (five in the state of Jalisco and two in the state of Colima) (IMECBIO 2000b).

Land-use in the Reserve's communities consists of maize cultivation and cattle breeding, which is complemented by the collection of non-timber forest products and wood for domestic use. Since the establishment of the Reserve in 1987, community forestry takes place permanently in one of the communities, and incidentally in other communities. In all cases, an official forest management plan and an environmental assessment study is required (*ibid.*; Jardel *et al.* 1997).

Many communities in the Sierra de Manantlán are geographically isolated and their inhabitants suffer numerous interrelated social problems, such as: high school absenteeism and illiteracy, high levels of mortality, inferior consumption patterns, insufficient medical attention, inhospitable domestic conditions (Jardel 1992a; Graf and Rosales 1996; IMECBIO 2000b). The communities are further characterised by a lack of employment opportunities and consequently high migration rates to urban areas and the United States, weak organisational structures (due to internal divisions), *cacicazgo* (strongmenship), alcoholism, violation of human rights, and violence within the domestic sphere and between community members (Jardel 1992a).[5] Land tenure problems have been an important cause of conflicts within and between these communities for generations. There are also individuals who do not reside in these communities, but who have vested interests in its land and resources (*ibid.*; Graf *et al.* 1995; Rojas *et al.* 1996).

Although the communities in the RBSM are considered to be among the most marginalised in Mexico, substantial differences exist between and within them (Graf and Rosales 1996). Forestry and cattle breeding activities have been the main processes, which have accentuated this social differentiation (Jardel 1992a; Louette *et al.* 1997a).

The Reserve's Management Rationale

The management of biosphere reserves, such as the Sierra de Manantlán, is based on land-use zoning arrangements that divide the area under protection into more or less concentric zones, somewhat resembling a fried egg. Three zoning types are distinguished: core zones, buffer zones, and transition areas. The strictly protected core zones consist of areas with the highest biodiversity value, while the (human-inhabited) buffer zones encompass peripheral areas where some form of land-use is allowed (Batisse 1986; Jardel 1992a; IMECBIO 2000b). The transition area, called an influence zone in the RBSM-terminology, consists of the area surrounding a biosphere reserve. It is, however, not included in the (legal) decree of a biosphere reserve (Jardel 1992a).

The rationale behind zoning is the following. On the one hand, buffer zones create suitable habitats around relatively small core zones, allowing plant and animal species to maintain viable populations. On the other hand, a 'supply' of natural resources is made available to the human residents (Hall and Rodgers 1992).[6] As the land tenure regime has not been changed, biosphere reserves can basically be seen as huge zoning regulations that establish restrictions on land-use (Jardel *et al.* 1996).

In the RBSM, the Manantlán Institute for Ecology and Biodiversity Conservation (*Instituto Manantlán de Ecología y Conservación de la Biodiversidad: IMECBIO*), a dependency of the University of Guadalajara, has played a crucial role in promoting biodiversity conservation and sustainable development.[7] Until 1993, it served as the Reserve's most important administrating and management agency. After the discovery of *milpilla*, university personnel established the *Las Joyas* field research station in 1984 in the higher part of the mountain range to protect the plant's habitat and to conduct basic ecological research. Technical assistance and extension work were initiated in some of the Reserve's communities in the period that followed (Jardel 1992a).

At the end of 1993, the federal government created the Directorship of the Sierra de Manantlán Biosphere Reserve (*Dirección de la Reserva de la Biosfera Sierra de Manantlán: DRBSM*) within the Ministry of Environment, Natural Resources and Fishery (*Secretaría de Medio Ambiente, Recursos Naturales y Pesca: SEMARNAP*).[8] The DRBSM is in charge of implementing the RBSM-decree, which describes the 'rules of the game' for conservation and development (INE 2000a, 2000b, 2000c; cf. Gerritsen and Forster 2001). It is also the administrating agency for the Reserve.

The Directorship of the RBSM has filled an 'institutional vacuum', as governmental presence was lacking until 1993. Due to this institutional vacuum, IMECBIO had assumed various roles related to the Reserve's management, such as 'watchdog', protected area manager, development agent and consulting agency, without having adequate legal attributes, budgets, or human resources (Jardel *et al.* 1996).

Nowadays, applied research must provide the missing scientific knowledge needed for the management plan. The research is also directed at forming professionals in conservation. Through environmental education the inhabitants of the region are made aware of the Reserve's existence and the need for biodiversity conservation (Jardel 1992a). Management activities incorporate a regional perspective (Jardel *et al.* 1996), are community-based and of a participatory nature. Whenever possible, preliminary studies are carried out to gain insight into the local social organisation and farmer strategies, after which a participatory planning process is initiated. Specific studies are realised in the different communities in order to improve the quality of development activities (Gerritsen 1996a, 1996b; Gerritsen and Graf 1997; Gerritsen 1997b).

Notwithstanding the substantial work done in the Reserve, development activities still depend greatly on outside support. This is caused in part by the positivistic paradigm in conservation science: planning is firmly rooted in natural science categories and criteria. Both IMECBIO and DRBSM have relatively clear and fixed definitions of rules, procedures and methods, limiting flexibility in their conservation and development approaches (Jardel 1992a; IMECBIO 2000b). IMECBIO is also limited by its basic university tasks of research and teaching, while the DRBSM cannot fully escape from bureaucracy and sectarianism, which is a common problem for many governmental agencies in Mexico (Gerritsen 1997b; 1998b).

2.3 The Indigenous Community of Cuzalapa

To reach Cuzalapa in the southern part of the Sierra de Manantlán one takes the highway from Guadalajara, the capital of the state Jalisco in western Mexico, to the Pacific Coast. After some four hours, this highway ends at the crossroads of *Tequesquitlán*. After turning left, one arrives some 24 kilometres further at Cuautitlán, the municipality's main village. Cuautitlán is one of the two gateways into the southern part of the Sierra de Manantlán. It is also the first place farmers stop when coming from the Sierra. Cattle breeding and sugarcane production are the main economic activities, as is reflected in the landscape, which is dominated by extensive pastures with grazing cows and large sugarcane fields.

Leaving Cuautitlán, the road becomes unpaved and starts to enter lower hills. The first part of the road passes along secondary vegetation of mainly oak. The number of meadows and cattle is astonishing. After about half an hour, the scenery changes again as the road approaches the river Cuzalapa that divides the territory of Cuautitlán and Cuzalapa. Crossing the river, one enters the valley of Cuzalapa and the hills make way for mountains that surround the valley. The first hamlet to be reached is La Rosa, which lies at the crossroads to the main villages of Cuzalapa and Ayotitlán. Farmers can frequently be seen waiting here to go either to Cuautitlán, or further into the Sierra.

From La Rosa, it takes another half an hour to reach the main locality of Cuzalapa, which bears the same name. This part of the journey winds alongside hills and provides a beautiful view of low-lying irrigation fields dotted with and surrounded by trees. Meadows and secondary vegetation dominate the scenery uphill, while forests can be seen at the higher elevations of the mountains. The road enters the main village after passing two very huge and old *Parotas* (Enterolobium cyclocarpum) and crossing the *Paloma* river. After entering the village, it passes the health clinic and one of the two churches of the village of Cuzalapa. It is said that the *adobe* (i.e. clay-dung mixture used for building) church is one of the thirteen churches that were constructed by the Spaniards after their arrival in the region.

At first sight, the village of Cuzalapa gives a quiet, easy-going impression. Indeed life appears to smoothly revolve around two cropping seasons per year in which similar activities are undertaken. The inhabitants of Cuzalapa confirm this impression:

> *Really, Cuzalapa is a peaceful community: it is quiet, and does not have any problems. Those other people* [i.e. the inhabitants of a neighbouring community] *are very conflictive. They are always fighting. You better not go there. But here you will not find any problems, we are a very peaceful people.*[9]

The village is divided into the (elder) settlement of Cuzalapa and the (more recent) one of *El Naranjal* located by the *Tecopaxtle* river. However, not all of the inhabitants explicitly make the distinction between the two parts of the village. Some striking differences can be observed between Cuzalapa and El Naranjal. The centre of the village is located in El Naranjal, where relatively more houses are made of brick, and where parabolic antennas and shops can be found. Cuzalapa, on the other hand, contains more home gardens, the graveyard, a communal man-made garden, and a communal piece of land for religious feasts.

Socio-Economic Conditions

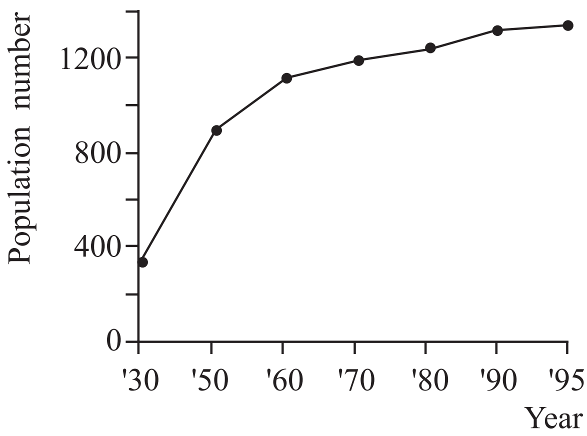
Aside from the main village of Cuzalapa, several hamlets form part of the community of Cuzalapa, of which the following are the largest: *Canoítas*, *El Durazno*, *El Vigía*, *La Pareja*, *La Rosa*, *Las Gardenias*, and *Paso Real*. According to 1995 governmental data, approximately 1,330 inhabitants lived in the whole community, of whom 52 per cent were male and 42 per cent were younger than 14 years (INEGI 1996). Most of the inhabitants lived in the main village of Cuzalapa and, to a lesser degree in the hamlets of El Durazno and La Pareja. Table 2.2 illustrates this distribution.

Table 2.2 Distribution of Cuzalapa inhabitants among localities in 1995 (INEGI 1996)

Locality	*Number of inhabitants*
Canoitas	32
Cuzalapa (village)	817
El Durazno	146
El Vigía	78
La Pareja	142
La Rosa	84
Las Gardenias	29
Cuzalapa (total)	1328

Roughly speaking, Cuzalapa experienced two periods of major demographic change in the twentieth century (Figure 2.2). After 1930, the population gradually increased, partly due to the emergence of commercial forest exploitation activities in Sierra de Manantlán in the 1940s. Since the 1960s, a stabilisation in population numbers appears to have taken place, due to the ending of the forest exploitation activities and due to increased (out-) migration of Cuzalapa inhabitants.

Figure 2.2 Demographic changes in the period 1930-1995 (Graf and Rosales 1996; INEGI 1996; field data of the author)



Cuzalapa has basic services, such as electricity, a health clinic, daily bus service, shops and running water, but it lacks sewerage and postal services. The services it has are mainly centred in the main village, and are not that accessible for everyone. Moreover, they often malfunction. Inhabitants of the hamlets have to walk up to two hours to reach the main village. Communication problems exist in the more remote hamlets, partly due to the topography of the region. Medical attention is insufficient because of a lack of human and material resources. Common causes of death, particularly for children and those living in the more remote hamlets, are related to the relatively harsh living conditions (Gerritsen 1995; Graf and Rosales 1996).

Many of the houses in Cuzalapa are in deplorable condition, although some improvements have been made in the last five years. They lack maintenance and often electricity, drinking water and sewer installations. Table 2.3 shows that housing conditions in 1995 were better in the main village of Cuzalapa, El Durazno, Las Gardenias, and in La Pareja, than in Canoítas, El Vigía and La Rosa.

Table 2.3 Housing conditions in 1995 (INEGI 1996)

Locality	*Percentage of houses with*		
	Drinking water installation (%)	*Drainage (%)*	*Electricity (%)*
Canoítas	0	0	0
Cuzalapa (village)	82	43	81
El Durazno	94	72	97
El Vigía	0	0	64
La Pareja	96	96	96
La Rosa	80	0	7
Las Gardenias	100	86	100
Cuzalapa (total)	78	37	77

Differences in education conditions also partially follow geographic lines. In general, school attendance is irregular amongst children and illiteracy rates are relatively high amongst adults, particularly in the smaller hamlets. Table 2.4 presents education conditions in Cuzalapa in 1990 for the different localities.[10] It shows that the inhabitants (elder than 15 years) of Canoítas, El Vigía and La Rosa are relatively less educated than those in the other localities. El Vigía has a higher school attendance by children, because a school was established in this locality some years ago.

Table 2.4 Education conditions in 1990 (adapted from Graf and Rosales 1996)

Locality	*School attendance (%)*	*Illiterates > 15 years (%)*
Canoítas	80	65
Cuzalapa (village)	90	24
El Durazno	91	15
El Vigía	100	54
La Pareja	88	25
La Rosa	75	52
Las Gardenias	80	20
Cuzalapa (total)	89	26

The above description gives a general impression of social conditions in Cuzalapa, i.e. in the main village and the different hamlets. Canoítas, El Vigía and La Rosa are the more marginalised localities in Cuzalapa, as was also confirmed by field visits. Compared to the people living in the other hamlets, the inhabitants of these three hamlets are in worse health. They are also poorly dressed and do not possess cars; they have houses that are in more deplorable condition and are made of *adobe* (a clay-dung mixture) instead of bricks; and they often do not have electricity or water installations. Alcoholism and violence are also more frequent. The main village of Cuzalapa differs from the rest, as both richer and poorer households can be found there.

Social Differentiation

Although Cuzalapa is an indigenous community, its inhabitants do not categorise themselves as *indígenas* (i.e. indigenous people) or *mestizos* (i.e. non-indigenous people).[11] Instead, they see themselves as either *Pobres* (poor) or *Ricos* (rich). However, it is mainly the poorer farmers who make this distinction:

> *'We call a rich man* [*'un rico'*]*, he who has the necessary means to carry on the struggle* [to carry on the struggle refers to earning a living]. *A poor man* [*'un pobre'*] *is someone who has to go looking for everything. A rich person does not have to look for anything, as he has land, money, and enough fertiliser.* […] *The rich people, they have a lot: land, cattle.* [...] *We, we do not have anything, and they do not want to share their wealth with us. They are bastards* [*'cabrones'*]*, we are damned* [*'jodidos'*].

Thus, the poor, who represent the majority of the farm households, have a strong belief that their situation is caused by the rich. The above farmer went on to say:

> *We are poor, we will always be poor. He who has money* [*'billetes'*] *does whatever he wants to.* [...] *If you have the proper contacts, you make a deal with the commissioner* [i.e. the local authority for land and natural resources] *and you will have more land.* [...] *And the government, they only make things worse. Instead of helping us, the poor! They only harass us.* [...] *We do not have the power or the strength to change things; they do us harm* [*'nos chingan'*] *and we let them. We are lost* [*'estamos jodidos'*]*, but what can we do?* [...] *Well, nothing!* [...] *We do not know how to change things, we do not know how to write or to read. We are ignorant.*

In contrast, the rich seldom speak about themselves as wealthy, but rather as hard workers:

> *Those people* [i.e. the poor] *are lazy, they do not want to work. The whole day they hang around and only get drunk.* [...] *They do not feed their children. And they have a lot of them to feed. It is no wonder that they are poor, they do not want to work.* [...] *We never hold up our hands. We have worked hard for what we have.* [...] *And we have never done anything illegal. We just have enough money to improve our situation. Everything we have done has been in agreement with the general assembly.*

Poorer households have little land: a few hectares of cultivable land and some grazing land. Some own cattle, but their herds are relatively small. When possible, poorer households gain additional income through off-farm activities, like farm labour, carpentry, masonry or car mechanics. Just a few people work for the local government, for which they get a small financial compensation. The main activity of the rich is cattle breeding, although they also cultivate maize and beans. They generally own large plots of land and large herds of cattle. Some of them also own shops and sell all kinds of goods (Gerritsen 1995).

A growing number of landless households have emerged amongst both the poor and the rich. This group consists mainly of the adult sons of land-holding farmers and of those with no land rights. At community level, some non-commodity mechanisms and circuits exist which permit this group to have access to production factors and non-factor inputs. For those whose parents have little land, it is becoming more and more difficult to obtain land rights, due to the current land tenure situation. Consequently, migration is a common feature in Cuzalapa.

2.4 Farming and Forestry in Cuzalapa in the 1990s

According to governmental statistical data, 26 per cent of the total population of Cuzalapa was economically active in 1990. Of this group, 82 per cent worked in the primary sector, 6 per cent in the secondary, and 11 per cent in the tertiary sector (Graf and Rosales 1996).[12] Table 2.5 illustrates economic activities per locality. It shows the dominance of primary sector activities.[13]

Some 640 ha of land in Cuzalapa are designated for irrigated maize cultivation, while some 430 ha are rain-fed. The remaining land, i.e. pasture lands and forests, is used for cattle production and for collection of non-timber forest products and wood (Sandoval and Martínez 1995). In the following sections, I will take a closer look at each one of these activities, and attempt to demonstrate that within each of them, multiple relations between man and nature exist. In other words, a complex process of co-production is taking place in Cuzalapa.

Table 2.5 Economically active population (EAP) in 1990 (based on Graf and Rosales 1996)

Locality	*EAP (%)*	*Primary (%)*	*Secondary (%)*	*Tertiary (%)*	*Not specified (%)*
Canoítas	32	100	0	0	0
Cuzalapa (village)	26	76	8	14	2
El Durazno	26	85	2	13	0
El Vigía	22	92	8	0	0
La Pareja	26	91	0	9	0
La Rosa	22	92	0	0	8
Las Gardenias	32	100	0	0	0
Cuzalapa (total)	26	82	5	11	2

Maize and Bean Agriculture

Agricultural practices in Cuzalapa are centred around maize (and bean) cultivation during two annual cropping cycles, that is, the rainy season (the so-called *aguas* or *temporada de las aguas*) and the dry season (the so-called *secas* or *temporada de las secas*).

During the rainy season (*las aguas*) from June till November, rain-fed maize cultivation dominates the valley of Cuzalapa. Activities start with the cutting and burning of the most disturbing weeds in May, before the first rains fall. The land is then prepared by ploughing with horses and mules, or by using a tractor rented in the neighbouring village of Cuautitlán. After field preparation, weeds are left to decompose. Farmers sow after the first rains during the months of June and July. Sowing takes place during the second ploughing. Farmers walk behind the plough, horses and mules (the so-called *yunta*), and put the maize seeds into the ground at intervals of 30-40 cm, corresponding with the size of the steps they make. The amount of seeds put into one planting hole depends on the variety used (Gerritsen 1995).

Up to seven different maize varieties can be used per growing season, with an average of two per field. The varieties preferred depend on the crop's intended use. For *tortillas* (maize pancakes) mainly white varieties are used. For *elotes* (not yet mature ears of corn used for direct consumption) yellow or black varieties are preferred. For pasture lands, yellow varieties are preferred. For *pozole* (a soup of ears of corn and pork meat) white varieties are sown, as they produce big ears. A total of 26 different maize varieties are found in the valley of Cuzalapa. Short-growing varieties are grown mainly in the rainy season, while long-growing varieties are cultivated mainly in the dry season. Variety choice in the rainy season is related to the presence of more risks. The varieties also differ in planted surface areas. Generally, local varieties make up the majority of the area cultivated (80 per cent), while hybrid varieties are only sown on smaller plots (Louette *et al.* 1997b).

Part of the maize crop is sown in *cañuela*, i.e. it is planted at a very high density strip-wise at the borders of the fields. Sown in this way, leaf production is very high. The purpose of this method is twofold: it produces forage for the cattle, horses, or mules, and it functions as a soil and water conservation measure, as it diminishes both water erosion and water loss. Maize is sometimes grown this way in the whole field to produce forage.

After the maize seedlings have emerged (chemical) fertiliser and herbicides are applied. Utilisation of these inputs, which were introduced in Cuzalapa in the 1970s, is common. The quantity and periodicity of application greatly varies, due to differences in soil characteristics and the scarcity of economic resources to purchase these inputs. Most farmers use fertiliser and pesticides without the proper knowledge; they prefer to uphold tradition even though soil conditions have changed. Commitment of the farmers to their fields also influences the application of fertilisation; but the most important factor is the amount of cash available. Inputs are added several times during the growing cycle, and weeds are cut using a *cazanga* (a round cane knife). Generally, the rain-fed fields are left fallow after the harvest till the next cropping season, to allow the soil to regain its fertility. This depends, however, on the amount of land a farmer owns.

Harvesting takes place from November till January. The exact time depends on the variety used and other farm activities. The plants are bent one month before harvest to prevent the ears of corn from being affected by the rains (Gerritsen 1995). The farmers store part of the maize harvest as a seed lot for the next cropping cycle. However, as seed exchange within and outside the community is important (Louette *et al.* 1997b), the ears of corn collected from a farmer's own harvest represent only 53 per cent of the seed lots; 36 per cent are obtained form other farmers in Cuzalapa, while 11 per cent are introduced from other regions. After the harvest, the leftover crop is retained for the households' animals, or it is sold to other (cattle-owning) farmers in Cuzalapa. Crop residues are also sold to cattle-breeding farmers of the neighbouring villages Cuautitlán and Casimiro Castillo. Depending on field size and cattle number, grazing of crop residues takes place for 8 to 20 days.

The type of maize cultivation described above is called *yunta de lluvia*. It takes place mainly on levelled fields. On slopes or areas full of stones, rain-fed maize cultivation takes place through *coamil*, as farmers cannot access these fields with their *yunta* [horses and mules]. *Coamil* is the traditional method of maize cultivation in which a piece of land is cleared and burned. With a *coa*, a wooden stick with an iron blade, planting holes are made into which the maize seeds are placed. *Coamil* plots are used for only one or two years, after which they are left fallow for longer periods. This is thus shifting cultivation of maize.

In the dry season, irrigation agriculture takes place. It starts in November and ends in May. Maize is no longer the only crop in the field. Beans (Phaseolus vulgaris cv. *Bayo* or *Bayo Berrendo*) are also a dominant crop. They are grown between maize rows, or separately on more inundated parts of the fields. Fertiliser is applied as in the rainy season. Herbicides are used only in the fields where maize is planted alone as it affects the growth of beans. The harvest takes place from March to June, after which the crop residues are eaten by cattle. Irrigation agriculture (*yunta de riego*) takes place on fields near rivers and streams (the so-called *rieguitos*), which are generally different from the rain-fed fields. Farmers prepare these fields in October or November by animal ploughing, or by using a tractor. The weeds have then already been cut and burned. A pre-flood irrigation then follows in order to soften the soil. After about two to four weeks, fields are irrigated again, and maize and beans are sown during ploughing with horses. During the same period, farmers clean and reconstruct irrigation canals, which lead the water from the rivers to the irrigated fields. Farmers whose fields are located at the same river or creek make arrangements for cleaning and reconstructing the existing irrigation canals and the times of irrigation. Agreements are made especially in the months of April and May, when the greatest water shortage is experienced. Gravity leads the water over the fields. The main gullies in the field, which are dug diagonally in the fields according to their slope, are excavated when the maize plants have reached a height of some 30 cm. An *azadón* (a hoe) is used to open and close the different furrows ensuring the irrigation of the whole field. Flooding of the fields takes place every 8 to 15 days. The exact length of the flooding intervals depends of the terrain. Fields located further away from the rivers need a longer flooding period, as the total amount of water per time unit is less then at the parcels near the river. The various maize varieties also have different water demands.

In both cropping seasons, maize and beans are produced mainly for domestic consumption. Part of the yield is sold, but this can vary greatly per cropping season. Farmers face several problems related to their crops (Table 2.6). Their biggest problem is soil fertility. Others include diseases and pests, water availability in the dry season, prices for crops, and wind during thunderstorms that flattens the plants.

Table 2.6 Agricultural problems in the 1990s (Gerritsen 1995:20)

Problem	*Relative importance (%)*
Soil fertility	49
Diseases and pests	21
Water availability	14
Economic situation	12
Wind (during thunderstorms)	4

Farmers also grow some other crops on their fields, such as *Pepino* (cucumber: Cucumber sp.) and *Calabaza* (squash: Cucurbita sp.). But these are less important than corn and beans. *Pepino* and *calabaza* are grown in both the rainy and dry seasons, but varieties differ per cropping season. An important cash crop is the spontaneously growing *tomatillo* (a small green tomato: Physalis philadelphicum). Although the *tomatillo* is wild, it needs soil disturbance (i.e. ploughing) in order to develop. However, it does not grow in all fields. Cultivation of *Marihuana* (Cannabis sativa var. indica) and *Amapole* (Papaver somniferum) also take place. However, no data on these crops were obtained during the fieldwork as their cultivation is highly forbidden by Mexican law.

Cattle Breeding

Cattle were introduced in Mexico after the Spanish Conquest, and as in many other parts of Mexico (Toledo 1990b), cattle breeding has become an important economic activity in the Municipality of Cuautitlán (Louette *et al.* 1997a). Cattle breeding spread from the eastern state of *Veracruz* to other parts of Mexico (Barrera 1996), but it is unclear when such activities became important in the Sierra de Manantlán. The first mention of cattle is made in the eighteenth century. Cattle breeding has become especially important since the 1970s, due to governmental policies and the unfavourable economic conditions for maize (Louette *et al.* 1997a; Gerritsen 1995).

In the late 1990s, approximately 5,160 animals were roaming in the Cuzalapa.[14] Although a lot of cattle graze in the valley of Cuzalapa, clear differences in herd size exist between cattle-raisers, as illustrated in Table 2.7.[15]

Table 2.7 Cattle distribution in Cuzalapa in the 1990s (N=100) (Gerritsen and Forster 2001:148)

Size of herd	*Cattle-raisers*		*Cattle*	
	Absolute	*Relative (%)*	*Absolute*	*Relative (%)*
<20	33	33	301	7
20-60	53	53	2,298	56
>60	14	14	1,530	37
Total	100	100	4,129	100

As in most parts of Mexico and the Sierra de Manantlán, cattle breeding in Cuzalapa is characteristically extensive in labour and use of external inputs (Gerritsen 1995; Louette *et al.* 1997a; Toledo 1990b). Basically, it consists of moving the animals around the different pasture lands, milking and feeding them salt, and treating diseases. The indigenous breeds (the so-called *ganado criollo*) are crossbred mainly with the breeds *Suiza Europea* (Bos taurus spp.), *Holstein Frisian* (Bos taurus spp.) and *Cebú* (Bos indicus).[16] The main objective of keeping cattle is to build a financial resource, and animals are thus generally only sold when cash is needed. Farmers also use the milk and make several milk derivatives. Average milk production per day is low and ranges between one and four litres per cow (Gerritsen 1995). Investments in cattle production are also relatively low. Therefore, the expansion of this activity is (necessarily) related to obtaining more land for grazing. Compared to other regions in Mexico, however, herds in Cuzalapa appear to be relatively small. Grazing takes place in all kinds of vegetation and at various elevations, as long as water is available. As such, cattle production adds value to terrain that is not suitable for agricultural production (Louette *et al.* 1997a). Farmers keep cows with calves near their houses to facilitate milking, while the other animals freely roam in the hills. Farmers go up the hills every 8 to 15 days to check on their animals. Cattle that are allowed to roam in the hills are generally wilder and more difficult to domesticate. When possible, herds are accompanied by a bull to facilitate domestication.

Cattle production is directly linked to agriculture, as described in the foregoing section. Crop leftovers of maize cultivation are used or bought from farmers who own few or no cattle. Cattle can also be found in the cultivation fields from November to December and from April to June. The critical period for cattle is April and May, as pastures and water are then limited. It is also in this period that a lot of cows die, due to diseases or starvation. Farmers buy sugarcane as additional fodder, but one has to posses a car or truck in order to be able to go to Cuautitlán. Sowing exotic pasture species for grazing has become a common practice in Cuzalapa, and takes place in combination with a *yunta de lluvia* or a *coamil*. Table 2.8 gives an overview of the most common species. Pasture seeds are sown when the maize plants have come up. After maize harvesting, fields are used permanently as pastures.

In nearly every compound of Cuzalapa, some poultry and often hogs can be found. They are maintained mainly for domestic consumption, but they also often sold when farmers are in urgent need of cash. Women generally manage them and have control over the profits when they are sold (Kreutzer *et al.* 1998).

Table 2.8 Exotic pasture species (adapted from Gerritsen 1995, Table 2.8)

Common name	*Scientific name*
Estrella africana	Cynodon spp.
Gordina	Melinis minitiflora
Guinea	Panicum maximum
Jaragua	Andropogon rufus
Pará	Panicum purpurascens
Sudán	Sorghum halepense var. sudanense
Zacate Buffel	Cenchrus ciliaris
Andropogón	Andropogon spp.
Zacate Rodex	Chloris gayana

Farmers' Use and Management of Trees and Forests

Forestry activities in Cuzalapa are directed at fulfilling basic and domestic needs. No commercial exploitation of forest resources takes place. Farmers employ a wide range of tree and forest management practices that take place mainly in the lower parts of the valley and are mainly directed at the trees in the agricultural fields. Tree and forest management practices play an important, but supporting role, for the other farming activities. They are only partially aimed at an active management of tree and forest resources to maintain their protective and productive roles (Gerritsen 1995). Chapters 5 and 6 will extensively discuss the most common uses of trees and forests and the management practices employed. Tenure rules over trees and forests influence their use and management. At household, community, and national level, a number of rules and control structures exist to regulate tree and forest use and management. These will be explained in detail in Chapters 6 and 7.

2.5 Co-Production in Cuzalapa through Time

Cuzalapa has a long history of land-use, as its origins lie in pre-Hispanic times. A great many changes have occurred in its valley, especially since the arrival of the Spaniards in the fifteenth century. In this section, I will undertake a historical journey to provide the reader with a more profound understanding of the social and ecological changes that have taken place in Cuzalapa. During this journey I will describe different periods and the major changes that took place in each of them. It will become clear that the landscape of Cuzalapa has been used and managed for centuries. In other words, co-production has taken place and resource diversity has been created over a very long time period. It will also become clear that today's co-production is influenced by various actors who have used and managed the Cuzalapa landscape at one time or another in its past. The intensity, at which this occurred, however, has varied through time.

The Pre-Hispanic Period

Relatively little is known about Cuzalapa before the coming of the Spaniards, as available information is scarce. Yet, it appears that the Sierra de Manantlán was divided into several indigenous provinces, of which *Amula* was the biggest. In turn, *Amula* was composed of six autonomous political units (Laitner-Benz 1992). Cuzalapa and the neighbouring communities of Ayotitlán and Cuautitlán formed part of the political unit of *Amula Occidental* (western *Amula*). According to several documents, population numbers in the region were higher at the beginning of the sixteenth century than in 1960 (Laitner-Benz and Benz 1994). These documents also describe pre-Hispanic life in the region as 'primitive' and 'poor', compared to other indigenous groups in Mexico. This is explained mainly by the fact that the inhabitants did not pay tribute to a *cacique*.[17]

Due to the mountainous character of the region, shifting maize cultivation (i.e. *coamil*) was the dominant production method. Semi-permanent agriculture also took place, but only on a small scale. Thus, two harvests per year could be obtained (*ibid.*). The indigenous population also possessed domesticated animals. Furthermore, hunting of birds, rodents and lizards and fishing provided meat and other products (Gúzman 1991; Brockmann and González 1994). The basic diet of the *Nahua* population of *Amula* consisted of corn, beans, chillies and probably cucumber.[18] Due to marked differences in relief and topography, a great number of wild plants and animals were used (Laitner-Benz and Benz 1994). Thus, co-production already took place in Cuzalapa before the coming of the Spaniards (see also Slicher van Bath 1992).

Colonial Times

Amula province was first mentioned in Spanish documents in 1524, 32 years after the discovery of America by Columbus. Cuzalapa community authorities still possess a map that dates back to 1531, when:

> *'the Spanish king came to this locality* [i.e. Cuzalapa] *to greet our king and recognise all the land that was enclosed on our map as indigenous property'* [...] (RAN 276.1–765-B.C., own translation).[19]

The latter suggests that that conquest of *Amula* province was relatively easy and that the indigenous population put up less resistance here than in other parts of Mexico. It also appears that indigenous warriors co-operated with the Spaniards. Amongst other forms of assistance, they went to other regions to help the Spaniards in their subjugation process (Laitner-Benz and Benz 1994).

In the first decades of the Spanish Conquest, personal interest was its main driving force. It was not until the second half of the sixteenth century that the Spanish crown began to centralise decision-making over the new colony. Consequently, new organisational and socio-political structures were created. The dominant structure of the colonial economy was established during the seventeenth century. It was also in this period that *haciendas* (large agricultural estates) became the central production unit, although this did not occur very systematically (Cosío *et al.*, 1994; Meyer 1986).

It appears that due to the absence of a rigid colonial administration, *Amula* province was able to maintain its socio-political integrity during the first decades of the colonisation process (Laitner-Benz 1992). After this period, however, indigenous culture and traditions were gradually replaced by new, often western, ones (Brockmann and González 1994).

The coming of the Spaniards had a profound impact on the native population of *Mesoamérica* (today's Mexico and Central America), mainly through the introduction of new diseases. In *Nuevo España* (today's Mexico) population numbers generally decreased by 65 per cent to 78 per cent (and by as much as 95 per cent in some cases) in the period from 1525 to 1540 (Laitner-Benz and Benz 1994; Barrera 1996; Slicher van Bath 1992). *Amula*'s situation was not different from that in the whole country (Laitner-Benz and Benz 1994). According to Laitner-Benz (1992) mortality rates in the western part of Mexico reached 99 per cent of the original population, and in several documents reference is made to a large-scale epidemic in 1546-47 in the region.

Due to the decreased population numbers, the intensity of co-production diminished, permitting a (slow) restoration of the region's ecosystems. Consequently, the Spanish colonists who followed the conquerors encountered relatively 'empty' lands (Barrera 1996). This situation is in stark contrast to the co-production by the indigenous population in the *Amula* province that existed before the Spanish Conquest, and which entailed different agricultural practices as described above. The decrease in population numbers caused not only the destruction of the existing political organisation, but also of a vast body of empirical knowledge and skills (Laitner-Benz and Benz 1994; Laitner-Benz 1992; Slicher van Bath 1992).

After the first drastic reduction, population numbers started to rise again, but now the inhabitants of *Mesoamérica* also consisted of Spaniards and of African slaves. In Mexico, colonisation started at the eastern coast and spread slowly to the other parts of the region (Barrera 1996). Amongst other changes, new knowledge and skills on co-production emerged. Existing techniques were also adapted to the changing situations in the centuries that followed (Laitner-Benz and Benz 1994). Thus, acculturation processes of the indigenous people in general, and the *Nahua* population of Cuzalapa in particular, may have originated in the sixteenth century.

The Spaniards introduced a great many new land-use practices, of which cattle breeding is an important one. Cattle production in Mexico has proven to be quite successful due to the relatively low demographic pressure and similar bio-geographical conditions to the cattle regions of Spain (Barrera 1996). The Spaniards often made reference to the pasture potential in the *Amula* region. However, in the available historical documents hardly any reference is made to the presence of cattle (Laitner-Benz and Benz 1994).

The colonial period ended at the dawning of the nineteenth century. Mexico's War of Independence took place in the period 1810-1822. It was quite a turbulent time, but the Sierra de Manantlán appears to have remained in the outer limits of the revolutionary theatre. Some battles did take place there, however, such as in Cuzalapa's neighbouring village of Ayotitlán in 1811. The Sierra de Manantlán was also considered to be a refugee zone for *guerrilleros* ('warriors'), but detailed information on this is not available (Brockmann and González 1994).

Hacienda La Loma Delgada

Haciendas had been part of the Mexican landscape since the colonial period, but their peak came in the nineteenth century. Post-independence legal changes aimed at revitalising Mexico and freeing it from its colonial heritage and the negative effects of the War of Independence, led to large-scale disentailments of, above all, the communal lands of indigenous communities. These changes were implemented on the federal level from 1856 onwards through the *Lerdo*-law (*Ley Lerdo*), although many similar laws had already been implemented since the end of the colonial period in several of the newly established Mexican states. In the state of Jalisco, where Cuzalapa is located, these laws had been implemented since 1822. Central in these laws is the prohibition of corporate land tenure forms, such as those of indigenous communities. This led to a restructuring of land property in the Mexican countryside favouring, above all, the haciendas (Meyer 1986, García de León *et al.* 1988). Consequently, the process of co-production also changed.

Two haciendas were located within the territory of Cuzalapa: the hacienda *La Loma Delgada* and the hacienda of *Ahuacapán* (Brockmann and Gonzalez 1994; Jardel 1998).[20] A private property of approximately 677 ha, called *Chichimequilla*, also existed within Cuzalapa limits (Research in progress with Dr N.R. Forster). It was the hacienda *La Loma Delgada* that had a very direct impact on the lives of the indigenous inhabitants of Cuzalapa, because of its location in the valley. The hacienda *Ahuacapán* occupied only part of the higher uninhabited areas of the territory of Cuzalapa.

Only few people recall the exact nature of the hacienda *La Loma Delgada*, but according to historical documents it encompassed 13,412 ha (i.e. 56 per cent of Cuzalapa territory)[21] and it was most likely established in the second half of the nineteenth century. It changed owners twice during its existence. During the Mexican Revolution in 1916, it came into North-American hands through the *Loma Delgada Land Company*, and it was apparently sold again to Mexican proprietors in 1921 (Research in progress with Dr N.R. Forster). In 1959, an engineer suggested the following scenario for Cuzalapa in the 1910s:

> *'According to the accounts I could gather* […] *the* [North-] *Americans Burt and Budrow took possession of the Loma Delgada* [hacienda] *by sending Indians to be killed, that they owned it for a maximum of five years from 1916 until 1921, that they disappeared one night without a trace, and that it is not known whether they went back to their native country or were killed by the revolutionaries'* (RAN 276.1-765-B.C., own translation).

Agriculture and cattle breeding are said to have been the principal activities on the hacienda. Forests fulfilled a complementary function, providing products such as fire- and construction wood. The main agricultural products were *piloncillo* (a sweet processed from sugarcane), sugar, alcohol, maize and beans. These products were sold in Autlán, Guadalajara and foreign countries (Figueroa 1996).

According to oral history, the inhabitants of Cuzalapa worked either as farm labourers living at the hacienda (the so-called *peones a deuda*), or as relatively 'free' farmers (the so-called *peones libres*) working with the *hacendado* (the owner of the hacienda) (cf. García de León *et al.* 1988).[22] The 'free' farmers dedicated their time to the processing of sugarcane, shifting cultivation practices, small-scale cattle production and collection of non-timber forest products.

Although the hacienda changed local socio-political conditions, the indigenous inhabitants of Cuzalapa still went to the neighbouring indigenous community of Ayotitlán to arrange their civil affairs. After the arrival of the Spaniards, Ayotitlán had replaced Cuzalapa as the regional centre for decision-making. The *consejo de ancianos* (the council of elders), the traditional institution for socio-political affairs, was seated in this community.

The Coming of Mestizo Settlers

Two important events transformed twentieth-century Mexico: the Revolution (1910-1917) and the *Cristero* War (1926-1929).[23] The central issue in both wars was agrarian reform. In both cases, the nation's impoverished peasantry fought for 'Land and Liberty' (*Tierra y Libertad*) at a crisis point in Mexican history when 95 per cent of the family heads were landless (Markiewicz 1993; Warman 2001). The Constitution of 1917 (through Article 27) codified the legal basis for (hacienda) land expropriation and set tenure regulations for the reform sector, including prohibitions on land alienation (Sanderson 1984).

By expropriating haciendas, the state either restored property to indigenous communities if they could legally prove their claim, or established *ejido*'s, if a group of twenty or more landless farmers petitioned for the land. Article 27 also gave the nation the right of eminent domain over land and water, and the right to restrict property owners in the interest of the public good (Toledo 1996). Unprecedented land reform was carried out under the *Lázaro Cárdenas* regime (1934-1940) (Warman 2001), which greatly expanded the number of *ejido's*, regulated their farming practices, and strengthened their ties to the state (Markiewicz 1993). Following that precedent, the PRI (*Partido Revolucionario Institucional*, Institutional Revolutionary Party), Mexico's governing party in the period 1938-2000, used land reform and assistance to *ejido's* and indigenous communities as a form of patronage to control the countryside and maintain farmer support (Markiewicz 1993; de Janvry *et al.* 1997). While the state was highly involved with *ejido*'s and indigenous communities in many economic and political dimensions, it also gave their members (i.e. male household heads, see Warman 2001) juridical power to self-govern their collective natural resources, including forests and water, and to allot agricultural plots for individual use. Once again, a reconstitution of co-production took place.

The founding of many *ejido*'s and indigenous communities on former hacienda lands was anything but a peaceful process. In Cuzalapa, some farmers and the revolutionary army appear to have fought side by side against *caciques* (local bosses) and *cristeros* in order to reconstitute community land (Gerritsen 1995). Brockmann and González (1994) mention that the *Cristero* War was a significant event in the Sierra de Manantlán region due to the active participation of the local population. According to elder farmers, Cuzalapa inhabitants fled, especially during the last war, into the hills and hid in the more remote *ranchos* (hamlets), or caves uphill.

As the southern part of the Sierra de Manantlán is difficult to access, the hacienda *La Loma Delgada* could exist until the end of the 1920s without being affected by the political changes that took place in the rest of Mexico.[24] According to historical documents, the expulsion of the hacienda owner of Cuzalapa took place in 1934 (Research in progress with Dr N.R. Forster). An elder farmer recalled:

> *We all went to finish with the hacendado and we carried guns. The hacendado got so scared that he had to flee dressed in women's clothes.*

After the Revolution and the *Cristero* War of the 1920s, a large number of *mestizo* settlers came to Cuzalapa, most of whom were probably in search of a peaceful place to live. These new inhabitants appear to have come mainly from the villages and cities surrounding the Sierra de Manantlán mountain range. Before the 1920s, Cuzalapa had also known newcomers, but these appear to have originated mostly from the neighbouring indigenous communities of Ayotitlán and Chacala. However, some *mestizo* settlers had already arrived as early as the second half of the nineteenth century. They had settled mainly in El Durazno and La Pareja (Research in progress with Dr N.R. Forster). Regarding the indigenous settlers, an elder farmer in Cuzalapa recalled that:

> *They came during the dry season, when there was no work in their communities. They came to Cuzalapa to work in the bean harvest. And you know what often happens: they meet a pretty girl and then stay in Cuzalapa.*

Upon their arrival, the *mestizo* newcomers found empty lands with relatively few indigenous people living in Cuzalapa. Shifting maize and bean cultivation, cattle breeding, and on a smaller scale, wheat, rice and sugarcane production dominated the valley. These activities appear to have taken place mostly near the different localities, as:

> *'their hills are covered almost totally with pine and oak forests, and to a lesser degree, with other species* [*'monte alto de pino, encino y roble, y en corta escala otras maderas*]*'* (RAN 276.1-765-B.C., own translation).

Since there was enough land, no objections were made to the settling of the newcomers, as a farmer recently commented:

> [In those days] *nobody worried* [about the land], *as there was enough of it. But when it started to become more scarce, everybody tried to grab whatever they could get hold of.*

As another settler commented, there were also considerable socio-economic differences between the newcomers:

> *I brought my animals with me when I came to Cuzalapa, but there were also a lot of people who had nothing. They came without any possessions*. [...] *In those days all* [land] *was free. One could set down one's animals where one wanted. Besides, there was more woodland. Now* [in the 1990s], *everything is different. All* [land] *is in use and without pasture one cannot maintain one's animals. Besides, we are using up everything* [i.e. the natural resources].

Compared to the original inhabitants of Cuzalapa, the *mestizo* families had a different cultural and historical background. In most cases, their relation with the hacienda-owners had been different.[25] They also knew about other agricultural practices, such as cattle breeding. Until the 1950s, the indigenous and *mestizo* inhabitants of Cuzalapa appear to have had a relatively peaceful relationship, although disputes over control of community institutions did take place. Moreover, indigenous and *mestizo* families began to intermarry, and today only very few families can be considered 'purely' indigenous or *mestizo*. Some of the newcomers also allied with the indigenous inhabitants against the hacienda-owner in their struggle to recover the community's land. In contrast to the indigenous inhabitants, some of the newcomers could read and write, and they soon moved into important positions in the community.

The Reconstitution of the Community's Lands

As mentioned, the hacienda *La Loma Delgada* was taken over by the inhabitants of Cuzalapa in 1934. The private property *Chichimequilla* appears to have been returned to their possession between 1942 and 1948. But agrarian reform, which established Cuzalapa as an indigenous community, was delayed until 1950, 34 years after the first formal application in 1916 and after several years of legal struggle.[26] The process of land restitution was extremely slow and bureaucratic, and Cuzalapa farmers even turned to farmer unions, when governmental institutions did not respond. A farmer commented on the latter:

> *We had to participate in many reunions and even go to Mexico-city* [which today is a 12-hour bus drive from Cuzalapa].

Although the presidential resolution is dated 1950, restitution of land was not completed until 1964. To start with, Cuzalapa farmers had to wait until 1959 before the *Departamento de Asuntos Agrarios y Colonización* (Department of Agrarian Affairs and Colonisation, i.e. the responsible governmental agency) initiated a consultation process with neighbouring communities and private land-owners to establish the property limits with Cuzalapa. In the period 1950-1959, many incidents occurred in which neighbouring communities and private land-owners claimed Cuzalapa land as theirs. Despite this problem, the limits of Cuzalapa were never properly measured, but estimated during a relatively short reconnaissance of the community (Research in progress with Dr N.R. Forster). The responsible engineer justified this approach in a letter to his superior as follows:

> *'the signer* [of the letter, i.e. the engineer] *opted for the most practical measure to designate definitive possession* [i.e. a short reconnaissance]*, as determining the definitive limits would require the work of 12 men daily over a period of, at least, 60 days in order to verify the topographical field work* [i.e. a total of 720 working days]*: this is something the indigenous community could not bear as they all have urgent work to do in their fields'* (RAN 276.1-765-B.C., own translation).

As a consequence of the incomplete implementation of the agrarian reform, land invasion problems continued. It was not until 1964 that the limits of the community were properly measured. This occurred when community authorities in the village of Cuzalapa decided to employ an engineer and pay him 14,000 pesos. Land-holding farmers contributed to this payment, each according to his own financial possibilities (Research in progress with Dr N.F. Forster).

It was also in 1964 that the Department of Agrarian Affairs and Colonisation approved the limits of Cuzalapa, but it failed to adjudicate over 4,672 hectares of (the total of 23,963 ha of) community land. This land had become part of a neighbouring *ejido*, *Barranca de la Naranjera*, whose land reform had been formally completed in 1958. In 1959, the engineer responsible for Cuzalapa described the mechanism to his superior as follows:

> '[…] *the ejidatarios of this agrarian community maliciously gave wrong names* [to the different parts of their communities] *in order to be able to invade the indigenous community of Cuzalapa. For example, in the definitive* [land reform] *plan of Barranca de la Naranjera, the name Chan Gavila appears, but it* [the hill] *does not have this name, because it is the peak of the Chan Gavilancillo mountain* [and which is located in the territory of Cuzalapa]. *They* [the ejidatarios of Barranca de la Naranjera] *did so in order to move to the East* [i.e. invading the land of Cuzalapa]' (RAN 276.1-765-B.C., own translation).

Agrarian reform created significant change in the community by legalising residents' land ownership and, above all, by establishing new institutional arrangements to govern land and natural resources. Cuzalapa's agrarian reform of 1950 benefited 251 households, and the male heads became official *comuneros* (land-holding farmers with voting rights in the general assembly of indigenous communities) (Gerritsen 1995).

Elderly farmers recall that the agrarian reform of 1950 did not dramatically change land distribution. The hacienda *La Loma Delgada* had already been taken over 16 years before, and the reform expropriated land from only some five farmers, either because they were related to the hacienda owner or they did not live in Cuzalapa. Only 15 of the beneficiaries were landless prior to the reform. Inequities in land distribution existed, but these were not significantly altered by the agrarian reform.

The agrarian reform also established new institutions to govern land and natural resources. A directive board (*mesa directiva*) replaced the council of elders. The directive board includes an executive committee (*comisariado de bienes comunales*) and a vigilance committee (*comité de vigilancia*). The latter monitors the day-to-day activities of the former. The executive committee is headed by the commissioner of common property (called *comisario de bienes comunales*, or more often *comisariado de* *bienes comunales*), while the vigilance committee is headed by the overseer (*consejo de vigilancia*). A secretary, a treasurer, and three assistants (*suplentes*) assist the commissioner of common property, while 2 secretaries and three assistants assist the overseer. Thus, the directive board includes 12 persons, but in practice the commissioner of common property has the most responsibility and power. Both the executive and vigilance committees are elected to three-year terms by the general assembly, which includes all *comuneros* and, in theory, is the highest authority in indigenous communities (see also Rivera 1994).

Conflicts over Land

As stated above, the 1950s and 1960s were characterised by many conflicts and disputes over land and also over natural resources both within Cuzalapa and between Cuzalapa and other communities. It was therefore primarily in this period that communal access to land was determined. These conflicts also set the base for the political dimension of the processes of co-production.

Conflicts between Cuzalapa and the neighbouring indigenous communities of Ayotitlán and Chacala about the limits of their lands continued until 1964. In the same period, the hamlets of El Durazno and La Pareja had initiated procedures to establish an *ejido*. However, they encountered strong opposition from the rest of the community, mainly Cuzalapa (Gerritsen 1995). It appears to have been a conflict over power in the community, as Cuzalapa and El Durazno were two opposing nucleuses (Research in progress with Dr N.R. Forster). Major conflicts, however, were solved when the presidential resolution was finally executed (by the measurement of the community's limits) and agrarian reform was completed.

An important factor in determining today's land distribution has been the control of the directive board by a minority group of some 30 per cent of the farmers. This group is centred around four, originally *mestizo* families who have dominated decision-making and, to a substantial degree, co-production in Cuzalapa. They are known as the *caciques* (local bosses) and are affiliated with the PRI. The remaining farmers are divided into the 'democratic group' and the '*jacqueteros*' (the local term for those who change jackets - *cambiar jacquetas* - and function as swing voters). In the 1990s, the three political groups were almost the same size. The democratic group is affiliated with the opposition *Partido Revolucionario Democrático* (Democratic Revolutionary Party, PRD), but it has failed to become a countervailing power to the *caciques*, mainly because of internal splits (Figueroa 1996).[27] It has been very divided, especially in the last few years.[28] The *jacqueteros* are not politically organised and ally either with the *caciques* or the democratic group, depending on the benefits to be gained. In most instances they have supported the *caciques*.

Political alliances have conditioned the allocation of, mainly communal, land since the agrarian reform. The *caciques* have used their control over the directive board for their own benefit, distributing communal land to allies while making it difficult for those in opposition to obtain it. Nowadays, many comments like the following can be heard in Cuzalapa:

> *You see, the rich* [i.e. the caciques], *they have a lot of money. They got hold of much land. They just paid the commissioner* [an elected official who holds office for three years] *and he then gave them some land. He should be removed, because he is only working for the rich.*

The strategy of the *caciques* to obtain land and weaken the opposition has been a many-facetted one. Meetings of the general assembly have been held very irregularly. Many were not convoked officially and were often manipulated. *Comuneros* who opposed *caciques*' actions have occasionally been excluded from meetings by force, sometimes by local police officers. Their names were even erased from the 1992 official list of *comuneros* (the so-called *censo*), thereby depriving them of *voz y voto* (voice and vote), the right to participate in the general assembly. The *cacique* group's direct linkages with the PRI at the municipal and state levels have enabled it to leverage government funds to forge political alliances within the community.

It should be noted that, beyond political alliances, another factor has influenced land access (and co-production) in Cuzalapa. Since the 1960s, financial resources have become increasingly important for securing communal land. Fences have become necessary to keep cattle out of agricultural fields and to formalise rights to land. In fact, historical documents indicate that, in the late 1960s, the directive board obliged farmers to fence any newly obtained land. Since most *comuneros* in Cuzalapa lacked the requisite financial resources, both the number of the fields requested, as well as their size varied substantially. Financial resources have also enabled various outsiders (mainly from the neighbouring *ejido* of Cuautitlán) to obtain land in Cuzalapa, generally for the purpose of grazing.

Since the late 1970s/early 1980s, almost all of Cuzalapa's land has fallen into the hands of individual farmers and only a few small parts are still accessible on a communal basis. Thus, the great majority of the communal lands in Cuzalapa have been *de facto* privatised. The different fields of the majority of the *comuneros* are generally widely spread in the valley. Today, the general assembly in Cuzalapa includes some 240-250 *comuneros*, of whom 25-30 have an unclear legal status due to the conflicts and disputes described above.[29] The irregularities in land allocation have led to significant differences in the size of the land-holdings, and it is just a small group of farmers that claims the majority of the community's land. As almost all of the land is allocated, it has become very difficult to apply for a new piece. At the end of the 1990s, Cuzalapa had approximately 110 landless farmers, mainly sons of *comuneros* (Gerritsen 1995).

Table 2.9 illustrates land distribution in Cuzalapa. It is based on a sample of 94 *comuneros*, from whom data on land ownership was gathered and checked several times during the fieldwork. The table confirms the inequalities in land access.

Table 2.9 Land distribution amongst *comuneros* in the late 1990s (n=94) (Gerritsen and Forster 2001:145)

Size of land-holding (ha)	*Comuneros*		*Land*	
	Absolute	*Relative (%)*	*Absolute (ha)*	*Relative (%)*
<20	63	67	550	21
20-70	24	26	1,251	49
>70	7	7	786	30
Total	94	100	2,587	100

Forest Exploitation and Cattle Breeding

Parallel to growing problems with land access have been chronic conflicts and disputes over natural resource use in Cuzalapa, especially in the communal lands. Forest exploitation and cattle breeding have gained in importance during the second half of this century, and both mainly use natural resources on communal lands.

From the 1940s till the 1960s, a private timber company exploited the forests of Cuzalapa, but without applying adequate reforestation measures. Jardel (1998) mentions 1945 as the year in which the North-American timber company Sawmills of the Pacific arrived in the region. Timber activities in Cuzalapa started in 1946 with the establishment of the first sawmill in El Durazno for exploiting the forests in the southern part of the Sierra de Manantlán. Other sawmills were established in the central part of the Sierra de Manantlán, including the higher parts of the community of Cuzalapa. Sawmills generally moved from one area to another, depending on the availability of high-quality wood, a process accompanied by the emergence and disappearance of small hamlets established for the sawmill labourers. These labourers appear to have come from the Mexican states of *Michoacán* and *Morelia,* and only few local inhabitants worked in the forestry industry. The cut wood went directly by truck to the harbours of Santiago and Manzanillo in the neighbouring state of Colima, from where it was sent by boat to the United States. In 1956, one of the lumber dealers, Longino Vázquez, succeeded in obtaining the higher part of the Sierra de Manantlán as private property. In the same year, five sawmills were operational in the hamlet of El Durazno. In 1960, and again in 1969, exploitation rights changed hands to other lumber dealers. After 1965, most sawmills were shut down except for the one in Rincón de Manantlán in the higher part of the Sierra de Manantlán, which stayed operational until 1983. During the height of forest exploitation, the Sierra de Manantlán was full of trucks loaded with hardwood coming from and going to Colima. During the same period, there was a permanent military presence in the region, mainly to protect the economic interest of the lumber companies. The companies paid compensation to the community for the timber extracted, but it was mainly the *cacique* group in Cuzalapa that benefited. The companies left between 1967 and 1969 when the majority of the farmers did not want them to exploit their forests any longer, and when they could create sufficient opposition. Opposition emerged because forest exploitation benefited only a small part of the community and it led to severe forest degradation (*ibid.*; Gerritsen 1995; Figueroa 1996).

In the years 1981-1984, a second exploitation period took place when some of the cattle-raisers of Cuzalapa established a co-operative sawmill, *la Cooperativa Silvícola Cuzalapa* (the Cuzalapa Silvicultural Co-operative), in order to exploit dead wood in the forests of the community. Procedures for obtaining a permit started in 1977 and were driven by the fact that:

> '*in our woodlands one can find 582 logs thrown away in five different places.* […] *Likewise, 45 logs are found next to the dirt road in the La Cumbre place, which is equivalent to 50 m^3 of the variety of Pine, which was thrown away two years ago, and for which we need a forest guide and the respective permits in order to get and sell the wood that has already deteriorated some* […]. *We have a client and we do not want to lose the money'* (RAN 276.1-765-B.C., own translation).

The timber companies that had exploited the forests of Cuzalapa before had left the wood.

Some members of the *caciques* appear to have made major investments, although the community obtained a ten-year credit from the government through the *Fondo Nacional de Fomento Ejidal* (FONAFE: National Fund for Ejido Fomentation). The poor and landless farmers were expected to benefit from jobs that would be created. However, when the sawmill was in operation, the *cacique* group did not share the profits with other farmers (Research in progress with Dr N.R. Forster). Moreover, they cut living trees without the agreement of the other farmers, leading to severe ecological damage. According to many farmers, water availability in the dry season also decreased substantially in those years. A number of severe conflicts arose, leading to fights between the opposing groups in the community. When the state governor banned exploitation of the forests in 1984, this temporarily put an end to the conflicts. In the years that followed, negotiations took place to sell exploitation rights to a private lumber company (called *Silvicultura de Occidente, S.A;* Silviculture of the West). This plan was halted by opposing farmers and through the establishment of the Sierra de Manantlán biosphere reserve. Farmers opposing exploitation supported the decree of the Sierra de Manantlán biosphere reserve, as it was seen as a way to stop further unsustainable woodcutting.

Since the 1970s, cattle breeding has become increasingly important in Cuzalapa and it has replaced forestry as the main productive and income-generating activity. Until the end of the 1960s, farmers in Cuzalapa only possessed a few animals, with the exception of three or four cattle-raisers who owned some 200-300 animals each. These large herds disappeared at the end of the 1960s, either through inheritance amongst various relatives, or through their sale. From the 1970s onwards the total herd size increased again, as many people obtained cattle through the credits offered by the BANRURAL bank (Gerritsen 1995). Most of today's cattle breeding activities date back to this period. Cattle breeding got another strong impulse in the 1990s, due to the remittances sent back home to Cuzalapa by emigrants living in the United States. This money was mainly used to buy cattle and land, and to construct houses.

The Emergence of the Sierra de Manantlán Biosphere Reserve

With the declaration of the Sierra Manantlán as a biosphere reserve, new rules and regulations started to govern land-use (IMECBIO 2000b). This had a profound impact on Cuzalapa as the largest agrarian community within the limits of the Reserve. Approximately 91 per cent of its territory lies within the Reserve. The total surface area of the community is approximately 23,963 hectares. Of these, 17,170 hectares (72 per cent) surrounds part of one of the Reserve's buffer zones and 4,653 hectares (19 per cent) surrounds one of the Reserve's core zones (the *Manantlán-Las Joyas* core zone). The remaining 2,140 hectares (9 per cent) are located outside the reserve, forming part of the influence zone (IMECBIO 1998a).

The creation of the RBSM put to an end to conflicts over commercial forest exploitation in Cuzalapa. However, conflicts over land and natural resources have continued and are partly caused by the existence of the RBSM. The *cacique* group strongly opposes the Reserve, as access to land and natural resources have been restricted. The land of several members also lies in the Reserve's core zone. Timber cutting, forest clearing and hunting of endangered animals still take place, although they are formally prohibited.

Acculturation Processes in Cuzalapa

In the previous sections, I described the historical context in which the current co-production and resource diversity in Cuzalapa are embedded. Clearly the twentieth century was a period of accelerated changes. Among other areas, it had a major impact on the culture and traditions of the original inhabitants of Cuzalapa, the indigenous *Nahua* people (Gerritsen 1998c). The cultural situation of the native farmers has changed considerably, as exemplified by the following description related by an elder *mestizo* farmer who arrived in the late 1920s in Cuzalapa:

> *I still knew some legitimate Indians* [*'inditos*': literal translation: little Indians] *without shoes and with their woollen trousers* [*'calzones de manta'*]. *They did not speak Spanish very well, but we understood each other. They cultivated coamil [shifting cultivation of maize], had a cow or two and some had some bulls* [*'bueyes'*], *which they shared amongst themselves. Their houses were made of branches and palm leaves. They only had a few sons, two or three in every family.*

Today, the original inhabitants of Cuzalapa can be distinguished from the mestizos most clearly through their physical characteristics. The Nahua descendants in the Cuzalapa population are much darker coloured and smaller in height than the mestizos. However, it is very difficult to distinguish specific cultural expressions. This is due in part to intermarriages between indigenous and *mestizo* farmers. Descendants of the original population do not see themselves as a separate group within the community.[30] Thus, it appears that almost all Nahua-elements have disappeared from everyday life. In other words, acculturation processes have had a strong impact.[31]

Acculturation of indigenous peoples in Mexico dates back to the sixteenth century at the time of the Spanish conquest, as was partially described in the foregoing sections.

Catholicism has also had an important role in these processes (Nigh and Rodríguez 1994). It appears that Catholic priests have visited the region since 1550 (Brockmann and González 1994). Important changes have also taken place since the beginning of the twentieth century (Gerritsen 1998c). As one farmer commented:

> *The people who came from other places brought other ideas, other ways of working.* [...] *The way of living of the Indians?* [...] *Well, I never saw them, it was told to me by the elders. According to the stories of the elders, in former days there were few people in the community working. It was also very poor. There was a lot of land, but only little was being cultivated.* [...] *Later came the others and they started to grow more.* [...] *They did not cultivate with a 'coa'* [a spear-like farm tool used for shifting cultivation] *anymore.* [...] *And the Indians started to take over the same ideas of those who came from outside the community.* [...] *Nowadays, the outside people feel that they are the owners of the community's land too.* [...] *In the old days, there was only little cattle, but with the coming of the outsiders more people started to obtain animals.*

Today, specific indigenous features are observed only in the different (Catholic) feasts in the community, and only a few elder farmers recall their exact meaning. It is almost impossible to recognise the different cultural traditions and expressions in the other domains of life of the indigenous inhabitants of Cuzalapa. Nowadays in Cuzalapa, being indigenous is, above all, determined by one's socio-economic position, i.e. by being poor (van den Bosch 1996).

2.6 Conclusion

In this chapter, I gave a general description of the study area, i.e. the indigenous community of Cuzalapa and the Sierra de Manantlán biosphere reserve. This description included several elements that will be elaborated in more detail in the following chapters, such as diversity in farming and forestry, the local socio-economic context and the wider institutional context of the Reserve, including its management principles. This chapter has shown that a highly complex process of co-production has taken place in Cuzalapa (and in the Reserve), over a long period of time, but in differing intensities and scales. Moreover, struggles over natural resources, especially land, have been a very common feature in Cuzalapa and the other communities of the Reserve.

Notes

1 Parts of this Chapter have been published as Gerritsen (1995; 1996a, 1996b, 1997,1998c, 2001a, 2001b), Gerritsen and Graf (1997) and Gerritsen and Forster (2001). Some of the data underlying this and the following chapters have been generated within a research project on the conformation of land tenure in Cuzalapa. Dr Nancy Forster of the University of Wisconsin, Madison, Wisconsin, United States, co-ordinated this research project, in collaboration with María Guadalupe Ortiz Gómez, B.Sc., and the author. Publications on this research are forthcoming. In the text, it will be referenced as follows: (Research in progress with Dr N. R. Forster).

2 Note the reversal of speech, as conservationist literature generally refers to farmers living *within* the boundaries of a protected area. Chambers (1997) describes the need for and implications of a reversal of professional discourse.

3 This evolution of the RBSM is similar to many conservation projects in the world (Wells *et al.* 1992; Kamstra 1994; Ghimire and Pimbert 1997).

4 An *ejido* is a farmer community in which the cultivable land is distributed individually amongst its members. A *comunidad indígena* is a farmer community in which cultivable land is managed amongst the members individually or communally, according to the specific traditions of an ethnic group. In both cases, forests and water resources remain in communal use. *Ejido* territory comprises newly appointed land, while it is reconstituted in the case of a *comunidad indígena.* They are both an outcome of the Mexican Revolution (Rivera 1994).

5 The term cacicazgo is very common in rural Mexico, and it '*is used to refer to a dominant relation with a local leader, land-owner or local politician [the so-called cacique]. It conveys the idea of a degree of economic or political power, but there is a strong implication of 'influence' and the capacity to manipulate other people's actions*' (Torres 1992:113, endnote 12).

6 From this definition one could expect substantial attention to be given to development objectives and activities in buffer zones. However, *'in all the buffer zone definitions, the highest priority is given to protection of biodiversity while benefits for local people are of secondary importance. Notwithstanding the existing literature and definitions, the buffer zone concept is often used incorrectly'* (Kamstra 1994:34).

7 DERN-IMECBIO changed names twice. Originally it was named Natural Laboratory *Las Joyas*. In 1993, it was renamed the Manantlán Institute for Ecology and Biodiversity Conservation (IMECBIO, according to its Spanish abbreviation). Since 1998, it has been called the Department for Ecology and Natural Resources-IMECBIO, although this last name change still has to be formally approved by the University Council.

8 In 2000, SEMARNAP was renamed *Secretaría de Medio Ambiente y Recursos Naturales* (*SEMARNAT*: Ministry of Environment and Natural Resources).

9 All farmer citations in this and the following Chapters are translated from Spanish to English by the author himself, unless otherwise indicated.

10 Data on educational conditions in 1995 were encountered only for the municipality level. Therefore, 1990 data were used.

11 In Mexico, when talking about an indigenous community, reference is always made to ethnic groups (the so-called *indígenas*) (see also Bonfil 1994).

12 Similar data for 1995 were not encountered

13 It also illustrates that services are found in the larger localities, as mentioned before.

14 This number is based on an extrapolation of cattle possession by a sample of 100 cattle-owning farmers registered with the Cattle Breeder Association of Cuautitlán. The 'sample farmers' own 4,129 animals and represent about 71 per cent of all cattle-raisers in Cuzalapa. Of the remaining 29 per cent of the cattle-owning farmers, 9 per cent did not have cattle anymore (and thus were excluded from the sample), while data could not be obtained for the other 20 per cent.

15 Table 2.7, above all, has an indicative value, as farmers can also manage the cattle of (some of) their relatives working outside Cuzalapa.

16 The indigenous cattle are smaller and less productive than the introduced races, but better adapted to hillsides and mountains. Only very farmers still have 'pure' indigenous cattle.

17 In pre-Hispanic times, *caciques* were the indigenous noblemen (Cosío *et al.* 1994) and not strongmen, as the term is understood today.

18 The current diet of the inhabitants of the region very much resembles the pre-Hispanic diet.

19 When historical documents are mentioned, reference is made to documents of the *Registro Agrario Nacional* (the National Agrarian Register) of the *Secretaría de Reforma Agraria* (the Ministry of Agrarian Reform), seated in Guadalajara, the capital of Jalisco. This historical data will be referred to in the text as 'RAN' with the corresponding file number.

20 Both Brockmann and González (1994) and Jardel (1998) mention that the hacienda *Ahuacapán* emerged at the end of the sixteenth century. No explicit references are made to the hacienda *La Loma Delgada*, which gives rise to the idea that it might have been of lesser size and importance. The remains of the hacienda *La Loma Delgada* are less impressive than those of the hacienda Ahuacapán.

21 There is some confusion in the historical documents about the exact surface area. Although the area of 13,412 ha is most often mentioned, some of the correspondence also mentions 14,434 ha, i.e. 60 per cent of current Cuzalapa territory.

22 According to some of the elder farmers, approximately one hundred people lived on the hacienda and earned a very low, subsistence-level, salary.

23 The *Cristero* War was a brief religious conflict, which broke out in central and western Mexico when President *Calles* (1924-1928) attempted to enforce constitutional restrictions on the Catholic Church. The fierce opposition of the conservative *cristeros* slowed progress toward agrarian and other liberal reforms (Thiesenhusen 1995).

24 The only entrance road from *Cuautitlán* to *La Rosa* and *Cuzalapa* was not built until the 1930s. The area was still inaccessible for long periods during the rainy seasons until the early 1990s, when major repairs were done to improve accessibility.

25 For example, some of them had been responsible for *hacendados*' cattle, while others had processed the hacienda's sugarcane.

26 In 1934, Cuzalapa farmers applied for restitution for the second time, after the first application (submitted in 1916) was turned down due to incomplete documentation that evidenced their land claim (Research in progress with Dr N.R. Forster).

27 The democratic group never gained control of the directive board. However, it did gain control of the municipality delegation from 1989 to 1992 (Figueroa 1996). The delegation is the second most important community institution, after the directive board, and it administers civil affairs (marriages, births, deaths, and local police).

28 Internal splits have also developed within the *cacique* group in the past few years.

29 Conflicts are so widespread that one cannot even be sure of the total number of *comuneros*. For 1991, for example, two official *comunero* lists existed (Research in progress with Dr N.R. Forster).

30 Reference is made here to identity, which is one of the most important criteria for describing indigenous peoples (Bonfil 1994).

31 Acculturation is understood as the contact between two cultures. This either involves a direct social interaction or an indirect exposure of one culture to another. The outcome of these contacts are an assimilation by one group of the culture of the other group, which eventually leads to the modification or 'loss' of the existing culture and social identity (van Haaften, cited in van den Bosch 1996).

3 The Regional Farming Style in Cuzalapa[1]

3.1 Introduction

In this chapter, I will describe farming diversity in Cuzalapa in the 1990s by means of the theoretical notion of farming styles. I will also describe the most important mechanisms of resource mobilisation, and discuss the changes that have taken place in the Cuzalapa valley since the 1960s that have influenced farming diversity.

3.2 Farmer Discourse and Farming Practice in Cuzalapa

Cuzalapa farmers share a set of general ideas and notions regarding farming and natural resource management. They agree on the ways that fields can be worked, which tools are to be used, and on desired plant densities. They also agree on how to take care of cattle, when to bring them uphill, and where to establish new pastures. Furthermore, Cuzalapa farmers agree on the possible uses of wood species, and on which wild animals are living in the community's vegetation. Farmers can talk at length about the different ways in which these activities are, can, or must be carried out. They also discuss farm characteristics, i.e. available resources, and a farmer's capacity to deal either with limitations, or to make use of farming opportunities available to him. Thus, agency emerges in the farmers' discourse.

Based on the many discussions I had with farmers, it became clear to me that a regional farming style can be distinguished in Cuzalapa. Farming diversity can best be conceptualised according to the ideas of Hofstee (1985), who referred to a farming style as a specific cultural repertoire shared by a group of farmers in agrarian communities. Cuzalapa farmers do not explicitly distinguish different styles in the way conceptualised by van der Ploeg (1994), when he refers to differential farmer responses under certain local conditions.

Although a regional farming style is present, differences exist within the Cuzalapa farmer population. They emerge through the translation of general ideas and notions into specific farm contexts. Cuzalapa farmers explain differences amongst themselves by referring to *Pobres* (poor people) and *Ricos* (rich people). I introduced these terms in Chapter 2 to describe social stratification. But being *Pobre* or *Rico* does not only relate to a farmer's socio-economic status, it also relates to the possibilities for farming.

Pobre farmers sometimes also refer to each other as *Agricultores* (agriculturists) or *Campesinos* (farmers), but the latter two terms are not heard very frequently. *Rico* farmers are also known as *Ganaderos* (cattle breeders). There are more *Pobre* then *Ganadero* farmers. A database of 166 farmers that I constructed suggests the presence of 65-75 per cent *Pobre* farmers amongst the whole farmer population in Cuzalapa in the late 1990s.[2]

Compared to the term *Pobre*, the term *Ganadero* has obtained a more explicit place in farmers' discourse, as has the *Ganadero* way of farming. In contrast, *Pobre* farmers are less inclined to distinguish and specify their own farming strategy:

> *It* [i.e. cattle breeding] *is a somewhat different form of working. They* [i.e. Ganadero farmers] *have their cattle and their pasture, and someone like myself only sows* [maize]. *They 'move' resources so much easier than we can; they can buy pasture whenever they want. They can hire helpers* ['*mozos*'] *as much as they want to do the work for them. For us, it's different.*

Interactions between *Pobre* and *Ganadero* farmers are commonplace. In fact, *Pobre* and *Ganadero* farm development was linked in the 1990s. I will illustrate this in the following sections.

Logic of Farming in Cuzalapa

Both *Pobre* and *Ganadero* farmers agree that the overall goals for farming are to obtain:

> […] *enough to eat and some money to pay one's costs* (Gerritsen 1995:52).

This is achieved by 'carrying on the struggle' (*hacer la lucha*), which is an important notion for Cuzalapa farmers. A farmer who successfully carries on the struggle ensures good living conditions for himself and his family.[3] He is also able to bear most problems by himself. A *Pobre* farmer commented:

> *'Everything depends on doing the job right. If you carry on the struggle successfully, you will manage the situation. That brings a lot of advantages. If you sell* [grazing rights for] *your pasture* [at the right moment in the cropping season], *you* [and not the buyer] *can determine its price. If there is an emergency, you just sell a cow, and you don't risk getting indebted to others.'*

In everyday life, 'carrying on the struggle' is translated as working hard in the different domains of farming. A farmer who carries on the struggle successfully does not only have some land for cultivation, but also some cattle. Land and cattle property is of central importance. Cattle possession in particular is seen as a symbol of wealth and prosperity. Obtaining (more) land and cattle is an important driving force underlying the dynamics of the regional farming style: it allows a *Pobre* to become richer, i.e. to become a *Rico* (i.e. *Ganadero)*, while it allows a *Ganadero* to increase his status.

Obtaining (relatively) independently the resources needed for farming is another aspect of success. It is one of the criteria for craftsmanship: a good farmer does not depend (too much) on other farmers. He is also respected within the community. Helping other farmers in need is the other dimension of being respected. Being respected represents both a moral obligation and functions as a security net. The following statement illustrates this:

> *'Well, you see, you have to help people who are in need. I always try to help people with the little I have. If I am in need, one day somebody will help me too. Of course, those who do not want to help will have more difficulties in finding people who will help them when they are in need.'*

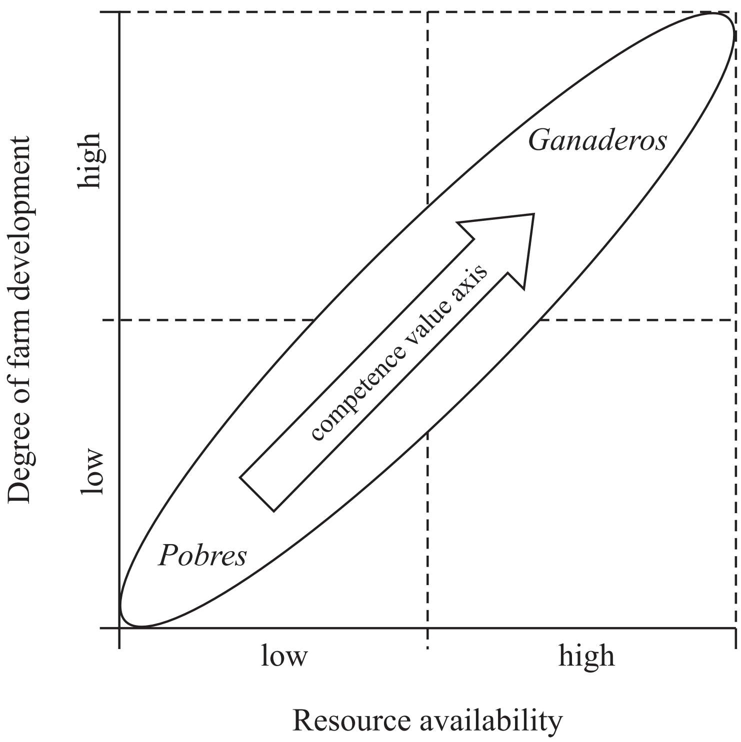
Farmers who have caused others to lose respect for them find it more difficult to mobilise resources.

Competence Value Axis

Farming logic as described above can be conceptualised by presenting a *competence value axis* (Bennett 1982:342). This axis can be considered as the management style (or production orientation) followed by farmers in a given local context. Its definition is based on folk classifications, rather than a purely economic analysis. Consequently, the term management has to be understood in a broad sense, including ecological, social or emotional criteria (*ibid.*).

Figure 3.1 schematically represents the competence value axis for Cuzalapa. It shows the (ideal) farm development pattern (traditionally) pursued by farmers. It also shows that the *Pobre* and *Ganadero* ways of farming can be considered theoretically as two stages in farm development.

Figure 3.1 Competence value axis underlying the regional farming style



Farming Practice in Cuzalapa

When shifting from farmers' discourse to farming practice, a somewhat different picture of diversity in farming and natural resource management in Cuzalapa emerges. To start with, a small group of farmers owns the majority of the land and cattle. Most of the other farmers have (very) limited resources at their disposal. In other words, socio-economic differences between *Pobres* and *Ganaderos* are bigger than expressed by the farmers themselves. It has also become much more difficult for a poor farmer to become rich.

Nowadays, farming diversity in Cuzalapa is considerable and diverging farming strategies can be observed. On the one hand, numerous farmers are involved in both agricultural and cattle-breeding activities. They thus adhere to the strategy underlying the regional farming style. On the other hand, some farmers have diverged from this style and focus more attention on either cattle breeding or agriculture. A number of farmers also dedicate substantial time to off-farm activities, as their access to land is very restricted. Despite these changes, Cuzalapa farmers still refer to themselves as *Pobre* or *Ganadero* farmers. Diversity, as encountered in farming practice, can thus be found within these two groups. I will discuss this in more detail in the next section.

Changes initiated in the 1960s and 1970s have slowly transformed the Cuzalapa valley. The farmers of Cuzalapa recall that differences were less pronounced before that period. The effects of the processes that shaped the Cuzalapa landscape in the 1960s and 1970s, such as land reform, forest exploitation, cattle breeding, demographic growth and community politics, have become more visible. In addition to these processes (described in Chapter 2), two additional factors can be distinguished that have played a role since the 1970s, i.e. the role of the Mexican government and the establishment of the biosphere reserve in the Sierra de Manantlán mountain range.

3.3 Differentiation within the Regional Farming Style

Generally speaking, *Pobre* farmers follow a livelihood strategy that can be considered multi-facetted. Farming is diversified and supplemented by many additional endeavours, including off-farm activities. The most common activities are maize cultivation, small-scale cattle breeding, wage labour, and collection of non-timber forest products. The *Pobres*' land-use is generally subsistence-oriented. *Ganadero* farmers employ a more specialised livelihood strategy, with cattle breeding as the dominant activity. Most cultivate maize, but as a secondary endeavour that is generally carried out by (*Pobre*) farm labourers, and sometimes *(Pobre)* sharecroppers. *Ganaderos*' land-use is thus more market oriented, and cattle are commonly sold. Their cattle-breeding strategy is labour extensive, involving few investments. Part of the logic of extensive cattle breeding involves a continuous effort to secure pasture area and, consequently, land (Gerritsen and Forster 2001).[4]

Differences between farmers can be described by looking at land and cattle property. Farmers often refer to these factors, as they symbolise a person's wealth (Gerritsen

1995). Table 3.1 presents an indication of land and cattle ownership of *Pobre* and *Ganadero* farmers, based on a sample of 133 farmers.[5]

Table 3.1 Land and cattle possession amongst *Pobre* and *Ganadero* farmers (N=133)

	Land (ha)			*Cattle (#)*		
	Average	*Stand. Dev.*	*Median*	*Average*	*Stand. Dev.*	*Median*
Pobre farmers (n=105)	9.9	12.8	6	2	3.6	0
Ganadero farmers (n=28)	52.2	39.6	42.5	59.8	63.9	45

Table 3.1 shows variation within both groups. Among the *Pobre* farmers, variation can be generalised by distinguishing three farmer categories. More or less, two categories can be distinguished amongst *Ganadero* farmers. These categories will be described in the following two sections.

Differentiation amongst Land-owning Pobre farmers

The first category of *Pobre* farmers represents those who dedicate most of their time to agriculture.[6] They own a few hectares of rain-fed and irrigation land. Maize and bean cultivation is carried out twice a year. These farmers have limited access to resources and are involved in off-farm activities, as time allows in between their work on the farm.

Farmers within this category have a good overview of their land and their crops, as they spend a lot of time on their fields, even if they are not all equally dedicated. Little produce is sold, as yields are low; almost all the harvest is used for subsistence. Maize crop residues and pasture grazing rights are sold to cattle-breeders. This has become an important income source since market prices for maize have decreased. The money gained is used for buying fertiliser and pesticides, or for hiring a tractor.

The second category of *Pobre* farmers represents those who cultivate maize and beans, and who dedicate part of their time to small-scale cattle breeding.[7] For them, agriculture is as important as cattle breeding. Their access to resources is also limited.

These farmers own an average of six heads of cattle.[8] The cattle's function is to allow the farmer to save money in living stock. Whenever extra money is needed an animal is sold, but this generally takes place only in cases of emergency. Milk is used for home consumption, but milking takes place very irregularly and production is relatively low. Farmers improve their herd by interchanging calves with other Cuzalapa farmers. They also sometimes borrow a breeding bull (the so-called *'semental'*).

Farmers within this category own some grazing land (i.e. '*agostadero'* land), in addition to rain-fed and irrigation fields. Maize and beans are produced mainly for the family's own consumption. Maize crop residues and pasture are needed mostly for their own cattle. They therefore hardly ever sell crop residues or pasture grazing rights. If they do so, it is only in small amounts. When financial resources are available, they buy grazing rights. This concerns small areas of pasture land, as many farmers prefer to maintain a herd size that can be fed with their own resources. Permanent pasture establishment takes place only on a small scale, as farmers need their land for cultivation. Over the long term, herd size is relatively unstable. This is due to a combination of factors such as the cattle's proneness to sickness and diseases, temporal sale, and the relatively small herd size.

Most herds remain in the lower parts of the valley throughout the year, as little land is owned on the higher slopes. Cattle are moved around frequently between cultivation fields and the grazing land, and this activity has to be carefully planned. Farmers who do not own enough land in the lower elevations, are forced to move their cattle uphill.

Table 3.2 presents land property of the two *Pobre* farmer categories described above, according to suitability for cultivation.[9] The table illustrates the considerable variation between these two groups.

Table 3.2 Absolute land distribution amongst Pobre farmers, according to category (N=77)

	Maize and bean cultivation (n=40)			*Agriculture and cattle breeding (n=37)*		
	Average	*Stand. Dev.*	*Median*	*Average*	*Stand. Dev.*	*Median*
Rain-fed (ha)	0.9	1.5	0	2.8	3.4	1.5
Irrigation (ha)	3	2	3	3.8	2	3
Agostadero (ha)	6.2	10.9	0	9.4	14.3	4
Total land (ha)	10.7	11.1	7	15.5	15.2	9

Landless Pobre Farmers

The farmers described so far are *comuneros,* i.e. officially registered land-owners (see Chapter 2). But there are also landless farmers in the community. Given the current land-distribution situation, the possibilities for these farmers to permanently obtain some land for cultivation are very limited. These farmers comprise the third category of *Pobre* farmers.[10]

Most of the landless farmers are the grown-up sons of *comuneros*. Some work on their father's farm, or a relative's farm. Sometimes, they are already *de facto* farm heads, when the father is sick or too old to take decisions or to do the work on the farm. Possibilities to inherit the farm depend on the number of children in the parents' household. A young farmer explained his own situation:

> *My father is comunero in Cuzalapa, he owns the land of our family. I am the beneficiary, although I do not* [yet] *have a voice and vote* ['*voz y voto*': i.e. the right to decide in the general assembly].

This category of *Pobre* farmers also consists of farmers who were not born in Cuzalapa (the so-called '*avecindados'*). Compared to the sons of *comuneros*, the *avencindados*' possibilities to obtain land are even more limited.

For landless farmers, sharecropping (*siembra a medias*) is an important activity. They also engage in wage and farm labour, some fishery activities, and the collection of non-timber forest products.[11] Employment opportunities vary during the year. At the beginning and end of the cropping seasons opportunities are better, as the demand for agricultural labour is then higher. Landless farmers thus depend a lot on other farmers to obtain food and income.

Pobre Farm Development

Generally speaking, the *Pobre* farmers in all three categories are entangled in a web of unstable commodity and non-commodity relations, although to different degrees. In other words, they are confronted with relatively high insecurity, due to limited resource access. They also depend to a considerable degree on community relations for resource mobilisation. A *Pobre* farmer explained:

> *You already know, we are 'jodido'* ['damned', i.e. they are in a situation that cannot be changed very easily], *we have little money. Every season, we have to find ways to pay for the* [chemical] *fertiliser, find somebody whom we can sell our pasture* [grazing rights] *to, or find somebody for sharecropping.* [...] *We are poor people.*

Insecurity makes *Pobre* farm development dynamic over time. Many landless farmers work toward obtaining some land and cattle, while many land-holding farmers with few or no cattle are interested in obtaining (more) cattle. In most cases, these changes in the farmers' situation are not drastic, as they imply only small adaptations that can easily be incorporated in existing farming activities. For example, landless farmers have often already worked on the land that they obtain, while calves are obtained one or two at a time instead of in large numbers all at once. Moreover, some changes are not necessarily positive. Many *Pobre* farmers can tell stories about how they had to sell land or cattle out of necessity, or how they lost them because of diseases or accidents. As noted earlier, the small herds of *Pobre* farmers are more prone to risk.

Table 3.3 presents some details of *Pobre* farmers' agricultural activities, based on data obtained from a survey I conducted in 1994 amongst 30 *Pobre* (and 10 *Ganadero*) farmers to obtain specific data on input use and yields, as well as on a number of other activities. Table 3.3 shows an important variation (indicated by the standard deviation) within this group of farmers. Variation is caused by biophysical factors such as soil fertility, soil texture, slope, and water availability. It is also caused by socio-economic factors such as craftsmanship and farmers' agency to obtain resources. I will describe this further in the next sections.

Striking in Table 3.3 is the production level of *coamil*-maize compared to rain-fed or irrigated maize. The higher production level of *coamil*-maize can be explained by looking at soil fertility. *Coamil* is practised on more fertile fields that are located uphill and which used to be under forest cover. Cultivation takes place for two to three subsequent years, after which a fallow period of some five to six years is common.[12] Rain-fed and irrigation fields are found in the lower elevations and the same fields are cultivated once or twice a year. Thus, fallow periods do not exceed six months to one year.[13]

Table 3.3 *Pobres*' agricultural inputs and outputs in 1993/1994 (N=30)[14]

	Average	*Stand. Dev.*	*Median*
Yunta de lluvia (rain-fed maize cultivation):			
Maize production (kg/ha)	545	445	400
Fertiliser use (kg/ha)	281	325	250
Herbicide use (litres/ha)	0.4	1	0
Yunta de riego (irrigation maize and bean cultivation):			
Maize production (kg/ha)	572	442	480
Bean production (kg/ha)	211	155	160
Fertiliser use (kg/ha)	257	194	250
Herbicide use (litres/ha)	0	0	0
Coamil (shifting maize cultivation):			
Maize production (kg/ha)	1409	855	1200
Fertiliser use (kg/ha)	186	223	100
Herbicide use (litres/ha)	3.5	3.6	2.5

Social Definition of Ganaderos

Ganadero farmers' activities revolve around cattle breeding. The term *Ganadero* is used by both *Pobre* farmers and by the *Ganadero* themselves to indicate farmers who have large herds of cattle. *Ganadero* farmers are also characterised as being wealthy.

Ganadero farmers regard themselves above all as cattle-breeders, as they devote most of their time to this activity. They also cultivate maize and beans, for which they generally employ farm labourers. Agricultural activities take place mostly in the dry season and are also very important because of the fodder they produce. Agriculture thus has a different meaning for *Ganadero* farmers, than for *Pobre* farmers.

Generally speaking, Cuzalapa farmers start to consider someone a *Ganadero* when he has some 15-20 or more animals.[15] Farmers state that cattle breeding then starts to dominate farm organisation. But opinions can differ. A *Ganadero* from one of the localities with more cattle, stated:

> *For me, a cattle breeder is somebody who has 100 or more animals, or at least 50; then he is really managing a herd. According to the* [governmental] *Cattle Breeder Association, a person who has 15 animals is a cattle breeder. But it is the same with the agriculturists. Before, people cultivated 10 or 20 medidas* [i.e. 2-4 ha].[16] *Now, they sow only two or three* [i.e. 0.4-0.6 ha]. *Can somebody who grows only two or three* [*medidas*] *be called an agriculturist?*

Differentiation amongst Ganadero Farmers

As is the case amongst *Pobre* farmers, variation is found amongst the *Ganaderos*. Variation is present in the number of cattle they own and in pasture management. With respect to cattle property, two general categories can be distinguished amongst *Ganaderos*: those whose herds comprise less than 60 animals and those with larger herds. Table 3.4 presents these two categories in an adapted version of Table 2.7, in which *Pobre* farmers with cattle are left out.[17] Table 3.4 shows that a majority of 69 per cent of *Ganadero* farmers own a herd of between 20 and 60 animals, while the remaining have (much) larger herds.

Table 3.4 Cattle distribution amongst *Ganaderos* (N=77)

Herd size	*Ganaderos*		*Cattle*	
	Absolute	*Relative (%)*	*Absolute*	*Relative(%)*
20-60	53	69	2,298	60
More than 60	14	31	1,530	40
Total	77	100	3,828	100

Differences amongst *Ganadero* farmers are also related to specific farm conditions, especially pasture availability. Pasture availability is not only a factor of herd size, but also of land property. *Ganadero* farmers with enough of their own land (in relation to herd size) are careful to save their pasture land for critical times in the year. These farmers dedicate an important amount of time and effort to animal care, and the size of their herds is generally moderate to large. *Ganadero* farmers who do not have enough of their own pasture land (in relation to herd size) buy grazing rights every cropping cycle. The total amount depends on the availability of pasture on their own farm. Animal care is even more extensive amongst these farmers, as the size of their herds is generally large to very large. A young *Ganadero* farmer commented:

> *My father invests nearly all he has in buying pasture* [grazing rights]. *Each year he sells some 20 toretes* [young bulls] *to pay the rent* [of pasture land]*, to cultivate maize and pay the 'mozos'* [wage labourers]. *Don Fulano has less costs, because he has sufficient* [pasture] *land of his own, so he does not need to rent more pasture land.*

Ganadero Farm Development

Ganadero farmers sell their cattle to obtain economic resources for living and farming. The whole year round, milk and cheese are produced, which is used for their own consumption, or sold to other farmers. A *Ganadero* farmer commented:

> *The sale of the calves takes place mainly in November and December, because you will find the best pasture in the rainy season* [i.e. June till December]. *The bull calves will be fatter then* [and a higher price can be obtained]. *People from Cuzalapa and from Cuautitlán buy the cows. Most cattle-breeders do not sell outside the community. We own cattle for several reasons: for saving, to sell toretes* [small bulls]*, or to sell cheese. In this way, we get the money we need.*

Ganadero farmers improve their herds mostly by buying breeding bulls from outside Cuzalapa.

Compared to *Pobre* farmers, *Ganadero* farmers own a lot of land. Table 3.5 illustrates how this land is used.[18]

Table 3.5 Absolute land distribution amongst Ganadero farmers (N=28)

	Average	*Stand. Dev.*	*Median*
Rain-fed land (ha)	6.1	11.4	1
Irrigation land (ha)	5.6	4.1	4
Agostadero land (ha)	41	36.2	34
Total Land	52.5	39.6	42.5

Expanding one's farm through land purchase is seen as a condition for successful farm development. A *Ganadero* farmer commented:

> *You have to keep looking forward. This means that you have to keep looking for new land. Some do, and therefore we possess more land. Others don't, and therefore they only have little, and cannot earn enough to make a living. We look forward; those who don't, won't manage to survive. My father already started to look for land when he was young. I am just following his example.*

Ganadero farmers often sell part of their agricultural production. Table 3.6 presents some details on the agricultural activities of *Ganaderos,* based on data obtained from the 1994 survey on agricultural activities of *Pobre* and *Ganadero* farmers. Noteworthy in Table 3.6 is the yields of maize produced under *coamil* practices. They are very low compared to those of *Pobre* farmers (see Table 3.3). This can be explained by the fact that *Ganadero* farmers practice *coamil* mostly through sharecropping, and they are more interested in the crop residues (as a source of fodder) than the ears of corn.

Table 3.6 *Ganaderos*' agricultural inputs and outputs in 1993/1994 (N=10)

	Average	*Stand. Dev.*	*Median*
Yunta de lluvia (rain-fed maize cultivation):			
Maize production (kg/ha)	1007	568	880
Fertiliser use (kg/ha)	398	164	375
Herbicide use (litres/ha)	1.5	0.9	1
Yunta de riego (dry season maize and bean cultivation):			
Maize production (kg/ha)	811	484	609
Bean production (kg/ha)	529	456	400
Fertiliser use (kg/ha)	381	160	317
Herbicide use (litres/ha)	0.3	0.5	0
Coamil (shifting maize cultivation):			
Maize production (kg/ha)	933	231	800
Fertiliser use (kg/ha)	163	142	240
Herbicide use (litres/ha)	4.7	5	4

Pasture availability is the most limiting factor for *Ganaderos'* farm development, especially in the months of April and May (at the end of the dry season).[19] Therefore, *Ganadero* farmers constantly look for ways to increase fodder availability for their cattle. As it has become difficult to purchase land, the purchase of grazing rights on pasture land and maize crop residues has become very common. The establishment of high-quality pasture also takes place.

Fodder availability and animal care is also related to the (seasonal) movement of cattle in the Cuzalapa valley. Whereas *Pobre* farmers are restricted in the movement of their cattle by cropping seasons, the *Ganaderos* can choose where to graze their cattle based on the availability and quality of pasture. In Cuzalapa, cattle movement takes place in two general ways. *Ganadero* farmers, who have land in the north-eastern part of the valley, keep their cattle in the lower parts of the hills during the rainy season. In the dry season, they move their herds uphill as far as the neighbouring community of San Miguel de Ayotitlán. As the climate is colder at this higher elevation, pasture is available later in the dry season. Moreover, as maize is harvested in January, relatively high-quality fodder is available just before the critical months of April and May (Gerritsen 1995). The remaining *Ganadero* farmers keep their cattle uphill during rainy season, when there is enough water and pasture available. In the dry season, they let their animals graze in the lower elevations. Of these farmers, those that have enough land in the level parts of the valley to keep their cattle there throughout the year. In all cases, cattle that enter the fields of *Pobre* farmers do so in November and in May to graze on the crop residues and pastures.

Gender Aspects of Pobre and Ganadero Households

Amongst both *Pobre* and *Ganadero* families, the men and (elder) sons perform most of the farm activities that are related to crops, cattle and most of the tree and forest products. Women also play important roles on the farm, depending on the farm's characteristics, the women's age and their socio-economic status (see also Moser 1993 for a theoretical discussion).

Pobre women perform many different activities. Apart from looking after the household, home garden and children, they take lunch to their husbands in the fields. *Pobre* women (and daughters) occasionally work in the fields in periods of labour shortage, such as the period of sowing and harvesting (Kreutzer *et al.* 1998). The poorest women also work as farm labourers (Ayala 1998). A *Pobre* women explained:

> *The women, we also work in the fields. The harvesting of the tomatillo* [wild tomato] *is a very busy activity that involves a lot of women. Sometimes, as many as 15 women.*

Pobre women are involved in the making of handicrafts, cheese and fruit juice. They also collect non-timber forest products and (sometimes) firewood.

Ganadero women dedicate a lot of time to domestic activities too, but they do not work in the fields. They also participate in milking and cheese making and occasionally assist in moving the cattle from one meadow to another. Mainly younger unmarried women do this.

Some *Pobre* and *Ganadero* women own cattle themselves. Cattle are obtained mostly through inheritance. Some women also own domestic animals kept in the home gardens near the houses. As women take care of these animals, they also have control of the remittances obtained by their sale (Kreutzer *et al.* 1998).

A number of female-headed households exist amongst *Pobre* and *Ganadero* families. The husbands of these households have left either temporarily or permanently, or are deceased. These women depend on their (male) children and sometimes also their relatives to perform the work on their farms. They also sometimes hire farm labourers. The poorer women in this group are often forced to do the work themselves, as they cannot afford to hire wage labourers.

Apart from the female-headed households, there are also women, who work by themselves, independent from their husbands. A women farmer commented:

> *You see, I started working on my field because my husband started to drink, and he did not take care of me and my children anymore. Of course, I did not do all the work by myself, but I also hired some 'mozos'* [wage labourers].

Conclusion

In this section, I described a number of characteristics of *Pobre* and *Ganadero* farmers in Cuzalapa. This description highlights the considerable diversity that exists amongst Cuzalapa farmers and their farming strategies. Table 3.7 summarises the general characteristics of *Pobre* and *Ganadero* farmers.

Table 3.7 Overview of general characteristics of *Pobre* and *Ganadero* farmers

Characteristics	*Pobre farmers*	*Ganadero farmers*
Overall farming strategy	Multi-facetted	Towards specialisation
Production orientation	Subsistence-oriented	Partially market-oriented
Main activity	Agriculture, small-scale cattle breeding	Cattle breeding
Secondary activity	-	Agriculture
Other activities	Wage labour, farm labour, fishing, collection of non-timber forest products, etc.	None
Labour force	Family-based	Family-based, wage labour
Land property	Low	High
Cattle property	Low	Moderate to High
Main limitation	Farm reproduction	Farm expansion
Farmer diversity	High	Medium

3.4 Mobilising Resources within the Regional Farming Style

Nowadays, the difficulties faced by *Pobre* farmers mostly involve farm reproduction, while *Ganadero* farmers are limited in farm expansion. But there are a number of mechanisms through which *Pobre* and *Ganadero* farmers can mobilise the resources that they need. Mobilisation can take place either through market-independent mechanisms at community level, or through (local and regional) markets. Table 3.8 presents an overview.[20] The importance of the different mechanisms has changed over time. Until the 1960s, resource mobilisation took place for most farmers mainly through market-independent mechanisms. Nowadays, market-dependent mechanisms have also become important.

Under current production conditions, *Pobre* and *Ganadero* farm development processes are linked through several of the mechanisms mentioned in Table 3.8. *Pobre* and *Ganadero* farmers are also linked through political ties, as described in Chapter 2. In this section, three mechanisms will be described that have become increasingly important in Cuzalapa, although *Pobre* and *Ganadero* farmers attribute different meanings to them. First, the practice of sharecropping will be described. Then I will take a closer look at the commodisation of grazing rights. Finally, the role of migration will be highlighted.

Table 3.8 Mechanisms for resource mobilisation (Gerritsen 1995:49)

	Market-independent mechanisms	*Market-dependent mechanisms*
Land	Inheritance; marriage; communal decisions; use of communal land; illegal land transactions	Purchase and sale of land; renting and hiring; illegal land transactions (Incorporation into the land market)
Capital	Savings; family capital; money from friends; money sent by family members abroad	Loans from other *comuneros*; loans from banks; earnings from wage labour or craftsmanship; earnings from sale of timber and non-timber forest products (Incorporation into capital market)
Labour	Family labour; working *a medias* (sharecropping); working *a peonadas* (reciprocity relation)	Purchase and sale of labour (Incorporation into the labour market)
Draught Animals	Family; friends; working *a medias*	Renting and hiring; purchase and sale
Fertiliser	Shifting cultivation, dung, intercropping, working *a medias*	Purchase of chemical fertiliser; sale of grazing rights
Seed	Own production and selection; family exchange, gifts from friends; loan	Purchase from other *comuneros*, or from other communities
Cattle	Marriage; inheritance; gifts from family; cattle *a medias*; cattle *a partida*; exchange within the community	Purchase within or outside the community (Often combined with incorporation into labour market)
Knowledge	Craftsmanship and *art de la localité*[1] gained by experience and embodied in community norms about good farming; family relations outside the community	External prescriptions and control by agrarian banks and rural extensionists; temporary migration to urban areas and the United States

1) *Art de localité*: local knowledge, or farmers' knowledge, which encompasses essentially the co-ordination of tasks and domains. Plants, soils, cattle, water, markets, social relations, etc., only have meaning in their mutual relations (van der Ploeg 1991).

Sharecropping

Sharecropping (the so-called '*siembra a medias*') is an important mechanism for obtaining limited or lacking resources. Basically, a landless farmer (the so-called '*mediero*': sharecropper) asks a *comunero* (the so-called *patrón*: the landowner, literally: the boss) to work together on the land of the latter by sharing costs and benefits. When the two farmers reach an agreement, they start working together for one cropping season. The *mediero* does the work in the field, while the *patrón* provides land, draught power and tools, and pays the costs for (chemical) fertiliser and pesticides. During harvesting, the maize yield is divided equally, while the patrón keeps all of the crop residues.

Sharecropping appears to have taken place in Cuzalapa at least since the first half of the twentieth century. During the 1950s and 1960s, it appears to have taken place between poor farmers and a relatively small number of rich land-owners. *Medieros*, i.e. the poor farmers, primarily undertook sharecropping to resolve food and income shortages at the beginning of the cropping season, while the *patrón* participated to obtain maize and to train young oxen. In those times, draught power was provided by oxen and not by horses and mules. An elder farmer explained:

> *In the old days, people did things differently. The 'patrón' gave maize and 'dinero de habilitación'* [i.e. money to make production possible: '*para habilitar la producción*']. *This was to help the 'mediero' at the beginning of the cropping season* [when there was a shortage of maize amongst poor farmers]. *The money was paid back 'como corre la cosecha'* ['as the harvest runs', i.e. independent of production levels]. *This means that there was no dividend for the 'patrón' in this arrangement. It was a way to help the 'mediero' and his family. The patrón's support consisted of 3 'hectolitros' of maize* [about 240 kg] *and 50-200 pesos. Besides, one got 5 'medidas'* [20 kg] *of beans and 50 'maniojas de maíz'* [maize leaves to feed the bulls]. […] *Nowadays, it isn't like this anymore; the tradition has been lost. I recall 1967 or 1968 as the last time that it was done like I told you. From around that time, people started to have more to eat and everybody got a field of his own. The habit of giving 'dinero de habilitación' was changed with the introduction of horses* [replacing oxen traction, in the 1960s]. *People started to change the arrangement, because the horses work faster. They are also more economical, as they eat less.*

The changes in the regional farming style have also had an impact on the nature of the sharecropping arrangement. A farmer commented:

> *After the sixties, the 'patrón' started to ask for a dividend* [for the 'dinero de habilitación']. *That's the reason the tradition changed. Today, compared to the old days, people cultivate less 'a medias'; only those most in need do so.* [...] *I also cultivate 'a medias'. You know, we are 'damned'* [*jodido*] *too.*

As this farmer indicated, sharecropping is now practised primarily by *Pobre* farmers. It generally involves two farmers who work together, usually during one cropping season. Although sharecropping has changed over the decades, farmers still use the same concepts to describe the arrangement (i.e. *mediero* and *patrón*); and it still has an important socio-economic function: if a farmer is not able to cultivate his own land, he will still have a way to obtain maize. It also allows farmers to preserve good relationships with other community members, i.e. to maintain mutual respect. The following statement illustrates this:

> *I will almost never refuse to work 'a medias' when somebody asks me to. You see, this time I will help the farmer who is in need. The next time, I can be the one in need and then they will help me. If I refuse, the next time people will not be willing to work with me.*

Nowadays, there is no fixed system for sharecropping. In fact, its nature very much depends on the farmers involved as well as on some farmer-specific conditions. As one farmer explained:

> *The way to work 'a medias' depends on the cropping season and the arrangement between the 'mediero' and the 'patrón'. During the dry season, when there is a big need for pasture, I am sure that the 'patrón' will pay the fertiliser without too many problems. In the rainy season, when there is more pasture available, it will be different. It then depends on the landowner and his consciousness. Well, you know, there are people who want to do harm to others* [*'que quieren joder otros'*]. *The 'mediero' and the 'patrón' first talk about the conditions* [before closing the deal]. *Sometimes, the 'patrón' pays all of the fertiliser, and then I* [as *'mediero'*] *will not claim my share of the 'rastrojo'* [crop residues]. *Sometimes, when the 'mediero' pays half of the costs of the fertiliser, the patrón has to leave half of the pasture. But that makes sense only when the 'mediero' has some cattle. The 'mediero' will always obtain half of the* [maize] *yield, the difference lies in the pasture. The same counts for the labour. Normally, it is the 'mediero' who does all the work, but if the 'mediero' and the 'patrón' agree on this, both can do part of the work. This can happen, for example, when weeding is a lot of work. Then the 'mediero' can negotiate that the 'patrón' also does his share of the work.*

Ganadero farmers also participate in sharecropping arrangements, but their motives are different than those of *Pobre* farmers. They participate in order to obtain more pastures upon which to graze their cattle, either directly through the crop residues, or indirectly through the establishment of high-quality pasture after the maize harvest. *Ganadero* farmers hardly ever work in the maize fields themselves; they only provide the necessary resources. This is illustrated by Table 3.9, which shows the percentage of *Pobre* and *Ganadero* farmers who sharecropped in the rainy season of 1994.[21] The table confirms that sharecropping is more important amongst *Pobre* farmers as a way to secure access to natural resources and non-factor inputs. Amongst the *Pobres*, it is mainly the landless farmers, for obvious reasons, who are involved in sharecropping arrangements.

Table 3.9 Percentage of farmers sharecropping in 1994 (N=40)

	Of total sample (%)	*As mediero (%)*	*As patrón (%)*
Pobre farmers (n=30)	47	71	29
Ganadero farmers (n=10)	30	0	100
Total	43	59	41

Not all *Pobre* farmers are willing to participate in a sharecropping arrangement. On the contrary, various *Pobre* farmers prefer to cultivate independently. One of these farmers commented:

> *I generally do not cultivate 'a medias'. Look, I do not have much land. If I cultivate 'a medias', then little of the harvest is left for my family and me. Besides, I have my son to help me. Therefore, I prefer to work alone.*

Pobre farmers who do not want to get involved in a sharecropping arrangement have the option to rent land from others, which generally takes place only for one cropping cycle. *Ganadero* farmers also rent land, but mostly for grazing purposes. Finally, working on the fields of another farmer can also have a reciprocal character (the so-called working *a peonadas*). Farmers then do not get paid, nor do they share costs and benefits. Instead, the owner of the land works in return for an equal period on the land of his helper. Working *a peonadas* only takes place for a day or two and mostly in periods of labour peaks, such as, for example, during the bean harvest or cow vaccinations. One farmer explained:

> [...] *We also work 'a peonadas'. This means that I work a certain number of days on your land, and than afterwards you work on mine. It can be 'con todo y apero'* [i.e. with all farm tools]*; with plough, tools, horses, or simply alone by myself.*

Commodisation of 'Pastura'

Pastura has become increasingly important in farming practice in Cuzalapa. The term refers to pasture land and crop residues; both of which are used to feed cattle. The commodisation of *pastura* grazing rights between *Pobre* and *Ganadero* farmers has become common practice in Cuzalapa. Table 3.10 illustrates this. It shows that *Pobre* farmers are more involved in selling, while *Ganaderos* mostly purchase *pastura* grazing rights. The *Pobre* farmers who do buy *pastura* generally buy smaller quantities, contrary to *Ganadero* farmers. The *Ganadero* farmers, who sell *pastura*, normally have more than enough for their own cattle; so they sell the surplus.

Table 3.10 presents additional results from the 1994 survey. It shows that not all farmers are involved in commodisation. *Pobre* farmers not involved often have little land and need the available *pastura* for their own cattle or horses and mules. *Ganadero* farmers not purchasing *pastura* generally have enough on their farm.

Table 3.10 The commodisation of '*pastura*' in Cuzalapa in 1994 (N=40)

	Pastura:	
	Purchase (%)	*Sale (%)*
Pobre farmers (n=30)	17	60
Ganadero farmers (n=10)	70	10
Of total	30	48

Table 3.10 also indirectly illustrates the different importance of *pastura* for *Pobre* and *Ganadero* farmers. For *Pobre* farmers it is an important income source, while the *Ganadero* farmers' interest is in obtaining more and better-quality fodder for their cattle.

Pastura commodisation appears to have started in the early 1970s. Since the early 1990s, it has become a scarce resource for both *Pobre* and *Ganadero* farmers, which has influenced its price. As a *Ganadero* farmer commented:

> *Every year you have to buy 'pastura' and it gets more expensive every year.*

The commodisation of grazing rights on pasture land takes place mainly during the dry period when available pasture is very limited. Grazing rights on maize crop residues (the so-called *rastrojo*) are bought at the end of the cropping seasons, following the agricultural calendar. According to many farmers, the sale of the crop residues has become essential for cattle breeding in Cuzalapa. This illustrates the direct relation between agriculture and cattle breeding in the valley, i.e. the *Pobre* and *Ganadero* ways of farming. One farmer explained:

> *Without agriculture, you would not have that much cattle in the community. Almost all* [*Ganaderos*] *farmers buy the 'rastrojo'* [crop residues]. *The other day, Fulano was so desperate for pastura that he offered to buy Mangano's rastrojo with the ears of corn still unharvested.*

There are also farmers who buy pasture grazing rights in the rainy season, although this takes place less frequently. A farmer commented:

> *I prefer to have my animals close to the house, therefore I buy some pasture* [rights] *in the rainy season. You see, I could leave them further away in my agostadero* [i.e. grazing land]*, but there is always the risk that my animals will get stolen. It has already happened to me twice.*

As with sharecropping, there is no fixed system for the commodisation of grazing rights. On the contrary, much depends on the arrangements made by the farmers involved. The following statement, describing a less fortunate *Pobre* farmer, illustrates this very clearly:

> *You see, Fulano has big financial problems. So this is now the second year that he has to sell* [the grazing rights on] *his 'rastrojo'* [i.e. crop residues] *at the beginning of the cropping season* [instead of at the end of the season]. *And of course, the Ganadero knew that the poor bastard* [*'el pobre cabrón'*] *was in need, so he paid him a very low price.*

It is mostly *Ganadero* farmers who can afford to buy *pastura*. *Pobre* farmers with cattle are more limited, and often have to look for other ways to obtain *pastura*. The following statement illustrates this:

> *Look, we do not have much land, only a few fields that we cultivate for maize. We leave a part fallow for our cows, but it is not enough. Now, don Fulano lets our calves graze in his 'agostadero' on the hill.* [...] *He lets us, so that no other people can come and graze their animals on his land. You see, I look after his land and cows a little. Maybe if I am lucky, he will give the land to me so that I can fence it.*

In fact, some of the *Pobre* farmers who own cattle even sell their *pastura* in order to obtain cash money, although it negatively affects their farm. A farmer commented:

> *There are persons with few cattle and little land who sell their 'pastura'. Of course, they suffer, because their own cattle do not have enough to eat. They do it for the money. They prefer to suffer than to sell a calf to get the cash.*

The limited access to *pastura* of many *Pobre* farmers also affects the development of their farms. A *Pobre* farmer explained:

> *I would like to expand my herd, but as you know I have little land. So I would have to buy 'pastura'. That means selling a calf or two, and that is exactly what I don't want to do.*

Thus, due to the scarcity of *pastura* and limited financial resources, many *Pobre* farmers with cattle have limited options. In fact, this is one reason that an increasing number of *Pobre* farmers do not want to purchase cattle anymore. But there are also other reasons that ideas regarding farming as a whole have changed. For example, the introduction of new cattle races has replaced the (apparently) more easy-to-handle traditional race (the so-called *ganado criollo*: indigenous/locally bred cattle). A *Pobre* farmer commented:

> *Many* [*Pobre* farmers] *do not want to have cattle. They say the animals are annoying* [*'latosas'*]*, and that it is better to sell* [grazing rights to] *one's pasture land.*

It is not only the ease or difficulty of handling a certain race that determines farmers' decisions. It is also the physical characteristics of both cattle and Cuzalapa's environment. For example, *Friesan Holstein* cattle are less fit for hilly terrain, while they are also more prone to diseases. *Cebú* cattle are more adapted to the conditions of Cuzalapa, but they have a relatively low milk productivity. The introduction of certain races can cause a chain of consequences in farming practice, such as an increased need for veterinarian services or changes in cattle movement during the year, which only some of the farmers are willing to bear (see van der Ploeg 1987, 1999 for a theoretical discussion). Finally, the given land-distribution situation and socio-economic situation of farmers has also influenced farmers' decisions regarding cattle possession and expansion.

Due to both the increased importance of cattle and the increased scarcity of *pastura*, many, mainly *Ganadero* farmers, have started to establish pasture of a higher nutritional quality on their farms, i.e. through the introduction of exotic species. Table 3.11 presents these results from the 1994 survey. Many *Pobre* farmers have followed the *Ganadero* farmers' example in raising the quality of existing pastureland. As one farmer explained:

> *Pasture cultivation was first introduced in the 1960s by a cattle farmer who brought exotic seeds from outside the community. At first, the people were not very interested, but as the cattle activities became more important, more and more cattle breeders started to cultivate it. In a way, the introduction of high-quality pasture was one of the factors, which permitted cattle breeding to become important. The other farmers, those without cattle, started some 10 or 15 years ago* [i.e. the early 1980s]. *It was also around this period, or a little earlier, that people started to buy and sell their pastura.*

Table 3.11 Exotic pasture establishment in 1994 (N=40)

	Percentage of farmers establishing exotic pasture (%)	*Average amount of pasture established (ha)*		
		Average	*Stand. Dev.*	*Median*
Pobre farmers (n=30)	43	3	7	0
Ganadero farmers (n=10)	100	17	20	11
Total	58	7	13	2

Apart from buying *pastura, it* can also be obtained by raising cattle *a medias* or *a partida,* which are two cattle-raising arrangements similar to sharecropping. A farmer explained:

> *In both the 'a medias' and the 'a partida' arrangements, the 'mediero' contributes the pasture land, while the 'patrón' contributes part of the cattle products and/or the calves born. Cattle raising 'a partida' is different in that the herd consists of calves which have not yet had a 'parto'* [i.e. a calving]. *Here, the owner is obliged to give the 'mediero' the first calves that are born, as it takes a longer time to obtain them. Generally, this arrangement only takes place when there is a very urgent need for pasture. In the 'a medias' arrangement, the cows are already mature, so calves are born sooner. Here the 'mediero' and the 'patrón' can share the products of the arrangement right from the beginning. In both cases, the 'mediero' eventually has the possibility to obtain his own herd.*

Thus, in a *a medias* or *a partida* arrangements for cattle, a cattle farmer (the *patrón*) looks for another farmer (the *mediero*) who owns few or no cattle, but who possesses pasture land. When an agreement is reached, the animals are then put on the pasture land of the *mediero*. Maintenance costs, labour demands and any cattle products (milk, meat, or calves) are then shared by the farmers involved. As with sharecropping, much depends on the arrangement. By reaching an agreement, the cattle-owning farmer assures for himself the use of some pasture land, while the *mediero* has the opportunity to establish his own cattle herd. The difference between the *a medias* and the *a partida* arrangements is basically the division of the products. In both arrangements, it appears that the *mediero* is in a more disadvantageous position than the *patrón*, as calves are generally born only once every two years. Besides, due to the extensive character of cattle breeding, cattle density per hectare is relatively low.

The above description refers to the traditional *a medias* and *a partida* arrangements for cattle in the regional farming style. Due to the changes mentioned before, the *a partida* arrangement has disappeared; the last time that it appears to have taken place in Cuzalapa was in 1995. The *a medias* arrangement hardly takes place anymore amongst *Pobre* farmers, while its meaning has changed for *Ganadero* farmers. Amongst *Ganadero* farmers, cattle *a medias* now takes place mainly between migrants and the relatives that remain in Cuzalapa. In this new arrangement, the *patrón* is the migrant, while the *mediero* is a relative living in Cuzalapa and that takes care of the migrant's animals until the migrant's return to the community. Often, the relative buys cattle for the migrant with the remittances that are sent to him from abroad. A *Ganadero* farmer explained:

> *Those who work in the United States, they only come back to buy cattle and then they return to 'El Norte'* [i.e. the USA] *again. They come, they buy, they leave the animals with a family member, and then they go off again.* [...] *All the cattle-breeders have cattle 'a medias'. In one way or another, they all take care of cattle belonging to a relative.*

Migration appears to have become important in the expansion of cattle breeding in Cuzalapa. It is one of the social factors that have influenced the development of the regional farming style. It will be looked upon in more detail in the next section.

Migration

High migration rates are common in Western Mexico, especially in the states of Jalisco, Zacatecas and Michocán (see Arroyo 1989; Arroyo *et al.* 1991; Arroyo 1995; Velázquez and Papail 1997).[22] The situation in Cuzalapa is not very different from general patterns. Graf and Rosales (1996) estimated that 1,078 Cuzalapa residents migrated during the preceding 30 years, coinciding with 81 per cent of the total population in 1995. Results from a survey on migration that I conducted in 1998 revealed that many *Pobre* farmers and *Ganadero* farmers have migrated at some point in their lives, or have relatives working as migrants outside Cuzalapa. Table 3.12 illustrates this. It also shows that migration is more common amongst *Pobre* farmers than *Ganadero* farmers. However, the survey focused on elder farmers, whereas the younger generation of *Ganadero* farmers now also includes a considerable number of migrants.

Table 3.12 Migration in Cuzalapa in 1998 (N=40)

	Farmers who have migrated at least once during the last 40 years (%)	*Farmers who have migrant relatives (%)*
Pobre farmers (n=30)	59	83
Ganadero farmers (n=10)	25	100
Total	51	87

The destinations of Cuzalapa migrant farmers can be grouped into four categories:

1 Nearby cities in the valleys surrounding the Sierra de Manantlán, including those in the neighbouring state of Colima, such as Autlán, Casimiro Castillo, Colima, Cuautitlán, El Grullo, La Huerta, Minantitlán, Talpa, Tecomates and Villa Purificación.
2 The United States, mainly to the southern states of California, Texas, New Mexico and Arizona.
3 The coastal region of Jalisco and Colima, including the cities: Armería, Cihuatlán, Manzanillo, Madrí, Melaque, Puerto Vallarta, Santiago, and Tecomán.
4 Other destinations, mainly other states, such as Aguascalientes, Michoacán, Nayarit, and Zacatecas.

The predominance of the destinations is different for *Pobre* and *Ganadero* farmers, as illustrated in Table 3.13.

Table 3.13 The relative importance of migration destinations in 1998 (N=40)

	Major cities in the region (%)	*United States (%)*	*Coastal region of Jalisco and Colima (%)*	*Other destinations (%)*
Pobre farmers (n=30)	26	33	36	5
Ganadero farmers (n=10)	15	68	18	0
Total	22	44	30	4

Table 3.13 shows a differential pattern of migration within the regional farming style. Land-holding *Pobre* farmers mainly go for shorter periods to the major cities nearby in the region, where they work in the sugarcane industry or in horticultural activities. Landless *Pobre* farmers migrate to the coastal region of Jalisco and Colima to work in construction related to the tourist industry. *Ganadero* farmers also migrate to the coastal region, or they work in the United States (in agriculture, or construction activities). *Pobre* farmers migrate less than *Ganadero* farmers to the United States, mainly due to the costs involved. For those going as a *mojado* (illegal migrant), working in *El Norte* (the United States) can be a tricky business. A migrant explained:

> *Don't think that 'El Norte' is the land of milk and honey. First, it is very difficult to go there if you don't have a green card* [i.e. the proper migration documents]. *A 'pollero'* [i.e. someone who takes illegal migrants to the other side of the Mexico-USA border, also called *'coyote'*] *charges between 500 and 1000 dollars* [in 1998]. *Then, there is the constant danger of getting caught.* [...] *When one finds work, one works some 10 hours a day, but living expenses are very high: of every 100 dollars you earn, you pay about 80 for living expenses. And then one's parents also expect you to send them some money too.* [...] *No, it is very difficult* [*'está cabrón'*], *even more so under these new laws of the 'gringos'* [i.e. citizens of the USA].

Working conditions in the United States can differ substantially for migrants. A *Ganadero* migrant commented:

> *Now, I have a green card. I work 14 hours a day and earn US $ 1,000 monthly. I pay 200 dollars a month for rent and 15 per day for dinner.*[23] *Sometimes I have to fix my car, which costs at least 16 dollars. You know, a car is absolutely necessary to get around.* [...] *Of course, not everyone is in the same position. If you work as a gardener, you earn much less. And if you don't have a fixed job, it is even more difficult.*

Migration destinations of Cuzalapa farmers have changed over the years. According to Cuzalapa farmers, the United States has risen rapidly as a migration destiny since the 1980s, while in the same period the coastal region became less important. Also, fewer people now migrate to other Mexican states. A farmer commented:

> *Nowadays, the people travel* [*'camina'*] *much easier than before. Now they are here and in the next moment, they are in El Norte. Nowadays, more people also go. As there is no land anymore and no work to be done in our community.*

The changes in migration patterns described above were confirmed by Arroyo *et al.* (1991). They described migration in the Autlán region, which includes the communities of the Sierra de Manantlán (such as Cuzalapa), as a rather new phenomenon. They also mention that from 1945 onwards the inhabitants of this region started to migrate to the United States, which was a relatively late start compared to other parts of Jalisco, and Mexico as a whole, where this migration had already taken place since the beginning of the twentieth century.

Cuzalapa farmers have many reasons for migrating, such as land scarcity and the lack of work and other income-generating possibilities in the community. Consequently, temporary migration takes place to the main cities in the region, or to the coast, while migration to the United States can last for several years. Many migrate to the United States to obtain money to buy cattle, to get married, or to give their children a good education. A farmer commented:

> *There are people who go to the United States to work, where they earn money and come back and buy land or cattle. We, who are afraid to go that far, well we stay here and carry on the struggle in the community.*

There are also other reasons for migration, such as reunification with family members who have already migrated. Adventure or possibilities for studying can also play a role. Younger women sometimes leave Cuzalapa with their husbands. Table 3.14 gives an overview of the different reasons for migrating and their relative importance.

Table 3.14 Reasons to migrate in 1998 (N=40)

	Pobre farmers (n=30) (%)	*Ganadero farmers (n=10) (%)*
Poverty-misery/Unemployment/Looking for well being/Lack of promising future and incentives	53	39
Looking for family and family union/ Community and family migration culture	16	26
Adventure	11	13
Other reasons (education, following husband)	20	22
Total	100	100

The results presented in Table 3.14 suggests that it is mainly their socio-economic situation that determines *Pobre* farmers' migration objectives and destinations, while other reasons prevail for *Ganadero* farmers, such as family members living abroad, possibilities for obtaining better education, and adventure.

Not only the destinations, but also the reasons for migrating have changed over the years. According to farmers, during the last twenty years economic reasons have started to prevail over reasons such as looking for adventure, or obtaining a certain kind of education.

Often, part of the migrant's earnings is sent to the family in Cuzalapa as a financial support, but the amount varies greatly. According to farmers, remittances are generally small amounts, which are sent irregularly. As such, they do not contribute that much to the household economy. Besides, as soon as migrants start their own families, remittances often decline, or are not sent anymore. A farmer explained:

> *It is of some help, but one is not tied to it. Anyway, one has to do his job. Besides, when my son got his own family, he did not send that much money anymore. It's tough for them also out there.*

Instead of sending money, various migrants within Mexico often also give money when they visit their relatives in Cuzalapa.[24] It is also given in the form of household items, such as a stereo and television set, or refrigerator. Situations are similar for U.S. migrants. Relatives in Cuzalapa often save the remittances sent from migrants in the United States. These remittances are then used to buy land and cattle, either by the migrant during his visits or before then by the relative. This relative, who is usually the father or brother, then manages the herd (mostly through *a medias* arrangements), until the migrant decides to return permanently to Cuzalapa.

3.5 Dynamics of the Regional Farming Style

In the previous sections, I described the regional farming style, farmer differentiation and the most important mechanisms for resource mobilisation. From this description, it is clear that many changes have taken place in Cuzalapa. Although farm diversification remains important for *Pobre* farmers, cattle breeding has obtained a more central place in *Ganadero* farming strategies. Several mechanisms for resource mobilisation were described that are available to *Pobre* and *Ganadero* farmers, although the two groups are driven by different objectives. Participation permits either farm reproduction or expansion. The farmers' participation also shows that farmer interaction and differentiation go hand in hand. They are an outcome of both farmer co-operation and competition (or struggle) .

In this section, I will summarise the foregoing and link the different factors that have led to the current divergence and diversity in Cuzalapa farming. In other words, I will discuss in more detail the transformations that have taken place in the regional farming style.

Changes in the Cuzalapa Valley

The 1960s and 1970s can be considered a turning point for farming and natural resource management in Cuzalapa. Many on-going social processes existing before that period came to an end. In the 1960s, major conflicts over land distribution came to an end by finally implementing the presidential resolution of 1950 that set the community's limits. It stopped most of the land invasions and the internal power struggle over control of the community. By the late 1970s all land seemed to have been distributed, resulting in an unequal land distribution.

Since the 1970s, farmers have been confronted with more farming difficulties, which is related to the land-distribution situation, demographic growth and the specific ways of farming in Cuzalapa. The practice of shifting cultivation has become less frequent, as land has become scarce. Fallow periods have also shortened and existing fields are used more often, including rain-fed and irrigated ones. Productivity initially decreased. The introduction of chemical fertiliser in the 1970s partially resolved this downward trend, but the solution in itself created new (economic) dependency relations. Expansion of cattle breeding and the related conversion of agricultural land into more profitable pasture land has further reduced resource access. Consequently, possibilities for young farmers to start a farm have become more limited. This has led to an increasing out-migration, as other income generating activities are absent in Cuzalapa.

Changes in the Mexican Countryside

The development pattern in Cuzalapa is related to the general political-economic conditions that have governed the Mexican countryside. Post-revolutionary development in Mexico was aimed at a far-reaching modernisation of the countryside. As attention was giving mainly to the industrial sector (mostly the oil industry), the countryside was considered a source for cheap food and labour. Development initiatives were limited to relatively small, but highly productive, regions. Most of the remaining parts of rural Mexico were passed over (Warman 2001; Toledo 2000). Governmental policy expectations were not met, and in the 1950s general agricultural and cattle productivity started to decrease. The negative consequences of this decrease became first visible in the 1960s. During the 1970s, the notion of crisis was commonly accepted, while the crisis manifested itself most clearly in the 1980s. Prices for maize started to decrease first. Cattle meat prices did not start to decrease until the 1990s (Calva 1994; Warman 2001).

Since the 1980s, several governmental reforms have taken place to resolve the crisis and to revitalise the countryside. On the one hand, a process of decentralisation can be observed, aimed at 'regionalising' decision-making and increasing popular participation. On the other hand, neo-liberal politics are being further implemented, as exemplified by land reform through the Article 27, reduction of the governmental apparatus and the opening up of markets through trade agreements (such as, for example the North American Free Trade Agreement – known as NAFTA or TLC according to its Spanish abbreviation - in 1994) (Warman 2001).

Governmental Policy and the Regional Farming Style

The processes described in the section above have had an impact on the regional farming style. They contributed to the increase of farmers' differentiation and changed farming dynamics in Cuzalapa. The unequal land distribution and completed land reform led to the emergence of a new group of farmers, i.e. sharecroppers. This group can be considered new in the light of their possibilities to obtain land in the near future. Furthermore, existing differences between *Pobre* and *Ganadero* farmers have increased.

Conditions for both *Pobre* and *Ganadero* farmers have become more difficult, as the economic crisis has indeed affected them both. But conditions for the *Ganaderos'* way of farming are still more favourable than those for *Pobre* farmers. The *Ganadero* way of farming is becoming more dominant in the valley of Cuzalapa. Cattle, its most important material representation, can be seen everywhere. Another outcome of this trend is the transformations that can be seen in the landscape, as it is adapted to respond to the fodder needs of cattle. This trend has also influenced the development of many *Pobre* farms, as an increasing number of these farmers have started to sell *pastura* and establish pasture land.

Several factors explain the increased dominance of the *Ganadero*s' way of farming in Cuzalapa. The wider political-economic context has played an important role, as described before (Warman 2001, Toledo 2000). Generally speaking, *Ganadero* farmers have benefited more from external incentives and policies compared to *Pobre* farmers. They have also coped better with farming limitations. This can be explained partly by their better economic position, which has allowed them easier access to the different markets necessary for reproducing and expanding the farm enterprise. *Pobre* farmers are in a different situation. They are not at all or only partially incorporated into many markets.

The Mexican government directly attempted to influence farm development of *Pobre* and *Ganadero* farmers from the 1970s onwards. In the 1970s, the Mexican government gave agricultural credits as one of the measures to counteract the economic crises. By 1976, the governmental bank *BANRURAL* started visiting Cuzalapa, offering credit (consisting of fertiliser or cash). During the first years, many farmers accepted the loans, which were used to improve pasture lands, or to buy cattle. This allowed several farmers to obtain some cattle. Eventually, most farmers could not repay their loans, due to bad yields, or because they had used the money for other purposes. Those with a valid reason did not have to repay the money. The others had to sell some of their cattle. It was in this period that the interest of the majority of the farmers for agricultural credits began to fade.

In the early 1980s, Cuzalapa was declared a *zona ganadera* (cattle-raising zone) by the directive board, implying that from that time on cattle-raising activities were seen as more important than agricultural activities. Furthermore, technical assistance and credit were made available mostly for *Ganadero* farmers. Unlike *Pobre* farmers, *Ganadero* farmers have enough collateral for repayment of any credit. The late 1980s were a period in which many *Ganadero* farmers applied for loans. By 1994, 42 per cent of the *Ganadero* farmers had received credit (Gerritsen 1995:50). However, many *Ganadero* farmers were not able to repay the credits due to an extreme devaluation of the Mexican peso in 1994. For those farmers, debts were restructured and the period for repayment was extended (the so-called *cartera vencida*) (*ibid.*). Now the banks do not grant new loans until current loans are repaid.

In the 1990s, most farmers and their families also received several governmental subsidies, of which PROCAMPO is the most important for agriculture and cattle breeding. It consists of a governmental subsidy for farmers, aimed at raising maize productivity within the context of NAFTA. It is directed at levelling the current governmental subsidy scheme to world market prices over a period of fifteen years. But, it has benefited above all *Ganadero* farmers, as maize prices have been low, input prices high and the financial conditions of many *Pobre* farmers precarious (see Ortiz 2001).

The development initiated in the 1970s has been reinforced since the 1980s through migration to the United States. Since the 1980s, the United States has become increasingly important as a migration destination. It is mostly *Ganadero* sons who migrate to the United States to obtain financial resources to buy land and cattle, and thus start a (cattle) farm in Cuzalapa. Newly bought cattle are initially managed by relatives, until land becomes available (either through inheritance or purchase). It is through this group that the *Ganaderos*' way of working was able to expand and become more dominant in Cuzalapa during the last decades. Cattle breeding has not so much expanded amongst the land-holding *comuneros* themselves, but amongst their sons using migration remittances.

Situation of Pobre Farmers

The processes described above have generally limited the possibilities for *Pobre* farmers to develop their farms. Most of them have problems in reproducing their farms. In other words, their farm development is stagnating compared with the competence value axis underlying the regional farming style. For young *Pobre* farmers in particular, it is difficult to start their own farms and often also to take over their fathers' farms. Due to the unfavourable market prices for maize, it has become harder to obtain a proper income from the farm. It is in this context that market-independent mechanisms for resource mobilisation have become more important, especially sharecropping. The rise of the *Ganaderos'* way of farming has also created a new income source: *pastura* trading. But, cattle and *pastura* trading also negatively influence job opportunities. The increased importance of cattle breeding and *pastura* has contributed to a more extensive agrarian practice, which has been affecting, above all, young *Pobre* farmers. Consequently, migration has become a more generalised phenomenon. A farmer commented:

> *Nowadays, the people are much lazier* [*'son mucho más huevones'*]. *In the old days, they used to do things better. The people would cultivate everywhere; now there is only pasture land to be seen and the people hardly do any work anymore. Before, they worked the whole day, while now they only work until two* [p.m.]. *Many also leave the community, looking for luck in other places.*

Shifting from Farming Practice to Farmer Discourse

The foregoing has not only changed farming practices, but also the ideas of many Cuzalapa farmers. For a growing number, their ideas do not coincide with the original notions underlying the regional farming style. A farmer commented:

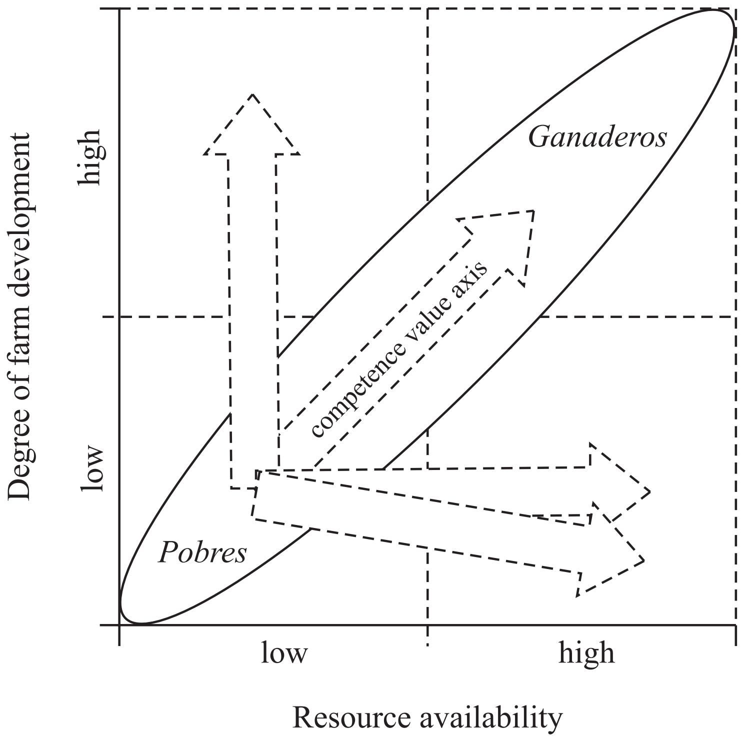
> *No, under the current situation I don't want to have more cattle. Pasture is expensive, but also for buying some cattle you need to have sufficient money. There was a time when I would have liked to buy more animals, but nowadays they give more problems than benefits* (Gerritsen 1995:52).

This statement indicates that the changing ideas are not only a consequence of the economic crisis. They are also related to the multi-dimensionality of natural resources, i.e. the different factors determining land access and natural resource management. However, not everybody agrees with the above statements:

> *Well, one has to work, hasn't one? You know I could work less and rest more. I could get drunk like many others, but what does it bring me? One has to work in order to feed one's family.*

Thus, there are still farmers who stick to traditional ideas on farming. However, empirical evidence suggests that a transformation of the regional farming style is taking place, due to the processes described above. This has led to an increased farming differentiation. A divergence in farming strategies can also be observed, but this transformation has not yet obtained its own place in farmer discourse. Farmers still stick to many of the original notions and still see themselves and each other mainly as *Pobre* or *Ganadero* farmers, i.e. they stick to traditions.

Figure 3.2 Possible competence value axes in Cuzalapa



Emergence of New Competence Value Axes

The conclusion drawn in the above section can be conceptualised by adjusting the competence value axis underlying the regional farming style that I presented in the beginning of this chapter. Theoretically speaking, new management styles are emerging in Cuzalapa that do not coincide with the one underlying the regional farming style (see Figure 3.1). In other words, not all farmers direct the development of the farm towards obtaining more land and cattle. This is illustrated by Figure 3.2, which shows the existence of two other possible competence axes for Cuzalapa farmers, based on the arguments presented until now.

3.6 Final Remarks

In this chapter, I described several aspects of the regional farming style in Cuzalapa. As stated earlier, farming styles represent the shared set of common ideas of farmers regarding farming and natural resource management. In this chapter only sporadic attention was paid to the translation of this common intellectual good into specific farm practice. Therefore, in the next chapter, I will present seven case studies to illustrate how farmers translate the commonly shared notions on farming and natural resource management into the specific conditions of their farms. I will do so from an economic perspective, i.e. by looking at the income and expenditures of these farmers.

Notes

1 Parts of this chapter are published as Gerritsen (1995, 2001b) and Gerritsen and Forster (2001).

2 The data were obtained in the period 1993-1998 through the so-called "snowball method" (Bernard 1988). The percentages were obtained using land and cattle property as distinctive criteria, as these are two central dimensions in Cuzalapa farmers' definition of a cattle-breeder (Gerritsen 1995).

3 There are many more male than female land-holding farmers. Therefore, I use the male form when referring to male and female farmers in this book, unless otherwise indicated.

4 Cuzalapa cattle do not only graze in the established pasture lands, but also in secondary vegetation and forests. Thus, the pasture area can also include secondary vegetation or forests, even though pasture quantity and quality is less there.

5 This sample of 133 farmers was taken from the database of 166 farmers. Not all farmers in the database were used in this (and some of the following analyses), due to incomplete data sets.

6 They represent approximately 38 per cent of the *Pobre* households in the database, i.e. the sample of 105 farmers.

7 These farmers represent approximately 35 per cent of all *Pobre* households in the database, i.e. the sample of 105 farmers.

8 The standard deviation is 4.1, while the median is 5. These data are based on a sample of 22 farmers taken from the database. Note that *Pobre* farmers who do not own any cattle were excluded from this calculation. Table 3.1 indicates average cattle property when including them. Furthermore, not all cattle-owning *Pobre* farmers are included, due to incomplete data sets.

9 This sample is again taken from the database of 166 farmers. Note that it only represents land-owning *Pobre* farmers. Thus, the landless farmers described below are left out.

10 They represent approximately 27 per cent of the *Pobre* farmers in the database, i.e. the sample of 105 farmers.

11 In Cuzalapa, farm and wage labourers are called *jornaleros*, i.e. those who earn their days wage (the so-called *jornal*).

12 In the 1950s, fallow periods of some 15 years were common.

13 Even more striking is the fact that *coamil* is practised less than before, which is caused by the increased importance of pasture and the land-distribution situation in the 1990s. I will discuss this in Chapters 5 and 6.

14 Maize and bean yields per hectares are probably underestimated, as no corrections were made for the parts in the fields that were not planted, such as field borders and some parts that are unsuitable for cultivation (N. Forster, 1998: pers. comm.). For the same reason, fertiliser and herbicide use is probably higher than indicated in the table.

15 Note that official norms are based on criteria that only partially coincides with the ones of farmers. According to the Cattle Breeder Association of Cuautitlán (*Asociación Ganadera de Cuautitlán*) a cattle-farmer is one who has 10 or more animals (although norms have changed over the years). Having one's own brand is the other criterion applied. Being registered as a cattle breeder is compulsory for trading cattle.

16 A *medida* is a local weight and is equivalent to four kilos. It refers not only to a unit of weight, but also to a square measure, i.e. the surface that can be planted. Both are related each another.

17 This sample is not taken from the database of 166 farmers, but it is based on a sample of *Ganadero* farmers registered with the Cattle Breeder Association of Cuautitlán, to which Cuzalapa belongs.

18 The sample is taken from the database of 166 farmers. Note that this sample does not represent all *Ganadero* farmers in the database. Data sets are incomplete for the remaining *Ganadero* farmers.

19 Cattle mortality rates are high in these months, due to the scarcity of water and pasture. Consequently, many *Ganaderos* reserve pastures on irrigation fields, to make them available for cattle in these two months.

20 Table 3.8 is based on Table 8.3 in van der Ploeg (1990:175).

21 Based on the results of the survey I conducted of 30 *Pobre* and 10 *Ganadero* farmers to obtain specific insights into their agricultural activities.

22 In the period 1995-2000, 10.6 per cent of all migrants (from Mexico) to the United States originated from Jalisco, making it one of the three Mexican states with the highest migration rates (Alonso 2000). However, net migration is balanced for Jalisco, as an equal number of people came to Jalisco from other Mexican states (INEGI 2000).

23 This leaves this migrant with a monthly net income of 350 dollar. However, he has to pay some other costs, such as clothes, working tools, or travel costs to Mexico.

24 Migrants visit Cuzalapa, above all, during the *fiestas taurinas* (a kind of rodeo feast) in November or during *la llegada de la virgens* (an indigenous religious feast) in April/May.

4 Some Portraits of Cuzalapa Farmers

4.1 Introduction

In Chapter 3 I described the regional farming style in Cuzalapa, which refers to the general set of shared notions that guides farming practice. The regional farming style thus is characterised by both normative and operational elements. The latter, i.e. the translation of the general set of shared notions into farm practice depend on great many factors such as farmers' capabilities, access to material and social resources and activities. These factors are strategically combined for obtaining a means of living, i.e. a livelihood strategy (Carney 1998; Ellis 1993, 1998).

In this chapter, I will take a closer look at the livelihood strategies of *Pobre* and *Ganadero* farmers. I will do so by presenting seven case studies, which I will analyse from both a general and economic perspective. Five *Pobre* and two *Ganadero* farmer case studies will be presented to give a comprehensive view of the regional farming style in Cuzalapa, as described in Chapter 3.

4.2 Farming Diversity Further Explored

The case study families were followed during the period 1993-1998. Their 'portraits', i.e. their descriptions, are also based on this period. All portraits share the same basic structure. Each portrait consists of a general description of the family and their farm, including household composition and decision-making, family networks within the community, and farm characteristics. Then, an economic assessment is made to understand the financial manoeuvrability of the family and the importance of the different (monetary and non-monetary) income sources, including available resources.

The economic assessment of the *Pobre* families was done in August 1996, while the assessment of the *Ganadero* families was done in January 1998.[1] This was because the *Pobre* families were more accessible than the *Ganadero* families, so more time was needed to establish a proper rapport with *Ganadero* families. The results of the assessments were extrapolated to a yearly basis.

Farm Economics

The economic assessment consisted of calculating the value of the different income sources and costs/expenses of the families, including non-commoditised income and farm resources.[2] Costs of family labour were not included, in contrast to labour mobilised through the market. It was not possible to quantify all income in the same way. The value of non-timber forest products, for example, is more difficult to estimate, due to fluctuations in its use.[3] Therefore, in absolute terms, the economic analyses presented in the following sections have mostly an indicative value, describing general trends and allowing comparative assessment. The rubrics that I took into account in the economic analyses (adapted from Yaron *et al.* 1992) are monetary income (Table 4.1), non-monetary income (Table 4.2), expenditures (Table 4.3) and local resources (Table 4.4.). In Tables 4.1 to 4.4 I included a very brief explanation of the way the calculations were made.

Table 4.1 Monetary income

General Rubric	*Type*	*Value calculation based on:*
Agricultural and cattle production for sale (exchange values)	Maize, bean and *tomatillo* production	Governmental prices (in relation to farmers' average production levels over the period 1993-1996; years with very bad yields were left out of the calculation)
	Non-timber forest products	Average prices in Cuzalapa (trade takes place in the community)
	Pastura grazing rights	Average prices in Cuzalapa (trade takes place mostly in the community)
	Cattle/hogs and chickens	Average prices in Cuzalapa (trade takes place mostly within the community)
	Family production (fruit juices, cheese, other lactic products)	Average prices in Cuzalapa (trade takes place mostly within the community)
	Wage labour[1]	Wages paid in Cuzalapa
Subsidies, credits, remittances, etc.	Formal employment (income gained from official services[2])	Governmental norms for salaries
	Donations (scholarships)	Official prices
	Governmental subsidies for agriculture or cattle breeding	Governmental norms
	Family business (shops)	Official prices
	Remittances from migrants	Estimations by relatives receiving remittances

1) According to the farmers, there is work available for about nine months a year. The values in the various figures are also calculated for this period.
2) Within the community a small number of governmental functions exist, for which a very small compensation is paid.

Table 4.2 Non-monetary income

General Rubric	*Type*	*Value calculation based on:*
Agricultural and cattle production for home consumption (use values)	Maize, bean and *tomatillo* production	Governmental prices (in relation to farmers' average production level over the period 1993-1996; years with very bad yields were left out of the calculation)
	Cattle/hogs and chickens	Average prices in Cuzalapa (trade takes place mostly within the community)

Table 4.3 Expenditures

General Rubric	*Type*	*Value calculation based on:*
Costs and expenses of the farm household	Agricultural and cattle production (non-factor inputs and labour mobilised through the market)	Market prices in Cuzalapa and the municipality (where the costs are incurred)
	Living expenses, such as food, clothes, etc.	Average prices in Cuzalapa and the municipality (where the costs are incurred)
	Other expenses such as bus fares, medical costs, etc.	Official prices

Table 4.4 Local Resources

General Rubric	*Type*	*Value calculation based on:*
Available resources	Land	Average prices in Cuzalapa (land sale and purchase takes place within the community[1])
	Cattle, horses, pigs and chickens	Average prices in Cuzalapa (sale and purchase takes place within community)

1) The price of land depends on several factors such as quality and quantity, urgency to buy or sell and additional costs, such as barbed wire or pasture establishment.

4.3 Five Portraits of *Pobre* Farmers

4.3.1 The Case of Juan de la Cruz[4]

Juan de la Cruz (42) and Estela (35) were both born in Cuzalapa and have been married for 19 years. They live at the outskirts of the older part of the main village of Cuzalapa. Their house is made of mud, cattle dung and branches, and it is in a deplorable state, lacking maintenance. The family is among the poorest in Cuzalapa. Juan commented:

> *Our situation is very difficult; we have nothing. Sometimes, I don't know what to do. You know, we're fucked up* [estamos jodido], *we are poor. It's a real mess* [está a la *chingada*].

They have had 11 children: three sons and eight daughters, of whom three have died due to sickness. Seven children and one grandchild live within their household, of whom six are younger than fifteen. Juan's elderly parents also live in the same house with Juan and his family. Thus, the household consists of 12 persons. Juan has three brothers and four sisters living outside Cuzalapa, but he hardly ever sees them. His wife has two brothers and two sisters, whom she also rarely sees. Juan knows a lot of people in Cuzalapa, as he heads a group that performs traditional dances during an important religious-indigenous feast in Cuzalapa (the so-called *llegada de las virgenes*). But, he deals almost exclusively with *Pobre* farmers. He sympathises with the Democratic group, but he generally does not express his political preference.

Farming Activities

Juan does not own land himself; it is his father who is registered as a comunero. But, Juan does almost all of the work. Sometimes his (eldest) children and his parents help him. Due to age and sickness, the latter's help is limited. Estela hardly ever works on the land, as she takes care of the house and the children. Friends sometimes help Juan, and he, in turn, helps them on other days. Juan, his wife and his mother take the decisions on living expenses. Decisions on farming are taken by Juan and his father, although it frequently happens that the whole family participates in discussions.

The family cultivates twice a year on their two hectares of irrigation land located next to their house. Generally speaking, production is low due to low soil fertility and insufficient chemical fertiliser. Juan sometimes cultivates *a medias* (i.e. he sharecrops) on other farmers' land, mainly in the rainy season. But, he recognises that it does not leave him with much production, as the harvest is then divided. Sometimes, Juan also leaves part of his land fallow, although it results in a lower total production and, consequently, less corn for his family. Juan's father receives a governmental subsidy for maize cultivation, called *PROCAMPO* twice a year, with which they buy part of the chemical fertiliser. As Juan and his family have no cattle, each cropping season they sell the grazing rights on their *pastura*. This allows them to buy more fertiliser, to be applied mostly in the next cropping season. If they encounter a generous buyer, the costs for land preparation by a tractor can also be paid. They normally use horses for land preparation, although Juan and his family do not own any:

> [...] *so we have to hire them from other people. We prefer using horses above a tractor, because of the costs. Last year, I paid the costs of the horses by working a few days on his* [i.e. the horse owner's] *land.*

Juan's main objective for farming is to feed his family. Due to low yields and low prices for maize, all production is used for their own consumption. He sells some (wild-growing) *tomatillo,* however, there are big fluctuations in the market prices. Juan commented:

> *I work on our land, because one has to feed his family. But, it is very difficult to do a good job, because there is no money. And there isn't any work in the community either. We sell some tomatillo, but usually prices are not that good. When they* [i.e. the middlemen] *come to town, the first days they pay more than the days that follow, as many people offer their tomatillo.*

Farm Economics

Figure 4.1 presents the economic analysis of Juan and his family, while Table 4.5 presents the overall balance of monetary income sources.

Figure 4.1 Economic assessment of Juan de la Cruz's farm in 1996 (in Mexican pesos)

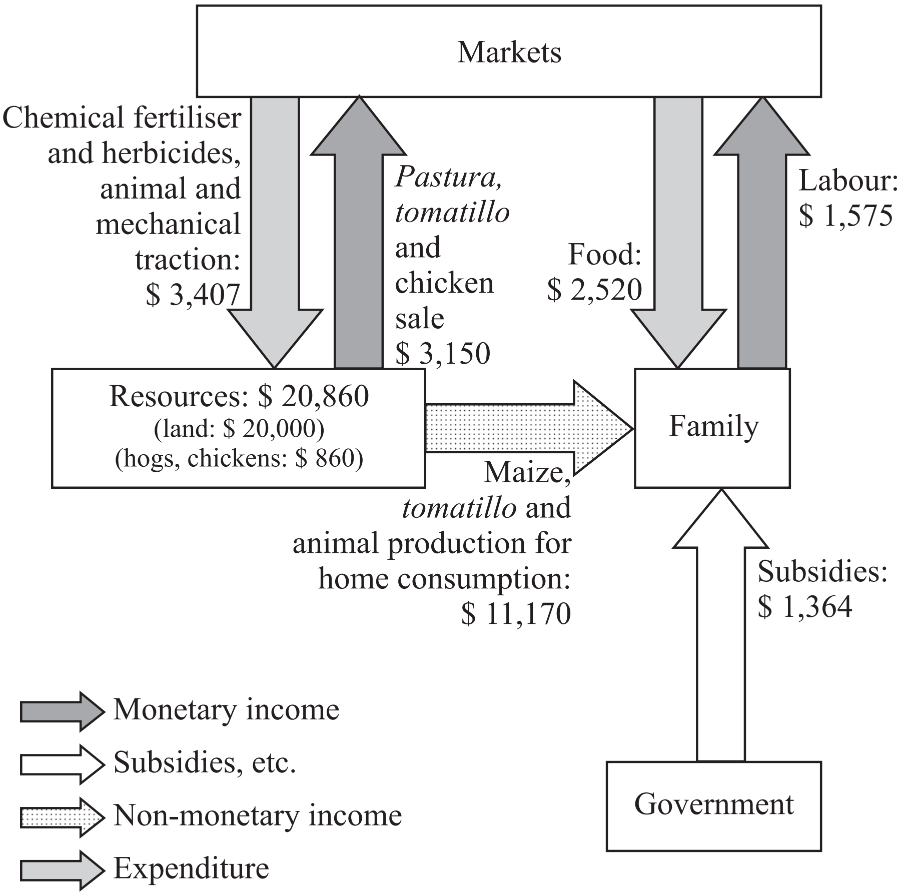


Table 4.5 Monetary income and expenditures of Juan de la Cruz in 1996 (in Mexican pesos)

Income ($ %)			*Expenditures* ($ %)		
Pastura, tomatillo and chicken sales	3,150	52	Chemical fertiliser and herbicides, animal and mechanical traction	3,407	57
Labour	1,575	26	Food	2,520	43
Subsidies	1,364	22			
Total	*6,089*	*100*		*5,927*	*100*
Overall balance: + $ 162					

The sale of *pastura*, *tomatillo* and some chickens, farm and wage labour and subsidies were the most important income sources in 1996.[5] They represent 52 per cent, 26 per cent and 22 per cent, respectively, of the total monetary income, with which the family can buy food and necessary farming inputs. Noteworthy is the importance of the sale of *pastura* grazing rights. Although this is not indicated in Figure 4.1 or Table 4.5, it makes up 63 per cent of the total monetary income obtained from natural resources, i.e. through the sale of produce.

Farm reproduction outside the market sphere is difficult, due to low soil fertility of the fields. As they have little land, it is more difficult for Juan and his family to leave their land fallow, even for one cropping season. They thus have to use chemical fertiliser. But Juan generally applies less fertiliser on his land than required to obtain a regular harvest. During interviews, he also mentioned that production was not enough to cover family needs in the period 1993-1996. Maize produced during one cropping cycle already runs out before the new harvest.[6]

As they have very limited financial resources, Juan is often forced to sell his *pastura* at the beginning of the cropping season. Consequently, he obtains lower prices than if he sold it after the harvest.[7] One cropping season, Juan started to cultivate maize on his land under *coamil* practices (i.e. shifting cultivation practices), which is very unusual for land that can be prepared by horses:[8]

> *I did not have money to buy fertiliser, so we decided to do a coamil. Nor could we get some horses to plough, as everybody already was busy working theirs. Normally, when we do not have the way to cultivate our land, I look for ways to cultivate a medias.* [...] *Some time ago, my father proposed to sell our land to resolve our problems, but I don't want that. I was heavily opposed.*

In 1997, the household's situation became more difficult, when Juan started to heavily drink alcohol and debts mounted. In the same year, Juan was not able to cultivate their land anymore. Debts had become so high that Juan had to grant grazing rights on his land to a *Ganadero* farmer without any payment. He then started working as a *mediero*, but obtained only a little maize and bean production. Since he could not sell his family's grazing rights, Juan started to do more farm labour to obtain some cash money. It was in this period that the two eldest children migrated to one of the cities in the region to work in tomato cultivation. The situation seemed to improve in 1998, when Juan could sell his *pastura* again. He even succeeded in enrolling a cattle-breeder from the neighbouring village of Cuautitlán, who paid double for the grazing rights. This cattle-breeder also paid at the beginning of the cropping season.[9] A new and more prosperous time appeared to have arrived; at least, for the moment.

4.3.2 The Case of Enrique Hernández

Enrique Hernández (62) has been married to Adelia (55) for 32 years. Both were born in Cuzalapa, although Adelia's grandparents come from another region of Jalisco. Their house is made of *adobe* and is located one block from the centre of Cuzalapa; it is in relatively good condition. Enrique thinks of his family as being poor, as he explained:

> *Well, we do not have much, we always have to carry on the struggle. There are people in Cuzalapa who have a lot, but we only have a little.*

They have nine children, five of whom live in Cuzalapa. Two live within Enrique's household, while three have their own houses in the main village of Cuzalapa. Of the children who have left Cuzalapa, two live in Autlán and two are working in the United States. Enrique has several brothers living in Cuzalapa, but he does not see them very often, as they are not on good speaking terms. Adelia has some relatives living in Cuzalapa whom she sees regularly. Enrique knows a lot of people, as he used to be the cofrade mayor (main person responsible) of an important catholic-indigenous feast in Cuzalapa. He also used to be an active member of the Democratic group, but he has distanced himself from this group in recent years. In turn, he appears to have become a member of the Cacique group.

Farming Activities

Enrique is registered as a *comunero* and owns four hectares of irrigation land. His production is regular, but he hardly sells any maize, due to the size of his family. But, he does sell the wild-growing *tomatillo* on his land. On farming he commented:

> *One has to work hard on his land, what else is there to do? I am very often on the land, but that's me. One has to take good care of one's land.* [...] *I cultivate twice a year, but that is no problem; the land still gives.* [...] *I work in order to eat. I don't sell any* [yield]*, as there is only little to sell. Besides, where would I sell it? There is no market around!*

Enrique very rarely participates in an *a medias* (i.e. sharecropping) arrangement. He sometimes does leave half of his land fallow to regain soil fertility, mainly in the rainy season. Generally, he does the work in his field by himself. His son who is living with him also helps. Two other sons, who have their own households in Cuzalapa, also participate.[10] His wife and daughter do not work on the land, but perform the domestic tasks. Regarding both the land and his household, Enrique takes major decisions, as his wife explained:

> *He generally decides on what to buy. You know, he is the man in the house. Sometimes, he gives me money and I buy the things for our family.*

According to Enrique, his land gives enough for two harvests yearly. Whenever possible he uses chemical fertiliser, and occasionally also higher-producing hybrid varieties on his land. There also appear to be political motives at stake for cultivating twice a year, as another farmer commented:

> *You see, he obtained his land in an illegal way. When his father died, he made sure to get the land registered in his name, although he is not the only son.*[11] *He still has serious fights with his brothers over this matter. I think that they even don't speak anymore to each other.*

Another reason for cultivating twice a year is to prevent the Cuzalapa Directive Board from claiming his field. They want to reconstruct the entrance road to Cuzalapa, which would then cross the middle of Enrique's land.[12]

Enrique sells the *pastura* of his land to cover the expenses of chemical fertiliser. This and other costs are paid for by the *PROCAMPO* subsidy and by remittances sent by his sons working in the United States. He also obtained a small credit from the municipality.

Farm Economics

Figure 4.2 presents the economic analysis of Enrique and his family, while Table 4.6 presents the overall balance, indicating the monetary income sources.

Figure 4.2 Economic assessment of Enrique Hernández's farm in 1996 (in Mexican pesos)

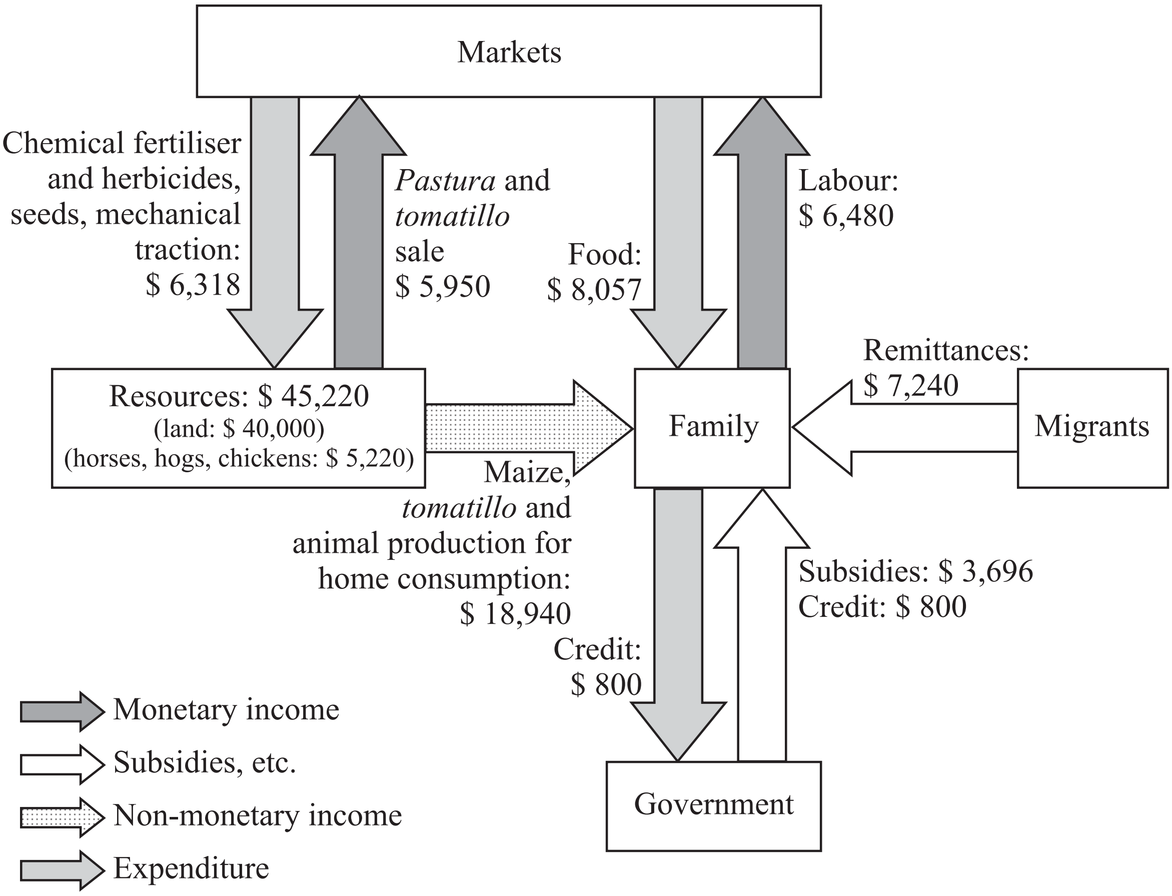


Table 4.6 Monetary income and expenditures of Enrique Hernández in 1996 (in Mexican pesos)

Income ($ %)			*Expenditures* ($ %)		
Remittances	7,240	30	Food	8,057	53
Labour	6,480	27	Chemical fertiliser and herbicides, seeds, mechanical traction, seeds	6,318	42
Pastura, tomatillo and animal sales	5,950	25	Credit	800	5
Subsidies	3,696	15			
Credit	800	3			
Total	*24,166*	*100*		*15,175*	*100*
Overall balance: + $ 8,991					

Figure 4.2 and Table 4.6 show that Enrique obtains his financial resources in various ways: remittances from his sons in the United States, (his sons') farm and wage labour, sale of *pastura* and *tomatillo*, and subsidies. They represent 30 per cent, 27 per cent,

25 per cent and 15 per cent, respectively, of the total monetary income. Noteworthy again is the importance of the sale of *pastura* grazing rights. Although this is not indicated in Figure 4.2 or Table 4.6, it makes up 67 per cent of the total monetary income obtained from the natural resources on his farm. Compared to other years, it appears that the income obtained by labour was somewhat higher in 1996, as two sons were able to work for several months with the same farmer.[13]

From the fieldwork, it appeared that reproduction of Enrique's farm could take place relatively easily through markets. Reproduction of the farm outside the market sphere appears to be much more difficult, as was described above. But Figure 4.2 represents Enrique's better times, which lasted until 1997. His good fortune changed afterwards. Since 1997, Enrique's sons in the United States have not only sent smaller remittances, but they also send them more irregularly. The *tomatillo* production also decreased substantially, probably due to intensive use of the land. Thus, two major income sources lost a great deal of their importance. Consequently, Enrique changed course and started to rent out half of his land to a farmer (related to the *Cacique* group) twice a year.[14]

4.3.3 The Case of Constantino Gónzalez

Constantino Gónzalez (49) has been married to Claudia (41) for about 24 years. Both were born in Cuzalapa. Their house is made of *adobe* and can be found in the older part of the main village of Cuzalapa. Constantino considers his family to be poor:

> *You already know us, we're poor, we are 'damned'* [estamos jodido]. […] *We do not know how to write and read.*

They have had seven children; one son and six daughters, of whom one daughter has died. Their son and the eldest daughter live at the coast of Jalisco, whereas the remaining four daughters live in Cuzalapa in Constantino and Claudia's household. Constantino's father and his six brothers do not live in Cuzalapa. His father and three brothers live at the coast of Jalisco, and the others live in the United States. Claudia has three sisters, of whom one is living in Guadalajara. The two others live at the coast of Jalisco. Constantino and Claudia hardly ever see their families. Constantino knows a lot of people in Cuzalapa, as he values good relationships very highly. Constantino also used to be an active member of the Democratic group.

Farming Activities

Constantino is registered as a *comunero* and owns two hectares of irrigation land and three hectares of *agostadero* land. His irrigation land is located in the nearby hamlet of La Vigía, while his *agostadero* land is located on the lower hillsides, about half an hour walk from Cuzalapa. He cultivates twice a year. He cultivates on his irrigation land in the dry season, and he cultivates *a medias* (as a *mediero* on somebody else's land) in the rainy season. Constantino explained:

> *I only cultivate on my irrigation land in the dry season. If I would cultivate it twice a year, its strength* [i.e. the soil fertility] *would decrease a lot. Besides, it would very*

> *easily get plagues. Therefore, I cultivate a medias with another farmer in the rainy seasons. Probably next year, if God is willing* [*'si Dios quiere'*] *I will leave my land fallow in the dry season also, so it can rest one season more.*

Constantino and Claudia take decisions regarding living expenses together. But, it is Constantino who generally manages cash money: often, he also takes final decisions. Constantino also takes all the decisions related to farming practice, although he does discuss a lot with Claudia.

Constantino mainly produces for home consumption. He sells maize when he can, but he does not produce to sell. He does not sell *tomatillo*, as it does not grow on his land. As he explained:

> *I have little land, so I sow so that we have something to eat. If there is enough, then I sell or give away some, but it is never a lot.* [...] *You know, we are poor, we don't have much. We do not always have money to buy fertiliser.*

Occasionally, Constantino's daughters help him, mostly during labour shortages. They then perform less physically demanding tasks than he does. Thus, another reason for Constantino to cultivate *a medias* is to resolve labour shortages.

In the 1980s, Constantino took care of his mother's cattle, but the family had to sell them out of necessity.[15] Now he would like to buy some animals, but he recognises that it has become very difficult. The purchase of cattle requires not only an important investment of capital, but also sufficient pasture. He sells the grazing rights on his land instead, which allows him to buy chemical fertiliser and pay some other costs:

> *I used to have some animals, but I lost them some years ago. I would like to have some again, however, nowadays it has become much more difficult. You know, the pastura and everything. Some years ago, I started to sow some pasture, so that they pay me more for it* [i.e. grazing rights on pasture land].

Constantino does not receive the *PROCAMPO* subsidy. He did not enlist himself during its first years out of mistrust of the government. Now he would like to receive it, but local authorities say that registration is no longer possible. This probably has to do with Constantino's (now passive) membership of the Democratic group (see also Ortiz 2001).

Farm Economics

Figure 4.3 presents the economic analysis of Constantino and his family, while Table 4.7 presents the overall balance, indicating the monetary income sources.

Figure 4.3 shows that Constantino obtains financial resources through the sale of *pastura* and through wage and farm labour. These income sources represent 53 per cent and 47 per cent respectively of the total monetary income. Noteworthy again is the importance of the sale of *pastura* grazing rights. Although this is not indicated in Figure 4.3 or Table 4.7, it makes up 100 per cent of the monetary income obtained from natural resources on his farm.

Figure 4.3 Economic assessment of Constantino Gónzalez's farm in 1996 (in Mexican pesos)

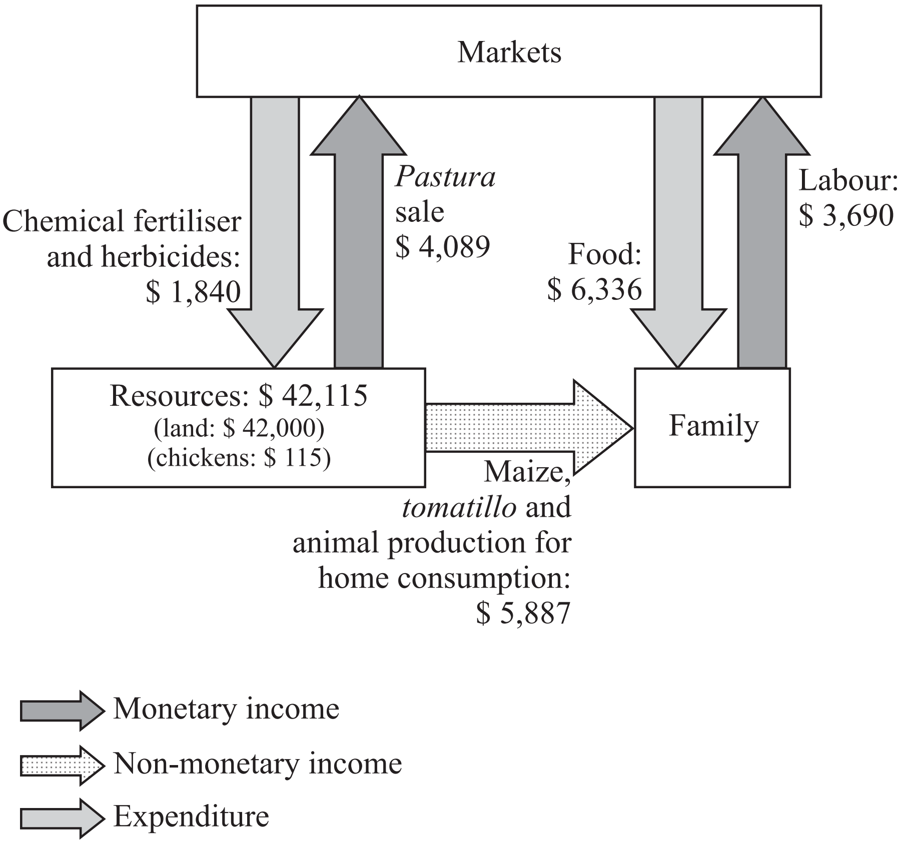


Table 4.7 Monetary income and expenditures of Constantino Gónzalez in 1996 (in Mexican pesos)

Income ($ %)			*Expenditures* ($ %)		
Pastura sale	4,089	53	Food	6,336	77
Labour	3,690	47	Chemical fertiliser and herbicides	1,840	23
Total	*7,779*	*100*		*8,176*	*100*
Overall balance: - $ 379					

Farm reproduction outside the market sphere takes place through Constantino's participation in *a medias* arrangements, while farm reproduction through the market is more difficult due to the very small financial margin, which was negative for 1996.

4.3.4 The Case of Cosme Aragón

Cosme Aragón (46) has been married to Lucia (44) for 26 years, and both were born in Cuzalapa. Their house is made of *adobe* and is located near the river that divides the village of Cuzalapa in two. It is in relatively good condition. Cosme and his family belong to the poorer inhabitants of Cuzalapa, but they never refer to themselves very explicitly in terms of being poor or rich.

They have had nine children: five sons and four daughters; but four of their children have died due to sickness or scorpion bites. Currently, four live in their household. Their eldest daughter lives at the coast. Cosme's father and mother also live in

Cuzalapa, and they have a house of their own. He has three brothers and one sister, but they do not live in Cuzalapa. He sees his brothers regularly, as they live relatively nearby. He hardly sees his sister, as she lives farther away in Guadalajara. Lucia has four brothers and they all live outside Cuzalapa. She hardly ever sees them or her mother, who also lives farther away. Cosme always votes PRI, but he never participates actively in community politics, as he does not like the meetings.[16] He knows a great many people and he is very respected in the community. This is partially due to the fact that he is the local water board official and the only electrician in Cuzalapa.

Farming Activities

Cosme does not own land himself, but he works for his father, who is registered as a *comunero*. Although his father owns the land, Cosme does almost all the work. His father is too old to do the work by himself. Apart from his father, his eldest son also helps him. Cosme's wife and mother take care of the households. As there is enough labour within the family, Cosme and his family almost never employ farm labourers, or participate in sharecropping arrangements.

Cosme normally takes the household decisions, although he discusses most issues with his wife. Lucia commented on the household economy:

> *Well, I have to tell him what I want to buy, so that he loosens the money* [*'afloja el dinero'*]. *If he does not want to give, well, then there is nothing more to do than to hold on* [*'no hay más que aguantar'*].

Lucia also has some of her own income that she decides on, but normally she spends it on family needs. Cosme and his father take decisions regarding farming practice, without involving Lucia.

The family owns some five hectares of land, consisting of three irrigation fields, where they grow maize and beans twice a year. Two of the fields are located near the village of Cuzalapa, while the third one is located half an hour walk away. Cosme and his father generally leave two to three hectares fallow for restoring soil fertility and for pasture. The main farming goal for Cosme and his family is to produce enough maize and beans to fulfil their needs. Cosme commented:

> *We sow what we need and a little more, and if we are lucky there is a good harvest. You know, sometimes people come and they ask for some corn. Well, you have to give them some, haven't you? It makes no sense to cultivate much more. There is no market.*

Cosme and his farther do not sharecrop. They used to do it a long time ago, but they stopped several years ago. Cosme commented:

> *We never cultivate a medias, as there is no need to. My father and my son help me on the land, and we have enough maize for my family and for my parents.* [...] *We also have some animals to take care of, so there is enough work to do.* [...] *I also have some other small jobs* [*'trabajitos'*], *so there is not much time left to work with others.*

They own two cows and two calves, two horses and some chickens.[17] Although they have some cows and relatively little land, they never buy *pastura*. But they never sell theirs either. Cosme commented:

> *You see, we have some animals, so we always have to save some of the land to use for pasture. My father and I, we cannot cultivate all our land. Our animals also have to eat. We do not want to sell them, as they are for emergencies. Last year, for example, my uncle who lives in Guadalajara died, so we sold a calf to pay the bus fare and some of the funeral costs.*

Cosme and his father manage their cattle very extensively, although the cattle are never taken uphill. Animal care is reduced to the minimum and, consequently, costs for cattle breeding are low.

For Cosme and his family, the cattle's main function is for saving. They are also milked, but this takes place very irregularly and productivity is low. *Tomatillo* does grow in Cosme's fields, but he does not sell it. He prefers to give it away to those who ask for it. He explained:

> *Well yes, we have tomatillo, but it isn't that much. Besides, it is a lot of work to gather it. We gather what we need, and give some to other people.*

Although very occupied on his father's farm, Cosme spends a lot of time on other (farm and off-farm) activities. He sometimes works for other farmers, renting not only his own labour to them, but also some tools, such as his horses and plough. He is responsible for the community's drinking water system, and he is the community's (only) electrician. This gives him and his family a very small additional income. Cosme's father also receives *PROCAMPO*, with which some of the (chemical) fertiliser is bought. But, as Cosme stated:

> *It does not help us that much, as the costs of fertiliser have risen a lot. Besides, one has to follow many procedures and pay for almost every form in order to get the subsidy. They* [i.e. governmental technicians] *used to come to Cuzalapa, but nowadays one has to go to Cuautitlán.*

Farm Economics

Figure 4.4 presents the economic analysis of Cosme and his family, while Table 4.8 presents the overall balance, indicating the monetary income sources.

Table 4.8 presents the different monetary income sources of Cosme and his family. It shows that farm and wage labour and subsidies are the most important sources, complemented by family production. They represent 54 per cent, 25 per cent and 15 per cent, respectively, of the total monetary income. According to Cosme, Figure 4.4 reflects a normal year. Indeed, in the period in which the families were followed, no major changes took place in their way of farming.

Figure 4.4 Economic assessment of Cosme Aragón's farm in 1996 (in Mexican pesos)

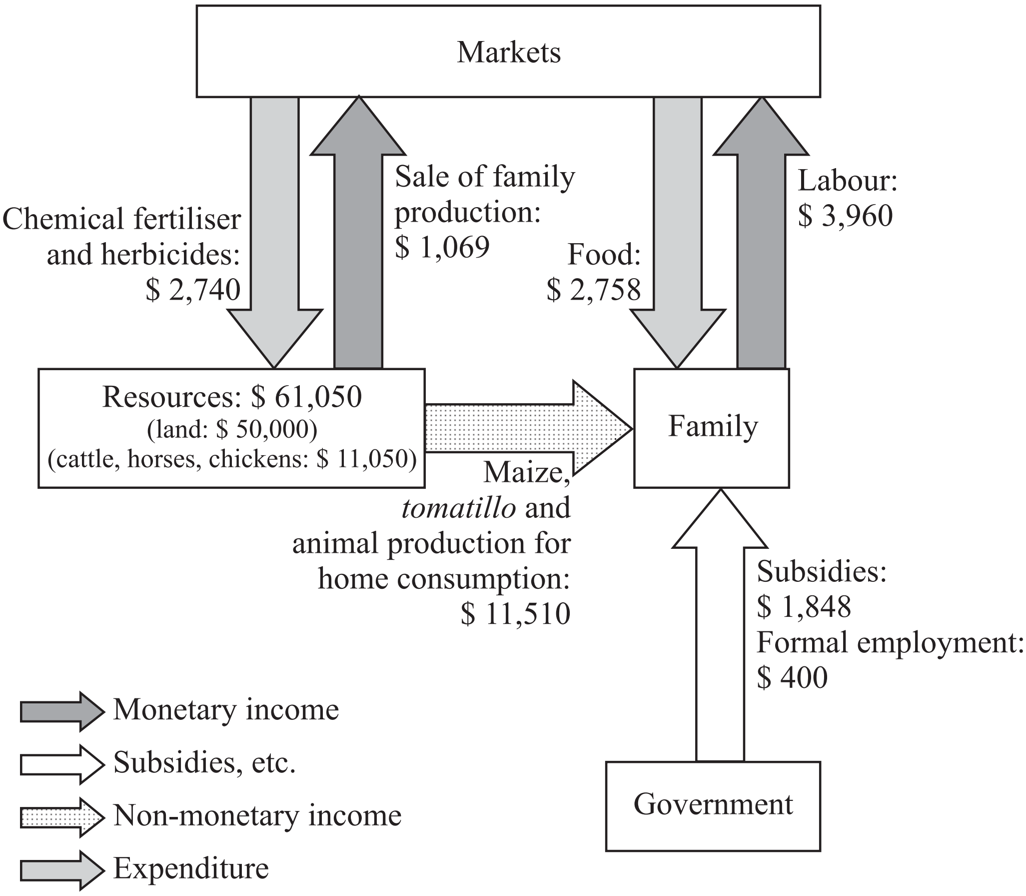


Table 4.8 Monetary income and expenditures of Cosme Aragón in 1996 (in Mexican pesos)

Income ($ %)			*Expenditures* ($ %)		
Labour	3,960	54	Food	2,758	50
Subsidies	1,848	25	Chemical fertiliser and herbicides	2,740	50
Farm production	1,069	15			
Formal employment	400	6			
Total	*7,277*	*100*		*5,498*	*100*
Overall balance: + $ 1,779					

4.3.5 The Case of Ismaël Ramón

Ismaël Ramón (63) has been married to Clementina (60) for about thirty years. Ismaël was born in El Chante, a small town located in one of the valleys surrounding the Sierra de Manantlán. He came to Cuzalapa when he was four. His wife was born in Cuzalapa. Their house is made of *adobe* and located at the outskirts of the village of Cuzalapa. Ismaël considers himself to be a poor farmer. He commented:

> *We are poor, you know, we do not have any money. Besides, nobody wants to help us, and the government does nothing either.*

They have one child, Pedro (30), who lives separately with his wife Gaby but always works with his father. Ismaël's parents are deceased, as well as most of his brothers. He does not have any contact with his remaining brother, who resides in the United States. Clementina's family lives in Cuzalapa, however, they are not on very good speaking terms. Ismaël is a very individualistic farmer. Although he knows many farmers, he prefers to go his own way to avoid problems. His political behaviour also reflects this. He votes PRI, but does not participate in Cuzalapa community politics. According to Ismaël, it would only bring trouble.

Farming Activities

Ismaël and Clementina own two irrigation fields, each one comprising more or less one hectare. One is located at the outskirts of Cuzalapa, while the other is a half an hour walk from their home. Clementina is registered as *comunera.* Ismaël used to be *comunero* of a field donated to him by his father-in-law. He gave up his right when he was planning to leave Cuzalapa permanently in 1967, which, in the end, he never did.

Ismaël appears to take all household decisions, both regarding living expenses and agricultural activities, as he adamantly commented:

> *It is me who takes the decisions in the house, in the fields and regarding the cattle. Pedro does what I tell him to. That's how we live here.*

But, Clementina has more influence than one might believe when hearing Ismaël, as she is both registered as a *comunera* and formally the family's cattle- and landowner.

The family cultivates maize and beans twice a year. But one of their two fields is left fallow in the rainy season. Ismaël commented:

> *Well, one cultivates to have something to eat. We cultivate both our fields in the dry season, to have enough pasture. In the rainy season, we only cultivate one, the other we leave for our cows, so they have pasture.*

Ismaël and Pedro do all the work on their land, including taking care of their 11 cows.[18] Thus, the household has two farm labourers. Clementina and Gaby only occasionally work on the land. Although there is a relative scarcity of labour within the family, Ismaël never employs farm labourers. Nor does he or his son cultivate *a medias*. Ismaël explained:

> *I'll never work with other farmers, Pedro and I can do all the work. I do not want to depend on others. I work what is mine and the rest work what is theirs. If you work with others, it only creates problems, and you end up with little maize, as you have to divide it with others.*

Although they have various cows and only little land, Ismaël and his family do not buy *pastura* from others farmers, nor do they sell theirs. They manage their cattle extensively, involving very few costs, such as the purchase of salt. In better years, he also buys some sugarcane as complementary fodder, but this implies major costs. Regarding the cattle, obtaining pasture is Ismaël's greatest worry:

> *We leave our cows in the hills, but we do not have our own agostadero. We use the esquilmos* [i.e. one of the few communal lands left]*, but the pasture is not very good there. I have asked the commissioner for some land, but he does not want to give any. So I now leave my cattle on the land of Don Concho. I leave my cattle there and at the same time take care of his land and animals. Maybe in return he will give me some of his land uphill.* [...] *It is a real burden, I have to go uphill every day* [i.e. a three-hour walk twice daily]*, and there is so much to do in the milpa* [i.e. cultivation field]*. Sometimes, I get so despaired that I even think of selling the damned cattle.*

Ismaël is also very worried about the workload, especially since Pedro has come up with plans to go to the United States. He commented:

> *When my boy goes away, I will have to sell my cows, because then I will not be able to do all the work anymore.*

Ismaël often complains about the harm that other people want to do to him. Most of his complaints refer to his cattle, the lack of *pastura* and the apparent unwillingness of the local authorities to resolve his (*pastura*) problems.

Ismaël also has *tomatillo* on his fields, which he only collects for household consumption. They receive the *PROCAMPO* subsidy, which is used for the purchase of chemical fertiliser, but, according to Ismaël, it does not outweigh the production costs.

Farm Economics

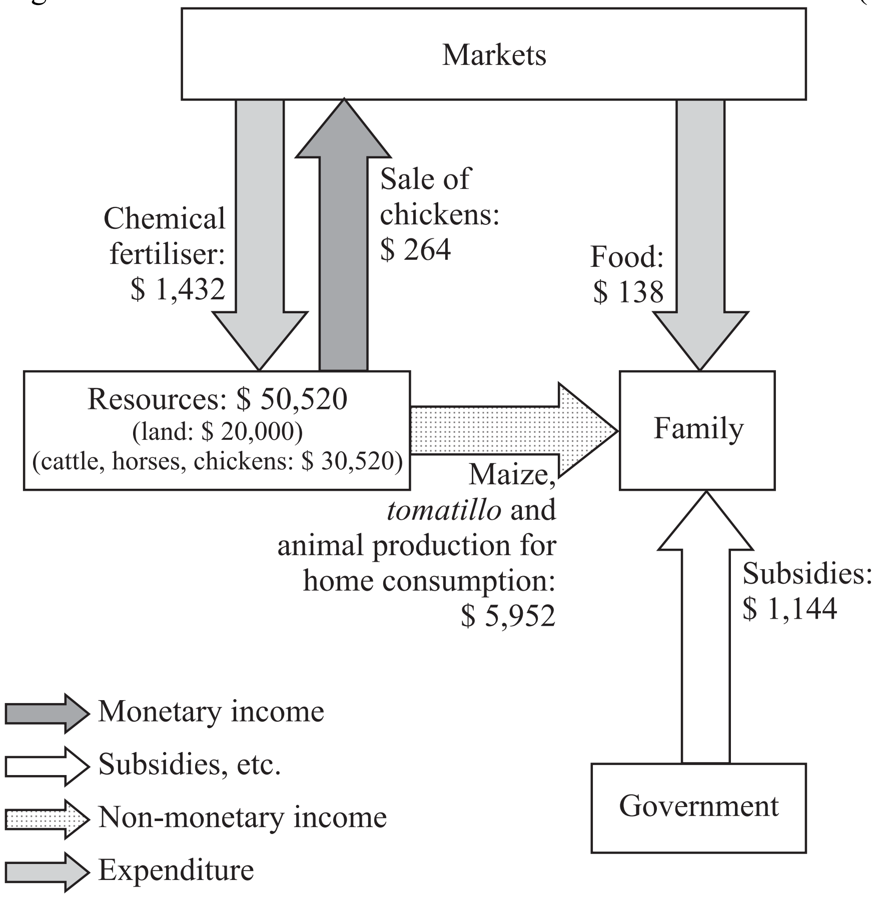
Figure 4.5 presents an economic analysis of Ismaël and his family, while Table 4.9 presents the overall balance, indicating monetary income sources.

Table 4.9 Monetary income and expenditures of Ismaël Ramón in 1996 (in Mexican pesos)

Income ($ %)			*Expenditures* ($ %)		
Subsidies	1,144	81	Chemical fertiliser	1,432	91
Small animal sale	264	19	Food	138	9
Total	*1,408*	*100*		*1,570*	*100*
Overall balance: - $ 162					

Figure 4.5 shows that Ismaël and his family have very few monetary income sources; farming very much depends on subsidies, representing 81 per cent of the total monetary income. Contrary to the other households, monetary income and expenditures are extremely low. According to Ismaël, the period in which their monetary income and expenditures were registered was a particularly difficult one, as they had run out of maize and beans. It appears that Ismaël's actual farming strategy is under some pressure. He cultivates both fields in the dry season in order to have pasture in the two most difficult months, i.e. April and May. This forces the family to leave their cattle in the hills during almost the whole dry season when there is less pasture and water available. Leaving cattle in the *cerro* (i.e. uphill) also increases the risk of robbery and a number of diseases, as experienced by Ismaël in the past.

Figure 4.5 Economic assessment of Ismaël Ramón's farm in 1996 (in Mexican pesos)



4.3.6 The Socio-Economic Position of Pobre *Farmers*

In the foregoing section, I described the livelihood strategies of five *Pobre* farmers, with an emphasis on farm economics. Diversification characterises these strategies, which refers to farmers' agency for engaging in different activities over time. The outcome is diversity, i.e. the composition of these activities at a given instant in time (Ellis 1998). Amongst *Pobre* farmers, diversification is found not only in activities, but also in income sources, which partially overlap.

Pobre farmers' income sources are summarised in Table 4.10. Following Ellis (1998:5), a distinction is made between farm income (crop and livestock income, including consumption-in-kind), off-farm income (wage and exchange labour on other farms, including labour payments in kind) and non-farm income (i.e. non-agricultural income sources).

Table 4.10 Income sources of *Pobre* farmers in 1996

Farm income	*Off-farm income*	*Non-farm income*
Sale of grazing rights on *pastura* Sale of farm production (maize and beans)	Sale of labour force Sharecropping (*siembra a medias*) Reciprocal help (working *a peonadas*)	Governmental subsidies (such as *PROCAMPO*) Remittances (sent by migrants in Mexico and the United States).

Based on the case studies, four observations can be made regarding Table 4.10. Firstly, most income sources have to be mobilised every cropping season and often at specific moments. Consequently, different time horizons can be distinguished in the strategies of Cuzalapa farmers (Zoomers *et al.* 1998). Secondly, the mobilisation of (monetary) income requires a (partial) integration into (incomplete) markets (Ellis 1993). Market distantiation can also take place, when, for example, agricultural yields are low or job opportunities are lacking (van der Ploeg 1990). Thirdly, several income sources require the activation of social networks, which are directly related to community politics in Cuzalapa (see Chapter 2).[19] Fourthly, the reliability of income sources differs. For example, remittances and governmental subsidies are relatively uncertain income sources, because farmers are less certain about their exact moment of arrival.[20]

Pobre farmers diversify monetary income sources for several reasons, such as obtaining enough income, reducing risks and reducing intra-year income variability. The latter emerges from the seasonality of farm-based income streams. Diversification can also reduce inter-year income variability, resulting from instability in agricultural production and markets (Ellis 1998). Which income sources are important for farm households depends on the available resources and a farmer's agency. Farmers' decisions to activate a certain income source are not only determined by available monetary income. Labour availability within the family and expected production levels, among other factors, can also play a role. The importance of the different factors can vary per household, as the farmer portraits also illustrated.

Comparison of Income and Expenditures

Most *Pobre* farmers, including those portrayed in the case studies, have little monetary income, of which most is spent on agricultural inputs and household needs. This is illustrated by Table 4.11, which compares monetary income and expenditures.[21]

Table 4.11 Direct means of *Pobre* case study farmers in 1996 (in Mexican pesos $)

	Monetary income	*Expenditures*	*Yearly Balance*
Juan de la Cruz	6,089	5,927	+ 162
Enrique Hernández	24,166	5,175	+ 8,991
Constantino González	7,779	8,176	- 397
Cosme Aragón	7,277	5,498	+ 1,779
Ismaël Ramón	1,408	1,570	- 162

Table 4.11 shows that two of the five families have a negative financial balance, while two other families only have a small positive balance. Thus, available monetary income is small or does not outweigh expenditures. In other words, (almost) all monetary income is spent. It is noteworthy that agricultural yields are hardly ever used to pay for the non-factor inputs used, i.e. farm reproduction. The same is true for the two farmers who own cattle, which are only sold in cases of emergency. They are paid for by the other income sources such as the sale of *pastura*, subsidies and off-farm wage labour. As the farmers' primary concern is to assure the family's food supply, more production is consumed than sold. The latter can be considered a symptom of their precarious situation, as production levels hardly or do not exceed family consumption levels.

Tables 4.12 and 4.13 illustrate the relative importance of markets in resource production and reproduction, i.e. the degree of market dependency or commodisation (van der Ploeg 1999:62-63). Table 4.12 relates commoditised resources to the total resources produced and reproduced on the case study farms. In Table 4.12, 'own resources' refer to the resource base (land and animal property), resources consumed by the family (maize, beans and some small animals), and resources sold to other farmers (*pastura*, some small animals and wage labour). Resources obtained through markets refer to food that is bought and to agricultural inputs such as chemical fertiliser and herbicides. Even though time horizons between resource base and produced and reproduced resources exist, which makes a comparison difficult, Table 4.12 shows that relatively few resources are mobilised through markets. It also suggests that this is less so for the *Pobre* case study farmers who own cattle.

Table 4.12 Relation between resources obtained through markets and total resources used on farms of *Pobre* farmers in 1996 (in Mexican pesos $)

	Own resources (a)	*Resources obtained through markets (b)*	*Total resources used on farm (c=a+b)*	*Tentative relative relation (b/c)*
Juan de la Cruz	36.755	5,927	42,682	14%
Enrique Hernández	76,590	15,175	91,765	17%
Constantino González	55,781	8,176	63,957	13%
Cosme Aragón	77,589	5,498	83,087	7%
Ismael Ramón	56,736	1,570	58,306	3%

The market dependency can be looked at also from another point of view, i.e. the relationship between resources sold and commodities acquired through markets (van der Ploeg 1999: 62-63). In Table 4.13, I have done so for agricultural production of the *Pobre* case study farmers.

Table 4.13 Market dependency of *Pobre* farmers in 1996 (in Mexican pesos $)

	Resources sold	*Costs for agricultural production*	*Balance*
Juan de la Cruz	3,150	3,407	- 257
Enrique Hernández	5,950	6,318	- 368
Constantino González	4,089	1,840	+ 2,249
Cosme Aragón	1,069	2,740	- 1,671
Ismaël Ramón	264	1,432	- 1,168

Table 4.13 shows that *Pobre* case study farmers are extremely dependent on the market for production, as the overall balance is negative in four of the five cases. Except for Constantino González, sudden changes in the prices of the resources obtained through markets directly affect them. It is in this context that the importance of the PROCAMPO subsidy emerges. As was also stated by the farmers, it is a necessary subsidy for the continuation of farming.

The precarious situation of many *Pobre* farmers and the importance of assuring their food supply leads to a farming practice that does not (fully) correspond with the one desired, i.e. the one that underlies the regional farming style. Several of the farmers buy less chemical fertiliser than needed for crop development. During hard times, they also spend less financial resources on certain household needs, such as eggs, milk, meat, or clothes and shoes. In other words, both farming and food patterns change. Both (farming and home consumption) are related to each other, and several *Pobre* farmers risk being caught in a vicious circle of poverty and deprivation, as was the case with Juan de la Cruz.[22] Furthermore, the insecurity implied in having little monetary income suggests that farm development of *Pobre* farmers is characterised by a 'lack of equilibrium' instead of by 'continuity' (Zoomers *et al.* 1998: p. 14). This means that farmers have to constantly evaluate whether they can continue to farm in a certain way (van der Ploeg 1990). Every cropping season, it is unclear which resources will be available for farming. In other words, farm reproduction is constantly at stake. Some of the case studies also illustrated this.

Farming Performance

Cuzalapa farmers do not have a very precise overview of farm economics, but they are very well aware of their own and other farmers' performance. In judging performance, they use criteria such as a farmer's ability to support his family, obtain a good production, maintain a healthy herd of cattle, etc. In this way, farmers read their 'social environment' and draw conclusions on the craftsmanship of fellow farmers (van der Ploeg 2000: pers. comm.).

Food and (monetary) income are two criteria for evaluating farming performance and which underlie the regional farming style. Both are a prerequisite for living comfortably (*'vivir ajusto'*). According to farmers, somebody lives comfortably when he does not have to think every day about where to get the money for the household, when he has enough food and clothes, and has enough work to do. Craftsmanship is another important criteria. When farmers are asked to define a 'good farmer', a generalised picture emerges of someone who knows how to work, who has the necessary farm tools, who does not depend on others, and who knows how to get good results. This picture very much coincides with the basic notions of the regional farming style.

In 1996, based on the outcome of the economic analysis, I invited the case study farmers to rank themselves and the other case study farmers individually, according to the criteria of living comfortably and craftsmanship. The results of the combined ranking exercises are presented in Tables 4.14 and 4.15.

Table 4.14 Ranking of the case study families according to living comfortably

	Living comfortably[1]
Juan de la Cruz	e
Enrique Hernández	a
Constantino González	b
Cosme Aragón	c
Ismaël Ramón	c

1) Legend: a: living most comfortably; e: living least comfortably.

Table 4.15: Ranking of farmers according to craftsmanship

	Craftsmanship[1]
Juan de la Cruz	5
Enrique Hernández	4
Contantino Gónzalez	1
Cosme Aragón	2
Ismaël Ramón	2

1) Legend: 1: Best working farmer; 5: Worst working farmer.

The results of the ranking can be linked to some of the results of the economic analyses, as having enough to eat and some money to spend refer to agricultural production for home consumption and purchased products other than agricultural inputs (as these are used for farm reproduction). In all case study families, these purchased products have been food. Figure 4.6 presents the economic data with the qualitative results of the ranking. Note that the economic data in Figure 4.6 (i.e. the X- and Y-axes) represent absolute values, which are not related to specific household characteristics, such as size and composition.

Several conclusions can be drawn from Figure 4.6. Firstly, it shows that Enrique Hernández is considered by all of the farmers to be the one who lives most comfortably. He is also the best-situated in economic terms. One of the other farmers stated that:

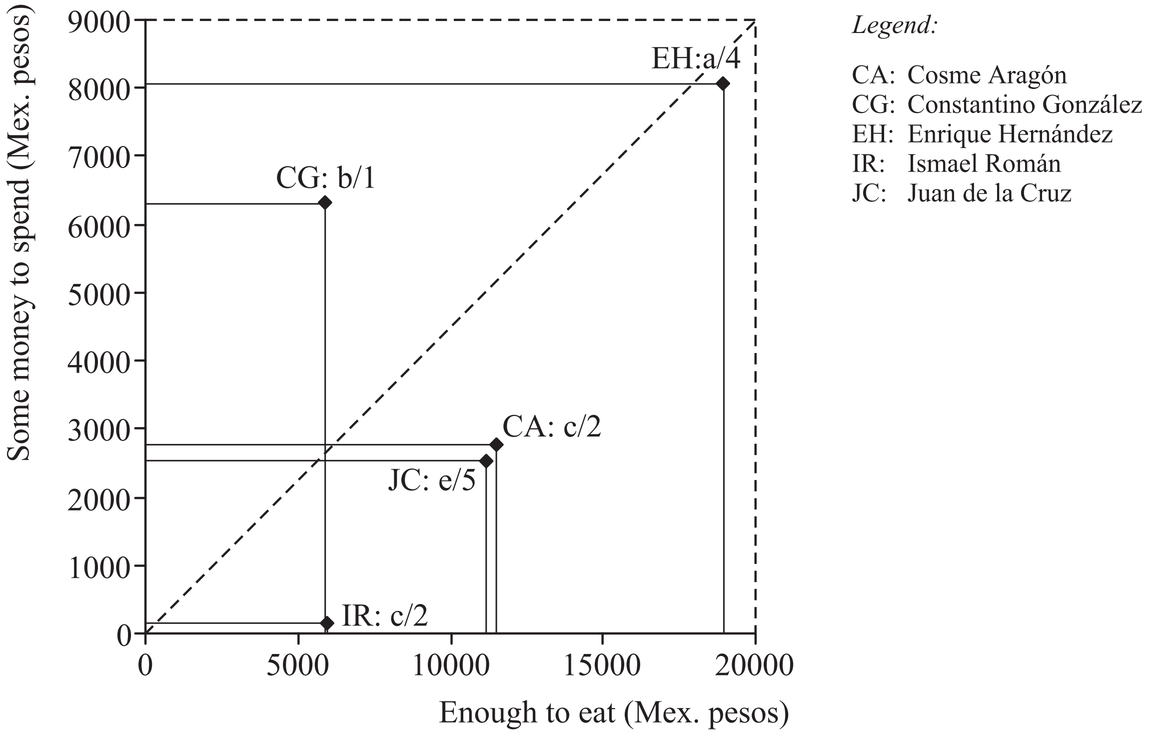
> *Enrique Hernández is living comfortably, because he receives money from his children who are in the United States.*

The farmers also agreed that Juan de la Cruz and his family do not live comfortably, as:

> *He does not provide enough food for his family, nor money. Besides, he is a drunk* [*'es un borracho'*], *he does not take care of his children.*

The situation of Juan de la Cruz is only partially reflected in Figure 4.6, which places Juan in a better position than Ismaël Ramón and a comparable position to Cosme Aragón. Although his consumption level is higher than Ismaël Ramón's, he also has more mouths to feed. The same can be said when comparing him to Cosme Aragón. The low consumption level of Ismaël Ramón is explained by his stinginess. Ramón is known in Cuzalapa for being a very stingy person. Although he is relatively better off, he rarely spends money. Besides, he almost never socialises with other farmers, not even in the part of Cuzalapa village where he lives. The situation of Constantino González is explained by the fact that he also received remittances from his son, even though he did not receive them anymore when the economic analysis was done. Finally, Cosme Aragón is in an intermediate position. He is living comfortably, but he does not have very much monetary income at his disposal.

Figure 4.6 Farming performance of *Pobre* case study farmers in 1996(in Mexican pesos)



The ranking of farmers in relation to craftsmanship shows that Constantino González, Cosme Aragón and Ismaël Ramón are considered to be the best working farmers. The reasons given by the case study farmers are that these three hardly depend on other people, they are hard workers, or they have sufficient land or animals. Thus, the criteria for craftsmanship go beyond the availability of non-monetary and monetary income. Enrique Hernández was ranked lower because he lets his sons do a lot of the work in the field, he depends on other farmers in order to produce, and he apparently talks more than he actually does. Juan de la Cruz was perceived as the least skilled farmer, because he depends on other farmers and he is not capable of obtaining what is necessary. His 'portrait' presented earlier also confirms this.

The above ranking exercises demonstrate two points. On the one hand, farmers are able to evaluate the performance of fellow farmers. It is in this way that respect is obtained (or lost), which is important for mobilising limited resources. On the other hand, the social definition of farming performance appears to change, as remittances were also mentioned as a criterion. This is surprising and at the same time worrying, because it implies that *Pobre* farmers do not obtain a minimum income from their own farms anymore, i.e. from agricultural production. Instead they depend on relatives outside the community, as well as on other income sources. The economic data partially confirm this. The latter is also related to the transformations in the regional farming style, which I described in Chapter 3. In fact, Figure 4.6 can be seen as an image of these transformations. The diagonal line can be considered as one of the manifestations of the competence value axis, which I presented in Chapter 3. The different positions of the case study farmers in relation to the ideal situation represented by the axis imply that farming is realised differently under current production conditions in Cuzalapa. In other words, farming practice does not fully coincide with the commonly shared notions on farming.

Conclusion

This section shed some light on the livelihood strategies of *Pobre* farmers, based on five farmer 'portraits'. It showed that farm reproduction takes place in various ways, which is partially related to the transformation of the regional farming style. It also gave a rough description of how farmers perceive themselves and others. The discussion reveals that *Pobre* farmers can be considered 'peasants', as they:

> '[…] *are households which derive their livelihoods mainly from agriculture, utilise mainly family labour in farm production, and are characterised by partial engagement in input and output markets which are often imperfect or incomplete'* (Ellis 1993:13).

4.4 Two Portraits of *Ganadero* Farmers

4.4.1 The Case of Pablo Monroy

Pablo Monroy (65) is married to Ana (63). Both were born outside Cuzalapa. Pablo was born in the agrarian community of Ahuacapán, located a one and a half-hour drive away from Cuzalapa, while Ana was born in El Chante (a small town two hours from Cuzalapa). Pablo and his family own two houses. One is made of brick and is located in the centre of the main village of Cuzalapa. The other house, which is made of *adobe*, is in the part of the Cuzalapa valley called *La Loma Delgada,* a one-hour walk from Cuzalapa, where Pablo's land is located. Pablo and his family belong to the richer households, as Ana commented:

> *Well, we are fine. We have some animals, some milk. That's all. We're doing well, but that is all.*

They have 11 children: eight sons and five daughters. Of their children, five are living in the United States, three are living at the coast of Jalisco, and three live in Cuzalapa. Of their children in Cuzalapa, only one is living with his parents and the other two have their own houses. Pablo's only brother lives in Cuzalapa, and he sees him daily. He hardly sees his three sisters, who live at the coast. The majority of Ana's relatives live in Cuzalapa, but she does not see them that often, as she normally is busy working in the household.

Pablo has had several functions within former directive boards, although he is not a member of the *Cacique* group. He knows many people in Cuzalapa. Nowadays, he hardly participates in community politics. He prefers going his own way, staying out of trouble. He spends most of his time in the relatively remote *La Loma Delgada*.

Farming Activities
Pablo is a *comunero* and owns some 45 ha. Most of his land is level or located on the lower slopes, and 12 ha are used for agriculture. Pablo cultivates six hectares twice a year, from which he obtains good yields, according to his own admission. Every cropping cycle, half of his land is left fallow. He hardly uses herbicides; he prefers to weed manually to reduce costs. He receives the *PROCAMPO* subsidy for ten hectares, which he mainly uses to improve the entrance road to his land. He is also registered for another governmental subsidy called *Alianza para Agostadero*, which is similar to *PROCAMPO*.[23] He sells most of his maize and beans. Furthermore, *tomatillos* grow on his land, which he sells to the middlemen who come to Cuzalapa.

Pablo used to take all the decisions within the household. This changed when two of his sons returned from the United States. Now they actively participate in decision-making, especially regarding farm development.

Pablo also owns some 30 animals, which he obtained through hard labour, as he explained:

> *I used to work with the Gutiérrez'* [who have many cattle] *as an assistant. I milked their cows for over twenty years. They gave me some cattle a medias, and little by little I built up my own herd. Then, I also got some land from the community.*

Although he owns 30 animals, the herd that grazes on his farm consists of 80 animals. The herd includes animals belonging to his sons who live in Cuzalapa but do not have land of their own. Pablo and his sons (in Cuzalapa) also manage *a medias* the cattle of his migrated sons, which they bought with their earnings from the United States.[24] Until 1998, Pablo did not buy *pastura*. He commented:

> *I did not buy pastura, because I could do with what I have* [*'ajustó lo mio'*]. *We are struggling* [*'luchando'*] *to maintain what we have. This year* [1997] *we carried on the struggle with 80 animals. Let's see if we can do it with 100 next year. I am sowing pasture (estoy empastando)* [in order to obtain more and better-quality pasture]. [...] *When I have 100 cattle, I will have to buy* [*pastura*]. *Up until now, I have maintained. But, I still have some rights on a free agostadero. Now only one family uses it.* [...] *We want to use it also. It is not fair that they use it by themselves.*[25]

When Pablo is in need of financial resources, he sells some calves. He sells them preferably to his sons living in the United States, to avoid any cattle leaving the family.[26] His wife commented:

> *Pablo sells his animals to his sons in order to buy fertiliser. Before, he used to sell them to other people, but nowadays many people already have their own animals.*

As pasture has become scarce, Pablo started to improve the pasture lands on his farm:

> *It is very important to take good care of your meadows in order to have good pasture. Some do not take care and afterwards they lack pasture. I was looking for pastura [to buy], but I did not find it. So I started to clean our meadows and sow pasture. And it turned out well. So, now I am planning to clean all my meadows. And I don't need to buy any pastura anymore.*

In contrast to maize production, Pablo uses quite a lot of herbicides for pasture improvement, a decision that is mainly influenced by his two sons that returned from the United States. The production costs for maize and *pastura* are paid for by the sale of calves, which numbered around 14 each year until 1997/98. But Pablo is planning to increase the yearly sale to 40. He commented on the changed circumstances:

> [Part of] *the family is already here, so we are going to let more cows have calves. You see, my son just bought a new breeding bull.*

Farm Economics

Figure 4.7 presents the economic analysis. Table 4.16 presents the overall balance, indicating monetary income sources.

Figure 4.7 Economic assessment of Pablo Monroy's farm in 1998 (in Mexican pesos)

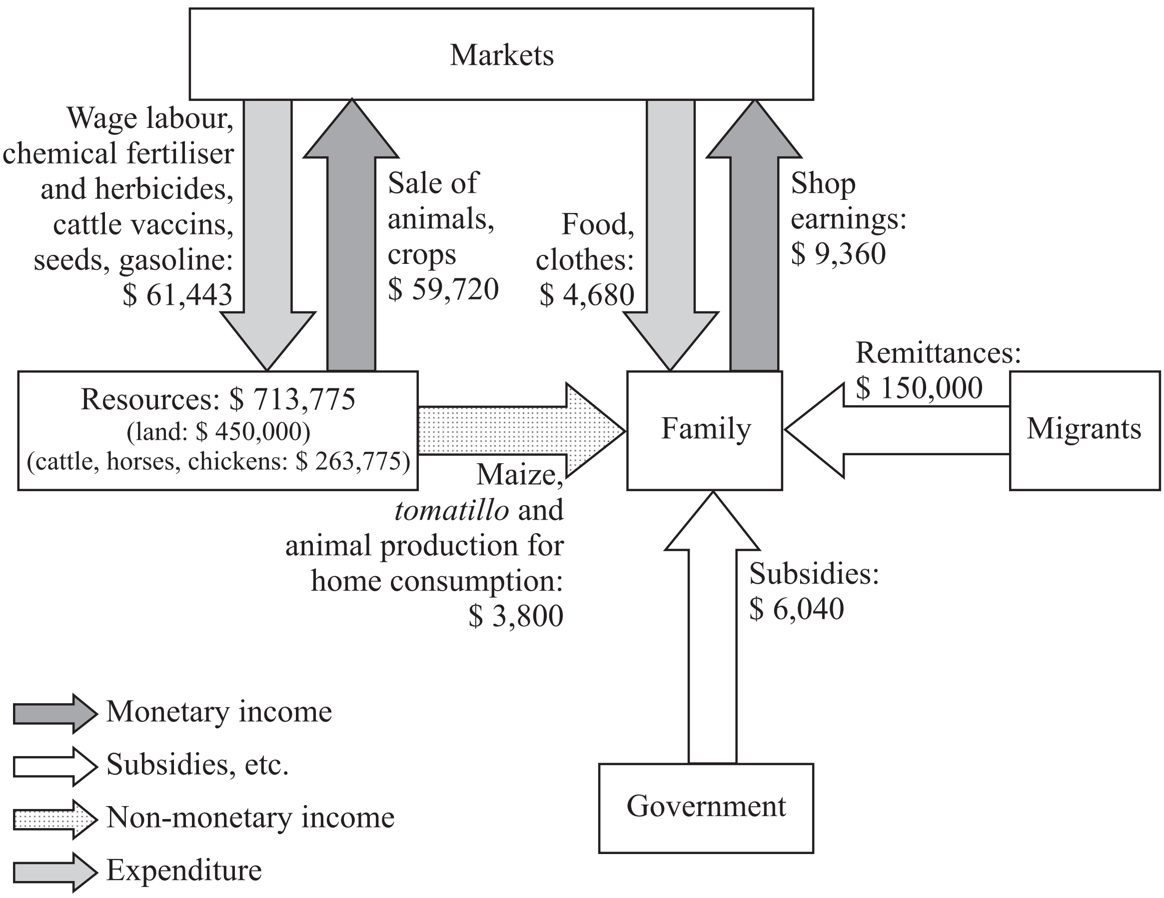


Figure 4.7 shows that Pablo's main income sources for farming are the sale of cattle and crops, and governmental subsidies. Remittances sent by his sons have been mainly used to buy more cattle and when possible, land. It is also saved in a bank. Without the remittances, the overall balance is a positive $ 8,997. Ana runs a little shop, but the profits are relatively low and used for her own needs.[27] For her, the shop is important, above all, for her own family, and not so much for selling products to other people in Cuzalapa.

Table 4.16 Monetary income and expenditures of Pablo Monroy in 1998 (in Mexican pesos $)

Income			*Expenditure*		
Remittances	150,000	67%	Wage labour, chemical fertiliser and herbicides, cattle vaccines, seeds, gasoline	61,443	93%
Sale of animals and crops	59,720	26%	Food, clothes, etc.	4,680	7%
Shop earnings	9,360	4%			
Subsidies	6,040	3%			
Total	*225,120*	*100%*		*66,123*	*100%*
Overall balance	+ $ 158,997				

Pablo is a 'self-made' cattle-breeder, who (until 1997) maintained his herd size at a level that coincided with the pasture available on his lands. Since the end of 1997 important changes have taken place, due to the return of two of his sons from the United States and the earnings they brought with them. The total herd size was increased and pasture was sown on a larger scale. The first ideas to rent pasture land from other farmers also arose. More and more, Pablo's sons have been taking over their father's farm. It became also clear that Pablo is more or less retiring from farming practice and that he wants to leave room for his sons. Pablo also acknowledged this:

> *Well, yes, it is because of my sons that we are now sowing pasture. I am helping my sons so they will have their own* [farm]. *You know, I am already finished* ['*estoy acabado*'].

4.4.2 The Case of Tino Cervantes

Tino Cervantes (78) is married to Adela (66) and both were born outside Cuzalapa. Tino was born in the capital of the neighbouring state Colima and came to Cuzalapa when he was four, while Adela was born in Ahaucapán. Tino and his family own two houses: one of the very few two-story brick houses in Cuzalapa, and an *adobe* house in the hamlet Las Gardenias, where they lived before they moved to Cuzalapa. The family of Tino belongs to the richest in Cuzalapa, although he never wants to admit this:

> *We are as the poor, not rich at all. We own little and have to work hard to maintain what we have.*

They have ten children: eight daughters and two sons. Of their daughters, four are living in Cuzalapa with Tino and Adela, while the other (elder) daughters live in the United States. Of the sons, one is living in the United States, while Paco (30) just returned from the United States.

Tino has a brother living in Las Gardenias, but they are not on speaking terms. Neither Tino nor his family have many contacts in Cuzalapa; they interact more with cattle-breeders from El Durazno and Cuautitlán.[28] Tino also knows a lot of people in the neighbouring community of Ayotitlán, where his cattle graze during part of the dry period. Tino is a PRI member 'in flesh and bones' *('en carne y huesos')*, but he always stays far from any political activity. Adela and her daughters run a little shop of soft drinks and sweets that provides them with some income.

Farming Activities

Tino is registered as a *comunero* and owns some 150 ha in the valley and hills of Cuzalapa; 90 hectare is *agostadero* land, while 60 hectare can be used for agricultural purposes. Tino cultivates twice a year: 15 ha in the rainy season and 10 ha in the dry season. He generally obtains average yields, but as he cultivates a relatively large area, he sells a substantial amount. Tino takes all the decisions in the household, although decisions regarding farming practices are often taken together with Paco.

Tino generally hires various wage labourers to do agricultural activities, such as weeding and harvesting. As he is rather wealthy, he also uses a lot of non-factor inputs. Tino explained:

> *We cultivate some 10 ha in the dry period and some 15 ha in the rainy season. The costs are quite high; per hectare we pay some $2,000* [approximately US$ 235] *and more for the fertiliser, the tractor, and for hiring wage labourers.*

Although much is invested in agriculture, the most important activity for Tino is his 340 cattle, which he owns together with his second son Paco. [29] Some 30 cows for milking graze in the pasture lands near Las Gardenias. The remaining cattle wander in the north-eastern hills of Cuzalapa and in the hills of the neighbouring community of Ayotitlán. Tino does not have enough pasture land himself, so he rents a lot::

> *We have some 340 cows and only little land. So we also rent land. In the rainy season, we buy pastura in Ayotitlán, while we rent grazing rights in the valley [of Cuzalapa] in the dry period. It costs us some $ 35,000 yearly* [approximately US$ 4,903]. *To obtain enough money to pay for all the expenses, we sell around 25 calves every year.* [...] *We receive PROCAMPO* [for 25 ha]. [...] *My sons in the United States also send us some money.* [...] *We used to have credit* [from a parastatal bank] *until eight years ago, but we left it because it caused too many problems.*

According to Tino, the purchase of *pastura* is the highest cost he has to incur on his farm. He is also enlisted for the subsidy of *PROCAMPO* and the *Allianza para Agostadero* programme, but his situation is similar to Pablo Monroy's regarding the latter subsidy. Tino's daughters make cheese in the rainy season, which generates a small additional income. In the dry season, the cows only give a little milk, which is mainly used for the newly born calves.

Tino is a very occupied man, who, despite his advanced age, leaves his house every day at six in the morning to take care of his animals and crops. He commented:

> *Those who do not have a lot, they go to sleep without too many worries* [*'pendientes'*]; *they do not think too much about the next day. Unlike them, I have a lot of things to take care of. One not only has to think all by himself, he also has to co-ordinate* [*'nivelar'*] *all activities. So, you see, I work with my hands and with my*

head. When I go to bed, I think of all I have to do the next day. I get up every day at six or seven, and work until very late.

About his motives to keep on working at his advanced age, despite the difficult situation in the agricultural and cattle-breeding sector, he commented:

One has to work to maintain oneself. I have some cattle and cultivate some maize, so that I can live well. [...] *Things have become much more difficult. Don't believe that cattle bring you that much. Prices have decreased a lot, so you have to sell more.* [...] *I could sell my cows and get a lot of money, but money disappears soon and I will have nothing. It's hard work in the countryside, but one has to go on.*

Farm Economics

Figure 4.8 presents the economic analysis. Table 4.17 presents the overall balance, indicating monetary income sources.

Figure 4.8 Economic assessment of Tino Cervantes' farm in 1998 (in Mexican pesos)

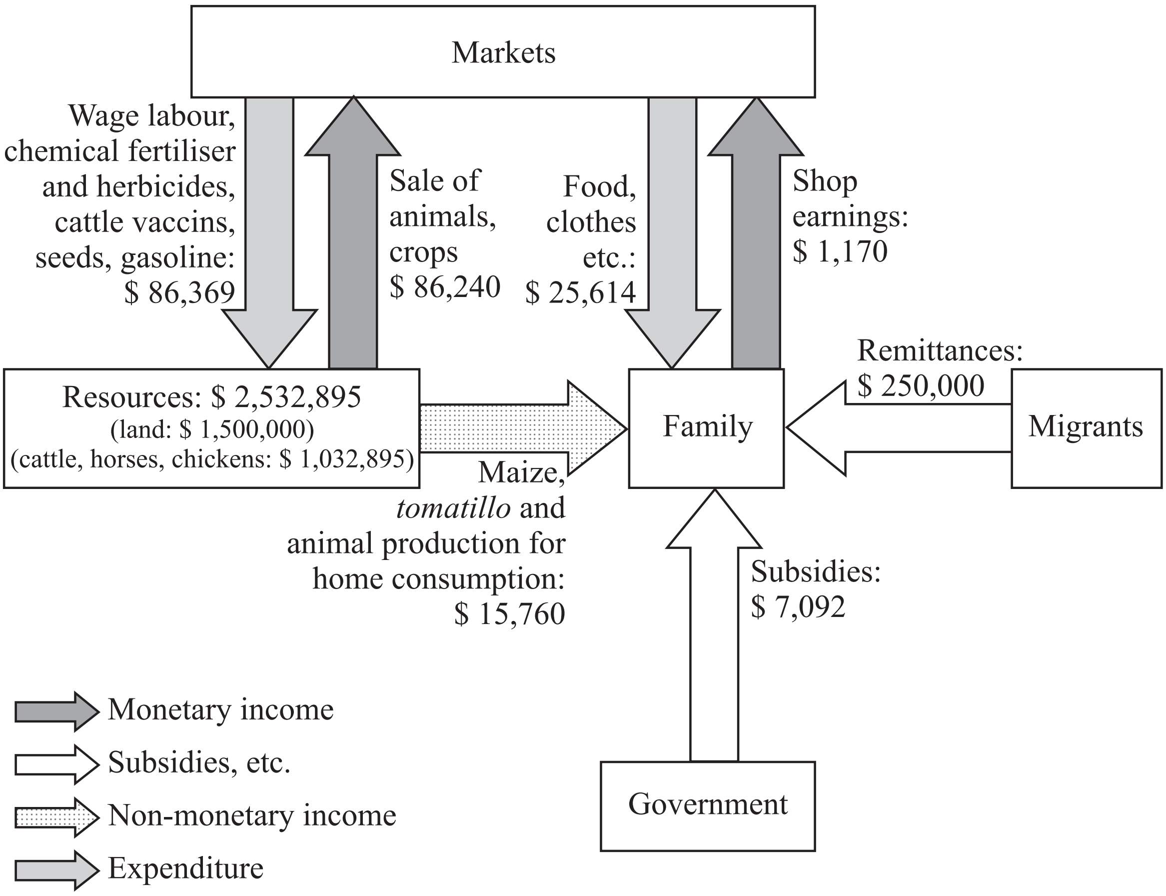


Figure 4.8 and Table 4.17 show that income earned from crop and animal sales is important, above all, for farm reproduction, complemented by the *PROCAMPO*-subsidy. Paco commented:

> *We sell calves in order to buy pastura. But also for the family expenses, and for buying* (new) *cows.*[30] [...] *I just bought 15 ha of* [irrigation] *land* [with a house and near a stream] *for $ 250,000.00* [approximately US$ 29,240.00].

Remittances sent by Tino's sons are important for farm reproduction and expansion, just as in the case of Pablo Monroy. Earnings from his wife's shop are relatively less significant.[31]

Most of the costs appear to originate from the purchase of *pastura*. Due to the relative scarceness of land, Tino rents every year large amounts of pasture lands, but he also looks for ways to purchase more land. However, there are moments throughout the year in which liquid means are scarce, and thus other strategies have to be employed, like the borrowing of money.[32]

Table 4.17 Monetary income and expenditures of Tino Cervantes in 1998 (in Mexican pesos)

Income ($ %)			*Expenditures* ($ %)		
Remittances	250,000	73	Wage labour, chemical fertiliser and herbicides, cattle vaccines, seeds, gasoline	86,369	77
Sale of animals and crops	86,240	25	Food, clothes, etc.	25,614	23
Subsidies	7,092	2			
Shop earnings	1,170	(0.3)			
Total	*344,502*	*100*		*111,983*	*100*
Overall balance	+ $ 232,519				

4.4.3 The Socio-Economic Position of Ganadero Farmers

The *Ganadero* farmers' income sources are summarised in Table 4.18. It shows that their income sources are less diverse, compared to *Pobre* farmers. Revenues from their own yield and from subsidies can pay for farm reproduction and production costs, while farm expansion is paid mainly out of remittances.

Table 4.18 Income sources of *Ganadero* farmers in 1998

Farm income	*Off-farm income*	*Non-farm income*
Sale of farm production (cattle, maize and beans)	-	Governmental subsidies (such as *PROCAMPO*)
-	-	Remittances (sent by migrants in the United States).
-	-	(Shops)

Comparison of Income and Expenditures

In contrast to *Pobre* case study farmers, the two *Ganadero* farmers do not have any problems reproducing their farm. Table 4.19 illustrates this.

Table 4.19 Direct means of *Ganadero* case study farmers in 1998 (in Mexican pesos $)

	Monetary income	*Expenditures*	*Yearly balance*
Pablo Monroy	225,120	66,123	+ 158,977
Tino Cervantes	344,502	111,983	+ 232,519

For both farmers, remittances sent by family members in the United States are their major income source, while the sale of calves and agricultural produce provide additional income. The portraits reveal that the remittances are used to further build up resources (mainly the purchase of land and cattle and to a lesser degree machinery), while the income obtained by the sale of calves and production is used for covering production costs. The building up of these resources is done in anticipation of the migrated sons' return. In fact, in most cases these sons are the *de jure* owners of the newly obtained resources, although they are managed under an *a medias* arrangement. The case of Tino Cervantes differs from the case of Pablo Monroy in the sense that part of remittances that Tino recieves is needed for farm reproduction, as the financial balance is negative when not taking remittances into account.. This may not be so surprising when one considers that Pablo Monroy's possibilities for farm expansion appear to be greater than those of Tino Cervantes.

Striking in the economic data is the limited amount of resources (i.e. as part of all their resources) that *Ganadero* farmers obtain through markets. Their situation is thus comparable to that of *Pobre* farmers (see Table 4.12). Tables 4.20 and 4.21 illustrate this. Table 4.20 shows the amount of resources obtained through markets in relation to all resources used on the farm.

Table 4.20 Relation between resources obtained through markets and total resources used on farms of *Ganadero* farmers in 1998 (in Mexican pesos $)

	Own resources (a)	*Resources obtained through markets (b)*	*Total resources used on farm (c=a+b)*	*Tentative relative relation (b/c)*
Pablo Monroy	777,295	61,443	838,738	7%
Tino Cervantes	2,634,895	86,369	2,721,264	3%

Table 4.21 shows the relation between resources that are sold and resources that are obtained through markets.

Table 4.21 Market dependency of *Ganadero* farmers in 1998 (in Mexican pesos $)

	Resources sold	*Costs for agricultural production*	*Balance*
Pablo Monroy	59,720	61,443	- 1,723
Tino Cervantes	86,240	86, 369	- 129

Similar to the Pobre farmers' situation (see Table 4.13), the situation of these farmers is almost in balance, which also indicates that they are highly dependent on markets. Furthermore, the table suggests that *Ganadero* farmers also primarily seek to ensure their food supply. This, in turn, suggests that these farmers consider their farms, above all, as a means of investment. This image also emerged in Chapter 3.

Farming Performance

The general and economic analyses show differences between the two *Ganadero* case study farmers. Pablo aims at maintaining his herd size at a relatively stable level in order to have sufficient *pastura* on his own farm without having to buy from other farmers, while Tino is constantly looking for *pastura* to buy. The return of Pablo's sons from the United States seems to redirect farm development, making it more similar to Tino's farming strategy.

Pablo Monroy also dedicates more effort and financial resources to animal care than Tino Cervantes. Table 4.22 illustrates this by presenting an analysis of the costs made by the two farmers for cattle production.

Table 4.22 Costs for cattle production in 1998 (in Mexican pesos $)

	Total labour cost	*Labour cost per cow*	*Total costs for non-factor inputs*	*Non-factor input cost per cow*
Pablo Monroy	35,400.00	442.50	19,215	240.50
Tino Cervantes	56,262.50	165.50	15,240	44.80

Table 4.22 shows that Pablo, although he owns much less cattle, invests relatively more in cattle-breeding activities (animal care and pasture improvement) than Tino. In other words, Pablo can be considered a more intensive *Ganadero* farmer than Tino. Pablo commented:

> *Some people care for their animals better than others. I take good care of my animals so that they yield more. I used to not do it, because I only had a few animals. Now, I already have more; I take good care of them.. It is the same with my pasture lands. Before I did not have the means* [*'no tenia con que';* i.e. the means to improve the quality of the pasture]. [...] *You see, to us* [Pablo and his sons] *it is important to obtain more cattle in little time.*

Another *Ganadero* farmer agreed:

> *Some like to give more* [*'echar más'*, i.e. medicines, chemical treatments, etc.], *others are more calm. They treat the diseases of their animals, but they do it less. They have a different kind of intelligence. You know, we are all different.*

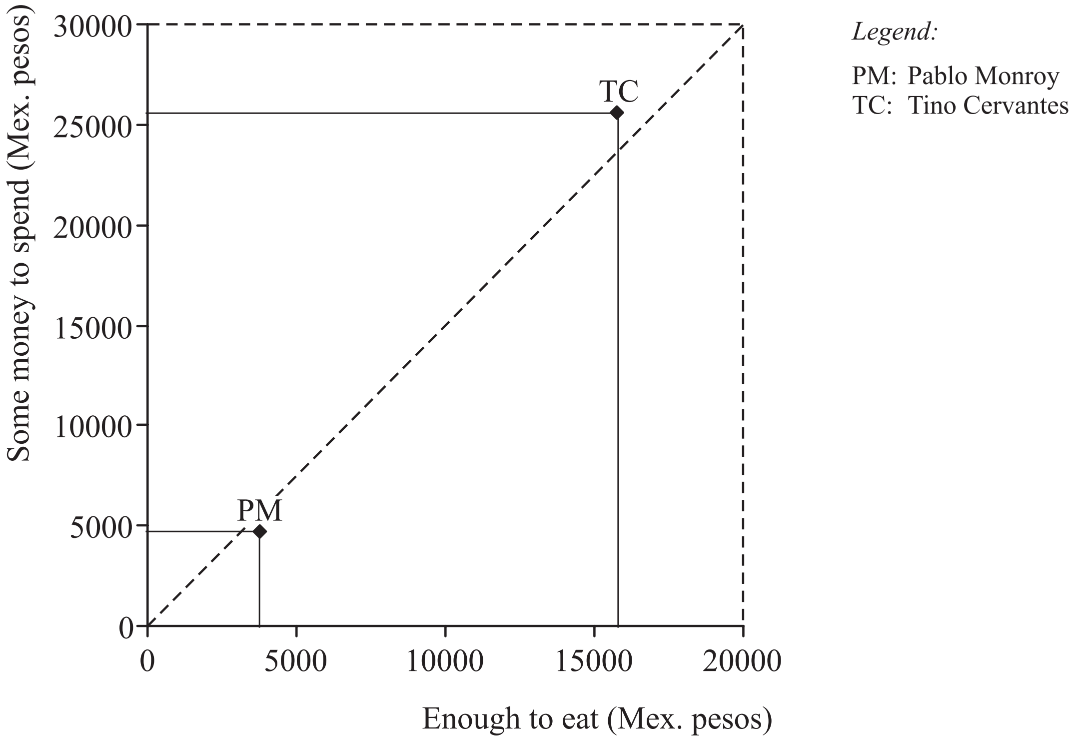
Similar to *Pobre* farmers, *Ganadero* farmers' performance can be understood by looking at availability of food and income, although no ranking exercise was performed with these farmers. Figure 4.9 presents the results of this analysis.

From the figure, it becomes clear that *Ganadero* farmers' economic behaviour regarding home and market consumption is very similar to that of the *Pobre* farmers' (see Figure 4.6).

Animal Care amongst Pobre Farmers

Compared to *Ganadero* farmers, *Pobre* farmers spend only little effort in animal care and pasture improvement. But, as with Pablo and Tino, we can observe more intensive and more extensive cattle management among the cattle owning *Pobre* farmers. Among our *Pobre* case study farmers who own cattle, Ismaël Ramón hardly invests in animal health, while Cosme Aragón does so regularly. However, Cosme uses his social networks in the community for doing so, and he only has to provide labour. He commented:

Figure 4.9 Farming performance of *Ganadero* farmers in 1998 (in Mexican pesos)



> *You already know that I know a lot of people, as I fix the light for many people. So, when they vaccinate or treat ticks, they notify me and let me take my animals to their corrals, without charging me anything.* [...] *We cannot afford to buy* [the medicine or the tick-treatment], *as the bottles are for a minimum of ten animals, and they are expensive; we only have a few animals. It is better to go with those who have many cattle.*

But it was not always like this, as he proceeded to explain. Changes are related to the technological developments in Cuzalapa:

> *Nowadays, it is much easier, as all* [the *Ganadero* farmers] *have their own corrals. So, it is much easier to apply the vaccine. I remember the times that one had to tie down the animals on the ground. Before it was harder, much more difficult; nowadays, most people already have their corrals and their tick-baths.*

The Extensification of the Agrarian System in Cuzalapa

Ganadero farmers pursue a type of farm development that is based on scale enlargement, as they are looking to obtain more cattle and land. This was noted in Chapter 3 and it also became clear from the two *Ganadero* farmer portraits. Noteworthy is that a process of extensification accompanies the *Ganadero* farmers' pursuit of scale enlargement, as already concluded in Chapter 3. The economic data presented in this chapter confirm this,[33] as is illustrated by Tables 4.23 and 4.24, which compare the resource bases of both *Ganadero* and *Pobre* farmers in relation to the total production that is obtained.

Table 4.23 Production in relation to available resources for *Ganadero* farmers in 1998 (in Mexican pesos)

	Total resources (a) ($)	*Total production (b)* ($)	*Tentative Resource Productivity (a/b)* (%)
Pablo Monroy	713,775	63,520	9
Tino Cervantes	2,532,895	102,000	4
Total	*3,246,670*	*165,520*	*5*

Table 4.24 Production in relation to available resources for *Pobre* farmers in 1996 (in Mexican pesos)

	Total resources (a)($)	*Total production (b)* ($)	*Tentative Resource Productivity (a/b)* (%)
Juan de la Cruz	20,860	14,320	69
Enrique Hernández	45,220	24,890	55
Constantino González	42,115	9,976	24
Cosme Aragón	61,050	12,579	21
Ismaël Ramón	50,520	6,216	12
Total	*219,765*	*67,981*	*31*

The results of the table indicate that *Ganadero* farmers have a more extensive farming practice. Based on the empirical data presented in Chapter 3 and this chapter, it may also be suggested that *Ganadero* farmers do not so much develop their farm, as use their belongings as a way of investing resources. Similar trends have been observed in other communities of the Reserve, as well as other parts of Central and South America, especially in the Amazonian region (see Louette, *et al.* 1997a; Kaimowitz 1996; Hecht 1992).

Conclusion

The above descriptions suggest that *Ganadero* and *Pobre* farmers basically follow the same farming strategy. Thus, one might conclude that *Ganadero* farmers, as well as *Pobre* farmers, are 'peasants'. They integrate partially in markets, or can distance themselves from them. The latter became clear when cattle prices decreased in the late 1990s. When prices started to decline, many *Ganadero* farmers sold fewer calves on the market and thus expanded herds within the farm. The difference between *Pobre* and *Ganadero* farmers lies in their socio-economic conditions. *Pobre* are poor peasants, while *Ganadero* farmers can be considered rich peasants.

4.5 Conclusion

In this chapter, I presented seven case studies of farmers to illustrate the regional farming style in Cuzalapa. While I described general farming patterns in Chapter 3; in this chapter, I focused on individual strategies of *Pobre* and *Ganadero* farmers for obtaining a livelihood. For situations such as the one in Cuzalapa, it appears that farming styles and livelihood strategies are complementary concepts for understanding farming dynamics, as they conceptualise diversity at different levels, i.e. community and farm level. Several conclusions can be drawn. Firstly, to fully understand farming diversity, attention must be given to off-farm and non-farm activities. Secondly, *Pobre* and *Ganadero* farmers mobilise resources in similar ways. This confirms the important notion of the regional farming style, i.e. the underlying logic is shared. Theoretically speaking, both *Pobre* and *Ganadero* farmers can be considered peasants, as they basically follow the same livelihood strategy. They differ in the sense that *Ganadero* farmers can sustain a livelihood and expand their resources much more easily than *Pobre* farmers. In other words, farm production and reproduction is assured amongst *Ganadero* farmers, while it is a constant challenge for *Pobre* farmers. This, in turn, appears to lead to new strategies that diverge from the original competence axis as presented in Chapter 3. In other words, it is an outcome of the transformations that have been taking place in the regional farming style.

Notes

1 All amounts mentioned in the following figures and tables refer to Mexican pesos. One U.S. -dollar was equivalent to 7.40 Mexican pesos in August 1996 and to 8.55 Mexican pesos in January 1998.

2 The *Pobre* case study families could not give a very clear overview of their daily income and expenditures, in contrast to the *Ganadero* families. This is probably related to their (low) educational level. To overcome this, they were given a specially designed bookkeeping form. In practice, it was mainly the eldest children that filled in the forms. For the *Ganadero* households, household income and expenditures were estimated during various discussions with their members. The author calculated all other values such as value of inputs and outputs in agriculture, cattle breeding, subsidies, etc.

3 This is related to its production: not all non-timber forest products can be harvested yearly.

4 For obvious reasons, all names that are mentioned in this chapter are fictitious.

5 The month in which the data were gathered was valued by Juan as a slightly better month than others, as there was a higher (wage and farm) labour demand in Cuzalapa.

6 The months of February/March and August/September are difficult months for many *Pobre* farmers, when stored maize runs out, and maize from the ongoing season is yet to be harvested.

7 At the end of the cropping season, one has a better overview of the quality and quantity of *pastura*. Thus, one can demand higher prices. But, the 'deal' with *Ganadero* farmers is already discussed (and often closed) during the cropping season.

8 Furthermore, a *coamil* normally is practised only on hillsides and not on plains, such as where Juan's field is located.

9 Whenever possible, farmers prefer selling *pastura* to cattle-breeders from Cuautitlán above those of Cuzalapa, as the former pay higher prices. They have more cattle than *Ganadero* farmers (and thus have a greater need for *pastura*), and therefore they are willing to pay more. However, it is more difficult to enrol them. They live a half-hour drive from Cuzalapa and there are relatively few cattle farmers from Cuautitlán who come to Cuzalapa to buy *pastura*.

10 The participation of the sons who have their own households varies per cropping season, depending on the *a medias* and renting arrangements they participate in, or the off-farm activities they undertake by themselves.

11 Normally, when a *comunero* dies, the wife first inherits the land. When she dies, the land is divided amongst the children. Most *comuneros* already make arrangements ahead of time to avoid family disputes over land.

12 Enrique's membership of the *Cacique* group helped to decrease the pressure regarding the road construction on his land.

13 A farmer from Autlán established a papaya (Papaya indica) plantation in Cuzalapa, and employed Enrique's sons. The farmer left Cuzalapa in 1998, abandoning the plantation. However, it was never totally clear how much of the sons' income was actually given to Enrique and his wife.

14 These changes in farming might indicate that the income obtained through labour is less important than suggested in Figure 4.2.

15 Constantino's mother purchased her first animal in 1974, and succeeded in increasing her herd up to ten animals. Due to death and sale, the herd decreased little by little. The last animal was sold in 1982. According to Claudia, Constantino was never that fond of the cattle, because they were very difficult to handle.

16 Mexican politics is dominated by three parties, PRI, PAN and PRD. The central-right PRI was in power from 1938 until 2000. The right-wing PAN took over power in 2000, while the left-wing PRD has never played a very important role in Mexican politics.

17 Cosme's father bought his first calf in 1965 with his own mother's money, and he got up to 18 animals in 1970s. Due to death and sale, the herd size decreased to the current four animals. Cosme's father maintains the remaining animals mainly in memory of his deceased mother.

18 Clementina bought her first calf in 1953. The total herd size increased up to 25 cows, but was heavily reduced to the current number due to cattle theft in the hillsides.

19 The Cuzalapa case illustrates that community mechanisms do not always stop or slow down the impoverishment of its members (Butler Flora 1990).

20 As a result of this uncertainty, farmers have developed alternative strategies for obtaining money at times, such as borrowing from the bank. This is the case for the PROCAMPO subsidy that is meant for raising agricultural productivity. In Cuzalapa, it is used to repay the bank loans obtained at the beginning of the cropping season, in order to be assured in time of cash money for buying chemical fertiliser and herbicides (Ortiz 2001).

21 Note that the comparison is a tentative one, as the conditions of the farmers are not totally similar and thus not totally comparable.

22 Consequently, the consciousness and appropriateness of their strategies obtain a different meaning, as some decisions are taken under the burden of crisis, i.e. when there are not many alternatives available (Zoomers, *et al.* 1998).

23 This programme provides subsidies (of $ 500.00 per ha per cropping season, i.e. approximately US$ 58.50), to stimulate pasture establishment. But at the time of the fieldwork, the farmers were paid only $200.00 (US$ 23.40).

24 According to Ana, (in July 1998) his sons had an amount of 150,000 pesos (approximately US$ 17,000) of remittances saved at a bank.

25 Pablo refers to the illegal appropriation of the communal lands by a few families, as described in Chapter 2.

26 In Cuzalapa it is quite common to sell animals to sons in order not to diminish the total herd size. Generally, the older, more unproductive cows are sold to other farmers, or middlemen. Selling cattle to relatives only takes place when the latter have sufficient financial resources.

27 Figure 4.6 only indicates the net profits. Costs to start and maintain the shop (in 1998) were 9,360 Mexican pesos (US$ 1,095).

28 There are many people who do not like (or respect, see Section 3.1) Tino and his family that much, as they are not that willing to help farmers in need.

29 Tino obtained his cattle through inheritance. But, of the current herd approximately 40-50% was obtained through remittances sent by his sons in the United States. These animals are *de jure* property of his sons, but managed in an *a medias* relationship with Tino. Furthermore, Tino has 40 animals *a medias* with a farmer in Canoitas, one of the hamlets of Cuzalapa.

30 It is common practice amongst Cuzalapa cattle-breeders to sell old and unproductive cows or young bulls in order to buy young (productive) calves that will strengthen the herd.

31 In Figure 4.8 only the net profits are indicated. Costs to start and maintain the shop in 1998 were $ 3,370.

32 In February 1998, Tino visited a (female) moneylender in El Durazno to borrow $ 5,000 pesos (approximately US$ 585.00). Tino explained:

Sometimes, one wants to buy pasture land, without having the available means [‘no tiene con que’]. So, I go to her [i.e. the moneylender] and she lends to me. Then, afterwards [i.e. one month later] I pay her. It is a quick way of obtaining money.

33 The results are tentative, due to the different time scales that underly the resource base (i.e. produce can be obtained yearly) and the total production (which is related to one cropping cycle). Besides, the farm conditions of Pobre (and Ganadero) farmers differ regarding cattle-property as stated before. Finally, the calculations are based on results from two different years, i.e. 1996 and 1998.

5 Farmers' Perspective on Natural Resources in Cuzalapa[1]

5.1 Introduction

In Chapters 3 and 4, I described the role of 'man' in co-production by discussing the regional farming style and farmers' livelihood strategies in Cuzalapa. In this and the next chapter, I will shift attention to the effects of co-production on 'living nature'. I will do so by discussing the Cuzalapa farmers' perspective regarding their environment and its diversity. In Chapter 1, I referred to the perspective of specific actors (such as Cuzalapa farmers) regarding the environment as 'resource diversity'.

Basic Perspectives on Resource Diversity in Cuzalapa

The scenic value of the Cuzalapa landscape is most impressive. But it also has considerable ecological value, as it comprises eleven vegetation types and many plant and animal species: 972 (vascular) plant species, some 280 bird species and 83 mammal species are distinguished (Vázquez *et al.* 1995; Guzmán *et al.* 1998; E. Santana 2000: pers. comm.; Iñiguez 1998). Thus, from a scientific perspective, Cuzalapa has a highly bio-diverse landscape.

Like scientists, Cuzalapa farmers make sense of their landscape and its diversity by assigning names to various parts of it. Farmers 'order' the landscape by distinguishing between several areas that have specific physical and socio-economic conditions. Their categorisation of the landscape does not focus on biologically defined ecosystems, but locally valued natural resources. These values include socio-economic conditions, notably the uses that can be made of the specific natural resources within a specific part of the landscape, as well as the access to these resources.

The farmers' ordering of the landscape is the outcome of a complex organisational process that includes the dimensions of time and space. These two dimensions are organised through farm labour in order to meet the farmers' needs and aspirations vis-à-vis living nature. Through this organisational process, the natural environment and its diversity become part of the farmers' life world (Mendras 1970; van der Ploeg 1987).

Cuzalapa farmers' familiarity with their landscape is illustrated by the names they have given to the different parts of it. For instance, a farmer can cultivate in a *playa* (flat terrain, mostly alongside a river or a stream), which, according to site-specific characteristics, can be named *El Coco* or *Palo Blanco*, or *Llano Grand.* Similar, his land or cattle can be located in the hills, named *La Ventana*, *Changavilán*, *Tierras*

Encontradas, or *Zacahuatla*. In addition to the names of specific locations, farmers also express their familiarity with the landscape by making distinctions between specific land-use zones and types of forest vegetation, often in relation to land ownership. For example, they talk about *coamil* (shifting maize cultivation field) or about *matorral* (a type of secondary vegetation) owned by the farmer *Fulano*, which in turn, can be located on the hill *Torogoma*. The boundaries between the different parts in the landscape are not always that clear, especially if one ventures beyond the lower parts of the valley and into the hills. At first sight, farmers have a somewhat confusing definition of their natural environment, at least for outsiders. But on closer scrutiny a definite knowledge of landscape patterns associated with diversity in resources becomes obvious. In order to differentiate these local views from scientific views, I will refer to these local views as resource diversity.

Farmers' Classification of the Landscape

During fieldwork I analysed Cuzalapa farmers' perceptions of resource diversity at landscape level.[2] Resource diversity at landscape level consists of a number of units, which can be understood by distinguishing two dimensions: 1) land-use and 2) forest cover. A number of locally recognised land-use zones and types of forest vegetation (including secondary vegetation) can be distinguished, which will be described extensively in this chapter.[3] In addition to the farmers' landscape knowledge, their species knowledge in relation to the different resource units will be described.

The underlying (farmers') criterion for differentiating the land-use zones is the potential of parts of the landscape to be used for a specific purpose. The land-use zones can be further subdivided into a number of subzones, according to site-specific conditions and management practices. Criteria for differentiation of forest cover are vegetation characteristics (including characteristic species), use and management practices that have taken place, as well as site-specific conditions. Farmers divide the existing forest vegetation in the community into two broad categories, i.e. low and high woodland, both of which can be subdivided further into various types. From a scientific perspective, low woodland can be considered secondary vegetation, while high woodland can be regarded as forest ecosystems.

Each one of the different resource units has a specific place in farming practice as a whole. They represent the outcome of farmers' co-ordination of different natural cycles, which are characterised by specific spatial conditions and time horizons (van der Ploeg 1987). The co-ordination of these natural cycles opens up possibilities for farming practice. At the same time, through farmers' actions living nature is co-produced, which, in turn, leads to specific (cultural) landscapes and diversity in natural resources. Furthermore, Cuzalapa farmers' resource diversity is part of a knowledge-practice-belief complex. This complex consists of

> *'a component of local observational knowledge of species and other environmental phenomena, a component of practice in the way people carry out their resource use activities, and further, a component of belief regarding how people fit into or relate to ecosystems'* (Berkes *et al.* 2000:1252).

In other words, resource diversity can be considered part of the regional farming style. It represents both notions and knowledge regarding living nature and their translation into concrete action. Their interaction is particularly important:

> *'It is in this way that the l'art de la localité* (the art of the specific) *emerges, i.e. a knowledge system that enables male and female farmers to understand, to co-ordinate and develop the production process in such a direction that it, whenever possible, coincides with their own interests and perspectives'* (van der Ploeg 1987:11, own translation).

Figure 5.1 presents a schematic representation of resource diversity and its specific units, according to the two dimensions of differentiation (land-use and forest cover) mentioned above.

The land-use zones will be described in detail in Section 5.2, while the different forest vegetation types will be described thoroughly in Section 5.3. The description of the types of forest vegetation will be more extensive and detailed than the description of land-use zones, because the factors impacting on land-use differentiation were already described exhaustively in Chapters 2, 3 and 4.

It is important to note that Cuzalapa farmers do not see land-use zones and forest vegetation as completely separate categories, because the boundaries between them are not always clearly distinguishable. The 'overlap' between land-use zones and types of forest vegetation can be understood as the outcome of transformations in the landscape caused by farmers, which, in turn, have resulted in land-use zones with adapted tree and forest covers (Wiersum and Gómez-González 2000). Note that for the sake of simplicity, the different resource units will be characterised as having relatively clear boundaries.

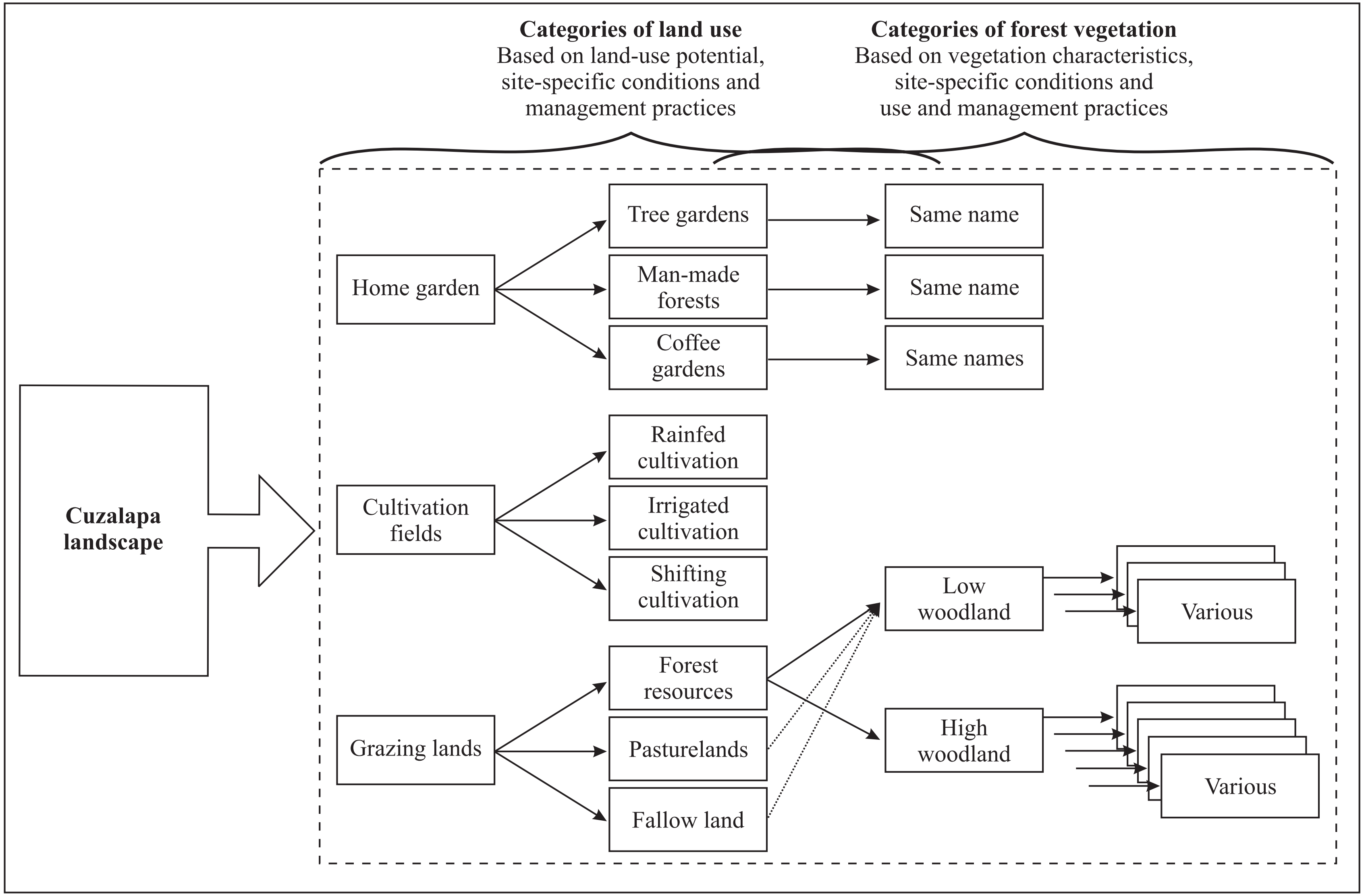
5.2 Farmers' Classification of Land-Use

In general, farmers distinguish between three land-use zones in the Cuzalapa landscape: 1) *huertos,* i.e. tree gardens, 2) *yuntas*, i.e. cultivation fields and 3) *agostadero* land, i.e. grazing lands. At this level of natural resource use, no specific land-use category for forest vegetation is distinguished. Forest vegetation is seen as a subcategory of *agostadero* land. This illustrates that within each of these land-use categories further land-use subzones are distinguished by farmers, which I will describe below. This subdivision is based on the site-specific conditions and management practices that are applied.

Huertos

The first main land-use zone is *huertos* (tree gardens, plural of *huerto*), which are also called *huertos solares* or *huertos familiares.* Three categories of tree gardens can be distinguished. The first category can be found in the majority of compounds in Cuzalapa. It consists of relatively simple multi-story tree gardens that provide the farmers and their families with fruits, including bananas and mangos, as well as a number of herbs, which are used for home remedies (the so-called '*remedios caseros'*) or to give a special flavour to food. They also provide shade and can have an ornamental purpose through the flowers they produce.

Figure 5.1 A schematic representation of farmers' resource diversity in Cuzalapa


Categories of land use
Based on land-use potential, site-specific conditions and management practices
Categories of forest vegetation
Based on vegetation characteristics, site-specific conditions and use and management practices
Cuzalapa landscape
Home garden
Cultivation fields
Grazing lands
Tree gardens
Man-made forests
Coffee gardens
Rainfed cultivation
Irrigated cultivation
Shifting cultivation
Forest resources
Pasturelands
Fallow land
Same name
Same name
Same names
Low woodland
High woodland
Various
Various

The second category of *huertos* refers to older tree gardens that can be considered man-made forest. One man-made forest in Cuzalapa, called *la Huerta de los Reyes,* is communal property. It is located at the south-eastern part of the village of Cuzalapa. *La Huerta de los Reyes* was originally planted by the Reyes family, who owned the property. It appears that the Cuzalapa directive board took over control of the garden after the family left the community. In a general assembly, it was decided that all the farmers and their families could use the garden, however, only for their own needs. It is prohibited to sell any of its fruits.

The third category of *huertos* is tree gardens that are dominated by coffee plants. The Cuzalapa farmers call these tree gardens *cafetales* (plural of *cafetal*). Banana and several (fruit) trees are also present, next to the coffee shrubs. The *cafetales* differ in this way from the other categories, which mostly provide food and herbs.

Species diversity in all categories is moderate to high, but considerable differences can be found in the number of species present. Furthermore, many smaller animals are kept in the *huertos*, such as chickens, ducks, turkeys, or hogs. Many of these home gardens were established by previous generations of Cuzalapa farmers, as most of the trees are aged. Table 5.1 presents the various species found in the home gardens.[4]

Table 5.1 Species found in home gardens (adapted from Gerritsen 1995:22)

Common name	*Scientific name*
Aguacate	Persea americana var. americana
Cafecillo	Coffea arabica
Canelillo	Clethra rosei
Coco de aceite	Orbignya cohune
Guayaba	Psidium guajave
Lima	Citrus limette
Limón	Citrus limon
Mamey	Ponteria mammosa
Mango	Magnifera indica
Nance	Byrsonima crassifolia
Naranjo	Citrus sinensis
Platanillo	Calathea soconuscum
Platano pera	Musa spp.
Tepeguaje	Lysolima acapulcense
Tescalama	Ficus morazaniana

Yuntas and Coamiles[5]

The second main land-use zone consists of the cultivated crop fields, i.e. the *yuntas* (plural of *yunta*) and *coamiles* (plural of *coamil*). Three categories can be distinguished, based on site conditions and management practices. As mentioned in Chapter 2, farmers distinguish between rain-fed fields (the *yuntas de lluvia)*, fields that can be irrigated (the *yuntas de riego*), and shifting cultivation fields (the *coamiles*). All these fields are found in the lower parts of the valley near the village Cuzalapa and near the hamlets. The irrigation fields are found alongside the different rivers and streams in Cuzalapa, while the rain-fed fields and *coamil* fields are generally found farther away from the rivers and on the lower hillsides. On the *yuntas*, seasonal crops are cultivated, and trees grow both in and around the fields. Table 5.2 presents species diversity in the *yuntas* fields. Unlike the *yuntas*, *coamil* fields normally do not contain trees, as the great majority of tree species have been removed through the practice of cutting and burning.

Table 5.2 Species found in the cultivation fields (Gerritsen 1995:21)

Common name	*Scientific name*
Achiote	Bixa orellana
Aguacate	Persea americana var. americana
Aguacatillo	Nectandra glabrescens
Anona	Annona reticulata
Arrayán	Psidium guineense
Chivatillo	Zanthoxylum arborense
Guácima	Guazuma ulmifolia
Guamúchil	Pithecellobium dulce
Huisache	Acacia cochliana
Mamey	Ponteria mammosa
Nance	Byrsonima crassifolia
Parota	Enterolobium cyclocarpum
Tescalama	Ficus morazaniana

Agostaderos

The third land-use zone which farmers distinguish in the Cuzalapa landscape is called *agostadero* land, or more commonly *agostaderos* (plural of *agostadero*). *Agostaderos* are locally perceived as uncultivated areas where animals, mostly cattle, can graze or browse. A farmer commented on the origin of the word and its meaning:

> *Agostadero comes from 'agostar'* [i.e. to graze, to pasture]. *It is all those areas where our cattle find their food.*

A great variety of *agostadero* fields exist, depending on the existing vegetation cover and former land-use practices. Broadly speaking, three categories can be distinguished: 1) fallow lands, i.e. the *yunta de lluvia*, *yunta de riego*, or *coamil* left fallow, 2) natural or established pasture lands, i.e. the so-called *pastizales* (plural of *pastizal*) and 3) forest vegetation, i.e. the so-called *monte* and *arbolera*. There is considerable variety in *agostadero* in the community depending on vegetation cover and former land-use practice, but also on location. *Agostadero* fields can be found in the flat and low-level lands, as well as in the hills (the so-called *cerro*).

On flat lands and lower slopes, *agostaderos* consist of the cultivation fields that have been left fallow, or which have been converted into meadows. Consequently, *agostaderos* can be temporary or permanent. An *agostadero* is temporary when a farmer has plans to clear it for cultivation in the near future. The duration of these temporary *agostaderos* depends on the type of field. The rain-fed and irrigation fields are cultivated at least once a year. Thus, in these fields *agostaderos* are established only for one or a few cropping cycles. Shifting cultivation fields are used only one or two cropping seasons and are then left fallow for five to six years. Temporary *agostaderos* are normally found in the lower and flatter parts of the valley, but some are also located on the hillsides. The more remote fields are generally used for practising *coamil*.

Farther uphill, the number of trees and shrubs increases, i.e. *monte* and *arbolera* become more dominant. This increase, however, is not necessarily related to altitude. One can find hills in Cuzalapa where natural meadows are present at higher altitudes than oak forests, which is related to the specific site conditions. Thus, some parts of the *agostaderos* in the hills are areas covered with pastures, while other parts contain woodlands. Hence, tree diversity and density within the *agostadero* lands varies from low to very high. The tree species found in pasture land are similar to those found in the agricultural fields (see Table 5.2). More extensive species lists for *agostaderos* covered with *monte* and *arbolera* are presented in the next section and in Annexes 2-7.

Not all forest vegetation is necessarily suitable for grazing. Site-specific characteristics determine the suitability for grazing purposes, which is related, above all, to its fodder and browsing potential. However, farmers can modify the characteristics of forest vegetation. Opening-up the forest stand to increase the available light, for example, makes it possible to sow exotic pasture species. Consequently, pasture availability and quality increase.[6]

Farmers name the *agostaderos* located on the higher slopes *agostaderos de esquilmo* or simply *esquilmos* (plural of *esquilmo*). These used to be the communal grazing lands.[7] Now they are almost all in the hands of relatively few (*Ganadero*) families, although there are still two *agostaderos de esquilmo* on the south-western and south-eastern side of the village of Cuzalapa, which are still used collectively by a number of *Pobre* farmers.

Social Definition of Agostadero

The folk concept *agostadero* can be considered *'not* [totally] *clear, nor* [very] *precise'('clairs et précis')* (van Kessel 1990:87).[8] The same is also true for other concepts used by Cuzalapa farmers: they can entail a number of variations regarding the specific subject being referred to. The concept of *agostadero* clearly illustrates this, as it entails different categories of grazing lands. These concepts can be flexibly applied to a wide range of different (ecological) situations, thus permitting a full understanding of living nature as part of farming practice and natural resource management (van Kessel 1990; van der Ploeg 1987). This understanding of different settings (including their natural cycles) can create new perspectives on time and space as they permit the use and management of new ecological niches. These new perspectives are embedded in the labour process and the wider socio-economic and political context (van der Ploeg 1987).[9]

Although the folk concepts, such as *agostadero,* are *'not clear, nor precise'*, they are perfectly understandable for farmers. But, they require an *'active interpretation of living nature, based on practical experiences* […] (*ibid.*:143, own translation), *as well as the ability to read their different appearances in daily practice'* (van Kessel

1990:82, own translation). Thus, these folk concepts are of strategic importance, as they allow the farmers to interpret their working situations (i.e. the ecological setting farmers work and live in) in an adequate and meaningful way and to link this with their life worlds (van der Ploeg 1987).

Table 5.3 presents an overview of the farmers' classification of *agostadero* lands, including their geographic locations. As explained above, this classification system illustrates not only the (ecological) variety in *agostadero* lands, but also the different meanings of the folk concept.

Table 5.3 A generalised characterisation of agostadero land (based on Gerritsen 2000:16)

Class	*Subclass*	*Location*
Fallow land	*Yunta de lluvia*	Lowlands (*llanos, playas*)
	Yunta de riego	Lowlands (*llanos, playas*)
	Coamil	Lowlands and hills
Pasture land	Natural	Lowlands and hills
	Newly established	Lowlands and hills
Secondary vegetation and forest	Several (Section 5.3)	Lowlands and hills (*esquilmos*)

5.3 Farmers' Classification of Forest Vegetation

In the foregoing section, I explained that farmers classify their landscape according to its potential for a specific land-use. Consequently, the above-described diversity in land-use zones emerges. Farmers further distinguish a number of forest vegetation types that form part of *agostadero* land, i.e. within *monte* and *arbolera* vegetation. This subdivision of *monte* and *arbolera* is based on vegetation characteristics (including characteristic species), site-specific conditions, and use and management practices that have been applied. I will describe the different types in detail in this section.

Social Definition of Monte and Arbolera

Monte is a folk concept for forest vegetation in Cuzalapa that has a direct link with farming practice. According to an elderly farmer in Cuzalapa:

> [...] *monte is all the land where one can cultivate* [or where one has cultivated].

Monte refers to all those areas with either secondary vegetation or forest, which one clears and burns for practising (shifting) maize cultivation. It also refers to places where one has cultivated, and thus cleared and burned in the past. *Monte* is present in the lower and hilly parts of the community. It can be considered as one of the visible outcomes of co-production.

Arbolera (which literally means tree stands) is another folk concept used by Cuzalapa farmers to refer to forest vegetation in their community and which is related to the concept *monte*. *Arbolera* refers to those areas in the hills with forest vegetation that have been left (relatively) undisturbed, or that are not that suitable for farming. The presence of tall trees is used (as one of the indicators) to differentiate between *monte* and *arbolera*. According to farmers, *arbolera* has more tall trees than *monte*.

Furthermore, the understorey vegetation is denser in *monte* vegetation than in *arbolera* vegetation. This is due to the more closed canopy of *arbolera* vegetation. Because less light is available at soil level, it is more difficult for (certain) species to become established.

In practice, the differences between specific *monte* and *arbolera* types is not always that clear, at least not in the lower and slightly hilly parts of the community. The following statement by a farmer regarding oak forest illustrates that a forest vegetation type can be both *monte* and *arbolera*.

> *Arbolera is where you cannot cut trees. The government prohibits this.* [...] *You know, where the trees are thicker than* [the diameter size of] *5 cm* [as defined by the Mexican Forest Law]. [...] *The encinera* [i.e. oak forest] *uphill cannot be cut anymore.* [...] *The other* [*encinera,* located nearer to the village] *is monte, as you can still cultivate there.*

This statement makes it clear that the significance of *monte* and *arbolera* are related to their role in farming practice and natural resource management. Similar to the concept of *agostadero*, these concepts can be considered fluid, which allows them to be used in different contexts.

Other reasons also explain the fluidness of *monte* and *arbolera* concepts. Firstly, although not all *arbolera* sites are suitable for cultivation, such as certain oak and pine forests, these types of forest vegetation are sometimes cleared for cultivation. This is caused by the land-distribution situation. There are farmers, for example, who only own land located uphill and therefore have no choice but to try and cultivate there. Cattle raising has also caused many transformations in both *monte* and *arbolera* vegetation, as the demand for pasture has increased. Forest exploitation in the past also changed the species composition and structure of many forests (Jardel and García 1987). Nowadays, secondary species are dominant in the forests, as many tall trees have been removed. Finally, forest law, which became effective after the establishment of the RBSM in 1987, prohibits forest clearing. Consequently, as a farmer (who lives near the RBSM nuclear zone and, thus, is more affected by the Reserve's restrictions) commented:

> [Nowadays] *it is only the small monte that we have here. Before, one could cut the tall trees and the tall monte could then grow again. But now, the government prohibits that.*

Amongst farmers, differences exist regarding the use of the terms *monte* and *arbolera*. There are farmers who use the terms interchangeably, while others make more explicit use of either *monte* or *arbolera.* This apparent differential use of terms might be related to the establishment of the Reserve, as its zoning rules prohibit forest clearing. Thus, theoretically, much *monte* vegetation has become part of the *arbolera* vegetation, i.e. forest that is not cleared for farming.

Differentiation of Monte and Arbolera

There are several types of *monte* and *arbolera* vegetation, as a farmer explained:

> *You see, there are agostaderos that have ocoteras* [i.e. pine forests]. *There are also agostaderos that have robleras* [i.e. oak forest, plural of *roblera*] *or tepeguajeras* [plural of *tepeguajera,* i.e. forest of *tepeguaje*; Lysolima acapulsense]. *These are found in small patches and are good for fences. There are also agostaderos that have encinos* [plural of *encino,* i.e. oak trees]. *Sometimes they are mixed with roble* [i.e. another oak tree species] *or pino* [i.e. pine tree]. [...] *The agostaderos are different according to where you find them. They are not all the same: some have already been planted with pasture, while others are still pure monte.*

Farmers refer to woodland classes (*clases de monte*), when they talk about the various types of *monte* and *arbolera. Monte bajo* are scrubs, thickets and bush lands, whereas *monte alto* and *arbolera* (forests) refer to taller vegetation (*arbolera* being the tallest trees). In other words, vegetation height determines the differences, in addition to the characteristics of the vegetation.

Within the categories of *monte bajo* and *monte alto/arbolera* farmers further distinguish several vegetation types. Figure 5.2 illustrates this, while Table 5.4 presents the scientific nomenclature.[10,11] Farmers distinguish these types, according to their characteristics as scrubs or a tree stand. These types can be further subdivided according to the dominating tree species present, which are called *clases de madera* (wood classes) by the inhabitants of Cuzalapa. Farmers name the different types of *monte* and *arbolera*, above all, after the dominating (tree) species.

Table 5.4 Monte and arbolera types and their scientific equivalents

Common name	*Common name*	*Scientific name (according to Vázquez and Cuevas 1995)*
Monte bajo	*Matorral*	Secondary vegetation
	Barbecho	Secondary vegetation
	Other *monte bajo*	Secondary vegetation
Monte alto	*Roblera*	Oak forest (deciduous)
	Encinera	Oak forest (subdeciduous, mesophytic, or with the presence of pine species)
	Ocotera	Pine forest or pine-oak forest
	Monte alto/arbolera en las barrancas y los arroyos	Tropical deciduous forest or Tropical subdeciduous forest (including gallery forest)
	Other *monte alto* and *arbolera*	Tropical deciduous forest, tropical subdeciduous forest (including gallery forest), or cloud forest

Farmers can talk about the different *monte* types in varying ways according to their size. For example, farmers can call a tree stand *matorrilla*, which is a small, just established *matorral*; or *matorrera*, which is a relatively higher, longer established *matorral*; or just *matorral*, which is neither particularly big or small. Furthermore, farmers can include the management of succession in the name they give to vegetation. For example, a *pastizal barbechado* is a meadow where *barbecho*-vegetation has just been removed. As such, farmers cannot only go into more detail on the spatial characteristics of a specific forest resource, but they can also introduce a time dimension as well as refer to management practices applied in the past. Finally, farmers can use synonyms for the different types of *monte bajo* and *alto* and *arbolera*. Table 5.5 illustrates this.

Figure 5.2 Farmers' classification of secondary vegetation and forest

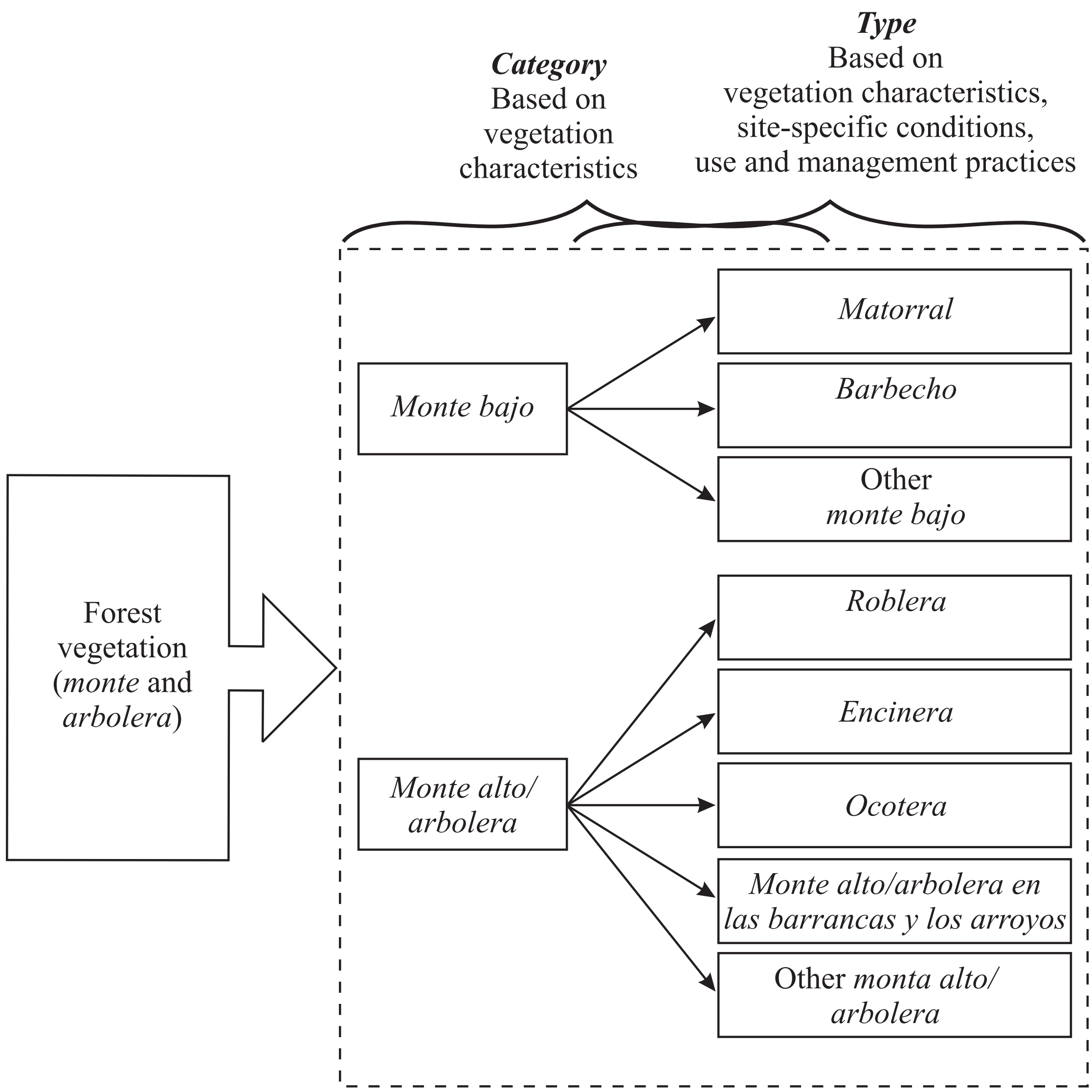


Table 5.5 Cuzalapa farmer classification of *monte* and *arbolera* vegetation

Monte Classes	*Synonyms*	*Woodland subclasses*	*Classes of woods, shrubs, or other species*
Monte bajo	*Monte chico, Monte delgado, Chaparrál, Chapón*	*Matorral, Barbecho,* Other *monte bajo*	Various, named after dominant species
Monte alto and *Arbolera*	*Monte grueso, Monte grande, Monte virgen*	*Roblera, Encinera, Monte alto and arbolera en las barrancas y los arroyos, Ocotera,* Other *monte alto* and *arbolera*	Various, named after dominant species

Following the line of thought of Wiersum and Gómez-González (2000), the different *monte* and *arbolera* types can be considered *'intermediate* [forms of] *forest* [and secondary vegetation] *types'*, which:

> *'may be defined as any mixed tree stand, in which species composition has been adapted to suit human needs, but which are still 'nature analogous'* […] *in the sense of preserving most of the structural characteristics and ecological processes prevailing in natural forest'* (*ibid.*:2).

Intermediate forests are thus characterised by having a direct link with the other component of land-use systems, i.e. farming.

In the following sections, I will present a more detailed description of the different types of *monte bajo* and *monte alto* and *arbolera*. It must be noted that in practice, the different *monte* (*bajo* and *alto*) and *arbolera* classes are not always that easily distinguished, as they can be found in the same geographical space, either next to one another, or underneath one another. I will discuss this in Section 5.4.

Basic characteristics of Monte Bajo

Monte bajo vegetation is characterised by an average height of one and a half to two metre. The scrubs and trees can grow taller, but when their height exceeds about five metres, the vegetation is no longer called *monte bajo,* but *monte alto*. *Monte bajo* (low scrubs) is also known by farmers as *monte chico* (little scrubs), *monte delgado* (thin scrubs), *chaparral* (stocky scrubs), or *chapón* (small scrubs). *Monte bajo* starts to grow when cultivation fields are left fallow, especially *coamiles,* or when pasture lands are no longer maintained, i.e. when the practice of burning is discontinued. It will also grow in places with *monte alto* or *arbolera* that are disturbed through natural or human-induced causes.

Farmers distinguish several types of *monte bajo*, of which *matorral* and *barbecho* are particularly widespread in the lower parts of the valley. *Other monte bajo* types consist of either disturbed *monte alto*, or species that are not found in *matorral* or *barbecho* vegetation. These less significant types will be named 'other *monte bajo'* from here onward.

Matorral, Barbecho and other Monte Bajo

Matorral is the first type of *monte bajo* and it consists of small bushes, varying in height from one to three metres. Its growth never exceeds this height. Often, it regenerates through sprouts (the so-called *rebrotes*). According to the farmers:

> *A matorral does not serve us at all. Besides, it does not grow high.* [...] *It is the monte that one cuts because it disturbs the pasture* (Merino and Gerritsen 1999: 9, own translation).

The exact height and density of *matorral* bushes depends on age and site-specific characteristics, such as soil fertility, or the degree of shade provided by the existing trees in the field. It also depends on management practices that have been applied by farmers, such as the use of herbicides and fire, or the number of times a *matorral* has been cut through the years. In some places *matorral* vegetation is quickly taken over by *barbecho* secondary vegetation (see below), while in other places *matorral* can be present for several years. The latter *matorrales* (plural of *matorral*) are generally found on poorer soils, or soils that have been more intensively managed, especially with the use of fire.

Matorrales can be found on all soil types present in Cuzalapa, such as white soils (*'suelos blancos'* or *'arenosos'*, i.e. Entisols), red soils (*'suelos rojos'*, i.e. Inceptisols), brown soils (*'suelos café'*, i.e. Mollisols) or black soils (*'suelos negros'*, i.e. Mollisols).[12] According to Cuzalapa farmers, it is the lack of soil fertility ('barrenness' of the soil) that determines the presence of *matorral* vegetation. Farmers talk about these soils as *'stony and dry'*, as *'thin'*, and as *'no good for maize'*. According to Sandoval and Martínez (1995) the majority of the soils in the lower parts of Cuzalapa (and where most *matorrales* can be found) are of limited suitability for maize cultivation, principally due to low soil fertility and the risk of laminar erosion.

Farmers name the various *matorrales* after the most frequently found species. Many *matorrales* are dominated by only one or a few species. Table 5.6 presents the species most frequently found in *matorral* vegetation, as recognised by farmers.[13] Annex 2 contains a list of all *matorral* species mentioned by farmers during the fieldwork.[14]

Table 5.6 Most frequent *matorral* species, according to farmers (Merino and Gerritsen 1999:10)

Common name	*Scientific name*
Capitana	Verbesina greenmanii or Crotalaria mollicula
Cuatalaca	Caseria arguta
Tacote	Podachaenium eminens
Escoba	Melochia tomentosa or Baccharis pteronioides
Serrilla	Mimosa albida
Tacote amargo	Calea urticifolia
Cadillo	Triumfetta gonophora
Cirial	Unidentified species
Guayavilla	Psidium guineense
Tepame	Acacia macracantha or Acacia pennatula
Chan	Salvia mexicana
Bejuco negro or *Bejuco prieto*	Cordia spinescens
Bonetillo	Casearia arguta
Zacate	Cyperus hermaphroditus

Matorral can also be present as understorey vegetation in the different *monte alto* vegetation types. Here, it does not develop further, mainly due to lack of light. Often, it is dominated by the same species as the one dominating the *monte alto*. *Matorral* as a folk concept thus can have two different meanings. On the one hand, it can refer to secondary re-growth. On the other hand, it can consist of natural forest regeneration. Note that Table 5.6 and Annex 2 refer to *matorrales* consisting of secondary growth and not natural forest regeneration.

Barbecho vegetation is the second type of *monte bajo* and it is characterised by farmers as:

> [Those places] *where monte delgado* [thin woodland] *grows that one cuts to grow maize* (Merino and Gerritsen 1999:11, own translation).

Another farmer characterised *barbecho* as:

> [agricultural] *fields covered with monte chico* (*ibid.*:11, own translation).

Farmers refer with *barbecho* to fields cleared of *monte bajo* in order to start cultivation, and the secondary vegetation that starts to grow when cultivation fields are abandoned after the harvest. These two meanings for the same folk concept clearly illustrate the time-space relation related to farming, which I mentioned before. From now onward, I will focus on the latter meaning of *barbecho*, i.e. as a type of secondary vegetation.

Originally, *barbechos* (plural of *barbecho*) were directly related to *coamil* fields, as this type of vegetation establishes itself between three months to five years after *coamil* cultivation fields are abandoned. In principle, *barbecho* vegetation can also grow in the irrigation and rain-fed (semi-permanent) fields. In practice, however, this is less probable, due to the frequent use of these fields. Fallow periods on irrigation and rainfed fields are so short (i.e. one cropping season) that *barbecho* vegetation hardly has enough time to become established. It is therefore mainly the *matorral* vegetation type that grows on these fields.

Barbecho vegetation can reach a height of up to five metres, depending on the site-specific conditions. Generally, *barbechos* are found on the lower slopes of the community, as stated by a farmer:

> [...] *there where the hills start* (*ibid.*:11, own translation).

According to farmers, the lower areas receive sufficient nutrients, which come down from the *monte* vegetation located uphill, such as oak forest. Therefore, these parts of the hills are most suitable for (shifting) maize cultivation. *Barbecho* vegetation grows mainly on the black soils (i.e. Mollisols). But, there are also *barbechos* found on the higher slopes, sometimes even in sites less suitable for cultivation. The reason for the presence of *coamiles* and *barbechos* in these places is the land-distribution situation. It is mainly *Pobre* farmers who practise *coamil* in these less suitable places.

According to farmers, tree species that establish themselves in *barbecho* vegetation are cut easily, due to the relative softness of their wood. They also characterise *barbecho* vegetation as cool, although the soil gets dry and warm after clearing. *Barbecho* regenerates through both sprouts and seeds, depending on the species. Table 5.7 presents the most frequent species found in *barbecho* vegetation, as recalled by farmers. Annex 3 contains a list of all *barbecho* species mentioned by farmers during the fieldwork.

Table 5.7 Most frequent *barbecho* species, according to farmers (Merino and Gerritsen 1999:13)

Common name	*Scientific name*
Guázima	Guazuma ulmifolia
Cabeza (de negro)	Annona purpurea
Hormiguillo	Cordia alliodora
Tepame	Acacia pennatula or Acacia macracantha
Roble	Quercus spp.
Guayabo	Psidium guajava
Rosa morada or Madera	Tabebuia rosea
Mora	Conostegia xalapensis
Huizcolote	Acacia hindsii
Tepeguaje	Lysiloma acapulcense
Cuatalaca	Casearia arguta
Parota	Enterolobium cyclocarpum
Juaniquil peludo	Inga eriocarpa
Guaje	Acacia malicenta
Encino	Quercus spp.
Cirial	Unidentified species

Apart from *matorral* and *barbecho* vegetation, more types of secondary vegetation are found in the community, i.e. 'other *monte bajo'*. I will consider 'other *monte bajo*' as the third type of *monte bajo*, even though it embraces different types of vegetation. Generally speaking, it refers to the secondary vegetation that can be found in areas unsuitable for cultivation, but whose vegetation cover does not exceed a height of (maximum) ten metres. Some of these *monte bajo* vegetation types are disturbed *monte alto*. But, there are also areas that are neither *matorral*/*barbecho*, nor *monte alto*. This *monte bajo* vegetation is mostly named after the dominant plant species present. Examples of other *monte bajo* are the *rasquera* (*monte bajo* with *rasca* -Morisonia americana-), small parts of *otateras* (plural of *otatera*) with *otate amargo* (Guadua paniculata).

Basic Characteristics of Monte Alto and Arbolera

Monte alto and *arbolera* refer to all forest vegetation that exceeds a height of five metres and that is older than five to ten years. It consists of forest and old secondary vegetation. Similar to *monte bajo*, farmers use several synonyms for *monte alto*, the most common of which being *monte grueso* ('thick' or 'dense' woodland). Cuzalapa farmers use *monte alto* and *monte grueso* interchangeably. Reference is made to *monte virgen* (virgen woodland), when *monte alto* is relatively undisturbed, i.e. after a period of at least 50 years. Thus, *monte virgen* is related to *arbolera* vegetation. However, farmers state that *monte virgen* hardly exists anymore in Cuzalapa, due to forest exploitation in the past.

Monte alto and *arbolera* are called *bosque* when the vegetation cover is dense and high. The folk concept *bosque* refers, above all, to the condition in which a specific *monte alto* is encountered. In other words, much depends on the management practices in the past and present. A farmer commented:

> *Bosque is those parts of the hills, where you have big trees, where there are a lot of vegetables and where it is always cool. These are the parts that are difficult to enter; there is a way in, but there is no way out.* […] *In the agostaderos, there are tree stands* [*'arboleras'*]*, but it is not bosque, at least in my opinion.*

According to farmers, *bosque* is found in the higher elevations of the community. The most important *bosque* area left which farmers mention is located within one of the Reserve's strictly protected core zones. This gives rise to the idea that the term *bosque* as a folk concept might be a hybridisation of local and scientific concepts (cf. Jansen 2000; Foster 1960) But, there are also other areas (in the community) that are considered as *bosque* and that are located outside the core zones. These are all located in the higher elevations of the community. The following statement also makes the difference between *bosque* and *monte* very clear:

> *Look, I kept on thinking the other day about what you asked me. A lot of you people* [i.e. those related to the RBSM] *think that everything is bosque, that the barbecho is bosque. But no, the bosque is* [for example] *the ocotera* [i.e. pine forest] *in the higher parts.* […] *For you, everything is bosque here in Cuzalapa. For us, it's different, one knows where it was cultivated before.*

Similar to the *monte bajo* vegetation, farmers distinguish between different types of *monte alto*. They distinguish *roblera* and *encinera* (forests dominated by oak trees) from *ocotera* (forests dominated by pine trees), as well as from *monte alto* and *arbolera en las barrancas y los arroyos*, i.e. forests in ravines and alongside streams uphill. Similar to *monte bajo*, farmers distinguish a number of types of *monte alto* that are named after the dominant species. Not surprisingly, the same is true for *arbolera* vegetation. I will refer to them as 'other *monte alto* and *arbolera*' from here onward.

It may be clear from the above that the different types of *monte alto* and *arbolera* can be *bosque,* depending on their specific characteristics. But, it is above all *arbolera* that is named *bosque*. The only exception is *roblera* vegetation. All farmers interviewed clearly stated that *roblera* can definitely never be *bosque*, due to the dryness of the growth site and the height of trees, which are generally small, compared to the other *monte alto* types.

The next section presents a more detailed description of the different *monte alto* and *arbolera* types.

Roblera, Encinera, Ocotera and other Monte Alto and Arbolera

Roblera vegetation is the first type of *monte alto* or *arbolera* that is distinguished by farmers. It is forest vegetation dominated by deciduous oak trees (<u>Quercus</u> spp.). Farmers sometimes refer to this type as *roblada*, but this term is less common than the term *roblera. Robleras* drop their leaves in spring, i.e. during the hottest months of the year. In disturbed sites, oak trees mix with other tree species, but oak is still the dominant species. Table 5.8 presents the most frequent species, as mentioned by

Cuzalapa farmers. Annex 4 contains a list of all *roblera* species mentioned by farmers during the fieldwork.

Table 5.8 Most frequent *roblera* species, according to farmers (Merino and Gerritsen 1999:17)

Common name	*Scientific name*
Roble blanco	Quercus gluacessens or Quercus magnolifolia
Roble prieto	Quercus peduncularis
Lechuguilla	Agave maximiliana or Agave attenuata
Encino	Quercus gentryii
Roble	Quercus spp.
Tepeguaje	Lysiloma acapulcense
Nance	Byrsonima crassifolia
Juaniquil peludo	Inga eriocarpa
Capitana	Verbesina greenmanii
Roble amarillo	Quercus magnolifolia
Cocolmecas	Smilax moranensis

Robleras can be both dense and open stands. Generally, denser *robleras* are found at middle and higher altitudes, while the open stands are located at lower altitudes, where farming is more intensive. Under the *roblera* cover, *matorral* and natural and established pasture can be found, especially in the open *robleras*, or in the open spaces within a dense *roblera*. According to farmers, *robleras* can be found on all types of soils, although it appears to be present more frequently on black (i.e. Mollisols) and red soils (i.e. Inceptisols).

According to farmers, many of the present *roblera* stands were damaged during past forest exploitation. Many of the trees are also suffering from a disease, which appeared after a draught period (of about eight years) that took place some 20 years ago. The farmers also mention a beetle (locally called *comegen*) that is eating the wood and damaging the trees.

Farmers call the second type of *monte alto* and *arbolera encinera*. Similar to *roblera* vegetation, *encinera* vegetation is dominated by oak trees. But, *encineras* (plural of *encinera*) do not drop their leaves during the hottest months of the dry season. They do so at the beginning of the rainy season and only for a very short period. Thus, *encinera* vegetation is green during the hottest period of the year. *Encineras* are dominated by subdeciduous oak species. Although oak trees dominate, other tree species can also be found in these stands. Table 5.9 presents an overview of the most frequently mentioned species. Annex 5 contains a list of all *encinera* species mentioned by farmers during the fieldwork.

Encinera vegetation can be found in the lower, middle and upper elevations of the community. Contrary to *robleras*, *encineras* are characterised by farmers as being fresher and having more humidity. Under the oak tree canopy both *matorral* and natural or established pasture can be present, but less so than under *robleras*, due to the reduced light availability. Similar to *robleras*, *encineras* can be found on almost all soil types, although it appears that black (Mollisols) and red soils (Inceptisols) are most frequent. Farmers mention the decomposition of the oak tree leaves as the main explanation for the thick humus layer.

Table 5.9 Most frequent *encinera* species, according to farmers (Merino and Gerritsen 1999:21)

Common name	*Scientific name*
Encino asta	Quercus xalapensis or Quercus elliptica
Encino blanco	Quercus gentryii
Encino prieto	Quercus peduncularis
Azajar	Styrax ramirezii
Lechuguilla	Agave maximiliana or Agave attentuata
Colcomecas	Smilax moranensis
Roble	Quercus spp.
Encino roble	Quercus elliptica
Cacao	Magnolia iltisiana
Fresno	Fraxinus uhdei
Nogal	Juglans major var. glabrata

Farmers name the third type of *monte alto* and *arbolera ocotera*, which is dominated by pine trees (Pinus spp.). This vegetation is found in the highest and coolest parts of Cuzalapa, often on the ridges of the mountains. *Ocoteras* are found mainly on red soils (i.e. Inceptisols) that have a relatively good texture. Natural pasture as well as *matorral* can be present, although the pine tree needles (the so-called *'ocochal'*) make the establishment of understorey vegetation difficult. This is due to the changes they induce in the acid level of soils. Similar to the other *monte alto* types, several species can be present, in addition to the dominating pines. An important species is the *encino*. Table 5.10 mentions the most frequent species found in the *ocoteras*. Annex 6 contains a list of all *ocotera* species mentioned by farmers during the fieldwork.

Table 5.10 Most frequent *ocotera* species, according to farmers (Merino and Gerritsen 1999:25)

Common name	*Scientific name*
Ocote	Pinus psuedostrobus
Oyamel or pinabete	Abies religiosa
Nogal	Juglans major var. glabrata
Cacao	Magnolia iltisiana
Fresno	Fraxinus uhdei
Lechuguilla	Agave maximiliana or Agave attantuata
Zarzamora	Rubus sp.
Encino	Quercus castanea
Cedro or cedro blanco	Cupressus lusitanica
Tinhuica or pinhuica	Unidentified species
Capulín	Zanthoxylum arborescens or Ardisia compressa

Forest vegetation found in ravines and streams differs from the above-mentioned monte alto and arbolera types, because of the species encountered. These so-called *monte alto/arbolera en las barrancas y los arroyos* are mostly tropical deciduous and subdeciduous forest (including gallery forest) and can be considered the fourth type of *monte alto* and *arbolera*. Farmers also refer to these forests as *joyas* (literally, jewels) when talking about their vegetation and the abundance of water found there.

Generally, the *monte alto/arbolera en las barrancas y los arroyos* do not have one dominant species, but are characterised by a great species diversity. Table 5.11 presents the species most frequently mentioned by farmers. Annex 7 presents a list of all species in *monte alto/arbolera en las barrancas y los arroyos* mentioned by farmers during the fieldwork.

Table 5.11 Most frequent species in *monte alto/arbolera en las barrancas y los arroyos*, according to farmers (Merino and Gerritsen 1999: annex 7)

Common name	*Scientific name*
Encino	Quercus spp.
Roble	Quercus spp.
Nogal	Juglans mayor var. glabrata
Azajar	Styrax ramirezii
Fresno	Fraxinus uhdei
Cedro	Cedrela odorata
Ocote	Pinus sp.
Lechuguillo	Agave maximiliana or Agave attentuata
Clavellina	Psuedobombax palmeri
Árbol María	Calophyllum brasiliense var. rekoi

Finally, similar to *monte bajo* vegetation, several types exist amongst the *monte alto* and *arbolera* vegetation, which are different from the above mentioned. They can be considered the fifth type of *monte alto* and *arbolera* and I will refer to them as 'other *monte alto* and *arbolera*', as stated before. Generally speaking, they only represent small areas in the community. For example, a *mojotera* is *monte alto* where *mojote* (Brosimum alicastrum) predominates, while a *rascera* is dominated by *rascas*. A *monte alto* dominated by *Guázima* (Guázima ulmifolia) is called *Guazimera*, while a *Parotalera* is *monte alto* dominated by *Parota* (Enterolobium cyclocarpum).

Warm and Cold Monte and Arbolera

Cuzalapa farmers do not only differentiate *monte* and *arbolera* according to their dominant species, but they can also describe them according to their temperature. A farmer commented:

> *There is warm and cold monte, and monte that has both qualities. This depends on the stems and leaves. The robleras are a warm monte, while encinares are a colder monte. Ocote is a tree that has two qualities; it has fresh leaves, but a warm stem. The nogal is a cold tree, and can be found near water.*

The temperature of *monte* (*bajo* and *alto*) and *arbolera* can refer to both ecosystems and individual species, and is determined by several factors. To start with, the temperature of *monte* and *arbolera,* or their dominating species, depends on the altitude at which they are found. Another farmer commented:

> *The La Ventana hill is a warm hill* [‘*es un cerro caliente’*]*, while the El Gaviláncillo hill is a cold one. You know, that one* [i.e. El Gaviláncillo] *is higher.*

Apart from the altitude, sun exposure and soil temperature also play a role. According to farmers, soil and species must be compatible:

> […] [the temperature also] *depends of the quality of the soil, or the quality of the tree.* […] *A cold plant cannot grow in a warm soil.*

Finally, the temperature of the different *monte* and *arbolera* vegetation can vary according to seasons, which is related to the period that trees drop or change their leaves. The following comparison between *roblera* and *encinera* vegetation illustrates this:

> *The roblera drops it leaves during the months of April and May, while the encinera drops its leaves from September 15 until the end of October. During the dry season, it* [i.e the encinera] *has new leaves. Therefore, it feels cool. The roblera feels very hot during the months of April and May.* […] *You know, all the trees have their moment to change their leaves.*

The temperature of *monte* and *arbolera* can be considered an additional dimension of farmers’ perception of their natural environment, which is expressed through the (bipartite) concepts of warm and cold. Similar to the other Cuzalapa farmers’ concepts, this concept allows them to categorise a wide range of different ecological settings. The concepts are applied to different aspects of living nature, such as: soils, species, ecosystems, or hills, as the examples in this section illustrate. Furthermore, they make sense in relation to farm labour, as they permit the farmer to cope with natural processes (van Kessel 1990; van der Ploeg 1987).

5.4 Farmers’ Knowledge about Resource Diversity

In the foregoing section, I described how Cuzalapa farmers view their landscape, including diversity in natural resources. This description showed that farmers are ‘knowledgeable’ about their landscape and its different parts and they are ‘capable’ of making changes. They do so through farming practice. In other words, the landscape can be considered the visible outcome of co-production. In this section, I will further discuss Cuzalapa farmers’ view of resource diversity at landscape level. I will do so to further enhance the reader’s understanding of Cuzalapa farmers’ knowledge and actions regarding resource diversity.

Differentiation in Farmers’ Knowledge about Resource Diversity

Knowledge on resource diversity and the species contained in each one of its units differs amongst farmers, based on their age, gender, and distance from a specific land-use zone or type of forest vegetation. It also depends on the frequency of visits that a farmer makes to the different parts of the landscape. Generally speaking, male farmers appear to have a better knowledge of the natural resources in the higher elevations of the community than female farmers. Older farmers also appear to know more than young farmers. Three farmers commented:

> *Going into the hills is like going to the city. If one does not know the way, one does not find the roads.* [...] *A lot of the youngsters do not go anymore, amongst others reasons because of the Reserve.* [...] *Before, the people went into the hills more and with the whole family.* [...] *Because people used more ocote* [Pinus sp., i.e. pinewood used as fuel that is found at higher elevations]. *In those times, there was no light available.*

> *We do not live with the modern things, but with the old ones, as our ancestors did. Like me; my father taught me everything.* [...] *The young people do not know anymore, they go to El Norte* [i.e. The United States] *and when they get back, they don't remember anything anymore.*

> *The people who come here* [i.e. up into the hills] *are people with cattle or people who want to hunt deer. There are a lot of them. The others hardly ever come here.*

Differences in knowledge of plant species amongst farmers were first described by Benz *et al.* (1994), who studied ethno-botanical knowledge on useful plant species in the Sierra de Manantlán. According to their research,

> *'use of the plant resource in the RBSM appears to be a function of relative taxonomic abundance of the area's flora'* (*ibid.*:34).

They further concluded that: *'many informants appear to know much about a few species and a little about a large number of species'* (*ibid.*:36). Kreutzer *et al.* (1998) described gender differences regarding knowledge of natural resources. Kreutzer *et al.* found differences between the knowledge of men and women, which appeared to be related to natural resource type and location.

To understand differences in knowledge of the natural environment, Jansen (2000) suggests using the terms 'social' and 'technical heterogeneity'. He states that:

> *'social-economic differences, conflicts, monopolisation of information, differential relations with labour objects and unequal access to natural resources* [understood by Jansen as social heterogeneity] *can lead to important differences in knowledge within farmer communities.* […] *This, in turn, is related to a technical heterogeneity, due to* […] *big variations in soils and microclimates. To be able to work in these situations farmers are obligated to develop knowledge that very specifically relates to the cultivation of their* [own] *field'* (*ibid.*:326, own translation).

Social and technological heterogeneity, thus, can be seen as the outcome of the translation of the general notions underlying the regional farming style into the specific (social and natural) conditions of each farm. Several of the explanatory factors mentioned by Jansen also apply to Cuzalapa, such as socio-economic differences, conflicts, unequal access to natural resources, and environmental variety.

Knowledge of Species

Farmers possess a vast body of ecological knowledge, which relates to physical differences in the landscape, specific species distribution, the relation between physical aspects and species distribution and succession processes on abandoned land, growth characteristics of specific species, etc. This body of knowledge is embedded in the different farming domains and expressed through a number of folk concepts. Cuzalapa farmers are also knowledgeable about insects, reptiles, mammals and birds, although fieldwork did not explicitly address these themes. From fieldwork it appears that farmers do not explicitly relate animal species to specific resource diversity units. Usually, several resource diversity units are mentioned, which can be explained by the mobility of the fauna (Merino and Gerritsen 1999). Table 5.12 presents a preliminary list of animals mentioned by farmers, as well as their distribution within the Cuzalapa landscape.

Table 5.12 Some animals and their distribution, as mentioned by farmers (based on Merino and Gerritsen 1999:27)

Common name	*Scientific name*	*Distribution*
Venado	Odocoileus sp.	Hills
Jabalín	Tayasu tajacu	Everywhere
Tejón	Nasua narica	Everywhere
Mapache	Procyon lotor	-
Armadillo	Dasypus novemcinctus	Everywhere
Ardilla	Sciurus colliaei	-
Conejo	Sylvilagus floridanus	Matorral
Paloma	Zenaida sp.	Everywhere
Chichalaca	Ortalis poliocephala	Barbecho
Choncho	Penelope purpurascens	Higher elevations
Pajaro carpintero	Piculus spp.	-
Iguana	Iguana iguana or Ctenosaura pectinata	Lower elevations
Zorra	Urocyon cinereoargenteus	Everywhere
Coyote	Canis latrans	Middle and higher elevations
Tlacuache	Didelphis virginiana	Everywhere
Gallinita	Dendrotyx macroura	Everywhere
Leon	Puma concolor	Higher elevations
Tigre	Pantera onca	Higher elevations
Culebra	Drymarchon corais	Lower and middle elevations
Víbora	Crotalus basiliscus	Lower and middle elevations
Saltamontes	(Ortoptero)	Everywhere

Farmer's knowledge of their natural environment is not unlimited but bounded. Two farmers commented on this:

> *There is a lot of monte one knows, but there is also a lot of strange monte. I do not know how it is called. You know, I know it by sight, not by name.*

> *We know those parts of the hills where we enter. We do not know those where we never go.*

The boundaries of farmers' knowledge are set by co-production, i.e. by both farming practice and the characteristics of the natural resources. They are also set by other factors, such as the current land-distribution situation and the creation of the RBSM. These factors can be understood as forming part of the wider political-institutional context, in which co-production is embedded.

Succession Management and Landscape Patchiness

The different resource units that farmers distinguish do not exist in isolation, but are logically related to one another. Analytically, three types of relationships can be distinguished: 1) between land-use zones, 2) between land-use subzones and forest vegetation, and 3) between different types of forest vegetation. These relationships are both socio-economic and ecological. These relationships can be considered the outcome of farmers' management of succession patterns, by which I refer to the active role that farmers play in managing the different land-use zones and the forest vegetation types. I thus use the term succession in the broad sense. I do not only refer to ecological succession, but also to succession in land-use activities. Both can be recognised in the landscape. Furthermore, with the management of succession, reference is made to the dimension of time in resource diversity. The following comment illustrates this for *coamil* and secondary vegetation that grows after field abandonment:

> *In good soils, we used to cultivate coamil,* [and] *the next year we would have an escobera* [i.e. matorral dominated by Escoba: Melochia tomentosa]*, then a tacotal with tacote rodellón* [i.e. matorral with Podachaenium eminens]*, and than later a barbecho of Hormiguillo* [Cordia alliodara]*, Guázima* [Guazuma ulmifolia]*, Huizcolote* [Acacia hindsii]*, Guayabo* [Psidium guajave] *and Huizache* [Acacia cochliacantha] [would start to grow] (Merino and Gerritsen 1999:9, own translation).

Through farming activities farmers induce a succession pattern that leads to the creation of land-use zones and the transformation of forest vegetation. The exact nature of this succession pattern depends not only on farmers' actions, but also on natural (i.e. ecological) conditions. Through the management of succession, the different resource units obtain their specific (spatial) place on the farm and in the landscape. In other words, patchiness emerges in the landscape, which refers to the dimension of space in resource diversity (assessed at landscape level).

Farmers can manipulate the different succession patterns in order to transform resource diversity (as a whole) to better suit their needs and aspirations. This manipulation is also reflected in the landscape. In other words, farmers can actively influence the patchiness of the landscape. Theoretically, influencing landscape patchiness can go in two (ideal) directions. On the one hand, the landscape can be transformed in divergent and specified units that play specific roles for farmers and farming practice and that can open up new possibilities for succession management. These new possibilities can further transform and specify the existing resource diversity units. Enrichment of resource diversity is the outcome. On the other hand, the opposite situation can also take place, i.e. impoverishment of resource diversity. This can happen when farmers direct farming activities towards obtaining one or few products of the landscape. Both situations can also take place at the same time. A farmer acknowledged this:

> *A matorral below an encinera grows quickly up to a barbecho, when one cuts the trees* [of the encinera]. […] *When one lets the monte grow after having been cultivated, an encinera can grow up again, or a roblera.* [...] *In the lower parts, where many* [farmers] *cultivate and where the animals go* [i.e. where cattle graze]*, it does not 'walk'* [*'camina'*] *anymore* [i.e. the monte does not grow anymore].

The creation of landscape patchiness can be considered one of the most visible forms of co-production. But the degree of co-production varies for the different parts of the landscape, as well as within these parts. This is due to the multiple time horizons that can be distinguished. Mendras (1970) described this as follows:

> '*A tree takes at least thirty years to grow. Between the three weeks of a chicken's growth and these thirty years, the diversity of cycles in agricultural production is astonishing. It furnishes an infinite variety of combinations among which the choice is delicate, but decisive for the profitability of the farm' (ibid.*:72).

Regarding resource diversity (as a whole), different degrees of co-production can be observed within land-use zones, as well as between land-use zones and forest vegetation. The time horizons of crops and pasture are different from each other, as well as from those of trees, secondary vegetation and forests. Differences between the forest vegetation types can also be observed, as certain tree species grow quicker than others. Regarding forest vegetation, farmers will state that farming practice has (had) a bigger impact on *monte bajo* (i.e. secondary vegetation) than *monte alto* and *arbolera* (i.e. forests). A farmer commented on this:

> *Going uphill, one sees monte* [which is] *much greener because of the strength of the soil, and also because there are fewer cows.*

The underlying logic that guides the creation and transformation of the different landscape units are the uses that can be given to each one of them. However, farmers also attribute intrinsic values to the landscape, and the community's natural resources are considered by many farmers to be a natural heritage ('*patrimonio natural*'). In fact, the conflict over forest exploitation in the 1980s was driven in part by the need to protect the community's natural heritage. A farmer commented:

> *What we have* [i.e. natural resources]*, we have because we have looked after it for those who follow* [i.e. the new generations].

The Organisation of Time and Space

I stated above that succession management and landscape patchiness refer to the dimensions of time and space in resource diversity. These dimensions do not exist in isolation, but are logically organised through farming practice and farmers' management of forest vegetation. In Figure 5.3, a schematic visualisation of succession management of land-use zones and forest vegetation is presented. The figure shows that succession (understood in the broad sense) can take place between home gardens, cultivation land and grazing lands as well as between *monte bajo* and *monte alto* and *arbolera* vegetation. As stated earlier, this succession is both humanly-influenced and ecological.

Figure 5.3 Succession management of resource diversity units

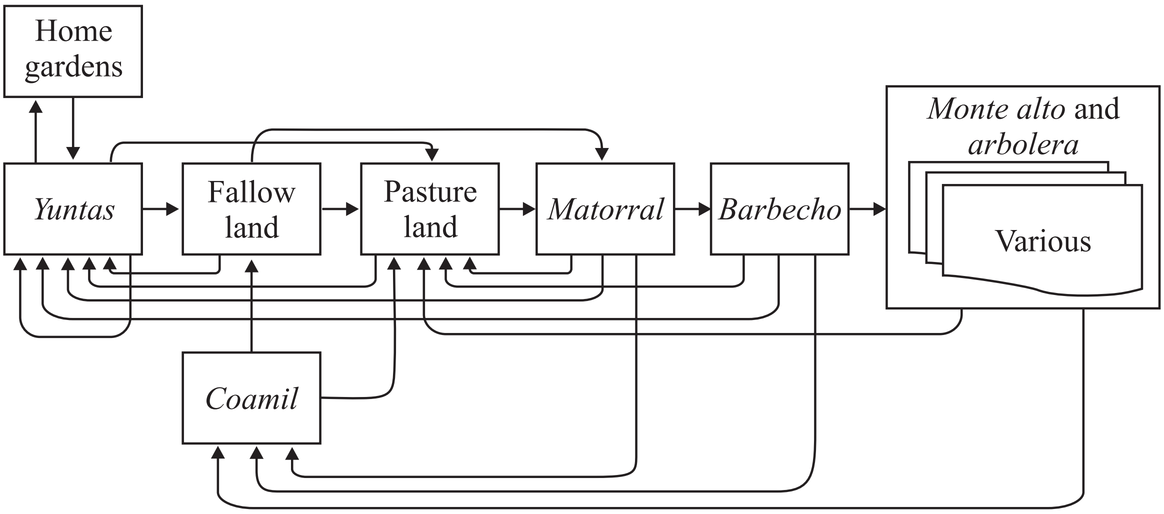


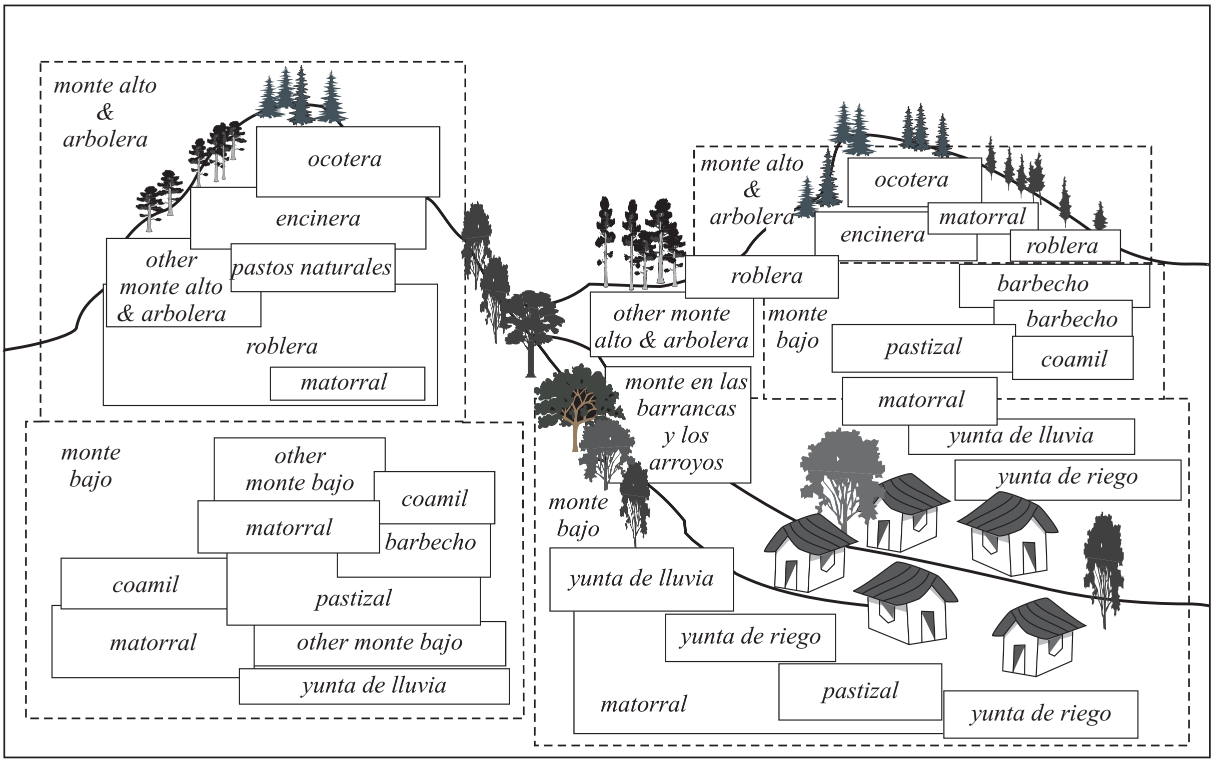
Figure 5.3 shows that the resource diversity units are related (in time) to each other, although the hierarchy that exists between the different succession relationships is not indicated. Figure 5.3 thus represents an ideal situation, without distinguishing the relative importance of each one of the resource diversity units for farmers. I will discuss the most important succession processes (i.e. succession hierarchy) in detail in Chapter 6. Due to the multiple time horizons that underlie the different units that compose resource diversity, a highly diverse landscape is both maintained and constructed through farming and natural resource management.

The succession depicted in Figure 5.3 used to take place primarily in relation to *coamil* fields. Today, however, one can observe it also in rain-fed and irrigation fields (that have been left fallow) and pasture lands (that are no longer maintained). There are, however, different degrees to which this takes place. Whether or not the succession pattern fully takes place depends to a great extent on the specific (biophysical) conditions at a certain site. It also depends on the *monte* species that became established after an area was abandoned, i.e. species characteristics. Some *monte* types are more aggressive than others. In fact, certain types can displace others, as in the following example of two *monte alto* vegetation types, called *rascera* and *nancera* by farmers:

> *Look, the rasca vieja* [i.e. *monte alto* of *rasca vieja;* Curatella americana] *goes seeding itself* [*'se va semillando'*]. *Before, there used to be a lot of nances* [Byrsonima crassifolia] *here, but the rascera finished with the nancera* [i.e. *monte alto* dominated by *nance*].

The organisation of resource diversity units in time also implies an organisation in space, due to the different time perspectives in succession management. This is illustrated by Figure 5.4, which schematically represents the spatial dimension of resource diversity, using the folk concepts of Cuzalapa farmers. It presents the patchiness of the landscape in Cuzalapa, as perceived, created and transformed by Cuzalapa farmers.

Figure 5.4 Resource diversity in the Cuzalapa landscape through farmers' eyes



The organisation of space is dependent on the time horizons underlying the different units, the area's specific ecological characteristics and farmers' decision-making. The following statement illustrates the importance of the ecological characteristics of the site and (indirectly) the farmers' decision-making:

> *The barbechos are* [always] *at a lower altitude than the robleras. That is why they* [can] *collect the decomposition* [*'pudrición'*] *of the roblera and why the milpa* [i.e. maize cultivation field] *can grow beautifully. Some of the decomposition also goes to the irrigation fields, through the* rivers (Merino and Gerritsen 1999:11, own translation).

A number of socio-economic factors can also be distinguished, such as the availability of labour and financial resources to carry out certain activities. Chapter 4 illustrated this.

Traditionally, a direct relationship existed between land-use and land quality in Cuzalapa. Farmers used to cultivate on the best soils, letting cattle graze on soils less suitable for maize production. Land quality can be considered as one of the (local) criteria underlying the organisation of time and space in resource diversity. But, there are now cases in which land-use is (partially) disconnected from land quality; a reorganisation of time and space has been taking place. For example, cows are held in forested areas with low fodder availability, while *coamiles* are sometimes cultivated on poor soils. This is due in part to the current land-distribution situation, and the increased availability of external inputs and new tools, such as herbicides, chemical fertiliser, or a motor saw.[15] The disconnection between land-use and land quality has also increased through the expansion of cattle-breeding activities. The following statement illustrates farmers' awareness of this problem:

> *I have a little field that is within a roblera. It is there where I go hitting the maize into the ground* [*'clavando el maisito'*]*, but it* [i.e. the *roblera*] *is not very suitable for that, as there are many stones and the soils are thin.*

The disconnection between land-use and land quality will be discussed further in Chapter 6.

Biodiversity in the Cuzalapa Landscape

In the beginning of this chapter I mentioned various studies that indicated the presence of a high biodiversity in the landscape of Cuzalapa. By now, it can be suggested that this biodiversity is embedded in the resource diversity (as a whole), which is actively created, maintained and transformed by farmers. This, in turn, suggests that resource diversity is one of the social carriers of the biodiversity that is present in the Cuzalapa.

5.5 Conclusion

In the foregoing sections, I described the Cuzalapa landscape, its diversity and its dynamics. Clearly, this landscape cannot be understood as a collection of isolated and static land-use and vegetation units, but rather as the highly interrelated and dynamic outcome of co-production. The organisation of time and space by farmers is crucial in this process, which is further shaped by the local ecological, socio-economic and political settings.

Table 5.13 Cuzalapa farmers' perspective on resource diversity

Landscape level	Primary focus	↓ *Gradual Contextualisation on use property*
Species level	Secondary level of focus on useful species	
Genetic level	Crop varieties/cultivars	

Five conclusions can be drawn from this chapter. Firstly, the richness of the empirical data illustrated that farmers are knowledgeable about the different resource diversity units in their community. The farmers' perspective on resource diversity appears to be primarily focussed on the landscape level and secondly on useful species. The use of different crop varieties and cultivars gives an indication of diversity at genetic level.

Table 5.13 presents a summary of the perspective of Cuzalapa farmers on resource diversity.

Secondly, the different resource diversity units are socially organised by farmers in time and space. In other words, each one of the units has its specific place in the different domains of farming and, as such, contributes to farm production and reproduction. Thirdly, farmers are knowledgeable about the ecological and socio-economic relationships that exist between and within the different landscape units. Fourthly, some light was shed on the social processes that currently influence the dynamics of resource diversity in Cuzalapa, although I will present a more in-depth discussion of this in Chapter 6. It will become clear that they are of great importance in the construction of resource diversity at landscape level. Finally, reference has to be made to the historical conformation of resource diversity, as described in Chapter 2. In other words, resource diversity as it is known today is the result of the accumulated effects of farming as co-production.

Notes

1 Parts of this chapter are published as Gerritsen (1995, 1999 and 2000). Angela Merino, a former forestry student of the University of Cordoba in Spain performed an important part of the fieldwork that underlies Section 5.3. Of the two publications that emerged from this collaboration, Merino and Gerritsen (1999) will be referred to in the text, as I heavily draw from it. I acted as co-director in the second publication (Merino 2000), which is Angela's B.Sc.-thesis.

2 Theoretically, resource diversity can be analysed at different levels, similar to the biodiversity concept. Benz *et al.* (1990) present an analysis of the most important endemic species in the RBSM. From Louette (1994) ideas can be obtained regarding the analysis on a genetic level. Note that the levels of analysis only make sense when they coincide with an actor's perceptions.

3 Note that I use forest vegetation in the broad sense, i.e. to include different types of secondary vegetation. The primary characteristic is the presence of a woody component.

4 Cuevas *et al.* (1992) and Vázquez *et al.* (1995) were used for species identification during fieldwork. The support of personnel of the Laboratory of Flora of IMECBIO, especially Luis Gúzman and Francisco Santana Michel, is gratefully acknowledged

5 The term *yunta* literally means 'pair' and originally referred to a pair of oxen, which later were replaced by horses and mules in many regions of Mexico. Thus, *yuntas* are fields that can be cultivated by animal traction, being either oxen or horses and mules. The term *coa-mil* refers to fields (i.e. *milpa*), where maize is sown by using a *coa*, an agricultural tool that somewhat resembles a spear. Generally speaking, *yunta* fields are larger than *coamil* fields, because farmers can prepare larger plots of land using oxen than using a *coa*.

6 This already indicates the malleability of resource diversity, which I will discuss in Chapter 6.

7 I discussed this in Section 2.5.

8 As van Kessel (1990) also stated, these concepts are confusing outside their specific context. In other words, they only obtain meaning in a specific knowledge-practice-belief complex.

9 It is not only the natural cycles that can create new time perspectives in farming and natural resource management. One can also identify a number of social cycles, such as demographic changes of the farm family, or migration patterns (van der Ploeg 1987).

10 The scientific nomenclature was obtained during a field visit in 1999, when two farmers, an ecologist and the author jointly visited the different *monte* and *arbolera* types and discussed their characteristics. Based on this discussion, Table 5.4 was elaborated.

11 Different (scientific) classifications exist regarding vegetation types in the RBSM. The classification used in Table 5.4 is a phytogeographic one (Vázquez and Cuevas 1995). It was chosen to familiarise the reader with the different units of Cuzalapa farmer resource diversity. See the RBSM management programme for a more detailed classification that was elaborated specifically for biodiversity conservation (IMECBIO 2000b).

12 See Martinez and Sandoval (1993) for an extensive (scientific) description of Cuzalapa soils.

13 Tables 5.6 to 5.10 and Annexes 2 to 7 were compiled by asking 30 randomly selected farmers about the plant and tree species that they know in the different *monte* vegetation types. The tables also indicate the frequency in which the different species were mentioned. The first tree species listed in the table was thus mentioned by the most farmers.

14 Using statistical analysis, Bader (2001) concluded that 58 per cent of the farmers (interviewed by her) know an average of 6 to 15 (superior plant) species in riparian vegetation in Cuzalapa. She also showed a positive correlation ($\alpha = 0.001$) between species frequency mentioned by farmers and species frequency found in this same vegetation type. Finally, she showed that not all species mentioned by farmers are necessary limited to the vegetation type asked for. Farmers also tend to mention species with a high utility, such as, for example, certain fruit species (*ibid.*:47).

15 In other words, the organisation of time and space is also related to the multi-dimensional nature of natural resources, which I explained in Chapter 1.

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6 Farmers' Use and Management of Natural Resources in Cuzalapa[1]

6.1 Introduction

In Chapter 5, I described resource diversity in Cuzalapa at landscape level. It became clear that farmers are knowledgeable about their landscape and that the organisation of time and space underlying resource diversity is related to farm production and reproduction. In this chapter, the focus shifts to Cuzalapa farmers' use and management of resource diversity within the land-use and forest cover dimensions. Attention will also be paid to the differences between *Pobre* and *Ganadero* farmers. Thus, this chapter further enhances our understanding of resource diversity.

In the following sections, I will first discuss the use farmers make of the landscape and the management practices they apply to its different parts. Then, I will describe the transformations in landscape diversity that took place during the second half of the twentieth century, with an emphasis on the 1990s. I will show that Cuzalapa farmers' resource diversity is highly dynamic. Both use and management of the landscape have changed through time.

As in Chapter 5, I will pay special attention to woody components in resource diversity, i.e. the land-use and forest vegetation types. Furthermore, the discussion on forest vegetation will be limited to *matorral*, *barbecho*, *roblera*, *encinera*, *ocotera* and *monte alto* and *arbolera* in ravines and alongside streams. I limited (this part of) the fieldwork to these types for three reasons. Firstly, these vegetation types are easier to identify in the field, which facilitated discussions with farmers. Secondly, they represent the majority of all *monte* and *arbolera* surface area. Finally, 'other *monte bajo'* and 'other *monte alto* and *arbolera'* comprise various vegetation types, which are not easily generalised.

6.2 The Use of Natural Resources in Cuzalapa

For Cuzalapa farmers, the different resource diversity units are important for both the products and the environmental services they can provide. The land-use zones and forest vegetation types are used for many purposes, the most important of which is to obtain food, water, wood and non-timber forest products. These categories can be broken down into a wide range of specific products, such as maize, beans, meat, milk and other dairy products, medicines, forage, wood for construction, firewood, wood for agricultural tools, ornaments, and fibres. Gúzman *et al.* (1998) mention 209 useful forest vegetation species, representing some 21 per cent of all flora of the Sierra de

Manantlán. Furthermore, hunting, provision of grazing spaces and material, the contribution of trees and forests in cropping, and soil and water conservation are all important for farmers. A farmer explained this:

> *Well, the trees give fruits and wood when we need it. Besides, they retain the water, which we need for irrigating the plants in the dry season.* [...] *The trees give shade to the animals when they are eating the rastrojo* [i.e. crop residues]. *And when one needs a pole for fencing, or for one's house, one cuts a tree.*

Finally, forest resources are considered to be part of the community's heritage; they are valued as nice places for a picnic, and they contain useful species for several of the indigenous-religious feasts in Cuzalapa.[2]

Since the mid-1980s Cuzalapa farmers have used forests only for domestic purposes. Commercialisation of wood does not take place, while non-timber products are sold only in very small quantities. There are two reasons for this. On the one hand, many (mostly *Pobre*) farmers in Cuzalapa oppose commercial forest exploitation due to negative experiences in the past. On the other hand, the establishment of the biosphere reserve in the Sierra de Manantlán has made forest management possible only under certain (legal) conditions, which have not been fulfilled in Cuzalapa.

This section takes a closer look at the various uses of the different landscape units in Cuzalapa. The following sections, which focus first on land-use zones and then on forest resources, illustrate that farmers obtain many products and services from the landscape. Use is made not only of specific components of the different parts of the landscape, but also of the parts as a whole.

Use of Huertos, Yuntas and Coamiles, and Agostadero Land

As described in detail in Chapters 2 and 3, farmers use home gardens (*huertos*), cultivation fields (*yuntas* and *coamiles*) and *agostadero* land in various ways. Home gardens are used for many purposes. They provide food and medicines, as well as shade during the hottest time of the day. They are valued for ornamental purposes, and they are the dwelling places of hogs and poultry.

The rain-fed and shifting cultivation fields are used principally for producing maize, while the irrigation fields also provide beans. The trees within and around the rain-fed and irrigation fields are also important, as they are used for firewood, or for poles for fencing. They are also used for construction wood, for household utensils, or for making agricultural tools. Furthermore, the trees are of use for the cattle that graze in these fields as most bare edible fruits and pods. Farmers also eat many fruits and pods. The trees and tree stands near rivers are popular recreation spots, as families go there to have picnics, or fish for shrimps.

Agostadero land is mainly used for grazing and browsing, which take place to different degrees depending on the characteristics of the vegetation cover. The grazing potential further depends on the time of year, which is closely related to water availability. In the dry period, cattle browse and graze only in those parts of the *agostaderos* where water holes or streams and rivers are present. This was already described in Chapter 5. Table 6.1 presents a summary, indicating *agostadero* type and subtype, use (i.e. grazing or browsing) and duration of use.

Table 6.1 The differential use of *agostadero* land

Type	*Subtype*	*Use*	*Duration*
Agricultural fields left fallow	*Yunta de lluvia*	Grazing	Temporal, following cropping cycle
	Yunta de riego	Grazing	Temporal, following cropping cycle
	Coamil	Grazing	Temporal, following cropping cycle
Pasture land	Natural	Grazing	Temporal, depending on water and pasture availability
	Newly established	Grazing	Permanent, depending on water and pasture availability
Monte and *arbolera*	*Monte bajo*	Browsing and grazing	Permanent, availability often following the seasons
	Monte alto and *arbolera*	Browsing and grazing	Permanent, availability often following the seasons

Use of Monte Bajo

As described earlier, *monte bajo* vegetation consists of *matorrales*, *barbechos* and 'other *monte bajo*' (which will not be discussed in this chapter). The use of *monte bajo* is generally not as important to farmers as the use of other forest vegetation types.

The first and second most important uses of *matorrales* vegetation mentioned by farmers are for medicinal purposes and fodder. *Capitana* (Verbesina greenmanii) is one of the *matorral* species that is generally valued by (male and female) farmers for its medicinal qualities. Farmers also mentioned the medicinal qualities of *Chan* (Salvia mexicana) and *Tacote amargo* (Calea urtificolia). Other less important uses include *Chan* (Salvia mexicana) for making natural soft drinks, and *Escoba* (Melochia tomentosa) for making brooms. The forage value of *matorrales* is generally considered to be low. Only a few plant species are eaten and often this is:

> [...] *only when the cows are hungry* (Merino and Gerritsen 1999:9, own translation).

Notwithstanding the relatively low forage value of most of them, there are some *matorrales* that contain species that are preferred by cattle, such as *Tepame* (Acacia macracantha or Acacia pennatula), or *Bejuco* (Serjonia sp.). Most of the time, *matorrales* directly compete with pasture land. As the latter is more valued, farmers will convert *matorrales* whenever possible into pasture lands. In those fields where *matorrales* and established pasture land are found together, the lack of labour and financial resources to weed these fields restricts further transformation of the *matorrales*.

Regarding potential environmental services, most farmers agree that *matorral* vegetation does not contribute to water and soil conservation, as this vegetation is found, above all, on poorer, more intensively used soils.

The second type of *monte bajo* vegetation to be discussed here is *barbecho* vegetation. Farmers use *barbechos* more intensively than *matorral* vegetation. One of its most important functions is the restoration of soil fertility of abandoned *coamil* fields. In this way, when a farmer decides to clear the field again:

> *The earth will have more dirt* [*'el mugre'*] *and the milpa* [i.e. maize field] *looks as if it is being fertilised.* [This is due to the fact that] *the decomposed material* [*'la pudrición'*] *makes the milpa grow better* (*ibid.:*12, own translation).

The role of *barbecho* in soil fertility restoration refers to the vegetation type as a whole. But the different plant species in *barbecho* vegetation are also valued individually. The *hormiguillo* (unidentified), the *cuate* (Eysenhardthia polystachya) and the *rosa morada* (Tabebuia rosea) are used for construction purposes, while the *tepeguaje* (Lysiloma acapulcense) and the *cuate* are used for fencing and firewood. Sometimes, *barbecho* vegetation also holds some fruit trees, such as *nance* (Byrsonima crassifolia), *guayabo* (Psidium guajava), *gauyavilla* (Psidium guineense) and *guaje* (Acacia macilenta). Often, forage trees are also present, such as *parotas* (Enterolobium cyclocarpum), *cabezas de negro* (Annona purpurea), *guasimas* (Guazuma ulmifolia) and *juaniquiles* (Inga eriocarpa). Often, farmers also use them for nutritional purposes, such as is the case with the *parota* pods, or the fruits of the *cabezas de negro* (Merino and Gerritsen 1999:12).

Use of Monte Alto and Arbolera

As described earlier, *monte alto* and *arbolera* consist of *robleras*, *encineras ocoteras, monte alto* and *arbolera* in ravines and alongside streams, and 'other *monte alto* and *arbolera*' (which will not be discussed here). These different types are characterised by a great many uses.

The first type of *monte alto* and *arbolera* I will discuss is *roblera*. Its primary use is wood, which is used for many purposes, such as firewood, construction, poles for fencing, household utensils and tools. Farmers value the wood of the *robles* as it is hard and resistant. One farmer stated:

> *The roble splits* [*'rajas de roble'*] *can last up to 30 years* (Merino and Gerritsen 1999:15, own translation).

The *robleras* are also used as *agostaderos,* i.e. the cattle graze in either natural or newly established pasture underneath the *roble* canopy. According to some farmers, the cattle also eat the acorns of the oak trees, although this is more common for hogs. But, farmers do not take their hogs to the hills anymore; nowadays they are found only in home gardens.

Robleras are also used for other, less important, purposes. Fungi are collected, as well as medicinal plants, such as *capitana*, *colcomeca* (Smilax moranensis), *cocliste* (Bromelia plumieri), *oreja de becerro* (unidentified), and *lechuguilla* (Agave maximiliana). Farmers also mentioned soil and water conservation as important functions of *roblera* vegetation, although to a lesser degree than the other *monte alto* and *arbolera* vegetation types. Finally, some hunting can also take place. It is mainly *Pobre* farmers who mentioned this.

The second type of *monte alto* and *arbolera* is *encinera* vegetation. *Encineras* are used mainly for firewood. Farmers use the wood less for poles, as the wood of *Encino* decomposes rapidly in the soil. It is also used for construction purposes, although farmers prefer *roble* wood. This again is due to the hardness of *roble* wood, compared to the wood of *encino* trees. Similar to the *robleras*, *encineras* stands are used by farmers for hunting, collecting fungi and certain plant species for nutritional and medicinal purposes. Farmers attribute medicinal properties to the *encino*, i.e. the dominant tree in *encineras*.

Grazing and browsing also takes place, although pasture is not that abundant due to the relatively closed canopy of *encineras*. Thus, more shade is present, which prevents the proper growth of pasture. Grazing and browsing are also less important, due to the limited surface area of *encineras* compared to *roblera* vegetation.

Encino wood is commercially more valued than *roble* wood. However, due to the establishment of the RBSM, commercial exploitation is difficult to realise, which many (mostly *Ganadero*) farmers regret. One of them stated:

> *One should cut the trees which are getting old and useless* (Merino and Gerritsen 1999:21, own translation).

Regarding environmental services, farmers recognise that soil and water conservation is better under *encinera* canopy, compared to *robleras*. This is because *encino* leaves decompose easier.[3] Related to water storage capability, the size of the leaves also has an impact on soil erosion, which is illustrated by the following statement:

> *The trickle* [*'goteo'*] *is wider in the roblera, because the leaf is bigger.* […] *The soil gets washed away more easily.*[4]

The third type of *monte alto* and *arbolera* to be discussed is *ocotera* vegetation. Similar to the other *monte alto* and *arbolera* vegetation types, *ocoteras* are valued for several products and services. Farmers appreciate *ocotera* vegetation above all for the wood of the pine trees (i.e. *ocote*), and they are very well aware of its commercial value. Pinewood is very useful for constructing the roofs of the houses, as well as for making furniture. In the old days, it was also used for roof tiles (the so-called *tejamaniles*). Another important use of the *ocoteras* is as fuel for lighting the fire in kitchen stoves. It used to also provide light in the house, but this use disappeared with the installation of electricity in Cuzalapa. Farmers differentiate between pines that are more suitable for construction and furniture and those that are more suitable as firewood. This suitability appears to depend on the age of the pine trees, as a farmer commented:

> *One has to know. Those* [pine trees] *that are not mature cannot be used for lighting the stoves* (Merino and Gerritsen 1999:23, own translation).

Ocoteras forests are also an important habitat for many animals. According to the farmers, *venado* (Odocoileus sp.), *jabalines* (Tayasu tajacu), *ardillas* (Scurius collieia) and *chonchos* (Penelope purpurascens) are just some of the animals that can be hunted in *ocoteras*. Grazing also takes place, but only in the open spaces of *Ocoteras,* which are located at lower altitudes. *Ocotera* vegetation also provides fungi and edible plants, as well plants that can be used for medicinal purposes. Finally, there are also farmers who go to the *ocoteras* in order to:

> [...] *get rid of the boredom of the rancho* [i.e. hamlet]*, pass the day comfortably and maybe hunt some animals. Well, that is if one sees one.*

The environmental services of *ocotera* are similar to those of *encinera* and *roblera*; farmers mentioned both soil and water conservation.

The last type I will discuss in this section is *monte alto* and *arbolera* in ravines and alongside streams, which are also used for several purposes. Browsing and grazing is the most common use, but it depends on the nature of the ravines or streams. It also depends on the cattle breed that a farmer owns, as a *Ganadero* farmer commented:

> *You know, one goes to the ravines nearby. One does not go to the higher ravines, because they are very ugly* [*'feo'*]. [...] *Before, one used to take the cattle more often to the ravines. It was 'ganado corriente'* [i.e. an unidentified indigenous race]. *Nowadays, with the Cebú cattle* [Bos indicus] *it is different. These cattle resist more* [i.e. walking on the steep slopes and ravines, compared to the indigenous race].[5]

The possibility to browse and graze in the ravines, but also in the other *monte* vegetation types uphill, depends on the availability of water.

Several medicinal plants can be found in the ravines, such as *gordolobo* (Gnaphalium bourgovii), *tabarillo* (unidentified), *palo grueso* (unidentified), *lechuguilla* (Agave maximiliana), *manzanilla* (unidentified), *garañona* (Satureja macrostema var. laevigata), *cedro* (Cedrela oderata) and *nogal* (Juglans mayor var. glabrata). Wood can also be found that is useful for several purposes, such as construction, firewood and the production of household utensils.

Hunting also takes place of numerous animals mentioned by farmers, such as *jabalín* (Tayasu tajacu), *venado* (Odocoileus sp.) and *tejón* (Nasua narica). The farmers indicated, however, that *monte alto* and *arbolera* vegetation in ravines is not preferred as a hunting ground, due to its steepness. The same is true for the collection of non-timber forest products, but accessibility depends very much on the specific location of a species.[6] Finally, water conservation is also frequently mentioned for the *monte alto* and *arbolera* in the ravines and alongside the streams, as this is where many of the water holes are located.

Analysing Natural Resource Use

The foregoing sections indicate that Cuzalapa farmers make use of different parts of the landscape, i.e. the different resource diversity units. It also illustrates that these units are used for various purposes, although overlap exists.

In this section, I will compare the resource diversity units in relation to their uses, following the dimensions of land-use and forest cover. This comparison will be made in two ways. First, I will look at the importance of the different use categories in relation to their importance for the household, for agriculture and for activities related to cattle breeding. Secondly, I will analyse whether use categories are related to specific parts of the landscape (i.e. directed at agro-ecosystem components) or at resource units as a whole (i.e. directed at the whole agro-ecosystem) (see Wiersum 1997c; Wiersum and Gomez-Gonzalez 2000). The latter analysis will be a first step toward understanding the process of (agro-)ecosystem manipulation by farmers and its possible effects on resource diversity. Thus, it gives further insight into the process of co-production in Cuzalapa.

Tables 6.2 and 6.3 present a comparative analysis of the use categories attributed to the main land-use zones distinguished by farmers. The less important uses are given in brackets in the table. Note that the use categories attributed to trees and forests that can be found within each one of the land-use zones are also included in the tables. It indicates the interwovenness of land-use zones and forest vegetation in Cuzalapa farmers' view of resource diversity. Tree and forest use will be discussed in more detail when presenting the comparative analyses for *monte bajo* and *monte alto* vegetation (especially in Table 6.4).

Table 6.2 Comparative analysis of main use categories of land-use zones in relation to types of farming practice

Use category	*Huertos*	*Yuntas and coamiles*	*Agostadero land*	*Number of units used*
For household use:				
Construction wood	(X)	(X)	X	3
Firewood	–	X	X	2
Household utensils	–	(X)	X	2
Medicines	X	–	(X)	2
Ornamental purposes	X	–	–	1
Recreational purposes	–	X	(X)	2
Shade	X	(X)	–	2
Small animal dwelling place	X	–	–	1
Subtotal	*5*	*5*	*5*	*15*
For agricultural purposes:				
Agricultural tools	–	(X)	X	2
Maize and bean production	–	X	–	1
Subtotal	*0*	*2*	*1*	*3*
For activities related to cattle breeding :				
Fruits and pods	X	X	X	3
Grazing and browsing	–	(X)	X	2
Poles for fencing	–	(X)	X	2
Subtotal	*1*	*3*	*3*	*7*
Total number of use categories	*6*	*10*	*9*	*25*

From Table 6.2, it can be concluded that the three main land-use zones are valued for a great many uses. These uses are related to household, agricultural and cattle–breeding activities. Overlap in uses is found especially regarding trees and forests. Figure 6.3 further illustrates that it is mostly the individual components of the (main) land-use zones that are valued, which is not that surprising considering that they include several subzones and forest types.[7]

Table 6.3 Comparative analysis of main use categories of land-use zones in relation to vegetation components and units as a whole

Use category	*Huertos*	*Yuntas and coamiles*	*Agostadero land*	*Number of units used*
Related to specific part of land-use zone (i.e. component):				
Agricultural tools	–	(X)	X	2
Construction wood	(X)	(X)	X	3
Firewood	–	X	X	2
Fruits and pods	X	X	(X)	3
Household utensils	–	(X)	X	2
Medicines	X	–	(X)	2
Ornamental purposes	X	–	–	1
Poles for fencing	–	(X)	X	2
Shade	X	(X)	–	2
Subtotal	*5*	*7*	*7*	*19*
Related to land-use zone as a whole (i.e. agro-ecosystem):				
Grazing and browsing	–	(X)	X	2
Maize and bean production	–	X	–	1
Recreational purposes	–	X	(X)	2
Small animal dwelling place	X	–	–	1
Subtotal	*1*	*2*	*3*	*6*
Total number of use categories	*6*	*9*	*10*	*25*

Similar to Tables 6.2 and 6.3, Tables 6.4 and 6.5 present a comparative analysis of the use categories attributed to the different types of forest vegetation distinguished by farmers.

Five conclusions can be drawn from Table 6.4. 1) *Monte alto* and *arbolera* have an equal number of use categories, but *monte bajo* and *monte alto* and *arbolera* vegetation types are characterised by specific dominating use categories. Different wood products are looked for, above all, in *monte alto* vegetation, while soil fertility restoration is mostly valued in *monte bajo* vegetation (i.e *barbecho*). This indicates that resource diversity as a whole is important for farmers. 2) The different use categories vary in importance. Some use categories, such as wood for different purposes, medicinal plants, browsing and grazing, and non-timber forest products, are extracted from more parts of the landscape than other use categories. Poles for fencing are extracted from, above all, two units (i.e. *barbecho* and, especially, *roblera*), while hunting takes place mostly in *monte alto*. 3) *Barbecho* vegetation, *roblera* vegetation and *monte alto* and *arbolera* vegetation in the ravines and along the streams show a slightly greater diversity of uses than the other *monte* types. This is not so surprising considering the greater surface area of *roblera* vegetation in the community and the higher diversity and complexity of many of the *monte alto* and *arbolera* forests in ravines and alongside streams. Thus, the extent of species distribution and floristic composition appear to determine the number of uses of the natural vegetation (Benz *et al.* 1994). Other factors, however, also play a role, such as the distance a farmer has to travel to reach specific resource diversity units, as well as the specific farming conditions. Access to natural resources can also be very different amongst Cuzalapa farmers. 4) Household needs emerge as an important reason for using the different vegetation types, as demonstrated by the number of resource diversity units used. However, Table 6.4 also reflects the increased importance of natural vegetation for cattle breeding, as grazing takes place in all forest vegetation types. 5) It appears that direct instrumental use values (i.e. products that can be obtained) dominate over the indirect ones (i.e. environmental services), although the latter do play an important role in agricultural practice, i.e. especially in shifting maize cultivation. In this respect, *barbecho* is important for soil fertility restoration, while maintaining *monte alto* vegetation contributes to (soil and) water conservation. When one considers the importance of agriculture in the valley, one can say that *monte bajo* and *monte alto* fulfil complementary functions. However, again due to the expansion of cattle breeding, shifting maize cultivation has decreased in importance, and the area previously used for this form of cultivation is increasingly being transformed into pasture lands. The fact that soil fertility restoration was mentioned as a use category for *roblera* vegetation is somewhat surprising, since poorer soils are normally found there. The farmers were probably referring here to the higher risk of erosion, and thus to the need for protection.

Table 6.4 Comparative analysis of main use categories of forest vegetation in relation to types of farming practice

Use category	*Monte bajo*		*Monte alto and arbolera*				*Number of units used*
	Matorral	*Barbecho*	*Roblera*	*Encinera*	*Ocotera*	*Monte alto and arbolera in ravines and alongside streams*	
For household use:							
Firewood	–	X	X	X	X	(X)	*5*
Hunting	–	(X)	(X)	(X)	(X)	(X)	*5*
Non-timber forest products	X	X	(X)	(X)	(X)	(X)	*6*
Wood for construction	–	X	X	X	X	(X)	*5*
Subtotal	*1*	*4*	*4*	*4*	*4*	*4*	*21*
For agricultural purposes:							
Soil and water conservation	–	–	X	X	X	X	*4*
Soil fertility restoration	–	X	–	–	–	–	*1*
Subtotal	*0*	*1*	*1*	*1*	*1*	*1*	*5*
For activities related to cattle breeding:							
Browsing and grazing	X	X	X	X	X	X	6
Poles for fencing	–	X	X	–	–	(X)	3
Subtotal	*1*	*2*	*2*	*1*	*1*	*2*	*9*
Total number of use categories	*2*	*7*	*7*	*6*	*6*	*7*	*35*
	7		*7*				

Table 6.5 Comparative analysis of main use categories of forest vegetation in relation to vegetation components and units as a whole

Use category	*Monte bajo*		*Monte alto and arbolera*				*Number of units used*
	Matorral	*Barbecho*	*Roblera*	*Encinera*	*Ocotera*	*Monte alto and arbolera in ravines and alongside streams*	
Related to specific part of forest vegetation (component):							
Firewood	-	X	X	X	X	(X)	5
Hunting	-	(X)	(X)	(X)	(X)	(X)	5
Non-timber forest products	X	X	(X)	(X)	(X)	(X)	6
Poles for fencing	-	X	X	-	-	(X)	3
Wood for construction	-	X	X	X	X	(X)	5
Subtotal	*1*	*5*	*5*	*4*	*4*	*5*	*24*
Related to forest vegetation as a whole (eco-system):							
Browsing and grazing	X	X	X	X	X	X	6
Soil and water conservation	-	-	X	X	X	X	4
Soil fertility restoration	-	X	-	-	-	-	1
Subtotal	1	2	2	2	2	2	11
Total number of use categories	2	7	7	6	6	7	35
	7		7				

From table 6.5 it can be concluded that the use of the various types of *monte* and *arbolera* are in some cases directed at specific components of the (agro-)ecosystem, and in some cases at the (agro-)ecosystem as a whole.

6.3 Management of Natural Resources in Cuzalapa

Cuzalapa farmers actively manage the different resource units they distinguish in their landscape, including the trees that these contain. They do not just use the tree resources passively, but manage these purposefully, as the following statement acknowledges:

> [...] *It is important to protect the trees, as they give freshness and water. Here in our field, there is a water hole. So you have to protect it, because the water is for irrigation and for our cattle.* [...] *There are people that cut trees as they interfere with ploughing, or with the milpa. But there is always a reason. You should not cut just like that.*

In this section, I will take a closer look at the management activities with which resource diversity is maintained or transformed in Cuzalapa. Management of resource diversity is understood here to be all conscious efforts to maintain or transform landscape diversity in order to stimulate increased production of landscape products and environmental services. Stimulation in this context can be directed at both the land-use zones and forest vegetation (types), and it can be directed at these (agro)ecosystems as a whole, or at specific components of them.

From this section, it will become clear that Cuzalapa farmers employ a wide range of management practices in the different landscape units. Note that fieldwork was directed mostly at tree and forest resources, which will therefore be discussed in more detail than the land-use zones.

Management of Huertos, Yuntas and Coamiles, and Agostadero Land

In the Chapters 2 and 3, I described land-use in Cuzalapa with an emphasis on agricultural and cattle-breeding practices. It became clear that agricultural and cattle-breeding objectives predominate in the different land-use zones of the Cuzalapa valley. Tree and forest management plays a complementary but nonetheless important role in farming practice. Management practices regarding trees in the cultivation fields and the grazing lands depend on crop and pasture development. Table 6.6 presents an overview of the tree and forest management practices that farmers apply in the main land-use zones. Management practices that are less frequently applied in a specific land-use zone are given in brackets.

Table 6.6 Tree and forest management practices applied in land-use zones (adapted from Gerritsen 1995:62, Table 9.6)

	Huertos	*Yuntas and coamiles*	*Agostadero land*
Burning of trees to control animals	X	X	(X)
Burning of trees to facilitate cutting	–	X	(X)
Cutting of branches to reduce shade	(X)	X	(X)
Cutting of branches to control animals	X	X	(X)
Cutting of sick parts of trees	X	X	(X)
Girdling	(X)	X	(X)
Mulching and watering	X	–	–
Planting of (fruit) trees	X	X	–
Protection of desired species in agricultural fields and pasture lands	–	X	X
Protection of fruit trees in home gardens	X	–	–
Protection of trees near streams and rivers	–	X	X
Removal of undesired trees	(X)	X	(X)
Seed collection from fruit trees	X	X	X
Transplanting of wild tree seedlings	–	–	X

Management of Monte Bajo

Generally speaking, farmers do not manage *monte bajo* vegetation very intensively. Resource management is primarily done through agricultural and cattle-breeding practices, i.e. maize cultivation and pasture establishment (and maintenance); but some specific tree management practices do exist. There are some differences, however, between the *monte bajo* types *matorral* and *barbecho*.

Farmers do not value *matorral* vegetation very highly, as was stated in the first section of this chapter, as well as in Chapter 5. This is due to its competitiveness with pasture. Consequently, when farmers have time and are motivated, they will cut and burn this vegetation to establish pasture. Even though they are rare in this vegetation type, farmers protect valuable species whenever they are present. The use of agrochemicals to get rid of *matorral* vegetation is also common. The practice of cutting and burning has decreased as herbicides have made it easier to clean the fields. As stated before, farmers make use of some of the *matorral* species, but they do not take specific measures to maintain them (Merino and Gerritsen 1999).

Barbecho vegetation is characterised by a more intensive management than *matorral* vegetation. As described earlier, *barbecho* vegetation exists due to the necessity to allow fallow periods for *coamil* fields:

> [...] [if the fields are allowed to] *rest, one does not need that much* [chemical] *fertiliser* [when the field is used again for maize cultivation] (Merino and Gerritsen 1999:12, own translation).

Barbecho vegetation is considered to be important for the retention of soil and organic material, while cutting and burning it liberates the nutrients fixed in trees and the soils. Burning also has the added benefit of destroying the seeds of the *monte alto* vegetation that invades *coamil* fields during fallow periods. However, just as with *matorral* vegetation, the use of agrochemicals has partially replaced this function of burning.

Farmers do not readily cut and burn the trees in *barbecho* vegetation located near water holes, streams and rivers. Nor do they cut the trees in the *barbechos* that are considered to be important. Often these are forage trees, such as *Guázima* (Guazuma ulmifolia), *Tepame* (Acacia pennatula), *Parota* (Enterolobium cyclocarpum), *Higuiera* (Ficus glabrata) and *Juaniquil* (Inga eriocarpa). Other useful species are also maintained in the fields, such as *Rosa morada* (Tebebuia rosea), which is used for construction purposes and *Tepeguaje* (Lysolima acapulcense), which is valued for its poles for fencing. Generally, the usefulness of a certain species determines whether the trees will be cut or maintained by the farmers. As one farmer commented:

> *We maintain the species that are of service to us*. […] *All trees that one sees and that are of some use, we leave* [to stand in the field] (Merino and Gerritsen 1999: 14, own translation).

Management of Monte Alto and Arbolera

As in *monte bajo*, farmers apply various management practices in the different *monte alto* and *arbolera* vegetation types. The exact management practices depend on the products and services desired by farmers. Both differences and similarities exist regarding the management of *roblera*, *encinera*, *ocotera* vegetation and *monte alto* and *arbolera* vegetation in ravines and alongside streams and rivers.

Actually, most *roblera* vegetation in the community is fenced and the management very much depends on the individual farmers. The majority of the farmers now use the *roblera* stands on their land for grazing purposes. The establishment of pasture is common, especially *Jaragua* (Andropogon rufus), which grows more easily than other pasture species, such as the very common *Guinea* (Panicum maximum). Generally, pasture is established on the more open areas within *robleras* forests, which are found mostly at lower altitudes on more level terrain. To establish pasture in *roblera* vegetation, existing *matorral* vegetation is cut and burned. After the establishment of pasture, burning takes place every five years in order to prevent the development of (new) *monte bajo*. Again, the use of agrochemicals is a relatively new method to prevent *monte bajo* from developing (Merino and Gerritsen 1999).

Farmers who do not establish pasture make use of the natural pasture that is often present under *roblera* canopy. They also cut and burn this pasture, but it appears to be a more sporadic practice than in *robleras* with newly established pasture. Cutting and burning is hardly ever performed in the *robleras* found at higher altitudes and that have poorer and stonier soils. A *Ganadero* farmer commented:

> *As the majority of the robleras are on weak soils* [*'tierras debiles'*]*, with a lot of stones, the pasture does not grow well* [*'no jala la pastura'*]*. When one burns, even the seeds of the natural pasture will be finished and the ashes will get washed away* (Merino and Gerritsen 1999:18, own translation).

In addition to the adverse soil conditions and erosion risk, there are also other reasons not to establish pasture. The lack of economic and human resources and a farmer's laziness (*'flojera'*) can also play a role.

Cutting and burning is not the only management practice that takes place in *roblera* vegetation to stimulate pasture development. Tree thinning increases the available light and the cut trees can then be used for firewood and as poles for fencing. Although most of the *roblera* trees are cut to stimulate pasture and thereby satisfy farmers' needs, most farmers agree that it is irresponsible to cut whole *roblera* stands. These trees are seen as an important source of poles for fencing, firewood and wood for construction. In fact, farmers whose *robleras* stands are getting very sparse abandon the practice of cutting and burning. They also protect the natural regeneration, by preventing other farmers from cutting the *roble* trees in their fields, among other ways. One of these farmers, who is probably one of the most progressive ones in conserving the woody vegetation in his field, commented:

> *I do not burn* [my *roblera*]*, because the robles are tender* [i.e. young]*, so burning can damage them. You could burn them when they are bigger, but you should not do it.*

After all, burning affects all plants. [...] *I want to put a sign stating that tender wood should not be cut. They are allowed to cut the old trees. We have to take care of the young trees.* [...] *I am thinking of also putting on the sign that people have to ask my permission to enter my field. Anyone who wants to can come and cut wood, but always after asking me and only if he does not cut the tender wood.*

The majority of the *encinera* stands, i.e. the more open *encineras* stands at lower and middle altitudes, are managed similarly to *roblera* vegetation. Pasture establishment has become a common management practice. Natural pasture is also managed, which sometimes is cut and burnt to stimulate growth. But, as a *Pobre* farmer stated:

The encino [tree] *is more vulnerable to fire* [than, for example roble trees]*, as it burns longer* (Merino and Gerritsen 1999:22, own translation).

According to many farmers, the surface area covered with *encineras* is less than *robleras*, as:

Many of them were cut for the saw mill (*ibid.*:22, own translation).

Many of the denser *encinera* vegetation stands are not managed very actively, due to the shade that limits pasture development. Furthermore, the humidity of these stands makes burning more difficult. However, there is also a more practical reason for the less active management of *encinera* vegetation. This type of vegetation is namely more common at higher elevations of the community. Finally, due to its importance for water protection, there are various farmers who believe in the necessity to protect it:

Damaging her [i.e. *encinera* vegetation] *is more dangerous* ['*delicado*']*, due to the water and some plants, such as the Azajares* (Styrax argenteus) (Gerritsen and Merino 1999: 22, own translation).

Encineras are protected by farmers for several reasons, such as their water-holding potential and the value of their wood, among other reasons. A farmer explained this as follows:

[One should protect the *encinera*]*, so, in this way, more vegetables* [i.e. understorey forest] *and healthier trees will grow* (*ibid.*:22, own translation).

In most of the *ocoteras*, no specific management practices take place, which is due mainly to their location. They are found at the highest elevations of the community, i.e. at the ridges of the hills. Some of them are also found within one of the Reserve's core zones. Within the core zone:

One cannot fence a terrain; the ocoteras are forbidden trees (*ibid.*:25, own translation).

Cattle is also not allowed in the *ocoteras* that are located in the core zone, but, as a farmer commented:

It is forbidden, but the cattle enter anyway, start to trample, the soil gets looser, and the terrain gets washed away [during the rainy season]. (*ibid.*: 25, own translation).

Like *encineras, ocotera* stands have suffered a lot from forest exploitation and forest fires. This does not normally take place anymore, although:

> […] *some clearings are still made* (*ibid.*: 25, own translation).

Many, mainly *Pobre,* farmers want to protect *ocotera* vegetation from forest fires and commercial exploitation. It is also these farmers who see the Reserve managers as allies. *Ganadero* farmers think differently in the sense that they do support commercial exploitation, but only:

> […] *in those places, where one can* [i.e. where the possibilities exist].

Management practices applied by the Cuzalapa farmers in the *monte alto* and *arbolera* vegetation in the ravines can vary depending on the location. Management practices at the higher, more inaccessible, parts are almost non-existent:

> […] *just like that, they* [the Cuzalapa farmers] *just leave it.* [Generally speaking] *we make use of what is closer* [to the houses of the farmers].

The *monte alto* and *arbolera* in ravines located in lower and middle parts of the community are submitted to more farmer management. Broadly speaking, the management practices applied are similar to those in the other *monte* types. Burning and cutting of trees for pasture establishment takes place, although less frequently:

> […] [as] *it is more dangerous in the ravines* [due to less control over the fires compared to other *monte* types].

Many farmers also recognise the importance of protecting this vegetation for the purpose of water conservation. Furthermore, several tree species are desired for transplanting into home gardens, such as *palmilla* (Adantium trapeziforme), *nogal* (Juglans mayor), *árbol maría* (Calophyllum brasiliense), *fresno* (Fraxinus uhdei), and *palo grueso* (unidentified species). Finally, but apparently only occasionally, farmers go hunting in the ravines.

Analysing Natural Resource Management

In this section, a comparison will be made of the different management practices that farmers apply in the different resource diversity units. In this comparative analysis, management practices will be ordered according to the classification of Wiersum (1997a, 1997c), who distinguishes between: controlled utilisation practices for trees, protection and maintenance of desired products (and resources), stimulation of desired products, purposeful regeneration and interface management. These different categories (except the last one) represent both a gradual increase in human energy input per resource unit and increasing manipulation of the original vegetation. The first two types (controlled utilisation and protection and maintenance of desired products) have less impact on vegetation than the last ones (stimulation of desired products and purposeful regeneration). This distinction allows us to understand the gradient of resource transformation. Interface management does not refer to vegetation transformation, but to tree and forest management practices aimed at (agricultural) crop and animal development. It is thus quite different than the other categories.

Tables 6.7 and 6.8 present an overview of the management practices employed in *huertos*, *yuntas* and *coamiles*, and *agostadero* lands. Note that when discussing the management of *agostadero* land, reference is made above all to the grazing lands that are found in the lower parts of the Cuzalapa valley. The grazing lands found uphill are treated when discussing the different types of forest vegetation (i.e. *monte* and *arbolera*).

Table 6.7 Comparative analysis of main management practices in the main land-use zones, listed according to degree of transformation (i.e. from minimal to greater impact)

Management practices	*Huertos*	*Yuntas and coamiles*	*Agostadero land*	*Number of units with specific man. Practice*
Controlled utilisation practices for wood:				
-	-	-	-	0
Subtotal	*0*	*0*	*0*	*0*
Protection and maintenance of desired products and resources:				
Protection of desired species in agricultural fields and pasture lands	–	X	X	2
Protection of fruit trees in home gardens	X	–	–	1
Protection of trees near streams and rivers	–	X	X	2
Subtotal	*1*	*2*	*2*	*5*
Stimulation of desired products:				
Cutting of sick parts of trees	X	X	(X)	3
Mulching and watering	X	–	–	1
Subtotal	*2*	*1*	*1*	*4*
Purposeful regeneration:				
Planting of (fruit) trees	X	X	–	2
Transplanting of wild tree seedlings	–	–	X	1
Seed collection from fruit trees	X	X	X	3
Subtotal	*2*	*2*	*2*	*6*
Interface management:				
Burning of trees to control animals	X	X	(X)	3
Burning of trees to facilitate cutting	–	X	(X)	2
Cutting of branches to avoid shade	(X)	X	(X)	3
Cutting of branches to control animals	X	X	(X)	3
Girdling	(X)	X	(X)	3
Removal of undesired trees	(X)	X	(X)	3
Subtotal	*5*	*6*	*6*	*17*
Total number of management practices applied	*10*	*11*	*11*	*32*

Table 6.7 illustrates that the most common practices farmers apply are burning and cutting, and planting and protecting trees as methods of interface management (i.e. crop and pasture development). Tree planting takes place, above all, in home gardens,

but also in the cultivation fields and pasture lands. The reasons for planting wild trees are several. Cuevas *et al.* (1995) mention ornamental reasons as being the most important, followed by nutritional and medicinal purposes. They also mention the following less frequent reasons for tree planting: for shade, foraging material, insecticide, poles for fencing, tools, and wood for construction. Finally, the diversity of management practices in cultivation fields and *agostadero* lands is worth noting, as it indicates the importance of interface management in these land-use zones.[8] It is one of the expressions of the interrelation of agricultural, cattle-breeding and tree and forest resource management activities. In other words, tree and forest management practices cannot be seen separately from the other practices that farmers apply.

Table 6.8 presents another comparative analysis for land-use zones. It compares the different management practices and the type of transformation that they cause. This table suggests that the management practices are directed mostly at components in the land-use zones. This is due to the variation that exists within the land-use zones.

Table 6.8 Comparative analysis of main management practices in the main land-use zones, listed according to type of transformation (i.e. of specific component or whole agroecosystem)

Management practices	*Huertos*	*Yuntas and coamiles*	*Agostadero land*	*Number of units with specific man. practice*
Applied to specific part of unit (component):				
Burning of trees to control animals	X	X	(X)	*3*
Burning of trees to facilitate cutting	–	X	(X)	*2*
Cutting of branches to reduce shade	(X)	X	(X)	*3*
Cutting of branches to control animals	X	X	(X)	*3*
Cutting of sick parts of trees	X	X	(X)	*3*
Girdling	(X)	X	(X)	*3*
Mulching and watering	X	–	–	*1*
Planting of (fruit) trees	X	X		*2*
Protection of desired species in agricultural fields and pasture lands	–	X	X	*2*
Protection of fruit trees in home gardens	X	–	–	*1*
Protection of trees near streams/rivers	–	X	X	*2*
Removal of undesired trees	(X)	X	(X)	*2*
Seed collection from fruit trees	X	X	X	*3*
Transplanting of wild tree seedlings	–	–	X	*1*
Subtotal	*10*	*11*	*11*	*32*
Applied to unit as a whole (ecosystem):				
-	-	-	-	*0*
Subtotal	*0*	*0*	*0*	*0*
Total number of management practices applied	*10*	*11*	*11*	*32*

Tables 6.9 and 6.10 present the analyses of the management practices applied in the different forest vegetation types.. These analyses will also be done in two ways, similar to those regarding the use of resource diversity. In Table 6.9, the management practices are presented by ordering them according to the degree of vegetation transformation they cause. Like Table 6.5, Table 6.10 analyses the type of transformation, i.e. whether management practices are applied to a specific component or (agro-) ecosystems as a whole. Note that the management practices that are mentioned in the two tables also include those that are generally considered typical for agriculture or cattle breeding. They (again) can be considered as an example of the interrelations that exist between land-use zones and forest vegetation types.

Tables 6.9 and 6.10 show that farmers apply an important number of management practices in the different resource diversity units. Table 6.9 indicates that many management practices are aimed at the stimulation of desired products, i.e. mostly pasture. However, the protection of trees and water holes is also important, above all, in *barbecho* and *roblera* vegetation. Most pasture is also established in these two vegetation types. It is interesting to note that farmers do not (appear to) apply any controlled utilisation practices for wood, nor interface management practices. Table 6.10 shows that the management practices are applied to specific components rather than whole ecosystems. This suggests that the different landscape units are maintained by farmers and not totally transformed. In other words, farmers purposefully maintain the landscape patchiness. Finally, through the application of management practices farmers influence natural cycles. This, in turn, can have an impact on both species composition and structure of the different types of forest vegetation. However, this aspect was not specifically studied in this research.

Table 6.9 Comparative analysis of main management practices applied in forest vegetation, listed according to degree of transformation (i.e. from minimal to greater impact)

Management practices	*Monte bajo*		*Monte alto and arbolera*				*Number of units with specific management*
	Matorral	*Barbecho*	*Roblera*	*Encinera*	*Ocotera*	*Monte alto /arbolera* in ravines	
Controlled utilisation practices for wood:							
-	-	-	-	-	-	-	-
Subtotal	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Protection and maintenance of desired products and resources:							
Protection of trees	(X)	X	X	(X)	(X)	(X)	*6*
Protection of vegetation for soil conservation	-	-	(X)	-	-	-	*1*
Protection for wood production	-	-	X	X	X	-	*3*
Protection of water holes	-	X	X	X	X	X	*5*
Subtotal	*1*	*2*	*4*	*3*	*3*	*2*	*15*
Stimulation of desired products:							
Application of agrochemicals	X	X	X	X	-	-	*4*
Burning to stimulate pasture	X	X	X	X	X	X	*6*
Cutting to stimulate pasture	X	X	X	X	X	X	*6*
Thinning	-	-	X	(X)	(X)	-	*3*
Subtotal	*3*	*3*	*4*	*4*	*3*	*2*	*19*
Purposeful regeneration practices:							
Pasture establishment	X	X	X	X	X	X	*6*
Protection of natural regeneration	-	X	X	(X)	(X)	(X)	*5*
Transplanting of wild seedlings	-	-	-	-	-	X	*1*
Subtotal	*1*	*2*	*2*	*2*	*2*	*3*	*12*
Interface management:							
-	-	-	-	-	-	-	*0*
Subtotal	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Total number of management practices applied	*5*	*7*	*10*	*9*	*8*	*7*	*46*
	7		*10*				

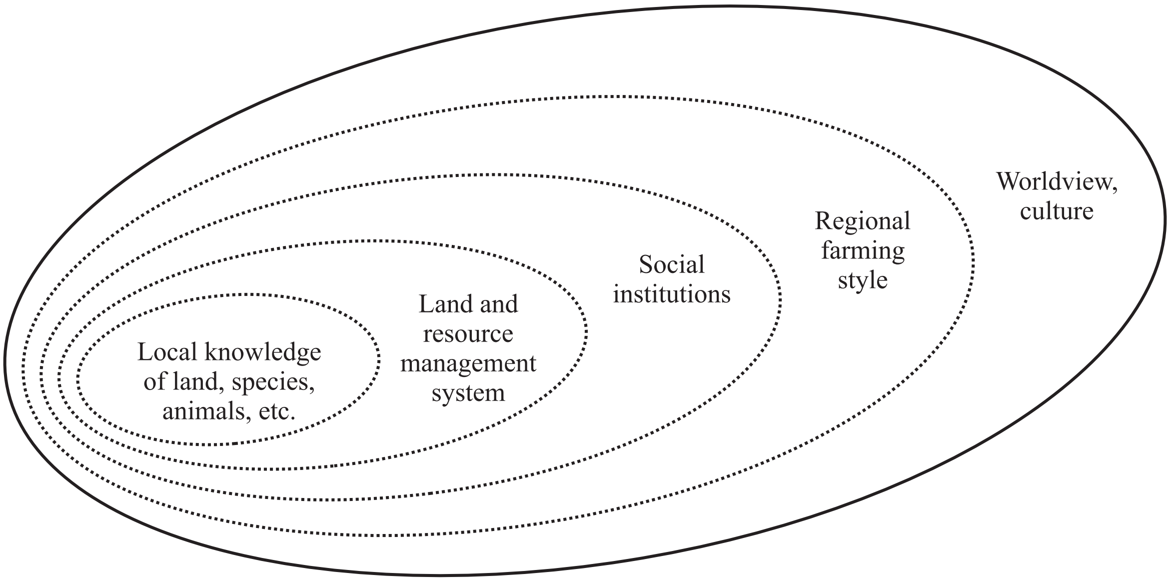
Table 6.10 Comparative analysis of main management practices applied in forest vegetation, listed according to type of transformation (i.e. of specific component or of whole agroecosystem)

Management practices	*Monte bajo*		*Monte alto and arbolera*				*Number of units with specific management*
	Matorral	*Barbecho*	*Roblera*	*Encinera*	*Ocotera*	*Monte alto /arbolera* in ravines	
Applied to specific part of unit (component):							
Application of agrochemicals	X	X	X	X	-	-	*4*
Burning to stimulate pasture	X	X	X	X	X	X	*6*
Cutting to stimulate pasture	X	X	X	X	X	X	*6*
Pasture establishment	X	X	X	X	X	X	*6*
Protection of trees	(X)	X	X	(X)	(X)	(X)	*6*
Protection of water holes	-	X	X	X	X	X	*5*
Protection of natural regeneration		X	X	(X)	(X)	(X)	*5*
Transplanting of wild seedlings	-	-	-	-	-	X	*1*
Subtotal	*5*	*6*	*6*	*6*	*5*	*6*	*34*
Applied to unit as a whole (ecosystem):							
Protection for wood production	-	-	X	X	X	-	*3*
Protection of vegetation for soil conservation	-	-	(X)	-	-	-	*1*
Thinning	-	-	X	(X)	(X)	-	*3*
Subtotal	*0*	*0*	*3*	*2*	*2*	*0*	*7*
Total number of management practices applied	*5*	*7*	*10*	*9*	*8*	*7*	*46*
	7		*11*				

6.4 Embeddedness of Natural Resource Use and Management in the Regional Farming Style

The use and management of the different resource units, including the tree and wild forest species that they contain, cannot be understood separately from the different domains of farming. On the contrary, they constitute an integral part of them. Thus, the management of resource diversity and the knowledge on which it is based is embedded in the regional farming style. I refer here to the land-use zones and forest vegetation types, as well as the social institutions that govern the use and management of land and natural resources. Institutions in Cuzalapa were briefly described in Chapter 2. In the following, they will be discussed more specifically in relation to tree and forest vegetation. Following the line of thought of Berkes *et al.* (2000), these different components of the regional farming style can be considered to be different levels of the knowledge–practice-belief complex.[9] In the case of Cuzalapa, this complex can be seen as an integrated natural resource and farming management system or landscape management system. The different levels of this landscape management system are schematically illustrated by Figure 6.1.[10]

Figure 6.1 Levels in the landscape management system of Cuzalapa farmers (adapted from Berkes *et al.* 2000)



In this section, I will discuss the interrelations of two levels of the landscape management system: the relation between resource diversity and the regional farming style, and the relation between the institutions and the regional farming style. Furthermore, differences in natural resource use and management between *Pobre* and *Ganadero* farmers will be discussed in order to illustrate that differentiation between the two groups exists not only in agricultural and cattle-breeding practices, but also in the way natural resources are used and managed.

Co-ordination of Farming and Natural Resource Management

Sections 6.2 and 6.3 described several relations between forest vegetation use and management and the other activities on the farm, i.e. the relation between resource diversity and the regional farming style. Each one of the landscape units has its own place in farming as a whole and they all provide several products and services that are useful for farming. As discussed earlier, the application of management practices in forest vegetation is an outcome of conscious decision-making by farmers. It should be emphasised here again that several of these management practices are aimed at maintaining farming processes. The following example regarding water conservation illustrates this:

> *There are people who protect trees for their freshness and for the water. In our field, we have a water hole, there below those trees. So you have to protect it.* [...] *There are people who cut trees because they interfere with ploughing or harm the milpa* [i.e. maize field]. *But there must always be a reason, you must not cut for no reason.*

As the use and management of natural vegetation is related to other farm activities, co-ordination of different activities is important to farmers. It requires an organisation of time and space within the context of the farm. The following example illustrates co-ordination and decision-making involving two (competing) income-generating activities within the domain of production:

> *You know, I have a lot of Arrayanes* (Psidium sartorianum) *in one of my fields. Many people tell me to sell them, but I do not, as many birds eat them, such as chichalaca* [Ortalis poliocephala], *palomas* [i.e. doves: Zenaida sp.], *pericos* [i.e. parrots], *and I do too. Because I have the fruits, the birds will not eat the maize. It is to protect my work*. […] *Most people hardly do so* [i.e. leave the fruits], *they sell them all.*

Not one, but several factors influence decision-making regarding which activities are to be undertaken. Some factors are of an ecological-productive nature, while others are based on socio-economic, political or subjective reasoning. For example, the decision to cut a tree depends not only on the possible effects on maize cultivation, but also on the perceived effects on soil conditions. As one farmer explained:

> *You know, guamuchiles* [Pithecellobium dulce], *arayanes* [Psidium sartorianum] *mojotes* [Brosimum alicastrum] *or robles* [Quercus sp.] *let the soil dry out, while the leaves of mangos* [Magnifera indica], *aguacates* [Persea americana var. americana], *encinos* [Quercus sp.] *or tescalamas* [Ficus morazaniana] *strengthen the soil.*

Possible damage to (parts of) the farm, as well as its natural environment can also be a reason for performing management practices in a certain way. Another farmer commented:

> *Here we do not burn, because the fire will burn the fences. It's important to protect the forests for their pasture. It is bad to burn the cerro* [i.e. hills], *because then the pasture will not return easily.* [...] *One should not burn because of the wild animals* ['*animales del monte*'], *so that they also have enough to eat. It's important to protect the forest for science and for when one gets hungry. Besides, the water in the hills is good, it is not contaminated* [*'no tiene cochinadas'*].

As stated before, there are also more subjective reasons for deciding to apply certain management practices, which is illustrated in the following statement:

> *We don't cut the trees in our fields, because that is what my grandfather commanded, and as it is the wish of a deceased one.* [...] *If my grandfather would not have commanded this, we already would have cut the trees that disturb us.*

Fear of losing cattle can also influence a farmer's decision:

> *I had 25 cattle, but they stole almost all of them. I started with a calf that my wife bought and little by little we succeeded in increasing our herd to 25, until ten years ago. Now, the few that are left, well, I do not take them uphill anymore. I do not want them to get stolen again.*

Various factors have been presented that play a role in co-production. It is, however, not only the farming activities that determine the different management practices applied in resource diversity. The reverse is also true. The ecological characteristics of the different units also influence farming practice. Irrigation agriculture can only take place on level terrain near streams and rivers, while (horse and mule) ploughing cannot take place on fields that have too many stones.[11] Also, cattle-farmers have to choose breeds that are adapted to the biophysical conditions of the Cuzalapa landscape. The following comment illustrates this, showing also how both nature and farming practice can be transformed:

> *The Cebú* [Bos indicus] *is good for the hills, unlike the pinta* [Friesian Holstein: Bos taurus]. *Pintas do not hold out, their legs are too weak. Breeding Cebú with Suiza* [i.e. Suiza Europea: Bos taurus] *cattle is also good for* [the cattle's ability to wander in] *the hills.*

Ecological characteristics may not only influence the breeds cattle-farmers use, but also the number they manage. A farmer, who raised six dairy cows in 1999, commented:

> *Well, we do not have sufficient pasture for having more milking cows.*[12] [And] *there is no water either. During the rainy seasons there is more pasture* [available and, thus, more milking cows can be held]. […] *We also have problems with maize cultivation, as often water is cut* [in the dry season].

In practice, it is often a combination of both socio-economic and natural factors that influence farmers' practice and thus their resource diversity use and management. The following statement illustrates this:

> *Look, the rains came late this year. Therefore, many* [farmers] *cultivated with* coa [i.e. a spear-like farm tool], *so that the horses can rest. Besides, everything is very expensive. The land preparation with the tractor* [the so-called *'tractoreada'*] *and the* [chemical] *fertiliser.* […] *And with one heavy storm* [*'y con una borrascada'*], *one can lose everything.*

The different examples presented here and in the foregoing sections illustrate that diversity between and within the landscape can be seen as the outcome of farmers' conscious actions vis-à-vis given ecological conditions. It is also in the management of natural resources that co-production is the most visible, as:

> '[…] *spatial changes are conceived and realised through farm labour, just as a change in the relevant space can also imply far-reaching consequences for farm labour'* (van der Ploeg 1987:4, own translation). *'The result is that space is not conceived, any more than is time, as an abstract area infinitely divisible into universal units. It is always a real and particular expanse perceived through a repeated work experience'* (Mendras 1970:62).

This repeated work experience is related to different units in the landscape. Thus resource diversity must not be understood as a static phenomenon. On the contrary, it is a highly dynamic outcome of the process of co-production. I will discuss this further in Section 6.5.

Rules and Regulations Regarding Trees and Forests

As part of the general notions underlying the regional farming style, a number of customary rules and regulations for trees and forests can be distinguished. They apply to the farming community as a whole and they are embedded in a control (or monitoring) structure, i.e. indigenous tree tenure (Wiersum 1997a). Broadly speaking, indigenous tree tenure in Cuzalapa is determined by the nature of tree and forest resources and it is related to the land tenure situation. Tenure is different for planted and for naturally growing trees, and it depends on the legal status of the land on which the trees are found (Gerritsen 1995).

Planted trees are the property of the person who plants them, who obtains exclusive usufruct rights in this way. Planted trees are primarily found in home gardens, though they are also established in the cultivation fields and pasture lands. Planted trees in the communal man-made forest belong to the whole community and all farmers and their families can make use of them.

Naturally growing trees can be found in all the land-use and vegetation types. Naturally growing trees in the cultivation fields and in *agostadero* land basically belong to the land-owner, but use is free to all farmers and their families. Thus, all community members can use trees and forest in the cultivation fields, pasture lands and hills. Naturally growing trees in a home garden belong exclusively to the *comunero* and his family. Those in the communal man-made forest belong to the whole community, and therefore all farmers can make use of them.

Comuneros and their families perform a decision-making and monitoring and controlling function regarding the use and management of tree and forest resources within their farm. Farmers who want to make use of any tree or forest product on a *comunero*'s land first have to ask permission. In practice, however, permission is not always asked for:

> *Yes, you should ask permission from the owner. But you know, it does not always happen. If you only need a pole or something, or when the owner is not around, well, you just cut what you want* (Gerritsen 1995:65).

Much depends also on the quantity of the product cut. The same farmer proceeded to explain:

> *Generally, you just let somebody look for fruits or some wood he wants. Nobody will say anything about it. The next time you will go to his field and pick his fruits* (*ibid.*:66).

Gathering products in another farmers' field becomes a problem when a person starts to collect in greater quantities:

> *Well, when this peasant starts gathering large quantities, it becomes a problem. I do not have a problem when somebody looks for some fruits. The next time, I will look in his field. But I will not allow him to look for too many fruits* (*ibid.*:66).

The Cuzalapa community institution, i.e. the directive board, also regulates the use and management of the tree and forest resources. The overseer is responsible for watching over the use and management of trees and forests. Any violation has to be reported to the commissioner of common property. The commissioner will then discuss the issue with the farmer involved. In case of severe violations, further steps are taken by informing the general assembly of farmers, or the forestry officer. However, the directive board in Cuzalapa does not always carry out its duties as it should. This was also already described in Chapter 2. A *comunero* commented on one of the former directive boards:

> *The commissioner does not do his work properly. He lets certain people cut wood, although he knows that it is forbidden. In fact, he is not impartial. He gives permission to some of the farmers, while he refuses to give the same permission to others* (*ibid.*:66).

In addition, a voluntary warden regulates the use and management of the communal man-made forest. The communal man-made forest can only be used for domestic purposes, while the remaining fruits are sold. The money earned is used for community works (*ibid.*).

Next to the customary rules and regulations, a number of formal rules and regulations also govern the use and management of resource diversity in Cuzalapa. The formal rules and regulations apparently started to play a role in the sixties. At that time, a number of *comuneros* discussed tree and forest use during a general assembly, attended by a forestry officer. They decided that dead or small trees could be used freely for one's own needs. For the use of big or living trees, the commissioner of common property needs to be informed. If a farmer wants to sell (dead or living) wood outside the community, a permit from the forestry officer is needed. Furthermore, one needs a permit for forest clearings (the so-called *desmontes*) (*ibid.*).

These rules and regulations still apply in Cuzalapa. Farmers should apply for permits for the use of larger quantities of wood through the commissioner of common property, who, in turn, contacts the forestry officer. However, some rules and regulations have also changed, due to the establishment of the RBSM in 1987. For example, the cutting of certain, specially protected, species is now prohibited. Since 1994, *desmontes* (i.e. forest clearings) have also been forbidden, and the gathering of large quantities of dead wood has to be reported to the commissioner of common property.

This restricted access to tree and forest resources has caused changes in Cuzalapa tree tenure. To farmers, it is now the government (in general terms), and no longer the community, that owns the forest resources. This is the case, above all, with the forests in and near the RBSM core zone. In addition, a growing number of *comuneros* are less willing to permit other farmers to gather wood and non-timber forest products on their land (Research in progress with Dr. N.R. Foster).

Differential use and management of resource diversity by Pobre and Ganadero farmers

Some differences can be observed in how *Pobre* and *Ganadero* farmers use and manage resource diversity. Generally speaking, *Pobre* farmers appear to make more diversified use of the different resource units than *Ganadero* farmers do. *Ganadero* farmers are interested, above all, in their browsing and grazing potential. A *Ganadero* farmer commented:

> *Whenever I have time, I will go looking for colcomecas* [Smilax moransis] *and congos* [different types of *fungi*]. *If I do not have time, well, I only go to look after my cows.*

Differences between *Pobre* and *Ganadero* farmers are more evident in *monte alto* and *arbolera* than in *monte bajo* vegetation. For *monte bajo*, differences are less explicit, and both *Pobre* and *Ganadero* farmers mostly value its forage potential. They are, however, driven by different interests. For *Pobre* farmers it is an income source, while for *Ganadero* farmers it provides fodder for their cattle.

Although *Pobre* farmers make more diversified use of forest vegetation, *Ganadero* farmers visit the higher parts of the community more frequently. According to a *Pobre* farmer:

> *Only the cattle-breeders and the people who want to hunt deer go into the hills.* [..] *They* [the majority of the inhabitants] *do not know the forests, because they never go into the hills. But, it is also because they* [those of the Reserve] *do not let us cut anymore.*

Amongst the *Pobre* farmers, there is a group of specialists who are knowledgeable about medicinal plants in the hills. These specialists are known as *curanderos* (i.e. medicine men). A *Pobre* farmer commented:

> *The rich, they do not go into the hills, they always ask us, the people of La Vigía, to go for the* [medicinal] *plants.* […] *They do not know where the plants can be found. They only go into the hills by horse. Here, one walks by foot.* [...] *The animals* [i.e. cattle] *trample the medicinal plants.* [...].*There are people who know a lot about the plants in the hills. I also know* [some], *but there are others.* [...] *Fulano de tal, he is a curandero, Mangano also, but he only treats fears* [‘*sustos*’]. *And then there is also Doña Fulanita, she used to live in La Pareja. She knows a lot about herbs and is curandera of fears and diseases. The cattle-breeders do not know about the plants, because their only business is cattle.*

The land-distribution situation and the zoning regulations of the reserve are two important factors that explain the differences between *Pobre* and *Ganadero* farmers. Relatively more *Ganadero* farmers possess land uphill, while, at the same time, the zoning regulations almost totally prohibit the use of resource diversity within the current core zone. The latter has caused greater insecurity among the farmers about resource access in the buffer zone (Research in progress with Dr N.R. Foster).

Another difference amongst and between *Pobre* and *Ganadero* farmers has to do with their knowledge of the different resource diversity units and the species present. It appears that middle-aged *Pobre* farmers have more profound knowledge than young *Pobre*-farmers and young and middle-aged *Ganadero* farmers. This might be attributed to the indigenous background of these farmers, in contrast to the mestizo background of most middle-aged *Ganadero* farmers. It is also caused by their socio-economic situation. The different products that can be obtained from the resource diversity units do not involve any costs, other than time and labour. The lack of knowledge amongst young (*Pobre* and *Ganadero*) farmers has been caused by various factors, such as educational opportunities, improved social infrastructure, increased out-migration, limited land access and the creation of the Reserve.

6.5 Transformations in the Cuzalapa landscape in the Twentieth Century

In Chapter 5 I presented a generalised picture of resource diversity and the management of its succession (Figures 5.3 and 5.4). In this chapter its dynamic nature and the underlying processes that lead to the creation and/or transformation of different landscape units were described. To complete the picture, I will focus in this section more explicitly on the transformations that have taken place in the Cuzalapa landscape in the second half of the twentieth century, particularly in the 1990s. These transformations are related to the changes that occurred in the regional farming style.

Table 6.11 Social carriers of resource diversity in Cuzalapa

Social carrier	*Type*	*Impact on resource diversity*	*Previously discussed in Chapter*
Commercial forest exploitation	Accepted values of vegetation	Forest cover change and transformation/Forest fragmentation/Variation in structure and species composition	2
Farmers' tree and forest management practices	Accepted values of vegetation	Selective maintenance of forest vegetation	(5) and 6
Land tenure situation	Rules and regulations on resource access	Variation in land-use pattern	2
Zoning regulations of Reserve	Rules and regulations on resource access	Land-use and forest cover change and transformation/ variation in land-use pattern	2 and 7
Maize cultivation	Accepted farming practice	Land-use and forest cover change and transformation	2
Cattle breeding	Accepted farming practice	Land-use and forest cover change and transformation	2 and 3
Controlled burning	Accepted farming practice	Land-use and forest cover change and transformation	(2 and 3)

On the Social Carriers of Resource Diversity

The existence of resource diversity is not a coincidental phenomenon, but is determined by a number of social, technical and natural factors. These factors are dynamic and can be regarded as the carriers of resource diversity. The social and technical factors have an impact on the structure and species composition of forest vegetation, while the natural factors mostly set the bio-geographical boundaries.

Here I will focus on the social factors, which are summarised in Table 6.11. Table 6.11 also indicates the general impact that each one has (had) on resource diversity as a whole, which I will discuss in more detail in the following section.

Transformations in Resource Diversity

Transformations of the Cuzalapa landscape have taken place for centuries. Two processes increasingly shaped resource diversity in the second half of the twentieth century, i.e. commercial forest exploitation and cattle breeding.

As mentioned in Chapter 2, commercial forest exploitation played an important role from the 1940s until the 1980s. As a result of this activity, the majority of the *monte alto* and *arbolera* vegetation in Cuzalapa and the Sierra de Manantlán is relatively young and consists of secondary growth (IMECBIO 2000b).[13] The commercial forest exploitation that took place in the period 1940-1960 did not have any relation to the regional farming style, but it was incorporated as an off-farm activity in the early 1980s. The halting of this activity, however, did not mean that the forest vegetation was no longer incorporated in farming practice, as the previous sections have demonstrated.

Since the seventies, the expansion of the cattle-breeding sector has been an important factor in the development of resource diversity in Cuzalapa. As a result of the increased importance of cattle breeding, pasture to feed the cattle has become more important and this has impacted resource diversity (as a whole), as well as the different landscape units.[14] It has led to changes in the land-use zones and transformations in the different types of forest vegetation.

Broadly speaking, three main types of changes and transformations can be distinguished as a result of the growing importance of cattle breeding. Firstly, a change in land-use mainly in cultivation fields, where the maize crop is replaced by (exotic) pasture. Secondly, a change in land-use as a result of vegetation cover removal. *Monte bajo* vegetation and some home gardens are transformed into permanent meadows by establishing exotic pasture species. Thirdly, changes in land-use in combination with transformation of the forest vegetation cover. Many *monte alto* and *arbolera* forests have changed in structure and composition, due to the application of management practices aimed at increasing pasture availability.

The process of land-use change and vegetation cover removal has been relatively slow. The following statement makes this clear for the replacement of maize by pasture:

> *People started to sell* [grazing rights on] *pasture* [land] *about 30 or 40 years ago.* […] *For about the last 15 years, maize has been replaced by pasture. But, you see this* [process of land-use change] *taking place slowly.*

Decreased maize prices and increased meat prices (mentioned in Chapter 3), have partially induced the land-use change. The same farmer explained:

> *We changed crops, as the countryside is very 'closed'* ['*es muy cerrado el campo*'; i.e. there are many problems and few alternatives] *and maize does not pay. We used to sell it before, but left it some 12 years ago. One does not gain back the costs of transportation. Together, my brothers and I used to cultivate some 23 hectares, which used to leave us* [a yield of] *one ton per hectare. In 1986 we started to cultivate less. Nowadays, we only cultivate eight hectares.*[15]

Different time horizons underlie the changes and transformations in the landscape, including the management of the corresponding succession processes. Land-use change, either alone or in combination with vegetation cover removal, generally takes place over a period of one or a few cropping seasons. The transformation of *monte alto* and *arbolera* vegetation takes place differently than the conversion of home gardens, cultivation fields and *monte bajo* vegetation. Instead of a relatively drastic removal of the vegetation, more gradual changes that generally take more time can be observed. Generally speaking, in *monte alto* and *arbolera*, farmers gradually remove the understorey (i.e. *monte bajo*) and open up the forest canopy. This is done in order to stimulate pasture establishment by increasing light availability. A farmer explained a possible way of opening up *monte alto*:

> *Look, first you cut the monte bajo that is underneath the arbolera. Then you burn the weeds and cut some tree that disturbs you a lot with its shade. Then you establish the pasture, which is burnt every three years.*

The cited farmer indicated the gradual nature of forest cover transformation. However, cases exist of farmers who drastically removed all forest cover in a certain place, even though forest clearing is prohibited by law.

Reorganisation of Time and Space and Landscape Patchiness

The transformations that have been occurring in the landscape of Cuzalapa are schematically represented in Figures 6.2 and 6.3. These figures illustrate the dynamic of resource diversity at two different moments, indicating succession management and the relative importance of the different succession relations. Based on oral history, Figure 6.2 presents a reconstruction of the dynamic of resource diversity in the late 1970s (adapted from Louette *et al.* 1998). At that time, agriculture still used to be a very important land-use activity, including shifting cultivation. Figure 6.3 shows the dynamic of resource diversity in the late 1990s, at which time many of the management activities were based on cattle breeding, i.e. pasture availability in the landscape (see also Louette, *et al.* 1998)

Figure 6.2 Reconstruction of the dynamic of resource diversity in the late 1970s

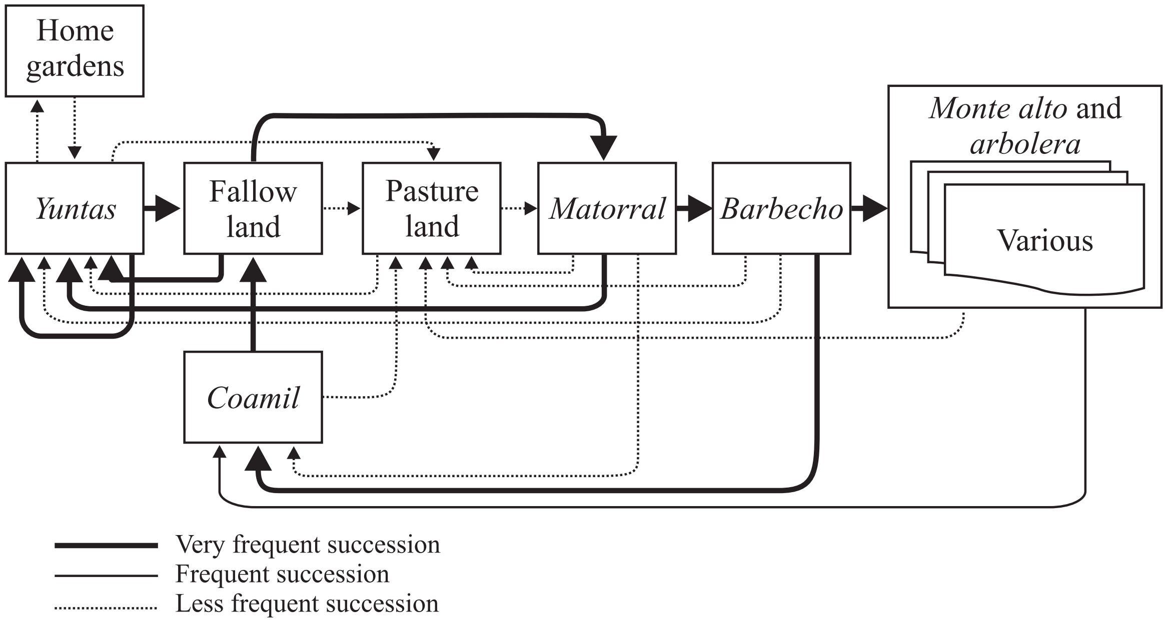
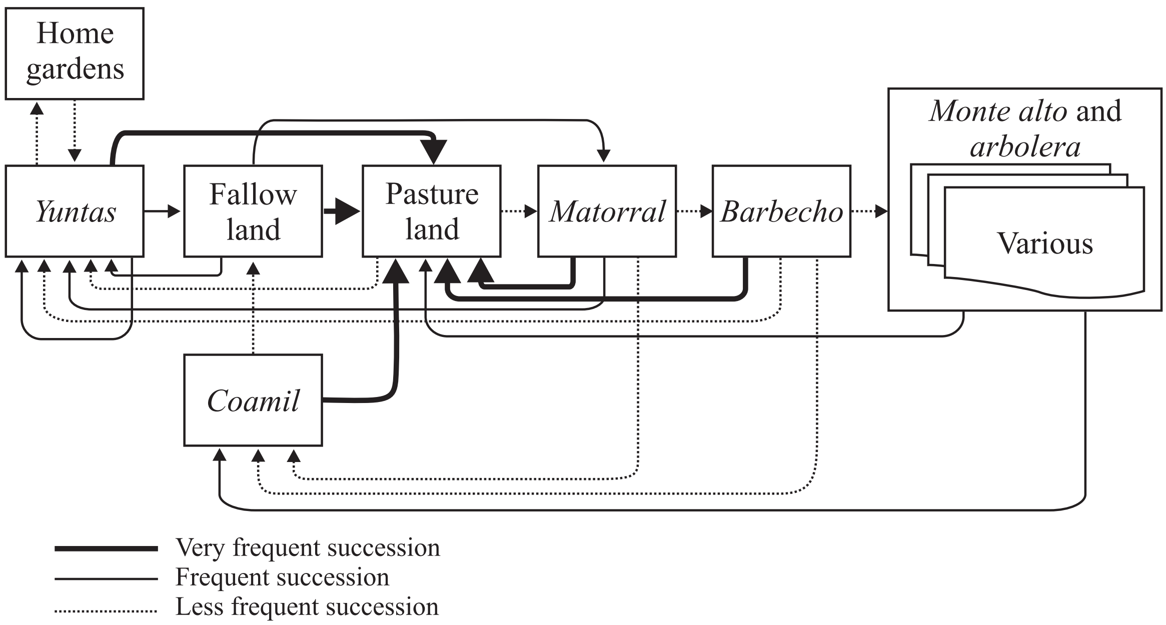


Figure 6.3 The dynamic of resource diversity in the late 1990s



The comparison of both figures indicates a number of transformations in resource diversity in Cuzalapa. Figure 6.3 clearly shows the increased importance of pasture, as many management activities are (re-)directed at enhancing it. A number of succession relations have become more important than others, which I will discuss briefly here.

The first transformation refers to cultivation fields and home gardens that have been transformed into permanent pasture lands. In cultivation fields, this takes place by replacing the maize crop with pasture. The home gardens that are cleared are often the old and unproductive ones. Generally, this does not take place on a very large scale. Furthermore, their transformation into pasture land is indirect, as farmers often cultivate maize (under *yunta* practices) in the cleared home gardens before establishing pasture. This can be explained by the higher soil fertility, as organic matter has accumulated over longer periods. Thus, high maize yields can be obtained without using (much) chemical fertiliser. The second transformation refers to the clearing of *matorrales* and *barbechos*. Similar to home garden conversion, the farmers often cultivate maize (through *coamil* practices) before permanently establishing pasture lands. Finally, the third transformation refers to the conversion of *monte alto* and *arbolera* into pasture land, although (in the 1990s) this took place to a much less degree than the other two types of transformations. This process is again combined with *coamil* practices. The clearing of *monte alto* is called *desmontar*, but it rarely takes place anymore due to the land-distribution situation and the zoning regulations of the SBMR (that prohibit forest clearings without proper permits).

Several studies have tried to quantify the transformations that have taken place in the landscape of Cuzalapa. Based on preliminary results, Louette *et al.* (1998) estimated an increase of 69 per cent of 'open areas', i.e. cultivation fields and pasture lands for the period 1970-1993 in Cuzalapa. According to these authors, farmers have opened up 2,956 ha for cultivation and grazing, which mostly refers to secondary vegetation and forests at lower altitudes. According to Jardel *et al.* (2000), the changes in the period described by Louette *et al.* represent an annual decrease of 0.08 per cent of the 'dense forest area', by which they refer to *monte alto* and *arbolera*. In other words, as these authors also state, the degree of deforestation can be considered low in Cuzalapa. The increase in open areas refers, above all, to pasture lands, according to Guevara *et al.* (1997), who analysed more in detail the land-use changes in the lower parts of Cuzalapa territory for the period 1991-1996.

The quantitative data presented here suggest that, until the late 1990s, farmers (actively) maintained the different land-use zones and forest vegetation types instead of removing (some of) them totally to create needed pastures. Impoverishment of resource diversity thus has not taken place, even though forest vegetation has been opened up to better meet farmers' needs. This finding appears to be substantiated by an observation that was made by Jardel *et al.* (2000), who stated that:

> '[…] *in the southern part of the Sierra* [i.e. Cuzalapa] *one observes in area photographs taken in 1942 with an oblique angle a cleared surface* ['*una superficie desmontada'*] *dedicated to mountain agriculture* ['*agricultura de ladera'*] *that is bigger or at least similar to the current one'* (*ibid.*:10).

Farmers' active maintenance of resource diversity (as a whole) became clear during the fieldwork. Even though pasture has become more important, most farmers will not totally abandon maize cultivation, nor will they totally remove their home gardens.[16] Moreover, even though cattle also graze in *monte alto* and *arbolera*, this vegetation is still important for wood, water or other non-timber forest products. A *Ganadero* farmer commented:

> […] *We have always had cattle in the forests, and we have always maintained the forest.*

In other words, farmers actively maintain the resource diversity for the specific role it plays in farming practice.

Although landscape diversity is maintained, its surface area and structure of composition (of the woody vegetation in the case of *monte* and *arbolera*) do vary over time. The following statement illustrates the variability in farming practice and resource diversity, as experienced in the 1990s:

> [New] *coamiles are not opened anymore; there is little barbecho* [vegetation]. *You barely have any desmontes* [i.e. *monte alto* and *arbolera* clearings] *either.*

This variability of resource diversity demonstrates its dynamic character.

Variation in Resource Diversity Transformations

Above, I described general patterns of resource diversity transformation. In practice, however, this process is more complex, due to the specific social, technical and natural carriers that have influenced the characteristics of resource diversity, as well as the specific use and management by farmers. In the above description, land-use change and vegetation cover transformation were related to altitude, in that land-use change takes place at lower and vegetation cover transformation at higher altitudes. In some cases, however, these two processes can also be observed at other altitudes or, particularly in some parts of the community. Louette *et al.* (1998:9) observed that:

> *'the expansion* [of the pasture area] *occurred in the first place in the areas within the* [lower parts of the] *valley that were covered with vegetation in 1971* [probably mostly *monte bajo*] *and some areas that are found at the foothills. However, the steepness* [*'lo escarpado'*] *of the surface in the north and the poverty of the soils in the north-western region limited displacement towards these zones. For these reasons, the growth of the pasture surface area increased towards the southern and south-eastern part of the watershed, principally in the* [level] *zone located near the village of Cuautitlán.* […] *Today* [in 1998]*, one can observe an incipient increase of pastures towards the north-eastern part of the watershed* [near the Manantlán-Las Joyas core zone and notwithstanding the escarpment]*.'*

This differential character of land-use and vegetation cover changes is caused by several factors, such as the specific biophysical and geomorphologic characteristics of the Cuzalapa landscape (IMECBIO 2000b). The social carriers that were mentioned in Table 6.11 also play a role. A farmer commented on the current land-distribution situation:

> *Before, we used to talk about the free agostaderos* [as everybody could make use of them without restrictions]*, but it is not like that anymore. Today, everybody has his own* [part of the *agostaderos*].

The actual land-distribution situation has not only caused the differential nature of resource diversity transformation, it has also changed farming practice. As was stated in the above section, *coamiles* is hardly practised anymore because shifting from one field to another has become more difficult. This is most likely one of the reasons for the emergence of *matorral* vegetation, which grows especially well on intensively used (but poorer) soils.[17] However, other factors also play a role in the decreased importance of shifting cultivation, such as the introduction of chemical fertiliser and herbicides, the emergence of *pastura* as a commodity, and the increased importance of cattle breeding.

Due to the *de facto* privatisation of the Cuzalapa territory, much now depends on the individual farmers and their strategies. A farmer commented:

> *There are people who do not care about the hills* [i.e. *monte alto and arbolera], they just burn the pasture and do not worry. Or they just go and cut the trees without asking permission.*

The section on the differential use and management of resource diversity by *Pobre* and *Ganader*o farmers also described this.

The farmers' political affiliation at community level further influences their perception and actions regarding resource diversity and its management. The *Cacique* group, made up of mostly *Ganadero* farmers, is much more interested in commercial forest exploitation than most *Pobre* farmers. A member of the democratic group commented:

> *The Ganaderos do not protect the monte; they want pasture. The Pobres, well, some protect and others do not. Some know the benefits, others do not. They are not interested in protection. Those who do not have land do not protect it for the same reason. Besides, they do not lose anything.*

Lack of access to land and the need for (non-timber) forest products can also influence the attitude of farmers regarding the transformation of resource diversity. A farmer commented:

> *A lot* [of farmers] *who do not have a field are more willing to cut trees. There are some from Cuautitlán who only have* [rented] *esquilmos* [i.e. grazing lands uphill] *for the rainy seasons, so they want to cut down more monte. In Santa Rosa* [i.e. one of the hamlets of Cuzalapa]*, it is the same, they only have land that can be worked in the rainy season, so they want to open more forest.*

The land distribution situation and the needs of many farmers have also led to restricted access imposed by those who do own land uphill, thus, indirectly protecting *monte alto* and *arbolera*. A farmer commented:

> *We protect those species that give fruits, but not those that do not. Well, sometimes we do, in order to have wood.* […] *Nowadays, it is the big trees that one protects. Now that everybody gets* [the wood] *from his own* [land]. *They do not let one take* [wood] *from other fields. Before, one could cut where one wanted, it has been different for some 10 years* [i.e. since the late 1980s]. *Nowadays everybody looks after their* [part of the] *hills.*

Thus, nowadays, the management of *monte alto* and *arbolera* very much depends on the land-owning farmers who have fenced the different parts of the landscape.

Finally, technology development has also influenced resource diversity transformation, which in turn influences both resource diversity characteristics and farming practice. The following statement illustrates this:

> *In the old days, we used to cultivate with oxen, which was very difficult. It is not easy to manage them, because they are difficult to tame. One suffers a lot when ploughing with oxen. Some twenty years ago, ploughing started to take place with horses, because they are easier to accommodate and one suffers less.* [...] *My sons started with horses, but I do not know.* […] *And nowadays, with all those machines, one hardly works anymore.* [...] *Today, the people are much more lazy* [*'son más huevones'*]. *Before, things were done better. One cultivated in all parts, nowadays it is all pasture and cows, and the people do nothing. Before, one would work the whole day, today, they only work until no later than 2 p.m.* […] *The Fulano family still let you work until late, but they pay little, so not many people are willing.*

6.6 Conclusion

In this Chapter, I described the use and management of resource diversity by Cuzalapa farmers, including the changes and transformations that have taken place in the second half of the twentieth century. It became clear that farmers share a general set of notions and ideas regarding the value of natural resources, which is embedded in the regional farming style. The transformation of the regional farming style has had an influence on resource diversity. A tendency toward homogenisation can now be observed in the landscape, which includes the opening up of the forest cover in Cuzalapa. However, farmers also actively manage the trees and forests in their community and maintain the different resource diversity units. These two divergent trends indicate that on the one hand, farmers recognise the importance of trees and forest and their role in farming practice. On the other hand, the farmer differentiation that exists within the regional farming style is also (partially) reflected in the landscape and its management.

The described trends in the landscape of Cuzalapa do not only influence the characteristics of landscape diversity, but also the biodiversity that is embedded in its different units. However, this aspect was not specifically studied in this research.

Notes

1 As in Chapter 5, parts of this chapter are published as Gerritsen (1995, 1999, and 2000). Angela Merino, a former forestry student of the University of Cordoba in Spain performed an important part of the fieldwork that underlies Sections 6.2 and 6.3. Of the two publications that emerged from this collaboration, Merino and Gerritsen (1999) will be referred to in the text, as I heavily draw from it. I acted as co-director in the second publication (Merino 2000), which is Angela's B.Sc.-thesis. Furthermore, some of the data underlying this chapter were generated within a research project on the conformation of land tenure in Cuzalapa. Dr Nancy Forster of the University of Wisconsin, Madison, Wisconsin, United States, co-ordinated this research project, in collaboration with María Guadalupe Ortiz Gómez, B.Sc., and the author. Its publications are forthcoming. In the text, this work will be referenced as following: (Research in progress with Dr N. R. Forster).

2 Reference is made here to intrinsic, aesthetic and cultural/religious values (see also Posey 1999).

3 *Encino* leafs are small and thin compared to the big and thick leaves of *roble*.

4 It is also the soil that plays a role. As could be read in Chapter 5, *roblera* soils are poorer and stonier, compared to soils under *encinera* stands. It is, however, also related to the management practices, i.e. the frequency of burning.

5 Regarding the new cattle races used, *Cebú* is fitter for grazing in mountainous areas than, for example, *Friesian Holstein*. It also has a higher meat production. Those farmers interested in milk production cross the *Cebú* breed with *Friesian Holstein*, as the first is more suited to the biophysical conditions of Cuzalapa, and the latter gives a higher milk production.

6 Due to the relatively inaccessibility of the ravines at higher altitudes, this is one of the places where *marihuana* (Cannabis sp.) is cultivated. Farmers are extremely reluctant to talk about it, as its cultivation is forbidden and heavily punished by law.

7 Note that in both tables not all the use categories mentioned for *yuntas* and *coamiles* apply to the latter, as most trees and forest resources are cut when establishing the cultivation field in this land-use practice.

8 As more attention was given during fieldwork to forest vegetation, the number of management practices mentioned for home gardens is probably somewhat underestimated.

9 I first presented this concept in Chapter 5.

10 Note that Figure 6.1, which is based on Figure 1 in Berkes *et al.* (2000:1257) '*falls short on the feedbacks among the ellipses, and the close coupling of some parts of the system, especially management systems and social institutions*' (*ibid.*:1256).

11 It may be clear that these characteristics can be 'manipulated' in order to transform resource diversity to better serve farmers' objectives (van der Ploeg 1999).

12 Cows for milking are kept near the house on meadows with exotic pasture to ensure that the milk is white and has a good flavour. Cows that graze uphill produce milk that is not totally white and that tastes different. This is due to the browsing of herbs and trees in the different *monte* vegetations.

13 For the Las Joyas field station, which is located close to the higher parts of Cuzalapa, Pineda *et al.* (2000) estimate that the majority of the vegetation is younger than 40 years, although scattered trees of 50-100 years can be found also.

14 In Mexico, this process is known as *'ganaderización'* and it is taking place in many of the country's tropical regions (Toledo 1990b), including (the other parts of) the Sierra de Manantlán (Louette *et al.* 1997a).

15 Thus, in this specific case, maize cultivation surface area has decreased by 65%.

16 One of the more practical reasons for not abandoning maize and fruit cultivation is that by producing maize and fruits, one does not have to buy it. See also Chapter 4.

17 The natural conditions of specific sites can also condition the growth of specific types of woody vegetation such as *matorral*. It is thus not only influenced by land-use practices.

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7 The Mexican Policy Perspective on Natural Resource Management[1]

7.1 Introduction

In Chapters 2 to 6, I described the perspective of Cuzalapa farmers on natural resource management, which I called resource diversity. In this chapter, I will shift attention to the Mexican policy perspective on natural resource management. Some 90 per cent of Cuzalapa territory falls within the Sierra de Manantlán Biosphere Reserve (SIIR-SM 1998). Consequently, many formal rules and regulations govern resource use and management.

I will describe this policy perspective at the national level and the regional level (i.e. the RBSM). At national level, I will describe the historical evolution of conservation as a policy issue in Mexico (Section 7.2). I will do so to provide the reader with a basic historical understanding of the attention paid by different Mexican governments to conservation and natural resource management in Mexico, particularly in the countryside. The application of the biosphere reserve concept in the Mexican context will also be examined (Section 7.3). At regional level, I will present an analysis of the management programme of the RBSM, which is the conceptual and normative framework for all conservation and development activities in the Reserve (Section 7.4). This chapter concludes with a general discussion of the Mexican policy perspective on natural resources in relation to Cuzalapa resource diversity (Section 7.5). It will become clear that the Mexican policy perspective differs substantially from the perspective of farmers.

7.2 The Emergence of Conservation as a Policy Issue

The impact on nature caused by the indigenous inhabitants of Mexico before 1500 can be characterised as highly diverse, due to the existence of many different indigenous peoples in Mexico. Consequently, conservation measures taken at the time also differed among the separate indigenous groups. The rules and regulations that existed were often of a religious nature (Simonian 1999). Small protected areas were created, consisting of small patches of forest, or agroforestry systems. A famous one is the enriched forest of Chapultepec in what is now Mexico City, which was fenced in 1428 (de la Maza 1999).

During colonial times, large-scale forest exploitation took place to meet the great demand for wood for housing and mine construction. Often, this led to forest degradation and deforestation. Some measures to protect these forests were implemented, but mainly economic interests drove them (de la Maza 1999). Erosion control also became a political theme, but this took place much later (Simonian 1999; de la Maza 1999). The effectiveness of the different laws depended very much on the individual Spanish civil servants; and in any case, they did not apply to all citizens. *Hacendados* (large-estate owners) were left relatively undisturbed and conservation amongst this group depended on individual attitudes (Simonian 1999).

Mexico's War of Independence (1810-1822) caused an abolishment of the laws decreed in the colonial period. Simonian (1999) describes this period as extremely unfavourable for conservation, as previously protected natural resources became freely accessible again. A further exploitation of forests took place, as the war-torn economy had to be revitalised. Some concern over conservation did exist, however. For example, (the first) forest regulations were decreed in 1861. But these laws contradicted others, which promoted further land and forest clearing, such as the *Ley Lerdo*, declared in 1856. The *Ley Lerdo* changed land tenure in mostly indigenous communities, amongst other ways, by facilitating forest exploitation by national and foreign timber companies. Furthermore, large-scale construction of railroads during the dictatorship of Porfirio Díaz (1876-1911) facilitated access to many forest areas (*ibid.*).

At the end of the nineteenth century, conservation became more important in Mexican politics. This was due to Miguel Angel de Quevedo, an engineer concerned with conservation. Thanks to his initiatives, the *Junta Central de Bosques* (Central Forest Board) was established in 1904. The Central Forest Board aimed at directing attention to forestry issues in Mexico, and, amongst other activities, it published a journal with results of Mexican forestry research (*ibid.*; de la Maza 1999). De Quevedo's efforts also led Porfirio Díaz to establish the legal basis for protected area establishment in 1894, by formalising the governmental right to expropriate land. However, the first protected area was not established until 1898. A comprehensive forest law was dictated in 1909, but it was operative only in federal and not state lands. Its impact, thus, was limited (de la Maza 1999).

Reforming Mexico's Countryside

During the revolutionary period (1910-1917), many armed conflicts took place in the Mexican countryside. During this time, de Quevedo went to Europe, where he studied forestry in France. In the meantime, many of his initiatives regarding forestry protection were not followed up. Soldiers looking for firewood or other (non-timber) forest products sometimes destroyed forests. At the end of the Revolution, de Quevedo returned to Mexico to renew his conservation activities, which he actively pursued until 1940 (Simonian 1999).

The Revolution had a very important impact on Mexico, as land was given to formerly landless peasants. It drastically changed the countryside (Thiesenhusen 1995). It also had some positive effects on natural resource conservation, although this issue did not have a high priority. In 1917, Article 27 of the Constitution established the possibility to expropriate land for conservation purposes. In the same year, President Venustino

Carranza (1914-1920) established the first (post-revolutionary) national park: *El Desierto de los Leones* (Simonian 1999). His successors, the Presidents Alvaro Obregón (1920-1924) and Plutarco Elías Calles (1924-1928) also designated several protected areas, mainly as national parks (de la Maza 1999; Vargas 1984).

De Quevedo's main objective remained forest conservation. In 1922, he established the *Sociedad Forestal Mexicana* (the Mexican Forestry Society), which was the reincarnation of the Central Forest Board created during the dictatorship of Porfirio Díaz. The Central Forest Board had dissolved when de Quevedo went abroad during the Revolution. In 1926, the first post-revolutionary forest law was published whose regulations became operative in 1927.[2] This law has been important for conservation, as it was used as the basic legal framework for forestry in the decades that followed (Simonian 1999).

The First Rise of Conservation

Although progress was made after the Revolution, in practice, conservation rules and regulations were only partially applied. Again, implementation depended a lot on the civil servants involved. It was not until the Lázaro Cárdenas government (1934-1940) that conservation practice received more attention (Vargas 1984). President Cárdenas was important for Mexico in many ways. It was not until his regime that the 1917 land reform was implemented in a more systematic manner (Thiesenhusen 1995). Furthermore, Cárdenas was the first president to prepare an official policy document for his presidential period (de la Maza 1999).

Cárdenas supported de Quevedo's ideas, and established over 40 national parks and a great number of forest reserves and protected forest zones. In 1935, he also created the *Departmento Forestal, de Caza y de Pesca* (the Forestry, Hunting and Fishing Department), which is considered to be the first serious attempt to incorporate an agency responsible for conservation into the Mexican government (Simonian 1999).

Despite their general agreement, differences of opinion also existed between Cárdenas and de Quevedo. While de Quevedo preferred a more restrictive style of conservation, Cárdenas was more in favour of a conservation style that benefited the peasantry. As such, reforestation and the creation of (farmer-based) forest co-operatives were important goals during his government (*ibid.*).

By 1940, Cárdenas had converted 30 per cent of the total Mexican territory into protected area. However, his government lacked the financial and human resources needed to administer these areas. Consequently, most decrees existed only on paper (de la Maza 1999). For similar reasons, the Forestry, Hunting and Fishing Department was closed in 1940. In this period de Quevedo also lost political influence, due to his ideas on conservation and land reform. In de Quevedo's opinion, restrictions for conservation were necessary, as he believed that land reform had opened up forests for destruction by farmers. Conservation policy under the Cárdenas government, however, has to be considered important. It was the first systematic and governmentally supported attempt to create a scientific basis for natural resource protection (Simonian 1999).

The Decline of Conservation

Two reasons explain the progress in conservation during Cárdenas' presidency: 1) the existence of a governmental agency for conservation, and 2) presidential support. From 1940 until the early 1970s, both factors were largely absent. In addition, this period was characterised by rapid demographic growth, urbanisation and industrialisation. Consequently, natural resource exploitation and degradation also increased (Simonian 1999).

As most policies were directed at modernisation, conservation programmes lacked funds and personnel. Achieving conservation was also considered to be necessarily compatible with industrialisation. In contrast to Cárdenas, his successors largely abolished support for a dual economy (i.e. peasant economies next to commercial farming). All governmental support was aimed at developing commodity farming in a few rural areas (*ibid.*, see also Barkin 1995; Linck 1988).

In this period, conservation activities diminished, but attention also shifted from forest to soil and water conservation, which was important for the highly productive agricultural regions. In 1946, President Ávila Camacho (1940-46) declared the Soil and Water Conservation Law, after having created the Department of Soil Conservation some years before. His successor, Miguel Alemán (1946-1952) created the post of Secretary of Agriculture, but designated insufficient funds to make it really operative. President Ruiz Cortínes (1952-1958) also stressed the importance of soil and water conservation, but assigned even smaller budgets to the corresponding governmental agencies (Simonian 1999; Vargas 1984).

The government of President Alemán focussed attention on forests by promulgating the Forest Law in 1948, but the initiative turned out to be mostly rhetorical. In practice, economic values remained more important than biological ones. Consequently, forest degradation proceeded, while few professional foresters even existed. In 1950, for example, there were only 12 forestry students in the whole of Mexico. Only seven national parks were designated in the period 1940-1970. Under the government of Lopez Mateos (1958-1964), a more complete forestry programme was designed and implemented. But the lack of governmental support severely limited its possibilities and impact. Forest conservation policy under his successor Díaz Ordáz (1964-1970) was similar to the policies of the governments that had preceded him (Simonian 1999).

From the late 1960s, it became clear that modernisation policies did not meet expectations (Warman 2001). In the period 1964 to 1976 conservation measures were redefined to better address the country's needs. Some protected area decrees were nullified, while laws were proclaimed that facilitated forest clearing, such as the *Programa Nacional de Desmontes* (the National Program for Forest Clearing) (de la Maza 1999).

Although governmental efforts in the period 1940-1970 supported mostly economic interests, conservation was not totally abandoned. It took place outside the governmental sphere. A small number of people, including Enrique Beltrán, Miguel Álvarez del Toro, and Gertrude Blom, were working to achieve a sustainable use and management of natural resources. An important activity of these conservationists was the diffusion of natural values amongst the Mexican society (Simonian 1999). At international level, important developments were also taking place. Together, the national and international developments led to a period that can be characterised as the second rise of conservation from the 1970s onwards (Gutierrez 20000; Simonian 1999; de la Maza 1999).

The Second Rise of Conservation

The importance of conservation increased in the 1970s, due in part to two international developments: in 1971, UNESCO initiated the 'Man and Biosphere program (MAB)', and in 1972, the United Nations Conference on the Human Environment in Stockholm drew attention to growing environmental problems. It was at the latter conference that the concept of 'ecodevelopment' was born, which was later redefined as sustainable development (Simonian 1999). In the 1980s and the 1990s, three other international events reinforced the importance of conservation and sustainability: in 1980, the International Union for the Conservation of Nature (IUCN) published its 'World Conservation Strategy', in which sustainability and local participation are mentioned as key issues of natural resource conservation; in 1987, the Brundtland committee published the research document 'Our Common Future', synthesising the world's environmental problems; and in 1992, the international Rio de Janeiro Meeting on Development and Conservation took place, at which biodiversity was recognised as an important environmental factor (Gutierrez 2000; Simonian 1999; de la Maza 1999).

In Mexico it has been, above all, the non-governmental sector that has promoted conservation and sustainability. The biologist Gonzalo Halffter, for example, was instrumental in the establishment of the first biosphere reserves. He very much stresses the importance of a scientific foundation for sustaining the establishment of protected areas, which he claims was lacking in protected area management before the 1970s. He has also criticised the inability of conservationists to meet the needs of local people in protected areas (Halffter 1984). The work of Halffter has been important for conservation in Mexico as it led to the creation of the first two biosphere reserves in the northern-Mexican state of Durango in 1979: *Mapimí* and *La Michilía* (Simonian 1999; de la Maza 1999; Gutierrez 2000).

Governmental attention for conservation increased from the 1970s onwards as successive governments followed a new course that were more or less similar to the lines formerly set by President Lázaro Cárdenas. The 1970's and the 1980's can be seen as start-up years for the consolidation of conservation and the environment as a policy theme (Simonian 1999; INE 2000a).

In the 1970s and the 1980s, environmental problems became part of the political agenda of both President Luis Echeverría (1970-1976) and President José López

Portillo (1976-1982). Both presidents strongly believed in the compatibility of environmental and industrialisation issues, and they both sought mainly technological solutions for Mexico's environmental problems. Unfortunately, just as in previous periods, more was said than done. However, some important steps were taken, such as the approbation of the *Ley para la Prevención y el Control de la Contaminación* (*LPCC*: the law for pollution prevention and control), which was primarily directed at resolving Mexico City's pollution problems. Due to the economic crisis of 1980, President López Portillo focussed governmental attention on maintaining economic growth instead of resolving environmental problems, which he thought would be improper in times of economic crises. However, in 1982 he did declare the *Ley Federal de Protección al Ambiente* (*LFPA*: the Federal Law on the Protection of the Environment). It was the first law that defined far-going legal attributes for conservation (Simonian 1999; Gutiérrez 2000). Together with the *Ley Federal de Caza* (the Federal Law on Hunting) and the *Ley Forestal* (the Forestry Law) it determined governmental conservation actions in Mexico for this period (Vargas 1984).

Three important conservation initiatives took place under the regime of President Miguel de la Madrid (1982-1988). Firstly, the *Secretaría de Desarrollo Urbano y Ecología* (*SEDUE*: Ministry of Urban Development and Ecology) was created in 1982. The SEDUE was the first environmental ministry established within a Mexican government since the Cárdenas government. However, it did not meet any of its objectives. Its attention was aimed more at the urban areas, especially Mexico City. Secondly, the *Sistema Nacional de Áreas Naturales Protegidas* (SINAP) was also established, whose purpose was to co-ordinate efforts regarding protected areas. Thirdly, the *Ley General de Equilibrio Ecológico y Protección al Ambiente* (*LGEEPA*: the General Law on Ecological Equilibrium and Environmental Protection) was approved in 1988. The LGEEPA, which was based on the LFPA, was the most complete law on conservation passed since the Mexican Revolution. Amongst other changes, it delegates responsibility for conservation efforts to the state and municipality level. Protected area establishment is also considered to be an important conservation instrument. Finally, it is the first law that considers linking conservation activities with development goals (Gutiérrez 2000; Vargas 1984; Simonian 1999; INE 2000[a]).

President de la Madrid and his successor President Carlos Salinas de Gortari (1988-1994) changed political course to solve Mexico's environmental problems. Both presidents thought that environmental problems could only be solved by joint actions between government and society. In other words, conservation became part of the political discourse of governmental agencies, which was no longer dominated by purely economic interests (Simonian 1999).

The Institutionalisation of Conservation as a Policy Issue

The 1990s brought a further maturation of Mexican environmental and conservation politics. In 1994, President Ernesto Zedillo Ponce de León (1994-2000) created the

Secretaría de Medio Ambiente, Recursos Naturales y Pesca (*SEMARNAP*: Ministry for Environment, Natural Resources and Fisheries).[3] SEMARNAP was headed until 2000 by the biologist Julia Carabias, a former researcher on integrated conservation and development projects at the *Universidad Nacional Autónoma de México* (*UNAM*: National Autonomous University of Mexico). The importance of SEMARNAP lies in joining the mandates of environmental protection and natural resource management within the same ministry (Simonian 1999),

> *'to attend in an integral manner to the country's conservation, natural resource use and environmental protection from a sustainable development perspective'* (INE 2000a: 11, own translation).

More specifically, the SEMARNAP approach to environmental problems lies in joining normative, legal-administrative and technical-scientific functions (Gutiérrez 2000). This had not been done before in Mexico's political history. Legal reforms of the LGEEPA in 1996 further modernised environmental legislation (Simonian 1999: INE 2000a).

Protected Areas in the 1990s

Through the creation of SEMARNAP, the administration of protected areas became the responsibility of one governmental department. Until 1976, many different dependencies of mainly the forestry sector were in charge. From 1976 to 1982, the responsibility of protected areas was divided amongst five governmental agencies. With the creation of SEDUE in 1982, this number was reduced to two: SEDUE and SARH (*Secretaria de Agricultura y Recursos Hidráulicos*: the Ministry of Agriculture and Hydraulic Resources). SEDUE was in charge of the protected areas that were joined with the SINAP, while SARH took care of forest management and exploitation and the remaining protected areas (Ordoñez and Flores 1995). In 1995, protected area management became part of the activities of one governmental agency, i.e. the *Instituto Nacional de Ecología* (INE: the National Institute for Ecology), which is part of SEMARNAP (INE 2000[a]).

Protected area management also received more attention with the creation of a formal policy document in 1995: the so-called *Programa de Áreas Naturales Protegidas 1995-2000*; (*PANP 1995-2000*: Protected Natural Area Programme). The programme sets the conceptual and legal basis for conservation in Mexico (SEMARNAP 1996).[4] The PANP 1995-2000 can be seen as the first attempt in Mexico's history to systematically join conservation efforts, putting an emphasis on the improvement of the institutional context for conservation (INE 2000a). Being a new ministry, SEMARNAP has concentrated its actions on a limited number of protected areas to experiment with the new guidelines of the PANP 1995-2000 (SEMARNAP 1996).[5]

Since 1995, more actions have been taken to strengthen the political basis for protected area management. In 1996 the *Consejo Nacional para Áreas Naturales Protegidas* (*CONANP*: National Council for Protected Natural Areas) was established, which is an advisory board that joins representatives from different non-governmental sectors. Consolidating the federal *Comisión Nacional para el Conocimiento y Uso de la Biodiversidad* (*CONABIO*: National Committee for Knowledge and Use of Biodiversity) has strengthened the scientific basis for conservation (Simonian 1999; de la Maza 1999). Finally, in 2000, the *Comision Nacional de Áreas Naturales Protegidas* (*CNANP*: National Committee for Protected Natural Areas) was created within the SEMARNAP, through which protected area management obtained a broader institutional mandate (INE 2000a).[6]

The foregoing development has led to the creation of a new set of programmes, dependencies, institutions and instruments for achieving conservation. Tables 7.1 and 7.2 present an overview. Some have already been mentioned, while I will discuss the most relevant ones in the remaining parts of this chapter.

Table 7.1 Legal instruments for conservation at federal level (INE 2000b: 60-61, own translation)

Instrument	*Description*
National Development Plan 1995-2000	Policy document of Zedillo government
Environmental Plan 1995-2000	Policy document of Zedillo government
General Law on Ecological Equilibrium and Environmental Protection (LGEEPA)	Most important Mexican law on environmental issues
Program for Mexican Natural Protected Areas 1995-2000	Policy document of Zedillo government
National System for Natural Protected Areas (SINAP)	Federal agency for co-ordinating protected natural areas
By-law of the LGEEPA	Additional rules and regulations of the LGEEPA
National Council for Protected Natural Areas	Advisory body for conservation
Ecological Land-Use Planning (*ordenamiento ecológico del territorio*)	Basic normative instrument

Table 7.2 Legal instruments for conservation at protected area level (INE 2000b: 60-61, own translation)

Instrument	*Description*
Management programmes	Region-specific normative framework for conservation and development
Environmental impact assessment	Basic normative instrument
Annual operative plans (the so-called POA)	Strategic planning instrument
Technical advisory council (the so-called CTA)	Decision-making body
System of Units for the conservation, management and sustainable use of wildlife (the so-called UMA)	Region-specific normative framework for conservation and development of wildlife, based on the management programme of a protected area
Expropriation and purchase of land	Basic normative instrument

Conclusion

In this section, I described the historical development of conservation and, to a lesser degree, protected area management in Mexico. Conservation and protected areas have been important as a policy issue during two periods, i.e. during the government of

President Cárdenas (1934-1940) and since the 1970s. During the other periods, attention to the environment was very limited. Thus, governmental attention to conservation and protected areas can be considered a relatively recent phenomenon in Mexican politics. Moreover, the limited availability of financial and human resources has determined to a great extent the degree to which conservation has been put into practice.

The surface area that was placed under governmental protection by the end of the twentieth century is considerable. In 1999, some 7 per cent (approximately 13,887,887 ha) of the Mexican territory was under some form of protection, of which biosphere reserves represent the most important modality in terms of surface area (INE 2000b: 12). The great majority of protected areas are inhabited by local, mostly indigenous peoples (Nigh and Rodríguez 1995). It is generally agreed that the implementation of SEMARNAP's environmental policy faces many challenges (INE 2000a). At the end of her administration, Minister Carabias commented in an interview about her mandate as Minister of SEMARNAP and the challenges that lay ahead:

> *I think that it is fundamentally a problem of time; because* [we had] *to start from a process in which conservation and development were very disconnected. We had to generate a programmatic platform, the instruments, the institutions, training, organisation. It is a process that has to mature and which I still would see* [taking place] *in 20 years. I do not think of it as something that our administration could not do and that this one* [i.e. new administration] *will* (Castillo 2000c, own translation).

Several authors, such as Nigh and Rodríguez (1995), Graf *et al.* (1999), World Bank (1999) and Gutiérrez (2000), agree with Carabias that there are still many challenges ahead for conservation and protected area management in Mexico.

7.3 The Mexican Modality of Biosphere Reserves

In Mexican conservationist circles reference is made to the 'Mexican modality of biosphere reserves', when discussing conservation in biosphere reserves. I will discuss this modality in this section. After a general description, I will discuss the implementation of this modality using the RBSM as an example, as it is recognised as one of the more successful biosphere reserves in Mexico.

Basic Description of the Mexican Modality

Mexican modality refers to Mexico's own management scheme for conservation in biosphere reserves. As part of this modality, conservation is not only understood as mere (ecosystem and species) protection, but also as ecosystem and species maintenance, sustainable use of natural resources and ecological restoration. Conservation defined in this way is to be achieved by stimulating local participation, by implementing development-oriented research for strengthening conservation activities and by co-ordinating the different institutional efforts. The latter has been realised through the creation of a specific (governmental) agency to administer the Reserve (the so-called Directorship of the Biosphere Reserve), and by the implementation of a national conservation strategy (Halffter 1984). Furthermore, this strategy is laid down in the *Programa de Medio Ambiente 1995-2000* (Environmental Program 1995-2000) and the already mentioned PANP 1995-2000 (INE 2000b). Strategic alliances between academic and governmental agencies at different organisational levels are also considered very important (Halffter 1984). Finally, flexibility in both administrative structure and daily management is seen as one of the system's strengths. The combination of all these elements is considered important, as it permits the implementation of an adaptive management.

The Mexican modality has been applauded as an extremely strategic scheme for achieving conservation in rural areas, and for linking crucial components that determine success. Referring to the biosphere reserve concept in general, Gómez-Pompa (1998) states:

> *'The idea looked brilliant, as it combined elements that are difficult to criticise. Politically and economically, it was a viable concept. The concept was adopted with enthusiasm. The key to its acceptance was that it did not imply any change to what countries already were doing; there were no economic obligations, land acquisitions, relocations of people, nor sanctions of any type. The big difference between biosphere reserves and other protected areas was the participation of scientists in the whole process of selection and approval of the areas,* [and] *the recognition that there were people inside the reserves, which is a factor that had to be taken into account'* (*ibid*.: 6, own translation).

The Sierra de Manantlán biosphere reserve was one of the first biosphere reserves established in Mexico and one of the first reserves where the Mexican conservation modality has been applied in practice (Graf *et al.* 1999). The research institute IMECBIO of the University of Guadalajara played a leading role in the Reserve until 1994 (Jardel 1992a). The creation of the RBSM in 1987 was a joint effort of many people, including farmer groups in the Sierra de Manantlán. Santana (2000) states:

> *'protected areas, like Las Joyas* [the scientific field station of the RBSM] *and the RBSM don't just happen, committed people make them happen* [...] *Hugh Iltiss* [a recognised botanist from the United States] *came up with the idea to start a reserve, and he did the right thing at the right time to get key Mexican and U.S. players interested in his idea. Gónzalo Halffter convinced everyone that, to have a possibility of success, it should be a biosphere reserve. Raul Padilla* [former dean of the University of Guadalajara] *created the political conditions for making it all happen.* [...] *The long-term (1985-1995) support from the World Wildlife Fund and the National Park and Wildlife Foundation (1994-2002) have been fundamental in consolidating the RBSM* [...]*'* (*ibid.*: vii/viii).

The conservation efforts undertaken in the RBSM since its establishment are highly valued in Mexico. In 2000, at the end of her period as minister of the SEMARNAP, Julia Carabias commented in an interview that:

> [The Sierra de Manantlán Biosphere] *is clearly a history of success, and is absolutely an example for the other biosphere reserves in the country.* […] *The success is due to the collaborative work at the three governmental levels* [local,

> state, and federal], *even though the reserve is located in two states, and due to social participation* (Castillo 2000[a], own translation).

The Mexican modality for biosphere reserves is considered to be a successful approach to conservation. For the RBSM, success lies in the protection of the flora and fauna in the core zones, a decrease in forest fires, the resolution of a number of conflicts over conservation, the collaboration between several governmental agencies and the creation of two discussion platforms in the region. But, a number of challenges still remain. These challenges concern the precise role of farmers' participation, effective management in core and buffer zones and institution building. I will discuss these three themes in the next sections. A fourth challenge that also relates to the farmers' participation is the question of how to harmonise management of the Reserve with the farmers' perspective of biological diversity (i.e. resource diversity). This challenge is the main theme of this book.

Participation in the Sierra de Manantlán Biosphere Reserve

Participation is considered to be a central prerequisite for achieving success in biosphere reserves, as many different actors converge in the same geographical space and attribute (different) values to the same natural resources. This is also true for the RBSM. One conservationist stated in an interview:

> [The experience of the Sierra de Manantlán biosphere reserve] *shows us that you have to reach agreement with the inhabitants and the farmers.* [...] *It is common to think that a decree* [i.e. the 1987 presidential resolution] *limits activities, such as forest production. The truth is that it can be an activity that can be compatible with conservation in a buffer zone.* [...] *You have to obtain socio-economic data, which enables you to establish viable alternatives from a sustainability perspective.* [...] *You have to convince others that a reserve brings advantages, such as economic resources, technical assistance and support from environmental organisations.* [...] *It is worth it, but it depends on the people living there. It is they who make conservation work. If they do not approve of the project, protection will take place only by force* [i.e. law enforcement] (Castillo 2000b, own translation).

Participation is crucial for successful protected-area management. Since the 1996 reform of the LGEEPA, Mexican environmental law establishes that: *'social participation is an obligation in all phases of the creation and management of a natural protected area'* (INE 2000[a]:51). Participation refers to co-ordination at the institutional level and at the regional level with (non-governmental) actors. Governmental institutions are expected to work together (the so-called 'inter-institutional co-ordination') to improve the link between different conservation and development activities and to make governmental intervention more effective and efficient. Close co-operation is also intended to make it easier to resolve (local-level) conflicts. Involved institutions have either bilateral relations with the Directorship of the Reserve, or they participate in consultative boards at regional and state level (SEMARNAP 1996; World Bank 1999).

Participation of regional actors is sought at the agrarian community level and at the level of the whole Reserve. It is conceptualised in terms of co-management of natural resources (Borrini-Feyerabend 1996). At community level, the directive board (i.e. the local institution for land and natural resources) is approached to discuss and agree on conservation issues. Specific farmers' groups or organisations are target groups for specific projects. They are also addressed directly in those communities where local institutions are dysfunctional (Gerritsen 1998b; Gerritsen and Forster 2001). In all cases, agreements are formulated and signed to formalising working relationships between farmers and the Directorship of the Biosphere Reserve (IMECBIO 2000b).

At the Reserve level, the *Consejo Técnico Asesor* (*CTA*: technical counselling committee) represents a discussion platform for many different actors. It consists of all those actors that are relevant to the Reserve's management, such as agrarian communities and its formal and informal authorities, but also civil, academic and conservation organisations (SEMARNAP 1996). Governmental agencies are not formally included, except for the municipality presidents (INE 2000a). In the Sierra de Manantlán, two CTAs are operational (since July and November 1997, respectively), as the Reserve is located in both the state of Jalisco and the state of Colima. One of the CTAs represents the involved actors of Jalisco, while the other represents the actors living in Colima.

Each CTA must follow internal regulations, which, in the case of the RBSM, were approved in July 2000. These regulations state that:

> *'the general function of the CTA is to consult about strategies and courses of action for the management of the natural protected area.* [The general function is also] *to co-ordinate actions between the three levels of government, the communities, private land-owners, non-governmental organisations and citizens, as well as to provide technical supervision.* [The CTA is also expected to] *advise and submit recommendations to the Directorship of the Reserve for the adequate administration, management, development and operation* [of the Reserve], [thus] *helping* […] *to implement the national environmental policy for protected natural areas'* (CARBS-EJC 2000: 2, own translation).

The different mechanisms for farmer involvement in the management of biosphere reserves have gone through a rapid evolution in the RBSM, after having been absent for the first ten years of the Reserve's existence (Kreutzer 1998a). However, the application of participatory mechanisms in daily practice is limited, or sometimes driven by other interests. For example, the number of actors directly involved is minimal (Kreutzer 1998a; Kreutzer and Gerritsen 1998a, 1998b), especially in communities whose local institutions are dysfunctional (IMECBIO 2000b; Gerritsen and Forster 2001). In practice, it is mainly male farmers who are interested in the projects that are being addressed, while the participation of women is scarce. Moreover, according to Kreutzer (1998a), who extensively studied the participatory process in the RBSM for the period 1984-1998, the roles of the main participating actors are clearly and narrowly defined. According to her analysis, governmental institutions deal mainly with normative and legal aspects, while the farmers' role is limited primarily to the consultation and executive phases of the Reserve's management. In other words, farmer participation is operationalised mostly in functional terms (Gerritsen *et al.* 1997; see also Pimbert and Pretty 1995; Kaus 1995). Finally, the possibilities for participation depend on the actors' different educational, social and cultural backgrounds (Chambers 1983, 1997).

The Challenge of Effective Management in the Buffer and Core Zones

Biosphere reserves change the rules and regulations governing natural resource use and management within their limits. In Cuzalapa, but also in other communities, the struggle over resource access that began when the Reserve was created still continues. Part of the problem lies in the actual zoning (i.e. the division of the Reserve in core and buffer zones) and the lack of a proper institutional basis for implementing the different regulations, especially in the core zones. Consequently:

> *'The actual zoning has been perceived as a problem and an erroneous governmental decision. As a result, the support given by the communities to the reserve in the beginning* [i.e. late 1980s] *as a way to protect their forests against external agents has started to dissolve'* (Graf *et al.* 1999: 8, own translation).

Zoning regulations apply to both buffer and core zones. Results of tenure research indicate that today the zoning regulations create a sense of insecurity amongst farmers in Cuzalapa with respect to resource access.. (Research in progress with Dr. N.R. Forster, see also Chapter 6). This is because many farmers do not understand the exact nature of the Reserve's rules. Most farmers are not familiar with the basic concepts, nor the rules and regulations, that govern natural resource use and management (Gerritsen 1998a, Kreutzer 1998b). At the same time, these rules and regulations overlap existing customary tenure regimes (Gerritsen and Forster 2001). Graf *et al.* (1999) state that:

> *'in practice the core zones are not functional due to the difficulties in creating compensatory measures, as well as ineffective governmental measures for protection. In the first case, conflicts over tenure, unequal land distribution between individuals and families within communities* [and] *the illegal appropriation of resources limit the implementation of compensatory measures for support for productive projects, payment of environmental services, or work in the Reserve's management, as the beneficiaries are not always the same as those who own, dispute or usufruct core zone land. In the second case, the legal, operative and financial limitations of the official dependencies make the application of protection and vigilance measures difficult. Without effective management, but under a strict regime of protection, the core zones,* [...] *are susceptible to becoming spaces where illegal activities flourish, such as illegal wood cutting, illegal hunting, and drug cultivation. It is also in the core zones where the most critical forest fires take place, with regard to frequency and surface area'* (*ibid.*: 7-8, own translation).

The actual zoning and the corresponding regulations are not only challenging from a social perspective, but also from an ecological perspective. Contreras (1999), for example, argues that the most important endemic species of migratory birds have been left out of the protected area systems. She states that:

> '*the need for rezoning of existing protected areas is also important to our analysis. In the case of the Sierra de Manantlán, for instance, there is inadequate zoning based on the objective of conserving endemic bird species, although it appears to provide adequate protection for* [other] *endangered species'* (*ibid.*: 34).

To overcome some of the problems that have emerged from the current zoning regulations, the Reserve management has proposed a re-zoning. Re-zoning, however, will take at least five years to be implemented, due to the legal context of protected areas (IMECBIO 2000b).

The Challenge for Institutional Co-ordination

The strengthening of institutional co-ordination is a relatively recent process in the RBSM. It was weak until 1994, i.e. for the first seven years of the Reserve's existence. Many institutions did not want to participate in the Reserve's management, as they felt threatened by its emergence. The creation of the Directorship of the RBSM in 1994 has improved the co-ordination of many of the different governmental agencies working in the Sierra de Manantlán mountain range (Graf *et al.* 1999). But challenges still exist regarding the co-ordination with other institutions, the specific bureaucratic culture in Mexico and the possibilities for academic institutions of becoming involved in protected area management.

A World Bank study concluded that Mexican bureaucracy (in general) is characterised by relatively weak links with other institutions and with civil society. According to a study on inter-institutional co-ordination, there is a lack of clarity on how to incorporate local proposals in programme design and implementation. Besides, a strategic long-term vision on rural development is missing. Furthermore, there is hardly any co-ordination between the different institutions in the design and budgeting phases of the programmes. Finally, there is confusion as to the rights and responsibilities that have been delegated to the discussion platforms at regional level (World Bank 1999, see also Castañeda 2001 for a case study from the RBSM).

Mexican governmental agencies are also characterised by a specific institutional culture that further limits their possibilities. Referring to forest valuation in the RBSM, Morton *et al.* (1998) state that:

> '[...] *there may well be a valid case for subsidy as a tool to maintain the traditional way of life in the Sierra de Manantlán and to support its conservation. It is clear, however, that current programmes are not based on an argued case of this kind. Instead, they reflect a pattern of political action that is long-established in Mexico and, indeed, much of Latin America, where all tiers of society are practised at lobbying for state support of all kinds and where many sections of the bureaucracy see the intermediation of this activity as central to their function'* (*ibid.*: 25).

As stated before, academic institutions are seen as important counterparts in the Mexican modality for biosphere reserves. But, a number of factors can be identified that limit their contributions. To start with, researchers employed by academic institutions are also involved in other tasks, such as teaching and research, which impede them from dedicating all of their time to conservation and development work. Moreover, the more practical information required by reserve managers does not receive much attention from the University of Guadalajara, often resulting in a reluctance amongst many staff members to get involved in community development. Furthermore, due to the specific academic requirements, most research results are not very accessible to farmers, either because of their format or the research timeline. The underlying problem here is the unsolved dilemma between the more practical activities of community development and natural resource management and the academic functions of university staff, such as research and teaching (Gerritsen 1998b; cf. Chambers 1997).

Conclusion

This section demonstrated that biosphere reserves in Mexico are externally induced projects that require, most importantly, participation for successful implementation. Several mechanisms have been designed, which, however, are not fully operative in daily practice. As such, and notwithstanding the considerable progress that has been made in comparison to traditional nature conservation projects, biosphere reserves can be characterised as conservation projects that still have relatively weak links to both local inhabitants and the various institutions involved. Furthermore, their conceptualisation and design have led to a number of management problems. Thus, as Gómez-Pompa states: *'The model is still on trial. To this day, no one has yet succeeded in creating a biosphere reserve that functions as foreseen in the UNESCO model'* (Gómez-Pompa 1998: 7, own translation).

Although biosphere reserves have achieved some positive results, 'success' should be measured according to their objectives, i.e. conservation, development, and research and education. While advances have been made in the areas of conservation and (ecological) research, progress in achieving development objectives is lagging behind (see Nigh and Rodríguez 1995; Pimbert and Pretty 1995). Moreover, as indicated above, even some basic conservation objectives of biosphere reserves, such as core zone protection, have still not been achieved (Graf, *et al.* 1999). In turn, research and development have been strongly influenced by the scientific paradigm (see Jardel, *et al.* 2000b). These issues will be elaborated in the following description of the RBSM management programme.

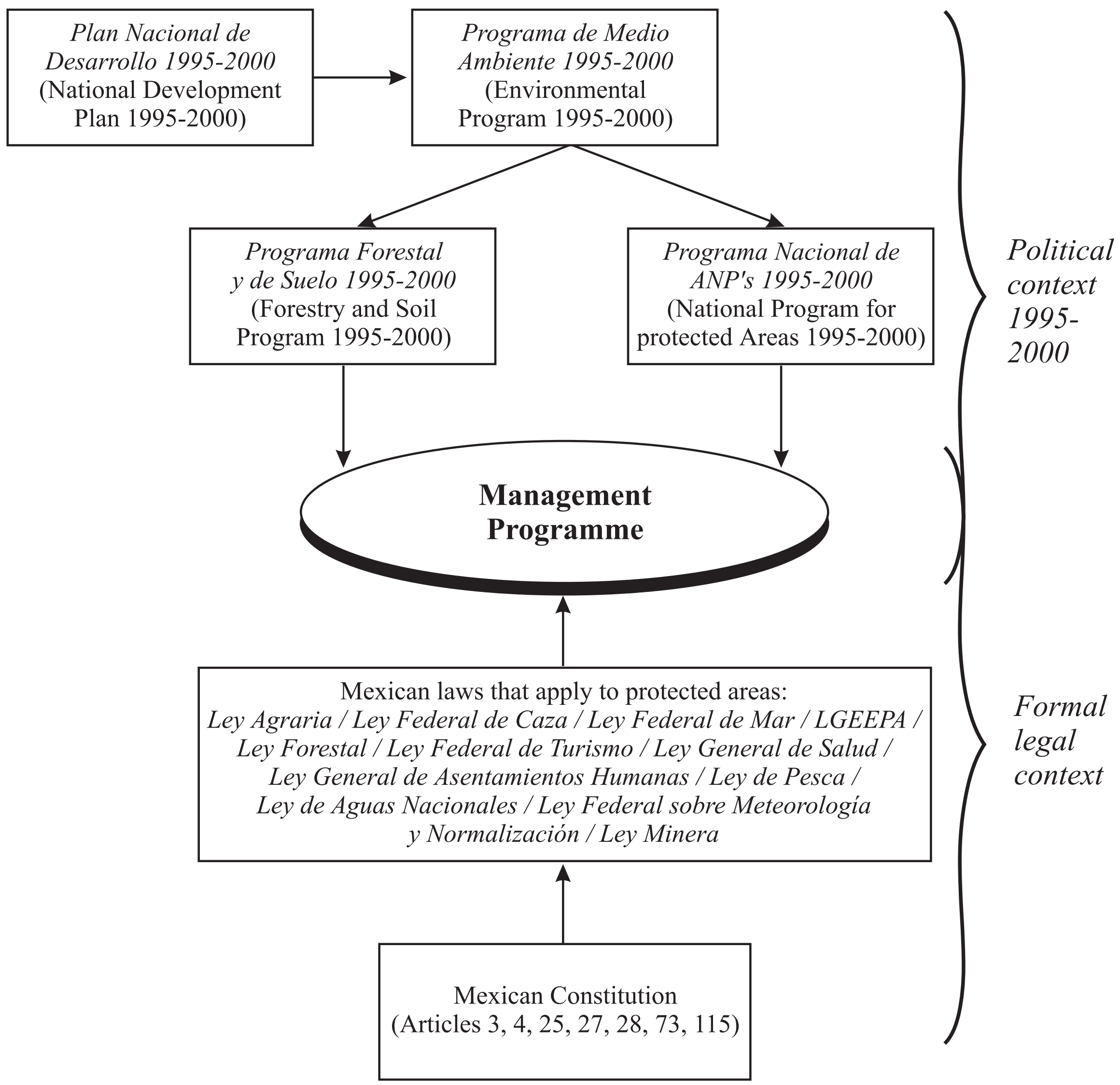
7.4 The Management Programme of the RBSM

Management programmes are central policy instruments for biosphere reserves. They represent the legal and conceptual framework for guiding all development and conservation actions. They are based on environmental legislation and on a scientific problem assessment. In the PNAP 1995-2000, this is stated as follows:

'The management programmes have to be based on the respective decree, in which the declaration of the natural protected area is made, and they have to be developed within a land-use-zoning plan. This must be derived from what is established by law, from a solid scientific and technical knowledge base and from a very precise process of local consensus generation, which will depend on the particular conditions of each area, and for which there is no universal formula. The management programme must be issued in such a way that it obtains legal force' (SEMARNAP 1996: 81, own translation).

Figure 7.1 presents the most important federal laws and political programmes that played a role in the period 1994-2000 for management programmes in Mexico.

Figure 7.1 The legal and political context of management programmes at federal level (based on Gutíerrez 2000; INE 2000[a], 2000b)



As illustrated in the figure, two political programmes play an important role: the Forestry and Soil Program (*Programa Forestal y Suelo*) and the National Program for Protected Areas (*Programa de Areas Naturales Protegidas*). Both originated from the more generic Environment Program (*Programa de Medio Ambiente*) and the National Plan for Development (*Plan Nacional de Desarrollo*). Many federal laws govern natural resource use and management in Mexico (Table 7.3), although the individual laws do not necessarily apply to each protected area. Based on these federal laws and programmes are a number of state laws and political programmes that can be seen as a specification of the general legal dispositions at state and municipality level.

Table 7.3 Laws that govern protected areas in Mexico

Ley Agraria (Agrarian law)
Ley Federal de Caza (Federal Law on Hunting)
Ley Federal de Mar (Federal Law on Seas)
Ley General de Equilibrio Ecológico y Protección al Ambiente (General Law on Ecological Equilibrium and Environmental Protection)
Ley Forestal (Forestry Law)
Ley Federal de Turismo (Federal Law on Tourism)
Ley General de Salud (General Law on Health)
Ley General de Asentamientos Humanos (General Law on Human Settlements)
Ley de Pesca (Fisheries Law)
Ley de Aguas Nacionales (Law on National Waters)
Ley Federal sobre Meteorología y Normalización (Federal Law on Meteorology and Normalisation)
Ley Minera (Mining Law)

Management programmes of protected areas in Mexico all share the same basic structure, independent of their category (INE 2000a), and they are all valid for five years. Once published, they cannot be changed easily for five years. Thus, management programmes are basically generic. Table 7.4 presents the general structure of the Mexican management programmes for protected areas.

Table 7.4 Content of a management programme (INE 2000[a])

Description of the protected area within the national, regional and local context
Description of the area and of its (ecological and socio-economic) problems
Objectives
Land-use planning through zoning
Administrative rules
Components of the management programme
Evaluation of the management programme

Counting with management programmes for protected areas was one of the priorities of the Mexican government under President Zedillo in the period 1994-2000. In this respect, important advances have been made. In 1996, Mexico did not have any management programmes, while in 2000, 23 programmes were approved, and 18 were in the process of approval. These programmes represented 19 per cent and 15 per cent, respectively, of all protected areas in Mexico, making up a total progress rate of 34 per cent in 5 years (INE 2000a).

In the following sections of this chapter, I will take a closer look at the management programme of the Sierra de Manantlán biosphere reserve. I will do so from different angles; and I will address the specific situation of Cuzalapa as appropriate.

Genesis of the Management Programme of the RBSM

Since the RBSM conservation project was initiated in 1985, several documents have been created that can now be seen as earlier versions, or as parts of, the actual management programme. These earlier versions were used mainly for internal use at IMECBIO. Here, I will discuss the (unofficial) versions of 1992 and 1997, as they were important factors in the creation of the current management programme. The current management programme was published by SEMARNAP in the spring of 2000 (see IMECBIO 2000b). It was not until that time that the RBSM had a legally approved instrument for its management.

The 1992 version of the management programme is titled '*Estrategia para la Conservación de la Reserva de la Biosfera Sierra de Manantlán'* (Strategy for the Conservation of the RBSM), or simply *'La Estrategia'* (The Strategy). The University of Guadalajara also published it as a book in 1992 (Jardel 1992a). The *Estrategia* was the first official document that defined the concepts and ideas of the RBSM management strategy. It was presented to governmental agencies, but was never formally accepted. As the *Estrategia* never got the legal status of an official management programme:

> '[...] *in practice it was applied as a guide for the actions of IMECBIO, being an instrument for the diffusion of the conceptual approach to the project, for obtaining funds and* [for] *consensus-building with governmental institutions and local communities'* (Graf *et al.* 1999: 4, own translation).

In 1997, a new version of the management programme was presented; the so-called *Programa de Manejo de la Reserva de la Biosfera Sierra de Manantlán – Documento para Discusión* (management programme of the RBSM - document for discussion, IMECBIO 1997). In contrast to the *Estrategia* of 1992, the 1997 version was more strategic and operative than conceptual. The current management programme is based on this version, which was in turn derived largely from the 1992 version.

The 1997 version of the management programme is more congruent with the official guidelines for management programmes than its 1992 predecessor. This can be explained by the fact that the PNAP 1995-2000, which describes the general guidelines for management programmes, was published in 1996. In other words, a more favourable institutional context existed in 1997 than in 1992.

Researchers of IMECBIO from the University of Guadalajara wrote both versions of the management programme, based on their working experience in the Sierra de Manantlán since their arrival in 1985.[7] Within IMECBIO, a group of researchers (the so-called 'management programme team') had regular discussions on the Reserve, its problems and the management that they thought was most appropriate.[8,9] They also discussed the team's results with all (approximately 52) IMECBIO researchers in order to obtain a broad institutional consensus. In both 1992 and 1997, one researcher integrated the final version of the management programme, based on previous discussions and the draft versions of parts of the management programme written by different members of the management programme team.

Once completed, the 1997 draft version of the management programme was submitted for public discussion. Graf *et al.* state that:

> *'For the last two years* [i.e. 1997-1999]*, the working agenda of the CTAs was focussed on the consultation process of the management programme and the integration and evaluation of the annual operative programmes* [which are derived from the management programme]*. The management programme was submitted to five participatory analysis and discussion workshops, where important contributions to the programme were made. Sixty-one representatives of communities and social organisations participated in these workshops.. The results of the workshops were presented to the CTAs for their approval, and, afterwards, the document was presented to the assemblies of the 17 most important ejidos and* [indigenous] *communities, which represent 90 per cent of the population of the Reserve and 95 per cent of the community land of the area* [i.e. the RBSM]*. In the same manner,* [the management programme] *was presented to the municipalities and two state governments for approval. Afterwards, the management programme was sent for consultation to various state and federal* [governmental] *agencies, to academic institutions and to non-governmental organisations. Finally, the results of the whole process were presented again to the CTA for its final approval. A little more than 2000 persons participated during the whole consultation process'* (*ibid.*:11, own translation).

Cuzalapa hardly participated in the consultation process; only one informal leader was present in the workshop. Nor was the management programme presented to the general assembly of Cuzalapa.

To facilitate the consultation process with farmers, a special document was created. An NGO specialised in popular education was hired to write the 41-page document, which explained the basic ideas of biosphere reserves and the management programme, including its basic guidelines and the actions proposed. The administrative rules that govern natural resource use and management were mentioned only superficially.

After the consultation process, the DRBSM modified the 1997 version presented by IMECBIO, after which it was sent to the central office of SEMARNAP in Mexico City. In Mexico City the document was changed into its final version: the *Programa de Manejo de Reserva de la Biosfera Sierra de Manantlán, México* (the Management Program of the RBSM, Mexico, IMECBIO 2000b).[10] Major changes made in the final document refer to the administrative rules and regulations that govern natural resource use and management in the RBSM. Although the 1992 and 1997 versions included a number of rules and regulations, those mentioned in the official management programme are most congruent with federal laws on environmental protection. There are, however, fewer administrative rules in the official management programme published in 2000 than in the 1992 or 1997versions.[11]

Table 7.5 Particular objectives of the RBSM (IMECBIO 2000b: 29-30: own translation)

Conservation	*Development*	*Scientific Research and Education*
Contribute to the maintenance of essential ecological processes for ecosystem functioning, natural resource production and environmental service generation, on which society depends.	Orchestrate social development based on sustainable natural resource utilisation that is compatible with ecological conservation.	Generate scientific knowledge about the structure, functioning, and dynamics of eco- and socio-systems and their interactions.
Contribute to the maintenance of the biological diversity (of species, genes and ecosystems) of Western Mexico and protect endemic, threatened, vulnerable, and rare species, as well as other species in need of special protection.	Promote an organisational process amongst the Reserve's inhabitants, based on democratic and participatory principles for achieving a sustainable natural resource utilisation that contributes to quality of life improvements and poverty and inequality reduction.	Offer conditions for scientific research and the monitoring of the environmental conditions and the social and ecological processes, as part of other international networks of biosphere reserves and the Mexican system for protected areas.
Favour the recuperation, restoration or rehabilitation of degraded areas caused by inadequate management practices.	Develop, from a regional and sustainable perspective, ecological planning models for productive activities and land-use.	Generate natural resource management models and experiment, in a participatory way, with appropriate and applicable technology for social development and conservation.
Promote recognition and protection of the values of the cultural, archaeological and historical heritage.	Promote an educational, communicative and experience-interchange process between local inhabitants, civil servants, technicians and scientists that permits the valorisation, appropriation, and application of both empirical and scientific knowledge for a sustainable natural resource management.	Offer conditions for the formation of human resources in the field of ecology, sustainable natural resource management and social development, to strengthen the capacity of the actors involved in the Reserve's management.
Maintain and promote natural resource use forms that are adapted to local ecological and social conditions and that contribute to the conservation of biodiversity and ecological processes.	Support the initiatives of the indigenous communities for rescuing their cultural heritage, as well as strengthening their identity and forms of social organisation.	
Protect landscapes and scenic values.		
Generate consciousness about environmental problems and the appreciation of natural values, and promote a change in values and attitudes of social actors in favour of the conservation of the natural and cultural heritage.		

Objectives and Basic Principles of the Management Programme

The management programme of the Sierra de Manantlán biosphere reserve has five general objectives. Firstly, it must ensure the implementation of the presidential decree of 1987, as well as the governing legal dispositions regarding natural resource use and management. Secondly, it must contribute to the implementation of federal environmental programmes, such as the PNAP 1995-2000 and the Environmental Program 1995-2000. Thirdly, it establishes the guidelines and administrative rules for the management of the Reserve. The guidelines and rules are based on a regional sustainability perspective, which, in turn, is based on a rational resource management perspective, the conservation of the region's natural and cultural heritage and environmental protection. Fourthly, it must establish the actions to be developed in the short-, medium- and long-term in the RBSM and its influence zone. Finally, it must integrate the administrative structure of the Reserve's management and its procedures in such a way that the objectives of the RBSM can be achieved, co-ordinated and agreed upon with the involved stakeholders (IMECBIO 2000b). Thus, the management programme objectives specify the (operational and legal) preconditions for all conservation and development activities. Note that the (general and particular) objectives of the management programme are different from the objectives of the RBSM. The Reserve's general objectives are biodiversity conservation, social development and research and education (*ibid.*). Table 7.5 presents an overview of the Reserve's particular objectives.

After a section on the Reserve's objectives, a chapter in the management programme provides a thorough description of the ecological and socio-economic characteristics of the RBSM, its problems and the potential for different types of (actual) land-use. This description is based mostly on a scientific problem assessment. The following chapter then deals with a number of basic principles that can be considered as conceptual guidelines and policies for all development and conservation actions. It begins by describing the basic concepts of biosphere reserves, i.e. ecological conservation, social development and sustainability. The basic principles that guide the conservation strategy in the Sierra de Manantlán are the following:

– All actions are to be directed at ensuring *a link between conservation and development activities*. In other words, conservation and development are perceived as part of the same strategy. The linking of these two objectives must ensure the survival of biological diversity and ecological processes, above all, in those parts that are more susceptible to environmental damage. An adaptive management is proposed to properly face the different environmental conditions, as well as to overcome the limitations of scientific knowledge.

– An *integral strategy of protection and restoration/rehabilitation* must be followed to ensure biodiversity conservation. Central in these actions is the ecological restoration of RBSM landscapes.

– All actions are based on a *regional management perspective*. This perspective is followed because many ecological processes take place at this level and because any actors surrounding the RBSM depend on the Reserve's environmental services, especially water.

- *Rights to the natural resources* are attributed to the inhabitants of the Reserve, so they must be the main beneficiaries of the project. At the same time, they have an *obligation to protect and use the natural resources in a sustainable way* in their communities. The obligation to pay for the environmental services maintained by the presence of the RBSM is attributed to society at large.[12]
- All development actions aim at *strengthening local capacities and community organisations* in relation to natural resource management and use.
- The RBSM's administration is to be based on *participatory mechanisms*. Two levels are distinguished, a regional and a local level. At the Reserve (i.e. regional) level, the CTAs are the main participatory mechanisms. At the local level, community institutions are approached (IMECBIO 2000b: 94-99). In both cases, however, they do not represent all the actors present in the RBSM, as was described in Section 7.2. Furthermore, their position has been weakened due to legal reforms (Calva 1994) and *de facto* land privatisation processes in the Reserve (Gerritsen and Forster 2001; IMECBIO 1998a; IMECBIO 1998b; IMECBIO 2000a; Olvera *et al.* 2000; Jardel and Cruz 2000).
- *Scientific research* is an integral part of the Reserve's management. Decision-making on the Reserve's management must have a solid scientific basis, which originates from necessities of the different actors of the RBSM. To overcome the limitations of scientific knowledge, *an adaptive management scheme* is proposed, as stated before (IMECBIO 2000b: 94-99, see also Jardel *et al.* 2000b)).

Apart from these general guidelines, a number of more specific guidelines are mentioned in the management programme regarding planning of the Reserve's management, land-use zoning, forest production, agricultural and cattle production. The common denominator of all these general and more specific guidelines is the sustainability concept, and in particular its ecological dimensions.

The description of the general and specific guidelines for RBSM management is followed by a number of administrative rules. These rules will be extensively discussed in the next section. They are followed in the document by a number of management tables (*'matrices de manejo'*). These tables, which are elaborated per management sector, describe natural and cultural values, existing conservation and development problems and courses of action.[13] A chapter that describes a number of management components, or sub-programmes also follows the management tables.

The components (or sub-programmes) of the management programme are based on the PNAP 1995-2000. The components, including the goals and actions to be taken are considered:

> '[a] *priority* [in the period 2000-20004] *for achieving the objectives of the protected area. The sub-programmes are the following: conservation and ecological restoration, community development, natural resource utilisation, scientific research,*

> *education and training, and administration for the* Reserve' (IMECBIO 2000b:141, own translation).

Table 7.6 presents an overview of the management components and their sub-components.

Table 7.6 Management components and sub-components (IMECBIO 2000b:141-158, own translation)

Conservation and ecological restoration	*Community development and natural resource utilisation*	*Scientific research and education*	*Administration of the Reserve*
Protection and vigilance	Land tenure regularisation	Basic inventories and information systems and monitoring	Organisation of the Reserve's management
Forest fire prevention and fighting	Local-level land-use planning	Ecological and social studies	
Land-use planning	Infrastructure and human settlements [*regularisation*]	Formation and training	
Core zone management and conservation	Agriculture and soil and water conservation	Communication and environmental education	
Conservation of rare, endemic, threatened and specially protected species	Cattle production		
Reforestation and ecological restoration	Integral management of forest resources		
Control of aquatic contamination and rehabilitation of fluvial systems	Utilisation of fauna and fishing		
[*Protection of*] archaeological, historical and cultural heritage	Tourism and open-air recreation		

Land-use Zoning in Agrarian Communities in the RBSM

Activities related to the majority of the components and sub-components (mentioned in Table 7.6) have already been put into practice, although to different degrees. Here I want to give some special attention to one of the sub-components, i.e. land-use zoning in agrarian communities, as it is directly related to the central topic of this book.[14]

Since 1997, much attention has been given to the elaboration of local land-use plans (the so-called *planes comunitarios de manejo de recursos naturales*), for which participatory rapid appraisals are seen as the methodological tools. The underlying idea is to discuss the scaling down of the general guidelines of the management programme to the level of agrarian communities. By doing so, it is hoped that at community level, natural resource use and management can be regulated and both biodiversity conservation and sustainable development can be achieved. In practice, zones with different use and management gradients (e.g. intensive use, moderate use, strict protection, restoration, etc., related to agriculture, cattle breeding or forestry) are to be distinguished in an agrarian community. This zoning is to be formalised in a special (land-use zoning) plan approved by the general assembly of agrarian communities.

In 2000, five local-land-use plans were elaborated for five pilot communities (Cuzalapa, El Terrero, Platanarillo, Toxín and Zenzontla) by mixed research teams consisting of researchers of the University of Guadalajara and a small number of inhabitants in four of the pilot communities. It was not possible to implement the local land-use plan in Cuzalapa, due to the opposition of its directive board. Implementation in the other communities was more successful in the sense that in those communities a participatory assessment could be carried out. In El Terrero, Platanarillo and Zenzontla long-term development projects had already taken place. Toxín is a similar case to Cuzalapa. With the majority of their land located in one of the core zones, farmer resistance was considerable. The community plan was than also seen as a way to reach agreement on the use of the forests located in the core zone. Although the participatory rural appraisals in the other communities were concluded, the land-use zoning plans were not implemented in any of them.[15]

The Reserve's Administrative Rules

Chapter 6 of the Reserve's management programme describes the administrative rules that govern the use and management of natural resources in the Reserve's buffer and core zones. A revision of the 74 administrative rules that govern natural resource use and management in the RBSM indicates that environmental criteria underlie most rules, based on the scientific conceptualisation of biological diversity (i.e. the biodiversity concept) and Mexican (environmental) law. For many activities a permit, an authorisation or a concession from SEMARNAP is required, i.e. from the Directorship of the Reserve or the local regional delegation of SEMARNAP. For other activities, SEMARNAP has to be informed or notified. Table 7.7 shows the activities that need the involvement of SEMARNAP by presenting rules 13 to 17 of the management programme.

The administrative rules further describe the activities that are allowed, as well as the way in which they have to be performed. In most cases, reference is made to the so-called official Mexican norms (*'Normas Oficiales Mexicanas'*), which are relatively detailed prescriptions regarding many activities related to the environment and natural resources. They are emitted periodically by the Mexican government and published in the official newspaper of the Mexican government (Gutiérrez 2000). There are also a number of activities that are (strictly) forbidden in the core and buffer zones of the Reserve. Table 7.8 presents the corresponding administrative rules.

Table 7.7 Rules 13 to 17 of the RBSM management programme (IMECBIO 2000b:115-116: own translation)

Rule 13: A permit from SEMARNAP is required for the following activities: I Offering of services for the realisation of recreational activities and eco-tourism. II Filming, taping and photographing for commercial and cultural purposes. III Camping and staying overnight in installations of the Reserve *[administration]*.
Rule 14: An authorisation from SEMARNAP is required, congruent with the applicable legal dispositions, for the following activities: *I* Land-use change of forested terrain and of forest capacity. II Utilisation of forest resources for timber exploitation. III Collection of flora or fauna, as well as other biological resources for scientific research. IV Utilisation of wild flora and fauna. V Realisation of public and private works. VI Restoration and rehabilitation of degraded areas. VII Forestry plantations.
Rule 15: A concession from SEMARNAP is required for: *I* Use, exploitation and utilisation of national waters. II Use and exploitation of federal zones [*located next to rivers and roads, amongst other areas*].
Rule 16: In accordance with the terms established in the Forest Law and its rules and regulations, SEMARNAP must be notified before persons engage in activities which imply utilisation of non-timber forest products.
Rule 17: To protect the natural resources of the Reserve and support the Reserve's Directorship, responsible persons must inform the personnel *[of the Directorship]* before engaging in the following activities: I Camping and staying overnight. II Realisation of agricultural burnings. III Environmental education. IV Control of harmful fauna.

Procedures for obtaining permits, authorisations and concessions are relatively complicated (Research in progress with Dr N.R. Forster), especially for farmers with relatively low educational levels, as is the case for the majority of farmers in the RBSM (Graf and Rosales 1996). Table 7.9 illustrates this by presenting the administrative rule that refers to one of the basic activities of farmers, i.e. the collection of wood for domestic use, which can be considered representative for the other rules on natural resource use and management.

Table 7.8 Rules 67 and 68 of the RBSM management programme (IMECBIO 2000b:112-123, own translation)

Rule 67: The following activities are forbidden in the Reserve's core zone:

a) Dumping or unloading of residual waters, *[different types of]* soils, *[different types of]* greases, or any other type of contaminants, solid waste, liquid waste, or any other type of waste; to the use of explosives or any other substance that can induce alterations of the ecosystems.
b) Utilisation of forestry resources, flora and wild fauna.
c) Land-use change.
d) Implementation of public or private works, except those necessary for achieving the Reserve's objectives.
e) Introduction of living species, exotic to the Reserve's local flora and fauna.
f) Disturbance, capture, or destruction of nests or burrows to collect feathers, eggs or any part of products of wild fauna species, as well as any alteration in their habitat.
g) Opening-up of new roads and the construction of infrastructure works.
h) Establishment of new *[human]* settlements.
i) Construction of hydraulic works and the extraction of water from the subsoil.
j) Establishment of beehives.
k) Use of vehicles, or means of transportation for recreational goals outside the permitted zones.
l) Recreational use of motorcycles..

Rule 68: The following activities are strictly forbidden in the Reserve's buffer zone:

a) Construction of roads in areas with high risks of erosion, land slipping, or landslides, as determined by the characteristics of the soil and the steepness of the slopes. On existing roads, the water outlet sites must be relocated and protected if they are located on a slope, which is heavily susceptible to erosion.
b) Dumping of contaminated water into riverbeds and reservoirs, or infiltration of contaminated water in the aquatic layers that exceeds the limits and norms established by the applicable legislation.
c) Cutting, clearing, cleaning, or changing the vegetation cover in the area that consists of the federal zone of waterbeds, reservoirs and water holes.
d) Conversion of forest lands into agricultural and pasture lands.
e) Commercial forest exploitation in threatened ecosystems, such as cloud forest, sub-deciduous tropical forest, riparian and gallery forest.
f) Exploitation of mining resources, without the authorisation of the SEMARNAP based on environmental impact *[studies]*.
g) Fishing with the use of chalk, natural or synthetic poisons, or with electric or explosive utensils.
h) All tourist or recreational activities that can cause natural resource degradation affect the human population's health and well being, or that can damage communal, *ejido* or private property.
i) Use of vehicles or other means of transportation for recreational goals outside the permitted zones.
j) Recreational use of motorcycles.
k) Implementation of public or private works, without the permission of SEMARNAP.

Table 7.9 Rule 45 of the RBSM management programme (IMECBIO 2000b:120: own translation).

Rule 45: The utilisation of poles, pebbles, and wood for the maintenance or management of the fields of the local population and resident personnel dedicated to the administration and management of the Reserve can be done only by the owners of the terrain and by the inhabitants of the Reserve, or by its Directorship [of the Reserve], in a limited and controlled way, for uses related to maintenance and construction, signs, and for home consumption and domestic use. These uses have to be supervised by the Directorship [*of the Reserve*] and are subject to the authorisation of SEMARNAP, conform the established [*legal dispositions*] in the Forestry Law, the LGEEPA and corresponding official Mexican norms, and the remaining legal dispositions.

Obtaining a permit, authorisation or concession also involves a lot of paperwork. It further implies that farmers have to travel to the governmental institutions. The great majority of these institutions are located in the major cities of the region, which lie outside the RBSM's boundaries. This entails travelling times of one to five hours and involves costs that can be substantial for many farmers (see Chapter 4).

Related to the environmental legislation and administrative rules that govern biosphere reserves are the forest management plans and environmental impact assessments that have to be made for (all types of) forest resource utilisation. Only officially recognised foresters can make these studies (INE 2000c). Table 7.10 presents an overview of the activities that require environmental impact studies. The list is more detailed than the requirements set by the management programmes of biosphere reserves, as it is taken from the by–laws of the LGEEPA. In other words, it also counts for areas that are not under some form of legal protection.

Table 7.10 Activities that require environmental impact studies (INE 2000c:15-22, own translation)

Exploitation of tropical forests and of species that have a difficult regeneration.
Forestry plantations. Land-use change in forest areas, as well as tropical forests (*selva*) and arid zones. Works and activities in marshes, mangrove forests, lagoons, rivers, lakes and sea inlets, as well as in littorals and federal zones. All works in protected natural areas. Fishing activities that can threaten the preservation of one or more species, or that can damage ecosystems. Bird breeding activities that can threaten the preservation of one or more species, or that can damage ecosystems. Agricultural and cattle-raising activities that can threaten the preservation of one or more species, or that can damage ecosystems.

In practice, many farmers often do not apply for permits, and make local arrangements instead. At the same time, the Directorship of the Reserve permits natural resource use for domestic purposes without proper permits or studies, as the Directorship lacks both human and material resources for control and vigilance (Research in progress with Dr. N.R. Forster). Furthermore, as stated before, despite the complexity of the administrative rules of the RBSM, most farmers lack proper knowledge of the formal rules and regulations. In the case of the RBSM, farmers' training in administrative rules and regulations has been largely absent. Until 1994 this was caused by the lack of governmental presence in the Reserve, while the absence of a management programme made this even more difficult until 2000 (Graf et al. 1999; Kreutzer 1998). Information dissemination to the inhabitants of the Sierra de Manantlán about the RBSM (i.e. the underlying conservation project) took place in the buffer zones during its initial years, but these activities soon shifted to the cities surrounding (i.e. outside) the Reserve. It was not until 2000 that environmental educational activities were undertaken within the Reserve. These activities, however, are directed mostly to forest fire prevention.

Cuzalapa Farmers and the Management Programme

Like many other farmers in the Reserve, Cuzalapa farmers are not very well informed about its administrative rules and regulations (IMECBIO 2000b). But, differences amongst farmers can be observed. *Ganadero* farmers are generally better informed than *Pobre* farmers and those who have fulfilled community functions and elder farmers are generally also better informed (Gerritsen 1998a). Furthermore, women are less informed than men (Kreutzer 1998b).

Due to the lack of knowledge on the Reserve's rules and regulations, a feeling of insecurity regarding land and resource access prevails in Cuzalapa. Several of the farmers fear that the Reserve will take away their land, especially those farmers whose land is (entirely or partially) located in the core zone. However, some farmers are not so concerned. They believe that the Reserve will protect their rights to land and natural resources (Research in progress with Dr N.R. Foster). Thus, opinions about the RBSM differ, which is related to the politic groups in Cuzalapa.

The Reserve managers perceive Cuzalapa as an extremely conflictive community and until now, no development or conservation action has been successful there, except for small-scale productive projects with part of the Democratic group (IMECBIO 1998). Conflicts exist above all with the *Cacique* group in Cuzalapa. This agitation dates back to before the Reserve's establishment, when the Democratic group halted unsustainable forest exploitation with support of the University of Guadalajara. This ban affected above all a number of *Cacique* group members who had made major investments. In 1987, some seven weeks after the Reserve's establishment, the *Cacique* group of Cuzalapa, but also farmers from the neighbouring *ejidos Barranca de la Naranjera* and *Ahaucapán*, went to court to demand the nullification of the presidential decree that established the Reserve. The trial is still a pending issue.

It is notable that the conflict between the *Cacique* group and the Reserve management (including the University of Guadalajara) is a conflict over natural resource management and conservation. It does not exist with other institutions working in Cuzalapa, such as the bank *Banrural*, or the forestry officer of SEMARNAP in La Huerta. Both consider Cuzalapa to be a model community. Only a minority of farmers has initiated procedures for natural resource utilisation as required by the Forest Law. The forestry officer stated in July 2000 that in the period 1985-2000, Cuzalapa farmers applied for 10 permits annually. This means that the vast majority of Cuzalapa farmers do not apply for these permits (Research in progress with Dr N.F. Foster).

Apart from not being familiar with the proper procedures, many farmers do not apply for permits because the formal rules underlying the RBSM compete with a number of customary rules. In situations where effective control is absent, such as the RBSM, it is above all, the customary rules that govern natural resource management. The following statement illustrates this:

> *With the thin trees, there are no problems. It is more difficult with the thick trees.* [...] *It is difficult to see* [the exact limit to] *where they let us* [cut].

The administrative rules of the RBSM have not only created more insecurity for farmers, but they have also created feelings of frustration, such as those expressed by farmers participating in projects of the University of Guadalajara in Cuzalapa:

> *The Reserve is like a beautiful woman whom you cannot touch. It does not do you any good.*

> *The hills are rich, but a poor man stays poor. Sometimes, one does not even have money to buy guaraches* [a kind of sandals; the typical footwear of Mexican farmers]. *You know, here we live amongst great wealth, but we cannot enjoy it.*

Finally, the formal rules are generic, and thus unable to capture local heterogeneity in natural resource management. In the case of forest clearing, for example, the landowner is held responsible for any land-cover change even though in practice more farmers are normally involved. After the initial forest clearing and burning, other farmers come to look for firewood and wood for construction. These farmers, thus, further clear the recently established cultivation field or pasture land.

7.5 Impact on Resource Diversity of the Mexican Policy Perspective on Natural Resource Management

When comparing the considerations, on which the management programme of the RBSM is based with the Cuzalapa farmers' perspective on land-use in the Reserve, it is obvious that the corresponding conservation and farming activities are based on very different realities. These realities illustrate that there is a normative difference between professional and community perspectives (Wiersum 1999) regarding the use and management of natural resources. Because the conceptualisation of biosphere reserves and its management programme in Mexico have not grasped the local realities in the Sierra de Manantlán, biosphere reserve management is still contested (cf. Graf *et al.* 1995; Jardel *et al.* 1996). These different views will be contrasted in the following analysis.

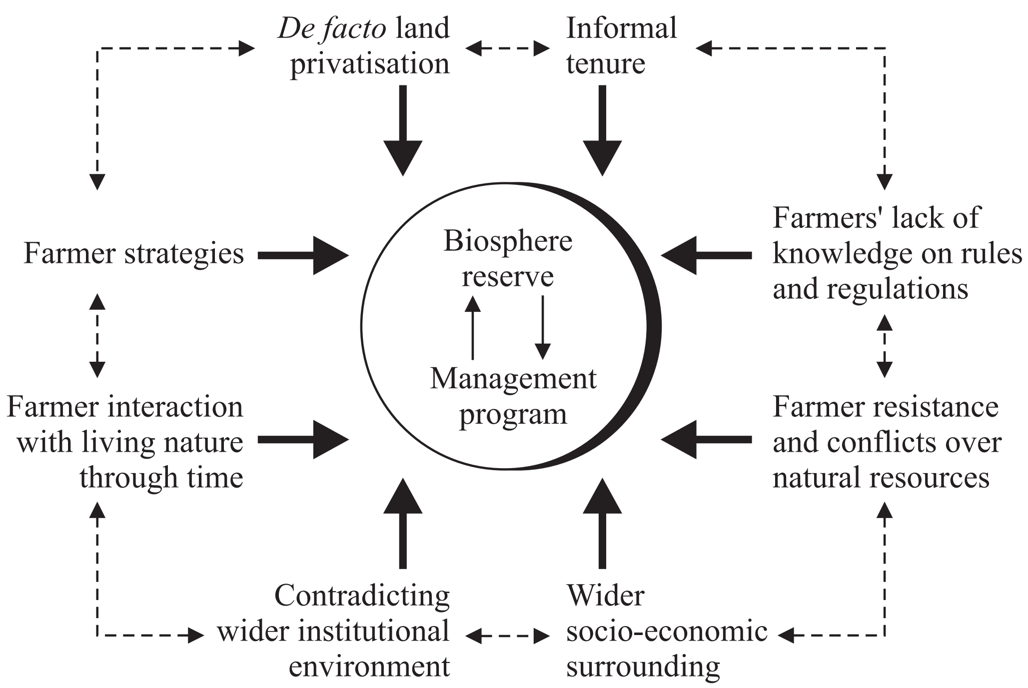
Table 7.11 compares the professional perspective with the Cuzalapa farmers' perspective regarding biological diversity. The underlying (professional) perspective of the RBSM is based on the biodiversity concept. It shows that biodiversity conservation is focussed mainly on species level, while biodiversity at landscape level (i.e. ecosystem diversity) can be considered a secondary consideration. Biodiversity conservation at genetic level is hardly even considered (Wiersum 2002: pers. comm.). The description of the Reserve's management rationale in Chapter 2 illustrates this. The Cuzalapa farmers' perspective was already described in Chapter 5 (see Table 5.13). Their primary focus is on the landscape level, while a gradual contextualisation on use properties takes place on species and genetic level.

Table 7.11 Professional and Cuzalapa farmers' perspectives on biological diversity

	Professional perspective		*Cuzalapa farmer perspective*	
Landscape level	Secondary level of focus	*Complementary, but separated contextualisations*	Primary focus	*Gradual contextualisation On use properties*
Species level	Primary focus on nature conservation		Secondary level of focus on useful species	
Genetic level	Genetic focus	Strict separation	Crop varieties/ Cultivars	

Not only do the two perspectives on biological diversity differ, but the institutional environment of the farmers' landscape management activities also conflicts with the Reserve's management. Figure 7.2 illustrates the discrepancy between localised situations and the management rationale of the RBSM by schematically presenting the local factors that contrast with the Reserve's institutional environment and its policy instruments. The figure is based on the analysis made in the foregoing sections and chapters.

Figure 7.2 Local factors that contrast with the institutional environment of the RBSM



In practice, the contrast between the local and institutional contexts is more complex than illustrated in Figure 7.2. Both within and between the local and institutional context highly differentiated processes take place that are dynamic over time. The following comment exemplifies the dual feelings that farmers have vis-à-vis governmental agencies by using the example of forest fires:

> [...] *It behoves one not to burn the forest. We take care and we want the government to help us with the fire. But, if they do not allow us to cut a tree for our own needs, what are they doing? The forest belongs to the community; it is ours.*

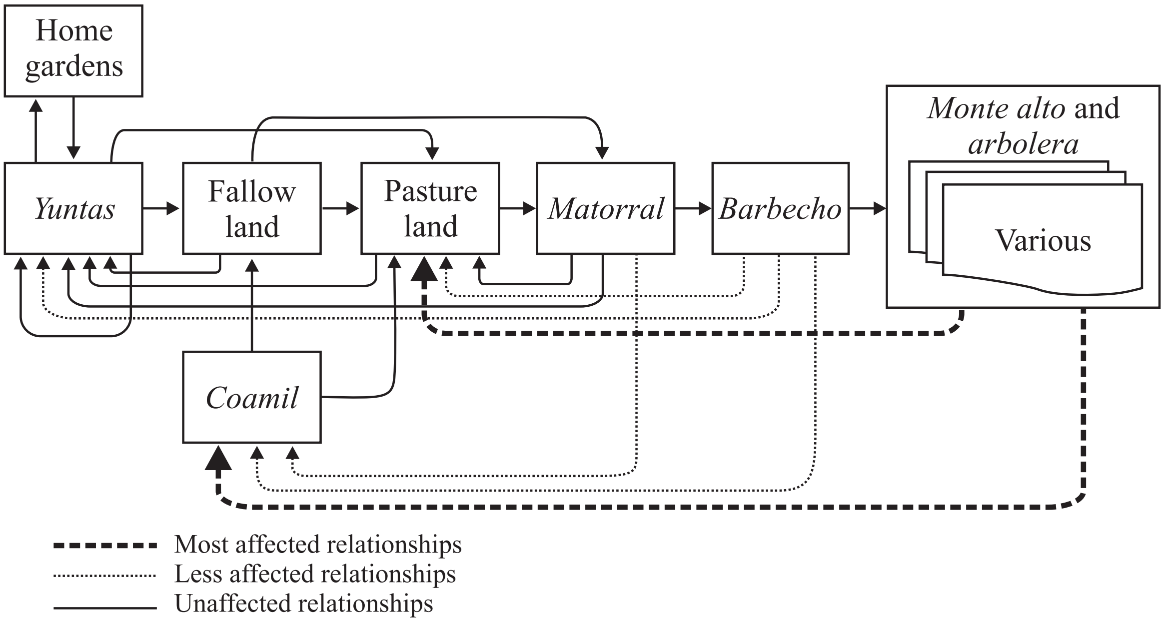
The Organisation of Time and Space of Resource Diversity and the Current Management of the RBSM

It is not only contested realities that differentiate the management of the Reserve from Cuzalapa farmers' perspective on resource diversity. The Reserve and its zoning regulations also have a (direct and indirect) impact on the on-going dynamics of resource diversity. Theoretically speaking, through the zoning regulations, the Reserve induces a reorganisation of time and space in resource diversity by dividing the farmers' landscape into specific management zones. More specifically, it also influences the succession management of the different landscape units. The majority of the rules and regulations are aimed at forest (species and ecosystem) protection, which refers especially to *monte alto* and *arbolera* forests. Rules do not govern *monte bajo*, although 'grey-zone' situations exist (especially with certain types of *barbechos*), in which the differences with *monte alto/ arbolera* are not that clear. Furthermore, the feeling of insecurity over resource access, described before, has made farmers more cautious regarding the application of management practices in forest vegetation. Thus, the rules and regulations represent restrictions for farmers regarding the management of especially the higher parts of the landscape.

As a result of these professional management perspectives, various time and space relations in the farmers' landscape are under pressure and the evolving agro-ecosystems are mostly perceived as threats to forest conservation rather than as options for new biodiversity and its conservation. The impact of these restrictions of the organisation of time in resource diversity is illustrated by Figure 7.3.

Figure 7.3 is based on the schematic representation of succession management of resource diversity that I have also used in Chapters 5 and 6. Note that the changes that I described in Chapter 6 are not indicated in Figure 7.3. The dotted lines in the figure indicate the changes that are induced (through the zoning regulations of the Reserve) in the current management of succession of resource diversity. It may be clear that this includes a reorganisation of time, which in turn has its impact on the spatial distribution of the different resource diversity units in the landscape. It may also be clear that by changing succession management in the *monte alto* and *arbolera* vegetation, the ecological succession will start to dominate. This, in turn, will probably lead in the middle and long term to a decrease in the number of forest ecosystems and thus in the biodiversity that can be found in each one of them (see Oliver and Larson 1996). In other words, in the long run the current management scheme of the Reserve will ultimately undermine its principal objective, i.e. biodiversity conservation, unless special measures are taken.

Figure 7.3 The RBSM influence on resource diversity in Cuzalapa



Due to the lack of human and material resources, the *de facto* implementation of the rules and regulations and control measures is most intensive in the core zone, especially in the Las Joyas field station located in the Manantlán-Las Joyas core zone. In the buffer zone, it is still not that far reaching. Here, rules can still be bent or avoided, especially regarding the more open *monte alto* and *arbolera*, where *monte bajo* can be found as understorey vegetation. A farmer commented:

> […] *Look, one cuts the monte bajo that stands below the arbolera. Then, one burns and cuts an occasional tree that stands in the way and that gives too much shade. Afterwards, one 'throws'* [i.e. sows] *the pasture and burns every three years.*

In other words, the impact of the RBSM rules and regulations on succession management in the buffer zone has been limited so far.

Increased Insecurity as Consequences of the Reserve's Management

The actual management of the RBSM has caused a number of other consequences. To start with, it has caused a feeling of insecurity over resource use amongst farmers, as I stated before. A farmer commented:

> *Today, we take better care of the monte. You know, we are already a bit afraid, as they can fine us.*

This feeling is also related to resource access, as a significant number of farmers in Cuzalapa fear that the Reserve will take away their land. Finally, the contrast between formal rules and local practice has further caused a number of consequences at community level. The formal rules are used to resolve disputes, or are used as additional 'weapons' for revenge (Research in progress with Dr. N.R. Foster).

Due to this insecurity, some farmers have started to use their *monte bajo* vegetation more intensively. But the current land-distribution situation and the increased importance of cattle raising in Cuzalapa also play a role here. Other farmers have adapted their strategies, as a consequence of the zoning regulations. A women farmer commented:

> *Look, I have an irrigation field where I can sow maize. I also have a field with pure monte alto, where I started to establish pasture* [in a more open part]. *But I cannot use it [due to the zoning regulations], so I sell the* ramoneo [i.e. grazing rights on forest vegetation].

7.6 Conclusion

In this chapter, I gave extensive attention to the Mexican policy perspective on conservation and protected areas. This perspective can be characterised as having a strong formal legal basis and a focus on the (scientific) biodiversity concept. The governmental/scientific perspective contrasts sharply with the Cuzalapa farmer perspective described in Chapters 3 to 6. Furthermore, the Mexican policy perspective has not grasped resource diversity, i.e. the social carriers underlying biodiversity conservation. Consequently, in the medium or long term, it will not only halt farm development, but also undermine its own main objective. It also leads to conflicts over resource access.

Notes

1 Parts of this chapter are published as Gerritsen *et al.* (1997). Some of the data underlying this chapter were generated within a research project on the conformation of land tenure in Cuzalapa. Dr Nancy Forster of the University of Wisconsin, Madison, Wisconsin, United States, co-ordinated this research project, in collaboration with María Guadalupe Ortiz Gómez, B.Sc. and the author. Its publications are forthcoming. In the text, it will be referenced as follows: (Research in progress with Dr N. R. Forster).

2 In Mexico, *'ley'* (i.e. law) refers to general dispositions, while a *'reglamento'* (i.e. rules and regulations) specifies the putting in practice of the general dispositions, including a description of the institutional framework.

3 SEMARNAP was renamed SEMARNAT (Ministry of Environment and Natural Resources) in 2000.

4 Other programmes have also been elaborated for making conservation compatible with the different sectors of society. See INE (2000a) for an overview.

5 The Sierra de Manantlán biosphere is part of these protected areas, which are known as priority regions in governmental and some academic circles (SEMARNAP 1996, see also Pérez 2000).

6 Until 2000, protected area management fell under the responsibility of the *Unidad Coordinadora de Áreas Naturales Protegidas* (*UCANP*: Co-ordinating Unit for Protected Natural Areas) of INE, with a more limited mandate (INE 2000[a]).

7 The Mexican government hired IMECBIO as consultant.

8 The author has been part of this working group in the period 1995-2000.

9 For the 1992-version, nine researchers formed the management program committee, while this number rose to 15 persons for the 1997-program.

10 The 1992 version has 316 pages, the 1997 version 177 pages, and the 2000 version 201 pages. As such, the management programme of the RBSM is one of the most elaborate in Mexico.

11 The *Estrategia* contains 197 administrative rules for governing the RBSM. The 1997 version mentions 113 rules, while the final version counts 74 rules and regulations (Jardel 1992a; IMECBIO 1997, IMECBIO 2000b).

12 Compensation schemes for environmental services have been largely absent in Mexico. This did not become a political issue until 2000 under the government of newly elected President Fox.

13 For operative reasons, the Reserve is divided in seven parts, called management sectors, where specific management actions are being implemented. The delimitation of the different management sectors is based on the political division of the region at municipality level and the limits of the agrarian communities (IMECBIO 2000b: 125).

14 For an overview of the other community development activities (i.e. mostly the implementation of small-scale development projects) in the RBSM in the period 1995-2000 see Gerritsen (1996a, 1996b, 1997a, 1997b, 1998b), Gerritsen and Graf (1997), Gerritsen *et al.* (1997), Graf *et al.* (1995) and Jardel *et al.* (1997).

15 El Terrero is an exception in the sense that land-use zoning was elaborated and operationalised for the community's forests. This community is the only one in the Reserve that has a co-operative sawmill and an approved forest management plan, which includes an environmental assessment of the logging impact.

8 Diversity at Stake[1]

8.1 Introduction

In the beginning of Chapter 1, I stated that biodiversity conservation has become an important goal to achieve for mankind as a whole. In the same chapter, an overview of the debate on biodiversity conservation was presented and special attention was given to the establishment of protected areas that are inhabited by farmers, such as the Sierra de Manantlán biosphere reserve. From this exploration, it became clear that achieving conservation in populated protected areas is accompanied by many challenges. Amongst others, I stated that renewed attention should be given to the farmer-living nature link. In the second half of Chapter 1, I described a number of theoretical considerations that might give new insights into this relationship; the concepts of co-production, farming styles and resource diversity were proposed. These concepts focus on the heterogeneous and dynamic characteristics of the farmer-living nature link, as well as its effects on both farm development and biological diversity.

In Chapters 2 to 7 these concepts were applied in the description of the conditions and development trends in the study area, i.e. the indigenous community of Cuzalapa in the Sierra de Manantlán biosphere reserve. Farmers' use and management of the landscape were described, including the creation, maintenance and transformation of resource diversity. Attention was also given to the social and political-economic processes and the formal institutional context that influence the dynamics of resource diversity. The results that are described in Chapters 2 to 7 suggest that both social and biological diversity are at stake. On the one hand, an increasing number of Cuzalapa farmers are experiencing difficulties in reproducing their farms. On the other hand, a process of land-use and vegetation cover change is taking place, triggered by the increased importance of cattle breeding, and which eventually may negatively affect the biodiversity that is present in Cuzalapa. Furthermore, the empirical chapters showed that social and biological diversity can be understood only when the two are seen in relation to each other, as multiple complex relationships that exist between farmers and living nature. This complex intertwining gives rise to a critical reflection on the current management scheme of biosphere reserves in general and the Sierra de Manantlán biosphere reserve in particular.

In this chapter, the indicated points will be further examined and discussed more in relation to the research questions that were posed in Chapter 1. In this discussion, I will also offer some general theoretical observations regarding conservation issues in rural areas in general and in populated protected areas in particular. Consequently, this chapter consists of two parts. It starts with a theoretical-empirical retrospective (Section 8.2), which is followed by some theoretical considerations for strengthening endogenous potential for biodiversity conservation (Section 8.3).

8.2 The Cuzalapa Case Reviewed

In Chapters 2 to 7 I described several features of the farmer-living nature interface in Cuzalapa, including the formal institutional environment as represented by the Reserve (which I will refer to in this chapter as the 'Cuzalapa case'). In this section, the empirical data and previous discussions will be examined by answering the different research questions that I posed in Section 1.4. Each of the following subsections subsequently regards the different research questions.

The Relation of Farmers with Biological Diversity: The Concept of Co-Production[2]

The Cuzalapa case illustrates that the relations of farmers with biological diversity manifest themselves within and through a process of co-production. The exact nature of the process of co-production depends on farmers' management of the different parts of living nature, as well the specific environmental conditions that locally exist. Farmers' perceptions of biological diversity are reflected by a number of natural resources that are useful to them; it is mainly instrumental values that underlie Cuzalapa farmers' valuation. Natural resources are incorporated in farming practice through a conscious organisation of time and space. This organisation of time and space is highly complex, due to many social and natural cycles that are localised within the context of farm and landscape. Farmers play a strategic role in the ordering of these social and natural cycles; as different time horizons underlie farming practice, biological diversity is actively created, maintained or transformed. The exact nature of this diversity is dependent upon both farming strategies and the biophysical characteristics of living nature.

The Cuzalapa case also illustrates that the relation between farmers and living nature is not static, but highly dynamic. In order words, within and through co-production, the different farm assets (including the existing diversity in resources) are constantly produced and reproduced. This on-going social process of organisation of time and space does not result in discrete, but gradual transformations in biological diversity. These transformations also result in a changed diversity in natural resources, which, in turn, open up new conditions for farm development. Furthermore, the renewed relationship between farmers and living nature as an outcome of co-production represents the departure point for a new process of co-production, in which a new biodiversity can also be co-produced.

The Effects of Co-production on Farmers: The Concept of Farming Style[3]

The outcomes of co-production in relation to its effects on farmers and farm development have been studied in this book by looking at different farming styles and by focussing on farmer livelihood strategies from an economic perspective.

The Cuzalapa case indicates that the concept of farming style gives insight into the present agricultural system and its dynamic from a farmers' perspective. It further indicates that farming styles in situations such as in Cuzalapa are related to the different ways in which resources are mobilised within the context of the farm and the community rather than how farmers confront the wider socio-economic and political context.

Looking at specific livelihood strategies makes it possible to obtain insights into the differentiated ways in which Cuzalapa farmers translate their shared repertoire on farming into the development of their own farms. It has also given insights into the relation between farming activities and the other activities that households are engaged in. In other words, it provides an understanding of farmers' responses to specific ecological and socio-economic conditions from a wide perspective.[4]

Due to the *de facto* land-distribution situation of the study area, the application of the farming style concept in Cuzalapa did not shed light on the mobilisation of resources that are communally owned. In those areas where resources are communally owned, most probably more attention will be given to the rules and regulations that govern resource use and management, as well as to the way farmers incorporate them in farming practice. The farming style concept may then have to be combined with other theoretical notions, such as for example concepts from tenure research (see, for example, Ostrom 1990; North 1990; Gibson *et al.* 2000).[5]

The Effects of Co-production on Living Nature: The Concept of Resource Diversity[6]

In this study, the concept of resource diversity was developed and applied to understand the effects of co-production on living nature in general and its diversity in particular. The Cuzalapa case illustrates that resource diversity in the study area is composed of a number of land-use (sub)zones and forest vegetation types, although boundaries between the different resource units are gradual and not always clearly distinguishable. Furthermore, each one of these units is an integral part of co-produced farming practice.

Using the concept of resource diversity made it possible to understand the effects of co-production on diversity in living nature as part of farmers' social definition and actions. In this context, Remmers' use of the terms 'plan' and 'performance' may become relevant for discussing the direct link between farm dynamics and their socio-material outcome (Remmers 1998).[7] Here, I propose to consider the term 'plan' as referring to the socio-material outcome of co-production (i.e. resource diversity) while 'performance' can be understood as the underlying socio-economic processes that influence farm dynamics and thus co-production. 'Plan' in the Cuzalapa case can be understood to mean the resource patchiness of the landscape, while 'performance' relates to farmers' organisation of time and space that takes place within and through the process of co-production.

The recognition of the specific meaning of these terms assists in understanding the shortcoming of the biodiversity concept for conservation planning in populated protected areas and the relevance of the concept of resource diversity. Biodiversity is a scientific concept that is presented as value free and universally applicable, it is '[…] *separated from any kind of specific social organisation'* (Morales 1999:12, own translation). Thus, 'plan' and 'performance' are disconnected in the biodiversity concept; biodiversity only refers to 'plan'. The 'plan' underlying biodiversity refers to the specific composition and distribution of species and ecosystems in a given time and space. In contrast, resource diversity entails both 'plan' and 'performance', as attention is given to the social processes influencing resource composition and distribution in a given time and space. However, even though biodiversity is mostly disconnected from its local socio-economic and political 'performance', a link can be identified with a global 'performance'. This global 'performance' manifests itself through international programmes for conservation and sustainability. The creation and maintenance of protected areas are usually based on these programmes.[8] Consequently, these 'global' performances have an impact on local 'plans' and 'performances': the Cuzalapa case also illustrates this.

The Social Factors that Influence the Process of Co-production[9]

The process of co-production, as well as farming styles and resource diversity, allow us to understand the socio-economic processes that underlie the creation, maintenance and transformation of biological diversity. The Cuzalapa case illustrates the presence of a number of local and external social factors that have been influencing the process of co-production. It is the combination of the two that influences both farming styles and biodiversity. These factors can only be fully understood, when seen within a historical context.

In Cuzalapa, two related local social factors helped shape co-production in the second half of the twentieth century: the land-distribution situation and community politics. The land-distribution situation determined access to land and natural resources, as well as it influenced the current possibilities for farm development. It also has had an impact on the process of co-production. Community politics are one of the reasons for the land-distribution situation, but it also influenced the use of its forests.

The external factors can be summarised into two broad categories: the expansion of cattle breeding, which in Mexico is referred to as *ganaderización*, and the Reserve's zoning regulations. The *ganaderización* reflects the wider political-economic context in Mexico that is currently more favourable for cattle breeding than agricultural production. It is one of the visible effects of the Mexican agrarian crisis that has struck the countryside since the end of the 1960s. The Reserve's zoning regulations are the expressions of a renewed governmental policy initiated in the 1970s in Mexico that attempts to incorporate an environmental dimension in its overall development model.

The process of *ganaderización* and the protective status of the region can be considered as 'structuring factors' for farming practice and biological diversity, in addition to the local factors; all have impacted the process of co-production, although to different degrees. The description and discussions in the foregoing chapters illustrate this. The *ganaderización* in particular has induced new responses by farmers and:

> *'In this way it is possible to see, from a dialectic standpoint, globalisation* [in Cuzalapa represented by the *ganaderización* and the Reserve's zoning regulations] *as a generating force for diversity and as provocateur of a new construction of the local* [i.e. of the locality]' (Morales 1999:14, own translation).

The process of *ganaderización* and the Reserve's zoning rules can be considered both complementary and conflictive. They are complementary in the sense that both can be considered as the outcome of a trend that tries to link several localities into one dominant development model, i.e. neo-liberalism.[10] They are conflictive in the sense that the process of *ganaderización* indicates trends that can lead to a further homogenisation of the landscape, while the zoning regulations aim at maintaining certain location-specific environmental conditions. In other words, a tension in Mexican politics exists, due to separated developments of different governmental sectors. A further tension exists at the regional institutional level, with the dependency in charge of the Reserve's management. The tension is caused by the fact that the DRBSM has to fulfil both a normative and a facilitating role.

Implications of Co-Production for the Management of Populated Protected Areas[11]

The implications of looking at co-production for the management of biosphere reserves are twofold. On the one hand, co-production gives insight into the perceptions and actions of farmers regarding living nature. On the other hand, co-production sheds light on the social dynamics underlying co-produced biological diversity.

The Cuzalapa case demonstrates that co-production can be regarded as one of the social factors that influence biodiversity through the creation, maintenance and transformation of resource diversity. In contrast, the creation of the core zones has caused an (artificial) separation of farming practice and biodiversity, which in the long term will negatively influence the composition and distribution of the latter, unless special measures are taken. These measures will have to be based on the process of co-production, or will have to imitate its effects.[12]

A clear example of such measures that have to be taken is the conservation of <u>Zea diploperennis</u>, the 'flagship' species of the Reserve (Jardel 1992a), whose survival depends on anthropogenic influences (i.e. shifting cultivation practices) (Benz *et al.* 1990). Due to the Reserve's establishment, one of the two major populations of <u>Zea diploperennis</u> in the Sierra de Manantlán has become part of one of the core zones, while the other has become part of the Reserve's buffer zone. All anthropogenetic factors have been excluded in the core zone, while land-use practices are relatively unchanged in the buffer zone. Consequently, from ecological studies it has become clear that, in time, the <u>Zea</u> <u>diploperrennis</u> populations in the core zone will become genetically poorer and will be replaced by more shade-tolerant species, while they will survive and will be genetically richer in the buffer zone *(ibid.)*. Thus, in the long term the Reserve's flagship species will be threatened by extinction within the core zone, as natural disturbances do not secure its survival. To prevent this, ecologists of the University of Guadalajara have been elaborating a special management plan for rescuing Zea diploperennis, which is based on traditional land-use practices (Sánchez 1999: pers. comm.).

Even though the process of co-production and its effects will have to be imitated in the strictly protected core zones, the continued maintenance of strictly protected areas within the Sierra de Manantlán biosphere reserve might still be justified when revising the Cuzalapa case. The Cuzalapa case can be interpreted as indicating the need for strictly protected areas in order to prevent the current trend of *ganaderización* from developing into an overall landscape homogenisation (most probably) leading to a loss of biodiversity. However, whether this option is institutionally and financially viable is questionable. Moreover, if strict protection is opted for, solutions will have to be sought for the conflicts and insecurity over resource access that currently accompany the implementation of strictly protective measures for biodiversity conservation.

Implications of Endogenous Development for the Management of Populated Protected Areas[13]

A premise underlying this research is that the challenge for management of protected areas lies in identifying and strengthening endogenous development potential that favours biodiversity conservation. In other words, instead of implementing conservation schemes that are based on externally-induced professional management practices, farmers should be encouraged to enhance (or at least maintain) resource diversity.[14]

The concept of resource diversity, but also of farming styles, can be understood as expressing and reflecting endogenous potential and its effects on living nature. The use of these concepts allows us to more precisely define the exact role of farmers in biodiversity conservation. Morales (1999) referring to the endogenous potential in general stated this as follows:

> *'The local is, thus, apart from an identifiable empirical reference, a point of departure for future designs. As such, the locality does not only constitute a counterforce to globality, but also an entity to be developed* [...]*'* (*ibid.*:15, own translation).

Several studies have been published that show empirical evidence of the viability of this argument regarding the importance of local factors and development (see, for example, Chambers 1983; Long and van der Ploeg 1994; Pretty 1995; de Haan and Long 1997; Remmers 1998; Toledo 2000).

The Cuzalapa case presents a number of insights into the endogenous potential for biodiversity conservation. It indicates that it is difficult to speak of an endogenous potential *sui generis*. The regional farming style is characterised by internal differentiation, while the exact nature of resource diversity can differ at farm level. However, the latter was not specifically examined in this study. Moreover, resource diversity refers to a fluid and differentiated concept. Cuzalapa farmers use the land-use and vegetation units that compose the diversity in resources in different ways. The endogenous potential of Cuzalapa thus can further vary per land-use (sub)zone, or forest vegetation type.

The Cuzalapa case further illustrates that farmers strategically combine different farming elements, such as labour force, farming instruments and (local and external) resources. The exact configuration of these elements depends on farmers' strategic goals as well as on the possibilities and limitations for mobilising resources. This has important implications for both understanding farming practice and intervention schemes. Agricultural, cattle-raising and forestry activities are part of farming as a whole, and are highly connected and intertwined. In other words, one cannot understand endogenous potential by looking at these different elements separately, as the different farming activities within, but also possibly between, farming styles are an outcome of a complex co-ordination process.[15]

Conclusion

The current conservation paradigm entails great challenges. These challenges can be generalised into two categories. On the one hand, endogenous potential should be identified and evaluated regarding its viability for sustainable natural resource management and biodiversity conservation. This research aims at contributing to such identification. On the other hand, institutional attempts to attain sustainability should be evaluated and redirected in such a way that a favourable policy environment for endogenous development is created (Pretty 1995). This theme was not explicitly touched upon in this book. Central in the debate are three questions: What biological diversity is to be preserved?, To what degree should it be preserved?, and most importantly: How should it be preserved? The answers to these questions should be the outcome of societal and political discussions, for which a number of conditions will have to be created. I will discuss some of these conditions in the following section.

8.3 Some Reflections on the Theoretical Implications of this Research

In order to strengthen endogenous potential for biodiversity conservation in protected areas that are inhabited by farming communities, a number of conditions should be fulfilled for creating a favourable institutional and political-economic environment. In this section, I will discuss four conditions that I consider important. First, more professional attention should be given to various perspectives on biological diversity rather than just the scientific one alone. This recognition may not be easily translated into concrete action, as many different interests can be distinguished in populated protected areas. Often, these interests conflict, indicating the need for mechanisms for negotiating natural resource use and management. Therefore, the creation of platforms for natural resource management is the second condition that should be fulfilled. This also should include the fulfilment of a third condition, i.e. the redefinition of the concept of participation, as a principle for conflict management. Furthermore, in order to be applicable, these mechanisms should be embedded in a new or at least renewed conservation paradigm. In other words, an alternative conservation model should be developed. The latter implies a revision of the role of science and scientists and the need to develop a discipline that combines ecological and social knowledge. Thus revising the role of science and scientists and the combination of ecological and sociological knowledge are the third and fourth conditions that should be fulfilled. In the remaining paragraphs, I will further discuss each of the conditions mentioned.

The Existence of Multiple Perspectives on Biological Diversity

In this study, I described the Cuzalapa farmers' perspective on biological diversity, which, amongst others, was compared with the scientific one. The recognition of the existence of farmers' and scientific perspectives on biological diversity can be related to a more general recognition that multiple perspectives on biological diversity can exist in practice.

This recognition gives rise to some relativist reflections. In Chapter 1, I stated that different actors regard nature depending on their interests, which, in turn, depend on their perceptions.[16] Thus,

> *'the fact that different actors attribute different meanings to the same thing implies, above all, that the knowledge about the context is always* ***partial*** (Remmers 1999:47, emphasis in original text).*'*

Besides, as Remmers states:

> '[…] *it is the perception of a human being -his/her plan – that influences what is known or not known, what is changed or not changed, what is undertaken or is not undertaken'* (*ibid.*:48).

Furthermore, it might be assumed that:

> *'the decisions, actions, and practices made at all levels (local, national, and international) are made by people acting in ways that they perceive to be in their own interest, given their background, values and situation'* (Byers 1996:2).

This suggests important consequences for the best conservation approaches that look at increasing farmer participation. As Borrini-Feyerabend (1996) states:

> *'Approaches to stakeholder participation in different protected areas need to fit their specific historical and socio-political contexts and cannot be appreciated outside such contexts'* (*ibid.*:22).

Recognising the existence of multiple perspectives on biological diversity requires the opening-up of social spaces in which different actors with specific values and interests regarding (the same part of) living nature can meet. Each one of those actors can have direct or indirect rights to the same natural resources, a certain body of knowledge, and a certain degree of power for implementing and sustaining natural resources management over a longer period (Byers 1996). Furthermore, the interests of different social actors can relate to one another in a complementary, an indifferent or a conflictive way.

The situation of the RBSM as described in the preceding chapters and other studies on protected areas (Wells and Brandon 1992; Pimbert and Pretty 1995; Ghimire and Pimbert 1997) show that the relation between different stakeholders can be conflictive; although different degrees can be distinguished. Conflicts arise when the values that actors attribute to the same resources and the consequent use and management practices are mutually exclusive (Byers 1996). This stresses the need for participatory mechanisms, which can resolve the differences in order to achieve biodiversity conservation. One such mechanism is the so-called *platform for natural resource management*. It will be discussed in more detail below.

Platforms for Natural Resource Management

To reach basic agreements on natural resource management by different actors, specific socio-political spaces will have to be created where different actors can meet and negotiate. I will refer to these social spaces as platforms for natural resource management.[17] Platforms for natural resource management can be:

> *'one-time meetings, elected committees, formally appointed boards or councils or even parastatal or government bodies'* (Röling and Jiggins 1998:303).

Their existence is based on the argument that environmental problems can only be considered problems when they are shared by a wide range of actors. This, in turn implies that:

> *'the problem needs to be socially constructed depending on existing (micro and macro) economic opportunities, strategic reasoning and the conception of ecosystem assets by the stakeholders'* (Dangbégnon 1998:19).

Platforms for natural resource management can be established at various organisational levels, such as the local, regional, national and international levels. They can also address resource management from different perspectives, such as for example the use of resources, their degradation and their maintenance in good health (Dangbégnon 1998).

Lutz and Caldecott (1996) argue that to assure biodiversity conservation at the local level, a non-local perspective in the platforms for negotiating sustainable resource use is indispensable. The role they attribute to this non-local perspective is the following:

> *'This non-local perspective is vital in conservation, the fundamental concern of which is to avoid, if necessary to manage, conflicts of interests of species, generations, regions and nations. Therefore, empowerment of local groups should be balanced by a continuing role for central government to deal with market failures and to ensure social equity and environmental protection'* (Lutz and Caldecott 1996:2).

The non-local perspective, however, might be complicated to conceptualise, when one regards the variety of global biodiversity agreements and organisations.[18] Besides, at global scale a tension exists between programmes aimed at biodiversity conservation and trade agreements directed at economic growth (Vorhies 1999). Dangbégnon (1998) further states that the solutions, as formulated in platforms,

> *'can be possible only if successful collective action is effective, although individual actions must be consistent with collective action, otherwise it can only provide partial responses by the organizations, which intend to intervene'* (Dangbégnon 1998:21).

This is, however, more easily said than done, as institutional studies have shown (World Bank 1999).[19]

The creation of platforms for natural resource management should go hand in hand with a learning process, as actors with different educational backgrounds meet on the platforms (Maarleveld and Dangbégonon 1999). However, those actors with highest educational level are likely to be in an advantageous position (see Chambers 1997). Furthermore, in those situations where active or latent conflicts are present, *conflict management* should be part of the capacities of those co-ordinating the platforms for resource management, which, in turn, demands a re-conceptualisation of participation. This issue will be discussed below.

The Re-conceptualisation of Participation

Since the 1970s, participation has become an important concept in the discussions on sustainability, as is the case for populated protected areas (Chambers 1983; Wells *et al.* 1992). Nowadays, a great variety of methodologies for strengthening participatory processes exists. The majority of these methodologies conceptualise participation as a shared learning process for improving living conditions (Chambers 1997).[20] Conceptualising participation as a collective learning process may be possible, but only when there is a basic agreement on how natural resources should be managed. In the contexts of protected areas, where conflict over access and use of natural resources can exist, participation may be more difficult to be achieved. Different types of conflicts can be distinguished:

> '[…] *conflicts tend to go along with three broad frictions in the participatory process: (a) difficulties in maintaining an agreement or compromise after it has been secured; (b) problems in securing an agreement; and (c) failure to tackle the most significant problem in the first place'* (Leeuwis 2000:946).

The incorporation of principles of conflict management in participatory processes can help to disentangle and reconcile the interests of different actors (*ibid.*). According to Caldecott (1996), this requires explicit operational procedures:

> *'Many problems can be avoided, however, if local empowerment is accompanied by lines and procedures for communication, appeal and supervision, through which each local group can continue to relate to national authority* (*ibid.*:139).

The Role of Science and Scientists

The recognition of multiple perspectives on biological diversity, the creation of platforms for natural resource management and the incorporation of principles of conflict management in participatory approaches will demand different knowledge and skills of managers of protected areas as well as the involved scientists. In this context, training emerges as an important topic, which should be understood in a broader context:

> *'Training* [...] *must be viewed as part of a larger process of reorienting institutional policies, procedures, financial management practices, reporting systems, supervisory methods, reward systems and norms'* (Pimbert and Pretty 1995:8).

The reorientation of conservation professionals also implies *a new role for both natural and social scientists*.

During the last decades, natural science (in general) has made important progress in shifting from a problem-oriented approach towards a solution-oriented approach (Newman 1993), but still much remains to be done. Castillo and Toledo (2000), based on a study by Pienowski and Watkinson (1996), state that:

> *'An analysis of the influence on management practice or policy of 50 representative articles published over the last 30 years in one prominent ecology journal, the Journal for Applied Ecology, showed that most of these articles lacked an indication of the practical applications of the work or of management recommendations derived from the research'* (*ibid.*:66). According to Gómez-Pompa (1998), one of the leading biologists in Mexico: *'as scientists, we have to study in-depth the biodiversity in zones managed by farmers. The secondary vegetation derived from the traditional agriculture remains an enigma for the conservation of biodiversity. It is important to remember that we find an elevated number of rare and endemic species in secondary vegetation. We also must remember that the families with the biggest number of species are fundamentally secondary: Asteracea, Poaceae, Euphorbiaceae, Piperaceae, etc.'* (*ibid.*:9).

Within the social sciences, environmental issues are a relatively recent field of attention. Social science contribution, however, is to be considered important, next to farmer knowledge, as Castillo and Toledo (2000) also state:

> *'Information from the social sciences and the knowledge generated by rural communities world-wide* [...] *have an important role to play in formulating strategies for natural resource management and conservation'* (*ibid.*:66).

The above suggests the desirability for at least two changes in science. On the one hand, social and natural scientists should reach an epimistological consensus on conservation and sustainable development. In other worlds, social and natural scientists should know and understand 'the world outside' in similar ways, or at least share a basic agreement. This in itself poses a huge challenge to science, due to its basically reductionistic nature. Secondly, best conservation practices should be based on empirical knowledge, which, in turn, should be analysed in a clear theoretical framework. Central for this understanding is an endogenous perspective, which, in turn is expressed and reflected by co-production, farming styles and resource diversity.[21]

The Combination of Social and Natural Science

To fully understand co-production, farming styles, resource diversity and other features of endogenous potential, rural sociological analysis should preferable be combined with contributions from natural sciences. The linking of social and natural scientific elements should take place in such a way that a flexible research tool can be developed that takes into account the specific features of the endogenous potential to be strengthened. Rather than merely joining different knowledge elements, a new methodology should be developed (see also Sevilla and Molina 1990). Furthermore, combined social and natural scientific research preferably should done by inter- or transdisciplinary teams, as the majority of the professionals have a disciplinary formation.[22] Finally, the research agenda should include participatory rather than only scientific problem assessments.

In this study, I intended to combine rural sociological analysis with elements from community forestry theory. Other authors have also explored the crossing of disciplinary boundaries. Both Remmers (1998) and Morales (1999), for example, link rural sociological analysis with agro-ecology, while Toledo (1990a, 2000) links sociological and cultural analysis with biological and ethnoecological research methods. Several of the contributions in Moran (1998) resemble Toledo's analysis by looking at the interfaces between anthropology and ecology. Finally, Smeding and Joenje (1999) propose linking social science with landscape ecology and agro-ecological analysis, while Broekhuizen and van der Ploeg (1995) give an overview of different disciplinary side-steps that have been undertaken in research on endogenous development potential in marginal European regions.

The approach that I have developed in this study analyses the farmer-living nature link at the level of landscape and the farm. In situations like the Cuzalapa case, both have to be assessed. Baudry (1989) argues that the landscape level is especially important in relation to biodiversity conservation, due to: '[...] *the importance of the landscape as a level of organisation of processes, such as dispersion of plants and animals, nutrients and water flow'* (*ibid.*:119). Besides, as is the case in many agrarian communities of Mexico, a great number of farming activities take place on communally-owned land. Consequently, the landscape should be considered as an agro-ecological system, with different elements that are used and management individually or collectively. Combined social and natural scientific research of the landscape as a whole, or of its individual elements can inform policymakers and practitioners when formulating guidelines for interventions. This type of research can further look at ways of assessing the sustainability of farming styles in order to find ways forward. Within the context of biodiversity conservation, a central question then would be: *'How can farms actually be 'restyled' in order to achieve a better coherence with landscape patterns and processes and a better adjustment of farming to nature'* (Smeding and Joenje 1999:110). Clearly, answering this question and putting it into practice may be more successful if the different conditions that I described in this section are met.

Notes

1 Parts of this Chapter are published as Gerritsen (1999, 2000), Gerritsen and Morales (2001) Gerritsen *et al.* (2002a, 2002b).

2 Reference is made here to the main research question.

3 Reference is made here to the first specific research question.

4 The political context was not discussed when looking at the livelihood strategies. It was, however, generally discussed in Chapter 2.

5 Gerritsen and Forster (2001) describe the preliminary results of applying tenure concepts to the Cuzalapa case.

6 Reference is made here to the second specific research question.

7 Remmers adopted these terms from Richards (1989).

8 The discussion here indicates that it may be necessary to analyse the concepts of 'plan' and 'performance' at different organisational scales, as well as from different disciplinary viewpoints.

9 Reference is made here to the third specific research question.

10 See also Waters (1995).

11 Reference is made here to the first part of the fourth particular research question.

12 See also Gerritsen *et al.* (2001, 2002a, 2002b).

13 Reference is made here to the second part of fourth particular research question.

14 Toledo (2000) refers to the latter as 'sustainable community development'.

15 Neglecting this crucial aspect of farming is one of the core reasons for the difficulties that external agents perceive in 'making projects work'. Instead of critically revising the basic suppositions of the project (Long and van der Ploeg 1989; van der Ploeg 1991), blame for its failure is often placed on the farmers' side. Ignorance, lack of organisation, lack of a certain culture (such as a – science-based - forestry culture), influence of strongmen are common explanations. Although these factors certainly play a role, they only partially explain a project's success or failure.

16 See Kaus (1993) and Lazos and Paré (2000) for case study descriptions of Mexican biosphere reserves. Both illustrate different perspectives regarding nature between the different involved stakeholders. The study of Kaus is especially interesting, as the biosphere reserve in question was the first one established (in 1977). It is thus one of the protected areas with the longest experience in putting the Mexican modality for conservation into practice.

17 The platforms are also known as e.g. platforms for decision-making about ecosystems, platforms for learning and decision-making, platforms for resource use negotiation, platforms for collective action in multiple-use common pool resources (Röling 1994; Röling and Wagemakers 1998, Dangbégnon 1998; Steins and Edwards 1999).

18 Existing global biodiversity agreements are the Convention on International Trade in Endangered Species, the World Heritage Convention, the Ramsar Convention on Wetlands, the Framework Convention on Climate Change, and the Convention on Biological Diversity. Existing global biodiversity organisations are the World Conservation Union (IUCN), the World Wildlife Fund for Nature (WWF), the United Nations Environment Program (UNEP), the World Bank Group, the Global Environment Facility (Vorhies 1999).

19 See also Castañeda (2001) for a case study in the transition zone of the RBSM.

20 Many publications and journals focus on participation and participatory methodologies. See the bibliography of Chambers (1997) for an overview.

21 Halffter, founding father of the Mexican modality for biosphere reserves, stated in 1995, 16 years after his participation in the creation of the first biosphere reserve in Mexico in 1979: *'it is necessary to count with an appreciation that is based on real information obtained in situ of what the ecological,*

economic, social, cultural (biodiversity perception) and political scenario is of each region' (Halffter 1995:10).

22 Following Leeuwis (1999:2, endnote 1): '*Inter-disciplinary teams refer to forms of co-operation whereby scientists from different disciplines work together in a team that aims at solving certain problems. In the team, the researchers stick to their own disciplinary perspective. However, they deliberately co-ordinate the research questions that each discipline addresses at various points in time, and carefully analyse the implications of particular insights and research findings for questions posed in other disciplines. This type of co-operation goes further than 'multi-disciplinary' co-operation, whereby disciplines remain more autonomous; the results from different disciplines are merely 'added-up'. In 'trans-disciplinary' co-operation researchers with different backgrounds develop a common conceptual framework and language [...], thus, 'transcending' their original disciplines.*'

Epilogue

From Scientific Analysis to Policy Implications

Many theoretical reflections have filled the pages of this book. For readers concerned directly with policy-making and project implementation, scientific analysis may not be readily translatable into professional day-to-day practice. Therefore, in this epilogue I will give a number of practical recommendations for strengthening the central role of farmers' participation in nature resource management (i.e. the endogenous potential for biodiversity conservation) in inhabited protected areas. These recommendations are based on both the theoretical-empirical discussions in the foregoing chapters and a number of related discussions in literature that are relevant for protected areas that are inhabited by farmers.

Ten Recommendations for Policy Makers and Practitioners

1 Applied sociological research on farming and natural resource use and management strategies of local actors (including their interactions with the wider institutional context), should become an important central feature of planning activities in populated protected areas. Such research might generate valuable insights into the perceptions of the involved actors, as well as into their actions regarding living nature (In addition to this book, see also Pimbert 1999; Lazos and Paré 2000).

2 Applied sociological research on the strategies of local actors should include a gender focus, due to the differing perceptions and activities of male and female actors regarding farming and natural resource use and management (Moser 1993; Lazos and Paré 2000; Kreutzer et al. 1998; Partida 2001).

3 Applied ecological research should be grounded in the strategies of local actors regarding natural resources, and it should assess the multitude of ecological impacts of the various elements of such strategies in order to be able to make a real contribution to resolving environmental problems (In addition to this book, see also Castillo and Toledo 2000).

4 Applied ecological research should be focussed on resource diversity within the farm and the community, where the endogenous conservation potential is in fact hidden (In addition to this book, see also Pretty 1999).

5 An agro-ecological approach should be part of conservation strategies in populated protected areas to be able to "re-green" farming practice and maintain and restore

biodiversity in agro-ecosystems, as well as to improve farmers' livelihoods (Pretty 1995).

6 Participation of farmers in the management of populated protected areas should be re-conceptualised from a learning approach into a negotiation approach (Leeuwis 2000), due to the often conflictive relationship between managers of protected areas and local actors (In addition to this book, see also Leeuwis 2000, Ghimire and Pimbert 1997).
7 The shift towards a negotiation approach should be accompanied by the creation of new participatory mechanisms, such as the so-called platforms for natural resource management.

8 Formal and informal tenure arrangements should be clarified in order to make platforms for natural resource management work, as the latter often compete with one another regarding the governance of natural resource management (Forster 2000). After clarifying formal and informal tenure arrangements, new tenure arrangements should be designed that begin with an informal social understanding regarding natural resource use and management.

9 Conservation strategies should be based on a process planning approach that includes a set of indicators for monitoring social and environmental improvement (In addition to this book, see also Pimbert and Pretty 1995, Ghimire and Pimbert 1997; Leeuwis 1999, Pimbert 1999, Remmers 1998).

10 Bureaucratic culture and professional practice should be transformed through training and procedure simplification (In addition to this book, see also Caldecott and Lutz 1995; Pimbert 1999).

A Final Remark

Strengthening endogenous conservation potential is not an easy task. Indeed, great challenges lie ahead. This and other studies (see for example, Long and van der Ploeg 1994; van der Ploeg and van Dijk 1995; Haan and Long 1997, Toledo 2000), however, have shown that important interests are at stake. Practice, including my own experience, has also shown that it is a slow, time-consuming and never-ending process.

Annex 1 Glossary of Mexican Terms

Adobe	Clay-dung mixture used for building houses
Agostadero de esquilmo	Grazing land on the hillsides
Agostadero	Grazing land
Avencindados	Immigrants in agrarian communities
Barbecho	Secondary vegetation
Bosque	Dense forest
Cacique	Strongmen
Cafetal	Coffee garden
Cargo	The responsibility for a certain activity in indigenous communities
Cerro	The hills
Coa	A wooden stick with an iron blade, used in *coamil* farming practices
Coamil	Maize cultivation through shifting cultivation practices
Comunero	Land-holding peasant in indigenous communities
Comunidad indígena	Indigenous community
Cultivation a medias	Sharecropping
Desmonte	Land clearing
Ejido	Agrarian community
El Norte	United States of America
Encinera	Sub-deciduous oak forest
Encino	Oak tree
Forestal	Forestry officer
Ganaderización	Expansion of cattle-breeding sector
Ganadero	Cattle-breeder
Hacendado	Owner of hacienda
Hacienda	Large agricultural estate
Huertos	Home gardens
Indígena	Original inhabitant of a *comunidad indígena*
Jornalero	Wage labourer
LGEEPA	Mexican law on the environment
Machete	Cane knife
Matorral	Secondary vegetation
Mayordomo/a	Ceremonial sponsorship, person responsible for the organisation of catholic-indigenous feasts
Medida	Local weight
Mediero.	Sharecropper
Mestizo	Non-indigenous person in Mexico
Milpa	Maize field
Monte alto y arbolera en	Gallery and riparian forest

las barrancas y los arroyos	
Monte alto	Forest vegetation
Monte bajo	Secondary vegetation
Monte	Woodland
Ocote	Pine tree
Ocotera	Pine forest
Pastizal	Pasture land
Pasto	Pasture
Pastura	Pasture and crop residues
Patrón	Sharecropper
Pino	Pine tree
Pobre	Agriculturist
Rancho	Hamlet
Rastrojo	Crop left-over (i.e. crop residues) in maize cultivation
Riegadillos	Arable fields suitable for irrigation
Roble	Oak tree
Roblera	Deciduous oak forest
Siembra a medias	Sharecropping
Técnico	Extension officer
Tomatillo.	Wild-growing tomato
Tortilla	Maize pancake
Yunta de lluvia	Rain-fed maize cultivation using horses and mules on flat areas
Yunta de riego	Irrigated maize cultivation
Yuntas	Cultivation fields

Annex 2 All *Matorral* Species Mentioned by Farmers (Merino and Gerritsen 1999)

Common name	*Scientific name*
Aceitilla	Bidens pilosa
Ajenjibre	Zinger officinale
Arrayán	Psidium sartorianum
Barbasco	Senna foetidissima var. grandiflora
Bejuco negro or Bejuco prieto	Serjonia sp.
Bonetillo	Casearia arguta .
Cabeza de negro	Annona purpurea
Cadillo	Triumfetta gonophora
Candelilla	Pedilanthus palmeri
Capitana	Verbesina greenmanii or Crotalaria mollicula
Capulín	Zanthoxylum arborescens or Ardisia compressa
Cascabelillo	Crotolaria longirostrata
Cirial	Unidentified species
Cocliste	Bromelia plumieri
Cocolmeca	Smilax moranensis
Conguerán	Phytolacca icosandra or Phytolacca rugosa
Coyulillo	Trichospermum mexicanum
Cuatalaca	Caseria arguta
Chan	Salvia mexicana
Chivatillo	Unidentified species
Chumbejo	Siparuna andina
Escoba	Melochia tomentosa or Baccharis pteronioides
Espadano	Unidentified species
Garabato	Macharerium salvadorense or Pisonia aculeata var. aculeata
Guaje	Acacia macilenta
Guardalagua	Bouvardia sp.
Guayavilla	Psidium guineense
Helecho	Drijopteris rossi
Hierba del arlomo	Piper rosei, Chamissoa altissima or Baccharis trinervis
Higuerilla	Ricinus communis
Hormiguillo	Cordia alliodora
Huisapol	Cenchrus ciliaris
Jaragua	Hyparrhenia rufa
Jocuistle	Bromelia plumieri
Lechuguilla	Agave maximiliana or Agave attentua

Malva	Turnera caerulea
Mojote	Brosimun alicastrum
Mora	Conostegia xalapensis or Ostrya virginiana
Nance	Byrsonima crassifolia
Pacacho	Vernonia capreifolia
Picadillo	Manihot rhomboidea subsp. Microcarpa
Rabelero	Gyrocarpus jatrophifolius
Rasca vieja	Curatella americana
Retama or Amargosilla	Calea urticifolia
Salvia	Salvia sp.
Santa María	Tagetes lucida
Serrilla	Mimosa albida
Tacote	Podachaenium eminens
Tacote amargo	Calea urticifolia
Tacote amarillo	Tithonia diversifolia
Tacote blanco	Montanoa speciosa
Tacote prieto	Vernonia capreifolia
Tacote rodellón	Unidentified species
Tepame	Acacia macracantha or Acacia pennatula
Tepeguaje	Lysiloma acapulcense
Varudo	Margaritaria nobilis
Zacate	Cyperus hermaphroditus
Zacate burro	Paspalum plicatulum
Zorrillo	Petiveria alliacea

Annex 3 All *Barbecho* Species Mentioned by Farmers (Merino and Gerritsen 1999)

Common name	*Scientific name*
Aguacatillo	Nectandra glabrescens or Symplococarpum purpusii
Ahuilote macho	Vitex pyramidata
Annona	Annona reticulata
Árbol maría	Calophyllum brasiliense var. rekoi
Arrayán	Psidium sartorianum
Azajar	Styrax ramirezii
Bonetillo	Casearia arguta
Cabello de ángel	Calliandra houstoniana.
Cabeza de negro	Annona purpurea
Cacao	Magnolia iltisiana
Cadillo	Triumfetta gonophora
Camichín	Ficus pertusa
Campanillo	Bourreria superba
Capitana	Verbesina greenmanii or Crotalaria mollicula
Capulín	Zanthoxylum arborescens or Ardisia compressa
Cicua	Pavonia pleuranthera
Cirial	Unidentified species
Clavellina	Pseudobombax palmeri
Cocliste	Bromelia plumieri
Corazón de buey	Unidentified species
Corchuelo	Unidentified species
Coyulillo	Trichospermum mexicanum
Cuajiote	Bursera fagaroides
Cuatalaca	Casearia arguta
Cuate	Eysenhardtia polystachya
Chivatillo	Unidentified species
Chumbejo	Siparuna andina
Encino	Quercus sp.
Escoba	Melochia tomentosa or Baccharis pteronioides
Escualatera	Unidentified species
Espino monte	Acacia cochliacantha
Frutilla	Cordia prunifolia
Granjeno	Celtis iguanea
Guaje	Acacia macilenta
Guardalagua	Bouvardia sp.
Guayabo	Psidium guajava

Guayavilla	Psidium guineense
Guázima	Guazuma ulmifolia
Hierba del arlomo	Piper rosei, Chamissoa altissima or Baccharis trinervis
Higuera	Ficus glabrata
Histacuero	Unidentified species
Hormiguillo	Cordia alliodora
Huevo de tejón	Tithonia tubaeformis
Huizilacate or _Mamey	Pouteria sapota or Bimelia cartilaginea
Huizache	Acacia cochliacantha
Huizcolote	Acacia hindsii
Ajenjibre	Zingiber officinale
Juaniquil peludo	Inga eriocarpa
Mano de león	Cecropia obstusifolia or Dendropanax arboreus
Mataiza	Sapium pedicellatum
Mojote	Brosimum alicastrum
Mora	Conostegia xalapensis
Nance	Byrsonima crassifolia
Naranjillo	Matudaea trinervia
Navajilla	Cyperus mutisii
Pacacho	Vernonia capreifolia
Palo blanco	Ilex brandegeana
Panicua	Cochlospermum vitifolium
Parota	Enterolobium cyclocarpum
Picadillo	Manihot intermedia
Roble	Quercus sp.
Rosa amarilla	Hamelia xorullensis
Rosa morada or Madera	Tabebuia rosea
Serrilla	Mimosa albida
Tacote	Podachaenium eminens
Tacote amargo	Calea urticifolia
Tacote blanco	Montanoa speciosa
Tepame	Acacia pennatula or Acacia macracantha
Tepeguaje	Lysiloma acapulcense
Tepejilote	Cryosophila nana
Varudo	Margaritaria nobilis
Zapote blanco	Casimiroa watsonii
Zapotillo	Couepia polyandra
Zorrillo	Petiveria alliacea

Annex 4 All *Roblera* Species Mentioned by Farmers (Merino and Gerritsen 1999)

Common name	*Scientific name*
Azajar	Styrax ramirezii
Barbasco	Senna foetidissima var. grandiflora
Cabeza de negro	Annona purpurea
Capitana	Crotalaria mollicula or Verbesina greenmanii
Clavellina	Pseudobombax palmeri
Cocliste	Bromelia plumieri
Cocolmeca	Smilax moranensis
Cola de caballo	Equisetum hyemale var. affine
Cola de zorra	Muhlenbergia speciosa
Copal	Bursera fagaroides
Cuajiote	Bursera fagaroides
Cuatalaca	Casearia arguta
Chumbejo	Siparuna andina
Encino	Quercus sp.
Encino asta	Quercus ellipitica or Quercus xalapensis
Encino prieto	Quercus peduncularis
Guaje	Acacia macilenta
Guayabo	Psidium guajava
Guayavilla	Psidium guineense
Guázima	Guazuma ulmifolia
Hierba de venado	Porophyllum punctatum
Hormiguillo	Cordia alliadora
Huevo de tejón	Trychospermun mexicanum
Huizcolote	Acacia hindsii
Juaniquil	Inga eriocarpa
Lechuguilla	Agave maximiliana or Agave attenuata
Mojote	Brosimum alicastrum
Mora	Conostegia xalapensis, Ostrya virginiana or Solanum nigrescens
Nance	Byrsonima crassifolia
Ocotes	Pinus sp.
Oreja de becerro	Unidentified species
Pacalaca	Unidentified species
Palo dulce	Eysenhardtia polystachya
Panicua	Cochlospermum vitifolium
Parota	Enterolobium cyclocarpum
Rasca	Morisonia americana

Roble	Quercus sp.
Roble amarillo	Quercus spp.
Roble blanco	Quercus magnoliifolia or Quercus gluacessens
Roble colorado	Quercus spp.
Roble prieto	Quercus peduncularis
Rosa morada	Tabebuia rosea
Tepame	Acacia pennatula
Tepeguaje	Lysiloma acapulcense
Trompetero	Cecropia obtusifolia
Varudo	Margaritaria nobilis
Zacate cortador	Unidentified species
Zacate espadano	Unidentified species
Zapotillo	Couepia polyandra
Zorrillo	Petiveria alliacea

Annex 5 All *Encinera* Species Mentioned by Farmers (Merino and Gerritsen 1999)

Common name	*Scientific name*
Árbol María	Calophyllum brasiliense var. rekoi
Avellana	Quercus rugosa
Azajar	Styrax ramirezii
Cabeza de negro	Annona purpurea
Cacao	Magnolia iltisiana
Capitana	Verbesina greenmanii or Crotolaria mollicula
Capulín	Zanthoxylum arborescens or Ardisia compressa
Cedro blanco	Cupressus lusitanica
Colcomecas	Smilax moranensis
Cuerno de venado	Unidentified species
Chumbejo	Siparuna andina
Encino asta	Quercus elliptica or Quercus xalapensis
Encino blanco	Quercus gentrii
Encino colorado	Quercus xalapensis
Encino chino	Quercus gentryii
Encino prieto	Quercus penduncularis
Encino roble	Quercus elliptica
Fresno	Fraxinus uhdei
Guázima	Guazuma ulmifolia
Hormiguillo	Cordia alliadora
Lechuguilla	Agave maximiliana or Agave attentuata
Lengua de venado	Eupatorium oerstedianum
Nance	Byrsonima crassifolia
Naranjillo	Matudaea trinervia
Nogal	Juglans major var. glabrata
Ocote	Pinus sp.
Oyamel	Abies religiosa
Palo dulce	Eysenhardtia polystachya
Panicua	Cochlospermum vitifolium
Parota	Enterolobium cyclocarpum
Platanillo	Canna indica or Maranta irindinacea
Roble negro	Quercus spp.
Rosa morada	Tabebuia rosea
Tepeguaje	Lysiloma acapulcense
Tingüica or Pingüica	Unidentified species
Hierba de venado	Porophyllum punctatum
Zarzaparrilla	Smilax spinosa

Annex 6 All *Ocotera* Species Mentioned by Farmers (Merino and Gerritsen 1999)

Common name	*Scientific name*
Algodoncillo	Populus guzmanantlensis or Acer skutchii
Azajar	Styrax ramirezii
Cacao	Magnolia iltisiana
Capitana	Verbesina greenmanii or Crotolaria mollicula
Capulín	Zanthoxylum arborescens or Ardisia compressa
Cascabelillo	Crotolaria longirostrata
Cedro or *cedro blanco*	Cupressus lusitanica
Cóbano	Swietenia humilis
Colcomecas	Smilax moranensis
Cordobán	Ardisia compressa
Chumbejo	Siparuna andina
Encino asta	Quercus elliptica or Quercus xalapensis
Encino prieto	Quercus peduncularis
Encino rosillo	Quercus scytophylla
Encino	Quercus castanea
Fresno	Fraxinus uhdei
Gordolobo	Gnaphalium sp.
Guardalagua	Bouvardia sp.
Jaboncillo	Heliotropium rufipilum
Lechuguilla	Agave maximiliana or Agave attentuata
Madroño torcido	Arbutus xalapensis
Naranjillo	Matudaea trinervia
Nogal	Juglans major var. glabrata
Ocote	Pinus sp.
Oyamel or *Pinabete*	Abies religiosa
Rasca vieja	Curatella americana
Roble	Quercus spp.
Tabardillo	Unidentified species
Tinhuica or *pinhuica*	Unidentified species
Zacate cortador	Unidentified species
Zacate espadano	Unidentified species
Zarzamora	Rubus sp.
Zarzaparrilla	Smilax spinosa

Annex 6 All *Ocotera* Species Mentioned by Farmers (Merino and Gerritsen 1999)

Common name	*Scientific name*
Algodoncillo	Populus guzmanantlensis or Acer skutchii
Azajar	Styrax ramirezii
Cacao	Magnolia iltisiana
Capitana	Verbesina greenmanii or Crotolaria mollicula
Capulín	Zanthoxylum arborescens or Ardisia compressa
Cascabelillo	Crotolaria longirostrata
Cedro or *cedro blanco*	Cupressus lusitanica
Cóbano	Swietenia humilis
Colcomecas	Smilax moranensis
Cordobán	Ardisia compressa
Chumbejo	Siparuna andina
Encino asta	Quercus elliptica or Quercus xalapensis
Encino prieto	Quercus peduncularis
Encino rosillo	Quercus scytophylla
Encino	Quercus castanea
Fresno	Fraxinus uhdei
Gordolobo	Gnaphalium sp.
Guardalagua	Bouvardia sp.
Jaboncillo	Heliotropium rufipilum
Lechuguilla	Agave maximiliana or Agave attentuata
Madroño torcido	Arbutus xalapensis
Naranjillo	Matudaea trinervia
Nogal	Juglans major var. glabrata
Ocote	Pinus sp.
Oyamel or *Pinabete*	Abies religiosa
Rasca vieja	Curatella americana
Roble	Quercus spp.
Tabardillo	Unidentified species
Tinhuica or *pinhuica*	Unidentified species
Zacate cortador	Unidentified species
Zacate espadano	Unidentified species
Zarzamora	Rubus sp.
Zarzaparrilla	Smilax spinosa

Annex 7 All Species from the *Monte Alto* and *Arbolera en las Barrancas y los Arroyos* Mentioned by Farmers

Common name	*Scientific name*
Ahuilote macho	Vitex mollis
Alamo	Populus guzmanantlensis or Acer skutchii
Árbol María	Calophyllum brasiliense var. rekoi
Asta	Quercus elliptica
Azajar	Styrax ramirezii
Bejuco de hiedra	Serjonia psilophylla
Bejuco equipalero	Heteropterys laurifolia
Bejuco negro or *Bejuco prieto*	Cordia spinescens
Cacao	Magnolia iltisiana
Camote del cerro	Dioscorea remotiflora
Caña de indio	Costus pictus
Capitana	Verbesina greenmanii or Crotalaria mollicula
Capulín	Zanthoxylum arborescens or Ardisia compressa
Cedro	Cupressus lusitanica
Clavellina	Psuedobombax palmeri
Cóbano	Swietenia humilis
Cocolmeca	Smilax moranensis
Cola de Caballo	Equisetum hyemale
Cordobán	Ardissia compressa
Cuajiote	Bursera fagaroides
Chumbejo	Siparuna andina
Encino	Quercus castanea
Fresno	Fraxinus uhdei
Garañona	Satureja macrostema var. laevigata
Guardalagua	Bouvardia sp.
Guázima	Guazuma ulmifolia
Hierba de venado	Porophyllum punctatum
Huitapil	Cecropia obtusifolia
Lechuguilla	Agave maximiliana or Agave attentuata
Madroño	Arbutus occidentalis
Manzanilla	Matricaria recutita
Mojote	Brosimum alicastrum
Nance	Byrsonima crassifolia
Naranjillo	Matudaea trinervia
Nogal	Juglans major
Ocote	Pinus spp.
Oyamel	Abies religiosa

Palmilla	Adiantum trapeziforme
Palo de agua	Unidentified species
Palo grueso	Unidentified species
Pino	Pinus spp.
Roble	Quercus spp.
Rosa Morada or *Madera*	Tebebuia rosea
Serilla	Mimosa albida
Suelda	Agonandra racemosa
Tacote	Podachaenium eminens
Tepeguaje	Lysiloma acapulcense
Tescalama	Ficus sp.
Tingüica or *Pingüica*	Unidentified species
Zapotillo	Coupeia polyandra
Zarzamora	Rubus sp.

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summary

This study seeks to contribute to the scientific debate on biodiversity conservation in protected natural areas that are inhabited by local farming communities. More specifically, by combining rural sociological and community forestry theory it aims at understanding the farmers' role in natural resource management in biosphere reserves. The research underlying this book took place in the Sierra de Manantlán biosphere reserve in Western Mexico. Chapter 1 presents the theoretical framework of this study, while Chapters 2 to 7 describe the results of the fieldwork. In the concluding Chapter 8, the debate on biodiversity is re-examined by reflecting on the empirical findings. The Epilogue presents 10 policy recommendations.

Chapter 1 begins with an overview of the biodiversity debate. Since the 1970s, biodiversity has been a central topic in many discussions regarding the natural environment. Biodiversity is a concept from natural science that describes the biological diversity that can be distinguished at genetic, species and ecosystem level. It has become a leading principle in conservation in general, and in the management of species and ecosystems in protected areas in particular. Limitations of the concept emerge in relation to populated protected natural areas. Biodiversity primarily reflects values attributed by scientists; it is used predominantly as a scientific concept that refers primarily to the option, bequest and existence values of natural species. Farmers also attribute values to the diversity found in the natural environment, but these are predominantly instrumental values. Such instrumental values do not only include direct use values, but also indirect use values such as cultural and spiritual values. In response to these values, farmers have often actively maintained biodiversity in their land-use systems. Nowadays the 'human nature' of biodiversity is increasingly recognised, but the concept itself is still mainly used to refer to a biological phenomenon. Consequently, this concept cannot easily be used to gain insight into the social processes underlying the multiple manifestations of biodiversity in either natural or human-influenced environments, nor the process of transformation of biodiversity from natural to anthropogenic ecosystems.

These limitations demonstrate the need to re-assess the concept of biodiversity by focussing on local peoples' perspectives rather than scientific perspectives. Such a re-assessment is of special relevance when considering best approaches towards biodiversity conservation in protected areas inhabited by local communities. The theoretical foundations of this argument lie in the acceptance of social and biological heterogeneity. In this book, heterogeneity is analysed through the concepts of co-production, farming styles and resource diversity. Co-production refers to the multiple and often mutually reinforcing relationships between farmers and living nature. The role of farmers in co-production is analysed using the notion of farming styles, which refer to shared sets of notions and ideas on farming and the active responses of farmers to local ecological, socio-economic and political conditions. Resource diversity is described as the diversity in natural resources as known and actively maintained by farmers; it is the socio-material outcome of co-production. Resource diversity is created in a process of ongoing interactions and mutual transformations of natural and social phenomena. During this dynamic process of co-production, resource diversity is constantly produced and reproduced. This ongoing socio-material process includes an organisation of time and space that results in gradual transformations of resource

diversity. Rather than leading to a process of unilateral loss of biodiversity, as is often assumed in official conservation efforts, such transformations result in changing landscape mosaics with each landscape unit representing and containing its own specific form of resource diversity. These changing landscape mosaics can offer new opportunities (or limitations) for farming styles. Consequently, both natural and social conditions are set for a new process of co-production.

Chapter 2 describes the study area, i.e. the indigenous community of Cuzalapa in the Sierra de Manantlán Biosphere Reserve in Western Mexico. The Sierra de Manantlán is a mountain range that covers almost 140,000 hectares. It was declared a biosphere reserve in 1987, due to its biological diversity and great potential for commercial forestry and the harvest of non-timber forest products for medicinal and nutritional purposes. Thirty percent of the total area inside the Reserve is set aside as strictly protected core zones. The remaining land is the buffer zone, where less restrictive rules and regulations govern land-use by the farming communities. The peripheral area located outside of the Reserve is called the transition zone. The land tenure regulations of the Reserve were imposed on existing properties with their attendant tenure institutions. The scientific field station in the Reserve is state property and encompasses one percent of the total area. During its 15 years of existence, the Reserve's conservation mission has expanded from protection of individual species to an integrated conservation project with a regional approach to sustainable development. Realising the dual mission of conservation and development in practice, however, has challenged Reserve managers.

The indigenous community of Cuzalapa is located on the southern slopes of the Reserve. The community encompasses 23,963 hectares, of which approximately 72 per cent are in the buffer zone and 19 per cent are in one of the core zones. In 1995, the community comprised 1,330 inhabitants (302 families) living in a main village and eleven hamlets. Land-use in Cuzalapa is centred on maize cultivation, although cattle breeding has become increasingly important since the 1970s. Cattle breeding is characteristically extensive in labour and external inputs: scale enlargement is necessary for farm development. With low prices for corn, it has become the most important economic activity, including the trade of pasture and crop residues. Trees and forests are important for farmers for domestic purposes and in farming practice. Due to the Reserve's regulations, commercial exploitation no longer takes place.. In Cuzalapa, the process of co-production dates back to pre-Hispanic times. However, since the beginning of the twentieth century, many changes have taken place that have set both the natural and social conditions for a new process of co-production.

Chapter 3 describes the regional farming style in Cuzalapa. The regional farming style represents the shared set of notions and ideas that farmers have regarding farming practice. The regional farming style is characterised by a resource mobilisation that mainly takes place on the farm and in the community. Links with markets and institutions are weakly developed. The regional farming style is further characterised by an internal differentiation amongst farmers, who can be categorised as either *Pobres* or *Ganaderos*. *Pobre* farmers are involved in agriculture, small-scale cattle breeding, and off- and non-farm activities, while cattle-breeding activities dominate *Ganadero* farming practice. *Pobre* farmers' access to resources is severely limited, in contrast to that of *Ganadero* farmers.

Since the late 1960s, many processes have influenced the development of the regional farming style. Since that period, cattle-raising activities have become increasingly important and have been changing farming practice substantially. Cattle breeding has been triggered by dysfunctional community institutions in the 1960s/1970s, governmental policy in the 1970s/1980s and migration to the United States in the 1980s and 1990s. Currently, *Pobre* farm reproduction has become more difficult, which has made sharecropping more important. Moreover, the pasture trade has become a more important income source than maize. The development of *Ganadero* farms is not limited by their reproduction, but by their expansion, as currently all the community's land is in the hands of individual farmers. This altered situation of *Pobre* and *Ganadero* farmers has led to new responses to local ecological and socio-economic conditions. It also suggests that a transformation of the regional farming style is taking place and that new styles might be emerging.

Chapter 4 presents seven case studies of Cuzalapa farmers. A central feature of their descriptions is an economic analysis, illustrating different income sources in the farming strategies. Five *Pobre* case studies describe their livelihood strategies, which indicate that maize cultivation has been displaced as a main income source for family subsistence by pasture trade, remittances and off-farming income. Furthermore, the economic data indicate new farmer strategies are emerging that no longer fully coincide with the traditional production orientation underlying the regional farming style. Two *Ganadero* case studies shed light on the economic situation of these farmers. Their descriptions suggest the existence of two general categories: cattle-breeders who aim at increasing pasture availability within their own farms and who apply an intensive animal care strategy, and cattle breeders who aim at increasing pasture availability by buying grazing rights. Comparing the *Pobre* and *Ganadero* case studies reveals that both groups basically follow the same farming strategy of mobilising resources mostly within their own farms and in the community. Both can be considered peasants. Both are highly market dependent in the sense that any kind of changes in markets affect their farm development, even though *Ganadero* farmers can buffer these changes more easily. Finally, the expansion of cattle breeding indicates a trend towards an extensification of the agrarian system in Cuzalapa.

Chapter 5 describes resource diversity as known and actively maintained by Cuzalapa farmers at landscape level. At this level, farmers distinguish three main land-use zones: home gardens (*huertos*), cultivation fields (*yuntas* and *coamiles*) and grazing lands (*agostadero* lands). The underlying criteria of this classification are the potential for land-use of the different parts of the landscape and the management practices that farmers apply within each of these parts. Within the main land-use zones, farmers further distinguish a number of subzones. Farmers subdivide the *agostadero* lands according to the characteristics of fields and the vegetation that they contain. The concept of *agostadero* refers not only to a spatial, but also to a temporal dimension. It refers not only to different parts of the landscape, but also to different agricultural cycles. The same is also true for the other units that compose resource diversity in Cuzalapa. Farmers do not explicitly distinguish forest resources (that is forest ecosystems and secondary vegetation) as separate land-use zones, but they consider them to be part of the grazing lands (that is *agostaderos*). They refer to forest-related resource units as *monte* and *arbolera*, and they further classify this main class into a number of subclasses.

Underlying the farmers' differentiation of resource units is a vast body of ecological knowledge related to landscape patchiness, specific species distribution, the relation between physical aspects and species distribution and succession processes on abandoned land, growth characteristics of specific species, etc. This body of knowledge is embedded in the different farming domains and expressed through a number of folk concepts. In other words, it is part of the regional farming style. Farmers' knowledge of their natural environment is not unlimited but bounded. The boundaries of farmers' knowledge are set by co-production, that is, by both farming practice and the characteristics of the natural resources. They are also set by other factors, such as the land distribution situation and the creation of the Sierra de Manantlán biosphere reserve. The current land-distribution situation is characterised by the *de facto* privatisation of all community land, while the establishment of the biosphere reserve was accompanied by a set of new rules for natural resource use and management. Both factors represent the (wider) political-institutional context, in which co-production is embedded.

Chapter 6 focuses on the use and management of the different resource units in the landscape. Farmers make use of them in many ways, which are related to the household, agriculture and cattle breeding. Use is made of both components and (agro-)ecosystems as whole. The same applies to management practices: many are applied to the individual resource units in order to increase their utility for farming as a whole. Management practices too are applied to both components and (agro)-ecosystems as a whole. The description of the management of resource diversity makes it clear that its existence in Cuzalapa is an outcome of co-production, which involves a specific organisation of time and space. This indicates that resource diversity is actively created, maintained and transformed by farmers in order to meet their needs and aspirations regarding natural resources. Since the 1970s, a process can be observed in which resource diversity in Cuzalapa has been transformed to better meet the needs of farmers in relation to cattle-breeding activities. The transformation processes that are actually taking place in Cuzalapa's resource diversity suggest an impoverishment of landscape diversity, as several land-use zones are being transformed into pasture lands, and forest vegetation is being opened up to increase pasture availability. This trend might also have a negative effect on the distribution and composition of the biodiversity in Cuzalapa, but this was not specifically studied.

In *Chapter 7*, attention shifts from the Cuzalapa farmers´ perspective to the Mexican policy perspective on natural resource management. This chapter discusses four main aspects. First, attention is given to the historical conformation of conservation in Mexican governmental planning. Secondly, the application of the biosphere reserve concept in Mexico is analysed. This analysis shows that biosphere reserves are challenged regarding the role of farmer participation, the implementation of zoning regulations and the strengthening of a favourable institutional environment. These three issues are the pillars of the application of the biosphere reserve concept in the region. Thirdly, the management programme of the Sierra de Manantlán biosphere reserve is discussed, which is the legal and operative framework for all actions in protected areas in Mexico. The management of biosphere reserves is based on a partial separation of farmers and living nature, and a great number of formal rules and regulations. Due to a partial knowledge on these rules and regulations by farmers and a partial implementation of them by the Reserve's management, insecurity over access to resources is present amongst many Cuzalapa farmers. Furthermore, the rules and regulations induce a reorganisation of time and space in resource diversity, which is more advanced in the core zone than in the buffer zone. This reorganisation suggests that a trend towards decreasing resource diversity and thus biodiversity will develop unless special measures are taken.

Chapter 8 discusses the overall results of this research, as well as the implications of the study. The implications of looking at resource diversity for the management of biosphere reserves are twofold. On the one hand, the concept of resource diversity allows us to obtain insight into the perceptions regarding natural resources of actors other than biosphere reserve managers. On the other hand, it sheds light on the social dynamics underlying its constitution. The specific case of Cuzalapa demonstrated that resource diversity as maintained by farmers could be regarded as one of the social carriers of biodiversity. The creation of the core zones represents an artificial separation of farming practice and biodiversity. As the existing biodiversity was not just pristine ecosystem-based, but based on the indigenously evolved landscape pattern, such segregation can negatively influence the biodiversity composition and distribution in the medium and long term, unless special measures are taken. These measures will have to be based on farming practices, or will have to imitate their effects. On the other hand, however, the current trends in the landscape of Cuzalapa might be interpreted as indicating the need for the maintenance of strictly protected areas within the Sierra de Manantlán Biosphere Reserve in order to prevent these trends from developing into an overall landscape homogenisation leading to the loss of biodiversity.

In biosphere reserves opting for co-management of natural resources, resource diversity can be a helpful tool in discussions between different actors regarding natural resource use and management. While the concept of biodiversity puts emphasis on the ‘ecological side’ of natural resource management, the concept of resource diversity stresses the ‘social side’. Using both concepts complementarily allows us to establish explicit interfaces for negotiating sustainable land-use and tailoring intervention approaches to the specific context of local communities. Finally, all too often farmers are conceived as functional partners in conservation, who have to made ‘aware’ of the importance of biodiversity conservation. Co-management of protected areas is possible only within a new conservation professionalism, which, amongst others, addresses the need for conservation in local notions and processes rather than scientific concepts alone.

Chapter 8 concludes with a number of conditions that have to be fulfilled in order to strengthen endogenous conservation potential, which includes resource diversity. These conditions include the recognition of the existence of multiple perspectives on biologoca; diversity, the creation of platforms for resource management, the redefinition of participation and of the role of science and scientists and the necessity of the combination of ecological and sociological knowledge.

Finally, in the *Epilogue*, an attempt is made to translate the theoretical-empirical discussions of Chapters 1 to 7 into 10 practical recommendations for policy makers and practitioners.

Resumen

Con este libro se pretende contribuir al debate científico en relación a la conservación de la biodiversidad en áreas naturales protegidas inhabitadas por comunidades agrarias. Particularmente, en el entendimiento del papel de los campesinos en el manejo de los recursos naturales en reservas de la biosfera, combinando teoría de la sociología rural y del manejo forestal comunitario. El estudio en que se basa este libro se llevó a cabo en la reserva de la biosfera Sierra de Manantlán en el occidente de México. En el capitulo 1 se presenta el marco conceptual, mientras que en los capítulos 2 al 7 se describen los resultados del trabajo de campo. Después, se reexamina el debate acerca de la conservación de la biodiversidad en base a la evidencia empírica. Finalmente, se incluy un epílogo en donde se presentan algunas recomendaciones para funcionarios y científicos involucrados en las áreas naturales protegidas.

El *capitulo 1* inicia con una descripción del panorama general del debate acerca de la biodiversidad, el cual ha obtenido un lugar central en muchas discusiones acerca del medio ambiente desde de los años 1970´s. Biodiversidad es un concepto que viene de las ciencias naturales, el cual describe la diversidad biológica a nivel genético, de especies y de ecosistemas. Este concepto, se ha convertido en el hilo conductor para la conservación en general, y el manejo de especies y ecosistemas en particular. Sin embargo, el uso del el concepto presenta limitaciones cuando se trata de áreas naturales protegidas inhabitadas. Primero, porque el concepto refleja solamente los valores atribuidos por los científicos a la naturaleza; se usa principalmente como concepto científico que refleja valores intrínsecos y de opción. Mientras que los campesinos también atribuyen valores a la naturaleza, los cuales son mas que nada de carácter instrumental. Estos valores instrumentales no solamente representan valores de uso directo, sino también valores de uso indirecto (como valores culturales y espirituales). Como consecuencia de esta valoración, los campesinos frecuentemente han mantenido la biodiversidad en sus agroecosistemas. Hoy en día, se reconoce el carácter humano de la biodiversidad, sin embargo, el concepto de la biodiversidad sigue refiriéndose a un fenómeno biológico. Por estas razones, con este concepto no se puede entender muy bien los procesos sociales que influyen las múltiples manifestaciones de la biodiversidad, ni de los procesos de transformación de biodiversidad en el continuo de ecosistemas naturales a ecosistemas antropogénicos.
Estas limitaciones indican la necesidad de re-evaluar el concepto de la biodiversidad enfocándose en la perspectiva de la población rural en vez de la perspectiva científica. Una re-evaluación de este tipo tiene sentido especial considerando la identificación de los enfoques más apropiados para la conservación en áreas naturales protegidas inhabitadas por comunidades agrarias. La argumentación teórica se centra en la aceptación de la heterogeneidad social y biológica que existe a nivel local. En este libro, la heterogeneidad se estudia usando los conceptos de "co-producción", "estilos agrarios" y "diversidad en recursos". Con el termino co-producción se refiere a las múltiples relaciones entre los campesinos y la naturaleza viva, los cuales a través de la interacción se refuerzan

mutuamente. El papel de los campesinos en el proceso de co-producción se analiza utilizando la noción de estilos agrarios, con el cual se hace referencia al cuerpo compartido de nociones e ideas en relación a la agricultura, así como las respuestas activas de campesinos frente a condiciones locales ecológicas, socioeconómicas y políticas. Diversidad en recursos describe la diversidad en recursos naturales como la conocen y manejan de manera activa los campesinos. La diversidad en recursos se crea a través de un proceso de interacción y transformación mutua y continua de los fenómenos sociales y naturales. Durante este proceso dinámico de co-producción, se produce y reproduce la diversidad en recursos constantemente, lo cual incluye una (re-)organización de tiempo y espacio que resulta en transformaciones graduales de la diversidad en recursos. En vez de un proceso unilateral e irreversible de perdida de biodiversidad como se supone frecuentemente en esfuerzos conservacionistas oficiales, estos tipos de transformaciones resultan en mosaicos cambiados del paisaje con cada uno de las unidades de paisaje representando e incluyendo su forma especifica de diversidad en recursos. Estos mosaicos cambiantes en el paisaje pueden ofrecer nuevas posibilidades (o limitaciones) para los estilos agrarios. Como consecuencia, se crean tanto las condiciones naturales y sociales para un nuevo proceso de co-producción.

En el *capitulo 2* se describe el área de estudio, i.e. la comunidad indígena de Cuzalapa en la reserva de la biosfera Sierra de Manantlán. La Sierra de Manantlán es un área montañosa de casi 140,000 ha., y fue declarada reserva de la biosfera en 1987 debido a su riqueza biológica y su gran potencial para la explotación forestal comercial y la cosecha de productos forestales no-maderables para fines medicinales y nutricionales. Treinta por ciento del área total dentro de la reserva se reserva para las zonas núcleas, loas cuales están protegidas estrictamente, mientras el área restante se considera zona de amortiguamiento, donde un numero de reglas administrativas regulan el uso de la tierra por las comunidades agrarias. El área alrededor de la reserva se refiere como zona de transición. Las reglas administrativas de la reserva se sobrepusieron sobre las propiedades existentes y sus respectivas instituciones. En los 15 años de la existencia de la reserva, su misión cambió de un proyecto de protección para especies hacia un proyecto de conservación integral con un enfoque regional y una perspectiva de sustentabilidad. Sin embargo, logrando la misión dual de conservación y desarrollo ha desafiado a los manejadores de la reserva.
La comunidad indígena de Cuzalapa se localiza en la parte sur de la reserva, representando 23,963 ha, de los cuales aproximadamente 72% se ubica en la zona de amortiguamiento y 19% en la zona núcleo. En 1995, la comunidad consistió de 1,330 habitantes (302 familias) viviendo en un poblado principal y varias rancherías. El uso de la tierra se basa en la siembra de maíz y la ganadería. La ganadería es extensiva en el uso de mano de obra e insumos externos, y ha cobrado mucha importancia desde de los anos 70's. La lógica de la ganadería se basa en una ampliación de los bienes, especialmente de la tierra. Con los bajos precios del maíz, la ganadería se ha convertido en la actividad económica más importante, incluyendo la compra y venta de pastura y rastrojo. Los árboles y los bosques son importantes para los campesinos para uso doméstico y para las diferentes actividades agropecuarias. Debido al establecimiento de la reserva, no se está llevando a cabo la explotación forestal. En Cuzalapa, el proceso de co-producción tiene sus origenes en tiempos pre-hispánicos, sin embargo, muchos cambios han ocurrido sobre todo desde principios del siglo 20, creando nuevas condiciones para el proceso de la co-producción.

El *capitulo 3* describe el estilo regional de Cuzalapa, el cual representa el cuerpo compartido de nociones e ideas acerca de la práctica agraria de los campesinos de Cuzalapa. El estilo regional se caracteriza por una movilización de recursos que se está llevando a cabo sobre

todo en los propios bienes de los campesinos y en la comunidad. Los vínculos con los mercados y las instituciones son desarrollados débilmente. El estilo agrario también se caracteriza por una diferenciación entre los campesinos, esta diferenciación se puede categorizar en *Pobres* y *Ganaderos*. Los *Pobres* están involucrados en la siembra de maíz, ganadería a pequeña escala y trabajo asalariado, mientras que la ganadería domina las actividades de los *Ganaderos*.
Desde finales de los 60s, muchos procesos han influenciado el desarrollo del estilo agrario regional. Desde este periodo, las actividades ganaderas han obtenido más importancia y han cambiado la práctica en su totalidad. La ganadería tuvo un impulso por una función inadecuada de la institución local en los 60/70s, la intervención gubernamental en los 70/80s y la migración hacia los Estados Unidos en los 80s y los 90s del siglo veinte. Actualmente, la reproducción de los bienes de los Pobres es difícil, lo cual explica la importancia de la siembra a medias. Además, ahora la compra y venta de pastura es más importante que el maíz como fuente de ingreso. El desarrollo de los bienes de los *Ganaderos* no se limita por su reproducción, sino por su expansión, debido a que toda la tierra de la comunidad está en manos de individuos. Esta nueva situación de los *Pobres* y los *Ganaderos* ha causado nuevas respuestas a las condiciones socioeconómicas y ecológicas locales. Estas respuestas tambien sugieren que se está transformando el estilo agrario regional y que pueden surgir nuevos estilos agrarios.

En el *capitulo 4* se presentan siete estudios de caso de campesinos de Cuzalapa. Un aspecto central en sus descripciones es el análisis económico, ejemplificando las diferentes fuentes de ingreso. Cinco estudios de caso de los *Pobres* describen sus estrategias de sobrevivencia, los cuales indican que el cultivo de maíz ha sido reemplazado como fuente principal de ingreso por la venta de pastura, ingresos de la migración e ingresos no agropecuarios. Además, los datos económicos indican que se están desarrollando nuevas estrategias campesinas, las cuales no coinciden totalmente con la orientación productiva tradicional del estilo agrario regional. Dos estudios de caso de los *Ganaderos* ejemplifican también su situación económica. Sus descripciones sugieren dos categorías de ganaderos: ganaderos que mantienen suficiente pastura dentro de sus propios bienes y que manejan de manera intensiva a su ganado, y ganaderos que intentan aumentar la disponibilidad de pastura a través de la compra; su cuidado del ganado es menos intensivo. La comparación de *Pobres* y *Ganaderos* revela que básicamente ambos grupos siguen la misma estrategia para la movilización de recursos en sus bienes y la comunidad. En otras palabras, se puede considerar ambos como “peasants”. Además, ambos dependen mucho de los mercados en el sentido que cualquier cambio en los mercados afecta a sus estrategias, aunque los *Ganaderos* pueden amortiguar mejor estos cambios. Finalmente, la expansión de la ganadería representa una tendencia hacia un sistema agrario más extensivo en Cuzalapa.

El *capitulo 5* describe la diversidad en recursos como es conocido y manejado de manera activa en el paisaje por los campesinos de Cuzalapa. A nivel de paisaje, los campesinos distinguen tres zonas de uso de la tierra: huertos, yuntas y coamiles, y agostaderos. Los criterios para diferenciar estos tipos son el potencial de uso de tierra y las prácticas de manejo que aplican los campesino a las diferentes partes del paisaje. Dentro de estas tres grandes zonas, los campesinos distinguen un número de subzonas. Los campesinos también subdividen los agostaderos según las características de las tierras y la vegetación que crece. Con el concepto de agostadero, los campesinos no solamente se refieren a una dimensión espacial, sino también temporal; no solamente se refiere a diferentes partes del paisaje, sino también a los ciclos agrícolas. Se puede decir lo mismo de los otros conceptos locales de los

campesinos de Cuzalapa. Los campesinos no distinguen explícitamente a los recursos forestales (i.e. ecosistemas forestales y vegetación secundaria) como zonas de uso de tierra separadas, sino como parte de los agostaderos. Ellos nombran a los recursos forestales usando los terminos de monte y arbolera, los cuales subdividen en diferentes tipos.
Los campesinos tienen un acervo de conocimiento ecológico importante, el cual incluye la diversidad en el paisaje, la distribución de especies, y los procesos de sucesión en parcelas abandonadas y las características de crecimiento de las especies, entre otros. Este acervo de conocimiento es parte de los diferentes dominios de la práctica agraria y expresado por un número de conceptos locales. En otras palabras, es parte del estilo agrario regional. El conocimiento de los campesinos acerca de su entorno natural tiene sus limites. Los limites se dan por el proceso de co-producción, es decir, tanto por la práctica agraria como por las características naturales del medio ambiente. Otros factores también juegan un papel, como son la tenencia de la tierra y la creación de la reserva de la biosfera Sierra de Manantlán. La tenencia actual se caracteriza por una privatización *de facto*, mientras el establecimiento de la reserva de la biosfera creó nuevas reglas sobre el uso y manejo de recursos naturales. Ambos factores representan el contexto politico-institucional más amplio, en que está insertada el proceso de co-producción.

El *capitulo 6* se enfoca en el uso y manejo de las diferentes unidades en el paisaje de Cuzalapa. Estas unidades del paisaje son usadas de diferente manera por los campesinos, y este uso se relaciona con la unidad campesina familiar, la agricultura y la ganadería. Se usa tanto los componentes de las unidades, como las unidades en su totalidad (i.e. los agro-ecosistemas). Asimismo, las prácticas de manejo están dirigidas a recursos individuales y a los recursos en su totalidad para aumentar su utilidad para la agricultura en general. La descripción del manejo de la diversidad en recursos naturales muestra que el tipo de manejo es el resultado del proceso de co-producción, lo cual implica una organización de tiempo y espacio, asimismo indica que los campesinos crean, mantienen y transforman de manera activa la diversidad en recursos para satisfacer sus necesidades y aspiraciones en relación a los recursos naturales. Desde los anos 1970s, se observa un proceso en donde la diversidad en recursos se ha transformado para responder mejor a las necesidades de los campesinos en relación a las actividades pecuarias. Los procesos de transformación que actualmente se están llevando a cabo en el paisaje de Cuzalapa sugieren que existe un empobrecimiento de la diversidad en recursos a nivel del paisaje, debido a que varias zonas de uso de tierra se han transformado en pastizales. Esta tendencia puede tener un efecto negativo también sobre la distribución y composición de la biodiversidad en Cuzalapa, pero no se estudió esto de manera especifica.

En el *capitulo 7*, la atención cambia hacia la perspectiva formal mexicana en relación al manejo de recursos naturales, para lo cual se discuten cuatro aspectos generales. Primero, se da atención a la conformación histórica de la conservación en la planificación gubernamental mexicana. Segundo, se analiza la aplicación en la práctica de las reservas de la biosfera en el contexto mexicano, el cual muestra que existen desafíos en relación a la participación local, la implementación de las reglas administrativas y el reforzamiento de un contexto institucional favorable. Estos tres aspectos se consideran básicos para el buen funcionamiento de las reservas de la biosfera en México. Tercero, se discute el programa de manejo de la reserva de la biosfera Sierra de Manantlán, ya que representa el marco normativo y legal para esta reserva en particular y de las áreas naturales protegidas en México en general. El manejo de las reservas de la biosfera se basa en una separación parcial de la práctica agraria y la naturaleza, y una gran cantidad de reglas administrativas formales. Debido al conocimiento parcial de las reglas formales por parte de los campesinos y una implementación parcial de las mismas por las autoridades formales de la reserva, actualmente se presencia inseguridad sobre el acceso a los recursos entre muchos campesinos de Cuzalapa. Además, las reglas administrativas inducen a una reorganización de tiempo y espacio en la diversidad en recursos, lo cual es más avanzada en las zonas núcleos que en las zonas de amortiguamiento. Esta reorganización sugiere una tendencia hacia una disminución de diversidad en recursos y, por lo tanto, biodiversidad, si no se toman medidas de manejo especiales.

En el *capitulo 8* se discuten los resultados generales de esta investigación, así como sus implicaciones. Las implicaciones de analizar la diversidad biológica usando el concepto de diversidad en recursos son dobles. Por un lado, el concepto de diversidad en recursos permite obtener una idea acerca de las percepciones de actores acerca de los recursos naturales, los cuales son diferentes a las percepciones de los gerentes de las reservas de la biosfera. Por otro lado, el concepto permite entender la dinámica social en relación a la conformación de la diversidad en recursos. El caso especifico de Cuzalapa mostró que la diversidad en recursos, creado y manejado por los campesinos, se puede entender como uno de los factores sociales que determinan su biodiversidad. La creación de las zonas núcleo representa una separación artificial de la práctica agraria y la biodiversidad. Debido al carácter antropogénico de la biodiversidad existente, la segregación influirá de manera negativa a la composición y distribución a mediano y largo plazo, si no se toman medidas de manejo especiales. Estas medidas se tendrán que basar en la práctica agraria, o imitar sus efectos. Sin embargo, la tendencia actual en el paisaje de Cuzalapa hacia una homogeneización se pudiera interpretar como justificación para el mantenimiento de las zonas núcleo, las cuales son estrictamente protegidas, para evitar la perdida de biodiversidad.
En las reservas de la biosfera donde se busca el manejo colaborativo, el concepto de diversidad en recursos puede ser una herramienta útil para la discusión entre los diferentes actores en relación al manejo de recursos naturales. Mientras el concepto de la biodiversidad se enfoca hacia los aspectos ecológicos, el concepto de la diversidad en recursos pone énfasis sobre los aspectos sociales. Usando dos conceptos de manera complementaria permitirá establecer interfaces explícitas para negociar el desarrollo sustentable y permitirá diseñar intervenciones adaptadas a las situaciones especificas locales. Todo esto requiere cambios importantes en la ciencia de la conservación, ya que por mucho tiempo se ha considerado a los campesinos más que nada como contrapartes funcionales, entre otros aspectos, enfatizando la importancia de las perspectivas locales en la discusión sobre la conservación de la biodiversidad, aparte de la perspectiva científica.
El capitulo 8 concluye con un número de condiciones que se debería realizar para reforzar el potencial endógeno para la conservación, el cual incluye la diversidad en recursos. Estas condiciones incluyen: el reconocimiento de la existencia de múltiples perspectivas de la diversidad biológica, la creación y reforzamiento de plataformas de manejo de recursos, la re-definición del concepto de la participación, el papel de los científicos y de la ciencia, y la necesidad en combinar conocimiento ecológico y social.

Finalmente, en el *epilogo* se hace un intento para traducir las discusiones teoricas-empiricas presentadas en los capítulos 1 a 7 en algunas recomendaciones para funcionarios y extensionistas.

Samenvatting

Deze studie levert een bijdrage aan het wetenschappelijke debat over het behoud van biodiversiteit in natuurparken waar boerengemeenschappen wonen. Meer specifiek beoogt deze studie de rol van boeren in het beheer van natuurlijke hulpbronnen te begrijpen door toepassing van een combinatie van ruraal-sociologische en sociale bosbouwtheorie. Het onderzoek vond plaats in het biosfeerreservaat Sierra de Manantlán in West Mexico. Hoofstuk 1 beschrijft de theoretische onderbouwing, terwijl hoofstukken 2 tot en met 7 de empirische resultaten weergeven. In het concluderende hoofdstuk 8 wordt het biodiversiteitdebat weer onder de loep genomen door terug te blikken op de empirische resultaten. De epiloog bevat tien beleidsaanbevelingen.

Hoofdstuk 1 begint met een overzicht van het biodiversiteitsdebat. Sinds de jaren zeventig is biodiversiteit een centraal thema in veel discussies betreffende het milieu. Biodiversiteit is een concept dat voortkomt uit de natuurwetenschappen en de biologische diversiteit beschrijft op genetisch, soort- en ecosysteemniveau. Het is een leidend principe in natuurbeheer in het algemeen en in het beheer van soorten en ecosystemen in natuurparken in het bijzonder. Beperkingen van het concept treden op in de natuurparken waar boerengemeenschappen wonen. Biodiversiteit wordt vooral gebruikt als een wetenschappelijk concept dat verwijst naar intrinsieke en toekomstige natuurwaarden. Boeren waarderen de diversiteit in natuur ook, maar zij hanteren vooral instrumentele waarden. Deze betreffen niet alleen directe, maar ook indirecte gebruikswaarden (zoals culturele en spirituele waarden). Door deze waardetoekenning hebben boeren vaak actief de biodiversiteit in hun landgebruiksystemen gehandhaafd. Tegenwoordig wordt het menselijke "karakter" van biodiversiteit in toenemende mate erkend, maar het biodiversiteitsconcept verwijst nog steeds met name naar een biologisch fenomeen. Derhalve kan dit concept niet makkelijk gebruikt worden om inzicht te krijgen in de sociale processen achter de meervoudige manifestaties van biodiversiteit in natuurlijke of door mensen beïnvloedde natuurlijke omgevingen, en in de transformatieprocessen van biodiversiteit in natuurlijke naar antropogene processen.
De beperkingen van het biodiversiteitsconcept geven de noodzaak aan om dit concept opnieuw te onderzoeken vanuit een boerenperspectief. Een dergelijke revisie is met name relevant bij het zoeken naar de beste benaderingen voor biodiversiteitsbehoud in natuurparken bewoond door boerengemeenschappen. De theoretische fundamenten van dit argument liggen in de acceptatie van sociale en biologische verscheidenheid. In dit boek wordt verscheidenheid bestudeerd door gebruik te maken van de concepten co-productie, bedrijfsstijlen, en hulpbrondiversiteit. Co-productie verwijst naar de verschillende en elkaar vaak versterkende relaties tussen boeren en natuur. De rol van boeren in co-productie wordt onderzocht door gebruik te maken van het concept bedrijfsstijl. Dit verwijst naar het gezamenlijke gedachtegoed en de praktijken van boeren betreffende de landbouwbeoefening en de actieve antwoorden van deze boeren op de veranderende ecologische, socio-economische en politieke context. Hulpbrondiversiteit heeft betrekking op diversiteit van natuurlijke hulpbronnen zoals die wordt gekend en actief wordt gehandhaafd door boeren; het

is de sociaal-materiële uitkomst van co-productie. Hulpbrondiversiteit is de uitkomst van een proces van voortdurende interacties en transformaties van natuurlijke en sociale fenomenen. Dit dynamisch proces van co-productie produceert en reproduceert hulpbrondiversiteit voortdurend. Dit doorlopende sociaal-materiële proces houdt ook een organisatie van tijd en ruimte in die resulteert in graduele transformaties van hulpbrondiversiteit. In plaats van een unilateraal verlies van biodiversiteit, zoals vaak wordt aangenomen in officiële natuurbeschermingsinterventies, resulteren zulke veranderingen in landschapsmozaïeken, waarbij elke landschapseenheid een bepaalde diversiteit van hulpbronnen bevat en representeert. Deze veranderde landschapmozaïeken kunnen nieuwe mogelijkheden (maar ook beperkingen) vormen voor de diversiteit van hulpbronnen. Als gevolg hiervan zijn zowel de natuurlijke als de sociale condities bepaald voor een nieuw proces van co-productie.

Hoofdstuk 2 beschrijft het onderzoeksgebied, i.e. de indiaanse gemeenschap Cuzalapa in het biosfeerreservaat Sierra de Manantlán. De Sierra de Manantlán is een berggebied dat ongeveer 140,000 ha omvat. Het werd in 1987 verklaard tot biosfeerreservaat, vanwege de hoge biodiversiteit en het grote potentieel voor commerciële bosbouw en bosbijprodukten voor medicinaal en nutritief gebruik. Dertig procent van het totale gebied is gereserveerd als de strikt beschermde kernzone, terwijl het resterende gedeelte tot bufferzone is verklaard, waar minder strikte regels het bestaande landgebruik sturen. Het gebied dat om het reservaat heen ligt, wordt transitiezone genoemd. De huidige regelgeving is naast een groot aantal informele regels alsmede lokale instituties operationeel. Het wetenschappelijk veldstation Las Joyas is staatseigendom en omvat 1 procent van het gebied. De laatste 15 jaar is de natuurbeschermingsmissie van het reservaat geëvolueerd van een beschermingsstrategie van individuele soorten naar een meer integrale strategie, waarbij een regionale en duurzame aanpak centraal staat. Het verwezenlijken van deze strategie stelt de natuurbeschermers echter nog steeds voor grote uitdagingen.
De indiaanse gemeenschap van Cuzalapa woont op de zuidelijke hellingen van het reservaat. De gemeenschap omvat 23,963 ha, waarvan 72% in de bufferzone en 19% in de kernzone. In 1995 omvatte deze 1330 inwoners (302 families), die in 1 dorp en elf gehuchten leven. Landgebruik in Cuzalapa betreft vooral maïsteelt, hoewel veeteelt sinds de jaren zeventig van de vorige eeuw steeds belangrijker is geworden. De veeteelt is extensief van aard met betrekking tot arbeidsbenutting en gebruik van externe productiemiddelen; schaalvergroting is noodzakelijk voor de bedrijfsuitbreiding. Door de lage maïsprijzen is veeteelt de belangrijkste activiteit, inclusief de handel in rechten op weidegrond en gewasresten. Door de regelgeving van het reservaat, vindt commerciële bosbouw niet plaats. Het proces van co-productie in Cuzalapa gaat terug naar de periode voor de komst van de Spanjaarden. Sinds het begin van de 20ste eeuw hebben veel veranderingen plaatsgevonden die zowel de natuurlijke als de sociale voorwaarden voor een nieuw proces van co-productie hebben gesteld.

Hoofdstuk 3 beschrijft de regionale bedrijfstijl in Cuzalapa. De regionale bedrijfsstijl betreft het gezamenlijke gedachtegoed van boeren omtrent landbouwbeoefening. De bedrijfsstijl in Cuzalapa karakteriseert zich door een mobilisatie van hulpbronnen die met name binnen het eigen bedrijf en dorp plaatsvindt. De relaties met markten en instituties zijn slechts zwak ontwikkeld. De bedrijfsstijl kenmerkt zich verder door een interne differentiatie tussen boeren, die begrepen kan worden door naar de categorieën *Pobre*- en *Ganadero*-boeren te kijken. *Pobre*-boeren zijn betrokken bij landbouw, kleinschalige veeteelt en niet-landbouwactiviteiten, terwijl veeteeltactiviteiten domineren bij de *Ganadero*-boeren. De

toegang tot natuurlijke hulpbronnen is zeer beperkt voor de *Pobre*-boeren, in tegenstelling tot de *Ganadero*-boeren.
Sinds het eind van de jaren zestig hebben veel processen de ontwikkeling van de regionale bedrijfsstijl beïnvloed. Veeteelt is erg belangrijk geworden en heeft tot grote veranderingen in de landbouwbeoefening geleid. De opkomst van de veeteelt is te verklaren door een slecht functionerende lokale institutie in de jaren zestig en zeventig, overheidspolitiek in de jaren zeventig en tachtig en migratie naar de Verenigde Staten in de jaren tachtig en negentig van de vorige eeuw. Tegenwoordig is de reproductie van de bedrijven van *Pobre* boeren moeilijker, waardoor het zogenaamde *"sharecroppen"* in belang is toegenomen. Bovendien is de handel in graasrechten een belangrijkere inkomensbron dan de maïsteelt. De bedrijfsontwikkeling van *Ganadero*-boeren is niet beperkt door de reproductie-, maar door de expansiemogelijkheden, aangezien tegenwoordig al het land in het dorp in individuele handen is; aankoop van nieuw land is dus erg moeilijk. Deze veranderende situatie voor zowel *Pobre*- als *Ganadero*-boeren heeft ertoe geleid dat zij op zoek zijn gegaan naar nieuwe antwoorden op de lokale ecologische en sociaal-economische condities. Het suggereert ook dat er een verandering in de regionale bedrijfsstijl plaatsvindt.

Hoofdstuk 4 beschrijft vier case-studies van Cuzalapa boeren. Centraal in de beschrijvingen staat een economische analyse, die de verschillende inkomensbronnen binnen de boerenstrategieën illustreert. Vijf case-studies van *Pobre*-boeren beschrijven hun overlevingsstrategieën, die aangeven dat maïsteelt niet langer de belangrijkste inkomstenbron vertegenwoordigt. De handel in graasrechten, migratie-inkomsten en overheidssubsidies hebben een belangrijkere rol gekregen. De economische gegevens tonen bovendien aan dat er nieuwe boerenstrategieën ontstaan die niet meer volledig overeenkomen met de traditionele productieoriëntatie van de regionale bedrijfstijl. Twee *Ganadero*-case-studies geven inzicht in de economische strategieën van deze boeren. Hieruit blijkt de aanwezigheid van twee categorieën veeboeren: degenen die proberen voldoende veevoer op het eigen bedrijf te waarborgen en die hun vee relatief intensief beheren en degenen die continu veevoer aankopen en er een meer extensief veemanagement op na houden. Het vergelijken van de strategieën van *Pobre*- en *Ganadero*-boeren geeft aan dat beiden in principe dezelfde strategie volgen: beiden kunnen begrepen worden als "peasants". Beide groepen boeren zijn ook in hoge mate marktafhankelijk, in de zin dat elke marktverandering directe gevolgen heeft voor hun bedrijfsvoering, alhoewel de *Ganadero*-boeren deze veranderingen makkelijker kunnen opvangen. Tot slot: de uitbreiding van de veeteeltactiviteiten suggereert een trend die tot extensivering van het landbouwstelsel in Cuzalapa zal leiden.

Hoofdstuk 5 beschrijft de diversiteit van hulpbronnen zoals die gekend en actief beheerd wordt door de boeren uit Cuzalapa op landschapsniveau. Op dit niveau onderscheiden boeren drie landgebruikzones: homegardens (*huertos*), landbouwvelden (*yuntas* en *coamiles*) en graasgronden (*agostaderos*). De criteria voor deze classificatie zijn het potentieel van de verschillende delen van het landschap voor een bepaald landgebruik en de beheerspraktijken die boeren toepassen. Binnen de landgebruikzones maken boeren een verdere onderverdeling. Boeren onderscheiden de graasgronden in op grond van de karakteristieken van de velden en de vegetatie. Het boerenconcept voor graasgronden verwijst zowel naar een ruimtelijke als een tijdsdimensie. Het verwijst niet alleen naar verschillende gedeeltes in het landschap, maar ook naar verschillende landbouwcycli. Hetzelfde geldt voor de andere landschapseenheden die deel uitmaken van de hulpbrondiversiteit in Cuzalapa. Boeren onderscheiden niet expliciet bossen en secundaire vegetatie, maar beschouwen die als onderdeel van de graasgronden.

Boeren noemen de bossen en secundaire vegetatie *monte* en *arbolera*, die verder worden onderverdeeld in meerdere subcategorieën.
Boeren hebben een indrukwekkende ecologische kennis van de landschapsdiversiteit, specifieke soortenverdeling, de relatie tussen fysische aspecten en soortenverdeling en –successie op verlaten landbouwvelden, groeikenmerken van specifieke soorten, etc. Dit kennisdomein maakt deel uit van de ander kennisdomeinen van boeren en wordt uitgedrukt in een aantal lokaal specifieke begrippen. Met ander woorden, het is deel van het gedachtegoed van boeren en dus van de regionale bedrijfsstijl. De kennis van boeren kent zijn limieten. Deze worden bepaald door het proces van co-productie. Andere factoren spelen ook een rol, zoals de landverdelingsituatie en het instellen van het biosfeerreservaat. De huidige landverdeling kenmerkt zich door een *de facto*-privatisering van land in het dorp, terwijl het reservaat nieuwe regels met betrekking tot het gebruik en beheer van de natuurlijke hulpbronnen met zich meebracht. Beide factoren kunnen gezien worden als de wijdere institutionele context waarin het proces van co-productie zich afspeelt.

In *hoofdstuk 6* richt de aandacht zich op het gebruik en beheer van de verschillende landschapseenheden. Boeren maken veelvuldig gebruik van deze eenheden; dit is gerelateerd aan de behoeftes binnen het huishouden, de landbouw en de veeteelt. Gebruik wordt gemaakt van zowel componenten alsmede hele agro-ecosystemen. De beschrijving van het beheer van de hulpbrondiversiteit maakt duidelijk dat het bestaan ervan in Cuzalapa een uitkomst is van co-productie, die een specifieke ordening van tijd en ruimte inhoudt. Hieruit blijkt dat boeren de diversiteit van hulpbronnen in Cuzalapa actief creëren, handhaven en veranderen om zo in hun behoeftes aan natuurlijke hulpbronnen te bevredigen. Sinds de jaren zeventig is de diversiteit van hulpbronnen in Cuzalapa getransformeerd om beter te kunnen voldoen aan de boerenvereisten met betrekking tot veeteelt. De transformatieprocessen die tegenwoordig plaatsvinden, suggereren een verarming in de landschapsdiversiteit, aangezien verschillende landgebruikzones omgezet worden in weidegrond, terwijl de bosvegetatie wordt veranderd om beter aan de veevoerbehoeftes te kunnen voldoen. Deze trend kan wellicht ook tot een negatief effect op de verdeling en samenstelling van biodiversiteit leiden, maar dit is niet specifiek bestudeerd in deze studie.

In *hoofdstuk 7* verschuift de aandacht van boeren naar het beleid van de Mexicaanse overheid met betrekking tot het beheer van natuurlijke hulpbronnen. In dit hoofdstuk worden vier aspecten bediscussieerd. Ten eerste wordt vanuit een historisch perspectief aandacht gegeven aan de plaats van natuurbeheer in overheidsplanning. Ten tweede wordt de toepassing van het biosfeerreservaatconcept in Mexico geanalyseerd. De analyse geeft aan dat uitdagingen bestaan met betrekking tot de precieze rol van boerenparticipatie, de praktische uitvoering van de zonering en het creëren van een gunstige institutionele omgeving. Deze drie punten vormen de basis voor de toepassing van het biosfeerreservaat in Mexico. Vervolgens wordt als derde punt het beheersplan van het biosfeerreservaat Sierra de Manantlán bediscussieerd, welke het normatieve en legale raamwerk is voor alle natuurbeheer- en ontwikkelingacties in het gebied. Het beheer van het biosfeerreservaten is gebaseerd op zowel een gedeeltelijke scheiding van boeren en natuur, als op een groot aantal formele regels. Onder veel boeren in Cuzalapa bestaat onzekerheid over de toegang tot hulpbronnen, door een onvolledige uitvoering van deze regels en doordat velen onbekend zijn met de precieze regelgeving. De formele regelgeving leidt bovendien tot een herordening van tijd en ruimte in de diversiteit van hulpbronnen, die verstrekkender is in de kernzone dan in de bufferzone. Deze herordening zou een verlaging van de hulpbrondiversiteit in Cuzalapa en dus ook biodiversiteit kunnen inhouden, tenzij speciale maatregelen worden genomen.

In *hoofdstuk 8* worden de resultaten van het onderzoek bediscussieerd, alsmede de implicaties van deze studie. De implicaties van het kijken naar hulpbrondiversiteit zijn tweevoudig. Aan de ene kant geeft het concept van hulpbrondiversiteit inzicht in de percepties van actoren in biodiversiteit, naast die van de natuurbeheerders. Aan de andere kant geeft het inzicht in de sociale processen die tot haar vorming hebben geleid. Het specifieke geval van Cuzalapa geeft aan dat hulpbrondiversiteit gezien kan worden als één van de sociale dragers van biodiversiteit. De creatie van de kernzones vertegenwoordigt een kunstmatige scheiding van landbouwbeoefening en biodiversiteit. Aangezien de aanwezige biodiversiteit niet voortkomt uit ongerepte ecosystemen maar uit een door boeren gevormd landschap, heeft een dergelijke scheiding van landbouwbeoefening en biodiversiteit een negatieve invloed op de bestaande samenstelling en verdeling van biodiversiteit, tenzij speciale maatregelen worden genomen. Deze maatregelen zullen dan gebaseerd moeten zijn op de bestaande landbouwpraktijk, of zullen haar effecten moeten nabootsen. Echter, aan de andere kant kan de huidige trend in het landschap van Cuzalapa ook een argument zijn voor het handhaven van strikt beschermde kernzones om te voorkomen dat de homogenisering van het landschap leidt tot verlies van biodiversiteit.
In biosfeerreservaten waar men op zoek is naar gezamenlijk beheer van natuurlijke hulpbronnen (het zogenaamde *'co-management'*), kan het concept van hulpbrondiversiteit een hulpmiddel zijn in de discussies tussen de verschillende actoren met betrekking tot gebruik en beheer van de aanwezige natuurlijke hulpbronnen. Terwijl het biodiversiteitconcept met name aandacht geeft aan de ecologische kant van hulpbronbeheer, geeft het concept van hulpbrondiversiteit met name aandacht aan de sociale aspecten die van belang zijn. Het gebruik van beide concepten op een elkaar aanvullende wijze geeft de mogelijkheid om expliciete interfaces te creëren om te onderhandelen over duurzaam landgebruik en om specifieke interventies te ontwerpen die beter passen bij de specifieke kenmerken van boerengemeenschappen. Echter, boeren worden te vaak gezien als functionele partners die bewust gemaakt moeten worden van het belang van biodiversiteitbeheer. Co-management van natuurparken is enkel mogelijk indien een nieuw paradigma voor natuurbeheer wordt ontwikkeld, waarin onder meer de noodzaak tot natuurbeheer meer vanuit lokale noties wordt begrepen dan enkel vanuit het wetenschappelijk perspectief.
Hoofdstuk 8 eindigt met een aantal voorwaarden waaraan zou moeten worden voldaan worden om het endogene potentieel voor natuurbeheer te versterken. Deze voorwaarden houden onder meer in het accepteren van het bestaan van meerdere perspectieven van biodiversiteit, de creatie van platforms voor hulpbronbeheer, de herdefinitie van het participatieconcept en de rol van wetenschap en wetenschappers, en de noodzaak om ecologische met sociaal-wetenschappelijke kennis te combineren.

Tot slot, wordt in *de epiloog* een poging gedaan om de theoretisch-empirische discussies van hoofdstukken 1 tot 7 te vertalen in een aantal praktische beleidsaanbevelingen.

Curriculum vitae

Peter Rijnaldus Wilhelmus Gerritsen was born in Groenlo, the Netherlands, on September 28, 1965, where he spent his youth and attended primary and secondary school.

In 1983, he moved to Wageningen to study Forestry at Wageningen Agricultural University, where he obtained his M.Sc.-degree in Agroforestry and Social Forestry in 1990. After graduating, he worked one and a half years as course assistant in the M.Sc. program Management of Agricultural Knowledge Systems (MAKS) at Wageningen University.

In 1993, he laid the foundations for his Ph.D. by conducting research on farming styles and indigenous forest management in the Sierra de Manantlán biosphere reserve (RBSM) in Western Mexico. During the fieldwork period, the possibility emerged to be employed by the University of Guadalajara, the host institution and in 1994, he started working at the *Coordinación Universitaria de Apoyo a las Comunidades Indígenas* (CUACI: the Support Co-ordination for Indian Communities) as an action-researcher in the southern part of the RBSM. The work at CUACI consisted of promoting small-scale agricultural projects to improve farmers' livelihoods in indigenous communities.

Since August 1995, he has been working at the *Departamento de Ecología y Recursos Naturales* (DERN-IMECBIO: Department for Ecology and Natural Resources) at the South Coast University Centre of the University of Guadalajara in the areas of teaching, research and extension. Within DERN-IMECBIO, he first assumed the function of head of Laboratory for Community Development, with the primary task of co-ordinating agroforestry activities of the development project *Desarrollo Agroforestal de la Sierra de Manantlán* (DASM: Agroforestry Development in the Sierra de Manantlán), funded by the Department of International Development of the British government. Due to a reorganisation in 1997, he became head of the so-called Academy of Development and Environment, which is occupied mainly with university administrative issues, which he fulfilled for one year. Since 1998, he is senior lecturer-researcher at DERN-IMECBIO.

His research experience includes work on tenure (Western Mexico, 1998-1999), social aspects of biodiversity conservation in protected areas (Western Mexico, 1995-1999), action research (Western Mexico, 1994-1995), farming styles and indigenous forest management (Western Mexico, 1993-1994), communication and innovation (the Netherlands, 1990-1992) community forestry (Mali, 1989), and agroforestry (Venezuela, 1987). He has written various articles and other scientific publications on these topics.

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