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SUSTAINABLE LAND USE IN THE ATLANTIC RAINFOREST OF BRAZIL

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1.0 INTRODUCTION

At the time of the first settlement by Portuguese colonists in 1532, the Atlantic Rain Forest of Brazil covered more than 1,000,000 square kilometres, nearly eleven times the size of Portugal itself. It stretched from approximately latitude 30°S in the present day state of Rio Grande do Sul northwards to latitude 4°S in the state of Rio Grande do Norte, - a distance greater than from the Florida Keys to northern Maine (Map 1). Today only 7.5% of the original forest cover remains, though the region still maintains the name of the Atlantic Forest: *Mata Atlântica*, in Portuguese. Less than 10% of the remnant is still in primary forest cover, and the rate of destruction is accelerating. In 1988 the government prohibited any further cutting - yet in the six years from 1985 to 1990 at least another 500,000 ha were destroyed (Consórcio Mata Atlântica, 1992). Rosário da Limeira, the case study area, is typical of the hundreds of small districts all through the southern part of the *Mata Atlântica*. The little remaining forest is fast disappearing as it is cleared to make way for agriculture despite the legal prohibition on felling the forest, but productivity on the cleared land is very low and declining, as the land degrades.

The current study derives from interviews with local farmers, government and non-governmental agencies, the personal observations of the author living and farming in the area, and his professional experience of natural resource management programmes in other countries. The paper describes the physical geography of the study area, and analyses the historical and sociological context of the over-exploitation of the land. It will examine cultural attitudes to conservation and the significance of these on conservation policy. It will show that continuing land degradation is an inevitable consequence of the political and economic structure of the region. Land degradation is as much caused by poverty as by greed, as poverty compels people to extract continuously from a shrinking natural resource base (Schramm and Warford, 1989). Chambers calls the situation of many rural societies one of 'integrated' rural poverty, where the poor rural household confronts clusters of disadvantage: it is poor, it is weak, it is isolated, vulnerable, and powerless (Chambers, 1983). These are the disadvantages that have to be overcome in order to be able to have a real impact on land degradation.

The study argues that the trend of degradation can be reversed if its causes rather than its symptoms are addressed. The change to a more liberal national political climate, the emancipation to an autonomous municipality, the realisation on the part of local government of the need for a genuine grass-roots participation in development, and the concomitant growth of political awareness, are all factors that create the political climate that will allow for land use changes in Rosário da Limeira. At the same time, technologies do exist which local farmers could use to adapt to their own particular circumstances, that would improve the long term sustainability of their agriculture. The study concludes with the indications for an action plan of an implementable programme focussed on sustainable land use, devolving the executive and decision making powers to those most affected by the land degradation.

2.0 THE GEOGRAPHY AND HISTORY OF THE ATLANTIC FOREST

2.1. Geography

The *Mata Atlântica* region covers 12% of the whole country, and is now home to 80 million people, almost 50% of the population of the country. The region generates 80% of Brazil's Gross National Product (Consórcio, 1992), and includes two of the largest cities in Latin America, one of which is also one of the largest cities in the world: São Paulo. The ecosystem of the Atlantic Rainforest is one of the most threatened in Latin America and is quite different from its much more famous neighbour, the Amazon Rainforest. The whole ecosystem includes various subsystems that are detailed in Table 1, of which the lower montane forest is the type predominant in the study area. (Dinerstein *et al*, 1995; Rizzini *et al* 1988).

Table 1

TYPOLOGY OF THE ATLANTIC RAINFOREST

<u>TYPE</u>	<u>RANGE</u>	<u>CHARACTERISTICS</u>
Tropical humid broadleaf	Coastal areas. Only remains in small patches, mainly in Bahia and Espirito Santo.	Dense population of tall trees, a lower sparser layer of smaller trees, shrubs and palms, and a large number of lianas and epiphytes
Tropical semi-deciduous forest	Inland areas of São Paulo, Paraná and Minas Gerais.	50-80% of the trees are deciduous. Canopy up to 20m: characteristic spp. include "Copaíba" (<i>Copaifera langsdorfii</i>), "Sucupira" (<i>Bowdichia virgiloides</i>), <i>Dalbergia</i> , <i>Machaerium</i> , etc.
Semi-deciduous plus <i>Araucaria</i> pines	Deeper more fertile soils South of Lat. 20°S.	(<i>Araucaria angustifolia</i>), with a canopy of about 30m, below which grows a second layer with a canopy of about 20m
Lower montane	800-1800m	Canopy about 12-25m high and denser undergrowth of great biological diversity. Typical trees of this system are "angico" (<i>Piptadenia macrocarpa</i>), "maçaranduba" (<i>Persae cordata</i>), "canela amarela" (<i>Ocotea rigida</i>), "jacarandá pardo" (<i>Machaerium villosum</i>), and "cedro" (<i>Cedrella fissilis</i>)
Higher montane	Above 1800 m	Shrubby vegetation and grassland
Mangroves	Bays and estuaries	<i>Rhizophora mangel</i> , <i>Avicenna schauriana</i> , <i>A. germinas</i> , <i>Laguncularai racemosa</i>
<i>Restinga</i>	Coastal dunes	Diverse xeromorphic communities, with thin grasslands, dense forest with canopy of about 12m, and thickly vegetated swamps

Source: Consórcio, 1992: Rizzini et al., 1988

While the extent of the decline in the area of the *Mata Atlântica* has been well documented, there has been little study of the cause and effect of deforestation in the area in terms of land degradation, the loss of productive lands and siltation of the rivers. Some areas around Cubatão, in São Paulo State, and in the Organ Mountains of Rio de Janeiro State are subject to landslides in heavy rains which are partially attributable to deforestation, but there are no quantitative data.

2.2. Biodiversity

Brazil is a country of tremendous biodiversity on the global scale: it contains the third highest number of mammals and birds in the world. The *Mata Atlântica* is ranked as a neotropical forest of globally outstanding importance, with the highest biodiversity of Brazilian forests. The state of its conservation is in a critical condition and of the highest priority (Dinersen *et al.*, 1995). The exact number of plant species is unknown, but is probably in the region of 10,000. In the State of Minas Gerais alone - an area smaller than the state of Texas - there are 750 bird species, as against 450 in the whole USA. The proportion of endemic species is high as can be seen from Table 2. Twenty one species and subspecies of monkeys are found there: 14 of these are endangered and several are literally on the verge of extinction (Mittermeier in Wilson, 1986). One hundred and seventy one of the 202 species in Brazil threatened with extinction come from the *Mata Atlântica*, and the list is still growing.

Table 2

ENDEMISM IN THE ATLANTIC RAINFOREST

ORDER	PERCENT ENDEMIC
Trees	50
Palms	70
Epiphytes	70
Primates	80
Small Mammals	39
Butterflies	40
Reptiles	40
Endangered Animal Species	85

Source: Consórcio, 1992; Mittermeier in ed. Wilson, 1986

2.3 The Study Area

The area on which this study focuses is the *município* (an administrative unit, with its own elected local government, approximately equivalent to an American county) of Rosário da Limeira, in the state of Minas Gerais. It lies about 300km to the south-east of the state capital, Belo Horizonte, 35km north-west of the town of Muriaé of which until 1996 it was an administrative district. The village of Rosário da Limeira, the municipal seat, has a population of about 2000 and is the only centre with any degree of urbanisation. The rest of the population live in scattered homesteads and there are four or five hamlets each with a chapel and a primary school. There is no paved road in the *município*. Ninety percent of the population depend directly on agriculture or indirectly on services that support agriculture. Coffee, milk and beef are the main products of the area.

The *município* has a population of about 10,000 people, with an area of about 117 sq km, including the watersheds of two confluent of the Muriaé river. Mountainous, with elevations from 300 to 1500m, it has strongly acid soils and an annual rainfall of 1000-1200mm. It no longer contains any "virgin" forest: some patches remain of cut-over primary forest not bigger than 100 ha, mainly in inaccessible areas, and patches of secondary forest on crests and around springs. Subjective estimates indicate that within the micro-region, in the last five years, another 1000 ha of forest have been cut. There is also subjective evidence of a decline in soil fertility, and ample evidence of soil erosion, but again there are no hard data. Rainfall records over the past fifty years show a declining trend, but the statistical series is not long enough to establish a conclusive link between this and deforestation, given the normal cyclical nature of weather patterns over a long period.

2.4 History

From the time they first discovered Brazil, Europeans were attracted by the commercial possibilities of the *Mata Atlântica*. The discovery by Gonçalo Coelho in 1501 of a red dyewood (*Caesalpinia echinata*), similar to an Asian species known as Brazilwood, and much sought after by dyers, gave rise to a lucrative trade. Those involved in the trade became known as "brasileiros"; in the course of time the country which had been officially named "Land of the True Cross" came to be called Brazil. So important has the Atlantic Forest been to the history of Brazil that even the name of the country has its origins therein.

Agricultural development in Brazil began in the sixteenth century, even before the Brazilwood trade began to decline. Cattle brought to the first Portuguese settlement flourished and expanded rapidly, so that soon the natural grasslands were fully occupied and farmers began to clear forest for pasture. More land was cleared for sugar plantations in the seventeenth century, and later for gold mining, and in the nineteenth century the development of the iron industry and the expansion of the railways brought yet more devastation to the forest.

In the early part of the nineteenth century, coffee came to the *Mata Atlântica*. Under the purely extractive cultivation system then used, a coffee plantation remained economically viable for twenty years: very often it was then abandoned and turned into pasture. The heir of one of the great pioneers of coffee in Brazil, Francisco Peixoto de Lacerda Werneck, remarked that he had inherited "very old and sterile plantations, from which soil my father took all his fortune, but which he left completely ruined" (cited in Dean, 1995, p187). The exploitative nature of Brazilian agriculture has led sociologists to draw unflattering conclusions on the nature of the Latin American culture and its propensity for short term profits instead of long term investments (see Véliz, 1994).

With its lack of mineral resources and poor access, it was not until the 1920s that Rosário de Limeira became intensively settled, by farmers living from timber and subsistence agriculture. The boom in coffee prices in the 1950s spread the establishment of coffee plantations, and serious deforestation began, setting off a vicious circle from which there still seems to be no way out. As if the history of coffee production in the rest of the country 70 years earlier had never happened, the settlers in Rosário da Limeira began to follow exactly the same pattern of deforestation and over-exploitation of the land. As coffee prices declined in the late 1960s, the poorer coffee stands on depleted soils were replaced by pastures. The 1970s brought the so-called "economic miracle", when Brazil's military government printed money to pay for prestige investment projects. In the 1980s came the moment of truth when Brazil had to pay the bills for the grandiose dreams of its improvident military rulers. Inflation ran like the plague throughout the economy and subsidies to agriculture were drastically cut, just when the terms of trade all over the world had turned against agriculture. Under this pressure, marginal coffee land was converted to pastures, leaving hillsides criss-crossed by the cattle trails of bare earth, forming a perfect conduit for funneling rain water into rills and gullies, exposing soils to severe water erosion. This then is the plight of the peasant farmers of Rosário da Limeira today: isolated from markets and technical assistance for any alternative cash crops to coffee, with declining competitiveness in rice production, and only maize and beans for subsistence, their future is bleak. Despite the forecast long term downward trend in coffee prices, no effort has been made to find a substitute cash crop for coffee. Government support for small-scale agriculture is limited to special lines of credit for coffee planting, and for most farmers, planting more coffee means clearing more land.

3. THE SOCIO-POLITICAL CONTEXT

3.1 Introduction

Rosário da Limeira is typical of the small towns of the southern and south-eastern administrative region of Minas Gerais, known as *Zona da Mata*, and traditionally regarded as the poorest area in the state. Per capita GNP in the rural areas of the region is not much above the poverty level for Brazil, and education and health indices are well below the state average. Literacy rates in the rural areas are around 50% compared with the national average of 70%, and among women are nearer 30% (IBGE, 1997). Only about 40% of the population has access to electricity in spite of considerable investment by Government in rural electrification, and inadequate sanitation is a common cause of disease, especially among children. Health care has much improved since 1996 when Rosário da Limeira became an independent *município* administering its own health programme but, before that, the nearest medical facility was in Muriaé. Infant mortality rates in the region are above the state average. Poor roads are a major handicap to outside investment and to the producer who has goods to market. A number of potentially profitable agricultural activities could be developed, such as production of pigs, poultry, fish, fruit and vegetables, but all face the barriers high transport costs to market and lack of market infrastructure.

3.2 Land Ownership

Most of the inhabitants of the rural area are independent small-scale farmers, descendants of the original pioneers who settled the land under Brazil's law of *usucápiao* - right of ownership through possession and use (Laranjeira 1984), equivalent to the American homestead law. Inheritance under Brazilian law gives an equal inheritance right to all the surviving heirs of the landowner, so a continual process of fragmentation occurs. Hence, many of the forefathers of the present farmers of the area were relatively big land owners, but now only the better-off have farms as big as 30 ha. With the current level of technology, this is about the minimum size for an economically viable family unit, and farmers on this scale probably only constitute ten percent of the land owners of Limeira.

While land distribution is skewed - 60% of the land is owned by 40% of the owners - it compares relatively favourably with other parts of the state where 85% of the farmers own 20% of the land. The area has not been the scene of the bloody conflicts over land rights that are common in the Amazon region (Le Breton, 1997). This is probably because there is no large group of landless farmers frustrated in their desire to own their own land by the lack of land availability. There is now a shortage of seasonal casual labour, another indicator of the absence of a large population of landless poor. As farms fragment, small-scale farmers move out and their plots are absorbed into larger land holdings, as happens the world over. Thus ever decreasing numbers of families are supported by the land.

In many countries, the forest either belongs to the State (in ex-colonies, for example) or to the local community, as in many parts of Africa, or a combination of the two, as in the indigenous people's reserves in Brazil. Where forest land is 'owned' by a community, as in indigenous societies, it is possible for the community to regulate its use, but in most of the *Mata Atlântica*, and in all of Rosário da Limeira, the forest is privately owned. Since most of the land in Rosário da Limeira belongs either to the descendants of original settlers, or was legally acquired from them, it also means that Government is not directly responsible for the management of the forest.

3.3 Government Policies and Institutions

The degree to which economic policy in general causes land degradation is much discussed in development literature. Many writers seem to believe that any incentive to small-scale farmers to plant a cash crop is likely to cause them to overexploit their land, and is part of a plot by international banks to force Third World countries into paying higher interest rates (e.g. Lappe and Collins, 1981; George 1976; Blaikie 1987 p. 126). Conspiracy theories make popular reading, of course, but the implication that ignorant peasants had best confine themselves to producing maize and beans since that is all they know about is an extremely insulting idea that is also bad economics. Small-scale farmers want to be able to participate in the cash economy just the same as any one else, and if their basic food needs can be acquired more cheaply elsewhere, then it makes sense for them to produce the higher value products. The deterioration in the terms of trade for agriculture have put increasing pressure on farmers to produce higher value crops. The Government does encourage the production of export crops by offering special credit lines, which may be available to small-scale farmers, while production credit for subsistence crops is not.

Agricultural policy in Brazil has historically favoured large farms. Extension and research have concentrated on this sector, and the provisions for income tax, land tax and credit, were framed in such a way that only larger farms could benefit from them (World Bank, 1989, p59; Binswanger, 1987). The massive subsidies for large farms that used to come through agricultural credit have now dried up but have not been replaced by lines of credit for small farms, except for coffee production. The National Agrarian Reform Institute (INCRA) still considers forested land as 'unproductive' and therefore subject to a higher level of tax (Binswanger, 1989) and eligible for expropriation for settlement. A draft new land law is now before the Congress which will try and resolve some of the inconsistencies of the old one: one of its objectives is to discourage large, unproductive land holdings, but a major tax increase or a change in the legal definition of unproductive land could easily result in large scale clearing of forested land.

In Brazil's agricultural economy, high interest rates have resulted in higher costs and accentuate the cost squeeze which farmers already face from the deterioration in the terms of trade. This forces them into unsustainable production levels in order to generate the returns needed to pay the high cost of money. As Schneider remarks:

“in spite of increasing calls for sustainable development, the mining of natural resources still appears to be the prevalent form of resource use in many tropical forest areas...given our

assumptions about decay rates, high interest rates force farmers to seek quick - albeit unsustainable - profits, unless sustainable activities can offer initial profits that are 50-70% as high as initial unsustainable profits. Most known "sustainable" activities for tropical land use, under current technologies, simply do not offer such high annual incomes". (Schneider, 1995 p21).

It has been common to ascribe this to the external debt, but in fact in Brazil the real problem has been the internal debt caused by years of spendthrift governments with little public accountability.

The basic framework for environmental protection in Brazil is the Environmental Protection Law of 1981 (Brazil 1981), a very comprehensive law, modelled largely on the American National Environmental Policy Act of 1969 (NEPA). From the beginning, the political will to implement it has been weak: the supporting directives of the National Environmental Council were not promulgated until 1986 and many of the provisions of the law have never been implemented. Furthermore, the context in which the law has to operate is quite different from that in the United States. Many of the institutions that are taken for granted in the NEPA (such as environmental associations, local interest groups, lobbyists, town meetings etc.) either do not function or do not exist at all in Brazil. Bureaucratic procedures in Brazil are far more complex than in the US, and the cumbersome law enforcement system, administered by under-trained and under-budgeted agencies, is much less agile. In addition to this, pervasive corruption both within the judiciary and the enforcement agencies make it difficult for a law designed for the USA to function well in Brazil.

The Federal Forest Code of 1965 (Brazil, 1965) sets out the general framework for forest conservation. In addition, the Federal Constitution provides for the executive power to ensure "the preservation and restoration of essential ecological systems" and declares the *Mata Atlântica* a national heritage (Brazil 1988, Art 225). At the national level, the Brazilian Institute for the Environment and Natural Resources (IBAMA) (Brazil, 1989a and b) has responsibility both for environmental protection and forest conservation. Its nearest representation is the regional centre, some 200 km away from the study area. Many of its powers are delegated to the State Forestry Institute (IEF) which has the prime responsibility for conservation of forests and some more general environmental protection functions. State forest legislation follows the federal law: it declares that the forests within the state are goods of public interest to all the inhabitants of the state (Minas Gerais 1991, Art. 2) and defines a wide range of protected areas on slopes, in watersheds, degraded areas, roadsides and others in considerable detail. In particular, it imposes stiff punishments for infractions of the law concerning the preservation of the *Mata Atlântica*. Enforcement is carried out by a Forest Police section of the state military police.

The Constitution of the State of Minas Gerais (Minas Gerais 1989, Art. 171) delegates some of the State's environmental protection functions to local governments. However, from lack of government commitment, translated into budget restrictions, these institutions are almost totally ineffective. Before Rosário da Limeira became an independent *município*, it was always the lowest in priorities for the allocation of any municipal resources, and received the fewest benefits, and services such as the IEF and the state agricultural extension institute, EMATER, never had more than a token presence. EMATER has now established a presence in the new *município*: IEF so far has not. The Forest Police has a regional centre in Muriaé, with eight officers responsible for seven municipalities, and until 1998 had neither car nor telephone. There is no federal enforcement agency within 200 km of the area.

3.4 The Political Context

The traditional political structures in rural Brazil have their roots in the land grants of the Portuguese Crown. The Catholic Church was another very influential factor in rural Brazil, and it too always supported the traditional political and economic establishment. The big landowners told their workers whom to vote for, and threatened them with dismissal if they voted any other way. Since they virtually controlled all the employment and, indirectly, most of the commerce too, it was not difficult for them to secure compliance. It has long been a policy of leaders in developing countries, as Stone (1992) has noted, to consolidate their power at the centre:

"...depriving and squeezing the countryside, and to pamper the urban sector, where dangerous opposition is likelier to crop up....In most developing countries, city folk receive four or five times the per capita volume of direct anti-poverty assistance that is extended to the countryside. Government technical assistance programmes seldom reach the rural poor. ..." (Stone, 1992, p217).

Rosário da Limeira was a text book example of how such a system worked. For years forgotten at the far end of the *município* of Muriaé, the pay-off in political investment was just too low to justify anything more than the barest minimum in the way of expenditure on development there. Remote as it is from the main political jetstream, even Rosário da Limeira felt the breeze of change and in 1995 petitioned the state government under a provision of the state constitution to separate off from Muriaé and become an independent *município*. The power struggle that followed in 1996 in the election of the new local government saw a classic ranging of the forces of tradition on one hand and progress on the other: the old guard, the landowners, handed out bribes and threats, and the technocrat candidate promised action plans, progress and change. The latter won with a handsome majority, and a new chapter opened in Rosário da Limeira's history. Indeed, it is in response to these changes that this study is being undertaken.

4.0 THE CONSERVATION VS. DEVELOPMENT ISSUE

4.1 The Debate

In the rich countries of the western hemisphere, discussion on development usually starts from the premise that conservation, rather than consumption, is the best use for their forests. Since the proportion of forest land is relatively small in those countries, its potential contribution to the overall development of the country is not a big issue. However, half of Brazil is under forest, where population density is low, and many people believe that agricultural production is the best use of 'unused' land. Brazil needs to use its natural resources to meet its great development needs. People want better schools, better health, better access etc.: they do not want more trees and do not see why trees should be given priority over people. As Gilberto Mestrinho, a former governor of Amazonas state, put it: "Ten million people can't be condemned to hunger so that the animals and trees can grow", and pointed out that he had been elected by people, not by trees (quoted in Stone, 1992, p. 218).

4.2 The Protagonists

4.2.1 Introduction

Any acceptable development and conservation policy has to be built on the common ground of a compromise that recognises the attitudes of each of the protagonists in the debate: environmentalists, small-scale farmers, large landowners and the government. The self-perceptions of each and their attitudes toward each other can best be understood in the cultural context and the way people perceive their environment. Nash's study on American attitudes towards nature brings this out clearly, and in his terminology, Brazil has historically been a "nature exporting" country, where the marginal value of civilisation is higher because nature is abundant (Nash, 1973). Brazilian society has only recently reached the level of development where the marginal value of civilisation has begun to decline and the marginal value of nature to rise; theirs has been the classical perspective of nature as no more than a set of potential resources (Short, 1991). The countryside for most people "...is for those who are poor, or for those who can capitalise on the poverty of others to make money for themselves...": it stands for "...poverty and repression, not rural idyll and pastoral plenty." (Redclift, 1984.) Historically, it has never been part of Brazilian culture to value nature. Jose Vieira Couto wrote in 1799 that the Brazilian farmer practices a barbarous agriculture and "... harbours neither affection or love for the land he cultivates, knowing full well that it probably will not last for his children." (quoted in Dean, 1995). Their attitude is expressed by the Amazonian rancher who said that he was proud he personally had felled 20,000 hectares of forest: "...There are many others who have followed my example - all experienced ranchers, hard workers, and good BraziliansGod knows, Brazil needs people like us" (Quoted in Le Breton, 1993, p.87). Another farmer in Amazonas, in an interview by a leading weekly magazine, said "Only Indians like trees" (*Quem gosta de árvore é índio*). (Veja Magazine, 5 July 1989). Many of his class would agree.

4.2.2 The Conservationists

The pro-conservationists are the environmental activists, mostly urban middle class, who have some understanding of the wider range effects of wholesale loss of forests, but no direct dependence on their existence. Environmental awareness has only begun to grow in Brazil in the last ten years, receiving a major stimulus from the UN Conference on Environment and Development in Rio de Janeiro in 1992.

The activists are less well organised and less focused than equivalent groups in the Northern Hemisphere and carry much less political weight: they do, however, represent a growing potential pressure group. They regard themselves as representing the concerns of the silent urban majority, worried about the long-term effects on society of increasing environmental degradation. They have little understanding of the realities of rural agricultural life and do not perceive how it is economic necessity that forces peasants to cut down forests, and not wanton destructiveness.

4.2.3 The Small-scale farmers

The small-scale farmers form the second group: they are the ones who are most dependent on the natural resources of the land, which, along with their own labour, are the only resources they have. They are on the front line of the issue, being at once those most directly affected by environmental degradation and at the same time most directly responsible for it. They are both pro-conservation and pro-development. The small-scale farmers want a reasonable standard of living: fair prices, access to markets, affordable credit, adequate health and education etc. and, above all, to be left in peace to get on with their lives. If they are aware at all of the environmentalists, they would consider them irrelevant and feel a certain resentment at the fact that most of the pressure for conservation comes from people who are not directly involved in trying to make a living from what nature provides (Timberlake and Thomas, 1990, p219). They see themselves as victims of the disinterest of government and exploitation by the buyers of their produce and suppliers of their inputs. Though they appreciate their environment, they realise clearly that if they are not to be given the conditions to flourish in rural areas, they would do better to move to the cities.

4.2.4 Government

The third party is the Government: it is essentially pro-development, because development means votes, but increasingly recognises both the power of the domestic conservationist constituency and foreign pressures. The diversity of political and economic interests in a country the size of Brazil make it difficult to generalise on the attitude of Government on a polemic debate about conservation versus development. It often finds itself caught between two fires and ends up acting as referee in favour of whichever player appeals to it. The executive branch of Government tries to meet both needs and, sometimes, internal conflicts result. For example, in 1998 INCRA, the land reform agency, zealous to meet its resettlement targets in an election year, and without consulting the environmental protection agency, expropriated for settlement land set aside for conservation in Fazenda Cafundó, one of the last remnants of coastal rainforest left in the state of Espírito Santo, and land that borders the biological reserve of Poço das Antas in the state of Rio de Janeiro, where the golden lion tamarin - a highly endangered endemic primate species - is being re-established with international assistance.

4.2.5 The Pro-development faction

Lastly is the diminishing but still very influential traditional oligarchy: the big landowners, the industrialists, the military, and the Church. They are strongly pro-development, in the classical mould of agricultural capitalists, to whom land is merely a resource to generate income or capital appreciation. They generally seek the maximum return for the minimum investment, following the old tradition in Brazilian agriculture, dating from colonial days. Coffee, rubber, sugar and more recently cocoa have all been through boom and bust cycles resulting from this philosophy. The recent decades of high inflation shortened investment horizons and speculation on land values became a more common motive for land ownership than production. While a landowner might plant fast growing eucalypts to meet consumption needs, replanting valuable timber would never be an attractive alternative.

The landowners believe that they are the ones with a truly progressive vision of Brazilian agriculture. They consider the environmental activists as trying to interfere with something they know nothing about. There is also a fear that environmentalism is a ploy by foreigners to gain control of Brazil's wealth. There has been a long history of rape of Brazil's natural resources by foreigners (Ure, 1986), typified by the collapse of the local rubber industry after the British stole rubber seeds from Brazil in 1876 to plant in Malaya. The suggestion by some foreign conservationists that the conservation of the Amazon is a matter of global concern which should be overseen by the international community is one that raises deep resentment in Brazil as an affront to its national sovereignty.

4.3 A Plan for More Sustainable Development

To be able to draw up a development plan for the future of Rosário da Limeira, the four different groups must come to a consensus about what constitutes development and what conservation. Such a consensus requires a change in old attitudes and an understanding of the standpoints of the other participants in the discussion. Urban environmentalists who wish to act as effective catalysts need a better understanding of development economics and of the reality of the rural environment. They need to understand to what extent the forest can contribute to the country's needs for its development, and how to achieve this. Small-scale farmers need to realise the danger of over-exploitation of their resources and to see these expressed in economic or financial values that they can understand. They should be prepared to implement themselves measures to reduce land degradation, not only in terms of technical changes, but also in terms of the assumption of political power. Large and small-scale farmers need to be shown where their interests coincide, and how they can work together. And Government? Given the constraints it faces, both political and financial, it should recognise its own limitations and not attempt to appropriate all control measures for itself without having the mechanisms to use them. Instead, as Article 28 of Agenda 21 makes clear, it should recognise that many environmental problems and their solutions have their roots in local activities: it should act as a facilitator to put appropriate powers in the hands of the local people most closely involved and most qualified to act, regulate and monitor the process.

5.0 THE SUSTAINABLE DEVELOPMENT MODEL

5.1 Introduction

Conservationists in the North argue that in a model of sustainable development, conservation and development are not mutually exclusive. They argue that Brazil should not follow the North American model, where rapid economic development was achieved at the cost of environmental devastation but, rather, that it should use its natural resources rationally and sustainably. Herman Daly says: "What is in dispute is whether growth, at the current margin, is really making us wealthier. As growth in the physical dimension pushes beyond the optimal scale relative to the biosphere it in fact makes us poorer. Growth, like anything else, can cost more than it is worth at the margin." (Daly, 1990).

To a poor Brazilian, this is a rich man's argument that carries little weight. It seems obvious to Brazilians that North America grew rich from the exploitation of its natural resources and that this must be a development model that works. Brazil's own history shows the extent to which exploitation of the *Mata Atlântica* contributed to the country's development in the 17th and 18th centuries through the sugar, coffee and mining industries that it supported, just as the forests of the eastern USA contributed to the industrial and agricultural development of that country. The model of sustainable development the conservationists propose is purely theoretical, with no historical precedent anywhere, least of all in the USA and Europe. Brazil cannot wait until such a model has been developed: people are hungry and need food, clothing, housing, health care and education now, not at some undetermined time in the future.

Sustainable development is something of an oxymoron. The concept of development implies that living standards should improve, whilst sustainability claims that the carrying capacity of natural resources should not be exceeded. (Therivel *et al.*, 1992, p 124). Carrying capacity in this context means the maximum rate of resource consumption and waste that can be sustained indefinitely in a region without impairing ecological productivity and integrity (Carley and Christie, 1992). Continuous improvement of living standards means growth, to provide a surplus over and above mere subsistence. The need to generate an ever increasing surplus to meet rising expectations and to absorb the demand from an increasing population soon bumps up against the limits of the land's carrying capacity, at which point it ceases to be sustainable. This physical law is not a new consequence of modern industrialisation: even ancient civilisations collapsed when they outgrew their resource bases. Carrying capacity can be increased by improved technology, up to a point, but, as has already happened in the *Mata Atlântica*, these limits prove finite and are soon exceeded by rapid growth in population. What naturally happens at that point is the people move off the land and into the cities, that are able to provide faster growth rates and where technology advances do not reach their limits so soon.

5.2 Economic Value of Conservation

The most convincing case for the conservation of forests is made when it is attached to economic values. One method of doing this, suggested by McNeely, is to look at the end use values (McNeely *et al.*, 1990). These can be classified as:

- (i) the consumptive use value, derived from assessing the value of nature's products - such as firewood, fodder and game meat - that are consumed directly without passing through a market;
- (ii) the productive use value, which is the value of products that are commercially harvested, such as timber, fish, medicinal plants etc.;
- (iii) the nonconsumptive use value, which is the indirect value of ecosystem functions such as watershed protection, photosynthesis, regulation of climate, and production of soil;
- (iv) the options value, the intangible values of keeping options open for the future; and
- (v) the existence value of simply knowing that certain species exist.

Combining these factors, Brown (1991, p133) quotes the estimate of Repetto and van Bolhuis (1989) of the value of economic losses to Brazil from deforestation at \$500-\$1000 million p.a.

Of the commercially exploited products, timber is clearly the most valuable, but the remaining usable timber resources are negligible in the *Mata Atlântica*. Reforestation for future exploitation has high initial cost and a long pay-back period: it is not an attractive investment. Non-timber forests products are a potential source of revenue, but they face the difficulty of market development. There is a growing market for exotic house plants such as bromeliads and orchids which the *Mata Atlântica* could supply, and with proper market development it could be an interesting proposition for small scale farmers in the forest. Many traditional medicinal plants are found in the *Mata Atlântica*, but the potential for commercial marketing is limited. The international conference on climate change in Kyoto in 1997 further developed the concept of the present value of forests for carbon sequestration. Some countries, have set up mechanisms to tax polluting industries and to use the tax revenue either for directly replanting forest in other countries (including Brazil), or to offset against the promotion of carbon sequestration by the polluter. Since most of Brazil's major cities lie in the *Mata Atlântica*, conservation and replanting for carbon sequestration is a very interesting option. However, Brazil does not have adequate mechanisms in place to monitor carbon emissions and these would need to be in place before a pollution tax structure could function efficiently to recover pollution costs through carbon sequestration.

The most valuable property of the tropical rainforest is often considered to be its biodiversity, a rich store of genetic potential for the development of products beneficial to people. There is no doubt that tropical biodiversity has made a considerable contribution to human welfare in the past. Plotkin, in Wilson (1986), details many tropical products introduced into the menus of non-tropical countries, but most of them appeared two or three hundred years ago: in the highly competitive global market situation of today it is difficult to imagine how whole new product lines based on tropical plants could suddenly arise in time to save the last remnants of the *Mata Atlântica*. Many commentators - including the Brundtland Report (World Commission on Environment and Development, 1987) - have expressed great expectations from the pharmaceutical industry as a potential user and conserver of tropical biodiversity. For example, Farnsworth, in Wilson (1986), lists 119 pure chemical substances derived from higher plants and used in medicine. The extent to which this industry is really interested in exploring this potential is an open question. (See also "Biotech's Secret Garden" in the Economist magazine of 30 May 1998). The case of the male potency drug Viagra is an example: most forest communities, in Latin America, Africa and Asia, know of and use natural products from their forests with the same properties as Viagra (for example, the Ianomami of the northern Amazon use a plant they call "yacuna"), but for the Pfizer Company, with considerable capital already invested in trained chemists and laboratories, it is apparently more economic to synthesise the drug than attempt to extract and commercialise a natural product from the tropical forests. It is significant that much of the resources currently devoted to research in new products from tropical biodiversity come from the public sector (international research centres and bilateral aid agencies): the private sector does not yet consider it an attractive investment.

The inhabitants of the *Mata Atlântica* need to see that the forest is already a performing asset with a present value, not with an underdetermined value at an uncertain time in the future. The unrealised potential of tropical biodiversity is not an incentive for conservation to those engaged in a daily struggle for existence. The consumptive use value is very low, the productive use value approaches zero. The concept of options and existence use values are meaningless to them, and the non-consumptive use value is unquantifiable. Cutting it down and replacing it with exotic plantations, such as fruit trees or eucalyptus, is a much more attractive prospect than the vague one that there might one day be a market for some of its fruits. Reforestation for carbon sequestration is an esoteric concept for small scale farmers that would only appeal to them if accompanied by regular cash payments. Biodiversity conservation might be more convincing if it could bring some direct benefit for them, and not just for some pharmaceutical company in Switzerland or the USA.

The *Mata Atlântica* farmers would appreciate some of the non-consumptive uses if they could be quantified more precisely. They are aware of declining soil fertility and diminishing water resources, but may not be aware of the causal relationships: it is often believed, for example, that the collection effect of rock surfaces is more important in replenishing ground water than forest cover, since springs emanate beneath the foot of rocks not from the middle of forests. The rate of soil loss from erosion too is often discounted, because it is a slow continuous process and it is not easy to perceive the actual volume of soil losses from a daily visual inspection of fields without reference to specific indicators.

Farmers are not the only losers from land degradation: the non-consumptive value of loss of water resources for urban consumption and for power generation is considerable. Urban environmental groups are attempting to raise consciousness of the issue, but with little impact outside the big cities. Hydro electric generation is by far the most important power source in Brazil, but neither the public sector power utilities or water authorities seem concerned by the possibility of water shortages; they are not accountable for their inactivity in securing their supplies, and have done little to date to protect their water resources (see Dean, 1995, p354). One of the few private power companies that existed before the recent privatisation policy serves a part of the study area, and has taken a more active role than the larger suppliers to secure its water resources, partnering the State Forestry Institute in a campaign to protect and reforest gallery forests around rivers. As the privatisation programme, still in the early stages of implementation, progresses, one can hope to see more such partnerships develop.

The most promising avenue for enhancing the non-consumptive value of the forests is through the development of the land's potential for ecotourism. Some African countries have very successfully developed ecotourism projects, such as the Campfire Programme in Zimbabwe, which enables local communities to share the revenues from wildlife management. Although ecotourism is a new concept in Brazil, there are strong indicators that it will be enthusiastically adopted by the urban middle classes as they become more adventurous in their leisure hours and their disposable income rises. At present, there are few facilities for them so there is a need for an investment programme. In Africa, protected areas with fauna habituated to human contact have been highly successful revenue earners: in Uganda tourists pay US\$150 each just to view a mountain gorilla and a small group of habituated gorillas can earn over \$1000 a day for local people. The woolly spider monkey (*Brachyteles arachnoides*), endemic to the *Mata Atlântica* and the largest primate of the neo-tropics, is even rarer than the mountain gorilla as there are believed to be only about 300 left in the world (Emmons, 1990). Why should it not generate the same revenues?

5.0 TOWARDS A LOCAL ACTION PLAN

6.1. Designing a Plan

6.1.1 Basic principles

Taking into account the physical, historical and socio-political circumstances of Rosário da Limeira, a plan of action for the preservation of the *Mata Atlântica* should include the following:

- (i) clear demonstration of the benefits of an action plan to the participants. Significant improvement to the quality of life must be assured to bring about changes in behavioural patterns (Smith, 1994).
- (ii) devolution of responsibility to the people involved. Given the limitations of the state infrastructure, much of the implementation must be entrusted to the people most concerned.

The extent to which they will be prepared to assume responsibilities is directly related to the extent to which they participate in the decision making process.

(iii) the dissemination of the basic technological practices that help to reduce land degradation and improve soil fertility. These are not to be offered as a 'package of practices' but as a menu of technical options from which farmers can choose elements that best meet their circumstances, or can adapt parts that are suitable and incorporate them into other practices.

6.1.2 Enabling the Beneficiaries

The participation of all concerned is necessary to mobilise people for collective action, so they will be empowered to organise their own institutions for making decisions that affect their community and assume the responsibility for their execution (Pretty, 1995, p168). The concept of participation is much discussed in literature (e.g. Longhurst, 1981; Chambers in Cernea, 1985; McCracken *et. al.*, 1988; FAO, 1990; Asamba *et al*, 1992), and it has been shown that a sense of ownership and commitment increases the sustainability of development. The mere label 'Participatory' is not enough to guarantee that people really will participate. Participation has a cost to it: people should want to participate, not to be forced into something they really have no interest in. They need to acquire new skills: to analyse and verify information, make decisions, resolve conflicts, acquire and use power, to negotiate and maintain channels of communication, and to express themselves in public (Bunch, 1982). Above all it requires the investment of time.

Existing public institutions have not been effective in enabling farmers to solve their own problems. They have generally started from the premise that only trained technicians have the skills to be able to identify problems and find solutions, and that peasant farmers do not have sufficient education for this. Consequently the technicians believed that it was incumbent upon them to both diagnose and prescribe but, as we have seen, their perspectives are often quite different. Very often, trained technicians interpret a particular agricultural situation in terms of the technical issues which characterise a problem: the cause, which lies in the social conditions, is not necessarily apparent to them. The technicians rely on their technical training, therefore, and impose their own criteria and constructs (Pretty, 1995). Even with a sincere intention to be participatory, programmes fail because the participation starts and/or ends at the wrong place. Participation 'takes place' at various moments: the agents have a public meeting, in which there is passive participation by people who attend and hear what the agents think are the required changes. There may be participation by consultation, in which the agents listen to what people have to say and then take the decisions, or participation in groups to meet certain objectives but without building a momentum which makes it a sustainable part of the farmers' overall planning process. Participation has to be a process, not an event.

The formal methodology of a participatory process is not well known in the area and some outside assistance might be required to introduce the concepts. The Participatory Rural Appraisal (PRA), described in the Participation Sourcebook (World Bank, 1993) and the Participation Handbook (Asamba, 1992), could be a starting point. The process, formerly known as Rapid Rural Appraisal and more recently as Participatory Learning and Action, is one by which a group can make a systematic diagnosis of their problems in a manner that allows all the voices of the group to be heard and all opinions and options considered, evaluates their resource base, and plans the responses. There are few organisations in the area with much PRA experience, but one possible group is the Centre for Alternative Technology (Centro de Tecnologia Alternativa - CTA), based in the nearby town of Viçosa, that is in turn linked with a national network of "alternative technology" organisations. The CTA has worked a little in Rosário de Limeira in the context of the creation of a State Park and could be contracted, either by the *município*, or directly by the farmers' associations, to assist them in carrying out a PRA and show them how to continue the participatory process.

6.1.3 Technical Solutions

It is now commonplace in some quarters to laud the skills and understanding of peasant farmers in the Third World, "...the new orthodoxy of peasant rationality and skills", as Adams calls it (Adams, 1990). Farmers do have a great depth of practical knowledge based on long experience but it should not be assumed that they fully understand the causes and effects of the phenomena they observe, or that they always use their own indigenous technology to its optimum advantage (Smith, 1994). Interviews with farmers in Rosário da Limeira show that there are many basic scientific principles they do not know.

For example, they may know that liming improves soil fertility but they do not know that it is the improved cation exchange capacity that allows the plant to take up other nutrients: they assume that the lime adds nutrients to the field and that therefore it is not necessary to add any others. They use urea to improve plant development, but do not know that phosphate deficiency is an even more limiting factor in plant growth; while they know that cow manure aids soil fertility, they do not understand the importance of organic matter in improving soil structure, and do not appreciate the role that green manures can play in this. They know that weeds compete with crops for nutrients, but do not realise that not all weeds compete to the same extent and that nitrogen fixing plants can be beneficial, not noxious. They consider all insects as pests, know little about natural biological controls of pests and consistently overuse pesticides and underuse fertilisers. As Chambers says, western scientific knowledge and indigenous knowledge are complementary, not mutually exclusive (Chambers, 1983, Ch. 4). The objective should be to give farmers not just technology, but scientific knowledge, so that they can have a better understanding of how both new and traditional practices work, and how they can be improved (Gupta, 1989). While it is important not to impose technology in a top-down manner, it does not follow that no new technology should be introduced or that farmers must rely only on their traditional practices. The traditional practices should be the starting point, certainly, but farmers must be given the option of actions they can take themselves to improve their situation, adding their traditional knowledge to new knowledge that helps them to see how their own practices can be improved and how new practices can be adapted to fit into their own systems.

Unfortunately, very little research has been done on sustainable land use in degraded forest lands. The Federal University of Viçosa has done some studies on management of native forest (Machado and Sant'Anna e Castro, 1993; see also Fischer, 1987) but with little practical application for peasant farmers. The recommendations of the state extension agency focus on agronomic practices for individual crops, but not on land management practices that encourage economic use of the remaining primary forest, regeneration of the degraded forest, and sustainable production on the former forest land. Technology to reduce land degradation exists on a general level, mainly developed in other states (see Batista da Costa, ed., 1994, and the references cited therein), but it has not yet been incorporated in EMATER's recommendations. Part of the process of joint research/extension/farmer generation of technology should involve both the adaptation of appropriate practices from other areas and the direction of research towards the particular problems of land degradation faced by farmers.

6.2. Activities

6.2.1 Determination of the Objectives

The objectives of the action plan must be clear from the outset. Is the objective a total ban on all exploitation of the forest? Is it not merely the conservation of the remnants but also their restoration? How are the rights of the people who live in the forest to be respected? What is the object of conserving the Atlantic forest: simply as a museum and for its aesthetic value, or as a storehouse of potential future genetic material, or to allow the last remaining fragments to be used, as all the rest was, to provide a living for its inhabitants? Would this be the most equitable balance of the needs of the present and future generations? A realistic objective would be to end the process of land degradation by the use of production techniques that are sustainable, and bring about a real improvement in productivity and in farm incomes, without being harmful to the environment.

The first step is to stimulate the growth of local organisations to bring about changes at the local level. There are two possibilities: one is to build on existing organisations, the other is to create organisations suited to the particular ends of the programme. There is little tradition of local organisations but the best organised and most active are the Base Communities, set up by the Catholic Church. The specific objective of the Base Communities is religious, rather than technical, and they are exclusive in the sense that non-Catholics do not participate. Nevertheless, they have successfully induced an ethic of group action or 'community spirit' and they could be used as a starting point to awaken interest and motivate the formation of groups more specifically directed toward land management. One of the Base Communities in Rosário de Limeira has constituted a local farmers' association which is organising local farmers for the bulk purchase of fertiliser and lime, and is applying for a group credit for coffee production: this is a model that other groups of farmers could follow.

6.2.2 Identification of the Problems

The diagnosis should then begin, using a suitable approach such as the Participatory Rural Appraisal. The first step would be to have series of meetings with each community to discuss the problem of land degradation. The effect on productivity of soil losses should be explained, using graphic materials that demonstrate losses quantitatively. Other, non-consumptive, uses of the land should also be discussed, and the concepts explained. In the meetings, all the community should participate, together with a representative from the municipal development committee, and one from the agency that will facilitate the PRA. It would be useful to have the presence of a representative from another community which has already run a successful community-based project. The role of the outsider is confined to guiding the discussion, keeping the objectives in view and relating it to what is possible in the context of the resources available within and outside the community.

In the first meeting, the need to improve agricultural production should be discussed, together with the need to use resources which already exist, without waiting for others to appear from outside. The extent to which the municipality is able to support the programme within the limits of its budget should be explained. This meeting would help to evaluate the degree to which the community feels that the programme offers sufficient incentive for it to participate, in view of the time that it will have to commit without immediate financial reward. If the community considers that it is worth its while to continue, it can take the next step and appoint a committee, which would act as the contact point with outside actors.

Once this committee is ready, the appraisal can begin at a time when there is not much activity on the farm, such as after the maize harvest and before the coffee harvest. It would normally take about three days, depending on the size of the community. On the first day, there would be a general meeting with the whole community to discuss the overall dimensions of the problems and establish the objectives of the programme, and the programme of visits and interviews within the community. The second day would be devoted to visits to individual farms and interviews with farmers and other members of the community. On the third day all the community would meet to make a community map, showing the farms of the community, the principal natural features, and the problem areas. From there, the discussion can move to an action plan that would identify the responsible parties, and the timetable. At this moment, it would be good to have the presence of a representative of the municipal development committee and the extensionist who will work with the community.

6.2.3 A Locally Appropriate Technology

Technical solutions need to be developed that would provide sustainable technology for agriculture, animal production, agro-forestry and natural forest management. Non-traditional alternatives, such as ecotourism, can be introduced at this point. Farmers should examine the possible technologies and decide which ones are best suited to local conditions. An important part of the overall approach is to stimulate the farmers' interest in proposing and carrying out their own research activities on their own farms. At the individual farm level even more adaptation can be expected. Improving land management is not simply a question of making a few changes: it affects the whole farm system. A change in the timing of the planting of beans, for example, affects the time available for weeding the coffee, which, in turn, impacts on other aspects of the farming system. The animal husbandry activities of the farm inter-link with the cropping activities, so a change in one has repercussions on the other, and thus throughout the farm. While technologies from the outside provide an invaluable additional resource, the adaptation to a particular system has to be done on the farm: technology generation must be a dynamic process.

Technical options would be offered to farmers in a menu of alternatives, from which they may choose one or more items. Eligibility to receive any of the financial benefits of the programme would be conditional on participation, i.e. on the adoption of one of the recommendations. However, farmers who do not want to commit themselves to technological change could still participate in other ways, such as by agreeing to multiply up seeds or seedlings for the programme. Since coffee plantations are a major focus of soil erosion, special attention should be given to develop technology to reduce it. Among the measures which could be tried are: the use of vegetative ground covers and green manures; the use of vegetative barriers to reduce erosion, and interplanting with nitrogen fixing trees and fast-growing timber species, a technique successfully used in Central America.

6.3 Financing.

If a conservation programme is to be sustainable, it is essential that it be designed to fit the locally available financial resources. The participants must be able to break away from the sense of dependency that comes from not having control over the resources if they are to assume the responsibility for the execution and management of the programme. This does not preclude the future possibility of the outside financial assistance that a successful programme would attract. Most the activities envisaged imply small additional costs within the reach of the participants if they agree to pool resources. Those that are beyond their capacity would generally be investments with indirect benefits to a larger group of beneficiaries and these could properly be considered as within the domain of the municipality.

With pressing needs to reduce budget deficits, neither the state nor the federal government is in a position to allocate new resources to a land management programme. Any local initiative should start from the assumption that support from the public sector would be limited to providing technical assistance. However, it would be possible to channel funds from existing government programmes (such as the micro-watershed programme and the fund for generation of rural employment) to financing part of the on-farm investments for groups of farmers undertaking a land management programme. In addition, the municipality has a development fund that could be used to provide some small incentives for farmers who adopt at least one of the practices approved by the community, in the form of the provision of free legume seeds or tree seedlings, or a subsidy in the price of lime, or similar. As participation in the programme increases, so the municipality could increase its financial participation and attract other resources from existing State government funds.

7.0 CONCLUSION

Preservation of the *Mata Atlântica* is not simply a matter of law enforcement and forest conservation. The experience of Rosário da Limeira is typical of most of the region of the *Zona da Mata* in Minas Gerais, and shows that deforestation is a symptom of a wider problem of land which has its roots in a tradition of the pursuit of short term gains from agriculture, and the marginalisation of peasant farmers from political and economic power. Because of its poor access and difficult topography, the area has limited possibilities for agriculture and coffee has been the only crop that offered a reasonable level of profitability. The long term decline in coffee prices has undermined this, and a different form of agricultural production must be found to prevent further land degradation.

The technical solution for land degradation requires the introduction of technology that exists in other places but is not known in Rosário da Limeira. However, technological change by itself will not provide a long term solution if it is not accompanied by other changes which allow farmers themselves to determine where their priorities lie, and give them the means to address them. This is not something that will occur naturally: it requires an concerted effort on the part of the community leadership strongly supported by local government. The recent political liberalisation offers a new opportunity for peasants to assume responsibilities for their own future. The change in the political status of Rosário da Limeira, now an independent *município*, opens a door for a reshaping of the relationship of government with small-scale farmers, but it is essential that local government itself should take a lead in bringing about the change. Since the success of any effort depends ultimately on changing attitudes on all sides, it follows that changes will take some time to have an effect. If land degradation in Rosário da Limeira can be reversed, the prospect for arresting the decline in the degradation of the *Mata Atlântica* is promising.

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