Pasture-Led to Logging-Led Deforestation
The Dynamics of Socio-Environmental Change in the Brazilian Amazon

by
Govindan Parayil and Florence Tong

Division of Social Science
Hong Kong University of Science and Technology
Clear Water Bay
Kowloon, Hong Kong

17 June 1997
PASTURE-LED TO LOGGING-LED DEFORESTATION
The Dynamics of Socio-Environmental Change in the Brazilian Amazon

Govindan Parayil
Division of Social Science
Hong Kong University of Science and Technology
Clear Water Bay, Kowloon
Hong Kong
Tel: (852) 2358 7828; Fax: (852) 2335 0014
E-mail: sogp@usthk.ust.hk

and

Florence Tong
Department of Social Studies
Hong Kong Institute of Education
42 Gascoigne Road
Yau Ma Tei, Kowloon
Hong Kong
Tel: (852) 2388 1145; Fax: (852) 2782 5330

February 1997
The causes and consequences of tropical deforestation cannot be confined to the geographical region of the Third World where it takes place, nor can it be studied in isolation from the realities of regional and global environmental change and political economy. Deforestation in the Brazilian Amazon is a telling testimony to this local-regional-global nexus of environmental change. Based on LANDSAT imaging surveys, as of 1991, around 426,000 km\(^2\) of rain forests have been destroyed, representing some 10.5 percent of 4 million km\(^2\) of the originally forested portion of Brazil’s 5 million km\(^2\) ‘Legal Amazon’ region.\(^1\) The deforestation rate in Brazilian Amazon during the 1978-1988 period was 22,000 km\(^2\) and it progressively declined to 11,000 km\(^2\) during 1990-1991.\(^2\) But the decline in deforestation during this period was primarily due to Brazil’s economic recession rather than to major policy changes.\(^3\) Despite the hope that the world’s attention on Brazil after the 1992 Earth Summit may have slowed down the deforestation rate further, new figures show that Brazil’s rain forest is disappearing at a faster rate after the global conclave in Rio de Janeiro. Recently released data show that the deforestation rate has gone up to 14,560 km\(^2\) in 1993-94.\(^4\) In addition to pasture formation for ranching activities which was the major cause for the disappearance of Amazon rain
forests, logging, mining and industrial activities are poised to bring back the high rates of deforestation again. The combined effect of all these activities could destroy the rain forests in a matter of few decades.

To find ways to influence the concerned parties and policy makers interested in finding ways to minimize or stop this tropical deforestation and to maintain Brazil’s legitimate right to use the forests of Amazonia on a sustainable basis, it is important to identify the root causes of this irreversible environmental change. Conversion of forest lands for pasture formation has been the most important cause for the disappearance of Amazonian forests during the period 1960-80. However, developments in the past fifteen years reveal a much more complex picture of Brazilian deforestation involving multiple and intersecting means of forest conversion and its varied causal mechanisms. Commercial lumbering has begun to outstrip cattle ranching as the greatest cause of forest destruction in many parts of Legal Amazonia. As will be shown later, lumber companies, among other agents of deforestation, are now joining hands with cattle ranchers to cut down the remaining commercially valuable trees of the Amazonian forests.

This paper will explore the socio-environmental dynamics of pasture-led deforestation to logging-led deforestation in the Brazilian Amazon and the root causes of this phenomenon. We will begin with a discussion of three major perspectives or theoretical frameworks used for analyzing environmental problems
in Third World countries. We will then use the case of Amazonian deforestation to explore the applicability of these theories for explaining the dynamics of this important environmental change, and suggest some ways to address the problem. The aim of this paper, therefore, is to discuss the growing complexity of environmental issues in the Brazilian Amazon and to verify the proposition that the root causes of environmental degradation in the region are not necessarily related to landlessness and human population growth. The problem is deeply rooted in the political-economic-ecological dynamics of Amazonia itself.

Three Theoretical Frameworks

In order to locate a possible analytical framework to understand the deforestation process in the Brazilian Amazon, three theoretical perspectives used to analyze environmental changes are outlined below. These are: the neo-Malthusian theory of population dynamics; Garrett Hardin’s reformulation of the ‘tragedy of the commons’; and, Peter Taylor’s and Garcia-Barrios’s socio-ecological analysis of environmental change. The first two concepts—familiar to most environmental analysts— are incapable of capturing the complexity of Amazonian deforestation while the latter offers valuable insights for understanding this important environmental change. Since the first two theories and various insightful criticisms
of them are well-known, a brief sketch of these theories will be presented here. Since the third theoretical frame is a new one, it will be explained in more detail.

*Neo-Malthusian population dynamics*

The neo-Malthusian thesis attributes the causes for the problem of over-exploitation of agricultural lands and forests and the consequent environmental degradation to the increasing population pressure on these natural resources.\(^5\) In general, the thesis postulates that population increase outstrips resource availability in Third World countries leading to such environmental ills as deforestation, soil erosion and loss of biological diversity, among other environmental problems. It also postulates that ‘overpopulation’ and resultant environmental disruptions occur when a population growing exponentially approaches and exceeds the carrying capacity of its environmental base which is a function of the amount of resources available for economic development and technological change.\(^6\) Unlike the orthodox Malthusian thesis which sees population increase as an expression of ‘natural law’ and the consequent death and destruction, the neo-Malthusian postulate assumes that the decision to have children is a rational response to the miserable economic situation facing the rural poor.\(^7\) It is rational for poor families in rural societies to have ‘more’ children as more hands that can work increase the earning potential of the families and act as providers of social security for parents.
during their old age. Since the ‘opportunity cost’ of raising ‘extra’ children is low for the poor, this ‘rational choice’ eventually results in a vicious cycle of further impoverishment because of alleged ‘population explosion’ and declining marginal productivity of labour and land. The neo-Malthusian thesis, in a nutshell, claims that there is a strong causal linkage between population growth, poverty, and environmental degradation, while it ignores the historical and political-economic factors underlying rural poverty, deprivation, and the environmental degradation processes.

‘Tragedy of the commons’ theory

In terms of its intellectual reception based on citations by environmental analysts alone, none rivals the ‘tragedy of the commons’ thesis. Hardin points out the supposedly universally held wisdom that resources held in common like pastures, forests, oceans and wildlife are vulnerable to over-exploitation. His argument assumes that an individual acting rationally in his self-interest seeks to maximize his own good, even though society or community as a whole, of which he is a part, suffers. That is, each individual tries to maximize his gain from the commons because the cost of resource use is shared by all members of the resource community while the gain is shared only by the individual. So, the greater the number of users, the more serious the problem of over-exploitation and resource
depletion. According to this proposition, the root cause of environmental
degradation in developing countries is the absence of coercive regulatory and
management practices within the context of capitalist private property regimes.
And, on top of this, the thesis assumes that environmental crisis is often exacerbated
by 'over-crowding' due to 'unchecked' population growth.\(^\text{10}\) The thesis claims that
resource users are incapable of working together for a shared goal of sustainable
development and exploitation of sharable natural resources.\(^\text{11}\) Hence, the solution to
environmental degradation like deforestation and overgrazing, in Hardin's view, can
be obtained by population control, privatization of publicly-owned resources,
outside-regulation as opposed to communal management of resources, and
imposition of proprietary control over natural resources by instituting market-driven
resource exploitation practices.

*The dynamics of socio-ecological change*

Analyzing environmental changes from a socio-ecological perspective, Peter
Taylor and Garcia-Barrios argue that globalized and uniformitarian aggregate
analyses can not provide useful insights into the dynamics of environmental change
taking place in the Third World.\(^\text{12}\) They argue that population growth or size and
environmental degradation are not necessarily related to each other. To find out the
root cause of environmental degradation, studies should be conducted on a 'locally-
centred' and 'trans-local' basis by analyzing the economic, political, and psychological forces at work and the dynamics of context-specific socio-economic changes (for example, changes in the labour supply, the social organization of production, and the availability of timely technological change).

Taylor and Garcia-Barrios argue that structural factors and policies affect the sustainability of resource management practices. This is because structural conditions (like government policy, educational opportunities, and land tenure systems) always discriminate against the rural poor, who are, therefore, deprived of local means of livelihoods and often have to enter the market economy as semi-proletarians to sustain and reproduce themselves. Taylor and Garcia-Barrios present a powerful example of how the migration of peasants from rural areas and the consequent decrease in population size caused the deterioration of land in Oaxaca state in Mexico.\textsuperscript{13} The breakdown of centuries old co-operative ventures to maintain terraced mountainous agricultural lands in Oaxaca led to serious soil erosion and environmental deterioration after the Spanish conquest of Mexico and the introduction of peripheral capitalism in modern Mexico. As a consequence of being detached from the land and local community, the rural poor became unable to adapt to technological change and sustain efficient agricultural production and resource management practices. In a word, structural conditions generate institutional insufficiency and poverty as well as environmental degradation.
Finally, Taylor and Garcia-Barrios show how poverty and institutional insufficiency may trigger environmental change in regions experiencing rapid population change due to migration and economic disruption. For instance, in recently colonized tropical frontier of the Brazilian Amazon, institutions regulating open access to the commons are systematically opposed by local interests. Just examining the size and rate of growth of the population, therefore, may not help us understand the causes of environmental destruction. Instead, 'in order to explain the escalation of consumption pressure on land', Taylor and Garcia-Barrios argue, 'one needs to examine the structural conditions of land tenure and resource distribution, and larger socio-economic forces that restrict employment creation and enhance social and geographical mobility'. Thus, while studying environmental change in the Third World, one should pay attention to the localized social and economic dynamics involving population and social change rather than solely focusing on the problem of so-called 'overpopulation'. And, analysis should be made on the differential social groups and power structures within and between nations with different interests in causing environmental degradation, rather than resorting to simplified and ahistorical monicausal explanations. Before analyzing the applicability of these models, a detailed account of the principal means of Amazonian deforestation is presented.
Pasture-led Deforestation in the Brazilian Amazon

Pasture formation has been identified as the major cause of the destruction of the Brazilian Amazonian forests.\textsuperscript{15} It is estimated that the conversion of forest to pasture proceeded at a rate of around 8,000 to 10,000 km\textsuperscript{2} per year in the early-to-mid-1970s and reached a peak of 22,000 km\textsuperscript{2} during the period of 1978-1988.\textsuperscript{16} Such large clearance of forests was spatially concentrated in the southern states of Para, Rondonia and Mato Grosso.\textsuperscript{17} To account for the pasture-led deforestation process, one has to examine the Amazon regional development programmes and frontier land colonization policies of the Brazilian government which began in the early to mid-1960s. Various Brazilian governments held the view that by opening up the Amazon Basin and exploiting the resources there would stimulate national economic growth which, in turn, would resolve the serious economic and social problems confronting the country.\textsuperscript{18} These development programmes formed part of the growth-oriented, capital-intensive development strategy adopted by the military governments in the years since 1964.\textsuperscript{19} The following factors can be attributed to understand the dynamics of pasture-led deforestation in the Amazon.

\textit{Legitimating military regimes}

The military seized power in Brazil in 1964 following a coup d'état. The unpopular and authoritarian military governments that ruled Brazil between 1964-85 were anxious to legitimize their hold on power by embarking on popular
programmes like combating high inflation rates and improving stagnant agricultural production. But the most ambitious plan was to ‘colonize’ the Amazon by encouraging people from different economic and social backgrounds to migrate to this region. The military governments provided high subsidies for the agricultural sector to maintain their cheap food policies, but, instead, most of the financial incentives went to cattle ranching. However, primary staples did not become cheaper or abundant for the poor. A number of legal and tax incentives were provided and this made cattle ranching and forest clearance a profitable business. The military regimes encouraged the marginalized and landless poor to colonize the Amazonian frontiers which only helped to exacerbate soil erosion and forest clearing by unwittingly becoming the agents of forest grabbing for multinational cattle and logging companies as will be shown later.

*Regional politics and border worries*

Brazil shares borders with ten countries of which several borders are unpatrolled or poorly demarcated. Brazilian politicians and government officials had long been concerned about Brazil’s ‘undefended’ and often poorly marked borders, and were especially concerned about the ‘unexplored’ and underpopulated land in the continental interior. And they held the view that the future of the country depended upon the occupation of the interior. The concern over national security and strong sense of national identity have provided a ‘territorial imperative’ to
occupy and exploit the Amazon region.\textsuperscript{24} The military regime which captured power in 1964 quickly brought these geopolitical concerns into political actions. In 1966, the military government launched Operation Amazonia with the objective of increasing the frontier region’s population. The slogan ‘integrate the region or lose it’ sums up the position of the military regime on the National Integration Programme and shows the influence of Brazil’s geopolitical thinkers.\textsuperscript{25} By encouraging settlement near the frontier regions, the military regime initiated the process of forest destruction.\textsuperscript{26} This was facilitated by such road construction projects as the Transamazon Highway for ‘integrating’ the Amazon into the rest of Brazil.

\textit{Infrastructure development}

The colonization and exploitation of the Brazilian Amazon was initiated by infrastructure development, especially, road building. The Belem-Brasilia Highway was built in 1958 to encourage the occupation of the continental interior and integrate the northern and western states with the rest of the country.\textsuperscript{27} It was along this road that the destruction of the forest, especially through the establishment of cattle ranches, first attracted outside attention. Later, under the National Integration Programme (1970-74), the Transamazon Highway, Cuiaba-Santarem Highway and a network of feeder roads were constructed to bring ‘men without land to land without men’ (\textit{sem terra}) in Amazonia. These roads opened the gates for the arrival of
many thousands of small farmers and cattle ranchers to Amazonia, especially, to Rondonia, the state with one of the greatest amount of deforested land. Altogether five major highway systems totalling nearly 30,000 km were constructed in the region. Deforestation has been more acute in areas which are easily reached by highways and feeder roads.

*Rural poverty and displacement of small farmers*

Deforestation is also related to the problem of displacement of landless farmers and rural poverty because of extreme inequality in income and land distribution in Brazil. While millions of peasants eke out a living from meagre patches, ‘a handful of barons rule over rambling estates the size of counties, even countries’. Eighty-one percent of Brazil’s farmland (outside Amazonia) is owned by only 4.5 percent of the population and more than 70 percent of the country’s rural households are landless. Rural poverty was worsened by the stagnation in the agricultural sector experienced in the late 1950s and early 1960s. The problem of landlessness was further accelerated by structural changes in the agricultural sector that occurred during the past several decades. Changes in land tenure and land use in the southern state of Parana in the 1970s very heavily influenced deforestation in Rondonia which lies at the south-western edge of ‘Legal Amazon’. Many small family farms that became uneconomical for cultivation in southern Brazil were incorporated into large corporate cattle ranches or coffee and soybean plantations.
Mechanization in the agricultural sector also led to the displacement of tenant farmers and sharecroppers.\textsuperscript{35} To solve these social and economic problems in the rural sector, the military regimes chose the development strategy of enhancing economic growth based on the opening of the Amazon rather than implementing real land reform. With the opening of the Amazon region in the last two decades, more and more displaced peasants had migrated to the region in the hope of getting free land.\textsuperscript{36} For instance, Rondonia experienced the most increase in the arrival of indigent internal immigrants. During the period 1968-78, an average of 28,500 persons migrated to the state per year. The figure increased to 65,000 during the period 1980-83, and 160,000 persons during 1984-88.\textsuperscript{37} The displaced farmers provide a semi-skilled labour pool for ranching and pasture formation, as will be shown later.\textsuperscript{38}

\textit{International trade and economics}

The structural changes in national and international economy and the Brazilian governments’ willingness to accede to these contingencies led them to embark on national development policies to promote economic growth and export by promoting agricultural expansion.\textsuperscript{39} Cattle ranching looked promising in the 1960s when there was increased global demand for beef, especially low quality beef for the US fast food (hamburger) shops.\textsuperscript{40} Besides, the FAO report on the potential of cattle ranching in Latin America encouraged the authorities to promote investment in the
livestock sector. Because of the UN endorsement, the livestock sector was able to solicit more loans from international loan agencies than other industrial sectors. This is reflected in the increase in the amount of livestock loans authorized by the World Bank and the Inter-American Development Bank in the past few decades. For the period of 1974-80, 63 percent of the World Bank loan earmarked for livestock had gone to Latin America, and in absolute terms the amount of loan in the seven years was more than that of the previous 15 years. All these factors encouraged the government to embark on its colonization programmes based on cattle ranching as the major agro-industrial venture. The incentives offered by the Brazilian government in the form of state subsidies and tax rebates in the agricultural sector attracted large multinational and Brazilian corporations such as Anderson Clayton, Nestle, Borden, Goodyear, Volkswagen, among others to set up ranching and other projects in the Amazon region.

*Inflation and land speculation*

The expansion of ranching activities into the Amazon was favoured by the high inflationary pressure of the 1960s and 1970s that stimulated land speculation. In Brazil land is a valuable asset for its usefulness as a hedge against inflation. The market value of the forest land that received government subsidies inflated at a rate of 200 to 300 percent per year in the 1980s. It is not difficult to acquire land in the Amazon forest, especially for the large corporations which have greater access to
information and credits. Additionally, cleared forest land (regarded as ‘improved’ land) generally has a higher market value than uncleared (‘unimproved’) land.\(^{45}\) For these reasons, pasture conversion for cattle ranching has been used as a means of protecting investors’ savings from the devastating effects of inflation. Land speculation centred on cattle ranching was further stimulated by the government policy of subsidizing land ‘improvement’ for cattle ranching in the Amazon. A number of fiscal incentives and concessions was provided for cattle ranches. These incentives included: SUDAM-sponsored ranches receiving grants up to 75 percent of the development costs; tax holidays and exemption from taxation to corporations if they invested their money in development projects in the Amazon region; ranches getting exemption from import duty on imported equipment; ranches receiving low-interest (8-12 percent) long-term (often 6-8 year grace) loans for land development; and, land tax reduction of up to 90 percent for those farmland or pasture converted from natural forest which encouraged ranchers to clear the forest.\(^{46}\)

**Insecure land tenure**

Brazil has no well-defined land tenure laws. For obtaining legal (ownership / usage) rights to forest land, the land must be cleared.\(^{47}\) In fact, it became a norm that landowners or land claimants who do not clear the land very often ran the risk of losing their legal rights to the land.\(^{48}\) This ‘use it or lose it’ customary land use law originated from the belief that natural forest must be cleared for demonstrating
its productive use. This perception is reinforced by the lack of efficient land titling and adjudication procedures, and corruption in the administration.\textsuperscript{49} Therefore, cattle ranching in the Amazon region has been used by the landowners and land claimants to establish claims to large areas of forest lands. Because of the insecurity of land tenure and high inflation rates, it was unprofitable to carry out long-term investment in land management. And most investment projects in the Amazon were short-term in the form of pasture formation which entailed little expense for development and required little labour.\textsuperscript{50} Indeed, legal incentives given by the government have accelerated the problem of forest clearing (legally or illegally). A squatter can get the right to use a piece of public land up to 100 hectares if the land is used in a productive way for one year and the right to own the land if it is used for five years.\textsuperscript{51}

\textbf{Logging-led Deforestation: The New Trend}

Until a decade ago, forest conversion to pasture which relied on lucrative government incentives and infrastructure development had been the root cause of deforestation in the Brazilian Amazon. Lately, as the government has removed many of the financial incentives for ranching projects and international development banks and some Japanese corporations and banks have stopped financing the construction of new roads in the Amazon, cattle ranching is no longer the only major
cause of forest destruction in many parts of Legal Amazonia.\textsuperscript{52} However, deforestation in the Amazon has accelerated rather than slowed down, especially along the western, southern and eastern edges of the region. What accounts for the continued forest conversion process?

Since the 1980s, the government has sanctioned several new non-pastoral development projects in the Amazon region. Several mineral and fossil fuel extraction projects are underway. The $3 billion World Bank and European Community funded mineral exploitation and mining activities in the Greater Carajas region are the best examples of this new industrial development push, and one of the most notable new industrial ventures in the Greater Carajas Programme that relies heavily on the forests for its energy sources has been the iron ore smelting activity started in 1981.\textsuperscript{53} The programme necessitated the construction of charcoal plants along the railway lines linking the mining regions with the sea port of Sao Luis, and this has facilitated the arrival of thousands of new settlers into the forest region.\textsuperscript{54} The charcoal required for iron smelting is made from the trees cut down from the local forests. Lutzenberger argues that cattle ranchers looking for more land find the Carajas Project a bonanza as they get not only the forest cleared but an added subsidy by selling the timber to charcoal producers.\textsuperscript{55}

In recent years, industrial development of Amazonia appears to have gotten out of government control as a number of privately initiated colonization activities were
undertaken by ranchers, farmers, miners, loggers, and charcoal producers. Apart from the government-supported regional development programme of Greater Carajás, it has been found that new developments like the growth of commercial lumbering are responsible for the increased pace of forest destruction in Amazonia. Wood products accounted for more than 25 percent of the industrial output in four of the states in the region in 1988. A new wave of forest clearance is now associated with commercial lumbering which has already become the leading industrial sector in the region. Complementary relationship has been set up between logging companies, sawmills and cattle ranchers. Logging-led destruction now co-exists with pasture-led deforestation, and logging activity is becoming the main catalyst of forest alteration. The process of forest conversion has now taken a new dynamic with the emergence of the old actors (cattle ranchers and small farmers) playing new roles of being loggers in timber-cutting activity. After cattle ranching, the lumber sector received the biggest income tax holiday from SUDAM-approved projects. By 1989, the government had issued 4,000 licenses for timber-cutting in the Amazon. This rapid rise in timber concessions saw the number of sawmills doubling in the 1980s, and the number of sawmills has been rising rapidly ever since. In the county of Paragominas, the number of registered sawmill has increased to 400 in the early 1990s from one in 1970.
The flourishing of commercial lumbering in the Brazilian Amazon has to do with the increasing global and domestic demand for tropical hardwoods. Though 28 percent of the world’s tropical wood is found in the Amazon, until very recently, this region has never been a significant supplier of tropical timber. However, since the forests in other parts of the tropics (Southeast Asia and West Africa) have diminished and more species of tropical trees have been found commercially valuable, timber traders have been turning to the Amazon for the supply of hardwood timber. The major importers of Brazilian timber are the United States, Britain and other Western European countries who could offer a higher price for valuable timber like mahogany because of its extensive demand among luxury home builders and furniture buyers. As mahogany is becoming extinct in other tropical forests, the importers are now willing to pay higher prices for Brazilian exports of this valuable timber. Owing to the rise in the price of mahogany and virola, the loggers are now prepared to travel deeper into the forests to spot these trees.

Aside from Western countries, Japan and other newly industrialized Asian countries are expected to increase their imports of timber in the form of raw logs from Brazil. Since 1988, Japan has began to import logs cut from logging sites in Rondonia where forest areas were due to be flooded for building the Samuel Dam. Another internal factor responsible for the demand in Amazon timber has been the exhaustion of other hardwood forests in Southern Brazil caused by a boom in
domestic construction. Because of rapid rise in domestic demand for timber in the housing industry, 17 of Brazil’s 25 states have been experiencing severe shortage of locally grown timber.63 As a result of the increasing domestic and global demand for tropical timber, illegal cutting of trees in the Amazon has become a very profitable business. Timber-cutters have now begun to intrude upon Indian and national forest reserves. Effective control of lumbering activities has been handicapped by the corruption of government officials, some of whom are friends of sawmill owners or sawmill owners themselves, and weak monitoring of the forest reserves.64

The damage brought by the growing lumber sector was highly related to the weak monitoring of reforestation programmes, if any, and mechanized methods of logging. Though logging companies are required by law to carry out reforestation programmes, reforestation cannot be done in areas far away from the logging sites. And even when reforestation occurs, regeneration of the original forest is difficult, if not impossible. This is because the so-called reforestation is mostly done by replacing the natural forest with tree saplings consisting mainly of one or two species of fast-growing trees and the reforested area is very often smaller than the logged areas.65 Besides, the forest ecosystem is increasingly vulnerable to degradation and destruction as many sawmills have switched to mechanical logging by employing heavy machinery such as bulldozers, skidders and trucks.66
Mechanized logging brings greater damage than traditional small-scale logging activity and makes it more difficult for logged forest to regenerate.

The new agents of forest colonization are loggers rather than small farmers and cattle ranchers. The networks of roads built by loggers, and sometimes by large cattle ranchers, allow landless peasants and small cattle ranchers to move into the logged forest. The profit from the sale of timber further subsidizes and finances the construction of roads and highways for continued penetration into the forests paving the way for large-scale deforestation and frontier expansion. Forest destruction proceeds first with selective felling, legally or illegally, of some marketable tree species like mahogany and virola from public forests by timber-cutters who are mostly seasonal labourers and landless farmers. This is followed by clearing and burning of the logged forest by hired labourers who are mostly small farmers for crop farming for a few seasons, and finally, the cleared land ends up as pasture described earlier. The forest conversion process can be summarized as follows: selective logging \(\Rightarrow\) clear-cutting \(\Rightarrow\) pasture formation. Working as hired labourers in the forest conversion process (whether pasture-led or logging-led), small farmers are unwittingly playing the role of agents of forest destruction.
Socio-Ecological Dynamics of Deforestation

It is difficult to establish a single root cause for deforestation in the Brazilian Amazon as shown earlier. Some of the currently popular theoretical frameworks for explaining environmental change resort to a monocausal approach. According to the neo-Malthusian theory, the cause for environmental degradation in the Third World has its origin in the structural poverty of the rural population which is caused by the so-called ‘population explosion’. In essence, the argument would follow that increasing population pressure upon already cleared and cultivated lands force the ‘surplus’ population to resort to destructive activities like deforestation. Deforestation in the Brazilian Amazon bears no relation to the issue of overpopulation in Brazil. Population growth rates in Brazil had in fact decreased through the 1970s and 1980s, the period during which deforestation became more intense.69 The population density of Brazil (excluding Amazonia) is around 23 people per km², approximately equal to the US population density.70 If all the farmland outside of Amazonia is distributed evenly, each person in Brazil could get ten acres of land.71 Being a rapidly industrializing country, if only needy landless peasants were given ten acres of land per head, that would still leave plenty of land for the landed oligarchy. Surprisingly, the need for land reforms in Brazil has not been seriously considered as one of the solutions for slowing down deforestation in the Amazon.72
The cause of deforestation is related to unequal distribution of arable land outside Amazonia rather than overpopulation. As mentioned earlier, land in Brazil is highly concentrated in the hands of a group of landowners. The problem of landlessness has caused massive migration of rural poor to the new frontiers in the Amazon region where they cleared forest land to practice swidden agriculture. Migration to this region had led to rapid regional population growth (6.3 percent per annum between 1970-80), more than twice the national average. The population of Legal Amazonia had already increased by more than 4 million from 7.1 to 11.2 million in the ten years. Most of them settled along highways and main roads for better access to social and urban facilities leading to increasing urbanization and rapid growth of regional urban centres like Belem, Manaus, and Cuiaba.

Contrary to the neo-Malthusian view that environmental degradation was initiated by the rural poor, it was the rich and powerful (including foreign investors and domestic agro-industrial entrepreneurs) and the government who are responsible for the large-scale degradation of the forest environment. Throughout the 1970s and 1980s, the elites lobbied the government for the granting of special concessions to them for opening up the Amazon. The military governments, to begin with, representing the interests of elites launched the regional development programmes in the Amazon and thus was primarily responsible for the large-scale conversion of the forest.
In fact, rural poverty does not necessarily and of in itself lead to environmental degradation. With regard to deforestation in Brazil, the rural poor participate in the forest destruction process in response to outside stimuli and pressures. The outside stimulus was government encouragement in the form of different colonization programmes. The outside pressure was also initiated by the droughts and natural disasters, and by landowners who buy out marginal farmers resulting in the social and physical displacement of small farmers. The displaced peasants and indigent immigrants who move to Amazonia become the unwitting agents of forest destruction by working as seasonal hired labourers for cattle ranchers and logging companies.

The ‘tragedy of the commons’ thesis argues that the root cause of environmental degradation is the absence of property relations of the forest commons, and the problem can be addressed by privatizing the commons. The situation in the Amazon is just the reverse. Forest conversion is associated with the privatization of the public forest lands which leads to the displacement and marginalization of small farmers and conventional forest users by large landowners, cattle ranchers, and, lately, sawmill owners. This enclosure movement encourages further frontier expansion by farmers, ranchers and loggers. Deforestation in the Brazilian Amazon cannot be attributed to a lack of property relations of the commons as would be stressed by Hardin. In fact, we suggest that reversing private ownership of forest
lands and instituting communal and cooperative management of the forest land and resources by the stakeholders, such as rooted forest people, rubber tappers, and displaced peasants under the protection of the Brazilian government might be a partial solution to the 'tragedy of the commons' situation in the Amazon.

Compared with the neo-Malthusian and 'tragedy of the commons' theories, Peter Taylor's and Garcia-Barrios's paradigm is more helpful for analyzing the root causes of forest destruction. This is because the latter paradigm draws our attention to the complexity of the environmental change which necessitates locally-centred studies by referring to the political-economic and socio-psychological forces at work embedded in the dynamics of socio-environmental change. Environmental issues are very often the consequences of the interplay of a number of processes and factors. Pasture development in the Brazilian Amazon, for example, was caused by a number of driving forces. Ranching had served the important political and ideological functions of legitimating the unpopular military regimes. The Brazilian geopolitical thinking stresses the concerns of national integrity and national security which justify the government's regional development programmes and the consequent strategy of frontier expansion. Pasture development was also driven by market failures (inflation), land speculation, government's irrational financial incentive schemes, and administrative failures such as corruption and overlapping jurisdiction between state and federal governments. Structural problems like
insecure land tenure and landlessness, partly explain the popularity of land acquisition by ranchers and squatters. Poverty pushes the landless peasants to find new land in the new agricultural frontiers. International factors like demand for beef and cultural influence (the prestige of ranching driven from the 'cattle culture') also favour conversion of the forest land into pasture. These driving forces and factors may reinforce each other and sometimes they are exacerbated by some of the consequences of deforestation. For example, clearing forest land for cultivation accelerates the process of soil erosion and loss of soil fertility which in turn drives small farmers into the vicious cycle of further clearing. Even when the initial driving forces, such as government's fiscal incentives and subsidies for cattle ranching and highway construction had dried up, the process of deforestation did not slow down. The reason for this is that the withdrawal of subsidies came too late as the unstoppable motor of forest destruction had already got in motion.

Moreover, new stimuli and driving forces emerged in the new socio-economic and political contexts of Brazil fueling the forest conversion process. The boom in global and local demand for tropical timber and change in the government policy of endorsing private colonization have led to destructive forest conversion practices, especially commercial logging. In the 1980s, government funding (subsidies and tax incentives) was replaced by private capital gained from investing in other forest sectors like lumbering. Along with the ascendancy of the civilian government in the
late 1980s, new groups of professional politicians and entrepreneurs entered the political arena and joined in the game of competing for forest resources with the established elites (cattle ranchers) as evident in the state of Roraima. They advocate continued economic exploitation of the Amazon forest by the private sector through the harvesting of minerals and timber, and development of massive hydroelectric projects.

Deforestation was also associated with a number of undergoing processes and groups of social actors. The processes of peasant settlement, infrastructure development, cattle ranching and timber harvesting are now interwoven and they together contributed to the degradation of the Amazon forests. In addition, several groups of social actors playing different roles are acting on the stage. They are the cattle ranchers, loggers, small farmers, miners, and indigenous forest peoples with different and often conflicting interests in the forests. While some are eager to find a way to alleviate the degradation, others are equally bent on exploiting the forests regardless of its fate. These new settlers and colonists perceive the socio-economic environment in different ways which in turn affect the decision made by them on forest resource exploitation and management practices. The means used to exploit the forest and the directions of penetration and settlement in the forest are a matter of individual and group prerogatives determined by their perception of the amount of resources available and the ecological dynamics of the forest. Therefore, Peter
Taylor and Garcia-Barrios are correct in arguing that aggregate analyses could not be of much help to understanding the dynamics of environmental change. Localized study of differential social groups and the socio-psychological forces involved would provide more hints about the root causes of environmental degradation in the Amazon.

**Discussion and Conclusions**

Cattle ranching would never be a profit-making venture as long as only the revenue from the sale of cattle is taken into account. Owing to the poor quality of the pasture land and the poor management of cattle ranches, the productivity of the pasture land declines drastically. Cattle ranches in the Amazon have one of the lowest off-take rates (percentage of animals regularly harvested) in the world, hovering around 10 percent. However, Browder estimated that cattle pay only about 25 percent of the production costs based on a 15 percent off-take rate. The profit associated with livestock was not generated by the sale of cattle, but, rather the profit generated through financial and land speculation. Cattle ranching was attractive because cattle could be used to occupy large areas of land with little labour requirement. Pasture formation enabled the ranchers to expand their land holdings by establishing claims on cleared lands. Moreover, land was a useful
hedge against inflation. The inflationary pressures and high market value for pasture land have provided ample incentives to clear as much land as possible.

In ecological terms, pasture formation is a costly and wasteful activity. Pastures in the Amazon easily lose their productivity and are often abandoned in less than ten years after their formation. Based on ecological and pedological studies, Serrao and Toledo estimate that Latin American pastures reach advanced stages of degradation after five to seven years, on average, after their formation. This is mainly due to the fact that the nutrients in the rainforest ecosystem are stored in the vegetation rather in the top-soil. So, the clearing of the forest cover removes most of the nutrients in the ecosystem. Moreover, without the presence of rooting plants and trees the surface soil could not be retained by the pasture land during severe tropical run-offs. The other most unfortunate side-effects of clearing rain forests are the loss of biodiversity and the release of carbon dioxide stored in the biomass when torched for removing the tree stumps and bushes for preparing the deforested land for pasture formation and cultivation. Amazon rain forests also play crucial roles in global biogeochemical cycles and stabilizing regional and global climates. More than half the rainfall in the Amazon basin is circulated within itself. The forest also serves the very important function of absorbing the rainwater which is returned to the atmosphere through evapotranspiration. It is also claimed that if only half of the Amazon is cleared, the rest of the forest will not survive because of
the irreversible ecological changes already set in motion, and, also the combined effect will make the agricultural areas of Southern Brazil arid and unproductive.

What are the real solutions to pasture-led deforestation? Some analysts suggest withdrawal of financial incentives and cattle subsidies in order to make livestock an unattractive investment proposition. Ironically, the process of deforestation is on the increase even though the government has withdrawn subsidies to the cattle sector. This is largely due to the recent trends of logging-led deforestation as well as the proliferation of privately-initiated colonization and resource extraction projects. More importantly, there is no single solution to the problem as the causes of deforestation are so complicated and associated with a number of social, political and economic problems and actors. It is heartening to learn that President Cardoso’s administration has taken note of the seriousness of Amazon deforestation and announced new measures to crack down on illegal cutting of mahogany and virola. To address this environmental problem, a policy package involving careful assessment and constant evaluation is needed. The policy package should include, among others, the following measures. Reinstating the rights of the rooted and indigenous peoples to manage and sustainably use a large portion of Amazonia; formulate land tenure laws specific to the new socio-ecological realities; impose high land taxes to stop land speculation; implement forest protection policy measures like setting up protected forest areas; restrict the construction of forest
penetration roads and new highway projects; provide alternative job opportunities for peasants and small farmers and economic immigrants from outside the Amazon region; and, most importantly, implement meaningful land reforms in Brazil.

The dynamics of pasture-led and logging-led deforestation in the Brazilian Amazon in the past few decades can only be analyzed by examining the reasons behind forest conversion within the particular historical, cultural, political and social contexts of Brazil. The root causes of forest conversion can be analyzed only superficially by resorting to the neo-Malthusian population and the 'tragedy of the commons' theses. Limited by too many generalizations, these two perspectives fail to provide a meaningful framework for analyzing this major environmental change. As Popper eloquently argued, the usefulness of a theory or hypothesis can be tested by its ability to offer better explanation for a phenomenon (natural or social) or by its problem solving effectiveness.\textsuperscript{87} Since theories cannot be proved true or false by verifying their truth status, they can only be corroborated through better evidence, and the evidence presented here does not support the first two theories. The root cause of pasture-led to logging-led deforestation has very little to do with 'overpopulation' and landlessness. Deforestation here is a consequences of a number of social, economic, ecological and political factors. This is also the reason why regional development programmes based on the exploitation of the forest land without a comprehensive vision of a sustainable forest resource utilization and
management strategy could not generate real ‘development’. Rather, these development programmes have created further environmental destruction and social unrest in the Amazon basin.
Figure 1: Map of Legal Amazonia

Source: Friends of the Earth Japan, *op cit*, Ref 22)
Table 1. Extent and rate of deforestation in Legal Amazonia 1987-1991

<table>
<thead>
<tr>
<th>Political Unit</th>
<th>Deforested Area (10^6 km²)</th>
<th>Percentage of original forest lost by 1991</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acre</td>
<td>2.5</td>
<td>8.9</td>
</tr>
<tr>
<td>Amapá</td>
<td>0.2</td>
<td>0.8</td>
</tr>
<tr>
<td>Amazonas</td>
<td>1.7</td>
<td>17.3</td>
</tr>
<tr>
<td>Maranhão</td>
<td>63.9</td>
<td>90.8</td>
</tr>
<tr>
<td>Mato Grosso</td>
<td>20.0</td>
<td>71.5</td>
</tr>
<tr>
<td>Pará</td>
<td>56.3</td>
<td>129.5</td>
</tr>
<tr>
<td>Rondônia</td>
<td>4.2</td>
<td>29.6</td>
</tr>
<tr>
<td>Roraima</td>
<td>0.1</td>
<td>2.7</td>
</tr>
<tr>
<td>Tocantins (Goias)</td>
<td>3.2</td>
<td>21.6</td>
</tr>
<tr>
<td>Legal Amazonia</td>
<td>152</td>
<td>327.8</td>
</tr>
<tr>
<td>Forest flooded by</td>
<td>0.1</td>
<td>3.9</td>
</tr>
<tr>
<td>hydroelectric</td>
<td></td>
<td></td>
</tr>
<tr>
<td>dams</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deforestation from all</td>
<td>152</td>
<td>376.7</td>
</tr>
</tbody>
</table>
Endnotes:

1 The rest of the one million km² of ‘Legal Amazon’ is made up of non-forest vegetation such as cerrado (dry savanna of central Brazil), pantanal (Mato Grosso humid savanna) and lavrado (Roraima humid savanna). See P.M. Fearnside, ‘Deforestation in Brazilian Amazonia: The Effect of Population and Land Tenure’, AMBIO, Vol. 22(8), 1993, pp. 537-545. See Figure 1 for the map of ‘Legal Amazon’ which is a concept used in Brazil to refer a 5 million km² area covering all or parts of nine states (Amazonas, Para, Mato Grosso, Rondonia, Roraima, Acre, and Amapa, Tocantins [previously known as Goias], and Maranhao). See Table 1 for the rate of deforestation during the past several years.

2 Fearnside, op cit, Ref 1.

3 Ibid.


6 It is important to note that the neo-Malthusian theory is currently drawing a great deal of attention among some prominent environmental analysts.


11 However, F. Berkes, D. Feeny, B.J. McCay and J.M. Acheson, ‘The Benefits of the Commons’, Nature, Vol. 340, 13 July 1989, pp. 91-93, argue with several empirical examples from around the world that communal-property resource management practices are possible for sustainable resource use without resorting to a private property rights regime to manage the commons.


14 Ibid, p. 15.

Pasture-led to Logging-led Deforestation

18 Hecht, *op cit*, Ref 7.
19 Kohlhepp, *op cit*, Ref 17. The development programme began in 1966 with the formation of such agencies as the Superintendency for the Development of the Amazon or SUDAM and a regional development bank known as BASA.
20 Hecht, *op cit*, Ref 7.
27 Moran, *op cit*, Ref 16.
28 Ibid.
29 Ibid.
30 Friends of the Earth Japan, *op cit*, Ref 22.
31 According to Philip Fearnside, *op cit*, Ref 1, at the time of the launching of the Transamazon Highway deforestation was only 2.4%. However, by 1991, the rate had gone up to 10.5%.
36 Hecht, *op cit*, Ref 7.
37 Browder, *op cit*, Ref 21.
38 Moran, *op cit*, Ref 16.
38 Hecht, *op cit*, Ref. 7.
40 Hecht, *op cit*, Ref. 7.
41 Ibid.
44 Browder, *op cit*, Ref. 21.
45 Moran, *op cit*, Ref. 16.
46 S.B. Hecht, ‘Logics of Livestock and Deforestation: the Case of Amazonia’, in T.E. Downing, et al., eds, *Development or Destruction: The Conversion of Tropical Forest to Pasture in Latin America*, Westview Press, Boulder, 1992. Such loans were often reinvested into short-term financial markets for high return. Also, given the inflation rate of over 50 percent in the 1970s, the real interest rates for the loans were actually negative.
47 Friends of the Earth Japan, *op cit*, Ref. 22.
49 Ibid.
50 Hecht, *op cit*, Ref. 43.
51 Friends of the Earth Japan, *op cit*, Ref. 22.
53 Moran, *op cit*, Ref. 16; Friends of the Earth Japan, *op cit*, Ref. 22.
54 Ibid; Kohlhepp, *op cit*, Ref. 17.
57 Browder, *op cit*, Ref. 21.
58 Moran, *op cit*, Ref. 16.
59 Monbiot, *op cit*, Ref. 56.
62 Friends of the Earth Japan, *op cit*, Ref. 22. This indicates that the Brazilian government has failed to strictly enforce its forestry code which forbids the export of raw timber.
63 Monbiot, *op cit*, Ref. 56.
64 Ibid.
Pasture-led to Logging-led Deforestation

65 Friends of the Earth Japan, *op cit*. Ref 22; Lutzenberger, ‘Who is Destroying the Amazon Forest?’, *op cit*. Ref 42.


67 Tyler, *op cit*. Ref 60.


70 Anderson, *op cit*. Ref 32.


72 However, because of popular pressure from trade unionists, left-wing politicians, even some segments of the Catholic clergy, and most importantly the Movimento Sem Terra or MST which is the movement that represents the interests of the landless peasants and squatters, President Fernando Cardoso has promised to settle 280,000 families by the end of his term in 1999 and to introduce land reforms. However, it is not clear where these landless people are going to be resettled. See *The Economist*, *op cit*. Ref 31.


74 Kohlhepp, *op cit*. Ref 17.

75 Monbiot, *op cit*. Ref 56.

76 Reitbergen, *op cit*. Ref 69.


78 Ibid.

79 Hecht, ‘Sacred Cow in the Green Hell’, *op cit*. Ref 43.


81 Hecht, ‘The Sacred Cow in the Green Hell’, *op cit*. Ref 43


