NATIONAL ECONOMIC DEVELOPMENT AND TROPICAL DEFORESTATION IN THE BRAZILIAN AMAZON

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ABSTRACT

The purpose of this thesis is to examine the tension between economic development and the environment in Developing Countries. To illustrate the tension, this thesis focuses on Brazil's development policies for the Amazon and the environmental consequences of those policies. Current development practices are evaluated and compared according to their economic benefit and environmental soundness.

The thesis also speculates on the changes in development practices resulting from the influence of the international community. The final section presents recommendations for the Brazilian government and the international community. The intent of these recommendations is to preserve the tropical rain forests of the Amazon, while promoting economic development for the region.

This thesis is a response to environmental groups fears of tropical deforestation and its global consequences. It was intended to review the current situation in the largest existing rain forest of the Amazon, and to reveal alternatives to the current development practices.

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NATIONAL ECONOMIC DEVELOPMENT AND TROPICAL DEFORESTATION IN THE BRAZILIAN AMAZON

Introduction

Countries today are often faced with tensions between national economic development and environmental problems. Tensions arise when development projects adversely effect the environment. An example of this situation is when an industry emits pollution which degrades the quality of air or water. The industry and the clean environment, in this case, appear mutually exclusive. Since industry and clean air or water are desired, ideally there should be an accommodation of both. Likewise, it is desirable to have both economic development and environmental protection.

In Developing Countries one would expect the tension between economic development and the environment to be greater than in Developed Countries. These countries are developing at a rate much faster than the Developed Countries of Europe and North America. The speed of development which was intended to close the gap with industrialized countries has had many adverse consequences. One tendency of rapid development is the priority for economic development and a disregard for the environment. An example of this occurrence is in the largest South American country of Brazil.

Brazil is often referred to as a "newly industrialized" country, ranking it somewhere between the traditional Developing Country and the Developed Countries of today. While Brazil has many problems typical of Developing Countries, it also has some responsibilities of a large relatively developed country. Some of Brazil's problems include a large population that is poor, inadequate income distribution, a high inflation rate and a huge foreign debt. Despite these indicators, Brazil has a very productive industrial sector which is competitive with the rest of the world. Brazil has more economic potential than most developing countries, due to its abundance of natural resources.

Brazil was considered an "economic miracle" in 1970, when the growth rate reached 10%. When the oil crisis hit in the early 1970's Brazil pushed for economic development to maintain the high growth rate. The early 1970's represents the most environmentally destructive period for the Brazilian Amazon. There is strong evidence that the Brazilian government sought to unload many of Brazil's problems in the large expanse of the Amazon.

Brazil's development goal in the 1970's was to raise the Gross National Product through various industrial and agricultural investments. Many investments were encouraged in the Amazon rain forest because the government sought to occupy to the relatively unpopulated area. While the Amazon makes up over 50% of the country, it had only 4% of the population in 1960 (Stone, 1985:84). The Amazon also attracted attention because of

its enormous wealth potential in valuable hardwoods, minerals and hydroelectric power.

An interesting aspect of Brazil's development in the Amazon is the far reaching effects on the environment. Recently the rate of tropical deforestation in the world was estimated at 11 million hectares a year (Environment, 1986). The implications of the current rate are that rain forests will be destroyed by the year 2000. The Amazon is the largest, most diverse and least explored rain forest existing today. For these reasons the Amazon is the focus of many groups interested in preserving rain forests.

My interest in the Amazon emerged from recent concerns about the global consequences of tropical deforestation.
My original intention was to explore the causes of deforestation and promote the need for protecting tropical rain forests from development. However, my position shifted from that for protectionism to that for sustained development. Sustained development opts for a better trade-off between the Brazilian priority of economic development and the need for environmental protection.

The shift in my position towards sustained development emerged from the situation of Brazil as a Developing Country. Brazil's priority for economic development is vested in the social, political and economic situation of the country. The need to catch up to the Developed Countries makes economic development Brazil's fundamental goal. Just as Europe and North

America exploited their environments in the early days of development, Brazil and other Developing Countries are doing the same now. In Developing Countries, the immediate need for social, political and economic stability appears to outweigh the long-term benefits of a stable ecosystem. After reviewing Brazil's priority for development it seems unlikely that the government will discontinue development in the Amazon.

Presently there appears to be an incongruity between the government's objectives for economic development and the results of the Amazonian projects. The government devised a program to integrate the Amazon to encourage national economic development. In order to contribute to economic development the projects would need to provide sufficient economic benefits. However, the various projects in the program have poor prospects of ever being economically successful. Not only do the projects provide little in the way of economic development, they may even cause an impoverished situation to arise in the Amazon.

Instead of encouraging progress and self-sufficiency an impoverished situation encourages dependency on another region. Other characteristics of an impoverished situation include extracting from the region without adequate reinvestment and the failure of the local economy to provide for the inhabitants beyond a subsistence level.

My hypothesis is that many of the current development practices in the Amazon are harmful to the environment and are not sustainable over time. The implications of unsustainable

development are that the country will not attain national economic development through the current type of development in the Amazon. Rather, an impoverished situation will arise where the benefits of the region flow outside of the Amazon.

To illustrate and prove my hypothesis the next section will focus on:

-The global environmental consequences of tropical deforestation.

-Policies to develop the Amazon

-Objectives in developing the Amazon

-An evaluation of current development practices

-International actors that influence development in the Amazon

-Recommendations for Amazonian development

The first chapter focuses on the rain forest ecosystem and the global consequences of deforestation. It is important to understand the potential for developing in the rain forest, and the repercussions if the resource is depleted.

The second chapter examines the policies to develop the Amazon. The government's goals for development are reviewed, as are the results of the Program for National Integration. The second chapter builds on the rain forest potential described in chapter one.

The third chapter illustrates some ideal objectives in developing in the Amazon rain forest to avoid an impoverished situation. The fourth chapter provides a closer examination of some specific land uses in the Amazon according to the objectives

given in the third chapter.

Chapter five explains the influence of international actors on the development process in the Brazilian Amazon. The influence from international actors is likely to contribute to sustained development in the future due to recent movements from environmental groups.

The final chapter gives recommendations for the Brazilian government and the international community to stimulate more sustained development rather than exploitative development.

Chapter I. ENVIRONMENTAL CONSEQUENCES OF TROPICAL DEFORESTATION

This chapter will discuss the global environmental consequences of destroying the Amazonian rain forest. The chapter includes:

-Introduction and Description of Tropical Rain Forests

-The Loss of Species

-The Build-up of Carbon in the Atmosphere

-The Desertification of the Land

-Chapter Summary and Conclusions

1.1. Introduction and Description of Rain forests

Most development projects in the Amazon result in tropical deforestation. Deforestation is the destruction of the forest canopy, by cutting down the trees. The tropical rain forests of the Amazon are a specific type of forest found in the tropical equatorial regions of the world. Rain forests refer to a particular forest which receives at least 100 inches of rain annually (Forsythe, 1985:12). It is this type of forest that makes up a large part of the Amazon.

Rain forests have one of the worlds most delicate and interdependent ecosystems, which are very susceptible to destruction. While the forest appears lush and abundant in flora and fauna, actually there is intense competition amongst organisms for nutrients within the forest ecosystem. This environment is very easily disrupted during development practices which upset the nutrient cycle of the ecosystem. An example of this disruption is when farmers cut the forest for crops, and a major problem of pests results. Malaria in particular becomes a very serious problem in new settlements. Mosquitos and other pests occur when the previous diversity of the forest is cut for a mono crop. The forest regulates its pests by having predators to feed on the pests and keep their numbers down. Often these predators are birds or other larger animals which can be kept out of an agricultural environment. The result is the loss of natures regulating device, and a major problem for farmers (Tropical Nature, 1985).

An important aspect of rain forests is the infertility of the soil. When the forest is cut, about 80% of the nutrients are lost forever (Stone,1985). Rain forests are said to have the most biological diversity of any ecosystem (Forsythe, 1985). Since the Amazon has the largest existing rain forest, it attracts the attention of many organizations interested in preserving this environment. Recently the extent of tropical deforestation has reached such high proportions that the issue has inspired international concern. The United Nations Food and Agriculture Organization (FAO), estimates that 7.5 million hectares of closed forest and 3.8 million hectares of open forest are cut each year (Environment, 1986:57). At the current rate tropical forests will be depleted in 20 years (Environment, 1986:57). This ominous prediction along with the resulting environmental problems of species loss, carbon build-up and desertification have inspired many interest groups to become involved with the tropical deforestation issue. This chapter will review some of the global consequences of Amazonian deforestation which include; species loss, carbon buildup, and desertification.

1.2. The Loss of Species

Rain forests are the most diverse ecosystem in the world. They are also one of the most unexplored. There is only about 5% of all the fauna and flora of rain forests recorded by modern man (Environment, 1986:57). Of an estimated 5-10 million plant,

insect and animal species in the world, 1 million ar found in the Amazon basin (Time, 1986:50). The Amazon river contains about 2,500 species of fish, which is ten times the variety in the Mississippi River (Time, 1986:50).

Species loss as a result of excessive deforestation has been called "the greatest biological calamity this world has ever known" (Environment, 1986:56). Rain forests are referred to as a "genetic reservoir" by Oldfield (Stone, 1985). Harvard sociobiologist E.O. Wilson has said the destruction of the Amazon would be a greater disaster than "energy depletion, economic collapse, limited nuclear war, or conquest by a totalitarian government" (Stone, 1987:151). The genetic damage done to the world as result of tropical deforestation would take millions of years to rectify (Environment, 1986). Much of modern medicine and pharmaceutical cures are found in rain forest flora. The American Cancer Institute has stated that "the loss of tropical rain forest would have serious negative ramifications in their research (Tropical Nature, 1985:211). Some modern medicines from the tropics include digitalis, curare and ephedrine. The rain forest also contain the ancestors to many if the species of plant used in todays food staples like maize and rice. These are only indications for the vast potential of this ecosystem. It is not just the loss of species we are familiar with today, but the ones we have not been able to discover yet that may cure diseases we have not yet experienced. It is precisely that the world is changing and new diseases may surface at any time. The

squandering of the rain forests denies us of our genetic stock which may supply a cure for future diseases or food crises.

The loss of species is most important to scientists of all fields who study natural biology, and who depend on the knowledge of nature for their own research. The knowledge gained through scientists is then related to the rest of the world in the form of medicines, food and industrial products. Some of the important industrial products found in rain forests are rubber, turpentine, rattan, jute, kapok, bamboo, and cellulose for rayon and plastics. Other valuable products include hardwoods like mahogany, teak, ebony and ironwood. Valuable minerals include, copper, nickel, manganese, and gold.

1.3. The Build-up of Carbon in the Atmosphere

Carbon is mainly produced by industry and motor vehicles, but is increasingly exacerbated by the burning of tropical forests. Rain forests have enormous stores of carbon dioxide. When the forests are cut or burned, the carbon that is stored in the biomass is released into the atmosphere (Stone, 1985:153). The rain forest has two roles in the carbon problem; The first is the production of carbon from burning the rain forest, and the second is the declining amount of forests to absorb carbon monoxide which is produced by fossil fuels.

The resulting carbon buildup is believed to contribute to the "greenhouse effect", which is the global heating of the earth. The increased level of carbon in the atmosphere upsets

the heat regulating system of the earths ecosystem. Carbon dioxide traps the sun's radiated heat in the earth's atmosphere, causing the temperature to rise, which could melt some of the polar ice cap. Tropical biologist Thomas Lovejoy estimated that the destruction of the rain forests could increase the earths temperature between 3 and 5 degrees (Time, 1983:49). Widespread flooding would result and the present climatic conditions would significantly alter. Much of the fertile lowlands around the world would become inundated.

An example of the magnitude of forest burning in the Amazon quoted from Thomas Lovejoy, "to clear immense tract of Amazon jungle, developers have set fires that produced so much smoke that airports 100 miles away were forced to shut down due to lack of visibility" (Time, 1983:49).

It is important to note that the carbon buildup issue is under much debate amongst scientists. It is generally agreed that the disappearance of the rain forest would contribute to a buildup of carbon. But there is no consensus as to the extent of destruction to the earths ecosystem. In 1983 the U.S. Environmental Protection Agency (EPA) issued a warning about the resulting carbon buildup from tropical deforestation and the possibility of the "greenhouse effect." In this report, the EPA estimated significantly warmer temperatures before the end of the century (Stone, 1985:152).

1.4. Desertification of the Land

The problem of desertification is a very serious result of deforestation. Desertification is the process that gives the deforested area characteristics of a desert. According to Lovejoy, half of the Amazon's rainfall is generated by the forest itself (Time, 1983:49). When the forest is cut the rainfall in the area is dramatically reduced. The scientific process is transpiration, which is the exuding of water vapor. When the rain forest is cut there is less rain, which results in a dryer climate (Time, 1983). Simultaneously, the enzymes in the soil cause it to become hard and unyielding if exposed to direct sunlight. The tropical forest canopy is so thick that direct sunlight almost never hits the soil. Tropical rain forests have characteristically thin topsoil and at least a few centimeters of decaying leaf and vegetation matter that keep the soil from washing away. When this decaying matter is removed along with the forest canopy, only the thin topsoil is left. The top soil is easily lost in wind or rain, resulting in the loss of the few remaining nutrients.

The process of cutting the forest and exposing the earth results in the drying of the soil, and the loss of rain follows. "If too much forest is lost, at some point there will be an irreversible drying trend" (Time, 1983). The overall and eventual effect is a desert condition of the area which was once a fertile rain forest.

Another result of this process is that it effects the

existing forest, and not just the areas that are actually cut. The loss of rain from the cut forest would result in an overall loss of rain for the region. Lovejoy and other scientists believe the dryer climate in the Amazon could have far reaching effects even outside of the Amazon region. The drying of the Amazon region would have a significant impact on the world ecosystem because of its huge size. According to Lovejoy, this could encourage the drying of the entire equatorial zone, which would tend to push the temperate zone further north, and shift the grain-growing belt in the U.S. into Canada (Time, 1983).

1.5. Chapter Summary and Conclusions

In summarizing the environmental consequences of Amazonian deforestation, it is important to remember the diversity of flora and fauna of the Amazon alone makes up 10-20% of the world's supply. Besides the abundance of species, there is incredible wealth in tropical hardwoods, industrial products, modern medicines, food, and minerals. Equally important to remember is that the huge size of the Amazon heavily contributes to regulating the world ecosystem. The implications of these factors are that if the Amazon is deforested scientists would be deprived of a huge natural gene pool which could be used in medicinal cures, industrial products and genes for food sources among others. Another implication of Amazonian deforestation is the contribution to the "greenhouse effect" where the carbon build up heats the earth's temperature and melts the polar ice

cap. The consequences would include widespread flooding in the world's lowlands. Finally, the cutting of the Amazon forests would result in a major loss of rain for the region, and possibly for the entire equatorial region. The drying of this zone would shift temperate climates further north, and alter the land productivity around the world.

Tropical forests are easy to damage or destroy because of the extreme interdependency and competition for resources. A critical factor in rain forests is the carrying capacity, which refers to the ability of the land and the resources to adequately sustain organisms. Despite the abundance of vegetation, the nutrients which nourish plants and animals are very scarce in the rain forest. There are many organisms competing for the few nutrients in the forest. If the number of organisms becomes too high the nutrients and other foodstuffs will not be able to sustain the organisms and result in species loss. The concept of carrying capacity is very important in rain forests because of the interdependence of the ecosystem.

Currently there are experiments about the "critical size" of forest left intact which is needed to sustain the organisms in the rain forest (Stone,1985). Biologists and other scientists are testing the smallest amount of forest left intact without species loss or an overburdened carrying capacity. The problem is not only the deforested area, but also the surrounding areas which must absorb the displaced organisms. When part of the forest the organisms which are able (including insects) often try

to flee to the remaining forest. While the critical size experiments might prevent species loss, they will do little to combat the carbon buildup and desertification if a sufficient amount of forest is not preserved.

The implications for development in this type of ecosystem are limited. The soil is easily exhausted in agricultural schemes, and there is little potential for regeneration once the land is destroyed. Therefore when devising development schemes it is important to prevent extremely destructive practices that will ruin the potential of the land forever.

Chapter 2. POLICIES TO DEVELOP THE AMAZON

This chapter will focus on the major policies and the process of developing the Brazilian Amazon in the past twenty years. The Brazilian government's development policies reflect the priority of the government for national economic development. The implications of the following policies are that the environment of the Amazon was of little concern to the government. The chapter outline includes:

- -Chapter Introduction
- -The Beginnings of the Development Impulse
- -The Program for National Integration
    - -National Security
    - -National Growth
    - -Population Redistribution
- -The Shortcomings of the National Integration Program

2.1. Chapter Introduction

The political situation of Brazil has had a fundamental influence in determining the development path of the country. From 1964-1985 the military governed Brazil. Before the military took control, economic instability was apparent in the soaring inflation rate. While the military government was not threatened by a revolution in the country, it occupied an insecure position because it lacked the popular support of the country. It therefore followed policies to reinforce its power.

This chapter is primarily focusing on the past military regime because of its development push into the Amazon. One characteristic of the military government was top down planning, where policies were dictated from above to the rest of the people. This government in particular was widely criticized for its lack of planning for the poor. It also followed policies which reinforced its own strength. The movement into the Amazon was an attempt to exert power over this previously detached region, and bring in revenues from the abundant natural resources. At the same time, the government channeled some of its problems into the relatively unpopulated area. One problem in particular was Brazil's large poor population, especially in the northeast. Rather than confront the income distribution problems of the country, the government sought to shuffle the poor into the Amazon region, which was used as a "safety valve" for the overflow people from the major urban areas. This government viewed the Amazon as a vehicle for reinforcing its own

power, and for relieving its problems.

2.2. Beginnings of the Development Impulse

The development impulse began with the first military president Castello Branco in 1965 initiated "operation Amazonia" (Stone, 1985:85). During this period the Amazon was behind the national average in income, education, health, among others. The planners began to think about exploiting the Amazon's potential in traditional uses like agriculture and cattle grazing (Stone, 1985:85). An old agency was re-established and renamed the Superintendency for the Development of Amazonia (SUDAM). SUDAM issued tax incentives and easy credit for agriculture, pasture and industry. This organization also encouraged "poles of development" around the Amazon basin in one of the first attempts to occupy the forest. Another attempt to revitalize the Amazon was to establish Manaus as a free-trade zone to encourage export-oriented industries in the basin. The late 60's also witnessed the completion of the Belem-Brasilia Highway which opened up the previously unoccupied region of Rondonia. Initially in "Operation Amazonia" the intention was to encourage foreign capital into the Amazon. However, later the government became wary of foreign investment and the potential for excessive profits sent abroad and the government no longer encouraged large foreign projects like D.K. Ludwig's Jari (to be expanded later).

After the creation of SUDAM and the initial push into the Amazon, President Emilio Garrastazu Medici intensified efforts to

utilize the Amazon. Medici devised the Program for National Integration (PIN) to integrate the Amazon region with the rest of Brazil. For this program a new government agency for colonization was created, INCRA (the National Institute for Colonization). PIN represents the most comprehensive plan to colonize and utilize the natural resources of the Amazon. PIN is the basis for this examination of environmentally destructive policies in the Brazilian Amazon.

2.3. Program of National Integration

The Program of National Integration was developed by the military government in 1970. The main motivations of the program was to integrate the Amazon region with the rest of Brazil were; National Security, national growth, and population distribution.

2.3.1. National Security

National Security was a large concern for the Military government of Brazil. The main problem with the Amazon region is the immense area, and lack of substantial population (only 4% of total). The Amazon shares its borders with eight countries that might potentially be interested in extending their own borders into Brazil. Historically, there has been a fear in Brazil that if Brazil did not develop the region, some other country or organization else would. These fears stimulated the government to develop the Amazon as soon as possible. The Brazilian government encouraged development in PIN from organizations that

supported the government. This extended the rule of the government deep into the region, and discouraged invaders from other countries.

PIN incorporated a network of roads and settlements throughout the forest to occupy previously unpopulated areas, and discourage any bordering countries from closing into Brazil's territory. Many towns were strategically placed along insecure boarders. The town of Porto Velho was placed very close to the problematic Bolivian boarder. Many people were crossing into Brazil from Bolivia to escape the economic woes of that country.

2.3.2. National Growth

Another reason for the Program for National Integration was to feed Brazil's 10% growth rate of Brazil which has been called the "Brazilian Miracle" (Smith, 1981:755). In the 1970's the oil crisis cut deeply into Brazil's profits because it imported 70% of their oil (Stone, 1985:90). Brazil began to go deeply into debt at this time, and the PIN was intended to further stimulate the domestic economy. Under PIN, SUDAM encouraged large scale development projects like cattle grazing, agriculture and mining (Stone, 1985:90). Famous projects like D.K. Ludwig's Jari, were aided by the government through generous subsidies which made the initial rent on the land negligible. Brazil encouraged foreign investment because the government did not have sufficient capital to invest in such projects itself.

In the history of the Amazon, there have been great booms

and busts. The rubber boom of the early 1900's brought in an incredible revenue. For a while the world saw the future in rubber, and at the time Brazil's Amazon was the only place to get the valuable product. Unfortunately this followed with a bust period, when rubber was more efficiently managed in Malaysia. However, this experience of sudden wealth is still in the minds of the Brazilians, as they view the incredible potential for wealth in the Amazon. The military government intended to capitalize on the prospects of sudden wealth in some of the larger projects in the Amazon.

2.3.3. Population Redistribution

One characteristic of Brazil is its great regional diversity. Brazil's Northeast is a region with 30 million inhabitants, which has annual increase of 1 million people. At this time the Northeast represented 30% of Brazil's total population but only 13% of the gross product (Stone, 1985:88). The World Bank listed 70% of the inhabitants of the Northeast to be poor (World Bank Country Study, 1985). In 1970 this area was hit by one of the severest droughts in the history of the area. This uprooted about 3 million people from the region, and prompted the government to devise a solution for the problem (Smith, 1981:755). The government offered land in the Amazon to relieve the population pressure and the dissatisfaction with government policies in the Northeast.

The Program for National Integration incorporated a variety

of networks to increase access into the region, and facilitate the exploitation of the natural resources. The networks were telecommunications, roadworks, and settlement schemes.

Telecommunications networks were a major focus in the integration scheme. Establishing communications was done through satellite and surface projects to reach the inhabitants of the Amazon. The tendency in the Amazon to disassociate the life in the jungle with the National identity, gave the national government incentive to develop better communications and transfer of information. Presumably this would increase national awareness and national support.

Roads were another form of network in the Amazon. The most notable roadworks are the Transamazon Highway and the Belem-Brazilia Highway. These huge road projects literally cut through the heart of the jungle to pave the way for access into the region.

Settlements often accompanied the building of roads under PIN. A variety of settlements were established; small peasant farmers, corporations, towns and even larger urban developments. Along the Transamazon Highway, peasants were offered 100 hectare lots of land and subsidies to settle near the highway. A huge movement to induce peasants to settle in Amazonia was established under the program. The peasants were targeted from the Northeast of Brazil plagued by the harsh drought, unemployment, and poverty far worse than the conditions of the south of the country. In this way the Amazon was used as a safety valve to relieve the

problems of a particular area.

The significance of the Program for National Integration is that it is the most recent comprehensive attempt to populate the Region. While there has been a history of exploitation of the natural and human resources in the Amazon, never has the attempt been so ambitious. However, this is not to say that the project was successful in its attempt. In fact, it is argued by many that the project was a failure (Smith, 1981).

2.4. Shortcomings of the Program for National Integration

The goal of the PIN to improve access into the Amazon through networks has been effective to a large extent. However, the results were far below expected. The shortcomings were mainly found in the road networks, and the induced settlements.

The road projects in the Amazon represent a very ambitious plan to open up the jungle, and provide access into previously uninhabited areas (except by indigenous peoples). However, most of these projects were plagued with many problems from the inappropriateness of projects to the environment, to the inadequate implementation of the projects.

Before the roads were set up in the Amazon, most transport was done by river. One reason for this is the difficulty of developing in the dense rain forest. Even today the highways are unpredictable in the rainy season. They suffer from severe runoff from the enormous amount of rain in the region, and from lack of services along the way, and sometimes from bandits or

hostile Indians. The most ambitious project, the Transamazon Highway is still a dirt road, even though it was begun in 1975 (Smith, 1981:214). Much of the road has even been reclaimed by the jungle (Smith, 1981).

Haste in implementing PIN led to waste on a massive scale. The Transamazon Highway was conceived and planned in 10 days (Kelly, 1983:73). Of the 100,000 families that were supposed to be placed along the Highway in the first five years, only 5,717 had settled in the first three years (Fearnside, 1982:49), and only about 8,000 had actually moved in by 1976 (Kelly, 1983:73).

Since the settlements often went hand in hand with the roads, it is not surprising that they fell short of the original expectations as well. The main goal of providing space for the poor Northeasterners was far short of the original plan. When the word was out about free land, peasants rushed into the Amazon from all over the country. Three quarters of the inhabitants were supposed to be from the Northeast, but only about 40% actually came from that region. The Transamazon project only absorbed about 1% of the growing population of the Northeast which grew 6% annually (Smith, 1981), thus failing to relieve the demographic pressures.

Besides failing to attract more settlers, the program did not prepare the peasants for the harsh conditions of the tropical rain forest. The responsibility of agricultural training was supposed to fall under INCRA's jurisdiction, but this was never done (Fearnside, 1982:49). There was no assistance program to

teach them how to cultivate the land, or deal with the pest problems. While some failed and moved back, others devised ways of planting in order to survive. The most common way to plant in the rain forest was through swidden agriculture or slash/burn. The farmers who used this ancient method to farm had to use large tracts of the forest. The method necessitated moving from one field to another every 2 or 3 years when the soil became exhausted. Not only does the method rarely provide beyond a subsistence level, it is extremely harmful to the environment.

Other problems with the settlements include health and land tenure. Currently, malaria is the largest health problem in the Amazon (Smith, 1985). Another problem was the inefficient land tenure system. Much of the land in the area has more than one owner in writing. In the fastest growing frontier Rondonia, the disputes over land are a dangerous situation for the inhabitants (Smith, 1985).

Another goal of the highway and settlement schemes to pave the way for future resource exploitation has only been partially realized. While some of the more recent projects in the Amazon have proved more successful, the disproportionate amount of failures brings a serious question to mind about the appropriateness of the tropical rain forest for large scale development projects. Unless the projects are specifically suited for rain forest conditions.

In short, the Program for National Integration failed in many ways. The roads and the settlement schemes were plagued

with problems. The roads invaded Indian lands, and disrupted lives in the area. Not only did the roads cause havoc and create waste, but the projects failed to provide a reliable mode of transport even to this day. The settlement schemes did generate many settlers, but not from the area of critical need. Another problem with the settlement schemes were with the type of land use of the peasants or the corporations which settled in the area.

The lack of knowledge about the rain forest resulted in extreme waste in the resources, and many failed development attempts. This was apparent with the small peasants, as well as with the large projects. Many of the peasants who migrated were not familiar with the difficulties of farming in a rain forest, and there was no assistance to instruct them in effective ways to manage their farm. Besides the infertile land which barely produced two crops, the constant plague of insects and diseases, including malaria, continually wiped out small farm initiatives.

The larger projects had different problems with the development of the Amazon. Some notable failures include huge agricultural projects which attempted to cultivate the forest with a single crop. Perhaps the grandest example of this is D.K. Ludwig's Jari.

Ludwig foresaw a worldwide pulp shortage, and mixed stands of native trees with a fast maturing Asian import, the gmelina, onto a plot of rain forest the size of connecticut. This was the largest attempt at mono culture (single crop), which ended with

200,000 dollars per day losses. The loses resulted from a combination of pests, and the weakened strain of timber. Ludwig sold off his project for $280 million to the Brazilians, who are now trying to find ways to make Jari profitable (Kelly,1983:76).

Other large scale attempts to develop the Amazon by private corporations include cattle grazing, agriculture and mining. Some of the greatest failures in agriculture resulted from the misconception of the interdependence of the ecosystem, including the infertility of the soil, and the abundance of pests which are extremely harmful to mono crops, and agriculturalists.

Chapter 3. OBJECTIVES IN DEVELOPING THE AMAZON

Chapter three will review some of the basic objectives for development in the Amazon. These objectives opt for sustained development in the rain forest. Various development projects will later be evaluated according to the objectives listed.

- -Chapter Introduction
- -Development Objectives
    - -Agronomic Sustainability
    - -Unsubsidized Economic Competitiveness
    - -Self-sufficiency
    - -Minimal Effect on other Resources
    - -Minimal Macro-ecological Effects
    - -Social Goals
    - -Maintenance of Areas for other Uses
    - -Maintenance of Development Options
- -Implementing Development Objectives

3.1. Chapter Introduction

After discussing the shortcomings of development initiatives in the Amazon, in particular those embodied in the Program of National Integration, this chapter will review some of the objectives for development and some alternatives to the current land uses. While the objectives of PIN were stated previously for the national security, national growth and population distribution, this chapter will review some goals that should be considered when developing an area such as the Amazon. The basic considerations of the government in developing the Amazon should be to benefit the present and future generations of people in the Amazon region, including all levels of society, even the Amerindians.

The first issue of preserving the rain forest for future generations has been underplayed in the frenzy for development in the Amazon. Only recently have areas in the forest been put aside for future use or nonuse. Without preserved areas the forest is squandered without adequate record. In order to preserve areas for future generations, it is necessary to divide the forest into areas for different uses.

The second issue involves many of the past development schemes which have benefited people from other regions, while doing little for those from the Amazon. The settlement schemes were designed to attract the excess population of the Northeast and other overcrowded urban areas. Many of the corporations are either foreign or based out of Sao Paulo. The benefits therefore

go to the south of the country, or to another country. By allowing the Amazon to be the dumping ground for Brazil's problems, as well as available for foreign exploitation, an underdeveloped situation has occurred in the Amazon. The economy in the Amazon is exploitative, based on what can be taken from the region, with little thought as to what should be put back or invested into the region. The resulting situation is an unequal exchange for the Amazon region, in favor of the other parts of Brazil and foreign countries (Bunker, 1985:69). The development of the Amazon should be devised by people of the region for the benefit of the region. People from the region have a vested interest in the decision-making. Most likely these people will see it is in their best interest to conserve the forest resources. If the decisions are made in another part of the country, there are bound to be differences between the two regions. Presently the decision-making is done in Brasilia, yet there is relatively little idea of what the concerns are in the Amazon region. Few decision-makers make it a point to extensively research the Amazon, or consult with Amazonian experts in INPA (Instituto de Pesquisas da Amazonia).

3.2. Development Objectives

A few conditions that should be keep in mind when planning development in the Amazon are to maintain the human population below the carrying capacity, limit the total consumption of the forest and limit the concentration of land holdings (Fearnside,

1982:65). Dr. Philip Fearnside a tropical scientist at INPA incorporated these conditions in his recommendations for development objectives; agronomic sustainability, unsubsidized economic competitiveness, self-sufficiency, minimal effects on other resources, minimal macro-ecological effects, fulfillment of social goals and maintenance of areas for other uses and maintenance of development options (Fearnside, 1982:65). These objectives in development in the Amazon are the ideal to strive for. This chapter will explain each objective, and then review some of the current development uses according to these objectives.

3.2.1. Agronomic Sustainability

When developing part of the rain forest, agronomic sustainability requires an adequate balance of nutrients to be left in the ecosystem (Fearnside, 1982:65). Agronomy is defined as "a branch of agriculture dealing with field-crop production and soil management" (Webster's Dictionary, 1973). This involves the continual productivity of the land and compensating the soil when losses occur due to soil erosion and leaching. To comply with this objective the problem of pest control with mono-crops would have to be kept to a minimum. The pest problem indicates an imbalance in the ecosystem. The natural forest usually manages pests and other agricultural annoyances, but when the forest is converted to another use the natural predators may not survive to keep the pests to a minimum. The imbalance of the

ecosystem is a sign of low agronomic sustainability. To sustain the agronomic productivity in agriculture and cattle grazing the soil productivity would need to be maintained by preventing the soil from becoming compacted and by fertilizing the soil.

3.2.2. Unsubsidized Economic Competitiveness

Unsubsidized economic competitiveness would prohibit subsidies and tax write-offs as incentives to develop in the Amazon. The previous subsidies for large and small-scale development would be discontinued. This would show the true cost of developing the forest. While many developments were originally encouraged in the rain forest through subsidies, the conditions are less than ideal. This system would discourage those who are attracted to the free land and not particularly the rain forest environment. The World Bank recently estimated that the cost of developing the Amazon is about 40% higher than in other parts of the country because of high transportation costs, and the need to import basic food-stuffs and everyday commodities (Stone, 1985:156).

3.2.3. Self-Sufficiency

To strive for the maximum self-sufficiency in the Amazon would decrease its vulnerability from exports abroad and from other parts of the country. Self-sufficiency is not to be confused with isolationism or protectionism. Rather, it is building up the economy from the inside without excessive

external dependence. The implication here is that the production in the Amazon would include food and other basic products needed for the population to survive.

3.2.4. Minimal Effects on Other Resources

Effects on other resources includes air and water pollution from development projects. If an industry was polluting the water and causing harm to the fish, the industry would be subject to halt the activity or clean it up.

3.2.5. Minimal Macro-Ecological Effects

The macro-ecological effects are the maintenance of species diversity, and preservation of climatic conditions as stated in chapter 1. Species loss, carbon build-up and desertification should be considered in the master plan of development in the Amazon, and in each individual project.

3.2.6. Fulfilling Social Goals

Social goals for Amazonia encourage a minimum standard of living and adequate income distribution. The minimum standard of living would have to be measured by some criteria (to be determined) which would help people to live above a subsistence level. An adequate income distribution would discourage excessive profits of corporations and large land-owners, and encourage more equitable projects. To encourage social goals projects that provide a lot of jobs on a stable basis are desired

over those that provide a few jobs for a short period of time.

3.2.7. Maintenance of Areas for Other Uses

Other uses in this case refer to surrounding areas that are designated for other uses. Often the lands reserved for Amerindians or for forest study are invaded by the neighboring projects. These lands would have to be protected without the stipulations that currently plague reservation lands. Currently the government can repossess reserved land for the national security or national development of the country. Under this system the government would not be allowed to take back land or build on reserved land, as it did for the Transamazon Highway.

3.2.8. Maintenance of Development Options

Maintaining development options preserves the land for future uses. If the forest is cut and the soil is allowed to harden, there is little chance of future use without reconstructive work on the soil through irrigation or fertilization. This objective would discriminate against development uses that are extremely harmful to the environment and which prevent future uses.

3.3. Implementing Development Objectives

The nine ideal objectives would have to be established and implemented through a governing body based in the Amazon. However, establishing this governing body in Brazil would be no

easy task because of Brazil's highly centralized structure. While there is representation from the states of Amazonia and Para (another state with area in the Amazon), these states are not very powerful in the union. They are often overshadowed by the south and central of the country which have enormous industrial power and wealth. Another difficulty is to deal with problems in the Amazon that the entire country of Brazil has not been able to deal with adequately. Two of these problems are improving income distribution and the standard of living of the inhabitants. Another problem is minimizing pollution. The wealthiest and most powerful city Sao Paulo suffers from excessive pollution, which so far not been able to do very much about. However, these objectives are what projects should strive for in the Amazon, and there should be enforcement of rules pertaining to development. To implement these objectives the present government in the Amazon would have to take the responsibility of determining development out of the hands of decision-makers in Brasilia. The next chapter will review some current uses in the rain forest according to these objectives.

Chapter 4. EVALUATING DEVELOPMENT PRACTICES

Chapter four will evaluate some of the current development practices in the Amazon according to the objectives from the previous chapter.

-Chapter Introduction

-Cattle Ranching in the Rain Forest

-Agricultural or Harvesting in the Rain Forest

  -Shelterwood Forestry

  -Silviculture

  -Clearcutting

  -Shifting Agriculture

-Table 1: Comparison of Development Options for Terre Firme

-Chapter Conclusions

4.1. Chapter Introduction

Some of the current development projects mentioned in this paper involve cattle ranching and various types of agriculture. This chapter will examine these development types while keeping in mind the nine objectives recommended by Fearnside. The types of uses are evaluated according to their appropriateness to the terre firme soil of the Amazon rain forest. Terre firme makes up about 98% of the soil in the Amazon (Stone, 1985:27). Terre firme refers to the very poor nutrient deficient soils of most rain forests (Stone, 1985:27). The following development uses have been evaluated according the Fearnside's criteria and with the soil potential (or lack of potential) in mind; cattle ranching, shelterwood forestry, silviculture, clearcutting and shifting agriculture.

4.2. Cattle Ranching in the Rain Forest

In the 1970's the Program for National Integration encouraged cattle ranching as a use for the Amazon. There are basically two kinds of cattle ranching, one using fertilizer and the other without fertilizer. Cattle ranching with fertilizer is potentially sustainable over time. This topic is being heavily researched by the PROPASTO (Pasture Program) section of EMBRAPA (Brazilian Enterprise for Agriculture and Cattle Ranching Research) (Fearnside, 1982:74). Fertilization is only one requirement for the sustained productivity of the soil. During grazing the soil becomes compacted, which can retard pasture

growth. Therefore, the amount of cattle would have to be monitored to prevent over grazing (Fearnside, 1982:74).

Cattle grazing with fertilizer is not economically practical because the fertilizer is very expensive and is usually subsidized. In terms of unsubsidized economic competitiveness, cattle grazing with fertilizer is rarely done because the land is inexpensive and the fertilizer is expensive. It has been more economical in the past to buy more land than to invest in fertilizer.

> "Solving fertility and other problems requires substantial cash inputs on part of ranchers, if not paid for by government subsidies. The question of sustainability is an economic one."
>
> (Fearnside, 1982:75)

Another problem with cattle ranching is the lack of self-sufficiency. Cattle ranching does not provide the basic foodstuffs to contribute to the Amazon's self-sufficiency. Rather it provides the meat for export abroad or for the southern urban areas. Simultaneously, cattle ranching does very little to further social goals. Ranching requires little in the way of labor once the forest is cut for grazing. Of 11 ranches along the Belem-Brasilia Highway totaling 216,685 hectares, only 275 jobs had been created in all catagories from laborers to managers (Hebette and Acevedo, 1979:140). This equals approximately one job for every 778 hectares.

Cattle ranching has also posed a serious threat to neighboring uses. There have been many cases where cattle have

moved into the neighboring areas which are protected for Amerindians or for research. One example of this was in 1978 when a ranching project moved its boarders into SUDAM's forestry reserve near Santarem (Rankin and Fearnside, 1978:75). Again the danger of expansion into other areas is that the land is easily destroyed and is difficult to restore. Ranching limits regrowth and future use because the soil often becomes compacted and then requires and long fallow period. Another problem with fertilized cattle ranching are the macro-ecological effects. To cut or burn the forest canopy contributes to the carbon problem. If the land is compacted it will cause desertification. Finally, the plant species that previously occupied ranching areas will be cut, burned or eaten. The animal species will either perish or flee to remaining forest cover. It is inevitable that some species will perish in this process, especially if the area is very large.

Cattle ranching without fertilizer is far worse than with fertilizer. Sustainability only lasts a few years, because of leaching and soil erosion. Ranching without fertilizer has all of the other problems of ranching with fertilizer, but it is more destructive to the soil. Pasture use is estimated by Fearnside to have the worst long-term use prospects of all development type, and there is little potential for future use of pasture lands (Fearnside, 1982:76). Due to the economic burden of fertilizer, most cattle projects in the Amazon today are without fertilization.

4.3. Agricultural or Harvesting Uses in the Rain Forest

There are many different types of agricultural uses in the rain forest. A few types to be examined are shelterwood forestry, silviculture, clearcutting and shifting agriculture.

4.3.1. Shelterwood Forestry

Shelterwood forestry is basically selective cutting of trees in the forest. While this is not traditional agriculture, it does involve harvesting the valuable timber in the forest. Experiments with silviculture have been done in Nigeria, and have been going on in SUDAM's forestry experiment station near Santarem in the Amazon since 1963 (Dubois, 1968,1971). Some problems with this method involve enforcement. One requirement of this program is to preserve at least 25 select crop trees to be left per hectare. However, experiments in Nigeria have indicated increased social pressure on the land and the rule has not been enforced (Fearnside, 1982:68). Preserving a few select crops and the inferior tree types, is an attempt to minimize destruction and maintain the forest canopy and the nutrient cycle of the rain forest.

The profits of shelterwood are not as high as more destructive methods. The reason is because selective cutting is as costly or more than clearcutting, and more area must be cut to get the same yield of timber. However, this method is sustainable in the long-term because it does not cause total destruction of the forest. For the same reason, shelterwood also

retains future use potential and avoids macro-ecological effects which result from total deforestation. In advancing social goals, shelterwood requires labor to cut the trees. To be economically and socially efficient the land area must be very large to absorb the labor during the regrowth of the forest (about 20-30 years) (Fearnside, 1982:69).

4.3.2. Silviculture

Silviculture involves removing the forest and planting one or more tree types. Most of the time silvicuture is using one crop otherwise called monoculture or mono-crop. The agronomic sustainability is not very high in the short run because the investment is more than simply cutting from the natural forest. It requires cutting the forest and planting a crop and later harvesting the crop. However, this method has a much higher agronomic sustainability in the long term because it is less destructive to the ecosystem than clearcutting. This method does not retain the original forest canopy like shelterwood, rather it grows an artificial canopy of the new crop. Silviculture does not retain the balance of nutrients in the ecosystem like the original canopy, and has resulted in significant problems with pests. The competitiveness of silviculture is more apparent in the long term because of the large investment involved in the method. But the competitiveness might improve if problems with the ecosystem and pests can be mastered.

Silviculture does require a large amount of labor to cut the

forest, plant and harvest the crops, and therefore satisfies the social goals. Silviculture does not tend to be self-sufficient because of the limited type of products. However, Ludwig's Jari project was experimenting with multiple use to encourage more self-sufficiency in silviculture (Fearnside, Rankin, 1978:329). Silviculture does not tend to effect neighboring uses. In fact silviculture plantations have been used as buffers for reserved areas. The investment of silviculture on the land encourages the farmers to protect the boundaries of the crop, which in turn protect the neighboring uses.

The future use potential of the land is probably intermediate, which is much better than pasture, but not as good as shelterwood. Also the macro-ecological effects are probably intermediate as well. The problems of carbon build-up might still occur, species loss is almost sure to happen, but desertification will probably not occur because the soil is protected from the sun and erosion should be minimized.

4.3.3. Clearcutting

Clearcutting is the complete deforestation of the forest for the timber. This method has very little prospects for agronomic sustainability because it destroys all of the forest canopy which results in the loss of most of the nutrients needed for regrowth. Clearcutting gives a very large profit in the short-term because there are few inputs. But in the long-term this method cannot be sustained due its destructive nature. This method requires

unlimited forests to be cut in order to maintain the system over a long period. There are no inputs into the forest in this method, once the forest is cut a new area is found.

Clearcutting is a not self-sufficient method. It requires food for the loggers and the people of Amazonia to come from outside of the project. Social goals are moderately filled because the process involves only a short period of time. Unless there is an enormous area to be cleared, the workers only do the initial cutting of the forest and are then no longer needed.

Neighboring resources are not usually endangered except for the potential problem of watershed resulting from the loss of the forest canopy. Macro-ecological effects are most serious in clearcutting, because the method results in total deforestation. The problem of carbon build-up, desertification and species loss are most serious in this method of development.

4.3.4. Shifting Cultivation

Shifting cultivation is the most common form of agriculture used by small farmers. Swidden or shifting agriculture involves cutting or burning part of the forest for a harvest and moving to another area once the soil is exhausted (about 2 or 3 harvests). Once the land is harvested it must lay fallow to allow it to repair to become productive again. This method originated from indigenous populations. Shifting cultivation is best used under conditions of low population density while allowing the land to fallow for a sufficient time period. Many of the small farmers

who moved into Amazonia have adopted the swidden method of agriculture. Under the ideal conditions (small area, low population, long fallow) swidden agriculture can be sustainable over time.

In the short-term shifting cultivation is competitive with other uses. In the long-term it is not very competitive because it requires a large amount of land to cultivate to allow the harvested land a long enough fallow period. Shifting cultivation does encourage self-sufficiency, and is practiced by many small farmers to provide for themselves and their families. At the same time social goals are being met because the method is highly labor-intensive. A major drawback of this method is that it rarely provides beyond a subsistence level.

The effects of shifting agriculture on neighboring areas can be substantial if it is not used properly. Many farmers move into the adjacent lands once their lands are exhausted. Because this method requires few inputs it has been very popular with small farmers, which has resulted in the extreme abuse of the method. There is currently a large population using this method (most of the PIN settlers), contrary to the requirement of low population. The large areas that are left fallow are often occupied by squatters (Fearnside, 1982:73), which prevents fallow and contributes to the destruction of the ecosystem.

The potential for future use is limited if the area is large and the fallow period is not long enough. If the area is small the forest can reclaim it over time. But the loss of the forest

cover results in a loss of most of the nutrients which can prevent future uses. Due to the destructive nature, shifting agriculture can substantially contribute to macro-ecological impacts of carbon build-up, desertification and species loss.

The following table created by Philip Fearnside rates the current uses of the rain forest according to his criteria to conserve rain forest resources.

4.4. COMPARISON OF DEVELOPMENT OPTIONS FOR TERRA FIRME

	1.Untouched forest	2.Cattle grazing		3.Shelterwood	4.Silviculture	5.Clear-cutting	6.Shifting agri.
		fertilized	non-fertilized				
Agronomic sustainability:	1	2	3	1	2	3	1-3
Competetiveness without subsidies							
short:	3	3	3	3	2	1	2
long:	?	3	3	1	2	3	2
Self-sufficiency:	-	3	3	3	3	3	1
Macro-ecological effects:	1	3	3	1	2	2	2
Social goals:	1-3	3	3	3	1-3	1-3	1-3
Effects on other lands:	1	3	3	1	2	2	2
Future uses of land:	1	3	3	1	3	3	3

Fearnside: "Alternatives for Development in the Brazilian Amazon" 1983:73.

4.5. Chapter Summary and Conclusions

After comparing some of the current pasture and agricultural uses in the rain forest, it is apparent that some are more destructive than others. Cattle grazing is not only destructive to the rain forest environment, but it is less productive than it would be in the cerrado in the west-central of the country. In fact, there is adequate land in Brazil which is better suited for many uses currently concentrated in the terre firme of the Amazon. The cerrado and the varzea are two such types which have been underutilized.

The cerrado are the savanna lands that border the Amazon. This type of land is considered much better for agriculture and cattle grazing than the terre firme of the Amazon. The latest guidelines by the Amazonian development agency SUDAM has now stressed the use of the cerrado (Stone, 1985:157). Besides the greater productivity of the soil of the cerrado, it has a lower opportunity cost if destroyed, it is better understood and is more resilient than the rain forest (Fearnside, 1984). The west-central of Brazil where the cerrado is located is also closer to the markets to facilitate the transportation of goods.

Another land type which is more agriculturally productive than the terre firme of the rain forest is the varzea. Varzea has a higher fertility level than the nutrient poor soil of terre firme (Fearnside, 1984). The varzeas refers to the productive floodplains along the river banks in the Amazon. This area is the only type of land which is productive in the rain forest,

because nutrients and minerals wash down the river as a result of annual flooding and become lodged in the riverbanks. These lands are good for planting annual crops like rice (Stone, 1985:22).

Other uses of the rain forest including timber and mining have also been encouraged. The rain forest has an abundant supply of valuable tree types. Unfortunately, it is very destructive to extract because one characteristic of rain forests are that the fauna is very dispersed. Thus, to get a particular type of wood, a very large area has to be cut. Shelterwood is one of the least destructive ways to acquire wood, provided the required amount of select trees are left for regeneration. Silviculture has intermediate impacts on the environment compared to more destructive methods like clearcutting. But there is ongoing research to make this a more viable method of development in the Amazon, which may make it more attractive in the future. Clearcutting is the most destructive agricultural use in the rain forest. It requires no inputs except for the extraction of the wood, and it leaves the land with little future potential. Likewise the current use of shifting agriculture is extremely destructive to the rain forest ecosystem. The latter method would be less destructive if it followed the example of indigenous people who have been using the method for thousands of years. Indigenous people keep their populations to a minimum to avoid overburdening the land, and they allow many years fallow.

To understand the underutilization of the varzea and the cerrado land types in favor of using the rain forest terre firme,

one must refer to the original motives for PIN. The development of the Amazon represented a way for the reinforcing the power of the government, and protecting the region from invaders. These are some of the reasons the Amazon has been the target for development, when it is clearly not the most appropriate for many of the projects.

Chapter 5. INTERNATIONAL ACTORS INVOLVED IN DEVELOPING THE AMAZON

This chapter will review the role of the main international actors involved in developing the Amazon. While the previous emphasis of this paper has been on the domestic actors (primarily the Brazilian government) in developing the Amazon, this chapter will illustrate the substantial influence from abroad.

-Chapter Introduction

-Multinationals

-The World Bank

-Environmental Groups

-Chapter Conclusions

5.1. Chapter Introduction

This section of the study will review the major actors who will influence the future development process in the Amazon. For the past 20 years the military government shaped much of the development process in the Amazon in major programs like the Program for National Integration. These two decades were characterized by top-down planning with little input from the bulk of the population. While the Brazilian government has been the largest initiator of development in the Amazon, there have always been other actors involved in the process. Some of the major actors have been multinational corporations, the World Bank, and environmental groups.

5.2. Multinationals

Multinationals are corporations which represent more than one country and typically establish themselves in many different countries. Foreign corporations have been involved in the Brazilian Amazon since the turn of the century. Henry Ford initiated a huge project to produce rubber. Though this project was plagued by many problems and was eventually abandoned, it is just one attempt of foreign companies to extract wealth from the Amazon. Often multinationals are attracted to less-developed countries like Brazil because the costs are less and pollution controls are bellow those of industrialized countries. There is a famous statement by the Brazilian delegation at the Stockholm Conference on the Human Environment in 1972, where a delegate

said "Send us your pollution. We need the jobs." (Stone, 1985:156).

In the past multinationals had a much stronger bargaining position than they enjoy today. Until recently Brazil has encouraged foreign investment, because Brazil was short of capital and technical expertise. During the initiation of PIN, Brazil offered subsidies to foreign companies to settle in the Amazon. However, Brazil has progressed quit far from this period and no longer needs to encourage investment through subsidies and tax write-offs. Now Brazil requires a 30% ownership with foreign companies.

While much of the influence of multinationals on development has eroded, the marks are left in the abandoned lands of Fordlandia (Ford's rubber plantation) and Jari. While Jari has since been taken over by Brazilian investors, the potential for experimental development is still fresh in the mind of Brazilian developers. These early multinationals sought to exploit the Amazon an a huge scale. Initially the Brazilian government invited outside investors, now they invest on their own huge projects. The current Carajas project being done by the Brazilian government is the largest of all projects attempted in the Amazon.

5.3. The World Bank

The World Bank is an international funding and development agency. While the Bank is made up of donors from around the

world, the voting power for loans is weighted according to the size of the donors contribution. The U.S. is the largest contributor, with about a 20% investment (Science, 1986:814). The World Bank was established after World War II for the reconstruction is Europe. As Europe recovered the Bank began to emphasize the development of the Third World. The Bank is currently the largest funding and development agency in the world. The Bank usually grants loans to developing countries for large projects that will contribute to the economic development of that country. The loans are often quite sizable and allow these countries to invest in large projects they would not be able to afford otherwise. For many poor countries, agencies like the World Bank provide the only immediate means for the capital to build large projects. The Bank often has a huge influence on the type of development projects because it makes certain provisions which must be met in order to receive the loan.

In the case of Brazil, the World Bank funded a massive regional development project called Polonoroeste. Basically, this project promoted land-reform and opened up the least populous area of the Amazon for the settlement of poor migrants (Science, 1986:813). Of the total cost of $1.6 billion dollars, the World Bank approved close to half a billion dollars in loans for the project (Science, 1986:814). The project caused massive deforestation that attracted the attention of many environmental groups in the U.S.. Norman Myers, a leading tropical forest expert from Britain, who sometimes works for the World Bank calls

the Polonoroeste project "reprehensible" (Boston Globe,1986, Oct. 5). While the Bank stated that it was aware of the potential for massive deforestation, it still provided the loans for the project. The Bank claimed the "Brazilians were prepared to proceed without the World Bank loans if necessary" (Science, 1986:814).

The importance of reviewing World Bank projects lies in their influence and example for other international agencies and countries trying to develop. By setting the example of massive environmental destruction, as in the Amazon, the Bank has sent an unwritten message to the world that this type of behavior is acceptable.

However, the Bank has recently been under so much pressure from international environmental groups that it has ceased the latest loan for Polonoroeste. Likewise, the Bank is attempting a more environmental approach in development. One of the changes in the Bank include adding ecologically trained people to the staff. Previously the Bank only employed 4 ecologists out of the 3,000 professionals, 50 who work in public relations and speech writing (Boston Globe, 1986, Oct. 5). Other changes include loan provisions for protection of Indian lands and tropical science research. Many of the changes in the World Banks attitude have resulted in the continual pressure from environmental groups (Science, 1986:814). While Polonoroeste is already underway and most of the damage to the forest is done, the change in the World Bank may prevent these types of projects from happening again.

5.4. Environmental Groups

Some of the most notable interest groups interested in preserving the tropical rain forests are the Sierra Club, the World Wildlife Fund, Rain Forest Action Network and the Environmental Defense Fund. Since these organizations are based in the U.S., it is difficult for them to directly influence policies in Brazil. Instead, these organizations pressure international developing agencies like the World Bank for more environmentally-conscious projects.

The recent change in the World Bank policy towards environmental issues is widely attributed to the pressure from these and other environmental groups. Much of the pressure was exerted through an extensive letter-writing campaign. This involved environmental groups from around the world (Boston Globe, 1986, Oct. 31). There were also demonstrations in Washington during the World Bank annual meeting (Boston Globe, 1986, Oct 5). While the U.S. has the largest voting power in the World Bank, it does not have a majority. Environmental groups based in the U.S. have contacted other countries in Europe and Japan to encourage these countries to force a more environmentally conscious attitude in the World Bank (Science, 1986:814). Environmental interest groups have also targeted Congress about the 20% voting power of the U.S. in the World Bank.

The result of these pressures has had an impact on the World Bank, which should have an impact on preserving the rain forests

in Brazil and in other countries. While this is an example of the international communities interest in conserving the tropical rain forests, the next step is for environmental groups in the developing country to become influential in the development process.

In the past environmental groups in Brazil were rare and had little influence on the government. However, environmental groups are growing in Brazil, and the new democratic government may be more responsive to their demands. As the world becomes more alarmed about tropical deforestation and its global impacts, developing countries are slowly becoming aware of their importance in preserving this natural resource. For the time being though, the main pressure for preserving the Amazon is still coming from abroad.

5.5. Chapter Conclusions

The international actors have a significant impact on the development process in the Brazilian Amazon. In the past much of the foreign influence resulted in extractive practices where the benefits of development were directed outside of Brazil. However, the position of foreign organizations is changing, and it has the potential to be more environmentally conscious. Previously the multinationals were encouraged to invest in large development projects like Jari. More recently multinationals are encouraged to engage in joint ventures with Brazilian firms. The Brazilian government needed to provide incentives for the earlier firms to

invest in the Amazon, because Brazil lacked the sufficient capital to invest themselves. However, Brazil has become very industrialized in the last fifteen years which has given it a better bargaining position with multinationals. Now that Brazil is less vulnerable to the whim of foreign firms, the government is in a better position to demand environmentally conscious projects.

The World Bank has also influenced development in the Amazon by providing loans for large projects like Polonoroeste. The massive deforestation caused by this project and others around the world, has forced the Bank to review its development policies in the Third World. With pressure from environmental organizations, the Bank has ceased funding for Polonoroeste, and is unlikely to support other projects that are as environmentally destructive. The change in the World Banks attitude toward environmental issues is likely to have an impact on future projects of developing countries.

In the last five years major environmental groups in the U.S. and other developed countries have mobilized to halt environmentally destructive projects in the Amazon and around the world. In the past year, the issue of tropical deforestation has been in a top concern of international environmental groups. This culminated in a huge campaign in 1986 where environmental groups wrote letters and protested to development agencies like the World Bank to halt projects causing tropical deforestation. This campaign included targeting Congress about World Bank

funding, and contacting foreign donors of the World Bank to ensure a majority vote in favor of environmental issues.

While much of the development in the Amazon is already established and is likely to continue, there is a growing awareness around the world about the importance of preserving the tropical rain forest environment. There appears to be a shift in emphasis from the multinational influence in development projects to that of an international funding agency. The recent emergence of powerful environmental groups and a more environment-conscious World Bank may ameliorate the present situation.

Chapter 6. RECOMMENDATIONS FOR THE BRAZILIAN AMAZON

Chapter six will review some recommendations for the development and the preservation of the Amazon. This study proposes sustained development through a variety of ways. The recommendations are broken up into those for the Brazilian government, and those for the international community.

- -Recommendations for Brazil
  - -Use of Other Land Types
  - -Zoning System
  - -Abolition of Subsidies and Settlement Schemes
  - -Promotion of Education and Research Centers
  - -Preserve and Learn from Indigenous People
  - -Shift the Decision-making to the Amazon Region
- -Recommendations for the International Community
  - -Target Development Agencies and Multinationals
  - -Support Protective Policies and Organizations

6.1. Recommendations for the Brazilian Government

Recommendations for the Brazilian government for sustained development of the Amazon include using other types of land, a system of land use zoning, the abolishment of development subsidies and resettlement strategies, promote education and research centers on tropical science and preserve and learn from indigenous people.

6.1.1. Use of Other Land for Development

When examining past development projects in the Amazon, it is clear that some are not suited for the rain forest conditions. This seems to be the case in many agricultural and pastoral endeavors. As mentioned before, Brazil has an adequate amount of land to satisfy most of the agricultural and pastoral needs of Brazil. The cerrados to the south of the Amazon are much better suited for cattle grazing and the varzea lands along the rivers are more fertile for agriculture.

The past development projects resulted from political decisions rather than based on the suitability of the rain forest for the projects. The shift to the cerrados and varzeas will reduce pressure on the Amazon and will be more economical for grazing and agriculture.

6.1.2. Adoption of a Zoning System

A system of zoning for the Amazon will designate the forest for different types of uses, including a substantial portion for

Amerindians and for research. Presently there is no such system, and most of the projects proceed independently of each other. The danger is that there are only estimates on the rate of deforestation and no actual record. Zoning would allow an accurate measure of deforestation by controlling the type and amount of every use.

Since different types of land uses in the rain forest have different impacts on the ecosystem, it is important to control the amount of the most harmful projects. Clearcutting is one of the most harmful agricultural uses on the rain forest ecosystem. This method is the most likely to contribute to species loss, carbon build-up and desertification. In order to minimize the effects of clearcutting, this method should be dispersed among other less destructive uses like shelterwood forestry or reserved forest areas.

Another aspect of this recommendation is to divide projects into short-term and long-term costs and benefits. While some projects have a very high return in the short-term and are very destructive, others have less return in the short-term but give benefits over a longer period of time.

6.1.3. Abolition of Subsidies and Settlement Schemes

The abolition of subsidies from the government for development projects in the Amazon would reveal the true price of developing the rain forest. According to Robert Skillings of the World Bank, without government subsidies the cost of projects in

the Amazon is about 40% higher than in other parts of Brazil (Stone, 1985:156). The costs are much higher because transportation of goods in the Amazon is done along the river, or by inferior roads by plane. In any case, the distances are long and the transportation is expensive. Also it is necessary to import basic foodstuffs and other everyday commodities.

The subsidies deflate the prices of the land which gives developers little incentives to take care of the land. The initial investment is so low, that when the land expires it is more economical to move to virgin land than to reinvigorate expired land. This process encourages more destruction of the forest than is necessary.

Settlements in the Amazon should also be abolished. The original idea of "land without men for men without land" (Boston Globe, 1986, Oct. 19) has been re-evaluated due to the poor results of past settlement schemes. The Program for National Integration had little success in improving the standard of living of the migrants who settled in the forest. The small farmers rarely went above a subsistence level because of the poor conditions of the forest.

Instead of shifting the responsibility of the poor into the Amazon, the government should concentrate on better urban and rural development. The move into the Amazon was a temporary distraction to the inequalities of Brazil and the inefficiency of government policies to reach the poor. The problems of poor agricultural conditions, insecure land tenure and primitive

living conditions among other things has plagued the PIN settlements.

6.1.4. Promotion of Education and Research Centers

The government of Brazil should capitalize on their unique resource and abundance of tropical rain forests by encouraging education and research centers to study tropical science. Currently there is an institute of tropical nature called INPA in Manaus. While the government has aided this institute, the input could be much higher. The past projects by the government have indicated a significant lack of understanding about the rain forests. By encouraging more research about this relatively unknown resource, the government could increase the success rate of future projects with a better understanding of the environment. Because of the remoteness of the Amazon region, few investors or politicians ever ventured into the Amazon to experience first hand the concerns of the region. When developing the Transamazon Highway the government neglected to consult rain forest experts which contributed to its limited success.

6.1.5. Preserve and Learn from Indigenous People

The indigenous people in the Amazon have an intimate knowledge of the rain forest resources, and should be learned from. These people have been exploited for centuries by invaders in the Amazon. The indigenous population has suffered

tremendously during development projects. The indians lack the immune system to fight modern diseases and many perish upon contact with construction crews building projects. Presently the Amerindian lands have been protected with stipulations for the developing on behalf of the national defense and national growth of Brazil. This practice should be abolished, and the lands should be protected in perpetuity.

The research of tropical science should include those practices of indigenous peoples who have lived in the rain forest for centuries. The Amerindians currently have the greatest body of knowledge about tropical forests and species. This knowledge could greatly benefit scientists in medicinal cures among other things.

6.1.6. Shift Decision-making to the Amazon Region

Perhaps the most important recommendation to encourage sustained development is to shift the burden of decision-making on Amazonian development from the capital of Brasilia to the Amazon. Even within the Amazon the land should be designated to people or organizations for development. By giving people a title to the land they will be more likely to devise projects that will endure over time. If the Amazon state government were giving a bigger stake in the profits of the region, it will be in their best interest to maintain and sustain future use of the land.

6.2. Recommendations for the International Community

Although the ultimate responsibility for managing development in the Amazon lies with the Brazilian government, there are measures the international community can take to help preserve this environment. While some of these recommendations are already at work, others constitute a "wish list" or potential way the international community can get involved in the development process. Some recommendations for the international community include, targeting policies of other development agencies and multinationals, reinforcing protection organizations and educational institutions.

6.2.1. Target Development Agencies and Multinationals

The change in World Bank policy towards more ecologically-sound projects is a major step towards the need for managed development. Another measure should involve other development agencies like the Inter-American Development Bank, UNCTAD and United Nations Development Program to take a stronger stand on environmental issues. The environmental groups in the U.S. were very effective in influencing the World Bank, and should be go on to influence other similar organizations. The governments of these countries should enforce environmental awareness to avoid projects like Polonoroeste.

The Multinationals have traditionally had little regulation from their base countries on how they work abroad. In 1972 when the government of Brazil said "send us your pollution. We need

the jobs" the multinationals should be strongly urged to act as they would at home and resist the urge to pollute or destroy the environment. Corporations could use their ecological practices as a marketing gimmick to sell their products. For example, if Burger King advertised that it discontinued buying cattle from the Central-American rain forest to buy more expensive U.S. beef, American consumers would probably support the change and the 5 cent price increase.

6.2.2. Support Protective Policies and Organizations

The support of protection organizations and policies like the Convention on International Trade in Endangered Species (CITES) would help reduce the amount of species loss from over-exploitation and poaching. Other foreign policies like the U.S. Endangered Species Act could help Brazil with funding and care for its endangered species.

Foreign policies like in the U.S. can influence practices in Brazil by regulating imports and exports of certain products. An example is the restriction of beef imports, and the supervision of export products like chemical defoliants and hazardous materials used to destroy forests.

Another way to influence practices in the Brazilian Amazon is for the U.S. to negotiate a mutually agreeable resolution for the present Brazil's debt crises. The poor state of the Brazilian economy is likely to encourage more destructive uses in the Amazon because they produce a fast return. If the economy

strengthens, the government should feel less compelled to use the most destructive practices to extract Amazon resources.

CONCLUSION

After reviewing the development policy for the Amazon in the form of the National Integration Program, many of the practices appear destructive to the environment. Besides exacerbating the global problems of tropical deforestation, projects in the Amazon do not appear to have adequately contributed to the national economic development of the country.

The military government of Brazil which was in power from 1964-1985, sought to alleviate some of Brazil's problems by developing the Amazon rain forest. The government developed the Program for National Integration which set up a variety of networks to open up the Amazon. The motivations of the government for this program were for national security, national growth and population redistribution. The government intended to occupy the vast areas of the Amazon to protect it from potential invaders. The need to stimulate national growth was an attempt to maintain the "economic miracle" even during the oil crises which severely hurt Brazil's economy. Population redistribution was originally devised for the poor people from the Northeast who suffered from the 1970 drought. Induced migration became a way for Brazil to relieve itself of the a growing poor population.

The results of the Program for National Integration were less than satisfactory because of the inappropriateness of many development practices for the Amazonian ecosystem. PIN involved large scale cattle ranching, agricultural endeavors, roads and settlements.

Cattle ranching is extremely destructive to the environment and provides little for the local economy. Pasture has minimal labor requirements and does not produce basic foodstuffs for the Amazon region. Pasture tends to benefit only a few large landowners who often live outside of the region. Most of the cattle is also sent out of the Amazon to the populated southern part of the country. Cattle ranching as a form of development contributes to the impoverishment of the Amazon because it benefits outside of the region with few investments into the Amazon. Besides serving outside interests, pasture destroys the rain forest and provides almost no future use potential. As a form of development ranching is only sustainable if there is an endless amount of land to graze. The overall and eventual effect of intensive grazing is the destruction of the rain forest. Even if the land is fertilized, the effects of grazing are disastrous to the rain forest ecosystem.

Of the many agricultural endeavors, this thesis focused on shelterwood, silviculture, clearcutting and shifting cultivation. Shelterwood and silviculture both involve investment into the land, whether by preserving part of the natural environment as in shelterwood or by planting as in silviculture. Both of these methods are only moderately destructive to the environment and therefore can be sustained over time. The continual use of the land can provide economic benefits into the future as well as protect the region from the effects of total deforestation. The economic benefits in shelterwood and silviculture are in the form

of labor for the local economy and in the profits from the harvest. Since both methods require labor for planting and harvesting, the local economy will benefit from the projects. Likewise the national economy can benefit not only in the short run but in the long run due to the continued productivity of the land. While shelterwood and silviculture are not problem-free, they appear to be the best examples of sustained development at this point. Experiments are currently going on in the Amazon and around the world to make silviculture more productive and more resistant to pests. The main problem with shelterwood is the enforcement of the 25 crop tree minimum.

Clearcutting has extremely devastating effects on the environment and provides only moderately for the local economy. Like cattle grazing, clearcutting benefits large landowners who tend to invest profits outside of the region. While the benefits may aid the national economy, they do little for the local economy. Clearcutting has high profits in the short term, but is dependent on abundant land for continued productivity. Since clearcutting greatly contributes to tropical deforestation, it is likely that at some point the forest area will be depleted or turned to desert. Clearcutting is not sustainable over time because it prevents the future productivity of the land. Currently clearcutting is a very large and profitable industry in the Amazon. However, Brazil may be faced with an ailing economy if it relies on methods like clearcutting as a way to achieve national economic development. Without devising methods that are

sustainable over time, one day there will be no more trees to cut.

Shifting agriculture is another product of the National Integration Program. While shifting agriculture was used for centuries by indigenous people, only in the last two decades has this method become seriously abused. The benefits of shifting agriculture do contribute to the local economy because it highly labor intensive. However, it depletes the forest and rarely provides beyond a subsistence level. Slash-burn, as it is otherwise called, has not improved the situation of the migrants who came to the Amazon for a better life. Rather, it has continued the poverty of the migrants.

The poor results of PIN also indicate that what appears to be the most economically efficient land use is not necessarily the most economical in the long-run, because of the destruction to the environment. Clearcutting the forest has a high return in the short-run, but has disastrous environmental effects in the long-run. Shelterwood gives a moderate return in the short-run, but preserves the environment in the long-run. Silviculture has moderate effects in the long and short run as well. Shifting agriculture is highly misused, but it does provide in the short-term for many small agriculturalists. Cattle ranching is by far the most harmful of all uses. Besides the destruction to the environment, it provides little for the region in economic terms.

The solution for the Amazon is sustained development. This refers to a balance between development and the environment. The

ideal objectives for managed development include; agronomic sustainability, self-sufficiency, unsubsidized competitiveness, maintenance of other resources, maintenance of other areas, social goals, future use potential and minimal macro-ecological effects. These are goals to strive for when devising land use in the Amazon. The development projects should provide for the present and future generations of people in the Amazon region of all levels of society. These objectives imply a shift of priority for regional economic development rather than for the benefit of the nation. The previous and current emphasis of developing the Amazon have resulted in an exploitative situation where most of the production benefits outside of the region. At the same time, the standard of living in the Amazon is below the national average. It is expensive to buy many basic commodities including food, because everything must be imported into the Amazon region.

There appears to be viable ways to maximize developmental and environmental concerns when developing the Amazon rain forest. The need for a balance between these two objectives lie in the desire of Brazil to economically develop and in the desire for the world to preserve the tropical rain forest ecosystem. The importance of preserving the rain forest ecosystem of the Amazon lie in the potential global consequences of tropical deforestation which include: the loss of species and much of the world's genetic stock of fauna and flora; a build-up of carbon which can heat up the earth's temperature and cause worldwide

flooding as a result of melting some of the polar ice cap; and desertification which can shift the world's temperate climate further north and disturb current agricultural practices in the world.

While the Brazilian government initiated the master plan of development in the Program for National Integration, there are many other actors involved in the development process. Some of the major actors are multinational corporations, the World Bank and environmental groups. Multinationals have traditionally had an exploitative relationship in the Amazon. These corporations retain most of the profits and often exported their products outside of the Amazon and even outside of Brazil. There was little benefit for the Amazon region. The World Bank is an international funding and development agency which has also been involved in the Amazon. Until recently the World Bank contributed to very destructive practices in the Amazon. However, there are strong indications that this behavior is changing due to pressure from environmental groups around the world. The World Bank is currently under a lot of pressure to follow environmentally-conscious guidelines. Environmental groups in the developed countries have been very influential in targeting organizations like the World Bank to have more ecologically-conscious projects. The indications of recent events are that the influence of international actors is changing from the exploitative-type of development of multinationals to a more ecological type of development from the World Bank which is

being influenced by environmental groups.

The recommendations for the Brazilian government towards more managed development include; using other lands in Brazil when appropriate, land-use zoning, abolition of subsidies and settlement schemes, promotion of education and research centers, preserve and learn from indigenous people and shift the decision-making to the Amazon region. Recommendations for the international community are to target multinationals and development agencies for environmentally-conscious practices and to support protective policies and organizations which exist to further environmental goals.

The findings of this study are that development practices in the Amazon can reflect a balance between development and the environment. The past destructive projects have attracted international concern over the depletion of the rain forest. The external concern over this environment has been very instrumental in encouraging a better balance between development and the environment goals in the Amazon. It is likely that the trend of international influence will continue now that the government changed from the military dictatorship to a democracy in 1985. The current government may be more receptive to criticism on harmful development practices and more environmentally responsible in future projects. The indication is that the destructive practices will probably taper off as the need for sustainable productivity arises. Unfortunately, the awareness and desire for sustainable development may come when the

depletion of the rain forests and the impoverishment of the region is too far gone.

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