Development in the Amazon Basin Countries: Alternatives to Extraction of Non-Renewable Natural Resources

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Introduction

National Development has been measured in terms of economic growth since the eighteenth century. To achieve at least passable economic growth and thus, national development, most of the developing countries have emphasized extraction of non-renewable natural resources, usually fossil fuels and minerals. Such extraction of non-renewable natural resources has been carried out under circumstances in which environmental protection and sustainability of natural resources have not been considered. Nowadays, as pressures have mounted to increasingly raise rates of economic growth through greater economic production, the negative impacts on environmental degradation and the destruction of nature are more evident in these developing countries. This ever-increasing push toward economic growth, production and the uncontrolled extraction of these natural resources which such production requires, in most of these countries has now reached such levels that highly fragile and sensitive ecosystems, which are the last and most valuable natural reserves in the world, are becoming gravely threatened.

Ecuador presents an important example of this worldwide trend. In Ecuador, pressures to promote greater economic growth and supporting Government and private sector policies and processes have already led over the past years to some incursions of groups seeking to extract hydrocarbons from the extremely fragile and irreplaceable lands of the Yasuní Biosphere Reserve and National Park in the Amazon jungle. Ecuador faces this delicate and difficult choice. On one hand, the country recognizes the value of, and wants to shield this magnificent natural reserve; on the other hand, the government is under extreme pressures to produce high levels of economic growth in order to achieve development and catch up with its neighbors economically. Thus, Ecuador's government understands that the economic benefits that they are seeking, and which will be based upon extraction of fossil fuels in these sensitive areas will at the same time create enormous and possibly irrevocable losses in this unique ecosystem, one of the richest and diverse hot spots in the world. However, the Government of Ecuador has not managed to find concrete alternatives which will help the country reach its badly needed economic growth and development goals without allowing uncontrolled extraction of non-

renewable natural resources. This research paper will analyze the benefits that countries in the Amazon Basin would obtain if they choose to forgo extraction of non-renewable natural resources in their fragile and sensitive ecosystems and examine alternatives and approaches they might undertake which would enable them to avoid sacrificing their socio-economic development goals.

There are many studies which have promoted the idea that if the extraction of non renewable natural resources is rational, and then this presents an adequate and fair way for achieving economic development goals, while at the same time maintaining basic environmental preservation and protection. This paper will attempt to demonstrate that such a compromising approach is not desirable in some fragile areas. This study will attempt to show that developing countries of the Amazon Basin can benefit more by totally rejecting the concept of allowing extraction of non-renewable natural resources, particularly fossil fuels, within this highly valuable, rich and fragile rainforest. Moreover, this study aims to open up general debate about dependency on hydrocarbons extracted in natural reserves and sensitive ecosystems. As a result, the paper will seek to encourage thinking about halting extraction and use of non-renewable natural resources and rather seeking alternative mechanisms and strategies to support national socio-economic goals. Finally, this research will touch on the possible ethic values which underpin development models for developing countries that force extraction of natural resources in extreme highly sensitive areas.

On one hand, the methodology applied in this research has been qualitative. It is based on review and analysis of secondary analytical materials. The sources used throughout this research are written documents such as books, journals, scientific magazines, newspapers and websites; the criteria for selection of these documents are based on the relevance and reliability of the authors or institutions that have published them. Use of unstructured interviews that have been undertaken without predefined protocol. The major questions are derived from the core concepts within the various hypotheses and theories, which in turn, permits exploring the topic more broadly. Furthermore, the research for this paper includes an important case study on an initiative whose basic approaches continue to be debated and under review and study, which means that the information contained in this study case has been constantly changing. On the other hand, this research is addressed to the public who is involved in the environmental and developmental fields such as students, professors, governmental authorities and NGO professionals. However, it

is hoped that the paper will also interest and attract the general public because the paper has attempted to avoid complex language. After the audience has read this research, it is hoped and expected that they will bring more question and promote greater open debate on the topic of violating precious ecological areas and their contents as inputs into economic development production models.

This research paper is divided into four parts. The first three chapters provide background and description. The fourth chapter seeks to provide some analysis and conclusions. The first chapter contains an historical review of the extraction of non-renewable of natural resources in the Amazon Basin countries. It explains how these developing countries through history have become dependent on the extraction of hydrocarbons to support their production based economic development strategies. This dependency on hydrocarbons has historically been at the heart of the economic development strategies for these countries. Second, this chapter will explore the reputed benefits that these countries have achieved through extraction of hydrocarbons. In this part of the chapter, the research focuses on the economic benefits obtained by extraction of fossil fuels. At the same time, this section offers the reader reflections about the how these alleged benefits in reality must be seen when put within the context of the negative impacts of extraction of these non-renewable natural resources in these same countries. Finally, this chapter concludes by presenting what we feel is the real picture of the net benefits a development strategy based on extraction of hydrocarbons, namely few if any real benefits when weighed against the severe and irrevocable destruction and degradation of the environment and the country's natural resource base.

The second chapter argues significant and sustainable development in the countries of the Amazon basin can be achieved through alternative approaches and strategies which do not require extraction of non renewable natural resources. This alternative of development is based on the idea that preservation of non-renewable brings its own benefits; that destruction and exhaustion of non-renewable natural resources is not a sustainable development strategy; and that national policy makers and international development thinkers must place greater emphasis on finding development strategies that are not based on a disappearing and unsustainable input. Finally, this chapter begins to address the question how development without exploitation of natural resources can be promoted through strategies, policies and sanctions. Importantly, this section will go on to suggest that well thought out government actions and the participation of

civil society are part key elements of any solution. Policies and regulations have to be formulated and implemented in order to get development where exploitation of natural resources is falls out of not the main component of the country's developmental options.

The paper's third chapter is a study case, which tries to place in a real context the arguments above. The study is of the Yasuní national park in Ecuador which is will be benefiting from an initiative launched by the international community in order to preserve this extremely fragile and diverse world ecological reserve. This natural reserve has been threatened because of exploitation of hydrocarbons for many years. This section analyzes the efforts that Ecuador's government and the international community have been doing to keep the areas underground oil reserves from being extracted. Finally, this chapter concludes with ideas and examples which may encourage other developing countries to undertake similar initiatives in order to prevent exploitation of natural resources as part of their development strategies.

The final chapter begins an analysis which attempts to incorporate discussion of the two first chapters and begin to identify policies and recommendation which might address a change of the developmental models present in those developing countries. This analysis attempts to demonstrate that innovate approaches and implementation of adequate intergovernmental policies and commitments among these countries could help prevent destruction of the most important and ecologically valuable reserves of the world.

There are some limitations to this research. First, the time available for this work has been limited. Analyzing written sources and performing interviews takes some time. Second, there is much written about the subject, some of which is not necessarily reliable and precise, but not always easy to identify immediately. This problem is more common with the information found on the internet where work can be more editorialized than analyzed and sources and explanations are short cut. As a result, this specific research paper will be centered more on books and journals that have a known reliability. Third, people who participate in the interviews are professionals who work mostly in the NGO community. Interviews with government representatives are limited because of location problems and they do not agree to make themselves available for interviews by email or phone. Finally, the study case is based on an initiative which is continuing to be reviewed and analyzed by the international community and Ecuador's government. Thus, there continue to be new findings changes and modifications which complicate getting a solid and accurate analysis.

Literature Review

The Amazon jungle comprises a set of very delicate and sensitive ecosystems. While these have taken thousands of years to develop, they can be completely degraded and destroyed in a short time. Extraction of hydrocarbons presents a very real threat of quick destruction of these ecosystems. Certainly, the most immediate and coherent alternative for preventing this destruction is halting development of oil exploration. The following literature review follows this reasoning and is based on five considerations: the environmental consequences to the Amazon Basin resulting from hydrocarbon extraction; economic models based on intensive oil development; indigenous communities affected by environmental problems caused by the hydrocarbon industry; a sustainability and sustainable development model for extracting hydrocarbons; and alternatives for preventing exploitation in the Amazon jungle. Furthermore, those who are concerned with the negative consequences of oil extraction mainly focus on the environmental impact and indigenous communities, while those who support oil extraction often base their argument on economic models and sustainable development.

It took many decades for the world to understand that extraction of non-renewable natural resources in the Amazon basin was one of the main causes of destruction and degradation of this rich ecosystem. Today, there are many reasons for halting extraction of non-renewable natural resources in the Amazon jungle. The first section of the literature review touches on this conviction. Development of oil and gas in the Western Amazon – Colombia, Ecuador, Peru, Bolivia and Brazil - has been the main cause of environmental negative impacts (Finer, Jenkins and Pimm 2). The “direct impacts include deforestation [caused by] access roads [construction], drilling platforms, and pipelines, and contamination from oil spills and wastewater discharges” (2). The exploitation of hydrocarbons in the 1970s caused extensive contamination in the Ecuadorian and Peruvian parts of the Amazon jungle (2). Furthermore, biosphere reserves that are part of the Amazon jungle are threatened with extinction in some years if the oil extraction follows. It is said that in Bolivia’s Amazonia, exploration of 15,000 square kilometers could begin soon in large parts of Madidi and Isiboro Secure National Parks and Pilon-Lajas Biosphere Reserve (6). Sven Wunder mentions that oil booms have cause more indirect environmental problems, specially deforestation, in Ecuador because the government has encouraged agricultural colonizing in the Amazon jungle and developing non-tradables such as urban constructions and roads near forested areas (Kaimowitz 232). Furthermore, this author states that

"oil drilling's more direct effects on deforestation turned out to be major in the Ecuadorian case because much of the drilling occurred in previously inaccessible tropical forest regions that were relatively close to the highland population centers" (232). In the case of Peru, the oil/gas frontier has advanced enormously in the last eight years (Napolitano and Ryan 6). "The total area available for oil/gas exploitation in the Peruvian Amazon has increased dramatically since2000; in the 13 month period from May 2006 to June 2007 the area under hydrocarbon concessions almost doubled to 81% of the land area of the Peruvian Amazon" (6). The second part of the literature review addresses what governments recently are doing. According to Larry Rother, the governments of countries that cover the Amazon Basin are eager for development and hydrocarbon extraction seems to be the best option. As a result, ecosystems in the Amazon jungle are threatened again, this time by virtue of models of "sustainable development". For instance, Brazil's government has promised economic benefits to residents in Amazon State from an oil project valued at $1.15 billion. The project design was developed after extensive consultation with scientist and environmentalists precisely with an eye to minimizing damage to the jungle that covers this state (Rother, Vast Pipelines in Amazon Face Challenges Over Protecting Rights and Rivers 1). Old oil projects that stagnated in the in the late 1970s in Brazil are being considered for reactivation in the coming years. This is the case of Petrobras which hopes to "begin production in 2010, after construction of a pipeline that would run through dense and remote jungle to a refinery near the Jurua River" (Rother, Vast Pipelines in Amazon Face Challenges Over Protecting Rights and Rivers 2). In addition, Venezuela's government plans to build a 5,000-mile gas pipeline from Caracas to Buenos Aires which "will cut through the northern Amazon to Manaus and then split in two directions" (Rother, Vast Pipelines in Amazon Face Challenges Over Protecting Rights and Rivers 2). In the case of Peru, country's economy is currently based on a model of intensive oil development. The Peruvian government has assumed a neoliberal tone in which private investment, external capital, and free market principles are the main elements to its economic and development agenda (Stetson 5). "One oil company investing in Peru, citing the 2006 Global Monitor study, addressed Peru as 'the most entrepreneurial country in the world,' which is somewhat reflective of the type of investment environment that the government hopes to create" (5). Nowadays, the intensive oil development model implemented by the governments of the Amazon Basin has boosted exploration of more oil/gas reserves in the jungle, so "companies will need to cut into the forest to conduct speculative tests,

including explosive seismic investigation and test drilling" (Sample 2). If exploration is successful, roads, drilling and pipelines come in (2).

Nonetheless, some scholars and politicians claim that hydrocarbon extraction is the solution to solve social problems because the high profits generated by this industry. According to José Gordillo Montalvo, the high income generated by the oil industry in Ecuador helped to develop the main road systems, as well as the telecommunications and electrical sectors; moreover, the quality of life in the urban cities improved considerably. The country's middle class increased significantly in comparison to the rest of the society, meaning the emergence greater equity of the income distribution (Gordillo Montalvo 69). In the case of Ecuador, "production and commercialization of hydrocarbons are strategic issue like the property and administration of the inter-oceanic canal in Panama" (72-73). The current president of Ecuador, Rafael Correa, has been very explicit in mentioning that Ecuador could still development more of the Amazon by increasing oil production; "if we produced [more] oil [from new reservoirs],down to the very last drop will go to benefit the Ecuadorean people [because] oil well used will help the country emerge from poverty" (Bass 7). Ian Bowles and Glenn Prickett argue that multinational oil companies can follow extraction hydrocarbons into the rainforest as long as they broaden corporate environmental and social responsibilities for operating in the rainforest (Bowles and Prickett 73-74). Multinational oil companies in Ecuador like Arco Oriente Inc. (Agip) have developed a significant project applying technologies designed for protecting very sensitive and fragile ecosystems. Thus, they argue, "ARCO has set out to prove that Ecuador's rich oil resources can be developed to benefit the country at large while preserving the rain forest and the wellbeing of its 250,000 residents" (82-83). In addition, successful petroleum development in sensitive environments includes themes such as:

> …clear corporate environmental policies and procedures; effective environmental compliance and information management systems; minimizing disturbance of natural surroundings; detailed environmental and social assessments; comprehensive environmental and social awareness training; [and so on] (87-88).

International organizations like the Inter-American Development Bank claim that the big Camisea's project for extracting gas "has helped to protect 1.5 millions of rainforest in the Peruvian Amazon" (Hamilton). Furthermore, Roger Hamilton mentions that this project for gas development "is serving as a model for energy extraction in a sensitive cultural and environmental environment" (Hamilton). Moreover, Hamilton goes on to state that "an extractive

project that is well designed and carried out, with the right commitments from the companies and the government, can both boost the country's economy and help create a model for development with environmental and social protection" (Hamilton).

The Amazon jungle could host some isolated and non-contacted indigenous communities. The third part of the literature addresses the problems of the indigenous communities. Governments and oil companies claim that they are bringing development to these regions with their oil extraction activities. According to Paul Sabin, protests from Amazonian indigenous peoples are not because they are

> …oppose all development, wishing to remain in a purely "traditional," unchanged culture. A more complex story emerges upon closer examination. Here, as in other instances of extractive development, native groups complain that there has been too little of the right kind of development and too much of the wrong kind (Sabin 146).

Jane Bradbury emphasizes that environmental problems caused by oil extraction have brought many difficult social problems to this region. People who are living in communities within oil development areas have been suffering serious health problems such as headaches, sore throats, eye and nose irritations, tiredness, childhood leukemia, cancer and more spontaneous abortions since oil companies arrived (Bradbury 173). The oil industry has caused acute negative environmental, social and health impacts into indigenous communities across the world; "among the negative impacts are deforestation for the laying of seismic lines, roads and drilling installations, causing ecosystem destruction and spills leading to the loss of fish and game and contamination of vital water and land resources" (Napolitano and Ryan 6). The western Amazon compresses at least fifty indigenous groups which are leaving within oil and gas concessions (O'Rourke and Connolly 596). The "oil production activities not only disrupt sensitive environments, but also threaten the survival of indigenous populations that live in these ecosystems" (596).

The fourth part of the literature review touches on the alternative or sustainable development model. This model of development has been the best argument for developing countries in order to preserve nature without unduly hurting economic growth. However, the meaning of sustainable development is very confusing and weak for some authors. Sharachchandra M. Lélé states that

> sustainable development is in real danger of becoming a cliché like appropriate technology – a fashionable phrase that everyone pays homage to but nobody cares to

> define….Agencies such as the World Bank, the Asian Development Bank are quick to adopt the new rhetoric (252).

Furthermore, Lélé mentions that sustainable development is a contradictory-laden concept because it is based on economic growth for achieving environmental protection; so, nature preservation would depend on economic growth which means more extraction of natural resources (259). Additionally, Judith Kimerling claims that the term appropriate technology or advanced technology has been used as a part of sustainable development concept. This term has been used for most of the oil companies for arguing that their operations are fulfilling with a model of sustainable development. The phrase used by the oil companies in Ecuador "compatible with the Ecuadorian Amazon Region" has caused more confusion because it is not clear whether the technology used in this region is really compatible with the fragile ecosystem or whether this technology has been designed for a developing country that means that it could have some deficiencies and restrictions (Kimerling, Modelo o Mito? Tecnología de Punta y Normas Internacionales en los Campos Petroleros de la Occidental 122). Laura Rival argues that "the concept of sustainable development is being used to justify forms of development which are in no way sustainable, such as Ecuador's oil policy of unbridled extractivism" (2). In contrast, oil companies are convinced that sustainable development is a model that helps them keep their business profitable while they protect the environment. Lew Watts, Shell Gas & Power director stated at the World Petroleum Congress in Rio de Janeiro in 2002 that the business of his company is based on seven principles of sustainable development: generate robust profitability, deliver value to customers, protect the environment, manage resources that invest in renewable energies sources, respect and safeguard "our own people and all other stakeholders", as well as work with all stakeholders (Williams 36). Moreover, Watts claimed that "fealty to sustainable development will be the ultimate test of an oil and gas company's survival. That fealty is necessary, for three reasons: it is the right thing to do; if we don't, we won't be allowed to operate; it will be the key competitive differentiator" (36). According to Mohammed H. I. Dore and Jorge M. Nogueira, some studies suggest that "there are many indigenous economic activities [in the Amazon region in Brazil] which are probably environmental sound, but certainly unsustainable in the long run due to low levels of productivity, output and income" (494). The author mentions that sustainable development does not have a concrete and implementable meaning until some questions are resolved, such as "can the forest be so harvested that the natural rainforest conditions prevail and yet yield its human residents and

adequate reward and living income? Or can this be done without a massive invasion of the rainforest?" (494).

Finally, other authors such as Kevin Koenig mention that countries like Ecuador are seeking more appropriate alternatives to extraction of hydrocarbon resources. The current Ecuadorian government is aware that old development models based on fossil fuels and attempts to drill our way to prosperity have failed (Koenig 11). The current Ecuadorean government is trying "to move beyond reliance on oil and toward an equitable strategy for true energy independence that prioritizes poverty eradication, renewable energy, clean transportation systems, and sustainable agriculture and tourism" (Koenig 11). The government of Ecuador has proposed keeping Yasuní National Park's oil reserves underground as long as the international community can afford part of the cost of those reserves. The costs avoided by leaving the oil underground would be

> the costs of deforestation and loss of biodiversity, the costs of land and also air pollution (because of gas flaring), plus the costs of illness and loss of human cultures. These are local costs avoided. Moreover, there is a cost [avoided which has global ramifications] – that of the carbon dioxide which is not produced" (Martinez Alier and Temper 4).

Some other innovative proposals have appeared lately that can prevent destruction of the Amazon jungle. For instance, Biodiversity Business Risks would restrict loans to companies that threaten to have high impacts on ecosystems such as oil & gas and mining companies because of their direct footprints on ecosystems (Mulder xi-xii). Financial institutions such as commercial and multilateral banks would be extremely circumspect about lending money to oil companies which develop their operations in very fragile and sensitive ecosystems because these Financial institutions could "be exposed to liability risks or reputational risks when a project that comes under heavy biodiversity-related scrutiny attracts major NGO attention" (9).

Chapter I

The Extraction of Non-Renewable Natural Resources in Amazon Basin Countries

Background

The origin of the Amazon Basin dates from the beginning of the Cenozoic Era 65.5 million years ago (Amazon Rain Forest). This extraordinary place embraces the most complex and delicate ecosystems with a surface of 6,869,000 square meters, making it the most extensive rainforest in the world (Goulding, Barthem and Ferreira 18-9). The Amazon Basin is distributed in different percentages along seven countries: Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru and Venezuela (16). While 67% of the Amazon jungle is in Brazil, none of other six countries have more than 12% of it in their territories. However, this outlook changes when the surface percentage of each country in the Amazon Basin is taken into account (16). In this case, the five countries with the highest percentage of their total surface in the Amazon jungle are: Bolivia with 66%, Peru with 62%, Brazil 56%, Ecuador 48%, and Colombia 35% approximately (16).

The Amazon region was an inhospitable, dangerous, and mysterious region for centuries. However, this scenario changed when non-renewable natural resources, such as important reserves of hydrocarbons and minerals, were discovered in the region in the last several decades. Moreover, the high and growing worldwide demand of hydrocarbons, combined with the volatility of oil prices, created a profitable business through oil extraction. The governments of the Amazon basin quickly proceeded to grant Amazon land to multinational and national oil companies.

According to Humberto Campodónico in his article *Amazonia and Oil Exploitation* (*Amazonía y Explotación Petrolera*), the extraction and exploration of hydrocarbons in the Amazon Basin have increased five-fold in the last eight years. Around 52 million hectares have been granted to oil companies throughout the entire Amazon up to 2007. Seventy per cent of this land is in the Peruvian Amazon, 13% in Brazil, and 10% in Ecuador. Five million hectares have been granted for extraction in Ecuador, the largest amount for extraction in any Amazonian country. On the other hand, taking into account the area granted for concessions, Peru has the greatest extension with 35 million hectares granted to the oil companies (Campodónico 1).

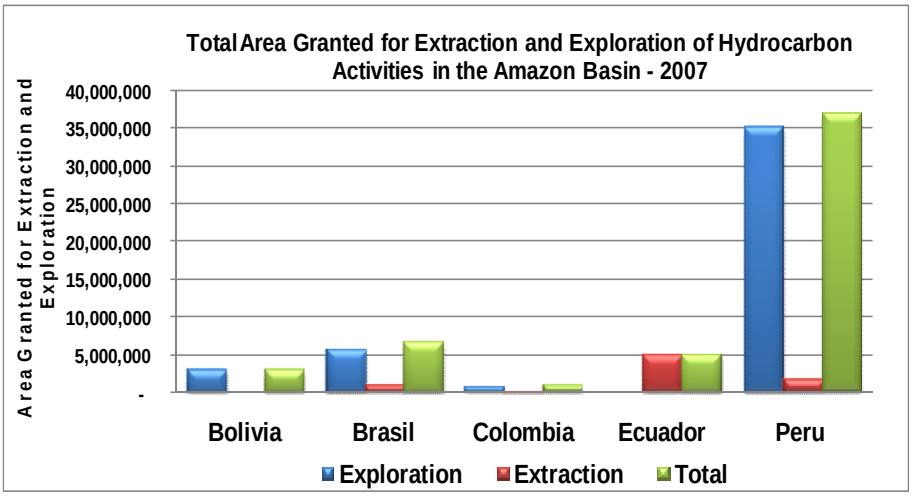

Figure1. *Area granted for extraction and exploration of hydrocarbon activities in the Amazon Basin – 2007* (Campodónico)

The magnitude of the oil industry development in the Amazon Basin has relied on factors such as economic policies, national security issues, the presence of other natural resources, and social and environmental disruptions. However, high economic growth has been the main goal of aggressive extraction in all of the countries in the region. Moreover, the oil revenues have been the main source of economic benefits in some of these countries. Figure 1 shows that countries like Bolivia, Brazil, and Peru have strong expectations for increasing their oil production in the future because they have granted broad exploration areas to the oil companies. Most of these countries are trying to achieve a high level of economic growth through increasing their oil exports over time.

Figure 2 shows an upward trend of the oil production in the Amazon Basin. This trend has made that economy of these countries highly dependent on continued oil exploitation. Thus, these governments have focused on creating policies and laws enabling the hydrocarbon sector to be the backbone of their economies. Experiences in the past seemed to have demonstrated that oil extraction could solve many economic and social problems. This thought could be still persisting on these governments. Some countries of the Amazon Basin have been developing new strategies for creating a new oil boom, apparently under the expectation that their economic and social problems could once more be resolved through the benefits therefrom derived.

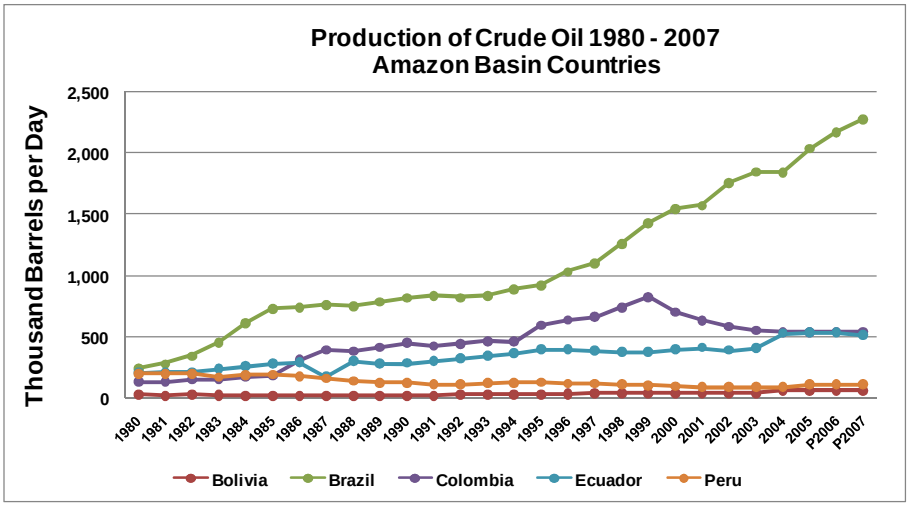

Figure2. *Production of Crude Oil between 1980 and 2007 in the Amazon Basin Countries* (Energy Information Administration)

Benefits of Non-Renewable Natural Resources Extraction

The development of the oil industry involves complex processes such as exploration, drilling, production, and refining, as well as the construction of massive infrastructure such as roads, airports, camps, pipelines, drilling and production facilities, and refineries. The giant financial investment required for carrying out the hydrocarbon industry is feasible because costs are amortized through the significant short-term revenues that are realized. For this reason, developing country governments have seen in this industry the solution for reaching a high economic growth in a short term. On one hand, there are countries in the Basin where the economic growth has been directly related to the oil industry for decades, such as is the case of Ecuador. On the other hand, there are countries like Brazil and Peru that have begun with an aggressive exploration and extraction of hydrocarbons within the Amazon only within the last few years. Finally, energy integration is a sound strategy that is growing among those countries in order to meet their intensive energy demand and end imports dependency on hydrocarbons from other regions.

Ecuador: Miracles of the Oil Boom

Ecuador is an example of how the oil industry could change the economy of a very poor country. The oil boom in Ecuador transformed its economy in just one decade from 1971 to 1981. Ecuador improved significantly its economic performance as a result of oil revenues. Its

GDP increased from US$1,602 million in 1971 to US$13,946 million that meant an economic growth of eight per cent per year. This country reached a historical economic growth of 25.3% in 1973. The per capita GDP had an outstanding growth as well from US$260 in 1971 to US$1,668 in 1981. Moreover, Ecuador's international monetary reserve increased by US$508 million during that decade (Acosta, El Petróleo en Ecuador: Dimensiones y Conflictos 2). According to Carlos Larrea, the oil extraction not only speeded up Ecuador's economic growth, but also the profound development in the health and education sectors. The rate of illiteracy shrank 10% and the child mortality rate decreased significantly from 1974 to 1982. Moreover, the Ecuadorian government invested the oil revenues in programs for boosting the industrialization of other sectors; implementation of great infrastructure such as hydropower dams, refineries, telecommunications, and roads; and creation of social development programs (Larrea 63-65).

Nevertheless, after the beginning of the 1980s, the international financial crisis, a significant drop in the price of oil, and decreases in the oil reserves ended the oil dream. The Ecuadorian government underwent serious economic problems due to the drop in its international monetary reserves and a high government expenditure deficit. Social problems such as poverty, lack of economic resources for education and health, and elimination of social development programs began to undermine the quality of life of the population. However, Ecuador's governments have always been overly optimistic on economic solutions and benefits generated by oil extraction. Today, the dream of a new oil boom is resurgent with the new administration. Ecuador's president, Rafael Correa, aims to aggressively revive oil exploration and extraction in the Amazon jungle. This leftist government wants to increase oil exports, in order to utilize the additional economic benefits to decrease poverty levels and create social development programs. The government is focused on developing the Ishpingo Tambococha Tiputini (ITT) fields that lie in the Yasuni National Park, one of the most fragile and sensitive ecosystems in the Amazon jungle. This is a 920-million barrel reserve that has the potential for generating US$700 million annually for the country (Bass 1-7). The government's ambitious plan is to increase oil production to 700,000 barrels per day in the next few years. It is assumed by the Ecuadorian government that this increase will not only bring great economic benefits, but also make up 50% of Ecuador's national budget. The government assures that "oil exploration and production is thought to be necessary to ensure the country's wellbeing. It plans to increase production,

and it holds auctions to increase foreign investment" (Wertheim, Ecuador Presidential Election Troubles Oil Sector 24).

Projections for investments in the oil sector in Ecuador are very high for the coming years. Ecuador will invest US$1 billion in oil and gas exploration projects until 2010 with the help of neighboring countries such as Brazil for developing new reserves (Wertheim, Petrobras Set to Invest $1 Billion in Ecuador 39). In January 2008, the Minister of Mines and Oil, Galo Chiriboga, stated that the government has as a priority investing US$301.9 million in the oil sector. This investment would generate direct cash inflow of US$1.624 billion for the government in the next decade. In addition, these oil revenues could fulfill the expectations for achieving a high economic growth (elcomercio.com).

Peru: Exploring the Amazon Jungle

Peru represents the current oil boom in the Amazon region with the development of Camisea's project which is a huge project for exploiting natural gas. According to the Inter-American Development Bank (IDB), there are many economic benefits that Camiseas's project will bring to Peru in the next 30 years. Peru's GDP will get a 0.8 percent increase per year through the execution of the project. This important economic growth is seen by the Peruvian government as the key to reduce poverty, the toughest social problem. Other important benefits will be the improvement of the trade balance because of exporting high volumes of gas and importing substitution of hydrocarbon in the future, making $105.7 million profit per year between 2005 and 2015 due to 37.24% in royalties and taxes. The decrease in the unemployment rate due to new direct foreign investments in a long term causes a positive economic impact in the whole country. In addition, the influenced areas by this gas project will get additional benefits by which these towns could achieve a higher and better economic development. The electricity fee will be reduced by 10 percent in the first ten years of the projects which will help people save more (Inter-American Development Bank 5-6). On the other hand, the IDB mentions that there will be environmental benefits because power plants and the industry sector will use gas for generating electricity rather than use diesel or gasoline. In the future, the government of Peru will implement a public transportation system which will use gas like fuel. This way, use of gas in these activities will reduce the emissions volume of green house gases in big cities like Lima for instance (7).

However, Peru is not depending only in Camisea's project for getting great economic benefits in the future. As Figure 1 shows, Peru has granted millions of Hectares in the Amazon jungle for hydrocarbon exploration to the oil companies in order to extract high hydrocarbon volumes in the near future. Peru's government is confident about the great economic benefits that the oil industry will bring to this country. "Alan Garcia, Peru's president, dreams of a petrochemical industry that will attract at least $3 billion and create thousands of jobs by mid-2011, when he leaves office" (The Economist). The government is speeding up the oil production through the multinational companies in order to increase exports. Furthermore, "Perupetro the national oil company expects between $800m and $1 billion in investment in the coming year" (The Economist).

Brazil: Ending an Era of Dependency on Hydrocarbon Imports

On the other hand, Brazil as a country in economic transition is eager to extract more hydrocarbons to meet the energy consumption demanded by its growing industrial sector which is the backbone of its economic growth. According to the National Center for Policy Analysis, Brazil's almost absolute dependency on oil imports, was as high as about 80 percent in the 1970s, but has come to an end in 2007. This independence from hydrocarbons imports has been achieved trough production of ethanol and a significant increase in domestic oil production. However, production of ethanol could not meet the expectations for energy demand since the 1980s. Therefore, Brazil's government has placed particular emphasis on boosting domestic oil production since then (Shurtleff 1-2). The Energy Information Administration (EIA) states that "Brazil increased domestic crude oil production around 9 percent a year from 1980 to 2005, to 1.6 million barrels of oil per day…most notably, in 2007, Brazil announced a huge oil discovery off its coast that could increase its 14.4 billion barrels of oil reserves by 5 billion to 8 billion barrels, or 40 percent" (2). Nonetheless, offshore oil reserves are not the only ones that Brazil's government wants to develop. Oil and gas reserves were also found in western Amazon's untouched remote areas. Thus, "the National Petroleum Agency had planned to invest $36 million to look for oil and gas in Acre, an Amazon state bordering Bolivia [in 2007]" (Associated Press). Furthermore, Brazil's government plans to develop the Jurua oil/gas reservoir discovered in 1978 in Rondonia state. Hydrocarbons produced from this reservoir would transport through the dense and remote jungle to Porto Velho, the capital of Rondonia where a refinery would be built. The oil/gas production of this field is expected to begin by 2010 (Rother, Vast Pipelines in Amazon Face Challenges Over Protecting Rights and Rivers). Furthermore, the Brazilian government has developed another

project of great magnitude in the Amazon basin (Amazon State) in order to produce gas (Urucu gas field) and meet the energy demand in the city of Manaus (1.5 million people).

The Urucu project which is a 400mile pipeline is considered one of the most remote energy infrastructures in the Amazon Basin (Llana). This pipeline transports 10.5 million cubic meters of natural gas per day through the fragile and very sensitive ecosystems, from the huge gas field into the Urucu oil province in the Amazonas state to the same state capital of Manaus (Llana); (Lemos). The Brazilian government's plan is to build a significant petrochemical complex in Manaus that may require $1.1 billion in the investment for processing and taking advantage of this natural gas. The economic benefits that the government expects from this Urucu-Manaus project are to supply local resources for energy generation in Manaus, and boost production of petrochemical products. Part of the petrochemical complex would be focused on urea and ammonia production that would be sold in the north of Brazil. This helps farmers in this region to avoid buying fertilizers from other regions which makes these products more expensive (Lemos). According to Suframa, a Brazilian government investment agency, "the annual revenues potential after [implementation of the petrochemical complex] should exceed $1.6 billion, with ethylbenzene topping the list with about $700m a year" (Lemos). These high profits that would be generated by the hydrocarbon industry in the coming years could improve the economy even more for Brazil and achieve an outstanding economic growth. This could be a great opportunity for Brazil to use these economic resources for social development. As a matter of fact, Brazil's president Luiz Inacio Lula da Silva has mentioned that he "wants the oil profits to be used directly to benefit the population. Its stated priorities are education, fighting poverty and social security" (Osava).

In addition, Brazil's government has mentioned that economic and social benefits coming from the hydrocarbon development can be generated even from the construction stage. For instance, construction of the Urucu-Manaus pipeline has benefited local labor force who has been two-thirds of the total labor force hired for this project. This project has required the creation of 10,000 jobs and job training programs of 500,000 people (Rother, Vast Pipelines in Amazon Face Challenges Over Protecting Rights and Rivers). For residents of Manacapuru a small town in the area, the pipeline construction has generated 4,000 local jobs (Llana). Finally, for these local communities involved into the Urucu-Manaus project, benefits are based on compensations granted by the oil companies. Thus, part of this compensation has been the construction of seven additional secondary pipelines, "so that local communities can also use cleaner

gas, instead of diesel fuel, for electricity. [Petrobras, the oil company] also awarded the state government a $21 million grant for social services, such as jobs training, potable water, and free healthcare services" (Llana).

Regional Energy Integration

Crucial political changes in most of the Amazon Basin countries are encouraging their integration for the improvement the economic growth and the eradication poverty in this region. Commitments among these governments aim at the industrialization and eradicating dependency on hydrocarbons in order to achieve a higher economic growth and create a stronger region. Thus, countries of the Amazon region and the rest of South America are attempting to develop megaprojects which can increase the energy demand in the region. Venezuela's president Hugo Chávez has suggested the building of 5,000 mile pipeline which would cross the Amazon rainforest from Caracas to Buenos Aires, and the cost of the project would be around $24 billion (Rother, Vast Pipelines in Amazon Face Challenges Over Protecting Rights and Rivers). According to president Chávez, "the pipeline should be the locomotive of a new process of integration whose objective will be to defeat poverty and exclusion." (Rother, Vast Pipelines in Amazon Face Challenges Over Protecting Rights and Rivers) On the other hand, Bolivia and Brazil have developed a bilateral hydrocarbon project by which gas produced in Bolivia (Rio Grande) will be transported to Brazil (Mato Grosso) through a 1,958 miles pipeline (346 miles in the Bolivian side and 1,612 miles in the Brazilian side) with a maximum throughput capacity of 1.06 billion cubic feet per day. This private project has been considered the most expensive in Latin America (Center for Energy Economics 1-2); (Passos).

The cost of this project was $2 billion approximately and it was financed by multilateral organizations like the World Bank and Inter-American Development Bank (Passos). Moreover, this project is part of the plan for energy integration in the region by which governments want to reduce costs of energy and increase availability of hydrocarbons in the region. The main purpose of this project in the case of Bolivia has been to increase gas exports for receiving direct economic benefits. The original plans were to increase gas exports by 25%. However, gas exports have been increasing more than 25% in the last year (The World Bank). The World Bank statistics show that Bolivia's hydrocarbon exports reached 52.15% of the total exports in 2006 (The World Bank Group). Before construction of the international gas pipeline in 1998, Bolivia had an economic growth of 1.91%; however, after starting operation of the pipeline, Bolivia's

economic growth reached 5.92% in 2004. In addition, the economic benefits received by hydrocarbon between 1999 and 2004 were $2 billion (McGuigan 32-37). Finally, the loan proposal for this project issued by the Inter-American Development Bank stated that

> …construction of the pipeline will lead to a substantial increase in the use of natural gas in Brazil with positive long term impacts on the environment, industrial competitiveness, and Bolivia's trade balance. In both countries the project will contribute to the advance and consolidation of economic and institutional reforms in the energy sector, opening up concrete opportunities for greater private sector participation" (Inter-American Development Bank 2).

Finally, we have been able to appreciate the significant and great economic benefits that the exploitation of non-renewable natural resources has generated in the Amazon basin countries. Billions of dollars have been invested and other billions of dollars have been earned in return by extraction of hydrocarbons. Most of these governments have seen how their GDP has reached high levels in a short term because of the hydrocarbon exploitation. Thus, policies and regulations have been created for protecting and reinforcing the hydrocarbon sector. In addition, aggressive future exploration and development plans are part of the economic development strategies in these countries. However, this scenario of richness and bonanza is not worth it when fragile and sensitive ecosystems in the Amazon jungle have to be sacrificed and destroyed for achieving this economic growth. Environmental protection in the Amazon basin is not a priority when exploitation of non-renewable natural resources is present in this place. Instead of implementing and reinforcing environmental protection policies for protecting those ecosystems, environmental protection is seen as a threat for the development of the hydrocarbon industry. Thus, the destruction of ecosystems in the Amazon basin is increasing everyday with fatal consequences. The next section of this chapter is focused on environmental damage and destruction caused by the hydrocarbon industry in the Amazon jungle.

Extractive-Based Economic Growth Strategies: the Real Cost

The capacity of Amazon basin countries' governments to understanding and accepting such a destruction and degradation of ecosystems in the Amazon jungle has been limited, because of high economic benefits generated by the hydrocarbon industry. Environmental protection policies implemented by these governments are based on the minimization of the impacts caused by the hydrocarbon sector. However, the minimization of environmental impacts means to make the destruction and the degradation processes slower rather than preventing destruction and devastation. This section is a reflection and review of the real cost of extracting

non-renewable natural resources in the Amazon basin. In addition, this section includes the case of TEXACO Oil Company in Ecuador by which the meaning of environmental destruction caused by the oil industry, can demonstrate the magnitude of such ecological disaster.

Economic Benefits at the Expense of Amazon Basin's Destruction

Degradation and destruction caused by the hydrocarbon industry in the Amazon jungle show the same aggressive pattern everywhere. According to Aprajita Kashyap,

> Oil and gas development have emerged as an overpowering activity in the Amazon rainforest. In Peru and Ecuador search for oil and gas drove development. Environment and social impact included: Dislocation of indigenous people for, disease, pollution [air, water and land], deforestation and depletion of natural resources, [and] dependency for further development" (Kashyap 259).

The environmental impact caused by the oil industry on humid tropics can be more severe that the damage caused in other ecosystems. Ecosystems in the Amazon jungle are extremely fragile and complex. Land-clearing is one of the most common processes carried out in the oil industry. This process has a direct environmental impact that causes serious problems on ecosystems because of the removal of vegetation. Excessive removals of vegetation cause erosion and desertification. After the desertification of the sensitive soil, sedimentation and pollution of streams and ponds is present, causing a complete disintegration of the ecosystem. Another direct environmental problem is the pollution of fresh ground water sources, due to drilling operations (Rosenfeld, Gordon and Guerin-McManus 56-57). However, indirect environmental impacts have caused more degradation of high biodiversity ecosystems. Access to the forest via oil roads and pipelines paths built in those remotes places has enabled colonization and deforestation in those natural sanctuaries. It has been estimated that "for every kilometer of new road built [in the rainforest], roughly four hundred to twenty-four hundred hectares are deforested and colonized" (57).

Deforestation of Amazon's rainforest prevents the possibility of getting alternative economic benefits that these ecosystems could generate. Amazon's rainforest can supply a great variety of native agricultural products such as fruits, vegetables, alternative medicines and latex for meeting necessities of natives and local communities. However, deforestation caused by a high rate of colonization destroys these traditional systems generating big economic and ecological losses. Settlers focus on an aggressive extraction of these delicate and fragile tree species which do not have the capacity of a quick natural regeneration. So, erosion and

desertification are the most immediate consequences that reduce the possibilities of following with an ecological agricultural system (Grimes, Loomis and Jahnige 405). In addition, destruction of Amazon's rainforest because of the non-renewable natural resources will affect the ecotourism industry that could be one of the most profitable businesses in the Amazon basin countries in the next years. Ecotourism is more attractive and valuable when carried out within pristine and virgin ecosystem like in remote natural reserves, and national parks located in the Amazon jungle. However, degradation of these ecosystems and the presence of the oil industry means destruction of landscapes, leaving these places unattractive for developing a strong ecotourism industry (Galvin 4, 10-11). Moreover, indigenous communities who are settled in this basin will have no more natural resources for creating business which can help them avoid depending on the oil industry.

According to Diego Azqueta y Gonzalo Delacámara in their publication "El Costo Ecológico de la Extracción de Petróleo" [The Ecological Cost of Oil Extraction], the hydrocarbon industry in the Amazon basin affects the three main rainforest's ecological functions because of deforestation. First, the protection against erosion and desertification in these ecosystems disappears. Erosion generates high volumes of sediments which pollute fresh water sources. The cost of maintenance pumps and small dams in the local communities increases in a high percentage. Agricultural lands irrigated with these polluted water destroys arable land, so people have to migrate further in the jungle for getting new arable land. Therefore, deforestation for new arable and cattle land will diminish the capacity of carbon sequestration and storage processes, which are the second functions of these ecosystems. Finally, the high capacity of storing biodiversity that is the third function of those ecosystems will be lost completely. The economic value of these complex, delicate, and high biodiversity of those ecosystems cannot be measured (Azqueta and Delacámara 66). To lose these ecosystems would mean to lose the biggest sources of medicinal plants. These raw materials that are extinguishing everyday because of ecosystem degradation are becoming more expensive (66).

Direct and indirect environmental impacts caused to ecosystems in the Amazon basin, due to extraction of non-renewable natural resources, have been generating inestimable economic losses. Thus, the great economic benefits and economic growth originating through decades by the hydrocarbon industry become contradictory. It does not make sense to have a great economic growth only for a few years when cost for recovering these ecosystems in the

Amazonia could not be paid, even with the entire revenue that has been earned during the extraction of hydrocarbons. Finally, ambition for achieving a higher economic growth has prevented disclosing the actual devastating consequences on economic development that new generations will face in the near future.

Case of the Real Cost: Destruction in the Ecuadorian Amazon Jungle

To the people of Ecuador, the word "TEXACO" means destruction, abuse to indigenous communities, and environmental degradation; in addition, this word conjures up memories of one of the darkest stories told in the history of Ecuador with regard to environmental problems.

The government of Ecuador granted a concession of 4,350,000 acres to the Texaco Company in 1965 in order to begin their exploration operations (B. Miller 2-3); thus, environmental degradation began at this time with the deforestation of vast areas of the rainforest, since it was necessary to build helipads, camps, and clear, straight trails for the next step: seismic operations. Seismic lines and detonations were considered essential in order to determine the location of the oil reserves in subsoil formations. Unfortunately, through the process thousands of miles of land were ripped apart from the many pounds of dynamite that were used across this region (Sawyer 100-1). These exploration operations were repeated in each area where the company assumed there might be oil reservoirs. The destruction became more and more apparent. According to T. Christian Miller, "the legacy of oil explorations [cut] across the Amazon jungle like a scar. Texaco's roads [sliced] through the jungle. Settlers used those roads to slash and burn their way into the rain forest to plant crops and raise cattle[;] all told, about 2.4 million acres of jungle disappeared" (T. C. Miller).

The technology that was used to drill the first exploratory wells was deplorable and obsolete. The knowledge to drill and the expertise for dealing with water formations and oil residues was simply not there (Sawyer 101). Furthermore, it is known that the treatment pits were not covered with liner, and therefore numerous toxic chemicals filtered into the ground, where they reached fresh groundwater reservoirs. In some cases, the water from oil formations and the mud that was drilled were discharged into rivers with large fish populations- from which indigenous communities derived their food source.

Environmental Degradation

The exploration stage always poses a large economic risk. It can be reasoned that Texaco wanted to save money, and did not want to invest in environmentally friendly procedures and practices, as it was unclear just how large the oil reservoirs were, and of which quality the crude oil was. However, when Texaco realized their initial investment had paid off, and that there was much oil to be found in the reservoirs, the company still ignored the environment. Texaco decided to drill hundreds of wells in the Amazon jungle, using the same obsolete technology to develop the entire region.

Texaco drilled 339 wells and had 22 stations in an area of 1,094,590 acres, all within twenty years of operation (Oilwatch 29). Although there are now countless environmental problems due to Texaco's drilling and production operations, the main problems are the land and water pollution from a lack of formation water management, oil residues, and reserve pits.[1]

The formation water is very toxic due to the high salinity concentration- which is six times more than the sea water- and also contains a high quantity of pollutants, heavy metals, toxic salts, and hydrocarbons. Examples of hydrocarbons found in the water are benzene and other polycyclic aromatic hydrocarbons (PAHs), which can be carcinogenic, have a toxic effect on procreation, and can cause mutations and skin itching (Oilwatch 29); (Maldonado and Narváez 6-7).

Since the 1950's, "the industry standard for proper disposal of the toxic waste-water that is extracted with crude oil has been to re-inject it into the ground rather than dumping it into the environment" (Strickland). This was not the case in Ecuador. There were never drilled water disposal wells in the Amazonia to re-inject the waste-water, and instead discharged the water to the rivers and in the rainforest (Amazon Watch). According to Simeon Tegel, "18.5 billion gallons (450,000,000 barrels) of this water of formation was discharged in the period Texaco operated the sites" and "to put it in perspective, the amount of toxic waste they dumped was 30 times the amount spilled in the Exxon Valdez disaster" (Strickland).

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[1]Water of Formation "is the water that occurs naturally within the pores of rock. Water from fluids introduced to a formation through drilling or other interference, such as mud and seawater, does not constitute formation water." (Schlumberger 2007) Water sea has a sodium concentration of 35,000 ppm (parts per million), but the formation water has a sodium concentration between 150,000 and 180,000 ppm (Acción Ecológica, Boletín 2003) A reserve pit "is dug and lined with plastic next to the drilling rig. It will hold unneeded drilling mud, cuttings, and other materials from the well." (Hyne 239)

Before Texaco began its destructive operations, people in the region were able to use the water from rivers, wells, and other sources for drinking and other primary functions. However, once Texaco began drilling, the water became unacceptable to drink and use. A simple analysis showed that if 150,000 people were living in this area and they consumed 50 liters of water per person per day, the total consumption of water would be 7,500,000 liters/day. (Acción Ecológica). While the water pollution problems may have affected the largest number of people, the reserve pits, or waste pits, are the most visible evidence in terms of the environmental damage caused by Texaco. These pits, or pools, were used to store the waste from the drilling operations and the production facilities. Even when these pools were filled to the brim with toxic waste- coming from the water of formation, oil residues, drill cuttings and mud, or dangerous chemicals Texaco covered them with only soil at the most. In other cases, these dumps were abandoned without coverings, or even worse, the waste was burned. It is important to note that these pools were never first cased with liner or plastic before they were filled with the hazardous materials (Acción Ecológica).

The Amazon jungle is a humid region with rainfall throughout the year. When this rain water blended with the toxic waste from the dumps, these pits spilled over into the environment; thus, a toxic fluid flowed through forests and reached rivers and other sources of fresh water, leaving land pollution in its wake. Secondly, in the days after the rainstorm, the toxic liquid trickled down through the soil to mix with fresh groundwater flows. Texaco built approximately 1,000 of these waste pits, and every single one was poorly constructed. Each had a capacity of 4,165 cubic meters. Furthermore, the food chain was also affected from this contamination. Many species of animals drank the contaminated water and ingested the metals as mentioned before; these animals were relied upon by indigenous communities as a daily food source. In addition, fruit trees and a broad array of plants used for food and medicinal purposes were polluted, too. The lethal consequences of the water contamination became apparent in the health of the people a few years later (Oilwatch 29); (Kimerling, Amazon Crude 58-61). Air pollution began with the oil industry moving into the area and has been a serious problem ever since. Many people do not know that gas is a main component of crude oil, too. The gas retrieved from the Oriente fields is separated from the oil and water formation, but must be burned due to a poor quality of combustion. It cannot be processed. Texaco never implemented a plan for controlling

this burning, and so gas was burned around the clock, twenty four hours a day. In addition, the company burned the foul waste in the pits without any precautions.

According to Kimerling, Texaco "burned daily without any air pollution controls 53 million cubic feet of waste gas from the separation process." Moreover, between 1972 and 1991 Texaco had burned 235,600 million cubic feet of gas without any temperature and emissions control (Kimerling, Amazon Crude 63). When this gas is burned, various nitrogen oxides, sulfur, methane, ethane, propane, and carbon dioxide are released into the air. These gases have been the cause of many health-related problems to the people: headaches, convulsions, itchy skin, eye infections, mutations, cardiac diseases, deaths, and brain lesions. There has even been an increase in the death rate of newborn babies. In addition, some of these gases lead to acid rain and other residues forming which pollute the water and soil (Kimerling, Amazon Crude 63-4); (Acción Ecológica 49).

The most irresponsible activity performed by Texaco could perhaps be the burning of the toxic and dangerous waste contained in the pits. This waste was burned for hours, "generating dense plumes of black smoke. Settlers call the rains that follow these burns "black rain," and reported that they left a blanket of ash on crops, animals, water, and clothing, and caused skin problems among children. Moreover, the produced gases from burning this matter had heavy metal and other dangerous compounds, more toxic than the gas being burned" (Kimerling, Amazon Crude 67).

Pipelines: Dangerous Snakes

Transportation is the last stage in the production process of oil. Thousands of miles of pipeline have been built in the Amazon jungle since the start of the production. All towns and cities where the pipelines cross have been impacted. This system of pipelines, called the System of Trans-Ecuadorian Pipeline of Ecuador (SOTE) [System de Oleoducto Transecuatoriano del Ecuador] cuts through the Amazon Region to the Ecuadorian Pacific Cost, with numerous branches connecting to a main pipeline from where 85.4 percent of this oil -174,600 barrels per day- were exported to the US until 1989 (Kimerling, Amazon Crude 51). When Texaco managed SOTE, 16.8 million gallons of crude oil spilled into the environment from the main pipeline. This equates to a spill 1.55 times larger than the Exxon-Valdez spill. This was not the only spill, but data on more frequent spills from secondary pipelines or branches is limited or non-existent

(Acción Ecológica); (Acosta, Amazonía por la Vida : Debate Ecológico Sobre el Problema Petrolero en el Ecuador 14).

There were no contingency plans for oil spills; when spills occurred technicians waited for the pipeline to drain completely before beginning with repairs. In this time, hundreds of gallons of oil were spilled into the environment, polluting the water and land. Another point to consider is that the pipelines were poorly maintained and frequently rusted from the rainwater. Texaco designed SOTE because Ecuador did not have the proper know-how to build the system itself. However, it is clear that Texaco did not place environmental protection at the top of its list, as the system was built in an unstable geological area, causing problems at a catastrophic level. In March of 1987 a major earthquake shattered part of SOTE and millions of gallons of oil were spilled into the rivers and forests for several days (Kimerling, Amazon Crude 70-1). Finally, Texaco built a giant network of roads without any environmental consideration. As soon as a new drilling location was found, thousands of trees were cut down to make room for roads, disturbing many animals. Once the road was cleared, the company would spill oil residue across the road to avoid dust. Millions of gallons of oil waste were spilled onto the roads while Texaco operated in the jungle. Environmental degradation could not get much worse; sadly, oil and toxic waste has covered this green landscape since the oil industry came to the Amazon jungle.

Chapter II

Development without Extraction of Non-Renewables

The devastating effects on the Amazon Basin's environment caused by the hydrocarbon industry have raised regional governments' consciousness about ecological problems. In addition, after the Rio Declaration in 1992, the concept of sustainable development was broadly accepted as a guiding principle to preserve the environment and minimize the impact on it. Implementation of more sustainable practices has permitted the extractive industries to continue to exploit non-renewable natural resources discovered in vulnerable ecosystems. In the case of the hydrocarbon industry, use of best practices and technologies and the implementation of environmental impact assessments and environmental management plans have improved oil companies' operations. Those modifications have decreased environmental damage and slowed the process of degradation in the Amazon jungle. However, this region encompasses very sensitive ecosystems within national parks and protected areas that may not withstand extraction activities such as hydrocarbon development. The high level of biodiversity present in these places is extremely vulnerable and sensitive. The slightest changes in those habitats would alter and destroy the complex and outstanding interconnections between animals and plants.

According to Yadvinder Malhi's publication, *Climate Change, Deforestation, and the Fate of the Amazon,* the Amazon jungle embraces a quarter of all the world's terrestrial species, in some areas, more than 5,000 species per 10,000 square kilometers which represents the highest concentration of biodiversity on the planet (Dirzo and Raven 148-9), and 15% of the terrestrial photosynthesis. Precipitation systems and cycles across South America and part of the Northern Hemisphere depend on the Amazon jungle because of evaporation and condensation processes. For these reasons, Malhi et al. encourage maintaining some areas that host the greatest biodiversity in the Amazon jungle intact, such as those between forest and savannah, between the Andean piedmont and montane forest, and humid refugia and migration corridors for terrestrial ecosystems (Malhi, Roberts and Betts 169-171).

This chapter is focused on preventing hydrocarbon extraction within high biodiversity ecosystems in the Amazon jungle for achieving economic growth by presenting alternatives that have economic benefits. A comparative economic analysis between the hydrocarbon industry and those alternatives is necessary. The goal of this research is to demonstrate that there are

some alternatives, such as ecosystem services, through which development and economic growth can be created without extracting hydrocarbons. The chapter will show that extracting non-renewable natural resources -- even by applying a sustainable model such as implementation of best practices, the use of advanced technology, and ensuring corporative accountability – cannot be the ideal solution for achieving economic growth and preserving those fragile and sensitive ecosystems in the Amazonia.

Ecosystem Services: Alternative Development Strategies

The idea that the Amazon Basin can generate great economic wealth without extracting non-renewable natural resources has had limited currency with most of Amazonian governments. Hydrocarbon exploitation has been a short-term solution for achieving economic growth in most of the region's countries. Yet non-renewable natural resources such as oil and gas will be exhausted in a couple of decades in the region (Energy Information Administration). In addition, oil price volatility will create uncertainties and extreme fluctuations in the economic growth of these countries. The economic benefits of extracting hydrocarbons in the Amazon region have become insignificant compared with the high cost that countries will have to pay for remediating the profound environmental degradation and destruction brought about by hydrocarbon extraction, and most rainforests cannot be completely remediated at all (Monitor). By contrast, high biodiversity ecosystems in this region can bring about significant long-term economic benefits rather than the short-term benefits generated by hydrocarbon development. Ecosystems in the Amazon jungle have the capacity of providing many services benefiting human beings. According to Gretchen C. Daily in her publication, *What Are Ecosystem Services?* "ecosystem services are the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfill human life" (Daily 227). World Resources Institute's (WRI) definition states, "ecosystem services are the benefits that people get from nature; examples include fresh water, timber, climate regulation, recreation, and aesthetic values" (Ranganathan, Raudsepp-Hearne and Lucas 3). Ecosystem services can also provide a reconciliation between development and nature since most of the human beings have forgotten their connection to nature. They are the point where conservation overlaps with development (i).

Ecosystem services are considered an integral part of human well-being. According to Butler and Oluoch-Kosura, ecosystem services can meet human beings' essential necessities

such as shelter, clothing, food, and livelihood. In addition, ecosystem services may bring non-material benefits as well such as good health, a sense of security, and good social relations (Butler and Oluoch-Kosura 1-2). These authors state that, "in many cases, an insufficiency or maldistribution of ecosystem services contributes to a sense of insecurity, and often, to poor social relations" (2).

The great variety of services that ecosystems provide to human populations depends on complex biological, chemical, and physical interactions. Taking into account these interactions and geography a wide variety of ecosystems have been identified that provide services: mountains and poles, forests and woodlands, inland waterways, drylands, cultivated lands, urban, marine, and coastal areas, and islands (Millennium Ecosystem Assessment Board 6). These ecosystems consist of services such as provisioning, regulating, and supporting, as well as cultural services. At the same time, each of these services has sub-categories (23-24).

The Amazon jungle is an example of a forest and woodland ecosystem. According to Pita Verweij, et al., the most significant ecosystem services provided within this category for the Amazon region are production of non-timber forest products (NTFPs) and sustainably harvested, erosion prevention, fire and disease protection, pollination of coffee plantations in the forest, carbon storage, and maintenance of biodiversity. Additionally, the jungle provides cultural and spiritual benefits, the importance of its mere existence, and recreational and ecotourism use (Verweij, Schouten and Beukering 4). However, the services taken into account for this study are carbon storage, and ecotourism. These services show the greatest promise, generating great economic benefits as well as solving some social problems.

Carbon capture and sequestration: the great capital of the Amazon jungle

Carbon is present in nature as an organic and inorganic element. Organic carbon is stored in plants and trees. By contrast, inorganic carbon is spread out in the atmosphere. According to R.A. Houghton, the total carbon present in the mass of elements in the Earth's crust is approximately 0.27%. Moreover, carbon makes up 50% of the weight of dry organic matter. This author mentions that "the amount of carbon contained in terrestrial vegetation (550± 100 Pg [1 Pg = 1 petagram =10^{15}g = 10^{9} metric tons]) is on the order of the amount in the atmosphere (800 Pg). "Forests are particularly important as carbon reservoirs because trees hold much more carbon per unit area than other types of vegetation" (Houghton 316-17). The broad and dense Amazon rainforest stores or sequesters large amounts of organic and inorganic carbon, both

above ground and in the soil (16-7). Rhett A. Butler mentions that capacity of storing carbon in the Amazon depends on forest structure and vegetation types. This rainforest can store in its ground biomass for old growth vegetation between 550-1283 metric tons of carbon dioxide per hectare (R. A. Butler). Amazonia is one of the most important carbon sinks on Earth. Carbon present in the atmosphere is taken up by photosynthesis and released by the respiration processes of plants. Yadvinder Malhi, author of *Carbon in the Atmosphere and the Terrestrial Biosphere in the 21st Century*, states that "every year 120 PgC (16% of the atmospheric stock) are transferred from the atmosphere to the biosphere via the process of plant photosynthesis" (Malhi 2926). Nonetheless, photosynthesis and respiration processes create an imbalance between them causing terrestrial ecosystems to become sinks (Houghton 324-5). In addition, warmer temperatures and high humidity in the Amazon rainforest may increase carbon sequestration which will in turn improve carbon sink capacity as well (325).

Processes such as photosynthesis, respiration, and storage make up the carbon cycle on Earth. However, this cycle has been disrupted because huge amounts of carbon dioxide have been released into the atmosphere through human activities such as the use of fossil fuels and deforestation since the Industrial Revolution. While some national governments are implementing the best international policies for reducing these carbon emissions, much more needs to be done to ensure that the Amazon jungle continues to serve as the most important carbon sink for diminishing the carbon cycle imbalance.

According to Verweij et al., preservation of this carbon sink can generate significant economic benefits that can be generated through the creation of international markets for trade in carbon emissions. Conservation of the Amazon jungle would be a more profitable short-term achievement than attempting to prevent greenhouse gas emissions in developed countries (18-9). The carbon market is an initiative by which Amazon Basin countries may stop deforestation that causes approximately 20%-25% (1GtC) of the total global greenhouse gas emissions (Coalition for Rainforest Nations). Implementation of this carbon market proposal would encourage halting extraction of hydrocarbons within the Amazon region. Oil/gas extraction development causes direct deforestation through construction of roads, camps, drilling platforms, and production facilities. Likewise, the colonization and illegal logging produced as a result of the development of the oil/gas industry generate indirect deforestation. Therefore, implementation of this carbon market proposal would be a solid approach that would halt deforestation in the Amazon jungle

while generating economic benefits and preventing extraction of hydrocarbons in the Amazon's most vulnerable and sensitive ecosystems. At the same time, preventing deforestation would increase the rainforest's capacity to capture carbon.

William F. Laurance states that "each hectare of old-growth tropical rainforest typically contains 120-400 tons of carbon in its aboveground vegetation and much more if plant roots and carbon in the soil are considered" (Laurance 21). According to the carbon market – which varies considerably – one intact hectare of rainforest could be worth anywhere from $400 to $8000 or more (21). For example, that means that if we would take into account the 982,000 hectares of the Yasuni National Park in the Ecuadorian Amazon, and we consider a price of $8,000 per hectare because of its high degree of biodiversity and old-growth stands, the economic benefits that this park would generate for sequestrating carbon would be $7.86 billion. This general analysis shows the great economic benefits that just one protected area and one type of ecosystem service can generate.

Nevertheless, success in this carbon market proposal for protecting the Amazon jungle will depend on the best model implemented for curbing deforestation. This proposal may encourage halting extraction of hydrocarbons in the Amazon rainforest. Prevention of deforestation in this region would become a priority because this program would generate economic and environmental benefits. Philip M. Fearnside in his publication *Amazon Forest Maintenance as a Source of Environmental Services* cites that creation of national reserves or national parks are an effective mechanism for diminishing deforestation as long as the timeframe of the project is taken into account (Fearnside 107). In addition, Fearnside mentions that "time can be given value in various ways in carbon calculations" (107). For instance, if small natural reserves are created next to areas of frontier deforestation, they will be expensive because their implementation cost will demand strong policies and mechanisms for immediate protection. While being more expensive to implement these mechanisms in frontier deforestation areas, the benefits derived will be immediate. On the other hand, reserves created far from the deforestation frontiers, while cheaper to implement, will take much longer to demonstrate the same benefits (107).

Furthermore, it is important to mention that the carbon market approach can present some constraints because of weaknesses and failures in its implementation. For example, Philip Fearnside mentions "leakage" as a constraint by which carbon trade could fail. Leakage is

explained as a nullification of the carbon benefits reached on the protected area because deforestation can "migrate" to other areas out of the new protected area boundaries. That happens when people, in particular settlers, move to unprotected areas in order to create new arable land and clear new sections of rainforest for their agricultural activities (109). However, this leakage can be prevented through implementation of transparent and strong polices by governments of the Amazon region. They would be responsible for making of the carbon trade an alternative to extraction of non-renewable natural resources by which the most vulnerable ecosystems in this region could thus be preserved.

Carbon market mechanism and deforestation in the rainforest

The initiative for implementing carbon credits through avoided deforestation has met with some resistance. First, according to William F. Laurence, some environmentalist groups in Europe have opposed implementing this mechanism. They argue that this initiative would let developed countries such as the United States avoid responsibilities for achieving a permanent emission reduction commitment. Furthermore, carbon credits would permit those countries to continue increasing their industrial and automobile carbon emissions (Laurance 20-1). Second, Amazon Basin countries such as Brazil are not convinced of the value to them of carrying out this initiative due to fears that it could limit their future development options in the Amazon region (22). However, both European environmentalists and Amazon Basin countries' governments have realized over the years that carbon credits may in fact be a good alternative for halting deforestation and controlling greenhouse gas emissions. Currently, there are some reasons the carbon credits initiative may be accepted by developed and developing countries. First, climate change effects are speeding up due to increasing carbon dioxide emissions in the atmosphere. Second, developing countries such as China and India are emitting larger amounts of carbon dioxide than some developed countries. Third, deforestation in the Amazon jungle seems to have no end in sight, so countries in the Amazon Basin are becoming aware that implementation of a system for halting deforestation is crucial (21).

The carbon credit strategy has only focused on some strong projects for mitigating deforestation in the Amazon Basin. In the UN Framework Convention on Climate Change (UNFCCC) conference in Bali, Indonesia in 2007, the initiative called *Reducing Emissions from Deforestation and Degradation* (REDD) has been taken into account as part of these projects (Seeberg-Elverfeldt, Schwarze and Zeller 2). REDD began as an initiative proposed by the

Rainforest Coalition, “a group of developing nations with rainforest who formally offered voluntary carbon emission reductions by conserving forests in exchange for access to international markets for emissions trading” (2).

According to Christina Seeberg-Elverfeldt et al., REDD is an initiative in which local people are paid for switching to more sustainable land use practices and enhanced ecosystem protection. Payments would be made by the beneficiaries of these ecosystem services, such as industrialized countries, that have to commit to large-scale carbon dioxide emissions reductions. This system of payment is called “payment for environmental systems” (PES) (3). Sven Wunder, in his publication *The Efficiency of Payments for Environmental Services in Tropical Conservation*, states that PES represents a new and modern way to promote conservation. PES will be voluntary and part of conditional agreements. Such agreements would be made between at least one seller and one buyer. Thus, individuals and/or entities who sell their ecosystem services would derive direct economic benefits from the buyers, avoiding intermediaries and other economic distortions this way (Wunder 48). Moreover, the PES scheme can be improved though the implementation of “baselines, calculating conservation opportunity costs, customizing payment modalities, and targeting agents with credible land claims and threats to conservation” (48).

Furthermore, REDD is in line with the “compensation reduction” proposal which is another initiative for reducing carbon emissions in developing countries. As a part of this proposal, developing countries can increase their participation in the Kyoto Protocol framework (Santilli, Moutinho and Schwartzman 269). REDD “would allow developing countries to sell emissions savings from forest conservation. Developed countries ('Annex I') would buy the savings to credit against their own emissions targets” (Climate Action Network Australia). In addition, countries under this model of avoided deforestation would be authorized to issue carbon certificates similar to the Certified Emissions Reductions (CERs) of the Clean Development Mechanism (CDM) (270). Those certificates “could be sold to governments or private investors; once having received compensation, countries would agree not to increase, or to further reduce, deforestation in future commitment periods” (270).

Johannes Ebeling and Maï Yasué mention that the Amazon jungle has the greatest potential for mitigating climate change through REDD. The deforestation rate in this region between 1990 and 2005 was 26% (3.7 million hectares) of global deforestation (Ebeling and

Yasué 1917). In addition, they say that by linking this region to the REDD initiative, great volumes of greenhouse gas (GHG) emissions would be tackled. The benefits of this initiative would be the low cost for diminishing GHG emissions and conservation of these fragile ecosystems within the rainforest (1918). Moreover, these authors mention that the international community has expended around $1.1 billion annually for protecting forests in the last decade. They have made some calculations based on deforestation rates and a range of current carbon prices on the international market. These calculations assume that "reducing deforestation rates by as little as 10% globally could generate substantial annual carbon finance such as $2.2 - $13.5 billion" (1918).

Although the calculation values mentioned earlier show high economic benefits, success of REDD programs will primarily be based on carbon prices. Carbon prices may determine competiveness between conservation and traditional practices such as extraction of non-renewable natural resources, logging, and ranching. For instance, Vera-Diaz and Schwartzman calculated the Break Even Carbon Prices (BEP) – the price of carbon through which REDD alternatives are financially attractive. Ranchers and loggers in the Amazon can use BEP as a way to gather baseline data and thereby know the point at which the REDD scheme becomes financially profitable for them. These authors calculated BEP based on three values of biomass content: 397 tC/ha, 155 tC/ha and 121 tC/ha). In this case, they found that BEP for conservation ranged from US$ 1/tC to US$ 14/tC. On the other hand, soybean plantations' BEP could range from US$ 6 tC to almost US$ 30 t/C. After this analysis, the authors concluded that, in principle, taking into account an average price of Certified Emission Reductions (CERs) in the EU emissions trading scheme between 2004 and 2005 – $ 5.63 t/CO2 (or 20.64 t/C) – "conservation could compete with the most common land-use activities in the Amazon, including cattle ranching following logging" (Volpi 33).

In some cases, creation of natural parks and reserves for carrying out the REDD initiative has been seen as a threat to development in the Amazon region by some Amazon Basin countries because they should reject exploitation of non-renewable natural resources. Nonetheless, some states in Brazil show this alternative as an economic benefit for local people and a way to decrease poverty in this region (Amend, Gascon and Reid 1). Marcos Amend et al. state that "recent evidence from the Brazilian state of Amazonas suggests that at least in some places the reality is [that] parks funnel money and jobs to places with [this initiative], and outsiders pay the

tab" (1). Today, 10 protected areas are part of an initiative for the protection of the Brazilian Amazon jungle. The cost of protecting these 10 areas is $1.76 million per year. A financial-flow analysis for this project has demonstrated that

> …only 1.49% could be identified as deriving from state and local government sources. An additional 5.98% came from non-governmental and private sources within the state of Amazonas. A further 13.13% was from undefined government sources. At a minimum therefore, 79.4% of park-related funds comes from outside the state and can be viewed as 'income' for the State's economy (Amend, Gascon and Reid 2).

Finally, REDD would be an initiative whereby people who live close to or within the rainforest could demand protection of these ecosystems. At the same, protection of the Amazon jungle would generate direct economic benefits for those involved in these projects. Thus, REDD would be an affordable alternative to extraction of non-renewable natural resources within those ecosystems for developing this region.

Ecotourism in the Amazon jungle: a highly profitable business

The incredibly high degree of biodiversity and the marvelous landscapes spread throughout the Amazon Basin have created the perfect scenario for developing those countries' ecotourism industries. According to the Ecosystem Service Classification, ecotourism is a cultural service (Ranganathan, Raudsepp-Hearne and Lucas 24). The International Ecotourism Society (IES) defines ecotourism as "responsible travel to natural areas that conserves the environment and improves the well-being of local people" (The International Ecotourism Society 1). Moreover, this definition encourages those who participate in ecotourism activities to follow some important principles such as minimizing environmental impact, building environmental awareness, providing direct financial benefits for conservation and local people, and "rais[ing] sensitivity to host countries' political, environmental, and social climate" (1).

In general, tourism may be compared to the oil/gas industry due to the investment magnitude and number of people involved in such industry. It has been reported that "tourism is one of the largest industries and employers in the world.…it currently accounts for 10.7% of the world's Gross Domestic Product (GDP) and employs 260 million people" (Verweij, Schouten and Beukering 25). Today, a significant aspect of tourism is focused on visits to tropical rainforests such as the Amazon jungle. According to some statistics from the IES,

> …ecotourism has been growing 20%-34% per year since the 1990s; in 2004, ecotourism/nature tourism was growing globally three times faster than the tourism

> industry as a whole; and most of tourism's expansion is occurring in and around the world's remaining natural areas (The International Ecotourism Society 2).

At the beginning, developing the tourism industry within this region faced many constraints. The presence of indigenous communities and fragile ecosystems with high biodiversity were part of these limitations. However, the model of ecotourism developed in the Amazon jungle has created multiple linkages between the twin goals of environmental preservation and community development. In this context, biodiversity conservation in the Amazon jungle has depended on the community-based ecotourism (CBET) which is "based on the principle that biodiversity must pay for itself by generating economic benefits" (25).

CBET: a millionaire industry

The concept that oil/gas development is the most profitable business in the Amazon jungle countries is currently undergoing changes. In fact, some countries like Ecuador have seen that ecotourism is generating great profits in the Amazon region. Moreover, ecotourism has the potential to become a more egalitarian industry in which poor people living in or near areas of interest can participate and derive economic benefits. Therefore, a form of ecotourism that not only preserves the environment, but also directly involves the local community in its development and implementation, can be an important part of attempts to diminish the poverty that is one the toughest socio-economic and political problems in the region. This connection between environmental preservation and community development forms the basis of CBET. Agnes Kiss states in her publication, *Is Community-Based Ecotourism a Good Use of Biodiversity Conservation Funds?* that "the attraction of CBET is the prospect of linking conservation and local livelihoods, preserving biodiversity whilst simultaneously reducing rural poverty, and of achieving both objectives on a sustainable (self-financing) basis" (Kiss 232).

Furthermore, it seems that CBET is becoming become an important motor for poverty alleviation in the most isolated and poor communities. William H. Durham et al. emphasize that "communities see in ecotourism an opportunity to generate income to support families, educations, health care, and local infrastructure" (Durham, Hoagland and Ediger 12). Additionally, ecotourism creates a service chain which includes "locally grown, often organic, food in their ecotourism plan, allowing local growers to benefit by selling produce to the lodges" (12).

Today, some governments from developed countries are funding CBET projects. This is the case of the US government: it has encouraged implementation of such projects in certain developing countries. The US government, through the United States Agency for International Development (USAID) had developed, by the mid 1990s, 105 projects which represented an investment higher than US$2 billion (Kiss 232). The World Bank financed 32 CBET projects in Africa between 1988 and 2003 (232). According to *Analysis of Community-Based Ecotourism in the Americas*, 34% of all CBET in the world is located in South America. The South American countries with the most developed ecotourism industries are Ecuador and Brazil: they have been able to consolidate a solid CBET industry, primarily Ecuador. In addition, most worldwide CBET operations are concentrated in tropical moist forests such as the Amazon Basin (Durham, Hoagland and Ediger 6-8)

The CBET experience in Ecuador

Deforestation is one of the main causes of the destruction of fragile ecosystems in the Amazon region. Of the countries located in the Amazon Basin, Ecuador shows the highest rate of deforestation. According to the Food and Agricultural Organization (FAO), the "estimated overall deforestation in Ecuador is 2,380 km^2/year from 1980 to 1990 and 1,370 km^2/year from 1990 to 2000" (Rodríguez 155). The causes of this aggressive rate of deforestation in Ecuador, principally in the Amazon jungle, have been attributed to activities such as "oil exploitation, which has allowed for the establishment of settlements along opened access routes" (155). However, some alternatives such as CBET have been implemented to prevent deforestation and destruction of these ecosystems.

At its inception, ecotourism in Ecuador did not represent a sustainable way to generate income; however, this industry has increased rapidly since the 1980s. Today, the CBET industry in Ecuador has a respected reputation and is serving as a model for developing similar projects in the other countries throughout the Amazon Basin (Verweij, Schouten and Beukering 25). It has been reported in some statistics that tourist expenditure in the 1990s in the entire Ecuadorian Amazon jungle reached US$ 5.32 million per year (25).

In some ways, the implementation of the ecotourism industry in the Ecuadorian Amazon has begun to change destructive practices such as timber exploitation, cattle farming, and extraction of non-renewable natural resources, at least on a small scale. Indigenous communities have seen that preservation of this tropical rainforest can generate direct economic benefits

through ecotourism projects. Randall Borman, an indigenous Cofan leader, claims that success of the CBET model in Ecuador is due to the fact that indigenous communities have been able to attain legal access to large territories in the Amazon and begin to develop their own CBET initiatives. This legal access has permitted those communities to prevent would-be colonists and the oil/gas industry from becoming established within the parameters of their territories. Colonists and the extractive industry are the main responsible parties for increasing the deforestation frontier. Thus, indigenous peoples have been able to implement more effective models of development based on nature preservation. Native communities such as Cofan have developed strong and solid relationships with important local and foreign tourism companies. These alliances have made it possible to carry out successful CBET programs (Borman 25-26). Inhabitants of Cofan have seen how ecotourism can generate great economic benefits. They have become convinced that CBET has been a success in this community because money has been "rolling in" (26). Moreover, they claim that they have been "managing the forest and earning a living at the same time, in spades" (26).

The quality of life of some indigenous communities in the Ecuadorian Amazon has improved considerably due the implementation of CBET projects. These communities have benefited economically, increased the number of employment opportunities for local communities, prevented environmental impacts, and preserved indigenous communities' culture and identity. CBET creates many direct job opportunities for members of the community. Most of the people in those communities may be involved in most of the activities. Ecotourism can generate skilled, unskilled, and semi-skilled jobs (Braman and Fundación Acción Amazonia 8). CBET involves people in activities of tourism infrastructure construction and project operation and maintenance (Organización Internacional del Trabajo 24). One of the most significant aspects about job opportunities within this CBET model is that it encourages a high degree of women's participation. Women have important decision-making roles that allow them to grow as individuals and important community members; additionally, they have opportunities to work in culinary tasks, upkeep of CBET physical facilities, and handicraft production (Organización Internacional del Trabajo 25). Direct participation of indigenous communities in CBET is quite high. In the case of Cofan, for example, participation of indigenous peoples is more related to ownership. According to some statistics, indigenous communities in Ecuador own 69.2% of the total projects (Durham, Hoagland and Ediger 11).

Moreover, the CBET model has been defined as an ally of environmental protection efforts and of indigenous communities' efforts to shore up their traditional cultures and resource-linked worldview. Implementation of CBET projects diminishes and curbs the presence of destructive practices such as mining, hydrocarbon operations, and cattle farming (Organización Internacional del Trabajo 24). These practices have contributed to skyrocketing levels of deforestation and pollution of the environment in this region rather than the creation of better environmental practices and the stewardship of natural resources. Environmental degradation in the Amazon Basin has increased the poverty level of its indigenous inhabitants (24). CBET projects have helped begin to stem this tide by preventing some logging, decreasing the hunting of endangered species, and employing destructive fishing practices (24). In fact, people through CBET have reached a higher level of awareness about biodiversity and the importance of preserving the fragile and sensitive ecosystems of the Amazon Basin (24). In addition,

> …community tourism operations add an economic value to the land and the undisturbed condition of the forest: the more intact and 'wild' an area, the more valuable it is for tourism. …some communities have voluntarily decided to set apart no-hunting zones in areas frequented by tourists, to ensure better wildlife viewing opportunities (Braman and Fundación Acción Amazonia 9).

Finally, CBET encourages preserving indigenous cultures, traditions, and history (IDB25). Indigenous peoples see that preservation of their ethnic identities strengthens CBET's financial benefits because foreigners want to not only visit biodiverse natural areas, but also learn about the indigenous cultures and traditions that are found there. Tourists who visit such places in Ecuador can immerse themselves in indigenous cultures in a way that would be impossible elsewhere, permitting them to see that the preservation of biodiversity must by necessity include the preservation of the indigenous people who for millennia have depended on and lived in that area (Moore 43). Furthermore, "traditional communities can feel greater self-esteem as a result of the respectful interest shown by visitors, especially if outside attitudes have tended to belittle them" (Moore 43). Therefore, CBET can represent cultural empowerment and restoration of traditional cultural integrity, as well as an opportunity for cultural exchange between inhabitant and visitor. Randy Borman, notes that "tourism has been a 'very positive cultural influence overall' in [the community] and that it has been an 'affirmation of the culture'" (Braman and Fundación Acción Amazonia 9).

These facts demonstrate that CBET is becoming a strong alternative to extraction of non-renewable natural resources within fragile ecosystems in the Amazon Basin. This alternative for

preserving the Amazonian environment while simultaneously generating great economic benefits for its local inhabitants could curtail and even possibly stop further exploitation of hydrocarbons. As was mentioned before, the economic benefits generated by CBET can create increased financial opportunities in those communities immediately. Thus, most of the indigenous communities in the Ecuadorian Amazon would not continue to be dependent on the oil companies or they would reject the oil/gas development in those areas altogether. Scott Braman argues that indigenous groups in the Ecuadorian Amazon region "have very limited opportunities to earn money and often turn to the oil companies for handouts (usually food, clothes, chain saws, or outboard motors) or jobs as manual laborers, or to extractive practices such as logging and clearing of land for cattle" (Braman and Fundación Acción Amazonia 1). Nonetheless, the author claims that indigenous communities have become aware of the destruction that oil/gas development have been causing. So, they see "the development of tourism as one of their only economic alternatives, and one capable of promising economic benefits, environmental protection, and cultural pride and empowerment" (1).

The two ecosystems services –the Carbon Market Mechanism and the CBET— presented in this chapter are clear and sound examples of alternatives to extraction of non-renewable resources within sensitive ecosystems such as protected areas and national parks in the Amazon Basin. Some Amazon Basin's governments see ecosystem services alone as an adequate option for alleviating poverty, and these alternatives supplement PES and address their concerns. In addition, worldwide concern of preserving the tropical rainforest, primarily the Amazon jungle, is pushing countries of this region to develop new programs of nature conservation. Therefore, implementation ecosystem services projects are becoming one of the best alternatives for achieving economic development and environmental protection in the Amazon region.

Although some Amazon Basin governments have wanted to prevent extraction of hydrocarbons in pristine ecosystems, this has been very difficult to achieve since this governments have not had concrete proposals. Nevertheless, some important initiatives have been appeared in the last years. For instance, Ecuador's government and the international community have launched the first proposal by which exploitation of an oil reservoir could be prevented. This proposal called "Yasuni-ITT Initiative" attempts to leave the oil reserves found within the Yasuni National Park underground. This innovative model is based on the carbon market mechanism, and will be described in the next chapter.

CHAPTER III

Yasuní-ITT Initiative: the future of the Amazon Jungle

Natural resources are commonly seen as the most valuable inheritance that human beings can leave to their future generations. In many cases, preservation of those natural resources—both renewable and non-renewable—has become part of national security policies. This concept is highly significant for Ecuador, as an aggressive extraction of non-renewable natural resources—hydrocarbon exploitation—has been a fundamental part of its economic model in the last four decades. The case of preservation of natural resources in Ecuador becomes more critical since this extraction of gas/oil is carried out within the most sensitive and fragile ecosystems in the Amazon jungle. This third chapter is a case study of the *Yasuní-Ishpingo-Tiputini-Tambocha Initiative* that is trying to leave the oil reserves found in the Yasuní National Park underground to preserve this fragile and sensitive ecosystem.

Ecuador is a marvelous country. It encompasses three natural regions – coast, mountains and Amazon jungle – within its boundaries, all of which have a rich biodiversity. Although insignificant to some now, the year 1979 could potentially be one of the most important to Ecuador's history, since the Yasuní area was declared a National Park. The Ecuadorian government stated this declaration for preserving the outstanding biodiversity present in this location. In addition, UNESCO recognized a biosphere reserve in the Yasuní National Park in 1989. This recognition guarantees that activities developed within this national park are directly related to nature preservation practices, environmental education, ecotourism and applied research. Finally, the Yasuní National Park was declared an Intangible Zone –Zona Intangible in Spanish– in 1999. This means that this area is considered exceptionally important due to the presence of contacted and non-contacted indigenous communities along with high biodiversity. This categorization of the Intangible Zone prevents developing any extractive activity due to its almost unique combination of nature and culture (Isch, Larrea and Martìnez-Alier 9-10).

According to Jose Fabara, the Yasuní National Park covers 2,426,574 acres and the Tagaeri-Taromenae Intangible Zone – a Huaorani group without western influence – 1,729,738 acres bringing the total to 4,156,312 acres. This protected area includes mainly a tropical forest, but also other kinds of forests such as non-flooded upland forest, flat forest, and seasonally and permanently flooded forest, which are adjacent to rivers and lakes (Fabara Rojas 10).

Moreover, the Yasuní National Park is considered one of the most pristine portions of the hypothesized Pleistocene life refugias. The Pleistocene refugias were a result of extreme climate changes in the quaternary era. This era was characterized by alterations of climate by which the Amazon jungle experienced abrupt changes of dryness and humidity. These changes formed vegetation islands that were refugia places for animals and plants. The Yasuní National Park is considered one of these islands (Isch, Larrea and Martìnez-Alier 10). Today, the Yasuní is

> …one of the most biologically richest places in the world with at least 351 tree species in 2.5 acres plot. In addition, it has been reported that an unprecedented number of species including 313 of epiphytes, 500 species of lianas, 12 species of primates, 567 species of breeding birds, 173 species of mammals, 121 species of amphibians, 562 species of fish, and thousands of species of invertebrates and microorganisms (Fabara Rojas 10-2).

Unfortunately, within this amazing park one can also find oil reservoirs, since some sections of the oil blocks have been assigned to a few multinational oil companies in order to exploit the oil.[2] There are eight oil blocks –10, 14, 16, 17, 15, 31, ITT (43) and one marginal oil field – managed by national and multinational oil companies overlapping this national park (Fontaine and Narváez 24). These companies own the percentage of Yasuní Park that lies within their blocks, which in most cases does not exceed 50% (Yasuní Rainforest Campaign). However, more than 80% of Block ITT (43) is overlapping the Yasuní (Fontaine and Narváez 24).

The great volume of oil reserves discovered in the ITT block in the last years has made Ecuador's government develop an aggressive oil extraction program which could be implemented in a few years. According to Fernando Reyes, the ITT oil field has been the biggest heavy oil reservoir discovered in Ecuador. The total oil volume that lies in this field is 5.586 billion barrels approximately. Studies have demonstrated that 66% of these oil reserves – 840 million barrels – could be recovered, which represents 20% of the total Ecuadorian oil reserves – 4.2 billion barrels – (Boedt and Martínez 20; University of Maryland).

Oil produced from the ITT block would have a viscosity between 14 and 15 API degrees, which means that this is heavy oil. The amount of formation water that this field would produce is calculated to 90 barrels of formation water per 10 barrels of oil. This would imply implementing big facilities to treat this fluid before being re- injected to prevent discharging this

[2] The Hydrocarbon Law in Ecuador defines a "Block" as a surface of 200,000 hectares. Each oil company was assigned 494,211 acres in order to explore and develop the project. Ministerio de Energía y Minas del Ecuador [Department of Energy and Mines of Ecuador]. Dirección Nacional de Hidrocarburos [National Bureau of Hydrocarbons]. LEY DE HIDROCARBUROS [LAW OF HYDROCARBONS]. 30 Mar. 2007 <http://www.menergia.gov.ec/secciones/ hidrocarburos/ HidroMarcoLegal.html>.

water in the environment (Isch, Larrea and Martìnez-Alier 14). In addition, Ecuador's government plans to produce 108,000 barrels/day through the first 17 years of the project and produce 58,000 barrels/day 29 years after beginning the project (Isch, Larrea and Martìnez-Alier 16). According to the University of Maryland's presentation in Quito-Ecuador, ITT block would produce 36 million barrels/year. In addition, this study takes into account a net profit per barrel of US$20. So, the annual revenue would be around US$700 million (University of Maryland 10-1). Thus, Ecuador's government sees on those economic benefits as a great alternative to alleviate poverty and other social problems in a short-term.

However, the memories of the Texaco project that caused incalculable environmental impact and social problems are still present. Oil development in Ecuador

> …has produced substantial economic resources, but also serious social and environmental problems. Nationwide, oil revenues have strengthened powerful economic concerns, hindering redistribution of wealth to the population at large. Locally, 'oil' communities, parishes and cantons are the poorest in the country. Finally, this industry has generated huge and growing environmental liabilities (University of Maryland 14).

Nonetheless, Ecuadorians and the international community do not want this to happen again within this national park that encompasses so much biodiversity and millenarian cultures. Thus, national and international efforts have joined to prevent oil extraction within the Yasuní National Park. This historical initiative aims to leave underground oil reserves of the ITT block. So, protection of this *natural bubble or island* that has been preserved intact through millions of years in the middle of the Ecuadorian Amazon jungle would be possible.

The Yasuní Initiative: a Historical Proposal to Preserve the Nature

Public awareness to preserve the Yasuní National Park against oil extraction started once the oil blocks were granted to the oil companies. Indigenous and environmental movements have pushed Ecuador's government to change the law and create regulations to preserve nature, primarily ecosystems in the Amazon jungle. Before October 2008, the Ecuadorian Constitution stated general articles about nature preservation. Additionally, Ecuador's constitution used to encourage exploitation of natural resources through practices of sustainable development as in some other Amazon Basin countries. For instance, Peru's constitution states only four general articles in reference to the Environment and Natural Resources. Moreover, the Peruvian constitution encourages exploiting natural resources in the Amazon jungle. Specifically, article

69 states that "the State promotes the sustainable development in the Amazon jungle through adequate legislations" (Georgetown University - School of Foreign Service). This opens up the limitless exploitation of non-renewable natural resources in the Peruvian Amazon basin.

On the other hand, the new Ecuadorian Constitution approved on October 7th, 2008 has included historical changes through which ***nature preservation*** is an important part of this Constitution. In these new articles, not only sustainable development is encouraged, but also ***Rights of Nature*** have been stated. Thus, article 71 mentions that

> Nature or Pacha Mama – nature in Quichua –, where life is created and reproduced, has the right to be respected in its entire existence along with the maintenance and regeneration of its fundamental cycles, structures, functions and evolutionary processes. Everybody-community, town or nationality can demand performance of the nature right to the public authority" (Georgetown University - School of Foreign Service).

Thus, historical changes like those in Ecuador's constitution have permitted to follow and implement environmental protection initiatives such as the Yasuní-ITT proposal.

Today, nature conservation and preservation are not only issues that concern radical environmentalist movements, but also any individual who wants to live in a clean and healthy environment. Thus, people around the world have raised interest in this proposal because this initiative can fight the main elements that are causing climate change and environmental degradation. Such elements are use of fossil fuels, deforestation, loss of biodiversity, as well as land and water pollution. As a group of scientists state,

> we argue that people need to embrace such novel propositions [Yasuní-ITT initiative] if the world is to avoid increasing atmospheric carbon dioxide to catastrophic levels by burning the planet's remaining fossil fuels. …forgoing extraction of oil reserves in remote and/or sensitive places could be an important component of a larger plan to limit carbon emissions (Christian, Finer and Ross 861).

The Yasuní-ITT proposal is an initiative launched on June 5th, 2007 by the Ecuador's government to the world. This initiative has two approaches. First, Ecuador's government wants to implement a new economic model based on renewable natural resources as an alternative to exploitation of non-renewable natural resources, and sustainable management of its biodiversity (Ministerio de Relaciones Exteriores, Comercio e Integración 1). Second, this proposal "consists of leaving 20% of the oil reserves of Ecuador unexploited and underground in perpetuity. In exchange, Ecuador expects to receive compensation equivalent to the value of the crude oil left unexploited" (Sevilla 3) (Sevilla 3). This compensation would be based on "receiving certificates negotiable in the carbon market in exchange for the non-exploitation of crude oil" (3).

To forgo extraction of 840 million barrels of oil reserves from the ITT block could prevent the release of 407 million metric tons – MMT – of carbon dioxide to the atmosphere (Moncel). According to some statistics, to not emit the 407 MMT of carbon dioxide would generate **US$7.932** billion taking into account a price of US$19.85/ton of carbon dioxide – December 2008 price ETS/EU –. Furthermore, considering the 840 million barrels, an extraction period of 30 years, a discount rate of 6%, and an oil price of US$49.25 per barrel – December 2008 –, the Net Present Value – NPV – of these reserves would be **3.327** billion (Ministerio de Relaciones Exteriores, Comercio e Integración 3). So, "the value for the amount saved in carbon dioxide emissions doubles the oil reserve value" (3).

Therefore, the Yasuní-ITT initiative is focused on emitting Yasuní Guarantee Certificates – or CGY according to the Spanish acronym – (Moncel). These certificates would be equivalent to those Carbon Offsets now traded under the European Trading System – ETS –. The CGYs would be purchased and traded by any company of the Kyoto Protocol – KP – Annex I-countries which operates under the ETS (Moncel); (Ministerio de Relaciones Exteriores, Comercio e Integración 3). The income generated by those certificates, which would be based on the price fluctuations of the international carbon market, would go directly to Ecuador's government (Moncel). Likewise, there would be other sources of funding such as "donations and debt swaps from countries that support the initiative, and private sector donations and individual contributions of global citizens" (Ministerio de Relaciones Exteriores, Comercio e Integración 3). The government would create a Trust Fund with the economic benefits which would be managed and overseen by NGOs, financial contributors, and representatives of the Ecuadorian Government (Moncel).

Finally, the Trust Fund would be created to address some challenges such as "maintaining biological diversity; respecting people who have decided to live in voluntary isolation; addressing poverty of the most vulnerable societal groups; preventing the contamination of areas with high biological values; reducing the potential emission of CO2 to the atmosphere; reducing the deforestation rate; and reducing CO2 emissions in the generation of electricity and in the use of energy in industries and homes" (Sevilla).

Feasibility of Implementing the Yasuní-ITT Initiative

The Yasuní-ITT initiative has been the most attractive, coherent and profitable proposal to leave great amounts of oil underground. However, some weaknesses and mistaken thoughts are threatening this innovative initiative. First, the international community has not been entirely involved or interested in this proposal. The international community groups pushing this proposal have been primarily international environmentalist groups. There has not been a concrete and direct response from developed countries' governments. It seems that this lack of interest on this proposal by other governments is related to the contradictory and unclear politics implemented by Ecuador's government. Georgina Donati mentions that the Yasuní proposal has presented some problems during its planning. At the beginning, the proposal "did not clearly guarantee the preservation of the Yasuní or respect the human rights of the people of the region, and excluded them from participating in the decisions that would drastically affect their lives" (Donati). The proposal has set a time limit to raise funds from the international community and have left open the possibility to repay these funds. So, the funds raised from the international community could be repaid by Ecuador's Government. Thus, the Yasuní oil field could be exploited, after all (Donati).

Second, the environmentalist Inés Manzano argues that this proposal has confused and incorrect definitions. Manzano states that creation of a parallel carbon market to the Kyoto Protocol is contradictory. In order to issue the CGYs, these certificates should be recognized or approved as equivalent certificates to carbon offsets or "European Union Allowances" (ElComercio.com Jan.07.09). Approval of the CGYs by the Kyoto Protocol Annex I countries' – the 27 European countries, Japan, Canada and Australia – would permit these countries to have access to these certificates to carry out the a 5.1% reduction of their emissions before 2012. Today, companies of these countries have only to turn to the European carbon emission certificates to pay for their carbon dioxide emissions. So, the CGYs would have to be traded in this carbon market with headquarters in Leipzig, Germany. Ecuador government's proposal is that 1% of the total carbon emission certificate transactions belong to the CGYs (ElComercio.com Jan.07.09). Likewise, Manzano says that the legal framework, administrator security, and complaint mechanisms of the certificate holder are not clear and do not have solid bases within this initiative. So, it is necessary to improve these aspects by implementation of feasibility studies (ElComercio.com Jan.07.09).

Moreover, transparency and credulity within management of this proposal has primarily been affected due to the double speak of the current Ecuadorian government. Ecuador's president, Rafael Correa, has been encouraging preservation of the Yasuní National Park through execution of the Yasuní-ITT initiative, but Correa has been inviting tenders for exploiting oil reserves within this natural reserve, at the same time (ElComercio.com Jan.14.09). According to Esperanza Martínez, member of Acción Ecológica and one of the driving forces behind this initiative, emphasizes that "these kinds of contradictions confuse the international community since this situation undermines the proposal creating uncertainties and lack of clarity in the proposal's process" (ElComercio.com Jan.14.09). In addition, Martínez mentions that the government has not been coherent and constant with the bases of this initiative. At the beginning, Correa was against including the issue of carbon emission certificates under the Kyoto Protocol framework as an alternative to leave the oil reserves underground. Nevertheless, the last model of the Yasuní-ITT initiative is entirely based on the carbon market mechanism. Furthermore, Ecuador's government suggests making some modifications to this protocol to include the CGYs (ElComercio.com Jan.14.09).

Another environmentalist leader, Patricio Chávez, argues that Ecuador's government has not had a serious position for this initiative. The government is selling the Yasuní National Park to the highest bidder which could be the international community or the oil companies (ElComercio.com Jan.14.09). Finally, Héctor Pazmiño, an oil industry consultant mentions that the Yasuní-ITT project is an innovative initiative, but the government has to make a final decision to define whether this oil field is exploited or preserved as a natural reserve forever. Two years have passed since this initiative was launched and there is not yet any concrete proposal. So, Ecuador has been losing a lot of economic benefits since there has been no exploitation of either renewable or non-renewable natural resources in this area (ElComercio.com Jan.14.09).

However, according to people behind this initiative, this proposal has become stronger, more explicit and convincing. Mistakes and incongruities have been fixed in the last two years, so this initiative has become more attractive as a business (ElComercio.com Jan.14.09). Joan Martínez Alier, in her publication Measurement of the Ecological Debt – *Cuantificación de la Deuda Ecológica* –, claims that there are some sound arguments to leave the oil underground, so the Yasuní-ITT initiative is a feasible alternative. One of these arguments is that this initiative

should be part of a new and different climate change policy framework. This framework would be based on the current carbon dioxide reduction agreement to fight climate change, plus the initiative of leaving oil underground and preserve the tropical rainforests. Reduction of the total carbon dioxide emitted by developed countries has not been effective. Those countries continue emitting high volumes of carbon dioxide into the atmosphere. So, other alternatives strategies should be considered to reduce these emissions more efficiently and quicker. Then, the alternative should be repayment of the Ecological Debt that developed countries have acquired from developing countries (Martínez Alier 25).

Industrialized countries and societies that have reached high standards of life are the main responsible to generate great volumes of carbon dioxide due to use of fossil fuels. Indiscriminate increment of carbon dioxide into the atmosphere has caused climate change that is a global problem with acute consequences. It is estimated that developing countries will be those countries that face the most devastating consequences. So, developed countries should pay developing countries because of environmental degradation through the Ecological Debt (Correa and Moreno 7-8). For example,

> …the average US citizen emits 19.73 tons of CO_2 per year, while the average Ecuadorian emits 1.68 tons of CO_2 annually. Using the difference between these values and the global average per capita emissions rate of 4.18 tons of CO_2, and assuming a US$10 per ton CO_2 cost of mitigation, the total US debt would be US$45.7 billion per year, while Ecuador could realize a credit of US$325 million per year (17).

Moreover, as a part of this debt, developed countries should pay for preserving and protecting tropical rainforest such as the Yasuní National Park. Rainforest are carbon sinks, so they are part of the solution to fight climate change more efficiently (Martínez Alier 25-6).

Second, Joan Martínez Alier mentions that oil reservoirs found in the Yasuní National Park content heavy crude oil which is cheaper than the light crude oil in the oil market. It is necessary to apply new and expensive technology to produce and transport this heavy oil. This has not been considered in most of the cases (Martínez Alier 26). Apparently, "to leave the oil underground is to forgo high economic benefits. …nonetheless, costs of exploitation could be higher than the profits earned by production of this oil field" (26). Furthermore, there has not been an analysis to estimate the economic losses due to environmental degradation and destruction generated by this oil project. The cost of extracting low quality oil in ecosystems with high biodiversity and presence of indigenous communities can be considered very high (26).

Finally, the Yasuní-ITT initiative seems to be a coherent and attractive proposal to prevent extraction of hydrocarbons in the Amazon jungle. At the beginning, the proposal had some weaknesses and contradictions, but the Ecuadorian government and the international community have been working on changes to improve this innovative project. This is the first time that Ecuador's government wants to implement something different and innovative to preserve the environment and prevent the development of some oil reserves. Additionally, developed countries that want to be part of this initiative need more information in order to clarify their many doubts.

Therefore, both the Ecuadorian government and international community will have to invest more time to develop the best model to implement. This is emphasized by Robert Hofstede, director of the International Union for the Conservation of Nature/South America (IUCN), who states that the Yasuní-ITT is an innovative initiative, but that it needs more time. Nonetheless, he feels that this proposal can be very successful if the framework is clear and coherent. Furthermore, he notes that it is a dynamic process which will undergo many changes according to varying world requirements and interests. Thus, this initiative has to be further refined, which in turn requires time and the active participation throughout the process of a group of people with a number of backgrounds, such as economists, anthropologists, biologists, soil scientists, etc. (ElComercio.com Jan.16.09).

Everything points to the Yasuní-ITT initiative being approved by Ecuador's government and the international community soon. The conditions to implement this proposal are the most adequate: 1) heavy oil is cheaper than light oil; 2) the extraction costs of this oil are very high; 3) the Yasuní National Park is one of the most outstanding ecosystems in the world; 4) the carbon market is a solid alternative and would generate great economic benefits; and 5) the international community is making a great effort to achieve this goal. Thus, Ecuador would be one of the first developing countries to reject extraction of non-renewable natural resources and the traditional economic model in exchange for protecting and preserving the Amazon jungle. To leave oil underground is not only Ecuador's responsibility, but also that of developed countries, as they are the greatest consumers of fossil fuels.

CHAPTER IV

Analysis

Extraction of non-renewable natural resources has been the backbone of the economic growth and development for most Amazon Basin countries. Oil and gas reserves were exploited for decades in this region without protecting and preserving the environment. However, after the creation of environmental institutions and implementation of environmental standards and sustainable development models, regulations, and best practices, the degradation of the Amazonian ecosystems has been mitigated. However, mitigation of environmental degradation will not by itself halt the encroaching threat of the extractive industries on the ecosystem. Governments in this region consider the Amazon jungle to be a limitless green ocean which never dries out. Much of the Amazon jungle in countries such as Ecuador and Peru has been granted the oil companies. Governments in the Amazon, through oil exploitation, have found the easiest and most profitable short-term way to fight social problems such as poverty. Nevertheless, more poverty and power asymmetries have been created after exploiting these non-renewable natural resources. It is now time to re-evaluate and figure out the real value (in both economic terms as well as of environmental services provided) of the Amazon jungle. The richness of the Amazon jungle is not found in the non-renewable natural resources that lie underground, but rather, in the extraordinary biodiversity that lies on its surface.

Creation of ecosystems in the Amazon jungle took millions of years. Every plant and animal species present in this rainforest is unique. Animals and plants in these ecosystems depend on each other to survive. Nonetheless, millions of hectares in which those species historically lived have been destroyed due to oil/gas development and their direct and indirect impacts. While current oil production operations cannot be stopped suddenly, it is nonetheless crucial to stop the forward progress of the oil frontier. The oil frontier is threatening the most sensitive and fragile ecosystems in the Amazon such as the Yasuní National Park.

Alternatives to extraction of non-renewable natural resources have been proposed to halt the oil frontier such as carbon capture and sequestration through *Reducing Emissions from Deforestation and Degradation* (REDD). These alternatives have been mainly focused on preventing deforestation and preserving the rainforest using the Amazon jungle as a carbon sink. Furthermore, the development of community-based ecotourism and plans to leave the oil

underground are part of these innovative options. Those alternatives are becoming attractive because they can generate substantial economic benefits for forest-dwellers comparable to the economic benefits generated by the extractive industry. However, implementation of these innovative projects will depend on the political will in developed countries (the North) and the capacity for negotiation of developing countries (the South).

The North and South are in the same boat and both have been responsible for destroying the Amazon jungle. The North asks the Amazon Basin countries to preserve and protect the Earth's lungs, the Amazon jungle. However, oil/gas reserves located in this forest are producing great amounts of hydrocarbons to supply the enormous and growing demand of fossil fuels of the North. Additionally, the excessive consumption of hydrocarbons in the North has created an economic dependence on oil/gas exports in countries located in the Amazon jungle. Thus, to both protect and preserve the Amazon – while weaning their economies off of their dependence on the benefits deriving from extracting hydrocarbons – seemingly appears to be an oxymoron requiring both internal efforts (i.e. within each Amazon country) as well as external (i.e. working to negotiate initiatives with Northern countries).

This traditional and inadequate economic model, based on the extraction of non-renewable natural resources, must change in the immediate term. Nevertheless, this change will not depend on decision-making coming only by the North and/or the South. Rather, this change must be part of a new environmental socio-political and economic order which formulates an international environmental legislative framework. Environmental protection and preservation of the Amazon jungle must be a commitment of the entire world community. This new international environmental legislative framework could be created to implement strong environmental policies which have been absent in the current international environmental system. Those policies could be focused on developing a new economic model, considering environmental protection and preserving as a national security issue, and carrying out a better corporative accountability model.

First, the current economic model based on extraction of non-renewable natural resources, which is the norm in the Amazon Basin, does not consider financial losses due to environmental destruction and degradation. Developing countries in the Basin such as Ecuador have improved their economic growth enormously due to oil development in the last four decades. However, the Texaco case is clear evidence of the billions in economic losses that

extraction of non-renewable natural resources has caused Ecuador. The environmental destruction caused by this company can never be fixed. Today, the quality of life of people who live in this area has decreased. They have many health problems and no longer can use water, land, and other natural resources because they are polluted. Before oil development, these resources were clean, found in sufficient quantities on people's territories, and people did not have to pay to use them to meet their subsistence necessities. Today, people have to pay high prices for potable water and they have to destroy thousands of hectares of virgin rainforest to access new fertile land to plant their crops. Hence, people in the Amazon region are becoming poorer. Economic benefits due to oil extraction have produced profound economic losses.

Governments of the Amazon Basin have to understand that the current economic model that depends so greatly on extraction of non-renewable resources is simply unsustainable. It is urgent that these countries develop a new economic model that seeks a balance between use and wise stewardship of the resource base. This new model must embrace both preservation and protection. The participation and commitment of developed countries are needed to create a new economic model for these countries in the Amazon. Nonetheless, in order to commit the North and South to work together on implementing a new economic model preventing the exploitation of non-renewable natural resources in the rainforest, it is necessary to create an international environmental regulatory system. This regulatory system has to be part of the international environmental legislative framework mentioned above.

The existence of this framework could force countries to enforce environmental regulations and norms which in turn would permit the development of a more equitable and sustainable economic model. Today, there are no sanctions for Amazon countries that extract oil from the jungle; additionally, there are no penalties for developed countries that buy the crude oil. Thus, strict international legislation could prevent the trade in hydrocarbons extracted from fragile ecosystems in the Amazon. These sanctions would help developed and developing countries to seek alternatives to extraction of hydrocarbons in the Amazon. Therefore, these alternatives would become an important part of a new economic model in which nature preservation and conservation would be the basis of economic growth. Additionally, it is necessary to create international environmental legislation which does not include the extraction of non-renewable natural resources as acceptable sustainable development models.

A dangerous phenomenon exists in the erroneous naming of extractive industry projects as being so-called "sustainable" when they are anything but. The companies purposefully use this as a strategy to distract attention from the fact that they continue on the road of business-as-usual with their polluting ways. Sustainable development, when implemented wisely, should contain as an integral part the protection and conservation of the resource base. However, this is far from the reality of the Amazonian extractive industries' projects that they bill as being "sustainably managed." There are some areas of the Amazon whose ecosystems are so fragile that even sustainable development models that attempt to tread lightly still risk damaging them, and oil extraction masquerading as having sustainable elements risks this as well. While the use of new technology and best practices as part of sustainable development models will slow down the destruction of the rainforest, they will not prevent its destruction.

Second, developed and developing countries have considered non-renewable natural resources as a valuable part of their national security. Primarily, developing countries that have great amounts of oil and gas reserves have focused on aggressively extracting these reserves in order to solve many tough social problems such as poverty. Furthermore, oil reserves bestow a certain degree of political power. The *modus operandi* of the Amazonian governments has become the reliance on extraction of oil and gas as the way to resolve their social problems and gain additional political power. However, they have not taken into account one of the most important aspects that can be a part of their national security: the fabulous natural capital that the Amazon jungle embraces within its invaluable ecosystems. Amazon Basin countries must realize that their national security lies in the preservation and conservation of this green reservoir that becomes ever more threatened.

It appears that these countries have not made a cost/benefit analysis between extraction of non-renewable natural resources on one hand and conservation of the Amazon jungle on the other. Their desperation for generating great economic benefits in the short-term has made them overlook that they *already have the most profitable industry in the Amazon, ecosystem services*. The Amazon jungle encompasses many ecosystems services, some of them described in Chapter II. Those services can generate significant economic benefits while maintaining the integrity of the jungle. Moreover, those services are renewable and people in this region can achieve a better quality of life through their wise use.

Thus, while preservation of the Amazon jungle must be the main component of national security for these countries, they do not realize that the indiscriminate extraction of oil and gas is in fact endangering their national security. Extraction of oil in the Basin will ultimately result in the destruction of all of its ecosystems, which will in turn greatly increase the poverty and social disruptions. For example, millions of people depend on fresh water sources and the climate created by the Amazon rainforest. Once this natural treasure is destroyed, people will not have access to those resources. Armed conflicts and massive migrations will follow, as people move farther afield away from their traditional homes and lands in search of fresh water and other natural resources. *In order to prevent these social disruptions, the Amazon jungle must be preserved.* Conservation and protection of the Amazon rainforest must be seen as a national priority by Amazon Basin governments as a key cross-cutting element in their national security policy, poverty alleviation, and environmental preservation efforts.

This chaotic and dangerous scenario can be prevented through the development of international environmental legislation. This legislation would bring order and discipline on environmental issues. The North and South need solid, clear guidelines to direct the use of their natural resources. The current anarchic system, by which natural resources are managed, has to change. Management of natural resources must be seen as a worldwide concern, not simply one related the physical area where the endangered ecosystems exist. The climate and natural cycles of Earth are changing as a direct result of human-made pollution and the degradation and destruction of the resource base. If Brazil destroys its rainforest, the US will feel the effects of it.

Climate change does not have borders.

Deforestation of the Amazon jungle is considered one of the causes of the increase in carbon dioxide emissions in the atmosphere. Furthermore, effects of climate change such as the increase in sea level, glacier melting, and severe erosion will bring more poverty and massive displacements of people in their wake. This is why the conservation and preservation of the Amazon jungle must be taken into account as a national security issue.

Finally, both environmental disasters and irresponsibility such as occurred in the Texaco case have happened due to the lack of strong, enforceable environmental policies as well as real corporate accountability. Multinational companies are not controlled by international environmental legislation. Most of the countries in the Amazon region have weak environmental regulations and/or their constitutions encourage the development of (“development” understood

by the governments as being initiatives that depend on the indiscriminate and unsustainable use of natural resources such as gas, oil, and timber) the Amazon jungle, as in the case of Peru. Thus, some multinational oil companies carry out their activities in the Amazon in ways that apply lower environmental standards then those they abide by in their own countries. Their corporate responsibility should be to fulfill both the environmental standards and regulations in existence in their own countries as well as those in the host country. If Texaco had applied the environmental standards demanded in the US at the time it was working in Ecuador, the environmental destruction that resulted in the Ecuadorian Amazon jungle would have been significantly less.

Therefore, it is critical to create an international environmental legislation by which companies such as Texaco can be punished due to ecosystem destruction and made to pay indemnities to the local communities where their work has produced environmental destruction and a diminished quality of life and level of health. Furthermore, in the case of the oil companies, corporate accountability must include a system of professional ethics that makes certain areas off-limits to oil/gas development if the risk is too great of its destruction. This would be *real* corporate accountability.

Additionally, international environmental legislation should involve monitoring the financial institutions that disburse loans and credits to oil companies to develop their operations in fragile ecosystems such as the Amazon jungle. It is necessary to penalize the financial sector that is contributing to the destruction of nature. This will only be possible through a strong and transparent international environmental legal framework. In this way, all of the stakeholders involved in oil/gas development would be monitored and held to account by such an international legal framework which helps to ensure greater corporate accountability.

Some of the most fragile and outstanding ecosystems in the Amazon jungle have already been completely destroyed. Future generations will not be lucky enough to see the marvelous and beautiful nature that was enjoyed by humans for thousands upon thousands of years. However, there are still some virgin ecosystems very deep in the Amazon which can be preserved forever – IF we decide to be proactive now and take the steps needed to ensure that the dire future I have described above does not come to pass. Perhaps, a new environmental regulatory framework will help to preserve and conserve the Amazon jungle. But at the end of the day, each one of us is responsible for treading lighter on the resource base.

“The preservation of biodiversity is not just a job for governments. International and non-governmental organizations, the private sector and each and every individual have a role to play in changing entrenched outlooks and ending destructive patterns of behavior.” – Kofi Annan, UN Secretary General on the 2003 International Day of Biological Diversity

Conclusions

The foregoing study of the extraction industry in Ecuador and other Amazonian countries leads us to a number of conclusions based on an analysis of the information discussed, as follows:

- The primary economic model currently in use in Amazon Basin countries is based on extraction of oil and gas reserves; a small portion of the money thus earned is used for projects intended to alleviate poverty and other social problems.
- These countries have significant projects that will increase the production of oil and gas in the next few years, enabling them to not have to be dependent on imports of hydrocarbons.
- Operations to extract hydrocarbons in the Amazon have destroyed broad extensions of virgin rainforests which has caused the loss of priceless biodiversity. For example, Texaco's extractions in Ecuador have caused acute direct and indirect impacts to the rainforest: thousands of hectares were deforested, and the water and land in Texaco's concession were polluted.
- Environmental degradation caused by the oil industry in the Basin has generated ever increasing poverty and land conflicts between indigenous *campesino* communities and the oil industry. Indigenous communities have been those most affected by environmental degradation because, in addition to the obvious threats to their health, land, and natural resources, they are negatively impacted in the ethnic-cultural realm as a result of their identity being so intimately linked to the land, going back generations upon generations. As a result, the inhabitants of today's Amazon have to pay for potable water and basic foodstuffs such as fish and vegetables.
- Expansion of the oil frontier is threatening extremely fragile and high biodiversity ecosystems. National parks such as the Yasuní in the Ecuadorian jungle are one example of such expansion. The governments in the Amazon region have not created strong enough policies and regulations to prevent the exploitation of hydrocarbons within those sensitive ecosystems.
- Innovative alternatives to preserve and develop the Amazon jungle have been developed during the last few years because the international community has become very concerned about the high rate of deforestation in the Basin. Such alternatives are focused

on developing a new kind of economic model which would be based on ecosystem services rather than on the exploitation of natural resources such as oil and gas.

- Carbon capture and sequestration and community-based ecotourism can be two strong options for protecting the Amazon jungle. They are part of an economic model that holds out the potential for generating significant environmental benefits in addition to raising the standard of living of Amazonian inhabitants.
- The carbon capture and sequestration proposal can be successful if the countries of the Basin commit to preserving the rainforest and avoid extracting non-renewable natural resources and undertaking other activities such as logging and ranching. In order for it to be successful, management of this alternative must be transparent and monitored by the international community.
- Community-based ecotourism can generate significant economic benefits for this region. Ecuador has developed a good model, wherein participation of indigenous communities has been the key to its success. As a result, some Ecuadorian indigenous communities have generated great economic resources.
- Innovative initiatives, such as the Yasuní-ITT that seeks to leave oil reserves underground, need to develop a more transparent framework by the proposer governments. They should commit to rejecting the exploitation of non-renewable natural resources in sensitive ecosystems.
- The governments of developed countries have not been actively involved in this process, nor given much importance to proposals such as the Yasuní-ITT, as they fear it would result in a smaller (and thus more expensive) supply of oil. Developed countries are still dependent on fossil fuels, and thus they maintain an active opposition to any alternatives to the current economic model based on the extraction of hydrocarbons.

Recommendations

- The countries in the Amazon should create a new economic model based on preservation of this rainforest. They have to find other economic alternatives to the extraction of non-renewable natural resources such as exploitation of ecosystem services.
- The current economic model in the Amazon does not take into account the cost of environmental degradation in the jungle. The implementation of a Green GDP model would work very well in the Amazon. When Amazonian countries calculate their GDP, they must begin to include the price and tradeoffs involved in the degradation of the rainforest.
- Both the developed nations in the North that import oil and gas, as well as Amazonian countries that produce them, must begin to make a comparative analysis between the economic benefits obtained from natural resource extraction on the one hand and the cost of destroying the rainforest on the other.
- Developed countries have to collaborate with countries in the Amazon to develop strategies to decrease both the production and use of hydrocarbons. These strategies should have at their core diminishing the dependency of all nations on fossil fuels and the development of alternative, sustainable sources of energy. As mentioned earlier, carbon capture and sequestration and community-based ecotourism can form important parts of an alternative strategy that can help to halt the production of hydrocarbon in fragile ecosystems.
- It is important to create international environmental legislation by which exploitation and consumption of non-renewable natural resources can be monitored and controlled. Strong and clear international norms and regulations must be developed – and countries in both the North and South must become signatories to them – that seek other alternatives for achieving economic growth.
- We must create an international legal system that punishes extractive industries for destroying the environment of fragile ecosystems in the Amazon. Such a system would compel oil companies to improve their operations significantly.
- The prices of non-renewable natural resources extracted in the Amazon must be high enough so that they truly reflect the environmental and social costs of their extraction. This would represent an important step in beginning to curb the extraction of these non-

renewables from sensitive ecosystems as a direct result of the contraction in the international market for them that would occur.

- Developed and developing nations must meet and together take steps to raise awareness as to the key role played by the Amazon jungle in the fight against climate change. The North and South must work together to save the rainforest. It is impossible to halt oil production suddenly; however, we have to begin halting oil extraction in ecosystems with high biodiversity such as those in the Amazon jungle and stemming the dependence on those resources in the richer countries.

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