Carbon Sequestration and Its Potential as a Market Mechanism Tool for Sustainable Development

Master of Arts in Law and Diplomacy Thesis

Submitted by Nichola D. Minott

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ABSTRACT

CARBON SEQUESTRATION AND ITS
POTENTIAL AS A MARKET MECHANISM
TOOL FOR SUSTAINABLE DEVELOPMENT

By

Nichola D. Minott

Chairperson of the Supervisory Committee: Professor William Moomaw
Department of International Environmental & Resource Policy

This thesis discusses the viability of carbon sequestration as a market mechanism tool for promoting environmental preservation, biodiversity and sustainable development. Specifically how forest-based carbon sequestration projects can be utilized as a viable method of income generation. Bolivia and specifically the Noelle Kempff Mercardo Climate Action Plan will be used as a case study.

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GLOSSARY

Additionality: a reduction in emissions by sources or enhancement of removals by sinks that is additional to any that would occur in the absence of a Joint Implementation or a Clean Development Mechanism project activity as defined in the Kyoto Protocol Articles on Joint Implementation and the Clean Development Mechanism.

Afforestation and **Reforestation:** both refer to establishment of trees on non-treed land. Reforestation refers to establishment of forest on land that had recent tree cover, whereas *afforestation* refers to land that has been without forest for a much longer period of time. Various definitions contrast these two processes using different time frames. Some definitions of *afforestation* are based on phrases such as "has not supported forest in historical time;" others refer to a specific period of years and some make reference to other processes, such as "under current climate conditions." The IPCC Guidelines define *afforestation* as the "planting of new forests on lands which, historically, have not contained forests." Some definitions emphasize a change in land-cover or land-use designation—for example, "The establishment of a forest or stand in an area where the preceding vegetation or land use was not forest" (Helms, 1998)—although this definition could equally fit many definitions of reforestation. For the purpose of this paper, the IPCC Guidelines' definition of *afforestation* and reforestation will be used.

Annex I Parties: The 40 countries plus the European Economic Community listed in Annex I of the UNFCCC that agreed to try to limit their GHG emissions: Australia, Austria, Belarus, Belgium, Bulgaria, Canada, Croatia, Czech Republic, Denmark, European Economic Community, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Italy, Japan, Latvia, Liechtenstein, Lithuania, Luxembourg, Monaco, The Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russian Federation, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United States.

Baseline: A non-intervention scenario used as a base in the analysis of intervention scenarios.

Carbon Sequestration (CS): by definition means the uptake and storage of carbon. Trees and plants, for example, absorb carbon dioxide, release the oxygen and store the carbon. It is a scientific fact that atmospheric concentrations of carbon dioxide can be lowered by reducing emissions or by taking carbon dioxide out of the atmosphere and storing it in inter-terrestrial, oceanic, or freshwater aquatic-ecosystems.

Clean Development Mechanisms (CDM): is a trading system conceived as part of the Kyoto Protocol in which developed countries, by sponsoring projects that reduce greenhouse gases in developing countries or buying carbon units from such projects, can earn emissions credits towards meeting their reduction goals. The idea behind such a system is that a greater amount of carbon dioxide emissions reductions can be achieved for less money in developing countries than in developed countries.

***'Compellance'*:** as defined by the author is derived from the word 'compel' which means to force or make necessary compliance to specific criteria, rules, norms etc. It is used to make a comparison between the current volunteer system and a more stringent alternative approach to the environment.

Emissions Trading: A market mechanism that allows emitters (countries, companies or facilities) to buy emissions from or sell emissions to other emitters. Emissions trading is expected to bring down the costs of meeting emission targets by allowing those who can achieve reductions less expensively to sell excess reductions (e.g. reductions in excess of those required under some regulation) to those for whom achieving reductions is more costly.

Global Warming: The progressive gradual rise of the Earth's average surface temperature thought to be caused in part by increased concentrations of GHGs in the atmosphere.

Greenhouse Gas (GHG): Any gas that contributes to the "greenhouse effect."

Intergovernmental Panel on Climate Change (IPCC): The IPCC was established in 1988 by the World Meteorological Organization and the UN Environment Program. The IPCC is responsible for providing the scientific and technical foundation for the United Nations Framework Convention on Climate Change (UNFCCC); primarily through the publication of periodic assessment reports (see "Second Assessment Report" and "Third Assessment Report").

Joint Implementation (JI): One of the three market mechanisms established by the Kyoto Protocol. Joint Implementation occurs when an Annex B country invests in an emissions reduction or sink enhancement project in another Annex B country to earn emission reduction units (ERUs).

Kyoto Mechanisms: The Kyoto Protocol creates three market-based mechanisms that have the potential to help countries reduce the cost of meeting their emissions reduction targets. These mechanisms are Joint Implementation

(Article 6), the Clean Development Mechanisms (Article 12), and Emissions Trading (Article 17).

Kyoto Protocol: An international agreement adopted in December 1997 in Kyoto, Japan. The Protocol sets binding emission targets for developed countries that would reduce their emissions on average 5.2 percent below 1990 levels.

Land Use, Land-Use Change and Forestry (LULUCF): Land uses and land-use changes can act either as sinks or as emission sources. It is estimated that approximately one-fifth of global emissions result from LULUCF activities. The Kyoto Protocol allows Parties to receive emissions credit for certain LULUCF activities that reduce net emissions.

Reforestation: Replanting of forests on lands that have recently been harvested.

Sequestration: Opportunities to remove atmospheric CO_2, either through biological processes (e.g. plants and trees), or geological processes through storage of CO_2 in underground reservoirs.

Sinks: Any process, activity or mechanism that results in the net removal of greenhouse gases, aerosols, or precursors of greenhouse gases from the atmosphere.

Source: Any process or activity that results in the net release of greenhouse gases, aerosols, or precursors of greenhouse gases into the atmosphere.

United Nations Framework Convention on Climate Change (UNFCCC): A treaty signed at the 1992 Earth Summit in Rio de Janeiro that calls for the "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system." The treaty includes a non-binding call for developed countries to return their emissions to 1990 levels by the year 2000. The treaty took effect in March 1994 upon ratification by more than 50 countries. The United States was the first industrialized nation to ratify the Convention.

EXECUTIVE SUMMARY

This paper addresses the probability of incorporating carbon sequestration (CS) as a viable market mechanism for sustainable development. The approach includes analyzing the utility of carbon sequestration projects as a mechanism for promoting sustainable forestry practices and environmental preservation, as well as addressing stakeholder interests in the implementation of these projects.

The goal is twofold: first, to provide the reader with an overview and conceptual framework of the issues and the problems associated with sequestration projects in general; and second, to discuss the economic and policy constraints and the challenges associated with the implementation of these projects. A related objective is to examine the methodology currently being used in this area and address the problems associated with leakages, specific to forest-based carbon sequestration projects.

The paper will explore in further detail the workings of carbon sequestration in the forest-based context. Using the author's experience in Bolivia as a case study, the paper will address the flaws and benefits in the current system. In addition, the paper looks at the benefits of a '*compellance*' versus volunteer approach to carbon sequestration projects and suggests alternatives to support compliance. Lastly, this paper will offer various prescriptive methodologies and alternatives for implementing this market-based mechanism into the larger framework of environmental agreements by incorporating key components of carbon conservation, sequestration and substitution projects, and thereby providing incentives to local communities, land owners and other stakeholders to promote carbon sinks. Finally, it will discuss the multiple benefits of such an approach and the future it holds in terms of its viability as a global market mechanism.

INTRODUCTION

Over the past decades the history of the environmental movement, specifically that of climate change has undergone a significant evolution from a consciousness-raising movement to one with practical implementation tools. Carbon sequestration is one such instrument in the environmental toolbox that has great potential for success as a market mechanism to help ameliorate some major environmental problems and provide income for sustainable development initiatives. Though it is a relatively new topic in the international arena, carbon sequestration and the role of carbon sinks in emissions trading plays a vital role in addressing the dangers of global warming.[1] The Kyoto Protocol and its three flexibility mechanisms: Joint Implementation, the Clean Development Mechanism and emissions trading, have been criticized over the years for their inefficiency, weak structure and lack of enforcement mechanisms. However, while many of the criticisms are valid, the basic objectives are worthy of further exploration and analysis.

In recent times, the world's forests have been cut at a rapid rate both for timber and to make room for agriculture and other developments. Tropical forests, once covering some 15.3 billion acres (6.2 billion ha), have been reduced through cutting and clearing by 210 million acres (85 million ha) between 1985 and 1990 and cutting is increasing exponentially in South America. If

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[1] Swingland, Ian R. (Ed.). *Capturing Carbon & Conserving Biodiversity: A Market Approach.* Earthscan Publications Ltd. London: 2002. p. 5.

deforestation is not controlled, the world will lose most of its tropical forests in the next several decades. Modern forest practices have developed in response to this crisis, as a means of halting forest destruction while still providing valuable forest products and protecting and preserving the habitats of many endangered species of plants and wildlife.[2] Likewise carbon sequestration has become a valuable tool in helping to reduce deforestation and redefining the 'value products' of forests, for example, placing value on the carbon capture potential of this endangered resource.

Global warming is closely tied to biodiversity loss, deforestation and desertification. These environmental problems further exacerbate the rise in global temperature which creates the vicious cycle the global community currently finds itself in. Many current conventions and treaties which address biodiversity, deforestation and desertification, historically, tend to have weak linkages which rely on voluntary codes of conduct. These linkages have proven to be ineffectual in reducing environmental degradation. What seems to be needed is a system which will create strong incentives for local people, governments and the private sectors to promote conservation efforts.[3]

Carbon sequestration has the potential to fill this void by establishing a link between local people, government and the private sector. But the value of

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[2] Bass, Stephen, Olivier Dubois, Pedro Moura Costa, Michelle Pinard, Richard Tipper and Charlie Wilson; March 2000; *Rural Livelihoods and Carbon Management*; International Institute for Environmental Development (London); p. 5.

[3] Ibid. p. 3.

forest-based sequestration projects extends beyond the financial and social benefits derived locally through forest preservation and carbon capture. Just as forests respond to local climatic conditions they also influence the climate. Through transpiration, the enormous numbers of plants found in rain forests provide huge amounts of water to the atmosphere, increasing humidity and rainfall, and cooling the air for miles around. Additionally, tropical forests replenish the air by absorbing carbon dioxide and emitting oxygen. By fixing carbon they help maintain the atmospheric carbon dioxide levels low, thus counteracting the global "greenhouse" effect. This natural relationship corresponds with the goals of the Kyoto Protocol and the reduction of GHG emissions.

The objective of this paper is to give the reader a conceptual framework of the topic, and provide a detailed analysis of the linkages between carbon and climate change and the issues associated with the current treaties, specifically the Kyoto Protocol. Methodology is addressed through analysis of the various tools of measurement, monitoring and verification of carbon benefits. The paper discusses the problem of leakage, *compellance* versus volunteerism and the feasibility of the market approach to carbon sequestration.

Third, the paper examines the flaws involved with the current approach and identifies some of the early success stories. The paper uses the Bolivia – Noelle Kempff Climate Action model as a case study of a large scale carbon project at work in a developing country. The goal is to examine in detail what

some countries are currently doing to link the various issues pertaining to carbon sequestration and sustainable development. Invoking research and information gathered from fieldwork in Bolivia, the author provides a model of a successful approach which incorporates local communities and sustainable development initiatives as an integral part of forest-based carbon sequestration projects.

Finally, the paper offers policy prescriptions and recommendations, examines potential markets and discusses what the future holds for carbon sequestration as a viable large-scale market mechanism for sustainable development and environmental preservation. The objective is to demonstrate that by converting intact forest property into financial capital it is feasible to protect the physical forest entity and provide incentives for sustainable forest management and sustainable livelihoods.[4] The author argues that carbon sequestration is the most viable method of ending the rapid degeneration of our natural resources by linking multiple stakeholder interests with the goals of reducing CO_2 in the atmosphere and thus reducing the rapid rate of deforestation.

[4] Supra Note 1. p. 3.

Chapter 1

CONCEPTUAL FRAMEWORK

The carbon cycle is widely recognized as one of the most significant biogeochemical cycles due to its role as the primary global regulator of carbon dioxide concentration.[5] Over the last century, human activity has had a profound impact on the environment. Fossil fuel consumption, deforestation and other unsustainable land use practices have resulted in a dramatic increase of carbon dioxide (CO_2) and other greenhouse gas (GHG) emissions into the atmosphere. Most scientists believe the increase of CO_2 emissions has created the human-induced climate warming conditions which are currently affecting the globe. If this trend is not altered, climate change will be the inevitable result. The long-term effects of global temperature change are largely unknown; however, adverse effects can already be seen in certain parts of the world in the form of droughts, increased severity of storms and flooding, particularly in the poorer regions of the globe.[6]

Climate change impacts not only weather patterns, it also affects agricultural outputs, socio-economic forecasts, mortality rates, and water-shed quality and biodiversity levels. As such, it cannot be addressed without taking a holistic approach by incorporating climate change solutions within a sustainable development framework. In order to have any impact on climate change through

[5] Ibid. p. 42.

CO_2 and GHG reduction, it is necessary to evaluate the feasibility, efficiency and the cost effectiveness of the various approaches.[7]

Forests for example, play a significant part in the global carbon cycle due to their ability to store large quantities of carbon in soil and vegetation.[8] Thus carbon sequestration projects can be successfully linked with sustainable forestry practices, forest preservation, renewable energy alternatives and sustainable development projects. The idea is to promote sequestration and carbon capture projects as a potential financial trading mechanism and as a possible funding source for environmental initiatives. This would provide the developing world with strong incentives to promote forest preservation and conservation of their natural resources due to the increased value of these resources as potential carbon sinks.[9]

Prior to addressing these issues it is important to understand the origins of sequestration and its significance to sustainable development initiatives and the environmental treaties. The origins of using sequestration as a potential development mechanism evolved with the recognition that land-use change and forestry (LUCF) activities could play a part as both sources and sinks for carbon. This led to their inclusion within the Kyoto protocol.[10] The Kyoto Agreement is the most important climate treaty and its connection to carbon sequestration

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[6] http://edcintl.cr.usgs.gov/carbonsequestration.html Accessed March 28, 2004

[7] Metz, Bert (Ed.), Ogunlade Davidson (Ed.), Rob Swart (Ed.) and Jiahua Pan (Ed.). *Climate Change 2001: Mitigation.* Cambridge University Press: Cambridge. IPCC 2001. p. 75.

[8] Supra Note 1. p. 42.

[9] http://www.usda.gov/oce/gcpo/sequeste.htm Accessed on December 1, 2003.

cannot be understated. In December 1997, over 160 nations came together in Japan and negotiated reductions in their net emissions of greenhouse gases, specifically CO_2. This agreement was pursuant to the guidelines of the 1992 Framework Convention on Climate Change.[11]

The Protocol made provisions to countries' reduction of GHG emissions targets. The outcome was, developed nations agreed to limit their greenhouse gas emissions to 1990 emission levels. Kyoto's defining features were that it (1) provided for legally binding emissions targets for Annex I (developed) countries and (2) recognized human-induced carbon sequestration as a viable method of achieving greenhouse gas emissions targets. Methods identified in Kyoto include land-use change and forest-related activities such as deforestation, reforestation and *afforestation*.[12]

Unlike other sequestration options, which have short duration times before carbon is automatically released back into the atmosphere, forest sequestration projects have the potential to accumulate carbon over decades and centuries. Additionally forest-based projects can sequester large amounts of carbon within relatively short periods (decades). The short fall is that large amounts of carbon can also be released very quickly into the atmosphere if there are forest fires. What makes this approach attractive is that forests which are already being utilized through sustainable forestry practices, wildlife habitat

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[10] Supra Note 1. p. 42.

[11] Sedjo, Roger, Brent Sohngen and Pamela Jagger. *Carbon Sinks in the Post-Kyoto World.* Resources For the Future Climate Issue Brief #12. Washington DC: October 1998. p. 3.

protection and for recreation can provide carbon sequestration as an additional benefit. The option also remains to utilize forests strictly to sequester carbon which has the additional benefit of helping to promote and increase biodiversity.[13]

With that being said, how can this naturally occurring relationship work within the framework of the Kyoto Protocol? What are the major components of the Kyoto Protocol and how do they relate to emissions reduction? Finally, what is the potential of affecting carbon mitigation through forest management? Article 3 of the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) demonstrates that it is possible to incorporate sequestration projects as part of environmental treaties. Specifically those treaties pertaining to greenhouse gas emissions and forest conservation. However the problem with implementing these projects within existing treaties lies in the relative 'newness' of carbon sequestration as a concept and the lack of political will on the part of many countries to invest in the idea without extensive research to guarantee success. The Kyoto Protocol, Article 3.3 discusses how to use sinks to remove carbon from the atmosphere:

> The net changes in greenhouse gas emissions from sources and removals by sinks resulting from direct human-induced land-use change and forestry activities, limited to *afforestation*, reforestation, and deforestation since 1990, measured as verifiable changes in stocks in each commitment period shall be used to meet the commitments in this Article of each Party included in Annex I. The greenhouse gas emissions from sources and removals by sinks associated with those activities shall be reported in a

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[12] Ibid.

[13]Ibid. p. 4.

> transparent and verifiable manner and reviewed in accordance with Articles 7 and 8.[14]

The challenge is incorporating and expanding these mechanisms in a manner that creates incentives for signing parties to vigorously implement and promote them. Article 3 of the Kyoto Protocol focuses on the net change in greenhouse gas emissions by way of sinks. The goal is to reach emissions targets of Annex 1 countries stated in the Protocol and tied to the 1990 base-year emissions levels. However, the Protocol limits the sink changes to *afforestation*, reforestation and deforestation with the notable absence of forest management, conservation and protection. The implication being that forest preservation activities would not count towards producing emissions reductions. However, some argue that forest management and conservation are implicitly encompassed within deforestation and reforestation.

Regardless of the ambiguity of the Protocol's wording, the fact remains that land-use change and forestry activities can mitigate carbon emissions through the following practices:

- Emission avoidance through deforestation prevention, reduced-impact logging
- Expanding carbon storage in forest ecosystems by protecting degraded forests, allowing them to regenerate, restoring native forests through natural generation, promoting agro-forestry techniques and establishing tree plantations on previously non-forested areas
- Substituting high emissions energy generating technologies for low emissions sustainable energy methodologies such as bio-fuels.[15]

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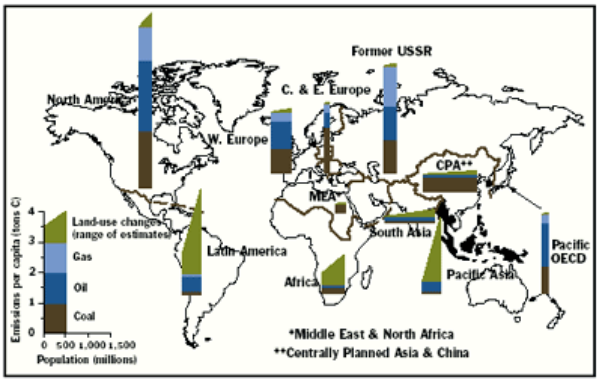
[14] http://www.ipcc.ch/present/presentations.htm The Carbon Cycle, Bob Watson. Accessed on December 15, 2003.

[15] Supra Note 1. p. 44.

CARBON AND CLIMATE CHANGE

Though CO2 concentrations are fairly uniform around the globe, as the diagram shows, higher concentrations can be found in the Northern Hemisphere than in the Southern, which can be indicative of the higher fossil-fuel consumption in the northern regions. Despite the direct affect that the increase in atmospheric CO2 concentrations has on the atmosphere temperature, the main concern is carbon dioxide's role as a greenhouse gas. GHGs allow solar radiation to pass into the Earth's atmosphere but also absorb some of the long-wave thermal radiation that is emitted back into space. This results in the warming of the atmosphere. Though CO2 is not necessarily the most effective GHG, it does exist in high concentrations and contributes to a significant portion of this warming effect.[16]

1990 CO_2 Emissions from Fossil-Fuel Combustion and Land-Use Change



Carbon dioxide emissions produced by fossil-fuel combustion are the main culprit in climate change. The dramatic release of carbon into the atmosphere within the past century has contributed to a 31% increase in atmospheric carbon dioxide concentrations in 2000.[17] Such an increase is

[16] Ibid. p. 27.
[17] Ibid. p. 15.

unprecedented and the sheer quantity of CO2 in the atmosphere has subsequently led to an increase in the global climate temperature. In addition to climatic warming, reductions in the global forest cover resulting from human activity have altered the biosphere significantly. The excess CO2 has several effects on the terrestrial ecosystem including altering plant growth rates, modifying ecosystem composition and disrupting the balance between the various species.[18]

Since fossil fuel emissions account for almost three-quarters of all CO2 emissions, the most significant impact on GHG reduction would be modification of fossil fuel consumption. However, while technologies are adapted and substitutes found for fossil fuels, sequestration of carbon into land sinks is a viable option to help reduce CO2 concentrations in the atmosphere.

[18] Ibid. p. 15.

ECONOMIC AND POLICY CONSTRAINTS

The economic, political and policy constraints of carbon sequestration are numerous. One impediment to implementing sequestration projects as a viable economic alternative is the significant difficulties in measuring the costs and benefits associated with sequestration. To date there are existing agricultural policies based in the European Union which have the potential to be adapted to carbon sequestration.[19]

The issues surrounding the economics of carbon sequestration and the design of policy are extremely complicated. However, the complexities of this issue are not solely isolated to carbon. There are similar issues in relation to environmental benefits of other programs, and as such, the hope is to draw from these examples to create a viable model for future use.

Due to the 'tragedy of the commons' dilemma in relation to the atmosphere, it is challenging to create incentives for individuals and nation-states to take action, with respect to controlling GHG emissions. With this in mind, the need for government action and policy implementation is clear, which incidentally is the rational behind the Kyoto Protocol. Financial incentives for carbon trading can be derived from government payments, from governments allowing carbon trading, from private industries and other interests seeking to

[19] Ibid. p. 173.

participate in carbon projects as a form of social responsibility, or participating in anticipation of legislation implementation.[20]

Economic Constraints:

The key concern is the economic feasibility of carbon sequestration as a valid method of emissions reduction. For an efficient policy to be implemented, a mechanism is needed to distinguish among the various land-mass abilities to sequester carbon and a valid method of measuring said abilities and accounting for leakages as they occur are vital components of such a mechanism. The knowledge of both the productive capacity of lands and their ability to sequester carbon is imperative to calculate the opportunity cost of sequestering carbon.[21]

However, calculating the opportunity cost is further complicated by the fact that land-use changes may produce other costs and benefits not specifically related to carbon sequestration. For example, one must consider the multiple benefits to individual businesses, as well as benefits to the national and international communities. It is highly unlikely that individual farmers will take the national and international benefits of increased carbon in their soils into account as part of their business practices. Therefore, government policies are needed to create the necessary incentives for farmers to increase carbon levels in their soils and motivate them to engage in more sustainable practices.

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[20] Ibid. p. 178.
[21] Ibid. p. 180.

Another constraint of implementing carbon projects is addressing the negative impacts to forest economies that result from the creation of new forestry lands. For example, expanded forests could lower the value of wood products; this could then lead to increased deforestation. It is quite possible that certain countries will continue deforestation practices to augment the decreased market value of wood. An additional peril is that with carbon credits for sequestration there is a danger that older forests might be cut down and replaced with younger, actively growing forests that sequester carbon more efficiently.

Likewise, these changes in land use might not have a significant impact on improving the environment when compared with the levels of GHG emissions arising from current energy consumption patterns. It is quite possible that after all these programs have been implemented they still might not be sufficient to have the environmental benefits as some have predicted.[22] Another major concern with forest based sequestration is how to calculate the cost of carbon sequestered and how to get an accurate measure of the carbon capture potential of forests. There is concern as to whether the technology even exists to calculate carbon soil accumulation and whether or not the costs justify the benefits of these measurements. With the economics of carbon sequestration, specifically forest based carbon sequestration projects, the costs associated with obtaining universally accepted measurements is very important. The technology

[22] Ibid. p. 181.

required to achieve accurate measuring methodologies may be so high as to make the entire scheme uneconomical.[23]

One possible economic approach would be to use the government in some form of cost-sharing arrangement. For example the government could subsidize education, training and sustainable forestry practices. Addressing the relatively temporary nature of sequestration remains a hurdle yet to be properly resolved.[24] Another possible solution that has been proposed is giving the land-owner credit when they remove one unit of carbon from the atmosphere and charge a full credit when carbon is released into the atmosphere. The credits could then be made into an annuity account where interest is collected as long as the forest remains in tact and the sink is in place. If the sink remains in place, the land-owner can access the earnings from the annuity account but not the principal balance. The principal is reduced when and if the carbon is released.[25] After a certain period of time, if the sink remains in tact, the land-owner can collect the principle balance remaining in the annuity account. With the financial incentives in place, forest-based carbon projects can be economically viable and the secondary benefits would promote increased biodiversity and long-term preservation of natural resources.

Leakage poses a potential for sink loss, another negative consequence for which appropriate measures have not yet been devised. Not only must one

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[23] Ibid. p. 183.
[24] Ibid. p. 189.
[25] Ibid.

consider the capacity loss but one must also consider the question of how to address the risk factor of such investments. One alternative is some type of insurance coverage plan which will be discussed in further detail in Chapter 3.

Policy Constraints:

From a policy perspective, the accumulation and storage of carbon causes significant problems. The quantity of carbon that can be sequestered is not infinite and the process varies depending on the stage of plant growth and soil composition. Initially the rate of carbon absorption is steady but eventually the process tapers off as trees mature and the soil becomes saturated. At this stage the sink still needs to be maintained. The maintenance of these sinks once they become saturated creates a liability risk as the process can be easily reversed through unsustainable forestry practices and natural disasters such as wild fires.[26]

Another important policy consideration is the possibility that an emissions-reduction action on one end can trigger negative offsets on another front. For instance, the effort to reduce carbon by converting agricultural land into forest plots inadvertently leads to deforestation and the opening up of other lands to agriculture and grazing elsewhere (this will be addressed in further detail in Chapter 2.). There are significant transaction and opportunity costs associated with endeavors such as these, and of course the costs vary depending on what type of carbon sequestration project is implemented. For example, there are costs associated with the measurement of changes in carbon sink capacity for

forest land designated for logging.[27] Due to the large differences in sink capacity based on the type of forests, altitudes and temperate zones there will be high variability in land quality and as such costs would be difficult to address.

With these multiple impediments to forest-based carbon projects, how does one approach the question of developing a carbon sequestration policy? Is a market for carbon the appropriate vehicle for forest-based sequestration or are direct government payments a more feasible alternative? A market-based approach would be appropriate if GHG emissions could be controlled and quantified in order to allow for trading.

However, due to the excessive externalities of forest-based sequestration projects, a free-market approach is unlikely to be the most efficient economic vehicle for sequestration. Based on the limitations of the market approach, as stated earlier, some form of government involvement is likely to be optimal. With that being said, what would be the most efficient way to undertake this endeavor? Projects have been developed worldwide to monitor the viability of the concepts of forest-based carbon projects, the Noelle Kempff Mercardo Climate Action project being the most notable.

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[26] Ibid. p. 185.
[27] Ibid. p. 186.

ISSUES AND CHALLENGES UNDER THE KYOTO PROTOCOL

The United Nations Convention on Climate Change (UNFCCC) adopted in 1992, with 188 countries ratifying the agreement as of February 2003 is the framework document for climate change. It creates the legal structure, process and administration to develop and implement the protocol.[28] The objective for the Convention is the stabilization of greenhouse gas (GHG) emissions in the atmosphere while maintaining economic development. The Convention establishes the conditions to which the protocols are subject. Articles 2, 3 and 4 link the compliance of the developed world with emissions-reduction commitments to sustainable economic development and cooperation in the maintenance of terrestrial sinks.[29] However the exclusion of 'prevented deforestation' as a potential carbon credit alternative could be viewed as limiting to the developing countries by blocking potential carbon credits which could be gained from an abundant resource.

The Protocol provides three 'flexibility mechanisms' intended to enable Annex I countries to meet their commitments in an economically efficient manner: Joint Implementation (Article 6), Clean Development Mechanism (CDM) (Article 12), and Emissions Trading (Article 17). Annex I countries can use these mechanisms to meet their carbon emissions commitments by reducing and/or removing atmospheric carbon dioxide. The main purpose of the

[28] Ibid. p. 283.
[29] Ibid. p. 285

flexibility mechanisms is to designate the responsibilities between Annex I (developed) and non-Annex I (developing) countries.[30] However, there is debate between countries as to their roles and to what extent these mechanisms should be used within the framework. For instance, Joint Implementation occurs between Annex I countries that play the role of host and investor and non-Annex 1 countries where the market and resources are located (in this case, large tracts of forest lands). The goal is to reduce emissions or enhance the removal of carbon by sinks.

The major issues and challenges under the Kyoto Protocol concern how forestry measures are prioritized and how policy is adopted. In the Clean Development Mechanism (CDM), with forestry measures restricted to *afforestation* and reforestation and the exclusion of wording for the protection of endangered forests, incentives are inadvertently created for continued deforestation in the developing world. The potential detrimental impacts on forests and biodiversity due to this exclusion are as yet unknown. To avoid the possible detrimental secondary impacts on natural forests it is imperative that a carbon market or some form of government regulation be developed to correct the negative incentives currently in place.[31]

The purpose of the Clean Development Mechanism is to assist developing countries to achieve sustainable development and at the same time

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[30] Ibid. p. 286.
[31] Ibid. p. 4.

meet the guidelines of the Convention. The CDM was a late development in the Kyoto negotiations process but based on how it was structured, it created a framework where not only Annex I countries but developing countries had incentives to participate, thereby creating a truly global agreement. However, the structure of the agreement contemplated only Annex I countries utilizing the carbon trading scheme. It soon became apparent that developing countries would also need to utilize the benefits of carbon trading as they begin to experience economic development and contribute their own GHG emissions to the atmosphere. The CDM never contemplated developing countries being subject to emissions limits due to economic growth, nor did it consider developed countries such as the former Soviet Union to experience an economic contraction or the US withdrawal from the negotiations. All of these factors created distortions and unanticipated consequences which have proven difficult to overcome.[32]

The uniqueness of the Kyoto Protocol framework is its ability to advance environmental benefits through market institutions. The Protocol has provided Annex I and non-Annex I countries substantial contributions but it lacks the strong financial mechanisms necessary to truly reduce emissions on any significant level. The Protocol's emissions-trading framework, particularly in relation to land-use activities, forest sink capacity, and carbon absorption potential, lacks significant data and political will. The lack of carbon inventory

[32] Ibid. p. 288.

data on the world's forests impedes efforts to develop effective land-use provisions especially as they relate to incorporating forest land sinks into the carbon emissions trading mechanism.[33]

PROBLEMS WITH THE SYSTEM

One of the major problems with international agreements and specifically the Kyoto Protocol is the attempt on the part of participants to remove the stronger parts of the treaties, advocate restrictions, increase bureaucratic regulation and top-down controls, all of which have not worked over the past 50 years. Strong resistance on the part of traditional environmental forces to utilize the market system to further the goals of conservation has also led to road blocks with this idea.[34] For example, forest conservation is included in Article 3.3 of the Protocol however; the wording is very vague on what is considered true conservation, protection and how to verify the changes in carbon stocks. The Protocol is also conspicuously silent on how to calculate and verify credits.[35]

Today the root causes of biodiversity loss and deforestation can be tied to the increased human population and poverty on the part of the developing world and high consumption patterns on the part of the developed world.[36] How does one address these seemingly insurmountable issues? It is indeed

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[33] Ibid. p. 309.
[34] Ibid. p. xix.
[35] Supra Note 11. p. 10.
[36] Ibid. p. 2.

futile to demand a radical change in consumption patterns for the developed countries. Likewise, it is equally unrealistic to require developing countries to slow down their economic progress for the sake of preservation of their natural resources, which their colonial tradition requires that they exploit to their fullest potential. This dilemma leaves environmental and conservation initiatives without sufficient economic and/or political will to be promoted and enforced effectively. It is therefore necessary to create innovative alternatives within the framework of environmental preservation and sustainable development. The goal is to create social and economic incentives for stakeholders to promote conservation practices. One such approach is to create a financial market-driven mechanism for sustainable land-use and forest preservation which could work in conjunction with government policies geared towards to local level.[37]

Emissions trading based on carbon sequestration projects, though a relatively new trading commodity, promotes complimentary incentives which link the financial benefits with the environmental benefits. There is clearly a symbiotic relationship between CDMs, creating global dividends and joint implementation projects, promoting sustainable forestry practices, poverty alleviation and the reduction of forestry/biodiversity depletion.

The problem remains in how these potential beneficiaries can reach consensus. The best alternative to achieving this goal is emphasizing symbiotic interest(s) among the various parties, address competing concerns and define

[37] Ibid.

common terms of success. Some would question whether policies should be based on profit, increased/sustained biodiversity or poverty alleviation? A combination of all three seems to be the most suitable approach based on current realities. It addresses the motivations of the developing world for economic parity with the developed world and the necessity of finding an ecological balance. Thus market motivated approaches can work within an environmental framework by allowing economic incentives in the promotion of environmental preservation and sustainable development provided that there are also government-induced incentives for the local populations.

The way the system is set up today; environmental treaties fail to give incentives to the developing world regarding the value of conservation of their natural resources. This is clearly evident through the ineffectual nature of current treaties and their failure to meet even the most basic goals for which they were created. To draw on current realities to emphasize the point, these failures are demonstrated in the continued increases in GHG emissions into the atmosphere, increased deforestation, reduced biodiversity and the increasing economic gap between the developed and developing world. These issues have only been exacerbated since the implementation of environmental treaties, which were originally established to address these problems.

Chapter 2

METHODOLOGY

To date, there are a number of carbon forestry projects throughout the globe that are in the initial phases of development. Due to the relative newness of forest-based carbon sequestration, the methodologies behind many of these projects have not been sufficiently examined nor have they had the opportunity to face off to scientific scrutiny. The data for these projects must be verifiable by outside organizations for accuracy and credibility. One of the difficulties in establishing a carbon-based model is quantifying the variability of carbon in project areas in comparison to non-project areas. The differences between the two over the same period of time in similar ecological situations should indicate the differences between business as usual practices and sequestration initiatives.[38]

The challenge of initiating a methodological approach is that it is difficult to come up with an acceptable baseline as a starting point and equally problematic to decide what standards of measurement should be applied for calculating the effectiveness of carbon sequestering. This chapter addresses the issues associated with the measuring, monitoring and verification of carbon projects and their benefits. Chapter 2 also explores the problem of leakage and the virtues and shortcomings of a volunteer system versus a '*compellance*'-type system. The chapter concludes by analyzing the viability of a market approach to forest-based

[38] Ibid. p. 118.

carbon sequestration and examines in detail the carbon sequestration pilot project in Noelle Kempff Mercardo National Park, Bolivia.

MEASURING, MONITORING AND VERIFICATION OF CARBON BENEFITS

This section will address some of the tools used for monitoring forest based sequestration projects. The first steps in initiating carbon-based forestry schemes is to determine which particular forestry and land-use project should be studied and then establish the criteria for monitoring said project. The key question that must be addressed is what is the starting point for measurement? For some projects the starting point will be based on carbon levels prior to land-use changes. For others, the difference will be immediately positive due to the halting of deforestation and the lengthening of the rotation of forests as more carbon is retained in trees.[39]

There are several types of carbon capture mechanisms related to forest projects;

- Projects established to avoid deforestation and conserve forest areas. This category encompasses conservation projects, reduced impact logging and improved forestry and fire management
- Projects designed to increase carbon sequestration such as reforestation and *afforestation.*[40]

Setting standards with respect to the measurements involved in different sequestration projects is vital to their success. In some forestry activities, the major carbon pools are found in large quantities of live biomass, dead biomass

[39] Ibid. p. 119.
[40] Ibid. p. 138.

and wood products. A decision must be made as to which pool to measure. Since various types of projects produce different results, the form of measurement used should be based on the type of forestry project being implemented.

As an example, in forestry-based sequestration projects, it is recommended that the carbon in trees be measured across the board. This is a more practical approach since the main source of carbon benefits for forestry-based sequestration projects is found in trees, unlike land-use change projects where carbon benefits are found in soil, plants and through varying farming techniques.[41] The variety of methods and approaches currently being used leads to different standards and results depending upon the project. This lack of uniformity hampers the credibility of forest-based carbon initiatives and creates concerns over the validity of these practices.[42]

To date the main tools for monitoring forest-based carbon sequestration projects are:

- Remote-sensing data
- Use of satellite technology and GIS imaging technology
- Use of low-flying airplanes
- On the ground measurements
- Measurement of soil-based carbon pools
- Measurement of wood (dead and live) carbon pool capacity
- Measuring the diameters of tree biomass as a method of estimating carbon capacity
- Use of sampling methodology based on size, species distribution (especially prevalent to tropical forests)
- Tagging of all trees in a specific plot

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[41] Ibid. p. 119.
[42] Ibid. p. 131.

- Data archiving

In order to establish a legitimate forest carbon pool, inventory must be taken of forest carbon through a series of nested plots for multiple-aged forests and single plots for even-aged forests. Trees should be tagged to create a statistically accurate means of evaluating changes in forest carbon pools. These specific plots can then be analyzed, measuring changes in carbon and creating statistical credibility. This generic type methodology is statistically well established and is the most efficient monitoring approach keeping in mind the costs.[43] The disadvantage in this approach is that generic equations my not reflect the actual biomass of trees within the project.[44]

Another component to forest carbon projects is dead wood, both lying and standing, which forms important carbon pools that should be incorporated into forest projects measurements. Dead wood is a significant component in forest ecosystems and often makes up 10-20% of above ground biomass in mature forests; however, it tends to be ignored in many forest-carbon counting schemes. Yet incorporating dead wood into the equation takes no more effort than measuring live trees.[45] Likewise, the root biomass represents up to 40% of total biomass in forests. However the methodology necessary to quantify this pool can be cost prohibitive and no practical field technique exists at this time.

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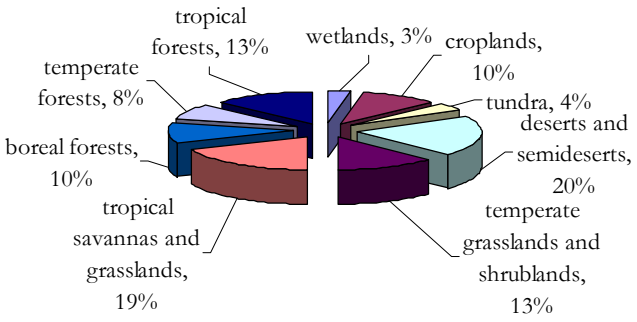
[43] Ibid. p. 121
[44] Ibid. p. 122.
[45] Ibid. p. 122.

There is continued debate regarding how to measure soil-carbon pools in forestry projects, however the ability to measure vegetation is well established and there is extensive documentation on carbon pools. There is also substantial literature on soil oxidation rates based on different types of land-use. These can be found in the *IPCC guidelines for national greenhouse gas inventories*; Houghton et al. 1997.[46]

Area of Vegetation Types as Percentage of Global Total



As the graph demonstrates, there are many different vegetation types around the globe. All of which have unique baseline projections which influence the carbon capture capacity of the land sink. In order to implement these projects efficiently, it is necessary to collect as much relevant data as possible. Such information includes land-cover/land-use map of the area to be studied, documentation of the resources and pressures on the land, a history of the particular land use, the regional climate conditions, and type of soil, geography and the socio-economic make-up of the surrounding/impacting communities. This information is significant in that it can assist in identifying and categorizing different forest types, thereby improving the baseline projections of

corresponding projects and helping to develop guidelines to address the issue of leakage.[47]

Ongoing Project Monitoring

The monitoring of carbon pools and measuring compliance of sequestration activities is a vital component to the success of carbon projects. Rather than monitoring every specified plot designated as a part of the project, selection of some pools could serve as an adequate indicator that the project is complying with the guidelines of agreement. As to the frequency and the intensity of monitoring, that depends to a large extent on the nature of the particular project. For example, the projects designated to avoid carbon emissions through the halting of logging and deforestation over the course of the project will have a constant amount of carbon. On the other hand, projects designed to sequester carbon such as, reforestation or *afforestation* projects, will experience significant changes in carbon stock, therefore periodic measurement is necessary as per the guidelines discussed above.[48]

Technology and sequestration

Remote sensing technology is a valuable tool in the monitoring of forestry projects. Satellite imagery has the potential to be utilized for monitoring compliance of forest protection projects. However, technology is not yet being

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[46] Ibid.
[47] Ibid. p. 120.
[48] Ibid. p. 123.

used as a compliance tool. Currently remote sensing is used to produce maps of project areas for estimating the rates of land-use change.[49]

For projects whose goal is to halt deforestation, minimal carbon monitoring is necessary due to the limited change expected over time, especially in the case of mature forests. The main component to this type of project is to prevent further deforestation. As such the most appropriate monitoring method is digital camera technology. This particular method would require monitoring at intervals; this approach would compare the change in topography over a period of time. It would help to determine any differences in carbon accumulation rates between logged and untouched plots. The ultimate goal is to use the data to revise the carbon benefits where necessary, evaluate the need for additional plots, and observe whether logging practices have changed over time.[50]

To ensure that the quality and the credibility of the project is maintained throughout the project; a reliable baseline, measurement and monitoring plan must be implemented for future projects. Additionally, the problem of leakages and errors in analyses must also be addressed. To accomplish this, set standards and criteria must be in place as part of the projects' protocol requirements. Formal procedures, documentation and consistent guidelines should be created to ensure continuity and verifiability of projects.[51]

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[49] Ibid.
[50] Ibid. p. 127.
[51] Ibid. p. 129.

ADDRESSING THE PROBLEM OF LEAKAGES

Conservation projects play a key role in forestry projects through land-use change projects that increase the carbon storage capacity in forests. However, since deforestation and forest management practices are specifically deleted under the Kyoto Protocol's CDM, this particular mechanism is under-utilized as it is a significant contributor to GHG reduction as deforestation and forest degradation contributes to 20-25% of global GHG emissions.[52] However, there is considerable debate as to whether or not such projects should indeed be a part of the solution to decreasing GHG emissions, based on the phenomenon known as 'leakage.'[53]

The primary concern about leakage lies in the policy of forest protection. In its efforts to reduce deforestation and increase forest protection, forest protection policies inadvertently can cause deforestation practices to be relocated to a different place with no GHG emissions benefits this is known as *activity-shifting leakage*. This action can be applied not only locally but within the international system. Based on the differentiated responsibilities of Article 3 of the UNFCCC, developed countries agree to binding limits to their GHG emissions within the guidelines of the Kyoto Protocol, however, developing countries are not held to the same standards. As such, one nation could indeed be in compliance with the guidelines set in Article 3 on a national basis but could

[52] Ibid. p. 138.
[53] Ibid. p. 134.

easily be exporting their high emissions industries or promoting deforestation to one of their developing country partners.[54] This provides a carbon premium for developed countries to maintain their natural forest while providing incentives for them to increase harvesting in the developing countries. This consequence is called *inter-annex leakage* or *Inter-annex market leakage*. It directs unsustainable timber harvesting from the developed world to the developing world.[55] Furthermore, leakage is not only limited to forestry-based projects, it can occur within all sectors of the economy where GHG mitigation is a factor. It has been argued that the Kyoto Protocol has inadvertently led to the relocation of certain energy-intensive industries to developing countries with less stringent environmental laws and enforcement mechanisms.[56]

Leakage and forestry projects:

Deforestation and forest degradation stem from many different causes: economic, social and political. The immediate manifestations of deforestation are logging and slash and burn techniques to open land tracts for agricultural conversion and grazing. These activities are influenced by culture, poverty, markets, government policies and the need for basic necessities (food, shelter, fuel).[57] As such, projects that improve forest management techniques rather than eliminate forest harvest all together have proven to be less vulnerable to activity-shifting leakage and more in synch with the goals of sustainable development.

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[54] Ibid.
[55] Ibid. p. 333.
[56] Ibid. p. 137.

One way to combat leakage is through the transfer of economically competitive and GHG friendly technologies which has a positive impact on leakage.

Likewise, if timber companies find sustainable forestry practices more profitable, there is more incentive to change traditional unsustainable forestry practices, thus creating additional positive leakage outcomes.[58] To a large extent, activity-shifting leakages are contingent upon whether the carbon capture activity engages or displaces the local population and land-owners. Studies have shown that if reforestation activities are implemented as an alternative or compliment economic benefits in comparison to unsustainable practices then negative leakage will follow. [59] An example of this is the Noelle Kempff Mercado project, which engaged the surrounding communities in its conservation activities. After logging in that region was halted, the Noelle Kempff Mercado project employed the former hunters and loggers in the park management and eco-tourist industry.

Methods of responding to leakage:

Site selection can influence whether or not the likelihood of leakage is high. Working with communities that are interested in the project is the first step to minimizing leakage. Selecting an area with few competing interests for instance, areas with already degraded lands and/or remote areas which are difficult to access.

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[57] Ibid.
[58] Ibid. p. 140.
[59] Ibid. p. 142.

The creation of multiple linkages with local communities is another effective method of reducing leakage. An example of such a model is the Noelle Kempff Mercado project in Bolivia where the communities, through employment opportunities, improved agro-forestry techniques and improved watersheds, have a vested interest in maintaining the project goals. An alternative approach used by the Noelle Kempff Mercardo project is contracts. The logging concessionaires that were bought out by the project investors signed contracts which committed loggers to decrease activity shifting, not to use the money from the project towards new timber concessions, and to abandon logging equipment. Additionally the Noelle Kempff Mercardo project was set up to follow the investments of displaced concessionaires and to monitor compliance with the contract.[60]

Another way of addressing leakage is to provide discounts to projects that promote effective monitoring and leakage control. Furthermore, projects can be pre-screened for vulnerability to leakage. For example, a project should have to meet specific monitoring and measuring guidelines prior to qualifying for entrance in the carbon sequestration program.[61] Unfortunately there are no studies currently available which prove that forestry projects are more prone or less susceptible to leakage than other projects such as ones in the energy sector.[62]

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[60] Ibid. p. 146.
[61] Ibid. p. 147.
[62] Ibid. p. 150.

'*COMPELLANCE*' VERSUS VOLUNTEERISM

One of the factors that has led to weak environmental agreements is the perception that environmental issues are an 'add-on' and do not warrant immediate attention. After all other 'important' issues are solved such as poverty alleviation, development, disease etc. then the environment can be addressed. Unfortunately this approach places the cart before the horse.

It has been proven that many problems such as poverty, development and even national security issues stem from misallocation of resources and unsustainable land-use practices. Unfortunately many of these issues are linked and cannot be efficiently addressed without first acknowledging and resolving the environmental issues. As such, how can environmental issues be appropriately addressed with the same urgency as economic development issues? The answer lies in linking both economic benefits with environmental benefits. Forest based carbon sequestration holds the key to that link through the economic benefits of selling carbon credits and creating a strong legal framework with strict guidelines in the form of contracts.

The nature of contracts and their legally binding framework allows participating parties the ability to seek recourse through the legal system. This creates incentives on the part of the stakeholders involved to make certain that the guidelines are met per the letter of the contractual document. If the contract is broken or the guidelines are not met, the parties involved have the ability to take the offending party to court and there is the possibility of getting financial

compensation per the legal agreement. This approach would guarantee that incentives are in place for participants to monitor and verify that the agreement is being complied with to the satisfaction of all parties involved.

In contrast, volunteerism is plagued by the 'minimum requirement' approach, inefficiency, and the maintenance of the status quo. This creates a system in which parties can tout their compliance and success through meaningless gestures and vague treaty wording without complying with the established guidelines or implementing any real environmental change. With the volunteer system the only 'weapon' available to parties to impose compliance is the 'shaming' method, which is severely inadequate in non-democratic countries where public opinion holds little or no weight and in countries where powerful industrial interests have the financial wherewithal to stifle any policy which would impede their profitability. With these impediments the 'shaming' strategy falls on deaf ears.

MARKET APPROACH TO CARBON SEQUESTRATION

The Kyoto Protocol and the United Nations Framework Convention on Climate Change's (UNFCCC) strong emphasis on incorporating market mechanisms as a method in reducing greenhouse gas (GHG) emissions is an efficient method of reaching environmental objectives and has led to the development of an international trading scheme of carbon credits. The attempt at establishing a free market system has facilitated government and private involvement in this scheme aimed at addressing the interests of economic, environmental and social impacts.[63]

The main concerns are the LULUCF projects in developing countries that are eligible for carbon crediting under the CDM. As previously stated, projects that were designed to help halt or slow deforestation were not considered eligible for crediting. This eliminated a large carbon trading resource from the CDM. Thus incentives were created to clear natural forests for the purposes of establishing carbon plantations.[64] Though carbon plantations would be an efficient trading vehicle it could cause irreparable damage to biodiversity and other important environmental benefits. Areas which might prove ideal for forest restoration might face competition from interests seeking to maximize the carbon capture capacity available through mono-cropped carbon plantations.

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[63] Ibid. p. 334.
[64] Ibid. p. 333.

In the current structure of the CDM, *afforestation* and reforestation projects range from small-scale agro-forestry projects to forest restoration to industrial plantations. The type of activities utilized depends in large part upon geographic considerations, environmental and social impacts as well as the eventual market price for carbon credits. It also depends on the motivating interests of the countries participating in a particular project.

It is clear that large-scale plantation projects provide more financial incentives given their high returns on carbon credits; however this could have negative impacts on biodiversity depending on where and how such projects are implemented. If carbon plantations are established in areas where land has been degraded and managed in accordance with sustainable development criteria they can provide both economic and environmental benefits. Likewise if native species are used, such projects can provide the foundation for the creation of natural forests and help promote biodiversity.[65] If carbon pricing is high enough it can lead to decreased deforestation and increased *afforestation* in developed countries. Conversely, low carbon prices may result in accelerated deforestation as countries use timber harvests to substitute for lost income.

In projects established adjacent to natural forests, the price of carbon credits can increase incentives to deforest and expand plantations if financial incentives are better for plantations in comparison to natural forest preservation. The clearing of natural forests to establish carbon plantations has occurred on

numerous occasions. For example, the Tokyo Electric Power Company tried to promote efforts to clear native forests in Tasmania in the hopes of establishing carbon plantations.[66]

In conclusion, the Kyoto carbon market scheme, the way it is currently worded creates uneven incentives to cut down natural forests and replace them with the more financially lucrative plantations rather than promoting the maintenance of already existing forests.[67] However, based on the model devised for carbon trading it is foreseeable that this market- based scheme could be adapted to such issues as protection of watersheds, fisheries, and biodiversity preservation. The benefits for such an approach would include:

- An actual reduction in GHG emissions in the atmosphere
- A greater linkage between private industries' financial performance and the quality of its environmental management
- Reduction in deforestation
- Increase in biodiversity
- Improved air quality
- Financial capital for governments to expand sustainable development projects
- Eliminates the 'tragedy of the commons'
- Improvement in soil quality
- Protection of watershed

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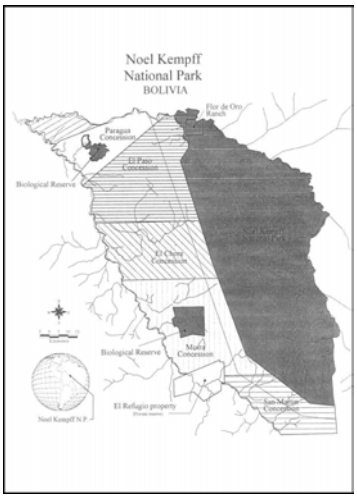
[65] Ibid. p. 334.
[66] Ibid. p. 335.
[67] Ibid. p. 340.

ANALYSIS OF EXISTING MODEL: BOLIVIA

The Noelle Kempff Climate Action Project, Bolivia

In 1996, the Bolivian government in conjunction with the Fundación Amigos de la Naturaleza (FAN), American Electric Power and the Nature Conservancy (TNC) created a forest-based joint implementation project which allowed for the expansion of Noelle Kempff Mercado National Park (four million acres of threatened tropical forests). British Petroleum America (BP Amoco) a large oil company, became involved with the project in 1997. The project duration is 30 years and is the largest existing forest-based carbon-trading project currently in operation.[68]



Noelle Kempff Mercardo is located in Northeastern Bolivia in the department of Santa Cruz, on the border with Brazil. The park was previously used for logging when BP Amoco bought out the logging rights for $10 million and turned the area into a national park, thus giving it legal protection from future logging. In exchange, the corporations are using the area to claim credits for the carbon dioxide that the trees absorb from the atmosphere as per the guidelines of the Kyoto agreement.[69] American Electric Power finds the option

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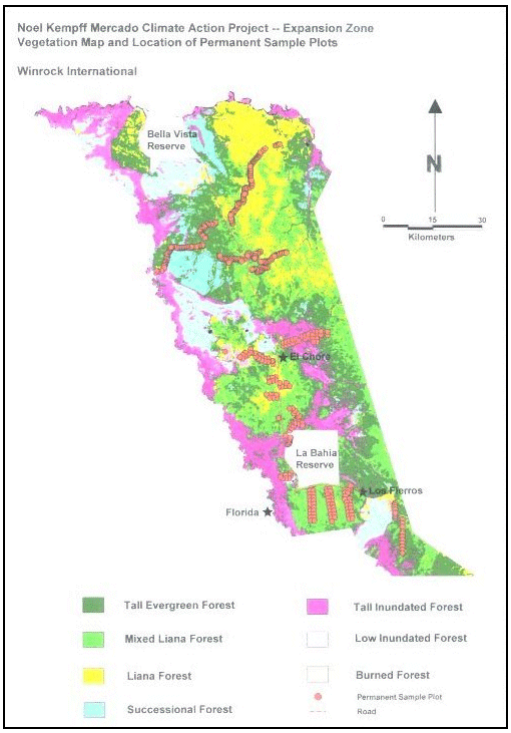
[68] Ibid. p. 125.

[69] Hirsch, Tim. *Carbon-Trading in Bolivia.* http://news.bbc.co.uk/go/em/fr/-/1/hi/world/americas/1016598.stm Accessed March 15, 2004.

more cost effective and allows for additional time as they develop environmentally safe improvements back in the United States.

Carbon Monitoring in Noelle Kempff National Park

In 1997, 625 parcels of land were set aside for monitoring of leaf and soil carbon samples and the project began measuring carbon pools. Fallen trees and branches were tested for carbon content. This pilot project encompassed several areas of complex tropical forests, so the measurement of carbon stock had a high degree of accuracy. The graph shows the areas where plots were established to measure stored carbon.



The main goal of the project is to sequester carbon and store it in areas that were previously slated for deforestation. The residual benefits are that the project is helping to preserve and maintain one of the most biologically diverse ecosystems on the planet as well as promoting sustainable development initiatives with the surrounding communities.

There are several components to the project: the first is the expansion of the park, the second is the rangers, located on site to protect against agricultural expansion and illegal logging in the park. Ecotourism and sustainable development initiatives are created for local communities. This includes the

hiring of park rangers and tour guides from the surrounding communities and finally the monitoring and verification activities using the local communities as resources. [70]

The accuracy of measuring and reporting the level of carbon captured is vital to the project's success. An advisory panel was established to verify the validity and thoroughness of the carbon monitoring procedures in place; results are subsequently reported to the Bolivian Government for certification. The measurements are used to calculate the level of carbon offsets for allocation to project investors.

> The project developed a unique and equitable offset sharing system that provides 49% of the offset credits to the Government of Bolivia, 49% to the industry contributors and 2% to American Electric Power, the lead investor, as a project development "bonus." The Government of Bolivia is required by contract to spend the proceeds from the sale of offset credits on Park management activities in Noelle Kempff and throughout Bolivia, and on other biodiversity preservation activities. [71]

In addition to the investors and the government participants, local communities around the park are involved in related economic development activities. Funds are set aside not only for forestry activities but for microfinance enterprises, such as agro-forestry projects, animal husbandry and small-scale tourism. The project has also assisted in funding health care programs, clean water supplies, improved schools and sustainable technology transfer. One of the more significant activities funded was offering legal and technical advice to the local indigenous people to gain title to their land.

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[70] www.noelkempff.com Accessed 4/25/04.
[71] www.noelkempff.com Accessed 4/24/04.

Local stakeholder benefits

Based on the author's observations, on the community level, local inhabitants also had a large stake in the project success. As stated above, many of the park rangers and tour guides were hired from the local community. The logic behind this initiative was they knew the park better than anyone else and by incorporating them into the park system FAN eliminated the potential for them to exploit the park resources through illegal deforestation and hunting. Likewise there were specific rules which the farmers had to abide. For example, they had to strongly impose low impact tourism, which means that they had to maintain the park in a pristine manner otherwise they would lose the benefit and income tied to being tour guides for park visitors. Additionally, several local farmers worked with scientists to measure the carbon capture potential of the park and though not educated beyond the fourth grade school level, had extensive knowledge in carbon sequestration, inventory and climate change.

Other sustainable development issues were also implemented within the local communities. FAN initiated a technology transfer initiative which facilitated the local health post by implementing an ongoing vaccination program. FAN installed solar panels in the local health post to

operate a refrigerator to keep the vaccinations and other vital medicines fresh. Panels were also installed in the local school to provide electricity to operate adult literacy classes in the evening. Likewise, various houses throughout the community had solar panel technology installed where the grid could not access. With this technology, community members were able to build small scale tourist residents to augment their income. In addition to technology transfer and economic incentives, animal husbandry, sustainable farming techniques and agro-forestry (rubber tapping) programs were initiated.

The Noelle Kempff Mercardo Climate Action Plan creates a unique example of multiple stakeholder interests being addressed. The international firms have a resource which assists them in meeting their GHG emissions initiatives. The Bolivian government has financial incentives through emissions trading with international companies and the local community has a stake in keeping the park pristine through;

- The economics of ecotourism
- Technology transfer
- Improved sustainable farming techniques
- Protection of watersheds and valuable resources
- Maintenance of their unique cultural heritage as stewards of the land.

All this was accomplished while meeting the guidelines of emissions reduction based on the Kyoto Protocol. This project and land area, which is about the size of the state of Massachusetts, has helped increase biodiversity and

conserves natural resources. It has also collaborated with local communities by ensuring the sustainability of livelihoods in the area.[72]

[72] *The Role of Land Carbon Sinks in mitigating Global Climate Change.* July 2001. The Royal Society. p. 8.

Chapter 3

FLAWS IN CURRENT APPROACH

Incentives to deforest:

As stated in the earlier chapters, there are several flaws in the CDM and in the incentives it creates as it pertains to carbon capture projects in the Kyoto Protocol. Based on how the system is currently set up there is less emphasis on already existing carbon stores which could create strong incentives to replace these stores (old growth forests) with fast growing tree plantations. The lack of distinction and the refusal of the protocol to acknowledge the differences between forests and plantations could lead to more, rather than less, greenhouse gas emissions being released into the atmosphere, which could in turn spawn rapid deforestation and drastic reductions in biodiversity. Therefore it is important to qualify to a greater degree the criteria for carbon trading.[73]

Defining terms of Carbon Trade

One of the most expedient forms of carbon sequestration is using tree plantations planted with fast growth trees that have maximum carbon absorption. This option, while beneficial to preventing desertification and helpful in advancing *afforestation* efforts would not be appropriate in regions where biodiversity is still abundant. Agreements should explicitly address how they choose to define the terms of carbon trade based on the regional requirements.

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[73] http://www.sinkswatch.org/ Accessed on December 15, 2003.

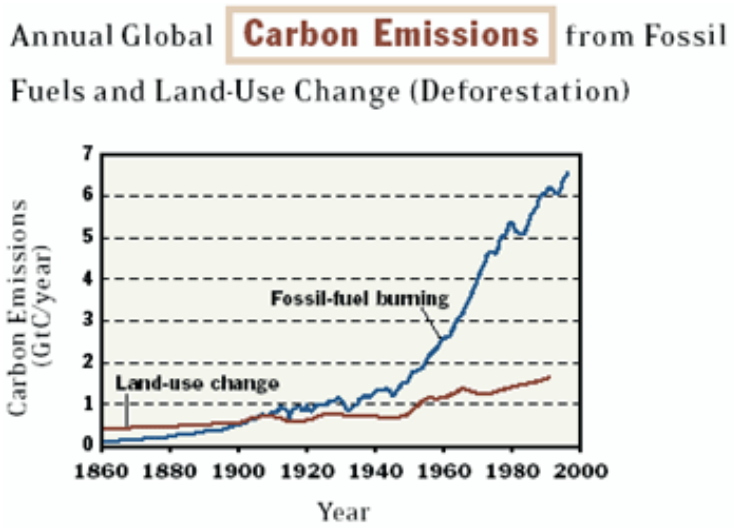
In tropical areas like South America, maintaining the richly diverse ecosystems that still exist and utilizing them as carbon sinks serves the purpose of meeting the goals of biodiversity, reforestation and carbon uptake. Any country which follows these guidelines through improving forest practices, increasing forest reserves and promoting sustainable forestry techniques should be eligible for additional credits as per the guidelines of the Kyoto Protocol.

Projects which would be eligible for funds from carbon sequestration are those that promote reforestation and the preservation of biodiversity, sustainable forestry practices, promotion and implementation of clean energy technologies, net reduction in greenhouse gas emissions, *afforestation* in areas subject to desertification and forest preservation as tools for carbon capture. These projects though diverse all have the same purpose of reducing GHG emissions and preserving our natural resources. However, the problem persists as to how to finance such varied and seemingly incompatible initiatives.

An excuse to maintain inefficient fuel consumption patterns:

It is argued that even if a comprehensive sequestration program were to be implemented which included all facets of carbon sequestration (i.e. forest-based and emissions trading programs) it would still have minimal impact on reducing CO2 from the atmosphere, due to the magnitude of the current fossil-fuel consumption patterns of the developed world. Figure 2.4 clearly shows the disparity between fossil-fuel use and land-use change as contributors to GHG

emissions. As such, one of the flaws in the sequestration model is that alone, carbon capture projects will not be effective weapons against GHG emissions without significant change in fossil fuel consumption patterns. Forestry-based sequestration should be viewed as a component in the overall strategy to reduce GHG emissions; sequestration is not a substitute for initiating changes in energy supply and improved technology which will be necessary if CO2 concentrations are to be reduced.[74] The promotion of carbon sinks may allow nations to avoid making the necessary changes in addressing their fossil fuel emissions and consumption patterns.



Additional challenges of Sequestration Models:

Many forest management programs tend to be geared towards timber production but few take into consideration the forest soil capacity for carbon uptake. For example, large scale timber extraction tends to disturb the soil and

[74] Supra Note 1. p. 5.

stimulate carbon loss which reduces the uptake capacity of the soil.[75] Yet very little is known or studies done to measure the impacts of these practices.

Carbon sequestration is a fairly recent idea, and there are no prior models to draw from in the implementation of these projects and quantitative information is still lacking. For this reason, it is difficult to calculate the long term consequences of these projects. Also, developing nations tend to have weak enforcement mechanisms despite laws being created to promote these projects and protect natural resources. Unfortunately political will and enforcement mechanisms have not yet caught up with the laws.

MULTIPLE BENEFITS

Actual reduction in greenhouse gases

The rationale for the use of carbon sequestration as a policy tool is manifold. Forests and forest soils can be utilized and managed in ways to absorb the carbon from the atmosphere as they undergo the process of photosynthesis and the natural carbon cycle. The faster growth rates in tropical climates, where a large portion of developing countries are located, combined with lower labor costs and cheaper land rents all contribute to keeping the cost of sequestration lower in developing versus developed countries. The task of emissions reductions, on the other hand, should be focused in the developed world where most of the emissions releases occur.

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[75] *The Role of Land Carbon Sinks in mitigating Global Climate Change.* July 2001. The Royal Society. p. 8.

Cheaper for the North to trade outside of its borders versus within

With the majority of the world's natural resources located within developing countries it would seem logical that the developed world should begin to create alliances to develop carbon trading regimes with these countries. The costs of implementing carbon sequestration programs in the developed world are much greater than in the developing world. GHG reduction projects are significantly more costly if implemented in the developed world in comparison to working through partnerships with non-Annex 1 countries to buy credits at a cheaper price. This approach creates a symbiotic relationship between the developed and developing countries.

Rather than being viewed as another exploitative program implemented by stronger northern nations, sequestration programs are mutually beneficial to both participants. Furthermore this market-based trading system creates additional revenue for non-Annex 1 countries while at the same time establishes a cost-effective means for Annex 1 countries to meet their emissions quotas under the Kyoto Protocol. It is estimated that the cost of domestic reductions of GHG emissions for developed countries, if emissions trading and other flexible mechanisms are not allowed, might be as high as $580/ton in Japan, $270/ton in

the European Union and $190/ton in the United States in comparison to the $1-20/t C range of costs in developing countries.[76]

Climate change is a global problem and therefore must be addressed on a global level with a view toward global solutions. Revenue and employment opportunities can be created on both a local and international scale.

Preservation of Vital Forest Lands

Soil conservation practices associated with sequestration projects such as forest belts not only reduce soil erosion but also increase the organic matter content of soils which increases yield output. Additional conservation strategies include converting marginal lands to compatible land-use systems, restoring degraded soils, and adopting best management practices such as sustainable forestry practices; all of which are classified as carbon sequestration and conservation projects.

The majority of the costs for sequestration (*afforestation*, deforestation) involve the up-front investment needed to buy land and perform the initial planting. As stated earlier, the carbon in soils is transferred to trees as they grow. One way to increase the capacity for carbon absorption is to expand current sink capacities. This can be accomplished by planting more trees. The focus on sustainable forestry can be combined with an emphasis not only on selective cutting, but also pro-actively planting and nurturing more trees. This method can

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[76] *Economic and Social Costs & Benefits of Carbon Sequestration Projects in Mexico: Policy recommendations for Future Projects*; Submitted by Gustavo A. Silva-Chávez to the Environmental Concentration at the Maryland School of Public Affairs for the Project Course on May 8, 2000.

help both projects in the long-run by expanding the current harvestable timber reserves and creating more terrestrial sinks for future exploitation.

Terrestrial ecosystems are an important part of the global carbon cycle. Carbon sequestration offers developing countries the chance of managing and enhancing these systems, as a means to prevent carbon dioxide from remaining in the atmosphere and causing climate change. Forests are estimated to sequester at least 25 percent of the carbon dioxide emissions from fossil fuel combustion and sinks offer the chance to be one of the mechanisms used to 'close' the carbon cycle that has been unbalanced by human GHG emissions.[77]

The preservation of vital forest lands is a residual benefit of sequestration projects. The premise being that economic value can be derived from the 'services' of the forest as a carbon absorption mechanism versus a resource for wood and wood products. This particular 'service' provided by forest lands will ideally hold more value than those attributed to the 'goods' (i.e. wood, land etc.) produced in these forests. This in turn will create fewer incentives to clear forests for wood products thereby leaving vital ecosystems in tact for future generations and further sequestration exploitation.

Impact of ecotourism

Another indirect impact of sequestration projects is the potential revenue derived from ecotourism due to the increased preservation of natural forest reserves. Non-Annex 1 nations can create and promote a "green image" of the

developing world which would increase the income to these nations and likewise provide additional funding for sequestration projects. Developed countries can promote ecotourism and vacation opportunities in the developing world which will further increase their incomes.

According to the World Tourism Organization, the industry accounts for approximately 8% of global employment.[78] Nature-based encompasses roughly 40% to 60% of the international tourist expenditures and shows signs of increasing at 10% to 30% annually.[79] The premise behind ecotourism is that visitors are willing to pay to see wildlife and/or communities in their traditional environments, thereby creating an incentive to preserve these systems.[80] Within the sustainable development framework, ecotourism can be an effective market tool to promote preservation of natural habitats which further justifies the need for forest preservation.

The potential earning power of the tourist industry can support conservation and sustainable management policies through this market-driven approach.[81] The premise is that when local communities earn a significant income from nature-based tourism and sustainable use they are most likely to shift from unsustainable practices as was demonstrated in the Noelle Kempff Mercardo Climate Action model. Most importantly this new initiative, with its

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[77] Ibid.

[78] Supra Note 1. p. 249.
[79] Ibid. p. 250.
[80] Ibid. p. 92.
[81] Ibid. p. 250.

direct and indirect benefits, provides an alternative approach in addition to sequestration projects to saving endangered ecosystems.[82]

Benefits for Stakeholders
Figure 3.2

DEVELOPED WORLD	DEVELOPING NATIONS	ENVIRNOMENTAL BENEFITS
-Financial Mechanism -Trading mechanism -Offsetting Carbon emissions -Income Generation -Cost efficient	-Financial Mechanism -Increased Biodiversity -Sustainable Forestry Practices -Income generation -Clean Energy alternatives -Technology Transfer -Employment Opportunities -Debt Reduction -Improved Yield Output	-Decrease in greenhouse gases -Increased Biodiversity -Decreased Deforestation -Sustainable Forestry Practices -Increased water quality -Reduced Land erosion -Soil Conservation

LINKAGE TO SUSTAINABLE DEVELOPMENT

The traditional approach to conservation and to sustainable development has not worked for the following reasons: poor planning, poor management, insufficient resources to implement policy and/or a lack of coordination with local communities. It has been proven many times that conservation projects cannot succeed without taking into account the needs and interests of local communities who must earn their livelihoods from the ecosystem. Most of these products are renewable natural resources such as forest goods and wildlife. However with the growing rural populations in many parts of the world, the demands on the ecosystems are rapidly exceeding the supply and the regeneration

[82] Ibid. p. 256.

rate of these resources. Despite the multitude of initiatives, examples of sustainable development and consumption are few and far between.[83]

For this reason, ecotourism blends well with sustainability initiatives. It is a popular method of income generation for local communities which places minimal impact on local natural habitats. However, similar to forest-based sequestration projects, there is significant leakage as the majority of the revenues never reach the country let alone the local communities.

There are similarities between ecotourism and carbon markets in that they both represent a non-extractive, non consumptive use of natural resources. Like ecotourism such markets create value in leaving natural habitats intact which blends carbon storage with maintaining biodiversity. This is most beneficial to the welfare of the rural poor as they can maintain their livelihoods essential to their survival. However the question remains whether or not there is sufficient income in both ventures to sustain them and whether or not the distribution is equitable to warrant promoting these projects. The ideal would be a combination of several sustainable practices working in conjunction with each other. For example blending of a variety of sustainable income generating ventures such as; agro forestry, agriculture, tourism, carbon sequestration and sustainable forestry practices.[84]

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[83] Ibid. p. 92.
[84] Ibid. p. 95.

Challenges of linking carbon markets with sustainable development

While there are overwhelming arguments which tout the benefits of using carbon sequestration to promote sustainable development objectives, the actual implementation of these types of projects is filled with obstacles. One of the major problems is that governments and often times citizens do not see carbon markets as a viable resource for income generation towards their own development goals. To that end, the World Bank in April 2000 began the process of developing a carbon market model. The goal was to facilitate the development of a global carbon market and use the process as a learning tool for how to utilize carbon as a transaction mechanism to achieve environmental benefits and cost efficient reductions that benefit developing countries and economies in transition.[85]

The World Bank used this unique opportunity to mobilize resources to address this challenge, created favorable market conditions and facilitated pilot projects which provided a learning opportunity for future projects.[86] However there is still reticence on the part of many nations to participate. The initial success or failures of many of these pilot projects will be the litmus test for change and increased participation.

The global carbon market based on current trends will be primarily a private sector enterprise, which can be advantageous or not depending on your

[85] Ibid. p. 96.
[86] Ibid. p. 99.

perspective. From the initial start-up perspective it is very precarious as most private sector investors are interested in secure investments and guaranteed results. With carbon sequestration neither can be certain. Issues such as political instability, weak judicial structures and a lack of accountability in some developing countries can have negative impacts in drawing potential investors. Also investors are very weary of being associated with projects which can have a negative impact on their reputations such as projects with detrimental environmental and social impacts on local populations.[87] From a positive perspective the private free market system can create an efficient model with limited bureaucracy and maximum efficiency.

However in the short-term actions need to be taken to address investor concerns. Some alternatives are subsidization or some kind of insurance mechanism or some form of risk guarantee. The World Bank and other investment operations are currently trying to tackle this issue. The mere fact that they have invested time and resources to this endeavor indicates their interest in this sector which is primarily because carbon financing and carbon trading mechanisms can have a significant impact on sustainable development and environmental issues, particularly in rural development and resource management.[88]

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[87] Ibid.
[88] Ibid.

It is evident that carbon emissions trading models can be and have been initiated on the national and international level. However, there are still challenges to be addressed with implementation on the local level. One of which is finding the balance between the short-term and the long-term needs of local communities. Sequestration projects are by nature established to address the long term needs of capturing carbon and keeping it out of the atmosphere. This goal comes into direct conflict with poor local communities as many face immediate pressing issues of survival and meeting daily requirements such as food, clothing and health. To make carbon sequestration desirable for these groups it is important to find the balance between their short-term needs and the long-term goals of sequestration and forest conservation.[89]

One way of linking the two needs is through advance payments or other immediate incentives such as jobs, loans, or other community development initiatives (building schools, health posts etc.). Some forest-based carbon projects buy the values in advance. However, with this type of scheme you always run the risk of failure to comply once payment has been made and with corruption in some judicial systems finding recourse through the legal system can be difficult. Requiring some form of collateral within the written contractual agreement might create incentives for compliance.[90]

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[89] Ibid. p. 100.
[90] Ibid. p. 101.

One of the roles the World Bank could attempt to address is using its influence to break down the restrictions developing countries have put up that impede carbon markets and offer additional incentives to countries that do agree to pursue and promote carbon sequestration projects. For example, lower interests in payments to the bank to offset the costs associated with other sustainable development projects. The goal is to incorporate and expand this trading mechanism in a manner which creates incentives for signing parties to vigorously implement and promote them.

Other objectives for pilot trading programs:

- An opportunity to test new approaches and new technologies
- Create a knowledge base and expertise in the area
- Create a cost index to verify the true price of carbon trading
- Creating financial capital to address sustainable development and environmental issues
- Create a new business model[91]

Since GHG emissions are a global problem stemming from multiple issues. The problem must be addressed in a similar multi-solution and cooperative approach in which all stakeholders make significant sacrifices to accomplish the goal of emissions reduction. The benefits of such an approach are multi-faceted. If carbon sequestration projects succeed, not only will there be direct benefits but indirect benefits in the financial, social and environmental sectors.

[91] Ibid. p. 350.

POLICY PRESCRIPTIONS

How to Finance?

Per the Figure 3.3, there are several different suggested methods of financing sequestration projects. First, governments wishing to purchase carbon credits within the sequestration program would be required to pay a membership fee. This payment would be automatically incorporated into the fund for project distribution and/or investment purposes. Likewise, private enterprises hoping to participate in purchasing and trading carbon credits would pay a fee or commission to the sellers through the fund. If they wished to sell their rights/credits there would be a sales tax which could also be used to fund sustainable development projects etc. Additionally, participating countries could apply for grants and low interest loans from the World Bank, USAID and other financial backers to implement projects which fell within the guidelines of the sequestration pool. Not listed but also vital to project implementation is the role of NGOs. In some cases, NGOs could purchase outstanding debts from developing countries (similar to the Debt for

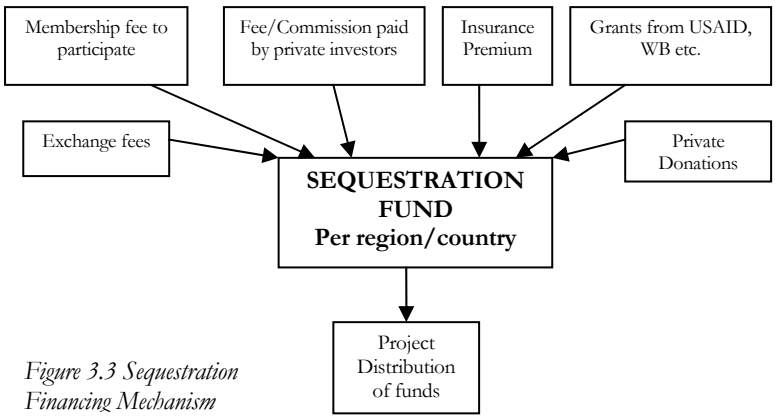
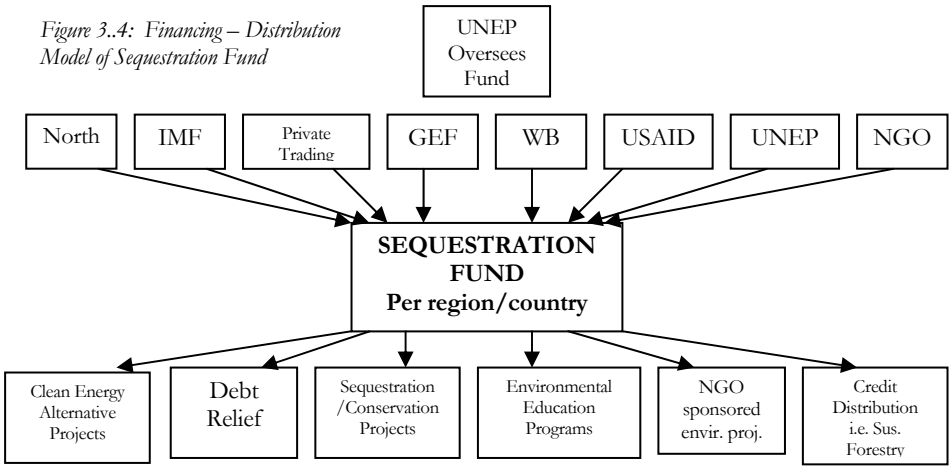


Figure 3.3 Sequestration Financing Mechanism

Nature Swap programs) and use those to finance forest and resource preservation projects subject to strict compliance measures on the part of the debtor nation.

Another method of acquiring funds would be through the establishment of an insurance mechanism which participating countries/entities would have to purchase. This approach would require participants to pay a small premium that could be used to offset any losses resulting from forest fires or pestilence which reduces the carbon intake of forest reserves. Individual entities would be required to purchase a minimum amount of insurance in order to participate. The amount would correspond to the carbon trade value. That in turn would be translated into acreage and a predetermined baseline amount of carbon absorption capacity per acre. The premium would be invested and a portion of the investment income would be put back into the fund. The rest would be used to compensate for losses due to fires and pestilence. But rather than paying companies for losses, the premium would be used to reforest and/or create other carbon sinks to replace lost sink capacity.

Figure 3..4: Financing – Distribution Model of Sequestration Fund



****Modeled from Debt for nature swap*
- *Independent Auditors and transparent format at all levels of process*
- *Agreements can be bilateral and/or regional in nature (i.e. U.S. agreement with Mexico and/or the Latin American Region)*

The diagram in Figure 3.4 above shows the possible participants in the sequestration fund as well as possible funding proposals/projects that would fall under fund eligibility. The diversity of project possibilities is an example of the multiple linkages which can be tied into sequestration funds.

Developed countries can invest in the fund, which would be a method of purchasing carbon credits based on the quality/quantity of forest reserves and their carbon capacity. The income in turn would be used to fund any of the above related projects. Yet another possibility would be if Annex 1 countries forgave a portion of the debtor countries' debts in exchange for carbon credits that in turn would be contingent on the loaner country meeting its emissions guidelines under the Protocol and the sequestration trading/funding mechanism.

Likewise, the IMF, GEF, World Bank, USAID and UNEP would use the fund to promote sustainable and environmentally friendly projects. The incentive for participation in the sequestration fund versus other development mechanisms would be the stringent guidelines and transparency which would compel participating countries to comply with strict procedures and policies in order to qualify for funds.

Private traders and investors would find it beneficial to participate in the fund based on the income earning potential of carbon trading in the marketplace. Companies such as electrical or other high GHG-generating industries that wish to purchase or sell extra credits on the international market to meet their perspective country guidelines through the sequestration purchase program would be eligible.

This scheme is not dissimilar to the Chicago Climate Change trading mechanism.[92] However the major difference is the transactions and pricing conducted between companies and credits would be based on the quality and the quantity of land/forest resources. For example, natural forests would be worth more in terms of carbon trading credits in comparison to *afforestation* projects. However, this is contingent on the region and the base measurements of land quality and carbon capacity. In regions of the world subject to land erosion, desertification and have been stripped of their forest reserves for a significant

[92] http://www.chicagoclimatex.com/trading/howItWorks.html Accessed on January 8, 2004.

period of time would logically have to rely more on *afforestation* projects in comparison to tropical regions which still maintain significant biodiversity and forest reserves at the time of program initiation. So, regions in the midst of desertification or vulnerable to it would receive a better price for *afforestation* projects. Countries which endeavor to preserve their already existing natural forests would receive an equally advantageous price for their carbon capture reserves versus cutting down 'old' forests and planting sequestration plantations instead.

Similarly NGOs who wish to participate in the program would purchase a portion of the countries' private debt (similar to the debt-for-nature swaps) or the debtor country could lease land rights to the NGO in exchange for monitoring and management of resources. Essentially the NGO would play the role of a land management consultant. Income would be derived from the sale of carbon credits and sustainable forest practices.

These prescriptions would of course be contingent upon all parties being under contractual agreement to fulfill the established guidelines of the particular fund. In order to create a system in which all parties benefit, debt forgiveness and debt purchase would have to be substantial. In that manner, if the debtor countries fail to meet the guidelines of the fund they would be forced to assume the full and immediate repayment of their former debts. Reducing the countries debt in exchange for improved environmental practices would establish incentives on the part of the debtor nations to commit to this scheme.

Requirements for participation

To facilitate the incorporation and full participation of all parties *strict eligibility* requirements are necessary. All Annex 1 and non-Annex 1 countries must have a credible *legal framework* in tact prior to project implementation. The developing nations must demonstrate the *political will* to follow through on project and fund requirements prior to participation. Furthermore, all developing nations must go through a *probationary/transition period* prior to bestowing permanent membership. If these nations fail to meet the established requirements in terms of legal framework, political will and infrastructure, their membership and access to funds will be denied or revoked. Dependent on where countries are in the process and the steps they have taken to ensure compliance would dictate their probationary period. Based on this framework a country can be denied membership if the above requirements are not met.

Enforcement and compliance measures

The best method to ensure compliance for sequestration trading and fund agreements is to create a system with reliable monitoring, transparent reporting tools at all levels, and strict penalties for non-compliance. Such penalties would be in the form of; loss of credits, fines, reinstatement of debt commitments, sanctions, loss of membership and loss of access to carbon trade and funds.

Strict guidelines for all parties ensure compliance with the goals of carbon trading. Additionally the system must be set up in a way in which it is not perceived to be in conflict with development. It should be viewed by all

participants as being mutually beneficial to development goals. For example, clean energy alternatives, though seemingly unrelated to forestry and sequestration are a method of reducing greenhouse gas emissions and is thereby eligible for funds. Likewise, credits given to companies who practice sustainable forestry techniques helps to reduce the severity of the impacts of deforestation, assists in maintaining biodiversity and is also eligible for funding.

Education of local communities and capacitating communities surrounding protected areas further incorporates them into the system and improves the sustainability of sequestration projects for future generations. In the Noelle Kempff project, the surrounding communities have positively benefited through increased income and job opportunities. These communities are now invested in the success of the park and the carbon capture project.

Lastly, deterrence is the best offensive strategy in ensuring compliance to the rules and guidelines of these projects. By creating a system with strict guidelines that are beneficial to all participating parties and incorporating participants from the ground up, you will ensure compliance, self-enforcement and long-term project success.

Market mechanism provides financial incentives

The incorporation of market mechanisms provides financial incentives which in turn promote a unification of interests. By incorporating a variety of different groups into the trading scheme you allow many different portions of society to financially benefit from sequestration projects. Furthermore the

carbon sequestration fund proposal would compliment a variety of other environmental and development projects within several already existing international environmental and development agreements. The program increases the options for bilateral and multilateral arrangements between Annex 1 and non-Annex 1 countries while assisting them in meeting their treaty obligations under the Kyoto Protocol. By allowing the World Bank, USAID, GEF, UNEP, NGOs etc. access to the fund it is the hope that if funding is denied for a project in a particular environmental agreement, countries can utilize the sequestration fund as an alternative financial source. Private investors, local communities, government organizations, would all benefit financially and would be more amenable to the promotion of other sequestration agreements. The financial and economic opportunities for private investors through sequestration agreements have the potential to draw many different sectors into these schemes. Additionally, the funding of local community initiatives such as alternative, renewable energy, educational initiatives, and job opportunities for local residents creates a buy-in on the local level to sequestration initiatives.

Credits given to forestry industries practicing sustainable forestry

By incorporating conflicting interests into the scheme the hope is to create incentives in which both potential adversaries and beneficiaries will have incentives to work within and maintain the goals of the sequestration projects. One idea is to provide credits to forestry industries that practice sustainable forestry. The idea is that sustainable forestry practices entitle certain logging

companies to better pricing of lumber than entities which do not engage in sustainable forestry practices. Additionally certain industries which prove and maintain sustainable forestry techniques are entitled access to certain timber producing areas provided they meet and follow strict sustainable forestry guidelines per agreements.

Credits given to energy exploration industries that practice restoration and clean energy projects/conservation

Energy exploration industries would be incorporated into sequestration programs in several ways. First, similar industries such as sustainable forestry, energy exploration industries would be eligible for credits based on their promotion and implementation of clean energy projects and conservation practices. They would be eligible to participate in carbon trading and a funding source for sequestration projects. There are multiple benefits to this particular idea.

There would be incentives to promote alternative energy such as wind power and solar power. These industries would be eligible for tax relief and subsidies based on the degree of company resources placed in the promotion and implementation of alternative energy systems. The dual objectives of promoting alternative energy schemes and the financial benefits of trading in carbon credits will play a part in the reduction of GHG emissions.

Using Carbon trading as a method of debt relief

Carbon trading as a viable form of debt relief would provide incentives for governments in developing nations to participate in and relinquish some degree of sovereignty to meet the requirements of the carbon trade. If nations, multi-nationals and NGOs agreed to assume some form of government debt in exchange for credits or other agreed upon exchanges it is the hope that many developing nations would buy into promoting sequestration projects through natural resource and forest preservation.

Similar to debt for nature swaps, the World Bank, GEF, UNEP and UNDP would monitor the process and oversee the exchanges. Through this financial mechanism, NGOs and multi-nationals have the opportunity to invest in sustainable development initiatives which can be income generating and environmentally friendly. In addition to development and environmental projects, the fund would support education and information dissemination among local communities and indigenous populations.

Checks and balances

Of course checks and balances must be in place to ensure the integrity of carbon projects. One crucial factor is deciding who should oversea projects. It is vital to project success that all parties have confidence in the integrity of the monitoring system. If the credibility of the monitoring mechanism is in question then the project cannot succeed. So the question of who is the appropriate organization to monitor such projects is important.

In many respects, UNEP would be the ideal body through which monitoring activities could be based. It is unique in that it has enough international credibility to be acceptable to all parties. Additionally, NGOs play a vital role in many environmental treaties as a credible third party, providing legitimate checks on organizations that can be subject to political pressure and specific interest groups with ulterior motives.

Another alternative is government organizations. For example, Annex 1 countries have the advantage in the use of government organizations as monitoring agencies. Generally speaking there are more economic resources and political will in developed countries than in less developed countries where priorities might not lie in the area of environmental conservation.

WHAT THE FUTURE HOLDS

The Kyoto Protocol and the UNFCCC has emphasized the role of carbon markets as a viable method for reducing GHG emissions through the development of international emissions trading mechanisms. New carbon trading markets have been formed in the past few years to address this issue, the Chicago Climate Exchange (CCX) in North America being one of the most notable. These markets are the first step to creating schemes that meet emissions reduction and provide financial incentives. This model has created a market which incorporates energy, industry and carbon sequestration in forests and on

farms.[93] By incorporating all the various mechanisms for sequestering carbon it establishes a database for information on the true costs associated with the carbon trade. As more experience and data is gained, it is certain the market will experience various levels of evolution in the next decade. The lessons learned from the current trading mechanism might be transferred to other environmental problems.

Additional adaptive mechanisms:

- Insurance mechanisms are also currently being developed to address these issues. For example, Swiss Reinsurance, one of the largest reinsurance companies in the world, is working to develop models to address climate change and specifically providing insurance credit for renewable energy initiatives and sustainable practices of the insured.
- A carbon tax has also been suggested as a method of controlling emissions through the polluter pays strategy as well as carbon tax relief for companies that promote carbon friendly technologies and practices.
- It is clear that new emissions-friendly alternative technologies will be put on the market which will further contribute to the reduction of GHG emissions in the atmosphere.

[93] Supra Note 1. p. 347.

CONCLUSION

Historically speaking, many environmental treaties and their corresponding methodologies have been flawed primarily due to environmental issues being viewed as incidental and irrelevant to the pressing needs of development and modernization. They are either given secondary consideration to 'real' economic/development issues or viewed as just another form of neo-colonialism by developed nations' desire to impose their cultural biases on the developing world in order to suppress the south's progress. Unfortunately, most of the developing world continues to view progress through western lenses. The developing countries continue to repeat or imitate the developed world's unsustainable patterns rather than searching for alternative sustainable and renewable models to achieve economic independence.

Carbon sequestration through forest preservation, reforestation, *afforestation* and clean energy promotion is one alternative which contributes to the reduction of GHG emissions, meets the guidelines of the Kyoto Protocol and offers primary and secondary benefits such as sustainable development alternatives, protection of biodiversity, and vital resources and addresses multiple stakeholder issues. Much research still needs to be done to understand the full implications of these projects and many challenges have yet to be faced before these projects can be implemented on a wider more international scale.

Annex 1 and non-Annex 1 countries have a great opportunity to achieve both their objectives of meeting Kyoto's guidelines as well as promoting

sustainable economic development in this potentially symbiotic relationship. However, it is important to note that unless developed countries truly make a concerted effort to reduce their energy consumption patterns no meaningful reduction in greenhouse gases can ever truly occur.

Additionally, all parties must have the political will and perseverance to meet the prescriptive requirements of participation in sequestration projects as well as the patience needed to see it through to its successful conclusion. By linking environmental initiatives, specifically forest based carbon sequestration to economic mechanisms; the developing world would have a tool for both environmental protection and financial benefits. The south is in a unique situation to be in the driver's seat because they still hold much of the world's forest resources.

One could argue that the major flaw in the system is not the inefficiency of forests as carbon sinks and their leakage potential but rather the flaw lies in the current approach and how to place value on resources that have been viewed as infinite and without 'economic' value. For example, the preservation of the forest as a financial resource versus solely compartmentalizing the value of forests into the value of the wood products it provides. Sequestration projects addresses the issue by finding economic value in forests not just for it's 'goods' but for its 'service' as a carbon sink.

The global community, specifically the developed world is quickly losing the luxury of continuing its wasteful habits without regard for the consequences

inflicted on the poorer regions of the world. Climate change is not an isolated occurrence. It affects all countries and all regions, as such global responses are required to tackle the problem. The example of the *Noelle Kempff Climate Action* project proves it is possible to address multiple stakeholder interests from both the local to the international level. The value of forest based sequestration extends from financial benefits to social to environmental to global benefits.

Based on the previously addressed prescriptions, much work still needs to be done but it is the author's contention that carbon sequestration *is* the most viable method of ending the rapid degeneration of our natural resources through its multiple linkages of stakeholder interests with the goals of reducing CO2 in the atmosphere and promoting sustainable development.

BIBLIOGRAPHY

Bass, Stephen, Olivier Dubois, Pedro Moura Costa, Michelle Pinard, Richard Tipper and Charlie Wilson. *Rural Livelihoods and Carbon Management*; International Institute for Environmental Development (London). March 2000.

Bergin, Tom. *EU Carbon Scheme May Be Good for Air and Investors*. London: Reuters, Nov. 27, 2003. Accessed November 29, 2003: http://www.planetark.com/dailynewsstory.cfm/newsid/22950/story.htm

Carbon Emissions Databanks. Accessed November 15, 2003: http://www.pointcarbon.com/schemes.php

Economic and Social Costs & Benefits of Carbon Sequestration Projects in Mexico: Policy recommendations for Future Projects; Submitted by Gustavo A. Silva-Chávez to the Environmental Concentration at the Maryland School of Public Affairs for the Project Course on May 8, 2000.

Haites, Erik. *Linking Domestic and Industry Greenhouse Gas Emission Trading Systems*. Prepared for Electric Power Research Insitute, IEA, and IETA, 2001. Retrieved November 19, 2003: http://www.ghgprotocol.org/docs/IETA.LinkingETSystems.trading.scheme.overview.pdf

International Emissions Trading Agency. *EU Allowances Emissions Trading Master Agreement v. 1.0 2003*. Retrieved December 2, 2003: http://ieta.org/Documents/WG_Documents/Contracts/EU_ETMA/IETA_EU_ETMA_v1_0.PDF

International Emissions Trading Agency Work Program. Accessed November 3, 2003: http://www.ieta.org/About_IETA/About_IETA/Workprogram_03.PDF

International Emissions Trading, From Concept to Reality. Prepared by OECD/International Energy Association, 2001. Retrieved November 19, 2003: http://www.iea.org/books/studies/2001/trading2001.pdf

Mullins, Fiona, and Richard Baron. *International GHG Emission Trading, Policies and Measures for Common Action*. Accessed November 19, 2003: http://www.oecd.org/env/cc/freedocs.htm.

Tietenberg, Tom, and Michael Grubb, Axel Michaelowa, Byron Swift, and ZhongXiang Zhang. *International Rules for Greenhouse Gas Emissions Trading*. Accessed November 15, 2003: http://r0.unctad.org/ghg/publications/intl_rules.pdf

The Role of Land Carbon Sinks in mitigating Global Climate Change. July 2001. The Royal Society.

Sequestration of Greenhouse Gases by Forest Belts on Agricultural Lands. Investment Project, Moscow 2003.

Swingland, Ian R., (Ed.) *Capturing Carbon & Conserving Biodiversity: The Market Approach.* The Royal Society: 2002.

UK Companies Urged to Apply for Emissions Trading Permits. Environmental Data Interactive, November 25, 2003. Accessed November 29, 2003: http://www.edie.net/gf.cfm?L=left_frame.html&R=http://www.edie.net/news/Archive/7789.cfm

Watson, Bob. The Carbon Cycle. Accessed on December 15, 2003. http://www.ipcc.ch/present/presentations.htm

Wiener, Jonathan. *Designing Markets for International Greenhouse Gas Control.* Accessed December 7, 2003: http://www.weathervane.rff.org