

Tree Trouble

**A Compilation of Testimonies on the Negative
Impact of Large-scale
Monoculture Tree Plantations
prepared for the sixth Conference of the Parties
of the Framework Convention on Climate
Change**

**by Friends of the Earth International
in cooperation with the World Rainforest
Movement and FERN**

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Introduction:

Tree Plantations as Carbon Sinks: A Lose-Lose Option

Climate change is one of the greatest threats to humanity. Millions of people may have already lost their homes, farms and, in the worst cases, their lives, due to a global warming-linked increase in the incidence of climatic extremes such as hurricanes and droughts. Impoverished local communities and Indigenous Peoples will be by far the most numerous and most severely affected victims of such climate change-related events and processes. They are hit hardest by floods, hurricanes and droughts, because they depend on what the land provides for their livelihood and have nowhere else to go. Climate change is also the biggest threat to forests and other ecosystems. It is expected to have a negative impact on at least one-third of the world's forests (varying regionally from one-seventh to two thirds) and entire forest types may disappear. For example, some studies predict that 25 per cent of the Amazon forests and up to 40 per cent of boreal forests will be lost if climate negotiators do not succeed in reaching effective agreements enabling industrialized countries to reduce greenhouse gas emissions.

To allow so-called carbon sinks to serve as an alternative to emission reductions would seriously undermine any such agreement. As both the International Institute for Applied Systems Analysis and the World Rainforest Movement argue, the uncertainties and confusions associated with any attempt at the necessary carbon accounting "far exceed any possible reductions". This would give Northern countries who appeal to "carbon sinks" a license to make huge yet completely unverifiable claims about the extent to which they are meeting their Kyoto Protocol targets. Also, emission abatement through carbon sinks is, per definition, temporary while the carbon (dioxide) released in exchange for the carbon sink is longer-lived in its effects. Putting trees in the Kyoto Protocol is thus a recipe for accelerating and subsidizing, not slowing, climate change.

The following case studies are intended to highlight an equally crucial reason why appealing to "carbon sinks" cannot help alleviate the threat of climate change. This is that "carbon plantations" would spell hardship and loss of land, livelihood, income and knowledge for potentially millions of rural dwellers, as well as loss of income, sovereignty and adaptability for their governments. Once again, a Kyoto Protocol including "sinks" would undermine, rather than enhance, the ability of the world's nations to handle the challenges of climate change.

Unfortunately, in addition to being a "green cosmetic" covering up irresponsible actions, setting up tree plantations would be much cheaper than making the fundamental changes in consumption patterns, industrial structure and energy technology which are needed to reduce CO₂ emissions in countries like the United States. This is why the US and a number of other Northern countries want to make use of carbon sinks to meet their (far too modest) quantified obligations under the Kyoto Protocol to reduce their greenhouse gas emissions by 5 per cent.

The risks are even greater now that negotiators, in their discussion of how biotic formations might be managed for climate benefits, seem to have agreed on a provisional definition of "forests" which includes any kind of tree plantation. The definition lacks any reference to biodiversity. Any monoculture, be it of eucalyptus, oilpalm or apple trees, would be considered as forest. In fact, under the current definition one big mango tree is enough to constitute a forest. Even worse, the draft definition includes "temporarily unstocked areas" -- a euphemism for lands which are completely deforested as a result of clearcutting or other destructive forestry practices.

It should also be noted that there is an increasing risk that only reforestation and afforestation projects will be included under the Clean Development Mechanism, which is supposed to fund

"sustainable development projects" (an undefined concept) in Southern countries. These countries do not have a quantified emission target and are thus not obliged to produce national inventories documenting the extent of deforestation within their national boundaries. Thus, a situation could occur in which deforestation eliminates the remaining natural forests in a country in the South while the government receives funding under the Kyoto Protocol for "reforestation" projects which result in large-scale monoculture tree plantations.

Monoculture tree plantations -- which, to make even an ostensible impact on climate would have to be large-scale and thus even more destructive -- are exactly the opposite of "sustainable development". Wherever implemented, they have resulted in negative social and environmental impacts. Their inclusion in a climate treaty as "carbon sinks" would exacerbate these impacts. It is clear who the victims of this lose-lose situation would be: world climate, all the people who depend on it, forest peoples and their forests, and local communities and biodiversity in general. This document highlights the social and environmental impacts of such monoculture tree plantations through case studies and other testimonies from Costa Rica, Ecuador, Australia, Paraguay, Indonesia, Chile, Cameroon, Colombia, Czech Republic, Bangladesh, Uganda and Tanzania. The evidence is clear: large-scale tree plantations are not a solution to either climate change or forest loss.

We therefore call upon the Conference of the Parties of the Framework Convention on Climate Change to limit the use of carbon sinks as much as possible and to ensure that monoculture tree plantations are excluded from all actions and mechanisms to mitigate climate change.

This document was compiled by Friends of the Earth International, in cooperation with the World Rainforest Movement, FERN, Norwatch and Future in Our Hands. We express our sincere gratitude to all the authors, editors and other people who contributed to this document. For more information on the impacts of monoculture tree plantations, please visit <http://www.wrm.org.uy> For more information on this campaign in general please visit <http://www.foei.org>

Monoculture Forestry

A Critique from an Ecological Perspective

Elaborated by Javier Baltodano, Coecoceiba/ Friends of the Earth-Costa Rica

"The people had already sowed their rice, their corn, their plantains, their yucca. They had everything and Ston Forestry (company) and its large tractors came with large machinery and wiped out the rice fields, the milpas (traditional agricultural systems), all was leveled to sow melina trees. It was a horrible thing, it was the drop that filled the glass....."

*A farmer talking about the replacement of farmers
by the Forestry Company Ston in the Southern zone of Costa Rica in 1991
(Van den Hombergh, 1999)*

1. Introduction

The current Western concept of monocultures of tree species developed in Europe in the 18th and 19th centuries, triggered by the shortage of timber caused by the reduction of forest cover. From the beginning, the aim was to simplify the structure and to speed up the cycles of natural ecosystems with the objective of producing wood in as little time as possible and, technically, in the most simple manner.

In this way, monocultures of tree species have ended up as being characterized by their uniformity. The production of the greatest quantity of timber (for wood, energy or construction) in the shortest time and cheapest way possible forms their sole objective. In some cases this can involve the joint cultivation of various species, but it always involves cultivating many individual trees of the same age, and it never reaches the level of biodiversity and complexity of a natural forest (please note that every forest can be considered as natural; the adjective only serves as an emphasis).

Like other agricultural monocultures, tree plantations have undergone intensive technical development during the last decades. Currently monoculture forestry is an activity which depends upon high inputs of energy, fertilizer and pesticide inputs. Likewise, due to technological reasons, the areas established in one single operation have increased, leading to a number of cases in which plantations cover hundreds of thousands of hectares.

However, despite its clear characteristics as an agricultural crop that has little in common with forests, except for the fact that both systems include trees, there has always been a tendency to treat forests and plantations as synonyms. It is still common today to read in textbooks and policy papers, and to hear in ordinary conversation, that the establishment of monoculture tree plantations is the same as "reforestation" (Pancel, 1993). One dictionary defines reforestation as "the act of repopulating a terrain with forest species.." (Spanish Royal Academy, 1992). Etymologically, however, the word reforestation means the "reestablishment of forests".

These semantic discussions would not have any real importance for the environment if it were not for their political consequences and categorical actions. Classifying the establishment of tree plantations as reforestation has attributed all the positive associations that humanity rightly attributes to forests to this type of activity as well. It is for that reason that in the majority of countries, in all sectors, varying from schools to the highest levels of political decision-making, the establishment of tree plantations is seen as a form of reforestation and thus intrinsically good and beneficial for the environment and society. This is certainly not true in the majority of cases.

When the concept and practice of tree monocultures was exported to tropical regions this situation

worsened. Basically, the tremendous biodiversity and the complexity of interactions that characterize a tropical forest make that this ecosystem differ even more from a tree monoculture than a forest in temperate zones. However, the technological package was imported in its entirety and thus the plantation of tree monocultures in the tropics is being referred to as “reforestation” with all the attributes associated to this term.

It is estimated that between 1959 and 1985 a total of almost 17 million hectares was planted in the tropics. In the eighties, the rate of establishment of tree plantations in the tropics has increased to 2 - 4 million hectares per year (Pancel, 1993). Due to mistaken concepts and policies (in many cases generated by the confusion caused by the term “reforestation”), many tree plantations were established to the detriment of original forests and/or caused negative impacts at the ecological and social level (Marchak M.P., 1999; World Rainforest Movement, 1999).

In the past two decades, the paper industry has increased its demand of raw material and monoculture tree plantations have been transferred from regions with a temperate climate to tropical regions where productivity is higher. Due to fiscal incentives and cheaper labor in impoverished tropical countries, the production costs are also considerably lower in these regions. As a consequence, social and ecological problems have intensified (Carrere, R., Lohmann, L., 1996).

Moreover, nowadays a new niche in the market threatens to give a new and substantial financial impetus to monoculture tree plantations. It concerns the so-called Clean Development Mechanism and specifically the financial incentives to establish carbon sinks mooted in the Kyoto Protocol, which are subject to approval during the Conference of the Parties of the Climate Change Convention that will take place in November 2000.

These Kyoto mechanisms are the result of a “damage control” strategy based on the claim that carbon sinks are an effective way of addressing climate change. In addition to being unproven (IIASA 2000), this claim misplaces the problem as one of how to “hide” the released carbon rather than one of how to reduce greenhouse gas emissions, especially those of industrialized countries. So-called sinks serve as a smokescreen concealing the fact that the search for and implementation of real solutions to the problem of climate change are being avoided. These Kyoto mechanisms have breathed new life into the idea of tree monocultures and are likely to intensify the problems caused by this activity.

This document flags and illustrates some of the impacts monoculture tree plantations have generated on the social as well as the environmental level, with a special emphasis on impoverished Southern countries. It is expected that these impacts will intensify if financial resources that sustain the establishment of these plantations continue to grow.

2. Social Impacts

First of all it should be noted that the negative impacts of monoculture tree plantations upon the social level not only include direct impacts, caused by the transformation of land tenure and the impoverishment of resources, but also indirect impacts. These are caused by the fact that the resources invested in monoculture plantations are thereby withheld from forestry production models which are better adapted to natural ecosystems and which follow the patterns elaborated through traditional knowledge, sometimes of thousands of years, of peoples and communities.

2.1 Misinformation and Confusion

Society in its entirety has been misinformed and confused concerning the difference between a

monoculture tree plantation and a forest. Misinformation and lack of knowledge have forced entire regions to accept tree plantation models developed at other latitudes. In more than a few cases they have been marked as inappropriate and aggressive by individuals and communities which have opposed these models. In other cases a large amount of resources have been wasted on models which, in the end, have not led to the expected results.

Such is the case in Costa Rica, especially in the Huetar Norte Region, where the species sown have kept on changing in accord with different fashions during most of the past 20 years, and one try after another has failed. During this period, tens of millions of dollars have been invested in monoculture plantations. Nowadays, more than 70% of these plantations are in a bad state or have not produced the expected results.

By contrast, the region has neglected, at least during the past twenty years, the natural potential of secondary regeneration. It has also lost time in getting to know its rich forest biodiversity (about 150 tree species of the forest have been exploited in this zone) and the small producer has basically been excluded from forestry activities.

False claims about the supposed similarity between forests and plantations have been spread to protect economic interests and give an “environmental” gloss to certain companies and activities. An example of this is the presentation of Gerald Freeman, one of the chief executives of Stone Container, one of the most important paper production companies in the USA, on a forestry project of his company in Costa Rica, when he referred to: “the sowing of 27 million trees which will result in a permanent tropical forest...” (van den Hombergh, H., 1999).

2.2 Change in Land Tenure and Replacement of Rural Communities and Farmers

It is common that large tree plantation projects promote a change in land tenure, modifications in an agricultural structure based upon the small and medium-scale producer, and the displacement of communities. The displaced families have to look for new opportunities in other areas, and thus they end up cutting primary forests, or increasing urban problems in the misery zones around large cities. The Ston Forestry company’s activities in the south of Costa Rica once again provide an example: “...the desire and need to be able to produce upon their own lands formed one of the main motivations of the farmers to oppose [the forestry project of] Ston, which was taking away people’s lands with ease and for low prices.” (Van den Hombergh, 1999, p.97). Despite strong opposition, this company displaced at least about 300 families from almost 14,000 hectares to sow Gmelina tree monocultures in the south of Costa Rica. Likewise, Carrere and Lohmann (1996) quote many examples which demonstrate how the aggressive expansion of monoculture forestry directly replaces communities or has direct negative effects upon vital resources like water or biodiversity, affecting the quality of life of the population.

“In a number of social contexts, large-scale industrial plantations can generate new jobs at the local level and this is one of the arguments, by the State as well as the companies, to try to convince communities to accept their projects. On average, however, plantation development results in a net loss of employment in the long term.” (Morrison and Bass, 1992, cited by Carrere and Lohmann, 1996.) Thus, for example, in the places which have supposedly seen the most successful establishment of industrial tree monocultures in Chile and Brazil, some communities have been rejuvenated and modern sawmills have generally improved the quality of life of their workers. However, at the same time, a large number of farmers and indigenous peoples were “excluded” and left without land due to the establishment of new plantations. (Marchak, 1995)

2.3 Lack of Participation and Loss of Local Knowledge

In many cases contemporary forestry development projects based upon tree monocultures were developed by technicians, persons alienated from the ecological, social and cultural reality of the site. Companies arrive with their aggressive policies to achieve their economic goals without any wish to understand history, culture or even more basic issues like the state of land tenure in the region. Moreover, small-scale monoculture tree projects implanted from the outside have seldom been successful and in a number of cases they have been referred to as "...an external intervention in villages and nations." (Dargavel, Hobley and Kengen, 1985, cited by Marchak, 1995)

In Costa Rica, the development of monoculture forestry goes hand in hand with the development of tree nursery production companies, which produce millions of small trees of the desired species in an intensive manner. In 1999, of the 2 million small trees necessary to plant the approximately two thousand hectares which are normally planted in one year in the Northern Zone of the country, 1.2 million consisted of two species and were produced by only two companies (Castro E., 1999). Small and medium producers who might involve themselves in the development of nurseries of native species have been excluded. Yet their inclusion could have provided a boost to their economy, motivated them to conserve forests as gene banks, and permitted them to build capacity in the management and administration of nurseries.

On the other hand, due to the pressure of monocultures, a lot of tradition and knowledge has been lost. An example of this is the case of the traditions of the Maleku people in the north of Costa Rica. In this zone some 40,000 hectares of tree plantations have been sown in the last decades, with about 41 million trees divided among four species. Some 90% of these plantations have benefited from forestry subsidies from the State. However, not a penny was spent to help the Maleku people to recuperate the *mastate* (*Poulsenia armata*, Familia *Moraceae*), a tree which disappeared due to the pressure of deforestation in the zone, and which formed the basis for an industry of *tapetes* and crafts of this people.

2.4 Impoverishment of Resources and Inequity in their Distribution

In general, it is common that a reduction of the availability of fundamental natural resources for local populations accompanies large forestry projects. As will be analyzed below, extensive tree plantation monocultures diminish biodiversity, the quality of water, and the structure and fertility of the soil. The result is a negative impact upon the quality of local life.

A paradoxical case and good example of this situation has occurred in South Africa, where there are a number of communities surrounded by huge tree plantations from which fuelwood to satisfy basic energy needs is unavailable. "There is no fuelwood to cook anymore; the forestry people have burnt our forests." said a woman in the region of Natal (Carrere and Lohmann, 1996).

On the other hand, resources generated by forestry projects remain in a few hands and in more than a few cases they constitute or enrich capitalist enterprises outside the country, or outside the areas where the plantations are found. Such is the case of Indonesia, where forestry industries are being concentrated in the hands of a few influential families as they grow. (Carrere and Lohmann, 1996)

3. Environmental Impacts

3.1 Biodiversity

Monoculture plantations have a biological diversity which is a lot lower than that of a natural forest

(Watson, 1999), and in the great majority of cases it is also much lower than the biodiversity of meadows with trees and other natural ecosystems. Monoculture tree plantations have contributed little to the conservation, study, and use of the biodiversity.

The function of plantations as a biological corridor that permits a genetic flow and interchange (for plants as well as animals) between natural forest patches which are being isolated in many regions has also not been evaluated.

On the other hand, it should be stated that reforestation programs that include mixed species and at least a percentage of tree species from reduced or threatened populations have reduced the serious threat of extinction which certain tree species all over the world face.

In many cases, tree plantations have replaced natural forest. Carrere and Lohmann (1996), present a rich compilation of examples where tree plantations have had a direct or indirect impact upon natural forests and thus upon biodiversity in general in the region. They analyze cases in South America, South Africa and Asia.

In other cases, tree plantations have affected, or have been established to the detriment of, other ecosystems of great importance for biodiversity conservation, such as tropical wetlands. In the south of Costa Rica, Ston Forestry, a subsidiary of Ston Container (one of the largest wood pulp processors) is facing judicial prosecution for causing the desiccation of wetlands (van den Hombergh, 1999)

On the other hand, large tree plantations adjacent to conservation zones can have a “border effect” upon such areas. In the Osa peninsula in Costa Rica, for example, some biologists are questioning the impact of hundreds of thousands of Gmelina fruit trees upon natural populations of parrots and guacamayos in the Corcovado National Park. If these populations increase due to a resource which may be cut at any time, they will have to look for refuge and food amongst the limited resources of the national park, thus affecting the equilibrium of its ecology.

3.2 Soil Deterioration: Infertility and Erosion

The discussion on the impact of tree plantations upon soil resources has been very polemical and tendentious and is not yet concluded. The main argument of forestry companies is that the impact of tree plantations upon the soil is of relatively little importance if compared to the impact intensive agriculture has. However, there is evidence that fast-growing trees have an extractive effect upon soil fertility and that they tend to impoverish the soil and unbalance its structure. (World Rainforest Movement, 1999)

Moreover, some species show repressive effects on the growth of other plants through the release of certain substances. This is the case with Eucalyptus, which tends to acidify the soil, and Gmelina, which inhibits the growth of plants which are not of the same species. Other plantation practices, including preparation of the soil before planting, plantation management, and harvesting, also favor erosive processes, especially in areas with steep slopes.

3.3 Deterioration of Hydrological Systems

Tree plantations present a physiological and morphological structure which is very different from that of a forest or other natural ecosystem. Thus, their capacity to absorb and release rainwater varies a lot according to the species and climatic conditions. It is recognized that large cypress plantations tend to stimulate evaporation and reduce the germination of seedlings. In this particular

species, water is retained in the foliage, from which large quantities evaporate before they reach the soil.

Other species like Teak (*Tectona grandis*), with its large leaves, tend to concentrate rainwater and release it in large drops that damage the soil, promoting erosion and heavy run-off.

The Eucalyptus presents a case similar to that of conifers, it tends to reduce the flow of water into the aquifers. This species tends to dry wetlands and swamps, which are being used to control of certain plagues (mosquitoes), and to dry wetlands. (Castro, E., 1999)

One of the aspects which probably influences the regulation of the hydrological cycle the most as far as the forest is concerned is the presence of the undergrowth. This undergrowth fulfills the role of a “sponge in the shade” which retains water without evaporation, and slowly releases it to the soil. However, in a managed tree plantation the undergrowth is eliminated.

The infiltration level of rainwater is another affected factor. This depends upon the type of humus generated by the tree plantations, the level of compaction that has occurred during the preparation of the soil and the type, and the depth and biomass of the roots found in the tree plantation (World Rainforest Movement, 1999). Compared to a forest, a tree plantation tends to have a lower infiltration level, which is why it promotes erosion processes and a reduction in the aquifers recharge.

4. Forests, Tree Plantations and the Urgent Need to Reduce Greenhouse Gas Emissions

4.1 A Dangerous Lie

It is true that wood consists of carbon molecules, and that a plantation should fix a certain volume of CO₂ during its growing stages. There is a tremendous difference, however, between a deposit of carbon in the subsoil (an oil and coal bank) and a tree plantation exposed to the atmosphere. Some of the most relevant aspects of this discussion include:

- The difference between mineral carbon accumulated in geological deposits and carbon in a plantation, which can be considered as “fragile”, is that above-ground carbon can be absorbed into the atmosphere at any moment (Lohmann, L., 2000). In fact, the majority of current plantations are based upon monocultures of fast-growing softwood species and in many cases the wood of these species is used as fiber for papermaking. This type of wood, and the paper or cardboard produced from it, decomposes rapidly, releasing CO₂ and other gasses which contribute to the greenhouse effect. Likewise, the wood is subject to accidental fires through which the accumulated carbon can be released.
- The establishment of plantations has direct and indirect impacts upon other areas. These impacts tend to lead to processes that release CO₂ and other greenhouse gasses. The displacement of farmers and communities, for example, favors deforestation in other areas. Likewise, desiccation of wetlands and other changes in the hydrological regime lead to increased frequency and intensity of wildfires.
- The costs of presumed carbon fixation through plantations are popularly supposed to be far less than the costs of a true reduction of emissions, and this is what the interest in plantations as carbon sinks is based upon, especially the interest of business.

4.2 The Forest is a More Stable Carbon Bank

Primary forests, or more natural models of environmental reconstruction which make use of natural

regeneration, as well as the establishment of mixed species which mimic the forest, such as Analogue Forestry Models (Analog Forestry Network 1997, Baltodano, J., 2000), are more stable and secure accumulators of CO₂. At the same time, these systems fulfill other social and ecological functions. The wood produced through these systems is of a better quality and can be used for structures and furniture that lasts a longer time. The forest is kept standing, is not subjected to clearcutting and short cycles, and due to its structure, is less vulnerable to fires.

4.3 Ecological Debt by Sinks

Ethically, the concept of “monoculture tree plantations as carbon sinks” embodies a major fallacy through which certain companies and governments are proposing to elude their responsibility for the future of humanity and our planet. Climate change, which is widely recognized as one of the greatest threats to life and the ecological equilibrium of our planet, is turning into a new market niche -- a market niche in which reducing the costs of capturing a metric ton of carbon has become more important than the reduction of the greenhouse effect.

Corporations and industrialized countries should reduce greenhouse gasses in a direct manner. Moreover, they should phase out the massive transport of oil and coal from underground deposits to the atmosphere.

On the other hand there is an urgent need to invest in the restoration and conservation of forest areas all over the world --forest areas which are integrated as a complement to the economies of local communities, which serve as a protection and buffer against disasters and which guarantee the conservation of biodiversity and related resources. Investment in ecological restoration should come from the industrialized world in the form of a payment of the ECOLOGICAL DEBT (and this is practically the only financial resource available) -- a debt which has accumulated through more than five centuries of unilateral exploitation and destruction of the resources that we all share and need.

The resources needed are available, and in any case, they are less than the damages which have occurred, even if one only takes into account the disasters caused by Hurricane Mitch in Central America or by the rains which hit Venezuela at the turn of the century. The resources are there; the only thing that is lacking is to leave stinginess behind and to take adequate political decisions.

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Tree Plantations as Carbon Sinks: The Case of Ecuador

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1. Introduction

For decades, governmental policies in Ecuador have promoted agroindustrial monocultures for export purposes, to the detriment of native forests, páramos and mangroves, and the lives of Indigenous, Afro-Ecuadorian and farmer's communities. Lately, the remnants of biodiversity in Ecuador have been threatened by the identification of a new source of income: the establishment of tree plantations destined to capture carbon.

The recent interest of companies and the government in the carbon emissions market is reflected in a number of headlines in national newspapers: "Capturing CO₂ can be an excellent business" or "Ecuador has a gold mine in its forests" (El Comercio, 2000). At the same time, modifications in existing legal frameworks and new laws to subsidize tree plantations and to provide the timber sector with access to the resources derived from the climate change agreements are proposed. This includes the creation of various governmental institutions to be mediators in capturing these resources.

For a number of years, "joint implementation" projects have been realized in Ecuador, financed by a consortium of Dutch electricity companies in collaboration with national institutions. The evaluation of these experiences has delivered a number of remarkable results: the project has not only failed to comply with the objective to absorb carbon, but the establishment of plantations of exotic tree species in regions with high biodiversity has even contributed to increased CO₂ emissions by altering the capacity of these valuable ecosystems to deliver environmental services.

2. The Forests and Tree Plantations in the Country

Ecuador is considered to be one of the 12 megadiversity countries on the planet. The total area of the country is 26.079.600 hectares, of which 18% consist of conservation areas and 20% consist of Indigenous and Afroecuadorian territories. The rest of the country consists of areas destined for agricultural activities, or forest areas that are not included in the National Protected Areas System.

On the Coast, only 6% of the forest and less than 30% of the mangroves remains, while in Amazonia, which still has 70% forest cover, 30% has already been deforested. In the Highlands of Ecuador only remnants of forests and páramo can be found. Páramos cover approximately 5% of the total area of the country.

In recent times, an accelerated destruction of forests has occurred in the heights of the Western mountain range, in the Ecuadorian Choco region, that is, the northwestern region of the Provinces of Esmeraldas, Carchi and Imbabura. The forests in these zones are about to disappear, as has already happened with the forests in the northwest of Pichincha.

The regions that are destroyed mainly through the extraction of trees for the timber industry, by tree plantations and by the implementation of monocultures, particularly of African Palm, are precisely the ones with the greatest richness in biodiversity, primary forests and páramo. These regions, rich in native forests, consist of state forest heritage, Indigenous and Afro-Ecuadorian territories or land owned by farmers.

Deforestation rates have been higher in the lowland regions of the country: the Coast, Amazonia,

and the tropical areas in the Andean region.

It is estimated that there are about 143.000 hectares of tree plantations in Ecuador, consisting of 120.000 hectares of pine and eucalyptus plantations in the highlands and 23.000 hectares of teak and *pachaco* on the coast. There is a proposal of Mitsubishi Paper Mills to invest 48 million dollar to plant 10.000 hectares of eucalyptus in the Esmeralda Province on the coast of Ecuador. This same company exports eucalyptus chips worth 20 million dollar from the country every year, harvested from plantations planted in the seventies as part of Integrated Rural Development projects (El Comercio, 2000).

The Province of Esmeraldas

It is estimated that between 1969 and 1991, more than 500.000 hectares of forest have been destroyed in this province, without even taking into account the destroyed mangrove forests. Currently, hardly 6% of the original forests can be found along the Ecuadorian Coast.

The regions of San Lorenzo and Eloy Alfaro, located in the northern part of the Province of Esmeraldas have been subject to an astonishing deforestation in the past years. In two years, 8,000 hectares of primary forests have been deforested in order to develop oilpalm plantations and a further 10,000 hectares of eucalyptus plantations are projected. At the moment, 2,000 hectares of teak and eucalyptus are planted as part of mechanisms to offset CO₂-emissions.

In these areas, companies have developed strategies to buy and rent land and other types of strategies which guarantee their access to and control over land.

The pressure upon these zones now has a new ingredient: the Esmeraldas - San Lorenzo highway project and the Coast road, which cross native forest zones and the lands of Afro-Ecuadorian communities. These roads facilitate the extraction and transport of timber, and benefit exclusively those who develop tree plantations and industrial monocultures like oilpalm monocultures.

3. Social and Environmental Impacts of Tree Plantations

In Ecuador, tree plantations do not contribute to the absorption of carbon. On the contrary, they cause a net increase in the release of carbon through the loss of original vegetation cover. Moreover, with the raise of temperature, the soils also release absorbed carbon and, additionally, when the timber is harvested, the carbon inevitably returns to the atmosphere.

In Ecuador, tree plantations are preferably established in the páramos. Páramos absorb more carbon than a tree plantation, as they have the capacity to store carbon in their soils, and through their algae, fungi, and in other microorganisms. In the case of PROFAFOR (a joint implementation project of Dutch electricity companies in Ecuador), it has been calculated that, in the best case, a tree plantation would be able to absorb 80 mt C/ha, while the destruction of the paramo could cause the release of more than 1000 mt C/ha. (Vidal, 1999)

Plantations of exotic species introduced in the Ecuadorian Andes, particularly *pinus radiata*, affect an ecosystem that is vital to the life of communities and the users of water: the páramo. The most important function of the páramos is the catchment and distribution of water, thus being the main source of supply of freshwater in the country.

In community workshops organized by Accion Ecologica in the Province of Bolivar a number of impacts of plantations with exotic species upon the fauna have been identified: the loss and

reduction of beneficial insects and autochthon fauna. Meanwhile, there has been an increase of birds that shelter in the plantations but feed themselves with agricultural seeds from neighboring lands as the plantations do not provide any food for them. In the Salinas canton, where one finds massive pine plantations in a mature state, it has been reported that hydrological sources are drying up and that the availability of water is becoming more difficult every time. (Vidal, 1999). Tree plantations are also areas prone to fires and hence to the rapid release of emissions. They are also easily affected by insect outbreaks, followed by subsequent loss of vegetation.

Although there are few examples of natural regeneration in mature plantations, in the majority of cases there is no development of undergrowth. The needles of pine trees do not decompose due to the low temperature and the organisms do not accept them as food, so as these needles are not digested, they remain as dense mulch on the forest floor. The soils below pine plantations turn more acid, greasier in texture, and they contain less humidity, organic material and phosphor. (Hofstede, 1997)

Current forest policy proposals provide subsidies to medium and large-scale companies only, and will disadvantage every small-scale forestry proposal, thus provoking an accumulation of resources and lands in the hands of one sector: the timber sector.

The specific needs of the local population are not considered either. To the contrary, they cause the local population to abandon its agricultural and conservation practices. They also lead to other forests being affected by the displacement of local populations. By privileging plantations with an objective of timber production, agroforestry and herding, traditionally practiced by the communities, are restricted.

To these economic, environmental and social problems, the increase of violence has to be added, as the regions become more violent due to the necessity to call upon armed guards or the protection of the police to "protect" the plantations.

4. Tree plantations in the Ecuadorian Andes to Mitigate the Carbon Emissions of the Netherlands

The first experimental joint implementation project that was realized in Ecuador is the project of PROFAFOR (Programa FACE de Forestacion) to establish tree plantations in the Ecuadorian Andes in order to mitigate the carbon emissions of the Netherlands. The agreement was established in 1993 with the federation of Dutch electricity companies, which created the Foundation FACE (Forest Absorbing Carbondioxide Emissions) in 1990 with the goal to plant 150.000 hectares of "forest" in the world, half of which would be planted in Ecuador.

The program in Ecuador has as its objective to plant 75.000 hectares of trees between 2.400 and 3.500 meters altitude, to absorb 35 million tons of CO₂. This figure was obtained from figures on the productivity of *pinus radiata* available in literature in New Zealand and Australia, as no reliable data existed on the productivity of pine and eucalyptus in the altitude at which they are planted in Ecuador. Until now, 22.000 hectares have been planted in the highlands, and a process to establish teak and eucalyptus plantations on the Coast has been initiated, where they are currently planting about 2.000 hectares.

PROFAFOR does neither buy land nor trees: it only invests in one single function of the trees, their capacity to sequester carbon. It establishes contracts which determine that the lands and their trees will be controlled for a period of 100 years. These contracts are concluded with farmer's and Indigenous communities, and with private sectors and legal entities like Fundacion Natura. In the

highlands, 250 USD per hectare of exotic species planted are paid (El Comercio, 1999).

PROFAFOR has been questioned about the way it has been promoting plantations, choosing exotic species like pine and eucalyptus in the highlands. From 1996 onward it has initiated the project ECOPAR to study the páramos and investigate alternatives to the plantation of exotic and native species. Despite this ongoing study, PROFAFOR continued to work with various communities and individuals in 8 provinces in the highlands, planting pine, and nowadays they can be found on the coast, in the Province of Esmeraldas, planting teak and eucalyptus.

5. The Kyoto Protocol: Plantations as Sinks

Emissions trade poses a number of injustices:

- It permits the true evasion of emissions reductions by highly polluting countries, as it is cheaper for the countries responsible for Climate Change to invest in plantations than to change technologies and reduce consumption of fossil fuels. However, the plantations do not comply with the objective to absorb CO₂.
- It admits that rich countries have more rights than poor countries as far as the utilization of the resources of the planet is concerned. It does not only accept that there has been a free right to occupy the atmosphere, but now it subsequently allows the occupation of the agricultural lands and forests of Southern countries by Northern plantations.
- It establishes new pressures upon Southern countries, as they have to substitute their food production for plantations to absorb the contamination of industrialized countries. Moreover, they have to sacrifice their forests in order to have trees planted in their place.
- It transfers the responsibility of conservation to Southern countries. By selling emissions quota, the Southern countries assume responsibility for the contamination of the atmosphere.

The principal export products of the Southern countries are money and raw materials, through this way the ecological debt has been built up. The money that the Northern countries destine for emissions trading will come, as always, from this source (Acción Ecológica, 2000a).

Ecuador is preparing itself to provide incentives for tree plantations and capture resources from the Clean Development Mechanism (CDM) through the development of new legislation such as the law on Sustainable Forestry Development in Ecuador.

In this proposed law it is established what will be subsidized: tree plantations of native species with protection objectives will be subsidized up to 100%. Tree plantations with exotic species on forestlands with a production objective will be subsidized up to 75%, and the same plantations established on agricultural land will be subsidized up to 50%. With this subsidy private companies with commercial objectives are being subsidized to compete with agricultural activity.

Various institutions are competing as the application of environmental policies derived from the agreement on Climate Change is concerned. Functions are being duplicated and there is no agreement amongst these institutions, as they all want to be the intermediary that will succeed to capture the resources of emissions trading. Thus, the Ministry of Foreign Affairs, its Chancellery, the Ministry of the Environment, the Ministry of Energy and Mines, and the National Institute of Meteorology and Hydrology are all involved in a battle concerning their direct relationship with the CDM.

In 1997, the **Joint Implementation Office** (JIO) was established by the Ministry of Agriculture. It was to consist of representatives of the Ministry of Foreign Affairs, the Ministry of the

Environment, the General Secretariat of Planning, and an NGO, the Corporation for Cooperation and Development (CCD), was appointed as the coordinator. However, it did not comply with the functions required. The Ministry of Environment on its turn created the **Ecuadorian Office for Clean Development** (EOCD), which has not coordinated its activities with the JIO (Vidal, 1999).

6. Conclusions and Recommendations

The joint implementation project that was developed in Ecuador has not had the expected results. On the contrary, it has caused negative impacts upon the environment and the communities where it has been developed. It has demonstrated its inefficiency to absorb carbon, and it has a negative balance due to the emissions it has provoked.

Tree plantations of exotic species are a true threat to biodiversity, affecting páramos and native forests. They also threaten the food sovereignty of Ecuador, affecting communal areas, which provide communities with water, food and plants. Along the coast, the farmers will now have teak, balsa wood, laurel and eucalyptus instead of products like rice.

The legal frameworks, instead of protecting the environment and guaranteeing the collective rights of the population, are modified under the pressure of the IMF and the World Bank to deepen structural adjustment. This way, Ecuador is about to approve the Law for the Promotion of Investment and Civil Participation. This law promotes and permits new and serious levels of impact upon the natural patrimony of the country, overrides existing environmental legislation, and eliminates the right of Indigenous communities and farmers to decide upon projects which affect their livelihoods (Acción Ecológica, 2000b).

To prevent global warming, countries like Ecuador should keep their oil under the ground, invest in clean energy, restore the coastal mangroves, protect hydrological watersheds and conserve native forests.

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Tree plantations and Carbon sequestration: A case study on Australia

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1. Tasmania, An Island of Trees and Loggers

Tasmania is one of the constituent states of the Commonwealth of Australia. The island has an area of 67,897 km² and a population of about 471,124. Tasmania is covered by some of Australia's most important tracts of temperate pristine forests. The island retains over 40% forest cover, including a large World Heritage Area and a number of other protected areas of great importance. Tasmania has some of the finest hardwood forests in the world. They contain a rich array of endemic and relict wildlife species from the time when the island was part of the ancient landmass known as Gondwanaland.

However, these forests are severely threatened. The timber industry is increasing its logging rate. Massive native forest clearance and replacement by tree plantations are well under way, with State Government targets of 10,000 hectares per annum. The remaining forests face threats from fire, disease, new roads, tourism impacts and introduced species.

A clear example is the Huntsman Valley, Great Western Tiers/Kooparooona Niara. Boral, North and Forestry Tasmania have intensively managed this area for eucalyptus pulp logs production for over twenty years. Over-clearing, especially on steep slopes (and insistence on planting up and down instead of along the contours) has produced over thirty major landslides. The largest landslide is still flushing sediment into the River Tamar, blocking the entire river at times. The Tamar flows through Launceston and is North Tasmania's largest river system. The Launceston City Council has to date spent over \$70,000 on dredging the river as a result of the landslides caused by Huntsman Valley loggers. Legal advice indicates that both private landowners and statutory bodies could be prosecuted under state planning acts for damages as a result of these unsustainable operations.

2. The Plantations Boom

The intensification of forestry operations in the north east of Tasmania has also caused increased clearcutting by private companies and replacement of forests by tree plantations of *radiata pine*. On a Government policy level, there is much to be concerned about in this respect. A number of schemes have been established to increase native clearance under the guise of plantation establishment, particularly the so-called "Plantation Vision 2020" program which seeks to double the number of hectares of plantations by 2020 with significant Federal Government support. The plans include the establishment of 650,000 hectares of plantations in Tasmania over the next twenty years. These plans form part of a proposed 2 million hectares of additional tree plantations in Australia. By the end of 2000, about US\$ 5 billion will have been invested in the establishment of tree plantations in Australia. Foreign multinationals, mainly from the US, will be the major investors. Many of them are handed over public land with terms up to 70 years. The US multinational Weyerhaeuser, for example, has just bought into the State of Victoria's recently privatized plantation estate and is looking at possibilities to invest in the establishment of tree plantations in Tasmania.

Meanwhile, the Australian mining giant North Ltd. has entered into a joint venture with Mitsubishi to alienate an additional 23,000 hectares over a 10-year period. North Ltd. already owns 150,000

hectares of land and is logging native forests to establish tree plantations on those areas. It plants *Eucalyptus globulus*, which is called Tasmanian Blue Gum. The tree is native to Tasmania, but these monoculture tree farms are genetically engineered and planted beyond the natural range of the tree.

The timber produced, woodchips, is destined for the Japanese market. Australia is exporting 7,000,000 tons of woodchips annually mainly through companies like Mitsubishi, Daishowa, and New Oji. This is about 40% of Japan's hardwood chips imports, all coming from a continent which is only 5% forested.

The rapid development of plantations also results from the Regional Forest Agreement process, which aimed to resolve serious forestry conflicts in Australia. This process has had the opposite effect, however, and deforestation has increased. The Tasmanian logging industry now has about 1,000 hectares more public native forest and 2-3% more public wood resource available to it than before the Agreement was signed. The loggers lost access to a mere 39,000 hectares of generally poor timber quality native forest while gaining access to 40,000 hectares of generally high quality timber.

Rapid tree plantation development has had a serious adverse impact on local communities. Nowadays, multinationals are buying good farmland from farmers who are in an economically vulnerable position. Some farmers, who have succeeded in surviving economically, have become isolated, surrounded by tree farms polluting their water and crops. The rapid development of labor-intensive tree plantations is also devastating their village life, with shops and services disappearing.

The loss of biodiversity caused by intensified logging and forest replacement by tree plantations is not ecologically sustainable, and even a large number of government officials in Australia are concerned by the mandatory target of 3 million hectares of tree plantations by 2020. There is evidence that threatened species on private land are being liquidated by this program, yet there are currently no monitoring/enforcement provisions to ensure this does not happen. For these and other reasons, the Tasmanian Green Party is opposing the further establishment of tree plantations.

3. Australian Carbon Fixes

Australia's greenhouse gas emissions are growing rapidly. Energy-related emissions already exceed the target Australia was allowed in the 1997 Kyoto Protocol (to restrict its emissions to 108% of their 1990 level by 2008-2012). If left unchecked, they will exceed 140% of 1990 levels in 2010. Current policies are wholly inadequate and without major policy development in the next two years, Australia has no chance of meeting its international commitment.

Obviously, the possibility of carbon sequestration credits under the United Nations Framework Convention on Climate Change (UNFCCC) is considered to be a very welcome way out by the Australian Government. This scheme could significantly affect the future of the Australian forests. Rules will need to be set to regulate how forests should be managed if they are to receive credits, and those rules may either threaten or benefit forests.

In Australia's first foray into the international carbon credit market, State Forests of New South Wales has signed a contract with the Tokyo Electric Power Company, selling the greenhouse gas credits from the planting of 40,000 hectares of forests. The first plantings of softwoods and hardwoods will start soon on the north and south coasts of NSW. The Tokyo Electric Power Company will then use the forests as a tradeoff when it is required to cut its net emissions of greenhouse gases.

Prof. Ian Noble of the Australian National University's Ecosystem Department notes that if greenhouse 'sinks' like these were really to reduce greenhouse emissions then proper accounting would be essential. "What happens when the forest is harvested, for example? The Kyoto Protocol is not explicit on this question and the upcoming COP6 meeting in The Hague will have to decide on whether this is factored into accounting".. It is also unclear what the standing of the agreement with Japan would be if Australia failed to meet the project targets. "Would it be a case of buyer beware or seller beware? What we are essentially doing with carbon sinks is buying time. If we don't use this time to make a transition to more sustainable forms of energy then we're being naive," according to Noble.

On top of that, there is a real limit to the extent that planting trees could reduce greenhouse emissions, even in theory. "We would have to plant forests 1 million times the size of the Melbourne Cricket Ground to meet our international obligations. It's just not practical," says Van Rood of the Australian Conservation Foundation.

However, the Federal Government is actively trying to use the Kyoto Protocol as another means of supporting the timber industry by encouraging 'carbon sequestration' through plantation establishment. It is very likely that these tree plantations will be established in exchange for credits even when they are established at the expense of native forests.

The fact that environmentally perverse outcomes are likely under Federal Government policies is evident in the "Greenhouse Challenge" program. Under this scheme, increased destruction of the ecological integrity of remnant native forests in exchange for carbon sequestration "credits" is actively encouraged. The "Greenhouse Challenge Vegetation Sinks Workbook", for example, promotes techniques such as regrowth spacing utilizing stem injection enrichment planting and fertilizing and adoption of intense selection silviculture in native forests which could seriously threaten the ecological integrity of these forests.

The principal areas of concern about this program are:

- Monoculture tree farms are being promoted as an effective response to global warming;
- Native forests - a significant carbon sink in themselves - will be lost for the establishment of tree farms, thus creating additional carbon pollution through clearing and burning;
- Current plantation establishment is rampant, unplanned, driven by market forces and not environmentally sustainable; and,
- Carbon 'sequestration' schemes have ignored the ecological impacts of intensive management of native forests.

Many investors may not be aware of the nature of current management practices in tree plantations. Government and forestry companies are likely to show external parties only the best aspects of tree plantations, while covering up the negative environmental consequences.

The Australian Government has been obviously influenced by the forest industry's view that carbon can be "sequestered" in tree plantations that will be logged for great corporate profit at a later stage. Both actors ignore the fact that there is a much greater value in conserving, in particular, remaining old growth native forests as a means of keeping large amounts of carbon in a fixed state. Meanwhile, these very actors are responsible for large-scale deforestation in an ecologically and socially unsustainable manner.

There is still a raging international debate over the real value of carbon 'sinks' for sequestration. Many scientists believe that the best way to store carbon is to maintain existing forest cover across the landscape. Clearing such forests to make way for tree plantations is certainly NOT an efficient

way to store carbon.

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Planting Problems in Paraguay: Shell and the Good Business of Reducing Nature

By Miguel Lovera, Sobrevivencia/ Friends of the Earth-Paraguay

1. Paraguay and its Forests

In less than half a century, the Eastern Region of Paraguay has lost most of its forests. It has faced a reduction in its forest cover from approximately 8,000,000 hectares to less than 1,000,000 hectares. These forests originally consisted of dense humid, sub-tropical and semideciduous forests with trees up to 35 meters high. In the same period, 25% of the dryer forests of the Chaco (the Western Region of Paraguay), which originally covered some 17,000,000 hectares, was destroyed.

These forests gave way to, amongst other things, extensive cattle ranging, monoculture export crops, subsistence farming, timber extraction, and urbanization. The advent of large-scale, monoculture, commercial tree plantations after World War II, led to a new form of agricultural land use, contributing to the further expansion of deforestation.

2. The Rise of the Plantation Business

Already in the sixties, official Government agencies of Paraguay and bilateral development cooperation agencies had been promoting monoculture forestry and, in 1973, the first law which directly supported this type of tree plantations was adopted. This law initiated a sequence of subsidies and official incentives for the substitution of tree plantations for forests.

Despite these incentives, only about 10,000 hectares of monoculture tree plantations were planted under this scheme in the entire country. However, since the adoption of a law which promotes and subsidizes "reforestation and afforestation" (Law 536) in 1995, this area has more than doubled. The effectiveness of this law, which achieved in half a decade what other laws and incentives achieved in three decades, was the result of its offer of a direct subsidy of 75% of the establishment costs and 75% of the maintenance costs for the first three years of tree plantations.

An aura of crooked management and corruption surrounded the history of this law, applied during one of the periods of the greatest institutional corruption and administrative bad governance Paraguay has ever faced. For that reason, the majority of planters that embarked under the scheme of the 536/95 law have not yet seen a single penny of the subsidies promised by the Paraguayan government.

3. Some Gain the Problems, Others the Money

Some planters, however, did succeed in collecting their State subsidies. One of them was the Forestry Company Yguazu. This company is a subsidiary of Royal Dutch Shell --- the second largest Oil Company in the world and one of the richest companies on the planet. In 1999 it proudly announced to the press that it had succeeded in collecting part of the subsidies donated by the State of Paraguay -- one of the poorest governments in the world ---for its tree plantations. The operations of Shell in Paraguay take place on two properties in the Eastern Region of the country. The objective of the company is to plant a total of 20,000 hectares of mainly eucalyptus trees. The operations are taking place on lands originally covered by subtropical forests. Although the company did not have direct responsibility for the deforestation of these lands, which had already

been deforested and converted to commercial agriculture, its operations do prevent the natural regeneration of the original vegetation. Native vegetation cover is a priority of national interest and, most of all, of local interest, considering the role of native vegetation in hydrological cycles, nutrient cycles, and the protection and management of soil fertility. Native vegetation also serves as habitat for native fauna and provider of medicines, food, wild foods and other products.

On one of Shell's estates, a parcel of 5300 hectares of forests is being conserved as a nature reserve. Regrettably, however, the parcel is entirely surrounded by a sea of eucalyptus monocultures, which implies that is condemned, sooner or later, to ecological isolation and subsequent degradation.

4. Lots of Money, Little Gain

In its brochures, Shell proudly announces that it has created nothing more and nothing less than 150 jobs with its activities. However, with 20,000 hectares planted and USD 20,000,000 invested, it can easily be calculated that each job required an investment of USD 133,333 in terms of costs directly associated with the plantation, while the average job in other agricultural activities in Paraguay requires an investment of USD 7,000 only. Likewise, it can be calculated that for each job created more than 133 hectares of land were occupied.

So there is little to be proud about, especially in a country in which more than 90% of the rural population has access to less than 9% of the available land and which faces an unemployment rate of more than 20%. A discreet silence from Shell about figures that demonstrate such a concentration of land and investment in the hands one TNC would have been more appropriate.

On top of this bluffing about its interaction with society, the company also frequently defends the system of monoculture by talking about in its "environmental education" programs, thus creating a major misunderstanding amongst new generations about the real significance of concepts like forest, reforestation, afforestation and even nature.

5. The Tree Business: Adding Deforestation

Tree plantation development does not only contribute directly to the destruction of forests and other natural ecosystems. It also contributes to increasing the pressure upon available arable land, which forms a major underlying cause of forest loss in Paraguay and other Latin American countries.

One of the plantations of Shell is located in the Department of Caazapá, a department which has often faced violence in the continuing social struggle of landless farmers against land concentration in the hands of large landholders. The farmers in this region have been trying to reclaim the lands that they and their ancestors possessed, but which were occupied by successive local elites that were encouraged by actors in the central government. Earlier this year, the public in Paraguay was unpleasantly surprised by acts of brutal repression by military forces, police and para-military forces (gunmen hired by large landholders), who attacked and removed farmers who had been occupying a number of lands they had reclaimed a few decades ago.

Although Shell did not have any direct involvement in these atrocities, its activities are contributing to a concentration of land and thus indirectly it is causing the farmers in the region to occupy new lands. In the majority of cases, these lands are covered with forests. The concentration of lands in hands of companies and individuals like Shell thus contributes to further destruction of natural areas, and not to the conservation of such areas. However, these linkages are difficult to establish and the companies themselves hide themselves behind "green curtains", which prevent the larger public from seeing the links between their gray interests and the real causes of forest loss.

6. Come and See....Benefits for All!

All and all, a country like Paraguay which is making all sorts of efforts to attract foreign investment in its impoverished economy can expect very little benefit from the kind of tree planting business Shell and other northern multinationals are offering.

Of course, it should also be noted that the state subsidy of 75% of direct costs, which normally equals 60% of the total costs, has to be deducted from Shell's original investment of 20 million, which implies that the real investment of Shell is only 11 million USD. Moreover, we can already expect that whatever amount the company will declare in the future in terms of profits, it will undoubtedly be exempted from taxes, at least from income tax, which is the only really significant tax that could apply.

The neighboring communities, small as they are, are also likely to receive the “benefit” of a free spray of pesticides from the airplanes of Shell. In this respect it is noteworthy that a number of affected persons have recently called upon the authorities of the Institute for Public Welfare to investigate the origin of the fish mortality which occurred in the Tebicuary river in the first months of 2000. The precise origin of a number of pesticides or herbicides like glyphosate in the waters of most of the main watercourses in the East of Paraguay cannot be identified. This is due to the fact that the infrastructure for environmental monitoring and research of the Paraguayan authorities is precarious. But a number of accusations point at the plantations of Shell.

7. A Renewable Future?

This phrase is one of Shell's favorite expressions, but the company seems to refer to its very own future in this respect. Despite the fact that it is one of the largest oil companies in the world, despite the fact that it has been one of the main actors responsible for environmental degradation processes and especially the emission of greenhouse gasses, the company is now stating shamelessly that it wants to lead the market in the generation of energy through biomass. It is particularly interested in the provision of fuelwood for the commercial generation of electricity – only, of course, insofar as far as clients are able to pay for this electricity.

Here again, the main business for a country like Paraguay will consist in generously lending its territories for the sake of a handful of jobs and a few tax dollars. These brilliant business deals have turned Paraguay, and a great part of the Third World, into an exporter -- and in the majority of cases donor -- of its least renewable form of capital: its lands.

8. Exchanging Old Carbon for a New Climate

The proposal of Shell is even more extravagant if one takes into account that Paraguay has a surplus of electric energy produced through its share in the largest hydro-electric dam in the world, Itaipú, and another mega-dam, the Yacyretá dam. It makes little sense for the country to participate in a process that generates more greenhouse gases, like wood combustion for energy production. It makes even less sense for the country to compete with itself in the generation and sale of electricity by developing alternative generative capacity.

Of course, it should be emphasized that destructive mega-dams like Itaipú and Yacyretá, which have impacted negatively upon thousands of people and precious ecosystems, should not be seen as an example of sustainable development projects to be financed through joint implementation. However, now that they exist, it makes much more sense for Paraguay to capitalize on the

electricity which it generates through these hydroelectric dams.

Like the governments of many other Latin American countries, the government of Paraguay has swallowed its original opposition to joint implementation. Now that joint implementation through the Clean Development Mechanism is considered to be a fact, the country has taken the position that it should prepare itself as fully as possible to participate effectively in the expected carbon business. For that reason, it established a National Joint Implementation Office earlier this year. Considering the unique position of Paraguay as a country with one of the greatest potentials for hydro-electric energy in the world, most of it unused, this office should focus upon capitalizing as much as possible upon the already-installed hydroelectric capacity. Regrettably, the efforts of the government of Paraguay are entirely directed towards the promotion of forest protection and tree plantation development, both of which have doubtful effect as mitigators of climate change.

Much of Paraguay's tremendous installed hydroelectric capacity cannot be used for Paraguayan industrial and commercial activities and transport, as the country lacks the proper infrastructure and technology. Broadening access to and use of electric energy for domestic use and for use in the industrial sector alone would allow the country to reduce up to 30% its internal consumption of wood. Large-scale monoculture tree plantations for biomass production will only achieve that the most active emitters of greenhouse gases, like Shell, will be allowed to continue with their polluting routine and irreversibly affect the global climate.

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A Study on the Finnish involvement in Industrial Pulp Plantations in Indonesia: Riau Andalan Pulp and Paper (Sumatra) and Finnantara Intiga (Borneo)

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1. Introduction

In the recent discussion of whether sink projects should be accepted in the Clean Development Mechanism, it seems that the realities of actual projects have often been forgotten. There is, however, a long list of sinister experiences of forestry related projects by Northern companies in developing countries. As most Northern forest companies see CDM projects as just a part of commercial projects one can learn about the possible range of problems related to CDM sink projects by looking at the recent commercial plantation projects.

Both CDM sink projects and commercial plantation projects face social problems created by insufficient public involvement and the violation of customary land use rights. The experiences tell us that these problems persist even after special efforts have been taken to solve them. These problems are even more important in light of some fundamental problems of CDM sink projects, namely the lack of permanence and carbon leakage. The following two cases, plantation projects by Finnish companies in Indonesia, give a picture of some of the problems faced by possible CDM projects.

2. Indonesian context

The Indonesian government has been promoting the establishment of large-scale pulp and paper industry from the 1980s. The goal has been to raise Indonesia to the top producers of pulp and paper in the world. The industry expanded rapidly during the 1990s, although recession at the end of the decade hit the industry hard, effectively halting all expansions and new projects for a couple of years. Investing in Indonesia was made attractive for foreign companies by offering subsidies, cheap labour and land for the fast-growing plantations that are supposed to feed the pulp mills.

Increasing mill capacity has been such a rapid process that plantations often have been established along or even after setting up the mills. Subsequently pulp and paper companies and the government have been under pressure to quickly find land for the plantations and ensure raw material supply for the mills. The result has often been that large areas of natural forest are being clearcut to feed the mills and areas traditionally used by local communities are taken over by the companies for the plantation with the approval of the government.

In many other cases there has been no true effort to establish plantations, as natural forests are still available as a source of fibre for a few years. Permits have been granted for 7 million hectares of commercial tree plantations (HTI) nation-wide, but only 1.6 million hectares have been planted so far (DTE2/00).

Western capital and companies are an integral part of this process. Indonesian industry would neither have the money nor the technical expertise to expand on its own. Finnish forest industry has been planning, supplying and finally operating many of the pulp and paper mill projects in Indonesia. The Finnish State has politically and financially promoted and supported Finnish industries. Examples of this co-operation between the State and companies are a large plantation

project in Riau, middle Sumatra (PT Riau Andalan Pulp and Paper) and a project in West Kalimantan (PT Finnantara Intiga).

3. PT Riau Andalan Pulp and Paper

In the early 1990s an Indonesian company, APRIL (Asia Pacific Resources International Ltd.) started building a joint pulp and paper mill, PT Riau Andalan Pulp and Paper, in the village of Kerinci, Riau province. The factory was planned by the Finnish consultancy Jaakko Pöyry. Machinery for the factories came largely from Finnish companies: Valmet supplied the paper machine, Sunds two fibre-lines, Tampella three recovery boilers, Ahlström an effluent treatment-plant etc (UPM 12.9.97).

The Finnish Export Credit Agency was ready to guarantee a 200 million USD loan for APRIL, but withdrew the guarantees because of the economic depression in 1999. As a result, APRIL was not able to purchase a second paper machine from Valmet, and the paper machine was left standing in a Finnish harbour waiting for a buyer. (APRIL 28.8.98, Helsingin Sanomat 28.4.99)

3. Forests and Plantations

The pulp mill started running in 1995 with a capacity of 750 000 t/a, being the largest single lined pulp mill in the world. By that time APRIL had planted merely 7000 ha of acacia plantations that can be harvested from the year 2000 onwards (Paper Maker Oct 1994, UPM 6.3.98). According to APRIL it will not be able to supply its pulp mill with the plantations before 2008 even if everything goes as planned (PPI 6/98). Up to that date the pulp mill uses wood originating from natural forest clearings.

APRIL has 285 000 ha of concessions in Riau in two agreements with the government of Indonesia. Even though there are no exact data available on how much of this area consists of natural forests, it can be assumed based on the data available that approximately 200 000 ha of the concession areas consisted of natural rainforest in the time APRIL entered the area. It is unclear how much of that forest is still left. APRIL's goal is to convert these areas to short rotation acacia monocultures. Before the plantations start to mature, clearings in these areas form the major supply of wood for the pulp mill.

Over 50 000 ha had been converted into plantations by the winter of 1998, i.e. at least 35 000 ha of rainforest had already been destroyed. By autumn 2000 nearly 100 000 ha of land had been converted into acacia plantations. Approximately 170 000 ha of the whole concession area are estimated to be suitable for conversion into plantations (SGS 1998, UPM 6.3.98).

Natural forests in APRIL's concessions are mostly lowland and swamp rainforests, the most species-rich ecosystems on earth (IUCN 1991). The majority of them have been previously selectively logged, i.e. largest trees have been cut for timber. Although some of the species are lost already, these logged-over forests are nevertheless important habitats for many endangered species. Part of APRIL's concessions were listed by the World Resources Institute as one of Sumatra's three remaining frontier forest areas (large, unfragmented forest areas capable of preserving ecological functions of forest if left standing intact (WRI, 1997)). Because of APRIL's clear-cutting thousands of plant and animal species - including endangered tree species valued for their timber, Sumatra tiger and elephant - lose an important part of their habitat and are driven closer to extinction. They cannot survive in the remaining fragments.

The plantations being established after clearing consist of two exotic species of acacia, *Acacia mangium* and *Acacia crassicarpa*, which are planted in monocultures. In the ideal case, the trees are felled after 7 years, by which time they should have reached a height of 25m, and new seedlings are planted. The fast growth is made possible by large-scale use of fertilizers, herbicides and pesticides (SGS 1998). There are relatively few experiences with large fast-growing timber plantations in Sumatra. Especially plantations on peat land, which cover a major part of APRIL's concessions, have suffered from poor health and their sustainability is questionable (Neilson & Fenton 1998, SGS 1998).

The effect of the pulp mill is not restricted to APRIL's own concessions, as the forest clearings in APRIL's concessions are not able to supply the pulp mill alone. The company procures large amounts of wood from other land clearings in Riau as well (APRIL 1997). In fact, if the company is able to build another pulp line in the Riau Andalan complex, even the fully planted concessions cannot supply the extended pulp mill capacity of 2 million t/a by their own (based on SGS 1998).

5. Land Tenure

In Indonesia local communities have had very weak rights to their customary land and livelihood, although there are legal provisions for this. In the case of APRIL's pulp mill in Riau there have been numerous conflicts where local communities have demanded their land rights in areas assigned as APRIL's concessions. In the estate where the mill was built in 1993 three villages have been severely affected: Sering, Kerinci and Delik. Their determined protests have led to some compensation, but the conflict of interest has not been settled.

Also in the forest concession areas there are continuous and escalating conflicts because village land is being logged and planted with acacia. There is about 60 000 ha of land where local communities have laid claims to APRIL. In reality this area may be greater because not all cases are noticed until the logging and planting operations start. The company says that the claims have been solved in an area of 30 000 ha, but according to known cases this seems unlikely. (Munoz 1999)

In many cases the villages have lost trust in the formal process and staged demonstrations to advance their demands. These have been met with oppression by the Indonesian State and by APRIL's personnel. For example, in July 1998, a member of the staff of APRIL stabbed Mr. Rasyid of Lubuk Jambi village to death in the course of a demonstration. In October 1997 a road block of Delik villagers was violently broken up by special mobile police unit called in by APRIL and the legal advisor of the villagers, Mr. Marganti Manalu was arrested. Later he was convicted under a clause typically used for political activists, to two years in prison. (Miettinen 1998)

The question in Riau is not just right to land but right to culture and livelihood. The mill forces the dramatic changes in the material and symbolic world of the communities upon them very rapidly. After having lost a central part of their culture, the forest, many of the traditional communities in Riau find it hard to sustain their material livelihood or preserve their culture.

6. UPM-Kymmene and APRIL

In September 1997 Finnish UPM-Kymmene, the third largest paper company in the world, announced an alliance with APRIL with the aim of integrating the fine paper operations of the two companies. The decision of UPM-Kymmene was immediately criticised by environmental citizens' organisations throughout the world. Despite the protests, UPM-Kymmene has gone ahead with the co-operation. UPM introduced some minor improvements in the field operations in Riau, but the problems remained far from being solved.

Instead UPM brought up arguments in the public debate defending APRIL's way of operating. They give an insight on industry's way of thinking: According to UPM, APRIL was the legitimate user of its concessions and was doing nothing illegal. In their view, the majority of the land claims were made by "land speculators" that had moved to the area only after the company arrived. Paper is needed for education, culture and democracy and thus APRIL's operations are a necessity. Only a small fraction of the whole area of Indonesia is needed for pulp plantations and thus conversion of forest for plantations can be justified. Plantations, unlike natural forests, bind carbon as they grow; plantations are helping to curb climate change. If it's not us, it's someone else. Obviously, these arguments by the company tell only a part of, if at all, the truth.

As a result of economic situation in Asia UPM decided to withdraw from Indonesia in 1999. In the process, it had arranged soft loans for APRIL and acquired 49% of APRIL's paper mill in Changshu, South China. Later, UPM bought the rest of the factory (UPM 23.8.00). This factory is relying on pulp produced by APRIL's pulp mill in Riau. Even after UPM bought the factory it was agreed that APRIL hold a six and half year pulp supply contract for the Changshu paper mill.

APRIL is part of an Indonesian conglomerate Raja Garuda Mas (RGM) which consists of enterprises ranging from oil palm to insurance. RGM is owned by Mr. Sukanto Tanoto, an Indonesian businessman of Chinese decent. APRIL owns 100 % of a pulp mill (Riau pulp 850 000 tpy) and a paper machine (Riau paper 350 000 tpy) in Riau, central Sumatra. UPM-Kymmene bought a paper mill with one machine (350 000 tpy) near Shanghai, China, from APRIL in August 2000. Before a technical spin-off operation in the beginning of 1999, an older, smaller pulp mill and rayon factory PT Inti Indorayon Utama was also part of APRIL. Indorayon, a well-known polluter, is still controlled by the Tanoto family. APRIL's pulp mills are fed with rainforest and plantation wood originating from areas (concessions) hired to it by the Indonesian government. The headquarters of APRIL are located in Singapore.

Riau paper produces uncoated fine paper sold under the label Paper One around the world. This paper is used as an office paper e.g. for copying and printing. Except for producing pulp for Riau Paper, Riau Pulp sells pulp to Europe (11%), Asia/Australia (69%) and Indonesia (20% of dried pulp production in the second quarter of 2000; APRIL 17.7.2000).

7. PT Finnantara Intiga

The Finnish forest company Enso entered a large-scale plantation project in West Kalimantan in the mid 90s. A joint company, PT Finnantara Intiga, owned by Enso and two Indonesian state companies, PT Gudang Garam and PT Inhutani III, was established in 1996. The companies had entered the area a few years earlier with pilot projects. In July 2000 Gudang Garam sold its stake to Stora Enso, a merger of Enso and Swedish Stora. Currently, Stora Enso owns 60% of Finnantara Intiga.

The original aim of the company was to establish approximately 100,000ha of fast-growing plantations, consisting mainly of *Acacia mangium* and *Acacia crassicarpa* tree species. Between 1996 and 1999 it established 23,000 ha of plantations. The target is to reach 50,000 ha of plantations by the end of 2003. The company holds a timber estate concession of almost 300,000 ha. (Stora Enso 9.7.00)

Enso's target was to build a pulp mill of 500 000 t/a capacity in the area. However, planting has not gone ahead as planned, and the focus has changed merely to "the production of raw material for pulp industries in the region" (Helsingin Sanomat 29.9.96, Stora Enso 9.7.00). The possibility of

obtaining more land for the plantations outside the present concession may be tempting for Stora Enso, as many mismanaged concessions have been recently cancelled in Kalimantan and free land

is available. Finnantara Intiga's concession is situated in the area of Sanggau and Sintang, inhabited by 60 000 people in 110 villages. The area had lost most of its forest cover before Finnantara Intiga entered. The company is not converting full-grown forest to other land uses but rather uses "degraded" grass- and bush land for its acacia plantations, similar as in the case of Riau Andalan Pulp and Paper. The project is marketed as reforestation of degraded lands. Most of the land belongs to the locals, and many of the planted areas are former agricultural lands and fallows. (Otsamo 1998, Otsamo 6.3.00)

Finnantara Intiga says it recognises the villagers as owners of the land in the area. Before establishing plantations the company has to get the land owners to sign a land use agreement with the company. The company negotiates with the traditional communal decision making system about the land use agreement. However, the weakening traditional system is often vulnerable to manipulation for example when under pressure from the overlapping local state government that supports the plantation scheme. This has led to situations where families have been forced to sign land use agreements against their will. (Lounela et. al. 2000, Lounela 3.9.00)

In exchange for the land use agreement villagers are promised work in the plantations, agricultural equipment, community development programs etc. A common worry among the villagers is that only a few people are given work in the plantations whereas the need would be larger after the loss of agricultural land. Use of daily labour has been common and has left the workers in an unstable situation. (Lounela 3.9.00)

In most of the villages part of the population has agreed to rent land to Finnantara Intiga, but the areas are small and fragmented. This is the main reason for the slow establishment of plantations in the area. (Otsamo 6.3.00, Otsamo 1998)

Land procurement of the company has caused some further problems in the villages. Already before the company moved in, the livelihood and culture of the local communities was changing rapidly, as the traditional sources of livelihood could not support the present population in the present landscape. Land use agreements have divided the villages and further undermined traditional land tenure institutions. Part of the population is working in the plantations and part of the population wants to keep the land under their control. There's often friction and even fights between those fractions. Many see the plantations occupying land for agriculture and pre-empting possibilities for other traditional livelihood sources. For example the company does not allow traditional shifting cultivation by burning land even outside the plantation area (Lounela et. al. 2000, Lounela 3.9.00, Djuweng Sep 99).

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Tree Plantations: Their Social and Environmental Impact in the Community of Empedrado, VII Region, Chile

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Summary

The development of the forestry sector in Chile in the last 30 years has undergone a profound change which is being characterized, amongst other indicators, by a massive increase of tree plantations with exotic species, and an increase in the generation of foreign currency through the timber exports. The opening of the markets during the military regime and the State support to tree plantations through Law 701 (1974) created the main conditions for this increase.

The community of Empedrado has faced a radical change in a period of 30 years (1961 – 1991). A change that is illustrative of the general situation and that is mainly caused by an increase in tree plantations with a 308% triggering a loss of cropland and natural prairies of 54%. This change triggered the virtual disappearance of the farming economy and the degradation of native forests. It also caused a decrease in agricultural and pasture land, the emigration of the rural population to the urban center of Empedrado, urban and rural poverty, scarcity of municipal resources (the large forestry enterprises do not contribute to the municipality), damage to the secondary road infrastructure, low education levels, analphabetism, alcoholism and other effects.

Farmers that did not migrate have been under pressure to overexploit their natural resources and thus deteriorate the productive capacity of the land that's left for farming.

Empedrado is a community with serious problems of poverty and unemployment, which is in contradiction with the heritage and richness of their forest resources. In the past 15 years, Empedrado was “favored” by Law 701, which exclusively stimulated the establishment of tree plantations of exotic species. This has caused the partial or total reduction of income from traditional agricultural practices.

The native forest resource in this county currently finds itself in an isolated state and in small areas only, and it has been gravely altered in its structure. Additionally, the low economic value and the scarce possibilities of sustaining a family make that those fragments are being even more degraded, also due to the lack of a program to support and help small and medium forest owners to manage their forest in an integrated and sustainable manner.

One of the main problems the farmer faces roots in the scarcity of possibilities expand their farming areas, as he cannot extend his crops to more fertile soils due to the fact that his farmlands are surrounded by tree plantations. Moreover, there are hardly any support programs for small landowners, through which they could find alternative employment, in particular employment based upon the integrated and sustainable management of their property.

The negative microeconomic reaction that a process of this size has triggered in the social sphere, make one doubt about planning policies that only take into account physical factors, and that primarily maximize the potential of a natural space, without taking into account the long-term social or environmental costs. This way, inhabitants of the forest and small farmers see the model of forestry development that is currently being imposed as a threat to their survival.

Tree Plantations in Cameroon: A Glance at the Possible Negative Impacts

By CED/FoE Cameroon

1. Introduction

The Cameroonian rainforest covers about 17 millions hectares of lands out of which about 110 000 are cut yearly for agricultural activities and a bit more for industrial exploitation. Regenerating nature hence appears to be a necessity and the government of Cameroon decided to undertake this regeneration by tree plantation. This program started 50 years ago (i.e. 1950) with the help of the "Fonds d'Aide et de Coopération". This program was implemented up to 1973. From 1974 to 1982, the national fund for forestry and fisheries (Fonds Forestier et Piscicole) was responsible for regeneration programs. From 1982/1983 to 1988/1989, the National Bureau for Forest Regeneration (ONAREF) operated, and has continued up to the present. About 40 000 hectares of tree plantations have been realised in 50 years. Out of this 25 000 ha have been established in dense rainforest, 10 000 ha in humid savannah. The species planted are very few compared to the total number of species that naturally exist in the Cameroonian forest.

The table below gives the figures of the species planted in the frame of the regeneration program.

Zone	Common name	Local name	Scientific name	Total area planted (Ha)
FOREST ZONE	Dibetou	Bibolo	Lovoa Trichilioides	N.A
	Okoumé	Okumé, Angouma	Ancoumea klaineana	5882
	Iloba	Eteng, Bakondo		12
	Azobé	Okoka	Lophira Alata	86
	Ayous (Obéché)	Ayos, Ngo	Triplochotou sclerosylon	N.A
	Framiré	Lidia Akom	Terminalia Ivorensis	1166
	Iroko	Abang, Bang	Chlorophora excelsa	N.A
	Sapelli	Assié	Entandrophragma cylindrum	N.A
	Sipo	Koukindjock timbi	Entandrophragma utile	N.A
	SUB TOTAL			
Savannah Zone	Eucalyptus		Eucalyptus Spp	
	Neem		Azadirachta indica	
	Acacia		Acacia spp	
	Cassia		Cassia spp	
	Dalbergia			
TOTAL				15 000 Ha

The total number of the tree species exceed 9 000 in the Cameroonian forest while 300 of them are actually exploited or known to be potentially exploitable. The regeneration programs are implemented with grassroots communities.

2. The Impacts of Tree Plantations

The official objective of the regeneration program is to plant trees in order to avoid species disappearance and to restore "the natural forest". This objective can be considered as noble in theory, but tree planting will cause negative impacts and side effects in the long run. These effects and impacts can be classified into three main groups: ecological, socio-cultural and economic.

2.1 The Ecological Impacts of Tree Planting

- Tree planting can generate many negative impacts. In the original forest, the number of species is so large and the microclimatic conditions created so varied, that biodiversity is very rich. In a tree-planting plot, on the other hand, generally one species and sometimes two are planted in a rigorously scientific order with fixed distances between trees, and the said trees are often even-aged. These conditions do not guarantee a long-lasting equilibrium in the so-called forest that will grow in this plot.

- Any tree species contributes to the development of particular ecological conditions linked to its nature. Planting a limited number of species will hence make the local ecological conditions tip to what the planted trees provoke. In this manner, very few insects, animal species, plants and microbes will be favoured while many others will be condemned to disappear.

- Out of 200 000 seedlings of Eucalyptus planted by ONADEF in the last two years in the Cameroonian savannah, at least 70% are already contributing to soil acidification by their root secretions. Also, Eucalyptus species are reputed to suck up groundwater rapidly from deep soil levels and send it in the form of water vapour to the atmosphere. This can disturb the local water cycle. Some researchers have observed drastic drops in the fish population of rivers surrounded by Eucalyptus plantations. Eucalyptus can sometimes resist firing in savannah areas, but also it contributes to fire spread because of the volatile flammable liquids secreted by its leaves when heated. Some local communities identify this species as a "fire spreading agent". By the years 1970s, a government program called Opération Sahel Vert contributed to the plantation of hundreds of hectares of Eucalyptus in the northern provinces. Most of these trees are very tall today and produce a lot of water vapour. The rains in this region are currently so heavy that they create catastrophic floods that destroy houses, bridges and kill people every year, including the year 2000.

2.2 The Negative Socio-cultural Impacts

Tree planting in many parts of Cameroon creates conflicts. According to the national legislation, any tree is the state's property unless someone can document that he or she was the owner of the land under it before planting. Such certification is usually impossible in the rural areas.. The state often delivers exploitation certificates on planted trees and this often creates conflicts between local communities and logging companies.

In some areas, certain tree species are considered as places for witchcraft meetings. Planting such large tree species disturbs the social equilibrium of the surrounding villages.

2.3 The Negative Economic Impacts

In the Sahel region (northern Cameroon), many local communities believe that the trees planted around their farms serve as habitats for crop-devastating birds and animals. They say that such trees result in a reduced quantity of crops to be sold for income or local consumption. In this respect, some communities claim that tree planting has promoted hunger and poverty in their area.

The Possible Impact of the Kyoto Protocol

If it is accepted that tree plantations are to be developed as carbon sinks, the ongoing projects in Cameroon will be reinforced and all the impacts mentioned would continue expanding. Other plantation projects would also be developed since the local government believes that the regeneration programs already implemented are insufficient.

4. Conclusion

Planting trees in the way it is done in Cameroon actually is not a solution to local and national environmental problems. It is just a political tool to make local communities and international donors believe that there is a struggle against environmental problems.

We therefore recommend that an emphasis must be put on researching sound technologies to rely on as strategies to address climate change

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Tree Plantations and Forests in Colombia

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Summary

The document tries to demonstrate, in a general and concise manner, the current forest situation in Colombia, as far as its forests, the establishment of tree plantations and the repercussions on the environment and the societies where the activities of reforestation companies are being developed are concerned. It also refers to the implications of the establishment of plantations as carbon sinks under the concept developed on basis of the Kyoto Protocol.

Colombia is eminently covered by forestlands. The current situation of our forests will be described, outlining how there actually exists a deficit in forest area and the problems this brings with it. The distribution of forestry plantations will be described, and how they are causing negative impacts upon the environment as well as upon the Indigenous and farmers' communities, particularly in the west of the country. The communities in these regions have seen their culture altered, their lands occupied, and their customs, production methods, lifestyles and quality of life deteriorated. These and other themes will be taken up briefly, although they clearly illustrate the main points being discussed here.

The supposed environmental benefit that is being pursued with the creation of new forestry plantations which act as sinks of carbon emitted into the atmosphere by anthropogenic activities, is currently being challenged as the model used is similar to the conventional model of plantation management. The current model has serious environmental and social impacts, and its management is adapted to an economic rather than an environmental perspective. The so-called "common benefit" would be restricted to a small group of individuals that has found a superb opportunity to develop a lucrative business on the basis of tree plantations. Amongst these individuals, we can find plantations owners, commercial networks, investment banks, government officials and forestry enterprises.

This way of reducing CO₂ concentrations in the atmosphere has little legitimacy if we take into account the fact that what is being promoted is the continuation of the imperial model of industrialized countries. Their polluting emissions to the atmosphere are justified through a payment to countries like ours for environmental services. Countries, which consider themselves to be in a situation of environmental and economic dependency on the transnational companies that want to develop these programs, thus demonstrating their meager commitment to the task of reverting the process of climate change.

The development of such practices in our country seriously compromises our sovereignty in face of multinationals and their foremen. Moreover, from a social point of view these patterns tend to increase conditions of poverty amongst the population, as well as the ecological debt of **the North**.

Conclusions

Colombia is a country with a large proportion of its original territory covered by forestlands but currently there is a shortage of more than 7 million of hectares of forests and a large part of its forests is subject to acute anthropogenic pressure.

The tree plantations in the country consist for approximately 80% of exotic species. Although they do neither cover as large a landbase nor have the tradition of other locations plagued with plantations in South America, they have represented serious social and environmental problems in

the regions where they are located.

The lack of control and monitoring of forestry activities by environmental authorities led to major environmental and social impacts in the places where they have been undertaken.

The Indigenous and farmer's communities in the west of the country are the ones which have been most seriously affected, through loss of / infringement on their livelihoods, culture, production methods, and social relations, including the loss of their traditional welfare arrangements and quality of life.

The development of plantations as carbon sinks in the way that is proposed at the moment will further increase negative environmental, social and economic repercussions for countries like ours.

The supposed benefit of tree plantations as carbon sinks will be gained by economic groups, such as plantation companies, investment banks and multinational companies rather than result in real benefit for local populations.

Spruce Monocultures in the Czech Republic

The Sumava Mountains Case Study

*By Jaromír Bláha, Director of Forests Program, Friends of the Earth Czech Republic
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1. Introduction: Tree Plantations in the Czech Republic

This case study examines the pitfalls of forestry which relies on monoculture plantations, and in doing so offers a warning to the ecologically devastating effect the joint implementation and other flexible mechanisms in the Kyoto Protocol could have on forests in the Czech Republic and elsewhere unless monoculture plantations are strictly prohibited.

The history of spruce monocultures in the Czech Republic reaches back to the second half of the eighteenth century. Since that time, Czech forests have been devastated by over-exploitation. The replacement of wood (until then the main source of energy, also for heating) by coal allowed for a reduction in wood harvesting, essentially saving Czech lands from complete deforestation. Around the same time, the science of forestry was born, with its goal of assuring adequate supply of wood in future years.

The first foresters quickly discovered that some species of trees (spruce, fir, pine) have better production features than others and started to selectively replant forested areas - especially spruce and pine because the shade-loving fir does not grow well in deforested areas. The foresters thus replaced other species with mostly spruce trees, and with pines in the lower elevations. They planted large areas with spruce and pine and later harvested the wood; this clearcutting and planting method was the preferred “forest” management strategy.

Both the monocultures and the clearcuts had disastrous impacts on the health of forest ecosystems in the Czech republic. What remained of natural original forest gradually decreased and existed mostly within inaccessible areas free of forest roads. The peak of the clearcut and monoculture management occurred in the 1970s.

At present forests and tree plantations make up one-third of the total area of the Czech Republic – approximately 2634000 hectares. Spruce and pine monocultures form 90% of this area. Forest/plantation management based on clearcuts continues, with an average rotation period of 115 years.

During the last six years there have been noticeable positive changes in forestry, such as rules requiring a minimum percentage of soil-improving and indigenous species during planting. Since 1996 the size of monocultures has also been restricted.

Table: Comparison of original species composition in the Czech Republic to what is found in Czech forests today:

<u>Species</u>	<u>Original</u>	<u>Today</u>
spruce	11.0	55.0
fir	18.0	0.9
pine	5.4	17.8
larch	0.0	3.7
other conifers	0.0	0.2

Total Conifers	34.4	77.6
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<u>Species</u>	<u>Original</u>	<u>Today</u>
oak	17.2	6.5
beech	37.9	5.9
hornbeam	1.8	1.2
ash	0.7	1.0
maple	1.5	0.8
elm	0.5	0.0
birch	1.1	3.0
linden	3.8	1.0
alder	0.6	1.5
other broadleaf	0.5	1.5
Total Broadleaf	65.6	22.4

However, the specified percentage of natural species given by the government (an average of 20%) is entirely insufficient to restore the stability within forest ecosystems. In an effort to back-track on even this minor concession to ecological needs, the Ministry of Agriculture is currently preparing an amendment to the forest law in which the "minimum portions" would no longer be required.

As spruce monocultures are the most extensive and also suffer from most problems, this study will mostly focus on this type of plantation.

2. Spruce Plantations and their Impacts

High mountain spruce forests are the only example of natural spruce forest in the Czech Republic (natural spruce growth at low elevations is very rare). Mountain spruce growth can be found in harsh climate conditions at elevations higher than 1000 meters above sea level and in the cold mountain valleys where the only other species that can survive are mountain-ash, birch, sycamore and maple.

Spruce monocultures have replaced not only natural mountain spruce forests but also the fir-beech forests of middle elevations and the oak forests of lower elevations. This means that foresters are growing spruce under conditions which are not suitable for it (out of its ecological optimum).

If the expected global climate change occurs, spruce vegetation might migrate into the higher elevations and natural spruce growth would remain only at the top of the few highest peaks in Czech mountains. In such a case we can also expect a mass degradation of spruce monocultures in the lower elevations where the spruce will be completely out of its ecological habitat. With this in mind it is incomprehensible that 50% of forests at these lower elevations are still reforested with spruce.

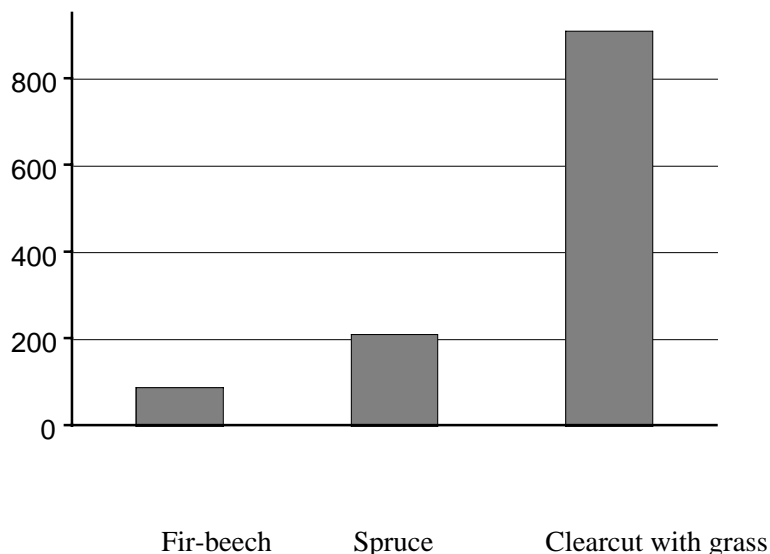
The inner structure of forests is significantly changed by the growth of spruce monocultures. The forest structure in a monoculture contains an artificially high stand density, trees all of the same age and species, and results in closure of the tree canopy. The vertical diversity is minimalized (lower younger and higher older trees and various bushes are missing) and the herb vegetation degree is intensely suppressed due to the increased shade (mostly in the younger growths).

The reduction in species and genetic diversity is even more radical owing to the unification of growth structure and decrease in sunlight. The methods used to extract wood during clearcuts further damage many species of plants, animals and micro-organisms, which are killed directly or indirectly by loss of habitat.

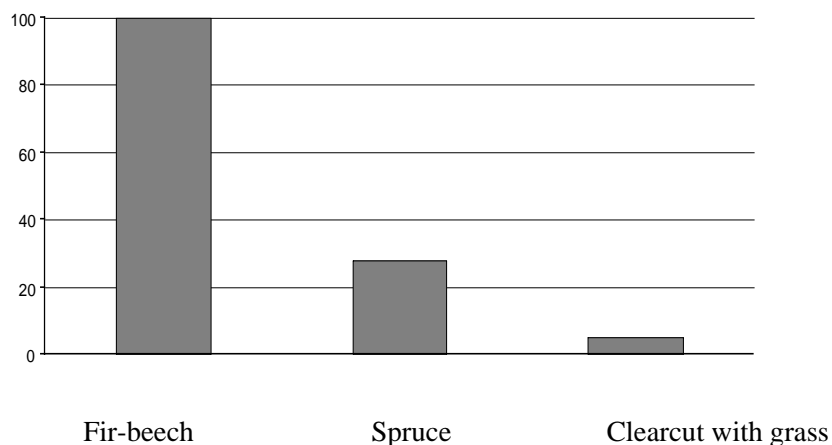
Because all the wood material is exported the forests forego the period of decomposition which is an irreplaceable source of biodiversity. Clearcuts completely change the character of vegetation, as the clearings (paseka) are soon covered by light-loving species like the red elderberry (*Sambucus racemosa*), great willow herb (*Chamerion angustifolium*) and grove ragwort (*Senecio ovatus*). In the last decade an invasive bush reed grass (*Calamagrostis epigejos*) has dangerously expanded within the spruce monocultures (in the mountain areas it is complimented by hairy reed grass - *Calamagrostis villosa*) and it represses the majority of native forests species. By expanding the range of spruce monocultures there is also a radical decline in most forest herbs which usually form a green floor cover in leafy and mixed forests.

The forest water system is disrupted by such changes, as is the water system in the countryside. Compared to natural forests, interception and absorption of precipitation is reduced.

Outflow of precipitation from different forests



Absorption of precipitation in different forests



In the graphs above, rainfall runoff and rainfall absorption of spruce forests and clearcut areas are

compared to mixed fir-beech forests, with the latter indexed at 100 and the former represented as a percentage of that.

Spruce monocultures also result in soil degradation. In the layers of fallen needles, a non-nutritious acidic humus forms and slows the decomposition process, resulting in soil compaction.

Correspondingly, the cycle of nutrients and energy is disrupted. Thanks to the acidic soil reaction caused by an absence of leaf mulch, there is an increase in the release of base ions (especially magnesium and calcium). Acidic rainfall then evokes a release of aluminum ions (Al^{3+}), ions which are very toxic to the mycorrhizal fungi which live on spruce roots. Owing to an absence of deep root trees (beech, fir, birch, mountain ash) there is no recycling to the surface soil of nutrients in deeper soil. By exporting all wood material from the forest, organic mass and nutrients are being removed from the cycle. In several places a reduction in nutrient capacity and degradation of soil also results in withered features and reduced growth rates for second and third generation spruce monocultures. There also is a loss in the sanitary function of forests. While natural forests give an impression of a living organism (due to the species variability, seasonal changeability, a variability of colors, smells, shapes, light), the spruce monocultures give an impression of a dead organism-stiffness, stereotype, unnatural uniformity. In the young spruce monocultures there is a deathly dusk.

The growth of spruce monocultures outside of the spruce's ecological optimum, the minimalization of biodiversity, the unification of spatial structure, the disruption of the water system and the degradation of soil combine to result in a clear crisis of ecological stability in spruce plantations. Although foresters strive to preserve the plantation trees through considerable inputs of energy (cleanings and thinings), fertilization and eradication of pests and weeds, the spruce monocultures are often seriously damaged by wind, snow, frost and bark beetles. If not killed by these natural disasters, they still wither to death on their own. During the years 1992-1997 the incidental calamity extraction (salvage felling) accounted for 60-80% of total timber extraction, and in some areas this number approached 100%.

For the time being, the social impacts of spruce monocultures are not a serious problem in the Czech Republic, although impacts can be expected in the future due to an increase in "calamity" (natural disaster) damages. The forest economy employs 36,700 people, or 0.7% of government employees nationwide. If the forest economy makes a shift to more ecologically-friendly forest management one result would be a small increase of the number of jobs in this sector of the economy.

The results of cultivation of spruce monocultures are fatal for the way people perceive forests. The spruce monocultures have been cultivated in the Czech Republic for 200 years, and consequently the public perception of forests has followed suit. People usually perceive the monocultures as normal forest because these forests are the only forests people ever see. They now perceive what remains of natural forests as something exotic, out of control and untidy. The meaning of the term forest has become skewed. People call spruce monocultures forests even though a monoculture can no more be called a forest than a corn field could be called a meadow.

3. A case study: Decay of spruce monocultures in the Šumava National Park, along the lower hillside of Trojmezna and Tístoliník:

Species composition of trees in Šumava:

<u>Species</u>	<u>Today</u>	<u>1000 Years Ago</u>
spruce	86,2%	37,5%
fir	1,2%	18,1%
pine	6,6%	17,0%
larch	0,1%	-
other conifers	1,3%	-
Total Conifers	95,4%	72,6%

<u>Species</u>	<u>Today</u>	<u>1000 Years Ago</u>
beech	4,3%	17,8%
maple	0,1%	3,7%
other broadleaf	0,2%	5,9%
Total Broadleaf	12,6%	27,4%

4. Topography of the Sumava Forests and Plantations

The ridge between Tistolíník (elevation 1311 meters above sea level), Trojmezna and Plechá (elevation 1378m) lies at the border of the Czech Republic, Austria, and Germany, and is the highest altitude region in the Czech portion of the Sumava Mountains. The strip of forest cutting a swath 500-800 meters wide down from the ridge forms the richest growth of mountain spruce forest in the Czech Republic. A full two-thirds of this forest has been spared from clearcuts, and since 1933 the area has been protected as a nature reservation. In the lower elevation the reservation passes gradually from a spruce forest into a mixed fir-beech-spruce forest. Below the reservation, where once mixed fir-beech forests inhabited the mountain, one now finds the third generation of spruce monocultures.

5. History of the Sumava Plantations

The first monumental event in the modern history of Sumava's forests resulted from the construction of a shipping channel in 1789 - 1822, by the largest land-owner in the Sumava Mountains at the time, Prince Schwarzenberg. The channel made it possible for the first time to easily transport large quantities of harvested wood. Previous untouched forests quickly became cleared, and the clearings were replanted exclusively with spruce seeds.

The second major turning point struck with a calamitous storm during the night of October 26, 1870. The biggest concentration of wind damages occurred in areas where 50 years before large sections of natural forest had been liquidated in order to meet quotas for shipping wood. The areas destroyed by the wind were replanted with monoculture spruce forests, and the fragile plantations here came under attack from the spruce bark beetle. The bark beetle infestation affected not only the artificial spruce monocultures, but also spread into the surrounding natural forest. Due to the beetle attack, the area suffered another round of major deforestation. The deforested areas were replanted again by spruce, partly through natural regeneration, and partly through human planting. The planting over time shifted from trees of local genetic origin to increased import of foreign gene pools.

Except for the above-mentioned reasons of instability of spruce monocultures it is necessary to consider in the mountain areas if the spruce growths generate on the wind-induced clearings or not. The extreme weather conditions in the wind-induced mountain clearings (temperature fluctuations, wind, frost) result in a natural selection of the so-called "pioneer" genotype in both planted and natural rejuvenating spruces. These are able to survive the extreme climate conditions, even thriving, and are thus able to execute the function of pioneers - they set the stage for other types of

forest. Pioneer spruce live relatively short lives (in comparison to the climax genotype of spruce which grows slowly in the shade of older trees). The vitality of pioneer spruces terminates after 80-120 years, so tree decay hits these areas on average after 100 years of growth. The experience in Šumava confirms this trend.

The expected decay of unstable spruce monocultures on the lower hillside of Trojmezna started in 1989. In 1988 the foresters had authorized construction of a wide forest road there, clearing a 9-meter strip of monoculture spruce to do so. The open growth was exposed to the wind and attacked by the bark beetle. Infested and wind-felled trees are processed transported out of the area each year, so the clearings only become bigger, exposing more trees to the beetles and the elements. Even consistent preventive cuttings could not contain the beetle infestation, and new beetles are attacked each year. Even after 10 years of failure foresters still will not admit that they are unable to prevent the decomposition of spruce monocultures. And even though this region fell within the area designated a national park in 1990, their destructive methods have not changed a bit. The present size of deforested area is more than 200 hectares and now reaches the border of the nature reservation (the "first," or most protected zone of the national park), and with it the remaining natural mountain spruce forest.

6. The Social Implications

The intense effort for expedited processing of wood felled or threatened by wind and beetle creates the short-term need for many seasonal workers. The management of Šumava National Park has hired companies and large groups of foresters from around the Czech Republic and neighboring countries, while at the same time many local people are unemployed. The emergency work-effort is to the detriment of generating permanent job opportunities for local people.

There is now a new debate about a proposed amendment to the forest law, one which threatens to cancel the limited requirements for planting diversified natural tree species, and this when the quotas are already grossly inadequate for anything approaching sustainable forestry. Friends of the Earth Czech Republic is trying to push forest legislation in the opposite direction – calling for an increase of this minimum quota. Failing an increase in the minimum natural diversity quota, the acceptance of a FCCC/Kyoto Protocol which allows and promotes the planting of spruce monocultures would start a new wave of spruce monocultures in the Czech Republic. Under present conditions of second and third generation spruce monocultures we are experiencing serious degradation of forest biotopes, making it clear that further moves in this direction would lead to the extinction of Czech forests, leaving only fragile plantations in their stead.

7. Conclusions and Recommendations

In tropical areas deforestation produces immediate and clearly visible local and global results. Meanwhile, the cultivation of monoculture conifer plantations in Europe represents a hidden form of forest ecosystem destruction, leading more slowly but just as surely to the permanent collapse of not only the forest, but the entire capacity of the landscape to support life.

The only way to prevent this collapse is by a gradual return to a natural species composition through forest restoration and forest rehabilitation. But it is also necessary to enact changes in the methods of forestry - no clearcuts, reduction of wood extraction in mountainous areas, reversal in the overpopulation of deer. For conservation and for all the benefits humans derive from the existence of wilderness, biocorridors creating a connected network of forests should be established which contain representatives of all types of forest ecosystems, and at a sufficiently large enough area to allow for their dynamic development.

Considering the negative impacts detailed in this study, it is highly crucial that FCCC Annex 1 countries focus on the development of integrated strategies to conserve and restore natural forest ecosystems in their countries (as required by both the FCCC and the Kyoto Protocol) and that they avoid further expansion of monocultures.

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CO₂lonialism - Norwegian Tree Plantations, Carbon Credits and Land Conflicts in Uganda

By Norwatch/ The Future in Our Hands

1. Introduction

Over the past years, Norwegian companies have acquired huge land areas in East Africa where they are planting, or planning to plant, fast-growing trees such as eucalyptus and pine. When the trees mature, the plantations could yield an income through the sale of timber and wood. Against the backdrop of the Kyoto Protocol signed in December 1997, however, the Norwegian players envisage another and more immediate source of income; namely, selling carbon credits based on the storage of CO₂ in tree plantations.

Two days after the Kyoto Protocol was adopted, Tree Farms (the company was then named Fjordgløtt) arranged a private placement that increased the company's capitalization from NOK 990,000 (USD 98,000) to NOK 13 million (USD 1.4 million). Five months later, the company invited outside investors to buy shares. One third of the new shares were bought by TRG, a company controlled by the Norwegian billionaire Kjell Inge Røkke.

In February, managing director Steinar Bysveen in Industrikraft Midt-Norge (which is behind the plans for a gas-fired power plant at Skogn, Norway) told NorWatch that one interesting source of carbon credits is "a tree-planting project with Norwegian owners in Africa". In the beginning of April this year, the identities of the Norwegian owners were confirmed. At that time, Industrikraft Midt-Norge and Tree Farms briefed the Foreign Ministry that the companies have made an agreement giving the power plant developers the first option on buying carbon credits from Tree Farms.

The same basic question applies both to the issue of new power plants and to the issue of climate change in general: Will the Norwegian tree-planting projects in Uganda contribute to a better climate, globally and locally - or is this just CO₂lonialism?

2. The Norwegian Players

Uganda, formerly called "the pearl of Africa", is a country that has undergone dramatic political changes since the 1970s. Often, the country is associated mainly with the misguided regime of Idi Amin in the 1970s. However, a couple of decades have passed since Amin was run out of the country by the military dictator Obote, who was, again, toppled in 1986. Since then, the country has been ruled by president Yoweri Museveni, but several guerilla groups are fighting the regime, which does not permit a multi-party system.

The country north-east of Lake Victoria has rich and varied nature areas, ranging from tropical forest to the south and west, to savanna and desert-like areas in the north. Like most other tropical countries, Uganda has problems with deforestation. Several sources that NorWatch met during the visit believed that the country will experience an acute lack of wood in ten years. Today, Uganda has more than 700 larger and smaller state-owned Central Forest Reserves set aside for forestry and forest protection. These cover a total area of 1,167,000 hectares (7% of Uganda). It is in some of these forest reserves that the Norwegian companies Tree Farms and Norwegian Afforestation Group have acquired land for their tree-planting projects.

3. Tree Farms

Tree Farms AS, formerly called Fjordgløtt AS, has its head office in Namsos (Norway). Mads Asprem, the driving force behind the company's East African foray, is on the company's board. Asprem, an investor and the director of Morgan Stanley Dean Witter in London, who is considered one of the best forestry analysts in Europe, is by far the largest shareholder in Tree Farms, with a 46,92% ownership. The third largest shareholder is Kjell Inge Røkke, who owns 9,37% through the company TRG.

In 1995, Tree Farms/Fjordgløtt was awarded a NOK 127,000 (USD 13,900) grant from NORAD to explore the scope for activities in East Africa. The following year, the company set up in Tanzania and Uganda, and, later, in Malawi as well. Today, Tree Farms controls at least 20,000 hectares (50,000 acres) of land in the region, and is in the process of acquiring a further 70,000 hectares in Tanzania.

Tree Farms' subsidiary in Uganda is named the Busoga Forestry Company Ltd. According to the manager, Jose Byamah, the aim is to run tree plantations covering some 80-100,000 hectares in the area. The only place where the company has started up its activities, however, is in the Bukaleba Forest Reserve. In June 1996, the Busoga Forestry Company made a deal with the Ugandan authorities to lease, for a period of 50 years, a 5,160-hectare area within this reserve, which is at Lake Victoria just east of the town of Jinja. The Bukaleba Reserve is a total of 8,000 hectares. The rest of the reserve was rented to the German company Deutsche Forst Consult.

Tree Farms has so far planted 600 hectares, mainly with fast-growing pines (*Pinus caribaea*, *P. oocarpa*, *P. tecunumani*) and eucalyptus (*Eucalyptus grandis*). On some smaller lots, the company has also planted the local tree species musizi (*Aesopsis emini*), mahogany (*Khaya anthoiheca*), and Musambya (*Macadamia lutea*). According to managing director Odd Ivar Løvhaugen, Tree Farms has, so far, invested NOK 5-6 million (about USD 600,000) in the project.

4. Norwegian Afforestation Group

Norwegian Afforestation Group was founded as late as September 15, 1999, by Norwegians in foreign aid circles in Uganda. The company manager is Svein O. Wilhelmsen, who, through his company Økotek AS, is also the largest shareholder (see Table 2). This company, too, received NORAD grants, worth NOK 121,000 (USD 13,200), for preliminary studies that resulted in the company setting up in the country last fall. On November 15, 1999, Norwegian Afforestation Group made a deal with Ugandan authorities to lease, for a 50-year period, land areas within the Kachung Forest Reserve in Lira district about 400 km north of Kampala.

The Kachung Reserve totals 3,590 hectares, 3,000 of which are controlled by Norwegian Afforestation Group. The rest of the reserve is presently leased to the local company Edola & Sons Ltd., which operates a saw-mill based on existing plantation forest. As mentioned, Norwegian Afforestation Group has not started planting forest. According to the company, they will only plant pines within their areas.

5. The Social, Environmental, and National Impacts of the Projects

5.1 Land-lease

The deals made by Tree Farms and Norwegian Afforestation Group with Uganda through the forestry authorities, function as follows:

- The land areas are leased by the companies for a 50-year period, with the option of

renewing the contract for another 50 years.

- A one-off sum is paid to the authorities when the contract is signed, regardless of how large the leased area is. This one-off sum is 500,000 Ugandan shillings (approx. USD 312).
- The authorities receive an annual rent of 5,000 shillings (approx. USD 3) for each hectare planted with forest. The rent is adjusted every ten years according to the index of inflation as defined by the Bank of Uganda. No rent, then, is paid for areas that the companies have not planted with trees.
- The rental agreement implies that the companies commit themselves to planting forest and conducting modern forestry within the concession area.

Conclusion: Both Tree Farms and Norwegian Afforestation Group have leased their lands from Uganda at a bargain price. The authorities have virtually no capacity to assess what value the companies plan to generate through carbon trading. By leasing out areas for "carbon plantations", Uganda is giving away the option of changing land use in the future. The entire lease agreement resembles neo-colonialism.

5.2 Land Conflict

Since the 1960s-1970s, local farmers and fishermen have moved in and out of the Norwegian as well as the German company's concession areas in Bukaleba. The forest reserve is in Iganga district, which is densely populated with migrants from other parts of Uganda, as well as from neighboring countries. With scant opportunities for work outside agriculture, and with a rapidly growing population, there is a huge pressure on land areas, including the Bukaleba Forest Reserve.

Already in the early 20th century, many people migrated into the area. However, because of an outbreak of the sleeping sickness (caused by the tsetse fly), people fled the area where the reserve now lies. When the tsetse fly was controlled in the 1970s, people moved back to Bukaleba. Also in the 1970s, Idi Amin gave permission for a cattle-herding project in the middle of the reserve, peaking at 3,000 grazing cattle. Politicians under the Obote regime in the 1980s also supported settlements in the forest reserve, and one minister from the area offered the following argument in favor: "Trees don't vote, but people do."

According to the rules and regulations applying to forest reserves in the country, everyone living or farming inside the reserve are illegal "encroachers". Still, some of the farmers claim they bought the land they are now working back in the 1980s, and that they therefore hold the right of ownership, or that the land they are farming has been owned by their family for generations.

Conclusion: Tree Farms' project cannot be carried out without some 8,000 people, mainly farmers and fishermen, being evicted from the company's areas and thus deprived of their livelihoods. The potential for social conflicts and increased poverty is therefore great. No similar conflict over land was observed by NorWatch at the Norwegian Afforestation Group project.

5.3 Free Labor

A few years ago, Tree Farms employed several hundred people to manage the plantations in the Bukaleba reserve. But today, it has only 43 employees, according to the assistant administrator at the company's forest station, Winfred Nakato. Of these, 20 people are working in the plantations. From the very beginning, Tree Farms has also based its operations on the so-called *taungya* system. In brief, this means that the farmers are allowed to grow maize, beans, and other products between the rows of planted trees during the first few years, until the trees have grown so high that other plant life will not grow beneath them. As early as 1998, when NorWatch first contacted investor

Mads Aprem about this project, it was emphasized that the company practiced the *taungya* system. Tree Farms have been strongly criticized for the use of the *taungya* system. The previously mentioned EU supported study, published by the Ugandan Ministry of Forestry, states that the manner in which this system has unfolded at Tree Farms "resembles a Middle Age feudal system but without the mandatory 'nobless oblige' and with the farmers paying for the bulk of the investment cost of the plantation establishment."

According to the study, the farmers actually have to pay Tree Farms to be allowed to farm on the company's lands. Payment is collected in the form of 100 kg of maize or 50 kg of millet per acre per season. In addition, the farmers must pay a cash rent, ranging from 10,000 to 85,000 shillings (USD 6 - USD 53), for their lots of land.

The EU supported study points out that Tree Farms is only paying 5,000 shillings (USD 3) per year to the authorities for every hectare actually planted with trees. The farmers' payments to the company per hectare, thus, are many times the amount paid by the company to the authorities.

Even though Norwegian Afforestation Group has not started planting forest in the Kachung Reserve, the company states clearly that they do not intend to make use of the *taungya* system. Manager Svein Wilhelmsen explains that they are against this system because it is against the policy of Ugandan forest authorities. The company plans to use female labor on the plantations, "at a normal decent wage level", as Wilhelmsen puts it in a comment to NorWatch. His explanation is that social conflicts and poverty are fought by giving work to women. By doing this, 100% of the salary returns to the family instead of 40% which is the case when a man receives the money, due to the fact that he will spend 60% on alcohol.

Conclusion: Tree Farms is exploiting farmers by using them as free labor to clear and prepare the land which is to be planted with forest (the *taungya* system). The fact that the company has also collected payment from the farmers by collecting maize from them (as well as probably cash), makes what goes on at Tree Farms resemble a Middle Age feudal system but without the mandatory "nobless oblige" and with the farmers paying for the bulk of the investment cost of the plantation establishment. The Norwegian Afforestation Group is against the *taungya* system and will not make use of it.

5.4 Carbon Profits

As mentioned, both Tree Farms and Norwegian Afforestation Group have CO₂ storage and carbon trading as an explicit aim for their East African tree plantations. Even though the rules for calculating CO₂ profits have not yet been worked out and adopted, the Norwegian companies have long since started setting up a carbon accounting system for their plantations. Today, Tree Farms' largest venture is in Tanzania. Since the publication of the CO₂lonialism report, the Tree Farms project in Uganda has changed from being a "carbon plantation" to a conventional timber plantation. According to the management in Tree Farms, the project has been excluded from the options contract with Industrikraft Midt-Norge and has therefore no relevance in relation to CDM and carbon credit trade. This fact is crucial because it leaves the Tanzania project as the only potential CDM project in Tree Farms' portfolio.

As for Norwegian Afforestation Group, the company's concession area in the Kachung Reserve is a total of 3,000 hectares, 2,800 of which are to be planted with pine. The company is going to clear most of the existing plant cover, which is savanna-like "woodlands". The exception, according to manager Svein Wilhelmsen, is the large trees that will be left untouched in accordance with the company's wish to conserve some of the biological diversity. Wilhelmsen has presented the

following CO₂ calculation to NorWatch: In 22-23 years' time (Tree Farms uses a 25-year growth period for pine), these 2,800 hectares of pine plantations will have stored a gross 2 million tons of CO₂. In other words, 714 tons of CO₂ will be stored per hectare. Wilhelmsen informs that the company has not calculated how much the net tradable quota will be, and points out that this will depend on the methodology that is finally adopted in international negotiations. However, Wilhelmsen says they have informed potential clients that the Kachung plantation will yield 1 million tons of net tradable carbon credits. If this turns out to be the final figure, Norwegian Afforestation Group will have 357 tons of tradable CO₂ per hectare (half of 714 tons of CO₂).

As mentioned before, by leasing out land for "carbon plantations", the authorities forego the opportunity of changing land use for other purposes. Once used to store CO₂ in the forest, the area must remain forested, in order not to release CO₂ back into the atmosphere. The need for using land for farming or firewood, as a result, for instance, of war or poverty, would not justify the authorities making use of the "Norwegian" areas without destroying the carbon accounts.

Conclusion: While Tree Farms and Norwegian Afforestation Group stand to make large profits from the sale of carbon credits from their tree plantations over the next 25 years, Uganda will be left with a few hundred thousand dollars in return. The carbon-storing plantations have to remain carbon-storing plantations for the foreseeable future, depriving the country's authorities of the choice of regulating the areas for other purposes in the people's interest. Nor would the Ugandans be allowed to use the carbon forests for their own carbon accounts when they themselves face commitments, because the credits will already have been sold to countries and companies in the rich countries, which, today, have commitments under the Kyoto Protocol.

5.5 Uncertain Carbon Accounting

A complete carbon account for the Norwegian companies' plantations, especially with regard to Tree Farms, would be highly uncertain for several reasons:

- It is impossible to predict what will happen to the approximately 8,000 encroachers who have to move from the Bukaleba reserve. They all earn a living from farming, animal husbandry, and fisheries, and they will have to move to new areas where clearing forested or unforested land for agriculture may be the only alternative for survival.
- The tree plantations must be kept safe from political unrest and domestic upheavals to prevent plantation operations from being shelved and the land being designated for other purposes (as stated, the Norwegian companies have rented the areas for 50 years, with an option to lease them for a further 50 years period).
- Political unrest is not the only thing to guard against. In the future, the plantations may go to waste, simply because there is no market for the wood and timber.
- Tree Farms' areas already suffer from fires, allegedly lit to some extent by farmers, but especially by hunters.
- An unanswered question is what the impact of the companies' plantations on the spots of natural forest they are planning to leave alone will be, or on the vegetation cover outside the companies' lands.
- A further complication is the question how much CO₂ is released from the soil through clearing and ploughing before the trees are planted.

Conclusion: There is great uncertainty as to the net amount of CO₂ that will be removed and stored by the Norwegian tree plantations. The Ugandan market for wood is poor, and may, in the long run, contribute to make the investors feel that re-planting is not in their interest. Fires, political unrest, and upheavals are factors that make it hard to guarantee that the activities will be allowed to

continue without obstacles. Another unknown factor is the impact of the monoculture plantations on the ability of the surrounding vegetation to remove and store CO₂. The carbon account is particularly uncertain for Tree Farms' project, which implies the eviction of an estimated 8,000 people who may clear new areas and forests in order to earn a living. All of this may lead to a carbon account that does not reflect reality.

6. Summary and Conclusions

The Norwegian afforestation projects in Uganda aim to give Tree Farms and Norwegian Afforestation Group an income from the sale of wood and timber, and of carbon credits. The two companies has a very different background. Tree Farms is backed by financially strong investors such as Kjell Inge Røkke and Mads Asprem, while Norwegian Afforestation Group has its origins in foreign aid circles in Uganda.

Both companies, however, are casting their projects as environmental friendly: What, after all, could be wrong with planting trees and storing CO₂ in a world that suffers from deforestation and pollution? Nor, perhaps, could anyone be against the companies' expressed intentions, providing employment and development for the Ugandan forestry sectors. And yet, NorWatch investigations show that the projects have some very questionable aspects. This applies particularly to the Tree Farms project.

- Both Tree Farms and Norwegian Afforestation Group have leased their land from the authorities for a bargain price.
- Tree Farms' project cannot be carried out without some 8,000 people, mainly farmers and fishermen, being evicted from the company's areas and thus deprived of their livelihoods.
- Tree Farms is exploiting farmers by using their unpaid labor to clear and prepare the land that is to be planted with forest.
- Due to farmers destroying the planted trees, to termite attacks on the eucalyptus trees, and to a lack of investments, Tree Farms' plantations are criticized for poor quality and a lack of progress.
- While Tree Farms and Norwegian Afforestation Group stand to make large profits from the sale of carbon credits from their tree plantations over the next 25 years, Uganda will be left with a few hundred thousand dollars in return.
- There is great uncertainty as to the net amount of CO₂ that will be removed and stored by the Norwegian tree plantations.

Tree Farms and Norwegian Afforestation Group have already positioned themselves in the hunt for carbon credits. Not until the November 2000 climate negotiations at the Conference of the Parties in The Hague, however, will it be decided whether carbon trading based on tree plantations in developing countries should be approved. If foreign investors are granted such an approval for earning money both from traditional forestry and the sale of carbon credits, countries such as Uganda may experience a Klondyke situation with cut-throat competition between foreign companies for cheap land - at the expense of people and the environment.

It may seem that we are facing a new form of CO₂lonialism.

Carbon Upsets: Norwegian "Carbon Plantations" in Tanzania

By Jorn Stave, NorWatch/ The Future in Our Hands - Norway

1. Introduction

Attempting to combine financial profits and environmental concerns, Norwegian investors are now acquiring huge land areas in the East African country of Tanzania. They are well in the process of planting fast-growing trees that will fix CO₂ from the atmosphere and thus contribute to preventing global climate change. In this way, the forest plantations could offset conventional greenhouse gas emissions, and this may yield a huge income through the sale of emissions credits to polluting industries in Norway and other rich countries. This new and potentially very lucrative market is not yet put in function, but will probably be established as early as this autumn when the parties to the international climate negotiations meet for their sixth conference (COP-6) in The Hague, the Dutch capital.

The Kyoto Protocol was signed in December 1997, and is the first international attempt to limit emissions of greenhouse gases to the atmosphere. However, the Protocol deals not only with emissions of greenhouse gases by sources, but also provides for the inclusion of CO₂ removals by sinks (e.g. forests) in the national carbon budgets. In addition, it is suggested that rich countries with commitments under the agreement shall be given the opportunity to invest in projects that reduce emissions - or increase carbon sequestration in terrestrial sinks - in countries without assignments. This mechanism is meant to introduce cost-effective climate change measures for industrialised countries, but it also requires the projects to contribute to sustainable development in the host country. These principles are the motive behind Tree Farms' investments in East Africa, and they form the point of departure for this report on the company's forestry projects in Tanzania.

Two days after the Kyoto Protocol was signed, Tree Farms - then named Fjordgløtt - arranged a private placement that expanded the company's capitalisation from 990,000 Norwegian kroner (NOK) (USD 112,170) to NOK 13 million (USD 1,5 million). Presumably, this was done in the hope that trade in carbon credits based on the fixation of carbon in forests or plantations in developing countries could give a large extra income from the company's operations in East Africa. Five months later, Tree Farms invited external investors to buy shares, and one third of the new issues were bought by TRG, a company controlled by Norwegian financier Kjell Inge Røkke.

As described in the Kyoto Protocol, the Clean Development Mechanism requires projects to be certified by so-called operational entities, to be designated by the Conference of the Parties. One company that has already initiated this process, and has started verifying carbon budgets for such projects, is the world's largest bureau of certification, the Société Générale de Surveillance (SGS). Tree Farms is now using this company to develop a model for carbon fixation in the plantations in Tanzania. The work is based on calculations of the amount of CO₂ that will eventually be stored in the mature plantations, and measurements of the carbon stock of the existing vegetation cover, which must then be subtracted to give net sequestration. The model takes into account the harvesting rotations by the fact that logged areas are immediately planted with new trees, so that there is a fairly constant carbon stock in the forest plantations at any given time.

Although Tree Farms has reached far in the certification process, the fate of the company's CDM projects depends on another important, but not yet clarified principle of the Kyoto Protocol; the requirement of *additionality*. This implies that, in order to qualify for carbon credits, projects must be additional to any that would occur in the absence of the certified project activity, requiring various scenarios or baselines for emissions and removals of greenhouse gases to be worked out. It is obviously very difficult to objectively establish such a reference or baseline, but in the case of

Tree Farms, the condition will probably be that tree planting operations would not have been conducted if the option of trading CDM-based credits had not existed. If, on the other hand, the company's land parcels would have been afforested regardless of the Clean Development Mechanism, the project cannot yield carbon credits. However, the exact set of regulations and procedures for CDM projects, including how to interpret and implement the additionality principle, has not yet been adopted. That will not happen before the sixth Conference of the Parties to the international climate negotiations (COP-6) in The Hague.

Norwegian and international forestry interests are lobbying strongly for allowing forest plantations in developing countries to yield tradable credits that can be sold to polluting industries in Annex I countries. The race for so-called *carbon profits* has at times made international climate negotiations resemble "trade shows", where "instead of focusing on how to prevent global warming, attendees jostled to get a piece of a lucrative emerging market: trading in pollution credits." For Norway, the establishment of such a market will be of great interest, since it is considered economically unrealistic for the country not to exceed its Kyoto assignment of a one-percent increase in emissions from 1990 to 2008-2012 through domestic measures alone. Recent figures from Norway's Central Bureau of Statistics show that building two new gas-fired power plants would contribute to a 29% increase in greenhouse gas emissions in the commitment period. Access to cheap emissions credits, e.g. from forest plantations in developing countries or clean technology measures in former East Bloc countries, rather than implementing costly emissions reductions for domestic industries, would therefore be of great economic interest to Norway.

At present, however, only Industrikraft Midt-Norge has plans to offset parts of its projected power plant emissions with carbon credits from afforestation projects in developing countries. These plans were confirmed both by Tree Farms and by Industrikraft Midt-Norge after the companies in April informed the Norwegian Foreign Ministry of an options contract on credit trade. Still, NorWatch has information indicating that also other Norwegian companies have shown an interest in Tree Farms' plantation projects in Tanzania.

2. Tree Farms in Tanzania

Tree Farms AS, which was known as Fjordgløtt AS until 1997, has its head office in Namsos, Norway, and was founded by forestry analyst Mads Aspren in 1995. The company has concentrated its operations to East Africa, and after a preliminary study financed by NORAD, the company set itself up in Tanzania and Uganda in 1996, and later in Malawi. Tree Farms executives emphasise that efforts are mainly directed towards Tanzania, where the company has established several subsidiaries. One of these is Escarpment Forestry Company Ltd. (EFC), which is responsible for the afforestation activities.

The trees are planted in three separate areas south of Sao Hill, in the Mufindi and Kilombero Districts (see Figure 2). These areas are located in the Tanzanian highlands at about 2,000 metres above sea level, where precipitation is large but mainly confined to the periods from March-May (the rainy season) and November-December (the short rains). The moist climate makes for favourable growth conditions, and the company has therefore concentrated on the water-intensive and fast-growing species *Pinus patula* (pine) and *Eucalyptus saligna* (eucalyptus). The company also intends to plant some local tree species.

So far, the Tree Farms subsidiary EFC has only planted about 1,700 hectares (ha), but the company is in the process of acquiring far larger areas. Altogether, EFC is negotiating for nearly 90,000 ha of land, and applications are being processed at various levels of the Tanzanian administrative system. According to the company, there are also plans to acquire land parcels for plantations in other parts

of Tanzania. These plans, however, have been suspended indefinitely until the company becomes self-financing and forest-based CDM projects are approved in the international climate negotiations.

3. Land Tenure

In order to acquire ownership rights to the plantation areas, Tree Farms must enter into a land-lease contract with Tanzanian authorities. The agreement is based on fixed national standards, according to which the company commits itself to using the lands solely for forestry activities. The contract is signed for a 99-year period, and throughout this period, the company must pay an annual land rent to the Government. The annual land rent paid to the Tanzanian Government is fixed at USD 1.9 per hectare, and is thus lower than the rent at Tree Farms' project in Uganda.

Yet, the company is pushing the authorities in order to reduce the rent by as much as 50% from the already low present level. Since the regulations and procedures of the Kyoto Protocol are unknown to most of the players in Tanzania, it is very likely that the authorities are missing out on huge gains by letting lands for 99 years at prices far below the expected profits to Tree Farms.

4. Land Use and Land Rights

Tree Farms is acquiring land parcels in three separate areas in southern Tanzania, totalling 87,568 ha. The lands consist of grass-covered savannahs, and are basically uninhabited and little used by the local population. The villages around the project areas have been consulted, and the company's land-lease applications are now pending at various levels of the country's administrative system. The villagers have been promised jobs, health services, education material, and improved road connections. Thus far, Tree Farms has used the local work force to plant about 1,900 ha of eucalyptus and pines, and has constructed new road sections in the plantation areas. The villagers, however, are disappointed that no promises have been met regarding health and education services.

5. Labour Conditions

When Tree Farms started planting in 1996/1997, they did so on a grand scale. In the course of a few planting seasons, the company had afforested some 1,500 ha, and up to 500 workers from the three surrounding villages were given employment opportunities. These were tasked with nursing the trees and planting the tree saplings on the savannahs. Some were also hired to build roads, and others worked as watchmen, responsible for looking after the plantations. The watchmen make sure that no animals stray into the areas, and that the villagers do not harm the juvenile trees. Moreover, guards have been hired to watch for fires and prevent them from spreading towards the plantations. Instead of contract workers, the company employs villagers as casual workers. Since the afforestation activities take place only between December and March, the work cannot replace the traditional dependence on agriculture and animal husbandry. Furthermore, wages are too low for anything besides the daily subsistence. Each worker gets TZS 800 (USD 1.00) a day, which is less than the Government's recommended minimum wage of TZS 835 (USD 1.05). Still, the villagers of Uchindile, Idete, and Mapanda identified a far greater problem than the low wages: Many workers had not been paid at all.

In all three villages, there was widespread disappointment with the company's payment routines. The casual workers are paid according to a daily rate, and are supposed to receive their wages once a month. However, some of the workers that NorWatch was in contact with had as much as eight months of unpaid wages from Tree Farms' subsidiary EFC, while others complained that payments had been irregular and unpredictable ever since the company started its afforestation projects. At the same time, some of the villagers were starting to develop a general distrust towards promises that

the projects would benefit the local communities. This scepticism had also been there initially, before the company informed about its social profile. The chairman of the Mapanda village council put it this way: "When the company arrived, many inhabitants were sceptical about giving away our land areas. But after being told about all the benefits of the project, the village council agreed to cede the lands we were not cultivating."

6. Carbon Profits

The options contract between Tree Farms and Industrikraft Midt-Norge has a carbon credit price of slightly less than NOK 40 (USD 4.5) per ton CO₂. Over a 25-year period, this would give the company a carbon profit of about USD 27 million for the Uchindile forest plantation, whereas the Tanzanian government would be left with USD 565,000 in rent payments. Hence, Tree Farms' expected gains from the trade in carbon credits, is in glaring contrast with the government's revenues from land rent. Furthermore, Tanzania must relinquish the option of using the plantation areas in its own CO₂ budgets when, as is likely, the Kyoto Protocol is expanded to include developing countries in the next commitment period. Tree Farms' lands are thus set aside for storing Norwegian greenhouse gas emissions, and future land conflicts cannot justify the use of the "carbon plantations" to serve other needs.

7. CO₂ Budgets and Environmental Impacts

A number of critics, both among scientists and environmentalists, have been sceptical of the idea that man-made emissions of greenhouse gases are to be offset through the storage of CO₂ in forests and plantations. The objections are based primarily on the scientific uncertainty with regard to the role of vegetation and soils in climate regulation (the complexity of the carbon cycle in forests is illustrated in Fig. 3), but questions have also been raised as to the ecological impacts of tree planting. Several studies have reported nutrient depletion and water deficiency as a result of eucalyptus and pine plantations. Besides, the planting of exotic monocultures leads to local reduction of biodiversity, and hence, conflicts with international aims to preserve the diversity of plants and animals. Based on these general considerations, it is necessary to assess Tree Farms' projects in Tanzania in a broader perspective.

The principle of sustainable development is a precondition for any CDM project, but it is particularly relevant with regard to forest measures, which may potentially affect a number of other environmental concerns. Tree Farms' plantation projects will e.g. cause the lush grass cover to be replaced with monocultures consisting of eucalyptus and pines. This will not just mean a direct reduction in the number of plant species, but will also affect animal life, by removing the diversity of habitats and forage resources. However, it is difficult to predict what actual impacts this may have on local biodiversity, since very few ecological studies have been carried out in this part of Tanzania. The impact assessment for the Uchindile plantation does mention that there are three plant species within Tree Farms' project area that are endangered (two orchids and one *Aloe* species), but as far as NorWatch knows, no conservation measures have been prescribed for these species. Nor are there plans to fund further scientific studies in any of the company's three plantation areas.

In chapter 2, it was pointed out that the Kyoto Protocol requires any net emissions reductions to be additional to any that would occur in the absence of the project activity, and that Tree Farms' position with regard to this presupposition is unclear. This is confirmed by Managing Director Odd Ivar Løvhaugen, who emphasises that the company's investments should not be considered solely as climate measures. Mr. Løvhaugen recalls that Tree Farms set up in Tanzania as long ago as 1996, more than a year before the Kyoto Protocol was signed. The company considers any trade in carbon

credits as an opportunity for additional earnings, but regards conventional forestry its main purpose and source of income. Tree Farms' ambitions for the Tanzanian forestry industry is that it develops in the same way as in Chile and New Zealand, who at present are leading exporters of plantation timber. Hence, Mr. Løvhaugen says that Tree Farms would have invested in the country's forestry sector regardless of the Clean Development Mechanism. The company's management is nevertheless very confident that the tree-planting operations in Tanzania will gain approval as CDM project activities, and they have also received positive indications from SGS consultants.

The Norwegian CDM projects in Tanzania will have a negative impact on local biodiversity, and they represent uncertain carbon sinks. Forest fires are a constant and significant threat, and the plantation areas cannot be guaranteed to remain untouched and uninhabited for all time. Tree Farms' calculations disregard the carbon content of soils and roots, which is probably of great significance to the total carbon budget. It is possible, however, that the company may credit the amount of carbon stored in wood products, even though this appears to be an even more uncertain and unstable storage method than fixation in forest plantations. In that case, emissions from the production of these wood products should also be included in the carbon budget.

8. Summary and Conclusions

This report has shown that Tree Farms' activities in Tanzania in many ways take place under conditions that differ widely from corresponding afforestation projects in Uganda. The villages that surround the company's plantation areas in Tanzania, and who hold ownership rights to the lands, have approved the land-lease applications, and in contrast to the Ugandan project - where some 8,000 people are engaged in agriculture or fisheries within the Tree Farms plantation areas - the land parcels in Tanzania are largely uninhabited and little used by the local population. The rent paid to the government is very low, however, and is in glaring contrast to the expected profits from the trade in carbon credits. Furthermore, the Norwegian company can be reproached for its wage payment practices, which has led to complaints from more than 100 workers of the surrounding villages, who have not received the pay they are entitled to. In addition, the report has presented a number of theoretical considerations about trading in carbon credits based on carbon storage in forest plantations in developing countries.

The exact set of regulations in the Kyoto Protocol has not yet been finally negotiated, and it is therefore difficult to assess Tree Farms' projects in Tanzania with regard to the Clean Development Mechanism. Some important principles, however, are explicitly stated in the Protocol, i. a. that (i) CDM projects must contribute to the ultimate objective of the Convention, which implies that the measures must result in long-term emissions reductions, (ii) the projects are to contribute to sustainable development in the host country, and (iii) emissions reductions must be additional to any that would occur in the absence of the project activity. The present report has argued that Tree Farms' activities in Tanzania can be said to conflict with all these points. It is particularly interesting that the company says the afforestation activities would have taken place regardless of the Kyoto Protocol's Clean Development Mechanism. Is it then defensible for Industrikraft Midt-Norge, which intends to purchase carbon credits from Tree Farms, to be provided the opportunity to increase its emissions by as much as is sequestered in the forest plantations in Tanzania? Or is this project a "loophole" which, instead of contributing to a better climate, implies the establishment of a new and profitable market favouring Norwegian industry and investors?

The debate about global climate change is well suited to illustrate the traditional conflicts between environment and profits, developing and industrialised countries. On the one hand, powerful industrial companies are fighting to establish a market for carbon credits based on temporal and uncertain climate measures. On the other hand are climate experts and the environmental movement, together with those people who will be most severely affected by global climate change.

Which voices carry the most weight will be seen later this year, when the international climate negotiations continue in The Hague. But there is every reason to fear that some parties will say that concerns over the global climate and the world's poor are best addressed through credits trading and afforestation. This report has shown, however, that this is not always - or necessarily - the case. Carbon offsets for some may cause upsets for others.

Global Warming and Monoculture Plantations: A Double Menace to Bangladesh

By Friends of the Earth-Bangladesh

1. Introduction

The industrial revolution has brought material abundance to the people of many nations. Powered primarily by the burning of fossil fuels, it has also brought air pollution on a massive scale and the release of carbon dioxide to the atmosphere at unprecedented rates. We are gradually learning to combat the air pollution, but carbon dioxide is another question. Carbon dioxide is a basic and unalterable result of burning fossil fuels. Our entire strategy of powering society is called into question by the concern that the accumulation of carbon dioxide will cause series of disasters to the earth's climate.

The following describes global climate change's impact on Bangladesh and the adverse effects monoculture plantations of the type which might be used to "mitigate" global warming have had on the country.

2. Global climate change and its impact in Bangladesh

The consequences of a global rise in temperature on Bangladesh are many, depending on the extent of the rise. Most notably, the mean sea level is expected to rise and the local climate is expected to become more severe in nature. These changes are going to have profound impact on the population, environment and economy of Bangladesh. First, sea level rises mean that the country will face an increased risk of flooding over a larger proportion of its area than at present. (Department of Environment, 1997).

Sea level rise will also cause intrusion of salt water that will damage fresh water ecosystems and affect both dry-season and monsoon crops. More frequent storms, cyclones and droughts will increase the intensity and frequency of natural disasters. In 1997, the negotiators of the Kyoto Protocol came up with an ingeniously-named project: the "Clean Development Mechanism". For the lay person, the message was that the governments of the world had finally agreed to create a mechanism that would allow atmospherically non-polluting development. But what this wording hides is anything but clean.

This mechanism is in fact a license to pollute. In Kyoto, industrialized countries committed themselves to reduce greenhouse gas emissions, but they simultaneously invented a way out of those same commitments. The mechanism is simple: instead of cutting emissions at source, they would "compensate for" emissions by implementing projects in other countries.

Some of the possible projects involve forests, tree plantations and soils that would allegedly act as "carbon sinks". Bangladesh has already been pushed by MDBs to take some of these projects -- mainly monoculture plantations -- to "absorb" some of the CO₂ which has been emitted by more developed countries (MDCs) to the atmosphere. Due to its inability to repay its huge debts to the International Monetary Fund, the World Bank and the Asian Development Bank, it seems that Bangladesh has no other option but to accept environmentally damaging forestry projects.

3. History of Commercial Forestry Practice in Bangladesh

In the Indian sub-continent many forests were once considered to be the property of the gods and permission from the local priest was required before one could fell a tree. Such a tradition made the British colonizers, who badly needed hardwood such as teak, impatient during the 18th century

when they consolidated their power in India. The British quest for teak was very determined. Eventually the property of the gods was converted to a commercial product. Demand for hardwood increased many times with increased industrialization. For example, a huge quantity of hardwood was needed for railway sleepers. In defiance of communal ownership of forests, the British expropriated millions of hectares of communally-owned forest. Villagers and indigenous forest communities lost control over trees, lost their homes, saw their medicinal plants taken away and their knowledge reduced to nothing.

Confiscation of forests by British colonialists took place throughout the second half of the nineteenth century. Massive confiscation of forest land by the state took place almost everywhere in South and Southeast Asia (even in uncolonized Thailand). Gradually, the fruits of the Asian forests were transferred to the rich Western countries. The colonizers began the process of confiscation of forest and Western companies consolidated control over the forest.

After the end of the direct colonial era, the developed countries and their local allies wanted to ensure continued supplies of wood from rural areas in Asian countries. They used both the multilateral development banks (MDBs) and various mechanisms such as International Tropical Timber Organization (ITTO), the Tropical Forestry Action Plan (TFAP) Now the Clean Development Mechanism (CDM) is set to allow MDBs and transnational corporations to extract still more wood and wood materials from less-developed countries. Proposed carbon-sink projects under the CDM would menace diversified forests from the most biologically rich countries like Bangladesh and would provide more inducements to this poverty-stricken country to set up monoculture plantations just for the benefits of climate-polluting countries.

4. Monoculture Forestry Practice in Bangladesh

The full extent of the devastation caused by the commercial use of forest land or monoculture forestry in Bangladesh has still not been properly appreciated. In the Chittagong Hill Tracts (CHT) in the southern part of Bangladesh, a remarkable loss of forest resources is attributed to commercial exploitation of immature trees for sale on the black market with the blessing of the Bangladesh Forest Department. The commercial use of forest land for monocultures of rubber and fuelwood have also had a significant negative impact on Bangladesh's environment.

Rubber Monoculture: Commercial forestry, including monocultures of rubber and fuelwood, has been a major cause of deforestation. Rubber plantations began in the Chittagong Hill Tracts on an experimental basis in 1959. In 1969 the Rubber Development Project began on a commercial basis. The government initially wanted to take over 40,000 acres of land for rubber plantations. But by 1988, only 25,000 acres could be brought under rubber plantations.

The Second Development Project for rubber plantations began in the Modhupur Forest area (in the central part of Bangladesh) in 1987. Yet whenever the rubber plantation authorities and the Forest Department tried to take possession of lands used by the local people, conflicts arose. Indeed, many local tribal people became concerned for their tenure on their traditional homelands because of attempts to take over "prescribed" lands for rubber or fuelwood plantations or woodlots. Allegations abounded of attempts by the authorities, some successful, to annex homesteads, croplands and registered lands for rubber plantations. In the end, the plan to bring 15,000 acres under rubber plantations could not be implemented. Only a little over 7,000 acres of forest lands were made available for the plantations.

Cultivation of natural rubber does not have much economic and environmental justification in Bangladesh. When they resumed support for the crop, the authorities claimed that it would be profitable economically and the production would match that of Malaysia. But when Bangladesh

went into rubber production in the Chittagong Hill Tracts and Sylhet (in the northeastern part of Bangladesh) production was much lower than projected.

Rubber plantation, if practiced as monoculture, is ecologically sensitive. On the one hand, rubber has been planted as monoculture in the traditional *sal* (*Shorea robusta*) forest in the Modhupur tract -- although the trees have not been much cared for. The unique biological diversity of the *sal* forest has been severely damaged. Since 1986, when rubber plantation began in the area, *sal* coppices which could have generated natural forest have been clearcut in many places. Until recently, coppices were also cut to make way for commercial fuelwood plantations. During the cutting, stumps were uprooted to be sent to the brick fields, thus destroying any possibility of regeneration of the *sal* forest.

Creation of mixed forest with local varieties instead of monoculture rubber plantations would be more economic and helpful for preserving the environment. Alienation of forest people and other local people from the rubber plantations, together with destruction of natural patches, has jeopardized intimate people-forest relations and antagonized the locals. The volunteers of Friends of the Earth Bangladesh have been able to draw attention of the Asian Development Bank (ADB), a prospective funder for the Second Development Project for Rubber Plantations, to the social and environmental hazards already created through ongoing rubber plantation activities. Consequently, the ADB abandoned the project after an initial survey and analysis.

Teak Monoculture: The teak plantations of the Chittagong Hill Tracts and elsewhere, when planted as a monoculture, are not free from criticism. Despite the fact that teak is a valuable tree, it is criticized for massive soil erosion and sediment pollution of waterways in many parts of Bangladesh. Teak leaves cause an acidic reaction in the soil which inhibits undergrowth. During the rainy season rainfall causes severe erosion of top soil and siltation in the Kaptai Lake. If costs and benefits are analyzed, teak is in no way parallel to the indigenous species.

Woodlot (Fuelwood) Monoculture: Commercial woodlot plantations have been introduced on forest land to meet the fuelwood requirements of local communities. Such plantations are one component of the ADB-funded Nursery Development Project, which was started in 1989 and ended in 1995. Introduction of exotic species through the project's woodlot plantations has been a source of controversy and debate.

Under the US\$48 million dollar project, US\$11.6 million was allocated for woodlot plantations in *sal* forest areas. A total of 16,000 acres of *sal* forest in many different parts of Bangladesh, mainly in the central part of the country, were to be brought under woodlot plantation. Today woodlot blocks can be found in the *Sal* forest of the Modhupur area and elsewhere. Exotic varieties such as eucalyptus have taken the place of naturally-regenerated native trees.

The main criticism of woodlot plantations is that they have threatened the habitat of forest communities such as the Garo people in the Modhupur Forest. Such communities are considered to be illegal squatters on forest land and their rights have been ignored when woodlot plantations are installed.

Severe ecological problems caused by woodlots have also been reported. In many places throughout the *sal* forest, coppices of *sal* trees and other indigenous species were clearcut for the preparation of woodlot blocks. This destroyed the possibility of regeneration of natural forest in many places.

The impact of clearing forests for woodlots and rubber plantations is enormous for wildlife and biodiversity. A rare subspecies of golden langur monkey resides in a limited area of the Modhupur

Forest. Its habitat is threatened both by rubber cultivation and by firewood production through woodlots.

Bangladesh is one of the first signatories of the Convention on Biological Diversity, and has thus committed itself to conserving natural and biological resources. What has been reported from the Modhupur Forest and other forest areas demonstrates that Bangladesh has explicitly violated this commitment.

5. Conclusion

Tree-planting, as it is carried out officially in Bangladesh, is neither a road to economic sustainability nor an effective means of carbon sequestration to stabilize the global temperature, now rising day by day due to rich countries' unscrupulous development actions and plans. The "*carbon-sink*" agenda is a political ploy of Northern countries to keep the concerned world public's eyes off the real problem.