

# **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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# 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 CO<sub>2</sub> 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 CO<sub>2</sub> 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 CO<sub>2</sub> 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 CO<sub>2</sub>. 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.

## 5. References

- Aguilar X. 1996. „Madera del bosque sin cortar árboles“, en : Revista Forestal Centroamericana, No.16, año5, 1996, Catie, C.R.
- Analog Forest Network, 1997. Analog Forestry Manual, Falls Book Center, New Brunswick, Canada, 18pp.
- Asacode. 1995. Los agricultores de ASACODE muestran el camino: El desarrollo forestal social en San Miguel, Costa Rica. Bosques, árboles y comunidades rurales, No 19-20
- Baltodano J. 1999. Reflexiones en torno al tema forestal en los distritos Cutris y Cureña, Cantón de San Carlos: Hacia una propuesta ecologista. Coecoceiba-Amigos de la Tierra, Costa Rica, San José, CR.
- Baltodano J. 1998. „Experiencias en Gestión Local del Pago de Servicios Ambientales“. En : I Congreso regional de Medio Ambiente y Desarrollo Sostenible, Ciudad de Guatemala 17-21 Agosto 1998. Facultad Latinoamericana de Ciencias Sociales, Guatemala.
- Baltodano J. 2000, La plantación forestal como herramienta campesina para la reconstrucción ambiental y la incorporación del árbol como complement dentro de la economía familiar. Coecoceiba- amigos de la Tierra CR, San José, Costa Rica. 7pp )
- Baltodano J., Juanes, C. Y Díaz F. 1999. Tratamiento Silvicultural y Pago de Servicios Ambientales en la Zona Norte de Costa Rica: Una contradicción poco discutida.COECOCEIBA-Amigos de la Tierra, Costa Rica, San José, Costa Rica
- Carranza, C.F.; Aylward, B; Echeverría, J.; Tosi, J. Y Mejías, R. 1996. Valoración de los Servicios Ambientales de los Bosques de Costa Rica. MINAE. San José, Costa Rica

Movimiento Mundial por los Bosques 1999. Campaña Plantaciones: Plantaciones de pulpa de papel, un problema creciente. Instituto Tercer Mundo, Jacson 1136, Montevideo Uruguay, 31pp)

Carrere R. Y Lohmann L. 1996. El Papel del Sur, Plantaciones Forestales en la Estrategia Papelera Internacional . Red mexicana de acción frente al libre Comercio (RMALC) e Instituto tercer Mundo. México DF 282pp.

Castro E. 1999. Plantaciones de Monocultivos Forestales en la Zona Norte, Una Revisión Bibliográfica. Coecoceiba-Amigos de la Tierra, Costa Rica, San José, CR,57pp

Lohmann L. 2000. El Mercado del carbono: sembrando mas problemas. Documento Informativo, Campaña de Plantaciones, Movimiento Mundial por los Bosques, Montevideo Uruguay, 31 pp

Marchack M.P.,1999 Logging the globe. Mc Gill University press, Montreal, Canada 404pp

Movimiento Mundial por los Bosques 1999. Campaña Plantaciones: Plantaciones de pulpa de papel, un problema creciente. Instituto Tercer Mundo, Jacson 1136, Montevideo Uruguay, 31pp)

Pancel L. 1993. Tropical Forestry Handbook, Springel-Verlag, Berlin, Germany 809pp

Pasos, R. 1994. El último despale. Proyecto Frontera agrícola Centroamericana. San José, Costa Rica

Real Academia Española 1992. Diccionario de la Lengua Española, XXI Edición. Editorial Espasa-Calpe.SA, Madrid, España 1513pp.

Sánchez, J.A.,1999, Experiencias en reforestación con especies nativas, con especial atención a la Región Huetar Norte de Costa Rica, Proyecto Río San Juan- Amigos de la Tierra, Miméografo, Upala, C:R.

Solís V. 1999. Algunas consideraciones en torno a las plantaciones forestales y el bosque secundario en la Zona Norte. En: Anexo 2. Memoria Seminario Taller: Situación actual y perspectivas de las plantaciones forestales y bosques secundarios en la Región Huetar Norte, Octubre 1999. Area de Conservación Arenal-Huetar Norte, MINAE.

Van den Hombergh H. 1999. Guerreros del Golfo Dulce, pag 42. DEI, Colección Universitaria, San José, Costa Rica, 339pp

Watson V., Cervantes S., Castro C., Mora L., Solís M., Porras I., Cornejo B. 1998. Abriendo espacio para una mejor actividad forestal. Políticas exitosas para bosques y gentes. Ed . San José, C.R. Centro Científico Tropical, 136 p.

# **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 CO<sub>2</sub> 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 CO<sub>2</sub> 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 CO<sub>2</sub>-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 CO<sub>2</sub>. 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 CO<sub>2</sub>.
- 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.

## Bibliography

- Acción Ecológica 2000a „Los madereros han encontrado dos formas de enriquecimiento: La nueva ley forestal y el mecanismo de desarrollo limpio“. *Alerta Verde* (Boletín de Acción Ecológica). No. 89, abril.
- Acción Ecológica 2000b „Posición de Acción Ecológica frente a la Ley Trole 2“. *Alerta Verde* (Boletín de Acción Ecológica). No. 95, agosto.
- El Comercio 1999, „Los pinos secan el suelo y dañan el páramo“. 2 de noviembre, Quito.
- El Comercio 2000, „Ecuador tiene una mina en sus bosques“. 25 de marzo, Quito.
- El Comercio 2000, „La captura de CO2 puede ser un excelente negocio“. 22 de junio Quito.
- Hofstede, R, 1997, „El impacto ambiental de las plantaciones de Pinus en la sierra del Ecuador“. Resultado de una investigación comparativa. Proyecto ECOPAR. Universidad de Ámsterdam, Ámsterdam.
- Vidal i Oltra, V.1999, „La aplicación de políticas sobre cambio climático en el sector forestal del Ecuador“. Universidad Autónoma de Barcelona. Bellaterra.

# **Tree plantations and Carbon sequestration: A case study on Australia**

*By Leonie van der Maesen,*

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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 km<sup>2</sup> 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/Kooparooka 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.

#### **4. References:**

- Cadman, T., 2000: *Preliminary Submission on the Development of an Australian Forestry Standard*.
- A. Graham and Rod Knight, 1998: Regional Forest Agreements, Lessons from Tasmania. In: *Wilderness News* Issue No. 150, p. 6-8.
- Maesen, L.vd. 1999: *A Study in Forest Activities; Industrial Logging Companies and NGOs 2nd Draft*.
- Reynolds, A., 2000: „Buying time as gases climb.“ CANA - ABC Report: e-mail.

# **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 gases, 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.

## **References**

- Sobrevivencia – Informe del Taller Nacional sobre las Causas Subyacentes de la Deforestación y la degradación de los Bosques – Sobrevivencia, Dirección de Parques Nacionales y Vida Silvestre, Programa de la Naciones Unidas para el Medio Ambiente, 2.000.
- ENAPRENA - PROAGRO, Diagnostico del Sector Forestal Paraguayo - - Estrategia Nacional para la Protección de los Recursos Naturales, 1995.
- Forestal Yguazu, Trabajar con la Naturaleza Produce Beneficios – Forestal Yguazu S.A. Shell Renewables Inc., 1.999.
- Idem ant.

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

*By Otto Miettinen and Harri Lammi, Friends of the Earth-Finland  
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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 crassiparpa*, 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 crassiparpa* 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).

## Sources

Magazines and press releases of APRIL, Down to Earth (DTE), Helsingin Sanomat, Paper Maker, Pulp and Paper International (PPI), Stora Enso, UPM-Kymmene (UPM)  
APRIL 1997, meeting with the company representatives in Helsinki, 17 Dec 1997.  
Djuweng, Stepanus, personal communication, September 1999.  
International Union for the Conservation of Nature (IUCN) 1991: The Conservation Atlas of Tropical Forests, Asia and the Pacific. London and Basingstoke. MacMillan Press.  
Lounela, Anu. Personal communication 3.9.00. Based on field work in Sanggau in 1999.  
Lounela, Anu & Topatimasang, Roem 2000 (eds.): Kuka vie kalat verkosta? Paikallisyhtiöiden oikeudet luonnonvaroihin Indonesiassa. Helsinki. Visio.

Munoz, C., presentation on behalf of APRIL in a seminar on the globalisation of the forest industry, Helsinki, 3 November 1999.

Neilson & Fenton 1998: The Forest Industry Sectors of Malaysia and Indonesia - The Reality? DANA Publications. New Zealand. Cited from <http://www2.wave.co.nz/~dana/malay/malaybroch.htm>

Otsamo, A. (Stora Enso) 1998 in the book Tropiikin vihreäkulta. Pohjolan pojat Kaakkois-Aasian sademetsissä. Eds. Sari Kuvaja, Marko Ulvila, Thomas Wallgren. Helsinki. Like.

Otsamo, Antti (Stora Enso) 6.3.2000. Letter to Anu Lounela.

Societe General de Surveillance Forestry (SGS): PT Riau Andalan Pulp & Paper Forest Management Audit Report, published 23 April 1998.

World Resources Institute (WRI) 1997: The Last Frontier Forests: Ecosystems & Economies on the Edge. Washington DC. WRI.

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

*By César Sepúlveda V. and Hernán Verscheure S. (ed.), Forest Program, Comité Nacional Pro-Defensa de la Fauna y Flora (CODEFF)/ Friends of the Earth-Chile*

### **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.

<b>Zone</b>	<b>Common name</b>	<b>Local name</b>	<b>Scientific name</b>	<b>Total area planted (Ha)</b>
<b>FOREST ZONE</b>	Dibetou	Bibolo	Lovoa Trichilioides	N.A
	Okoumé	Okumé, Angouma	Ancoumea klaineana	5882
	Ilomba	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
	<b>SUB TOTAL</b>			
<b>Savannah Zone</b>	Eucalyptus		Eucalyptus Spp	
	Neem		Azadirachta indica	
	Acacia		Acacia spp	
	Cassia		Cassia spp	
	Dalbergia			
<b>TOTAL</b>				<b>15 000 Ha</b>

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**

#### **4. 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

#### **References**

- Ndjatsana, Michel, 1993: Etude sur le gestion des forêts camerounaises (rapport)
- Carrere, Ricardo, 1999: Ten replies to ten lies; Plantation campaign, WRM
- Mbeu, Bille, 1999: La régénération aux oubliettes; Bubinga n° 25 p. 7
- Mouvement Mondial pour les Forêts Tropicales, 1999: Les plantations de bois à pâtes: un problème croissant
- FAO, 1987: Boisement en milieu rural; Etude n°64
- ONADEF, 2000: Rapport d'activités du centre de Maroua
- ONADEF, 2000: Rapport d'activités 1999/2000 du centre de Mbalmayo

## **Tree Plantations and Forests in Colombia**

*By Hildebrando Velez, Censat Agua Viva/ Friends of the Earth-Colombia*

### **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 CO<sub>2</sub> 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  
and Ivona Matjková, Department of Biology, South Bohemia University*

### **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:

<b><u>Species</u></b>	<b><u>Original</u></b>	<b><u>Today</u></b>
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
<b>Total Conifers</b>	<b>34.4</b>	<b>77.6</b>

<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
<b>Total Broadleaf</b>	<b>65.6</b>	<b>22.4</b>

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.

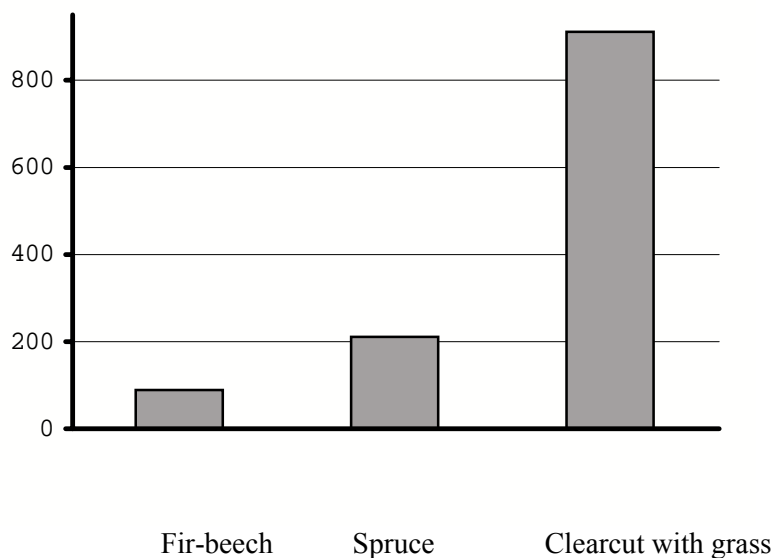
The inner structure of forests is significantly changed by the growth of spruce monocultures. The forest structure in a monoculture contains an artificially high stand density, trees all of the same age and species, and results in closure of the tree canopy. The vertical diversity is minimized (lower 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.

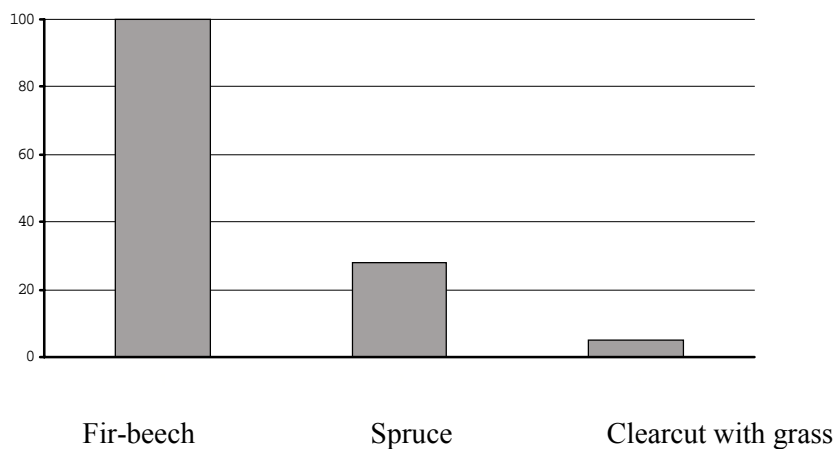
Because all the wood material is exported the forests forego the period of decomposition which is an irreplaceable source of biodiversity. Clearcuts completely change the character of vegetation, as the clearings (paseka) are soon covered by light-loving species like the red elderberry (*Sambucus racemosa*), 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 Trojmezná and Tístolínik:**

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%	-
<b>Total Conifers</b>	<b>95,4%</b>	<b>72,6%</b>

<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%
<b>Total Broadleaf</b>	<b>12,6%</b>	<b>27,4%</b>

#### 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 Šumava 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 year 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 Sumava 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.

## **Literature**

- Bláha J., Višák R., Forest: Natural or Artificial, Friends of the Earth Czech Republic 1999
- Buek A., Projected Evolution of Forest Vegetation, Mendel University of Agriculture and Forestry University Brno 1997
- Dostál J., New Flowers of Czechoslovakia, Prague Academy 1989
- Hladilin V., Care of Forest Ecosystems in Sumava National Park, doctoral dissertation. Department of Forestry CZU Prague 1999
- Košál L., personal communication
- Luká J., Analysis of Flood Situation in the Malej Svinky River Basin, Friends of the Earth Slovakia, 1998
- Lukac J., Let's Refill the Springs, Wolf Forest Protection Movement 1996
- Maser Ch., The Redesigned Forest. R.Miles, San Pedro 1988
- Míchal I., Petíek V., Care of Protected Areas, AOPK, Praha 1999
- Rejl J., Kopecka V., Bucek A.: Modeling of Possible Consequences of Global Climate Change on the Czech Republic, AOPK Praha 1997
- Úlehla V., Let's Refill the Spring, Life and Work, Prague 1947
- Višák R., Forest in the Midnight Hour, Abies Prešov, sent to publisher
- Report on the State of Forests and Forestry in the Czech Republic, Ministry of Agriculture 1999 and 2000