

## Program for Forests and Wood Environment Assessment

Contract Number 527-C-00-01-00091-00  
Colombia Alternative Development Project



Chemonics International Inc.  
1133 20<sup>th</sup> Street, NW  
Washington, DC 20036  
Telephone (202) 955-3300  
Fax: (202) 955-7540

## EXECUTIVE SUMMARY

### Introduction

The report evaluates the potential environmental impacts of and proposes mitigative measures for the “Forests and Woods Program”, financed by USAID under the Colombia Alternative Development Program. The objective of this program is to make forest management and wood processing an economic alternative to the illicit cultivation and processing of illicit crops.

### Significant Issues

- Plantations of exotic species may decrease biodiversity and change ecosystem functions.
- Mechanized logging and wood processing operations may create health and safety risks.
- Mechanized logging in lowland tropical forest could cause negative impacts on biological diversity and ecosystem functions.
- The introduction of more efficient sawmills may stimulate degradation and elimination of tropical forest.
- Improved marketing of wood products may increase demand for wood from tropical forests, thus stimulating additional forest degradation and deforestation.
- Mechanized logging requires the construction of access roads that could accelerate colonization in natural tropical forest.
- Forest management and wood processing may accentuate conflict within and between social groups over the distribution of the financial benefits from utilization of natural forest and tree plantations.

### Alternatives

- Alternative A: “Forests and Wood Program” – improvements to the “chain-of-production” (forest management-logging-processing-marketing).
- Alternative B: Tree plantations
- Alternative C: No Action

Recommended Alternative: Alternative A – “Forests and Wood Program”

### Mitigation Measures

- Develop and implement site specific management plans for all natural, secondary and plantation management and establishment activities according to Colombia-specific Forestry Stewardship Council (FSC) approved standards.

- Management plans should clearly incorporate and address the mitigative measures proposed in this EIA, as follow.
- Select plantation sites to avoid elimination of natural vegetation that is important for the conservation of floral or faunal biodiversity or ecosystem functions.
- Test native species in experimental plantations.
- Limit plantation size to a maximum of about 100 ha
- Provide comprehensive safety and health programs concurrently with the introduction and operation of new types of logging and wood processing equipment.
- Include environmental impacts within the selection criteria for mechanized logging equipment to be purchased as part of the program.
- Coordinate extraction and sale of logs from managed natural forests and plantations with the installation and operation of improved sawmills.
- Assure control over the forest management unit before construction of forest access roads.
- Design and implement an applied research and monitoring component as part of the proposed silvicultural actions.
- Include analysis and management of social conflict in the design and implementation of all proposed activities.

## CHAPTER I

### INTRODUCTION

This report evaluates the potential impacts on the environment of and proposes mitigative measures for the “Forests and Woods Program”, financed by USAID under the Colombia Alternative Development Program.

Chapter I establishes the background for the Environmental Assessment. It describes the scoping process utilized to identify the issues to be addressed in the environmental assessment, specifies the underlying purpose and need to which USAID is responding, describes the methodology utilized for the environmental assessment and states the limitations encountered in preparing the assessment.

#### Purpose of the Proposed Action

USAID/Colombia Strategic Objective 2 is “Promote economic and social alternatives to the production of illicit crops”. Component 4 of this Strategic Objective 2 is “Natural Resources and Environmental Management”. The “Program for Forests and Wood”, one of the activities under this component, has the objective of making forest management and wood processing competitive economic and socially acceptable alternatives to the cultivation of coca and poppy for the production of illicit drugs.

#### Scoping Process

The scoping process for the identification of potential environmental issues was undertaken as part of the preparation of this environmental assessment. This process involved review of documents describing the “Forests and Woods Program”, study of documents on the forestry and environmental situation in the areas where the “Forests and Woods Program” proposes to undertake activities and interviews with staff of CONIF (National Corporation for Forestry Research and Development) and USAID.

The scoping process identified a number of potential environmental issues associated with the classes of actions proposed under the “Forests and Wood Program”. Issues that were judged to be minor in their negative impact on the environment, unrelated to the proposed actions, or already adequately addressed in the approved design considerations were classified as “Non-Significant Issues” and were eliminated from further consideration in the environmental assessment. The scope of the environmental assessment was thus narrowed to those that were determined to be “Significant Issues”, based on the magnitude of their potential negative effects on the environment, on their connection to the proposed actions, or on the need for the activity design to address them more fully.

#### Non-significant Issues

Issue Statement: Subsidies for plantations, management & agroforestry may be diverted to other use that negatively impact tropical forests such as coca planting or pasture formation.

Rationale for Elimination: USAID funds will be used to pay for only cover the actual costs of plantation establishment and payment will be made only once the completion of the work has been verified. It will not, therefore, be possible for funds to be diverted to other than intended uses.

Issue Statement: Forest management may destroy or degrade archeological sites.

Rationale for Elimination: The “Forests and Woods Program” will promote the preparation of forest management plans and the orderly utilization of forest resources, according to relevant national laws and regulations. It will, therefore, promote the protection of archeological sites, not their destruction or degradation.

Issue Statement: Forest management operations may negatively affect protected areas, such as national parks.

Rationale for Elimination: Under the “Forests and Wood Program” forest management operations will not take place in or adjoining protected areas. Production of forest products from managed natural forests and tree plantations will reduce pressure to extract these products from protected areas.

### Significant Issues

The scoping process identified the following significant issues.

#### *Exotic tree plantations*

Issue Statement: Plantations of exotic species may decrease biodiversity and change ecosystem functions.

Source: USAID/Colombia

#### *Safety and Health*

Issue Statement: Mechanized logging and wood processing operations may create health and safety risks.

Source: Chemonics technical team

#### *Mechanized Logging*

Issue Statement: Mechanized logging in lowland tropical forest could cause negative impacts on biological diversity and ecosystem functions.

Source: Chemonics technical team

#### *Sawmills*

Issue Statement: The introduction of more efficient sawmills may stimulate degradation and elimination of tropical forest.

Source: EA team

#### *Marketing of Wood Products*

Issue Statement: Improved marketing of wood products may increase demand for wood from tropical forests, thus stimulating additional forest degradation and deforestation.

Source: EA Team

#### *Access Roads*

Issue Statement: Mechanized logging requires the construction of access roads that could accelerate colonization in natural tropical forest.

Source: EA team

#### *Social Conflict*

Issue Statement: Forest management may accentuate conflict within and between social groups over the distribution of the financial benefits from utilization of natural forest and tree plantations.

Source: EA Team

#### Limitations of the Study

Because of the danger involved in field travel in the sites of the proposed activities, due to terrorist activity, the environmental assessment was prepared without visits to the proposed field sites. It was not possible, therefore, to make first-hand observations of the environment which the proposed actions could affect. Nor was it possible to interview the inhabitants in and around the sites of the proposed activities to obtain their viewpoint on potential impacts. These restrictions limited range of the scoping process.

The Operative Plan for the “Forests and Wood Program” contains the only a consolidated, brief description of the proposed activities. This document, moreover, covers only the first year of the program in any detail. The description of the type and location of activities in subsequent years is only preliminary, thus making site specific recommendations impossible.

The environmental assessment does, however, discuss the categories of environmental issues that should be considered as the “Forests and Woods Program” is implemented. Thus, although the “Forests and Woods Program” may operate in other locations, it is unlikely to finance categories of actions that are not discussed in this Environmental Assessment. The mitigation measures recommended by this Environmental Assessment should, therefore, be applicable to actions that the “Forests and Woods Program” may undertake in other parts of Colombia. Crucial to this process will be the development of site specific management plans based on Colombia-specific FSC approved standards.

## CHAPTER II

### ALTERNATIVES

Chapter II first identifies alternatives that were eliminated from detailed consideration, stating the rationale for doing so. It then describes briefly the “Proposed”, “Reasonable” and “No Action” alternatives. Next the chapter presents the environmental impacts of the proposal and its alternatives in comparative form, sharpening the issues and providing a clear basis for choice

between the alternatives. The chapter then identifies a recommended alternative. Finally the chapter lists the recommended mitigation measures.

#### Alternatives Eliminated from Analysis

##### *Summary Description*

A program focused entirely on marketing of forest products.

##### *Rational for Elimination*

A program based entirely on marketing of forest products would fail to address the problems that could limit production of wood and wood products, negating the marketing efforts.

##### *Summary Description*

A program focused entirely on production of forest products.

##### *Rational for Elimination*

Good prices and stable demand provide the stimulus for production of forest products. A program focused entirely on production of forest products would not improve prices or stabilize market demand. It would fail, therefore, to provide the necessary conditions for stimulating production of forest products.

#### Alternatives Included in Analysis

##### *Alternative A: Proposed Alternative – Forests and Wood Program*

Alternative A, the Proposed Alternative, would undertake the actions described in the document “Forests and Wood Program Operative Plan”.<sup>1</sup> The “Forests and Wood Program” involves efforts to improve the “chain-of-production” for wood products, including plantations of native and exotic trees, management of natural forests, agroforestry, improvement of wood processing operations (sawmills and secondary processing) and marketing of wood products. The achievement of independent voluntary certification will be a focus of the natural forest management, plantation establishment and management, and wood processing activities.

During its first year, the program will focus on sites in the lowlands of Putumayo and Nariño Departments and the highlands of Nariño and Cauca Departments. The approximate location of these sites is indicated on Maps 1, 2 and 3. In subsequent years the program may expand to include sites in other departments. The Operative Plan for the “Forests and Wood Program” does not clearly indicate the magnitude of the proposed actions. It does not, for example, indicate precisely how many hectares will be placed under management or planted with trees.<sup>2</sup>

The National Corporation for Forestry Research and Development (CONIF) will implement the Program for Forests and Wood. Founded in 1974, CONIF as a mixed public/private sector

---

<sup>1</sup> CONIF, 2002

<sup>2</sup> The difficult situation in Colombia for carrying out field activities makes it very difficult to predict the magnitude of the proposed actions. For this reason, the Operating Plan describes categories of actions but does not give much detail about the proposed magnitude of these actions.

institution is now an entirely private institution thus having more administrative autonomy and flexibility than a typical government institution. CONIF carries out field research and extension activities and publishes high-quality technical publications.

*Alternative B: Reasonable Alternative – Tree Plantations*

Alternative B, the Reasonable Alternative, would finance the establishment of pure plantations of high-value, fast-growing, commercial tree species, some of them exotic to Colombia. This alternative has been financed previously in Colombia by such institutions as the World Bank and the Inter-American Development Bank and so represents a typical, standard reasonable alternative to the Proposed Action.

*Alternative C: No Action Alternative*

Alternative C, the No Action Alternative, would not utilize USAID funds to finance any actions to achieve the purposes stated in the Proposed Alternative. Note that this does not mean that actions, such as logging in primary tropical forest, would not occur, or that environmental impacts would not result from these actions, but only that USAID funds would not be utilized in financing such actions. Table 1 summarizes the categories of actions financed by USAID under the proposed, reasonable and no-action alternatives.

TABLE 1. Proposed categories of actions under proposed and reasonable alternatives

Category of Action Financed by USAID Funds	Alternatives for Use of USAID funds		
	Proposed (Chain-of-Production)	Reasonable (Tree plantation, management & harvesting)	No Action
Tree plantations	√	√	X
Management plan preparation	√	X	X
Silvicultural operations	√	X	X
Harvesting operations	√	X	X
Wood product development	√	X	X
Wood product marketing	√	X	X
Voluntary certification	√	X	X

Summary of Environmental Impacts

Table 1 presents the environmental impacts of the proposal and its alternatives in comparative form.

TABLE 1. Summary of comparative environmental impacts of alternatives

Significant Issue	Environmental Impacts of Alternatives		
	A: Forests & Wood Program	B: Tree Plantations	C: No Action
<b>Exotic tree plantations</b>	<b>Positive</b> Limited expansion of tree plantations; native species emphasis	<b>Negative</b> Expansion of tree plantations beyond management capacity; emphasis on exotic species replaces native with exotic species.	<b>Negative</b> Deterioration of existing tree plantations & disincentives for additional plantations.
<b>Safety and Health</b>	<b>Positive</b> Reduction in hazardous	<b>Negative</b> Continued hazardous and	<b>Negative</b> Continued hazardous and

	and unhealthy working conditions	unhealthy working conditions	unhealthy working conditions
<b>Mechanized Logging</b>	<b>Positive</b> Use of efficient harvesting techniques that reduce or eliminate damage to soil and remaining forests.	<b>Negative</b> Continued forest exploitation utilizing wasteful extraction techniques that damage remaining forests.	<b>Negative</b> Continued forest exploitation utilizing wasteful extraction techniques that degrade remaining forest.
<b>Sawmills</b>	<b>Positive</b> Increased efficiency in wood processing will increase residual value of standing timber and reduce demands on tropical forests	<b>Negative</b> Continued wasteful log processing with chainsaws does not raise residual value of standing timber or reduce demands on forest.	<b>Negative</b> Continued wasteful log processing with chainsaws does not raise residual value of standing timber or reduce demands on forest.
<b>Colonization</b>	<b>Positive</b> Control over forest areas prevents spontaneous colonization	<b>Negative</b> Continued spontaneous colonization & forest clearing	<b>Negative</b> Continued spontaneous colonization & forest clearing
<b>Forest management operations</b>	<b>Positive</b> Incentives for maintenance of forest cover and introduction of organized forest management conserves forest cover and therefore biodiversity.	<b>Negative</b> Reduced incentive for conservation of natural forest; increase in area of exotic tree plantations.	<b>Negative</b> Continued degradation and elimination of natural forest resources with associated biodiversity.
<b>Social Conflict</b>	<b>Positive</b> Planned forest management reduces conflict over forest uses between social groups and increases social benefits.	<b>Negative</b> Continued potential for conflict over use of forest resources & no increase in social benefits from forest.	<b>Negative</b> Continued potential for conflict over use of forest resources & no increase in social benefits from forest.

### Recommendation

This Environmental Assessment recommends the Proposed Alternative, the “Forests and Wood Program”.

### Mitigation Measures

- Develop and implement site specific management plans for all natural, secondary and plantation management and establishment activities according to Colombia-specific Forestry Stewardship Council (FSC) approved standards
- Management plans should clearly incorporate and address the mitigative measures proposed in this EIA, as follows.
- Evaluate environmental impacts as part of plantation planning.
- Select plantation sites to avoid elimination of natural vegetation that is important for the conservation of floral or faunal biodiversity or ecosystem functions.
- Test native species in experimental plantations.
- Limit plantation size to a maximum of about 100 ha
- Provide comprehensive safety and health training programs concurrently with the introduction and operation of new types of logging and wood processing equipment.
- Include environmental impacts within the selection criteria for mechanized logging equipment to be purchased as part of the program.
- Coordinate extraction and sale of logs from managed natural forests and plantations with the installation and operation of improved sawmills.

- Assure control over the forest management unit before construction of forest access roads.
- Design and implement a research and monitoring component to accompany the proposed silvicultural actions.
- Include analysis and management of social conflict in the design and implementation of all proposed activities.

### CHAPTER III AFFECTED ENVIRONMENT

This chapter succinctly describes the environment of the areas to be affected by the alternatives under consideration. The description is organized by the two geographic areas in which the Forests and Wood Program proposes to operate during its first year: the Eastern Tropical Lowlands (Putumayo Department) and the Highlands (Cauca and Nariño Departments). Other areas such as the costal plains of Cauca and Nariño and the highlands of Tolima and Huila may enter into the program in years 2-4.

#### Eastern Tropical Lowlands (Putumayo Department)<sup>3</sup>

In Putumayo, the sites of proposed actions would take place in the municipalities of Puerto Asis, Puerto Caicedo, Orito, Villa Garzón and the eastern areas of Puerto Guzman.

These municipalities include parts of the piedmont of the Andes and the valleys of the San Miguel, Putumayo and Mecaya Rivers. Elevations range from 260 to 450 masl.<sup>4</sup> Rainfall averages between 2000 and 4000 mm per year, with a drier season from December through February. The two principal types of soil are alluvial and non-alluvial. Both are generally not fertile and are often poorly drained. Large areas of soils suitable for permanent agriculture occur, however, in the Valle de Guamuez.<sup>5</sup>

The natural vegetation of most of the area is mostly humid and very humid tropical forest, with some areas of natural grassland. The original forest had a highly diverse flora and fauna, containing, for example, more than 400 species of trees with potential for wood production or other commercial uses,<sup>6</sup>

Large areas in these municipalities have been converted from natural forest to pasture and agriculture (including about 50,000 ha of coca production). Some of these areas have since been abandoned, as their soil's physical and chemical properties deteriorated, making livestock and agricultural production unprofitable. Over a million ha of primary or fragmented primary forest, however, still occur.

The total population of Putumayo is about 247,000. The indigenous peoples, numbering about 23,000, belong to the Awa, Cofan, Embera, Inga, Kamsa, Koreguaje, Muinane, Paez, Siona and Witoto groups. They own as common property (resguardos<sup>7</sup>) totaling an area of about 138,000 ha in 30 territories.

---

<sup>3</sup> Summarized from Instituto de Hidrologia, Meteorología y Estudios Ambientales (IDEAM), 2000.

<sup>4</sup> Meters above sea level

<sup>5</sup> Based on soil classification prepared by the Instituto Geografico Agustin Codazzi, 2002.

<sup>6</sup> IDEAM, Section 4.3

The remaining population is colonists or descendents of colonists. Colonization began in the 1930's around Mocoa, Puerto Caicedo and Puerto Asis and has spread from there to most of the remainder of eastern Putumayo. The present front of colonization is to the northeast and northwest of Puerto Caicedo and to the east of Puerto Guzman.

The economy of Putumayo has been based on wood extraction, agriculture, livestock, and petroleum. The largest source of income during the last decades, has been illicit coca production. Between 1992 and 2002 wood exported from the department fell from over 120,000 m<sup>3</sup> to less than 14,000 m<sup>3</sup>.<sup>7</sup>

### Highlands (Nariño & Cauca Departments)

The Operative Plan specifies that in the highlands of Cauca Department, the sites for the proposed actions would be in the municipalities of El Tambo, Popayan, Cajibío, Silvia, Timbio, Sotara, Totoro, Toribio and Jambalo.<sup>8</sup> The Operative Plan does not specify the sites and municipalities in Nariño Department.

The highlands of Nariño and Cauca Departments are dominated by the two Cordilleras of the Andes running north-south and the associated river valleys, including those of the Magdalena and the Cauca. Elevation is the main determinant of site conditions in the highlands, which are generally considered to begin at about 1000 masl and go up to over 4000 masl.

There are two dry seasons, one in January and February and the other from July through September. Average annual rainfall is from 500 to 1000 mm to the south of Pasto and higher to the north of Pasto. Rainfall in the highlands of Cauca Department in most areas is above 1,400 mm, except for in the Patía Valley.

The natural vegetation of the highlands of Cauca and Nariño Departments was various types of natural forest. These include the "subandean forest" between 1000 and 2000 masl, the "andean forest", between 2000 and 3000 masl and the "high Andean forest" between 3000 and 3800 masl. Above that elevation the natural vegetation was "paramo" grasslands and low shrubs and bushes. Very few areas of the highlands have remained entirely uninfluenced by human actions and almost all the natural forest above 1000 masl or so has now been converted to agricultural or pasture use. Much of the high grasslands (paramo), affected for centuries by human induced and natural fires, has now also been placed under cultivation or is used for pasture.

The highlands of Cauca and Nariño Departments are, in general, heavily populated, with both indigenous and "meztizo" peoples. In Cauca the largest indigenous groups are the Guambianos and Paeces. Indigenous groups have title to 164,412 ha in 10 "resguardos". In Nariño there are 22 indigenous "resguardos" with a total area of 206,822 ha. In Nariño there are 7 national parks with a total area of 546,000 ha and in Cauca Department there are 7 national parks with a total area of 397,587 ha.<sup>9</sup>

CONIF has mapped areas suitable for reforestation in Cauca and Nariño Departments, based on soil, climate and land use. The total area appropriate for reforestation in Cauca Department is 89,000 ha and in Nariño Department is 516,000 ha.<sup>10</sup>

---

<sup>7</sup> Gonzalez, J.F., 2002, 15

<sup>8</sup> CONIF, 2002, 7

<sup>9</sup> CONIF(1), 1999, 5-10 & CONIF (2), 9-13

<sup>10</sup> CONIF (1 & 2), 1998

The economy of the highlands of Cauca and Nariño Departments is based almost entirely on agriculture and livestock.

## CHAPTER IV

### ENVIRONMENTAL CONSEQUENCES

This chapter forms the analytic basis for the comparisons of the environmental consequences of the three alternatives that are summarized in Chapter 2. The analysis compares the impact of each of the three alternatives on the issues that were identified as significant during the scoping process. Based on the analysis, this chapter recommends mitigation measures to accompany the recommended alternative (Alternative A: Proposed Alternative).

#### Exotic tree plantations

##### *Issue Statement*

Tree plantations, especially those utilizing exotic species, could affect natural floral and faunal diversity, change ecosystem functions, and increase the threat of pest infestations.

##### *Discussion*<sup>14</sup>

Plantations of exotic tree species offer the advantages of rapid growth, availability of genetically improved seed, and well-known technical characteristics. The wood from these species also tends to have wide acceptance in national and international markets. Plantations are usually established in blocks on accessible sites. Plantation wood, therefore, generally has uniform characteristics and low extraction costs. Plantations also provide non-commercial products and services, such as firewood for local use, protection of the quality and quantity of water, protection of soil from erosion, and provision of habitat for plants and animals. Plantations may provide a source of employment, either in the plantations themselves or in wood industries. Wood from fast growing tree plantations may replace wood from natural forests and thus reduce the pressure to cut natural forests for their wood. Plantations may also reestablish the conditions for the return of natural flora and fauna.<sup>15</sup>

Tree plantations, however, also can cause negative environmental impacts. Sometimes the most serious is the replacement of natural forest by plantations of exotic species. The consequent negative impacts include the loss of the natural vegetation, increased soil erosion, changes in the water cycle, soil compaction, and loss of soil fertility. The negative impacts of tree plantations resemble those of agricultural crops: reduced soil fertility and soil erosion. In areas with a dry season tree plantations may increase the hazard of fire, since they are a uniform mass of inflammable material. Some species of exotic trees, including eucalyptus, may on some sites have allopathic interactions with natural vegetation, reducing the ability of native species to

---

<sup>14</sup> Summarized from Banco Mundial, 1991, pp. 81-87

<sup>15</sup> CONIF, 1998

regenerate. Plantations of exotic species also may be less resistant than native vegetation to wind, insects or diseases, thus becoming focuses for diseases and insect infestations.

In some cases the replacement of natural vegetation by plantations of exotic species may also cause negative social impacts. For example, plantation establishment and management may require the importation of laborers with different cultures. Plantations may also occupy land that has previously been used for grazing or eliminate forests that provided food, medicines or materials free to local people.

### *Comparison of Alternatives*

Alternative A's highland and lowland plantations will not replace natural forest but will occupy degraded sites where natural forest no longer grows. In the highlands, the plantations will serve the purpose of complementing the production of wood and non-wood products from the pine and eucalyptus plantations that the indigenous communities already have established. The indigenous communities will then be better placed to produce approximately the same volume of wood each year, and thus receive a more stable income from the plantations. Additionally, the production of wood fiber in plantations will supply wood for fuel, building and small industries, which might otherwise be obtained from the small areas of natural forest that remain in the highlands. Also, the tree plantations will provide vegetative cover to presently de-vegetated sites, thus protecting the soil from erosion and re-establishing the microclimatic conditions in the understory for regeneration of native species.<sup>16</sup>

The area of tree plantations financed under the Forests and Wood Program in Putumayo Department (tentatively about 2,000 ha per year) will cover such a small area compared to the area of natural forest (over 1 million ha) that it will have little environmental impact. Indeed, these plantations could be considered experimental, since almost no plantations have been established previously in Putumayo. If the plantations are established successfully, however, it will be possible to evaluate more adequately their negative and positive environmental impacts and on that basis make a decision as to the advisability from the environmental viewpoint of further expanding tree plantations in Putumayo Department. Moreover, the plantations will be established in small blocks (usually no larger than 50 ha) on sites, often former coca plantations, that have already been cleared of their natural forest and where soil has often been severely degraded by erosion and chemical contamination. Demonstration and research plots will be established to better understand the tree plantation's silvicultural requirements and the magnitude and character of potential positive and negative environmental impacts. The plantation program will include use of native species and specifically focus on increasing knowledge of their silvicultural requirements. Tree plantations have the potential to provide large volumes of high quality, uniform wood, which will provide an alternative to non-technical and often illicit logging in natural forests, including primary forests and forests that occur within national parks. Tree plantations will also provide an alternative to the elimination of natural vegetation for the use of land for unsustainable agriculture and pasture.

Alternative B would focus only on the establishment of fast growing tree plantations. According to the Operative Plan there are 90,000 ha of land apt for industrial plantations in the central Andean valley of Cauca. The establishment of too large an area of tree plantations within a short time period, however, carries the risks of flooding existing markets with more wood than they can absorb. The result would be a lowered commercial value for wood fiber from plantations.

---

<sup>16</sup> The beneficial environmental impacts of tree plantations, including those of exotic species, have been described in detail in CONIF (2000).

According to the Operative Plan there is little demand for the trees that are ready to be harvested from existing plantations on indigenous lands. Prices are therefore low for plantation trees. Alternative B, by focusing on rapidly increasing the area of tree plantations, would thus risk creating a bulge in wood production that would only aggravate the existing problem of low prices and therefore lack of interest in forest management and production as an alternative land use.

Alternative C, the No Action Alternative, would establish no new plantations. Although it would avoid the risk of the negative environmental effects of tree plantations, it would do nothing to achieve their positive environmental benefits.

In sum, Alternative A would create the least negative and create the most positive environmental impacts in relation to the issue of tree plantations of fast-growing, exotic species.

### *Mitigation Measures*

- Develop and implement management plans based on Colombia-specific FSC approved standards for plantation establishment and management
- Evaluate environmental impacts as part of plantation planning and incorporate mitigative measures in management plans
- Avoid elimination of natural vegetation on plantation sites.
- Test native species in experimental plantations.
- Limit plantation size to a maximum of about 100 ha

It is not possible for this environmental assessment to predict the potential environmental consequences for each planting site since each site has its own soil type, topography and exposure, natural flora and fauna. Once the planting sites have been located, therefore, as part of the planning for the plantation establishment, potential environmental impacts should be considered and, if necessary, mitigated. If, for example, the planting site includes a patch of natural vegetation that provides food or shelter for animals, the site preparation should exclude that area. Similarly, if the planting site adjoins a water body, the planning for the plantation should take that into account. Experiments with plantations native species will add to the knowledge of how to establish and manage these species. A limitation on the size of plantation blocks would reduce the risk of their infestation by pests or destruction of a large area of plantation by fire.

### Safety & Health

#### *Issue Statement*

New logging and wood processing techniques and equipment may create new or increased health and safety risks.

#### *Discussion*

The “Forests and Wood Program” proposes to introduce new wood harvesting and processing techniques and equipment, including logging equipment, sawmills and secondary wood processing equipment. Improved logging and wood processing operations may contribute to improvements in the status of human safety and health. Well-designed and maintained machinery, for example, when properly operated, is generally safer and less hazardous to human health than poorly designed and badly maintained machinery.

Nonetheless, the use of new machinery could also create new safety and health risks. Skidders, for example, create a different type of safety risk than manual transportation of logs. Likewise, the use of mobile sawmills rather than chainsaws for sawing up logs into boards or cants creates new types of safety and health risks. The use and disposal of new types of fuels, lubricants and chemicals also creates new safety and healthy hazards.

### *Comparison of the Alternatives*

Alternative A would change the character of risks to safety and health from log extraction and processing by financing new types of logging and wood processing equipment, such as skidders, cable logging systems, mobile sawmills and secondary processing equipment. It would also, however, create an opportunity for the provision of training to reduce these risks and would substitute safer for more dangerous processing equipment.

Alternatives B and C would not introduce new techniques and equipment for forest and wood processing operations, so they would not cause new types of safety and health risks. On the other hand, these alternatives would also not reduce existing safety and health risks in forest and wood processing operations through the introduction and financing of safer equipment and through safety and health training programs for forest and wood industry workers.

In sum, Alternative A would do more than Alternatives B and C to reduce safety and health risks associated with logging and wood processing.

### *Mitigation Measures*

- Incorporate comprehensive safety and health training programs concurrently with the introduction and operation of new types of logging and wood processing equipment as part of the management plan and implement accordingly.

Training in safety and health by itself would be inadequate. Rather, the program should include four parts: (1) equipment selection; (2) training; (3) incentives and enforcement; (4) monitoring and continual improvement. The detailed design of the safety and health program will require specialized technical assistance.

### Mechanized Logging

#### *Issue Statement*

Mechanized logging in lowland tropical forest may affect biological diversity and ecosystem functions.

#### *Discussion*

Harvesting operations are the point in forest management when it is most possible to influence the forest's future growth and species composition. Successful forest management, therefore, requires adequate control over harvesting practices. One component of such control is the availability of appropriate equipment. Appropriate equipment is, therefore, essential for efficient, sustainable management of natural forests in order to achieve the best combination of economic, social and ecological benefits. Acquisition of suitable logging equipment, such as chainsaws, skidders, forwarders, and logging trucks, thus are essential for successful, sustainable forest management.

Mechanized logging, for example, raises labor productivity, allowing higher levels of compensation to forest workers; increased income often translates into higher levels of human welfare, as measured by improved health and education. Increased productivity also raises the relative economic returns to forest management as compared to alternative land uses, making it a more competitive land use. Mechanized logging can also reduce the negative impacts on soil, water and vegetation from log extraction. Cable logging or low pressure tired skidders, for example, can operate in forested areas with relatively little impact on soils or remnant vegetation.

Mechanized logging may, however, cause negative environmental impacts. Inappropriate or badly operated skidders, for example, may cause compaction of forest soils, causing them to become less productive. Erosion on poorly located skidding trails or forest roads may cause sedimentation into water bodies or change water flow patterns, thus affecting the abundance and species composition of aquatic plants and animals. The workers associated with forest management may kill or capture wild animals or may collect forest plants, affecting their abundance, distribution or regeneration and reproduction. Logging operations may result in contamination of forest soils or water bodies with oil and chemicals. They may also cause destruction of trees and other vegetation that is not removed from the site itself or affect the habitat of some species of plants and animals, thus reducing their numbers or changing species composition. Removal of biomass in the form of logs may reduce the nutrients on the site, thus reducing its long-term productivity.

#### *Comparison of the Alternatives*

Alternative A would provide technical assistance, training and financing that would result in improvements to the system of logging presently utilized in the sites for the proposed actions. Such improvements would reduce the negative environmental impacts of logging operations as presently conducted, offer an economic alternative to coca cultivation and processing and bring substantial economic and social benefits to the rural poor living in or near the area of forest extraction.

Alternatives B and C would not provide technical assistance, training or financing for improvements to the presently utilized logging systems in the three regions. Barring other programs, the existing wasteful logging systems would therefore continue.

In sum, Alternative A provides a more effective means for protecting the environment of the proposed sites for the program's activities than Alternative B or C.

#### *Mitigation Measures*

- Include environmental impacts within the selection criteria for mechanized logging equipment to be purchased as part of the program.
- Define equipment as part of the management planning process and assure accordance with Colombia-specific FSC approved standards.

In the project areas there is not much experience with mechanized logging. It is not clear, therefore, which type of mechanized logging equipment would provide the best combination of reduced negative environmental impacts, cost and production capability for which of the various types of forests in which the program will carry out actions. Before buying logging equipment, therefore, their relative technical and financial advantages will be analyzed. Such analysis should include that of the negative and positive environmental impacts that would be created by

different types of logging equipment. This selection criteria should be an important factor in the selection of the equipment. Specialized technical assistance should be contracted to carry out such an analysis.

## Sawmills

### *Issue Statement*

The introduction of more efficient sawmills may stimulate degradation and elimination of tropical forest.

### *Discussion*

Introducing more efficient sawmills would be likely to increase the profitability of producing tropical wood products. Increased profits might stimulate additional logging. If done with poor equipment and badly trained operators such logging could cause negative impacts on the forest's biodiversity and ecosystem functions.

Improved sawmills are more likely, however, to cause positive environmental impacts. They would reduce waste compared to the present methods of sawing logs into boards with chainsaws. A reduced number of trees could therefore supply the same demand for wood. More efficient sawmills could increase the profitability of forest management relative to other land uses, reducing the incentive for elimination of forest. Improved sawmills could permit the utilization of a wider range of tree species and the use of poorer quality logs. Such wider utilization would increase the options for silvicultural practices. For example, with better markets for wood, it would be more feasible to eliminate the poorly formed or diseased trees and leave the highest quality trees as the source of seeds for regenerating the stand. In that way the genetic quality, from the viewpoint of utilization, would be increased rather than degraded. Additionally, the successful regeneration of a wider range of tree species would also conserve the floral and faunal species that might be associated with these species.

### *Comparison of the Alternatives*

Alternative A would introduce mobile sawmills, and possibly other types of sawmills utilizing bandsaws, , that would greatly improve the efficiency and quality of wood products from the sites of the program activities. It would, therefore, provide an incentive for forest conservation and management.

Alternative B would increase the area of plantations without increasing the efficiency of the utilization of the wood that they produce. It would do nothing to stimulate the conservation of natural forests through more efficient use of their wood.

Alternative C would do nothing to reverse the present wasteful system of wood production and consequent low prices to the forest owner from sale of timber trees and lack of incentive for forest conservation and management.

### *Mitigation Measures*

- Coordinate extraction and sale of logs from managed natural forests and plantations with the installation and operation of improved sawmills.

The potential environmental benefits from improved sawmills will be realized only if there is a link from the sawmill back to the forest owner in the form of higher prices for standing timber. If there is no link to the forest owner, then the sawmill owner could reap additional profits from the improved sawmill, but would create no additional incentive, in the form of higher prices for standing timber, for the forest owner to manage and conserve the forest.

### Marketing of Wood Products

#### *Issue Statement*

Higher and more stable prices for wood products may increase demand for wood, thus stimulating additional forest degradation and deforestation.

#### *Discussion*

Expanding the market for wood products could stimulate increased demand for logs and therefore increase the rate of logging in natural forests, augmenting the associated forest degradation and elimination.

Increased demand for wood products could also, however, make forest cover a more competitive land use relative to agriculture, including coca cultivation, and pasture. The soils of the proposed sites for natural forest management and tree plantations are classified as suitable only for forest management, not for permanent agriculture or pasture. Nonetheless, some of these soils are being used for agriculture and pastures. Poor prices for wood products could be one explanation for this discrepancy between actual and recommended soil use. Improved markets for wood products would be likely to keep some of the area classified as suitable for permanent forest production under forest cover.

#### *Comparison of the Alternatives*

Alternative A's marketing component provides a financial incentive for the individuals or groups that control land use to maintain part of their land under forest cover rather than convert it to agriculture, including coca, or pasture.

Alternative B, by contrast, does not include a marketing component and, therefore, does not provide a financial incentive for maintaining forest cover, whether natural or plantations.

Alternative C would not increase the financial incentive for conserving or creating forest cover. The present incentives for clearing forest in order to expand agriculture and pasture would continue unchecked.

In sum, Alternative A would provide the most environmental benefits.

#### *Mitigation Measures*

- Closely coordinate the proposed forest management and marketing actions.

In order for the financial incentives for maintenance of natural forest or for the establishment of additional plantations to be successful the marketing program must be coordinated with the forest management and wood extraction components of the program. Without such coordination, the

marketing and forest management actions could become separated and neither would benefit the other.

### Access Roads

#### *Issue Statement*

Forest management requires the construction of access roads that could accelerate colonization in natural tropical forest.

#### *Discussion*

Forest management requires adequate access to the forest by professionals, technicians and workers. They must be able to implement efficiently forest management tasks, such as inventory, research and monitoring, control of silvicultural operations, supervision of logging, protection of the forest from insects, diseases and insects. Such access requires the use of motorized vehicles and mechanized logging equipment. Without such access forest management becomes too expensive and time-consuming to be competitive with other potential land, such as agriculture and pasture, that require the elimination of the forest. Thus access roads are an essential part of organized forest management and of forest conservation.

Roads, however, can cause negative direct and indirect impacts. Direct impacts occur on or near to the actual site of the road platform through the movement of earth, the elimination of vegetation, and the change of water drainage patterns. Indirect impacts occur as a result of the access that roads provide to agricultural immigrants. Where land rights have not been firmly established, or where the government appropriates for itself control over unoccupied forest land, access roads, more than provide a means for the implementation of forest management, frequently provide a route into the forest for agricultural colonists. Such colonists claim land rights through the elimination of forest cover and the conversion of land use from forest to agriculture and pasture. Rather than contributing to forest management and conservation, therefore, access roads become a catalyst for deforestation. This trend is currently seen along roads in Putumayo Department.

#### *Comparison of Alternatives*

Alternative A would provide support for the establishment of defined forest management units with legally recognized boundaries marked on the ground. The construction of access roads would, therefore, achieve the purpose of aiding forest management rather than providing access to agricultural colonists.

Alternatives B and C, by contrast, would not change the current situation. Logging roads would continue to be built through open access forested areas, thus providing a conduit for agricultural colonization and the conversion of land use from natural forest to agriculture and pasture.

In sum, Alternative A provides the most environmentally beneficial response to the issue of access through roads to forest areas.

#### *Mitigation Measures*

In the management planning process, define road network and measures to assure control over the forest management unit before construction of forest access roads. Implement and regularly evaluate compliance with established control mechanisms.

Access roads into forested areas should be authorized and constructed only when control over the areas has been assured. Such control is based on clear legal title to the forest property. Also, boundaries of the forest property should be clearly marked on maps and on the ground. The location of the forest property should be public knowledge. Access roads should be closed to the general public and their management a responsibility assigned to the forest management company or community.

### Silvicultural operations

#### *Issue Statement*

Silvicultural operations may decrease biological diversity and change ecosystem functions

#### *Discussion*

Silvicultural operations modify forest growth rates and species composition in order to increase the flow of forest products and services to meet human needs or objectives. By increasing the production of products and services from a forest management unit, silvicultural operations make forest use a more competitive land use relative to agriculture and pasture. Since forests conserve biological diversity and ecosystem functions better than do agriculture or pasture, in areas where agricultural colonists are active in converting the land use from natural forest to pasture and agriculture, silvicultural operations serve an important function in conserving biological diversity and maintaining ecosystem functions.

Silvicultural operations do, however, modify forest growth rates and species composition and, therefore, could decrease biodiversity and modify ecosystem functions. For example, silvicultural practices may aim to decrease the occurrence of a non-commercial tree species in order to favor the growth of another, more commercial species. The non-commercial tree species may, however, play an important role in conservation of faunal or floral biodiversity or ecosystem functions. The simplification of forest species composition through silvicultural practices may, moreover, increase the vulnerability of the forest unit to insect or disease infestations.

#### *Comparison of Alternatives*

Alternative A would provide an opportunity to use silvicultural practices to increase the flow of products and services from forests and plantation to meet human needs while doing applied research on the effects of such silvicultural practices on biodiversity and ecosystem functions.

Alternatives B and C would not sponsor silvicultural operations. They would not, therefore, cause the potential negative impacts from silvicultural operations on biological diversity and ecosystem functions. Neither would they, however, promote the use of silvicultural practices to increase the flow of forest products and services to meet human needs or provide for applied research on the impacts of silvicultural practices on biodiversity and ecosystem functions. The forest would, nonetheless, be utilized and, on some sites, be eliminated for conversion of the land use to agriculture and pasture.

Alternative A, therefore is the best option for addressing the issue of the environmental impacts of silvicultural operations.

#### *Mitigation Measures*

- Design and implement an applied research and monitoring component as part of the proposed silvicultural actions

The silvicultural actions promoted by the “Forests and Woods Program” should produce technical knowledge applicable to specific forest types and sites. All silvicultural operations, therefore, should include provision for research and monitoring. Such research and monitoring should not be complicated but should contribute to the improvement of silvicultural prescriptions. An important focus of the applied research and monitoring should be the development of silvicultural practices that combine protection of biodiversity and ecosystem functions with an increase in the competitiveness of forest management as a land use alternative to agriculture and pasture.

#### Social conflict

##### *Issue Statement*

Forest management may accentuate conflict within and between social groups who live in or depend upon the forest.

##### *Discussion*

New sources of income from the forest can also become additional sources of social conflict. The “Forests and Wood Program” intends to make forest production and wood processing an alternative source of income. The potential exists, therefore, that the proposed actions could increase social conflict in some situations.

It was not possible for this environmental assessment to examine adequately the potential for such conflict in specific situations, given the limitations under which it was prepared. It is possible, however, to speculate about some circumstances which could provoke such social conflicts. Tree plantations, for example, will change land use on specific sites. The people presently utilizing the site for some purpose other than tree plantations will be affected. Other people, and not those presently utilizing the site, may, however, receive the benefits of the tree plantations. Social conflicts could result.

Likewise, forest management requires control over access to natural forest. Such control will limit forest use. Some people will benefit from such limitation. But others may lose a source of forest products or services. Similarly, improved sawmills will change the method of wood processing. Some people will benefit. Others, however, may lose their means of livelihood. If successful, for example, mobile sawmills would drive chainsaw producers of lumber out of business.

In sum, it would be unlikely that the activities proposed under the Forests and Wood Program would benefit everybody, all of the time, in every situation; consequently some social conflict is almost inevitable.

##### *Comparison of Alternatives*

Alternative A would improve the entire chain-of-production from forest to wood products, with a strong focus on the voluntary certification process. In order to be successful in reaching its objectives, and in order to be certified, Alternative A would have to take active measures to assure the fair distribution of the social and economic benefits from forest management and tree plantations. It would, therefore, work to reduce existing social conflict over forest resources and avoid creating additional social conflict.

Alternative B, by contrast, would focus the establishment of new tree plantations, without attention to the entire chain-of-production or certification. It would not give specific attention to the fair distribution of social and financial benefits. Social conflict might therefore increase as a result of the proposed actions.

Alternative C would take no action. Thus, although it would not create additional conflict, it would do nothing to reduce existing conflicts over forest resources.

In sum, Alternative A would work to avoid or reduce social conflict over forest resources, while Alternatives B and C would not.

#### *Mitigation Measures*

- Include analysis and management of social conflict in the design and implementation of all proposed activities.

To adequately predict and manage social conflict, and thus ensure the success of its activities, the “Forests and Wood Program” should systematically incorporate conflict analysis and management into the design and implementation of all its proposed activities. Professional specialists in conflict analysis and management will probably be required.

## BIBLIOGRAPHY

Banco Mundial. 1991. Libro de Consulta para Evaluación Ambiental, Volumen II, Lineamientos Sectoriales. 276 pp.

Corporación Nacional de Investigación y Fomento Forestal (CONIF). 2002. Programa Bosques y Maderas, Plan Operativo. Bogotá. 27 pp.

Corporación Nacional de Investigación y Fomento Forestal (CONIF). 1998. Guía para Plantaciones Forestales Comerciales – Cauca. Bogotá. 42 pp.

Corporación Nacional de Investigación y Fomento Forestal (CONIF). 1998. Guía para Plantaciones Forestales Comerciales – Nariño. Bogotá. 39 pp.

Corporación Nacional de Investigación y Fomento Forestal (CONIF). 2000. Impacto Ambiental de Plantaciones Forestales, Síntesis de Resultados: 1996-2000

Corporación Nacional de Investigación y Fomento Forestal (CONIF). 2000. Monitoreo Ecológico y Socioeconómico de los Bosques del Pacífico Colombiano, Síntesis de Proyectos. Bogotá. 160 pp.

Ministerio del Medio Ambiente, Instituto de Hidrología, Meteorología y Estudios Ambientales (IDEAM). 2000. Condiciones Ambientales y Socio - Económicas del Departamento del Putumayo (Documento Síntesis). 59 pp.

Ministerio del Medio Ambiente. 2001. Resultados de la Evaluación: Zona Piloto Olaya Herrera; Departamento de Nariño – Aplicación y Evaluación de los Criterios e indicadores para la Ordenación, el Manejo y el Aprovechamiento Sostenible de los Bosques Naturales en Colombia. 246 pp.