The Forest Sector in Ecuador: The Current Situation and a Framework for Sustainable Development

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ABSTRACT

The forest sector in Ecuador employs 5.7% of the country labor force. In 2003, wood products exports exceeded US$60 million. Sustainable forest sector development would require a number of macro and micro-level changes including expansion of forest plantations to relieve pressure from primary forest harvesting, enactment of new comprehensive national forest policies, an assessment of net benefits of maintaining current forest land use or transitioning to alternative uses. This paper discusses the current situation of the forest sector and a planning framework that can contribute to crafting national policies to promote a sustainable forest sector for Ecuador.

Introduction

The Republic of Ecuador, one of the smallest countries in South America, has a total area of 283,560 km^2, including the Galapagos Islands in the Pacific Ocean. Total continental land comprises 276,840 km^2 and water resources account for a total of 6,720 km^2. Located in the Tropics, Ecuador is rich in biodiversity benefiting by the presence of the Andes mountain chain that fragments local flora into small "habitat islands" (Hellin, 2002). The country can be divided in four major ecological regions: the coastlands, highlands, the Amazonian region and the Galapagos Islands. Each region has a different climate pattern that influences ecological variables such as rainfall, evapo-transpiration, leaching rainfall, flora and fauna drought stress.

According to the United Nations (2003) the country has a population of approximately 13.5 million people of which 70 percent are considered to be below the poverty line. The life expectancy at birth for both males and females is 71.6 years (UN Statistics Division, 2003). Ecuador is also the most densely populated country in South America and annually losses an estimated 100,000 hectares of forest due to agricultural and logging activities. This loss of forestland threatens many endemic species of flora and fauna (Hellin, 2002).

According to the Ecuadorian Central Bank (Banco Central del Ecuador, 2003), the country had a total estimated Gross Domestic Product of $US 24 billion in 2002. Oil contributes the largest proportion of GDP at almost 12 percent.

The Forests of Ecuador

According to Rizzo Pastor (2002), forests in Ecuador can be classified in five categories: National System of Preserved Areas, Protective Forest and Vegetation, Forest State Patrimony, Private Forests, and Forest Plantations. According to the Ministry of Agriculture (in Rizzo Pastor 2002), in 2002, 42.4 percent of the total land area of Ecuador was covered by one of these five forest cover types. In 1956, the total forest cover was 12 million hectares or approximately 43.7 percent of the total land area (Acosta-Solis, 1961).

The National System of preserved areas constitutes the largest category of forest type in the country accounting for 40.1 percent of the total forest area in Ecuador. This area is equal to 17.3 percent of the country's land area. Of the total 11.64 million hectares classified as forestland, 80 percent is located in the Amazonian region (Western Ecuador), 13 percent along the coastland and 7 percent in the highlands (Bravo, 2002).

According to Bravo (2002) 88 percent of timber production is harvested from native forests rather than forest plantations. Bravo (2002) estimates that 7.35 million hectares are managed as agroforestry systems. Forest plantations, in contrast to natural forest, are mainly

located in the highlands (90 percent) with an additional 8 percent located in the coastland and 2 percent in the Amazonian region.

According to Acosta-Solis (1961) one of the earliest inventories of the forest resources in Ecuador prepared by the American Forest Commission classified the forests of Ecuador in six different types based on their ecological characteristics. These are:

- Wet Tropical Forests (rainforest)
- Dry Tropical Forests
- Mangrove Swamp Forest
- Flood Plain Forest
- Mountain forests
- Wet & Dry Temperate Forest

These forest types are located in the various regions of the country. Mangrove Swamp Forests and Wet and Dry Tropical Forests are mainly found in the coastlands. Temperate Forests cover vast zones in the highlands while the Amazonian Region contains the Wet Tropical Forests (rainforest). The country also has other types of natural land covers such as Savannas in the coastland and the non-forested Inter-Andean plateau (known locally as paramo).

Wood Products and the Ecuadorian Economy

Agriculture, livestock and the forest sector account for an estimated 7.67% of the Ecuadorian GDP and employ 30% of the country labor force (Banco Central del Ecuador, 2003). The wood products sector alone employs approximately 200,000 people or 5.7% of the total labor force. In 1997 total gross product created by forest plantations, logging, primary and secondary manufacturing accounted for 2.75% of the national GDP. This share has declined over the years and in 2002 it accounted for 2.07% of the economy (**Table 2**).

Table 2. Gross product generated from forest plantations, timber and wood products and percentage relative to Ecuadorian national GDP (Values in 000's US$).

	Years					
	1997	1998	1999	2000	2001	2002
Forest plantations and harvesting activities	267,873	262,689	195,312	175,419	192,995	218,316
Wood products manufacturing sector	383,117	371,761	251,026	228,653	247,984	286,387
Total	650,990	634,450	446,338	404,072	440,979	504,703
Percentage relative to GDP	2.75	2.73	2.68	2.53	2.09	2.07

Source: After Banco Central del Ecuador (2003).

The forest sector is comprised of 1,611 logging companies, 2,346 primary wood products manufacturers, 3,198 secondary wood products manufacturers and other 1,945 companies involved in transporting wood products (Organization of American States, n.d.). The country lacks a good record system for the complete accounting of all forest sector activities. Furthermore, illegal logging operations mostly happening in the in the Amazonian region are not included in the national assessment of the forest products sector.

Of all wood harvested in the country, 67% is used either as fuelwood, illegally logged or wasted. This figure is not surprising as it is a common situation in developing countries (Juslin and Hansen 2003). Only 19% of the wood is manufactured into products other than building structures or pallets. These numbers reflect the low level of technological progress achieved by the FP sector in Ecuador.

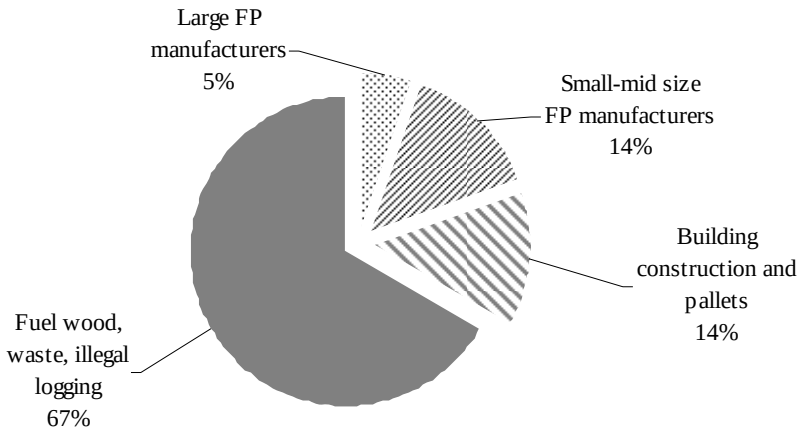


Figure 1. Wood use in Ecuador.
Source: Corporación de Promoción de Exportaciones e Inversiones and INCAE (1999).

The Ecuadorian economy depends heavily on exports to sustain a dollarized economy. Its main partners are the United Sates with whom Ecuador trades 38% of total exports, Peru (6%), Chile (5), Colombia (5%) and Italy (35). Wood products exports were negligible until the 1990's. The country's exports of wood products have experienced a steady growth since 1990 but from 1997 until the present it has experienced a decline. The economic crisis experienced by Ecuador that seriously affected the economy in the year 1998 is considered to be one of the main causes of this decline in exports. Nevertheless, the wood products sector still remains at higher levels compared to the beginning of the 1990's. **Figure 2** illustrates the case.

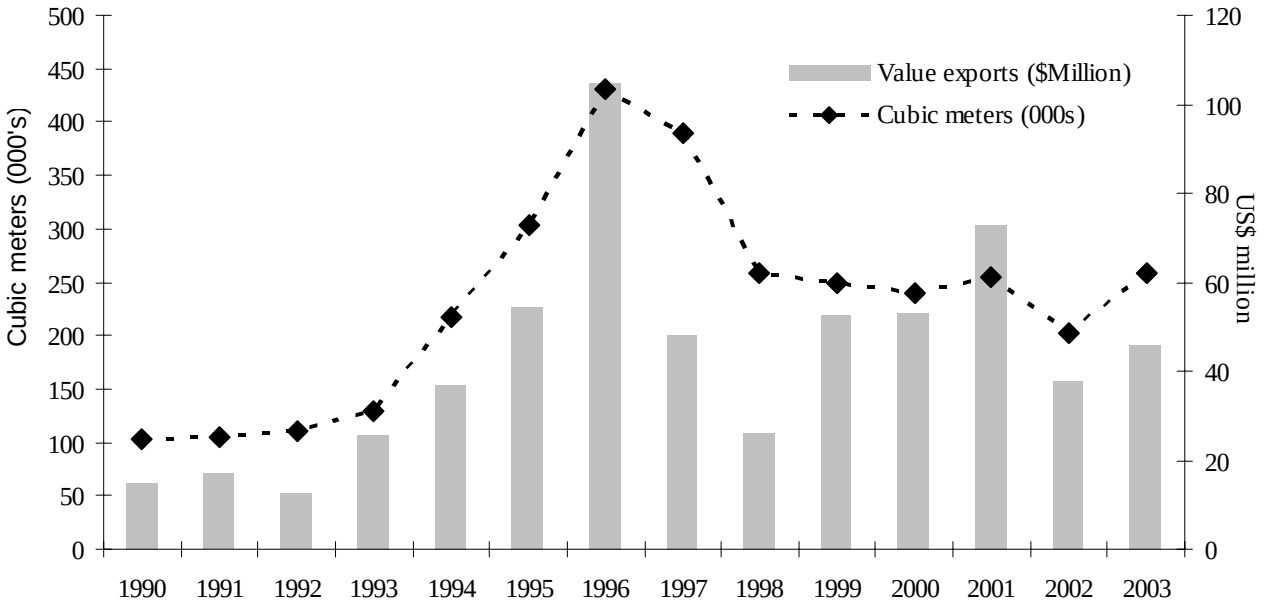
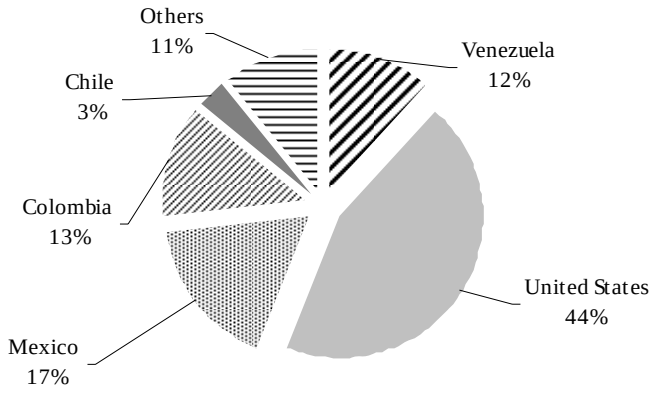


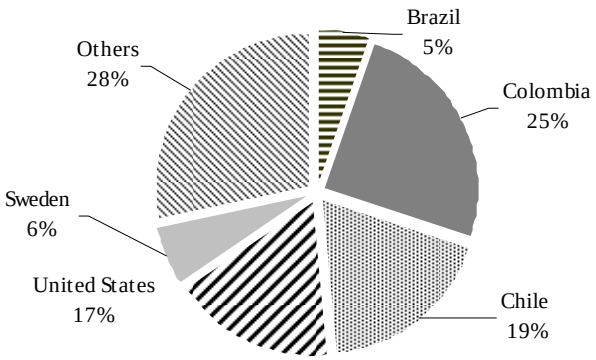
Figure 2. Ecuador Total Wood Products Exports 1990-2003
* Does not include Other Fiber Pulp, Recovered Paper, Newsprint, Printing+Writing Paper, Other Paper+Paperboard, Wood Charcoal, Chemical Wood Pulp. Source: FAO Statistical Division (2005).

In 2003 Ecuador exported a total $62.1 million in wood products. This figure is much smaller than total FP imports that reached $270.9 million during the same year. The trade balance of wood products has been historically negative (FAO Statistical Database, 2003). A large and increasing negative balance between imports and exports of wood products for the country is a sign that local demand is not fulfilled by the national supply. The market for wood products, despite experiencing a declining tendency, is still an important segment of over 300 million dollars considering the size of the Ecuadorian economy. There is potential for development of local suppliers of wood products, particularly in the forestry and forest manufacturing segments where considerable improvements can be achieved with appropriate training and technology adoption.

The USA is Ecuador's major commercial partner for exported wood products followed by Mexico, Colombia and Venezuela. Ecuador imports wood products from Colombia, Chile, The USA, Sweden, Brazil and other countries (**Figure 3**).



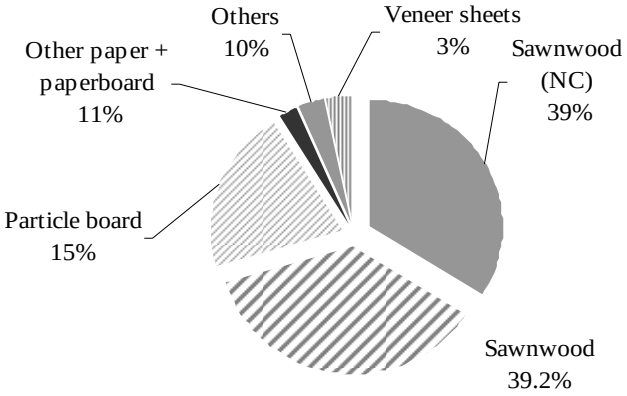
a) Importers of Ecuadorian Wood products



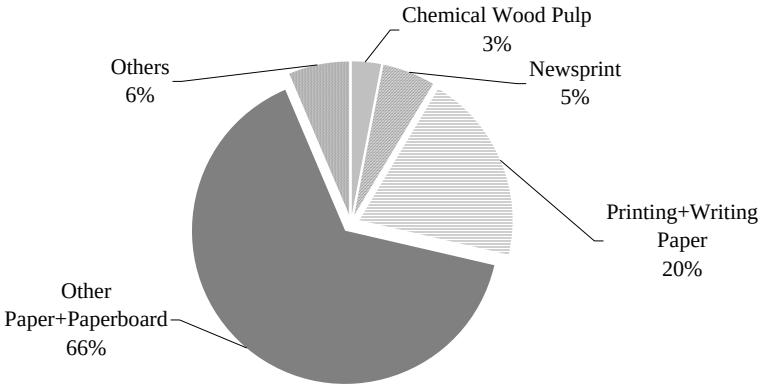
b) Exporters of Wood products to Ecuador

Figure 3. Ecuador's major trade partners for the year 2003.
Source: FAO Statistical Database (2005)

Ecuador exports low-value added wood products. Sawn wood accounts for over 78% of total FP exports. On the other hand Ecuador imports large quantities of quality wood products such as pulp and paper **(Figure 4).**



a) Ecuador main export wood products



b) Ecuador main import wood products

Figure 4. Ecuador's exports and imports wood products for the year 2003.
Source: FAO Statistical Database (2005)

In addition to primary products such as sawnwood, furniture manufacturing is a sector that is expected to grow in the coming years (Jativa, 2001). According to Jativa (2001) the balance between exports and imports of wooden furniture was negative from 1994 to 1998 with an average deficit of 3.9 million US dollars. In 1999 the negative balance declined to

approximate 471 thousand US dollars and in 2000 the difference exports/imports for furniture products was positive for the first time and was estimated to be over 2 million dollars. Jativa (2001) points out that 79 percent of all furniture exports are from members of the Ecuadorian Association of Wood Industries (Asociacion Ecuatoriana de Industriales de la Madera).

Evaluating Land Use Alternatives using NPV

According to the FAO (2000) almost 44 percent of the land area (11,886,600 hectares) in Ecuador is suitable for forest plantations. However, commercial plantations currently comprise only 1.42 percent of the national forest area. Establishment of new commercial forest plantations would require changes in land use from agricultural to forestry purposes.

Before broad based changes in land use policies are made, evaluation and comparison of net benefits of current land use to other alternative uses should be done. First, the economic value of the all benefits derived from natural forest in its current state or land being used for agricultural purposes should be estimated. Various methods have been developed to estimate the total economic value of forests including marketed and non-marketed benefits. In the case of timber and non-timber forest products (NTFP) such as fruits or latex that have a market value, the valuation process consists of multiplying the total annual harvest of each product by the associated average market price (Peters et al., 1994). The level of resource extraction should not exceed the Maximum Sustainable Yield Capacity (MSYC) in order to assure the sustainability of the resource.

After all benefits of the preservation of a forest or agricultural area have been identified and assessed, the next step is to estimate the Total Net Present Value (NPV) of the resource expressed in monetary terms. As defined by Hamilton (1995), the Net Present Value is the present (today's) value of total expected future *returns* minus the total present value of expected future *costs*. When comparing investments, the one with the highest NPV -assuming the same discount rate- is the more desirable alternative. This value can then be compared to development projects or alternative forestland uses in a Cost Benefit Analysis to determine the option that could derive more total benefits (Bishop, 1999)

Aguirre (1998) suggests that “non-market” values –intangible goods with non-monetary values- that include ecological processes such as amelioration of climate changes, waste assimilation, recycling of nutrients, protection of soils, pollination of crops, maintenance of species among others should be included in the assessment of benefits. The monetary valuation of intangible benefits is a difficult process since only some of these values are reflected in market prices and therefore need to be estimated using other tools such as the Contingent Valuation method (Bishop, 1999). Ecological processes and ecologically derived intangible forest products are often neglected in NPV calculations. Aguirre (1998) believes that these non-tangible products and services are difficult to value but must be considered particularly in tropical rainforests. Ecological products and services include water cycling, CO_2 sequestration, indigenous people/forest interactions, and herbal and other natural medicines for local communities.

Aguirre (1998) conducted a valuation of goods and services for tropical rainforests. In his analysis, he assessed the benefits from the conservation of a rainforest in Costa Rica. Annual benefits generated by one hectare of tropical rainforest in Costa Rica are estimated at US$ 886.7. Water cycling services account for over 50 percent of the total value of the rainforest. Overall non-market products/services have a significantly higher value than marketable goods.

A similar analysis conducted by Peters et al. (1995) estimated that a hectare of Amazonian rainforest in Peru has a net present value (NPV) of US$ 6,820. This calculation

included forest products and NTFP that could be monetized as well as intangible ecological values. This value can be compared to alternative land uses such as commercial forest plantations, cattle ranching, or agricultural crops. A common scenario in the Amazonian region is the harvest of all merchantable timber. For example, in 2002, one hectare of rainforest harvested near the city of Iquitos, yielded a total of 93.8 m^3 of commercial wood representing a NPV US$ 1,668 in value. Discounting for logging and transportation costs, the NPV is US$ 1,000/hectare. An alternative land use option is a plantation of *Gmelina arborea* for timber and pulpwood production with an estimated NPV of US$3,184/hectare. A third alternative is the establishment of pastures for cattle ranching with a NPV of $2,960 per hectare (Peters et al.,1995). A comparison of NPVs for these alternatives suggests that the preservation of the Amazonian Rainforest near Iquitos yields more benefits than other management uses. However, similar NPV analyses in other regions of the country may help identify areas where net benefits of preservation of forestland may not exceed the benefits of alternative land uses.

Decision Support Systems (DSS)

Bishop (1999) stresses that forest managers and policy makers face challenges in assessing benefits derived from tropical forests. The decision making process to promote specific land uses that maximize benefits to society is a multifaceted process. The integration of different variables and perspectives, including ecological, social and economic aspects can be facilitated by the use of analytical tools to support the decision making process.

One such tool is Decision Support Systems (DSS) which have been successfully applied in management decision making (Bidgoli, 1998). DSS is broadly defined by Power (2002) to include systems that use computers, data, documents, knowledge and/or models to facilitate decisions. DSS help provide information that can then be used to make decisions at local, regional and national levels.

Mennecke and West (2002) recommend the use of information technology (IT) tools to integrate information from a multitude of sources in the decision making process at the national level in both developing and developed countries. Local and national governments in many developed countries have found one IT technology, geographic information systems (GIS), to be a very useful tool in resource management, regional planning, and economic development. In the United Kingdom for example, for the last 25 years GIS applications have rapidly developed as a component of DSS by the food retailing sector. IT and DSS are becoming increasingly crucial to support both operational day-to-day and strategic long-term decisions However, as pointed out by Mennecke and West (2002) the practical use of GIS in many developing countries is hampered by the lack of accurate and detailed spatial and demographic data, political considerations and management issues.

A Framework for DSS and Forest Sector Development

We propose that IT, and GIS in particular, can be support applications for DSS applied to forest sector planning at the national level in developing countries. **Figure 5** shows a framework for a decision support system for the development of the forest sector in Ecuador. It begins with the assessment of benefits and costs of current and alternative land uses. Next, a net present value (NPV) is calculated for each alternative that can then be entered in a GIS platform. The GIS provides a visual aid that helps identify areas of high potential for forest sector development.

Market, manufacturing, resources, social variables, and other information can be integrated into the framework to identify potential distribution channels, locations for appropriate

existing or new manufacturing facilities, and estimate transports costs based on distances to major markets and ports. The meshing of market intelligence information with the results of an ecological/economic assessment can support the planning process for the forest sector and help in crafting national policies.

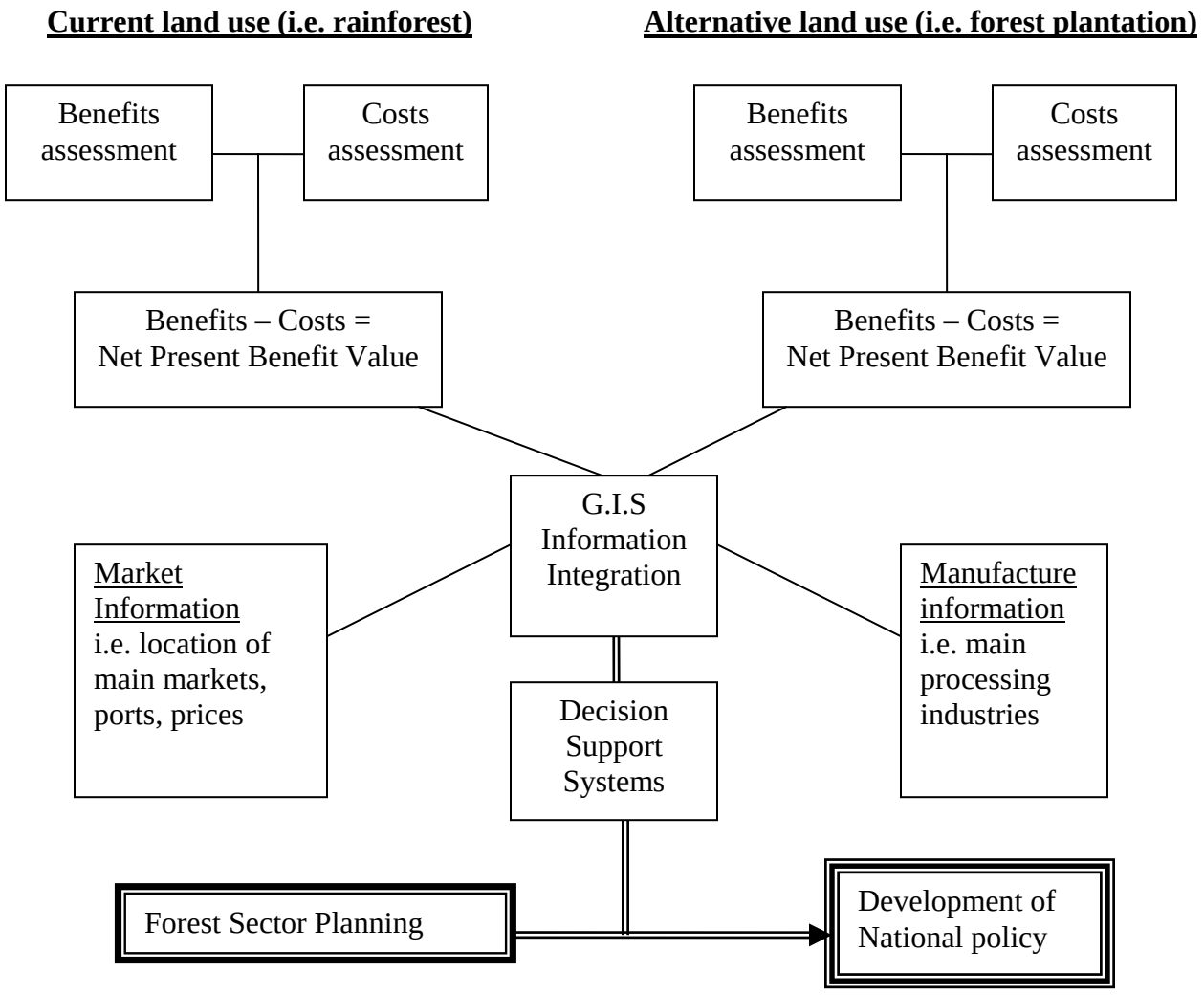


Figure 5. A Basic Framework for Forest Sector Planning and Policy Development.

The proposed framework would be in compliance with Executive Decree No. 346 issued in April 2000 by the Ecuadorian Government. Executive decree 346 introduces substantial changes to the regulations that apply to the pre-existing Law on Forestry and Conservation of Protected Areas and Wildlife. An innovative aspect of these reforms is to incorporate the following basic criteria for sustainable forest management into the legal framework for Ecuador's forestry sector:

- Sustainability of production
- Maintenance of forest coverage

- Conservation of biodiversity
- Co-responsibility for management
- Reduction of negative environmental and social impacts

We suggest that an additional criterion needs to be addressed to ensure sustainable forest sector development: education and training. Ecuador needs college graduates in forestry and forest products trained with a cross-disciplinary approach focusing on the sustainable management of forest resources. As stressed by Hellin (2002) Ecuadorian forestry graduates are ill-prepared for the forest management challenges facing the sector and hence.

Conclusions

Ecuador is a small country with a particularly rich forest resource base. Its diverse ecological regions allow it to support different forest types and potentially support a sizeable wood products industry. The forest sector is an important component of the national economy and provides a large number of jobs. Still the major wood products exported by Ecuador are low-added value products such as sawn wood.

The forest product sector in Ecuador has the potential to grow to satisfy local demand for wood products and increase exports. Research to aid in developing policies that promote forest sector development should include an appraisal of costs and benefits derived from any changes in land use. At the national level, Decision Support Systems that integrates data and information from a myriad of sources should be developed and implemented to support policy development and ongoing decision-making. The framework we propose is based on a multivariable-approach that includes ecological information, current land use, and channels to markets.

With the adoption of a clear forest policy and incentives for investment in the sector it could potentially experience a rapid development. The potential for development of the wood products sector is restrained to the enforcement of forest law (ITTO 2002, Leischner and Bussman 2002), additional private investment in the sector (Organization of American States n.d.), education of the general population (Becker n.d.) and better personnel training (Hellin 2002). Any plan aimed to achieve a sustainable development of the forest sector will also need to be accompanied by changes in the curricula in current forest sector degree programs.

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