

Bamboo production chain in Ecuador

ARIE KLOP*, ENRIQUE CARDENAS and CHRISTIAN MARLIN

SNV, Ecuador; Julio Zaldumbide N24-652 y Miravalle (La Floresta), Quito, Ecuador

Abstract—A production chain study of *Guadua angustifolia* was carried out for Ecuador in order to get a better insight in the products and actors involved in the growing, manufacturing, trading and end use of this indigenous bamboo species. The study revealed a whole variety of uses ranging from whole, round bamboo culms to parquet flooring. Most of the *Guadua* consumption is domestic and for household or construction uses. The export market is limited and mainly concentrated on bamboo poles for the construction sector in Peru. The largest potential markets seem to be national demands for the agricultural and construction sectors. Although there is some experience with the manufacturing and exportation of *Guadua* products, most actors involved along the chain present serious shortcomings in quality control and sustainability of the production. The growing interest in bamboo as an alternative natural product and the opening up of markets mean new opportunities for Ecuador, although much work has to be done on information gathering and promotion of *Guadua* as a new high quality product. The recent conformation of the National Consultative Council for Bamboo may lead to an increment of the interest in and competitiveness of the sector.

Key words: Bamboo; Ecuador; *Guadua angustifolia*; market; production chain; products; actors.

INTRODUCTION

The globalisation and consequent opening of international markets sees Ecuador confronted with the need to identify (new) exportable products that can compete on those international markets, through higher levels of production and quality and lowering of production costs. Bamboo, in particular guadua (*Guadua angustifolia*), has been identified by the Corporation for Promotion of Exportations and Investments (CORPEI) among 14 priority products with exportation potential [1]. For this reason, the SNV (Netherlands Organization for Cooperation Development) has conducted a study on the bamboo production chain in Ecuador, in order to contribute to a better understanding of its importance and potential for both national and export markets.

*To whom correspondence should be addressed. E-mail: aklop@snvworld.net

OBJECTIVES AND DELIMITATION OF THE PRODUCTION CHAIN

Definition

A production chain can be defined as follows: A system of interdependent actors and successive operations from the production till the consumption of a product, within a given socio economic environment.

Objectives

The general purpose of this study is to contribute to the development, strengthening and modernization of the bamboo production chain in Ecuador, focusing on the opportunities presented in national and international markets. Among the more specific objectives we can mention the following:

Identify the actors that intervene in the different positions among the chain, their strategies and their relations.

Identify the products and services provided actually and the service demand of the actors in the chain.

Identify strengths and weaknesses of the chain, allowing to establish politics, strategies and actions that will reinforce its strong points and reduce its limitations.

Length, width and depth of the chain

As the length of a production chain we understand its reach from the actors at the starting point to the actors at the end. In this case it was defined as the total chain from the primary production to intermediates or end users within Ecuador, be it for construction, furniture, handicraft, poles or industrial processing. Not included were the intermediate actors or end users outside Ecuador.

The width of a chain is defined as the scope of (sub-)products that will be contemplated in the study. In this case all the products and sub products of the guadua used or manufactured in Ecuador were taken into account.

As for the depth of the chain we understand the level of integration of the environment into the chain, that is to say: do we take into account only the actors that are directly involved or also the indirect actors (for example, service providers, policy makers) and to what extent? In our case we contemplated all actors (direct and indirect) that have any (potential) influence on the chain performance, with the limitation that those actors have a factual presence in Ecuador.

METHODOLOGY

The applied methodology combined the study of bibliography and internet sources with interviews, field visits and actors workshops. A first selection of actors was based on the registers of ECUABAMBÚ, an Ecuadorian NGO promoting the sustainable use of bamboo. According to the type of actor and geographic

distribution interviews were carried out on an individual base or in groups. This was combined with direct observations in the field of both production and (industrial) processing activities. Furthermore, a workshop was held with a broad representation of the main actors in the bamboo sector. The active participation of many actors in the gathering and first analysis of the information has lead to a broader scope and deeper insight in the bamboo production chain. This is expected to increase after the feedback of the results to the sector is finished.

STRUCTURAL AND FUNCTIONAL ANALYSIS OF THE PRODUCTION CHAIN

Bamboo and its uses in Ecuador

The economically most important bamboo species in Ecuador is *Guadua angustifolia*, a species known for its highly appreciated physical and mechanical properties and the large size of its culms that reach up to 30 m in height and 25 cm in diameter. This species grows naturally in Colombia, Ecuador and Venezuela and has been introduced in Central America, Caribbean and Asia. In Ecuador it is best known as ‘caña guadúa’, ‘caña brava’, ‘caña macho’ or just ‘caña’ [2].

Guadua has many uses, among them soil and water conservation, carbon dioxide capturing, landscape enrichment and the production of a vast diversity of products for household use, handicraft, agriculture, construction, etc. *Guadua* is fast growing and has a life cycle of about five years. Figure 1 shows the most common *Guadua* products used and manufactured in Ecuador and the relation between them. The most important uses are:

1. Whole or entire bamboo: used in rural infrastructures like sheds and fences. It is also used as temporal stilts or props in construction works.
2. The base or foot of the bamboo culm: the hardest and most resistant part of the guadua and can be up to 3 or 4 m long. It is, like the entire bamboo, used in rural infrastructures and construction works, but also for industrial processing into panels.
3. The top or apical part of the bamboo culm: the upper part of the guadua with a diameter of less than 10 cm that can reach till 3 or 4 m long. It is commonly used for props in banana and other cultures and has a life span of about two years.
4. Bamboo strips: The guadua is cut into small strips. For social housing programs and for tourist lodgings the strips can have a width of 4 cm and are often cut manually without caring for the maturity of the bamboo. For further industrial processing into parquet floors the strips are cut mechanically from mature bamboo and have a width of only 3 cms.
5. Cut bamboo: This is the whole bamboo cut lengthwise and then fold open to form a flat surface of great strength. It is used in social housing programs and tourist lodgings to form the walls.

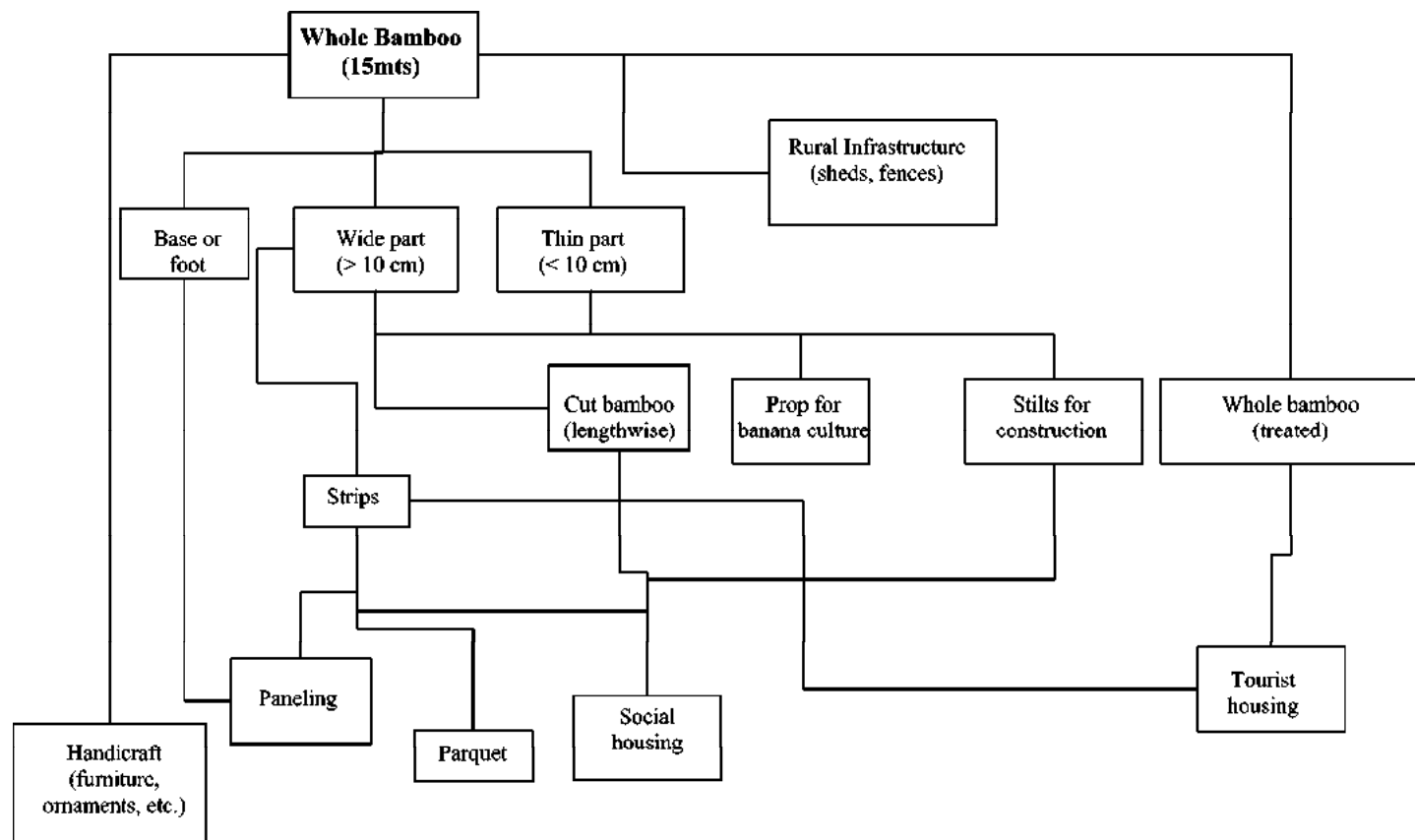


Figure 1. Bamboo products used and manufactured in Ecuador and the relation between them.

6. Parquet: This is the end-product of an industrial process using the highest quality bamboo strips that are glued together and finished into a luxury product. The high mechanical properties of guadua make it extremely useful for this type of end-product.

ACTORS AND THEIR INTERRELATIONS

Direct actors

In Fig. 2 we present the actors directly involved in the Guadua production chain in Ecuador. Five main groups of actors can be distinguished: (1) production or extraction, (2) commerce, (3) construction sector, (4) agricultural sector and (5) industry. We will briefly discuss the characteristics of the actors in each of these groups.

Production

In general there are no producers (small or big) in Ecuador that are dedicated exclusively to bamboo production. It is normally seen as complementary or a diversification of the production system.

Most of the guadua production in Ecuador is extracted from natural stands without any technical criteria, that is to say that no attention is paid to the maturity of the cut bamboo or the sustainability of the stand after cutting. Many times the entire stand is removed to make place for other land uses, like agriculture or animal husbandry, thereby seriously compromising the sustainability of the natural guadua stands in Ecuador. The majority of the guadua producers do not take post harvest measures like drying. Their main concern is to sell as soon as possible.

Only a small group of producers applies technical criteria in cutting and conserving the guadua. The small and medium producers in this group have had access to technical assistance from NGO's and some of the larger private enterprises have hired qualified personnel for this purpose (mainly from Colombia).

There is a very small amount of guadua produced from plantations (Fig. 3). No exact figures are available, but it is estimated that the area of cultivated guadua in Ecuador reaches only up to about 3000 ha. There is interest from the private sector to invest in more guadua plantations.

Among the problems encountered in the production sector, we can mention the following:

1. Lack of technical know how: Small producers as well as large enterprises are facing the problem of the lack of technical assistance in Ecuador. For the small producers this is partly solved by NGO's and international cooperation programs that include training on guadua production. The private enterprises had to hire qualified professionals and even trained field personnel from Colombia, where the guadua culture is much better developed.

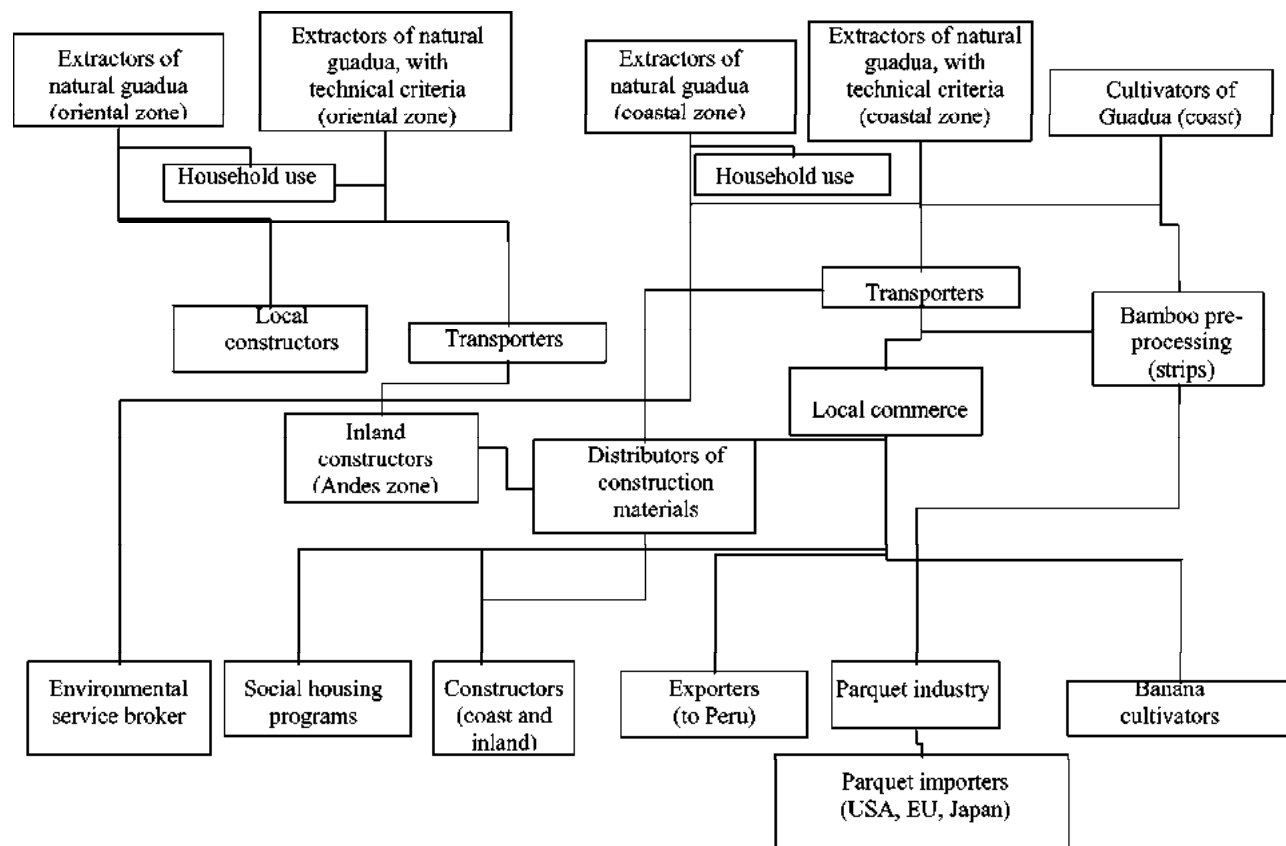


Figure 2. Actors directly involved in the bamboo production chain in Ecuador.



Figure 3. *Guadua angustifolia* plantation.

2. Selection and reproduction of germ plasm: Asexual reproduction of guadua is the best technique for establishing plantations, which requires specialized nurseries that are almost not available in Ecuador. For one of the larger private

plantations germ plasm was introduced from Colombia (L. F. Botero, personal communication).

Commerce

In the commercial sector of guadua we can find different types of actors operating:

The first one is the small producer that sells his guadua products directly to the users or — much more frequently — to intermediates. Some of the larger producers negotiate directly with the larger end-users, like construction firms, banana cultivators or the guadua-processing industry.

Two types of intermediates can be distinguished: small transporters, owners of one or two trucks, and producers who own a small truck or pick up vehicle. Both buy the guadua in the production area (mostly in the coastal zone) to sell it in the Andes region to constructors or at the larger deposits. An important part of the guadua is exported to Peru. The deposits are owned by larger commercial actors, who provide construction materials.

Another commercial actor is the small entrepreneur who buys the guadua directly on the farm, mostly ‘standing volume’ from natural stands, and realizes the extraction without any technical criteria, mostly resulting in total damaging of the guadua stand.

The critical points in the commercial sector are:

1. The quality of the guadua products: Practically no quality control is implemented along the production chain, resulting in low quality of most of the products, regarding to physical properties (immature culms) and life span of the product (fast deterioration for not drying).
2. Sustainability of the activity: Guadua commerce is considered an additional source of income for most actors involved and there is no consideration for the damage done in the stands.
3. Lack of transparency in price fixation: Much of the guadua commerce is quite informal and there is no transparency about the fixation of prices or payment agreements, especially from the intermediate actors.
4. Legal barriers: Guadua is considered a non-wood forest product and, therefore, higher tax rates are applied, demotivating the actors along the chain. Another legal barrier is the lack of conditions and guarantees for the export of guadua to Peru, considered the (potentially) largest market for Ecuador. Much of the guadua is exported illegally to Peru.

Construction sector

In this sector we distinguish three types of actors:

The first one are construction firms in general. They use the guadua as a low-cost material, mainly as support poles in the construction of cement floors in multilevel buildings (Fig. 4).



Figure 4. Use of bamboo poles for support in traditional construction.

Another actor is the Foundation ‘Hogar de Cristo’, that promotes social housing programs for low income families, using guadua as a cheap and easy to handle material.

The third and relatively small group is a group of designers and constructors who have discovered bamboo as a new material with specific characteristics and they incorporate it in their designs of buildings, furniture, etc. (Fig. 5).

The main critical point in the construction sector is:

the quality of the guadua used. As said before, there is no quality control along the chain and this is also true for most of the actors in the construction business.

This leads to a shorter life span of the materials used and — in case of the social housing programs — a shorter life-span of the houses.

Agricultural sector

Probably the most important sector for the use of guadua is the Banana sector, where it is used as props for the banana plants, especially in the cultures for the organic and fair trade markets, where the regulations forbid the use of plastic ties, the most common material used to fix the banana plants.

The most critical point in this sector is:

the high demand. Although they only use the upper part of the culm (with a diameter of 6 to 8 cm), that is considered a by-product, the demand in this sector is very high and some of the banana cultivators have started to produce their own guadua in order to be independent from the market.



Figure 5. Modern construction making use of bamboo as an alternative product.

Industry

In the industrial sector we find mainly two types of actors:

1. The primary processing industry where bamboo strips are produced. They can mainly be found in the coastal area. The bamboo strips are used for social housing programs or further processed in the parquet floor or panel industry.
2. The bamboo industry is emerging in Ecuador and only two plants have been identified: one produces parquet floors and the other bamboo panels.

The critical points for the industrial sector are:

1. Incipient technological development: Most of the technology used in the bamboo industry in Ecuador is adapted from Chinese technology and no spare parts or qualified technicians are available.
2. Attitude towards bamboo: Most of the actors (potentially) involved in the bamboo sector consider it an artisanal product and do not focus on standards of quality.
3. Demand of prime material: Although emerging, the guadua industry in Ecuador is already facing a problem with the supply of good quality prime material. This is partly due to the informal character of the sector and the lack of quality control, partly due to the lack of plantations, where the bamboo production can be better controlled. The best quality guadua grows in the eastern zone of the country (towards the Amazon), but the industry is located in the coastal zone leading to high transportation costs and the industry is relying actually on the production in the coastal area.

Indirect actors

In this group we find the actors not directly involved in the chain. One definition of indirect actors is that they do not control at any moment the prime material or the derived products in the chain, but do have influence on the performance of one or more of the actors in the chain.

Two main types can be distinguished:

1. Technology and service providers:

As we have already seen the lack of technological criteria in the different steps in the guadua production chain is one of the main bottlenecks. This is directly related to the almost absence of bamboo technology development and transfer by government and research institutes in Ecuador. Most of the technology used is transferred from Colombia or Asian countries. The few actors interested in improving their technology rely upon NGO's and international development agencies for the knowledge transfer. They are the only ones who have promotion and capacity building programs.

The same goes for financial services: guadua producers and processing industry (small as well as large) do not have access to financing schemes adapted to the development of guadua, being it an unknown product for the financial institutes in the country. However, some NGO's and development programs are offering small credit systems.

Among the most active organizations in this sector we can mention the following:

National organizations:

ECUABAMBU (association for the sustainable development of bamboo),

CORPEI (corporation for the promotion of export and investments),

UDENOR (Unit for the Development of the North),

SFA (foundation Amazon forestry service);

International organizations:

INBAR (International Network for Bamboo and Rattan),

CBI Netherlands (centre for promotion of import from development countries),

UNDP (United Nations Development Program),

SNV (Netherlands Organization for Development Cooperation).

2. Decision makers for the political framework and general context. The interest of the political actors for bamboo as an economic alternative is beginning to grow. Two initiatives are worthwhile mentioning:

In 2001 a group of important mayors from coastal cities asked in a public letter for the help of the central government in promoting the production and use of guadua. As a consequence of this letter the UNDP approved a US\$ 50 000 pilot

project for the promotion of guadua plantations, to be carried out by several municipalities in coordination with the Foundation Hogar de Cristo and one of the bamboo industries (FORESA).

Another important political actor is the newly formed Consultative Council for Bamboo, a Council to the Minister of Agriculture. The installation of this Council was made possible after the bamboo chain study aroused awareness of the situation among many of the actors involved, including the Ministry of Agriculture. Many of the actors mentioned above, i.e. CORPEI, ECUABAMBU, UDENOR, Chambers of Commerce, Association of Municipalities, representatives of the bamboo producers, the bamboo industry, NGO's, research institutes and international cooperation (the latter in the quality of observer), participate in the Council (besides the Ministries of Agriculture, Environment and External Commerce) [3].

MARKETS

Export markets

By far the largest producer and exporter of bamboo products is China, with enormous extensions of bamboo stands and technology developing rapidly. The principal bamboo importing country of the world is the United States of America, getting almost all its bamboo from China.

If we look at the export figures of bamboo from Ecuador over the period 1997–2001, as shown in Table 1, we see that the most important market is Peru, followed by the USA and Chile. In the case of Peru the figures do not reflect the real export volume. Large quantities of bamboo are traditionally exported to that country to be used in construction, but because much of it is exported illegally (without the required sanitary documents) it is not reported in the Central Bank statistics.

The exports showed a growth up till the year 2000 and decreased in 2001. This was mainly due to a growing demand on the internal market, especially for the social housing programs of Hogar de Cristo. If Ecuador is to increase its bamboo export, it should probably focus on legalizing the Peru market and otherwise look for niche markets, using the high quality of its *Guadua angustifolia* natural stands for special products that can compete with the Asian producers.

National markets

An approximation of the potential national demand for bamboo has been calculated, based on the interview results (see Table 2). The potentially largest market is the banana culture where the demand is calculated at 29 938 950 props per year. Calculating with an approximate production of 1000 culms per hectare per year this leads to some 30 000 hectares needed for the banana culture. For other uses we will need another 10 000 hectares.

Table 1.

Export of bamboo products from Ecuador 1997–2001

Destination	1997		1998		1999		2000		2001		Total 1997–2001	
	MT	1000 US\$ FOB	MT	1000 US\$ FOB	MT	1000 US\$ FOB	MT	1000 US\$ FOB	MT	1000 US\$ FOB	MT	1000 US\$ FOB
Peru	403	22.6	525	33.6	976	52	1247	72.04	320	20	3471.00	200.24
United States	6.82	0.3					0.02	0.03	10.92	2.68	17.76	3.01
Chile							6.48	1.75	9	0.4	15.48	2.15
Argentina									9	0.96	9.00	0.96
Canada			8.26	0.42							8.26	0.42
Norway					3.9	0.33	0.01	0.03			3.91	0.36
Germany							1.47	35.7			1.47	35.70
Sweden									0	0.08	0.00	0.08
Total	409.82	22.9	533.3	34.02	979.9	52.33	1255	109.55		24.12	3178.00	242.92

Source: Central Bank of Ecuador [1]. (MT is metric tonnes; FOB means: free on board; price including all costs till the product is on board of the vessel.)

Table 2.
Potential national demand for Guadua in Ecuador

Activity	Material	Number	Required area (ha)
Banana culture	Cuje*	29 938 950	
Demand 'Cuje'		29 938 950	30 000
Tobacco culture	Caña*	5 850 600	
General construction	Caña	1 260 000	
Social Housing programs	Caña	400 000	
Other uses	Caña	1 502 120	
Parquet floor industry	Caña	1 000 000	
Panel industry	Caña	340 000	
Peru market	Caña	250 000	
Demand 'Caña'		10 602 720	10 000

* Cuje, the upper part only of the bamboo culm; caña, entire bamboo culm.

It is estimated that the actual bamboo stands cover a total of about 8000 hectares, of which 3000 ha are plantations and 5000 ha are natural stands. It is clear that there is a negative balance between demand and offer, that is to say if all the potential uses (especially those for the banana culture) will be realized. This leaves a growth perspective for the national market.

ECONOMICAL AND FINANCIAL ANALYSIS

In the bamboo production chain study some preliminary financial calculations were made, to get a better insight in the potential revenues from guadua production.

A cost-benefit analysis of a technically managed natural stand of *Guadua angustifolia* shows a net revenue of about \$1000.00 per hectare per year. This is achieved with 22 days of family work, resulting in a net family income per day of \$45.00. Compared to an average wage of \$7.00 this is considerably high.

An economical analysis for guadua plantation with a projection of 10 years, gave similar results. From the fourth year on a positive result was to be obtained, culminating towards the sixth year to about \$950.00 per hectare per year.

Although it will be necessary to do more detailed feasibility studies, this first calculations show that guadua production can be economically profitable for rural families.

GEOGRAPHICAL ANALYSIS

A geographical analysis was made to identify the potential areas for *Guadua angustifolia* in Ecuador. The following criteria were used, based on the ideal growing circumstances for guadua:

Altitude between 400 and 1800 m above sea level.

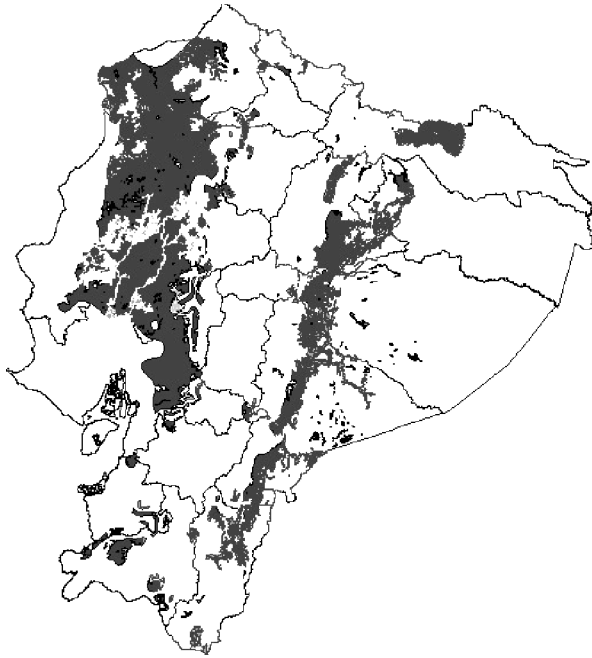


Figure 6. Geographical distribution of potential areas for *Guadua angustifolia* in Ecuador.

Temperatures between 18 and 28°C.

Annual precipitation more than 1200 mm.

The results are shown in Fig. 6 and illustrate clearly that there are two regions where the guadua can grow well:

The area of the Pacific coast has the largest potential.

The other region with potential is formed by the eastern slopes of the Andes, towards the Amazon basin.

FINAL ANALYSIS

As a final diagnosis we present a SWOT analysis of the most important facts found in the study:

Strengths

In Ecuador a total of 4 280 000 hectares of land combine the climatic conditions for guadua growing.

The coastal provinces have a comparatively better position due to their access to sea ports and a good internal infrastructure.

There exists a private sector interested in making investments in the development of the guadua culture and processing.

There is some experience with exportation of guadua. The main export market is in Peru, Ecuador's neighbour.

Active participation of many of the actors in the gathering and first diagnosis of the information for the study has lead to a renewed interest in the guadua culture, culminating in the installation of the Consultative Council for Bamboo.

Weaknesses

There is almost no reliable information about the guadua plantations or natural stands.

Technical development for the production and transformation of guadua is very incipient and most technology is 'borrowed' from other countries.

There is almost no organization in the sector; nowhere in the study organizations or representatives of producers, industry or other sub sectors were found.

Bamboo is identified with poverty: bamboo is considered a poor mans product. This hampers the visualizing of bamboo as a quality product for national and international markets.

Opportunities

The growing interest world wide in bamboo as an alternative natural product for many uses may open new markets for Ecuador.

The integration of regional markets within the continent means new opportunities. For the Amazon region the construction of the inter-oceanic highway (Ecuador–Brazil) may open new possibilities in the future.

The conformation of the Consultative Council for Bamboo may lead to an increment of the competitiveness of the sector.

The mechanical characteristics of *Guadua angustifolia* make it a good alternative for other bamboo species with less resistance, especially for highly demanding products like wooden floors.

The vicinity of the USA, which can be reached easily from the Ecuadorian ports, is a competitive advantage over other producer countries, like the Asian countries.

Guadua is a fast growing species and, therefore, has a high carbon dioxide capturing, giving it potential for environmental service trade.

Threats

The high tax rates on bamboo and its derived products in Ecuador are a threat for its competitiveness.

The strong development of the bamboo sector in other countries (Asia, Colombia) is a threat for Ecuador where there is no bamboo 'culture'.

The Forest Legislation does not recognize bamboo as a forest product and there is no control on its management, leading to clear cutting of many natural stands.

RECOMMENDATIONS

Based on the findings of the study we recommend the following:

Government institutes, private sector and NGO's in Ecuador should compromise resources for a further analysis of the bottlenecks of the bamboo production chain. In particular we recommend specialized studies on:

- The legal conditions that affect the competitiveness of the sector.
- International market studies aimed at identifying the niches for guadua products to be exported.
- Feasibility studies of guadua production, transformation and distribution in particular circumstances, especially in the eastern region of the country.

Promote investigation and technology development on production and transformation techniques, appropriate for the circumstances in Ecuador.

Promote technology transfer to the guadua producers and other actors in the chain.

Promote the use of high quality bamboo products as a natural and environmentally sound alternative, in order to amplify the national market.

Promote sustainable guadua production as a diversification of the agricultural production in Ecuador.

Promote the organizational strengthening of the actors in the chain; the Consultative Council for Bamboo is a good beginning, but not enough.

Promote financing schemes accessible for the bamboo producers and other actors in the chain.

Incorporate entrepreneurial criteria in every step of the chain.

Disseminate the information available on the bamboo production chain among its actors.

REFERENCES

1. CORPEI-CBI, Perfil de producto: Bambú (*Guadua angustifolia*). Proyecto CORPEI-CBI. Expansión de la Oferta Exportable del Ecuador (2002).
2. J. Moran, L. F. Botero and N. Naranjo, El Bambú o Caña Guadúa: conocer, propagar, sembrar y manejar adecuadamente la guadúa es una obligación de todos porque es un recurso natural del Ecuador, propiedad de los ecuatorianos. Proyecto SICA, Ministerio de Agricultura y Ganadería del Ecuador.
3. Ministerio de Agricultura, Acuerdo de Conformación del Consejo Consultivo del Bambú, Quito, Ecuador (2003).
4. Asociación Jesús del Gran Poder, Proyecto estudio económico-financiero para la siembra de 4 ha de caña guadúa (*Guadua angustifolia*). Pujilí, Cotopaxi, Ecuador (2003).

Copyright of Journal of Bamboo & Rattan is the property of VSP International Science Publishers and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.