



Current situation and future potentials of commercial forest plantations in Colombia

English summary of World Bank / PROFOR project
"Colombia: Reforestación Comercial Potencial (P148233)"

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English summary of World Bank / PROFOR Project “Colombia: Reforestación Comercial Potencial (P148233)”, developed by the Government of Colombia with the support of the Program on Forests (PROFOR) of the World Bank, conducted between January 2016 and March 2017.

Edition

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ABREVIATIONS

CAR	Corporación Autónoma Regional
CIF	Certificado de Incentivo Forestal
"CIF"	Cost, insurance, freight
CONIF	Corporación Nacional de Investigación y Fomento Forestal
CONPES	Consejo Nacional de Política Económica y Social
COP	Pesos Colombianos
CORPOICA	Corporación Colombiana de Investigación Agropecuaria
DANE	Departamento Administrativo Nacional de Estadística
DNP	Departamento Nacional de Planeación
EAM	Encuesta Anual Manufacturera
FAO	Organización de las Naciones Unidas para la Alimentación y la Agricultura, (por sus siglas en inglés: Food and Agriculture Organization)
FAOStat	FAO estadísticas
FEDEMADERAS	Federación Nacional de Industriales de la Madera
FINAGRO	Fondo para el Financiamiento del Sector Agropecuario
GHG	Greenhouse Gas Emissions
ICA	Instituto Colombiano Agropecuario
ICR	Incentivo a la Capitalización Rural
MADR	Ministerio De Agricultura y Desarrollo Rural
MDP	Tableros de partículas
MDF	Tableros de media densidad
NAMA	Acciones de Mitigación Nacionalmente Apropriadas (por sus siglas en inglés: Nationally Appropriate Mitigation Action)
GDP	Gross Domestic Product
PROFOR	Potencial de reforestación comercial en Colombia
UAF	Unidad Agrícola Familiar
USA	United States of America
UPRA	Unidad de Planificación Rural Agropecuaria

1 BACKGROUND

The Government of Colombia, with the support of the World Bank's Program on Forests (PROFOR), has commissioned a series of studies to identify the potential of commercial reforestation in Colombia. This is in line with the National Development Plan "*Todos por un mejor país 2014-2018*", which has the overall objective to increase the country's economic growth by improving the competitiveness of key sectors with high production potential. Included within this National Plan is the National Reforestation Program to promote forest plantations for commercial purposes, preserve natural forests, promote forestry value chains, and strengthen the institutional development of the sector, with particular emphasis on rural development.

This document summarizes and synthesizes the results of the PROFOR program in Colombia, based on the final report "*Current situation and potential for the promotion of commercial forestry plantations in Colombia*," which draws on the following set of diagnostic studies¹ that were prepared during the analytical phase of the project:

- Analysis of the value chains and logistics related to commercial forest plantations in Colombia; and,
- Analysis of the legal and institutional framework and financial instruments related to commercial forest plantations in Colombia.

The studies have been developed to analyze the challenges and potentials of the commercial forestry sector in Colombia and to give key recommendations that will guide the national government and other related actors to promote the sector. This shall lead to a more competitive sector at the national and international levels. The studies emphasize strategic aspects for the development of forestry plantations for commercial purposes in Colombia, with three priority regions, having been given special consideration: the coffee belt and the southwest (*Eje Cafetero y Suroccidente*), the Caribbean (*Caribe*), and the *Orinoquía* in the East. These regions are strategically important for the progress of the commercial forestry sector in Colombia, and accordingly, the approach compares the regions in order to promote commercial forest plantations and their associated industries at the regional level.

The analytical phase of the studies was carried out between January and July 2016, followed by the recommendations phase, which culminated in March 2017. During the development of the studies, ministries and public institutions provided valuable access to databases. In addition, for the data collection, interviews were carried out with different actors involved in the sector. In total, more than 160 interviews were conducted with companies, organizations, associations and institutions.

An inception workshop was held (Bogota, March 2, 2016) to identify problems and opportunities regarding plantation based value chains and challenges related to the institutional and legal framework. A validation workshop was held towards the end of the analytical phase (Bogota,

¹ The original versions of these reports are available in Spanish. The results presented are based on the report "*Situación actual y potencial de fomento de plantaciones forestales con fines comerciales en Colombia*", which offers a synthesis of two analytical studies "*Análisis de las cadenas de valor y de la logística de plantaciones forestales con fines comerciales en Colombia*", and "*Análisis del marco legal e institucional y de instrumentos financieros para plantaciones forestales con fines comerciales en Colombia*".

May 26, 2016) in which the drafted recommendations were refined during thematically and regional focus group discussions.

This document summarizes the main results with respect to the value chain analysis, from producers to secondary transformers; national and international markets, with an emphasis on the most outstanding products, and with the greatest potential for the country; logistics for the transport of round wood and finished products; financial incentives for the establishment of forest plantations; and the institutional, legal, and public policy framework. Furthermore, the final section briefly summarizes the set of specific recommendations that resulted from the analytical phase, based on the action plan developed during the project, in which each recommendation is thoroughly described.



Figure: Set of products developed in the framework of the World Bank/PROFOR project “Colombia: Reforestación Comercial Potencial”

2 MACROECONOMIC SYNTHESIS AND FUTURE SCENARIOS

The Colombian GDP has grown by more than 3 % per year (at constant 2005 prices) during the period 2005-2014. The GDP of the construction sector, which is the largest consumer of wood in Colombia, has grown by 7 % in the same period. This growth is expected to continue in the years to come.

However, the total contribution of the forestry subsectors to the national GDP has declined from 1.4 % in 2005 to 1.1 % in 2014. Whereas the furniture and paper sub-sectors have shown a stable development, the forestry production and wood processing sub-sectors have lost more than 0.1 % each (Figure A). This development can be attributed directly to the growing importance of imports of wood products that replace domestic production. Furthermore, the insufficient availability of wood and the limited competitiveness of Colombian wood products contribute to this trend.

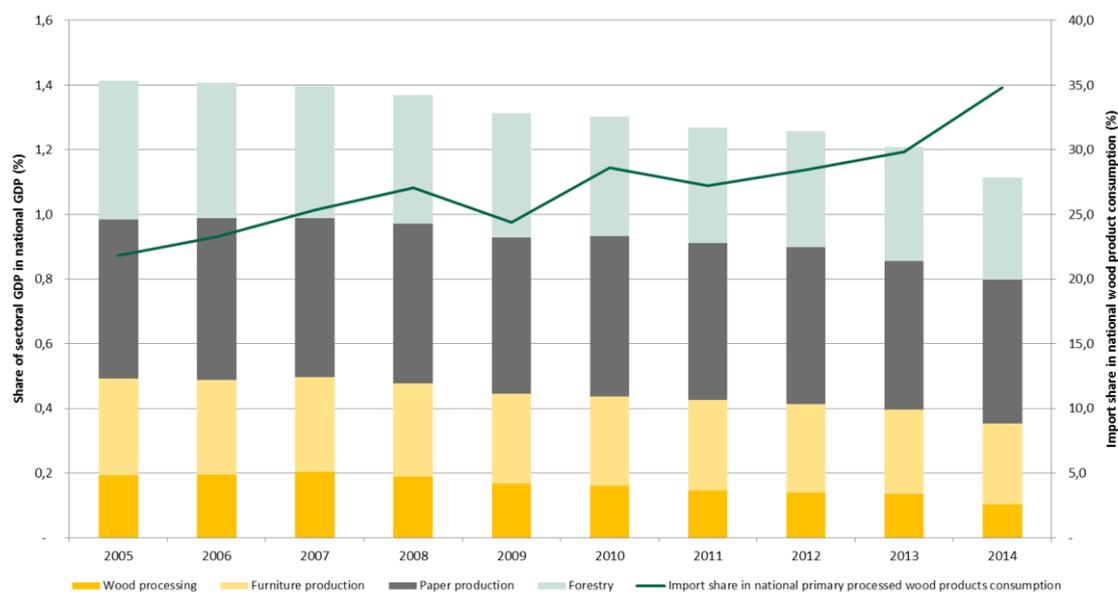


Figure A: Contribution of forestry sub-sectors to the national GDP and proportion of imported primary processed wood products 2005-2014

Source: DANE: Gross Domestic Product by Sectors of Economic Activity at Constant Prices - Seasonal Series - III Quarter of 2015. Figures Revised as of December 10, 2015. DANE: Combined presentation of the matrix supply-utilization of forest account flows, Base 2005. FAOStat: Forest statistics on foreign trade with pulp (years 2005-2013).

With the growth of the economy, the demand for wood products has also significantly increased: the volume of primary processed wood products (sawn wood, wood based panels, and wood pulp) consumed in Colombia has grown from 4 million m³ (in roundwood equivalents (r)) in 2005 to 5.3 million m³ (r) in 2013. Nevertheless, this growth in domestic demand was not supplied by Colombian industries, but mainly by imports. Of the volume of the wood products consumed by the domestic market in 2013, around 35 % was supplied by imports, mostly wood pulp and wood panels. This share was only 25 % in 2005. On the other hand, Colombian exports of wood products have not developed positively in recent years, representing only 3 % of the national production of these products (Figure B).

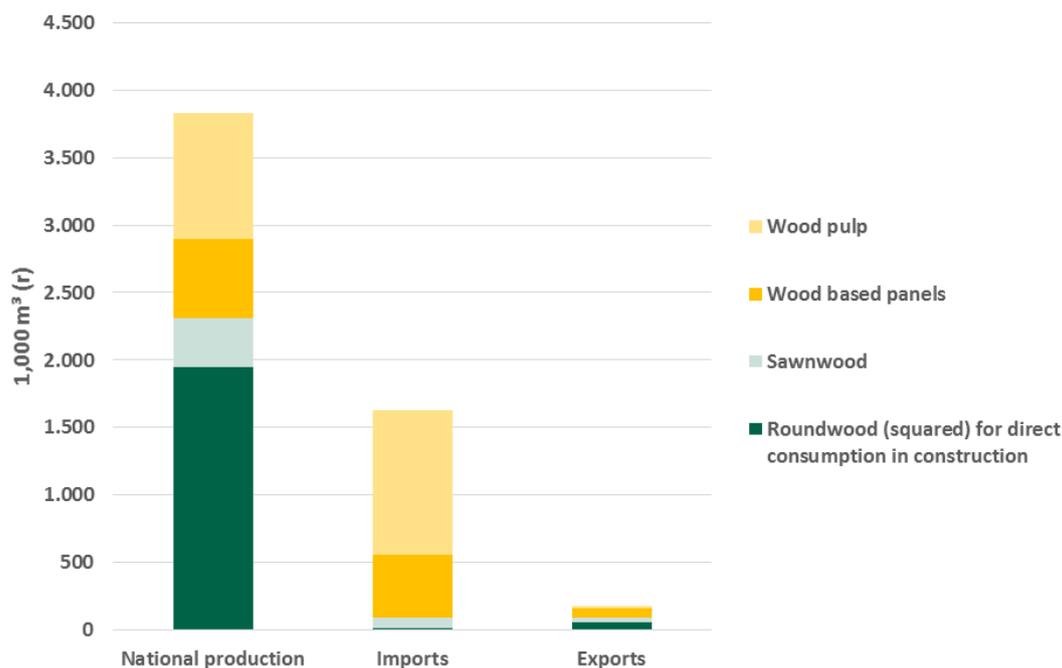


Figure B: Production, imports, and exports of primary processed wood products (2013)

Source: UNIQUE based on DANE: *Presentación combinada de la matriz oferta-utilización de los flujos de la cuenta del bosque 2005-2013, Base 2005*; FAOStat: *Estadística forestal del comercio exterior con pulpa (años 2005-2013)*; UN Comtrade 2016

Taking into account that the primary processed wood products enable added value in subsequent value chains (i.e. the secondary processing, such as in furniture, carpentry, packaging, and paper and paperboard), the priority for the future development of commercial forestry plantations in Colombia will be to increase raw material supply through the increase in planted area and enhancement of productivity of existing areas. At the same time, significant investments in wood processing industries must be realized.

The volume of imports of primary processed wood products is a good indicator for the deficit of the national production; the deficit in 2015 reached more than 1.5 million m³ (r). The deficit in raw material supply is expected to reach more than 4 million m³ (r) by 2030, based on the analysis of projected wood production from existing plantations and domestic market demand. Filling the supply gap would require an additional area of commercial plantations of about 147,000 ha (Figure C, base scenario). In order to produce the products demanded in the year 2030, investments in several large panels mills (MDF and particleboard), a number of plywood plants, a pulp mill, and numerous sawmills of various sizes are required. The gross production value of these new plantations and processing industries would result in gross production values around five times higher than 2014 levels; employment would increase by more than 11,000 (Figures D and E).

An export scenario was developed to illustrate the socio-economic impact of an enhanced reforestation program targeting international export markets. Aiming at an export volume of 10 million m³ (r) of wood products, the required plantation area would increase by 460,000 ha to a total of more than 800,000 ha nationwide. In terms of employment, this would result in 35,000 additional permanent staff in plantations and industries, and the total gross production value would be as high as 12,000 billion COP.

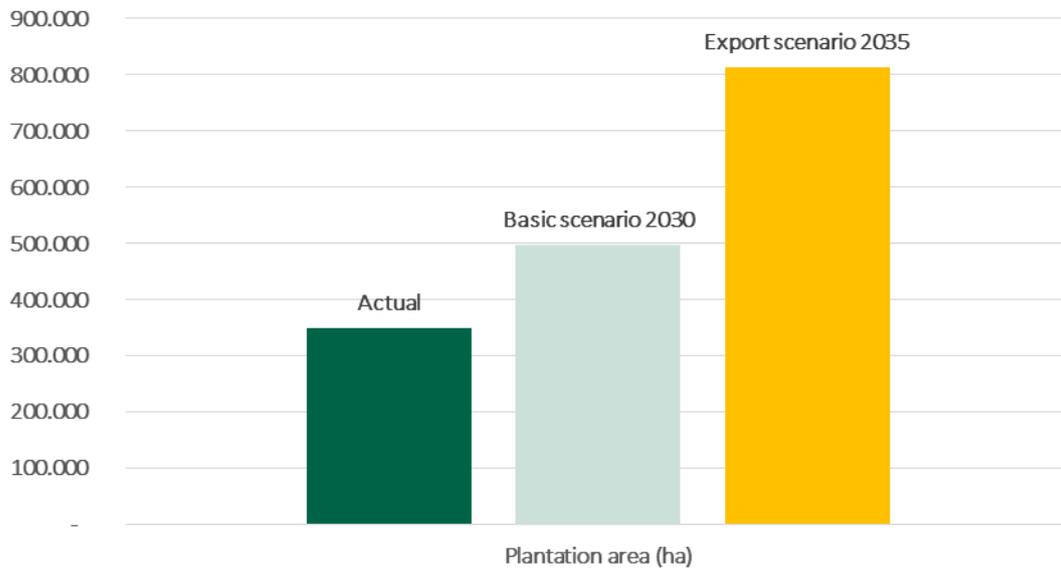


Figure C: Actual commercial plantation area (2015) and area required in 2030 and 2035

Source: UNIQUE-Silvotecnia based on study results

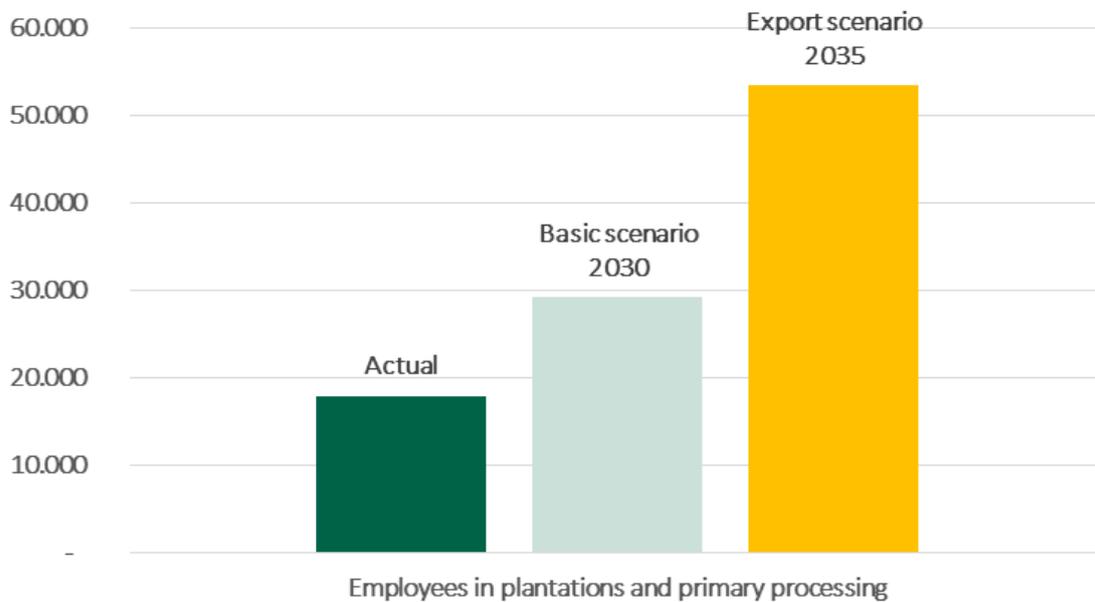


Figure D: Actual (2014) and projected employment in commercial plantations and primary wood processing in 2030 and 2035.

Source: UNIQUE-Silvotecnia based on study results

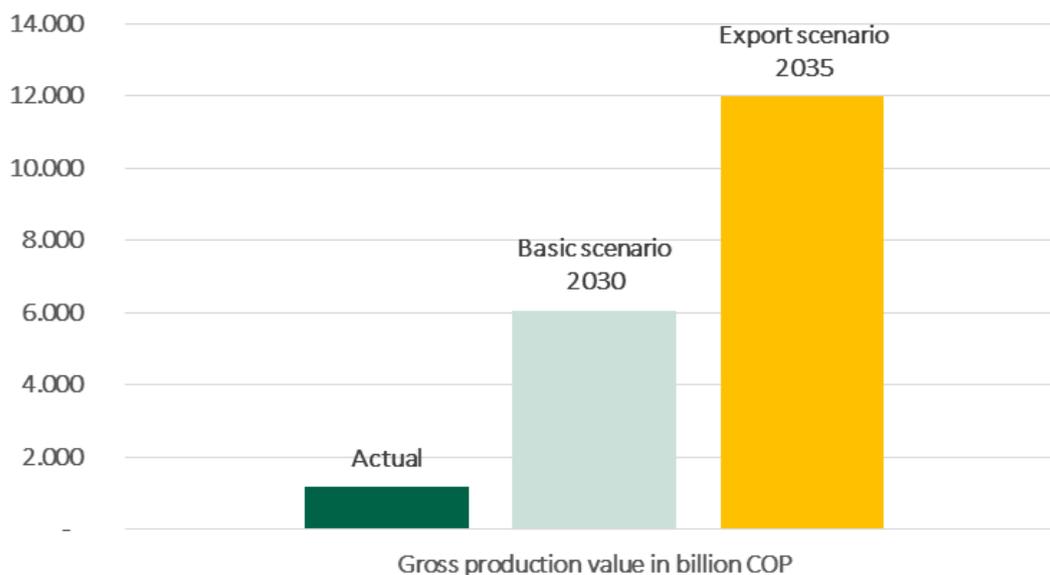


Figure E: Actual (2014) and projected gross production value in commercial plantations and primary wood processing in 2030 and 2035.

Source: UNIQUE-Silvotecnia based on study results

The increase in the area of commercial plantations would also contribute to Colombia's commitment to reduce its Greenhouse Gas emissions (GHG) by 20 % (target given at COP 21) and by 30 % (target increased based on international cooperation). This effect can be enhanced by introducing market options for carbon certificates. The Colombian carbon market will benefit from the carbon trade platform offered by the Colombian stock market, which acts as a transaction agent and operation registry.

It is important to note that the carbon market only provides an additional source of income to commercial plantations, but at the end of the day, a "real" market for the produced wood is required. In this context, wood from commercial plantation projects that are certified according to a carbon standard should be considered in the national green growth strategies. Therefore, the efforts of plantation owners to obtain certification according to a carbon standard must be accompanied by public programs. One approach would be to promote the wide-spread use of climate-friendly construction material and clearly establish its specifications.

The GHG mitigation potential of these wood products includes:

- Carbon stored in commercial plantations under sustainable and permanent management (therefore plantations certified according to a forest certification system, or a carbon certification system would be favored).
- Carbon stored in wood products (especially in construction), and the reduction of carbon emissions due to the substitution of materials with large emissions, such as concrete and steel.

3 DOMESTIC MARKET DEMAND

In Colombia, the projections of the domestic demand for primary processed wood products are on the rise. Projections of future demand result in a volume of 9.2 million m³ (r) in the year 2030, which raises questions about the availability of sufficient raw material to supply the domestic production of the required products and the availability of national industries to invest in new productive capacities. The final uses of these products are detailed in Figure F, indicating that the construction sector is the main driver of wood consumption in Colombia.

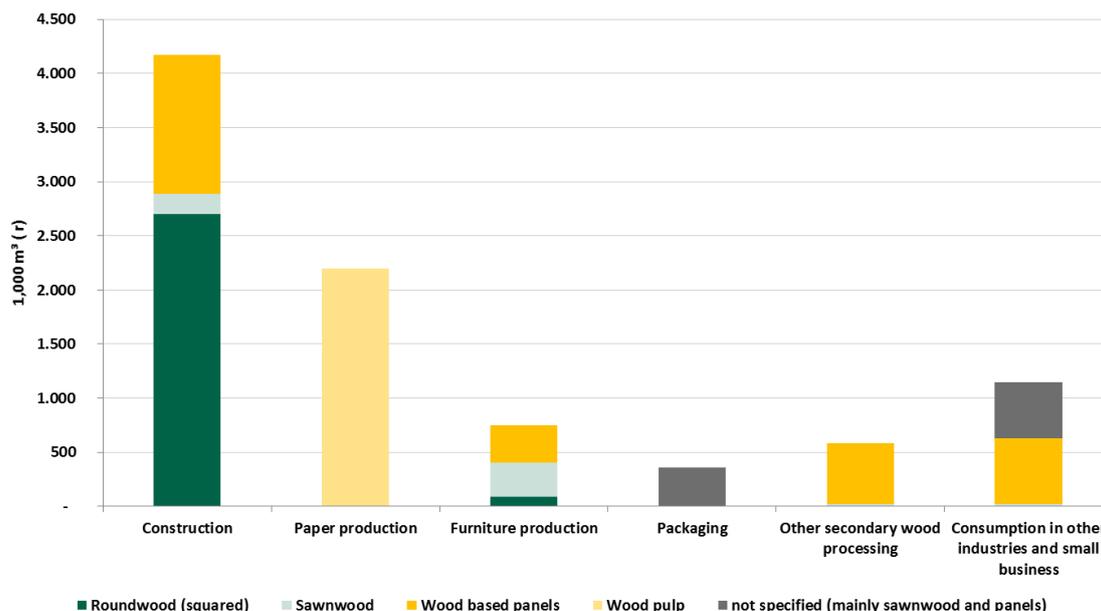


Figure F: Projected national demand of wood products in 2030 according to industry sectors.

Source: UNIQUE based on DANE: Combined presentation of the supply-use matrix of forest account flows 2005-2013, DANE EAM 2013; Base 2005; FAOStat: Forestry statistics of foreign trade with pulp (years 2005-2013); UN Comtrade 2016 Database; The category "not specified" includes sawn wood, wood based panels and round wood. It was not possible to establish a detailed breakdown the wood products consumed by micro-enterprises and by the producers of packaging.

Given the current industrial capacity, the majority of this growth would be met by imports if no new industries were established in the country. While investment in new processing capacity would be desirable, it would require a significant growth in the availability of raw material. The current status of wood processing industries in Colombia is characterized by small and medium size processing capacities (in comparison with international competitors in Brazil, Chile, or Uruguay). In addition, the international comparison of costs for raw material (Table A) shows that none of the main wood processing industries (pulp, wood based panels, and sawmilling) acquire raw material at internationally competitive prices, due to the low productivity of the plantations and the high transport costs. The lack of availability of raw material and the relatively high costs affect primary processing industries and the competitiveness of secondary processing (furniture, paper, etc.), which also competes with imported products and participates in the international market.

In order to strengthen the competitiveness of Colombian industries in relation to imports and improve the potentials for the export markets, primary wood processing industries should be established at internationally competitive scales. The main prerequisite for this development

will be (1) to reduce raw material costs and (2) to ensure the reliable supply of raw material at an adequate quality.

The key market segments in Colombia are described as follows to enable a better understanding of the required investment needs in plantations and processing industries:

- The construction sector is the most important consumer of sawn wood and wood panels in Colombia with a total volume of 1.8 million of m³ (r) for the year 2013. According to projections, by the year 2030 the market will demand more than 4 million m³ (r). The main strategies to improve competitiveness and stimulate the consumption of plantation timber in the sector include: the upgrading and qualitative improvement of existing and future plantations, investments in new panel mills and sawmill plants (with intake capacities of around 3 to 4 million m³), commitment by the public sector to increase the use of wood in public procurement and construction, and the dissemination of knowledge in modern structural wood products and their application at technical and university level.
- The furniture market, which is dominated by domestic products, has been characterized by an increase in imported finished furniture and wood based panels as raw material for national furniture production. To satisfy the projected demand in the year 2030, a volume of 750,000 m³ (r) raw material will be required. Plantation wood will play an important role in the supply of raw material. Many of the companies that produce furniture using solid wood have problems that relate to changes in the supply of timber, market changes and structural problems in their organization and technology. The main strategies to improve their competitiveness include: improving the integration and cooperation of the furniture industry with producers of wood based panels and sawn timber, introducing appropriate and modern technologies for the processing of plantation species, and improving the cooperation between medium and large companies with European and American retailers to improve their technological processes and the quality of products.
- The per capita consumption of paper products in Colombia has increased in recent years. However, only a small part of the paper consumed comes from domestic production based on pulp from forest plantations. The future paper demand is projected to be about 8 million m³ (r). However, only 1 million m³ (r) of wood pulp production capacities are currently established in Colombia. The main potential of the market should be the substitution of imports of wood pulp, as well as the improvement of the paper recycling system to reduce the need for imports.
- Demand is growing for packaging; the volume of wood consumed in these industries is expected to grow from 300,000 m³ (r) in 2013 to at least 360,000 m³ in 2030, e.g. for wood pallets and boxes. Most of the companies that currently produce these goods have modern production technologies installed and good recovery rates of production. For some of these companies it is common to import their raw material (kiln dry sawnwood), which is a good opportunity for timber plantations, especially for wood from thinner dimensions or lower quality timber.
- As for the consumption of wood biomass for energy uses, there is no significant market for consumption by industries or the energy sector in Colombia. However, within the framework of the Government's efforts towards green economic development and the mitigation of emissions from fossil fuels, there are certain prospects for commercial forest plantations in the future. Nevertheless, the amount of wood available for energy uses is not significant at

present, and is widely distributed geographically. The study has identified a potential demand of 7.3 million tons of biomass in heavy industry, potential demand of power plants, and the generation of energy in isolated regions (*Zonas No Interconectadas (ZNI)*), e.g. in the Orinoquía region. In order to supply this demand with new plantations, technological changes in combustion plant processes, investments in power grids, and improvement of infrastructure to enable the transportation of large volumes of biomass are required.

4 TRENDS IN INTERNATIONAL MARKETS

In addition to the national markets previously described, there is potential in international markets. To tap into this potential, however, long-term changes will be needed given the current deficit of wood and the limited industrial capacities in Colombia. This also means that export niches for secondary processed wood products, furniture and paper are clearly limited. Nevertheless, with a significant increase in the availability of wood from plantations and new investments in processing plants, international markets offer several potentials.

The analysis of the international markets considered three groups of countries: the countries with which Colombia has important export links of wood products (group 1: China, USA, Peru, Venezuela, and Ecuador); important wood importing countries amongst Colombian Free Trade Agreement (FTA) partners (group 2: the EU, Canada, Korea, Mexico, and Turkey); and the group of Central American countries (group 3: Costa Rica, Guatemala, El Salvador, Honduras, Panama, and Nicaragua).

Although there are significant differences between the countries analyzed, the export of primary processed wood products offers the best possibilities in the medium term (see Figure G), given the following factors:

- Due to the large size of the markets for these products, exporting niches can be found in all countries analyzed;
- Products offer flexibility vis-à-vis destination markets and are therefore more resilient in the face of cycles in individual countries or regions;
- The production of these products is standardized and the technical characteristics are harmonized in almost all countries;
- Hardly any import tariffs are imposed on these wood products in the vast majority of countries.

Once a competitive primary processing sector is established in Colombia, wood furniture and other secondary processed wood products will also become increasingly interesting for export.

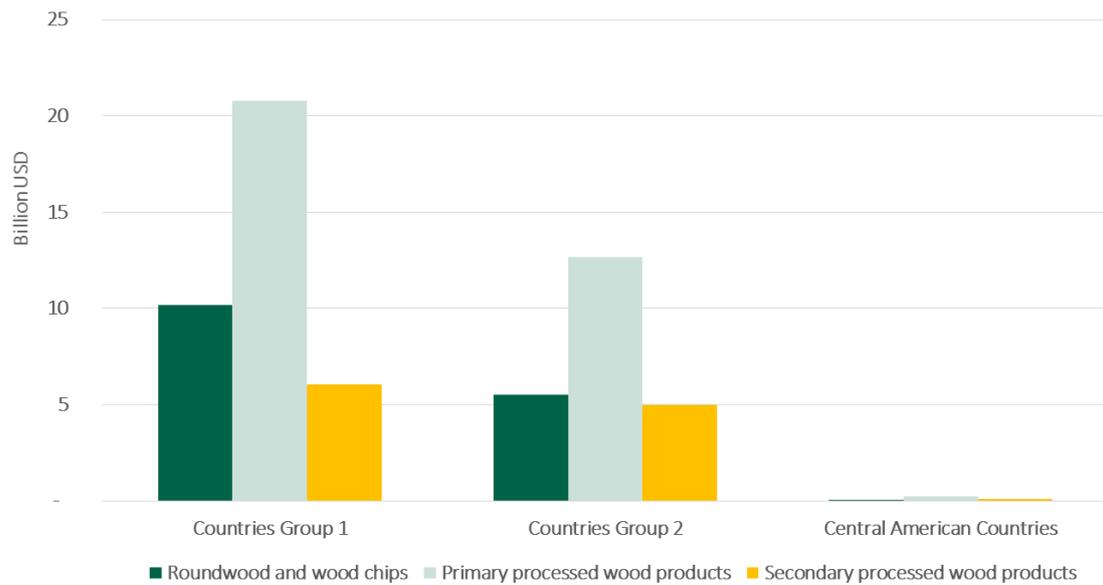


Figure G: Wood products imports according to country groups in 2015 or the most recent year of available data.

Source: UN Comtrade 2016; Import value ("CIF"); Raw material includes groups 4401-4405 (HS 2007), first transformation includes groups 4406-4413 (HS 2007), second transformation includes groups 4413-4421 (HS 2007).

The following considerations must be taken into account in order to exploit the full potential of international markets:

- In the case of sawnwood of conifers and hardwoods, the most interesting markets in the short term are those in Latin America and the USA. In Latin American countries, the greatest potential is found in countries where the Colombian industry has strong commercial relations already (e.g. Ecuador), and which do not have an advanced forestry sector of its own (i.e. Central America). Chain of Custody certification is recommended to obtain better access to the USA and European markets.
- Currently, the Colombian wood panel industry primarily serves the Colombian market. As a priority strategy, it is recommended to gradually increase national production capacities (MDF, MDP and plywood) to expand exports to Latin America. Investments would be required in new production lines and expansion of planted areas under sawlog regimes (long rotation).
- For the export of paper and paperboard, it is recommended to focus on markets for paper products rather than pulp because of competitive advantages. The market in Latin America is the most interesting market for Colombian paper producers. As prerequisites for the expansion of paper production on the basis of wood pulp would be detailed planning, which also needs to consider possible negative impacts on the environment.
- In the furniture sector, an expansion of exports should take into account the expansion of areas with suitable species under an appropriate management regime (i.e. for solid wood furniture made of hardwood species). In order to expand participation in the USA and European markets and comply with their wood legality regulations, it is also recommended to draw on certified raw materials. In any case, the expansion of exports of wood furniture would require the domestic availability of high quality sawn timber and wood based panels.

Hence, this potential is strongly linked with investments in the primary processing industries.

- An alternative potential for export markets is the export of wood chips to Asia and Europe feeding the overseas pulp and panel industry. This requires huge areas of high performance plantations, for which only the Orinoquía region offers sufficient suitable land. Infrastructure and logistics in the region is currently underdeveloped and fluvial exports through Venezuela are subject to political risk.

5 CURRENT SITUATION OF COMMERCIAL FOREST PLANTATIONS

In 2015, an area between 340 and 360 thousand ha of commercial forest plantations is presumed to exist in Colombia. Almost half of the planted area in the country is located in the coffee belt (46.7 %), followed by the Orinoquía and the Caribbean, whose participation is very similar and close to 22 %. The remaining parts of the country have a share of less than 8 % (Figure H). In relation to the location of actually installed wood processing capacities, it can be concluded that the Coffee belt and southwest region and the Caribbean region are the most important because they concentrate a large part of the national forest industry. Production in Orinoquía faces the challenge of being very far from the current wood processing industries.

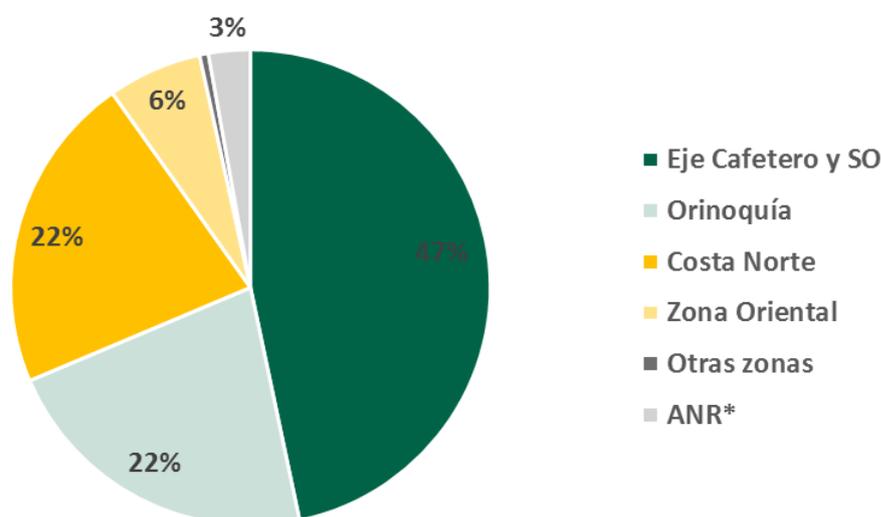


Figure H: Distribution of commercial plantations by region.

* ANR: Area not registered in ICA database.

Source: ICA database and FINAGRO database, corrected by Silvotecnia.

The study found that 51 % of the entire planted area belongs to owners with areas equal to or less than 100 ha. An area of 1 km² for timber production is difficult to manage if production costs are to be reduced, since these plantations generally have high fixed costs. Sometimes plantation owners associate in cooperatives or have agreements with larger producers, which allows them to reduce these costs. On the other hand, a total of 43.1 % of the planted area corresponds to plantations of 100 to 800 ha, and only 3.3 % of the area corresponds to large plantations of more than 800 ha. Larger plantations have a clear advantage over production costs per m³ of wood produced. The attraction of small producers as a source of supply for the industry is reduced due to dispersed location, small quantities, and low quality of wood. Without technical and financial support and without improved genetic material, small producers rarely participate successfully in the timber supply chain.

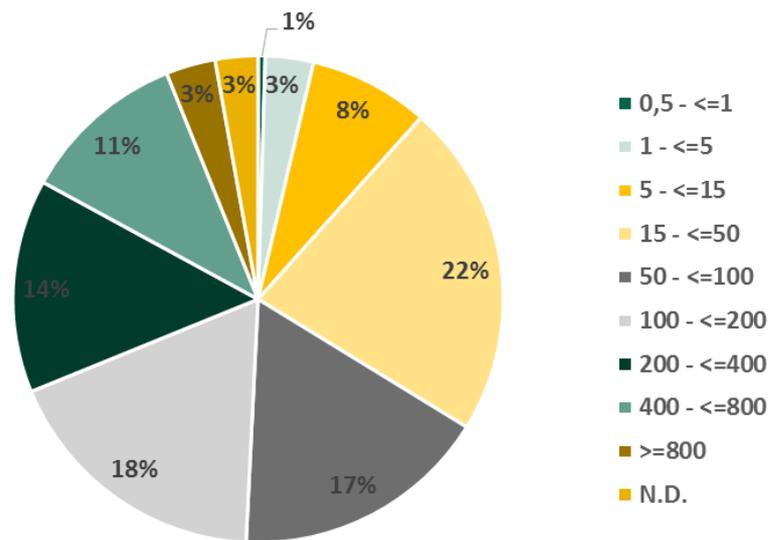


Figure I: Distribution of commercial plantation area by size (in ha)

Source: ICA database and FINAGRO database, corrected by Silvotecnia.

When estimating the available production (this implies excluding the volumes from plantations that are not accessible to the market due to large distances), an average of 2.35 million m³ per year results for the period 2017-2022, and 3.7 million m³ per year in 2023-2030 (Figure J). Considering the projected volumes required by the domestic market, there will be a shortage of wood supply for a large part of the industry in the coming years. Such a shortage is likely to affect mainly small and medium-sized processors, especially in the sawmilling and wood based panel industry. The consequences of this could lead to an increase in imports of wood, as well as other substitutes.

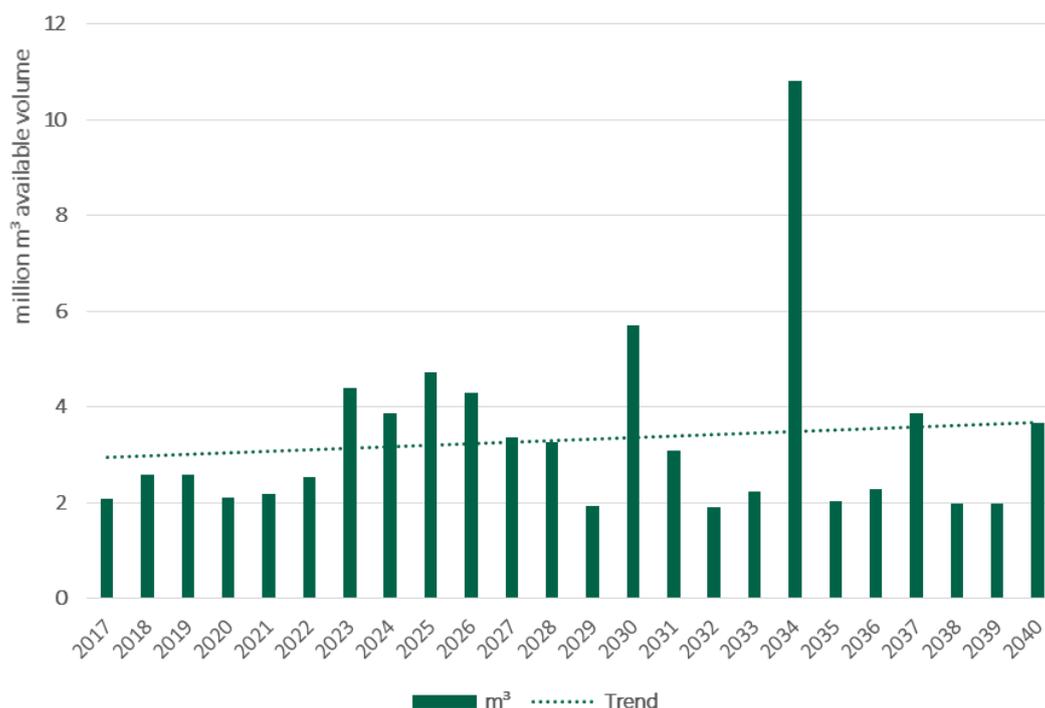


Figure J: Projection of harvesting volumes 2017-2040 available for existing domestic industries.

Source: Silvotecnia based on ICA/FINAGRO

Reviewing current plantation management systems in Colombia, these vary according to species and production target, and have cost structures similar to other regions of the world. However, management as currently practiced does not allow the full use of the theoretically possible wood productivity potential, which results in a high price of wood per cubic meter. With some exceptions, productivity per area is significantly low in most plantations, resulting in a cost per m³ of wood produced 60 % higher than international competitors (Table A). Colombia could greatly improve its performance with respect to productivity.

Improving current management of plantations to add maximum value through the use of specific technologies on fertilization, soils, and improved genetic material can help to improve productivity, wood quality and competitiveness.

Table A: Production costs of standing timber, harvesting and transport compared to Brazil

		Actual			Future potential	
		Brazil (<i>Eucalyptus</i>)	Colombia (<i>Eucalyptus</i>)	Colombia (<i>Pinus</i>)	Colombia (<i>Eucalyptus</i>)	Colombia (<i>Pinus</i>)
Cumulative costs	USD ha ⁻¹	3,370	3,260	6,340	3,260	6,340
Standing timber costs	USD m ⁻³	10	16	18	10	14
Harvesting volume	m ³ ha ⁻¹	336	200	360	320	450
Harvesting costs	USD m ⁻³	11	14	14	12	12
Transport costs	USD m ³ 100 km ⁻¹	8	12	16	10	10
Costs in log yard	USD m ⁻³	29	42	48	32	36

Fuente: UNIQUE

Data for Brazil: average of 6 medium and large companies that handle eucalyptus pulp or boards. Average costs for five years, including all activities from soil preparation, planting, forestry and management.

Data for eucalyptus Colombia: average of three Colombian companies producing eucalyptus for wood.

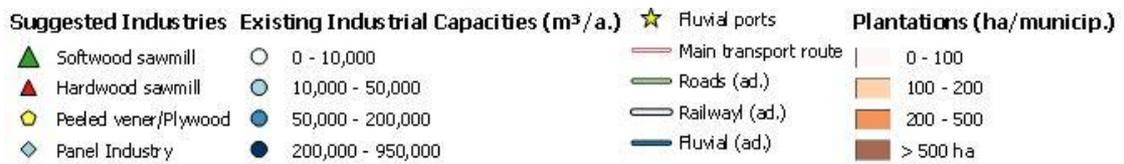
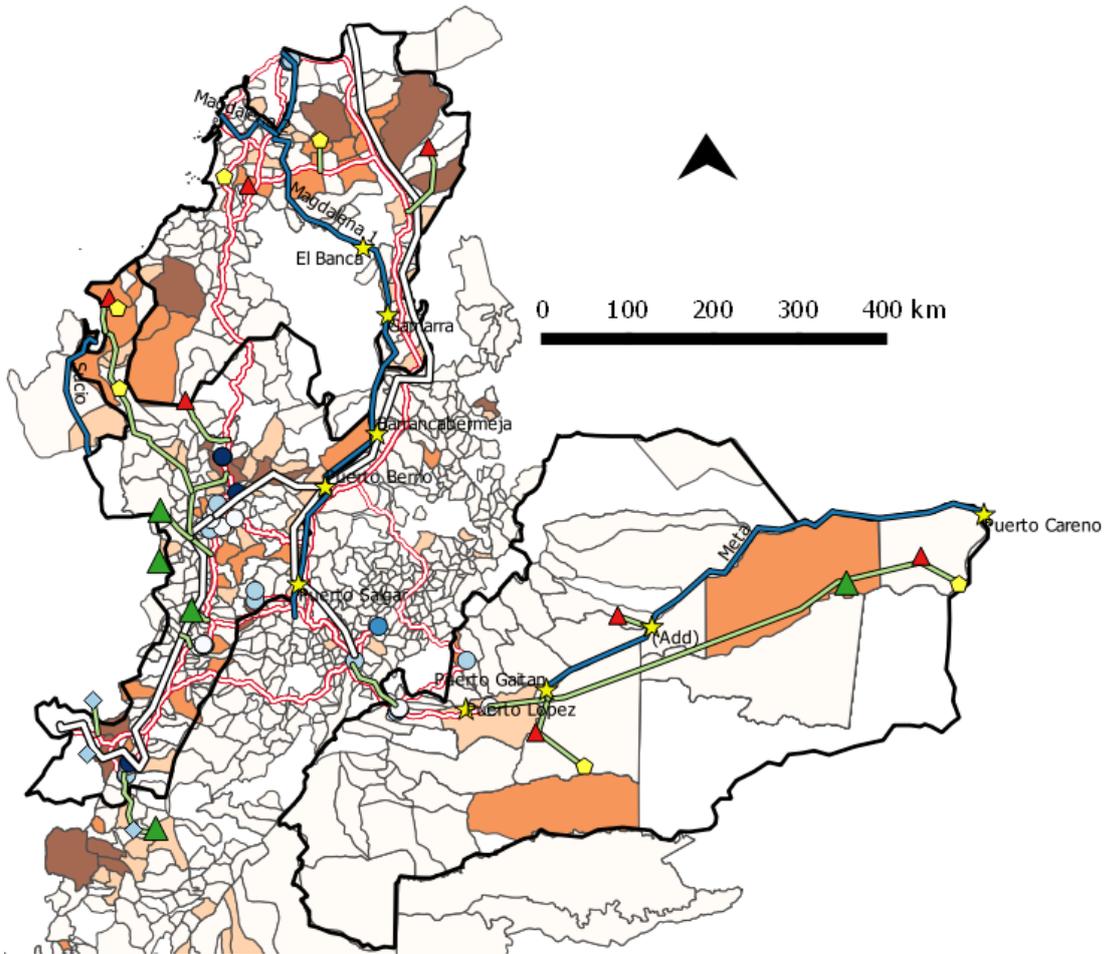
Data for pine Colombia: average of four producers (large and medium), with production of *Pinus* in rotation of 18 years for sawn-wood, chips and posts (multiproducts).

In addition, it is important to consider that forestry activities in Colombia are largely developed in mountainous regions, with implications on the costs of access, forestry management, harvesting, and transportation. As a result, the costs associated with logistics are very high due to poor road conditions, high distances between production and consumption centers, and the low availability of modern transport vehicles. Therefore, it is necessary to optimize and expand the available road network.

The map below shows the general situation with respect to logistics and infrastructure in the commercial forestry sector and the processing industry. It illustrates the main transport hubs for roundwood and wood products and where the existing processing centers are located on the main axes.

In order to gain access to proposed new industries ("suggested industries" in the map), located in areas with more remote plantations, it is necessary to improve the road infrastructure, railway network and river transport. The schematic maps of the 4G plan² indicate that virtually all road and river networks coincide with the main current axes of transport in the sector in Colombia. The rail network does not provide for a west - east connection from Medellín to Puerto Berrio, which could facilitate south - north transport. A dual-lane road between Medellín and the port planned in Turbo would solve part of the problem. The lack of data on the status of current road networks, railways, and inland waterway transport makes it difficult to quantify in detail which of the transport routes investments are needed to promote the forest sector and the timber industry on the national level.

² Colombia's Fourth Generation (4G) road infrastructure program involves the expansion of roadways, highways, ports and railways, with an investment of \$70 billion until 2035.



Map: Main transport axes for roundwood and wood products, existing processing capacities (in m³ intake) and suggested industrial and infrastructure investments in Colombia

Source: UNIQUE and Silvotecnia

6 FINANCIAL INCENTIVES TO COMMERCIAL FOREST PLANTATIONS

Regarding the financing mechanisms to support the development of the agricultural sector and the country's forestry subsector, two of the most well-known instruments are the Forest Incentive Certificate (CIF) and the Rural Capitalization Incentive (ICR). Both instruments, currently administered by FINAGRO, are subsidies granted by the Colombian government that seek to reward the success of private investments in these sectors. To date, access to financing mechanisms remains one of the main barriers to the development of the agricultural and forestry sector in Colombia. The restructuring of sector-oriented financial mechanisms is especially important in a post-conflict scenario in which the agricultural and forestry sector play a key role in promoting economic, social, and environmental development in rural areas that experienced internal armed conflict.

The grants provided by CIF do not correspond to real costs incurred by producers for the establishment and maintenance of forest plantations. Therefore, it is recommended to make accurate estimates of the costs associated with the investments required for the establishment and maintenance of forest crops, differentiating by region and type of producer.

For smaller (and some medium) producers, the bureaucratic requirements and lengthy procedures associated to the CIF create high transaction costs that discourage their participation. The benefits of the CIF are only granted to projects that are considered technically viable and financially profitable. This makes the CIF a premium that rewards profitable investments that do not require state support, rather than an instrument that drives additional investments in the forestry sector. It is important to develop specific criteria of commercial viability that allow the prioritization of those projects with greater potential.

The delivery of resources is not harmonized with the productive cycle of the sector's crops. The productive cycle of forest plantations is characterized by demanding large initial investments followed by an unproductive period that can last several years before generating a first income. The CIF finances 50 % (up to 75 % in some cases) of establishment costs in the first year, followed by 50 % of maintenance costs over the next four years.

The ICR is an important instrument for financing the Colombian agricultural sector, which could play a significant role in the promotion of investments associated with commercial reforestation. However, forest sector actors are generally not encouraged to access the ICR for a number of reasons, including: the lack of a stock market or sub-fund for the forest sector, the lack of harmonization between the financial cycle and the needs of the forest sector, and the difficulty of access to credit to small and medium producers, among others. Therefore, it is recommended to work with commercial banks and other financial entities, possibly in charge of FINAGRO, to develop appropriate credit lines for the sector, allowing for the adjustment of terms and grace periods, the use of forest stands as guarantee, and other long-term investment benefits.

7 POTENTIALS OF THE VALUE CHAINS OF THE STUDY REGIONS

The value chains associated to commercial plantation differ significantly in the three focus regions of this study. Therefore, a detailed value chain analysis was carried out to identify the main limitations and potentials on a regional level.

The regional analysis took into account the current situation of existing plantations, industries and infrastructure, the analysis of the zoning potential of the regions with respect to their suitability for commercial plantations (made by UPRA in 2015), and the projected development of the markets.

7.1 Coffee belt and southwest region

In the coffee belt and southwest region, there are vast areas with high aptitude for forest plantations, such as the Antioquia, with 1.4 million hectares. The main wood processing capacities in the region are installed in Valle del Cauca (Calí), Antioquia (Medellín), Pereira and Manizales. The region has the majority of municipalities with forest plantations up to 500 ha. Thus, it is characterized by a high density of smallholders. It is difficult to obtain large aggregated areas or operate with a high degree of mechanization. Hence, installing new large scale industries will be difficult, since several ten thousands of hectares are required for the supply of a single plant (for example wood pulp). Therefore, it is recommended to focus on promoting small and medium size processing industries (e.g. sawmilling and plywood) with a demand encompassing up to 10,000 ha (maximum of 20,000 ha) to supply one processing site. A further limiting factor in this region is the high competition with other land uses for productive land, which makes investments in new plantations rather expensive.

The total volume projection for the region indicates an average quantity of wood of 4,223,000 m³ per year in the first five-year period, dropping to around 3,500,000 m³ annually between 2020 and 2035, and a significant reduction to the level of 2,400,000 m³ as of 2036. The region needs a combination of increasing the productivity per area to be competitive, as well as expanding the area planted to secure the supply to the existing industry, allowing the growth of the sector.

To supply the wood processing industries, and transport processed products to the markets, the existing infrastructure needs to be improved. The main axes of transport are already defined, and the 4G infrastructure plan considers the improvement of these routes. The expansion of the fluvial transport network in the region (Rio Súcio and Rio Magdalena) is foreseen in the 4G plan and matches with the main transects of wood products transport. The 4G plan rail network is also considering forest product and timber industry product flows, but does not plan the East-West connection of Medellín to the Bogotá -Santa Marta line.

7.2 The Caribbean

The Caribbean region's commercial plantation roundwood production has reached about 1 million m³ of wood per year. There are significant planted areas with melina, eucalyptus, acacia, and teak. The processing industry is concentrated in the northern area around Barranquilla, far away from most of the planted areas. Since the species are hardwoods with interesting value for quality sawnwood production, it is advisable to expand the medium size processing industries (i.e. with regard to processing of melina). The availability of eucalyptus is expected to fluctuate considerably in the coming years, which makes the continuous supply of the industry with this species difficult.

This region hosts substantial plantation resources without access to markets. The first step for the future is to establish new small to medium size processing capacities, especially for sawnwood, plywood, and to some extent for MDF and particle board production. In a later stage it is advisable to expand the planted area, preferably with species with high added value, like teak. Production conditions are less favorable (due to climate, precipitation) for high performance plantations (as e.g. required for pulp and large scale panel production).

The transformation centers are connected by two main north-south highway axes, connecting Medellín and Bogotá. The 4G plan seeks the improvement of road transects, as well as fluvial transportation along the Magdalena River, and the Bogotá railway line to Santa Marta. The situation of the transport of wood and its processed products is thus the best of all the regions analyzed.

It is recommended to expand the road network of the main axes for 4-way highways. Along with the river transport option in some areas and the potential to use the railway, the region should be prepared to meet the volumes and requirements of the forestry sector and forestry industry. Container transport would play an important role and must be addressed with priority if export markets are targeted.

7.3 Orinoquía

The commercial plantation wood production available in this region is based on hard- and softwoods. With the current species composition, the region has potential for the production of sawn wood products from conifers and hardwoods. To install new industries, it is necessary to expand the planted area and adapt the management for the different uses of the wood. For medium to large consumer industries such as wood based panels (MDF, MDP, etc.) or large pulp and paper industries, the currently planted areas are not sufficient. Exploration activities (e.g. infrastructure, electricity grid) for other sectors, such as agriculture, livestock, and the oil industry, also benefit the expansion of commercial forest plantations.

This is the region that theoretically offers the highest potential to expand the area of forest plantations. The topography is the most favorable of the three regions and the soils offer the conditions to be highly productive, if adequately prepared and fertilized.

However, the infrastructure has to be improved with a west-east highway, as included in the country's 4G plan. In addition, the potential of using the Meta River, (given that Venezuela enables access to the Atlantic Ocean) could provide an opportunity to establish a large pulp industry

and the export of raw material, such as wood chips. The connection with Bogotá is also integrated in the 4G plans to connect the region better with the important wood consuming centers in the country.

Orinoquía has the greatest potential for an exceptional development of the commercial forest plantation sector: large tracts of land are available at low prices, with a flat relief and high potential for mechanization, low fertility soils but susceptible to improvement with adequate fertilization programs, and favorable climatic conditions for the cultivation of several species of recognized value for commercial reforestation.

8 KEY ISSUES OF THE INSTITUTIONAL FRAMEWORK

Although 20 % of the country's surface is highly suitable for commercial forest production, there is no specialized public entity to promote the activity of this sector. The institutional framework for governing commercial forestry plantations in Colombia is characterized by weak coordination and a lack of competences and resources.

The *Dirección de Cadenas Agrícolas y Forestales* of the *Ministerio de Agricultura y Desarrollo Rural* (MADR) is the only institution at the service of commercial forestry, and has limited influence at policy level. Furthermore, the *Instituto Colombiano Agropecuario* (ICA) implements, with many limitations, operational functions, such as the registration of plantations and control of compliance with the requirements for the mobilization of timber. The lack of coordination between the ICA and the environmental authorities (*Corporaciones Autónomas Regionales*: CARs) generates gaps in legal competencies that hinder and, in some cases, prevent the harvesting of standing forest plantations. In particular, there are no directives that guide a coordinated and efficient licensing process for plantation operations that could directly affect the environment (e.g. construction of logging roads). All this implies in a loss of time and resources, in addition to generating serious uncertainties for potential investors. In addition, the lack of coordination between the environmental authorities and the road police (*Policía de Carreteras*) facilitates continuous timber theft from registered commercial forest plantations, discourages denunciation and immediate response by the plantation owners, and generates economic losses in the plantations.

To effectively deal with the described issues, the creation of a centralised entity for the commercial plantation sector is recommended in order to strengthen the institutional framework for commercial forestry plantations. Although the national council on wood products (*Consejo Nacional de la Cadena Productiva de Maderas, Tableros, Muebles y Productos de Madera*) has been operating as a coordinating body, its influence in terms of high level policy is limited. The coordination unit of the National Commercial Reforestation Program (*Unidad Coordinadora del Programa Nacional de Reforestación Comercial*) within MADR, which was assigned administrative, technical, and operational competencies, has never been put into operation.

Therefore, the national council of wood should be strengthened through the integration of high-level public officials involved in the entire forest sector (Ministries and agencies, such as ICA, *Fondo para el financiamiento del sector agropecuario* (FINAGRO), *Unidad de Planificación Agropecuaria* (UPRA), the superintendence of ports and the police), as well as research institutions and private sector actors, academia and the private sector).

Agricultural research of the public sector is generally facilitated and co-funded by CORPOICA (*Corporación Colombiana de Investigación Agropecuaria*), which is an entity attached to MADR. Although the funded research promotes commercial forest plantations, resources are limited. CONIF (*Corporación Nacional de Investigación y Fomento Forestal*), currently focuses on studies mainly for the private sector. Strategies should be designed and implemented to restructure commercial plantation research and enhance public-private research cooperation on forest plantations and, in the long term, to set up a forest industry research body.

9 KEY ISSUES OF THE LEGAL FRAMEWORK

Through the definition of UAFs' (*Unidades Agrícolas Familiares*), the Colombian Government seeks to prevent the concentration of land in relatively cheap areas recently colonized, which restricts the feasibility of large productive units in such areas. Another issue is that there are diverging judicial rulings on vacant lands, which has created great confusion. Finally, the possibility of land dispossession in the areas affected by the armed conflict and the scope of the process of land restitution currently implemented by the National Government have made it difficult to acquire land as a productive factor for the implementation of forestry projects, since they require complex due diligence processes.

There are a number of possibilities to address existing legal security challenges in land tenure. For instance, to ensure that the regulation of the Act on rural development zones of special interest (*Zonas de Interés de Desarrollo Rural, Económico y Social ZIDRES*) accommodates particularities of forestry projects, in terms of productive cycles, land suitability, among others; and to design and implement incentives for long-term contracts to cover the productive cycles of commercial forestry projects.

In the last 20 years, the Colombian government has adopted several public policies aimed at promoting commercial forestry in the country, including the National Plan for Forest Development, 2000, CONPES 3237 2003-2006, the National Development Plan 2010 -2014, and the Plan of Action for Commercial Reforestation 2011. However, these policies have not been very effective, since they have not been coordinated with a simultaneous effort in budgetary matters and institutional capacity that would allow their effective materialization. Such a policy should define the vision for the commercial forestry sector, including the overall targets, such as hectares to be planted by a defined date. This goal should be consistent with the Plan "*Colombia Siembra*" and the Nationally Appropriate Mitigation Action (NAMA) for the Forestry Sector in Colombia.

Although the Code on Natural Resources (CRN) Decree 1791 of 1996 differentiated natural forests from planted forests, all forestry activities were originally anchored in the environmental sector. Their actual separation was only effective in practice when the Decree 1498 of 2008 appointed the agricultural sector to register commercial forest plantations and to license the transport of plantation timber. In any case, the distinction is exclusively based on criteria of human intervention and does not take into account ecological or socioeconomic factors or studies, as the CRN originally planned. In that context, the MADR resolutions 182 and 240 of 2008 established the requirements for the registration of commercial forest plantations and the extent of the control of the ICA for the registration and issuance of transport licenses, albeit the aim and goal of this entity is unrelated with the scope of the assigned task. In addition, there is no type of procedure that leads to a suspension or cancellation of the registration when irregularities are detected.

The activities required to address these challenges include: (1) to create a specialized entity for the forestry sector; (2) to strengthen the institutional coordination, and specifically the *Consejo Nacional de la Cadena Forestal*; (3) to standardize environmental procedures related to the forestry sector; (4) to strengthen research and development of the sector; (5) to implement ZIDRES for forest plantations and adjust the law to include elements which could solve current debates regarding rural establishments; (6) design and initiate a policy plan with goals, actions, incentives

and responsibilities, and; (7) strengthen registering procedures on the normative level with general definitions and jurisdictions, sanctions proceedings and the establishments of fees for service provision

10 SUMMARY OF RECOMMENDED ACTIONS

The analysis and conclusions presented in the reports of PROFOR's commercial plantation program in Colombia resulted in a set of recommended actions for the promotion of value chains based on commercial forest plantations. These recommended actions are described in detail in the "Plan of recommended actions - Promotion of commercial forest plantations in Colombia", which includes the description of the activities required by each action, detailed schedules, description of the key actors for implementation, and cost estimates.

The recommended actions relate to three main objectives:

- 1) Improve productivity and increase wood supply from commercial forest plantations.
- 2) Improve the competitiveness of Colombian wood processing industries and increase the participation of Colombian wood products in domestic and international markets.
- 3) Adjust the institutional and legal framework to improve the governance of commercial forestry plantations.

The following tables summarize the set of actions recommended per objective. Details for each action, including a time table, actors involved and a rough cost estimate are presented in the document "Plan de acciones recomendadas" (Action plan).

Table B: Recommended actions for improving and increasing wood supply from commercial forestry plantations (Objective 1)

Action	Targets	Execution time
Action PI 1: Improving the productivity by area	Increase of the Mean Annual Increment Pines: 32 m ³ /ha/year Eucalypts: 36 m ³ /ha/ year	5 years
Action PI 2: Consolidate and modernize education and research on forestry plantations	Public research and education agenda coordinated with the private sector	5 years
Action PI 3: Increase of area of commercial forest plantations	Increase of commercial forestry plantation area by 500,000 ha	Until 2030
Action PI 4: Organization and integration of small producers	Implementation of three smallholder integration models (public-private cooperation)	5 years
Action PI 5: Reduction of roundwood transport costs	Reduction of roundwood transport cost by 50 %	Until 2030
Action PI 6: Adjust technical considerations of the CIF	CIF adjusted to technical needs and realities of the commercial plantations sector	1-2 years
Action PI 7: Ensure the continuous and secured allocation of budget for the CIF	Source of permanently secured budget allocation identified	1-2 years
Action PI 8: Continue reforms in the ICR to promote the forestry sector	Development of specialized credits lines for commercial plantations	1-2 years

Table C: Recommended actions for improving national and international competitiveness of Colombian wood processing industries and increase the participation of Colombian wood products in domestic and international markets (Objective 2)

Action	Targets	Execution time
Action IM 1: Promoting wood consumption in the domestic market	Construction of 50,000 social housing units in wood	5 years
Action IM 2: Promote "competitive clusters" in medium and large industry	Investments in wood processing industries in three regional clusters with total capacities of 4 million m ³ roundwood intake	10 years
Action IM 3: Promotion of clusters of micro and small transformers	Implementation of 4 SME cooperation models in urban centers and three SME cooperation models in rural areas	10 years
Action IM 4: Increase wood product exports	Investments in wood processing industries with total capacity of 10 million m ³ roundwood intake.	Until 2030
Action IM 5: Improve wood product transport logistics and infrastructure	Reduction of wood products transport cost by 50 %	Until 2030
Action IM 6: Improve the participation of commercial plantations in national green growth strategy	Defined contribution of commercial plantations to NDCs	5 years

Table D: Recommended actions for adjusting the institutional and legal framework to improve the governance of commercial forestry plantations (Objective 3)

Action	Targets	Execution time
Action MIL 1: Strengthen the institutional framework of the forestry sector	Creation of an executive entity for commercial plantations	1 - 2 years
Action MIL 2: Strengthen coordination between institutions	Strengthening the national council on wood products	1 - 2 years
Action MIL 3: Standardization of environmental processes	Optimized licensing processes on environmental guidelines and directives for commercial plantations	1 - 2 years
Action MIL 4: Strengthen research in the forestry sector	Implementation of a coordinated forest sector research agenda endowed with specifically allocated resources	1 - 2 years
Action MIL 5: Improve legal security in land tenure	Incentives for long term land use contracts	1 - 2 years
Action MIL 6: Strengthen public policy on commercial forest plantations	Implementation of a commercial forest sector policy agenda with clearly defined objectives and targets (incl. monitoring and evaluation)	1 - 2 years
Action MIL 7: Improving the registration procedure for commercial plantations	Establishing a functional and transparent commercial plantation registry	1 - 2 years

