FORESTRY
SECTOR
IN URUGUAY



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Uruguay XXI
INVESTMENT, EXPORT AND COUNTRY
BRAND PROMOTION AGENCY

Uruguay XXI
PROMOCIÓN DE INVERSIONES, EXPORTACIONES E IMAGEN PAÍS

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WHY INVEST IN URUGUAY?

FORESTRY SECTOR

- Uruguay is internationally recognized for its political, democratic, and social stability. It has a solid macroeconomic base suitable for successful investments.

- The country is considered a privileged destination for international companies seeking quality, efficiency, experience, and new business opportunities.

- Both domestic and foreign investments are considered of national interest; the country grants them equal conditions and a broad range of incentives.

- The exchange market in Uruguay operates freely: no prior authorizations are required, and no restrictions are imposed on the purchase, sale, entry or exit of currency or capital, as well as on the transfer of profits, dividends and interest.

- Due to the abundant supply of pine timber in the northern part of the country, from certified and operating plantations, Uruguay is an attractive destination for first and second mechanical processing companies. The annual availability of this wood exceeds three million cubic meters, significantly more than the current industrial capacity.

- Uruguay's strategic location in the Southern Cone of the American continent makes it a gateway for the region, enabling multi-modal solutions that combine rail, land and sea transport. In addition, the country offers first-class logistic infrastructure, state-of-the-art telecommunications technology and a leading energy supply based on renewable sources.

- Uruguay shares the same latitude with many of the main forestry enterprises in the southern hemisphere, boasting a similar climate and soil of regions in Australia, New Zealand, South Africa, Argentina and Chile, which guarantees outstanding levels of international competition.

- The country offers a stable legal framework, favorable for investment in the forestry sector, backed by Law 15,939, which guarantees good forestry practices that comply with international sustainability demands.

- Uruguay's investment promotion Law (16,906) and Industrial Parks Law (19,784) offer attractive tax benefits for industrial activity. Furthermore, exporting companies may benefit from the temporary entrance regime, allowing the tax-free import of supplies (VAT and import taxes), and the refund of export taxes (between 3% and 6% of the FOB value).

- For further information, please contact our sector specialists here.

1. EXECUTIVE SUMMARY

The forestry sector has become one of the most dynamic drivers of Uruguayan economy this century. Since the Forestry Act in 1987, the number of tree plantations have remarkably increased, which has led to the growth and diversification of a wide range of primary, industrial and service activities, such as sawmill operations and cellulose production.

In 2021, this sector accounted for approximately 2% of the Gross Domestic Product (GDP) and has since experienced a steady growth reflected in increased economic activity, employment generation and investment. In the past two decades, in a context of increased exports, the forestry sector has recorded significant growth, rising from 5% in 2001 to almost 20% in 2022.

Over 1,800 companies are directly related to the forestry sector and employ more than 17,000 people. Most of the over 80 sawmills in the country are owned by Uruguayan companies. Foreign investment has been critical to the continuous growth of the sector, as its demand for products and services has led to improvements in efficiency and quality throughout the value chain. This was achieved through economies of scale and the adoption of international quality standards in the domestic industry. In 2023, UPM's second cellulose mill started its operations in Uruguay, with a total investment of US$ 3 Billion, equivalent to 5.4% of the country's GDP. This investment represents the largest foreign investment ever received by Uruguay as well as the largest investment in UPM's history, which has over 100 years of experience.

The increase in forestry production has driven important infrastructure projects like the construction of a port terminal that specializes in cellulose (with an estimated investment of US$ 280 million), the creation of the Central Railway that will connect the center of the country with the port of Montevideo (with an estimated investment of US$ 1 Billion) and improved access to Uruguay's main port with the construction of a viaduct that is over 1,800 meters long (with a US$ 130 million investment). These improvements are directly related to forestry development and once these works are completed they will significantly increase Uruguay's competitiveness in this sector.

2. THE FORESTRY SECTOR IN URUGUAY

2.1.SECTOR DESCRIPTION

The forestry sector in Uruguay encompasses several activities ranging from seed and plant production to the transport of end products. The sector is divided into four categories:

- Cellulose-Paper Chain: includes the production of untreated roundwood, chips, cellulose pulp, paper, cardboard, and other related products. World-renowned companies participate in this area.

- First Mechanical Transformation: includes activities that take wood from its initial state up to intermediate products such as boards, posts, wooden sheets, particles, among others.

- Second Mechanical Transformation: this phase focuses on the use of products obtained from the first transformation in order to manufacture goods such as panels, construction carpentry, glued laminated timber beams and boards.

- Energy: this category includes products such as chips, firewood, pellets and the energy production from biomass, among others.

The sector's activities can also be grouped into three types of phases according to the value-added chain.

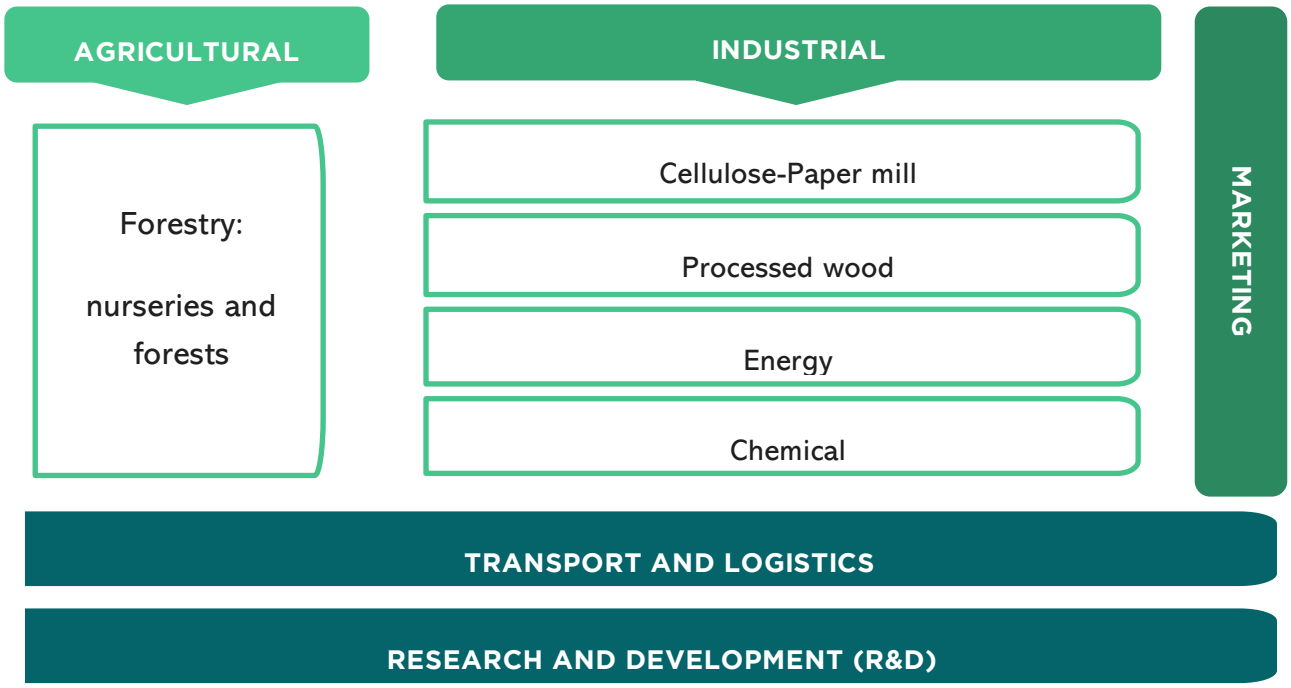
Primary Phase (Agriculture): includes the production of reproductive material and plants in nurseries, the planting and intermediary forestry treatments of the forests, as well as the harvesting of forestry products.

Secondary Phase (Industrial): includes the chemical or mechanical wood processing activities carried out in different lines, including the marketing of end products.

Logistics, Transportation and Associated Professional Services: covers a wide range of activities crucial to the efficient management and operation of the forestry industry. This includes the planning and execution of the supply chain logistics, the transport of raw materials

and forest products, as well as professional services such as forestry consulting, environmental engineering, and sustainable management of forest resources. This sector plays a key role in the supply of forest products, from the forest to markets and end consumers, ensuring the sustainability and profitability of the industry.

Figure 1
Main activities of the forestry sector

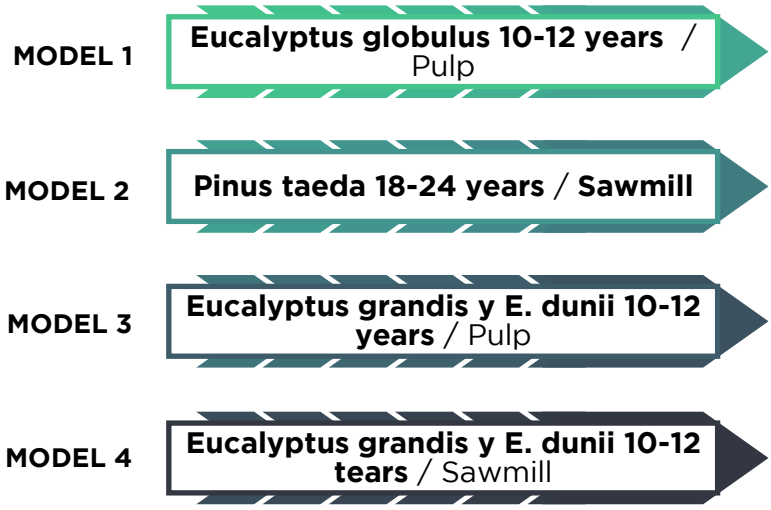


Source: Uruguay XXI based on the document in the Industrial Plan 1 of the Productive Office - Ministry of Industry, Energy and Mining (MIEM) - National Directorate of Industries.

The forest products industry in Uruguay has large vertically integrated companies that span from agricultural production to the final marketing step. Some of the main exporters are largely supplied by their own raw material. The largest and most productive sawmills mainly use domestic raw material and export their products. On the other hand, smaller companies focus on selling their products primarily in the domestic market and are not fully vertically integrated.

There are two main industrial chains in Uruguay: the cellulose chain and the mechanical transformation chain. In addition, other activities such as chip and roundwood exports are carried out, which may also be destined for pulp production or for sawmilling activities.

Figure 2
Main forestry models in Uruguay



Source: Uruguay XXI based on the document in the Industrial Plan 1 of the Productive Office - (MIEM) - National Directorate of Industries.

These models emerged to meet the changing demands that were a direct result of the Forestry Act of 1987 (No. 15,939) in Uruguay. Initially, timber exports were the basis and first way in which the local sector entered the international market for forest products.

The relative weight of eucalyptus roundwood exports, which was originally destined for cellulose production (E. globulus: model 1), gradually decreased with the emergence of local cellulose projects. Uruguay has the capacity to export almost two million tons of chips annually, although the local demand increasingly absorbs these products as input.

Sawtimber (E. grandis: model 4) has become a brand that mainly serves the Southeast Asian markets, serving as raw material for furniture industries targeting exports to Europe. However, its annual income is highly variable and depends on trade prices in Asia.

The forestry chain, regardless of its industrial transformation purpose locally, keeps a relatively simple structure that encompasses the following phases:

- **Nurseries:** includes seedling production and genetic improvement activities (breeding).
- **Forestry:** covers land preparation, planting and forestry management, including pruning and thinning, among other practices.
- **Harvest:** has to do with felling and timber harvesting in the field.

- **Timber loading and transportation:** involves the timber transport to industrial facilities by either land or riverways.
- **Industrial transformation:** here the activities are divided into:
    - Cellulose mills.
    - First mechanical transformation.
    - Second mechanical transformation.
- **Energy Production:** includes generating energy by burning black liquor in cellulose mills as well as by burning solid biomass such as chips and sawdust.
- **Export:** end products are exported from ports in Montevideo, Nueva Palmira or Punta Pereira.

Regarding process costs (which are the same for each individual stage of industrial transformation), 55% of the total cost for a 20-year cycle starts at "year zero", mainly due to land acquisition and initial plantings.

As an example, for model 3, which is currently the most widespread in terms of territory, the expected after-tax Internal Rate of Return (IRR) is 6%.

2.2. SAWMILLS

According to the latest survey carried out by the General Forestry Directorate[1], there are approximately 80 sawmills in Uruguay. Most focus on processing a single species or group of species like pine or eucalyptus. The main demand for sawtimber can be found in three specific areas:

- **Tacuarembó-Rivera.**
- **Paysandú.**
- **Metropolitan Area.**

The sawmills with the largest capacity are mainly found in the first area, which is also the most dynamic in terms of forestry activity. Among the most prominent sawmills in the area are:

- **Arboreal** (570,000 cubic meters/year): this company acquired Frutifor in 2020. This sawmill, located in Tacuarembó, uses pine wood and has implemented a highly

[1] General Forestry Directorate – "2020 Sawmill Survey" - The surveyed companies are all those identifies as "Mechanical wood processing industries", specifically sawmill industries, solely primary wood processing (carpentries, wood soaking mills and board mills are excluded). The companies that were not surveyed are divided into: 1) small, informal companies that could not be identified and thus are hard to reach, 2) companies that did not agree to participate in said survey.

automated production process. All of its production consists of dry boards of different categories that are exported to China or Vietnam. In 2021, the company doubled its capacity and invested in a solid wood manufacturing facility (CLT and Glulam), the first in the country and largest in the region. In 2023 they obtained a certification from the Material Testing Institute of the University of Stuttgart confirming that the structural timber manufactured at their sawmill complies with European standards

- **Lumin** (500,000 cubic meters/year): started by Weyerhaeuser in 2006, then acquired by BTG Pactual Timberland Investment Group (TIG) and British Columbia Investment Management Corporation (BCI) in 2017. This project uses around 500,000 cubic meters of wood[2], where approximately 55% is pine wood and the rest is eucalyptus. They produce different plywood that has several categories and "faces" of pine and eucalyptus. In 2019 the company invested around US$ 48 million in a new production line for high-quality panels. For a total of US$ 136 million, in 2023 the company then invested in a third mill to produce plywood in the department of Cerro Largo.
- **Urufor** (325,000 cubic meters/year): located in Rivera, Urufor and Cofusa are part of the same economic group involved in forestry production, industrialization, and marketing of high-quality Eucalyptus Grandis (Red Grandis®) timber. They are a vertically integrated unit and produce kiln-dried sawn boards and glued laminated timber products, used in the construction and furniture industries. Approximately 90% of its production goes to the international market and 10% is sold locally.
- **Dank** (265,000 cubic meters/year): located in the department of Rivera, this company was one of the precursors of forestry in the area. It produces pallet wood, re-manufactured wood, engineered wood and offers drying capacity.
- **Forestal Caja Bancaria** (120,000 cubic meters/year): this pension fund has pine and eucalyptus plantations in Paysandú and Durazno. It exports most of what it produces.
- **IMNSur** (40,000 cubic meters/year): this sawmill uses primarily pine, but also eucalyptus, and mostly exports its products to Mexico and the United States in the form of pallets and pallet wood.

Like other industries in the sector, sawmills faced challenges as a result of the demand for eucalyptus wood from cellulose mills. Many of them made changes in order to modernize their processes and those who survived are basically those who have their own forests. The largest sawmills that process pine experienced few challenges, since the pine wood supply far exceeds the demand and many are also forest owners.

[2] Lumin to invest US$ 136 million in a new plywood plan

The largest local sawmills consume anywhere between 100,000 and 500,000 cubic meters of roundwood per year and are divided into four categories: Arboreal and FYMNSA, that exclusively process pine wood (mainly Pinus taeda); URUFOR, that exclusively processes Eucalyptus Grandis, and LUMIN (previously Weyerhaeuser), that manufactures plywood from both species. Caja Bancaria and INMSUR are sawmills with processing capacities of between 40,000 and 100,000 cubic meters of roundwood per year, that combine pine and eucalyptus in different proportions.

2.3. CELLULOSE PULP

The growth of the forestry sector gave way to a thriving cellulose industry. In 2007, UPM's mill began its production and exports. In 2009, it expanded its production capacity to 1.4 million tons of cellulose. Montes del Plata began production in Colonia in 2014 and in 2020 it reached a production of 1.4 million tons.

With a total investment of US$ 3.47 billion, UPM opened a second mill in Paso de los Toros in 2022. This facility will consume 7.5 million tons of wood annually and produce 2.1 million tons of pulp.

With all three mills in operation, nearly 17 million tons of wood are consumed annually which then become 4.8 million tons of pulp. The cellulose production chain exported US$ 1.885 billion which represented 77% of the total value exported by the forestry sector.

This investment consolidated cellulose as the main export product in the country and may position Uruguay as the second largest global supplier of short-fiber cellulose in the coming years.

Uruguay, silvicultural & timber hub

Key players

2.4. ENERGY PRODUCTION FROM FORESTRY RESOURCES

Within the activities related to the industrial phase, the production of energy from forest by-products such as biomass and by-products of mechanical and chemical transformation is noteworthy. This activity has taken on a key role and has promising perspectives due to the increase of available raw material and energy-related governmental policies. In 2022, 39% of the energy matrix supply was sourced from biomass residue[3].

2.4.1. POWER GENERATION PLANTS FROM FORESTRY RESOURCES

Certain companies in the sector have biomass power generation plants:

- **UPM:** the UPM mill in Fray Bentos has the capacity to generate 161 MW of electric power, most of which is used to fuel its operations. Around 20 MW are commercialized with UTE (National Administration of Power Plants and Electric Transmissions). UPM's second mill in Paso de los Toros generates a power surplus of over 110 MW.
- **Montes del Plata:** this company has an installed capacity of 180 MW, of which around 80 MW are fed into UTE's grid.
- **Fenirol:** located in the department of Tacuarembó, Fenirol has an installed capacity of 10 MW, of which half is supplied to UTE's power grid. This mill uses mainly chips, eucalyptus sawdust and bagasse as fuel sources.
- **Bioener:** located in the department of Rivera, Bioener has a 12MW capacity.
- **Lumin:** Lumin's plywood plant, located in Tacuarembó, is self-sufficient in terms of energy, using waste from the industrial process in its boiler and supplying energy (in steam form) to the industrial process itself. The installed energy capacity is 12MW.
- **Ponlar:** located in the department of Rivera, Ponlar uses by-products from the Dank sawmill as a source of energy and has an installed capacity of 7.5MW.

[3] Source: Uruguay XXI based on UTE.

3. ECONOMIC RELEVANCE

In the period from 2016 to 2021 the Gross Domestic Product (GDP) related to the primary phase of the sector, including activities like forestry, timber extraction and related services grew at an average annual rate of 0.3%. The GDP contribution of primary activity has remained at 3% since the beginning of the period.

The added value of the industrial phase also displays a steady growth during this period, especially because of the start of operations of the UPM cellulose mill in late 2007 and Montes del Plata in mid-2014. In fact, the industrial phase registered an annual average growth of 6.5% in the past decade.

3.1. EMPLOYMENT

According to data provided by the Social Security Agency (BPS) the sector employs 17,120 workers directly. It is important to highlight that this number does not include indirect jobs that the sector generates, which includes transportation, logistics and related services.

Also, it is important to note that 15% of the country's population resides in the departments with the largest forested hectares, which underscores the economic and social relevance of this industry in Uruguay[4].

[4] Source: National Institute of Statistics (INE) - Statistical Yearbook 2022. The following departments were considered: Rivera, Tacuarembó, Cerro Largo, Paysandú, Río Negro and Lavalleja.

Table 1
Number of direct employees in the forestry sector

Forestry Phase	2021	2022
Forestry and related activities	4,348	4,537
Timber extraction	2,137	2,076
Harvest of forestry products (i.e. Timber)	28	21
Forestry support services	1,581	1,944
Industrial Phase		
Timber chipping, sawing and brushing	2,806	2,962
Manufacture of timber products	1,197	1,464
Manufacture of wooden furniture	2,056	4,256
Chemical transformation		
Paper and cardboard manufacturing	2,110	2,288
Total	**16,262**	**17,129**

Source: General Forestry Directorate based on information from the Social Security Agency (BPS).

3.1.1. TRAINING

Highly trained human resources play a key role in the development of the forestry sector, given the high technological level required and the potential increase in productivity that they can bring.

University education and technical training have adapted to meet the demands of this industry, preparing chemical engineers for cellulose production and architects specialized in wood construction.

The Labor University in Uruguay (UTU) also developed academic programs related to forestry and the timber industry. In the department of Rivera, one of the main centers of forestry activity, the Wood Technologist career is offered, which aims to train professionals capable of working in technologies, forestry harvesting and industrial wood engineering.

A summary of the educational offers relating to the forestry industry can be found in this annex. This indicates that, although there are still opportunities for improvement, the growth of the sector has led to the creation of technical and tertiary training alternatives, as well as the issuance of specific diplomas related to this industry.

3.2. ENTREPRENEURIAL ECOSYSTEM

According to data from the Social Security Agency (BPS), the forestry complex in Uruguay encompasses over 1,800 companies. Of this total, 92% are micro and small businesses that employ less than 20 workers.

In terms of activities, the forestry sector is divided into forestry and manufacture of wood products, each accounting for 48% of the companies in the sector. On the other hand, cellulose and paper manufacture represent 4% of the companies.

Table 2
Forestry sector companies by segment and size – 2022

Sub sector	MSES (Micro and small businesses)	Medium	Large	Total
Forestry	781	76	10	867
Timber products	835	27	4	866
Paper and paper products (including cellulose)	70	15	5	90
Total Companies	**1,686**	**118**	**19**	**1,823**

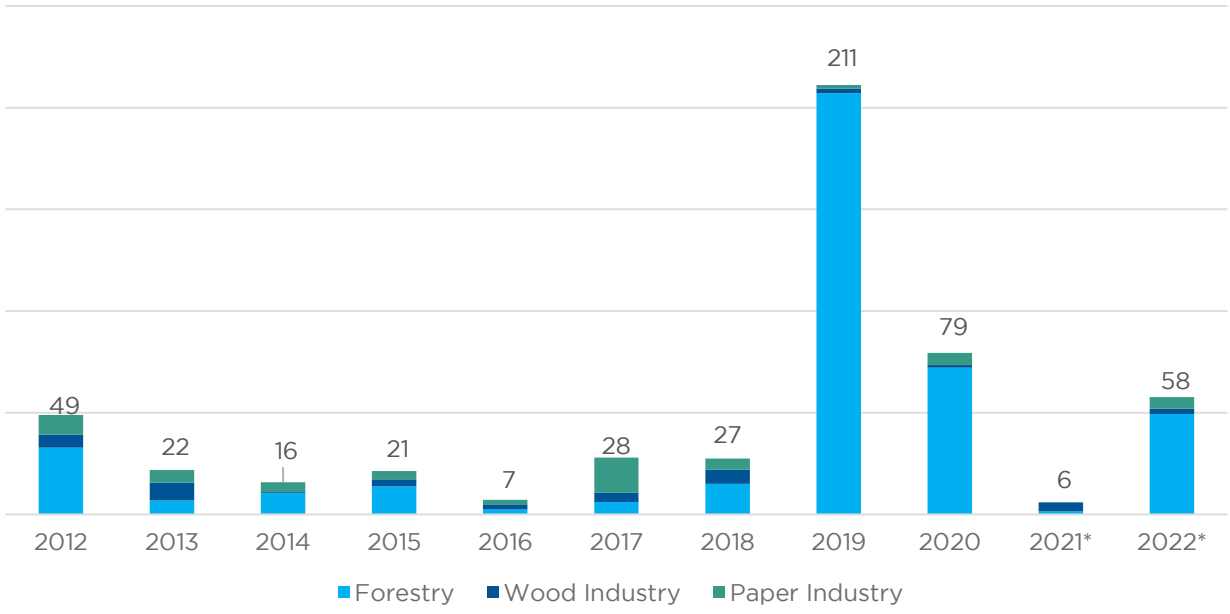
Source: Uruguay XXI based on information from BPS - 2022.

Among exporting companies, pulp producers UPM and Montes del Plata are leaders. Together they accounted for 75% of the total value of the sector's exports in 2022.

4. INVESTMENT

Since the announcement of the construction of UPM's second mill, forestry-related projects were boosted with investments for US$ 354 million in the cumulative period 2019-2022, which represent a 35% increase from the entire cumulative period of the previous decade (2009-2018). In recent years projects associated with forest tree nurseries, sawmills, wood brushing and wood machine work took center stage.

Graph 1
Promoted forestry sector projects – COMAP
(US$ Millions)



Source: Yearbook 2022, Office of Agricultural Programming and Policy - (OPYPA). (*) Preliminary data processed by Uruguay XXI

4.1. MAJOR INVESTMENTS IN THE FORESTRY SECTOR

4.1.1. UPM

The Finnish company UPM is one of the world's leading cellulose producers, operating in 12 countries with a total of 54 production facilities and employing around 18,000 people. In 2009 it acquired a majority stake in Botnia S.A. in Uruguay (now UPM Fray Bentos).

In July 2019 UPM confirmed the establishment of its second cellulose mill in Uruguay. The total investment was of US$ 3.47 billion. This is not only the largest foreign investment ever received by Uruguay, but also the largest investment made by UPM in its over 100 years of history.

In February 2023, the company opened its third eucalyptus nursery in Sarandí del Yí, Durazno. This required an investment of US$ 25 million and it created new job positions in construction and operations[5].

The investment of the second mill also required the creation of a specific cellulose terminal in the deep-water port of Montevideo, as well as investments in infrastructure and local facilities in several regions of the country.

In 2022, the company registered exports of US$ 1.68 billion. In Uruguay UPM is an important player in the economy, over 15,000 people have worked at the mills and over 3,700 indirect jobs were created through its operations whilst working with 235 contractors. The personnel are engaged in different stages of the production cycle, including activities in nurseries, forestry plantations, transport, mill operations and port activities.

With regards to primary production, UPM operates a subsidiary in Uruguay (UPM Forestal Oriental) which has over 30 years of experience in the country and supplies wood to the Fray Bentos mill. Approximately 70% of the wood comes from UPM plantations, while the other 30% is obtained from over 700 rural producers that participate in the company's Forestry Development Program. In 2022 an estimated 4.4 million tons of wood were sent from Uruguay to UPM.

UPM's industrial complex in Fray Bentos, inside the Río Negro department has a eucalyptus short-fiber cellulose mill with a capacity of 1.3 million tons. Most of this cellulose is exported and the shipping process requires transporting it by barge down the Uruguay river to the port

[5] Lacalle Pou inaugurated UPM nursery in Sarandí del Yí - Office of the presidency

of Nueva Palmira, where it is loaded onto transatlantic vessels bound for Europe or Asia. Aside from cellulose production, the mill in Fray Bentos also houses a biomass power generation unit.

UPM's industrial complex in Paso de los Toros has a eucalyptus short-fiber cellulose mill with a 2.1-million-ton capacity. The location selected for the project is in the area bordering the departments of Durazno and Tacuarembó, specifically in Pueblo Centenario. The location was selected considering the availability of forest resources as well as the goal to promote social and economic development to a region that historically has faced socioeconomic challenges. The departments that directly benefit from this investment - Durazno, Tacuarembó, Cerro Largo and Rivera- are areas with lower employment rates, less favorable education indicators and higher poverty levels compared to other parts of the country. The construction and operation of the facility is expected to have a significant impact on the economic growth and local development of this region.

Activities related to UPM's second mill in the value chain would result in a 2.4% increase of the GDP and would create 9,000 permanent job positions. The impact assessments suggest that cellulose production adds greater value, generates more employment, and contributes to more tax revenue by hectare compared to other forms of land use.

Table 3
Economic impact of UPM investments[6]

UPM	UPM Fray Bentos	UPM Paso de los Toros
% of the GDP	1.4%	2.4%
Positions (incl. Indirect)	7,000	9,000
Taxes	US$ 90 million	US$ 124 million

Source: study prepared by CPA Ferrere.

[6] Economic impact study of UPM operations in Uruguay - CPA Ferrere

4.1.2. MONTES DEL PLATA

The cellulose production company settled in Uruguay in 2009, because of an equal partnership between two of the most prominent companies in the global forestry sector: Arauco (Chile) and Stora Enso (Sweden-Finland).

The company manages around 165,000 hectares of forestland including its own and third-party properties in 13 of the country's departments. In addition, 35% of the properties handled by the company are protected areas for biological conservation, including native forests and endemic species subject to conservation and monitoring plans. In 2022, four million tons of timber were required to supply the Montes del Plata mill.

The company's industrial complex is in Punta Pereira, in the department of Colonia. It includes a mill with the capacity to produce 1.4 million tons of cellulose annually, a biomass power generation unit and a port terminal. The company directly employs around 620 peoples and, as a whole, the production chain generates around 6,500 jobs[7].

[7] Our company - Montes del Plata

4.1.3. LUMIN

Lumin, a company with an outstanding track record spanning over two decades in the Uruguayan market, is a leader in the forestry sector and in the manufacturing of wood-related products. Its focus is the manufacture of plywood, made from pine and eucalyptus wood.

The company settled in Uruguay in 1996 under the name Weyerhaeuser. In 2017 it concluded the sale of its operations in Uruguay to a consortium led by Timberland Investment Group, part of the Brazilian group BTG. Lumin owns extensive forestry areas in Uruguay distributed in the departments of Rivera, Tacuarembó, Cerro Largo and Treinta y Tres, totaling approximately 120,000 hectares, which include both pine and eucalyptus plantations. The industrial mill, located in Tacuarembó, has a panel production capacity of 270,000 m^3. In 2023, Lumin announced a US$ 136 million investment in a new plywood mill that will expand the previous capacity.

The company also operated a clonal nursery focused on growing tress specifically destined for the forestry industry and has a power generation plant that is supplied by factory waste and biomass. The generated energy is used to power the industrial plant and is fed into the power grid. Lumin employs 779 people directly in the five departments where it has operations[8].

4.1.4. ARBOREAL

In 2021 Uruguay witnessed the arrival of Arboreal, a project with significant impact in the country's timber industry by increasing the sawmill's drying capacity. This capacity increase gave way to an increment in annual production, reaching 570,000 cubic meters. This milestone had a positive effect on exports of processed wood products from Uruguay. The total investment for the project was almost US$ 60 million, because it included the purchase of Frutifor for US$ 25 million, a new CLT plant for US$ 22 million, a drying unit and another automatic plank sorting facility, each for US$ 6 million.

in the forestry industry.

[8] Annual Report 2022 - Lumin

This investment not only contributed to strengthening Uruguay's forestry industry, but it also positioned the country in the global cross-laminated timber market by deploying the largest and most advanced CLT facility in South America.

4.1.5. GARNICA[9]

Garnica is a Spanish plywood manufacturer with production facilities in Spain and France. In April 2023 it announced the opening of a new factory in the Uruguayan department of Treinta y Tres, with a US$ 42 million investment. The mill is expected to consume a volume of 150,000 m^3 of eucalyptus grandis annually and will create 150 new jobs.

4.1.6. KLUNTEX[10]

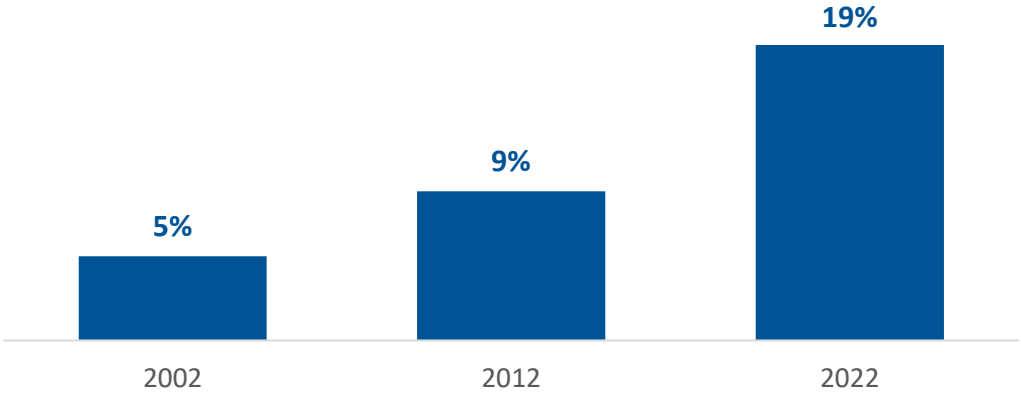
Kluntex Lumber, located in Rivera, is a United States capital company that produces pinewood lumber and clear board. In March 2022 it invested US$ 7 million for the construction of a productive mill and currently produces around 84,000m^3 of end product per year, with a 160,000 m^3 consumption.

[9] Garnica will open a new factory in Uruguay - Garnica
[10] Mayor announces a US$ 5 million investment and the creation of 70 new job positions

5. FOREIGN TRADE

Forestry export had a significant boost thanks to the establishment of cellulose mills: UPM (2007 and 2022) and Montes del Plata (204). This growth has led to an increase of the added value for the sector and an upsurge in investments in the forestry chain. These factors, combined with exports of products such as sawn wood, chips and raw wood have contributed to a marked increase in the forestry sector's share of total exports of goods.

Graph 2
Forestry sector exports
(% share of total goods exports)

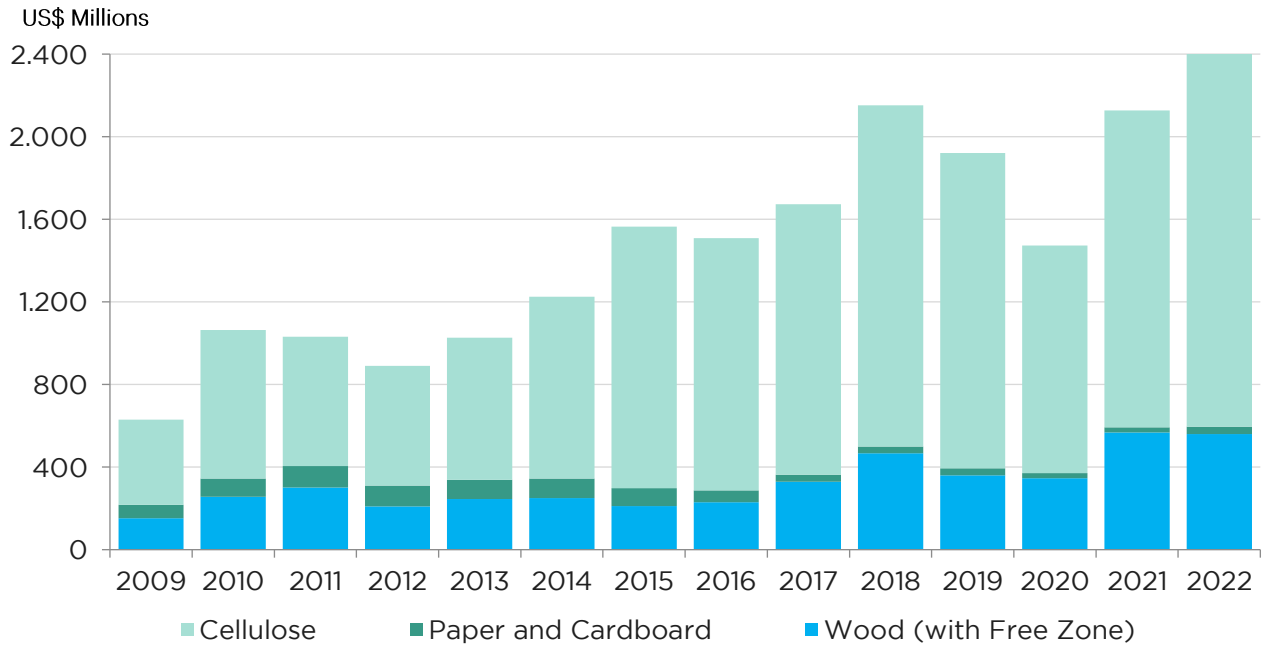


Source: Uruguay XXI based on data from the National Customs Directorate (DNA), Central Bank of Uruguay (BCU) and Montes del Plata.

In 2022, exports from the forestry complex, which include timber, wood products, cellulose, paper and cardboard experienced a 17% increase over 2021 and totaled US$ 2.48 billion. This was equivalent to 19% of the total value of goods exported by the country.

The increase of exports in 2022 is mainly due to the substantial growth of cellulose sales, which rose 22% and represented 75% of the total exports in the sector. This happened despite a slight 1% decrease (US$ 560 million in 2022) in timber and wood products. On the other hand, paper and cardboard sales grew 35% compared to 2021, although the latter only represented 1.4% of the total sales in the forestry complex.

Graph 3
Uruguayan exports – Forestry sector
US$ Millions



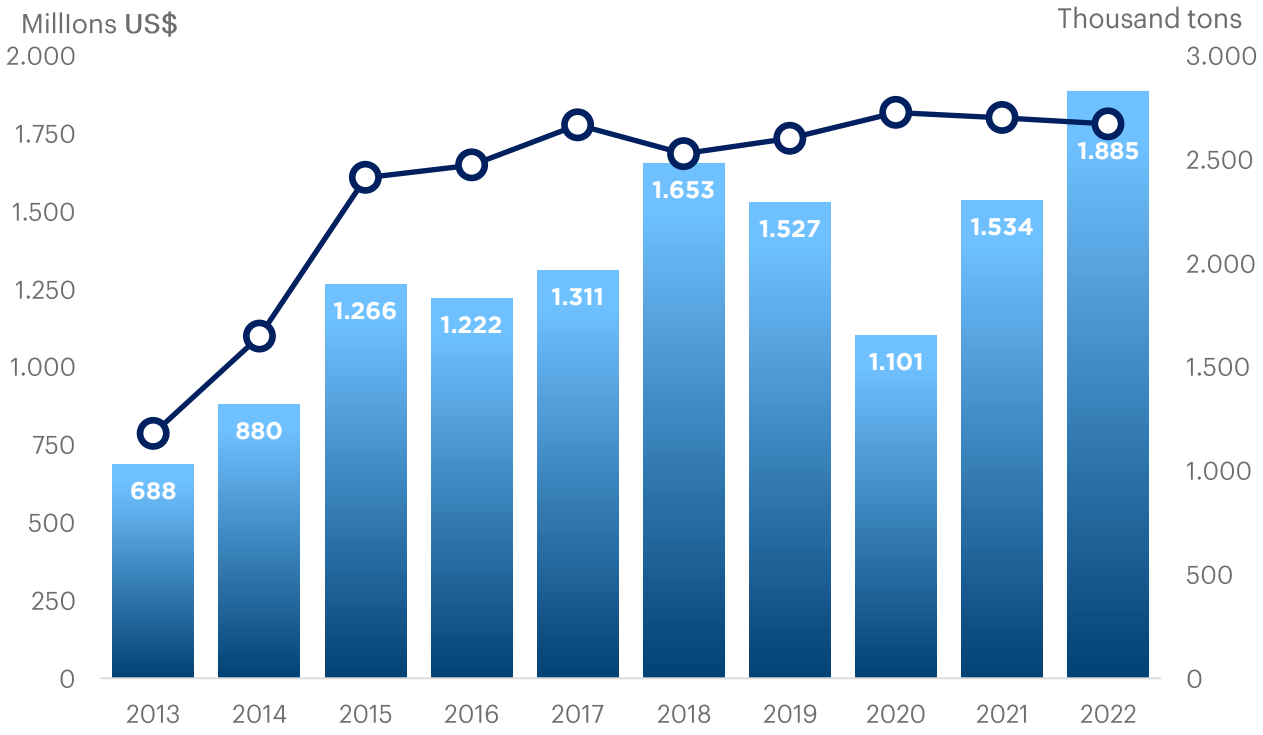
Source: Uruguay XXI based on data from DNA, BCU and Montes del Plata.

5.1.CELLULOSE EXPORTS[11]

Cellulose pulp is the main component used to manufacture paper and cardboard. In 2022, cellulose exports totaled US$ 1.885 billion, which accounted for a 17% increase compared to 2021. As a result, cellulose has become the third most exported product by Uruguay. This increase is mainly attributed to a 24% increase in export prices, which averaged US$ 706 per ton in 2022, although the volume slightly decreased compared to 2021. For 2024 a slight improvement of cellulose paste is projected, and it is expected to be in the range of US$ 650 per ton[12]. A price recovery was originally expected in 2020 prices, but the pandemic impacted international demand and increased global inventory levels.

[11] Exports of goods with free zones 2023 - Uruguay XXI
[12] Latin American cellulose pulp prices to benefit from improved demand and low inventories - Fitch Ratings

Graph 4
Uruguayan exports – Cellulose
US$ Millions



Source: Uruguay XXI based on data from the DNE, BCU and Montes del Plata.

Cellulose paste exports are carried out from three free trade zones. One is the Free Trade Zone in Punta Pereira, which houses the Montes del Plata mill and has its own port terminal for shipping goods abroad. The UPM mills have different logistic processes. The production in UPM Fray Bentos is moved in transit from the Free Trade Zone in Fray Bentos to the Free Trade Zone Nueva Palmira, where the goods are shipped abroad in larger vessels. UPM Paso de los Toros transfers its production to the port of Montevideo. From the Free Trade Zones where UPM Fray Bentos and Montes del Plata operate direct shipments are also sent by road to Argentina, a destination which receives 3% of the exported value.

5.2. TIMBER EXPORTS (EXCLUDING SHIPMENTS TO FREE TRADE ZONES)

Wood products exports have experienced significant growth in terms of value. Over the last five years (2018-2022) the average value of sales has increased 82% compared to the previous five-year period (2013-2017). This increment is due to a combination of higher sales volume and elevated export prices. Specifically, raw wood export played a significant sole in this increase, although lumber wood and chips have also contributed to a lesser extent.

In 2022, timber exports and timber by-product exports reached a value of US$ 560 million (excluding inputs destined for free trade zones). This number is 1% lower compared to 2021, when a record number of US$ 560 million in wood products and by-products were exported. The slight decline in exports is due to a marked fall of raw wood exports to China, a destination that played a key role in the 2021 record number.

Exports to China amounted to US$ 106 million in 2022, a decline of 51% compared to 2021 when a total of US$ 217 million was exported. The offset of this drop was the increase in exports to countries such as India and Portugal, to which US$ 84 million and US$ 90 million were exported respectively (28% and 115% y-o-y increase).

5.2.1. CHIPS

Chip sales had a steady growth of 53% year-on-year in 2022, although there had already been growth in 2021 due to the rebound effect in exports. This increase was explained by higher exports to Portugal, which went from US$ 42 million to US$ 87 million in 2022.

Placements measured in physical volume increased 39%, from 779,000 tons in 2021 to 1,081,000 tons in 2022. Sales totaled US$ 113 million and Portugal continued to be a main destination with 75% of total external sales for the year, followed by China with 20%.

Since 2015 Portugal has been the main destination for chips with 89% of placements. In early 2021 China announced the opening of its market to chips, and since then it is the second destination for this product. The Asian country has accumulated 9% of total chip exports since 2015, despite the fact that it has only been importing this product for two years. However, in 2022 exports decreased by 30%, going from US$ 32 million to US$ 22 million in 2022.

The average placement price in the last decade has remained approximately US$ 100 per ton. In 2022 the average price per ton went from US$ 105, with a variation between the two main

destinations, while the sales to Portugal had an average price of US$ 107 per ton, placements to China were made for US$ 95.

5.2.2. ROUNDWOOD

Foreign sales of timber grew sharply from 2016 onwards due to an increase in China's demand. In general, pine occupies a majority share in this flow. In 2022, it accounted for 81% of the volume, while the rest was eucalyptus. Part of these outflows are related to the harvest cycles of the plantations.

Total exports in 2022 were of US$ 157 million, a drop of 31% y-o-y. The volume placed was 1.9 million tons. India was the main destination, accounting for 53% of the total and almost 99% of pine timber. China took second place with 32% of the exported volume. The average export price of roundwood remained at US$ 82 in 2022.

5.2.3. SAWN TIMBER

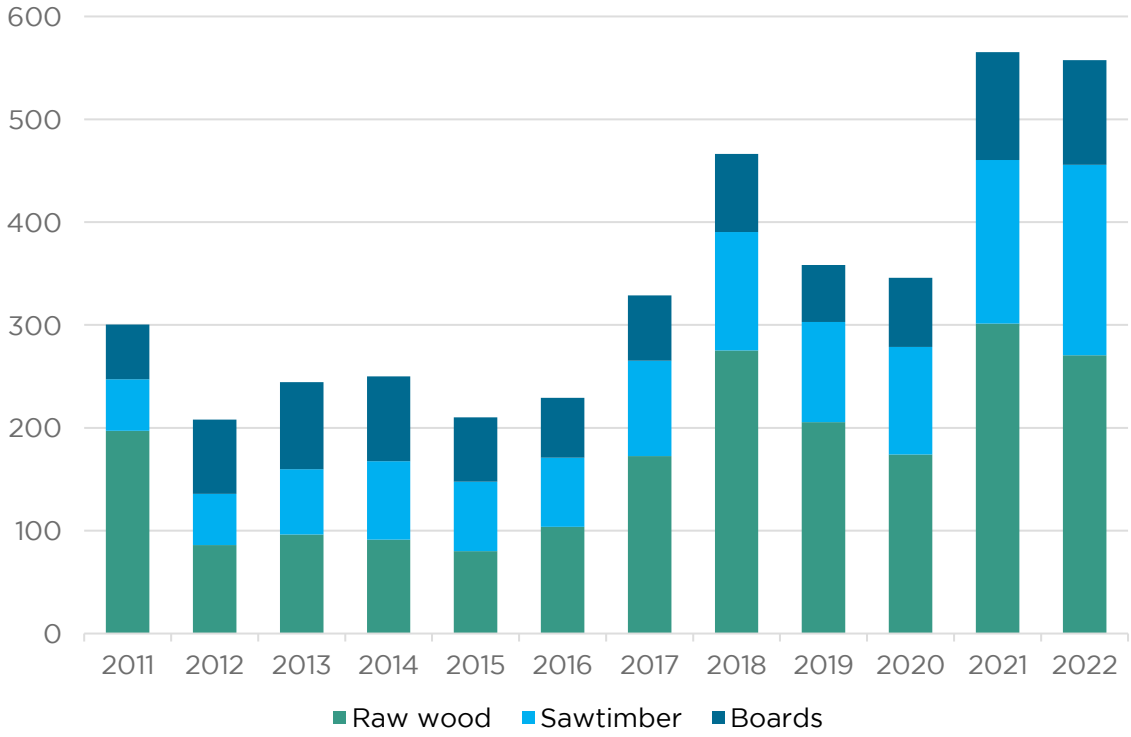
Sawn timber accounted for 28% of Uruguayan wood exports in 2021, reaching a total of UDS 185 million and surpassing 274 thousand tons. Sales of this product increased by 17% year over year, driven by an increase in export volume (22%) as well as a price increase (5%).

The main destinations for this product were the United States (25%), China (17%) and Vietnam (9%). Sawn timber is one of the products that adds the most value to Uruguayan exports in the sector, which is shown in its export price, totaling US$ 675 per ton in 2022.

5.2.4. BOARDS

Wood-based panels represent another high value-added product in the sector. In 2022, plywood exports reached US$ 102 million, marking a slight decrease of 3% compared to the previous year. This decrease was entirely due to the price factor, which stood at around US$ 807 per ton, representing a 9% drop year-on-year, despite a 7% increase in the exported volume. The main destination for boards was the United States, accounting for 58% of exports followed by Mexico with 20% and Chile with 6%.

Graph 5
Wood and wood product exports (excluding free trade zones)
US$ Millions



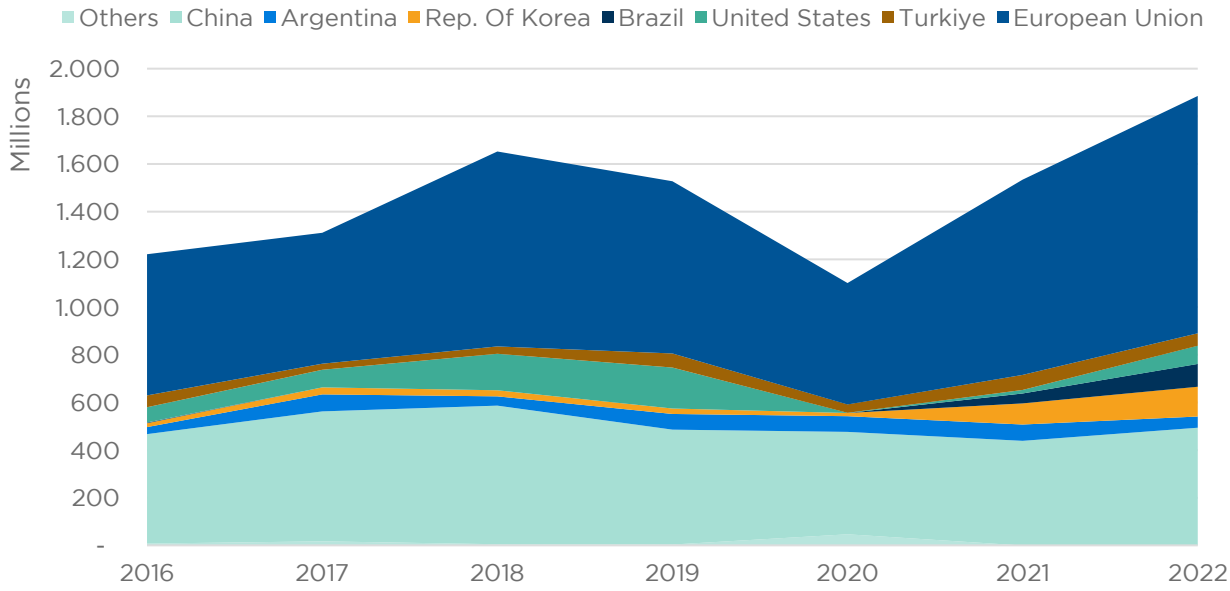
Source: Uruguay XXI based on data from the DNA and BCU.

5.3. DESTINATIONS[13]

In 2022, 80% of cellulose exports had two main markets as a destination: the European Union and China. The predominance of these destinations is consistent through time, although in recent years the European Union has become more important while China has decreased its share, despite the steady growth in its demand. The main difference between these destinations was the year-on-year growth rate of exports. In the past 10 years, exports that went to the European Union grew year on year at an average rate of 16%, while China's average growth rate for the same period was 7%. In 2022, the European Union accounted for 53% of total exports, while China represented 26%.

[13] For more information on cellulose destinations and other products, visit: Exports of goods with free zones by Uruguay XXI.

Graph 6
Cellulose exports by destination
US$ Millions



Source: Uruguay XXI based on data from the DNA and BCU.

Within the European Union the main final destinations were the Netherlands, Italy, Germany and Spain. In 2022, a total of US$ 996 million was exported to those destinations, an increase of 22% over 2021. In 2022 exports to China represented US$ 495 million, 26% of the total placed by the country.

A total of US$ 395 million was exported in 2022 to other destinations including the Republic of Korea (US$ 125 million), Brazil (US$ 95 million), the United States of America (US$ 77 million), Turkey (US$ 52 million) and Argentina (US$ 46 million).

5.4. PROJECTED FORESTRY SECTOR EXPORTS

In coming years, cellulose exports will become Uruguay's main export product. This is due to the operation of UPM Paso de los Toros[14]. Thus, Uruguay will be one of the world's leading exporters of cellulose after China, Germany and the United States[15].

[14] On May 29, 2023 the first load of cellulose from the UPM2 mill was made (link)
[15] Uruguay XXI estimate based on projected cellulose export volumes for Uruguay 2023 and TradeMap data.

Table 4
Exports
Millions US$ and Var. (%)

	2022		2023 (Projection)	
	Million US$	**Var. (%)**	**Millions US$**	**Var. (%)**
Exports without cellulose	11,499	17%	9,455	**-18%**
Cellulose	1,875	23%	2,907	**55%**
Total	**13,374**		**12,362**	**-8%**

Source: Uruguay XXI based on data from the DNA and BCU.

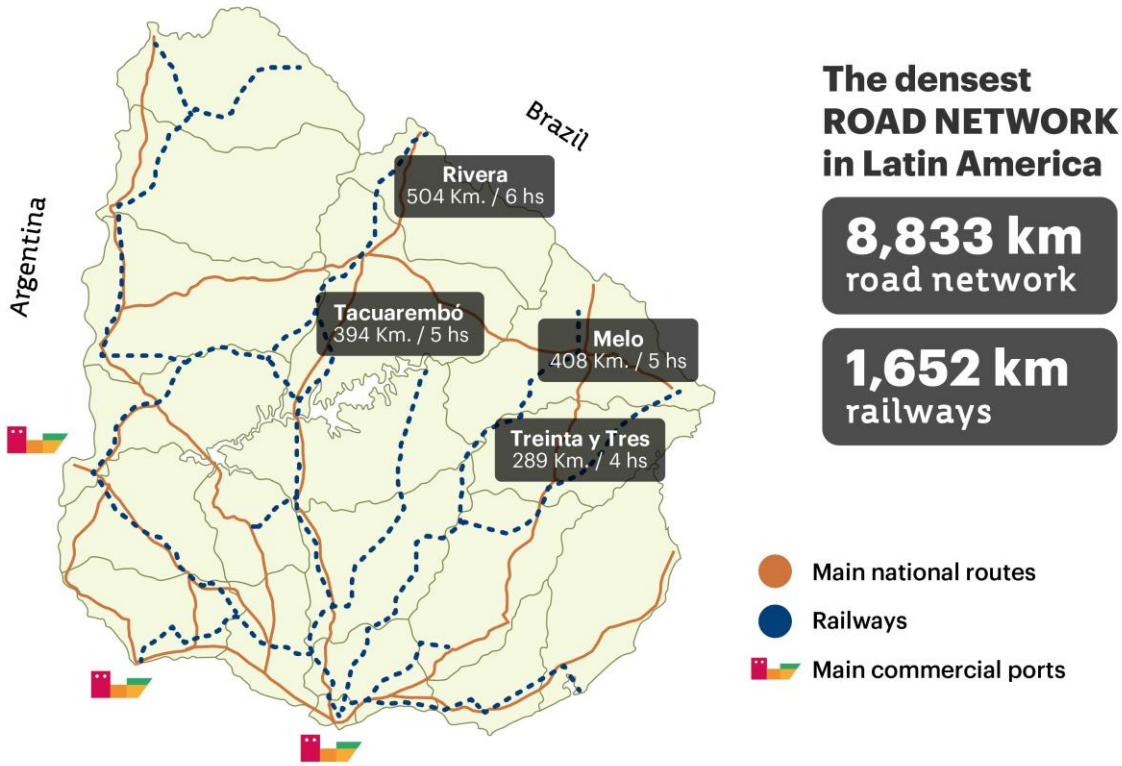
In 2023, cellulose production will reach 3.5 million tons, which represents an increase of 33% in volumes compared to 2022. This will mark the third consecutive year of growth in Uruguay's cellulose exports. Prices for BHKP cellulose (the variety produced in Uruguay) will continue on an upward trend, albeit at a slightly more moderate pace than in recent years, with an estimated increase of 8% in 2023. Thus, the total value of cellulose exports is estimated to be around US$ 2.9 billion.

6. INFRASTRUCTURE

Uruguay has an extensive and well-developed road network that spans approximately 8,833 kilometers. This is equivalent to a ratio of 45 kilometers of paved roads per 1,000 square kilometers of surface area. This solid road infrastructure facilitates the connection of the main production centers and storage areas with the country's most important ports.

In addition, Uruguay has 15 ports, eight of which are considered commercial ports and are distributed in various regions of the country, including Montevideo, Nueva Palmira, Colonia, Fray Bentos, Paysandú, Juan Lacaze and La Paloma -which operate under a free port regime-, as well as Salto. Of these, the ports of Montevideo, Nueva Palmira and La Paloma have the deepest draft, which makes them essential for port operations.

Figure 3
Transportation network map



Source: Uruguay XXI based on data from the Ministry of Transport and Public Works (MTOP)

Nevertheless, the significant growth in production and exports led to considerable challenges in terms of infrastructure, especially in relation to roadways. In response to this demand, the country is working on important projects to improve and expand its infrastructure to have a first-class transportation network.

6.1.1. SPECIALIZED FORESTRY PRODUCTS AND BULK SOLIDS TERMINAL

In October 2022, a specialized cellulose port terminal was completed in the port of Montevideo. The 24-hour terminal is expected to receive cellulose from UPM Fray Bentos via the Central Railway. The capacity of this new terminal is two million tons per year, which will enable it to load about 100 ships per year[16]. The specialized terminal occupies a 7.5-hectare site and is located at the northern end of the port of Montevideo. Its main purpose is to serve as a stockpiling and shipping point for wood chips and bulk products in general, with a storage capacity of up to 7,000 tons. It also has a fully automated facility for grain storage. This terminal is designed to operate with two conveyor belts and three platforms with lifting towers, allowing loading at a speed of up to 2,400 tons per hour. It also has a berthing dock suitable for Panamax interoceanic vessels.

6.1.2. ROAD NETWORKS[17] AND NATIONAL HIGHWAYS

Due to the increase in the volume of transported goods, driven by the development of the agricultural and forestry areas, the need to establish efficient connectivity between production terminals and production units was identified.

In this context, the first Public-Private Participation (PPP) project in road infrastructure was carried out, which included improvements to Route 21 from the city of Nueva Palmira to Mercedes, as well as Route 24 between Highway 2 and Highway 3. Route 21 is mainly used by bulk trucks going to the port of Nueva Palmira, while Route 24 is predominantly used for transporting lumber cargo.

In addition to these initiatives, the five-year plan for 2020-2025 of the Ministry of Transportation and Public Works (MTOP) was implemented, which at the end of the cycle is expected to accomplish the following:

- Maintenance works on 4,440 kilometers of roads throughout the country.
- A change of standard, improving 2,610 kilometers of national roads.
- 642 kilometers of new works.

[16] UPM opens specialized cellulose terminal at the Port of Montevideo - UPM
[17] See: Uruguay XXI – PPP

- The paving of 375 kilometers of gravel roads, eliminating gravel from national highways.
- Works on 227 bridges, including new bridges.

In total, 7,692 kilometers of roads will be intervened in five years, equivalent to 81% of the roadway network. In 2022, US$ 1.708 billion was invested in this plan.[18]

6.1.3. RAILWAY DEVELOPMENT

The most important project in the railway sector in Uruguay is the Central Railway (Ferrocarril Central) project[19], which involves a significant renovation of the country's railway network. This project comprises the construction and reconditioning of 273 kilometers of track connecting the port of Montevideo with Paso de los Toros (Tacuarembó). It also includes the rehabilitation of the Rivera line and the Litoral line, which connects Piedra Sola with Salto. These combined efforts will expand the supply of rail transportation in Uruguay, complementing the existing modes of transportation to date.

The Central Railway project will allow freight trains to run at a speed of 80 kilometers per hour and with a load capacity of 22.5 tons per axis. This will significantly benefit agricultural, mining, industrial, and forestry businesses located in the vicinity of the rail lines. The project includes an initial 26-kilometer section of double track, as well as multiple secondary tracks to facilitate train crossings and more than 40 rail bridges, some of which will be reinforced and others newly constructed. Overpasses are also planned due to the interaction with populated areas, which will have a significant impact during the construction phase.

At present, Uruguay's railway network covers an extension of 1,652 kilometers and has a fleet of 52 mainline locomotives and 764 railcars. This network connects with the railroad networks of Argentina through the El Precursor branch, which crosses the Salto Grande dam and connects the cities of Salto and Concordia with equal gauge in both countries, as well as with Brazil at the Rivera-Livramento border crossing, where there is a different gauge. However, current technology makes it possible to resolve this difference in track width.

In summary, the Central Railway represents a significant breakthrough in promoting a complementary, competitive, and sustainable mode of transportation, which will have a positive impact in terms of costs, travel times and logistical efficiency. The train is expected to be operational by December 2023.

[18] The largest works plan in recent times - MTOP
[19] Central Railway Project - https://www.gub.uy/ministerio-transporte-obras-publicas/ferrocarril-central

7. FORESTRY RESOURCES

7.1.PLANTED AREA

In Uruguay, an area of 1.1 million hectares has been quantified as effectively allocated to forestry use. A total of 11% of Uruguay's surface area is forested: 6% is planted forest and 5% is native forest[20].

Table 5
Forest surface area and total surface area

	Hectares	Percentage
Uruguay's total surface area	17,502,000	
Planted forest surface area	1,087,109	6.21%
Surface area of native* forest	835,349	4.77%
Total forest	1,922,458	10.98%

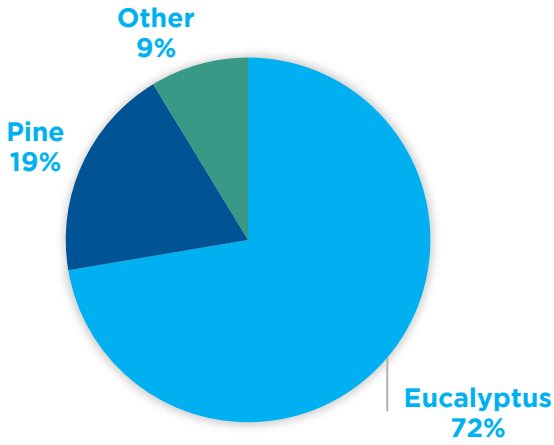
Source: Ministry of Livestock, Agriculture and Fisheries (MGAP) - General Forestry Directorate

Eucalyptus plantations account for 72% of the planted forest area, while pine plantations account for 19%. Eucalyptus species such as E. dunnii, E. grandis, E. globulus and others are used for cellulose pulp extraction. The main crop is E. dunnii.

[20] National Forestry Mapping 2021 - MGAP

Graph 7
Species in estimated planted areas (2021)[21]

Species	Estimated planted area (ha.)
E. grandis and E. saligna	324,115
E. dunnii	316,148
E. globulus	103,639
Other Eucalyptus	51,804
Pinus E. and Pinus taeda	152,940
Pinus Pinaster	3,790
Other	95,792
Total	1,048,227*



Source: compiled by Uruguay XXI based on data from the General Forestry Directorate - MGAP

In the 1990s, there was a steady increase in the planting of both pine and eucalyptus forests in Uruguay, driven in part by the Forestry Act that granted tax exemptions to investors in this sector. This trend began to gradually decline towards the first decade of the 21st century. During the period from 1990 to 2010, the average planting rate was around 28,710 hectares per year of eucalyptus and 11,123 hectares per year of pine.

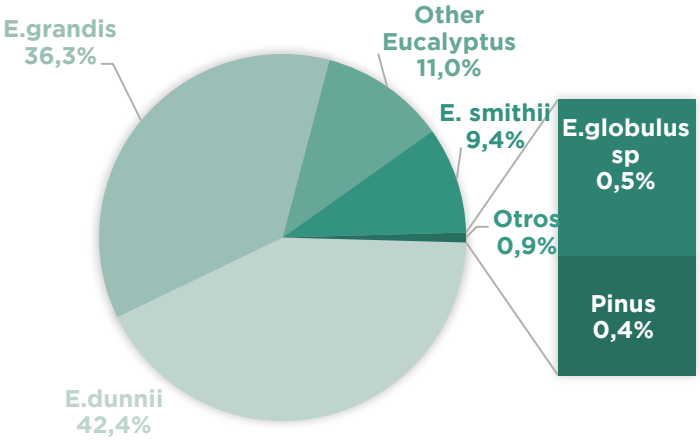
In the last decade, forestry demand experienced a significant boost thanks to the establishment of cellulose mills and sawmills in the country. This growth resulted in a notable increase in the area allocated to eucalyptus plantations, while at the same time there was a decrease in the area dedicated to pine plantations.

In 2021, 84,132 hectares were planted, almost entirely eucalyptus species.

[21] It was possible to determine 845,031 hectares, which contained plantations older than three years. The remaining 203,197 hectares are plantations younger than three years old, whose composition is estimated by means of a survey. National Forestry Mapping 2021 - MGAP

Graph 8
Species in estimated planted areas in 2021

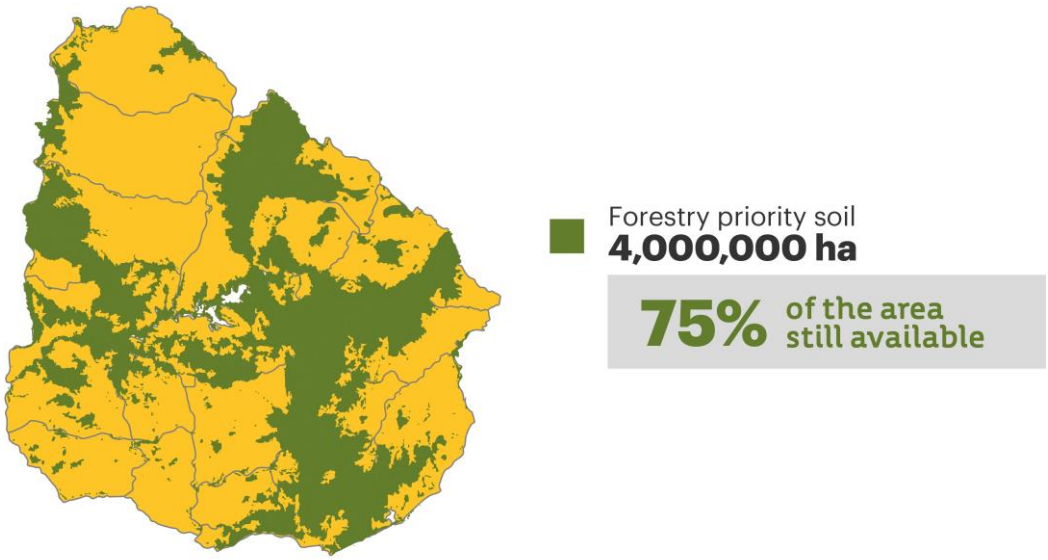
Species	Estimated planted area (ha.)
E. dunnii	35,693
E. grandis	30,506
Other Eucalyptus	9,290
E. smithii	7,915
E. globulus sp	413
Pinus	315
Total	**84,132**



Source: compiled by Uruguay XXI based on data from the General Forestry Directorate - MGAP

According to information from the General Forestry Directorate, the effective area of forest use was 1.06 million hectares in 2021, accounting for 6% of the country's surface area.

Figure 4
Forestry priority areas



Source: compiled by Uruguay XXI based on data from the General Forestry Directorate - MGAP

7.1.1. LAND COSTS

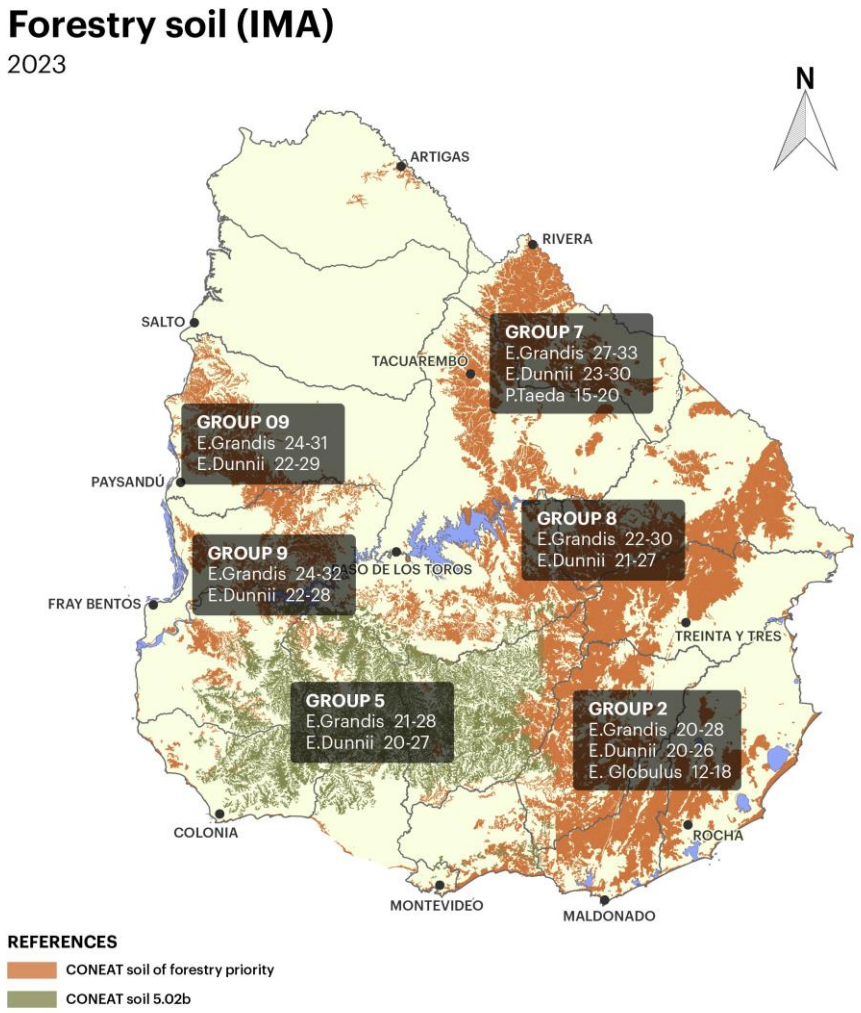
In addition to operating expenses, it is essential to obtain an accurate estimate of the cost of land acquisition. As previously mentioned, this cost will be included in the "year zero" budget, which is the period in which approximately 55% of the total cost for a 20-year cycle is generated.

Soil characteristic in Uruguay sometimes make forestry develop as the main activity, but it is also combined with agriculture or livestock farming. Most plantations are located on soils designated as priority soils for afforestation, which are part of the CONEAT (National Commission for the Agronomic Study of the Land) soil classification. However, in the southern and central regions of the country, where CONEAT 5 soils predominate, afforestation has experienced significant growth in recent years.

Several factors affect the value of land for afforestation, including the type of soil, the distance to ports or industrial facilities, and the percentage of the total area that can be allocated to plantations.

Soil types vary widely and are associated with different growth rates depending on the species of trees planted. From a technical perspective, the Mean Annual Increment (IMA, for its acronym in Spanish) is used as an indicator to measure tree growth, which reflects the increase in the volume of trees in a hectare over a year.

Figure 5
Mean annual increment (IMA) by species and area



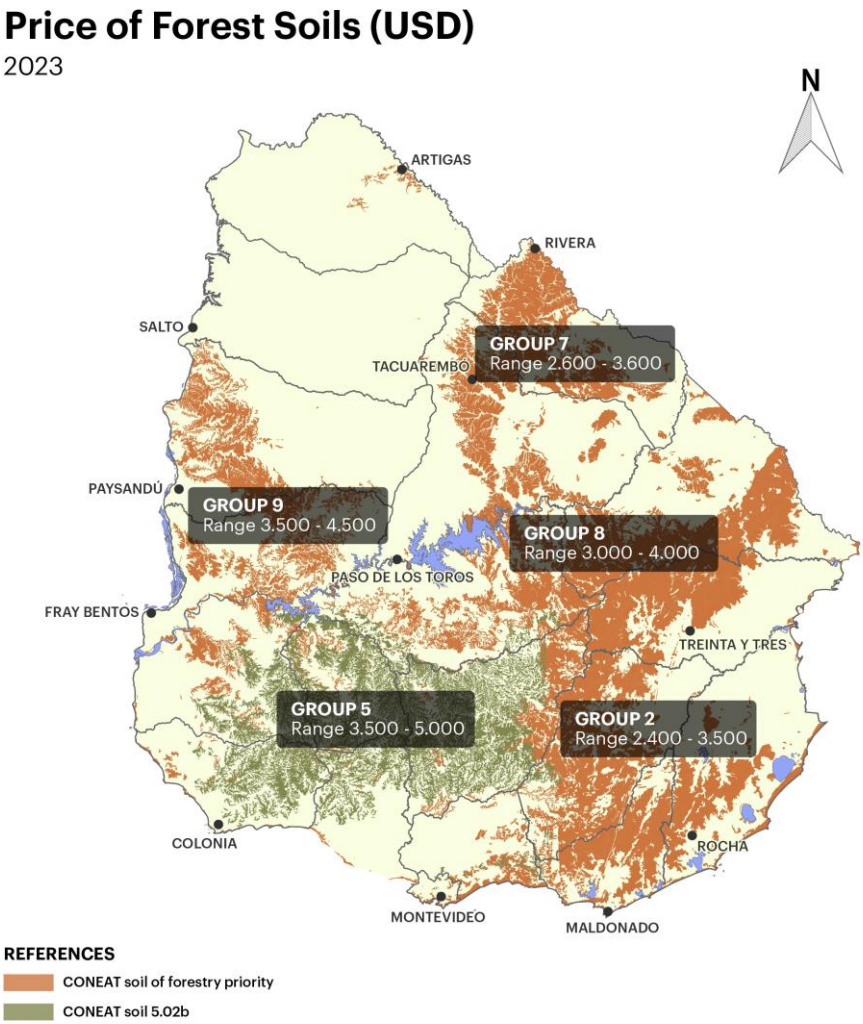
Source: Agroclaro based on the Office of Agricultural Programming and Policy (OPYPA), UPM, Montes del Plata, MGAP and the National Directorate of the Environment (DINAMA).

There is a forestry land rental market in the areas near cellulose mills, mainly in the coastal regions, the southern coast and the center of the country. This makes it possible to lease portions or all of the land for eucalyptus plantations, as long as a certain minimum scale is reached.

On the other hand, in the eastern and northern regions, where plantations are mainly geared towards the production of high-quality timber, most of the companies involved in the business are also landowners.

The valuation of forestry land becomes complex, as multiple variables must be taken into account. The following map provides price references for properties where forestry is the main activity.

Figure 6
Reference prices according to soil
Price range per hectare based on recent sales



Source: Agroclaro based on MGAP and AGESIC/INC metadata.

It is important to note that the land market in Uruguay experienced a significant increase in prices during the decade ranging from 2004 to 2014, largely driven by the boom in grain crops. However, land destined for forestry had a more moderate increase during that period and showed greater stability in terms of prices. As of 2019, there is a rise in demand for land, which led to an increase in property prices, especially in agricultural areas, in response to high grain

prices. The upward price trend continued in 2022, where the price increased 7% compared to 2021.

7.1.2. DEMAND FOR INDUSTRIAL WOOD

There is a constant demand for raw material in the industrial forestry sector. Sawmills and mechanical transformation plants require approximately 1.8 million cubic meters of wood per year. The cellulose mills of UPM Fray Bentos and Montes del Plata each need about 4.5 million cubic meters, while the third mill requires an additional 7.5 million cubic meters. In total, the forestry industry demands about 17 million cubic meters of raw material[22].

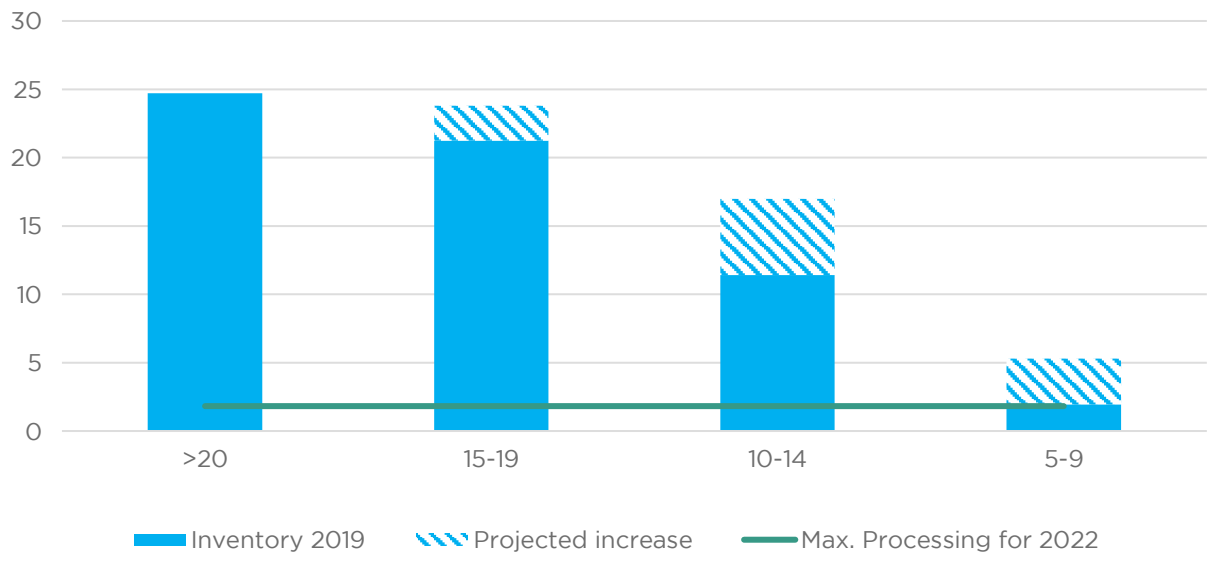
To estimate future eucalyptus and pine timber volumes, especially towards 2050, it is necessary to consider several factors ranging from the length of forest cycles in Uruguay to the current available data and the possible directions in which the Uruguayan forestry sector could develop.

In general terms, the duration of forest cycles in Uruguay tends to be between 10 and 20 years, depending on whether the purpose of production is for pulp or sawmilling. In addition, an average annual increment for each species of eucalyptus and pine must be considered in order to adequately calculate the projection.

Although pine plantation experienced a gradual decline in recent years and its importance decreased, the planted areas in the past guarantee a significant availability in the next 15 years, with considerable volume peaks soon. Currently, the average annual availability of timber, which surpasses three million cubic meters, far exceeds the industrial capacity available in Uruguay.

[22] Future of Forestry: current status and future outlook for the forestry sector in Uruguay

Graph 9
Pine inventories and sawmill demands – Millions m³

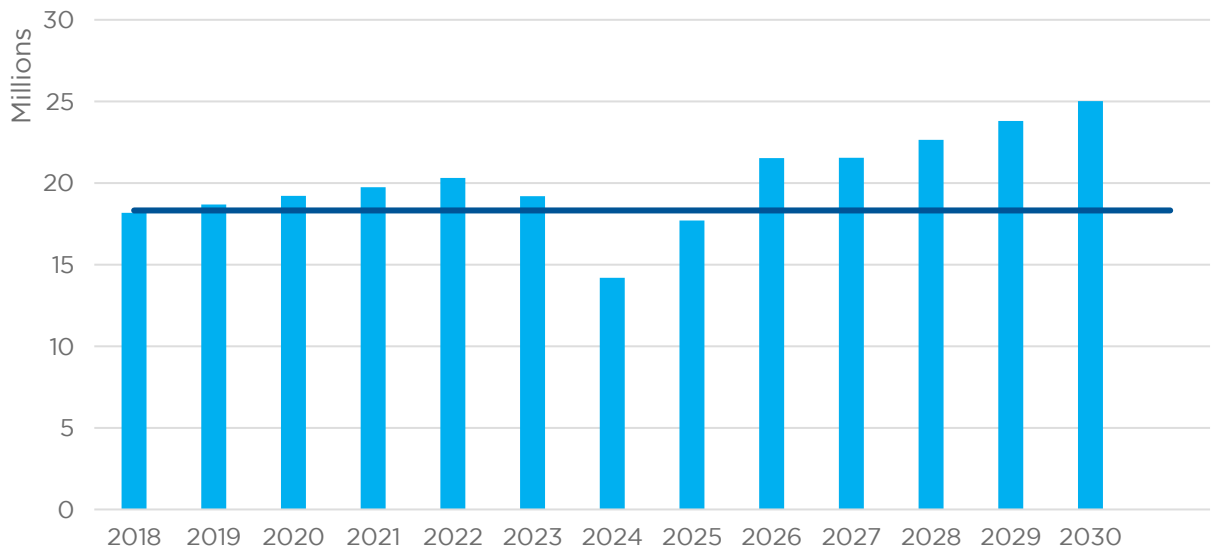


Source: Uruguay XXI based on Farropa and Barrios (2018).

The capacity of local sawmills to process pine allows the consumption of between 3,000 and 4,000 hectares of mature forest, which is equivalent to one million cubic meters per year. To cover this demand, the area used for pine plantations would have to be between 60,000 and 80,000 total hectares. This figure is currently double what is needed to meet the demand.

There are two scenarios for the demand for eucalyptus wood: a short-term scenario in which there could be a temporary shortfall in supply, as well as a long-term scenario in which supply far exceeds the existing demand for the three mills. This mild shortfall may put some pressure on other uses of eucalyptus, but by 2026 the stock would again far exceed the demand of the cellulose mills.

Graph 10
Eucalyptus supply and industrial demand– Millions m³



Source: Uruguay XXI based on Farropa and Barrios (2018).

8. WOOD CONSTRUCTION[23]

The use of wood in construction has historically been less common in Uruguay, where a preference for construction methods involving heavier materials has been prevalent over the past few decades. This is a significant cultural barrier that hindered research and progress in the use of wood as a building material and delayed its development as a major component in construction projects in Uruguay.

Growth of the domestic market is critical in order to expand the export of engineered wood products in the future. Increased local demand not only provides a solid foundation, but it also allows for better adjustment to the demands of other markets, while potentially generating economies of scale in an export-oriented industry. The local supply of raw materials, the ongoing development of related industries and the need for housing all offer significant potential for investment, exports and local housing.

[23] Sources referenced: Matías Marchesoni, Sophia Evans – "Wood construction in Uruguay - A pending story" || Forestry Magazine – "Wood construction: challenges and opportunities in Uruguay"

These construction methods add a second mechanical transformation to the material, adding value to the end product. In addition, wood production in construction promotes a sustainable system, with carbon sequestration throughout the production chain.

However, there are still certain challenges, such as the need to harmonize national and departmental regulations[24], and to promote the use of wood in business and civil construction, as well as in public works projects. It is worth noting that several institutions, mainly academic, have been analyzing the possibilities of wood construction for several years and support the widespread use of wood in housing construction.

Internationally, countries with a long-standing tradition in the use of wood for construction have made significant progress. Technological progress in structures has enabled the construction of multi-story wood buildings, supported by building codes that increasingly allow more levels, confirming the structural safety of this material and challenging cultural misconceptions that have limited its development.

Projections indicate an increase in the global use of wood as a building material, with an annual growth rate of 5% until 2027. The increase is particularly noteworthy in regions such as Latin America, the Middle East, Asia and North America.

Table 6
Engineered wood products market revenues by region
(US$ Millions)

Region	2021	2022	2023	2024	2025	2026	2027
North America	9,333	9,934	10,444	10,938	11,410	11,855	12,269
Europe	5,545	5,850	6,097	6,328	6,541	6,733	6,902
Asia Pacific	49,630	53,139	56,205	59,218	62,150	64,973	67,659
Latin America, Middle East and Africa	7,033	7,596	8,105	8,615	9,120	9,617	10,100
Total	71,541	76,519	80,851	85,099	89,221	93,178	96,930

Source: AMR Analysis.

The global engineered wood products (EWP) market was valued at approximately US$ 284 billion in 2019 and is projected to reach US$ 400 billion by 2027. Although it spans several

[24] The construction systems are validated through the Technical Aptitude Document (DAT), which validates the technical suitability and enables evaluation, technical and administrative instruments for these construction systems.

segments, construction is one of the leading segments, driven by improved building aesthetics and the renovation of aging structures in North America and Europe.

Major companies in the sector include Boise Cascade, Arauco, Huber Engineered Woods, Louisiana-Pacific Corporation and Weyerhaeuser[25]. Stora Enso also has initiatives in this market, with a particular focus on cross-laminated timber (CLT) products.[2627]

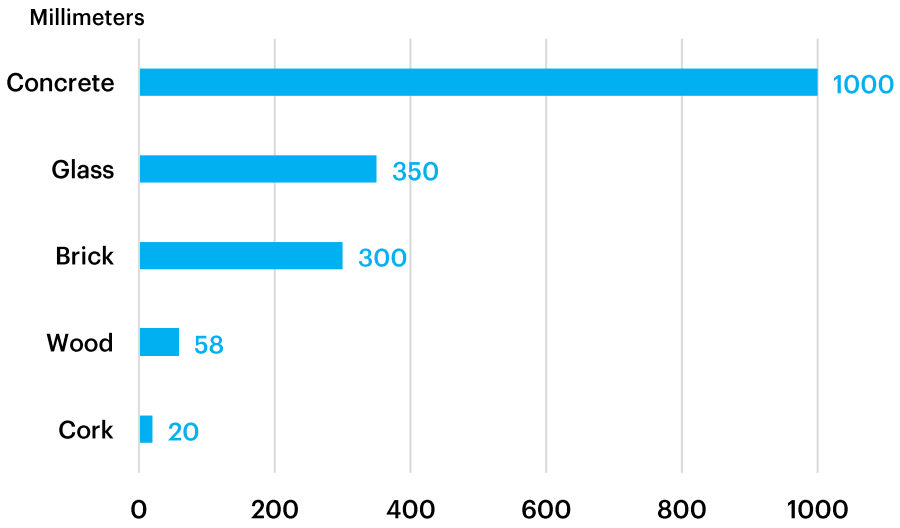
In several countries like Canada, Norway, Austria, the United States and even China, the trend shows an annual increase in the use of wood in construction. In the region, Brazil and Chile are the main markets, although they still fail to fully cover their local demand for EWP.

The "wood revolution" has many benefits. First, it accelerates the construction process by up to five times the speed of traditional methods[28], which leads to savings in labor costs and other aspects of the process. The technology applied to construction also improves efficiency and reduces errors compared to traditional methods, which simplifies assembly and generates less waste.

Another major benefit of wood construction systems is its thermal insulation capacity, as wood requires significantly less thickness than other materials to achieve the same insulation efficiency, both in cold and warm climates, which contributes to greater energy efficiency in buildings. The history of wood as a building material in cold climate regions highlights the importance of its thermal insulation. Graph 11 compares the insulation capacity of wood with other materials.

[25] Source: AMR Analysis – "Global Engineered Wood Market, 2020-2027".
[26] Source: Stora Enso – Wood Products.
[27] Source: Tardáguila – "CLT gains a foothold in the market and Stora Enso starts exporting to the United States".
[28] El Observador – "Wooden housing: the "stigmatized" material that the government wants to bet on".

Graph 11
Thickness required to reach the same thermal insulation value
(in millimeters)



Source: Jorge Calderón - "Design, manufacture and assembly of solid cross-laminated timber boards - CRULAMM & JMS" based on Holzbau, Grupo Rubner, Univ. Trento.

In the past, the main objections to the use of wood as a building material centered on safety concerns compared to other conventional options. Today, fire resistance regulations[29] guarantee greater structural strength over some of the more traditional building materials. Wood is a renewable resource that promotes sustainability in construction processes and, in addition, captures one ton of carbon dioxide [30] in every cubic meter. It is also known for its low energy consumption during production and throughout its life cycle. Compared to other building materials that generate significant emissions during their manufacture, wood performs a reverse process by sequestering carbon.

These aspects align with the objectives of several ministries, including the Ministry of Environment, which seeks to promote environmentally sustainable production and consumption practices. In the United States, 47% of greenhouse gas emissions come from construction.[31]

[29] Fire resistance is understood as the ability of an element to maintain its structural properties for a given time in the presence of fire.
[30] Source: Michael Green: Why we should build wooden skyscrapers. || Mechanical transformation generates products called Harvested Wood Products, which can be included in National Greenhouse Gas Inventories. See National Greenhouse Gas Inventories.
[31] Michael Green: *Why we should build wooden skyscrapers.*

Uruguay faces a housing deficit of approximately 65,000 homes and a qualitative housing deficit of 169,573 homes[32]. Wood is a natural alternative to address these problems, however, some challenges have yet to be overcome. First, it is necessary to advance in the standardization of structural wood in order to certify its use in construction, which would add value for both domestic demand and export. The UNIT committee for structural timber approved five standards since 2017 and further progress towards standardization is planned.

In addition, in 2020 the Honorary Timber Commission was established, which works to promote wood as a building material in Uruguay. In 2022, to address the standardization issue, the board introduced the project "Base Document for the Standardization of Wooden Buildings and Constructions", with the objective of increasing "the inclusion of domestically sourced timber in housing and building construction".

Some of the main engineered wood products include:

- **Cross Laminated Timber (CLT):** this building product is formed by joining panels of dry wood boards, in which one layer of boards is arranged perpendicular to the next. The boards are assembled laterally with glue on the edges and then joined to the next layer by applying glue across the width.

- **Laminated Veneer Lumber (LVL):** LVL is produced by gluing several sheets of wood together with a variety of bonding adhesives. The main characteristic is that the sheets in LVL are all aligned parallel to each other, while in plywood they are arranged at right angles to the next layer or in alternating orientation.

- **Glued laminated timber (Glulam):** this engineered product consists of two or more sheets of wood arranged in the same direction as the fibers and joined together by their surfaces. The sheets are assembled at their ends by means of notched joints and shorter pieces of wood. The benefit of Glulam lies in the possibility of obtaining lengths and sections that are not found in sawn lumber, in addition to allowing the manufacture of curved elements.

- **Nail Laminated Timber (NLT):** this material is formed by stacking lumber on edge and securing it with nails. Plywood is often used to make it into wall panels. It provides a solid, sturdy structure and is typically used for floors, decks, roofs and siding.

[32] Five-year Housing Plan for 2020-2024 - MVOTMA

- **Dowel Laminated Timber (DLT):** is created by joining several blocks of wood with hardwood pegs. These are assembled into panels by means of a hydraulic press that joins the different layers by friction. The planks contract and the pegs expand. DLT is used in walls, floors and ceilings.

- **Plywood:** In Uruguay, Lumin produces structural plywood panels made from pine and eucalyptus. This will also be the case at the future Garnica mill in the department of Treinta y Tres. These mills offer a variety of panel grades with various combinations of veneers. The panels are solid, light, durable and available in different aesthetic finishes. They are certified for use in construction in the United States and Europe and comply with the environmental regulations of several countries.

8.1. PROMOTING THE USE OF TIMBER IN CONSTRUCTION

In May 2022, the Ministry of Housing and Land Management (MVOT) submitted a roadmap for the construction of social housing in wood, with support from the Inter-American Development Bank (IDB) [33].

The document recognizes that, although Uruguay is not a country with a long-standing tradition of wood construction, it is necessary to promote this construction material, especially in housings and buildings.

In order to provide 105,545 housing solutions, the objective is to "promote the use of wood of national origin in construction solutions". This roadmap also establishes the inter-institutional work needed to achieve the objective: working jointly with the National Housing Agency (ANV) and other social actors such as the Movement for the Eradication of Unsanitary Rural Housing (MEVIR).

In January 2023, MEVIR opened the first nine dwellings of its sustainable wooden housing program in the department of Rivera. The program is centered on bringing together intergovernmental cooperation with the private sector[34].

Another of the projects promoted by MVOT and ANV are high-rise wooden buildings[35], specifically to provide social housing. The first building, located in the department of Durazno, will have a height of seven stories with a total of 24 apartments. It will consist of one floor built

[33] Roadmap for the construction of social housing in wood in Uruguay - MVOT
[34] The first integrated plan composed of sustainable wood housing by MEVIR - MEVIR
[35] Towards the construction of the first wood high-rise building in Uruguay - ANV

using traditional methods and the remaining floors will be made of cemented wood using non-polluting cement.

9. MAIN CERTIFICATIONS

9.1. FOREST PRODUCT CERTIFICATIONS

Forest certification is the independent evaluation of an entity's operations according to standards previously established by external agencies. In general, this certification process acts as an incentive to improve forest management practices. There are international certifying entities that are responsible for assessing compliance with these requirements.

9.1.1. FOREST CERTIFICATION

In a global context where significant deforestation trends are still evident in several countries, certification is offered to identify products that come from sustainably managed forests and in compliance with regulations. In addition, certification has become increasingly important as a market tool to differentiate products in the eyes of consumers who are increasingly aware and avid of sustainable production.

Uruguay has followed a forestry policy that ensures sustainable management in cooperation with its main companies, which have extensive experience in this area. Virtually all of Uruguay's forestry production and associated industries have obtained certification from the two main global agencies: the Forest Stewardship Council (FSC) and the Program for the Endorsement of Forest Certification (PEFC).

9.1.2. CERTIFICATION OF WOOD PRODUCTS

In terms of wood product certification, the Technological Laboratory of Uruguay (LATU, for its acronym in Spanish) plays a key role in supporting and promoting the development of the wood value chain. In this regard, LATU has a sawmill and lab where research is carried out on the physical, mechanical and chemical properties of timber from local plantations.

Although currently LATU does not carry out certifications of international scope, it has the technical capacity to do so, as it offers high quality analysis and testing services. A lab was recently added to carry out various tests on furniture and openings, with the capacity to certify European standards related to this type of products.

9.2. CARBON CERTIFICATES

Due to the growing importance of international initiatives to reduce greenhouse gas (GHG) emissions, companies and other entities are increasingly seeking strategies and measures to offset the environmental impact of their production activities. In this context, carbon certificates have acquired global relevance and have become a crucial component of the forestry industry.

The carbon market operates in line with the Kyoto Protocol as a mechanism that facilitates flexible transactions in which GHG emissions are traded through the purchase and sale of permits to emit CO2. This trade system allows governments, companies and individuals to purchase or sell GHG emission reduction units to meet their current and future environmental commitments.

Specifically, carbon credits act as tools that allow their holders to meet their environmental objectives by offsetting GHG emissions. In the case of forestry companies, trees capture CO2 during the photosynthesis process. In order to issue a carbon credit, it is necessary to register the plantation, carry out monitoring and obtain certifications that confirm the capture of a certain amount of carbon from the atmosphere.

Given this context, the growth of pine and eucalyptus plantations in Uruguay, which for over a decade have accumulated carbon in the forests, has had a positive impact on the environment by contributing to the balance of GHG emissions. Currently, more than five forestry projects in Uruguay issue carbon certificates. In addition to the participation of these forestry projects, companies that specialize in measurement, comparison and advisory services in this area have emerged.

At the beginning of 2021 Uruguay entered the international carbon credit market for the first time, with an exclusive focus on forestry plantations. This was achieved through Agroempresa Forestal's sale of 210,000 tons of carbon[36], with an approximate value of US$ 10 million. This inaugural sale abroad offers a glimpse of the potential market that the country could explore.

Currently, Uruguayan projects related to carbon certificates are managed through the Verra platform. Of the registered projects, nine are associated with forestry production, covering a total of 80,000 certified hectares and an estimated annual emissions reduction of 333,000 tons of CO2 (Verra, 2021). At similar sales prices, this could represent additional revenues of

[36] https://www.af.com.uy/

approximately US$ 16 million. Although regulations vary according to the end use of forest resources, this initiative offers a meaningful opportunity for the sector nationally[37].

10. OUTLOOK OF THE FORESTRY SECTOR

10.1. INCREASED MECHANICAL TRANSFORMATION OF PINE TIMBER

In the case of pine timber, there is a significant area of forest land reaching the end of its felling cycle. It is increasingly evident that the country must increase its capacity in pine wood processing if it wants to maximize the profitability of quality timber and not settle for the opportunity cost of exporting.

In addition to the relief that the possibility of exporting roundwood to China has meant for the owners of these forests, final roundwood, which has a higher value, has not yet been exported. Having to export roundwood from the harvest of the last 150 to 250 quality timber trees would represent a less profitable business.

[37] Future of Forestry: current status and future outlook for the forestry sector in Uruguay

10.2. PINE TIMBER WASTE ALTERNATIVES

The lack of options for placing by-products has presented challenges for mechanical transformation projects based on pine and eucalyptus. While in eucalyptus projects it is possible to take advantage of by-products in short fiber pulp mills, those using pine wood do not have this option, which could make these projects unfeasible.

The shortage of projects that consume the pine wood already available has led plantation owners to export the wood in roundwood form. However, investment for these by-products is necessary and is potentially lucrative in the long run.

10.3. REPLANTING PINE FORESTS

The 2019 update of the National Conifer Forest Inventory will provide key information to determine whether pine acreage is declining due to species substitution, especially in areas that recently reached their harvest cycles and which between 2017 and 2020 facilitated the export of approximately seven million tons of raw pine[38].

According to the nursery survey published by the DGF, the production of pine seedlings experienced a 57% growth in just two years, reaching a total of 787,000 plants. Although this represents only 1% of total nursery production, dominated mainly by eucalyptus, there is evidence of an intention to increase production, possibly motivated by the establishment and expansion of industrial mechanical transformation projects in the sector.

[38] Future of Forestry: Current status and future outlook for the forestry sector in Uruguay

11. INSTITUTIONAL FRAMEWORK AND ACTORS IN THE SECTOR

- **General Forestry Directorate (DGF) - Ministry of Livestock, Agriculture and Fisheries (MGAP)**

  The DGF is the main authority responsible for forest policy in accordance with the provisions of Law No. 15,939. Among other tasks, it is responsible for approving plans for the use and extraction of forest resources.

  Website: https://www.gub.uy/ministerio-ganaderia-agricultura-pesca/direccion-general-forestal

- **Honorary Timber Commission**

  It reports to the DGF and its purpose is to prepare, coordinate and monitor a plan for the promotion and development of the use of national timber for construction purposes, both for housing and furniture, among other uses. It is composed of representatives of the MGAP, the Ministry of Housing and Land Management (MVOT), the Ministry of Environment, the Ministry of Industry, Energy and Mining (MIEM), the Congress of Mayors, LATU, the University of the Republic and private universities.[39]

- **Other institutions**
  - Society of Forestry Producers (SPF): www.spf.com.uy
  - Association of Woodworking and Allied Industries (ADIMAU): www.adimau.com.uy
  - Chamber of Wood Processing Industries
  - National Agricultural Research Institute (INIA) - www.inia.uy
  - Technological Laboratory of Uruguay (LATU) - www.latu.org.uy
  - Uruguayan Chamber of Industries (CIU) – www.ciu.com.uy
  - National Energy Directorate (DNE - MIEM) – www.dne.gub.uy
  - National System of Protected Areas - MVOTMA (SNAP) - http://www.mvotma.gub.uy/snap
  - National Agency for Research and Innovation (ANII) - www.anii.org.uy
  - National Development Agency (ANDE) - www.ande.org.uy

[39] Source: Forestry Magazine – *"Let's study wood".*

- School of Architecture of the University of the Republic http://www.fadu.edu.uy
- School of Engineering of the University of the Republic https://www.fing.edu.uy
- Litoral Norte University Center of the University of the Republic - http://www.unorte.edu.uy
- School of Architecture of ORT University - https://fa.ort.edu.uy/
- Ministry of Housing and Land Management - https://www.gub.uy/ministerio-vivienda-ordenamiento-territorial
- Architects Society of Uruguay - https://www.sau.org.uy/

12. ANNEX

12.1. REGULATORY FRAMEWORK

To see the annex with information on the regulatory framework of the Uruguayan forest sector, go to the following link: regulatory framework.

12.2. THE URUGUAYAN FOREST

Uruguay shares the same latitude and climate zone as southern Australia, New Zealand, South Africa and central regions of Argentina and Chile, where some of the main forestry projects in the southern hemisphere are located. These climate and soil conditions guarantee forest industry stakeholders outstanding levels of competitiveness at global level. The wood produced in Uruguay's plantations is high-quality, both the wood used for cellulose pulp production as well as the wood used for the manufacture of solid wood products.

12.2.1. FORESTRY PRIORITY AREAS

Forestry activity in the country has grown steadily over the last 25 years, during which time the planted area has increased 30-fold. The planted area is now about 1.1 million hectares (affected area). On the other hand, the area of land declared a forestry priority reaches 4 million hectares[40], 25% of the total agricultural area of the country.[41]

Soil type, climate and distance to production outlets have an impact on the characteristics of forest plantations. This divides the country into three regions according to the criteria set by the General Forestry Directorate:

[40] Decree Nº 191/006, available at: http://www.impo.com.uy/bases/decretos/191-2006/1
[41] Note: This includes roads and firebreaks.

Table 7
Forested and priority forestry area by region
(Thousands of hectares)

Area	Departments	Native Forests	Forested area	Forestry priority area
Center-north	Artigas, Rivera, Tacuarembó, Durazno, Cerro Largo and Treinta y Tres	354	465	2,200
West Coast	Salto, Paysandú, Río Negro and Soriano	208	297	639
Southeast	Colonia, Flores, San José, Florida, Canelones, Montevideo, Lavalleja, Maldonado and Rocha	273	273	1,351
Total		835	1,035	4,190

Source: General Forestry Directorate – MGAP[42]

The **Southeast** region is the closest to the port of Montevideo. It is known for its strong maritime influence that avoids the existence of extreme temperatures, determining a better adaptation of species such as Eucalyptus globulus and lately E. dunnii has been included due to its productivity and adaptation to all soils. The main purpose of the plantations in this area is the production of pulp to supply the UPM mill in Fray Bentos and the Montes del Plata mill in Punta Pereira, Colonia, as well as the export of wood chips. The plantations destined for cellulose production have a short production cycle (10 to 12 years). In this region, the departments with the largest forest area are Lavalleja (83,000 ha), Rocha (52,000 ha) and Florida (50,000 ha).

The **Central-North** region is the largest forested area, concentrating 43% of the planted forests in Uruguay. It is known for its heavier frosts in winter, higher temperatures during the summer and the prevalence of sandy soils, which are conducive to the development of Eucalyptus grandis and Pinus. The main outlets for timber production in this region are Paysandú, Fray Bentos or Montevideo, depending on the location and type of product. The departments with the largest forested areas in this region are Tacuarembó (123,000 ha), Rivera (137,000 ha) and Cerro Largo (87,000 ha).

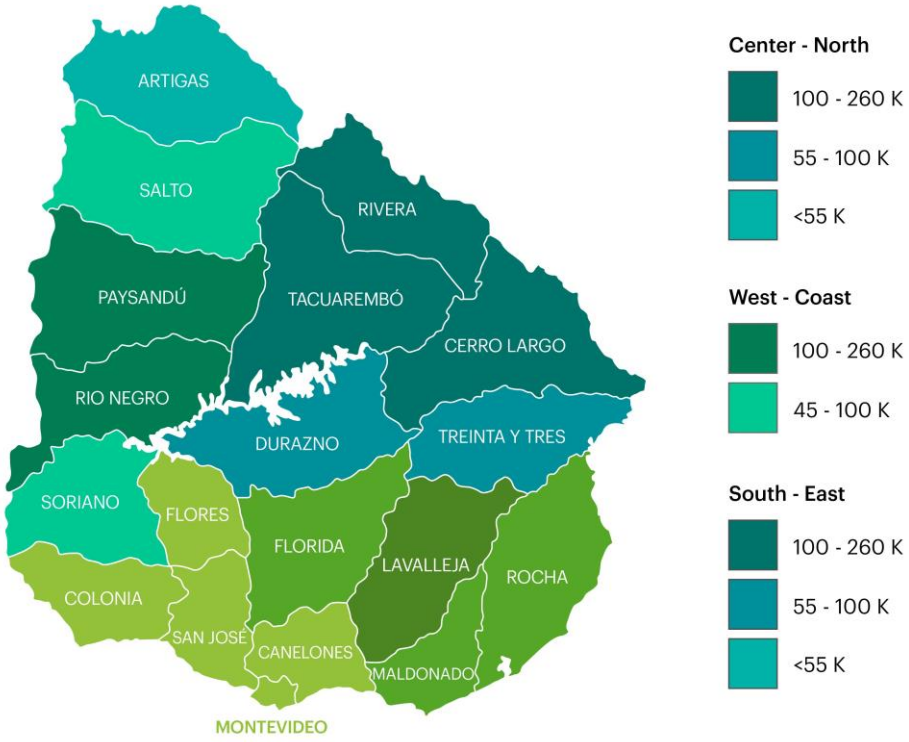
[42] Native Forest: Source: based on the 2016 native forest mapping carried out by the REDD+ Uruguay Project (MGAP-MVOTMA), the General Forestry Directorate made the estimation of the area pertaining to each department.
Forested area: compiled based on digital processing and interpretation of Sentinel 2 images (2017 and 2018). Information from the Evaluation and Information Division of the General Forestry Directorate - MGAP. Based on forest nursery surveys conducted annually, it is estimated that 33,662 hectares of new plantations may be added in the 2018-2019 period, bringing the area devoted to forest plantations to 1,068,374. The numbers will be updated in 2021.
Forestry priority soils: estimate of the total surface area broken down by departments of forestry priority soils set by the regulations in force, Decree No. 220/10.

The **west-coastal** region is also characterized by the presence of frost and sandy loam to sandy soils. This area is dominated by different species of Eucalyptus and to a lesser extent Pinus. Both have a slightly lower yield in this area compared to the north.

The ports and bridges used to transport forest products are Fray Bentos, Nueva Palmira and Paysandú. In this region, Río Negro (162,000 ha) and Paysandú (125,000 ha) are the departments with the largest forested areas.

Finally, Figure 8 shows the forested area of the country by region. Excluding native forest, 79% of the total forested area has the genus Eucalyptus planted (with a majority presence of three of its subspecies), while the genus Pinus accounts for the other 21% of the area.

Figure 7
Hectares forested by region



Source: compiled by Uruguay XXI based on data from the General Forestry Directorate - MGAP.

In this link you will find the Forestry Geoportal developed by the General Forestry Directorate, which geographically locates forest plantations, native forests and industrial facilities associated with the sector.

12.2.2. TYPES OF FOREST

The Forestry Act (Law 15,939) establishes different types of forests:

- **Protective forests:** their main purpose is to protect soil, water and other renewable natural resources. The destruction of these forests is strictly forbidden, but their exploitation is not. This means that pruning, thinning and replacement of old trees with new ones is allowed, without threatening the survival of the forest.
- **Yield forests:** the main purpose of these forests is the economic exploitation of the trees. They can be composed of any species suitable for the production of wood or wood material.[43]
- **Native or indigenous forests[44]:** natural forests with endemic species. Any cutting or other activity that threatens their survival is forbidden.
- **General forests:** those not included in the previous categories.

12.3. FORESTRY TRAINING PROGRAMS:

Careers related to the forestry sector.

- **Agronomy School of the University of the Republic:** it is the most traditional and oldest of the training opportunities related to the forestry sector. It offers the Agronomy degree (five years), which concludes with a degree in agricultural engineering. In the fourth year of the course, students have the possibility to choose between the agricultural, livestock, horticultural, fruit and forestry fields. The graduate who chooses the forestry option is called a forestry agronomist.
- **Forestry Engineering** (University of the Republic - College of Agronomy, College of Engineering and College of Chemistry):[45] the profile of graduates of the Forestry Engineering program requires a solid background in the basic and applied sciences necessary for their scientific and professional careers, with an in-depth focus on specific forestry areas and industrial processes related to the sector, observing aspects of the environment, especially social, environmental and sustainable management of natural resources, in order to allow critical and creative action in the identification and solution of problems. The course is taught at the University Center of Tacuarembó. The first student of this career graduated at the end of 2020.

[43] Decree 191/06.
[44] Although they are included in the protective forests, Law No. 15,939 and Decrees 22/93, 24/93 and 330/93 establish specific regulations on the protection of indigenous forests.
[45] Source: UdelaR

- **Master's Degree in Cellulose and Paper Engineering** (Engineering College - University of the Republic):[46] the objective is to add to and deepen the scientific training and technique of the professionals in the cellulose and paper production engineering field, obtaining a greater specialization than the one received in the graduate degree. The curriculum of the Master's Degree in Cellulose and Paper Engineering spans over two years and consists of programmed activities and a thesis. For each generation of students, a training plan of programmed activities (refresher and/or postgraduate courses, seminars, etc.) is established. The programmed activity is organized in a set of key subjects to broaden and deepen basic knowledge in the thematic area and a second set of specialized technological subjects.
- **Civil Engineering** (School of Engineering - University of the Republic): in this course there is a subject titled "Wooden Structures", which is mandatory for the structural profile, in order to train engineers in the use of domestic wood as a structural material. The Master's Degree in Structural Engineering also includes subjects related to structural calculations with wood.
- **Chemical Engineering** (School of Engineering - University of the Republic): in this course, there is an optional subject called "Fundamentals of Cellulose and Paper Production", which aims to introduce the student to the processes developed in cellulose pulp (particularly Kraft) and paper production mills.
- **Forestry Technician** (University of the Enterprise - UDE): this career offers a two-year program, which was the first alternative to agronomy offered by a private institution, directly focused on the needs of the forestry sector. If the program is reviewed, it covers all the steps in the forestry chain, except for chemical processing. The UDE also offers a course in Agronomy, but unlike the University of the Republic, it does not cover subjects directly related to forestry production, although it does cover plant production and protection.
- **Forestry Technician / Wood Technologist** (Labor University of Uruguay -UTU): the first, which lasts for two years, covers the entire forestry chain, from nursery and field work to forestry industries. The Wood Technologist program is developed in six semesters of related basic sciences, such as physics and mathematics, and a broad spectrum of subjects related to forest harvesting, mechanical wood processing and forest industry management.
- **Specialization Diploma in Design, Calculation and Construction with Wood** (DEEM) (School of Architecture - ORT University + School of Engineering - University of the Republic): although it is not directly linked to the traditional forestry chain, it seems

[46] Source: School of Engineering

important to mention this degree. It is taught jointly by the University of the Republic and the ORT University. It is a course specifically designed to provide knowledge about an area that is little explored by the current Uruguayan forestry sector, such as the use of part of the existing raw material to cover the needs of housing, civil construction, bridges, etc. in the country, both from solid wood and engineered wood products.

13. URUGUAY AT A GLANCE

13.1. MAIN ECONOMIC INDICATORS

Indicators	2017	2018	2019	2020	2021	2022	2023*
GDP (Annual Var %)	1.74%	0.16%	0.74%	-6.26%	5.28%	4.92%	1.97%
GDP (US$ Millions)	64,995	65,118	61,992	53,613	61,380	74,182	75,484
Population (Millions of people)	3.49	3.51	3.52	3.53	3.54	3.55	3.57
GDP per Capita (US$)	18,606	18,573	17,619	15,184	17,324	20,867	21,164
Unemployment rate - Annual Average (% Workforce)	7.9%	8.3%	8.9%	10.4%	9.3%	7.9%	8.1%
Exchange rate (Pesos per US$, Annual Average)	28.7	30.8	35.3	42.1	43.6	39.5	40.9
Exchange rate (Average Annual Variation)	-4.8%	7.3%	14.7%	19.2%	3.6%	-9.4%	3.5%
Consumer Prices (Cumulative annual % variation)	6.6%	8.0%	8.8%	9.4%	8.0%	8.3%	6.7%
Exports of goods and services (US$ Millions) **	16,845	17,216	17,185	13,735	19,336	22,605	23,283
Imports of goods and services (US$ Millions) **	13,367	13,964	13,499	11,364	14,903	18,716	20,057
Trade Surplus / Deficit (US$ Millions)	3,478	3,252	3,687	2,371	4,433	3,889	3,227
Trade Surplus / Deficit (% of GDP)	5.4%	5.0%	5.9%	4.4%	7.2%	5.2%	4.3%
Overall Fiscal Result (% of GDP)	-3.2%	-3.9%	-4.4%	-5.8%	-4.1%	-3.4%	-
Gross Capital Formation (% of GDP)	16.3%	14.9%	14.3%	16.4%	19.2%	18.8%	-
Public sector Gross Debt (% of GDP)	59.8%	59.1%	60.1%	74.5%	69.1%	64.3%	-
Foreign Direct Investment (US$ Millions) ***	-590	-11	2,018	746	2,244	3,839	-
Foreign Direct Investment (% of GDP)	-0.9%	0.0%	3.3%	1.4%	3.7%	5.2%	-

* Projected data is in red.
Sources: Data on GDP, foreign trade, FDI, exchange rate, international reserves and foreign debt are from the BCU; population growth, literacy, unemployment and inflation rates are from the National Institute of Statistics. Data estimated for 2021 based on the BCU economic and inflation expectations surveys and Exante projections. Fiscal result data are from the Ministry of Economy and Finance, since 2018 the figures are adjusted for the effect of Law N°19590 (fifty-year-olds).
** In 2017 the BCU adopted the methodology of the 6th balance of payments manual. Data based on this new methodology include purchase and sale of goods and re-exports and are available since 2012.
*** In 2017 the BCU adopted the methodology of the 6th Balance of Payments Manual. Data are net flows so they may assume negative values.

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