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Overseas Plantation Sawlog Fact Finding Study Tour

Spain, Chile, Uruguay, Argentina - 24 April 2010 to 17 May 2010

"Cuatro amigos buscan el mundo latino para árboles solitaries"

Peter Volker, Forestry Tasmania

Glenn Britton, Britton Timbers

Shawn Britton, Britton Timbers

Tony Jaeger, McKay Timber

Forestry Tasmania

BRITTON TIMBERS AUSTRALIA

McKay Timber

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Contents

Executive summary

During April 25 to May 17, a party of Tasmanians embarked on a mission to view the use of plantation grown eucalypts for solid wood and veneer applications. The party was led by Dr Peter Volker (Forestry Tasmania), Glenn and Shawn Britton (Britton Timbers) and Tony Jaeger (McKays Timber). The itinerary included visits to Galicia region of Spain, Concepcion to Osorno in Chile, Rivera in Uruguay and Concordia in Argentina.

Evan Shield (Forestry Consultant) has been an advocate for intensive early thinning, combined with high pruning, to produce high quality logs free of growth stresses for the sawmilling and veneer industry. This is based on sound scientific principles identified by Jacobs (1955) in "Growth Habits of the Eucalypts" and confirmed by silvicultural trials in South Africa (CCT Trial at Langepaan) and more recent trails in Australia and South America. Evan is often heard to say, "A lonely tree is a happy tree." We were interested to explore how this concept had been applied to eucalypt plantations, where there was also some progress in manufacturing and marketing of timber products.

The purpose of the trip was as follows:

1. The sawmillers had questions about the intended sawlog supply from plantations on Tasmania's State Forest as to its suitability for downstream processing.
2. What are the experiences of established industries overseas with utilising plantation eucalypt sawlogs for appearance and seasoning qualities destined for high value-added products (eg furniture, joinery, flooring)?
3. What silviculture regimes are required to produce these sawlogs?
4. What are the knowledge gaps we need to address in Australia?

Overall the conclusions from the mission:

- Plantation eucalypts present challenges for sawn timber and veneer manufacture due to need for high control of sawing, peeling and drying processes.
- Eucalypt plantations in the countries visited are generally free of pests and diseases which aids their exceptional growth.
- Low labour costs makes intensive silviculture more affordable.
- Competitive markets for logs and timber including export markets improves returns for growers and processors.
- There is strong support for industry development by government in all countries visited including investment in infrastructure (industrial parks, road and rail).
- Intensive silviculture is essential to produce defect free logs although, in Spain it was observed that good timber could be produced from *E. globulus* final crop trees which had been left after a number of thinning in mixed species stands grown to about 40 years.
- Attention to marketing and quality control was essential to gaining high value markets.
- High throughput sawmills require logs of uniform quality and the ability to backsaw some species is an advantage in these mills.
- There is still some doubt as to suitability of species such as *globulus, nitens* and ash eucalypts for back sawing, even using plantation grown trees.

- New industries are being developed with strong input from highly qualified researchers working closely with entrepreneurs, industry and customers.
- Reliance on a single market is dangerous for growers.
- Growers require a range of markets to achieve competitive pricing for their logs and to ensure investments in silviculture are realised.
- High value logs need to be treated with utmost care during harvesting, transport and log handling in factories.
- Market work and promotion needs to emphasize subtle changes in product due to use of eucalypts (eg higher strength in panel products, replace tropical timber etc).
- *E. nitens* poses significant problems for not only for the sawn solid wood industry but also the peeling industry through:
    - The inherent internal check problem (no matter what the growing regime)
    - Lack of strength, toughness and hardness
- Certification was seen as important for market reasons. Every enterprise had experienced difficulty with FSC and some ongoing issues with some FSC stakeholders. There was general consensus that the PEFC approach seemed give growers more certainty as to the consistency of standards, especially where these were combined with a robust national standard. Most larger enterprises we visited in South America and Spain had FSC certification. FSC certification was also being pursued under a group scheme in Spain, for smaller growers and processors.
- Plantations are seen as an agricultural crop and valuable resource leading to:
    - Development of processing facilities.
    - Increased regional employment.
    - More integration of agriculture and tree crops at farm and landscape level.
    - Governments see agriculture and forestry working together.
    - Private forestry evident and successful.
    - Greater community acceptance of forestry as part of the local economic activity.
- Entrepreneurial approach
    - Observed processing facilities that had developed using resources developed by the owners.
    - Strong support for industry development at local and government levels.
    - Use of researchers to work with operational staff to fine-tune processes.
- Products
    - Pruned log
        - Joinery, flooring, furniture, LVL
        - Sliced and rotary veneer for appearance and/or face in flooring (depends on wood properties)
        - Seasoned appearance grades – 25 to 50mm thick dried and finished boards
        - Quarter sawn at 75 to 200mm width
        - Strip flooring, 19 to 25mm thick
        - Engineered flooring
        - Laminated beams and panels for joinery

- Unpruned log
  - Rotary peeled veneer for cores in construction grade panels
  - Sawn timber for low value uses?
  - OSB
  - MDF
  - Pulp
- Strong desire from many places visited for collaboration on research and market development for eucalypt products (especially globulus, nitens and regnans).
- There is strong demand for high quality eucalypt products in sophisticated and high value markets in Europe, north and central America and Asia.

As a result of the study tour:

1. The group/delegation is firmly convinced that plantation grown eucalypt sawlogs can be grown and produced to a very satisfactory size and quality to produce select grade white eucalypt sawn timber providing the following basic criteria are strictly adhered to.
   a. Appropriate site selection/topography/soil quality/rainfall with species matched to site.
   b. Strict silvicuture regime from site preparation to harvesting as per the Evan Shields/Corfusa model, which has been financially successful over the past twenty years in Uruguay. In other words the "lonely happy tree" regime with absolutely no comprises at all, which results in stress free trees and high recoveries of good quality sawn timber
   c. Issues to be avoided are:
      i. lack of management and investment over the life cycle of the plantation, in other words we cannot afford to just put trees in the ground and pay scant attention to the necessary strict silvicultural requirements such as pruning and thinning,
      ii. old habits of overstocking to produce "suspect" commercial thinnings at various intervals during the growth cycle,
      iii. however there may be the opportunity for one commercial harvest for pruned peeler logs at approximately twelve years of age leaving one hundred trees per hectare for the final sawlog crop.
   d. The successful Corfusa/Urofor operation in Uruguay is a stark example of all of the above
   e. Broad based example of possible outcomes relating to the above

10,000 m3 logs @ 30% recovery= 3,000 m3 sawn timber @ $1.000/m3	$3,000,000
less 10,000m3 logs @ **$40/m3** stumpage	$400,000
	$2,600,000
10,000m3 logs@ 40% recovery = 4,000 m3 sawn timber@ $1000/m3	$4,000,000
less 10,000 m3 logs @ **$140/m3** stumpage	$1,200,000
	$2,600,000

   f. At the expense of repetition the above will only be achieved by investment in strict silvicultural management as is the case for any successful agricultural crop.

2. *E. nitens*
   Unfortunately our findings pertaining to plantation *E. nitens*, primarily in Chile, which is five to six years ahead of Tasmania with this species only mirrors our experience to date, that is good trees in terms of form, growth rates and suitability for green sawn timber. However huge problems of severe internal checking during the seasoning processes render some 80% of the material useless for high value products, therefore making this species currently unviable. Obviously more scientific work needs to be done in the future to determine if there may be any answers to overcome current seasoning problems. Backsawing does not seem to provide a solution to this problem. More work does need to be done, but at this stage, we are not confident in the suitability of the species for high value appearance grade products while there is still propensity to severe internal and surface checking.
3. *E. globulus* and *E. regnans*
   Both these species are currently being successfully grown, processed and marketed from Spain (globulus) and Chile (regnans) and should be used for a blueprint for us in Tasmania albeit this current success could be vastly improved with closer adherence to the "lonely tree" silviculture regime outlined in point 1 above.

Recommendations for the Tasmanian Industry

1. Need to do further investigation on suitability of *globulus* and *nitens* resource to fit current processing facilities (sawn timber and rotary veneer).
    a. Further investigation of sawing patterns and drying is required to optimise recovery.
    b. Post sawing and drying timber treatment should also be explored, especially for nitens, where these could change the essential characteristics of the wood (eg wood-plastic composites, torification etc which has been investigated extensively in Spain by CIS Madera).
    c. Forestry Tasmania needs to determine a clear market direction for the current plantation estate (particularly *E. nitens*). This will dictate the level of investment which can be put into those existing plantations

2. Develop a strategy for future plantation establishment in Tasmania
    a. This will investigate the suitability of *globulus* and *nitens* to fit different sites and land types in Tasmania (both public and private land).
    b. Determine a clear management regime prior to trees being planted. This will be variable according to site and species requirements as well as target markets.
    c. Determine a clear use for each species grown in different management regimes (eg sawlogs and peelers from high pruned and thinned *E. globulus*).
    d. Ensure there is suitable funds available to manage plantations for their intended outcome (expenditure on management should be seen as an investment in the final crop).
    e. A strategy must include a mechanism for regular dialogue with the processing sector to enable all players to be fully aware of the future resource model at regional level. The availability of resource will be the driver of processing investment at a regional level.
3. Intensive early thinning combined with high pruning is the only reliable method of producing high quality logs free of growth stresses and tension wood. This requires a single minded approach and commitment to implementing these regimes. High labour costs and relatively low log prices in Australia is an issue for doing this economically. As an indication, stumpage prices in the vicinity of US$120 per cubic metre were being quoted in Spain and South America for sawlog quality logs.
4. Combining forestry with agriculture, particularly cattle grazing, has been very successful in Uruguay. There is opportunity in Australia to adopt large scale commercial farm forestry which suits the approach to intensive silviculture and can be combined with other agricultural enterprises.
5. *E. nitens* – review available data to date and address outstanding issues
    a. Collaborate with Chile, particularly the PIT Nitens group on a regular basis. The thinned and pruned *nitens* resource in Chile is approx five years ahead of Tasmania and they too are looking for options and solutions.
    b. Review Tasmanian estate data and address outstanding issues (market, future management)

c. Issues for *nitens* include lower hardness, MOR, MOE, internal checking
d. Examine processing to achieve optimum return (eg face grade veneer for appearance may be a better utilisation of pruned resource than a sawn timber product).
e. Marketing is key to developing a niche for this "blond" hardwood timber.
f. Chilean pulp growers are turning to *nitens* because of higher yields of fibre per hectare i.e. volume x pulp yield, despite lower pulp yield in mill. There is also some indication that pulp mills prefer nitens but the reasons are unclear (suspect some pulp quality, effluent and other characteristics).

6. *E. globulus* –
    a. It is obvious that *globulus* has high strength and hardness, suitable for any market currently occupied by most hardwood timbers.
    b. Silviculture, particularly thinning, is important to avoid growth stresses and tension wood in logs.
    c. Determine a profile of suitable sites (either currently in *E. nitens* plantation or other public/private land) to embark on establishing a future high quality solid wood resource for Tasmania.
    d. Preferred species for Kraft pulp due to high pulp yield and other characteristics, but in Chile there is a move to increase *E. nitens* proportion at expense of *globulus*.
    e. Need to keep open communication channels with Spain and Chile on silviculture and product research and marketing.
    f. At appropriate time invite Manuel Touza (CIS Madera, Spain) to Australia and explore collaboration opportunities on wood research and product development with CIS Madera.
7. *E. regnans* –
    a. Not to discard *E. regnans* altogether as a possible plantation species in Tasmania.
    b. Develop some small trials within other plantations on various sites to further develop research into this species.
    c. *E. regnans* can be grown successfully in plantations in Chile and sawn timber appears no different from Australian grown Tasmanian oak. This indicates intensive management of native forest stands in Tasmania should not lead to any reduction in wood quality. Utilise Chilean resource to test markets for plantation grown timber in Australia.
    d. Chilean growers can successfully grow high quality regnans sawlogs in plantations of about 25 years age. This is problematic in Tasmania.
8. In Tasmania need close involvement of FWPA, CSAW, CRC Forestry, FT silvicultural research and industry in exploring new technology for processing and utilisation of existing plantation resource.
9. Need continued investment in (FT) tree breeding and silvicultural research to ensure the best possible growing stock is available to suit different growing regimes and conditions.
10. Attaching bioenergy facilities to utilise waste from log processing facilities requires attention to the quality, quantity and specifications of the resource – it's not a simple process of throwing everything in together.

11. FSC Certification needs to be carefully considered – there are issues for growers and producers, particularly additional costs and constraints that have been experienced in all countries visited.

A brief summary of observations from each country:

Spain

- Diversified plantation program based on pines, oak, ash and eucalyptus.
- Silvicultural regimes not specifically targeted at producing sawlogs, but still manage to supply a large quantity of high quality *E. globulus* logs into the market, as a result of thinning for pulpwood and small growers leaving trees to grow to 30 to 40 years age.
- Complicated land ownership makes broad scale plantation management difficult.
- FSC Certification had caused problems for growers as the rules were not always clear, especially around technical issues such as use of herbicides, water use of plantations and pest or disease management.
- Log costs are high due to diversified ownership and small scale logging operations.
- Established pulp and paper industry with ENCE Kraft mills at Ponte Vedra in southern Galicia and Navia in Asturia (just to north-east of Galicia).
- Long history of globulus plantations in Galicia going back to 1890s.
- Galicia is the main forestry and forest products region in Spain and one of the largest in western Europe.
- Push from researchers to introduce new regimes with aggressive early thinning and pruning in both globulus and nitens.
- High utilisation of timber into various markets including use of large green sawn beams on mussel barges, sawn timber directed to a large number of small sawmills, veneer logs to veneer, panel and plywood plants, two pulp mills near the region and a number of secondary processors using high grade materials supplied by primary processors.
- Most of the sawn timber industry consists of very small sawmills doing primary processing and selling products to secondary processors.
- Secondary processors have strong emphasis on marketing into very high value end uses in Europe (eg German window frames and European flooring).
- Secondary processors purchasing green select grade lumber from smaller sawmillers for drying and processing.
- Strong support for industry development, quality control, product evaluation and finding new ways to utilise wood products through support for CIS Madera (an industry supported timber research unit).
- Huge investment in infrastructure in the Galicia region with new highways and train systems being built.
- Large number of wind energy facilities throughout the region (nearly every hill had wind mills).
- Spain suffering badly from the global financial crisis with very high unemployment levels and depressed economy, although you wouldn't know it with the infrastructure projects going on and the proliferation of wind farms, new factories etc.

Chile

- Majority of plantation eucalypt program is pulpwood driven by two large companies (Arauco and Mininco).
- All *globulus* is grown for pulpwood, only *nitens* is being explored for sawlog.
- Very large radiata pine processing industry throughout the country including sawn timber, veneers, panels, MDF, OSB and pulp (Main companies are Arauco, Mininco and Masisa).
- Sawlog regimes in *E. nitens* and *E. regnans* have been adopted by private growers using high pruning and multiple thinning regimes, aided by very low labour costs and reasonable pulpwood prices.
- *Eucalyptus regnans* can be grown very well in plantations but has not been taken up on a large scale.
- Plantation grown *regnans* produced good quality appearance and seasoning grade wood with good recoveries from the pruned logs at 20 years age.
- Silvicultural regimes utilised 2 commercial thinning.
- Better knowledge of sawing and seasoning would get increased recoveries.
- Trials of sawing and veneer production in pine mills using pine sawing and drying regimes are not successful and can give an unjustified, poor impression of eucalypt potential.
- Eucalypts must be predominantly quarter sawn to produce high quality sawn material.
- *Eucalyptus nitens* has major issues with internal collapse where *globulus* and *regnans* do not seem to suffer this problem.
- Very fast growth rates and high carrying capacity of plantations makes Chile an ideal environment to grow high quality eucalypts. It is rare for similar productivity to be achieved in Australia.
- Veneer manufacturers were interested in eucalypts but so far their experience had not been good. Partly because of issues with drying and also splitting of logs post-harvest.
- Eucalypts mostly used for core veneers to confer strength and hide drying and other defects.
- Exploring options of specialist very high value products for eucalypt veneers (eg yacht fitouts, car interiors, panels).
- Strong government/industry funded project for *E. nitens* Program for Improvement of Technology project to examine processing and market opportunities for existing plantation resource.
- There is a large estate of pruned and thinned *E. nitens* ready for market now. Chile is at least five years ahead of Tasmania in this regard.
- All enterprises are export focussed due to limited internal markets for timber although this is changing as economy develops.
- Only one major export facility for forest industry near Concepcion, looking at developing a facility near Valdivia.

Uruguay

- Low grade timber can be used for pallet production due to low labour costs.
- Rough sawn lumber can also be exported.
- Large plantation program based on government promotion of forestry starting in 1987.
- Tax offsets for planting forests on "approved" soils.
- Innovative approach to planting – preferred *E. grandis* is frost sensitive so planted on upper and mid slopes, with frost resistant *E. dunnii* in lower slopes.
- Up to 30% of most properties maintained as pasture for cattle – maintains strong community support.
- Forestry and processing industry has contributed to diversification of economy and now residues are being used for energy production.
- *E. globulus* and *maidenii* plantations have been a failure.
- *Pinus elliottii* and *P. taeda* are the main pine species.
- 112,000 tonnes of unpruned *E. grandis* logs were exported from Montevideo in shipping containers in the first six months of 2010. These attract a price of US$143 per tonne and total export income of US$7.1M in the first six months of 2010. Destinations - 75% Vietnam, 16% China, 6% India
- Uruguay has established an export industry worth over US$1.2 billion from its plantation estate which has been developed over the past 20 years.
- Weyerhaeuser has a large rotary veneer mill at Tacuarembo which is processing mostly pine and is expanding into eucalypt.
- Urofor sawmill at Rivera is one of the most modern and high throughput eucalypt sawmill in the world, based on company owned plantations which have been thinned and pruned on intensive silvicultural regimes.
- Corfusa plantation company at Rivera grows 27,000 ha of plantation *E. grandis* which feeds the sawmill of its sister company Urofor. Tree improvement program provides seedlings and clonal material for the plantations. Intensive silviculture aims to produce 15m of pruned logs with SED of 40cm at around age 20.
- The use of biomass for energy production has been implemented with one stand alone plant (based on agricultural and some timber residues) and 2 plants associated with wood processing mills at Tacuarembo. The Urofor mill at Rivera also has a biomass plant attached. All plants have been designed at around 10MWhr production capacity.
- Weyerhaeuser has FSC controlled wood certification. Forestal Oriental plantation company, associated with Botnia pulp mill is in the process of getting FSC certification for its eucalypt plantations.
- A Uruguayan national forestry standard is under development with PEFC and many forestry companies will seek certification under this standard.

Detailed Trip Notes

Figure 1: Touring party at Villapol family gathering house in Trabada, Lugo, Spain, built with *E. globulus* and local stone. Glenn Britton, Shawn Britton, Peter Volker, Daniel Touza (CIS Madera), Tony Jaeger, Manuel, Villapol, Manuel Villapol, Gustavo Iglesias (GIT Forestry) (Photo: P. Volker)

Spain – Galicia

Galicia is the northern most region of Spain (Figure 2). It is characterised by mountainous topography. The climate of Galicia is continental oceanic with cold winters and mild summers. The average annual temperature is 12.0˚ C and rainfall is abundant throughout the year with approximately 1,000 mm falling.

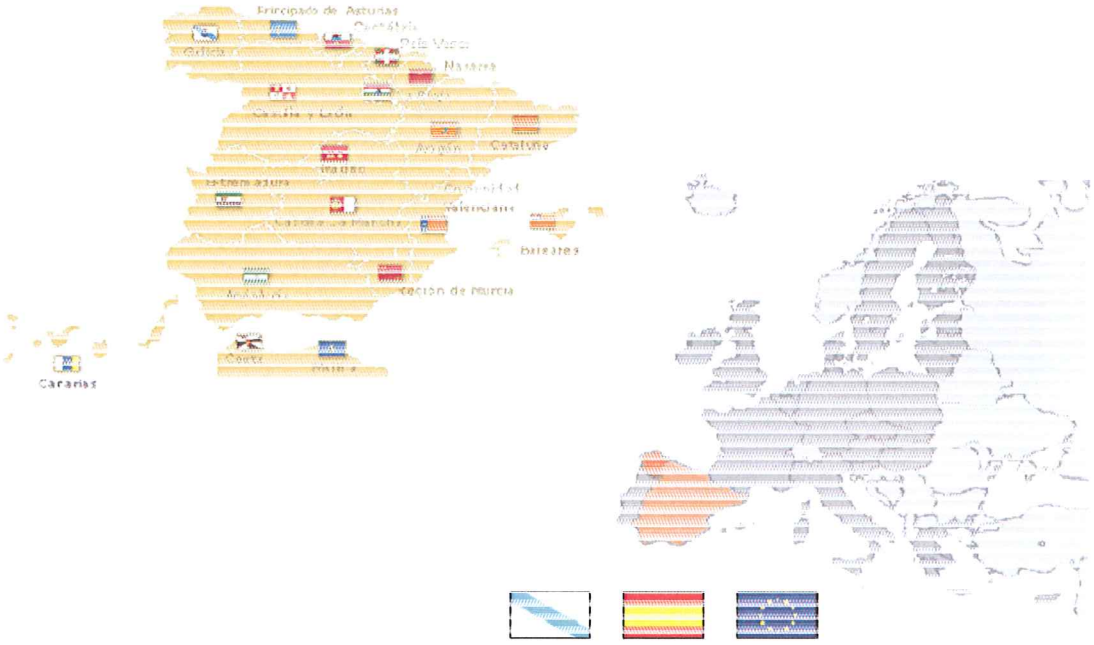
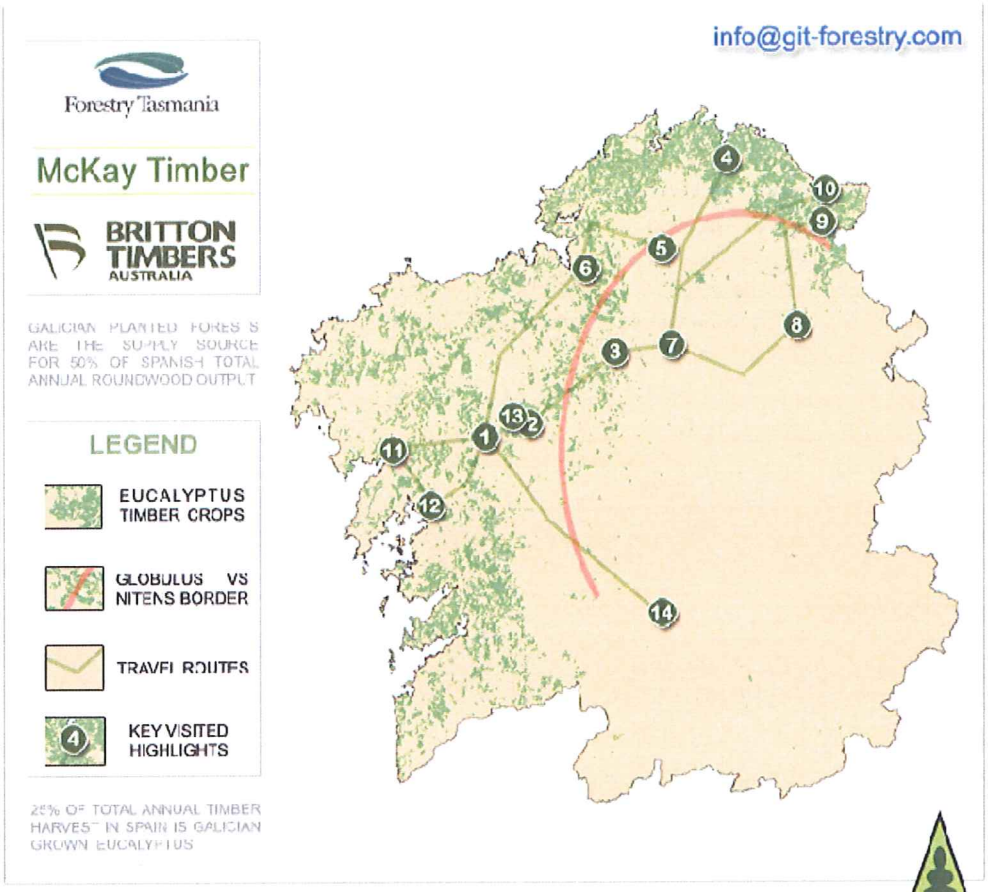


Figure 2: Spain, showing location of Galicia as the north-western region.

The vital statistics for Galicia are as follows:

- 2.7 million inhabitants
    - 5.5 times Tasmania
    - stagnating, ageing, coastal zone >70% inland <30%
- Total area: ~ 3 M ha
    - approximately the size of Belgium
    - 40% of Tasmania
    - Geographical dispersal of the population
    - 76% in municipalities < 2 000 inhabitants
- Own Language - Galician as well as Spanish.
- Primary sectors relevant to economy
    - Agriculture, Fishing, Forestry+Forest Based Industries
- Other important sectors
    - Energy, car industry, textile ...
- EU Convergence Region (<90% EU GDP/capita)
    - 81% EU GDP per capita entitles region to EU funding for infrastructure.



1. Santiago de Compostella - Examples of plantation grown *Eucalyptus* solidwood & laminated wood architectural uses & furniture.
2. Lavocolla - ENCE ***E. globulus*** clonal & seedling plantations (pulpwood).
3. Vilasantar - *Eucalyptus* veneer industrial operation. (Losan)
4. Chavin - Giant old growth ***E. globulus*** historical tree grove / Eucaliptal de Chavín Natural Monument.
5. As Pontes - *Eucalyptus* flooring industrial operation.(Galparpuet)
6. Eucalypt roundwood transport inspection.
7. ***E. delegatensis* ssp. *gigantea*** plantations (solidwood + pulpwood).
8. Multi-Product ***E. nitens*** Model Forest (veneer + sawnwood + pulpwood + biomass).(GIT Forestry)
9. Trabada - Laminated wood & solidwood *Eucalyptus* architectural uses & industrial operation. (Villapol) Museum of high value eucalypt timber made products.
10. Scenic views of the Northern coast *Eucalyptus* rainforest.
11. Serra de Outes - *Eucalyptus* sawmill industrial operation.(Vincente Suarez Bros.)
12. Boiro - *Eucalyptus* carpentry industrial operation (Mussel Farm Shipyard) (Manuel Sanchez Torrado).
13. *Eucalyptus* timber harvest & long beam preparation at wet mixed ***E. obliqua***, ***E. globulus*** and conifer planted forests. (Maderas Costina)

14. Galician Timber R+D Center. Solidwood eucalypt product quality testing. Museum of Galician made *Eucalyptus* timber & non timber products (all industrial lines) (CIS Madeira).

Figure 3: Itinerary for study tour in Galicia

Forestry has a long tradition in Galicia. In the late 16th century Galicians told the Spanish King that they were practicing silviculture so the land couldn't be claimed by the crown for ship-building. However, due to shortages elsewhere in Europe and good prices for timber during the 18th and 19th centuries most land was deforested. In the late 19th century the Spanish government started promoting forestry. Afforestation incentives were in place from 1927 to 1930 and then ceased during the civil war until the 1950s. Most (80%) of the planting activity was driven by private growers. Eucalypts began to be grown commercially after the 1960s although there were stands dating back to the 1890s in the region.

Table 1: Forest statistics for Galicia at 3rd National Forest Inventory (4th NFI is due for completion in 2010)

	3rd National Forest Inventory 1996	Change 1986-96
Forest	1,342,222 ha	+ 34%
Standing Volume	133 M m3 o.b.	+ 47 %
Average Volume / ha	94.70 m3 o.b.	+ 42 %
Annual Increment	11 M m3	+ 35 %
Annual Fellings	6 M m3 (1996) → 7.95 M m3(2008)	

The Galicia region in north-western Spain is the major eucalypt growing area in Spain and combined with Portugal has the only substantial eucalypt plantations in Europe. The vast majority of these plantations is *Eucalyptus globulus* and there is increasing interest in *E. nitens* for inland areas subject to frost and snow.

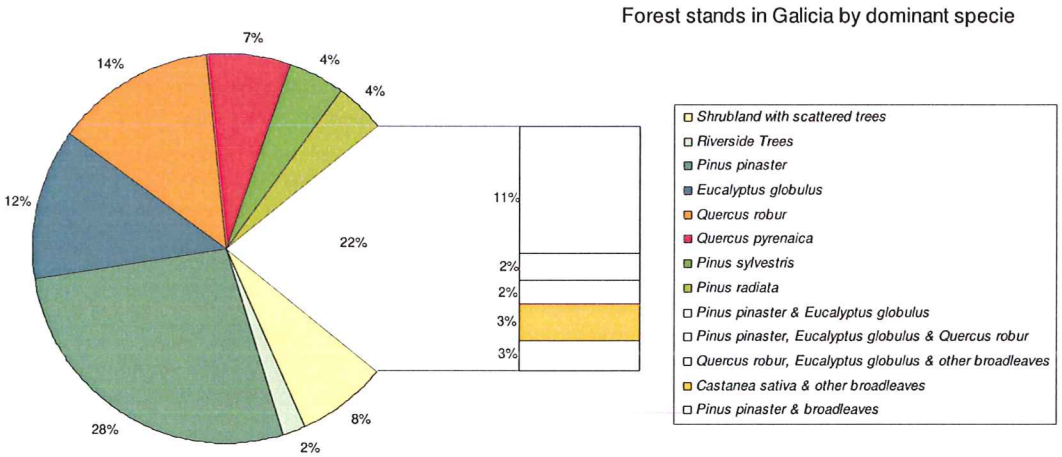


Figure 4: Forest stands in Galicia by species

ENCE paper company uses the blue gum in Kraft pulp mills at Ponte Vedra (Southern Galicia) and Navia (just to east of northern Galicia) and southern Spain (Huelva). It is the only industrial grower however it relies on supply from private forest owners for most of its wood.

Galicia produces 50% Spanish roundwood, 40% Spanish Sawnwood, 33% Spanish Panels,(74 % Spanish Fibreboards). 30% Spanish Pulp (Supplies 50% of Spanish wood for pulp)

- Annual turnover in Galicia: >2,000 M€
  - 3-4 % Galician GDP
  - Responsible of 5% of Galician trade to EU and overseas
- Direct Employment: 15,000 persons
  - 1.3% Galician Total Employment
  - 8% Galician Industrial Employment
- Induced Employment: 60,000 persons
  - 5.3% Galician Total Employment
- Supplied annually by 35,000 – 40,000 Forest Owners

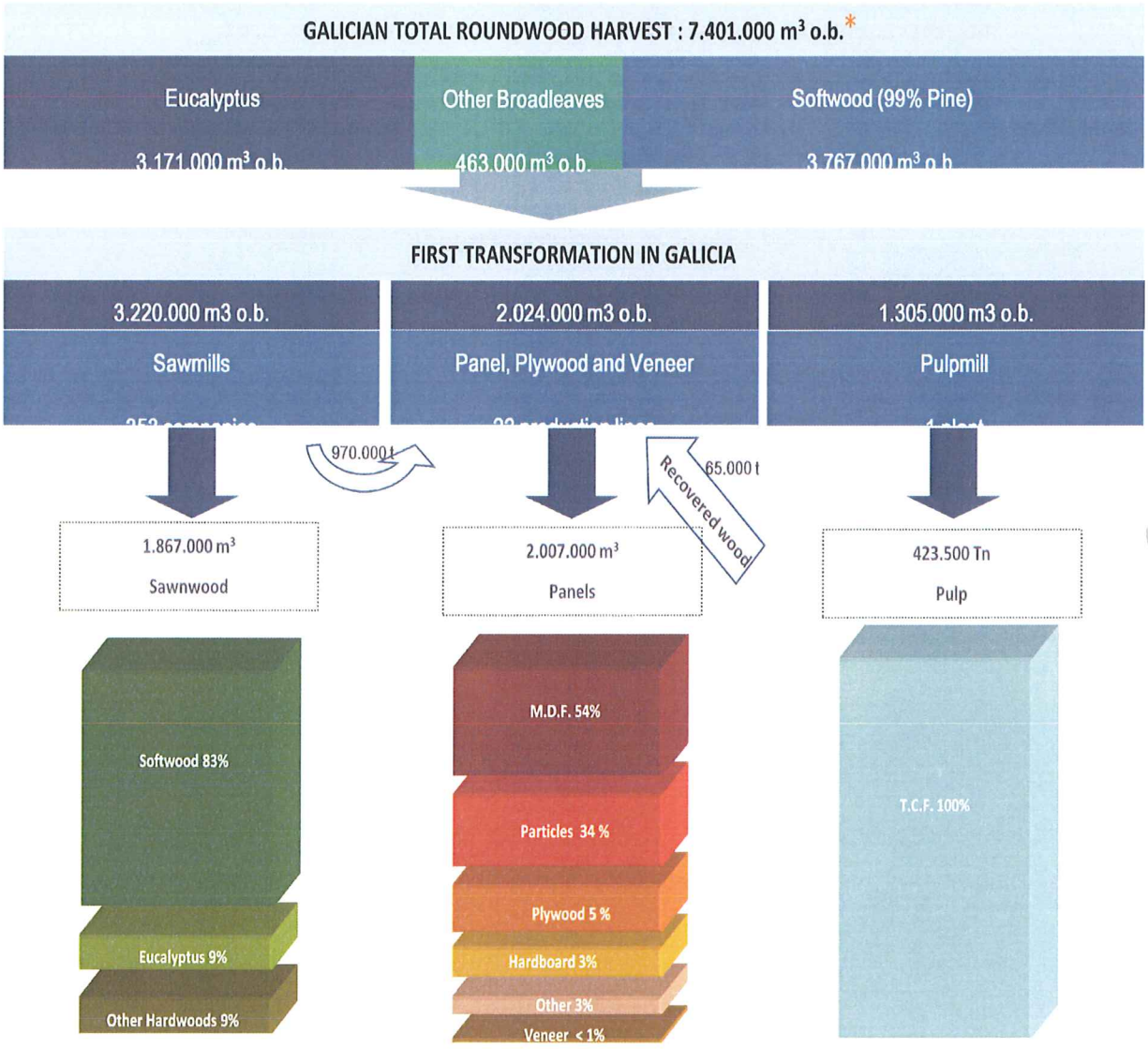


Figure 5: Galician forest industry

There are 353 sawmilling companies, 22 panel, plywood and veneer production lines and one pulp mill.

Land tenure in Galicia is quite complicated (Figure 6) with the average property size being less than 2 ha, in many cases much smaller. Therefore there is very little broad scale silviculture as individual property owners pursue their own objectives on very small pieces of land sometimes as small as 13 metres wide by up to 100 metres long. Most of the plantations have no deliberate silviculture. They are managed on pulpwood regimes without thinning, or thinned stands are left to grow on and may be thinned several times without pruning.

- 98% of the forest is privately owned

- 672,000 individual forest owners (in a 2.7 million population)
  - less than 2 hectares in 2 or 3 different plots per owner.
  - 80% of the plots is smaller than 0.5 ha.
- 2,800 private communal forests
  - average size 250 ha, 36% managed by Forest Service through contracts
- The price of forest land is approximately €6,000 per ha
- Industry Manages directly less than 12,000 hectares (9,000 ha owned by ENCE)

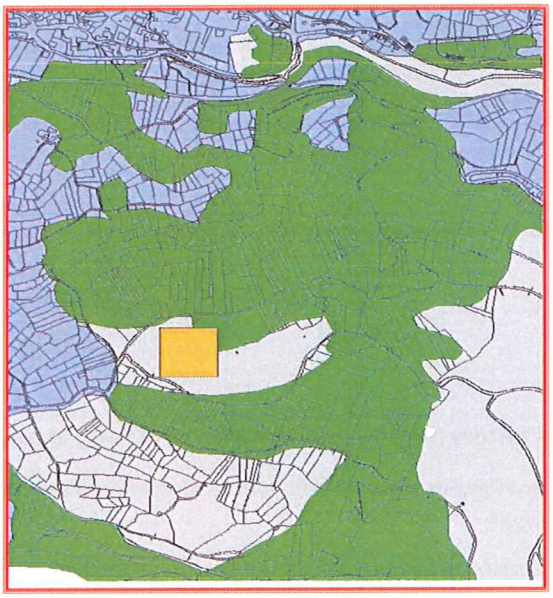
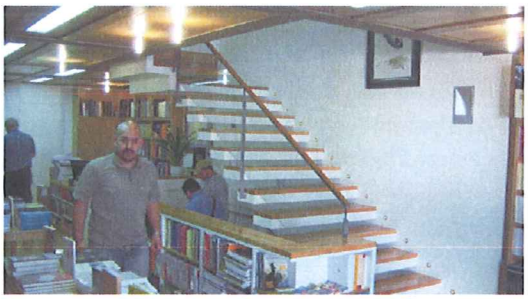


Figure 6: Typical land ownership in Galicia. The orange square represents 1 ha. Green areas is forest, blue is cultivated fields and grey is rocks and scrub.

Pulp wood prices are €50 to 54 per m^3 OB at mill door. The current stumpage is about €25 per m^3 compared with €44 in 2008. Sawlog (>35cm SED, 2.5m) stumpage prices are in the range of €50 to 70 per m^3. Transport costs €6 to 9, harvesting cost €18 to 20.

Most of the small private blocks do not have any active silviculture. They are often a mixture of species and ages. We observed an area that contained *E. globulus E. obliqua*, *Pinus pinaster* and *Quercus* mixed to gether in various age classes. Larger plantations are generally managed for pulpwood except where there is specific target at solid wood production. In that case there is active promotion of thinning and pruning led by research at CIS Madera and promoted by forward thinking foresters such as Gustavo Iglesias of GIT Forestry Consulting (our host for this trip)

Example of globulus in use



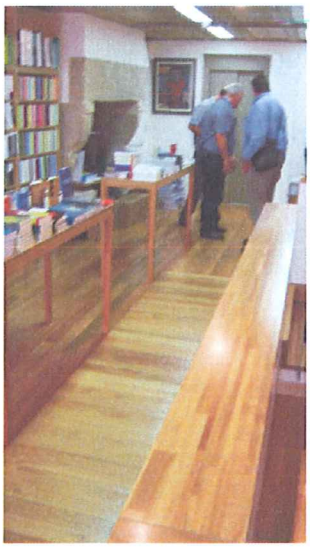


Figure 7: Bookstore in Santiago de Compostella using *E. globulus* sawn timber for stair treads, flooring, shelving and other appearance and utility functions. The shop keeper mentioned the floor was able to withstand high traffic and coped very well with wet and dirty foot traffic. Photos: P. Volker

Grupo Losán - Aserpal factory (sliced veneer for plywood) www.losan.es

Founded in l991. Aserpal factory specialises in the cutting and slicing of natural wood veneer and the production of dyed veneer.

With totally integrated systems, and by bringing together artisanship and technology, this factory has become specialised in the elaboration of fine wood surfaces, personalised in accordance with the aesthetic criteria established by each of the customers.

Figure 8: Losan sliced veneer factory

Figure 9: *E. globulus* and *Fraxinus* logs kept under water

Figure 10: Sliced veneer sheets of *E. globulus* showing little or no defect despite the trees not being pruned. (photos P. Volker)

Delivered log costs for *Fraxinus* and eucalyptus is €80/m^3. Need larger diameter logs with minimal defects. (see photo).

Logs are prepared by edge trimming to hexagonal shape, banded to prevent splitting and then soaked in hot water. Once the soak is completed the bands are removed and the log is halved, ready for slicing.

Losan has developed a new product called Uniblanco™ which is based on use of white oak and most likely utilises *E. globulus.*

Galparkét factory, As Pontes www.galparquet.com

The company Galparquet s.a. it is part of the Tojeiro Group. A group of Spanish capital, with roots in Galicia and activities in different sectors with more than seven thousand employees across the group.

Galparquet s.a. started in 1999 in As Pontes, La Coruña. In 2001 important improvements were made on the production line. In 2005 a new factory was built. This factory is at the moment one of the most modern and productive in Europe.

Galparkét produce flooring according to various configurations in a modern and highly automated factory.

The flooring system is characterised by use of plywood board which, in comparison with traditional floating floors, offers better stability, rigidity, resistance to pressure and breaking of edges as well as being moisture resistant. The thickness of the upper layer is 3mm and 1mm at the base. The Fusion Line uses HDF board as the underlay with a 0.6mm wood surface. The Eucalyptus used by Galparkét is among the hardest of the wood surfaces they use, only Jatoba is harder.

Figure 11: Example of *Eucalyptus* flooring product produced by Galparkét (Photo P. Volker)

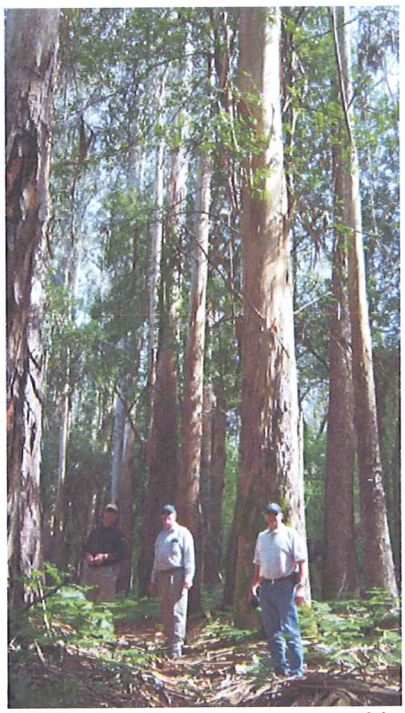
Figure 12: Quality control in flooring system 19mm finished product (350x70) with 3mm surface layer. (Photo P. Volker)

Chavin Giant Eucalyptus Natural Monument

In 1891 a small valley in the Northern Coast of Galicia (NW Spain) was subject to works of hydraulic engineering. Its steep slopes and narrow bottom made it suitable for the taming of a rivulet in the Landro-Loureiro basin, which was dammed. Soon a primitive electricity generation plant ("*fábrica da luz*") brought light to the nights of the foggy coast. A network of channels to divert excess water flow was also built in order to avoid catastrophic floods to the rich agricultural fields down stream. And here, by the 1890's, the first *Eucalyptus* were planted in order to stabilize soils.

More than a century later, the six hundred 95 to 115 years old *Eucalyptus globulus* of Chavín grow towering above the steep slopes, their roots drinking directly from channels and rivulet, to become the tallest *Eucalyptus* grove in Europe. The living Natural Monument at Souto da Retorta is one of the Cathedrals of the Cantabrian Coast, its pillars made of Tasmanian Blue Gums. Sheltered by the giants, a rich understorey of chestnuts, oaks, laurels and ferns grows happily in a unique microclimate.

Several of these trees are special. But tradition marks one of them, O Avó de Chavín (The Grandfather) as the main shrine of this magical place. Towering at 67 meters above the forest floor and with a perimeter at the base of more than 10 meters, Grandpa receives hugs of countless visitors including those from its ancestral home in Tasmania!



Stand of trees approx 100 year old

DBH 93.5cm

O Avó de Chavín (DBH 10.5m, Ht 67m)

Figure 13: Old *Eucalyptus globulus* in National Monument park near Chavin, Galicia. (Photos P. Volker)

Vicente Suarez Brothers sawmill (A Coruña)

Fairly basic sawmill cutting globulus beams which are eventually used in mussel farm barges. Also cutting 28mm thickness boards for sale to Villanova factory.

Paying €50/m^3 for logs delivered to mill which is roughly €25/m^3 stumpage.

Figure 14: Pepe de Vincente Suarez prepares log for breaking down on band saw.

Figure 15: Globulus logs in sawmill yard

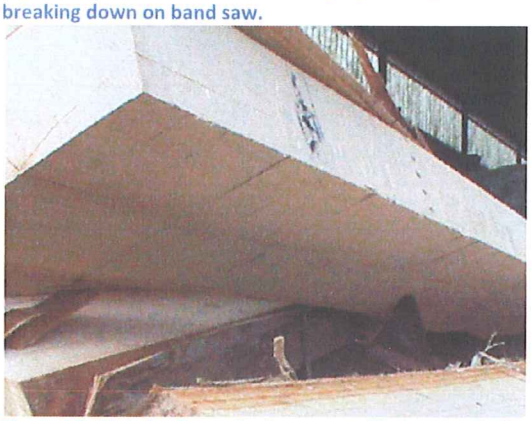


Figure 16: Globulus beam in the green mill, showing little or no defect.

Figure 17: Globulus beams are used to build these 30m x 27m mussel barges.

Figure 18: Preparing a log for cutting into a large beam.

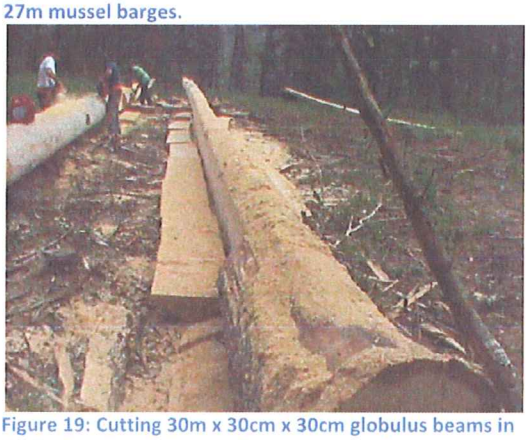


Figure 19: Cutting 30m x 30cm x 30cm globulus beams in the bush using chainsaws for use in mussel barges.

Villapol (Trabada) www.villapol.com

The Villapol family have used their own products extensively through various family owned buildings and businesses in Trabada village. This gives practical demonstration of utility of their products.

Figure 20: Villapol factory administration building at Trabada, LUGO, Spain (Photo P. Volker)

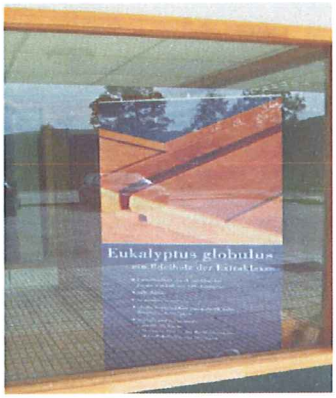


Figure 21: Marketing *globulus* flooring products Photo P. Volker)

Figure 22: Touring party outside Villapol family meeting house in Trabada, built with local stone and eucalyptus globulus timber Photo P. Volker)

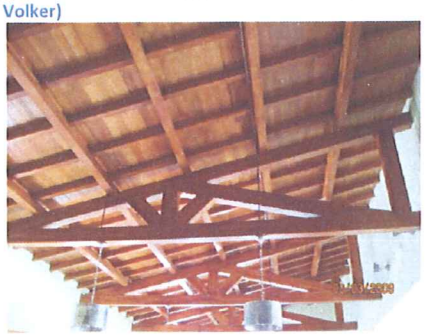


Figure 23: Interior ceiling of Villapol family meeting house showing use of globulus timber and laminated beams. (Photo T. Jaeger)

The company started as log buyers, purchasing tropical timbers and ran a small sawmill providing wood to the carpentry sector. In the past 10 years they opened a laminated wood factory using solid timber (100%) *Eucalyptus globulus*.

They have adopted the branding name of globulus and now sell into high quality furniture and joinery markets in Europe. One of the main customers is german window manufacturing company. Also producing laminated beams, moulded products including flooring and architraves.

The Villapol family had a lot of experience in growing trees, importing tropical timbers and a little experience in sawmilling. It was a big step to develop a large factory operation. They always had the feeling that the globulus could be used for higher grade products in solid wood. Previously the main use had been as rough sawn planks for boat building and other low-grade use.

Figure 24: Original Villapol sawmill used for processing purchased tropical timber logs and local *Eucalyptus globulus*. (Photo T. Jaeger)

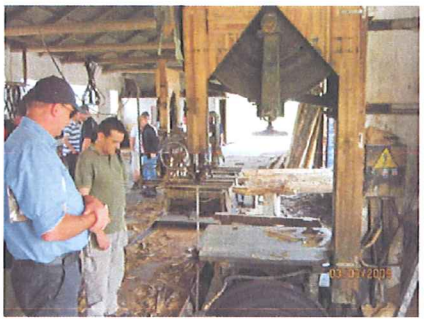


Figure 25: Bandsaw in original Villapol sawmill. (Photo T. Jaeger)

They relied on experience and advice from CIS Madera and other entrepreneurs to develop the factory, with the next generation of the family in mind to run a modern business. The investment was risky and different in that they were developing an industry which preceded the market. Therefore, they felt they needed "size" for economy of scale and commitment to develop a new market for a product with a dubious brand. They did this alone.

Figure 26: Racks of purchased *Eucalyptus globulus* prior to kiln drying. (Photo P. Volker)

Figure 27: E. globulus boards showing little end checking or collapse. (Photo T. Jaeger)

Figure 28: Villapol factory, laminating machine to right. (Photo P. Volker)

Figure 29: Dressed globulus boards ready for laminating (Photo P. Volker)

Figure 30: Customised timber pack of laminated boards. (Photo P. Volker)

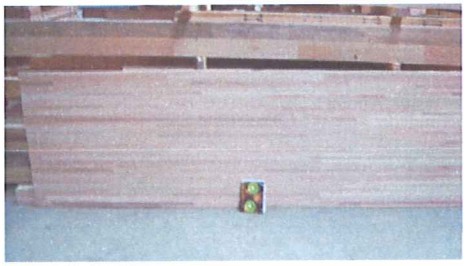
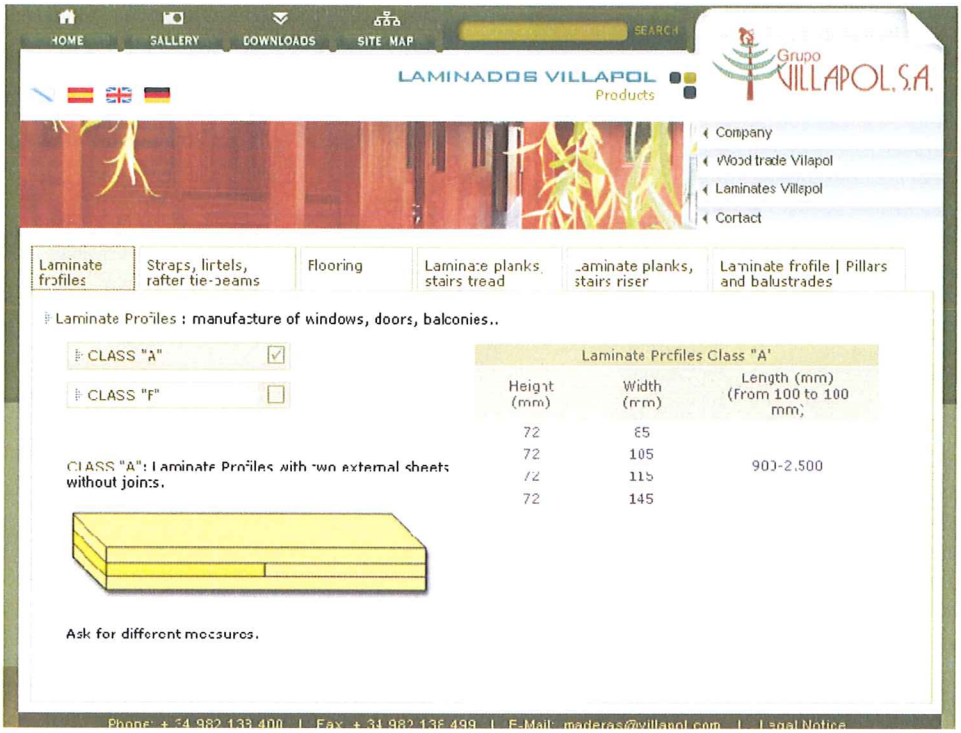


Figure 31: Laminated globulus to be used in flooring or joinery applications. (Photo P. Volker)

It was a large investment which relied heavily on important research background and technical imput to be able to produce a consistent and high quality product. Aggressive marketing was required to get market share. The plan was for four out of the first 10 years to prove product to the market and then start to increase sales.

The factory currently produces 4,000m^3 of laminated products per year with a capacity of 9,000m^3.



Villapol has perfected new techniques of drying and gluing to develop new uses of the E. globulus. One of these new applications is the **laminated profiles** formed by the union of three wood laminae previously limited by defects (naked, cracks...) and united to each other by gluing.

Advantages of laminate wood

- Reduction of drying time.
- Minor waste of raw material in case of using solid wood.
- More equal and free of fault product.
- Custom-designed product.
- Improvement of dimension stability regarding to solid wood.
- More stability against fire.
- Less wood to withstand the same weight.
- More natural durability.
- Heartwood and radial cut.

Applications

- Elements for carpentry manufacture of windows, balusters, banisters, mouldings, doorframes, bedsides.
- Elements for furniture: tables, beds, decorative purpose.
- Elements for urban furniture.
- Elements for structures: beams, tie-beams.

Figure 32: Laminates (globulus) used in window (Photo P. Volker)

Figure 33: Laminates (globulus) used in beams (Photo P. Volker)

Purchases green boards from sawmills in the region at €230/m^3 (eg the Vincente Suarez Brothers) or logs as follows.

Eucalyptus uncut

	Length (mm)	Diameter (mm)	Explanations
In order to obtain wood of great quality or it plates.	3,500 3,000 2,500 2,000	> 400	with crust
Board factory, sawmills and paste.	2,500 2,000	From 70 to 400	with or without crust
For mines, board factories and paste	3,000 2,500 2,000	From 50 to 140	with crust
For posts and stakes	2,000	From 40 to 50	With crust

After drying the cost of boards is €700/m^3

For each m^3 of green boards, 55% ends up as final product. The reference cost of the final product is €900/m^3.

Villapol SA Floorboard product

Eucalyptus Globulus		
Length (mm)	Width (mm)	Thickness (mm)
500 - 2,500	70	17
	80	22
	100	17
	100	22

The family have built a guest house in the village which demonstrates the use of *Eucalyptus globulus* in high value applications. A feature of the house is that it has 30,000 individual pieces of wood with not one nail.

Figure 34: Various views of Villapol family demonstration house built entirely from *Eucalyptus globulus* (30,000 pieces of timber with no nails). (Photos P. Volker)

CIS Madera (Ourense) www.cismadeira.com

CIS Madera is an industry funded research organisation based in Orense. Manuel Touza leads a small team of people working on processing technology for eucalypts. They are looking at drying technology, composite materials (eg wood with plastics), reconstituted wood and torified wood for outside use. In addition, they are also involved in silvicultural studies to reduce growth stresses in eucalypt plantations. As a result of this work Touza has intimate knowledge of the potential of blue gum for a number of uses.

Chile

The majority of eucalypt plantations in Chile are for the pulpwood market. Chile has a number of very large Kraft pulp mills with three main companies – Arauco, Mininco and Masisa. These

Figure 35: Map of southern Chile showing Australian towns at similar latitudes

companies also own other manufacturing facilities including veneer, particle board and sawmills. Arauco also has control of Chile's main port at Concepcion.

There is interest in growing eucalypts for solid timber in Chile which is driven by private growers. Hector Lisboa has substantial land holdings in Region VIII where he is concentrating on the use of *E. regnans* and *E. delegatensis* with intensive silviculture to produce clear logs for sawmilling and veneer production. He owns a small sawmill with kiln drying facilities near Arauco. At the time of our visit the sawmill had been severely damaged by the tsunami associated with the 27 February 2010 earthquake.

Lisboa is sawing *regnans* and *delegatensis*, but lacks some experience in sawing patterns and drying techniques, particularly reconditioning. His mill is capable of producing a high quality product, albeit in small quantities. He is producing good quality appearance and seasoning grade wood with high recovery from the pruned logs.

Figure 36: Hector Lisboa farm – *E. regnans* logs kept under sprinkler system, ready for transport to sawmill. (Photo P. Volker)

Figure 37: *E. regnans* plantation at Hector Lisboa's farm, south of Arauco – note crowns mostly on LHS due to wind. (Photo P. Volker)

Figure 38: 2R *E. regnans* plantation 8 months after planting. (Photo P. Volker)

Figure 39: 13 year *E. regnans* plantation after recent thinning to 400 sph. (Photo P. Volker)

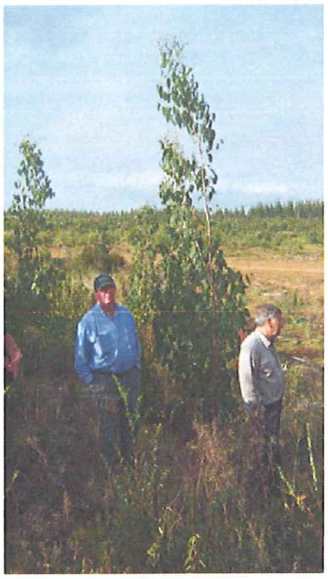


Figure 40: 18 month *E. regnans* (Photo P. Volker)

Figure 41: 31 month *E. regnans* (Photo P. Volker)

Figure 42: Guillermo Sanchez and Hector Lisboa with 25 year *E. delegatensis* (Photo T. Jaeger)

Figure 43: Sawn Tas oak at Lisboa's sawmill near Arauco. (Photo T. Jaeger)

There are a substantial number of private growers in the area from Temuco to Puerto Mont, around Osorno and Valdivia who are mainly growing nitens due to the colder climate. Many of these landowners include German and Austrian families. Due to the poor price for pulpwood these landowners have embarked on pruning and thinning regimes to produce large diameter clear logs, however at present they have no market.

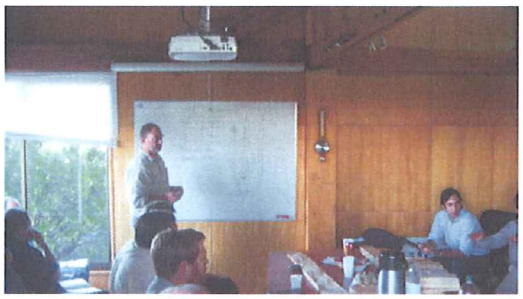


Figure 44: Shawn Britton speaking to Chile Nitens PIT members about timber drying. (Photo P. Volker)

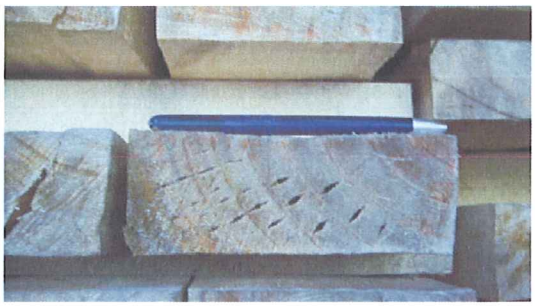


Figure 45: Internal checking on air dried *E. nitens* boards (Photo P. Volker)

Figure 46: Thinning nitens plantations on private property using bullocks. Logs were being sold for firewood! (Photo T. Jaeger)

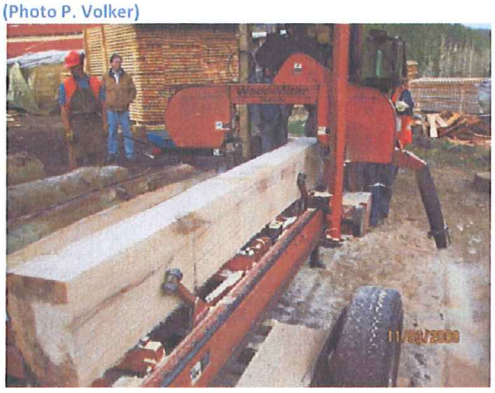


Figure 47: Sawing *E. nitens* with Wood Mizer (Photo T. Jaeger)

They have come together in a project called the Nitens PIT (translated - Program for Technological Improvement) which is funded by the owners and the Chilean government. Partners in the project include some smaller scale processors, private growers and forest management consultants and the scientific work is coordinated by INFOR (the Chilean Institute of Forestry – similar to CSIRO in Australia).

We visited sawmills and veneer mills which the primary feedstock is radiata pine. Their experience with eucalypts is not positive, but this can be attributed to lack of knowledge on how to process the eucalypts. It is obvious that pine milling techniques are not transferable to eucalypts. There are similar issues with nitens to experiences in Australia including growth stresses and internal checking during drying. Attempts at back sawing have not been successful. (see below)

A common problem in sawmills is that backsawing is used and this is not suitable for the eucalypts. In sawmills and veneer mills the pine drying schedules are too fast for eucalypts and therefore not effective. There is also little understanding of the need for reconditioning.

Observations on silviculture, growth and processing of *E. nitens* and *globulus*

E. nitens growth rates of 35 to 40 $m^3ha^{-1}an^{-1}$ are fairly standard in high rainfall and high quality zones between Concepcion and Puerto Montt – the best sites can produce up to 70. Standard regimes are to plant at 1600 sph, thin to 700 at about age 5 (60 to 80 m3 commercial recovered volume) and then thin down to final stocking of about 300 in two more stages.

E. globulus growth rates average MAI 30 to 35 over the whole estate, which includes some dry areas in the central valley. Better sites in the estate are up to 45. Rotation ages of about 15 years are preferred because wood age is a significant factor in specific wood consumption in the mill.

Observation of sites in the Valdivia to Puerto Montt area (Region X) is that *E. nitens* produces substantially more volume than *E. globulus* on the same site.

E. nitens has higher wood consumption (4.0 t wood/t pulp) for EKBP and therefore attracts a lower price than *E. globulus* (2.8 t wood/t pulp) - AUD$34 and $48 per m^3 respectively of wood without bark at mill gate.

E. globulus is grown predominantly by the 3 main industrial growers (CMPC, Arauco and Massisa) to feed EKBP mills. Most of the *globulus* is grown in the lower rainfall areas (800mm to 1800mm) centred around pulp mill developments in and around Los Angeles, Concepcion, Temuco and Valdivia at the southern extreme (predominantly Region VIII and IX). *Globulus* planting is mainly limited by cold in higher rainfall zones (Andes foothills in Region VIII and IX and all of region X and XI). I also observed severe defoliation in the southern areas probably caused by a number of factors including cold, *Mycosphaerella* and nutrition. There is little or no interest in *E. globulus* for solid wood at the moment – the demand for pulp is high, especially with new capacity at Santa Fe and Valdivia.

Wood is sold in *metroruma* which is a standard stack of 1m x 1m x 2.4m. A metroruma is calculated to equal $1.6m^3$ of wood or $1.5m^3$ of wood if bark is left on the logs.

A substantial proportion (variously quoted at 30 to 50%) of the *E. nitens* estate is held by private growers (estate sizes 50 to 500 ha) who are not happy with low pulp prices. These growers are starting to focus on solid wood regimes. Pruning is carried out to heights of up to 14 metres, however my observation that effective pruning to a DOS of about 15 cm was limited to heights of about 9 metres. At higher heights the branch size was too large and DOS was significantly greater than 15cm, effectively producing a small quantity of clearwood.

On a previous trip, Volker viewed some demonstrations of sawing *E. nitens*. At the Osorno sawmill he observed the sawing of nitens on a large band saw used for breaking down. The logs were about 60cm LED. There was considerable spring on the saw and boards suffered from severe spring and bow. At another trial 15 year old logs were sawn on a portable sawmill. There was considerable movement and splitting of some boards after sawing. There is interest in production of nitens sawn timber but inexperience with sawing and drying techniques. Some of the sawn timber that was cut on the previous trip was inspected during this 2010 visit. There was severe internal checking and collapse in the nitens boards.

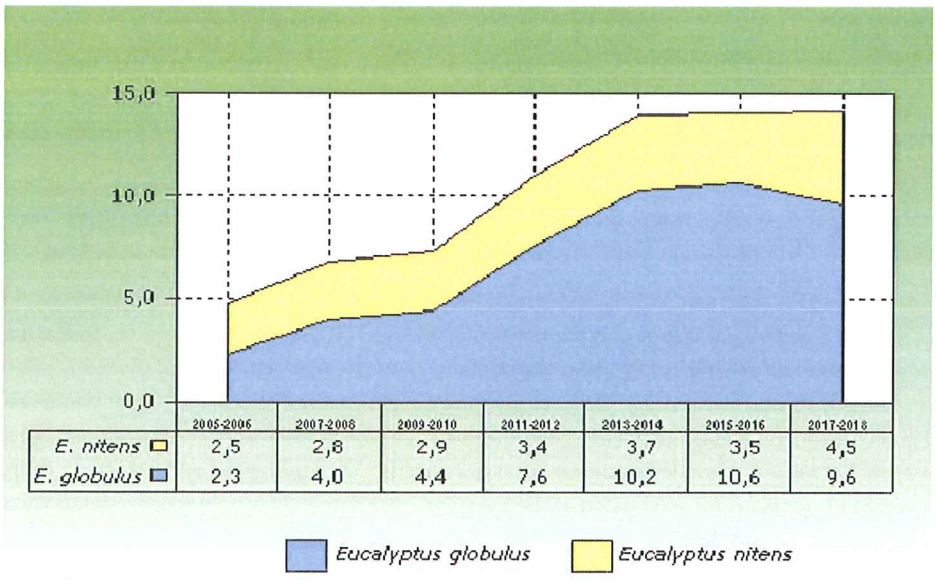


Figure 48: Future availability of eucalyptus plantation wood in Chile (Millions m3/year) from statistics sourced in 2006

While we were in Chile we heard there is a reported trend away from planting *E. globulus* towards *E. nitens* for pulpwood plantations. This is because the better growth of nitens produces more tonnes of fibre per hectare than globulus, even though the latter has a higher pulp yield. There are also reported benefits of using nitens for the fibre characteristics suited to end products being produced from Chilean pulp.

Uruguay

Figure 49: Map of Uruguay. Key locations – Fray Bentos: Botnia Kraft pulp mill, Paysandu: office and nursery headquarters for Forestal Oriental, Tacuarembo: Weyerhauser veneer and plywood mill with bioenergy plant, Urapanel plywood mill and a private consortium 10MW bioenergy plant, Rivera: Urofor sawmill, Cofusa plantations. Montevideo to Rivera is approximately 540km by road.

The forestry sector in Uruguay had its first legal milestone in December 1968, Law 13,723, but it was not until the enactment of Law 15,939 (28/12/1987) that the sector experienced a significant development. Further legal changes allowed the declaration of priority areas for forestry development as well as tax exemptions for import of capital equipment for forestry plantation development and processing infrastructure. The priority areas for forestry development were identified by soil mapping. In those areas plantations could be established so that they attracted the investment benefits of the above laws. Plantations could be developed outside these priority zones, but they would not have any advantage over other primary industry pursuits.

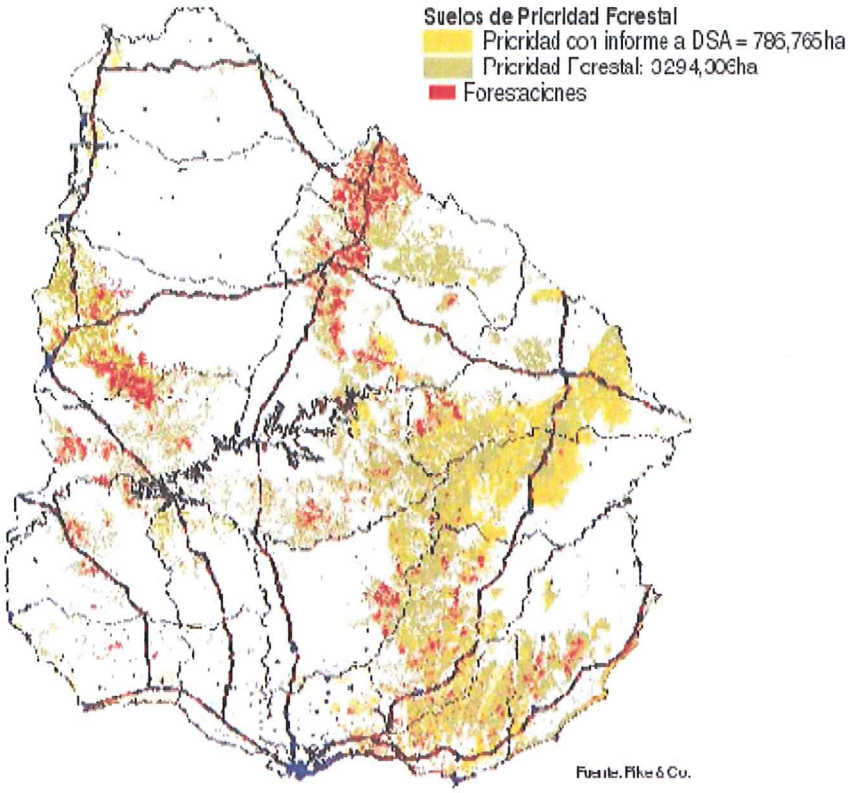


Figure 50: Map of Uruguay showing priority soils for forestry (green) and location of plantations (red)

There has been some considerable changes in the forest industry in recent times. In 2006 the Botnia pulp mill was constructed at Fray Bentos. It produces about 1 million tonnes per annum of Bleached Kraft Eucalypt Pulp (BKEP). In 2009 UPM bought Forestal Oriental and also a 91% share in the Botnia mill. Stora Enso bought the ENCE plantations (mostly globulus and maidenii) as well as a chipping facility on the Rio Uruguay. A new company, Montes del Plata announced an intention to build a new pulp mill of 1 M tonnes production capacity although the location is not known.

In late 2009 Urofor opened its new eucalypt sawmill in Rivera, which is designed to process up to 400,000 cubic metres of logs per annum. It is the largest eucalypt sawmill in the world. It utilises two sawing lines using a backsawing pattern. The products produced are flooring, joinery, furniture with low quality products going into pallets and general utility uses. The mill's feedstock is a 26,000 ha estate of thinned and pruned *Eucalyptus grandis* run by sister company Cofusa. Urofor and Cofusa are owned by the Otegui family.

The generation of electricity from forest biomass emerges as a response to the increased supply of raw materials and favourable State policies. There is a new biomass renewable energy plant at Tacuarembó, with a generating capacity of 10 MWh. Bioener (plant that generates with biomass produced by Urufor, with a capacity of 12 MWh) and Weyerhaeuser (also using by-products of industry - with 10 to 12 MWh of installed capacity) plants have been opened. The UPM Botnia pulp mill is generating electricity. The Urofor Mill will have an installed capacity of about 10MWh using chips and sawdust residues from the sawmill.

At December 2009 the year's planting program was 64,395ha of new plantations (56,930 eucalypts and pines 7,465) and replanting 19,571 ha (19,151 eucalypts and pines 420).

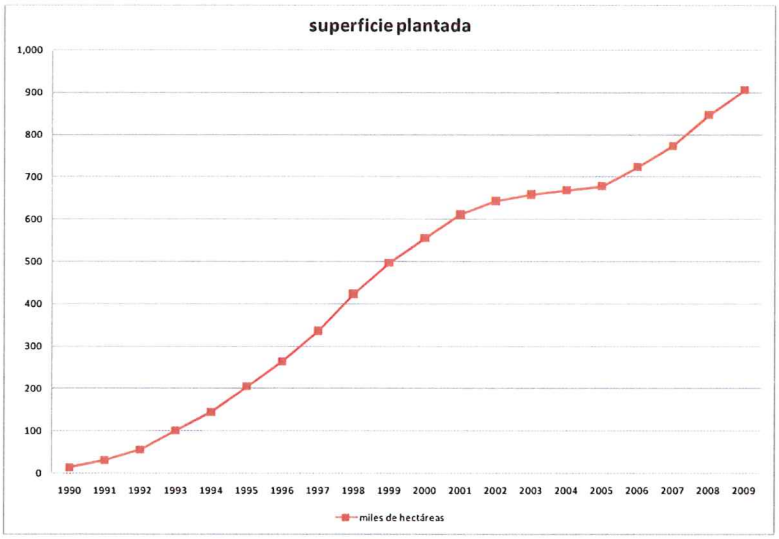


Figure 51: Increase in plantation area in Uruguay since 1990. The total area of plantations in Uruguay reached 1 Million hectares in 2009

Until the early 1990s, most of the plantings in Uruguay were small farm woodlots of *Eucalyptus tereticornis* used for firewood and fence posts. After the declaration of the forest promotion laws in 1987, there was increased interest in plantation development.

Figure 52: *Eucalyptus tereticornis* fence post (Photo P. Volker)

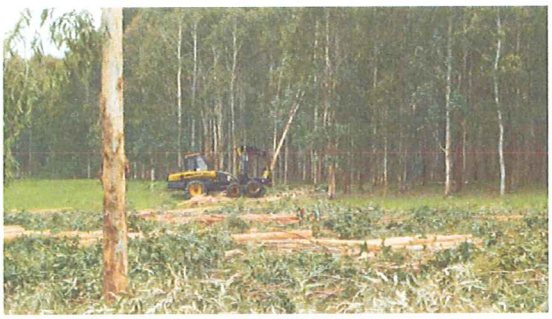


Figure 53: Clearfelling bluegum plantations near Tacuarembo. Note the wide expanse of grass. (Photo P. Volker)

Figure 54: Eucalypt plantation showing *E. grandis* on right and *E. dunnii* on left. (Photo P. Volker)

Figure 55: Local gaucho herding his cattle and happy with the eucalypt plantations. (Photo P. Volker)

The plantations in Uruguay are well-managed and fit into the general farming landscape. Most plantations have areas set aside for grazing (road edges, low lying areas) which are leased out to local farmers. This increases the social acceptance of forestry. There have been considerable economic developments with the increase in size and activity of the forestry sector. There have been some mistakes, including an early push to establish *E. globulus* and *E. maidenii* plantations largely encouraged by ENCE, a Spanish company with a desire for these species to feed its Spanish pulp mills.

Figure 56: Unsuccessful blue gum plantation near Tacuarembo. (Photo P. Volker)

Figure 57: Spacing trial of *Eucalyptus grandis* north of Tacuarembo. (Photo P. Volker)

In the mid 1990s Forestal Oriental, which was initially owned by Shell, established plantations of *Eucalyptus dunnii* in areas that were considered too cold for *Eucalyptus grandis.* This has now evolved into a focus on planting species according to landscape characteristics with *E. grandis*

planted on upper slopes, *E. dunnii* on lower slopes where frost could be an issue and leaving the gully bottoms unplanted and suitable for grass production. These plantations are the primary feedstock for the Botnia pulp mill.

Weyerhaueser

Weyerhaueser has a panel factory at Tacuarembo based predominantly on *Pinus elliottii* and *Pinus taeda* plantations in the region. The factory also processes *E. grandis* generally produced from commercial thinning of local sawlog plantations.

Weyerhaueser panel factory, Tacaruembo

- Log intake 350 K m^3 per year with 60 to 62% green recovery.
- Currently 70:30 pine:euc and aiming for 50:50.
- *E. grandis* almost same weight as the local *P. Elliottii* at 450kg/m^3 but much stronger.
- Using eucalypt for strength.
- Eucalypt has better recovery than pine due to less taper.
- Lower cost because of fast growth of eucalypts and replacing tropical hardwoods (market preference in Europe).
- Eucalypt use enables certification for structural grade products where exclusive use of pine would not allow this.
- Issue with soft and weak pine juvenile wood, causing "spinning" out on spindle lathes.
- Good quality grandis can replace meranti as face grade veneer.
- Biggest challenge with eucalypts is managing splitting.
- Markets – Europe, Mexico, Latin America, USA.
- Producing 150 Kt (87Kt dry) of residues per year which goes to 10MW co-generation plant
- Have FSC Chain of Custody and pursuing a Uruguayan forestry standard under PEFC.

Figure 58: Weyerhaueser bioenergy plant (Photo T. Jaeger)

Figure 59: Weyerhaueser bioenergy plant (Photo T. Jaeger)

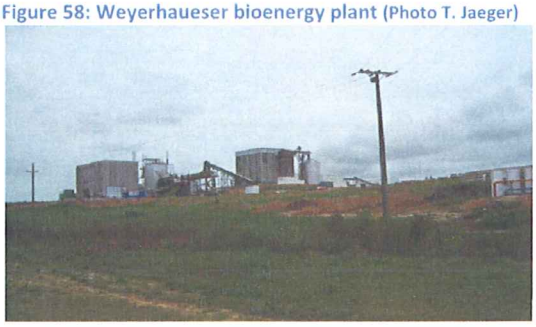


Figure 60: ERT Bioenergy plant, Tacuarembo (Photo P. Volker)

Figure 61: Forestal oriental 2R site preparation, Tacuarembo (Photo P. Volker)

Figure 62: Log transport near Tacuarembo (Photo P. Volker)

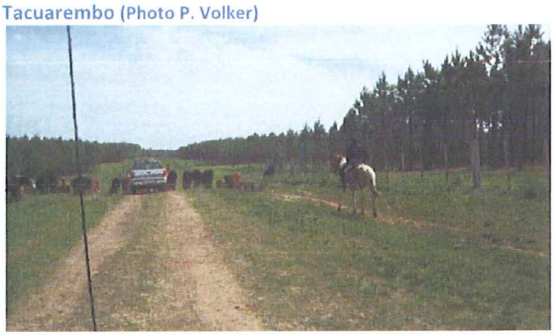


Figure 63: Cattle and plantations in harmony near Tacuarembo (Photo P. Volker)

Figure 64: Selecting *E. grandis* cuttings at Weyerhaueser nursery, Tacuarembo (Photo P. Volker)

Figure 65: *E. grandis* cuttings in nursery, Weyerhaueser, Tacuarembo (Photo P. Volker)

Cofusa plantations

Cofusa began establishing *Eucalyptus grandis* plantations in 1987 near Rivera and soon adopted intensive silviculture to produce high quality clearwood logs. The aim was to produce pruned logs of up to 11m length with small end diameter of >40cm. This has been an outstanding success and has led to the investment and building of the Urofor sawmill, the largest eucalypt sawmill in the world.

Figure 66: *E. grandis* a few months after pruning showing rapid occlusion. (Photo P. Volker)

Figure 67: Cofusa *E. grandis* plantation approximately 30 months old showing waste thinning and first lift pruning. (Photo P. Volker)

Figure 68: Cofusa, 19 year old *E. grandis* with final stocking of about 180 stems per hectare. (Photo P. Volker)

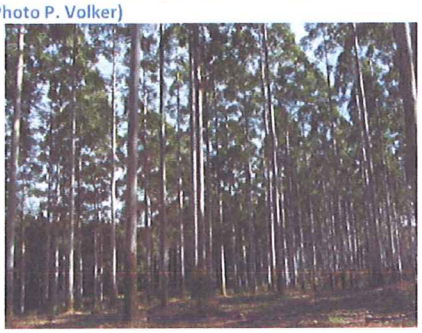


Figure 69: Cofusa, Trinidad block near Rivera, trees ready for clearfell with diameters close to 70cm. (Photo P. Volker)

Cofusa run their own breeding and nursery program. They produce cuttings which are deployed in clonal plantations and also seedlings. The issue with clonal plantations for longer rotations sawlog production is increased risk of catastrophic failure either due to clonal physiology or disease. Broad based genetics in the form of seedlings is preferred for sawlog plantations.

Urofor sawmill, Rivera

- New mill in operation for 6 months with 2 sawing lines.
- Using a lot of low grade wood and forcing drying of eucalypts
- Not orienting logs to optimise recovery from splitting, leading to end splitting in boards
- Observed splitting associated with mechanised harvesting (not growth stress)
- 50:50 mix of pruned and unpruned logs, unpruned timber goes to pallets in green state
- 385,000 m^3 per annum log input on 6 days per week x 2 shifts, can be improved
- Recovery varies from 45 to 50% based on invoiced dimensions with 12% of this as pallet wood, 35% of lumber from unpruned logs can be kiln dried.
- Use of residues for energy generation not as simple as first thought

  - Need to blend chip and sawdust in exact proportions which requires separation and remix.
  - Currently generating 6MW, hope to get to 10.5MW
- 31 kilns with 4,500 m^3 capacity of 25mm boards.
- 25mm boards 18 to 20 days in kiln, 41mm boards, 52 to 53 days in kiln
- 3 grades of wood in sawmill by ranges of width and length (Select , 2 premium grades)
- Using low grade wood for pallet manufacture – this makes operation viable.
- Cutting at 60 to 70m min^{-1} with average of 50
- Average diameter of logs coming into yard: 34cm SED
- Two sawing lines for pruned and unpruned logs
  - Pruned logs are 5m length and unpruned at 4.5m, scanner separates based on length
- 450km road transport distance to Fray Bentos pulp mill. Trains to Montevideo (550km).

Asserrado Ubajay sawmill, Colon, Argentina

This is a simple sawmill sawing and chipping small *E. grandis* from mainly unthinned stands. It cuts about 51,000m^3 per year with 40% green recovery. The productivity is 3m^3 per man per day with labour costs of USD4 per hour. Log cost is at mill gate is $41 per tonne including bark for SED 25 and $48 per tonne for SED >26. Bark is 15% by weight. Green cost of logs = $124 per m^3.

Prices obtained for various grades in USD per m^3 are: Clear 373 and Select 230. Chips are sold for USD28 per tonne at mill with a 35m transport distance costing USD17 per tonne. 10 to 20% of timber output is kiln dried. 36% of volume in mill goes out as chips.

Figure 70: Urofor, log intake deck (Photo T. Jaeger)

Figure 71: Urofor, log intake and flitch transfer decks. (Photo T. Jaeger)

Figure 72: Urofor, controlling log intake deck (Photo T. Jaeger)

Figure 73: Urofor, flitch turning (Photo T. Jaeger)

Figure 74: Urofor, boards on way to sorting machine (Photo T. Jaeger

Figure 75: Flitch on way to band saw (Photo T. Jaeger

Summary of Uruguay forest production in first six months of 2010

Data sourced from Informe sobre exportaciones de productos de Uruguay durante el primer semester de 2010. Rosario Pou & Asciados.

Product	Value ($US)	Export Volume	Value per m3 or tonne
Pulp	451,432,673	595,000t	
Chips and pulp logs	63,857,915	Chips 566,000t	US$93/t FOB
		Logs 123,000t	US$88/t FOB
Sawn timber	18,249,842	Eucalypt 17,000m^3	US$500/$m^3$ FOB
MDF	7,787,826	19,000 m^3	US$396/$m^3$
Plywood	22,154,239	41,000 m^3	US$583/$m^3$ FOB
Treated roundwood	404,383	7000 logs = 1000t	US$126/t
Pine chips	252,814		
Paper and cartons	39,641,684		
Pine logs	391,235		
Eucalypt logs	7,980,343	112,000 t	US$143/t FOB
Total	612,152,954		

These results are equivalent to the total achieved for the whole of 2009.

Spain (43%) is the most important market for pulpwood, reflecting the ownership history of the plantations previously owned by ENCE. Norway (31%) and Portugal (20%) are also significant markets.

The main market for pulp logs is Portugal (56%), Morocco (24%) and Spain (20%).

75% of eucalypt logs are exported to Vietnam mainly for the furniture industry; China takes 15% and India 6%.

Pine sawn timber is predominantly exported to USA (35%) and China (18%) and there are 19 other countries receiving this product from Uruguay.

Eucalypt sawn timber is exported to 24 countries with the main destinations being Belgium, China, Korea, USA and Indonesia.

MDF is exported to South and Central American countries.

Plywood is exported to Mexico (41%), UK (17%) and USA (9%) with Argentina and Chile also significant importers.

Treated roundwood is exported to Africa with Angola (62%) and Kenya (33%) the main markets.