

Annex B: Plantations

3.1 Introduction

There are approximately 670,000 hectares of plantations of exotic species in Uruguay, including about 70% eucalyptus and 28% pine. These plantations are most heavily concentrated in the Central North part of the country (the Departments of Rivera and Tacuarembó), the “Litoral” region in the West of the country along the Rio Uruguay (Departments of Paysandú and Rio Negro), and in the south-central and southeast parts of the country (Durazno, Florida, Lavellaja and Cerro Largo). In addition, there are about 100,000 hectares of plantations across the Rio Uruguay in Argentina’s Entre Rios and southwest Corrientes Provinces that could supply wood to the pulp mill projects. Most of the plantations have been established on flat to gently rolling grasslands, whose primary use to date has been for cattle grazing. For the most part, forest plantations are restricted to soils that are not suitable for agriculture, and plantations must not be established in areas of natural forest.

3.2 Plantation Forests in Uruguay and Argentina

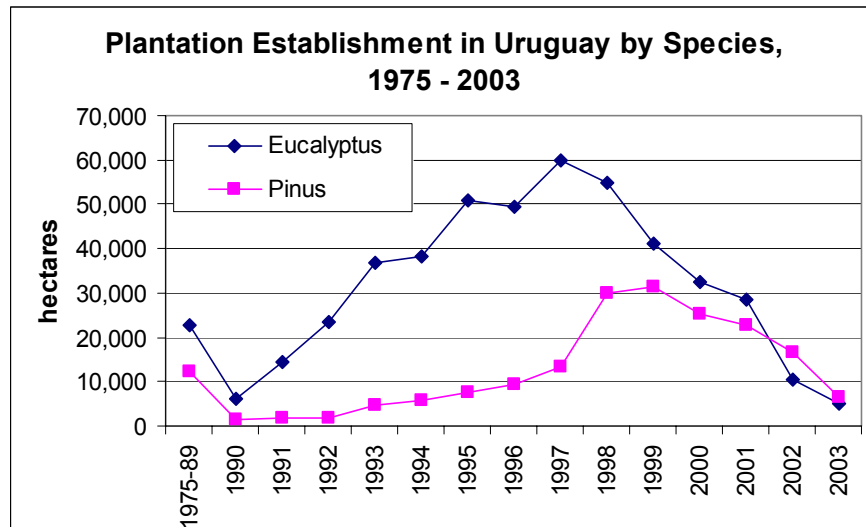
In Uruguay, the Forestry Act of 1988 (under the administration of the Ministerio de Ganaderia Agricultura y Pesca, and executed by the Dirección Forestal) encouraged forestry plantations by providing tax benefits and a financial subsidy covering a portion of the plantation establishment costs.¹ This program has been extremely successful in attracting new plantation establishment in Uruguay, including investments by overseas companies from Spain, Finland, Canada, and the USA. According to the Dirección Forestal, a total of about 400,000 hectares of eucalyptus and 130,000 hectares of pine were established between 1990 and 2000. The incentive program is still in place, but the financial subsidies are being phased out (since January 2004) and the subsidies will end by 2007.

Establishment of eucalyptus plantations peaked in Uruguay in 1997 at close to 60,000 hectares, and has since fallen to an annual rate of less than 10,000 hectares per year for the past several years. Pine plantation establishment has also fallen to a relatively low rate. This decline has been blamed on several factors, including higher prices for land, the economic “crisis” in Uruguay and Argentina, and declining prices for wood and wood products. Even with the lower rate of new plantation establishment, however, it is clear that a significant mass of forest plantations has been established through this program, and the country is only now beginning to develop the industry to process this wood. The two proposed pulp mills can be seen as the logical extension of a program begun

¹ In Forest Management Certification Report, SGS Qualifor (July 31, 2003) p.40, http://64.233.187.104/search?q=cache:AkEBk0Bd0bsJ:www.qualifor.sgs.com/8365-uy-fm-eufores_ma2004.10_ad65-01_final-psummary_2_.pdf+%22Forest+Management+Certification+Report%22+Uruguay+SGS+Qualifor+&hl=en it is stated that : “The parliamentary discussion during the process of approval of the law Forestry Act of 1988 shows that the aim of the legislators was to use the lands that were degraded by bad agricultural practices. This is encapsulated in Title 1 Article 5 of the Forestry Law 15.939. The decree 452/988 and the decree 296/994 prescribes the areas and soil groups where forestry plantations should be established (Art.2nd).”

in the late 1980s with the intention of attracting industrial development to Uruguay. The first phase, developing the plantations, has been largely completed, and the second phase, industrial development based on wood processing, is only now beginning.

Figure C3-1: Plantation Establishment in Uruguay



Source: Dirección Forestal

3.2.1 Forest plantations in Western Uruguay

The Dirección Forestal reports that as of the end of 2003 a total of 174,000 hectares of eucalyptus² had been established in the Litoral region³ of Western Uruguay. A private survey using the most recent satellite imagery and survey of Departmental ownership records in 2004 and 2005 identified a total of only 140,000 hectares of commercial plantations. The difference between the two sources is primarily due to lack of updating after harvest, and a much less rigorous definition of “net planted, commercially viable hectares”, by the Dirección Forestal. We believe the smaller figure is more accurate, because it has been based on intensive ground checking to confirm areas actually planted. Our understanding is that the two pulp companies are using this lower figure in planning their wood supply for the mill.

In total, approximately 210,000 hectares of eucalyptus plantations will be needed to support the two pulp mills, depending on the growth rate achieved in the plantations. The procedure for calculation of the plantation area needed is as follows:

- If we assume that the ORION plant will require 3.5 million m³ of eucalyptus pulpwood per year, and the CMB mill will need approximately 1.7 million m³, a

² Boletín Estadístico, Año 4-N°3, Diciembre 2004, Dirección General Forestal (December 2004).

<http://www.mgap.gub.uy/Forestal/Boletin%20estad%C3%ADstico2004.pdf>

³ The term “Litoral” region refers here to the Departments of Paysandu, Rio Negro, and Soriano. In addition, a very small area of plantations in Salto and Colonia is included.

total of 5.2 million m³ of eucalyptus pulpwood will be required per year to support the pulp mills.⁴

- If we assume an average growth rate of 25 m³/ha/year, and an 8 year growing cycle, then each hectare will yield 8 x 25 = 200 m³ at harvest.⁵
- To produce 5.2 million m³, a total of 5.2 million m³ divided by 200 m³/ha = 26,000 hectares per year must be harvested. Again assuming an 8-year cycle, this means a total of 8 x 26,000 or 208,000 hectares of eucalyptus plantations will be needed to support the two mills.

There are a total of 17.3 million hectares of land in Uruguay, of which 3.57 million hectares have been categorized as “Forest Priority Soils” by the Dirección Forestal. It is important to note that in order to qualify for the plantation subsidy and the tax benefits, only lands which have been categorized as “Forest Priority Soils” can be planted. In addition, all planting plans must be approved by the Dirección Forestal.

Table C3-1: Uruguay Land Area and Forest Plantations, as of Dec 31, 2004

Region	Total Region Area (ha)	Forest Priority Soils (ha)	(Eucalyptus + Pinus)	Not Planted Forest Priority Soils (ha)	Remaining Forest Priority Soils (%)
Center- East	3,433,000	1,073,889	54,600	1,019,289	95%
North	2,532,000	764,274	217,889	546,385	71%
South- East	5,052,000	888,816	142,328	746,488	84%
West	6,326,000	847,588	171,880	675,708	80%
Total	17,343,000	3,574,567	593,750	2,980,817	83%

As calculated above, a total of about 208,000 hectares will be needed to fully supply the mills with wood. There are already a total of nearly 172,000 hectares of plantations (including eucalyptus and pine) established in the Litoral region as of the end of 2004, equal to approximately 2.7% of the total land area. Because both pulp companies want to own a larger area of plantations (to ensure both consistency of supply and to achieve their goals regarding certified land management⁶), they currently plan to plant an additional area up to a maximum of perhaps 65,000 hectares, between both companies.

This implies that the total planted area in the Litoral will expand to close to 237,000 hectares, a 37.8% increase. With this additional planting, a total of 3.7% of the land area in that region will be in eucalyptus and pine plantations. Thus the expansion in existing plantations which can be attribute to the pulp mills will be equivalent to an increase from 2.7% to 3.7% of the total land area in the region, or an additional 1% of the land area in the Litoral will be converted to plantations to support the pulp mills, if the companies follow through on their

⁴ The precise volume to be used will depend in part on the actual species mix utilized. For example, if CMB utilizes a higher percentage of *E. globulus* than currently planned, then their total wood consumption will be lower than cited here.

⁵ Actual growth rates will vary by species and ownership. Forestal Oriental claims a higher growth rate than this on their *E. grandis* and *E. dunnii* plantations, while EUFORES claims a slightly lower rate for their *E. globulus* plantations. The rotation age assumed in this calculation does not matter, as in this example we assume a fixed growth rate.

⁶ See section 3.4.1 on FSC certification.

plans. In total, the plantation area needed only to support the mills, given the assumptions described above, will be equal to 3.3% of the total land area in the Litoral, or about 25% of the total forest priority soils.

Table C3-2: Plantation Impact in the Litoral Region of Uruguay

Total Land Area – Litoral region	6,326,000 hectares
Total Forest Priority Soils	847,588 hectares
Total Current Planted Area, all species	171,880 hectares
% of Land Area Planted	2.7%
Additional Eucalyptus Plantings Expected	65,000 hectares
Total Potential Planted Area	236,880 hectares
% of Total Area to be Planted	3.7%
Planted Area Needed for Mills	208,000 hectares
% of Area Needed to Support mills	3.3%
% Increase in Expected Planted Area	37.8%

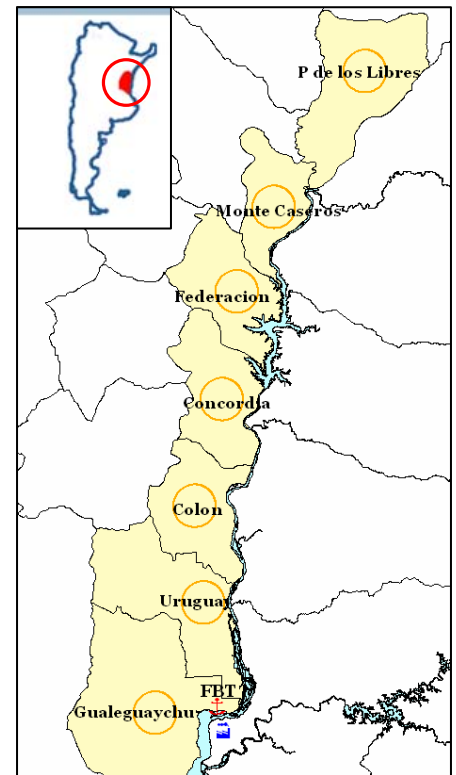
Even with the expansion described, there will still be 600,000 hectares of Forest Priority Soils available in the Litoral. Is it possible that the pulp mill companies will want to expand their plantation base beyond the area described above? At this point, there seems no reason to expect further development, for several reasons. First, not all “Forest Priority Soils” are necessarily good sites for growing trees. Some sites are naturally more fertile than others, and landowners looking for a good return will favor those sites. Second, not all sites are suitable for eucalyptus in particular, at least the species being planted for the pulp mills. Frost, poor drainage, and other factors make many sites on Forest Priority Soils unsuitable for eucalyptus. In addition, the pulp companies would be unlikely to want to expand their plantation base for economic reasons --- typically pulp mills seek to produce the wood they need on the smallest area possible, to reduce their costs. The exception to this would be if an expansion of the pulp mills takes place, but we are aware of no plans for this and assume any such expansion would have to go through a permitting process.

In summary, while it is certainly possible that forest plantations in the Litoral may expand beyond the areas anticipated in the above discussion, there is no reason to assume that such expansion would be the result of the development of these pulp mills. It is theoretically possible that other wood products industries (sawmills, furniture manufacturers, panel producers) may wish to develop operations in the future, but there is no program to promote this nor are there any known plans for such operations.

3.2.2 Argentina

There are an estimated 95,000–100,000 hectares of eucalyptus plantations in eastern Entre Rios and Southern Corrientes Provinces. See details and map below.

Province	Department	Planted Area (ha)
Corrientes	Monte Caseros	10,782
	Paso de los Libres	18,842
Total Corrientes		29,624
Entre Rios	Colon	21,638
	Concordia	30,895
	Federacion	10,277
	Gualeguaychu	1,120
	Uruguay	1,627
	(N/A)	49
Total Entre Rios		65,606
Total Area		95,230



In 2001, SAGPyA (Secretaría de Agricultura, Pesca y Alimentación, the agency responsible for forest administration in Argentina) estimated for this region an annual eucalyptus log availability of 2.0 million m³ in 2005, increasing to more than 5.3 million m³ by 2020.⁷ For the period 2007 to 2020, the average annual availability of eucalyptus pulplogs in this region is forecast to be 2.1 million m³. From discussions with the companies, it is possible that as much as 400,000—450,000 m³ of *E. grandis* pulplogs might be imported by ORION and/or CMB for their Uruguay mills. It is felt that this is a small enough percentage of the total available supply that it would have only a minimal price impact in Argentina. Actual imports will depend on the relative economics of this wood versus pulpwood in Uruguay. At the present time, Argentina levies a 10% export duty on pulpwood exports, and companies are ineligible for the 18% VAT rebate. Whether this wood from Argentina could arrive to the pulp mills in Uruguay at a competitive price remains to be seen.

Demand for eucalyptus pulpwood in Argentina today is quite small. Celulosa Argentina has two small pulp mills in Buenos Aires and Santa Fe provinces, which require less than 600,000 m³ of eucalyptus pulpwood per year. Both Masisa and Sadepan have particleboard plants in Entre Rios which consume eucalyptus fiber, but these mills rely primarily on residual chips from sawmills, not

⁷ Ré, Alberto; Gustavo Cetrangolo; y Jorge Glade PROYECCIÓN de la OFERTA y DEMANDA de MADERA ROLLIZA en el NORDESTE de ENTRE RÍOS y SUDESTE de CORRIENTES, 2001 a 2020 (Buenos Aires SAGPyA, April 2001).

on pulpwood. We are not aware of any other new projects being developed in Argentina, and understand from foresters there that there is a large surplus of small eucalyptus which currently has no market.

Historically, the eucalyptus plantations in Argentina supported a vigorous export trade. Eucalyptus pulplog exports from Argentina peaked at more than 1.4 million m³ in 1989. Exports were more than 1.0 million m³ in 1995, but declined to less than 300,000 m³ in 2000, and to only 35-40,000 m³ per year for the last 3-4 years.

Because of the surplus of eucalyptus pulpwood in Argentina, and the fact that only a relatively small volume is likely to be utilized by the pulp mills in Uruguay, there appears to be no reason to assume that any further conversion of grassland or agricultural land to forest plantation will take place. Argentina has had its own program of fiscal incentives⁸ to encourage establishment of new plantations, so new planting in recent years (relatively modest) can likely be attributed to that program, and not the vague possibility of selling some wood to the Uruguay pulp mills in the future.

3.2.3 Impact on land-use on a Regional Basis

The discussion above assumes that the vast majority of the pulpwood needed for the pulp mills will be produced in the Litoral region or other Departments close by. This is for the obvious economic reason that the longer the distance that wood is transported to the mills, the higher the cost. Thus, it is highly unlikely that any land outside of the Litoral will be converted from agriculture or grassland to eucalyptus plantations to produce wood for the mill. Any new plantations to support the mills will be located within 150 km of the mills.

However, there are two regions outside of the Litoral where it is possible that wood could be sourced for the pulp mills, but in both cases this should involve only the exploitation of existing forest plantations, rather than inducing any new planting of eucalyptus on grassland sites. For example, it is expected that thinnings and residual wood fiber from the Central North region of Uruguay (Rivera and Tacuarembó) will flow to the pulp mills, possibly by train. This wood will be from forest plantations being managed to produce solidwood products, and which will be processed in the new sawmills and plywood mills being built (and to be built) in this part of Uruguay. This will also include some species, such as *E. maidenii* and *E. grandis*, that might not be favored in the export markets out of Montevideo. The flow of wood to the pulp mills from this Central North region should not be expected to induce any further planting of grassland to eucalyptus, but will simply take advantage of wood already there.

⁸ Argentina has had in place a system of incentives to encourage establishment of new forest plantations for more than 10 years. This includes afforestation with exotic pine and eucalyptus species. The incentives are primarily subsidies (from SAGPyA) that return a percentage of the planting costs to the landowner after successful establishment of the plantations.

Similarly, for existing plantations in the south-central and south-eastern regions of Uruguay (Durazno, Cerro Largo, and Florida), it is possible that some of this wood could flow to the pulp mills rather than to Montevideo for export. This would depend on the relative economics of each market, the transportation options, species and costs involved. Again, it is difficult to imagine that any landowner in these Departments would establish *new* plantations simply with the intention of supplying pulp mills in Western Uruguay, mills whose owners are already planting large areas near the mills to supply their own wood.

Thus, the pulp mills are not expected to have any impact on land use changes in the Center or North regions of Uruguay.

3.2.4 Perspective on Land-use Changes

Other Land Use Changes in Western Uruguay. It is important to keep in perspective the magnitude of the land-use changes caused by the pulp mill projects, in encouraging further conversion of grassland to plantation. As discussed, there are a total of no more than 172,000 hectares of pine and eucalyptus plantations in the Litoral region, and the pulp mill projects can realistically be credited with attracting no more than an additional 65,000 hectares of eucalyptus plantations, for a total potential planted area of 237,000 hectares. These plantations will have been established primarily over the period 1992 - 2010.

For comparison, between the 2000/2001 growing season and the 2004/2005 season, a total of 372,000 hectares of soya were established in Western Uruguay, on lands which had been used previously for other crops or cattle grazing. More importantly, according to a recent report⁹, most (or perhaps all) of these new soya plantations consisted of plant material which has been genetically modified to be resistant to the herbicide glyphosate. Thus, not only was this land-use change to soya greater in magnitude, and much faster than, the land-use change to eucalyptus plantations, the soya plantations used genetically modified organisms, while the eucalyptus plantations do not. In addition, the soya plantations involve continuous cropping, and heavy use of agrochemicals, as well as the expansion of export facilities to accommodate the increase in export volumes. The amount of erosion measured in soya cropping is reportedly much greater than for maize, wheat, or grazing.

3.3 Employment in plantation operations

Plantation development in Uruguay has been found to have created more jobs than were previously available locally¹⁰ through cattle raising. Plantations are

⁹ Ismael Turban, "Impacto de la soja en Uruguay y su sistema productivo" Nuestro Agro, <http://www.nuestroagro.com.ar/noticia.asp?id=434&Fuente=2>

¹⁰ Geary, Thomas F., "Afforestation in Uruguay: Study of a Changing Landscape," *Journal of Forestry* 99, no.7 (July 1, 2001): 35-39; Carrere, R. & L. Lohmann, *Pulping the South: Industrial Tree Plantations and the World Paper Economy* (London: World Rainforest Movement, 1996).

recognized as crating more jobs—from field labour to management levels—as well as fostering the development of private contractors to provide support services. SGS, in its certification of the plantations of Forestal Oriental for FSC states that the following employment multipliers should apply to Uruguay:

Cattle grazing = 0.0047 jobs per hectare
Forestry = 0.0125 jobs per hectare for permanent employees only,
and 0.0255 jobs per hectare if seasonal employment is also considered.

Assuming these figures are correct, for the 208,000 hectares of plantations supporting the pulp mills, the number of permanent forestry jobs created would be 2600, with an additional 2700 seasonal jobs. By comparison, the same area of land if used for cattle grazing would only be expected to produce 978 jobs.

3.4 Impact of Plantations on the Environment

Both CMB and Orion are committed to ensuring that their plantations are sustainably managed and do not have detrimental environmental and social impacts. Both companies are addressing this through achieving independent certification of their sustainable forest management practices.

3.4.1 Certification of Plantations

Both companies are having their plantation operations certified to an international standard developed by the Forest Stewardship Council (FSC). This is a well-known standard which is widely supported by environmental NGOs¹¹. The standard addresses a wide range of environmental, social and economic criteria. FSC applies its standard through a network of certifying bodies, which are independent third-party organizations (usually consulting firms) which perform audits against the standard and issue certificates of compliance. Both CMB and Orion contract SGS (Societe Generale de Surveillance) Qualifor to provide audit services.

The World Bank through its Forests Policy (O.P. 4.36) requires that commercial harvesting of all forests (both natural and plantation) obtain independent certification of sustainable forest management. This policy provides guidance on the content and implementation of acceptable certification systems. IFC has examined the FSC standard which is being applied by SGS in Uruguay, and has found that it is generally consistent with the World Bank policy.

For both pulp mill projects, the use of wood certified to FSC standards is important to ensure that the plantations do not have a negative environmental or social impact on the country. In ORION's case, both its subsidiary Forestal Oriental and its partner in Tile Forestal (the Otegui Group, whose forest operation is called COFUSA) had their plantations certified by SGS to FSC criteria in 2000. These were the first two companies in Uruguay to achieve this certification for their plantations. Currently both companies are in the process of re-certifying

¹¹ For example, WWF strongly endorses FSC certification.

these plantations.¹² According to the file submitted to the IFC¹³, these two operations will supply an estimated 72.9% of ORION's wood needs during 2007-14. In addition, a number of third party suppliers to ORION (including Caja Bancaria, Caja Notarial, Uruwood, etc.) are reportedly in the process of becoming certified to FSC criteria, so that the company plans to have a total of 85.2% of their wood consumption sources from FSC certified forests. In CMB's case, its subsidiary EUFORES had its operations certified in 2003, and these forests will supply an estimated 57% of the mill's wood needs in 2008-2015. In addition, several third party suppliers are either certified or in the process of becoming FSC certified, so that the company projects that 88% of its total wood needs will come from FSC certified forests.¹⁴

It should also be noted that there is increasing market pressure being brought to bear on international pulp producers to demonstrate that their product comes from sustainably managed forests. In order for these companies to compete in the European market place, which is increasingly demanding a "green label" for forest products, they need to ensure that their product is certified, and that this certification is maintained.

Some NGOs have expressed concern that either Botnia or ENCE might introduce genetically modified organisms into Uruguay, through their plantations of eucalyptus. We note that neither company currently uses GMOs, and neither has announced plans for their use. More importantly, FSC criteria specifically prohibits the use of GMOs, so neither company would be able to use GMOs and maintain their FSC certification.

Regarding the complaint that the pulp mill projects are introducing "non-indigenous" tree species, it is true that the eucalyptus species being used to produce pulp are not native to Uruguay. However, as described earlier, there are at least 400,000 hectares of eucalyptus already planted in Uruguay, including all of the species to be used at the pulp mills. Thus, the pulp mill projects are not introducing those species, they are already present in Uruguay. Furthermore, these species are being planted on grassland ecosystems, where they may be replacing non-indigenous grass species, not native ecosystems, and are not displacing natural forest.

3.4.2 Additional Analysis of Environmental Impacts

In addition to stressing their FSC certification, the Addendum to CMB's EIA contains a section (5.3) which specifically addresses potential or real impacts of the plantations and associated harvesting activities. Section 5.3.1. reviews 13

¹² Certification is granted for a period of 5 years, so both companies are working to re-certify as of September 2005. In addition, Forestal Oriental has expanded its ownership, and wants to certify its newer lands as well.

¹³"Plantations area and wood supply, "

[http://www.ifc.org/ifcext/spiwebsite1.nsf/2bc34f011b50ff6e85256a550073ff1c/ead20d36b50195a5852570ba005a25dc/\\$FILE/Orion%20forestry%20info%20for%20disclosure.pdf](http://www.ifc.org/ifcext/spiwebsite1.nsf/2bc34f011b50ff6e85256a550073ff1c/ead20d36b50195a5852570ba005a25dc/$FILE/Orion%20forestry%20info%20for%20disclosure.pdf)

¹⁴ Addendum, p. 68.

potential environmental impacts of the plantations, including a table on page 82 which summarizes the significance of potential impacts. Also, the CMB EIA Addendum reviews 16 potential environmental impacts associated with harvesting activities, and summarizes the expected impacts from these in a table on pages 85-86. In combination with their FSC certification, it is difficult to see how CMB could have done any more to address the environmental impact of their plantations. The significance of various potential impacts are mostly described as “low” in their review, although a few are described as “medium.” Those impacts rated as medium include possible increase in soil erosion, increased sequestration of carbon dioxide, and possible impacts on some wildlife.

3.4.3 Impacts in General

In addition to the certification process, there have been other independent reviews of the impact of plantations in Uruguay. Geary (2001) points out that any impact on biodiversity of the eucalyptus plantations is hard to identify, as the grasslands in that country have been modified by human actions for hundreds of years. Cattle grazing in Uruguay is, of course, not part of the natural ecosystem:

“Because of the small percentage of the land area in Uruguay to be converted to forest plantations, a significant impact on biodiversity might seem unlikely. Moreover, the effect on natural biodiversity could be hard to interpret as biodiversity has been modified by centuries of pastoral and agricultural uses. Exotic grasses and other exotic pastoral plants are often the common vegetation. Erosion probably has irreversibly changed the ecosystem.”¹⁵

Geary stopped short of claiming any actual environmental damage related to the plantations, although he does discuss a number of possible impacts and expresses the need for more research and monitoring of potential impacts. In a longer version of his report, he did list three areas where, in his opinion, “immediate action” was needed:

- “Stop using dodecachloro pesticides.
- Undertake a comprehensive review of pesticides now used and of potential use for afforestation in Uruguay.
- Evaluate the threat of plantation fires and develop best management practices to protect the plantations and surrounding properties.”¹⁶

His primary concern appears to be the use of pesticides such as Mirex and Mirenex (both dodecachloro pesticides) to control leaf-cutter ants in the eucalyptus plantations. He states that the pesticide Blitz is much less toxic, and is preferred. The SGS document on certification for EUFORES plantations

¹⁵ Geary, Thomas F. “Afforestation in Uruguay: Study of a Changing Landscape,” *Journal of Forestry* 99, no.7 (July 1, 2001): 35-39

¹⁶ www.guayubira.ort.uy/plantaciones/impacto.html

states that the company does not use Mirex or Mirenex, and in fact was shifting to use of Arbosan which is even safer than Blitz.

Regarding other pesticides and herbicides, SGS mentions that both companies are taking steps to reduce chemical usage, and such steps are likely required to maintain FSC certification. This is an on-going effort at both companies, and the SGS documents contain mention of several programs (such as biological control of weeds through use of sheep, etc.) being used by FOSA and EUFORES.

Finally, regarding Geary's comment on the need to develop better management practices regarding forest fires, this was certainly a valid comment in 1999-2001, and in fact all the major Uruguayan companies have done this. We are aware that Weyerhaeuser (Colonvade in Uruguay) hired a US consultant to help them and other Uruguayan companies develop such a program, and both FOSA and EUFORES have made significant improvements in fire control since 2001. Most plantation operators maintain fire breaks as pasture, and these are used for cattle grazing where possible.

3.4.4 Eucalyptus Plantations and Water Management

It has been alleged that having 3% of the land area in the Litoral region planted to eucalyptus will lead to problems with reduced stream flow and lowered water tables. Geary (2001) mentions this concern in his article, and this potential problem has been discussed in many countries.¹⁷ It is commonly acknowledged that streamflow in forest plantations is lower than in grassland ecosystems on the same soil type. Regarding the situation in Uruguay, Dr. Daniel Martino states that:

“Forest plantations typically cause a reduction in surface runoff with respect to the grassland they replace. This is due to a combination of several factors, namely water interception by tree leaves, reduction of rainfall kinetic energy by tree biomass, and increased evapotranspiration (i.e., infiltration rate is higher due to reduced soil moisture content). This may cause some reduction in the flow of water streams, particularly at the small watershed scale, where there is a high concentration of planted areas.”¹⁸

Both the ORION and EUFORES plantations have been certified to criteria established by FSC. The auditing report for both companies was done by SGS, an independent and well-recognized third party. In the most recent document available on certification in Uruguay (the report to FSC on EUFORES plantations, dated July 31, 2003), SGS states:

“...the main environmental effect of Eucalyptus is known to be its heavy use of groundwater. Since water is not currently a limiting factor in Uruguay, this is apparently not of immediate concern. However, the

¹⁷ Geary, Thomas F. “Afforestation in Uruguay: Study of a Changing Landscape,” *Journal of Forestry* 99, no.7 (July 1, 2001): 35-39

¹⁸ Dr. Daniel Martino, Aug. 17, 2005, personal communication

international experience is such that pro-active research and management of its potential impacts need to be investigated.”¹⁹

To address possible impacts on stream flow, Forestal Oriental commissioned a study by a South African consulting firm in 2000. This study, conducted by Dr. David Scott of CSIR Division of Water in South Africa, found that on the eucalyptus plantations of FOSA in Uruguay, stream flows in the plantations were reduced by an average of around 25%. Their study did not address water table levels.²⁰

The fact that fast growing tree species should reduce stream flows compared to grassland ecosystems on the same soil type is not surprising. The question is whether or not this reduction causes any significant problems. Dr. Martino points out that the litter in a eucalyptus plantations has “a degree of hydrophobicity”, which may somewhat increase water run-off, and thus would “attenuate the effects of the other variables that reduce runoff.”²¹ Dr. Martino also points out that one reason to expect a reduced impact on stream flows from the plantations is the “presence of an illuvial high-clay Bt horizon in most Uruguayan soils.” This layer limits root penetration by the eucalyptus, and “Virtually 99% of the roots are concentrated within the top 1 m of soil. This restricts the volume of soil from which roots can extract water.” This means that the plantations should have relatively little impact on the water table.

Furthermore, Dr. Martino points out that:

“Most forests in Uruguay are planted in relatively small patches (due to topography, soil types and fire prevention regulations), and riparian areas are normally left unplanted. Effectively planted area seldom reaches 70% of total estate area. At the watershed level, planted areas usually do not reach 50% of the area. Due to this, any effects of plantations are normally diluted.”

This was also the conclusion reached by the study commissioned by FOSA: As long as the plantations do not cover too large an area within a given watershed, the impact on stream flow is not expected to be a problem. Whether the government of Uruguay should make a policy decision on limiting the percentage of a Department or watershed which can be planted is a decision that needs to be made based on the results of some comprehensive studies. Dr. Martino states that “There are two long-term paired watershed studies established in the country, but they still are not able to provide enough information to take conclusions.” Weyerhaeuser also states that on their Uruguay plantations, they

¹⁹ Forest Management Certification Report, SGS Qualifor (July 31, 2003) p.29, http://64.233.187.104/search?q=cache:AkEBk0Bd0bsJ:www.qualifor.sgs.com/8365-uy-fm-eufores_ma2004.10_ad65-01_final-psummary_2_.pdf+%22Forest+Management+Certification+Report%22+Uruguay+SGS+Qualifor+&hl=en

²⁰ Dr. David Scott, “Hydrological Effects of Afforestation and Forest Management by Forestal Oriental S.A., Uruguay”, unpublished study, September 2000.

²¹ Dr. Daniel Martino, Aug. 17, 2005, personal communication

have commissioned a joint study by a Uruguayan group and North Carolina State University to monitor the impact of plantations on the water table.

In recent discussions, Forestal Oriental has stated that they are in the process of commissioning an update of their 2000 study, and are interested in finding a Uruguayan partner to participate in a monitoring study of stream flow and water table levels.²² The SGS report for FSC on forest management does suggest that EUFORES initiate a study on the impact of eucalyptus plantations on the hydrologic cycle in Uruguay. As this issue of the *potential* impact on water supplies by eucalyptus keeps resurfacing, perhaps this is an area where the two companies could logically combine their efforts, to support an independent long-term monitoring program on the impact of the plantations on stream flows and water table levels.

In regard to water quality, both ORION and CMB point out that they use less fertilizer than other land uses in Western Uruguay, and because they only disturb the site once every 8 to 10 years, as opposed to annual cropping, they believe that problems with soil erosion are diminished in the plantations.

3.4.5 Protected Areas

In order to qualify for the tax reductions and other benefits of the plantation incentive program, companies must have their plantation management plans approved by the Dirección Forestal. Because most companies will not want to forego these tax benefits, it is very unlikely that any company would establish eucalyptus plantations on non-Forest Priority Soils. The Dirección Forestal has not designated any protected areas as having Forest Priority Soils, so it is very unlikely that any company would *want* to establish plantations in these areas. Without the tax advantage, financial returns from these plantations would be considerably reduced. Furthermore, harvesting is of course not permitted in protected areas, and it is inconceivable that any commercial entity would invest money in plantations in an area where they will not be permitted to harvest.

3.4.6 Other Comments on Environmental Impacts of Eucalyptus Plantations

In the popular press and from some environmental groups, criticism has been aimed at eucalyptus plantations in a number of countries. Arguments generally claim that eucalyptus changes the climate by reducing rainfall, degrades the soil, drains the soil of moisture, and reduces biodiversity. An excellent summary of these arguments, and a detailed description of scientific studies refuting them, have been provided by Couto and Betters²³.

In general, it appears that while there may have been problems in some countries with eucalyptus where moisture is severely limited, or where diverse

²² Eric Droomer, Forestal Oriental General Manager, August 18, 2005, personal communication.

²³ Couto, Laerico and David R. Betters, "Short-Rotation Eucalypt Plantations In Brazil: Social And Environmental Issues," Oak Ridge National Laboratory (February 1995), <http://bioenergy.ornl.gov/reports/euc-braz/toc.html>

native forests were replaced with eucalyptus plantations, these arguments have little bearing in Uruguay. All of the plantations in Uruguay were established on lands used previously for long periods as grazing lands. Moisture is not limiting in the areas planted with eucalyptus, and if anything these new forests increase the existing biodiversity by providing some new types of habitat. There are groups who continue to oppose any development of single species tree plantation, but we know of no credible opposition to eucalyptus plantations in Uruguay based on environmental problems.

The Couto and Betters (1995) study goes through all of the common arguments against eucalyptus plantations, and then cites numerous scientific studies that have been done to assess the actual impacts of these plantations in Brazil. While some issues are problems in particular areas, especially where diverse native forests were cleared to establish eucalyptus plantations, almost all of the studies refute the arguments against eucalyptus plantations. In particular, where eucalyptus plantations were compared with adjacent savannah ecosystems, there appears to be little problem with the plantations, especially in regard to their establishment in Uruguay. To quote from a summary of the Couto and Betters (1995) study

“...the existing scientific work indicates that:

1. no evidence of any change in the precipitation regime in a region as a result of the establishment of eucalypts or any other tree plantations;
2. the losses of water through evaporation of the intercepted water from rainfall by the canopy is smaller for eucalypt plantations than for other tree plantations or native forest;
3. the eucalypt plantation can contribute positively to control loss of the soil and nutrients by erosion;
4. water quality is not affected by eucalypt plantations;
5. the water balance of a eucalypt plantation does not differ from other tree plantations or native forest;
6. the main species that have been used in most of the short-rotation plantations have good control of stomatic transpiration;
7. the eucalypts are more efficient in the use of water than other tree species;
8. the effects of the eucalypts, other tree plantations, and native forests on the watersheds are the same;
9. the demand for nutrients by eucalypt is high but is comparable with that by other tree species and is much lower than that by agricultural crops;
10. there is no detrimental effect of the eucalypt plantations on the native vegetation; and
11. eucalypt plantations, as any other tree plantations, are not devoid of wildlife, and habitat can be improved by adequate management.”²⁴

²⁴ Lima, W.P. 1993. Impacto Ambiental do Eucalipto. Editora da Universidade de Sao Paulo, Sao Paulo, Brazil. 2nd ed.

