



Forestry Department

Food and Agriculture Organization of the United Nations

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OVERVIEW OF FOREST PESTS

URUGUAY

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**Forest Resources Development Service
Forest Management Division
Forestry Department**

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DISCLAIMER

The aim of this document is to give an overview of the forest pest¹ situation in Uruguay. It is not intended to be a comprehensive review.

The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

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¹ Pest: Any species, strain or biotype of plant, animal or pathogenic agent injurious to plants or plant products (FAO, 2004).

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Background

This paper is one of a series of FAO documents on forest-related health and biosecurity issues. The purpose of these papers is to provide early information on on-going activities and programmes, and to stimulate discussion.

In an attempt to quantify the impacts of the many factors that affect the health and vitality of a forest, the Global Forest Resources Assessment 2005 (FRA 2005) asked countries to report on the area of forest affected by disturbances, including forest fires, insects, diseases and other disturbances such as weather-related damage. However, most countries were not able to provide reliable information because they do not systematically monitor these variables.

In order to obtain a more complete picture of forest health, FAO continues to work on several follow-up studies. A review of forest pests in both naturally regenerating forests and planted forests was carried out in 25 countries representing all regions of the world. This *Overview of forest pests* represents one paper resulting from this review. Countries in this present series include Argentina, Belize, Brazil, Chile, China, Cyprus, Colombia, Ghana, Honduras, India, Indonesia, Kenya, Kyrgyz Republic, Malawi, Mauritius, Mexico, Moldova, Mongolia, Morocco, South Africa, Sudan, Thailand, Romania, Russian Federation, Uruguay; this list will be continuously updated.

Comments and feedback are welcome. For further information or if you are interested in participating in this process and providing information on insect pests, diseases and mammals affecting forests and the forest sector in your country, please contact:

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Information for Uruguay was compiled by B. Moore.

URUGUAY

Introduction

Uruguay's forest cover in 2005 was estimated at 1.5 million hectares, or 8.6 percent of the total land area (FAO, 2006). Other wooded lands cover 4 000 ha. Over 97 percent of Uruguay's forests are under private ownership.

Planted forests cover 766 000 ha representing 50.9 percent of total forest cover (FAO, 2006). In recent years the area of forest plantations has significantly increased, thanks to incentive policies. As a result, the forest cover increased 1.3 percent between 2000 and 2005. Uruguay has the highest afforestation rate in Latin America.

Forest pests

Naturally regenerating forests

Insects

Indigenous insects

***Megaplatypus mutatus* (Chapuis, 1865)**

Other scientific names: *Platypus mutates*; *Platypus plicatus*; *Platypus sulcatus*

Coleoptera: Platypodidae

Common names: bark beetle; ambrosia beetle

Host type: broadleaf

Hosts: *Pyrus communis*

Found only in Argentina, Brazil and Uruguay, *Megaplatypus mutatus* is a significant pest of numerous tree species. In Uruguay, it infests *Pyrus communis* (Giménez & Etiennot, 2003). Hosts in Argentina include *Acer negundo*, *Erythrina crista-galli*, *Eucalyptus dunnii*, *Fraxinus excelsior*, *Grevillea robusta*, *Quercus palustris*, *Quercus rubra*, *Ligustrum lucidum*, *Liquidambar styraciflua*, *Melia azedarach*, *Populus alba*, *Salix alba* and *Salix nigra* (Giménez & Etiennot, 2003). The hosts in Brazil include *Calophyllum brasiliense*, *Erythrina crista-galli*, *Eucalyptus europphylla*, *Eucalyptus robusta*, *Luehea divaricata*, *Malus sylvestris*, *Pyrus communis*, *Sebastiania commersoniana* and *Vitex megapotamica* (Giménez & Etiennot, 2003).

Damage is caused by the adults, which bore extensive gallery systems into living trees. The galleries not only degrade the quality of wood but cause structural weakness and windthrow following severe storms (Alfaro, 2003).

<http://www.fao.org/forestry/foris/webview/common/media.jsp?mediaId=7544&langId=1>

http://www.eppo.org/QUARANTINE/Alert_List/insects/PLTPMU.htm

Introduced insects

***Reticulitermes lucifugus* Rossi**

Other scientific names:

Isoptera: Rhinotermitidae

Common names: Mediterranean termite

Host type: broadleaf and conifer

Hosts: *Eucalyptus* spp.; *Pinus* spp.

Reticulitermes lucifugus is an important pest in Uruguay as it destroys sound wood used in buildings. Detected in Uruguay in the 1960s, its area of distribution has since steadily increased, and so has its economic importance. Damage to buildings mainly involves floors, door frames, window frames, etc. Homes, public buildings and shops have been damaged. These termites are active destructors of wood and any article containing cellulose. Dry wood of eucalyptus and pine have also been attacked in Uruguay.

<http://www.biodiv.org/doc/publications/cbd-ts-01.pdf>

<http://www.chem.unep.ch/pops/pdf/termrpt/termiterpt.pdf>

***Rugitermes* sp.**

Other scientific names:

Isoptera: Kalotermitidae

Common names:

Host type: broadleaf and conifer

Hosts:

Rugitermes sp. are currently under study in Uruguay where it is believed they live entirely in galleries inside tree trunks. No further information on hosts and damage could be found.

<http://www.chem.unep.ch/pops/pdf/termrpt/termiterpt.pdf>

<http://www.utoronto.ca/forest/termite/rugpage.htm>

Diseases

Indigenous diseases

No information was available on indigenous diseases affecting naturally regenerating forests in Uruguay.

Introduced diseases

No information was available on introduced diseases affecting naturally regenerating forests in Uruguay.

Other pests

Indigenous other pests

No information was available on the status of indigenous other pests (e.g. mites, nematodes, mammals, etc.) in the naturally regenerating forests of Uruguay.

Introduced other pests

No information was available on the status of introduced other pests (e.g. mites, nematodes, mammals, etc.) in the naturally regenerating forests of Uruguay.

Diebacks and other conditions

No records were available for diebacks and other conditions affecting Uruguay's naturally regenerating forests.

Planted forests

Insects

Indigenous insects

Hypsipyla grandella (Zeller, 1848)

Other scientific names:

Lepidoptera: Pyralidae

Common names: mahogany shoot borer

Host type: broadleaf

Hosts: Meliaceae; *Swietenia* spp.; *Cedrela* spp.

The mahogany shoot borer is the main pest species of *Swietenia* and *Cedrela* in the New World. The distribution of the mahogany shoot borer coincides with that of its principal host plant species, mahoganies and cedros, and includes the US (southern Florida), most of the West Indies, Sinaloa, Mexico, Central America, and South America except Chile.

The larvae bore into new shoots and twigs of Meliaceae (mahogany family), in particular *Swietenia* spp., killing the first few centimetres as well as attacking seed and fruit capsules. They pupate either in the twigs, shoots or the soil. Damage is caused by the killing of the terminal shoot of the plant which then induces branching and the main stem becomes distorted. This species of moth is one of the main factors preventing the ready establishment of mahogany plantations.

[http://www.aciar.gov.au/web.nsf/att/JFRN-6BN983/\\$file/pr97chapter2.pdf](http://www.aciar.gov.au/web.nsf/att/JFRN-6BN983/$file/pr97chapter2.pdf)

<http://www.fcla.edu/FlaEnt/fe80p34.htm>

<http://edis.ifas.ufl.edu/IN613>

<http://www.mahoganyforthefuture.org/projectmeliaceae/borer/borer.html>

http://www.creatures.ifas.ufl.edu/trees/moths/mahogany_borer-english.htm

Megaplatypus mutatus (Chapuis, 1865)

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divaricata, *Malus sylvestris*, *Pyrus communis*, *Sebastiania commersoniana* and *Vitex megapotamica* (Giménez & Etiennot, 2003).

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<http://www.fao.org/forestry/foris/webview/common/media.jsp?mediaId=7544&langId=1>
http://www.eppo.org/QUARANTINE/Alert_List/insects/PLTPMU.htm

Introduced insects

***Ctenarytaina eucalypti* (Maskell, 1890)**

Other scientific names: *Rhinocola eucalypti* Maskell, 1890; *Eurhinocola eucalypti* Pettey, 1927; *Psylla eucalypti* Maskell, 1890

Hemiptera: Psyllidae

Common names: blue gum lerp; Eucalyptus psyllid

Host type: broadleaf

Hosts: *Eucalyptus* spp.

Ctenarytaina eucalypti is a significant pest of eucalypt species. It originates from Australia but has since spread to other parts of the world in Africa, Asia and the Pacific, Europe North America and Latin America and the Caribbean. In Brazil and Uruguay, it is reported that severe damage is caused by both *C. spatulata* and *C. eucalypti*.

http://www.ento.csiro.au/aicn/name_s/b_1208.htm

http://www.eppo.org/QUARANTINE/Alert_List/insects/CTNRST.htm

<http://www2.udec.cl/entomologia/Psyllidae.html> (In Spanish)

http://anic.ento.csiro.au/database/biota_details.aspx?BiotaID=41359

[http://www.deh.gov.au/cgi-](http://www.deh.gov.au/cgi-bin/abrs/fauna/details.pl?pstrVol=PSYLLOIDEA;pstrTaxa=310;pstrChecklistMode=1)

[bin/abrs/fauna/details.pl?pstrVol=PSYLLOIDEA;pstrTaxa=310;pstrChecklistMode=1](http://www.deh.gov.au/cgi-bin/abrs/fauna/details.pl?pstrVol=PSYLLOIDEA;pstrTaxa=310;pstrChecklistMode=1)

***Ctenarytaina spatulata* Taylor, 1997**

Other scientific names:

Hemiptera: Psyllidae

Common names: Eucalyptus psyllid; Eucalyptus shoot psyllid

Host type: broadleaf

Hosts: *Eucalyptus* spp.

Ctenarytaina spatulata is a significant pest of eucalypt species. It originates from Australia but has since spread to other parts of the world in Africa, Asia and the Pacific, Europe North America and Latin America and the Caribbean. It was recorded in Uruguay in 1994. In Brazil and Uruguay, it is reported that severe damage is caused by both *C. spatulata* and *C. eucalypti*. Adults and nymphs feed on plant sap. They are mainly found on mature shoots, especially in the apical part of the tree. Attacked shoots show small necrotic lesions, proliferation of lateral shoots, and leaf distortions. *C. spatulata* produces large amounts of honeydew on which sooty moulds can develop.

This psyllid has several overlapping generations per year. First observations showed that *C. spatulata* is mainly present during winter and beginning of spring.

http://www.eppo.org/QUARANTINE/Alert_List/insects/CTNRST.htm

<http://www.invasive.org/browse/subthumb.cfm?sub=11941&start=1>

***Phoracantha recurva* Newman, 1840**

Other scientific names:

Coleoptera: Cerambycidae

Common names: longicorn beetle

Host type: broadleaf

Hosts: *Eucalyptus* spp.

Native to Australia, *Phoracantha recurva* has been introduced into Argentina, Brazil, Chile, Greece, Malawi, New Zealand, South Africa, Spain, Tunisia, the United States, Uruguay and Zambia. It was reported from Uruguay in 1998. This insect is a large black and yellow longicorn beetle that lay eggs under loose bark of *Eucalyptus* spp. It is primarily a pest of stressed trees, particularly water stressed trees or freshly felled timber; it rarely attacks healthy trees. The larvae tunnel under the bark and in the cambium layer and effectively ring barks the trees. The larval feeding can rapidly kill the trees or cause significant damage to the timber of affected trees. The adults live for several weeks and the larvae take 2 to 6 months to develop depending on moisture conditions in the logs.

Pathways of introduction include nursery stock, freshly cut timber, and timber and wood with high moisture content. The adults are moderately long lived and are strong fliers that are thus capable of naturally dispersing a fair distance.

<http://www.metla.fi/iufro/iufro95abs/d2pap105.htm>

<http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7425.html>

<http://www.invasive.org/browse/subject.cfm?sub=394>

http://www.eppo.org/QUARANTINE/Alert_List/insects/phoracantha.htm

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<http://www.biodiv.org/doc/publications/cbd-ts-01.pdf>

<http://www.chem.unep.ch/pops/pdf/termrpt/termiterpt.pdf>

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<http://www.chem.unep.ch/pops/pdf/termrpt/termiterpt.pdf>

<http://www.utoronto.ca/forest/termite/rugpage.htm>

***Sirex noctilio* Fabricius, 1793**

Other scientific names: *Sirex melanocerus* Thomson, 1871; *Paururus noctilio*

Hymenoptera: Siricidae

Common names: European wood wasp; sirex; sirex woodwasp; steel-blue horntail

Host type: conifer

Hosts: *Pinus radiata*; *P. taeda*; *P. pinaster*; *P. sylvestris*; *P. nigra*; *P. pinea*; *P. elliottii*; *P. echinata*; *P. palustris*; *P. patula*; *P. caribaea*; *P. kesiya*; *P. strobes*; *Abies* spp.; *Larix* spp.; *Picea* spp.; *Pseudotsuga menziesii*

The European woodwasp is native to Europe and northern Africa, where it infests various species of conifers including *Abies* spp., *Larix* spp., *Picea* spp., *Pinus* spp. and *Pseudotsuga* spp. Adult females lay eggs in stressed or dying trees. Each generation takes between one and two years. When the females lay eggs in trees they also insert a fungus and a toxic mucus which usually kill the trees, thus making a suitable habitat for the larvae. The larvae feed on the fungus causing degradation in the quality of timber.

This insect has been accidentally introduced into many Southern Hemisphere countries, where it poses the greatest threat to pine plantations, including Argentina, Australia, Brazil, Chile, New Zealand, South Africa and Uruguay (Ciesla, 2003). It was first detected in Uruguay in 1986 where it is now widespread. In these countries, the wasp has become a major pest in pine plantations, causing up to 70 and 80 percent mortality in certain areas of Uruguay and Australia respectively.

<http://spfnic.fs.fed.us/exfor/data/pestreports.cfm?pestidval=33&langdisplay=english>

http://www.na.fs.fed.us/spfo/pubs/pest_al/sirex_woodwasp/sirex_woodwasp.htm

<http://www.gisp.org/publications/invaded/gispSAmerica.pdf>

<http://www.invasive.org/browse/subimages.cfm?sub=4093>

<http://fabinet.up.ac.za/tpcp/pamphlets/pdf/sirex.pdf>

<http://fabinet.up.ac.za/biennialreport/docs/report1.pdf>

<http://www.metla.fi/iufro/iufro95abs/d2pos86.htm>

http://www.forestrytas.com.au/forestrytas/pdf_files/forest_health_leaflets/insect_pests/pestsinfosheet7sirexwasp.pdf

<http://www.maine.gov/agriculture/pi/pestsurvey/pestinfo/woodwasp.htm>

Diseases

Indigenous diseases

***Puccinia psidii* Winter**

Other scientific names:

Basidiomycota: Pucciniaceae

Common names: guava rust; eucalyptus rust

Host type: broadleaf

Hosts: Myrtaceae; *Eucalyptus* spp.; *E. globulus*; *E. grandis*; *Psidium guajava*

Puccinia psidii is a rust fungus believed to be native to areas of Central and South America. This rust fungus occurs naturally on native Myrtaceae in these regions and has moved on to introduced species of Myrtaceae such as *Eucalyptus* spp. It is known to kill significant numbers of eucalypts, particularly those in young plantations. *P. psidii* causes damage to young foliage and flowers. Infection appears as pustules on young leaves then rapidly progresses through the flowers and young shoots. The infected parts of the plant shrivel and die and subsequent growth is stunted and distorted. Very large numbers of spores are produced which are dispersed by both air and water.

In 2002, *P. psidii* was observed causing severe damage to one-year old trees during a routine disease survey of *E. globulus* in Uruguay. The disease occurred in one plantation in the Levalleja area and damage was uniform throughout the stand. The rust produced egg-yolk yellow pustules on the leaves and resulted in shoot tip dieback. *P. psidii* has previously been reported in Uruguay on native Myrtaceae and in recent years has been observed on *Psidium guajava* and *E. grandis*.

P. psidii has been considered as an agent for biological control of melaleuca (*Melaleuca quinquenervia*) in Florida, US.

http://www.eppo.org/QUARANTINE/Alert_List/deleted%20files/fungi/Puccinia_psidii.doc

<http://forestpathology.coafes.umn.edu/Uruguay.htm>

<http://www.bspp.org.uk/ndr/jan2003/2003-05.asp>

http://www.actahort.org/books/452/452_8.htm

<http://fabinet.up.ac.za/tpcp/pamphlets/pdf/eucrust.pdf>

<http://www.science.org.au/events/emergingdiseases/casestudies.htm>

Introduced diseases

***Botryosphaeria dothidea* (Moug.) Ces. & De Not.**

Other scientific names: *Caumadothis dothidea*; *Dothiorella mali*; *Sphaeria dothidea*

Ascomycota: Botryosphaeriaceae

Common names: Botryosphaeria canker

Host type: broadleaf

Hosts: *Eucalyptus* spp.

Botryosphaeria dothidea causes dieback and canker in *Eucalyptus* spp. It tends to attack trees that have been stressed by such factors as drought, late frosts, cold winds, hot winds, insect damage or pruning. The infection often leads to discolouration of the wood, which can extend throughout the tree. Infection by this fungus can lead to the development of cankers on stems and branches. The stems and branches often break at the site of the

cankers. There is a significant degree of variability in susceptibility to disease amongst *Eucalyptus* spp.

<http://forestpathology.coafes.umn.edu/Uruguay.htm>

<http://fabinet.up.ac.za/tpcp/pamphlets/pdf/botryosphaeria.pdf>

<http://www.indexfungorum.org/Names/SynSpecies.asp?RecordID=183247>

<http://www.forestryimages.org/browse/bimages.cfm?SUB=545&area=13>

***Ceratocystis fimbriata* Ellis & Halst.**

Other scientific names: *Ceratostomella fimbriata*; *Endoconidiophora fimbriata*; *Ophiostoma coffeae*; *Ophiostoma fimbriatum*; *Rostrella coffea*; *Sphaeronema fimbriata*

Ascomycota: Ceratocystidaceae

Common names: Ceratocystis wilt; black rot; Ceratocystis canker

Host type: broadleaf

Hosts: *Eucalyptus* spp.

Ceratocystis fimbriata is thought to be a complex of fungal species that cause a wilt disease on a wide range of host plants including aspen, cocoa, eucalypts and sweet potatoes. In Uruguay it is a significant pest of eucalypt species in particular. The fungus causes reddish-brown to purple radial stains within timber and at times cankers, although wilting may occur without cankers. Infection occurs through wounds, either naturally occurring (e.g. insect damage) or human-induced. For example, pruning of trees is likely to provide opportunity for infection. Hence, this disease poses a significant threat to intensively managed plantings of eucalypts. This fungus is able to survive adverse conditions within the host plant tissues and in soil, debris and cut timber. Pathways for introduction include soil, cuttings, planting material, packing material and dunnage.

<http://forestpathology.coafes.umn.edu/Uruguay.htm>

<http://www.apsnet.org/pd/pdfs/2004/0510-01R.pdf>

<http://www.public.iastate.edu/~tcharrin/FimbDis.html>

<http://www.public.iastate.edu/~tcharrin/CERRES.html>

<http://www.publish.csiro.au/paper/AP03032.htm>

<http://www.mycologia.org/cgi/content/abstract/97/1/57>

***Coniothyrium zuluense* M.J. Wingf., Crous & T.A. Cout.**

Other scientific names:

Ascomycota: Incertae sedis

Common names: Eucalyptus canker; Coniothyrium stem canker

Host type: broadleaf

Hosts: *Eucalyptus* spp.

First described in South Africa and later found in Thailand and Mexico, *Coniothyrium zuluense* is considered a severe disease of eucalyptus forests and a limiting factor to tree propagation, but data is lacking on its impact in Uruguay.

Infection initially causes necrotic spots on stems and branches which develop into large girdling cankers that reduce wood quality and may lead to tree death. Copious amounts of red/brown gum exude from the lesions.

<http://forestpathology.coafes.umn.edu/Uruguay.htm>

http://www.eppo.org/QUARANTINE/Alert_List/deleted%20files/fungi/Coniothyrium_zuluense.doc

http://www.cifor.cgiar.org/publications/pdf_files/Books/eucalypts.pdf

<http://www.padil.gov.au/viewPest.aspx?id=580>

<http://www.iufro.org/download/file/1365/2718/diseases-stem-canker.pdf>

***Mycosphaerella* sp. (Moug.) Ces. & De Not.**

Other scientific names:

Ascomycota: Mycosphaerellaceae

Common names:

Host type: broadleaf

Hosts: *Eucalyptus* spp.

Mycosphaerella is one of the largest genera of plant pathogenic fungi, having more than 1 000 named species, many of which cause economically important diseases in temperate and tropical crops, including forest trees.

<http://forestpathology.coafes.umn.edu/Uruguay.htm>

Other pests

Indigenous other pests

No information was available on the status of indigenous other pests (e.g. mites, nematodes, mammals, etc.) in the planted forests of Uruguay.

Introduced other pests

No information was available on the status of introduced other pests (e.g. mites, nematodes, mammals, etc.) in the planted forests of Uruguay.

Diebacks and other conditions

No records were available for diebacks and other conditions affecting Uruguay's planted forests.

Capacity for forest health protection

Government level

The General Directorate of Forests of the Ministry of Livestock, Agriculture and Fisheries has charge of forest administration and implementation of national forestry policy. Increased forest protection activities against pests, disease and fire are one of the country's environmental objectives.

Forest research is carried out by the National Institute for Agricultural Research, the University of the Republic, the Uruguayan Technological Laboratory and the private sector. In recent years, funds for forest research have been allocated primarily for environmental and health issues and the technological properties and processing of the various types of timber produced in the country. The Division of Protection and Forest

Management has a wealth of personal expertise and a lot of background information on the major pests affecting the main plantation species.

Considering the importance of planted forests in the national economy, the Ministry of Animal Husbandry, Agriculture and Fisheries set up an executive working group in 2002 to coordinate efforts to address the problem of diseases and pests. This group is made up of experts from the General Forestry Directorate, the Forestry Division of the National Agricultural Research Institute, the Agricultural Protection Service and the Association of Forest Producers.

FAO assistance was recently requested by the Government of Uruguay to:

- evaluate and optimize the present forest monitoring system by implementing a pilot forest disease and pest monitoring programme;
- support the formulation of national strategies for the early prevention, evaluation, monitoring and control of present and potential forest diseases and pests, using silvicultural techniques and forest management activities to this end;
- consolidate a database so that an adequate system of information on the health protection of natural and planted forests is available in the medium term;
- train various experts from both the public and private sectors in forest health issues.

Monitoring and detection

The tool for policy development for the country is the Forest Law which includes forest protection. It is obligatory to inform the authorities if a new pest is found in plantations whether they are private or government. Private estates pay for technical advice and are then under an obligation to carry out any prescribed measures. Technical support is provided through the plant protection division, Proteccion y Manejo Forestal of Ministerio de Ganaderia, Agricultura y Pesca.

Some pine plantations monitor for *Sirex noctilio* every year using adapted Brazilian system of monitoring. Other sound management techniques are also practiced and recommended.

One estate employs a pathologist to routinely examine and give advice on health status and to make recommendations for that estate.

Other sampling methods used include permanent sampling plots which are routinely checked for growth characteristics and for signs and symptoms of disturbance and ill health. Personnel are also trained to recognize signs of abnormality and encourage everyone walking through or using the estate to report symptoms of ill health and then the experts make diagnosis.

Data management

Although there are no precise countrywide figures regarding the area affected by forest diseases or pests, information does exist on some affected production units where infected trees have been recorded, ranging from the presence of pathogens and infected leaves, trunks and branches to standing death and various types of canker and rot.

Data collected by surveys requested by the private owners is available for the last 20 years but not in electronic format and is therefore not accessible for long-term forecasting.

Pest management

Some pesticides are used but only in the nurseries particularly against ants, silvicultural and biological control are preferred control options but there are no commercial natural enemy production facilities. After appropriate quarantine clearance, natural enemies are either brought directly from other countries or produced on a very small scale by the estates. Biocontrol agents have been applied in-country for *Sirex noctilio*. *Pissodes* spp. will soon be the target for a biocontrol introduction.

Private landowners

Plantations are predominantly privately owned in Uruguay with the majority of land being owned by large multinationals or foreign investors. These estates are managed on-site with technical support, sometimes from external consultants. Smaller estates have absentee owners with no on-site management.

Nowadays with lessons learned from previous experience, private plantation owners are taking more notice of species selection. Both government forestry authorities and large companies have rightly concluded that the incidence of insects and diseases in their plantations can be controlled through the application and practice of better forest management techniques, and through appropriate selection of site matching species, provenances and clones. In this respect they spend a considerable amount of time and funds in research activities towards that goal.

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^{OSN} = Other Scientific Name (other names, synonyms, other combinations, etc. that have been used for this species)

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