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OVERVIEW OF FOREST PESTS

COLOMBIA

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**Forest Resources Development Service
Forest Management Division
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DISCLAIMER

The aim of this document is to give an overview of the forest pest¹ situation in Colombia. 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).

TABLE OF CONTENTS

Introduction.....	1
Forest pests.....	1
Naturally regenerating forests.....	1
Insects	1
Diseases.....	2
Other pests	2
Diebacks and other conditions	2
Planted forests.....	3
Insects	3
Diseases.....	10
Other pests	10
Diebacks and other conditions	11
Capacity for forest health protection.....	11
Government level.....	11
Monitoring and detection.....	11
Data management.....	11
Pest management	11
Private landowners.....	13
References.....	13
Index	14

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:

Gillian Allard
Forestry Officer (Forest Protection and Health)
Forest Resources Development Service
Forest Management Division
Forestry Department
FAO
Viale delle Terme di Caracalla
00153 Rome, Italy
Telephone: +39 06 570 53373
Fax: + 39 06 570 55137
E-mail: gillian.allard@fao.org

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COLOMBIA

Introduction

Located in the northwestern part of South America, the Republic of Colombia is bordered on the north by Panama and the Caribbean Sea, on the east by Brazil and Venezuela, on the south by Ecuador and Peru and on the west by the Pacific Ocean. Rugged mountains, high rainfall and a location near the equator all contribute to the country's high level of biodiversity.

Approximately 60 728 000 ha is forested representing 58.5 percent of the total land area (FAO, 2006). There are also smaller areas of swamp forest, xerophytic forest, moorland, rockland forest and mangroves. Colombia's naturally regenerating forests consist of closed and open mixed broadleaf forests, bamboo, palms, a limited area of native conifers, *Podocarpus* spp. and high elevation forests of *Quercus humboldtii*. Other wooded lands comprise 18 202 000 ha (FAO, 2006).

The country has 312 000 ha of productive forest plantations representing 0.3 percent of the total land area (FAO, 2006). Plantation species are predominantly fast growing exotics with species of *Pinus* and *Eucalyptus* being the major genera represented. Other plantation species include other broadleaf species, *Gmelina*, *Tectona grandis* and other conifers, primarily *Cupressus lusitanica*.

Forest pests

Naturally regenerating forests

Insects

Indigenous insects

No information was available on indigenous insects of naturally regenerating forests of Colombia.

Introduced insects

***Eulachnus rileyi* (Williams, 1911)**

Other scientific names: *Lachnus rileyi* Williams

Hemiptera: Aphididae

Common names: pine needle aphid

Host type: conifer

Hosts: *Pinus* spp.

The occurrence of pine needle aphid, *Eulachnus rileyi*, on several species of *Pinus* in Colombia has been reported by Madrigal C. (1993). It occurs in planted and naturally regenerating forests. Typically, this insect causes only minor damage where it has been introduced, however, it has the potential to cause serious damage. Heavy infestations cause needles to turn yellow and drop prematurely, resulting in growth reduction.

All life stages feed on the underside of pine needles. In temperate climates, both sexual and asexual forms exist. Adults are normally wingless, but winged forms are sometimes produced. Populations tend to increase during dry periods. These insects could be moved with scion material. Once established in a new location, they are subject to wind dispersal.

<http://www.ipgri.cgiar.org/publications/pdf/828.pdf>

<http://www.cabicompendium.org/NamesLists/FC/Full/EULARI.htm>

Diseases

Indigenous diseases

No information was available on indigenous diseases of naturally regenerating forests of Colombia.

Introduced diseases

No information was available on introduced diseases of naturally regenerating forests of Colombia.

Other pests

Indigenous other pests

No information was available on other indigenous pests (e.g. mites, nematodes, mammals, etc.) of natural forests of Colombia.

Introduced other pests

No information was available on other introduced pests (e.g. mites, nematodes, mammals, etc.) of natural forests of Colombia.

Diebacks and other conditions

A dieback of *Quercus humboldtii*, a valuable component of high elevation forests in the Department of Antioquia, has been reported. This tree occurs in homogeneous stands where harvesting is regulated to protect the remaining forests of this species. The dieback affects both young and old trees. Symptoms include a progressive death of individual branches, eventually affecting the entire crown, marginal necrosis and yellowing (chlorosis) of the foliage and vascular discoloration of the twigs, branches and roots.

Investigations into the causes of this dieback suggest that several fungi, parasitic plants (mistletoes), insects and an unidentified nematode have been associated with affected trees. Fungi recovered include *Phialophora* spp. from necrotic foliage, *Pestalotia* spp. from both chlorotic and necrotic foliage and *Dothirella* spp. from dead branches. Several families of insects have been found feeding on the foliage and secondary wood borers, ants and termites have been associated with dead and dying trees. Ramírez Correa (1988) concluded that the dieback may be the result of several factors leading to similar symptoms.

Planted forests

Insects

Indigenous insects

Because of the intensity of forest management, considerably more is known about the complex of pests that affect forest plantations than natural forests in Colombia. A large number of insects indigenous to the country's natural forests have adapted to the exotic species established in planted forests and have caused significant damage. However, relatively little information is available on their frequency of occurrence or effects on tree growth.

In Colombia, indigenous insects have been detected in that country's exotic *Cupressus*, *Eucalyptus* and *Pinus* plantations, with the most frequently encountered groups being defoliating caterpillars of the family Geometridae, leaf-cutting ants and stem-infesting insects (Madrigal C. 1993). The defoliating insects occur primarily in plantations of *Pinus patula* greater than seven years old. They occur in high density stands with high levels of understorey vegetation. Leaf-cutting ants, on the other hand, prefer recently established plantations, especially *Eucalyptus*, usually less than one year old. The complex of stem-infesting insects occurs with varying frequency primarily in plantations of *Pinus patula* between the ages of 5 and 11 years (Madrigal C., 1993). Rodas P. (1998) reports 30 species of defoliating insects feeding on exotic forest plantations in the Andean region of Colombia.

According to available data, only about 1.2 percent of Colombia's forest plantations have suffered severe attacks by defoliating insects. Growth recovery following the collapse of defoliator outbreaks is approximately 60 percent and mortality is confined to about 0.48 percent of the total plantation area. Much of the insect damage is attributed to poor plantation management. Trees killed by insects are generally salvaged for pulpwood production (Madrigal C., 1993).

Acrospila gastralis

Other scientific names:

Lepidoptera: Pyralidae

Common names: pyralid caterpillar; pyralid moth

Host type: broadleaf

Hosts: *Tectona grandis*

***Amitermes foreli* Wasmann, 1902**

Other scientific names:

Isoptera: Termitidae

Common names: termite

Host type: broadleaf

Hosts: *Eucalyptus tereticornis*

***Amphicerus cornutus* (Pallas, 1772)**

Other scientific names:

Coleoptera: Bostrichidae

Common names: powderpost beetle; powderpost bostrichid

Host type: broadleaf

Hosts: *Tabebuia rosea*

<http://www.padil.gov.au/viewPestDiagnosticImages.aspx?id=85>

<http://www.forestryimages.org/browse/subthumb.cfm?sub=7355&start=1>

http://www.hear.org/starr/hiinsects/images/thumbnails/html/amphicerus_cornutus.htm

http://www.sbnature.org/collections/invert/entom/s_p_amphi_cornu.php

Anomala pyropyga

Other scientific names:

Coleoptera: Scarabaeidae

Common names:

Host type: broadleaf and conifer

Hosts: *Eucalyptus grandis*; *Pinus oocarpa*; *P. patula*; *Cupressus lusitanica*; *Cordia alliodora*

***Anomis illita* Guenée, 1852**

Other scientific names: *Anomis tortuosa* (Walker); *Anomis praerupta* Möschler; *Ristra tortuosa* Walker 1858

Lepidoptera: Noctuidae

Common names: okra leafworm

Host type: broadleaf

Hosts: *Bombacopsis quinquatum*

http://www.inra.fr/papillon/noctuid/ophideri/texteng/a_illita.htm

<http://www.butterfliesandmoths.org/species?l=4807>

<http://www.mbarne.force9.co.uk/jamaicamoths/images8/anoill.htm>

***Cargolia arana* Dognin, 1895**

Other scientific names:

Lepidoptera: Geometridae

Common names:

Host type: broadleaf and conifer

Hosts: *Cupressus* spp.; *Pinus patula*; *P. oocarpa*; *Eucalyptus grandis*

The most important group of insects attacking forestry plantations in Colombia are the defoliating insects including *Oxydia trychiata*, *Cargolia arana* and *Glena bisulca*.

Annually, these insects cause large scale defoliation to pines, eucalypts and cypress in Colombia.

<http://fabinet.up.ac.za/tpcp/newsletters/archive/may01/11.html>

***Ceroys quadrispinosus* Redtenbacher, 1906**

Other scientific names:

Orthoptera: Phasmidae

Common names:

Host type: conifer

Hosts: *Pinus patula*

<http://www.mantophasmatodea.de/phasmid/artdet.php3?ART=1828>

***Dictyla monotropidia* (Stål.)**

Other scientific names: *Monanthia monotropidia* Stål, 1860

Hemiptera: Tingidae

Common names:

Host type: broadleaf

Hosts: *Cordia alliodora*

Dictyla monotropidia attacks laurel (*Cordia alliodora*) and can cause leaf desiccation and defoliation of young trees.

http://www2.nrm.se/en/het_nrm/m/dictyla_monotropidia.html

***Euryscopa cingulata* (Latreille)**

Other scientific names:

Coleoptera: Chrysomelidae

Common names:

Host type: broadleaf

Hosts: *Eucalyptus tereticornis*; *Bombacopsis quinatum*; *Cordia alliodora*

Glena bisulca

Other scientific names:

Lepidoptera: Geometridae

Common names:

Host type: broadleaf and conifer

Hosts: *Pinus patula*; *P. oocarpa*; *Cupressus lusitanica*; *Eucalyptus* spp.; *E. grandis*

The most important group of insects attacking forestry plantations in Colombia are the defoliating insects including *Oxydia trychiata*, *Cargolia arana* and *Glena bisulca*.

Annually, these insects cause large scale defoliation to pines, eucalypts and cypress in Colombia. Attacks by larvae of the lepidopterans *Glena bisulca* and *Oxydia trychiata* in Colombia have caused complete defoliation and major losses in plantations of Mexican cypress (*Cupressus lusitanica*) and Mexican weeping pine (*Pinus patula*) (Ladrach, 1992).

<http://fabinet.up.ac.za/tpcp/newsletters/archive/may01/11.html>

***Heliothrips haemorrhoidalis* (Bouché)**

Other scientific names: *Thrips haemorrhoidalis* Bouché 1833

Thysanoptera: Thripidae

Common names: greenhouse thrip

Host type: broadleaf

Hosts: *Eucalyptus grandis*; *E. saligna*

Greenhouse thrips feed primarily on the foliage of ornamental plants. It attacks the lower surface first and, as feeding progresses and the population increases, the thrips move to the upper surface. The leaves become discoloured and severely damaged leaves turn yellow and drop. In addition to the feeding damage, both surfaces are covered with small droplets of a reddish fluid that gradually changes to black. These globules of fluid increase in size until they fall off and another one begins to form, resulting in a characteristic spotting of the infestation area with black specks of fecal material.

Greenhouse thrips can be found over much of the world due to its habit of living in greenhouses. It is a poor flier and remains in the shaded areas on the plant almost all the time.

<http://www.insectimages.org/browse/subimages.cfm?SUB=9184>

http://www.ento.csiro.au/aicn/name_s/b_1879.htm

http://creatures.ifas.ufl.edu/orn/thrips/greenhouse_thrips.htm

<http://www.ctahr.hawaii.edu/noni/thrips.asp>

<http://edis.ifas.ufl.edu/in232>

[http://www.deh.gov.au/cgi-](http://www.deh.gov.au/cgi-bin/abrs/fauna/details.pl?pstrVol=THYSANOPTERA;pstrTaxa=1355;pstrChecklistMode=2)

[bin/abrs/fauna/details.pl?pstrVol=THYSANOPTERA;pstrTaxa=1355;pstrChecklistMode=2](http://www.deh.gov.au/cgi-bin/abrs/fauna/details.pl?pstrVol=THYSANOPTERA;pstrTaxa=1355;pstrChecklistMode=2)

***Hemeroplanes parce* (Fabricius, 1775)**

Other scientific names:

Lepidoptera: Sphingidae

Common names:

Host type: broadleaf

Hosts: *Tabebuia rosea*

***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

Megalopyge orsilochus

Other scientific names:

Lepidoptera: Megalopygidae

Common names:

Host type: broadleaf

Hosts: *Tectona grandis*

***Melanolopia commotaria* Maassen, 1890**

Other scientific names:

Lepidoptera: Geometridae

Common names:

Host type: conifer

Hosts: *Pinus patula*; *Cupressus lusitanica*

<http://redalyc.uaemex.mx/redalyc/pdf/113/11311104.pdf>

Neuromelia albinearica

Other scientific names:

Lepidoptera: Geometridae

Common names:

Host type: conifer

Hosts: *Pinus radiata*

Oncideres tessellata

Other scientific names:

Coleoptera: Cerambycidae

Common names:

Host type: broadleaf

Hosts: *Samanea saman*; *Bombacopsis quinatum*

http://www.hort.purdue.edu/newcrop/duke_energy/Samanea_saman.html

***Oxydia olivata* Dognin, 1900**

Other scientific names:

Lepidoptera: Geometridae

Common names:

Host type: broadleaf

Hosts: *Alnus jorullensis*

***Oxydia trychiata* Guenée, 1858**

Other scientific names:

Lepidoptera: Geometridae

Common names:

Host type: conifer

Hosts: *Pinus* spp.; *P. patula*; *Cupressus* spp.; *C. lusitanica*; *Eucalyptus grandis*; *E. saligna*

The most important group of insects attacking forestry plantations in Colombia are the defoliating insects including *Oxydia trychiata*, *Cargolia arana* and *Glena bisulca*. Annually, these insects cause large scale defoliation to pines, eucalypts and cypress in Colombia. *Oxydia trychiata* is an indigenous species in Colombia that feeds on foliage and branches of host species. It is very destructive to plantations of exotic pines for the pulp and paper industry. It has also caused complete defoliation and major losses in plantations of Mexican cypress (*Cupressus lusitanica*) and Mexican weeping pine (*Pinus patula*) (Ladrach, 1992). This species has been successfully controlled by the introduction and release of an egg parasitoid *Telenomus alsophilae* (FAO, 2001).

O. trychiata has a wide distribution extending from Costa Rica to most of the countries in South America. The moth has three generations per year and apparently is capable of normal development on introduced tree species (citrus, coffee, pine and cypress). There has been an attempt to establish exotic conifer species in Colombia for the production of pulp and paper.

http://www.faculty.ucr.edu/~legneref/biotact/bc-34.htm#COLOMBIAN_DEFOLIATOR

<http://www.faculty.ucr.edu/~legneref/biotact/ch-33.htm>

<http://fabinet.up.ac.za/tpcp/newsletters/archive/may01/11.html>

***Planudes cortex* Hebard, 1919**

Other scientific names:

Orthoptera: Phasmidae

Common names:

Host type: conifer

Hosts: *Pinus patula*

***Steirastoma histrionicum* White, 1855**

Other scientific names:

Coleoptera: Cerambycidae

Common names:

Host type: broadleaf

Hosts: *Bombacopsis quinatum*; *Tabebuia rosea*

Introduced insects

***Cinara cupressivora* Watson and Voegtlin 1999**

Other scientific names:

Hemiptera: Aphididae

Common names: giant conifer aphid; cypress aphid

Host type: conifer

Hosts: *Chamaecyparis* spp.; *Cupressus* spp.; *C. lusitanica*; *Juniperus* spp.; *Thuja* spp.; *Cupressocyparis* spp.

Cinara cupressivora, a species believed indigenous to the eastern Mediterranean region, is known to infest plantations of *Cupressus lusitanica* (Watson *et al.*, 1999). Damage to hosts includes browning and defoliation which, in some cases, causes dieback and death of trees. No reports of the magnitude of damage caused by this insect in Colombia are available.

Conifers attacked include species in the genera *Chamaecyparis*, *Cupressus*, *Juniperus*, *Thuja* and species in the hybrid genus *Cupressocyparis*. Heavy foliar damage and tree mortality occurs on *Cupressus macrocarpa*. Frequently specimens of this species of aphid were initially identified as *C. cupressi*; however, detailed diagnostic work determined that they belonged to a new species (which was described as *Cinara cupressivora* by Watson and Voegtlin in 1999). [Note that numerous references (Web sites and texts) use the name *Cinara cupressi*, these are frequently misidentified specimens of *Cinara cupressivora*. As well, some references incorrectly synonymize these two species.]

<http://spfnic.fs.fed.us/exfor/data/pestreports.cfm?pestidval=161&langdisplay=english>

<http://www.issg.org/database/species/ecology.asp?si=121&fr=1&sts=>

<http://www.invasive.org/browse/subimages.cfm?sub=3636>

<http://www.afaec.org/html/98-202.html>

***Eulachnus rileyi* (Williams, 1911)**

Other scientific names: *Lachnus rileyi* Williams

Hemiptera: Aphididae

Common names: pine needle aphid

Host type: conifer

Hosts: *Pinus* spp.

The occurrence of pine needle aphid, *Eulachnus rileyi*, on several species of *Pinus* in Colombia has been reported by Madrigal C. (1993). It occurs in planted and natural forests. Typically, this insect causes only minor damage where it has been introduced, however, it has the potential to cause serious damage. Heavy infestations cause needles to turn yellow and drop prematurely, resulting in growth reduction.

All life stages feed on the underside of pine needles. In temperate climates, both sexual and asexual forms exist. Adults are normally wingless, but winged forms are sometimes produced. Populations tend to increase during dry periods.

These insects could be moved with scion material. Once established in a new location, they are subject to wind dispersal.

<http://www.ipgri.cgiar.org/publications/pdf/828.pdf>

<http://www.cabicompendium.org/NamesLists/FC/Full/EULARI.htm>

Diseases

Indigenous diseases

No information was available on indigenous diseases of planted forests in Colombia.

Introduced diseases

***Chrysosporthe cubensis* (Bruner) Gryzenhout & M.J.Wingfield**

Other scientific names:

Ascomycota: Incertae sedis

Common names: Eucalyptus canker

Host type: broadleaf

Hosts: *Eucalyptus* spp.; *Syzygium aromactium*; *Tibouchina* spp.

Chrysosporthe cubensis is a fungus that is widespread and causes disease in commercial plantations of *Eucalyptus* spp. This fungus occurs naturally on native Myrtaceae and the original host is thought to be cloves (*Syzygium aromactium*). It is now found on other species of Myrtaceae including *Eucalyptus* spp. It causes cankers which lead to breakages of limbs and trunks of trees and often mortality. Subsequent growth is stunted and distorted. *C. cubensis* is known to kill significant numbers of eucalypts, particularly those in young plantations. In Colombia it causes cankers on native species of *Tibouchina* as well as introduced *Eucalyptus* spp. (Wingfield *et al.*, 2001).

<http://www.fao.org/docrep/006/p3565e/p3565e05.htm>

<http://www.forestryimages.org/browse/bimages.cfm?SUB=3486&area=47>

http://fabinet.up.ac.za/personnel/docs/2004Gryzenhout_Studies_In_Mycology.pdf

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

http://fabinet.up.ac.za/personnel/docs/Rodas_Miconia.pdf

http://www.findarticles.com/p/articles/mi_qa4019/is_200105/ai_n8946157#continue

<http://www.cbs.knaw.nl/publications/sim/sim50/50-11.pdf>

<http://www.cbs.knaw.nl/simonline/sim-050/50-11.pdf>

Other pests

Indigenous other pests

***Tetranychus desertorum* Banks, 1900**

Other scientific names:

Acarina: Tetranychidae

Common names: desert spider mite, prickly pear spider mite; prickly pear red spider mite

Host type: broadleaf

Hosts: *Tectona grandis*

Mite feeding results in the destruction of chlorophyll; leaves become pale, stippled, and in later stages of infestation dry up and die. Loss of color is pronounced on the under surface of leaves before it becomes apparent on the upper side. Light infestations can be tolerated, but when heavy, can result in lowered yield and reduced quality of fruit.

http://www.ento.csiro.au/aicn/name_s/b_3993.htm

<http://www.deh.gov.au/cgi-bin/abrs/fauna/details.pl?pstrVol=ACARINA;pstrTaxa=7182;pstrChecklistMode=2>
<http://www.forestryimages.org/browse/subthumb.cfm?sub=7295&start=1>

Introduced other pests

No information was available for other introduced pests (e.g. mites, nematodes, mammals, etc.) of planted forests of Colombia.

Diebacks and other conditions

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

Capacity for forest health protection

Government level

Presently, there is no organization at the government level with direct responsibility for forest pest management. Consequently, the present country programme in forest health protection is discontinuous, somewhat incoherent and poorly funded (Madrigal C., 1993).

Monitoring and detection

The key aspect of prevention is to create awareness among all forest workers of the threats posed by damaging pests and diseases. Training in forest entomology and plant pathology, with emphasis on recognition of key pests and available pest management methods, is provided to all forest workers including managers, supervisors, forest engineers and technicians. Literature to help aid in pest detection and recognition has been provided. Some 270 forest workers have received training since this programme was initiated. Periodic, systematic phytosanitary inspections are carried out in all plantations. Pest species are identified and their occurrence is recorded in a database.

Following the discovery of a pest outbreak, a formal diagnosis is made. Factors evaluated during the diagnosis include the tree species involved, genetic providence, age, density, state of development, silvicultural procedures and area affected. In addition, the causal agent, population level, reproductive capacity, type of damage, occurrence of natural controls and other factors are evaluated.

Data management

Data on insect and disease occurrence are maintained in databases.

Pest management

Upon completion of the diagnosis, a plan of action is developed to address the problem. Pest management tactics commonly used include:

- *Physical management* which may include the use of prescribed fire or light to reduce insect population levels. In the case of caterpillars of the family Geometridae, for

example, light traps may be used in infested areas to trap moths, evaluate their density and determine the occurrence of associated species.

- *Mechanical control* which involves collection and destruction of the pupal and adult stages of the insect pest, especially during the early stages of an outbreak.
- *Cultural management* which includes thinnings, management of surrounding natural forests, regulation of plantation density and taking steps necessary to maintain high growth rates. This approach is considered a major factor in reducing the occurrence of defoliating insects in forest plantations.
- *Classic biological control*, using introduced natural enemies, is considered an important aspect of the country's overall pest management programme, especially against defoliating insects. Classic biological control programmes have been directed against at least six insect species. In 1990, Smurfit Cartón de Colombia developed a laboratory for mass rearing of natural enemies. Emphasis has been on rearing and release of a North American egg parasitoid, *Telenomus alsophilae* (Hymenoptera: Scelionidae), which parasitizes the egg stage of several native species of Geometridae. Detailed procedures have been developed for the mass rearing of this parasitoid. In addition, mass rearing of a second egg parasitoid, *Trichogramma* spp. (Hymenoptera: Trichogrammatidae), has been initiated for control of other defoliating insects. Two types of field releases are used: an inoculative liberation is used to establish a parasitoid population in an area and involves a release of 25 000 to 50 000 individuals per ha. An inundative liberation is used during periods of high pest population densities and involves releases of no less than 250 000 parasitoids per ha. Releases are timed with the oviposition of the target pest insect. Studies have been conducted to determine which flowering plants present in affected areas could serve as sources of food and nectar for the released parasitoids.
- *Microbial insecticides*. Limited use has been made of ground applications of the microbial insecticide, *Bacillus thuringiensis*, to reduce populations of defoliators of the family Geometridae. Some use has also been made of the entomopathogenic fungus, *Beauveria bassiana*, primarily as a soil application directed against the pupal stages of several defoliators.
- *Chemical control* of forest plantation pests has not been used extensively for several reasons including the following.
 - High risk of environmental contamination.
 - High cost of chemical products.
 - Limited availability of application equipment.
 - Lack of water supplies available for dilution.
 - Health risks to applicators.
 - Pesticide resistance.
 - Adverse effects on natural control factors.
 - Risk of extending rather than reducing the problem.

Private landowners

Although the capacity for the protection of the health of Colombia's forests may be minimal at the national level, several private companies maintain active programmes to protect their planted forests from the damaging effects of insects and diseases. One such company is Smurfit Cartón de Colombia, which produces both pulpwood and wood products. This company manages 37 500 ha of planted forests of *Pinus* spp., *Eucalyptus* spp. and other species in the Departments of Caldas, Quindío, Risaralda, Valle and Cauca (Rodas P., 1998).

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Index

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

- Acarina, 10
- Acrospila gastralis*
Hosts
Tectona grandis, 3
- Alnus jorullensis*
Insects
Oxydia olivata, 7
- Amitermes foreli*
Hosts
Eucalyptus tereticornis, 3
- Amphicerus cornutus*
Hosts
Tabebuia rosea, 3
- Anomala pyropyga*
Hosts
Cordia alliodora, 4
Cupressus lusitanica, 4
Eucalyptus grandis, 4
Pinus oocarpa, 4
Pinus patula, 4
- Anomis illita*
Hosts
Bombacopsis quinatum, 4
- Anomis praerupta*^{OSN}, 4
- Anomis tortuosa*^{OSN}, 4
- Aphididae, 1, 8, 9
- Ascomycota, 10
- Bombacopsis quinatum*
Insects
Anomis illita, 4
Euryscopa cingulata, 5
Oncideres tessellata, 7
Steirastoma histrionicum, 8
- Bostrichidae, 4
- Broadleaf
- Acrospila gastralis*, 3
- Amitermes foreli*, 3
- Amphicerus cornutus*, 4
- Anomala pyropyga*, 4
- Anomis illita*, 4
- Cargolia arana*, 4
- Chrysoportha cubensis*, 10
- Dictyla monotropidia*, 5
- Euryscopa cingulata*, 5
- Heliothrips haemorrhoidalis*, 5
- Hemeroplanes parce*, 6
- Hypsipyla grandella*, 6
- Megalopyge orsilochus*, 7
- Oncideres tessellata*, 7
- Oxydia olivata*, 7
- Steirastoma histrionicum*, 8
- Tetranychus desertorum*, 10
- Cargolia arana*
Hosts
Cupressus, 4
Eucalyptus grandis, 4
Pinus oocarpa, 4
Pinus patula, 4
- Cedrela*
Insects
Hypsipyla grandella, 6
- Cerambycidae, 7, 8
- Ceroys quadrispinosus*
Hosts
Pinus patula, 4
- Chamaecypris*
Insects
Cinara cupressivora, 9
- Chrysomelidae, 5
- Chrysoportha cubensis*

- Hosts
Eucalyptus, 10
Syngium aromactium, 10
Tibouchina, 10
- Cinara cupressivora*
 Hosts
Chamaecyparis, 8
Cupressocyparis, 8
Cupressus, 8
Cupressus lusitanica, 8
Juniperus, 8
Thuja, 8
- Coleoptera, 4, 5, 7, 8
- Conifer
Anomala pyropyga, 4
Cargolia arana, 4
Ceroys quadrispinosus, 5
Cinara cupressivora, 9
Eulachnus rileyi, 1, 9
Heliothrips haemorrhoidalis, 5
Melanolophia commotaria, 7
Neuromelia albinearia, 7
Oxydia trychiata, 8
Planudes cortex, 8
- Cordia alliodora*
 Insects
Anomala pyropyga, 4
Dictyla monotropidia, 5
Euryscopa cingulata, 5
- Cupressocyparis*
 Insects
Cinara cupressivora, 9
- Cupressus*
 Insects
Cargolia arana, 4
Cinara cupressivora, 9
Oxydia trychiata, 8
- Cupressus lusitanica*
 Insects
Anomala pyropyga, 4
Glena bisulca, 5
Neuromelia albinearia, 7
Oxydia trychiata, 8
- Cypress aphid, 9
- Data management, 11
- Desert spider mite, 10
- Dictyla monotropidia*
 Hosts
Cordia alliodora, 5
- Diebacks and other conditions, 2, 11
 Naturally regenerating forests, 2
 Planted forests, 11
- Diseases, 2, 10
Chrysoporthe cubensis, 10
 Naturally regenerating forests, 2
 Planted forests, 10
- Eucalyptus*
 Diseases
Chrysoporthe cubensis, 10
- Insects
Glena bisulca, 5
- Eucalyptus canker, 10
- Eucalyptus grandis*
 Insects
Anomala pyropyga, 4
Cargolia arana, 4
Glena bisulca, 5
Heliothrips haemorrhoidalis, 6
Oxydia trychiata, 8
- Eucalyptus saligna*
 Insects
Heliothrips haemorrhoidalis, 6
Oxydia trychiata, 8
- Eucalyptus tereticornis*
 Insects
Amitermes foreli, 3
Euryscopa cingulata, 5
- Eulachnus rileyi*
 Hosts
Pinus, 1, 9
- Euryscopa cingulata*
 Hosts
Bombacopsis quinquatum, 5
Cordia alliodora, 5
Eucalyptus tereticornis, 5
- Geometridae, 4, 5, 7, 8
- Giant conifer aphid, 9
- Glena bisulca*
 Hosts
Cupressus lusitanica, 5
Eucalyptus, 5
Eucalyptus, 5

- Insects
 - Neuromelia albinearia*, 7
- Samanea saman*, 7
- Insects
 - Oncideres tessellata*, 7
- Swietenia*, 6
- Insects
 - Hypsipyla grandella*, 6
- Syzigium aromactium*, 10
- Diseases
 - Chrysoporthe cubensis*, 10
- Tabebuia rosea*, 4, 6, 8
- Insects
 - Amphicerus cornutus*, 4
 - Hemeroplanes parce*, 6
 - Steirastoma histrionicum*, 8
- Tectona grandis*, 3, 7, 10
- Insects
 - Acrospila gastralis*, 3
 - Megalopyge orsilochus*, 7
- Other pests
 - Tetranychus desertorum*, 10
- Thuja*, 9
- Insects
 - Cinara cupressivora*, 9
- Tibouchina*, 10
- Diseases
 - Chrysoporthe cubensis*, 10
- Hypsipyla grandella*
- Hosts
 - Cedrela*, 6
 - Swietenia*, 6
- Indigenous diseases, 2, 10
- Indigenous insects, 1, 3
- Indigenous other pests, 2, 10
- Insects, 1, 3
 - Acrospila gastralis*, 3
 - Amitermes foreli*, 3
 - Amphicerus cornutus*, 3
 - Anomala pyropyga*, 4
 - Anomis illita*, 4
 - Anomis praerupta*^{OSN}, 4
 - Anomis tortuosa*^{OSN}, 4
 - Cargolia arana*, 4
 - Ceroys quadrispinosus*, 4
 - Cinara cupressivora*, 8
 - Dictyla monotropidia*, 5
 - Eulachnus rileyi*, 1, 9
 - Euryscopa cyngulata*, 5
 - Glena bisulca*, 5
 - Heliothrips haemorrhoidalis*, 5
 - Hemeroplanes parce*, 6
 - Hypsipyla grandella*, 6
 - Lachnus rileyi*^{OSN}, 1, 9
 - Megalopyge orsilochus*, 7
 - Melanolophia commotaria*, 7
 - Monanthia monotropidia*^{OSN}, 5
 - Naturally regenerating forests, 1
 - Neuromelia albinearia*, 7
 - Oncideres tessellata*, 7
 - Oxydia olivata*, 7
 - Oxydia trychiata*, 7
 - Planted forests, 3
 - Planudes cortex*, 8
 - Ristra tortuosa*^{OSN}, 4
 - Steirastoma histrionicum*, 8
 - Thrips haemorrhoidalis*^{OSN}, 5
 - Introduced diseases, 2, 10
 - Introduced insects, 1, 8
 - Introduced other pests, 2, 11
 - Isoptera, 3
 - Juniperus*
 - Insects
 - Cinara cupressivora*, 9
 - Lachnus rileyi*^{OSN}, 1, 9
 - Lepidoptera, 3, 4, 5, 6, 7, 8
 - Mahogany shoot borer, 6
 - Megalopyge orsilochus*
 - Hosts
 - Tectona grandis*, 7
 - Megalopygidae, 7
 - Melanolophia commotaria*
 - Hosts
 - Cupressus lusitanica*, 7
 - Pinus patula*, 7
 - Monanthia monotropidia*^{OSN}, 5
 - Monitoring and detection, 11
 - Naturally regenerating forests, 1
 - Diebacks and other conditions, 2
 - Diseases, 2
 - Insects, 1
 - Other pests, 2

- Neuromelia albinearia*
 Hosts
 Pinus radiata, 7
 Noctuidae, 4
 Okra leafworm, 4
Oncideres tessellata
 Hosts
 Bombacopsis quinatum, 7
 Samanea saman, 7
 Orthoptera, 5, 8
 Other pests, 2, 10
 Naturally regenerating forests, 2
 Planted forests, 10
 Tetranychus desertorum, 10
Oxydia olivata
 Hosts
 Alnus jorullensis, 7
Oxydia trychiata
 Hosts
 Cupressus, 7
 Cupressus lusitanica, 7
 Eucalyptus grandis, 7
 Eucalyptus saligna, 7
 Pinus, 7
 Pinus patula, 7
 Pest management, 11
 Phasmidae, 5, 8
 Pine needle aphid, 1, 9
Pinus
 Insects
 Eulachnus rileyi, 1, 9
 Oxydia trychiata, 8
Pinus oocarpa
 Insects
 Anomala pyropyga, 4
 Cargolia arana, 4
 Glena bisulca, 5
Pinus patula
 Insects
 Anomala pyropyga, 4
 Cargolia arana, 4
 Ceroys quadrispinosus, 5
 Glena bisulca, 5
 Neuromelia albinearia, 7
 Oxydia trychiata, 8
 Planudes cortex, 8
Pinus radiata
 Insects
 Neuromelia albinearia, 7
 Planted forests, 3
 Diebacks and other conditions, 11
 Diseases, 10
 Insects, 3
 Other pests, 10
Planudes cortex
 Hosts
 Pinus patula, 8
 Powderpost beetle, 4
 Powderpost bostrichid, 4
 Prickly pear red spider mite, 10
 Prickly pear spider mite, 10
 Private landowners, 13
 Pyralid caterpillar, 3
 Pyralid moth, 3
 Pyralidae, 3, 6
Ristra tortuosa^{OSN}, 4
Samanea saman
 Insects
 Oncideres tessellata, 7
 Scarabaeidae, 4
 Sphingidae, 6
Steirastoma histrionicum
 Hosts
 Bombacopsis quinatum, 8
 Tabebuia rosea, 8
Swietenia
 Insects
 Hypsipyla grandella, 6
Syngium aromactium
 Diseases
 Chrysoporthe cubensis, 10
Tabebuia rosea
 Insects
 Amphicerus cornutus, 4
 Hemeroplanes parce, 6
 Steirastoma histrionicum, 8
Tectona grandis
 Insects
 Acrospila gastralis, 3
 Megalopyge orsilochus, 7
 Other pests
 Tetranychus desertorum, 10

Termite, 3
Termitidae, 3
Tetranychidae, 10
Tetranychus desertorum
Hosts
Tectona grandis, 10
Thripidae, 5
Thrips haemorrhoidalis^{OSN}, 5

Thuja
Insects
Cinara cupressivora, 9
Thysanoptera, 5
Tibouchina
Diseases
Chrysosporthe cubensis, 10
Tingidae, 5