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Pest Risk Assessment of the Importation of *Pinus radiata* and Douglas-fir Logs from New Zealand

United States
Department of
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**Forest
Service**

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Executive Summary

Function of the pest risk assessment

United States companies propose to import *Pinus radiata* (known as radiata or Monterey pine) and Douglas-fir logs from New Zealand. Because the U.S. Department of Agriculture has no specific timber import regulations, the Animal and Plant Health Inspection Service (APHIS) asked the Forest Service to prepare a risk assessment that identifies potential pests, estimates the probability of their establishment, and estimates their consequences. The Pest Risk Assessment Team chose to concentrate on the risk to the resources of the Western United States because of the value of these resources and because of proposed shipments to Western ports. However, the analysis and conclusions are applicable to the entire United States.

The pest risk assessment team

Forest pest specialists provided technical expertise from the disciplines of forestry, entomology, pathology, and economics. The team was also assisted by representatives from APHIS and several New Zealand forestry organizations. In addition, a request to review the draft of this document was sent to over 80 people and more than 30 responses to the request were received and considered. In March 1992, members of the assessment team traveled to New Zealand. They examined insect and disease records provided by New Zealand agencies, toured logging areas and ports, inspected current industry mitigation procedures, and viewed pest problems in the forests.

Analysis

The team members screened the 30-year computerized list of insects and diseases reported for *Pinus radiata* and Douglas-fir in New Zealand. A screening procedure was developed to focus on species that represented those groups of organisms identified as having the greatest risk. From this process, the team members identified seven organisms to analyze in detail: *Kalotermes brouni, Leptographium truncatum, Platypus apicalis, Platypus gracilis, Prionoplus reticularis,* and the *Sirex noctilio/Amylostereum areolatum* complex. All pest analyses were approached from the assumption that proposed New Zealand industry mitigation procedures would be implemented before importation of logs would be allowed.

Conclusions and recommendations

Of the seven pests analyzed in detail using the risk assessment process, the estimated risks are as follows: low for *Kalotermes brouni* and the two *Platypus* species, moderate for *Leptographium truncatum* and *Prionoplus reticularis*, and moderate to high for the *Sirex noctilio/Amylostereum areolatum* complex.

Although the occurrence of *Sirex* in plantation forests of New Zealand is low, the potential for entry, colonization, and spread is high. Environmentally, *Sirex* and its associated fungus could reduce the genetic base of *Pinus radiata* and increase populations of other destructive pests, like bark beetles. Overstocked pine plantations and unhealthy forest stands would be particularly susceptible. Because *S. noctilio/A. areolatum* and *Prionoplus reticularis* may be found deep in the wood, currently proposed New Zealand industry mitigation measures need to be examined by APHIS to determine whether these measures will adequately mitigate the pest risk.

The Pest Risk Assessment Team recommends that APHIS consider the following points in thedevelopment of any additional protocols for log importation from New Zealand: time and place of fumigation, need for and efficacy of heat treatment, New Zealand Ministry of Forestry and APHIS inspection protocols, log handling at U.S. ports, log storage time and place in the United States, milling practices and APHIS monitoring at mills, and waste disposal.

New Zealand mitigation procedures currently proposed by industry include rapid processing from felling to shipping; debarking; fungicide and insecticide treatment; visual examination; and fumigation. This pest risk assessment assumed continuation of these procedures, and therefore the assessment is less valid if these procedures are discontinued.

Chapter 1. Introduction

Statement of purpose

This risk assessment estimates the probability of introduction and establishment of exotic insects and pathogens associated with the importation of *Pinus radiata* D. Don (Monterey or radiata pine) and *Pseudotsuga menziesii* (Mirb.) Franco (Douglas-fir) logs from New Zealand into the Western United States. This assessment also attempts to estimate the impact of these organisms if introduced into the Western United States.

The purpose of this risk assessment is to

- Identify exotic insect and disease organisms that may be introduced with imported logs from New Zealand.

- Assess the potential of introduction and establishment by introduced organisms.

- Assess the potential impacts of the organisms if they should become established.

This risk assessment is based upon the implementation of mitigation practices as proposed by New Zealand Ministry of Forestry and as described in chapter 3.

Background

The U.S. Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) is the government agency charged with preventing the introduction of exotic pests on plant material brought into the United States via international commerce. APHIS also has the responsibility to detect and, when feasible, eradicate exotic pests should they become introduced.

When a request is made to import a plant commodity, APHIS conducts a risk assessment to identify potential exotic pest problems. This information is used to decide whether to authorize importation of a commodity that may have adverse impacts in the United States. Mitigation procedures may be required to allow safe passage of imported materials.

APHIS requested the USDA Forest Service to prepare a pest risk assessment relative to importation of *Pinus radiata* and *Pseudotsuga menziesii* logs from New Zealand. Responding to this request, the Forest Service formed a pest risk assessment team to assess the risks posed by exotic pests that might be introduced from New Zealand. The Pest Risk Assessment Team produced this report, which looks at the significance of such exotic pest introductions.

As of this writing, the USDA has no specific timber import regulations and no permits are required for importation. To date, only small volumes of logs have been imported from New Zealand. These shipments were inspected at the port-of-entry and, if pests were found, mitigating measures were applied before the logs were released. However, U.S. timber companies are now proposing to import larger quantities of New Zealand saw and veneer logs. Therefore, it is necessary to identify potential pest risks to determine whether Federal regulations are required and, if so, what the provisions of such regulations should be. Three separate log shipments have been imported into the United States from New Zealand. Detailed descriptions of two of these shipments are presented in appendix C. The first shipment was not treated with methyl bromide (the proposed New Zealand fumigation treatment) and the second shipment was treated with methyl bromide before it left New Zealand.

First shipment: no methyl bromide treatment. The Motor Vessel (M.V.) *Washington Star* arrived in Seattle, WA, in December 1991 and discharged one package of *Pinus radiata* logs. The ship then traveled to San Francisco, CA, and discharged the remaining logs by December 30, 1991. All of the logs had been machine debarked, inspected for injurious pests, sprayed with fungicide and insecticide, and washed free of soil in New Zealand. This shipment was not fumigated. Upon arrival in Seattle, the logs were inspected by APHIS personnel, who found a live scolytid larva, probably *Hylurgus ligniperda,* under a patch of bark. They also sampled decayed wood and isolated an unidentified basidiomycete. This basidiomycete has still not been identified, but comparisons with known isolates of *Armillaria limonea, A. novae-zelandiae, Amylostereum areolatum, A. sacratum*, and *Ganoderma mastoporum* did not show compatibility. Logs in San Francisco were inspected by APHIS and California Department of Food and Agriculture personnel. More than 10 live scolytid larvae, probably *H. ligniperda* or *Hylastes ater,* were found. Isolations from wood samples identified *Sphaeropsis sapinea (=Diplodia pinea), Ophiostoma pilifera, O. picea, and Leptographium procerum*, as well as a number of typical aerial contaminants (*Trichoderma, Penicillium*). These logs were fumigated at the port of entry in January 1992 and released in June 1992.

Second shipment: methyl bromide treatment. The second shipment of *P. radiata* logs arrived in Sacramento, CA, on M.V. *Balayan* on January 28, 1992. Several mitigation practices had been applied in New Zealand. The logs had been visually inspected four times for pests. Logs with fluted ends were removed. The export logs were machine debarked, hand cleaned of bark patches, sprayed with fungicide and insecticide, and fumigated in the ship's hold with methyl bromide at 80 g/m^3 for 24 hours at 18 °C. The logs were examined upon arrival by the California Department of Food and Agriculture (CDFA). Samples were removed from stained areas and isolations performed. *Sphaeropsis sapinea* was recovered. No other pest organisms were identified on this shipment. The logs were released on March 3, 1992, and were processed at mills in Marysville, Oroville, and Eureka, CA, and monitored by CDFA and California Department of Forestry and Fire Protection (CDF) personnel at the sawmill. Examination of the sawn logs found only blue-stained wood, caused by *S. sapinea*. No other damage was noted (see CDF memos, appendix C).

Characteristics of proposed importation

The New Zealand government and private companies are interested in exporting logs as part of the general trade policy of New Zealand. Wood and wood products capture a significant share of New Zealand's volume of export trade. The supply of growing stock on plantation forests is increasing and will continue to increase over the next 15 years. While local consumption will rise slightly, New Zealand expects international exports of wood and wood products to increase sixfold over the next 25 years. New Zealand industry experts expect the export of logs to the United States may reach 17 million cubic feet a year and remain at that rate through the turn of the century (Tasman Forestry, Ltd., undated; W. McCallum personal communication) (appendix E).

New Zealand grows quality timber by selectively pruning and thinning plantation forests to ensure clear (knot free), maximum-diameter growth. The pruned butt logs yield lumber in long lengths and wide dimensions, while logs above the pruned log are ideal for shop-grade lumber. In contrast to species like Douglas-fir, *P. radiata* has only a small difference between the densities of early and late wood rings. Thus, quickly grown *P. radiata* with its wide rings has the same characteristics as slowly grown wood. This even texture means that *P. radiata* has excellent finishing properties and is easy to stain and paint. Similar properties are noted in ponderosa pine and sugar pine, both grown commercially in the United States.

Douglas-fir grown in New Zealand offers the same product features as second-rotation logs grown in the United States, even though grown in plantations under shorter rotation regimes. The principle use is as framing timber because of its structural strength.

Resources at risk

The forests of the Western United States are part of a broad band of vegetation that extends around the Northern Hemisphere in the mid to upper latitudes. These forests have enormous economic, esthetic, recreational, wildlife, and watershed value, not only to the region, but far beyond its borders. The coast ranges and the west slopes of the Cascade Range have some of the highest quality stands of large sawtimber in the world. The east slopes of the Cascades and the lower slopes and benches of the interior mountains are covered by open pine forests and juniper. White fir and Douglas-fir associations and mixed conifer (pine, fir, cedar, Douglas-fir, and larch) forests are found on the interior mountains above the pine zone and on north slopes. Grasslands and desert shrubs extend into the forest in the basins, uplands, and plains areas. Native conifer species found in the Western United States are listed below.

Common names	Scientific names
Douglas-fir	*Pseudotsuga menziesii*
western redcedar	*Thuja plicata*
western hemlock	*Tsuga heterophylla*
Sitka spruce	*Picea sitchensis*
sugar pine	*Pinus lambertiana*
ponderosa pine	*P. ponderosa*
western white pine	*P. monticola*
noble fir	*Abies procera*
Pacific silver fir	*A. amabilis*
grand fir	*A. grandis*
white fir	*A. concolor*
incense-cedar	*Libocedrus decurrens*
Port-Orford-cedar	*Chamaecyparis lawsoniana*
western larch	*Larix occidentalis*
coast redwood	*Sequoia sempervirens*

Timber resources of Alaska and the Eastern United States will probably not be at immediate risk from pests that may be imported from New Zealand. The Pest Risk Assessment Team has chosen to concentrate on the forest resources of the Western United States because of the value of these resources and because of proposed shipments to Western ports. However, the analysis and conclusions are applicable to the entire United States.

Biological considerations

New Zealand forests. New Zealand has a total land area of 65 million acres; of these, 18 million acres (27.6%) are forested, 15 million acres are in indigenous natural forest and 3 million acres are under commercial forest plantations. A large proportion of the forest species are endemic to New Zealand and belong to genera from the Araucariaceae (e.g., *Agathis*), Podocarpaceae (e.g., *Podocarpus, Dacrydium*) and Fagaceae (e.g., *Nothofagus*). The indigenous forests are generally not available for commercial timber production.

Plantation forestry in New Zealand dates back to the beginning of the present century when it was decided that plantations should be established to provide a sustainable source of wood to replace the dwindling supply from the indigenous forests. In a search for suitable plantation species, a large number of exotic softwood and hardwood species, mainly from the Northern Hemisphere, were planted in various parts of the country. Species belonging to *Abies, Acacia, Castanea, Chamaecyparis, Cupressus, Eucalyptus, Larix, Picea, Pinus, Populus, Quercus, Sequoia, Thuja,* and *Tsuga* were included in these trial plantations. Based on these trials, *Pinus radiata* was chosen as a major plantation species; however, planting of other species continued on a much smaller scale. Exotic forest trees of New Zealand, based on Weston (1957), are listed in appendix G. Trees belonging to these species have grown in New Zealand for at least 50 years. The present species composition of the commercial forest plantation estate is *Pinus radiata* (89%), Douglas-fir (5%), other softwoods (4%), and hardwoods (3%) (New Zealand Ministry of Forestry 1991a). In addition, many exotic softwood and hardwood species are extensively planted as ornamentals.

Pest and disease organisms in New Zealand forest plantations. The organisms that cause damage to New Zealand's commercial plantations can be divided into three groups for the purposes of this report:

1. Organisms endemic to New Zealand, normally living on indigenous hosts but capable of attacking introduced tree species (e.g., *Armillaria* spp., *Pseudocoremia suavis*)

2. Organisms introduced into New Zealand from locations other than the United States that are not present in the United States (e.g., *Sirex noctilio*)

3. Organisms introduced into New Zealand that occur in the United States on hosts indigenous to the United States (e.g., *Dothistroma pini*).

   (Note: Organisms placed in groups 2 and 3 were determined as having been introduced because they are found on exotic hosts only and not on indigenous species.)

Organisms in groups 1 and 2 are considered most likely to be injurious if introduced into the United States. The possibility that organisms in group 3 may be genetically different from those of the same species in the United States has been raised, but very little information is available on the subject. New Zealand forest pathologists contend that New Zealand populations of species in this group are most likely to be small samples from the much larger and more variable United States populations of the organisms.

All New Zealand plantations are inspected (and have been since 1956) by Forest Health Officers of the Ministry of Forestry for signs of ill health. Every plantation is inspected from the air at least once a year and a ground inspection is also carried out. The work of the Forest Health Officers is supported by forest pathologists and entomologists at the New Zealand Forest Research Institute. Significant mortality in the past has been related to overstocking, poor management activities, and adverse environmental conditions. Most of the plantations are now being managed intensively to meet market demands and are in a healthy condition. The major disease of concern, Dothistroma needle blight (*Dothistroma pini*), is managed through a combination of aerial fungicidal spraying and silvicultural measures.

Climate in New Zealand. The main islands of New Zealand extend for about 1,000 miles, from approximately 34°S to 47°S latitude. Over this length, the climate varies from subtropical to cool temperate. There is sufficient and generally well-developed rainfall throughout the year. The eastern parts of both islands are usually drier than the western parts, but the contrast is more marked in the South Island. In the North Island, the average rainfall is 52 inches; In the South Island, the rainfall exceeds 100 inches annually west of the dividing range and varies from 25 inches in the north to 45 inches in the south on the eastern side of the range. Mean temperatures and annual mean rainfalls for selected towns near forested areas are given below:

		Mean daily temperature (°F)		
Locality	Latitude	Max.	Min.	Annual rainfall (in inches)
North Island				
Kaitaia	35°S	69.3	51.2	50.2
Auckland	37.5°S	64.8	53.1	49.8
Rotorua	38°S	64.9	45.3	55.2
Napier	39.5°S	64.4	48.8	32.2
Wanganui	40°S	63.3	49.1	36.1
Wellington	41.5°S	59.8	48.3	42.9
South Island				
Blenheim	41.5°S	65.4	44.4	24.6
Hokitika	43°S	59.7	45.5	114.3
Christchurch	44°S	60.8	44.1	25.5
Dunedin	46°S	58.9	44.0	36.9
Invercargill	47°S	58.4	41.9	45.2

Similarities with the Western United States. The following list shows many of the tree species of the Western United States that grow as exotics in New Zealand.

Common names	Scientific names
white fir	*Abies concolor*
grand fir	*A. grandis*
noble fir	*A. procera*
Port-Orford cedar	*Chamaecyparis lawsoniana*
Monterey cypress	*Cupressus macrocarpa*
western larch	*Larix occidentalis*
Engelmann spruce	*Picea engelmannii*
Sitka spruce	*P. sitchensis*
knobcone pine	*Pinus attenuata*
lodgepole pine	*P. contorta*
Jeffrey pine	*P. jeffreyi*
sugar pine	*P. lambertiana*
western white pine	*P. monticola*
bishop pine	*P. muricata*
ponderosa pine	*P. ponderosa*
Monterrey pine	*P. radiata*
black cottonwood	*Populus trichocarpa*
Douglas-fir	*Pseudotsuga menziesii*
redwood	*Sequoia sempervirens*
giant sequoia	*Sequoiadendron giganteum*
western redcedar	*Thuja plicata*
western hemlock	*Tsuga heterophylla*

All of these species have been exposed for many years to the pests and pathogens present in New Zealand under climatic conditions very similar to the coastal and lower elevation west-side conditions in the Pacific Northwest. The behavior of pests and pathogens in New Zealand should therefore provide a guide to their behavior in these areas. Further inland and south in the Western United States, conditions are warmer and drier, and it is difficult to predict the pests' behavior under these conditions.

Chapter 2. Assessment of Organisms Posing Risk

Introduction

To assess the scope and magnitude of any potential risk and its impact, an understanding of the problem of pest introduction and establishment is critical. The probability of pest introduction is determined by several related factors: 1) the likelihood of a pest traveling with and surviving on a shipment from the place of origin, 2) the likelihood of colonizing suitable hosts at the point of entry, and 3) the likelihood of subsequently spreading to adjacent territories. The probability of introduction and establishment of exotic pests depends, in large part, on the quantity and quality of logs imported and the efficacy of mitigation measures.

Many insects and pathogens could be introduced on logs into the Western United States from New Zealand. However, because it was not practical to analyze all of them in detail, some form of selection was inevitable. Selection was based on the likelihood of the pest being on or in logs, the possibility of them escaping prescribed mitigation measures, and their potential high risk to Western U.S. resources.

The Pest Risk Assessment Team was responsible for compiling and assessing pertinent data. The following discussion summarizes the analysis process used by the team. This process was developed using the recommended methodology prepared by APHIS and presented in the Siberian larch importation evaluation (USDA Forest Service 1991).

Analysis process

Information was collected about the logs that were to be imported. This included species, origin, quantity, harvesting and shipping practices, destinations, and information on potential pests that may be associated with these logs.

From the literature and from information provided by the New Zealand Forest Research Institute from its forest health databases, lists were compiled of insects and microorganisms that have been recorded from *Pinus radiata* and Douglas-fir in New Zealand (appendix A, tables A1, A2, A3). These organisms were categorized using the characteristics shown in table 2-1. Organisms in categories 1 and 2 were considered further. Some organisms in category 3 were also considered further when there were questions about strains not native to the United States.

In appendix B the pest risk assessment forms give a brief outline of the pests that were screened as potential problems. This was included to show that pests, other than the seven analyzed in detail, were considered. The form does not follow the APHIS risk assessment process as does the form for pests that were analyzed in the body of the text. Therefore, the appendix forms were added for the convenience of the reader and to document the pests that were considered in the screening process.

The insect list presented in tables A2 and A3 notes all of the recorded insect recoveries from *P. radiata* and Douglas-fir. This list was screened for insects that are found in the bark, cambium, or wood (table 2-2). It includes 16 insect species, 5 of which are analyzed in detail; 11 of the insect species from table 2-2 were eliminated from detailed analysis for the following reasons:

- Mitigation measures, including fumigation, would eliminate the bark and cambium insects, and insects that bore a short distance into the wood.

- The insects attack branches, which would be removed in the logging process.

- Their life history is such that they only attack deadwood or wood products after processing.

- The insect is already found in the United States.

The objective was to examine in detail insects found deep in the wood that may pose a chance of escaping mitigation measures.

Microorganisms that are or could be pathogens in U.S. hosts were evaluated (table 2-3). Questions about pathogenic fungi not found in the Western United States or about strains not native to the United States were assessed using the Pest Risk Assessment Form (figure 2-1) to determine overall risk (appendix B). The team identified two fungi *(Amylostereum areolatum* and *Leptographium truncatum)* to analyze in detail in the individual organism assessment section of this chapter.

Review

The draft report was reviewed by an appropriate group of scientists and specialists from universities, and Federal and State agencies (appendix I). These reviewers had the opportunity to comment on all aspects of the report (appendix J).

The following pests are analyzed in this chapter.

Kalotermes brouni
Leptographium truncatum
Platypus apicalis and Platypus gracilis
Prionoplus reticularis
Sirex noctilio/Amylostereum areolatum

Table 2-1. *Categories of pests*

Category	Pest characteristics	Place on list
1	Organisms endemic to New Zealand, normally living on indigenous hosts, but capable of attacking introduced tree species (e.g., *Armillaria* spp., *Pseudocoremia suavis*).	Yes
2	Organisms introduced into New Zealand from locations other than the United States that are not present in the United States (e.g., *Sirex noctilio*)	Yes
3	Organisms introduced into New Zealand that occur in the United States on hosts indigenous to the United States (e.g., *Dothistroma pini*)	No

Table 2-2. *Summary of Possible Quarantine Insects Associated with Imported Logs from New Zealand*

Species	NZ Host		Other Hosts	Location		Category[1]	Estimated risk without mitigation[2]
	PR	DF		Cambium and bark	Wood		
Cerambycidae							
Arhopalus tristis	*		Norway spruce	*	*	2	M
Prionoplus reticularis	*	*	softwood		*	1	M
Stenopotes pallidus	*	*	softwoods	*		1	L
Navomorpha lineata	*	*	wide range		* branches	1	L
Hexatricha pulverulenta	*	*	softwoods/hardwoods	*		1	M
Platypodidae							
Platypus gracilis	*	*	softwoods/hardwoods		*	1	M
Platypus apicalis	*	*	hardwoods/softwoods		*	1	M
Curculionidae							
Mitrastethus baridioides	*		*Pinus* spp.		*	1	L
Psepholax spp.	*	*	softwoods		*	1	L
Torostoma apicale	*	*	wide range of hosts		*	1	L
Kalotermitidae							
Kalotermes brouni	*		softwoods/hardwoods		*	1	M
Termopsidae							
Stolotermes ruficeps, etc.	*	*	many hosts		* branch stub	1	L
Scolytidae							
Hylastes ater	*	*	*Pinus, Larix, Picea*	*		2	H
Hylurgus ligniperda	*	*	*Pinus*	*		2	H
Pachycotes peregrinus	*		softwoods		*	1	M
Siricidae							
Sirex noctilio	*		*Pinus* spp.		*	2	H

1 see Table 2-1 in chapter 2 for a description of categories
2 H = high, M = moderate, L = low

Table 2-3. *Summary of Possible Quarantine Microorganisms Associated with Imported Logs from New Zealand*

Species	NZ host		Location					Found in U.S.	Category[1]	Estimated risk without mitigation[2]
	PR	DF	Foliage	Branches	Bark	Sapwood	Heartwood			
Amylostereum areolatum	*					*	*		2	H
Armillaria limonea	*	*				*	*		1	M
Armillaria novae-zelandiae	*	*				*	*		1	M
Biatorella resinae	*	*						*	3	L
Ceratocystis novae-zelandiae	*	*				*			1	L
Cyclaneusma minus	*		*					*	3	L
Dasyscypha caliciformis	*			*	*	*		*	3	L
Diplodia pinea	*	*	*	*	*	*		*	3	M
Dothistroma pini	*		*					*[3]	3	L
Fusarium moniliforme var. *subglutinans*	*			*	*	*		*	3	L
Ganoderma applanatum	*					*	*	*	3	L
Ganoderma mastoporum	*					*	*		1	L
Ischnoderma rosulata	*					*	*		1	L
Junghuhnia vincta	*					*	*	*	3	L
Leptographium procerum	*					*		*	3	L
Leptographium truncatum	*	*				*		*[3]	2	M
Lophodermium pinastri	*		*					*	3	L
Melampsora larici-populina	*		*					*	3[4]	M
Nectria cinnabarina	*			*	*	*		*	3	L
Ophiostoma huntii	*					*		*	3	L
Ophiostoma ips	*					*		*	3	L
Ophiostoma piceae	*	*				*		*	3	L
Ophiostoma pilifera	*					*	*	*	3	L
Peniophora sacrata	*	*							1	L
Phaeocryptopus gaumannii		*	*					*	3	L
Phomopsis pseudotsugae	*	*		*	*	*		*	3	L
Pseudomonas sp.	*			*				*	3	L
Rhizosphaera kalkhoffi		*						*	3	L
Sclerophoma pithyophila	*	*						*	3	L
Stereum sanguinolentum	*	*				*		*	3	L

1 See Table 2-1 in chapter 2 for a description of categories
2 H = high, M = moderate, L = low
3 Questions about genetic variability or taxonomic identification
4 Recently discovered in Washington

Figure 2-1. *Pest Risk Assessment Form*

Scientific name of host(s): ....

Distribution: ....

Summary of natural history and basic biology of the pest:

....

Specific information relating to risk elements:

A. Probability of pest establishment..........
   1. Pest with host at origin: ....
   2. Entry potential: ....
   3. Colonization potential: ....
   4. Spread potential: ....
   5. Control options: ....

B. Consequences of establishment..........
   6. Economic damage potential: ....
   7. Environmental damage potential: ....
   8. Perceived damage (Social and political influences): ....

Estimated risk for pest: ....

Additional remarks: ....

Selected bibliography:

Summary of specific pest risk assessments

Each pest was evaluated to determine its risk to U.S. forest resources (figure 2-1). The assessments incorporate the risk elements discussed below. The probability of establishment is a function of the likelihood of the pest being in or on the logs, their potential for entry into U.S. ports, their potential for transmission and survival on U.S. hosts, and their potential for spread. Any of these potentials can be modified by mitigation measures. The consequence of establishment is the sum of monetary and non-monetary economic and environmental damage, plus other political or social influences.

Risk elements are underscored in the following list. The goal statements below each risk element asking for actual probability or impact are not attainable. Their function is to direct the known pest information into the risk assessment process. The estimated risk for a pest is an overall assessment based on known biological and technical information for each organism.

A. Probability of pest establishment

1. Pest with host at origin - risk potential

   - Determine probability of pest being on, with, or in the imported plant commodity at the time of exportation.

   - Determine if the pest shows a convincing temporal and spatial association with the imported commodity?

2. Entry potential - risk potential

   - Determine probability of pest surviving in transit.

   - Determine probability of pest being detected at port of entry under present quarantine procedures.

   Examine the following characteristics: the pest's hitchhiking ability in commerce, ability to survive during transit, stage of life cycle during transit, and number of pest individuals expected on the imported commodity.

3. Colonization potential - risk potential

   - Determine probability of pest coming in contact with an adequate food resource.

   - Determine probability of the pest coming in contact with appreciable environmental resistance.

   - Determine probability of pest to reproduce in the new environment.

Characteristics of this element include: the pest coming in contact with an adequate food resource, encountering appreciable environmental resistance, and ability to reproduce in the new environment.

4. Spread potential - risk potential

   - Determine the probability of a pest spreading beyond the colonized area.

   - Estimate the range of probable spread.

Characteristics of this element include: ability for natural dispersal, ability to use human activity for dispersal, ability to readily develop races or strains, and the estimated range of probable spread.

B. Consequences of establishment

5. Economic damage potential - risk potential

   - Determine economic impact if pest becomes established, including the cost of living with the pest.

Characteristics of this element include: economic importance of hosts, crop loss, effects to subsidiary industries, exports, control costs, and efficacy.

6. Environmental damage potential - risk potential

   - Determine environmental impacts if pest becomes established.

Characteristics of this element include: ecosystem destabilization, reduction in biodiversity, reduction or elimination of keystone species, reduction or elimination of endangered or threatened species, and effects of control measures.

7. Perceived damage (social and political influences) - risk potential

   - Determine impacts from social and/or political influences. Quality and amount of uncertainty should also be addressed.

Characteristics of this element include: esthetic damage, consumer concerns, and political repercussions.

Estimated risk for pest

The overall risk for each of the pests was estimated based on the assessment and the implementation of required mitigation measures. The level of risk also incorporated the perceived consequences of the establishment of each organism in the United States. These are qualitative and subjective estimates based on the best information available. The seven risk values were combined into a final pest risk potential, which represents the overall risk of the pest (Orr and Cohen 1991).

Risk assessments of specific organisms

Scientific name of pest: *Kalotermes brouni* Froggatt (Kalotermitidae) ✓

Other name: New Zealand drywood termite

Scientific name of host(s): Hardwoods and softwoods

Distribution: New Zealand

Summary of natural history and basic biology of the pest: Nests of this drywood termite are found in dead, but sound wood (Milligan 1984). Dead trees and logs can be suitable for nest establishment. Nests have also been recorded in living *Pinus radiata* heartwood (Zondag 1959). These pests can use dry, suppressed or broken branches that have been previously infested by longhorn beetles to gain entry into the tree. The success of drywood termites in living trees depends on dead branch stubs remaining so dry that they are not rapidly broken down by rot fungi. In conifers, resin reactions of living sapwood can effectively deter this termite. The adults swarm in late summer or autumn and the span of the various life stages is unknown. The development of a new colony is a slow process, however. When colonies are found, they are normally in the heartwood of old trees. The practices of pruning branches at 5 to 7 years of age and the extensive use of young *P. radiata* trees (28 to 32 years of age) for logs would make this termite an unlikely pest.

Specific information relating to risk elements:

A. Probability of pest establishment

1. **Pest with host at origin:** ***Low***
   The termites are rarely found in plantation-grown *Pinus radiata*. The galleries are loosely packed with frass so that the required methyl bromide treatment in New Zealand would effectively control any colonies.

2. **Entry potential:** ***Moderate***
   The insects are located deep in the wood, so visual inspection would fail to detect infested logs.

3. **Colonization potential:** ***Low***
   The beginning of a colony is a slow process, but dead trees or logs may be available for infestation near ports or mills. The adults fly only for several hundred feet, so the spread is slow when compared to other insects.

4. **Spread potential:** ***Moderate***
   Termites, including drywood termites, spread slowly (50 to 1,000 feet per year) because they are poor flyers and only about 1 percent of those that fly eventually establish a new colony. People would spread them more rapidly by physically moving infested wood.

B. Consequences of establishment

5. **Economic damage potential: *Low***
This termite will attack untreated wood. The damage can be serious if conditions are damp, with poor ventilation or water leaks, and even the presence of small nests can cause structural weakness. The damage is difficult to detect and could go undetected for long periods of time. In personal communication, Peter Gadgil (Leader of the Forest Health Unit at the Forest Research Institute, Rotorua, NZ), states that "even in this country of wooden houses, such reports of infestations by drywood termites are rare." Termite damage in New Zealand often is associated with house borer beetles. If this termite became established in the United States, estimated losses would be from $75,000 to $500,000 per year (see chapter 5, Evaluation of Economic Effects). If introduced into the United States, this termite would be added to the 43 species already found here.

6. **Environmental damage potential: *Low***
K. brouni would not cause large outbreaks or kill trees. It would compete with native pests that degrade and decompose.

7. **Perceived damage (social and political influences): *Low***
This pest would not cause aesthetic damage in the forest. Damage to wood in use could cause consumer concerns, adding to concerns about other termite species. Controls for termites are available but can be expensive.

Estimated risk for pest: *Low*

Selected bibliography:

Bain, J; Jenkin, M.J., 1983. *Kalotermes banksiae, Glyptotermes brevicornis* and other termites (Isoptera) in New Zealand. New Zealand Entomologist 7: 365-71.

Kelsey, J.M., 1944. The identification of termites in New Zealand. New Zealand Journal of Science and Technology 25B: 231-60.

Kelsey, J.M., 1946. Insects attacking milled timber, poles and posts in New Zealand. New Zealand Journal of Science and Technology 28B: 65-100.

Milligan, R.H. 1984. New Zealand drywood termite. New Zealand Forest Service Forestry Research Institute Forest Pest Leaflet 59.

Zondag, R., 1959. Attack by *Calotermes brouni* Frogg. on living *Pinus radiata*. New Zealand Entomologist 2: 15-17.

Scientific name of pest: *Leptographium truncatum* (Wingf. & Marasas) Wingf.

Scientific name of host(s): *Pinus radiata, P. strobus, P. taeda*

Distribution: New Zealand, South Africa, Canada

√

Summary of natural history and basic biology of the pest: *Leptographium truncatum* is a reported pathogen of *Pinus radiata* and *P. strobus* in New Zealand (Wingfield and Marasas 1983). Inoculation tests and observations indicate that it is not highly pathogenic and may be opportunistic (Wingfield *et al.* 1988). This fungus has not been reported in the United States, but it has been reported on roots of dying red pine *(P. resinosa)* in Ontario, Canada (Harrington 1988). Recent information strongly suggests that this fungus is conspecific with *L. lundbergii* Lagerb. and Melin (Wingfield and Gibbs 1991). These authors suggest that *L. lundbergii* occurs throughout the boreal region and may be present in the United States.

This fungus is probably vectored by insects in the family Scolytidae. It has been isolated from *Hylastes ater* and *Hylurgus ligniperda* (Wingfield *et al.* 1988). These insects primarily attack injured or stressed trees.

Leptographium truncatum has been found infrequently on *P. radiata*, primarily along roadsides and on moist sites (Wingfield *et al.* 1988). This fungus differs from *L. wageneri*, which causes black stain root disease in the United States, by invading both tracheids and rays. It did not cause seedling mortality in inoculation studies.

Specific information relating to risk elements:

A. Probability of pest establishment

1. **Pest with host at origin:** ***Low***
   Leptographium truncatum has been infrequently identified on stressed and weakened trees of *Pinus radiata* and eastern white pine (*P. strobus*) in New Zealand. *Leptographium lundbergii* is a common blue-stain fungus found in *Pinus* and *Picea* (Harrington 1988). Vectors have not been clearly identified, but these fungi are usually carried by bark beetles and possibly other insects found in beetle galleries (Harrington 1988). *Leptographium truncatum* has been isolated from *Hylastes ater* and *Hylurgus ligniperda* in New Zealand (Wingfield *et al.* 1988).

   There are no known effective control methods for this fungus in logs. The T312 fumigation schedule (USDA APHIS 1991) may be effective because these fungi are somewhat related to the oak wilt fungus, *Ceratocystis fagacearum* (Bretz) Hunt. Effectiveness of this treatment against *L. truncatum* should be evaluated, however. Complete bark removal would reduce the risk of transport of likely vectors, thereby reducing the opportunity for spread upon arrival in the United States. The lack of bark would also reduce the probability of potential native insect vectors attacking the logs and transmitting the fungus.

2. **Entry potential:** ***High***
   Entry potential is high. This group of fungi survives well in logs (more than a year with favorable temperatures and moisture regimes). It would be favored by the conditions expected to prevail during transport of the logs. Bark removal would not prevent survival in transit, and, in fact, mitigation would require a type of treatment that would kill hyphae occupying the entire sapwood cylinder of the logs. The likelihood of spores being produced in or on untreated colonized logs once they have been delivered to ports is extremely high.

3. **Colonization potential:** ***Moderate***
   The probability of coming into contact with a North American host is high. The proximity of *Pinus radiata* to West Coast ports makes contact likely if vectors are present. The comparable climates of New Zealand and the Western United States, suggest that environmental conditions would be conducive to colonization by the fungus. Similar species of *Leptographium* present in the United States suggest that some of their vectors could function to transport *L. truncatum*. These potential vectors native to the United States could be more efficient at spreading the fungus.
4. **Spread potential:** ***High***
   If established, this fungus has great potential to spread. Fungi associated with insect vectors are not limited in their spread by their own growth rates. Rather, the distances traveled by their insect associates are the critical factors. Bark beetles are capable of flying distances of several miles and can be carried even further by winds. Some of these insects have two or more generations per year, so it is possible that there could be two or more increments of vector spread annually. Also, spread of the fungus and associated insects can be increased substantially by human transport of harvested logs and firewood.

B. Consequences of establishment

5. **Economic damage potential:** ***Moderate***
   Introduction of *Leptographium truncatum* might expose *P. radiata* to a new root disease in the United States. This would cause increased tree mortality in the native stands, ornamental plantings, and Christmas tree plantations. Most damage would be to weakened or damaged trees. It is possible that scolytids native to the United States could function as vectors if the New Zealand vectors are not transported. Other western pine hosts are not known, but are likely. Introduction to these other possible hosts could result in increased tree mortality in commercial forests. Loblolly pine *(Pinus taeda)* and eastern white pine *(P. strobus)* have been identified as hosts of *L. truncatum*. Exposure of these species in the Eastern United States could result in increased tree mortality in commercial forests and Christmas tree plantations. Mortality of ornamental plantings would require tree removals and the associated costs in an urban environment. The greatest loss would be in the native stands of *P. radiata*.

6. **Environmental damage potential:** ***Moderate***
   Environmental damage associated with the introduction of *Leptographium truncatum* would depend on the number of new hosts that occur. The effect on the native *Pinus radiata* stands could be dramatic. Loss of cover could result in species shifts in the remaining acres of *P. radiata*.

7. **Perceived damage (social and political influences):** ***High***
   Increased mortality in the native *Pinus radiata* stands would have highly significant social and political impacts because of the large population centers associated with these areas, the high environmental regard for them, and their limited distribution. Losses of even small amounts of this limited resource would probably be considered intolerable with the resulting political implications. Damage

by *Leptographium truncatum* appears to be associated with stress situations which includes offsite plantings.

Estimated risk for pest: ***Moderate***

Additional remarks: The lack of documented effective mitigation measures suggests that *Leptographium truncatum* would eventually enter the United States. Subsequent colonization is probable. Damage caused by colonization of *L. truncatum* is unknown. The taxonomy of this group of fungi is sufficiently uncertain that an evaluation of the relationship between New Zealand's *L. truncatum* and *L. lundbergii* should be done. The pathogenicity of *L. truncatum* on other *Pinus* species that are probable hosts should be evaluated to estimate the damage that might be expected.

Selected bibliography:

Harrington, T.C. 1988. *Leptographium* species, their distributions, hosts, and insect vectors. In: Cobb, F.W. Jr., Harrington, T.C. eds. Leptographium root diseases of conifers. St. Paul, MN: American Phytopathological Society Press: 1-40.

U.S. Department of Agriculture, Animal and Plant Health Inspection Service. 1991. An efficacy review of control measures for potential pests of imported soviet timber. Misc. Pub. No. 1496. Washington, D.C. 28 p.

Wingfield, M.J., and Gibbs, J.N. 1991. *Leptographium* and *Graphium* species associated with pine-infesting bark beetles in England. Mycology Research 95: 1257-1260.

Wingfield, M.J.; Marasas, W.F.O. 1983. Some *Verticicladiella* species, including *V. truncata* sp. nov., associated with root diseases of pine in New Zealand and South Africa. Transactions of the British Mycology Society 80: 231-236.

Wingfield, M.J.; Capretti, P.; MacKenzie, M. 1988. *Leptographium* spp. as root pathogens of conifers, an international perspective. In: Cobb, F.W., Harrington, T.C., Jr., eds. *Leptographium* root diseases of conifers. St. Paul, MN: American Phytopathological Society Press. p.113-128.

Scientific name of pests: *Platypus apicalis* White and *Platypus gracilis* Broun (Platypodidae) ✓

Other name: Native pinhole borers

Scientific name of host(s): A wide range of hardwoods and softwoods, including *Pinus radiata* and *Pseudotsuga menziesii*. Attack on living *Nothofagus* can kill the trees.

Distribution: New Zealand

Summary of natural history and basic biology of the pests: These two beetles are mainly pests of native beeches (*Nothofagus*) in New Zealand (Milligan 1972, 1979). The damage, as their common names suggests, causes pinholes throughout the log. Apparently, they can complete a life cycle in felled *Pinus radiata* and Douglas-fir as well as stumps, logs, and branches in a moist environment. The beetles also attack rapidly growing eucalypts, but do not breed in them.

The beetles emerge during the warmer months, although some may emerge on warm winter days. The beetles are attracted to dying or freshly felled trees, an aggregating male attractant, and an attractant given off by rapidly growing eucalypts. Most of the early attacks are abortive, but a pathogenic fungus may survive in the process. *Sporothrix* sp., a blue stain fungus, has been isolated from beech trees that were infested by these beetles in New Zealand. The beetles' life cycle is 2 to 4 years.

Specific information relating to risk elements:

A. Probability of pest establishment

1. **Pest with host at origin:** ***Low***

   These beetles occur on *Pinus radiata* and Douglas-fir.

   In an efficacy review of the control measures for potential pests of imported Soviet timber (USDA APHIS 1991), shot-hole borers (Platypodidae) were effectively eliminated from the logs treated with methyl bromide. These beetles keep their galleries relatively free of boring dust so methyl bromide could penetrate the log to kill them. The proposed mitigating dosage is higher when used in New Zealand than the dose reported in the reference cited above.

2. **Entry potential:** ***High***

   The life cycle of these pinhole borers is2 years. All of the life stages could be present during shipment and they would have a good chance of surviving shipment. The attacks tend to be concentrated, so an infested log would have a high number of individuals.

3. **Colonization potential:** ***High***

   If these pests escape methyl bromide fumigation, the colonization potential would be high. This is based upon the wide range of hosts the beetles attack, the availability of the hosts at the port of entry, and the strong flight characteristics of the beetles. They would have a higher potential of establishment in moist climates along the coasts of northern California, Oregon, and Washington.

4. **Spread potential:** ***High***

   These beetles are good flyers, and they could spread 5 miles per year. In addition, they can be spread by the transport of infested logs and other dead wood materials. Because of the high number of host species, the beetles would probably find a suitable host within their flight capabilities, and their estimated spread potential is therefore high.

B. Consequences of establishment

5. Economic damage potential: ***Low***

These pests cause damage by the pinhole fungus-stained galleries they create. Attacks that are aborted also mar the wood, which decreases product value. In pulpwood, it would increase the pulping costs because of the gum pockets. In the economic analysis in this report, the estimated range of losses (present net value) would be from about $3 million to $119 million over 30 years. This value was calculated assuming no competition from other pinhole borers. In reality, the beetles will compete with other species, so the estimated loss will be lower than the calculated figure.

6. Environmental damage potential: ***Low***

These pests are mainly wood degraders that attack felled trees and logs. Because they are not known as tree killers, except of native beeches in New Zealand (*Nothofagus* spp.), they probably would not cause any environmental damage besides degrading wood products. The damage is estimated to be low.

7. Perceived damage (social and political influences): ***Low***

Because these pests degrade wood products, damage is not obvious to the public in a forest situation. The products with damage could be culled or marketed as unique products. For these reasons the perceived damage is estimated to be low.

Estimated risk for pest: ***Low.*** The risk for these pests is low because of the high effectiveness of methyl bromide against Platypodidae, the estimated low economic and environmental damage potential, and the estimated low perceived damage by the public.

Selected bibliography:

Coates, D., 1972. Defects in living silver beech caused by *Platypus and Psepholax*. New Zealand Forest Service Forest Research Institute Forest Entomology Report No. 32 (unpublished). Wellington, NZ.

Faulds, W., 1973. Discolouration associated with *Platypus* wounds in living *Nothofagus fusca*. New Zealand Journal of Forestry Science 3: 331-41.

Holloway, W.A., 1973. A study of *Platypus caviceps* in felled hard beech. New Zealand Forest Service Forest Research Institute Forest Entomology Report No. 39 (unpublished). Wellington, NZ.

Kershaw, D.J., 1969. The incidence of *Platypus* species in living silver beech at Rowallan Forest, Southland. New Zealand Forest Service Forest Research Institute Forest Entomology Report No. 24 (unpublished). Wellington, NZ.

Milligan, R.H., 1972. A review of beech forest pathology. New Zealand Journal of Forestry 17: 201-11.

Milligan, R.H., 1974. Insects damaging beech *(Nothofagus)* forests. Proceedings of the New Zealand Ecological Society 21: 32-40.

Milligan, R.H., 1975. *Platypus* in beech forests. In: New Zealand Forest Service, Report of Forest Research Institute for 1974. Wellington: p. 48-50.

Milligan, R.H. 1979. The native pinhole borers. New Zealand Forest Service Forestry Research Institute Leaflet No. 37.

U.S. Department of Agriculture, Animal and Plant Health Inspection Service. 1991. An efficacy review of control measures for potential pests of imported soviet timber. Misc. Pub. No. 1496. Washington, D.C. 28 p.

Scientific name of pest: *Prionoplus reticularis* White (Cerambycidae)

Other name: Huhu beetle

Scientific name of host(s): *Pinus radiata, Pseudotsuga menziesii*, and other softwoods. Also occasionally attacks hardwood logs and stumps, e.g., *Eucalyptus* and *Acacia.*

Distribution: New Zealand

Summary of natural history and basic biology of the pest: Hosking (1978) has a good summary of this insect's activity in New Zealand. Edwards (1961) also has observations on the beetle's ecology and behavior. The following descriptions are adapted from these two publications.

The huhu beetle infests logs, stumps, dead parts of living trees, and green or kiln-dried lumber. In visiting a port site in New Zealand, huhu damage was evident on a small number of logs. Damage is normally associated with a log scar at the butt end of the log. These logs can normally be culled out for local use at the port site. This beetle occasionally attacks dead parts of living trees that could be anywhere on the bole. It would not be possible to detect some of these infestations by viewing the outside log surface.

The beetles fly from late spring to early autumn in New Zealand. The females are strong fliers and are attracted to light. They can, therefore, be attracted to logs stored at the port and lay eggs on debarked logs or sawn timber at the port site. The life cycle is 2 to 3 years. The adult beetle is about 2 inches long with the mature larva being 2 to 3 inches long. The resultant damage is therefore quite severe if an infestation is established.

Specific information relating to risk elements:

A. Probability of pest establishment

1. **Pest with host at origin:** ***Moderate***
   The beetles occur commonly on *Pinus radiata* and rarely on Douglas-fir. *Prionoplus reticularis* is not common in or on freshly fallen logs, except during the flight season as egg masses. The huhu beetle is common in older, partially decayed logs.

In visiting a port site in New Zealand, culled logs damaged by the huhu beetle were fairly common. If the damage is associated with the main bole of the tree, the pest's presence would probably go unnoticed. Huhu beetle damage, which usually occurs on butt-end logs, can often be seen and culled out at the port or in the woods.

Even with debarking, treating the surface of the logs with insecticide, and fumigation with methyl bromide, this pest still has a chance of infesting logs. The beetle penetrates throughout the wood and has tightly packed, frass-filled tunnels, so that fumigation would not be totally effective. Surface treatment of the logs with an insecticide would not kill the emerging adults because of the long residual time needed.

2. **Entry potential: *High***
The entry potential may be high because of its 2- to 3-year life cycle; larvae and pupae could be found in the inner wood all year long.

3. **Colonization potential: *High***
The adults are good flyers and with the wide range of tree species suitable for hosts, the beetles have a good colonization potential. The climate in the coast, and lower west-side conditions in the Pacific Northwest are similar to New Zealand, so little environmental resistance would be expected.

4. **Spread potential: *High***
Beetles would probably fly several miles to find suitable host material. The wide range of host material, *Pinus* and *Eucalyptus*, would also enhance their chance of surviving.

B. Consequences of establishment

5. **Economic damage potential: *Moderate***
Prionoplus reticularis is not a major pest in New Zealand, where its primary commercial damage is usually associated with logging wounds at the base of the tree. It could be a pest in the United States, causing damage to decked logs or untreated timber in damp conditions. The Pacific Northwest and coastal California would provide damp, moist conditions suitable for this pest. The net present value of losses over 30 years is estimated to be from about $2.5 million to over $40 million. There are no known control techniques for this beetle. The huhu beetle would be competing with other Prioninae cerambycids.

6. **Environmental damage potential: *Low***
This pest is a tree or log degrader and does not kill trees. The main damage would be in degrading the products from logs.

7. **Perceived damage (social and political influences):** ***Low***
   This insect would not cause esthetic damage or consumer concerns. The adult beetles are large, so large adult flights may be of concern to forest visitors.

Estimated risk for pest: ***Moderate.*** Even with debarking, treating the surface of the logs with insecticide, and fumigation with methyl bromide, this pest still has a chance of entering on infested logs. The beetles penetrate throughout the wood, so fumigation may not be totally effective. Surface treatment of the logs with an insecticide would not kill the emerging adults because of the long residual time needed.

Selected bibliography:

Edwards, J.S., 1961. Observations on the ecology and behaviour of the huhu beetle *Prionoplus reticularis* White (Col. Ceramb.). Transactions of the Royal Society of New Zealand 88: 733-41.

Hosking, G.P., 1978. *Prionoplus reticularis*. New Zealand Forest Service Forest Research Institute Forest Leaflet 35.

√ **Scientific name of pest:** *Sirex noctilio F.* (Siricidae)/ *Amylostereum areolatum* (Fr.) Boidin

Scientific name of host(s): *Pinus* spp., especially *P. radiata, Pseudotsuga menziesii, Larix, Picea,* and *Abies*

Distribution: Native in Eurasia, northern Africa; introduced in New Zealand, Australia, Brazil, Argentinia, and Uruguay

Summary of natural history and basic biology of the pest: *Sirex noctilio* is endemic to Eurasia and northern Africa, reaching its greatest density in the Mediterranean zone. *S. noctilio* is generally considered to be a secondary pest of trees following primary damage in its native range (Spradbery and Kirk 1978). It has become established in New Zealand (1900), Tasmania (1952), and the Australian mainland (1961), and recently in Brazil, Argentina and Uruguay. In Australia and South America it causes significant tree mortality and is considered a major pest (Taylor 1981; Bedding personal communication). In recent years in New Zealand, *S. noctilio* has not been considered a major pest species (Nuttall 1989).

Tree species attacked by *S. noctilio* in its native range are almost exclusively pines (e.g., *Pinus pinaster, P. sylvestris, P. nigra, P. pinea)*, but it also has been recorded in fir and spruce (Spradbery and Kirk 1978). *Sirex noctilio* has been reported in larch and Douglas-fir (Krombein *et al.* 1979), but these reports are very rare occurences, or they may be mistakes in identification. The other species of European siricids are only rarely associated with pines (Spradbery and Kirk 1978). In New Zealand and Australia, the main host is *Pinus radiata*, a native tree of California. Under stress condition *Pinus* spp. are very susceptible to attack by *S. noctilio.*

The fungus *Amylostereum areolatum* occurs in close association with woodwasps, *Sirex* spp. Talbot (1977) states "Specific species of *Sirex* carry only one species of *Amylostereum.* In the case of *A. areolatum*, it is only known to be carried be three species of *Sirex*, none of which are known from North America." These three species are *S. juvencus*, *S. noctilio*, and *S. nitobei* (Talbot 1977). The fungus is pathogenic in association with *Sirex*, mostly on *Pinus*.

Much of the research on *S. noctilio* has been conducted in Australia and New Zealand, so the following information relates to the situation in these countries. *Sirex noctilio* normally completes one generation per year in southeastern Australia, but a portion of a population may take 2 years in the cooler climates of Tasmania and New Zealand (Taylor, 1981). In Australia, adults emerge from early summer to early winter with peak emergence in late summer or early autumn. Males usually predominate, with sex ratios of 4:1 to 7:1 (Morgan and Stewart 1966, Neumann and Minko 1981). After an initial flight period usually less than 2 miles, but with the potential of 100 miles (Bedding and Akhurst personal communication), females are attracted to physiologically stressed trees. They drill their ovipositors into the outer sapwood to assess the suitability for oviposition. At this time, a symbiotic fungus *(Amylostereum areolatum)* and a toxic mucus are injected into the sapwood along with the eggs (up to three separate eggs at a drill site). The fungus and mucus act together to kill the tree and create a suitable environment for the development of larvae. Crown wilt does not occur until a cross section of wood in at least one part of the stem has been invaded and killed by the fungus, which causes an inconspicuous white sapwood rot. Fecundity ranges from 21 to 458 eggs, depending upon size of the female (Neumann and Minko 1981). The eggs usually hatch within 10 to 15 days, but some may overwinter in cooler climates. Unfertilized eggs develop into males, while fertilized eggs produce females. All larval instars feed on the fungus as they tunnel through the wood. Larval galleries may penetrate to the center of a tree. The number of instars varies from 6 to 12, and the larval stage generally takes 10 to 11 months. Mature larvae pupate close to the bark surface and adults emerge about 3 weeks later (Taylor 1981).

Specific information relating to risk elements:

A. Probability of pest establishment

1. **Pest with host at origin:** ***Low***
   Sirex noctilio and *Amylostereum areolatum* are established in New Zealand. Historically, *S. noctilio* has been reported as a pest in New Zealand. However, because of the establishment of biological control agents and improved stand management, the occurrence of these organisms in plantation forests has been reduced. Volatiles from cut trees can increase the *S. noctilio* population in an area, and oviposition may occur on cut trees (Madden 1971). Required fumigation of logs will be highly effective in killing early stages in recently cut logs (Harris 1963a; USDA APHIS 1991). Other life stages of *S. noctilio* deep in the wood are not effectively treated by fumigation. However, the quality of logs desired for importation will minimize the likelihood of these later stages being present in the logs at the time of export.Therefore, the probability for logs intended for export to be infested with *S. noctilio* and *Amylostereum areolatum* is low.

2. **Entry potential:** ***High***
   Survival of *S. noctilio* larvae in logs can be very high. Survival greatly depends on a suitable moisture content for fungal growth, e.g., above 20% ODW (oven-dried weight) (Talbot 1977). Because its life cycle is generally a year or longer, it could

easily survive the transit period within logs and escape detection at the port of entry. Detection of either organism at the port of entry is unlikely.

3. **Colonization potential: *High***
S. noctilio has been transported to many parts of the world and has become established in pine plantations. A high probability is expected for pines within a 2-mile radius of ports of entry and/or destinations of the logs. Abundance of *Pinus* spp. in these areas would significantly increase the colonization potential. It is realistic to assume that other *Pinus* spp. in the United States would be susceptible to *S. noctilio.*

4. **Spread potential: *High***
If *S. noctilio* became established in Pacific Coast States, it is likely to spread throughout the Western United States, depending upon which pine species were suitable hosts. Most rapid spread would probably be through California, Arizona, New Mexico, Nevada, and Utah. Natural dispersal of *S. noctilio* has been estimated at 5 to 15 miles per year in Australia.

B. Consequences of establishment

5. **Economic damage potential: *High***
Sirex noctilio has the potential to cause significant mortality in overstocked pine plantations and unhealthy forest stands. In Australia, *S. noctilio* caused up to 80 percent tree mortality in *Pinus radiata* plantations over a 3-year period. In 1 year, *S. noctilio* killed 1.75 million trees in 141,000 acres of plantations aged 10 to 30 years (Haugen and Underdown 1990).

An economic assessment of the effects of *Sirex noctilio* and *Amylostereum areolatum* is presented in chapter 5. Based on the assumptions presented, the economic effect ranges from $24 million to $130 million.

An efficient biological control agent is available that can reduce and maintain *Sirex noctilio* populations below the economic damage threshold. A parasitic nematode, *Beddingia siricidicola* (Bedding) (formerly *Deladenus siricidicola*) can be mass-produced and inoculated into *S. noctilio* populations as they invade and colonize new territories (Bedding and Akhurst 1974). Minimum cost to establish the nematode is estimated at $3.50/acre in plantations (Haugen and Underdown 1990, Haugen *et al.* 1990), but a less intensive program could be implemented in natural stands. See appendix H for additional information.

Some increased economic loss would occur because of log degradation and decay caused by *Sirex noctilio* and *Amylostereum areolatum.* This would be a minor effect relative to the actual economic loss from tree mortality.

6. **Environmental damage potential: *High***
The effect of *Sirex noctilio* on the native forests of the Western United States could be significant. If *S. noctilio* became established and caused mortality in the

remaining native stands of *Pinus radiata*, a significant reduction in the genetic base of *P. radiata* could occur. In the Sierra Nevada mixed conifer type, changes in stand composition could occur with the selective mortality of pines due to an invasion of *S. noctilio*, depending upon the susceptibility of these pine species to attack. The potential damage to these stands would be increased during droughts or other climatic events that reduce tree vigor. Also, an increase in *S. noctilio*-associated tree mortality may increase the populations of other destructive insect populations, such as bark beetles, by increasing the available food resource. The establishment of *S. noctilio* in the forests of the Western United States would affect the populations of other insects. *S. noctilio* would be in competition with the native siricids, and because *S. noctilio* is more aggressive, it may reduce or eliminate native species. An expanding *S. noctilio* population would result in population increases of the native parasites of siricids (e.g., *Rhyssa* spp, *Megarhyssa nortoni, Schlettererius cinctipes,* and *Ibalia* spp.), which could further decrease the native siricid fauna. If *S. noctilio* became established and caused significant mortality, the impact could be severe in wilderness areas, cause deterioration in watersheds, and threaten key environments of endangered species. See chapter 4 for additional information.

7. **Perceived damage (social & political influences):** ***High***
Ornamental plantings of pines (especially *P. radiata*) would be at risk if *S. noctilio* became established, but this is a relatively minor impact compared to the potential damage in natural stands and plantations.

Estimated risk: ***Moderate/High***

Additional remarks: The risk from importing untreated *Pinus radiata* logs from anywhere in the world where a *Sirex noctilio* population is established is great.

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Chapter 3. Pest Risk Mitigation

Inventory of proposed New Zealand mitigation measures

The following procedures were used by New Zealand log exporters to reduce the pest risks associated with the logs carried on the M.V. *Balayan* and discharged at Sacramento in January 1992:

1. Visual inspection
2. Mechanical debarking
3. Fungicide application
4. Insecticide application
5. Methyl bromide fumigation (not used on M.V. Washington Star)

In the following sections, these procedures are discussed and the time frames for their use for future shipments of logs to the United States are shown in figure 3-1.

Visual inspection. Visual inspection of logs is an important component of the total mitigation procedures system. Logging, processing, and transportation methods proposed by New Zealand log exporters allow several opportunities for close inspection of individual logs prior to shipment. Additionally, log inventory management systems will be aimed at minimizing the time interval between stump and ship to prevent invasion by insects and fungi.

Plantation trees in New Zealand are handfelled using chainsaws, and this operation is closely monitored by forestry companies to ensure that trees are on the ground for as short a time as possible prior to extraction to landing areas. In general, companies currently aim to have all sawlog-quality logs on the landing within a few days of felling.

At the landing, each tree-length stem is visually examined by experienced "log makers" trained to look specifically for signs of dead wood, decay, or wood-boring insects. Current New Zealand practices exclude logs containing any such defect from the sawlog-quality classes and direct them to local pulp mills. All sawlog material comes from sound, live trees.

Lengths and diameters are measured by the log makers and stems are bucked to length prior to sorting. All sawlog rejects are directed to local mills. Logs destined for export are delivered directly to debarking stations. Although individual company practices and policies do vary, it is generally accepted that the total time from felling to debarking should not exceed 10 days.

It is significant that the buyers of sawlogs will either reject or substantially discount the value of sawlogs deemed not fresh or containing sapstain. This imposes a self-policing mechanism on log producers, and motivates companies to manage both woods operations and transportation scheduling closely to ensure speedy delivery.

Upon arrival of the logs at the export port, each log is again inspected by either the Ministry of Forestry or company staff prior to scaling. This procedure offers another opportunity to identify any logs showing signs of insect or fungal attack.

Mechanical debarking. Mechanical debarking will be carried out on all logs destined for shipment to the United States. This operation removes a minimum of 99 percent of the bark and most insects and diseases found on or in the bark. For example, foliage infected by *Dothistroma pini*, a fungal pathogen, may be lodged in crevices in the bark. In addition to eliminating "hitchhiking" pests and those associated with the bark, debarking makes any borer holes visible to the debarker operator, who inspects each log individually. Any log showing indications of insect attack or containing any unsound wood is also rejected for export at this time. At the time of debarking, insecticide and fungicide approved by the New Zealand Ministry of Forestry are sprayed onto each log, completely covering all surfaces.

Fungicides. Fungicides prevent sapstain, mold, and decay growth on logs awaiting fumigation and shipment. Fungicides are especially necessary if logs are to be held for extended periods on the wharf or in ships' holds for ocean shipment. Busan ©30WB, Cutrol ©375, and Antiblu © are fungicides currently used to treat debarked logs (appendix D).

Insecticides. Insecticides are applied to prevent reinfestation of the logs by insects. The insecticide used is Sumicidin 20WP (appendix D). The Ministry of Forestry recommends use of this insecticide, in combination with other listed mitigation measures, to ensure that insect-free logs are loaded at New Zealand ports.

An accepted standard regarding the timeframe for all activities discussed above is that all logs destined for export to the United States will be debarked and sprayed within 10 days of felling.

Fumigation. Fumigation of logs prior to export to the United States has been accepted by New Zealand exporters as a standard pest mitigation procedure. The New Zealand Ministry of Forestry recommends methyl bromide (appendix D) at 80 g/m^3 for 24 hours at a minimum temperature of 15 °C, which exceeds the current APHIS prescriptions (T404). All fumigation activities are undertaken by personnel approved by the Ministry of Forestry. Following fumigation, holds are to be sealed until arrival in the United States.

Days 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20. . . . . 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60

tree
felling

[VI][1]
bucking,
sorting,
and transporting

[VI]
Scaling,
mechanical
debarking,
sorting, and
treating

[EQA][2]
on-wharf storage

[VI]
loading and
sorting

fumigation
and
ventilation

transport to the United States

1 [VI] visual inspection for pests by trained industry personnel

2 [EQA] denotes an Export Quality Assurance visual inspection to phytosanitary specifications by Ministry of Forestry Personnel (NZ Ministry of Forestry 1991b).

Figure 3-1. *Schedule of pest mitigation activities currently applied on each New Zealand log destined for the United States*

Mitigation considerations for log importation

The following discussion covers some items to be considered by APHIS in developing protocols to mitigate the risks associated with importing New Zealand logs into the United States.

Transportation considerations. There is some risk of introducing exotic pests in transporting logs from New Zealand to the United States. Risks during transportation include:

- Contamination of treated logs from holds of transportation vessels not properly sanitized after carrying infested forest products.
- Infestation of logs stored above deck by flying or wind-borne insects and fungal spores.
- Contamination from infested forest products loaded on top of hold-stored logs at subsequent ports-of-call.
- Growth of fungal bodies stimulated by the favorable environment within ship holds.

In reviewing the transportation mitigation actions, the team assumed that all logs are treated as specified in the Pest Risk Mitigation section (debarking, insecticide and fungicide applications, and in-hold fumigation). Suggested transportation mitigation procedures include

- Preloading examination of vessels by Ministry of Forestry personnel to ensure proper phytosanitary conditions.
- Transportation of all logs in ship holds or containers.
- Fumigation procedures that use the hold or containers as the fumigation chamber.
- Sealing of all holds containing logs, and appropriate documentation by Ministry of Forestry approved personnel.
- Maintaining seal integrity throughout the transportation process until documents are verified and holds opened at the destination port in the United States by USDA, APHIS inspectors, or their representatives.

The New Zealand Ministry of Forestry has legislative powers through the Forests Act of 1949 and the Forest Produce Import Export Regulations of 1989 to provide phytosanitary surveillance for logs exported from New Zealand and the vessels which carry them. Additionally, the Forest Disease Control Regulations of 1967 empower the Ministry to introduce measures anywhere in New Zealand to control or eradicate forest pests and diseases. The Ministry of Forestry will also provide inspections and certification when required by the exporter to ensure that the phytosanitary requirements of the importing country are met before logs leave New Zealand.

Assessment of mitigation efficacy. ***Mitigation of pests on or within bark:*** Debarking at the port of origin substantially reduces pests associated with the bark and cambium. Insecticidal and fungicide treatments of debarked logs can further reduce pest risk by preventing fungal invasion and reinfestation by insects attracted to the debarked logs. Fumigation with methyl bromide can provide added protection by penetrating for 4 to 5 inches into the log (Cross 1992). Fumigation is very effective against all stages of insects, mites, snails, slugs, and nematodes as well as some fungi. Methyl bromide has become the fumigant of choice in quarantine treatments.

Mitigation of pests in wood: Survival of pests deep within the wood following treatment with methyl bromide has not been studied extensively, especially for logs fumigated aboard ships. Yu *et al.* (1984) reported 100 percent mortality of wood-infesting insects following on-board fumigation with methyl bromide at 25 g/m^3 for 24 hours at 10 to 20 °C, or 37.5 g/m^3 for 16 hr at 10 to 20 °C. The Yu study included a lyctid *(Lyctus lineraris),* shot-hole borers (Platypodidae), five species of other beetles (Scolytidae), and several hitchhiking surface pests (table 3-2). Methyl bromide has also been documented as an effective eradication measure for termites (Spear 1970, Wylie and Yule 1977).

The following fumigation schedules, taken from Section VI of APHIS' Plant Protection and Quarantine (PPQ) Treatment Manual (USDA APHIS 1985), are typical. Schedule T312 (a) and (b) was based upon research by Liese and Ruetze (1985). Schedule T404 was based upon the work of Harris (1963 a,b).

T312 Treatment of Oak Logs and Lumber for Oak Wilt Disease

(a) Logs

(1) Fumigate with methyl bromide at normal atmospheric pressure

240 g/m^3 (240 oz/1,000 ft^3) for 72 h at 5 °C (41 °F) or above
(240 g minimum concentration for 1/2 to 2 h)
(200 g minimum concentration for 12 h)
(120 g minimum concentration for 24 h)

(2) After the 24-hour period, add additional fumigant to bring concentration up to 240 g.

(160 g minimum concentration for 36 h)
(120 g minimum concentration for 48 h)
(80 g minimum concentration for 72 h)

(3) Aerate for 48 h

(b) Lumber

(1) Fumigate with methyl bromide at normal atmospheric pressure

240 g/m^3 (240 oz/1,000 ft^3) for 48 h at 5 °C (41 °F) or above
(200 g minimum concentration for 1/2 h)
(160 g minimum concentration for 2 h)
(100 g minimum concentration for 12 h)

(40 g minimum concentration for 24 h)

(2) After the 24 h period, add additional fumigant to bring concentration up to 240 g.

(120 g minimum concentration for 36 h)
(80 g minimum concentration for 48 h)

(3) Aerate for 48 h

T404 Wood Products, Including Containers

(a) Borers (woodwasps, Cerambycids, *Dinoderus*)

(1) Methyl bromide at normal atmospheric pressure

Chamber or tarpaulin

48 g/m^3 (48 oz/1,000 ft^3) for 16 h at 21 °C (70 °F) or above
(36 g minimum concentration for 1/2 to 2 h)
(30 g minimum concentration for 2 h)
(27 g minimum concentration for 4 h)
(25 g minimum concentration for 16 h)

80 g/m^3 (80 oz /1,000 ft^3) for 16 h at 4.5 to 20.5 °C (40 to 69 °F) or above
(60 g minimum concentration for 1/2 h)
(51 g minimum concentration for 2 h)
(46 g minimum concentration for 4 h)
(42 g minimum concentration for 16 h)

A more detailed coverage of methyl bromide can be found in USDA APHIS (1991), chapter 9.

Steam/Hot Water Treatment. Raising the internal temperature of logs to levels sufficient to kill deep wood pests has been suggested as a treatment method. The use of either steam or hot water to kill pest organisms in wood was recently reviewed (USDA APHIS 1991). As with other treatment methods, efficacy data on these types of treatment are limited. It was suggested that raising the temperature to 120 °F (49 °C) for 24 to 48 hours may be satisfactory. Shorter exposure periods may be adequate if log temperatures are increased to 140 to 158 °F (60 to 70 °C). A review of measures tested for the importation of Siberian larch logs recommended that heat treatments be employed that raised the temperature of the center of the log to 160 °F (71.1 °C) for a minimum of 75 minutes (USDA Forest Service 1992a). No documentation on the efficacy of this treatment schedule is provided, however.

Table 3-2 summarizes the efficacy of different mitigation measures on the principal pests of concern associated with New Zealand logs.

Table 3-2. *Efficacy of Mitigation Measures on Pests of Concern*

	Debarking	Insecticide	Fungicide	Fumigation	Steam/hot water
I. Pests on outer surface	HE	HE	HE	HE	HE
II. Pests on or within bark					
Hylurgus ligniperda	ME	N	NA	HE	HE
Hylastes ater	ME	N	NA	HE	HE
III. Pests in the wood					
Prionoplus reticularis	N	N	NA	PE	PE
Sirex noctilio	N	N	NA	PE	PE
Platypus apicalis	N	N	NA	HE	HE
Platypus gracilis	N	N	NA	HE	HE
Kalotermes brouni	N	N	NA	HE	HE
IV. Pathogens					
Amylostereum areolatum	N	NA	N	PI	PE
Leptographium truncatum	N	NA	N	PE	PE

HE = Highly effective
ME = Moderately effective
N = Not effective
PE = Probably effective but needs research
PI = Probably ineffective but needs research
NA = Not applicable

Additional considerations for mitigation protocols

- Because this document is predicated on New Zealand's requiring mitigation activities as currently proposed by the New Zealand timber industry, this pest risk assessment is less valid if untreated logs and logs with bark are shipped to the United States.

- Additional information is needed to determine the efficacy of heat treatments on organism survival and to determine the appropriate treatment schedule.

- Consideration should be given to the time and place of fumigation, sealing, and inspection.

- Mitigation protocols in the United States may include log handling, log storage, milling practices, waste disposal, and APHIS monitoring at mills.

- APHIS should consider the need for additional mitigation measures before New Zealand logs are imported into the United States. Particular attention needs to be given to the organisms that occur deep in the wood,—*Sirex noctilio/Amylostereum areolatum* and *Prionoplus reticularis*.

Chapter 4. Evaluation of Ecological Effects

Evaluation of the potential ecological effects of exotic insects and pathogens on native forest ecosystems is extremely difficult. For example, the host range of a potential pest is often unknown for a new environment, and estimates of growth loss and tree mortality are generally based on extreme extrapolations.

If a potential pest becomes established, it may have significant effects (direct and indirect) on stand composition, wildlife populations (game and nongame), water and nutrient cycles, recreation, wilderness values, and fire hazards. Although these effects can be more significant than the direct loss of timber values, little data are available to quantify these impacts. However, in a risk assessment, it is appropriate to state, hypothesize, and speculate upon these effects.

In the following sections, the ecological effects are addressed for the 7 species considered in detail (chap. 2). In the first section, characteristics of the potential pests are given relating to their adaptability and aggressiveness to forest ecosytems in the United States. In the second section, ecological impacts are discussed for each species, assuming that large-scale infestations occur.

Adaptability and aggressiveness of potential introduced pests

Kalotermes brouni **(New Zealand drywood termite):** This pest primarily attacks dead trees, but has been found in living *Pinus radiata*. It is not a tree-killing insect but normally acts as a beneficial organism because of its role in decomposing deadwood and reincorporating it into the soil. It would not be a likely pest and would not significantly change the forest ecology of an area if it were introduced.

Leptographium truncatum **(root disease fungus):** The recorded hosts of this fungus are *Pinus strobus, P. radiata* and *P. taeda*. There is also a report of it occurring on Douglas-fir in New Zealand. It is probably vectored by *Hylastes ater* and *Hylurgus ligniperda,* but related United States insects may be able to act as vectors.The wide geographic separation of the three *Pinus* hosts will limit the opportunity for widespread dispersal of the fungus. However, if other U.S. tree species are hosts, the capability for spread would be greatly increased. In New Zealand, *L. truncatum* occurs on wounded trees that are under stress. Trees in the United States most likely to be attacked include ornamental trees and trees grown in Christmas tree plantations.

Platypus apicalis **and** ***Platypus gracilis*** **(native pinhole borers):** These insects are found on a variety of tree species in New Zealand. They may kill some of the native beeches *(Nothofagus* spp.), but these trees do not occur in the United States except as ornamentals. For species that may be found in the United States, broods have been reared in *Pinus nigra, P. ponderosa, P. radiata, P. taeda, P. menziesii, Acer pseudoplatanus,* and *Salix babylonica*. Abortive attacks have occurred on various *Eucalyptus* species, *Populus trichocarpa,* and *Sequoia sempervirens*. It is expected that these pinhole borers will mainly be pests of pine logs. They also may affect rapidly growing eucalypts by causing gum defects. This may mar veneers and increase pulping costs of commercial operations.

Prionoplus reticularis **(Huhu beetle):** The huhu beetle is native to New Zealand and is found in both native and exotic softwoods and hardwoods. It also may be found attacking decayed hardwood stumps such as *Eucalyptus* spp. It is commonly found in *Pinus radiata* and rarely found in Douglas-fir. It probably would attack most softwoods within a climate similar to New Zealand. It is not a tree-killing insect, but infests trees with logging wounds, fire-killed trees, and logs decked in the woods or at a storage site. The main damage would be in degrading the products from logs.

Sirex noctilio/Amylostereum areolatum: The beetle *S. noctilio* was reared almost exclusively from *Pinus* spp. during a study in Europe (Spradbery and Kirk 1978). It was also reared from *Abies* spp. (2 of 8 species) and *Picea* spp. (2 of 3 species), but few adults emerged.

Little information is available on the susceptibility of pine species to attack by *S. noctilio*, including most of the species from the United States. Two U.S. species, *Pinus radiata* and *P. taeda*, are known to be highly susceptible to outbreaks of *S. noctilio* in New Zealand, Australia, and Brazil. Plantations of *P. elliotii* occur in southern Queensland (Australia), but *S. noctilio* has not yet reached these plantations. Some workers have assumed that *P. elliotii* will be less susceptible than *P. radiata*.

In Europe, *S. noctilio* emerged from each of the six native *Pinus* spp. sampled (Spradbery and Kirk 1978). Therefore, it can be assumed that many of the pine species in the United States will be suitable hosts. However, a wide range of susceptibility to *S. noctilio* attack is expected for *Pinus* spp. For example, numerous stands of *P. pinaster* (cluster pine), a native of Portugal and Spain, were not infested during the major outbreak in *P. radiata* plantations in South Australia.

Too little is known about the susceptibility of the major *Pinus* spp. in the Western United States to *S. noctilio* attack to quantify the damage potential. A worst-case scenario might be 80 percent stand mortality as seen during outbreaks in the *P. radiata* plantations of New Zealand and Australia. In natural stands, a much lower mortality would be expected.

Amylostereum areolatum is found principally in *Pinus* spp. in close association with *Sirex noctilio*. Their symbiotic relationship can result in tree death. *Sirex*, and therefore *A. areolatum*, is found on trees under stress. Environmental conditions in which *P. radiata* successfully grows in the United States would not limit spread and growth of *Amylostereum*.

Ecological impacts of large-scale infestations

Many of the general ecological impacts of a large-scale pest infestation have been discussed previously (USDA Forest Service 1991). Most of the organisms considered in this assessment would not likely cause such widespread damage. A few of the pests, *Sirex noctilio* in particular, could have major effects on the existing ecological conditions in forests of the Western United States.

The introduction of an exotic pest to native *Pinus radiata* stands could have significant ecological effects because of their limited geographic range. Even relatively low levels of tree mortality could narrow the genetic base of *P. radiata*. Alterations in species composition and size classes could reduce habitat for threatened or endangered species that may be present, or result in some additional species becoming threatened.

***Kalotermes brouni* (New Zealand drywood termite):** *K. brouni* would not cause large outbreaks in a forest situation. It would fit in with the native forest ecology by degrading and decomposing deadwood and would compete with other similar decomposers.

Outside the forest environment, *K. brouni* probably would affect wood and wood products. Many termites are quite specific in their habitat requirements so it is unknown whether *K. brouni* would survive in the Western United States. Other species of termites in the United States have been known to cause considerable economic damage in localized environments.

***Leptographium truncatum* (root disease fungus):** The ecological effects of introducing *L. truncatum* depends on its anticipated virulence on *Pinus radiata* or other pine species. In New Zealand, it is not a highly virulent pathogen. If it follows this pattern in the United States, limited pockets of tree mortality in native stands and Christmas tree plantations would be expected. These pockets would develop slowly, and tree decline and mortality would be gradual. This slow opening of the canopy would allow for replacement species to colonize these pockets. This would reduce hydrologic and erosion problems from tree mortality. Tree mortality in these stands could adversely affect visual and recreation values.

If *L. truncatum* is more virulent in *Pinus radiata* in the United States than in New Zealand, or if native insects are more efficient vectors, the number of centers created, their size, and the amount of mortality would be significantly higher. Disease centers would likely be occupied by shrub and early seral stages with slow replacement by more shade-tolerant tree species. This could alter habitat for various fauna, possibly including some threatened or endangered species. Fire risk would be significantly increased and the number of catastrophic wildfires would increase.

There are no known suppression activities for *L. truncatum* or closely related fungi once they have become established. Therefore, if the fungus is introduced into the United States, there would be no means to stop its spread. Because its vectors are attracted to wounded and stressed trees, many *P. radiata* in native stands and in landscape situations would be susceptible to attack and infection.

***Platypus apicalis* and *P. gracilis* (native pinhole borers):** If introduced into the United States, these New Zealand pinhole borers probably would not kill trees. They can kill native beeches in New Zealand, but the genus *Nothofagus* is not represented in the United States. Pinhole borers can complete their cycle on pine, Douglas-fir, maple and some willow species. They have abortive attacks on a number of genera including eucalyptus, poplar, and sequoia. These insect species introduce a sapstain fungus during their attack and are probably most important as a degrader of *Pinus* spp. stockpiled or decked in the woods.

These species of pinhole borers are found only in the wetter forests of New Zealand. The climates in northern California, Oregon, and Washington west of the Cascade Mountains would be suitable for these two species. Introduced into California or the Northwest, these insects would probably have no significant ecological impact.

***Prionoplus reticularis* (Huhu beetle):** If introduced into the Western United States, the huhu beetle would probably compete with native beetles that attack *Pinus* spp. in the following conditions: dead and/or dying trees, trees with logging wounds, and stored logs. The beetle in New

Zealand occurs in all forests from the very wet to the very dry. These conditions would be similar to those found in California, Oregon, and Washington.

Based on its habits in New Zealand, the huhu beetle would not be a killer of trees or cause any dramatic outbreaks to occur in *Pinus* spp. It may, however, cause declining, windthrown, fire-killed, or wounded trees to degrade faster. The beetle is quite large, so the degradation of logs, especially those stored in the forest for a long period of time, could be significant. In the United States it would have to compete with native cerambycids, buprestids, and bark beetles for an ecological niche. Thus, if it became established in the United States, it probably would not have a significant impact on the ecology of western forests.

Sirex noctilio/Amylostereum areolatum. Tree mortality attributed to *S. noctilio* and *A. areolatum* has been recorded from 30 to 80 percent during severe and widespread outbreaks in the *Pinus radiata* plantations of New Zealand and Australia (Rawlings and Wilson 1949, McKimm and Walls 1980, Haugen and Underdown 1990). A number of factors appear to contribute to the susceptibility of a pine stand to attack by *S. noctilio* (Madden 1988). Tree stresses due to overstocking and drought are often suggested as the main factors. Other contributing factors include physical damage to trees (wind breakage, fire, wounding from thinning or pruning operations, lightning, hail, etc.).

Chapter 5. Evaluation of Economic Effects

This section presents the economic evaluations of potential infestations of pests from New Zealand if they become established in the United States. The evaluations of potential pest impacts are primarily limited to wood and wood products as the dominant resource affected by these pests and a dominant value of forests. The forests of the United States also have esthetic, recreation, fish, wildlife, and watershed values, but potential economic losses in these areas are not measured in this analysis.

The lumber and other solid-wood products industry is one of the top three manufacturing industries in most regions of the United States. Many areas rely on harvesting and processing of forest products for major contributions to local and regional economies. The employment and income of many people depend on forests and forest-related industries. In 1986 the value of harvested timber moved to the local delivery point was approximately $14.6 billion in 1990 dollars (USDA FS 1990a).

The economic evaluations were made using the following general guidelines:

1) Each pest was analyzed independently, and the economic losses were developed in isolation from potential losses caused by other introduced pests. A simple sum of the economic loss caused by an individual pest may not produce a valid estimate of the total loss from the introduction of all of the pests evaluated here for two reasons:

    a) Many of the same host trees may be attacked simultaneously by several introduced pests. It is impossible to estimate what proportion of the damage to a given tree should be attributed to a particular pest.

    b) Simultaneous attack on host types may also increase mortality rates and growth losses through the synergistic effect of multiple attacks. Totaling the economic costs of each pest group may underestimate the total economic costs from a simultaneous introduction of all of the pests considered in this analysis. The possibility of simultaneous attacks is limited because the pests are specific to different hosts and because some attack only dead wood and others only living trees.

2) Each pest or group of pests analyzed has separate and diverse assumptions about spread and damage caused as indicated in the following individual pest effects discussions.

3) The analysis of each pest where timber losses are measured considered all unreserved forests of all ownerships (both public and private) in the 11 Western States (Washington, Oregon, California, Idaho, Nevada, Arizona, New Mexico, Colorado, Utah, Montana, Wyoming) at risk. Reserved forest includes the approximately 7 million acres designated as critical habitat for the Northern spotted owl by the U.S. Department of the Interior, Fish and Wildlife Service. The 7 million acres that may be reserved for the Northern spotted owl reduces the quantity of wood available for damage, but also tends to increase the price of timber.

4) It is recognized that integrated pest management measures would be implemented should epidemics of introduced pests occur. Costs of such efforts are not considered in this analysis. Because of the limited experience with these pests in the United States, the mitigation measures would be based on crude estimates. Therefore, only the total potential losses have been estimated and no mitigation measures are assumed, except for drywood termites where a wide-spread termite control program currently exists.

Economic evaluations

1) Economic losses are a function of one or more of the following:

- Reduced growth rates (increased mortality) of timber trees.
- Reduced growth rates (increased mortality) of trees for non-timber purposes.
- Loss of exports from the United States because other nations would restrict imports from the United States due to fear that U.S. logs and timber would become infected.

2) Only those pests that are possible colonizers in the United States are considered for economic evaluation. It is assumed that each will be established by 1995 and all present value calculations are computed to the year 1995. This assessment estimates the potential for losses after a pest is established in the United States and begins to spread.

3) All computations are in constant 1990 dollars.

4) A 4-percent discount rate (real rate) is used to determine the present value of the stream of estimated losses. The 4-percent discount rate is the customary rate used by the USDA Forest Service in the evaluation of natural resources activities. A 10-percent rate is also shown to indicate the sensitivity to discount rates.

***Kalotermes brouni* (drywood termite)**: This termite will be added to the 43 species of termites in the contiguous United States. Termites in the United States are divided into three types: dampwood, drywood, and subterranean, but only 13 species have the potential for significant economic destruction (Moore 1979).

The economic evaluation of this drywood termite is based on the following information obtained through personal communication with Joe K. Mauldin, USDA Forest Service, Southern Forest Experiment Station, Gulfport, Mississippi.

a) Control of termites and repair of damage caused by them results in a total economic impact in the United States of approximately $1.5 billion per year.

b) Drywood termites cause about 5 percent ($75 million) of the total damage per year.

c) Termites, including drywood termites, spread slowly (50 to 1,000 feet per year) because they are poor flyers and only about 1 percent of the termites that fly eventually establish a new colony. People could increase the rate of spread by moving infested wood from one place to another.

d) An additional drywood termite species in the United States could cause an added $75,000 to $500,000 in damages per year after 10 to 15 years of establishment along the west coast. This damage estimate assumes continuation of wide-spread and effective termite control efforts in the United States. An added termite species does not cause major increases in damages.

In the best-case scenario the present value of losses of $75,000 per year starting in year 15 and continuing through year 30 is $463,000 at a 4-percent discount rate and $136,000 at 10 percent.

In the worst-case scenario the present value of losses of $500,000 per year starting in year 10 and continuing through year 30 is $4.590 million at 4 percent and is $1.641 million at 10 percent.

***Leptographium truncatum* (root disease fungus):** *Leptographium truncatum* is a fungus that is capable of infecting *Pinus radiata* in the United States. It is unknown whether other western conifer species could serve as hosts. About 14,000 acres of unreserved timberland of *P. radiata* occur in the United States (USDA Forest Service 1990b). Generally located along the north coast of California, *P. radiata* had a 1984 inventory of about 14 million cubic feet (79 million board feet. It has little commercial value and harvest is minimal. *P. radiata* is also used as an ornamental tree. Because *P. radiata* is not a commercial species, the economic evaluation is based on the removal of dead trees and their replacement with trees of other species. An average cost of $400 per tree for removal and replacement is assumed in the many locations where *P. radiata* occurs.

The following basic assumptions were used in the economic evaluation:

a) *Leptographium truncatum* will be distributed throughout the 14,000 acres within 3 years after colonization. Initial colonization is assumed to start in northern California.

b) The spread among dispersed *Pinus radiata* stands will be a contiguous block.

c) *L. truncatum* will be evaluated for a 30-year period.

d) *P. radiata* will not regenerate on the affected centers but will be replaced with other species.

e) *L. truncatum* kills only *P. radiata*, with all ages being affected.

f) In the best-case scenario, damage from *L. truncatum* will start in the fourth year, and spread and damage will be at a maximum annual rate by the sixth year.

- Two new centers will start per 2,470 acres per year (rounded to 12 new centers per year).
- Each new center develops in size to 0.1 acre in 10 years.
- Ttrees die at a rate of 0.75 per acre per year.
- A maximum of 10 trees die per center per year.

g) In the worst-case scenario of *L. truncatum*, its spread and damage will start in the fourth year.

- Ten new centers per 2,470 acres per year (rounded to a total of 60 new centers per year).
- Each center develops to 0.2 acre in 10 years.
- Trees die at a rate of 1.5 per acre per year.
- A maximum of 20 trees die per center per year.

h) Economic losses are based on the following assumptions:

1) Dead *P. radiata* will be removed and replaced with other species.

2) The cost of tree removal and replacement with larger trees of other species is $400 per tree. The cost reflects the frequent use of *P. radiata* for ornamental purposes.

3) Starting in year 4 the dead trees will be removed and replaced each year.

The present value (at a 4-percent discount rate) of removing and replacing dead trees over 30 years in the best-case scenario, is $7 million. At a discount rate of 10 percent, the present value declines to $2 million (table 5-1).

The present value (at a 4-percent discount rate) in the worst-case scenario is $69 million. If a 10-percent discount rate is used, the present value is reduced to $22 million.

Table 5-1. *Economic evaluation data for* Leptographium truncatum

	Best-case scenario			Worst-case scenario		
Calendar year	Total centers	Number trees killed	Replacement costs $mil	Total centers	Number trees killed	Replacement costs $mil
1995	0	0	0.000	0	0	0.000
1996	0	0	0.000	0	0	0.000
1997	0	0	0.000	0	0	0.000
1998	0	0	0.000	0	0	0.000
1999	2	20	0.008	2	40	0.016
2000	8	80	0.032	32	640	0.256
2001	20	200	0.080	92	1840	0.736
2002	32	320	0.128	152	3040	1.216
2003	44	440	0.176	212	4240	1.696
2004	56	560	0.224	272	5440	2.176
2005	68	680	0.272	332	6640	2.656
2006	80	800	0.320	392	7840	3.136
2007	92	920	0.368	452	9040	3.616
2008	104	1040	0.416	512	10240	4.096
2009	116	1160	0.464	572	11440	4.576
2010	128	1280	0.512	632	12640	5.056
2011	140	1400	0.560	692	13840	5.536
2012	152	1520	0.608	752	15040	6.016
2013	164	1640	0.656	812	16240	6.496
2014	176	1760	0.704	872	17440	6.976
2015	188	1880	0.752	932	18640	7.456
2016	200	2000	0.800	992	19840	7.936
2017	212	2120	0.848	1052	21040	8.416
2018	224	2240	0.896	1112	22240	8.896
2019	236	2360	0.944	1172	23440	9.376
2020	248	2480	0.992	1232	24640	9.856
2021	260	2600	1.040	1292	25840	10.336
2022	272	2720	1.088	1352	27040	10.816
2023	284	2840	1.136	1412	28240	11.296
2024	296	2960	1.184	1472	29440	11.776
2025	308	3080	1.232	1532	30640	12.256
	Present value at 4		7			69
	Present value at 10%		2			22

***Platypus* spp. (pinhole borers):** This section evaluates both *Platypus apicalis* and *Platypus gracilis* as having similar biological characteristics and being able to cause similar potential economic losses.

The two species of *Platypus* beetles have a potential range of all of North America, but in this study the estimates of their effects are limited to the 11 Western States. If the pest is introduced elsewhere in the United States, the economic effects would be similar.

The *Platypus* beetles attack live trees, including New Zealand beech (*Fagus*), eucalyptus (*Eucalyptus*), poplar (*Populus*), and redwood (*Sequoia*), and cause holes and resin stains. There is no mortality in these tree species and the frequency of attack is very low. Thus there is little economic loss and the attacks on these trees are not evaluated. (The only trees killed by these species of *Platypus* are trees native to New Zealand.)

The *Platypus* beetles attack dead trees and felled logs of Douglas-fir and all pine species of the Western United States, and reduce the quality of the felled logs by boring pinholes and staining wood. The potential effects have not been adjusted to reflect the existence of similar species in the United States that cause damage to the same logs.

The economic evaluation is based on the following assumptions:

a) *Platypus* beetles are established on the west coast in the United States by 1995 and able to start spreading.

b) *Platypus* beetles can spread by flying, about 5 miles per year, and can spread by the transport of infested logs and other dead wood materials.

c) *Platypus* beetles will spread to all areas with Douglas-fir and pine species within the 11 Western States, and will infect all of these areas by the year 2025.

d) In the worst-case scenario, 5 percent of all felled logs will be attacked and each attacked log will lose 10 percent of its economic value.

e) In the best-case scenario 0.5 percent of all felled logs will be attacked and each attacked log will lose 10 percent of its economic value.

In the worst-case scenario, the potential losses are $119 million at a 4-percent discount rate and $35 million at 10 percent.

In the best-case scenario, the potential losses are $12 million at a 4-percent discount rate, and $4 million at 10 percent (table 5-2).

Table 5-2. *Economic evaluation data for* Platypus spp.

Calendar year	Price/MBF	Volume harvested	Harvest share affected per year (%)	Value at risk million $	Best-case losses $mil	Worst-case losses $mil
1995	$0.00	13,975	0.0	0.00	0.00	0.00
1996	$174.80	13,889	1.0	24.28	0.01	0.12
1997	$182.25	13,802	2.0	50.31	0.03	0.25
1998	$189.70	13,715	3.0	78.05	0.04	0.39
1999	$197.15	13,628	4.0	107.47	0.05	0.54
2000	$204.60	13,542	5.0	138.53	0.07	0.69
2001	$212.03	13,737	6.0	174.77	0.09	0.87
2002	$219.16	13,933	7.0	213.76	0.11	1.07
2003	$226.89	14,129	8.0	256.46	0.13	1.28
2004	$234.32	14,325	9.0	302.10	0.15	1.51
2005	$241.75	14,521	10.0	351.05	0.18	1.76
2006	$249.18	14,717	14.5	531.75	0.27	2.66
2007	$256.61	14,913	19.0	727.10	0.36	3.64
2008	$264.04	15,109	23.5	937.51	0.47	4.69
2009	$271.47	15,305	28.0	1163.36	0.58	5.82
2010	$278.90	15,501	32.5	1405.05	0.70	7.03
2011	$283.90	15,575	37.0	1636.03	0.82	8.18
2012	$288.90	15,649	41.5	1876.19	0.94	9.38
2013	$293.90	15,723	46.0	2125.61	1.06	10.63
2014	$298.90	15,797	50.6	2389.13	1.19	11.95
2015	$303.90	15,871	55.0	2652.67	1.33	13.26
2016	$308.90	15,944	59.6	2935.43	1.47	14.68
2017	$313.90	16,018	64.0	3218.01	1.61	16.09
2018	$318.90	16,092	68.5	3515.28	1.76	17.58
2019	$323.90	16,166	73.0	3822.43	1.91	19.11
2020	$328.90	16,240	77.5	4139.54	2.07	20.70
2021	$330.45	16,269	82.0	4408.39	2.20	22.04
2022	$332.00	16,298	86.5	4680.46	2.34	23.40
2023	$333.55	16,327	91.0	4955.74	2.48	24.78
2024	$335.10	16,356	95.5	5234.26	2.62	26.17
2025	$336.65	16,385	100.0	5516.01	2.76	27.58
			Present value at 4%		12	119
			Present value at 10%		4	35

Prionoplus reticularis **(huhu beetle):** The huhu beetle infests logs, dead parts of living trees, and untreated sawn lumber. The huhu beetle could be expected to spread throughout the cool, moist areas of the Pacific Northwest coast.

The evaluation of the huhu beetle is based on the following assumptions:

a) Huhu beetle will spread across the Douglas-fir subregion.

b) The huhu beetle can spread by flying up to 10 miles per year and also is transported on logs and other infested wood materials to a susceptible forested area.

c) Huhu beetle will establish along the coast and by 1995 start to move inland. The rate of movement will be relatively slow initially and will increase as the huhu population increases. For this analysis the spread rate is 1 percent per year in the Douglas-fir subregion for the first 10 years, and then 4.5 percent per year until all of the Douglas-fir subregion is affected by the year 2025.

d) The huhu beetle primarily attacks logs, stumps, and dead wood of living softwood species. It has no affect on living trees or dead hardwoods. It does not kill trees or reduce growth rates.

e) The huhu beetle does not affect kiln-dried, insecticide-treated, or preservative-treated sawn wood products. Some damage to non-treated sawn wood is possible but is not evaluated here.

f) Economic loss is caused by huhu attacks that damage felled softwood logs.

g) In the worst-case scenario:

- huhu beetle attacks 10 percent of felled logs
- 3 percent of value is lost per log

h) In the best-case scenario:

- huhu beetle attacks 2 percent of felled logs
- 3 percent of value is lost per log

The present value of losses in the 30-year evaluation period at a 4-percent discount rate in the worst-case scenario is $40 million. At a 10-percent discount the loss is reduced to $12 million (table 5-3).

In the best-case scenario the losses are $8 million at 4 percent and $2 million at 10 percent.

Table 5-3. *Economic evaluation data for* Prionoplus reticularis

Calendar year	Percent area affected	Acres affected (million)	Volume harvested MBF	Price/MBF (1990)	Value of harvest affected $mil	Best-case losses $mil	Worst-case losses $mil
1995	0.0	0	0	$0.00	$0.00	$0.00	$0.00
1996	1.0	197	8717	$271.71	$23.69	$0.01	$0.07
1997	2.0	394	8602	$266.08	$45.78	$0.03	$0.14
1998	3.0	591	8477	$258.40	$65.72	$0.04	$0.20
1999	4.0	788	8246	$244.22	$80.56	$0.05	$0.24
2000	5.0	985	8013	$234.94	$94.13	$0.06	$0.28
2001	6.0	1182	8573	$264.80	$136.20	$0.08	$0.41
2002	7.0	1379	8856	$287.49	$178.23	$0.11	$0.53
2003	8.0	1576	8340	$268.10	$178.88	$0.11	$0.54
2004	9.0	1773	8288	$264.31	$197.15	$0.12	$0.59
2005	10.0	1970	7978	$245.09	$195.55	$0.12	$0.59
2006	14.5	2855	8809	$289.13	$369.31	$0.22	$1.11
2007	19.0	3740	8754	$293.78	$488.63	$0.29	$1.47
2008	23.5	4625	8338	$275.50	$539.82	$0.32	$1.62
2009	28.0	5510	8237	$268.00	$618.10	$0.37	$1.85
2010	32.5	6395	8419	$283.88	$776.74	$0.47	$2.33
2011	37.0	7280	8649	$297.68	$952.66	$0.57	$2.86
2012	41.5	8165	8747	$307.96	$1,117.89	$0.67	$3.35
2013	46.0	9050	8735	$313.35	$1,259.10	$0.76	$3.78
2014	50.6	9935	8607	$311.16	$1,355.17	$0.81	$4.07
2015	55.0	10820	8544	$309.32	$1,453.61	$0.87	$4.36
2016	59.5	11705	8631	$313.63	$1,610.68	$0.97	$4.83
2017	64.0	12590	8674	$316.44	$1,756.79	$1.05	$5.27
2018	68.5	13475	8756	$321.10	$1,925.88	$1.16	$5.78
2019	73.0	14360	8836	$326.35	$2,105.01	$1.26	$6.32
2020	77.5	15245	8779	$331.91	$2,258.21	$1.35	$6.77
2021	82.0	16130	8779	$331.91	$2,389.33	$1.43	$7.17
2022	86.5	17015	8740	$331.74	$2,507.96	$1.50	$7.52
2023	91.0	17900	8730	$331.74	$2,635.41	$1.58	$7.91
2024	95.5	18785	8940	$330.55	$2,822.11	$1.69	$8.47
2025	100.0	19666	8940	$330.55	$2,955.09	$1.77	$8.87
				Present value at 4%		$8	$40
				Present value at 10%		$2	$12

Sirex noctilio* (wood wasp) and the related fungus *Amylostereum areolatum: *Sirex noctilio* is believed to be the pest with the greatest potential to cause significant damage to the trees and forests of the United States. *Sirex noctilio* and its associated fungus, *Amylostereum areolatum,* kill trees, which reduces inventory and growing stock, and eventually changes the amount, location, and cost of wood harvested. *Sirex noctilio* will be evaluated by estimating the reduction in trees available for harvest.

The potential economic risk associated with the establishment of *S. noctilio* is estimated in a market context (using timber supply and demand relationships) for three regions of the National Forest System: the Pacific Northwest, Pacific Southwest, and the Rocky Mountain Regions. The derived demand and stumpage supply functions were taken from the 1989 Forest Service Resources Planning Act (RPA) Timber Assessment (USDA FS 1990b) as modified by an assumption that timber supply would be further reduced by an amount equivalent to the estimated withdrawal of land for northern spotted owl critical habitat.

The analysis involves shifting the stumpage supply functions by the amount of the change in softwood growing stock inventories resulting from reduced forest growth or removal of land from the available timberland base. This approach was adopted because inventory levels are one of the main determinants of stumpage supply. Changes in inventories available act to shift stumpage supply functions in the long term, while changes in prices help establish supply levels in the short term. The necessary changes in inventories were computed by shifting the supply function of the base inventory (without *S. noctilio*) to a *S. noctilio*-modified inventory. Economic impacts were computed by calculating the equilibrium price and quantity by decade and region. Then the modified equilibrium price and quantity were calculated following a reduction in the stumpage supply functions assumed to be induced by changes in inventories caused by the activities of *S. noctilio*. Basic economic impacts are slow to develop and depend on the extent that lower growth reduces inventories and hence timber supplies.

This analysis makes no explicit assumption about salvage except to the extent that some products (fuelwood) come from dead material. Much of the dead material remains in the forests, where it may contribute to non-commodity products.

A number of assumptions were required to complete this analysis of the economic impacts. For the worst-case scenario, the assumptions are:

a) Base line is the "final critical habitat run" for the U.S. Department of the Interior, Fish and Wildlife Service. That is, the withdrawals or reduction in harvest levels necessary for meeting the Endangered Species Act requirements for northern spotted owl are assumed to be in place.

b) No action is taken to control spread or affect of *S. noctilio* in the United States.

c) *S. noctilio* is established by 1995 and starts to spread in the year 2000 from two west coast locations.

d) *S. noctilio* will spread 12 miles across the landscape in the year 2000, 13 miles in 2001, and thereafter at 25 miles per year through year 2025, when 100 percent of the 11 Western States will have *S. noctilio* present. *Sirex noctilio* will not spread beyond the 11 Western States for purposes of this analysis. Spread is assumed to start on the west coast and progress eastward. The total land area of 11 Western States is 750,416,000 acres and the forested acres are assumed to be evenly distributed so that the spread is at a uniform rate (table 5-4).

e) *S. noctilio* will affect all pine trees (ponderosa, Jeffrey, sugar, western white, lodgepole, Monterey, and other pines are include; hemlock, redwood, cedar, Douglas-fir, true firs, Sitka spruce, Engelmann spruce, larch, and all hardwoods are excluded).

f) *S. noctilio* will cause 30-percent mortality during an entire attack cycle for unthinned, natural stands; 10 percent for young, thinned stands; and 3 percent for older thinned stands. For purposes of this analysis, 15 percent of all pines in areas infested by *S. noctilio* are assumed to die.

g) Impact of *S. noctilio* applies equally to all ownerships of all unreserved timber land.

h) The *S. noctilio* risk is based entirely on the changes in inventory and the subsequent effect on timber available for harvest. Neither positive nor negative influences of changes in the number of trees per acre are estimated.

i) The annual increment of loss applies to the weighted average growing stock of all pines in all 11 Western States. The mortality caused by *S. noctilio* is in addition to mortality from all other causes.

In the worst-case scenario the present value of the losses caused by *S. noctilio* is $130 million at 4 percent and $24 million at 10 percent.

In the best-case scenario the present value of the losses is estimated to be $10 million at 4 percent and $2 million at 10 percent. The best case is calculated as 8 percent of the worst case, based on a spread rate of only 2 miles per year, compared to the 25 mile-per-year rate of the worst case.

These impacts are lower than initial expectations because *S. noctilio* will have only a modest effect on the inventory in the West by the year 2025 and pines are a relatively small share of the total timber inventory. The delay to year 2000 before *S. noctilio* is assumed to affect timber also decreases the potential losses. Finally, the available timber is sufficient to compensate for the reduction in pine without a reduction in harvest for several years.

The impact is greatest on producers of forest products in the West who lose their potential gains. Consumers are less affected because production in unaffected regions offsets the loss of production in the West.

Table 5-4. *Economic evaluation data for worst-case scenario for* Sirex noctilio

Calendar year	Accumulated acres affected[1] (1,000 acres)	Accumulated percent of trees killed
2000	289	.0
2001	1,358	.0
2002	5,024	.1
2003	11,304	.2
2004	20,096	.4
2005	31,400	.6
2006	45,216	.9
2007	61,544	1.2
2008	80,384	1.6
2009	101,740	2.0
2010	125,600	2.5
2011	151,980	3.0
2012	180,860	3.6
2013	212,260	4.2
2014	246,180	4.9
2015	282,600	5.6
2016	321,540	6.4
2017	362,980	7.3
2018	406,940	8.1
2019	453,420	9.1
2020	502,400	10.0
2021	553,900	11.1
2022	607,900	12.2
2023	664,420	13.3
2024	723,460	14.5
2025	750,416	15.0

[1] 750,416,000 is the total land area in acres in 11 Western States (excludes Alaska and Hawaii).

Summary of economic analysis

The estimates of potential losses demonstrate that there is significant risk to North American forests from the introduction of pests from New Zealand. These worst-case losses are made without consideration of suppression of these pests. Related to the potential economic losses, but not evaluated here, are jobs lost, watersheds damaged, recreation areas spoiled, adverse impacts on fish and wildlife, and damage to the ecology of the area. Application of suppression procedures would be expected to result in losses equal to or less than the worst-case potential.

The pests evaluated are those within the log that could survive treatment and shipment, and that have host plants that permit the pests to become established near the port of entry. The monetary estimates of potential losses are limited to the losses of commercial timber values, except for the *Leptographium* estimate, which is valued to reflect the ornamental and esthetic uses of *Pinus radiata*. Other non-timber-related impacts on recreation, wildlife, and watershed are not quantified.

The total present value of potential losses of $364 million (worst-case scenario at 4 percent) is 2.5 percent of the total value of harvested timber of $14.6 billion in 1986 (1990 dollars) (table 5-5). Potential losses caused by these New Zealand pests are significantly less than the $2,600 million potential commercial timber losses estimated for the Asian gypsy moth in a worst-case scenario (USDA FS 1992B).

Table 5-5. Summary of potential impact of introduced pests

	Present value of potential losses[1] (millions of dollars)	
Pest	Best case	Worst case
Kalotermes brouni	1	5
Leptographium truncatum	7	69
Platypus spp.	12	119
Prionoplus recticularis	8	40
Sirex noctilio/ *Amylostereum areolatum*	24	131
TOTAL	52	364

[1] At 4 % discount rate

Chapter 6. Discussion and Summary

The Pest Risk Assessment Team screened over 300 pests that have been recorded on *Pinus radiata* and Douglas-fir in New Zealand for the past 30 years. From this list, 31 pests (11 fungi and 20 insects) were screened in greater detail for risk potential. Based on this analysis, 2 fungi and 5 insects were chosen as representative of those groups of organisms posing the greatest potential pest problem. All five of the insect species penetrate deep into the wood and *Kalotermes brouni* and *Platypus* spp. may be the only species killed by methyl bromide fumigation. Similarly, the two fungi occur in the wood and may not be affected by fumigation. They also have overland dispersal mechanisms that could permit spread to forest stands in the United States from the ports of entry. Efficacy data are lacking on the use of steam treatments or hot water immersion treatments to control these organisms.

Of the five insect species of concern, only *Sirex noctilio,* in association with the fungus it introduces into the tree (*Amylostereum areolatum*) is regarded as a tree killer. The other fungus of concern, *Leptographium truncatum*, is also vectored by insects. *L. truncatum* has been reported in Ontario, Canada. The taxonomy of the genus is uncertain, and questions have been raised as to whether *L. truncatum* is a valid species or if it is actually another species already present in the United States. The other four insects of concern are either wood degraders or pests of wood in use. These pests, although not regarded as tree killers, may still cause appreciable loss through their activities.

The primary pest of concern in this evaluation is *S. noctilio*. In the past, outbreaks have caused significant damage in New Zealand, Australia, and other countries. This pest is presently held in check by a parasitic nematode and proper stand management in New Zealand and Australia. This natural control agent has been and continues to be successfully introduced into plantations in New Zealand and Australia.

Current mitigation procedures followed by New Zealand exporters should be continued. These measures include rapid processing from felling to shipping, debarking, fungicide and insecticide treatment, visual examination, and fumigation. This pest risk assessment assumed continuation of these procedures, and therefore this assessment is less valid if these procedures are discontinued.

It is recommended that APHIS consider the need for additional mitigation measures before New Zealand logs are imported into the United States.

Appendix A

Microorganisms and Insects of *Pinus Radiata* and Douglas-fir in New Zealand

The following lists are from records compiled by the New Zealand Ministry of Forestry Forest Health Program, Forest Research Institute, from 1960 to the present of insects and fungi identified on *Pinus radiata* and Douglas-fir. The list of insects includes those listed by Rawlings (1960) that actually feed on *P. radiata*. These records are not all-inclusive—they are a compilation of information from samples from these two tree species submitted to Forest Research Institute for identification.

Table A-1. *Microorganisms recorded on or associated with* Pinus radiata *and Douglas-fir in New Zealand (from New Zealand Forest Research Institute Forest Health database records, 1960-1992, and other literature)*

Microorganism species	Pathogen	Saprophyte/ mycorrhizal
Acremonium sp.		√ l
Alternaria sp.		√ l
Amanita muscaria (Linnaeus: Fries) Persoon		√ m
Amanita sp.		√ m
Amylostereum areolatum (Fries) Boidin	√ s	
Abortiporus biennis (Fries) Singer		√ wd
Armillaria limonea (Stevenson) Boesewinkel	√ r	
Armillaria novae-zelandiae (Stevenson) Herink	√ r	
Aureobasidium pullulans (De Bary) Arnaud		√ f
Biatorella resinae (Fries) Mudd	√ s	
Botryotrichum sp.		√ f
Botrytis cinerea Persoon	√ nursery	
Cephalosporium lecanii Ziman		√ e
Ceratocystis huntii Robinson	√ bl	
Ceratocystis piceae (Münch) Bakshi	√ bl	
Ceuthospora sp.		√ l
Cladosporium sp.		√ l
Clypeolinopsis sp.		√ l
Colletotrichum acutatum Simmonds f. sp. *pineum* Dingley & Gilmour	√ nursery	
Colletotrichum acutatum Simmonds ex Simmonds	√ nursery	

(cont.)

Microorganism species	Pathogen	Saprophyte/ mycorrhizal
Coniophora puteana (Schumacher: Fries) Karsten		√ l
Coniothyrium sp.		√ f
Coryneum sp.		√ l
Cryptosporiopsis sp.		√ f
Cyclaneusma minus (Butin) DiCosmo, Peredo & Minter	√ f	
Cylindrocarpon sp.	√ nursery	
Cylindrocladium scoparium Morgan	√ nursery	
Dasyscypha caliciformis (Willdenow) Rehm	√ s	
Dermocybe sp.		√ m
Diplodia pinea (Desmazieres) Kickx	√ s	
Dothistroma pini Hulbary	√ f	
Epicoccum sp.		√ l
Fusarium moniliforme Sheldon var. *subglutinans* Wollenweber & Reinking	√ s	
Fusarium moniliforme Sheldon	√ s	
Fusarium oxysporum Schlechtendal	√ nursery	
Fusarium solani (Martius) Saccardo	√ nursery	
Fusicoccum sp.		√ l
Geastrum sp.		√ l
Gloeosporium sp.	√ nursery	
Graphium sp.		√ wd
Grifola rosulata (Cunningham) Cunningham		√ wd
Gymnopilus junonius (Fries) Orton		√ wd
Hapolopilus nidulans (Fries) Karsten		√ wd
Hebeloma sp.		√ m
Hohenbeuhelia podocarpinea Stevenson		√ wd
Hypholoma fasciculare (Fries) Kummer		√ wd
Hysterium sp.		√ f
Junghuhnia vincta (Berkeley) Hood & Dick	√ r	
Lachnellula sp.		√ wd
Lentinus lepideus (Fries: Fries) Fries		√ wd
Lophodermium sp. (Leptostroma stage)		√ f
Lophodermium conigenum (Brunaud) Hilitzer		√ f
Lophodermium pinastri (Schrader) Chevalier	√ f	
Lycoperdon perlatum Persoon		√ l
Melampsora larici-populina Keebahn	√ f	
Mytilidion sp.		√ wd
Naemospora sp.		√ l
Nectria cinnabarina (Tode) Fries		√ wd
Nectria pinea Dingley		√ wd
Nigrospora sp.		√ l

(cont.)

Microorganism species	Pathogen	Saprophyte/ mycorrhizal
Paxillus panuoides (Fries: Fries) Fries		√ l
Peniophora gigantea (Fries) Massee		√ wd
Peniophara sacrata Cunningham	√ s	
Pesotum sp.		√ wd
Pestalotia funerea Desmazieres		√ l
Pestalotia sp.		√ l
Phaeocryptopus gaeumannii (Rohde) Petrak	√ f	
Phomopsis pseudotsugae Wilson	√ s	
Phyllosticta sp.		√ l
Phytophthora cinnamomi Rands	√ nursery	
Podoserpula pusio (Berkeley) Reid var. *tristis* Reid		√ l
Pseudomonas sp.	√ s	
Pseudomonas syringae van Hall	√ s	
Pycnoporus sanguineus (Fries) Bonderzew & Singer		√ wd
Pythium paroecandrum Drechsler	√ nursery	
Pythium sp.	√ nursery	
Rhizoctonia solani Kuehn	√ nursery	
Rhizosphaera kalkhoffi Bubak	√ f	
Rosellinia radiciperda Massee	√ r	
Schizophyllum commune Fries		√ wd
Sclerophoma pithyophila (Corda) von Höhnel	√ f	
Secotium erythrocephalum Tulasne		√ l
Skeletocutis amorpha (Fries) Kotalba & Pouzar		√ wd
Stemphylium sp.		√ l
Stereum sanguinolentum (Albertini and Schweinitz) Fries	√ s	
Stereum vellereum Berkeley		√ wd
Stomiopeltis sp.		√ f
Strasseria carpophila Bresadola & Saccardo apud Strasser		√ l
Strasseria geniculata (Berkeley & Broome) von Höhnel		√ f
Suillus luteus (Linnaeus: Fries) Gray		√ m
Thelephora terrestris Fries		√ m
Torula sp.		√ f
Trichoderma viride Persoon		√ l
Trichoderma sp.		√ l
Tricholomopsis rutilans (Fries) Singer		√ wd
Truncatella sp.		√ l
Tubercularia vulgaris Tode: Fries	√ s	
Tyromyces atrostrigosus (Cooke) Cunningham		√ s
Tyromyces setiger (Cooke) Cunningham		√ wd
Vermisporium obtusum Swart & Williamson		√ f

(cont.)

Microorganism species	Pathogen	Saprophyte/ mycorrhizal
Verticicladiella procera Kendrick	√ s	
Verticicladiella truncata Wingfield & Marrass	√ s	

bl	=	blue-stain fungus	r	=	root
f	=	foliage	s	=	stem
l	=	litter	wd	=	woody debris
m	=	mycorrhizal			

Table A-2. *Insects recorded from* Pinus radiata *in New Zealand*

Insect species	Location of attack: Bark/ cambium	Wood	Foliage/ other	Comments
COLEOPTERA: ANOBIIDAE				
Anobium punctatum de Geer		√		Found in US
Ernobius mollis L.	√			Found in US
Hadrobregmus magnus (Dumbleton)		√		Rare
Leanobium flavomaculatum Espanol	√			Rare
COLEOPTERA: ANTHRIBIDAE				
Helmoreus sharpi (Broun)	√			
COLEOPTERA: CERAMBYCIDAE				
Agapanthida pulchella White		√		Rare
Ambeodontus tristis (F.)		√		Rare
Arhopalus tristis (Mulsant)		√		
Blosyropus spinosus Redtenbacher		√		Rare
Callidiopsis scutellaris (F.)		√		Rare
Drotus elegans Sharp		√		Rare
Hexatricha pulverulenta (Westwood)		√		
Hybolasius modestus Broun		√		Rare
Leptachrous strigipennis Westwood		√		Rare
Navomorpha lineata (F.)		√		Rare
Navomorpha sulcata (F.)		√		Rare
Oemona hirta (F.)		√		Rare
Prionoplus reticularis White		√		
Somatidia antarctica (White)		√		Rare
Somatidia sp.		√		Rare
Stenopotes pallidus Pascoe		√		
Xylotoles griseus (F.)		√		
Xylotoles humeratus Bates		√		Rare
Xylotoloides huttoni (Sharp)		√		Rare
Zorium minutum (F.)		√		Rare
COLEOPTERA: CHRYSOMELIDAE				
Atrichatus aeneicollis Broun			√	
Eucolaspis brunnea (F.)			√	

(cont.)

Insect species	Location of attack: Bark/ cambium	Wood	Foliage/ other	Comments
COLEOPTERA: CURCULIONIDAE				
Anagotus helmsi Sharp		√		Rare
Asynonychus cervinus (Boheman)			√	
Crisius binotatus Pascoe	√			Rare
Steriphus diversipes lineata (Pascoe)			√	
Eugnomus maculosus Broun		√		Rare
Euophyrum porcatum Sharp		√		Rare
Euophyrum rufum Broun		√		Rare
Graphognathus leucoloma (Boheman)			√	
Hoplocneme punctatissma Marshall		√		Rare
Mitrastethus basidiodes Redtenbacher		√		
Otiorhynchus ovatus (L.)			√	
Otiorhynchus sulcatus (F.)			√	
Pactola variabilis Pascoe		√		Rare
Phloeophagosoma thoracicum Wollaston		√		Rare
Phlyctinus callosus Boheman			√	
Phrynixus terreus Pascoe		√		Rare
Psepholax coronatus White		√		
Psepholax granulatus Broun		√		
Rhopalomerus fasciatus (Broun)		√		Rare
Rhopalomerus maurus (Broun)		√		Rare
Rhoplaomerus tenuicornis Blanchard		√		Rare
Torostoma apicale Broun		√		
Xenocnema spinipes Wollaston		√		Rare
COLEOPTERA: DERMESTIDAE				
Dermestes maculatus de Geer		√		
COLEOPTERA: PLATYPODIDAE				
Platypus apicalis White		√		
Platypus gracilis Broun		√		
COLEOPTERA: SCARABAEIDAE				
Costelytra zealandica (White)			√	
Heteronychus arator (F.)			√	
Odontria sp.			√	

(cont.)

Insect species	Location of attack: Bark/ cambium	Wood	Foliage/ other	Comments
Odontria striata White			√	
Pyronota festiva (F.)			√	
Stethaspis suturalis Hope			√	
COLEOPTERA: SCOLYTIDAE				
Amasa truncata (Erichson)		√		Rare
Hylastes ater (Paykull)	√			
Hylurgus ligniperda (F.)	√			
Pachycotes pergrinus (Chapuis)		√		
Xyleborinus saxeseni (Ratzburg)		√		
Xyleborus compressus (Lea)		√		Rare
DIPTERA: STRATIOMYIDAE				
Inopus rubriceps (Macquart)			√	
HEMIPTERA: ADELGIDAE				
Pineus laevis (Maskell)			√	
HEMIPTERA: CICADIDAE				
Amphipsalta cingulata (F.)			√	
HEMIPTERA: COCCIDAE				
Ceroplastes sinensis Del Guercio			√	
Coccus hesperidium L.			√	
HEMIPTERA: DIASPIDIDAE				
Aspidiotus nerii Bouche			√	
Lindingaspis rossi (Maskell)			√	
Parlatoria pittospori Maskell			√	
HEMIPTERA: FLATIDAE				
Sephena cinerea Kirkaldy			√	
Siphanta acuta Walker			√	

(cont.)

Insect species	Location of attack: Bark/ cambium	Wood	Foliage/ other	Comments
HEMIPTERA: MARGARODIDAE				
Icerya purchasi Maskell			√	
HEMIPTERA: PENTATOMIDAE				
Oncacontias vittatus (F.)			√	
HEMIPTERA: RICANIIDAE				
Scolypopa australis (Walker)			√	
HYMENOPTERA: SIRICIDAE				
Sirex noctilio F.		√		
ISOPTERA: KALOTERMITIDAE				
Glyptotermes brevicornis Froggatt		√		Rare
Kalotermes banksiae Hill		√		Rare
Kalotermes brouni Froggatt		√		
ISOPTERA: RHINOTERMITIDAE				
Coptotermes acinaciformis (Froggatt)		√		Rare
Coptotermes frenchi Hill		√		Rare
ISOPTERA: TERMOPSIDAE				
Stolotermes inopinus Gay		√		
Stolotermes ruficeps Brauer		√		Rare
LEPIDOPTERA: GEOMETRIDAE				
Declana floccosa Walker			√	
Declana hermione Hudson			√	
Declana junctilinea (Walker)			√	
Declana leptomera (Walker)			√	
Gellonia dejectaria (Walker)			√	
Pseudocoremia fenerata (Felder & Rogenhofer)			√	
Pseudocoremia leucelaea (Meyrick)			√	

(cont.)

Insect species	Location of attack: Bark/ cambium	Wood	Foliage/ other	Comments
Pseudocoremia productata (Walker)			√	
Pseudocoremia sauvis Butler			√	
Zermizinga indocilisaria Walker			√	
LEPIDOPTERA: GLYPHIPTERYGIDAE				
Heliostibes atychioides (Butler)			√	
LEPIDOPTERA: HEPIALIDAE				
Wiseana sp.			√	
LEPIDOPTERA: NOCTUIDAE				
Agrotis ipsilon aneituma (Walker)			√	
Chrysodeixis erisoma (Doubleday)			√	
Euxoa admirationis (Guenee)			√	
Graphania insignis (Walker)			√	
Graphania mutans (Walker)			√	
Graphania ustistriga (Walker)			√	
Helicoverpa armigera Hubner			√	
Mythimna separata (Walker)			√	
Rictonis comma (Walker)			√	
LEPIDOPTERA: OECOPHORIDAE				
Izatha sp.	√			Rare
LEPIDOPTERA: PSYCHIDAE				
Liothula omnivora Fereday			√	
LEPIDOPTERA: TINEIDAE				
Erechthias fulguritella (Walker)			√	
Opogona comptella Walker	√			
Opogona omoscopa Meyrick	√			Rare

(cont.)

Insect species	Location of attack: Bark/ cambium	Wood	Foliage/ other	Comments
LEPIDOPTERA: TORTRICIDAE				
Ctenopseustis obliquana (Walker)			√	
Epiphyas postvittana (Walker)			√	
Harmologa oblongana (Walker)			√	
Planotortrix flavescens (Butler)			√	
Planotortrix notophaea (Turner)			√	
Pyrgotis plagiatana (Walker)			√	
ORTHOPTERA: GRYLLIDAE				
Teleogryllus commodus (Walker)			√	
ORTHOPTERA: STENOPELMATIDAE				
Hemideina thoracica White			√	
ORTHOPTERA: TETTIGONIIDAE				
Caedicia simplex (Walker)			√	
PHASMATODEA: PHASMATIDAE				
Acanthoxyla intermedia Salmon			√	
Acanthoxyla sp.			√	
Clitarchus hookeri (White)			√	
Clitarchus sp.			√	
THYSANOPTERA: THRIPIDAE				
Heliothrips haemorrhoidalis (Bouche)			√	
Hoplothrips corticis (de Geer)			√	
Thrips tabaci Lindeman			√	

Table A-3. *Insects recorded from* Pseudostuga menziesii *in New Zealand*

Insect species	Location of attack: Bark/ cambium	Wood	Foliage/ other	Comments
ACARI: TETRANYCHIDAE				
Oligonychus ununguis (Jacobi)			√	
COLEOPTERA: ANOBIIDAE				
Anobium punctatum (De Geer)		√		Found in U.S.
Ernobius mollis L.	√			Found in U.S.
Hadrobregmus magnus (Dumbleton)		√		Rare
Leanobium flavomaculatum Espanol		√		Rare
COLEOPTERA: CERAMBYCIDAE				
Arhopalus tristis (F.)		√		Rare
Eburilla sericea (White)		√		Rare
Hexatricha pulverulenta (Westwood)		√		
Navomorpha lineata (F.)		√		
Navomorpha sulcata (F.)		√		Rare
Prionoplus reticularis White		√		
Somatidia antarctica (White)		√		Rare
Somatidia grandis Broun		√		Rare
Somatidia longipes Sharp		√		Rare
Stenopotes pallidus (Pascoe)		√		
Tetrorea sp.		√		
Zorion minutum (F.)		√		Rare
COLEOPTERA: CHRYSOMELIDAE				
Eucolaspis brunnea (F.)			√	
COLEOPTERA: CURCULIONIDAE				
Crisius binotatus Pascoe	√			Rare
Psepholax spp.		√		
Rhopalomerus maurus (Broun)		√		
Rhopalomerus tenuicornis Blanchard		√		Rare
Steriphus diversipes lineata (Pascoe)			√	

(cont.)

Insect species	Location of attack Bark/ cambium	 Wood	 Foliage/ other	Comments
Torostoma apicale Broun		√		Rare
COLEOPTERA: PLATYPODIDAE				
Platypus apicalis White		√		
Platypus gracilis Broun		√		
COLEOPTERA: SCARABAEIDAE				
Costelytra zealandica (White)			√	
Odontria striata White			√	
Pyronota festiva (F.)			√	
Stethaspis suturalis Hope			√	
COLEOPTERA: SCOLYTIDAE				
Amasa truncata (Erichson)		√		Rare
Hylastes ater (Paykull)	√			Rare
Hylurgus ligniperda (F.)	√			Rare
Pachycotes peregrinus (Chapuis)		√		
Xyleborinus saxeseni (Ratzburg)		√		
Xyleborus compressus (Lea)		√		Rare
HEMIPTERA: ADELGIDAE				
Pineus laevis (Maskell)			√	
HEMIPTERA: CICADIDAE				
Amphipsalta cingulata (F.)			√	
HEMIPTERA: COCCIDAE				
Ceroplastes sinensis Del Guercio			√	
Coccus hesperidium L.			√	
HEMIPTERA: DIASPIDIDAE				
Lindingaspis rossi (Maskell)			√	
Parlatoria pittospori			√	
Quadraspidiotus perniciosus (Comstock)			√	

(cont.)

Insect species	Location of attack: Bark/ cambium	Wood	Foliage/ other	Comments
HEMIPTERA: MARGARODIDAE				
Icerya purchasi Maskell			√	
HEMIPTERA: RICANIIDAE				
Scolypopa australis (Walker)			√	
HYMENOPTERA: SIRICIDAE				
Sirex noctilio F.		√		
HYMENOPTERA: TORYMIDAE				
Megastigmus spermatrophus Wachtl			√	
ISOPTERA: KALOTERMITIDAE				
Kalotermes brouni Froggatt		√		
ISOPTERA: RHINOTERMITIDAE				
Coptotermes acinaciformis (Froggatt)		√		Rare
Coptotermes frenchi Hill		√		Rare
ISOPTERA: TERMOPSIDAE				
Stolotermes ruficeps Brauer		√		
LEPIDOPTERA: GEOMETRIDAE				
Declana floccosa Walker			√	
Declana hermione Hudson			√	
Declana junctilinea (Walker)			√	
Declana leptomera (Walker)			√	
Gellonia dejectaria (Walker)			√	
Pseudocoremia fenerata (Felder & Rogenhofer)			√	
Pseudocoremia leucelaea (Meyrick)			√	
Pseudocoremia productata (Walker)			√	
Pseudocoremia sauvis Butler			√	

(cont.)

Insect species	Location of attack: Bark/ cambium	Wood	Foliage/ other	Comments
LEPIDOPTERA: GLYPHIPTERYGIDAE				
Heliostibes atychioides (Butler)			√	
LEPIDOPTERA: NOCTUIDAE				
Graphania insignis (Walker)			√	
Graphania mutans (Walker)			√	
Graphania ustistriga (Walker)			√	
Helicoverpa armigera Hubner			√	
Mythimna separata (Walker)			√	
LEPIDOPTERA: OECOPHORIDAE				
Izatha sp.	√			Rare
LEPIDOPTERA: PSYCHIDAE				
Liothula omnivora Fereday			√	
LEPIDOPTERA: TORTRICIDAE				
Ctenopseustis obliquana (Walker)			√	
Epiphyas postvittana (Walker)			√	
Planotortrix excessana (Walker)			√	
Planotortrix flavescens (Butler)			√	
Planotortrix notophaea (Turner)			√	
Pyrgotis plagiatana (Walker)			√	
ORTHOPTERA: TETTIGONIIDAE				
Caedicia simplex (Walker)			√	
THYSANOPTERA: THRIPIDAE				
Heliothrips haemorrhoidalis (Bouche)			√	

Appendix B

Pest Risk Assessment Forms

The pest risk assessment forms give a brief outline of the pests that were screened as potential problems. These forms are not as complete as the forms for the seven pests analyzed in detail in chapter 2; they are included to document the pests considered in the screening process.

Pest risk assessment form

Scientific names of pests: *Armillaria limonea* (Stevenson) Boesewinkel, *A. novae-zelandiae* (Stevenson) Herink.

Other name: Armillaria root disease

Scientific name of host(s): Many hardwood and softwood species. The major hosts are *Acacia melanoxylon, Chamaecyparis lawsoniana, Cryptomeria japonica, Cupressus macrocarpa, Larix decidua, Pinus contorta, P. nigra, P. ponderosa, P. radiata, Pseudotsuga menziesii,* and *Tsuga heterophylla*

Distribution: *A. limonea*—New Zealand; *A. novae-zelandiae*—New Zealand, eastern Australia, New Guinea, South America (?)

Summary of natural history and basic biology of the pest: "*Armillaria* spp. are present mainly as saprophytes in indigenous forests. They cause a characteristic heart rot in living native trees, the decayed wood being wet, yellowish and divided into large pockets by black lines. Fruiting bodies of the fungi are found on rotten logs, snags, or other decaying debris, and may occur singly, in dense clusters, or in groups which can be up to 5m wide. Fruiting bodies have also been found on the stumps of recently felled trees of introduced species, but never on living, infected hosts. Although very large numbers of spores are released, the role of spores in the infection cycle is not known. Limited local spread of the disease in undisturbed indigenous forests takes place when rhizomorphs from infected stumps and roots come into contact with nearby logs or stumps. When indigenous forests are clearfelled many new stumps become colonised by *Armillaria* spp. and the fungi soon become widespread: rhizomorphs and mycelial fans can be found on new stumps within 1 year of clearfelling. Young pine seedlings become infected when their roots come into contact with rhizomorphs. The invading fungus spreads along roots beneath the bark in the form of white, fan-like mycelial sheets. Attack to living conifer tissue induces resin bleeding. Diseased trees wilt and may die, since the destruction of living tissue in the root collar region interferes with water translocation. Older trees are frequently more resistant to attack, and production of healthy tissue may continue around regions of infection. Once trees have been killed *Armillaria* spp. spread rapidly, colonising the decaying dead root and stem tissues. Mycelial fans may be observed up to a metre or more above ground level when bark is peeled from stems of killed trees. This type of colonisation does not produce resin bleeding" (van der Pas *et al.* 1983).

Specific information relating to risk elements:

A. Probability of pest establishment

1. **Pest with host at origin:**
Armillaria spp. occur as decay in the butts of trees, possibly up to 3 to 5 feet above ground line once a tree has died. Infected trees that are harvested and shipped would carry the fungi in the decayed wood. The butt portion of logs with advanced decay would have no value and would likely be removed from shipment. Some early stages of decay may be transported. Logs with advanced decay may be detected through visual inspection.

2. **Entry potential:**
Shipment of logs from New Zealand to the United States will not affect the survival of *Armillaria* spp. in the logs. Detection at the port of entry will depend upon the extent of decay present and the intensity of inspection. Because these fungi occur in the butt portion of the tree, advanced decay should be visible on the cut end of a log. Incipient decay will not be visible. Thorough, individual log inspection is required to identify the presence of *Armillaria* spp. advanced decay. Identification of the causal organism *(Armillaria* spp.) will require isolation and culturing the fungus from infected wood. This will require specialized facilities and several weeks to occur.

3. **Colonization potential:**
The probability of contact of *Armillaria* spp. with hosts in the United States will depend on the treatment of infected wood that is not processed at a mill. Defective material that is chipped and burned or processed will have little probability if done expediently. Material that is not treated, but that lies in cull piles for extended periods, could result in colonization as rhizomorphs grow from infected material to nearby woody tissue. The probability of this occurring would depend upon the size of the discarded material and its inoculum potential (Redfern & Filip 1991). This spread would be limited to the immediate area as long as the woody material is not removed from the mill. If fruiting bodies of these fungi develop from infected material, it is possible that spread may be more far-ranging. Some evidence suggests that basidiospores can colonize freshly cut wood or stumps from which infection can spread to adjacent living trees (Hood *et al.* 1991). The probability of this occurring depends on the proximity of the site to potential hosts and the availability of infection courts. The similarity between the United States and New Zealand climates suggest that there would be little environmental resistance. Drier conditions in some areas may reduce the length of time and amount of production of fruiting bodies.

4. **Spread potential:**
If colonization of native hosts by *Armillaria* spp. occurs, then the potential for spread is high. Successful colonization of native hosts will suggest that

basidiospore infection occurred. Because of the number of hosts of these fungi in the United States, it is likely that additional infection courts would be available. Spread would be sporadic because of the limited time of fruiting body production and the exacting requirements for their production and for spore infection. Spread potential from vegetative mycelium or decayed wood is low because of the limited likelihood of transport of this material. It is not known if genetic transference with U.S. species of *Armillaria* might occur.

5. Control options:
There are no known control options for these fungi. Visual inspection of logs will reduce the number of infected logs transported.

B. Consequences of establishment

6. Economic damage potential:
The majority of the economic damage would be to Christmas tree plantations. Establishment of these fungi in *P. radiata* plantations would reduce productivity by causing tree mortality in the first several years after planting. These plantations, however, are usually established on highly cultivated lands so the likelihood of the presence of an adequate inoculum source is low. Introduction of these fungi to native *P. radiata* stands would cause some tree mortality and root decay. The loss of supporting roots could increase windthrow, which could damage homes and improvements and increase the risk to public safety. It is unknown what effects these fungi may have on other native hosts, but an increase in tree mortality would be expected.

7. Environmental damage potential:
Environmental damage associated with the introduction of *Armillaria* spp. would depend on the number of hosts that would develop. The effect on the native *P. radiata* stands could be dramatic environmentally. Loss of cover could result in species shifts in the remaining acres of *P. radiata.*

8. Perceived damage (social and political influences):
Increased mortality in the native *P. radiata* stands would have highly significant social and political impacts because of the large population centers associated with these areas, the high environmental regard for them, and their significance because of their limited distribution. Losses of even small amounts of this limited resource would probably be considered intolerable with the resultant political implications.

Estimated risk for pest: ***Low.***

Selected bibliography:

Hood, I.A.; Redfern, D.B.; Kile, G.A. 1991. Armillaria in planted hosts. In: Shaw, III, C.G.; Kile, G.A., eds. Armillaria root disease. Agric. Hdbk. 691. Washington, DC: U.S. Department of Agriculture, Forest Service: 122-149.

Redfern, D.B.; Filip, G.M. 1991. Inoculum and Infection. In: Shaw, III, C.G.; Kile, G.A. eds. Armillaria root disease. Agric. Hdbk. 691. Washington, DC: U.S. Department of Agriculture, Forest Service: 48-61.

van der Pas, J.B.; Hood, I.A.; Mackenzie, M. 1983. Armillaria root rot. Forest Pathology in New Zealand Leafl. No. 4. 8 p.

Scientific name of pest: *Diplodia pinea* (Desm.) Kickx (=*Sphaeropsis sapinea* (Fr.) Dyko and Sutton)

Other name: Diplodia shoot blight

Scientific name of host(s): *Chamaecyparis lawsoniana, Pinus canariensis, P. contorta, P. elliottii, P. nigra, P. palustris, P. ponderosa, P. radiata, P. taeda, Pseudotsuga menziesii*

Distribution: North America, Central America, South America, Europe, Africa, Asia, Australia, New Zealand

Summary of natural history and basic biology of the pest: *Diplodia pinea* is cosmopolitan on a wide range of hosts, including many species of *Pinus, P. menziesii, Chamaecyparis lawsoniana,* and *Larix* spp. It causes a stem and foliage disease that can result in defoliation, dieback, shoot blight, canker, and mortality. In New Zealand, it causes shoot dieback of *P. radiata* in localized areas where warm, wet conditions prevail. It also causes whorl cankers on stems associated with pruning wounds. It has not been identified on a host indigenous to New Zealand. The fungus readily fruits on diseased tissue, slash, and cones. Spread occurs primarily by rain splash of the spores. Infection occurs directly in either wounded or unwounded, succulent shoots as they are expanding in the spring. Stems become infected through wounds. Differences in pathogenicity between strains of the fungus may exist, but have not been documented. Chou (1976b) examined 18 isolates from across New Zealand and did not find differences in pathogenicity. This is a limited study of an introduced fungus on an exotic host, however. Palmer (1991) and Palmer *et al.* (1987) have identified two isolate types from the northcentral United States that have different cultural characteristics and abilities to invade unwounded tissue. Infection intensity does appear to depend on environmental and host conditions. Dieback tends to decrease with increasing tree size (Chou 1976a, Chou 1984, Gibson 1979).

Specific information relating to risk elements:

A. Probability of pest establishment

1. Pest with host at origin:
Diplodia pinea is common on *Pinus radiata* in New Zealand and some logs for import to the United States will likely harbor the fungus. Only stem infections will be transported since limbs and branches will not remain on the logs. Observations on initial shipments document this likelihood (Cobb personal communication, Adams personal communication).

2. **Entry potential:**
Transit of logs will not affect fungus survival. The likelihood of detection will be moderate if logs are visually inspected and blue staining of the wood is evident.

3. **Colonization potential:**
Pine hosts and Douglas-fir, both native stands and ornamental plantings, grow near the ports of entry. Infection of these hosts would require the development of fruiting bodies of the fungus and subsequent spread of the spores to susceptible tissues. Pycnidia readily develop on the bark of dead shoots, but it is unknown if they would develop on the surface of debarked wood. Potential hosts would need to be in close proximity for effective spore dispersal to occur. There are also seasonal limitations when infection of shoots would be likely.

4. **Spread potential:**
If colonization by *D. pinea* occurs in native stands, spread would occur principally on trees that are stressed and in places where environmental conditions are conducive. The continuity of hosts in the Western United States would permit continual spread.

5. **Control options:**
There are no known control options for *D. pinea* in logs. Fumigation following the APHIS T312 schedule may be effective at killing the fungus in the surface inches. This would delay the time when fruiting body development may occur. However, fumigation of a trial shipment at $80 g/m^3$ of methyl bromide for 24 hours did not kill all infections.

B. Consequences of establishment

6. **Economic damage potential:**
D. pinea is resident in the United States causing damage primarily to ornamental and landscape trees. Transport of *D. pinea* on logs would not cause an increase in economic, environmental, or perceived damage unless a different, more virulent strain were introduced.

7. **Environmental damage potential:**
See Economic damage potential:

8. **Perceived damage (social and political influences):**
See Economic damage potential:

Estimated risk for pest: *Moderate.*

Additional Remarks: Determinations of the strain(s) of this fungus in New Zealand need to be made to accurately assess risk. If the strains presently occur in the United States, then there would be no additional risk. If the strain(s) are distinctly different, then the risk would depend on the virulence and host range of the introduced strain(s). Evaluation of an isolate from a New Zealand shipment to Sacramento, CA, is ongoing. As of April 22, 1992, its morphology and growth rate were comparable to less aggressive or more aggressive U.S. isolates, respectively. There appears to be a high level of variability within U.S. isolates (Palmer, personal communication). Pathogenicity studies of New Zealand isolates on several western conifer species should be done to resolve questions on genetic variability.

Selected bibliography:

Chou, C.K.S. 1976a. A shoot dieback in *Pinus radiata* caused by *Diplodia pinea*. 1. symptoms, disease development, and isolation of pathogen. New Zealand Journal of Forest Science 6: 72-79.

Chou, C.K.S. 1976b. A shoot dieback in *Pinus radiata* caused by *Diplodia pinea*. II. inoculation studies. New Zealand Journal of Forest Science 6: 409-420.

Chou, C.K.S. 1984. Diplodia leader dieback. Forest Pathology in New Zealand Leafl. No. 7. Rotorua, NZ: Forest Research Institute, 4 p.

Gibson, I.A.S. (comp.). 1979. Diseases of forest trees widely planted as exotics in the tropics and southern hemisphere. II. the genus *Pinus*. Kew, Surrey: CMI, 135 p.

Palmer, M.A. 1991. Isolate types of *Sphaeropsis sapinea* associated with main stem cankers and top-kill of *Pinus resinosa* in Minnesota and Wisconsin. Plant Disease 75: 507-510.

Palmer, M.A., Stewart, E.L.; Wingfield, M.J. 1987. Variation among isolatres of *Sphaeropsis sapinea* in the north-central United States. Phytopathology 77: 944-948.

Scientific Names of Pests: *Ganoderma mastoporum* (Leville) Pat. and *Ischnoderma rosulata* (Cunning.) Buchanan & Ryvarden

Scientific name of host(s): *Acacia dealbata, Agathis australis, Beilschmiedia tarairi, B. tawa, Castanea sativa, Coprosma arborea, Dacrycarpus dacrydiodes, Dacrydium cupressinum, Knightia excelsa, Kunzea ericoides. Metrosideros robusta, Nothofagus fusca, Larix decidua,* and *Pinus radiata*

Distribution: Australia, Asia

Summary of natural history and basic biology of the pest: *Ganoderma* spp. generally decay dead wood and function as wound parasites. *G. mastoporum* has been found on living and dead trees. *I. rosulata* occurs as a heart rot of live *Larix decidua* in New Zealand. It probably does similar damage on *Pinus radiata*. These wood decay fungi are spread by airborne spores produced by large woody to fleshy fruiting bodies that develop on the log or tree. Some opening in the bark (wound pruning stub, branch stub or knot) is required for infection and colonization of the woody cylinder (Cunningham 1965, Pennycook 1989).

Specific information relating to risk elements:

A. Probability of pest establishment

1. Pest with host at origin:
These decay fungi are not common in managed plantations forests. They usually occur in overmature forests and the rotation lengths being followed in New Zealand plantation forests (30-50 years) will reduce the likelihood that they are present in logs. About 90 percent of the butt rot currently occurs in Douglas-fir that have been wounded during thinnings (Allen Fraser, pers. comm.). Current harvesting practices during intermediate thinnings are reducing the amount of wounding of residual trees to less than 2 percent (Ron Reid, pers. comm.). This will reduce opportunities for infection.

2. Entry potential:
These fungi will survive transit in logs. The probability of detection is low unless the decay is evident at the end of a log.

3. Colonization potential:
Ports in California may have exotic plantings of *P. radiata* nearby. Other pine species may be susceptible to either one or both of these fungi which would expose other port areas to possible colonization. These fungi create sizeable fruiting bodies which could develop on decaying wood if permitted to sit long enough under satisfactory conditions. This may need to be for 6 months or longer. Without fruiting body development, there is little likelihood of colonization unless the decaying wood remained in contact with wounds on potential hosts.

4. Spread potential:
Once established, both of these fungi could spread once fruiting bodies develop. They would probably require some type of tree wound for successful infections to occur. The rate and distance of spread would depend on the range of hosts and the environmental conditions in the area.

5. Control options:
There are no known control options for wood decay fungi in logs.

B. Consequences of establishment

6. Economic damage potential:
Economic damage would be limited. If *P. radiata* were the only host, there would be no economic loss since it is not a commercial timber species in the United States. Occurrence on other hosts could result in some timber volume loss, but this should not be significant if reasonable rotation ages occur.

7. Environmental damage potential:
The primary effect of these fungi is wood decay. They do not generally cause tree mortality, although some *Ganoderma* spp. may kill trees under stress. Some lawn and ornamental *P. radiata* could be affected in this way.

8. **Perceived damage (social and political influences):**
Establishment of these fungi would result in little damage.

Estimated risk for pest: *Low.*

Selected bibliography:

Cunningham, G.H. 1965. Polyporaceae of New Zealand. New Zealand Department of Scientific and Industrial Research Bull. 164. Wellington: New Zealand Government Printer. 304 p.

Pennycook, S.R. 1989. Plant diseases recorded in New Zealand, vol. 2. Auckland: New Zealand Department of Scientific and Industrial Research. 502 p.

Scientific Names of Pests: *Junghuhnia vincta* (Berk.) Hood and *Peniophora sacrata* Cunningham

Scientific name of host(s): *Berberis glaucocarpa, Chamaecyparis lawsoniana, Cryptomeria japonica, Eucalyptus* spp., *Pinus contorta, P. elliottii, P. muricata, P. nigra, P. radiata, Salix matsudana, and Thuja plicata*

Distribution: New Zealand, Hawaii (USA), United States, Tropics

Summary of natural history and basic biology of the pest: These fungi occur infrequently in exotic pine plantations, predominantly on sites previously occupied by native forest and shrubs. The incidence of *J. vincta* has been estimated at less than 1 percent. Mortality usually occurs as single trees in direct contact with inoculum and occurs within 5 to 10 years of plantation establishment. Few new areas of infection occur thereafter; none have been observed in established stands. *J. vincta* produces a flattened basidiocarp on diseased tissue and is likely spread by air-borne spores. It causes a white rot of hardwoods in the Gulf Coast region of the United States (Gilbertson and Ryvarden 1987). *P. sacrata* also forms a flat fruiting body on the native hosts, but these are rarely observed on exotic pines. Spore dissemination of this species is thought to be unimportant (Dick 1983, Hood and Dick 1988).

Specific information relating to risk elements:

A. Probability of pest establishment

1. **Pest with host at origin:**
The low incidence of these diseases on *Pinus radiata* and their occurrence primarily early in the life of a plantation indicates that the fungi will not likely be transported in log shipments. The occurrence of the fungi in the butt extending up from the roots will allow ready detection of butt decay in the cut log.

2. **Entry potential:**
Transport of infected logs will not affect the survival of these fungi because of their existence in the butt portion of the log.

3. **Colonization potential:**
A number of west coast conifers likely to be present around the ports of entry are known hosts of these fungi. *Junghuhnia vincta* could develop fruiting bodies in transit, setting the stage for aerial spread of spores upon arrival. Conditions required for infection to occur are unknown. *Peniophora sacrata* apparently does not develop fruiting bodies readily on exotic pines and would require direct contact of infected woody material with host trees for infection to occur. The similarity between New Zealand and west coast environments suggest these fungi could survive and reproduce.

4. **Spread potential:**
If established, *Junghuhnia vincta* could spread by aerial dispersal of spores, although the importance of spores to disease spread, and what the infection courts would be, is unknown. Spread of *Peniophora sacrata* would be much more limited and likely would not occur unless woody material is moved in the forest. Inland and northernly spread and survival may be limited by low temperatures.

5. **Control options:**
There are no known control options for these fungi.

B. Consequences of establishment

6. **Economic damage potential:**
Low levels of young tree mortality might occur. Any damage would be limited in extent.

7. **Environmental damage potential:**
See above discussion on economic damage.

8. **Perceived damage (social and political influences):**
See above discussion on economic damage.

Estimated risk for pest: *Low.*

Selected bibliography:
Dick, M. 1983. Peniophora root and stem canker. Forest Pathology in New Zealand Leafl. No. 3. Rotorua, NZ: Forest Research Institute. 4 p.

Gilbertson, R.L.; Ryvarden, L. 1987. North American polypores vol. 2, Fungiflora. Oslo: Gronlands Grafiske.

Hood, I.A.; Dick, M. 1988. *Junghuhnia vincta* (Berkeley) comb. nov., root pathogen of *Pinus radiata.* New Zealand Journal of Botany 26: 113-116.

Scientific name of pest: *Melampsora larici-populina* Klebahn

Scientific name of host(s): *Pinus radiata, Populus* spp., *Larix* spp.

Distribution: Europe, Asia, Africa, South America, New Zealand, Washington State (USA)

Summary of natural history and basic biology of the pest: *Melampsora larici-populina* Kleb. is a heteroecious, macrocyclic rust in the Order *Uredinales,* Family *Melampsoraceae.* Uredinia are found on poplar leaves. Pycnia and aecia occur on the current year's needles of the conifer host, principally *Larix decidua* and *L. kaempferi* in New Zealand. It is found infrequently on *Larix* and *P. radiata* in New Zealand. At least four physiologic races of the rust have been reported from Europe.

Aeciospores are released from the conifer host in the late spring to early summer and infect poplar. Dull-orange uredinia are produced on the under surface of poplar leaves throughout the summer and urediniospores infect other poplar leaves. Brownish telia are produced on the upper surface of poplar leaves in the fall. Telia overwinter, producing basidia and releasing basidiospores which cause spring infections of conifers. Urediniospores produced on semi-evergreen poplars overwinter and remain viable and pathogenic the following spring.

Long-distance spread is by air-borne urediniospores. Within Australia, the rust spread 400 km with the prevailing winds in a 14-week period. The entry of *M. larici-populina* into New Zealand is suspected to have occurred via trans-Tasman Sea wind currents from Australia. Spread to the aecial host from the uredinial host of *Melampsora* spp. usually is limited to distances of 1,000 feet or less. (Spiers 1990).

Specific information relating to risk elements:

A. Probability of pest establishment

1. **Pest with host at origin:**
   M. larici-populina occurs infrequently on the foliage of *P. radiata* and *Larix* spp.

2. **Entry potential:**
   Potential would be high if any infected foliage debris remained on the logs.

3. **Colonization potential:**
   Rust spores are windborne and can be carried for great distances. There are large areas of native poplar throughout the Pacific Northwest; they are frequently adjacent to import sites and milling sites as well as along transport routes. Within 100 miles of the Columbia River on both the Washington and Oregon sides from the Pacific Ocean at Astoria to the Seattle, Tacoma, and Bellvue area in Washington, large acreages of hybrid poplar are being grown under a short rotation intensive cultivation (SRIC) program. Approximately two-thirds of the hybrids of *Populus trichocarpa* x *P. deltoides* and of *P. trichocarpa* x *P. maximowiczii* being grown in these plantations are susceptible to *M. larici-populina* (Newcombe and Chastagner personal communication).

4. **Spread potential:**
   The potential spread from *Larix* to hardwood via stage I and hardwood to hardwood via stage II is great, perhaps for hundreds of miles. Spread from hardwood to *Larix* would be generally local owing to the fragility of stage IV.

5. **Control options:**
Debarking would effectively remove all foliage. Fungicidal sprays and fumigation would likely kill any spores on the logs.

B. **Consequences of establishment**

6. **Economic damage potential:**
There is potential for great damage to *Larix* and to *Populus*. The potential damage to the hardwood species is especially worrisome because of the great interest and investment in fast-growing and high-yielding *Populus* spp. and hybrids in the Western United States. Even though some damaging *Melampsora* species, including *M. larici-populina*, are already in North America, we know very little about the pathogen distribution and pathogenic variation.

7. **Environmental damage potential:**
Heavy infections along stream courses could cause premature defoliation and adversely affect aquatic organisms.

8. **Perceived damage (social and political influences):**
Melampsora spp. cause great esthetic damage to foliage of both conifer and hardwood hosts. The public would not tolerate such damage from introduced pathogens.

Estimated risk for pest: ***Moderate.***

Selected bibliography:
Spiers, A.G. 1990. Melampsora leaf rusts of poplar. Forest Pathology in New Zealand Leafl. No. 20. Rotorua, NZ: Forest Research Institute. 8 p.

Scientific Names of Pests: *Ophiostoma* spp., *Leptographium* spp., *Ceratocystis* spp., and *Ceratocystiopsis falcata*

Scientific name of host(s): Many coniferous hosts, including *Pinus radiata* and *Pseudotsuga menziesii*

Distribution: Worldwide to New Zealand solely

Summary of natural history and basic biology of the pest: The specific fungi addressed in this section include *Leptographium procerum* (Kendr.) Wingf., *Ceratocystis coronata* (Olchowecki & Reid, *Ceratocystiopsis falcata, Ophiostoma huntii* (Robins-Jeff) deHoog & Scheffer, *O. ips* (Rumb.) Nannf., *Ceratocystis novae-zelandiae* Hutchinson & Reid, *O. piceae, O. piceaperdum* (Rumb.) Arx, and *O. pilifera*. General information on this group of organisms has been previously discussed (USDA Forest Service 1991). Of these the following have been identified on native trees in the United States or Canada: *L. procerum* (Alexander *et al.* 1988), *O. huntii* (Harrington 1988), *C. coronata* (Olchowecki & Reid), *C. falcata* (Rayner & Hudson 1977), *O. ips, O. piceae, O. piceaperdum,* and *O. pilifera* (Farr *et al.* 1990, Hepting 1971).

L. procerum has been identified as a pathogen of conifers in the Pinaceae (Harrington 1988, Alexander *et al.* 1988, Wingfield *et al.* 1988). *L. procerum* causes procerum root disease of eastern white pine *(Pinus strobus)* in the Eastern United States and has been associated with numerous species of dying pines and Douglas-fir in other parts of the world (Alexander *et al.* 1988).

Many species of *Ophiostoma*, *Ceratocystis*, and *Ceratocystiopsis* are staining fungi of wood and lumber products. They are usually vectored by insects in the family Scolytidae. Some are saprophytes, while others can be pathogenic. Only *C. novae-zelandiae* of the fungi has not been reported in North America. The recovery of this fungus in New Zealand was from native *Podocarpus* spp., *P. menziesii,* and *P. radiata.* These trees had obvious evidence of bark beetle activity (Hutchison & Reid 1988).

Specific information relating to risk elements:

A. Probability of pest establishment

1. **Pest with host at origin:**
   The above listed fungi have been identified as occurring on *P. radiata* and Douglas-fir in New Zealand. Although vectors have not been identified, this group of fungi is usually vectored by bark beetles and possibly other insects found in beetle galleries (Harrington 1988).

2. **Entry potential:**
   Entry potential for these fungi is high. These fungi survive well for some time in logs (more than a year with favorable temperatures and moisture regimes). They would be favored by the conditions that could be expected to prevail during transport of the logs (many logs packed close together in an enclosed, moist environment). Bark removal would not prevent survival in transit, and, in fact, mitigation of these fungi would require a type of treatment that would kill hyphae occupying the entire sapwood cylinder of the logs. These fungi fruit prolifically in insect galleries, bark or wood cavities, and on the undersides of logs, bark, or wood scraps, especially in moist situations. The likelihood of spores being produced in or on untreated colonized logs once they have been delivered to ports is extremely high.

3. **Colonization potential:**
   The probability of these organisms coming into contact with a North American host is high. The proximity of both Douglas-fir and *P. radiata* to many of the west coast ports makes contact likely if vectors are present. Many of these fungi are not particularly host specific. The comparable climates of New Zealand and the Western United States, especially the Pacific Northwest, suggest that environmental conditions would be conducive to spread of the fungi. Potential vectors native to the United States could be more efficient at spreading these fungi, especially the *Leptographium* spp.

4. **Spread potential:**
If established, these fungi have great potential to spread. Fungi associated with insect vectors are not limited in their spread by their own growth rates. Rather, the distances traveled by their insect associates are the critical factors. Bark beetles and Cerambycids are capable of flying distances of several miles and can be carried even further by winds. Some of these insects have two or more generations per year, so it is possible that there could be two or more increments of vector spread annually. Also, spread of these fungi and associated insects can be increased substantially by human transport of harvested logs and firewood.

5. **Control options:**
There are no known methods for controlling these fungi in woody material. The T312 fumigation schedule (USDA APHIS 1991) may be effective since these fungi are related to the oak wilt fungus, *Ceratocystis fagacearum*. Complete bark removal would reduce the risk of transport of likely vectors, thereby reducing the opportunity for spread upon arrival in the United States. The lack of bark would also reduce the probability of potential native insect vectors attacking the logs and transmitting the fungi.

B. Consequences of establishment

6. **Economic damage potential:**
Introduction of *C. novae-zelandiae* would add an additional blue-stain agent that could cause lumber and log degrade. It has not been observed as a pathogen in New Zealand. This fungus would affect bark beetle-attacked trees also infected by native blue-stain fungi.Economic damage potential: from the introduction of a new blue-staining fungus would be minimal. Numerous species of blue-stain fungi already present in the United States would normally be found in bark beetle attacked trees.

7. **Environmental damage potential:**
There is no expected environmental damage from the introduction of these fungi.

8. **Perceived damage (social and political influences):**
No perceived damage is expected.

Estimated risk for pest: ***Low.***

Additional Remarks: The lack of documented effective mitigation measures suggests that some of these fungi would eventually enter the United States. Subsequent colonization is probable, but damage associated with the blue-stain fungi would be minimal.

Selected bibliography:

Alexander, S.A.; Horner, W.E.; Lewis, K.J. 1988. *Leptographium procerum* as a pathogen of pines. In: Harrington, T.C.; Cobb, Jr., F.W. eds. Leptographium root diseases of conifers. American Phytopathological Society Press: 97-112.

Farr, D.F.; Bills, G.F; Chamuris, G.P.; Rossman, A.Y. 1989. Fungi on plants and plant products in the United States. St. Paul, MN: American Phytopathological Society. 1252 p.

Harrington, T.C. 1988. *Leptographium* species, their distributions, hosts and insect vectors. In: Harrington, T.C.; Cobb, Jr., F.W. eds. Leptographium root diseases of conifers. St. Paul, MN: American Phytopathological Society Press: 1-40.

Hepting, G.H. 1971. Diseases of forest and shade trees of the United States. Agric. Hdbk. 386. Washington, DC: U.S. Department of Agriculture. 658 p.

Hutchinson, L.J.; Reid, J. 1988. Taxonomy of some potential wood-staining fungi from New Zealand. 1. Ophiostomataceae. New Zealand Journal of Botany 26: 63-81.

Rayner, A.D.M.; Hudson, H.J. 1977. *Ceratocystis falcata* and its conidial state. Transactions of the British Mycological Society 68: 315-316.

USDA Forest Service, 1991. Pest risk assessment of the importation of larch from Siberia and the Soviety Far East. Misc. Pub. 1495. Washington, DC: USDA Forest Service.

USDA. APHIS 1991. An efficacy review of control measures for potential pests of imported soviet timber. Misc. Pub. 1496. Washington, DC: USDA APHIS.

Wingfield, M.J.; Capretti, P.; MacKenzie, M. 1988. *Leptographium* spp. as root pathogens of conifers, an international perspective. In: Harrington, T.C.; Cobb, Jr., F.W. eds. Leptographium root diseases of conifers. American Phytopathological Society Press: 113-128.

Scientific name of pest: *Arhopalus tristis* (Mulsant) (Cerambycidae) (formerly *A. ferus*)

Other name: Burnt pine longhorn

Scientific name of host(s): *Pinus* spp. and *Picea abies* (Norway spruce)

Distribution: Europe and New Zealand

Summary of natural history and basic biology of the pest: This pest is found in logs, stumps and standing dead trees, especially those killed by fire. Early larval stages feed in the inner phloem, and later larval stages feed in the outer sapwood, sometimes tunnelling to a depth of 4 inches. This deep penetration occurs in crowded conditions. The adults may emerge anytime between November and summer and live for several weeks. It takes from 1 to 2 years to complete their life cycle. The adults fly at dusk and the early part of the night. Adults often shelter in packets of sawn timber during the day.

Specific information relating to risk elements:
A. Probability of pest establishment

1. Pest with host at origin:
P. radiata

2. **Entry potential:**
Moderate

3. **Colonization potential:**
High because it attacks pine species as well as Norway spruce

4. **Spread potential:**
Moderate to high varying on location. Adults may fly more than 3 km to find attractive host.

5. **Control options:**
Sheltering adults in packets of sawn timber can be killed with methyl bromide. Areas around yards should be kept free on reject logs, slabs, or dying pines which may harbour *A. tristis*.

B. Consequences of establishment

6. **Economic damage potential:**
Moderate. It attacks fire-killed trees, standing dead trees, logs, and stumps.

7. **Environmental damage potential:**
Low. It attacks dead trees so damage would be low.

8. **Perceived damage (social and political influences):**
Not likely to cause damage in forest or urban area by killing trees.

Estimated risk for pest: ***Moderate.***

Additional Remarks: Suggest bark removal and fumigation.

Selected bibliography:

Forest Research Institute, 1973. A problem wood borer. New Zealand Forest Service Forest Research Institute What's New in Forest Research No. 6.

Hosking, G.P., 1970. Arhopalus ferus, an introduced cerambycid borer. New Zealand Forest Service Forest Research Institute Research Leaflet No. 29.

Hosking, G.P. 1978. Arhopalus ferus (Musant). New Zealand Forest Service Forest Research Institute Research Leaflet No. 27.

Scientific name of pest: *Hexatricha pulverulenta* (Westwood) (Cerambycidae)

Other name: Squeaking longhorn

Scientific name of host(s): Wide range of softwoods and hardwoods

Distribution: New Zealand

Summary of natural history and basic biology of the pest: *Hexatricha pulverulenta* is a pest of dead and dying trees. The adults are found between August and April, and their life cycle takes from 2 to 3 years. The larvae generally only penetrate 2 mm into the sapwood, but when pupating, up to 40 mm.

Specific information relating to risk elements:

A. Probability of pest establishment

1. **Pest with host at origin:**
   P. radiata and Douglas-fir.

2. **Entry potential:**
   Low—reported only rarely from the above hosts.

3. **Colonization potential:**
   Moderate—depends on dead or dying hosts in entry port.

4. **Spread potential:**
   Moderate.

5. **Control options:**
   Removing bark and treating with methyl bromide.

B. Consequences of establishment

6. **Economic damage potential:**
   Moderate—because it doesn't attack live healthy trees.

7. **Environmental damage potential:**
   Low.

8. **Perceived damage (social and political influences):**
   Low. This wouldn't be a pest that would be readily noticed by public.

Estimated risk for pest: ***Moderate.***

Selected bibliography:

Duffy, E.A.J., 1963: A Monograph of the Immature Stages of Australasian Timber Beetles (Cerambycidae). London: British Museum. 235 p.

Jeffreys, F.J., 1939. *Hexatricha pulverulenta* Westwood. Transactions and Proceedings of the Royal Society of New Zealand 69: 347-60.

Hosking, G.P. 1978. Squeaking longhorn. New Zealand Forest Service Forestry Research Institute Forest Pest Leaflet No. 28.

Scientific Names of Pests: *Hylurgus ligniperda* (F.) and *Hylastes ater* (Paykull) (Scolytidae)

Other name: Black pine bark beetle

Scientific name of host(s): Pine, spruce, true firs, Douglas-fir, and larch.

Distribution: Europe, Great Britain, Western Siberia, Japan, Australia, Chile, New Zealand and South Africa

Summary of natural history and basic biology of the pest: This pest assessment was adapted from the previous of pests on Siberian logs)USDA Forest Service 1991). These insects feed and breed in phloem of logging slash, stumps, stump roots, moribund and dead conifers, and feed at the root crown of seedlings. Even more importantly, all have the potential to be vectors of diseases associated with intensive management, e.g., the black stain root disease, *Leptographium wagneri*.

<u>Hylurgus ligniperda</u>—Females of this bark beetle initiate building of brood galleries that consist of short entry tunnels leading to a nuptial chamber cut in the phloem. Mating occurs in these chambers. Females then construct long egg galleries parallel with the grain. Eggs are laid in notches cut in the walls of the egg gallery and are covered with frass. Eggs are laid over 100 to 200 mm of the gallery; the female will then rest before once more extending the egg gallery. Accordingly, larvae feeding in the phloem are found in at least two sizes. The insects overwinter in the phloem of their hosts as fourth instars and then pupate in late April or early May. They emerge as adults in 2 weeks and begin host selection flights. The main damage caused by this bark beetle is that the new adults feed on roots of young pine seedlings until they reach sexual maturity. However, they can also feed on other green material, such as freshly felled logs.

<u>Hylastes ater</u>—This scolytid is similar to *Hylurgus ligniperda* both in distribution, habits, and damage potential. The population breeds primarily in pines; however, sexually immature adults feed in seedlings of pine, spruce, true firs, Douglas-fir, and larch, and also on other green material. Brood galleries consist of short entry tunnels leading to an oblique nuptial chamber where mating takes place. Single egg galleries are dug along the grain by females. About 100 eggs are oviposited in individual notches that the females cut in the lateral walls of the egg galleries. The larvae initially make feeding tunnels at right angles to the egg galleries, but later these become random in direction and eventually obliterate both the early larval tunnels and those made by the parent adults. The insects overwinter as late instars and emerge in late spring as sexually immature adults.

Specific information relating to risk elements:

A. Probability of pest establishment

1. **Pest with host at origin:**
   P. radiata and Douglas-fir.

2. **Entry potential:**
   Moderate to high.

3. **Colonization potential:**
This species, which breed in pine, could colonize stumps, fallen branches, and moribund pines if the material were found around the port of entry.

4. **Spread potential:**
The scolytid members of this ecological group are good fliers and concentrate in response to host volatile materials over long distances. As long as recently cut or broken host material is available, infestations of these species can inexorably spread.

5. **Control options:**
Methyl bromide, insecticide, and anti-sapstain spray at port of shipment.

B. Consequences of establishment

6. **Economic damage potential:**
The damage potential of these pests is high; they would readily breed in pines and spruce breeding material, and maturational feeding could destroy planted seedlings. Worse would be the potential vectoring of the black stain root disease. Seedling and young stand mortality (black stain root rot kills) may not be an immediate problem to the forestry sector in the Pacific Northwest. But as carefully planned harvesting operations, thinning regimes, and replanting programs utilizing expensively selected planting stock become routine forestry practices, little growth loss or stand mortality will be tolerated. In other words, as the economic damage level allowed in intensively managed stands drops, the rhynchophorans in question will become increasingly important economic pests.

7. **Environmental damage potential:**
Although the economic damage caused by these insects would not cause environmental problems, one of the suggested control strategies would. Seedling mortality can be reduced by dipping bare rooted seedlings in a slurry containing a pesticide. This potential practice would raise environmental concerns.

8. **Perceived damage (social and political influences):**
These pests would not reach the attention of the general public because damage caused by these insects is subtle. Either the private forestry sector or governmental agencies that practice intensive forestry would readily see the damage potential of these pests.

Estimated risk for pest: ***High.***

Selected bibliography:

Bain, J., 1977. *Hylurgus ligniperda* (Fab.). Forest Research Institute New Zealand Forest Service Forest and Timber Insects in New Zealand No. 18.

Clark, A.F. 1932. The pine bark beetle *Hylastes ater* in New Zealand. New Zealand Journal of Science and Technology 14: 1-20.

Francke-Grossman, H. 1963. Some new aspects in forest entomology. Annual Review of Entomology 8:415-438.

Milligan, R.H. 1978. *Hylastes ater* (Paykull), black pine bark beetle. Forest Research Institute New Zealand Forest Service Forest and Timber Insects in New Zealand. No. 29.

Scott, T.M., and King, C.J., 1974. The large pine weevil and black pine beetles. Forestry Commission Leaflet 58. London: Her Majesty's Stationery Office.

Swan, D.C. 1943. The bark beetle *Hylastes ater* (Paykull) (Coleoptera scolytidae) attacking pines in south Australia. Journal of Agriculture of South Australia. 46: 86-90.

U.S. Department of Agriculture Forest Service. 1991. Pest risk assessment of the importation of larch from Siberia and the Soviet Far East. Misc. Pub. 1495. Washington, DC.

Scientific name of pest: *Mitrastethus baridioides* Redtenbacher (Curculionidae)

Other name: Longnosed kauri weevil

Scientific name of host(s): *Pinus* spp., including *P. radiata; Agathis australis,* and *Dacrydium cuppressinum*

Distribution: New Zealand

Summary of natural history and basic biology of the pest: *Mitrastethus baridioides* pest attacks *Pinus* logs and occasionally untreated *P. radiata* timber. The adults are abundant between January and April and adults sometimes shelter in pine logs destined for export. Unlike the larvae of most weevils, larvae of the longnosed kauri weevil penetrate deep into the sapwood. Only moist or wet wood is affected. Personal communication with John Bain of the New Zealand Forest Research Institute indicates that this weevil occurs very rarely on *P. radiata* but is commonly found on the native kauri tree.

Specific information relating to risk elements:

A. Probability of pest establishment

1. **Pest with host at origin:**
   P. radiata.

2. **Entry potential:**
   Low.

3. **Colonization potential:**
   Low.

4. **Spread potential:**
   Low. It has to have moist pine logs available to attack.

5. **Control options:**
Methyl bromide treatment.

B. **Consequences of establishment**

6. **Economic damage potential:**
Moderate. This might cause damage in areas where logs are stockpiled for a length of time.

7. **Environmental damage potential:**
Low. It attacks logs rather than live trees.

8. **Perceived damage (social and political influences):**
Low. This wouldn't be a pest that the public would readily notice.

Estimated risk for pest: ***Low.***

Selected bibliography:

Broun, T., 1876. On insects injurious to the kauri pine *(Dammara australis).* Transactions of the New Zealand Institute 9: 366-71.

Hudson, G.V. 1934. New Zealand beetles and their larvae. Wellington: Ferguson and Osborn. 236 p.

Hosking, G.P. 1978. Longnosed kauri weevil. New Zealand Forest Service Forest Research Institute Forest Pest Leaflet No. 34.

Scientific name of pest: *Navomorpha lineata* (F.) (Cerambycidae)

Scientific name of host(s): Wide range of trees in New Zealand.

Distribution: New Zealand

Summary of natural history and basic biology of the pest: *Navomorpha lineata* attacks living trees. The larvae mine down the center of twigs and small branches of mature trees and also attack the stems of young trees. The adults are found from November to January, and the life cycle is about 1 year.

Specific information relating to risk elements:

A. **Probability of pest establishment**

1. **Pest with host at origin:**
Pinus radiata and Douglas-fir.

2. **Entry potential:**
Low.

3. **Colonization potential:**
Low.

4. **Spread potential:**
Low.

5. **Control options:**
This is a pest confined to branches or leaders so it wouldn't be associated with logs for export.

B. Consequences of establishment

6. **Economic damage potential:**
Moderate—it deforms leaders of Douglas-firs.

7. **Environmental damage potential:**
Low.

8. **Perceived damage (social and political influences):**
Low.

Estimated risk for pest: ***Low.***

Selected bibliography:

Bain, J. 1976. *Navomorpha lineata* (F.). New Zealand Forest Service Forestry Research Institute Forest Pest Leaflet No. 2.

Duffy, E.A.J., 1963: A monograph of the immature stages of Australasian timber beetles (Cerambycidae). London: British Museum. 235 p.

Dumbleton, L.J. 1957. The immature stages of some New Zealand longhorn beetles (Coleoptera-Cerambycidae). Transactions of the Royal Society of New Zealand 84: 611-28.

Scientific name of pest: *Pachycotes peregrinus* (Chapuis) (Scolytidae)

Scientific name of host(s): Softwoods

Distribution: New Zealand

Summary of natural history and basic biology of the pest: *Pachycotes peregrinus* attacks moist logs and slow-seasoning forest produce such as posts and poles. This borer may also attack freshly sawn timber stored under damp conditions. The adults attack the logs in the summer and the lifecycle is thought to be about two years. The larvae bore into the outer sapwood.

Specific information relating to risk elements:

A. Probability of pest establishment

1. **Pest with host at origin:**
   P. radiata and Douglas-fir

2. **Entry potential:**
   High.

3. **Colonization potential:**
   High. All softwoods could be attacked.

4. **Spread potential:**
   Moderate.

5. **Control options:**
   Bark removal and fumigation with methyl bromide.

B. Consequences of establishment

6. **Economic damage potential:**
   Moderate.

7. **Environmental damage potential:**
   Low. It mainly attacks moist logs or slow-seasoning forest produce.

8. **Perceived damage (social and political influences):**
   Low. Its damage wouldn't be obvious to the public.

Estimated risk for pest: ***Moderate.***

Selected bibliography:
Bain, J. 1977. *Pachycotes peregrinus.* New Zealand Forest Service Forestry Research Institute Forest Pest Leaflet No. 19.

Scientific name of pest: *Psepholax* spp. (Curculionidae)

Other name: Pit weevils.

Scientific name of host(s): Wide range of softwoods and hardwoods.

Distribution: New Zealand

Summary of natural history and basic biology of the pest: Pit weevils are usually confined to dead material, especially stumps and logs. Freshly sawn timber may also be attacked. The larvae may penetrate deeply into the sapwood. They also will attack treated posts and battens stored in damp conditions. The life cycle can be from 1 to 3 years.

Specific information relating to risk elements:

A. Probability of pest establishment

1. **Pest with host at origin:**
   Pinus radiata and Douglas-fir.

2. **Entry potential:**
   Moderate.

3. **Colonization potential:**
   Moderate.

4. **Spread potential:**
   Moderate.

5. **Control options:**
   Methyl bromide and insecticide treatment of logs prior to shipment.

B. Consequences of establishment

6. **Economic damage potential:**
   Low.

7. **Environmental damage potential:**
   Low.

8. **Perceived damage (social and political influences):**
   Low.

Estimated risk for pest: ***Low.***

Selected bibliography:

Bain, J. 1976. Pit weevils. New Zealand Forest Service Forestry Research Institute Forest Pest Leaflet No. 5.

Hudson, G.V. 1934. New Zealand beetles and their larvae. Wellington: Ferguson and Osborn. 236 p.

Miller, D. 1971. Common insects in New Zealand. Auckland: A.H. and A.W. Reed. 178 p.

Scientific name of pest: *Stenopotes pallidus* Pascoe (Cerambycidae)

Scientific name of host(s): Softwoods.

Distribution: New Zealand

Summary of natural history and basic biology of the pest: *Stenopotes pallidus* is a pest of dead and dying wood and the wood is penetrated to a depth of 20 to 30 mm. The adults are normally active in December and January (summer in New Zealand).

Specific information relating to risk elements:

A. Probability of pest establishment

1. **Pest with host at origin:**
   Pinus radiata and Douglas-fir.

2. **Entry potential:**
   Low.

3. **Colonization potential:**
   Low.

4. **Spread potential:**
   Low.

5. **Control options:**
   Debarking, fumigation with methyl bromide, and insecticide treatment at port before shipment.

B. Consequences of establishment

6. **Economic damage potential:**
   Low.

7. **Environmental damage potential:**
   Low.

8. **Perceived damage (social and political influences):**
   Low.

Estimated risk for pest: ***Low.***

Selected bibliography:

Duffy, E.A.J. 1963. A monograph of the immature stages of Australasian timber beetles (Cerambycidae). London: British Museum. 235 p.

Dumbleton, L.J. 1957. The immature stages of some New Zealand longhorn beetles (Coleoptera-Cerambycidae). Transactions of the Royal Society of New Zealand 84: 611-28.

Hudson, G.V. 1934. New Zealand beetles and their larvae. Wellington: Ferguson and Osborn. 236 p.

Morgan, F.D. 1960. The comparative biologies of certain New Zealand Cerambycidae. New Zealand Entomologist 2: 26-34.

Rawlings, G.B. 1953. Insects of *Pinus radiata* forests in New Zealand. New Zealand Forest Service, Forest Research Notes 1(8): 1-19.

Zondag, R.; Bain, J. 1976. *Stenopods pallidus*. New Zealand Forest Service Forestry Research Institute Forest Pest Leaflet No. 6.

Scientific name of pest: *Stolotermes ruficeps* Brauer (Termopsidae), *Stolotermes inopinus* Gay (Termopsidae), *Coptotermes acinaciformis* (Froggatt) (Rhinotermitidae), *Coptotermes frenchi* (Hill) (Rhinotermitidae), *Glytotermes brevicornis* Froggatt (Kalotermitidae), *Kalotermes banksiae* Hill (Kalotermitidae)

Other name: Termites

Scientific name of host(s): Wood of many tree species.

Distribution: New Zealand (*Coptotermes* spp., *G. brevicornis*, and *K. banksiae* have been introduced into New Zealand from Australia)

Summary of natural history and basic biology of the pest:
Stolotermes ruficeps
This insect has been found in decaying branch stubs of living plantation-grown *P. radiata*. It has never been found in the heartwood of pine. The winged reproductives are active in autumn and only fly around 30 m.

Stolotermes inopinus occurs only rarely. It has been recorded from *P. radiata* and Douglas-fir.

Coptotermes acinaciformis has been found in the dead stumps of *P. radiata*. This pest occurs only rarely in New Zealand.

Coptotermes frenchi occurs only rarely in New Zealand on Douglas-fir.

Glytotermes brevicornis has been only rarely found attacking logs or dead parts of live trees of *P. radiata*.

Kalotermes banksiae has been found on fairly sound logs and tree stumps of *P. radiata*. It occurs only rarely.

Specific information relating to risk elements:
A. Probability of pest establishment

1. Pest with host at origin:
P. radiata and possibly Douglas-fir.

2. **Entry potential:**
Low.

3. **Colonization potential:**
Low.

4. **Spread potential:**
Low - only spread or fly around 30 meters.

5. **Control options:**
Fumigation and insecticide treatment.

B. **Consequences of establishment**

6. **Economic damage potential:**
High.

7. **Environmental damage potential:**
Low.

8. **Perceived damage (social and political influences):**
Moderate.

Estimated risk for pest: ***Low.***

Selected bibliography:

Bain, J.; Jenkin, M.J.1983. *Kalotermes banksiae, Glyptotermes brevicornis* and other termites (Isoptera) in New Zealand. New Zealand Entomologist 7: 365-71.

Gay, F.J. 1969. A new species of *Stolotermes* (Isoptera: Termopsidae: Stolotermitinae) from New Zealand. New Zealand Journal of Science 12: 748-53.

Kelsey, J.M. 1944. The identification of termites in New Zealand. New Zealand Journal of Science and Technology 25B: 231-60.

Kelsey, J.M. 1946. Insects attacking milled timber, poles and posts in New Zealand. New Zealand Journal of Science and Technology 28B: 65-100.

Milligan, R.H. 1984. New Zealand wetwood termites. New Zealand Forest Service Forestry Research Institute Forest Pest Leaflet No. 60.

Morgan, F.D. 1959. The ecology and external morphology of *Stolotermes ruficeps*. Transactions of the Royal Society of New Zealand 86: 155-95.

Scientific name of pest: *Torostoma apicale* Broun (Curculionidae)

Scientific name of host(s): *Pinus radiata,* Douglas-fir, and dead wood of most species of trees.

Distribution: New Zealand

Summary of natural history and basic biology of the pest: The larvae feed on both sapwood and heartwood of seasoned and timber undergoing the seasoning process. In the forest they occur in logs and dead wood. The life cycle isn't well known and the galleries are often associated with sapstain fungi. It is not known whether it disseminates sapstain, or whether it prefers sapstained parts.

Specific information relating to risk elements:

A. Probability of pest establishment

1. **Pest with host at origin:**
   Pinus radiata and Douglas-fir.

2. **Entry potential:**
   Moderate.

3. **Colonization potential:**
   High. Especially in port situations where logs and lumber may be available.

4. **Spread potential:**
   Moderate.

5. **Control options:**
   Fumigation with methyl bromide and insecticide at port before shipment.

B. Consequences of establishment

6. **Economic damage potential:**
   Low—it is primarily a pest of deadwood.

7. **Environmental damage potential:**
   Low.

8. **Perceived damage (social and political influences):**
   Low.

Estimated risk for pest: ***Low.***

Selected bibliography:

Hammad, S.M. 1955. The immature stages of *Pentarthrum huttoni* Woll. (Coleoptera:Curculionidae). Proceedings of the Royal Entomological Society, London. (A) 30: 33-39.

Hickin, N.E. 1975. The insect factor in wood decay, 3rd ed. (revised). London: Association Business Programmes, Ltd. 383 p.

Kelsey, J.M. 1946. Insects attacking milled timber, poles and posts in New Zealand. New Zealand Journal of Science and Technology 28 (B): 65-100.

Milligan, R.H. 1979. A native wood boring weevil. New Zealand Forest Service Forestry Research Institute Forest Leaf No. 38.

Appendix C

Results of test shipments of *Pinus radiata* logs to the United States

Logs were shipped by Tasman Forestry Limited of Rotorua, New Zealand, to the United States in 1991. The first shipment came on the M.V. *Washington Star* and the second shipment on the M.V. *Balayan.*

M.V. *Washington Star*

New Zealand Export Inspection Certificate signed November 25, 1991, for six separate "packages" of *Pinus radiata* logs.

- One package of 70 pieces was shipped to TUMAC Lumber Co. Inc. of Portland, OR, with port of entry at Seattle, WA.
- Three packages of 468, 221, and 59 pieces were shipped to TUMAC Lumber Co. Inc. of Portland, OR, with port of entry at San Francisco, CA.
- One package of 262 pieces was shipped to Stevenson Co.-Ply Inc. of Seattle, WA, with port of entry at Seattle.
- One package of 27 pieces was shipped to Tree Product Enterprises Inc. of Seattle, WA, with port of entry at Seattle.

Treatment. All six packages were certified by the New Zealand Ministry of Forestry to have been inspected, sprayed, and washed at Mt. Maunganui (exit port) on November 25, 1991. Logs in these packages "have been inspected...are considered to be substantially free from injurious pests and diseases. On October 27 and 30, 1991, they were sprayed with BUSAN 30WB, concentration 2%, and SUMICIDIN 20WP, concentration of 250 grs/1000 litres, and were washed free of soil contamination." Note: Logs in this shipment were not fumigated but were machine-debarked.

Inspection at port of entry. At Seattle, the logs were inspected by USDA APHIS personnel, who found a live scolytid larva, probably *Hylurgus ligniperda*, under a patch of bark. They also sampled decayed wood and isolated an unidentified basidiomycete. This basidiomycete has still not been identified, but comparisons with know isolates of *Armillaria limonea, A. novae-zelandiae, Amylostereum areolatum, A. sacratum,* and *Ganoderma mastoporum* did not show compatibility.

At San Francisco, logs were inspected by APHIS and California Department of Food and Agriculture personnel. More than 10 live scolytid larvae, probably *Hylurgus ligniperda* or *Hylastes ater*, were found. Isolations from wood samples identified *Sphaeropsis sapinea (=Diplodia pinea), Ophiostoma pilifera, O.*

pidea, and *Leptographium procerum*, as well as a number of typical aerial contaminants (*Trichoderma, Penicillium*).
Logs at Seattle were released on March 3, 1992. Logs at San Francisco were fumigated about January 16 and were released in June of 1992.

M.V. *Balayan*

New Zealand Export Inspection Certificate signed December 31, 1991, for three separate "packages" of *Pinus radiata* logs.

- All three packages of 56, 3242, and 3581 pieces were shipped to Berdex International, Sacramento, CA, with port of entry at Sacramento, CA.

Treatment. This shipment was certified by the New Zealand Ministry of Forestry to have been inspected, sprayed, and washed at Mt. Maunganui (port of exit) on December 12, 1991. Logs in the packages "...have been inspected...and are considered to be substantially free from injurious pests and diseases. They are substantially free of bark and soil contamination. On December 27, 1991, they were fumigated in the ship's hold (CH3 BR; 80 g/m^3; 24 hours; 18 °C). Logs were debarked first by machine, then hand cleaned, sprayed with fungicide for stain, sprayed with insecticide, and 'fluted' logs were excluded from shipment."

The shipment arrived in Sacramento, CA, on January 28, 1992.

USDA APHIS inspected the shipment before and after discharge and California Department of Food and Agriculture took samples about January 29.

At inspection in Sacramento, samples were removed from stained areas and isolations performed. *Sphaeropsis sapinea* was recovered. No other pest organisms were identified on this shipment.

The logs were released on March 3, 1992, and were processed at mills in Marysville, Oroville, and Eureka, California. Examination of the sawn logs found only blue-stained wood, caused by *S. sapinea*. No other damage was noted.

State of California

The Resources Agency

Memorandum

To: Don Perkins
Staff Chief

Date: June 12, 1992

Tel: ATSS 492-0126
916/322-0126

From: Department of Forestry and Fire Protection
David Adams, Forest Pathologist
LA Moran Reforestation Center
PO Box 1590, Davis, CA 95617

File: Log Imports

Subject: New Zealand logs

I visited the Marysville Forest Products, Inc. mill near Marysville on March 9-11. I met the two General Managers: Ken Stayton and Don Baack. Both were very cordial and gave me access to wherever I needed to go to inspect the New Zealand logs as they were being processed. Also there to inspect the log processing were Mohammed Azher (CDFA), and Errol Strom and Ron Simeroth from Yuba County Air Pollution Enforcement. Don Baack gave us a tour of the facility and showed us a video of the New Zealand radiata pine plantations.

I spent 2-3 hours each of the three days looking at radiata wood in all stages of milling. I especially looked for decay around knots or in wood, unusual holes in the wood (such as might occur with *Sirex*), butts and other ends of logs on the deck for decay, and anything else that might be of significance. The only abnormality that I found was blue staining in the syapwood. The logs were very well de-barked.

Tim Tidwell went with me on 11 March and said that he isolated *Diplodia pini*, now called *Sphaeropsis sapinea*, from the blue stain in logs in West Sacramento. His only concern at this point was whether the fungus will be killed during the kiln drying. Tim has not yet heard from Mary Palm on her determination of the species genetics with regard as to whether it is the same or different than our same-named species here. Their kiln drying schedule is to raise the temperature to 170°F in 72 hrs. and hold it there for 24 hrs. before cooling down. The rough planks are stickered in layers so that each plank is equally exposed to the temperature conditions. The first planks to the planer will be on 16 March. I will visit the mill on that date and find some blue-stained, kiln-dried wood to take to Tim for isolation attempts.

A few radiata logs are going to the G-P mill in Oroville. These logs are to be sawn at 0600 hrs. on 14 March; they expect to take about one hour for this job. I will be there to inspect these logs. I have made contact with Jerry Roderick at the mill. Mohammed will not be going there.

State of California | The Resources Agency

Memorandum

To: Don Perkins
Acting Staff Chief

Date:June 12, 1992

Tel: ATSS 492-0126
916/322-0126

From: Department of Forestry and Fire Protection
David Adams, Forest Pathologist
LA Moran Reforestation Center
PO Box 1590, Davis, CA 95617

File: NZ Logs

Subject: New Zealand Logs: Oroville

I visited the L-P mill at Oroville on March 14, at 0530 hrs. Jeanne Martin went with me, for her own view of how those "upgraded Monterey pine" looked. We met with Jerry Roderick, manager Oroville mill; Bob Burger, Tumac Lumber Co. (importer); and P. W. (Peter) McLeay, Tasman Lumber Company, Ltd. McLeay is a manager at mills in Putaruru and Ngongataha, NZ.

The logs looked (of course) exactly the same as those I watched being milled at Marysville Forest Products, Inc. Blue stain was again noticeable. I mentioned this to McLeay and he said that the fungicide "Busan" was used in too low of concentration, hence the blue stain fungal invasion. Obviously, they would rather not have had any blue stain as it does lower the wood value. In an older publication that I have Busan is listed as a seed treatment fungicide.

I have received conflicting stories on this blue stain (*Diplodia pini*). Cobb says that he has seen it on standing trees in NZ. McLeay says no it doesn't occur in standing trees, it comes in immediately after the trees are felled. We observed it both as a butt discoloration and it also seemed to be associated with some knots. They say the debarking and fungicide together should prevent its occurrence if properly done. Maybe DeNitto can get this figured out; or maybe the forester McLeay said he would have call me can tell me what is happening. It looks to me as though the logs are lying about in the woods for more than a day or so.

In a related topic, I stopped by the Marysville Forest Products mill on March 19 to pick up some blue stained wood that has been passed through their kiln. I am giving this wood to Tim for him to attempt recovery of the blue stain fungus.

State of California | The Resources Agency

Memorandum

To: Don Perkins
Acting Staff Chief
Resource Management

Date: June 12, 1992

Tel: ATSS 492-0126
916/322-0126

From: Department of Forestry and Fire Protection
David Adams, Forest Pathologist
LA Moran Reforestation Center
PO Box 1590, Davis, CA 95617

File:

Subject: New Zealand log imports: Schmidbauer, Eureka

On Monday, March 23, I was at the Schmidbauer Lumber Co. mill in Eureka to inspect New Zealand logs as they were being milled. Mark Anderson, Schmidbauer Power Co. (the parent holding company of Schmidbauer Lumber Co.); Bob Burger, Tumac Lumber Co., Inc. (log importer); Richard Spadoni, Humboldt Co. Agricultural Commissioners' Office; and Carl Pfeiffer, CDF&A, Redding were there too.

These logs were no different from the other logs of this group shipped to Marysville and Oroville. Blue stain (*Diplodia pini*) was again apparent on log ends and associated with branches. I collected some blue stain wood for CDF&A lab isolation (it was *Diplodia*). Anderson said that Marysville Lumber Co. told him that blue stain was running about 20 percent of the volume. The blue stain represents a value loss that they don't want. Also, I did find one hole, about the size of a pencil through a piece of one board. This too was taken to the CDF&A lab with instructions to determine the cause of the hole: insect or cone peduncle are probable causes. The hole turned out to have originated from a mainstem cone peduncle.

MINISTRY OF FORESTRY

NEW ZEALAND EXPORT INSPECTION CERTIFICATE

To: Ministry of Forestry

MT.MAUNGANUI

DESCRIPTION OF CONSIGNMENT

Name and address of exporter: TASMAN FORESTRY LIMITED
VAUGHAN ROAD, ROTORUA, NEW ZELAND

Declared name and address of consignee: BERDEX INTERNATIONAL INC.
FOREST PRODUCTS GROUP, 2616 LA MESA WAY, P.O. BOX 255546, SACRAMENTO
CA 95865-5546

Number and description of packages:
56 PCS = 60.527 JAS M3 : "CS" GRADE
3242 PCS = 3051.682 JAS M3 : "S" GRADE
3581 PCS = 3297.539 JAS M3 : "CP" GRADE

Distinguishing marks: NZ/CS, NZ/S, NZ/CP

Place of origin: NEW ZEALAND

Declared means of conveyance: M.V."BALAYAN"

Declared point of entry: SACRAMENTO, U.S.A.

Name of produce and quality declared: NEW ZEALAND RADIATA PINE LOGS

Botanical name of timber: PINUS RADIATA

This is to certify that the logs described above have been inspected according to appropriate procedures and are considered to be substantially free from injurious pests and diseases and are considered to conform with the current phytosanitary regulations of the importing country.

DISINFESTATION AND/OR DISINFECTION TREATMENT

Date: 27-12-91

Treatment: FUMIGATION - SHIPS HOLDS

Chemical (active ingredient): CH3 BR

Duration and temperature: 24 HOURS - 18DEG C

Concentration: 80GRS/M3

Additional information:

Additional Declaration: SUBSTANTIALLY FREE OF BARK AND SOIL CONTAMINATION UNDER MINISTRY OF FORESTRY QUARANTINE SUPERVISION

MINISTRY OF FORESTRY
51
QUARANTINE

Ministry of Forestry stamp

Date: 31-12-91

Name of authorised officer: [signature]

Signature: [signature]

No financial liability with respect to this certificate shall attach to the Ministry of Forestry or to any of its officers or representatives.

MINISTRY OF FORESTRY

NEW ZEALAND EXPORT INSPECTION CERTIFICATE

To: Ministry of Forestry

MT.MAUNGANUI

DESCRIPTION OF CONSIGNMENT

Name and address of exporter: TASMAN FORESTRY LIMITED

VAUGHAN ROAD, ROTORUA, NEW ZEALAND

Declared name and address of consignee: STEVENSON CO-PLY, INC

SEATTLE

Number and description of packages:

262 PIECES = 107.130 JAS M3 PRUNED LOGS

Distinguishing marks: NZ/BI

Place of origin: NEW ZEALAND

Declared means of conveyance: M.V. "WASHINGTON STAR"

Declared point of entry: SEATTLE, U.S.A.

Name of produce and quality declared: N.Z. RADIATA PINE PRUNED LOGS

Botanical name of timber: PINUS RADIATA

This is to certify that the logs described above have been inspected according to appropriate procedures and are considered to be substantially free from injurious pests and diseases and are considered to conform with the current phytosanitary regulations of the importing country.

DISINFESTATION AND/OR DISINFECTION TREATMENT

Date: 27-10-91 & 30-100-91

Treatment: SPRAY

Chemical (active ingredient): BUSAN 30WB

CHEMICAL ~~Duration and temperature:~~ SUMICIDIN 20WP

Concentration: 2%

CONCENTRATION ~~Additional information:~~ 250grs/1000 LITRES

Additional Declaration: WASHED FREE OF SOIL CONTAMINATION UNDER MINISTRY OF FORESTRY QUARANTINE SUPERVISION

Ministry of Forestry stamp

Date: 25-11-91

Name of authorised officer: A. M Fraser.

Signature:

No financial liability with respect to this certificate shall attach to the Ministry of Forestry or to any of its officers or representatives.

EXP 5

FV - for info for RAA file

MINISTRY OF FORESTRY

NEW ZEALAND EXPORT INSPECTION CERTIFICATE

To: Ministry of Forestry

MT.MAUNGANUI

Bill White
Seattle disch - yellow
S/F disch - blue
copies of original certs.

DESCRIPTION OF CONSIGNMENT

Name and address of exporter: TASMAN FORESTRY LIMITED
VAUGHAN ROAD, ROTORUA, NEW ZEALAND

Declared name and address of consignee: TUMAC LUMBER CO.INC.
592 S.W.THIRD AVENUE-SUITE 600,PORTLAND,OREGON 97204-2540

Number and description of packages:

70 PIECES = 10740 MBF SCRIBNER PEELER LOGS

Distinguishing marks: NZ/W

Place of origin: NEW ZEALAND

Declared means of conveyance: M.V."WASHINGTON STAR"

Declared point of entry: SEATTLE,U.S.A.

Name of produce and quality declared: N.Z.RADIATA PINE PEELER LOGS

Botanical name of timber: PINUS RADIATA

This is to certify that the logs described above have been inspected according to appropriate procedures and are considered to be substantially free from injurious pests and diseases and are considered to conform with the current phytosanitary regulations of the importing country.

DISINFESTATION AND/OR DISINFECTION TREATMENT

Date: 27-10-91 & 30-10-91

Treatment: SPRAY

Chemical (active ingredient): BUSAN 30WB

CHEMICAL ~~Duration and temperature:~~ XXXXXXXXXXXXXXXXXXX SUMICIDIN 20WP

Concentration: 2%

CONCENTRATION ~~Additional information:~~ XXXXXXXXXXXXXXXXXX 250grs/1000 LITRES

Additional Declaration: WASHED FREE OF SOIL CONTAMINATION UNDER MINISTRY OF FORESTRY QUARANTINE SUPERVISION

MINISTRY OF FORESTRY
QUARANTINE

Ministry of Forestry stamp

Date: 25-11-91

Name of authorised officer: [illegible]

Signature: [illegible]

No financial liability with respect to this certificate shall attach to the Ministry of Forestry or to any of its officers or representatives.

MINISTRY OF FORESTRY

NEW ZEALAND EXPORT INSPECTION CERTIFICATE

To: Ministry of Forestry

MT.MAUNGANUI

DESCRIPTION OF CONSIGNMENT

Name and address of exporter: TASMAN FORESTRY LIMITED
VAUGHAN ROAD,ROTORUA,NEW ZEALAND

Declared name and address of consignee: TREE PRODUCT ENTERPRISES INC
SEATTLE

Number and description of packages:

27 PIECES = 51.411 JAS M3 PRUNED LOGS

Distinguishing marks: NZ/WD

Place of origin: NEW ZEALAND

Declared means of conveyance: M.V."WASHINGTON STAR"

Declared point of entry: SEATTTLE,U.S.A.

Name of produce and quality declared: N.Z. RADIATA PINE PRUNED LOGS

Botanical name of timber: PINUS RADIATA

This is to certify that the logs described above have been inspected according to appropriate procedures and are considered to be substantially free from injurious pests and diseases and are considered to conform with the current phytosanitary regulations of the importing country.

DISINFESTATION AND/OR DISINFECTION TREATMENT

Date: 27-10-91 & 30-10-91

Treatment: SPRAY

Chemical (active ingredient): BUSAN 30WB

CHEMICAL ~~Duration and temperature~~: SUMICIDIN 30WP

Concentration: 2%

CONCENTRATION ~~Additional information~~ 250grs/1000 LITRES

Additional Declaration: WASHED FREE OF SOIL CONTAMINATION UNDER MINISTRY OF FORESTRY QUARANTINE SUPERVISION

MINISTRY OF FORESTRY

QUARANTINE

Ministry of Forestry stamp

Date: 25-11-91

Name of authorised officer: G. W. Fraser

Signature:

No financial liability with respect to this certificate shall attach to the Ministry of Forestry or to any of its officers or representatives.

MINISTRY OF FORESTRY

NEW ZEALAND EXPORT INSPECTION CERTIFICATE

To: Ministry of Forestry

MT.MAUNGANUI

DESCRIPTION OF CONSIGNMENT

Name and address of exporter: TASMAN FORESTRY LIMITED

VAUGHAN ROAD, ROTORUA, NEW ZEALAND

Declared name and address of consignee: TUMAC LUMBER CO.INC.

592 S.W.THIRD AVENUE-SUITE 600, PORTLAND,OREGON 97204-2540

Number and description of packages:

468 PIECES = 58200 MBF SCRIBNER SAWLOGS & PRUNED LOGS

Distinguishing marks: NZ/SB

Place of origin: NEW ZEALAND

Declared means of conveyance: M.V."WASHINGTON STAR"

Declared point of entry: SAN FRANSISCO.U.S.A.

Name of produce and quality declared: N.Z.RADIATA PINE SAWLOGS & PRUNED LOGS

Botanical name of timber: PINUS RADIATA

This is to certify that the logs described above have been inspected according to appropriate procedures and are considered to be substantially free from injurious pests and diseases and are considered to conform with the current phytosanitary regulations of the importing country.

DISINFESTATION AND/OR DISINFECTION TREATMENT

Date: 27-10-91 & 30-10-91

Treatment: SPRAY

Chemical (active ingredient): BUSAN 30WB

CHEMICAL ~~Duration and temperature~~: SUMICIDIN 20WP

Concentration: 2%

CONCENTRATION ~~Additional information~~ 250grs/1000 LITRES

Additional Declaration: WASHED FREE OF SOIL CONTAMINATION UNDER MINISTRY OF FORESTRY QUARANTINE SUPERVISION

Date: 25-11-91

Name of authorised officer: R. [illegible] Fraser

Signature: [illegible]

Ministry of Forestry stamp

No financial liability with respect to this certificate shall attach to the Ministry of Forestry or to any of its officers or representatives.

MINISTRY OF FORESTRY

NEW ZEALAND EXPORT INSPECTION CERTIFICATE

To: Ministry of Forestry

MT MAUNGANUI

DESCRIPTION OF CONSIGNMENT

Name and address of exporter: TASMAN FORESTRY LIMITED
VAUGHAN ROAD, ROTORUA, NEW ZEALAND

Declared name and address of consignee: TUMAC LUMBER CO.INC.
1805 HILLTOP DRIVE,SUITE 205,REDDING,CALIFORNIA 96002

Number and description of packages:
221 PIECES = -40310 MBF SCRIBNER PRUNED LOGS

Distinguishing marks: NZ/WC

Place of origin: NEW ZEALAND

Declared means of conveyance: M.V."WASHINGTON STAR"

Declared point of entry: SAN FRANSISCO,U.S.A.

Name of produce and quality declared: N.Z.RADIATA PINE PRUNED LOGS

Botanical name of timber: PINUS RADIATA

This is to certify that the logs described above have been inspected according to appropriate procedures and are considered to be substantially free from injurious pests and diseases and are considered to conform with the current phytosanitary regulations of the importing country.

DISINFESTATION AND/OR DISINFECTION TREATMENT

Date: 27-10-91 & 30-10-91

Treatment: SPRAY

Chemical (active ingredient): BUSAN 30WB

CHEMICAL ~~Duration and temperature~~: SUMICIDIN 20WP

Concentration: 2%

CONCENTRATION ~~Additional information~~ 250grs/1000 LITRES

Additional Declaration: WASHED FREE OF SOIL CONTAMINATION UNDER MINISTRY OF FORESTRY QUARANTINE SUPERVISION.

FORESTRY

Ministry of Forestry stamp

Date: 25-11-91

Name of authorised officer: A. W. Fraser.

Signature:

No financial liability with respect to this certificate shall attach to the Ministry of Forestry or to any of its officers or representatives.

MINISTRY OF FORESTRY

NEW ZEALAND EXPORT INSPECTION CERTIFICATE

To: Ministry of Forestry

MT.MAUNGANUI

DESCRIPTION OF CONSIGNMENT

Name and address of exporter: TASMAN FORESTRY LIMITED
VAUGHAN ROAD, ROTORUA, NEW ZEALAND

Declared name and address of consignee: TUMAC LUMBER CO.INC.
1805 HILLTOP DRIVE,SUITE 205,REDDING,CALIFORNIA 96002

Number and description of packages:
59 PIECES = 11020 MBF SCRIBNER PRUNED LOGS

Distinguishing marks: NZ/LP

Place of origin: NEW ZEALAND

Declared means of conveyance: M.V."WASHINGTON STAR"

Declared point of entry: SAN FRANCISCO,U.S.A.

Name of produce and quality declared: N.Z. RADIATA PINE,PRUNED LOGS

Botanical name of timber: PINUS RADIATA

This is to certify that the logs described above have been inspected according to appropriate procedures and are considered to be substantially free from injurious pests and diseases and are considered to conform with the current phytosanitary regulations of the importing country.

DISINFESTATION AND/OR DISINFECTION TREATMENT

Date: 27-10-91 & 30-10-91

Treatment: SPRAY

Chemical (active ingredient): BUSAN 30WB

CHEMICAL ~~Duration and temperature~~: SUMICIDIC 20 WP

Concentration: 2%

CONCENTRATION ~~Additional information~~: 250grs/1000 LITRES

Additional Declaration: WASHED FREE OF SOIL CONTAMINATION UNDER MINISTRY OF FORESTRY QUARANTINE SUPERVISION.

MINISTRY OF FORESTRY

Ministry of Forestry stamp

Date: 25-11-91

Name of authorised officer: R. M. Fraser.

Signature:

No financial liability with respect to this certificate shall attach to the Ministry of Forestry or to any of its officers or representatives.

United States Department of Agriculture

Animal and Plant Health Inspection Service

International Services
Region III (Asia & Pacific)
6505 Belcrest Road, 229-Federal Building
Hyattsville, MD 20782-2058, U.S.A.
Tel. (1-301) 436-8292; FAX (1-301) 436-7703

Subject: NZ - Logs

From: Alvin Keali'i Chock, Regional Director

To: T. H. Russell, Jr., APHIS Attache
702 THC Rotorua, Fronde St., Rotorua NZ

Date: MAR 18 1992
No. of pages (including coversheet): 15

a. **Interceptions**: there are only two interceptions of
radiata from NZ; both determinations were by Natalia Vandenberg:

(1) Seattle 025800 WA, XII-19-91. Bark, 1 live larva (Coleoptera - Scolytidae - *Hylurgus* sp.), action required.

(2) San Francisco 018192, XII-31-91. Logs, 10+ live larvae (*Hylurgus* sp. or near), action required.

APHIS—Protecting American Agriculture

TELECOPIER TRANSMITTAL SHEET

Facsimile Transmission To:

Jim Haas, Berdex

From:

Dorthea Zadig
California Department of Food and Agriculture
Division of Plant Industry
Pest Exclusion Branch
(916) 653-1440

Number of Pages to Follow: 6

COMMENTS: Tentatively cultured from the San Francisco shipment was Diplodia pinea. Apparently this is a synonym for several organisms. In at least one form it already occurs in California. The significance of this culture will not be known until a more definite identification can be made.

Dorthea

1220 N Street, P.O. Box 942871
Sacramento, California 94271

January 30, 1992

Letter and enclosure faxed and sent to the attached list.

1-

Following an interim embargo on the importation of Siberian logs, intense commercial interest has continued to develop, particularly in the Pacific Northwest, centered on the importation and processing of unprocessed logs. Countries which have recently expressed an interest in exploiting this potential market now include: New Zealand, Chile, and possibly Mexico.

Except for the temporary embargo on Siberian logs, the United States has no specific federal regulations restricting the entry of imported logs, nor is any permit required. Currently, shipments are detained at the port of entry, under Title 7 USC Section 150aa-jj, for inspection and further action if risks are identified.

To date, two shipments of unprocessed Pinus radiata logs from New Zealand have arrived in California. One shipment of these logs has arrived in Seattle. All shipments are currently under a quarantine hold order pending analyses of samples for exotic pests. Live larvae of a federal action pest, a scolytid beetle, were found on the initial shipments from New Zealand into Seattle and San Francisco.

In the continued absence of a comprehensive policy and regulatory program by the United States Department of Agriculture (USDA), this Department is proposing the adoption of a state, or multi-state policy to address this situation. A draft of the mitigation strategies under consideration is enclosed for your review.

The Department has tentatively scheduled a meeting for February 5, 1992 at 1:30 p.m., in Room 102 of this building, to discuss strategy options. I realize that the notice is short, but I hope you will be able to participate in this important discussion. Please feel free to forward an invitation to this meeting to other concerned individuals.

Thank you in advance for your cooperation in this matter. I look forward to meeting with you next week. If you have any questions concerning this issue, please contact Martina Haleamau of my staff directly. She can be reached at (916) 653-1440.

Sincerely,

Isi A. Siddiqui
Assistant Director
Division of Plant Industry
(916) 654-0317

Enclosure

bcc: Bill Callison, Martina Haleamau, Bob Roberson, ~~Barbara Hass~~, Allen Clark, Dorthea Zadig, Conrad Krass, George Loughner, Don Alexander, WDA, Kathleen Johnson, ODA

SURNAME 80-106 | Siddiqui | ok | Haleamau | Callison for BHS

#1

Folder: Mailbox Thursday 12/19/91 03:01 pm

To: Urgent IDs 436-6828 From: Natalia Vandenberg
Subject: Urgent identification Date: 12/19/91

Port: Seattle, WA
Intercepton Number: 025800
PINET Port and Date:
PINET sequence Number:
Origin: New Zealand
Destination: Oregon, WA
Host: Pinus Radiata (bark) (wood prod.)
Number & stages, live?: 1 larva, alive.
Host info (in/on/with): in
Intended use of Host: consumption
Order & family: Coleoptera, Scolytidae
Genus. species, author: Hylurgus sp. (species not recognized)
Additional comments: Specimen returned.

(-End-)

(1. Reply/ ^ Edit (5) ^ Next item (9) Forward (13) Instructions
(6) Assign Keyword (10) Move/ ^ Copy (14) Recipients
(11) External copy (15) Print
(4) ^ Prev. item (8) Delete memo (12) Calendar (16) Exit
M 03 08 15:02 002:31 3507 1:2400 8n

Only insects were found on logs from New Zealand in Oregon Ports. They did not look for fungi. Fields Cobbs did go along with some of the AC Dept of Ag folks to inspect a load of New Zealand logs in San Francisco and he took samples from four logs. He said when they got there the logs were literally a fungus garden, with fungi growing all over them - even though the logs had supposedly been debarked and treated with a fungicide. He has cultured at least 10-15 different fungi; but has only identified four - they are:

-Diplodia pinea (presumably)

He said APHIS is ignoring this one because they say it is already in the U.S. He maintains that it is one of those species of fungi that have a number of different strains. When he was in New Zealand he saw Diplodia invading and killing branches. He also saw it invading pruning wounds in large trees and killing those trees within a year. This concerns him, because he says that it is more virulant than normal and therefore may not be the strain we have here.

The other 3 are staining fungi -

Ophiostoma pilifera which is not considered a pathogen
Ophiostoma picea which is considered a pathogen
Leptographium procerum which is a pathogen

Both the O.picea and the L.procerum were taken from resinous wood - in other words they invaded the tree before it was cut, and thought to be introduced into the tree by insects. Both of these have been relegated as staining fungi and not important, but we do not know that. They may not be. There is one article that postulates that Dutch Elm Disease originated out of O. picea.

The insects that Dave Overhaulser found on the logs in Oregon were either Hylastes ater or Hylurgis ligniperda.

If you want more information regarding you can talk to Fields. His phone is (510) 642-4663. He is very passionate on this subject.

26 February 1992

ISOLATION OF FUNGI FROM PINUS RADIATA LOGS FROM NEW ZEALAND

Five wood samples were received from Michael Guidicipietro (PPQ) and subsamples plated on PDA on 14 January 1992. The following organisms were isolated from the samples.

Sample 1 - interior wood at base - possible wood rot
- A. Basidiomycete - to be IDed by Dr. H. Burdsall (USDA/FS) Penicillium sp.
- B. Trichoderma sp.
- C. yeast + bacteria
- D. Trichoderma sp.
- E. Trichoderma sp.

Sample 2 - wood stain
- A. Trichoderma spp.
- B. Trichoderma sp.
- C. Trichoderma spp.
- D. Trichoderma sp.
- E. Trichoderma sp.
- F. Trichoderma sp.

Sample 3 - white mycelium
- A. Trichoderma sp.
- B. Trichoderma sp.
- C. Trichoderma sp.
- D. Gliocladium roseum (saprophytic - in U.S.)

Sample 4 - beaked perithecia present in wood
- A. Sporothrix/Ophiostoma
- B. Sporothrix/Ophiostoma
- C. Trichoderma sp.
- D. Trichoderma sp.

Sample 5 - healthy?
- A. Trichoderma sp.
- B. Trichoderma sp.
- C. Trichoderma sp.
- D. Trichoderma sp.

The basidiomycete is being identified by Dr. Harold H. Burdsall, Jr. (USDA/FS - Madison,WI). It is a possible wood decay fungus.

Sporothrix is the anamorph of some Ophiostoma species. In these isolates the two states were both present. These are often associated with wood. These isolates seem closest to Ophiostoma stenoceras (anam. Sporothrix schenckii)(in U.S.)

Dr. Gary Samuels, USDA/ARS, identified the Trichoderma and Gliocladium species. The Trichoderma isolates are all one species

MAR 18 1992

(near harzianum - in U.S.) except one which is Trichoderma viride (in U.S.). Michael indicated that Trichoderma was very abundant in the shipment on the surface of the logs. Some may also cause a discoloration of the wood vessels.

I confirmed the identification of an isolate of Sphaeropsis sapinea that was sent to me by Tim Tidwell, CDFA. He took samples and made isolations as did Dr. Fields Cobb, UC Berkeley. I do not have a summary of the results of their isolations.

Sincerely,

Mary Palm

Mary E. Palm, APHIS/PPQ
Mycology

Tasman Forestry Limited

Facsimile N.Z. No. 0 7 347-8755
International No. 64 7 347-8755
Telephone N.Z. No. 0 7 347-4899
International No. 64 7 347-4899
Telex No. NZ 21508 FLETMAR

Ngahere House
Private Bag 3031
Rotorua 3200, New Zealand
Vaughan Road, Rotorua

FACSIMILE MESSAGE

FAX No.:	347-7173	No. OF PAGES:	
COMPANY:	MOF	FROM:	ADRIAN GRAY
		DATE:	
CITY:		COUNTRY:	
ATTENTION:	ROSS MORGAN	TIME SENT:	19/3/92

"WASHINGTON STAR" Dischcharged seattle late Dec then Began discharged San Francisco Dec 26th 1991 Dischcharge in San Francisco completed Dec 30th. Samples taken by CDFA/USDA on Dec 30th USDA Found actionable pests on San Francisco logs and methyl Bromide Fumigation completed by Jan 16th.

Logs were released from Seattle on 5-3-92
San Francisco logs still not released.

"BALAYAN" Left NZ in late December after being Fumigated in ships hold prior to departure with methyl Bromide.

Vessel arrived ~~San~~ Sacromento Jan 22
2 USDA inspectors did a predischarge inspection and after this inspection discharge was approved. Dischcharge was completed on Jan 27th.

USDA Inspected again on Jan 28th
Samples were taken ~~by~~ by CDFA later in week either Jan 29 or Jan 30th.

Logs were released 3-3-92.

FORM 65-020 STATE OF CALIFORNIA/DEPT. OF FOOD & AGRICULTURE
PLANT INDUSTRY-PEST AND DAMAGE RECORD

COUNTY 57 ☐ ENTO. ☐ VERT. ☒ PLANT PATH ☐ NEMA ☐ WEED ☐ SEED

ACTIVITY 06 OWNER BERDEX INTERNATIONAL

SITUATION 07 ADDRESS PORT OF SACRAMENTO

SECTION CITY OR NEAREST P.O. WEST SACRAMENTO MO. DAY YR. 02 24 92

TOWNSHIP COLLECTOR Mohammad Azhar AFFILIATION F S C E U O

RANGE QUARANTINE SHIPPER

BASE & MERIDIAN QUARANTINE ORIGIN New Zealand ZIP CODE

SHPT. SIZE QUARANTINE DESTINATION Marysville ZIP CODE

CODE HOST, CROP NAME, TYPE OF TRAP Radiata Pine Logs

GENERAL OR PLANT PATH NUMBER OF ☐ ACRES ☐ PLANTS INVOLVED 6879 ☐ NO. ☐ % OF PLANTS AFFECTED ?

PLANT DISTRIBUTION ☐ LIMITED ☐ SCATTERED ☐ WIDE SPREAD ☐ ERADICATED

PLANT PARTS AFFECTED
☐ BUDS ☐ TUBERS ☐ GROWING TIPS ☐ LEAVES, UPPER SURFACE
☐ SEEDS ☐ BLOSSOMS ☐ FRUITS OR NUTS ☐ LEAVES, LOWER SURFACE
☐ STEM ☐ PETIOLES ☐ BULBS OR CORMS
☐ TRUNK ☐ ROOTLETS ☐ BRANCHES, LARGE
☐ BARK ☐ LARGE ROOTS ☐ BRANCHES, TERMINAL

PLANT SYMPTOMS ☐ LIMITED ☐ GENERAL
☐ GALLS ☐ ROOT ROT ☐ LEAF FALL ☐ LEAF MOTTLING
☐ CANKER ☐ DIE BACK ☐ FRUIT SPOT ☐ MARGINAL BURN
☐ GUMMING ☐ YELLOWING ☐ FRUIT ROT ☐ SLOW DECLINE
☐ WILTING ☐ SHOT HOLE ☐ ROUGH BARK ☐ SUDDEN COLLAPSE
☐ STUNTING ☐ LEAF SPOT ☐ MALFORMATION ☐ INTERNAL DISCOLORATION

ENTOMOLOGY CONDITION ☐ ALIVE ☐ DEAD ☐ TRAPPED # / SWEEP
STAGE ☐ EGG ☐ LARVA ☐ NYMPH ☐ PUPA ☐ ADULT
/ ROOT # / LEAF # / STEM # / LIMB # / ANIMAL # SQ. YD. # / TRAP

WEED & VERTEBRATE NET ACREAGE GROSS
DENSITY ☐ LIGHT ☐ MEDIUM ☐ HEAVY

CROP LOSS TYPE OF REPORT ☐ REPLACEMENT ☐ ADDITIONAL ☐ NEW
% CROP LOSS % PLANTS % MARKET VALUE CONTROL COST TYPE OF LOSS ☐ QUALITY ☐ QUANTITY

680096

REMARKS: Vessel. M/V BALAYAN

RUSH: QUARANTINE

CODE DETERMINATION RATING

Schizophyllum commune C

A common wood rot fungus affecting numerous families of trees.

2-25-92

DETERMINED BY: [signature] DATE

SEND REPORT TO:
PEST EXC Allen Clark / Mohammad Azhar

2/24/92 80 3186 Yolo 680096 02/07

FORM 65-020 STATE OF CALIFORNIA/DEPT. OF FOOD & AGRICULTURE
PLANT INDUSTRY-PEST AND DAMAGE RECORD

COUNTY 57 ☐ ENTO. ☐ VERT. ☒ PLANT PATH ☐ NEMA ☐ WEED ☐ SEED

ACTIVITY 06 OWNER BERDEX INTERNATIONAL

SITUATION 07 ADDRESS PORT OF SACRAMENTO

SECTION CITY OR NEAREST P.O. W. SACRAMENTO MO. DAY YR. 02 24 92

TOWNSHIP COLLECTOR Mohammad Azhar AFFILIATION F S C E U O

RANGE QUARANTINE SHIPPER

BASE & MERIDIAN QUARANTINE ORIGIN New Zealand ZIP CODE

SHPT. SIZE QUARANTINE DESTINATION Marysville ZIP CODE

CODE HOST, CROP NAME, TYPE OF TRAP RADIATA PINE LOGS

GENERAL OR PLANT PATH NUMBER OF ☐ ACRES ☐ PLANTS INVOLVED 6879 ☐ NO ☐ % OF PLANTS AFFECTED ?

PLANT DISTRIBUTION ☐ LIMITED ☐ SCATTERED ☐ WIDE SPREAD ☐ ERADICATED

PLANT PARTS AFFECTED
☐ BUDS ☐ TUBERS ☐ GROWING TIPS ☐ LEAVES, UPPER SURFACE
☐ SEEDS ☐ BLOSSOMS ☐ FRUITS OR NUTS ☐ LEAVES, LOWER SURFACE
☐ STEM ☐ PETIOLES ☐ BULBS OR CORMS
☐ TRUNK ☐ ROOTLETS ☐ BRANCHES, LARGE
☐ BARK ☐ LARGE ROOTS ☐ BRANCHES, TERMINAL

PLANT SYMPTOMS ☐ LIMITED ☐ GENERAL
☐ GALLS ☐ ROOT ROT ☐ LEAF FALL ☐ LEAF MOTTLING
☐ CANKER ☐ DIE BACK ☐ FRUIT SPOT ☐ MARGINAL BURN
☐ GUMMING ☐ YELLOWING ☐ FRUIT ROT ☐ SLOW DECLINE
☐ WILTING ☐ SHOT HOLE ☐ ROUGH BARK ☐ SUDDEN COLLAPSE
☐ STUNTING ☐ LEAF SPOT ☐ MALFORMATION ☐ INTERNAL DISCOLORATION

ENTOMOLOGY CONDITION ☐ ALIVE ☐ DEAD ☐ TRAPPED # / SWEEP
STAGE ☐ EGG ☐ LARVA ☐ NYMPH ☐ PUPA ☐ ADULT
/ ROOT # / LEAF # / STEM # / LIMB # / ANIMAL # SQ. YD. # / TRAP

WEED & VERTEBRATE NET ACREAGE GROSS
DENSITY ☐ LIGHT ☐ MEDIUM ☐ HEAVY

CROP LOSS TYPE OF REPORT ☐ REPLACEMENT ☐ ADDITIONAL ☐ NEW
% CROP LOSS % PLANTS % MARKET VALUE CONTROL COST TYPE OF LOSS ☐ QUALITY ☐ QUANTITY

680096

REMARKS: Vessel: BALAYAN
3 PACKETS

RUSH: QUARANTINE

CODE DETERMINATION RATING

Trichoderma sp and Monilia sp. C/C

present. Both saprophytes

2-25-92

DETERMINED BY: [signature] DATE

SEND REPORT TO:
PEST EXC: Mohammad Azhar / Allen Clark

FORM 65-020 STATE OF CALIFORNIA/DEPT. OF FOOD & AGRICULTURE
PLANT INDUSTRY-PEST AND DAMAGE RECORD

COUNTY: Washington ☐ ENTO. ☐ VERT. ☐ PLANT PATH ☐ NEMA ☐ WEED ☐ SEED

ACTIVITY | OWNER: Tumac Lumber Company

SITUATION | ADDRESS: 592 SW Third A #600

SECTION | CITY OR NEAREST P.O.: Portland, OR 97204 | MO. 12 DAY YR. 91

TOWNSHIP N S | COLLECTOR: USDA PPQ Wayne | AFFILIATION F S C E U O

RANGE E W | QUARANTINE SHIPPER: Tasman Forestry, Rotorua NZ

BASE & MERIDIAN H M S | QUARANTINE ORIGIN: New Zealand | ZIP CODE

SHPT. SIZE | QUARANTINE DESTINATION | ZIP CODE

HOST/CROP NAME-TYPE OF TRAP: Pinus radiata

GENERAL OR PLANT PATH | NUMBER OF ☐ ACRES ☐ PLANTS INVOLVED: 170
☐ NO. ☐ % OF PLANTS AFFECTED:

PLANT DISTRIBUTION ☐ LIMITED ☐ SCATTERED ☐ WIDE SPREAD ☐ ERADICATED

PLANT PARTS AFFECTED
☐ BUDS ☐ TUBERS ☐ GROWING TIPS ☐ LEAVES, UPPER SURFACE
☐ SEEDS ☐ BLOSSOMS ☐ FRUITS OR NUTS ☐ LEAVES, LOWER SURFACE
☐ STEM ☐ PETIOLES ☐ BULBS OR CORMS
☐ TRUNK ☐ ROOTLETS ☐ BRANCHES LARGE
☐ BARK ☐ LARGE ROOTS ☐ BRANCHES, TERMINAL

PLANT SYMPTOMS ☐ LIMITED ☐ GENERAL
☐ GALLS ☐ ROOT ROT ☐ LEAF FALL ☐ LEAF MOTTLING
☐ CANKER ☐ DIE BACK ☐ FRUIT SPOT ☐ MARGINAL BURN
☐ GUMMING ☐ YELLOWING ☐ FRUIT ROT ☐ SLOW DECLINE
☐ WILTING ☐ SHOT HOLE ☐ ROUGH BARK ☐ SUDDEN COLLAPSE
☐ STUNTING ☐ LEAF SPOT ☐ MALFORMATION ☐ INTERNAL DISCOLORATION

ENTOMOLOGY CONDITION ☐ ALIVE ☐ DEAD ☐ TRAPPED | # / SWEEP
STAGE ☐ EGG ☐ LARVA ☐ NYMPH ☐ PUPA ☐ ADULT
/ ROOT | # / LEAF | # / STEM | # / LIMB | # / ANIMAL | # SQ. YD. | # / TRAP

866096

WEED & VERTEBRATE | NET | ACREAGE | GROSS
DENSITY ☐ LIGHT ☐ MEDIUM ☐ HEAVY

CROP LOSS | TYPE OF REPORT ☐ REPLACEMENT ☐ ADDITIONAL ☐ NEW
% CROP LOSS | % PLANTS | % MARKET VALUE | CONTROL COST | TYPE OF LOSS ☐ QUALITY ☐ QUANTITY

REMARKS:
Sample shipment of logs to be tested
by CDFA according to Hyattsville
Permit BL #1474
2152523

DETERMINATION | RATING
New Zealand isolate of Sphaeropsis sapinea (=Diplodia pinea) isolated ~~from blue staining in wood.~~ Relationship of this fungus to fungi in North America called by the same name or ~~taxon, unknown at this time.~~ Further studies needed to determine this information. (Q)

DETERMINED BY: [signature] DATE 2-20-92

SEND REPORT TO:

TYPE OF SPECIMEN .866096 SPECIMEN NO. 866096
PLACE THIS TAG LENGTHWISE ON VIAL TYPE OF SPECIMEN

1

FORM 65-020 STATE OF CALIFORNIA/DEPT. OF FOOD & AGRICULTURE
PLANT INDUSTRY-PEST AND DAMAGE RECORD

COUNTY: SAC 84
☐ ENTO. ☐ VERT. ☒ PLANT PATH ☐ NEMA ☐ WEED ☐ SEED

ACTIVITY: 06
OWNER: BERDEX INTERNATIONAL
SITUATION: 07
ADDRESS: SACRAMENTO
CITY OR NEAREST P.O.: Port of Sacramento
MO. DAY YR.: 01 27 92
COLLECTOR: Tomas Pastalka + M. Azhar
AFFILIATION: F S C E U O
QUARANTINE SHIPPER:
QUARANTINE ORIGIN: New Zealand
QUARANTINE DESTINATION: Marysville
HOST CROP NAME, TYPE OF TRAP: RADIATA PINE LOGS
NUMBER OF ☐ ACRES ☒ PLANTS INVOLVED: LOGS 6879

REMARKS: Vessel: M/V BALAYAN

DETERMINATION: New Zealand isolate of Sphaeropsis sapinea [=Diplodia pinea] isolated from blue staining in wood. Relationship of this isolate to fungi in North America called by the same taxon unknown at this time. Further studies needed to determine this information.

DETERMINED BY: R Stillwell DATE: 2-20-92

SEND REPORT TO: Allen Clark / M. Azhar

TYPE OF SPECIMEN: 996102
SPECIMEN NO.: 996102

PLACE THIS TAG LENGTHWISE ON VIAL

996102

FORM 65-020 STATE OF CALIFORNIA/DEPT. OF FOOD & AGRICULTURE
PLANT INDUSTRY-PEST AND DAMAGE RECORD

COUNTY: 38
☐ ENTO. ☐ VERT. ☒ PLANT PATH ☐ NEMA ☐ WEED ☐ SEED

ACTIVITY: 02
OWNER: BERDEX INT. & TUMAC LUMBER
SITUATION: 07
ADDRESS:
CITY OR NEAREST P.O.: SAN FRANCISCO
MO. DAY YR.: 1 23 0 91
COLLECTOR: T. MASTALKA
AFFILIATION: F S C E U O
QUARANTINE SHIPPER:
QUARANTINE ORIGIN: NEW ZEALAND
QUARANTINE DESTINATION: CALIFORNIA
HOST CROP NAME, TYPE OF TRAP: PINUS RADIATA

REMARKS: CHECK FOR FUNGI

DETERMINATION: New Zealand isolate of Sphaeropsis sapinea [=Diplodia pinea] isolated from blue staining in wood. Relationship of this isolate to fungi in North America called by the same taxon, unknown at this time. Further studies needed to determine this information.

DETERMINED BY: R Stillwell DATE: 2-20-92

SEND REPORT TO: CDFA, 401 CHINA BASIN STR SAN FRANC. CA 94107

TYPE OF SPECIMEN: 975764
SPECIMEN NO.: 975764

PLACE THIS TAG LENGTHWISE ON VIAL

975764

Appendix D

List of pesticides currently used for log treatment

BROM-GAS® 2% and BROM-O-GAS® 5%
Great Lakes Chemical Corporation
PO Box 2200
West Lafayette, Indiana 47906

BUSAN® 1118 and BUSAN® 30WE
Buckman Laboratories, Inc.
1256 N. McLean Boulevard
Memphis, Tennessee 36108

ANTIBLU™ 246
Hickson International PLC
Yates New Zealand, Ltd.
4 Henderson Place
Onehunga, Auckland, New Zealand

SUMICIDIN 20WP
Shell International Chemical Company
Shell Centre
London, SE1 7PG, U.K.

Appendix E
Correspondence and background information

Tasman Forestry Limited

Ngahere House

Private Bag 3031,
Rotorua 3200, New Zealand.
Vaughan Road, Rotorua
Telephone 0 7 347-4899

24 March 1992

Mr Bill Whyte
Team Leader
USDA Risk Assessment Team

Dear Mr. Whyte

As requested by your USDA Risk Assessment Team, the following letter is provided as a statement of:-

1. The potential volume in 1992 and 1993 of NZ Radiata Pine and Douglas fir log trade as envisaged by the marketing consortium of the Forestry Corporation of NZ and Tasman Forestry Limited.

2. The broad US market conditions and consortium market strategies which will see this trade occur through a limited number of western USA ports.

The following information can only be provided as current intentions based on 1992 USA market conditions and the consortium's available log resource to supply the market.

POTENTIAL TRADE VOLUME JULY 1992 - JULY 1993

Radiata Pine = Up to 250,000 m^3 per year
Douglas Fir = Up to 100,000 m^3 per year

Please understand however, that actual volumes will be dependent on market conditions and at this stage indications are that the volumes will be significantly lower.

NATURAL TARGET USA TARGET GEOGRAPHIES

Our market research and our pioneering lumber marketing from both NZ and Chile has clearly identified the demands of the market and capabilities of Radiata as a species to compliment Ponderosa and Sugar Pine. Additionally pruned Radiata Pine and N.Z.'s large Douglas fir logs have the potential to effectively participate in the sanded plywood industry of the Pacific Northwest.

Combine to this market environment the reality of the major shipping patterns of bulk shipping between the USA and NZ or Australia, and future log trade between NZ and the USA appears to the consortium to be destined for disembarkation at any of the following ports:-

- Seattle, Washington
- Vancouver, Washington
- Portland, Oregon
- Coos Bay, Oregon
- Eureka, California
- Sacramento, California
- Stockton, California

In conclusion, I trust this information assists your task force in narrowing the focus of your risk assessment.

Regards,

Peter Sigley
EXPORT MANAGER

cc. Peter Price
Forestry Corporation of NZ Ltd

'92-07-17 16:38 ID:シンリンソウケン 3720 TEL NO:0298-74-3720 #332 P01

FORESTRY AND FOREST PRODUCTS RESEARCH INSTITUTE

P. O. BOX 16, TSUKUBA NORIN KENKYU
DANCHI-NAI, IBARAKI, 305 JAPAN
TELEPHONE:(0298)73-3211
FACSIMILE:(0298)74-3720

July 17, 1992

Dr. John Bain
USDA, Forest Service
~~Forest Pest Management~~
Methods Application Group

Dear Dr. Bain:

I apologize for not replying sooner to your inquiry about Sirex noctilio in Japan. I have returned from a short official trip and found your fax of July 13.

I asked plant quarantine people about cases of intercepting Sirex noctilio at ports in Japan. According to their information, only two cases of intercepting have been recorded so far. In 1960, S. noctilio was detected in New Zealand pine logs (Pinus radiata) at Tokyo port and in 1974 in logs of unknown tree species (not recorded) imported from New Zealand at Hiroshima port.

I hope that this information is of help to you.

Yours sincerely,

Yasuharu Mamiya

Yasuharu Mamiya

The New Zealand Herald
AUCKLAND, THURSDAY, MARCH 26, 1992
Telephones { Classified Advertising · 798-777
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$6 billion seen in NZ forests

By *RAOUL DAROUX*

Maximum processing of New Zealand's plantation wood resource could generate almost $6 billion in export earnings annually by the year 2010, according to Trade Development Board projections released by the New Zealand Forest Owners' Association.

Even maintaining the country's present mix of wood product would boost export earnings in today's dollar values to close to $4 billion.

The association's booklet on forestry facts and figures for 1992 shows New Zealand plantations yielded 13.1 million cubic metres of log production in 1991, up from 11.3 million in 1990.

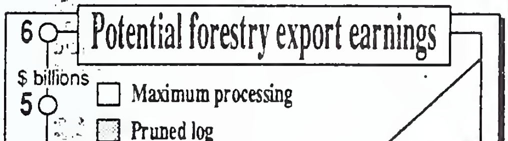
At the same time plantations were growing at 25 million cubic metres annually.

The booklet quotes United Nations figures for the world conifer harvest of 1142.8 million cubic metres in 1989, down from 1146.1 million in 1988.

The NZ industry has continued to diversify its export markets with Australia taking 31.2 per cent in the June 1991 year (1990, 39.7), Japan 29 (25.6), Korea 10.4 (9), Taiwan 5.9 (4.7), Indonesia 3 (4.2) and other markets 20.5 (18.2).

Estimated forest expenditure in 1991 has provisionally been put at $146 million, down from $177 million in 1990 and $154 million in 1989.

In part this would reflect the drop in planting with new land planting provisionally falling to 10,200 hectares in 1991 from 15,500ha in 1990, and restocking falling to 23,900ha down from 25,000.



Source: New Zealand Trade Development Board and Ministry of Forestry for export earnings 1970-1990

Appendix F
Resource material

General

Forest Research Institute Report (January to December 1989). 1990. Wellington: New Zealand Ministry of Forestry. 72 p.

New Zealand Background Notes (July 1989). Washington, DC: U. S. Department of State Bureau of Public Affairs. 13 p.

Medical Reference Guide. 1989. Shoreland Medical Marketing, Inc. 29 p.

Key Facts and three brochures. 1991. Tasman Forestry, Limited.

Forest Health

Griffith, J.A. 1989. New Zealand Journal of Forestry Science 19(2/3): 388 p.

Pinus radiata

Contributed Papers, combined conference, Institute of Foresters of Australia and New Zealand Institute of Foresters. Rotorua, New Zealand; 1980. May 12-16: 559 p.

Davenhill, N. 1988. A guide to the use of herbicides in forest establishment. New Zealand Forest Service Research Institute Bulletin No. 108. 52 p.

James, R.N.; Tarlton, G.L. 1989. New approaches to spacing and thinning in plantation forestry. In: Proceedings, IUFRO symposium at the Forest Research Institute, 1989 April 10-14. Rotorua, New Zealand. 360 p.

Sutton, W.R.J. 1974. New Zealand experience with radiata pine. Forest Research Institute New Zealand Forest Service. Forestry Commission Bulletin No. 55: 56-61.

Sutton, W.R.J. 1976. Comparison of alternative silvicultural regimes for radiata pine. New Zealand Journal of Forestry Science 6(2):350-6.

Sutton, W.R.J. 1984. New Zealand experience with radiata pine. Rotorua, New Zealand: New Zealand Forest Service Forest Research Institute. 21 p.

Williams, F.J.N. 1982. Review of 1979 New Zealand radiata pine management practices. New Zealand Forest Service Forest Research Institute Bulletin No. 11. 24 p.

Douglas-fir

Whiteside, I.D.; Wilcox, M.D.; Tustin, J.R. 1977. New Zealand Douglas-fir timber quality in relation to silviculture. New Zealand Journal of Forestry 22(1): 24-44.

Entomology

Elliott, D.A. 1976. The influence of disease and insect problems on management practice in Kaingaroa forest. New Zealand Journal of Forestry Science 6(2): 188-92.

Hosking, G.P. 1972. *Xeleborus saxeseni*: its life-history and flight behavior in New Zealand. New Zealand Journal of Forestry Science 3(1): 37-53.

Hosking, G.P. 1989. Pine wilt nematode: An example of active risk assessment. New Zealand Journal of Forestry Science 19(2/3): 335-7.

Hosking, G.P.; Bain J. 1977. *Arhopalus ferus* (Coleoptera: Cerambycidae): its biology in New Zealand. New Zealand Journal of Forestry Science, 7 (1): 1-15.

Hosking, G.P.; Bain, J.; Kay, M.; Zondag, R. The insect risk to New Zealand exotic plantation forestry. Forest Research Institute, Rotorua, New Zealand. 6 p.

Hosking, G.P. 1988. Exotic forest insects and diseases—an integrated protection programme in New Zealand. Planti Proceedings No. 3. Malasia: ASEAN Quarantine Centre and Training Institute: 323-331.

Sixteen leaflets in the series "Forest and Timber Insects in New Zealand: dealing with wood and bark-boring insects recorded from radiata pine and Douglas fir logs."

Nuttal, M.J. 1989. *Sirex noctilio* F., sirex wood wasp. Reprinted from Cameron, P.J.; Hill, R.L.; Thomas, W.P., eds. A review of biological control of pests and weeds in New Zealand 1874 to 1987. Tech. Comm. No. 10. Wallingford, UK: CAB International & DSIR.

Quarantine

Bugs and health: integral part of forest protection strategy. What's New in Forest Research, No. 197. 1990. Forest Research Institute, Rotorua, New Zealand. 4 p.

Cross, D.J. Concentration/time products for methyl bromide against insects in export log material. New Zealand Forest Service Forest Research Institute Report No. 62. 29 p.

Forest Research Institute. 1977. Introduced forest and timber insects. What's New in Forest Research, No. 51. Rotorua, New Zealand. 4 p.

Hosking, G.P.; Gadgil, P.D. 1986. Australian Forestry 50 (1): 37-39.

New Zealand Ministry of Forestry export quarantine facts and procedures.Wellington.

New Zealand Ministry of Forestry information for importers: forest produce import quarantine facts and procedures. Wellington. 7 p.

Trees into logs: ways to improve the process. 1988. What's New in Forest Research, No. 197. Forest Research Institute, Rotorua, New Zealand. 4 p.

Appendix G
Exotic forest trees of New Zealand

The following exotic forest trees grow in New Zealand (from Weston, G.C. 1957, Exotic forest trees in New Zealand. Forest Service Bulletin 13. Wellington: Government Printer.

Abies
- *A. alba* Mill
- *A. concolor* (Gord and Glend) Lindl.
- *A. grandis* (Dougl) Lindl.
- *A. nordmanniana* (Steven) Spach.
- *A. pinaspo* Boissier
- *A. procera* Rehd.

Acacia
- *A. dealbata* Link.
- *A. decurrens* Willd.
- *A. melanoxylon* R. Br.
- *A. pycantha* Benth.

Acer
- *A. pseudoplatanus* L.

Alnus
- *A. glutinosa* (L.) Gaertn.
- *A. rubra* Bong.

Araucaria
- *A. arucana* (Mollina) Koch
- *A. heterophylla* (Salsb.) Franco.

Betula
- *B. alba* L.
- *B. verrucosa* Ehrh.

Castanea
- *C. sativa* Mill.

Catalpa
- *C. speciosa* Warder.

Cedrus
C. atlantica (Endl.) Manetti
C. deodara (Roxb.) Loud.
C. libani Loud.

Chamaecyparis
C. lawsoniana (A. Murr.) Parl.

Cryptomeria
C. japonica (L.f.) D. Don

Cupressus
C. arizonica Greene
C. goveniana Gord.
C. lusitanica Mill.
C. macrocarpa Hartw.
C. sempervirens L.
C. torulosa D. Don

Eucalyptus
E. botryoides Sm.
E. camaldulensis Dehn.
E. delegatensis R.T. Baker
E. fastigata Deane & Maiden
E. globulus Labill.
E. gunnii Hook.
E. macarthuri Deane & Maiden
E. muelleriana Howitt
E. obliqua L'Herit
E. ovata Labill.
E. pilularis Sm.
E. regnans F. v. Muell.
E. saligna Sm.
E. viminalis Labill.

Fagus
F. sylvatica L.

Fraxinus
F. americana L.
F. excelsior L.

Juglans
J. regia L.

Juniperus
J. virginiana L.

Larix
L. decidua Mill.
L. leptolepis (Sieb. & Zucc.) A. Murr.
L. occidentalis Nutt.

Liquidamber
L. styraciflua L.

Liriodendron
L. tulipifera L.

Nothofagus
N. antartica Oerst.
N. dombeyi Blume
N. obliqua Blume
N. procera Oerst.

Picea
P. abies (L.) Karst.
P. engelmannii Parry
P. sitchensis (Bong.) Carr

Pinus
P. attenuata Lemm.
P. banksiana Lamb
P. canariensis C. Smith
P. caribaea Morelet
P. contorta Dougl.
P. coulteri D. Don
P. densiflora Sieb. & Zucc.
P. echinata Mill.
P. elliottii Engelm.
P. griffithii McClelland
P. halepensis Mill.
P. jeffreyi Grev. & Balf.
P. lambertiana Dougl.
P. massoniana Lamb.
P. montezumae Lamb.
P. monticola Dougl.
P. mugo Turra
P. muricata D. Don
P. nigra Arn.
P. palustris Mill.
P. patula Schlech. & Cham.
P. pinaster Ait.
P. pinea L.
P. ponderosa Laws.

P. radiata D. Don
P. resinosa Ait.
P. rigida Mill.
P. roxburghii Sarg.
P. strobus L.
P. sylvestris L.
P. taeda L.
P. thunbergii Parl.
P. torreyana Parry

Platanus
P. orientalis L.

Populus
P. alba L.
P. deltoides Bar.
P. nigra L.
P. tremula L.
P. tremuloides Mich.
P. yunnanensis Dode

Quercus
Q. petrea (Marruschke) Liebl.
Q. robur L., *Q. rubra* L.

Robinia
R. pseudoacacia L.

Sequoia
S. sempervirens (D. Don) Endl.

Sequoiadendron
S. giganteum (Lindl.) Buchholz

Taxodium
T. distichum (L.) Rich.

Thuja
T. plicata D. Don

Tsuga
T. heterophylla (Raf.) Sarg.

Appendix H
Potential management of *Sirex noctilio* in the United States

Potential management of *Sirex noctilio* in the United States

A potential pest management program for *Sirex noctilio*, the pest of major concern, is outlined. This program is modeled after the successful program from Australia.

Sirex noctilio is an infrequent to rare pest in its native range of Europe, North Africa, and Asia (Spradbery and Kirk 1978). It has become a major pest in pine plantations outside its native range (e.g., Australia, New Zealand, South America) by escaping its natural enemies and encountering a very susceptible host (*P. radiata*). The pest status of *S. noctilio* has been reduced to "infrequent or rare" after the biological control agents have become well established in these foreign plantations. Therefore, the probability for successful prevention and/or suppression of *S. noctilio* outbreaks would be very high (but not certain), if it became established in the United States.

Biological control

A management strategy for *Sirex noctilio* should begin with classic biological control, that is, the introduction of natural enemies from its native range. This strategy has been very effective in reducing tree mortality to sub-economic levels in Australia and New Zealand. This strategy is also very cost effective because the natural enemies are self sustaining within a *S. noctilio* population after widely established. However, severe stand mortality may occur if invading populations of *S. noctilio* are not detected at an early stage and releases of the biological control agents are not made at the appropriate time (see Haugen 1990).

Nematodes. A parasitic nematode, *Beddingia (=Deladenus) siricidicola* (Bedding) is the key biological control agent for *S. noctilio*. This nematode is specific to *S. noctilio* and feeds on its associated fungus, *Amylosterum areolatum*. This nematode sterilizes the female *S. noctilio* (Bedding 1972) and can increase within a *S. noctilio* population to greater than 95% infection within 4 years, resulting in the collapse of the host population (Haugen unpublished data). After the collapse, the nematode maintains the *S. noctilio* population at sub-economic levels. During the 30 years following the establishment of this nematode in Australia, no significant outbreaks have been recorded after the nematode has suppressed a *S. noctilio* population and is widely established within a region.

Techniques to mass produce this nematode in laboratory cultures and to artificially inoculate *Sirex*-infested trees have been developed (Bedding and Akhurst 1974). Refinements and changes to the inoculation procedure were made during 1987 in response to a major outbreak in Australia (Haugen and Underdown 1990).

If *Sirex noctilio* became established in the United States, *Beddingia siricidicola* would need to be introduced, because it has not been recorded in the U.S. (Bedding and Akhurst 1978). Most parasitic nematodes of siricids native to the United States (such as *B. canii, B. nevexii,* and *B. proximus*) may not be effective against *S. noctilio* because they feed on a different species of fungus (*A. chailettii*), while *S. noctilio* and *B. siricidicola* only feed on *A. areolatum* (Bedding and Akhurst 1978). However, the native nematode *B. wilsoni* has been recorded in association with *A. areolatum* and *S. juvencus* in Europe; so, this species may provide some regulation of *S. noctilio* populations. However, this nematode species is also parasitic on the parasitoids of siricids.

A nematode establishment program in the United States would be a gradual program. For an area, the program could be divided into three phases: 1) monitoring the geographic distribution of *S. noctilio* populations, 2) introducing the nematode, and 3) evaluating the establishment of nematode populations. Nematodes would be introduced into an infested area during a relatively short period (e.g. 3 years), then that area should not require additional introductions. However, further nematode introductions would be needed in new areas as *S. noctilio* expands its range.

Costs of the monitoring phase would increase as *S. noctilio* expands its range. A system of trap trees for detection of *S. noctilio* populations is recommended for the area 60 miles ahead of the known distribution (Haugen *et al.* 1990). The annual cost of this phase would depend on the type and age of the forest in the surrounding area and the rate that the advancing front is expanding.

For an example, assume that an initial localized infestation is located within 60 miles of 100,000 acres of pine forests. Of these 100,000 acres, 20,000 are in the susceptible category (10 to 25 yrs old and unthinned). The prescribed density is 20 trap trees for every 1,000 acres of susceptible forest. The estimated cost to establish a trap tree and to examine it for *S. noctilio* infestation is $3.00. Thus, 400 trap trees should be established in this area at a cost of $1,200 in the first year. If the infestation expanded rapidly, annual monitoring costs could exceed $200,000 within 5 years.

The cost of nematode inoculation within areas of recent *Sirex noctilio* establishment is estimated to be $0.30 to $2.70 per acre. A trap tree costs $3.00 to $6.00 to establish, fell, and inoculate with the nematode. In pine plantations, 150 trap trees are recommended for every 1,000 acres of susceptible plantations each year during a 3 year period to introduce the nematode. Thus, the cost would be $1.35 to 2.70 per acre of susceptible plantation.

Evaluations to determine the success in establishing the nematode should be required. Emerging *S. noctilio* from inoculated trap trees and uninoculated trees should be dissected to determine the nematode infection levels. Data from the inoculated trap trees will determine the success of introducing the nematode into the area, while data from the uninoculated trees will determine the success of establishing the nematode into the *S. noctilio* population. Costs of these evaluations will vary depending upon the sample intensity, but a reasonable guess would be 10 to 20 percent of the inoculation costs (i.e. $0.15 to $0.30 per acre).

Parasitoids. Five species of insect parasites *(Rhyssa persuasoria, Ibalia leucospoides, Megarhyssa nortoni, Rhyssa hoferi, and Schlettererius cinctipes)* are recommended for release during *S. noctilio* suppression programs in Australia (Haugen et al. 1990). *Rhyssa persuasoria* and *I. leucospoides* are natural enemies of *S. noctilio* and other siricids throughout Europe (Spradbery and Kirk 1978). These parasites (but possibly different subspecies) are also found in

North America on *Sirex spp.* and other siricids. *Megarhyssa nortoni, R. hoferi,* and *S. cinctipes* are native to North America (that is, outside the natural range of *S. noctilio*), where they parasitize other siricids and possibly wood-boring beetles. In Australia, these three species parasitize *S. noctilio* in the *P. radiata* plantations (Taylor 1981). Other parasites of siricids that are native to the United States include *Rhyssa howdenorum, R. lineolata, R. alaskensis, Ibalia montana, I. ruficollis,* and *I. rufipes* (Kirk 1974, 1975). Therefore, a parasites complex is already present in the United States to attack an invading *S. noctilio* population. However, the parasite complex, without the parasitic nematode, may not be able to prevent a *S. noctilio* outbreak. Taylor (1976) showed that the parasites could cause a decline in a *S. noctilio* population after it reached outbreak levels.

Other control alternatives

Silvicultural control is a recommended tactic for *S. noctilio* prevention programs in Australia (Haugen et al. 1990). Healthy, vigorously growing plantations have a lower susceptibility to *Sirex noctilio* attack; therefore, the key recommendation is to practice "on-time" first thinnings, as prescribed by an optimum thinning guide.

Resistance to *S. noctilio* attack has been investigated with the genetic stock of *Pinus radiata* in Australia. Resistance was assessed by the responses of cut shoots exposed to the fungus and mucus that *S. noctilio* injects into the tree during oviposition (Coutts 1969a, 1969b, 1969c, Kile *et al.* 1974). Wide variation was found among individual trees, but the resistance was not evident in preliminary field trials. Introduction of resistant stock (if a truly resistant stock could be selected) into plantations would take 30 or more years to implement, and in the interim, it would not prevent damage in the current stands.

Use of insecticides for control of *S. noctilio* has been investigated (Horwood *et al.* 1970, Morgan *et al.* 1971). The tested insecticides were found to be effective against *S. noctilio*, but their application would not be practical or cost effective in forest stands. These insecticides may be used to treat infested timber at ports of entry.

Summary

If *S. noctilio* became established in the United States, there are known biological control agents that have the potential to regulate *S. noctilio* populations below economically damaging levels for timber production. Importation and wide-spread release of a host-specific nematode would be needed. Many species of siricid parasites, known to be parasitic on *S. noctilio*, are native to the United States, so no importations would be required. However, a program to monitor *S. noctilio* populations, inoculate the nematode, and evaluate parasitism by the nematode would have significant costs.

Appendix I
Pest risk assessment reviewers, proposed and actual

An earlier draft of this document was sent to the indivuals listed here. Asterisks indicate those who responded. Individual responses are presented in appendix J.

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Appendix J
Comments received from reviewers

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June 30, 1992

MEMO TO: Dr. William B. White
Assistant Director, FPM
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Forest Service
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FROM: John D. Lattin John D. Lattin
Professor of Entomology
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SUBJECT: Review of Pest Risk Assessment on the Importation of *Pinus radiata* and Douglas-fir Logs from New Zealand

I am responding to your letter of June 1, 1992, requesting that I review the enclosed document entitled "Pest Risk Assessment on the Importation of *Pinus radiata* and Douglas-fir Logs from New Zealand." As requested, I have made extensive comments directly upon the draft manuscript. In my opinion these go well beyond editorial changes or minor comments. I will provide major comments in this memo to the extent time allows but I urge you to examine the comments on the draft document.

By way of background, I received my Ph.D. at the University of California, Berkeley, spending four years covering many diverse areas of the state. I am familiar with the major biological, ecological, and topographical features of that state. I have been at Oregon State University since 1955 in the Department of Entomology. I am also the Director of the Systematic Entomology Laboratory, a facility that includes a collection of over 2,500,000 specimens, chiefly from western North America. It contains the largest holding of Pacific Northwest insects in North America. I have worked on the H. J. Andrews Experimental Forest, since 1976 an old-growth Douglas-fir LTER site, conducting research on a variety of aspects of the role of insects and other arthropods in forested ecosystems. We recently published a 168 page paper documenting over 3400 species of arthropods on the HJA. I have worked on parts of the insect fauna on western conifers for many years, with particular emphasis on pines. I have published a number of papers on introduced insects and am on the Review Panel of the Office of Technology Assessment, The Congress of the United States, for their project on the Impact of Non-indigenous Organisms upon the United States.

My involvement in the importation of raw logs began in 1990 when I was asked to comment on the proposed importation of raw logs from Siberia. That led to my involvement as a member of the Pest Risk Assessment team of the Forest Service on that project. I wrote a fair amount of that 1991 document. I served on the small Scientific Advisory Panel to the Forest Service at the meeting in Sacramento, California, in March of this year. We rewrote the mitigation protocol that was submitted to Dr. Mel Weiss on March, 18, 1992.

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On November 26, 1991, I responded to the Oregon Department of Agriculture's request for comments on the possible importation of raw logs from New Zealand (copy enclosed). On March 24, 1992, I reviewed the USDA/APHIS Risk Assessment report on *Pinus radiata* and *Pseudotsuga menziesii* (copy enclosed). Most recently I have had discussions with the ODA regarding the unannounced arrival of two containers of *P. radiata* logs from Chile. Please excuse this long introduction but it explains some of what follows as well as my comments on the draft document you included with your letter.

It is well known that New Zealand has a long history of importing non-indigenous species. The books of Druett (1983) and Crosby (1986) provide extensive documentation on this point. New Zealand Forestry (anon., 1964) provides extensive coverage of the state of forestry in the country, including the role of exotic conifers. While *Pinus radiata* and Douglas-fir are covered in the risk assessment report, virtually no mention is made about the other exotic species grown there, including *Pinus ponderosa*, a very widespread western tree and one of great importance to western forestry.

Besides the many different plants and animals that have been introduced deliberately into New Zealand, a number of non-indigenous species of insects and diseases have been introduced accidentally. Some of these have come directly to the country, others may have arrived as secondary invaders from other countries. Many of these pest species originated in western Europe where their activities are well documented. The fact that these pests have come from a part of the world that does not contain North American conifer species naturally, and have been able to adapt to these tree species in New Zealand as have native New Zealand species, means that the introduction of any of these species into western north America poses a high risk of successful establishment.

In my opinion, the draft report you sent me requires considerably more work before it can be considered a final version. I have serious difficulties with the fact that so few people were involved in its preparation and that only a couple of these individuals are based in the very region that will be affected. There are a large number of very knowledgeable scientists within this region (see the 1991 Siberian Log Risk Assessment document) who could have and should have been involved. Simply asking people to review a completed document of this size is no where near as effective as having them involved in its preparation. The intensive discussions that occurred at the Portland meeting of the Siberian Log Team and at the Sacramento meeting on the mitigations protocols provided the type of breadth of coverage and experience needed to distill the essence of the problem. With all due respect to those few individuals on this project, who obviously worked long and hard, you need a much broader perspective than what is represented in the current draft report. The comments below are specific examples:

- The document needs better organization. There seems to be no reason for the way in which organisms are listed - a fungus, an insect, another fungus, another insect. Why not cover fungi and then insects and group them by taxonomic category rather than in alphabetical order (including in the appendices).

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- The report needs an adequate introduction, one that sets the scene and one that provides a comparison between New Zealand and western North America so far as ecological, biographical, and environmental considerations. Also a bit of history of the high percentage of introduced organisms should be included. Imagine my surprise to see some of the words I wrote for the introduction for the Siberian Log Risk Assessment document in the draft document you sent me!

- There is no clear statement about the procedures used to select the very few organisms discussed in detail. There are some major omissions, especially in the Scolytidae.

- I would urge you to consider coverage of more organisms. This list is far too short.

- The bark beetle *Hylastes ater* receives the highest rating as a forest pest (++++) by Bevan (1987) of the Forestry Commission in England.

- There is very little coverage in Douglas-fir. Most of the coverage is on *P. radiata*.

- The extremely wide distribution of Douglas-fir and the many biotypes it possesses makes it extremely vulnerable to exotic pests.

- The extensive modification of the forested landscapes because of tree harvest greatly increases the chances of successful invasion and establishment of pests.

- Absolutely no mention is made of the possibility of other types of organisms being introduced this way (e.g. agricultural pests, serious weeds). The high percentage of non-indigenous (as well as indigenous) species in New Zealand poses such a risk.

- I was especially concerned about some major omissions in the literature, including the most important of all - that of Ohmart (1982), an 81-page annotated bibliography of the insects on *Pinus radiata* throughout the world. In fact, no papers of Ohmart were mentioned at all. Since he worked in California and in Australia on *P. radiata* and other tree species as well, his publications should be consulted.

- In my opinion, the revised mitigation protocol presented to the Forest Service in March of this year should be included in this draft. Although it was developed for Siberian logs, it is directly applicable to New Zealand logs (and Chilean logs as well). These recommendations were hammered out at the Sacramento meeting of the Forest Service Scientific Panel and represented the best judgement available at the time. At that meeting, the USDA/APHIS Efficacy Review on Siberian Timber was itself thoroughly reviewed and found lacking in many details. We need some sound <u>new</u> work rather than relying on work that does not even apply (i.e. T312 on oak wilt and Yu, et al. 1984). Shipboard fumigation is very dangerous for the ship's personnel and of questionable value.

Oregon State University

- The fact remains that until proper mitigation procedures are available to guarantee pest-free logs, and they are not now available, such logs should not be brought into the country.

- The impression is given that in contrast to the Siberian logs, New Zealand with its modern approaches and equipment will be able to deliver pest-free logs is not borne out by the facts. Both shipments of logs from New Zealand arrived contaminated - including bark beetle larvae (very likely *Hylastes ater*, a species not even considered by this draft report).

- Most of the countries receiving *P. radiata* logs (and presumably Douglas-fir as well) have little in the way of remaining native forests (including, ironically, New Zealand and Chile). We still possess extensive native forests in western North America and do not want to see them go the way of the forests of the Northeast.

- The draft report needs a section on conclusions, a summary and a set of recommendations. The draft seems to run out of steam at the end. Tighter organization would help.

- Some of the pest risk forms are very brief in contrast to the one on *Sirex* for example. When single word answers to the questions are given (e.g. high), it is difficult to know much about the bases for such evaluations.

- In my opinion, the economic analyses models leave much to be desired. Using what seems to be a diffusion model for spread may be theoretically satisfying and easier to do, but I suggest some of the modelers take a good look at the topography and distribution maps of the forest trees of western North America (Critchfield et al.). Better yet, have them come and walk some of the Sierra Nevada Mountains, the Cascades, and the Coast Ranges. With the power of GIS, we should be able to do some rather sophisticated analysis these days.

- Rather than having to deal with the subject of the importation of raw logs on an <u>ad hoc</u> basis because of the lack of adequate regulations and proper mitigation procedures, why not draft appropriate regulations governing large-scale shipments <u>and</u> the proper, effective mitigation procedures. Both actions should be done <u>before</u> such importations are allowed.

- Finally, I have seen and read little about why these importations are necessary to the economy. Nor have we heard much from the large, private companies with enormous land holdings of their own in western North America. Their lands will be at risk, too.

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State
University

In my opinion, the importation of raw logs on a large scale into North America is a very questionable activity at best. Until such logs can arrive without any pests, their importation should not be allowed. Our western forests are simply too valuable to put them at risk. One has only to look at the forests of the Northeast to see what the consequences could be. Except for the European Gypsy Moth, these pests were accidentally introduced over many years. The wholesale importation of partially treated raw logs virtually guarantees the importation of some serious forest pests. Who then will assume the financial and environmental costs of such activities? After all of the years of effort, I seriously doubt that the Forest Service would want to assume that responsibility. One of today's mandates concerns maintaining and enhancing forest health. Prevention of the establishment of new pests would surely be included under this program.

I apologize for the long response but if I were not interested and concerned about your efforts in the area, I would have simply responded to your request with a bland "It looks all right to me." I have spent a major part of my professional career in the forests of western North America and I have a deep interest in their health, welfare, and the economic base they provide to this region. Further, I have worked with a good many Forest Service personnel over the years and know first-hand their dedication and deep affection for their work. My suggestions are offered in the spirit of cooperation.

dmw
enc
c: G. W. Krantz
K. Mobley

P.S. I would appreciate receiving a copy of the revised draft and the final document
J.D.L.

Oregon

DEPARTMENT OF FORESTRY

STATE FORESTERS OFFICE

"STEWARDSHIP IN FORESTRY"

2-0-8-200

July 1, 1992

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Dear Mr. White:

Thanks for the opportunity to review the *Pest Risk Assessment on the Importation of Pinus Radiata and Douglas-fir Logs from New Zealand*. I limited my review to disease issues and mitigation measures.

I found the assessment thorough and accurate, and it should provide a solid basis for developing protocols for importation of logs. Because *Sphaeropsis* was recovered from fumigated logs (Page 9, para 2), and because the efficacy of fumigation or heat treatments is uncertain, considerable risk (perhaps unacceptable risk) of introducing dangerous pests (especially pathogens) will exist until an efficaceous deep wood sterilization is developed and verified. I suggest stating more clearly the importance of deep wood sterilization in the mitigation strategy, as well as the current lack of efficacy data for such treatments. Deep wood sterilization should not be an option; it should be required in any log importation protocol.

Sincerely,

Alan Kanaskie

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Dear Mr. White:

Thank you for the opportunity to comment on the "Pest Risk Assessment of Pinus radiata and Douglas-fir Logs from New Zealand." My comments are restricted to potential introductions of insects from New Zealand and proposed mitigation measures. In reading the document I was immediately struck by the decision to mold the risk assessment around proposed mitigation procedures which resulted in five insects being dropped from detailed analysis (Pg. 12, para 6). Two of those insects, Hylastes ater and Hylurgus ligniperda, I would rank as very likely to establish in North America and become significant pests. In fact, all of your proposed mitigation procedures except one, fumigation, were applied to the log shipment carried on the Washington Star (Pg 8, para 7), which was later found to contain living scolytid larvae. The unfortunate truth is that all of your proposed mitigation procedures are not of equal importance. From the standpoint of excluding insects, fumigation is the most important tool.

Because this document only suggests mitigation measures and may be changed by administrators, I think an unequivocal statement is needed on the importance of fumigation for the exclusion of insects. It would also be helpful to mention that the five insects on page 12 were dropped from detailed analysis because of the expected efficacy of the fumigation procedure. If there is any tinkering or streamlining of mitigation procedures, it needs to be clear to administrators that fumigation or an equivalent procedure must be maintained to prevent pest introductions.

Sincerely,

Dave Overhulser

Dave Overhulser
Entomologist

DO/blb
I&D\PESTLTR
cc: Alan Kanaskie
LeRoy Kline

2600 State Street
Salem, OR 97310
(503) 378-2560

United States Department of Agriculture
Forest Service
Northeastern Forest Experiment Station
51 Mill Pond Road
Hamden, CT 06514
203-773-2016
FAX 203-773-2183

Reply To: 1630

Date: June 29, 1992

Mr. William B. White
USDA Forest Service
3825 East Mulberry St.
Fort Collins, CO 80524

Dear Mr. White,

I have reviewed the document, "Pest Risk Assessment on the Importation of Pinus radiata and Douglas-fir Logs from New Zealand", and my comments are made directly on the ms. (see the following pp for comments or questions: 10, 12, 14, 19, 21, 22, 26, 27, 29, 30, 31*, 32, 35, 36*, 38, 39*, 40, 41, 42*, 43, 45, 46, 55, 82, 83, 86, 87, 88*, 89, 90*, 91, 92, 93, 95, 97, 114, 116). I did not evaluate the choices of pests addressed in the document as I am not at all familiar with P. radiata and really only am familiar with eastern U.S. problems on Douglas-fir Christmas trees. I feel quite comfortable with the pests and the risks assigned them that are identified in the document.

Most of my comments,therefore, are editorial--some sections do need a bit of help. Some specific comments follow:

1. p. 10--I am concerned about the lack of risk assessment to the eastern and southern pine resources, and would like to have more assurance that safeguards will exist to prevent transhipment of materials from western ports to the east--or even to prohibit direct shipment to eastern ports.

2. p. 12--Are there parallel concerns--or parallel risk assessments being developed for Mexico? I feel there should be, especially if P. radiata occurs there. What will a relaxation of trade barriers between US and Mexico mean if shipments of logs to Mexico occurs? To western and eastern pine resources?

3. p. 39--As I mentioned in the notes on this page, I think the primary responsibility for the success of this program lies with N. Zealand, but the ultimate responsibility lies with us. We can not assume that everything will be caught at the point of origin. Continuous and vigorous monitoring here, by us, is the last (ultimate) and definitive step in the process.

Thanks for the opportunity to review this. Hope my comments help.

Sincerely yours,

David R Houston

DAVID R. HOUSTON
Principal Plant Pathologist

Enclosure

Oregon
DEPARTMENT OF
FORESTRY
STATE FORESTERS OFFICE
"STEWARDSHIP IN FORESTRY"

2-0-8-200

July 1, 1992

Mr. William B. White
USDA Forest Service
3825 East Mulberry Street
Fort Collins, CO 80524

Dear Mr. White:

Thank you for the opportunity to comment on the "Pest Risk Assessment of Pinus radiata and Douglas-fir Logs From New Zealand" document. Dave Overhulser, entomologist; and Alan Kanaskie, pathologist; of my staff have each responded separately regarding their specialty areas. Thus, my comments will be more of a general, administrative nature.

I do not feel that the USDA Forest Service and APHIS should continue to spend time, energy, and funds assessing each tree species and country of origin on a case-by-case basis. The bottom line, in my opinion, is that no products (logs, chips, packing material, crates, containers, pallets, etc.) containing pests should be allowed to enter into the US. We should get on with the business of developing and enforcing comprehensive, proven mitigative measures that would allow the importation of various products and at the same time protect US resources.

Sincerely,

LeRoy Kline

LeRoy Kline
Insect and Disease Director

LK/blb
I&D\NEWZEAL
cc: Dave Overhulser
Alan Kanaskie

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Washington State University

Research and Extension Center

Puyallup, WA 98371-4998
206-840-4500
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June 10, 1992

Mr. William B. White
Assistant Director, FPM
3825 E. Mulberry St.
Ft. Collins, CO 80524

Dear Mr. White:

I have scanned over the document "Pest risk assessment on the importation of *Pinus radiata* and Douglas-fir logs from New Zealand" that you requested I review. I have only a few comments relating to the sections of this document that concern Melampsora leaf rust.

During fall 1991, we confirmed the presence of *Melampsora larici-populina* within commercial poplar plantations along the Lower Columbia River in western Washington and Oregon. As the result of the discovery of this exotic rust in North America, a number of changes need to be made in the above-mentioned document relating to this pathogen.

In Table II-3 on page 16 under New Zealand hosts, I believe that *Pinus radiata* (PR) should be listed as a host and not Douglas-fir as currently indicated. In the same table under the column heading "Category", the current category should be changed from 1-A to 1-B.

I am also surprised that *Melampsora larici-populina* and *M. medusae* are not included in the list of fungi recorded from *P. radiata* and Douglas-fir in New Zealand that is presented in Table A-3 on pages 68-70. Both of these fungi were introduced into New Zealand during the mid to late 1970's and I would have expected to see them on this list.

The last item relates to a number of changes in the Pest Risk Assessment form for *Melampsora larici-populina* on pages 90-91. My suggested changes are indicated on the enclosed copy of this section of the document.

Please don't hesitate to contact me if you have any questions regarding any of my comments.

Sincerely,

Gary Chastagner

Gary Chastagner

GC:dr

United States Department of Agriculture
Forest Service
Institute of Forest Genetics
2480 Carson Road
Placerville, CA 95667
(916) 622-1225

June 17, 1992

Dr. William B. White
Forest Service, PFPM, MAG
3825 E. Mulberry Street
Fort Collins, CO 80524

Dear Dr. White:

Included are my comments on the review document "Pest risk assessment on the importation of Pinus radiata and Douglas-fir logs from New Zealand". Because I have recently retired, I have neither the time nor inclination to review the entire document. As such my comments are limited to technicial aspects of the disease portion. I made no editorial changes.

P-16 - See page for comments.

P-23-24 - It is possible that this fungus has a brooder host range than is now known, since it occurs on "unrelated" species of North American pines. My concern is not what effect it would have on P. radiata, but how pathogenic is it on our more valuable species of pines in the west. Also, we have many potential vectors of this fungus in our western pines. Therefore, someone needs to study the host range, pathology and vector relations of this fungus.

P-40 Leptographium truncatum

The comment that ornamental and Christmas trees would be the most likely to be infected may not be ture, except possibly for P. radiata. If other pine hosts are involved, then native trees could be highly susceptible. The western U.S. has experienced several years of severe drought stress, and pine hosts could be highly susceptible to attack by both vectors and the pathogen. I believe you need to get a clearer picture of the host range and pathogenicity of this fungas before you can realistically project damage or economic losses.

P - 45 Basic assumption a) The Port of Stockton and Sacramento are much closer to our valuable pine forests of the Sierra Nevada than to P. radiata forests. If other pine species are good hosts the colonization may begin in them.

P - 45-46- I don't know how people come up with these economic analyses. I guess something has to put down in dollars. My opinion is that they are mere guesses and are mostly wrong.

In general this pest risk assessment was well researched and written. Unfortunatly one never knows how pests will behave when introduced into a new environment.

Sincerely, Robert F. Scharpf

Robert F. Scharpf
Plant Pathologist Retired

BRIGHAM YOUNG
UNIVERSITY

June 11, 1992

William B. White
Forest Service, USDA
3825 E. Mulberry Street
Fort Collins, CO 80524

Dear Mr. White:

The draft copy of "Pest risk assessment on the importation of Pinus radiata and Douglas fir logs from New Zealand," was received. My comments on the manuscript follow. My review is limited exclusively to the Scolytidae and Platypodiae mentioned in the manuscript or those that might become a factor.

The total document presents a narrow view from a very limited perspective and most certainly does not reflect experience derived from the economic impact now being felt from the recent introduction of pest species not mentioned in this manuscript.

Bark and ambrosia beetles (Scolytidae and Platypodidae) are essentially internal parasites of plants. Although most of them breed in unthrifty, weakened, diseased, or felled stems, a few attack healthy, living tissue that may or may not result in death of the host. It is believed that all species are associated with mutualistic and/or commensal microorganisms, some of which are the cause or potential cause of plant diseases. All should be viewed as vectors of plant diseases, whether or not known diseases have been associated with them. Some Scolytidae are bark borers that feed directly on host tissue, ordinarily the phloem. Bark beetles are usually rather host specific and their normal bisexual habit increases the difficulty of their spread through commerce and simplifies management and control. Most of the economic problems with Scolytidae in North America have focused on bark beetles. Slightly less than half of Scolytidae species and all Platypodidae are ambrosia beetles. Ambrosia beetles feed primarily on the fruiting spores of their mutualistic fungi, not upon the tissues of the host into which they bore. As such, they can successfully breed in any host species tollerated by the fungi; thus, the beetles tend to have very broad host ranges that might impact any woody plant within its range. All Platypodidae and a few ambrosial Scolytidae are normally bisexual; consequently, they face a mate-finding problem that deters their success in migration. However, most ambrosial Scolytidae have a mating habit that includes arrhenotocous polygyny (male haploidy) in which any female (whether mated or not) can establish a breeding population. Over 80 percent of the Scolytidae introduced into the United States this century have this habit. If even one female with this breeding habit escapes detection, economic disaster can result. Ambrosia beetle economic problems on the U.S. west coast have been minor, but in the southeastern states they are now beginning to discover what economic disaster can mean. The pecan industry may not survive

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the importation of three species of Xylosandrus. The principal economic damage in tropical countries is the destruction of sapwood in felled trees and logs, not the death of standing trees.

The manuscript does not focus on two factors that should receive serious consideration. (1) If it were possible to ship insect-free logs from New Zealand, what is the possibilty that those logs would become infested en route at a port-of-call by pest species unknown in New Zealand, before they reach the U.S. west coast? My guess is that the probabilty would be very high. (2) A substantial number of economic scolytid pests are moving through commerce that have not yet been reported from New Zealand, although I have seen examples of two or three taken in New Zealand from breeding populations. I have also seen at least a dozen species taken from Pinus radiata plantations in Australia that have not been reported in the literature. Be assured that they will soon be in New Zealand, if they are not already there.

Xyleborinus saxeseni is a European species that was introduced into America, then apparently transported from British Columbia to New Zealand in about 1920. Since it is already widespread in the USA and Canada, its return would not alter the economic picture.

Hylastes ater, treated in this manuscript, is regarded as having a significant economic impact in pine and other conifer seedlings in European nurseries as emerging young adults form maturation feeding tunnels. This problem with American Hylastes species is virtually unknown here. The fact that this species has had an economic impact in Australia, New Zealand, South Africa, and South America (three countries), indicates that more attention to it is deserved than is given in the manuscript.

Hylurgus ligniperda, treated in this manuscript, is another European species that has spread to Australia, New Zealand, Africa, and South America. When diseases, parasites, and competition are removed, this species has a much greater impact on pine plantations than it has in its natural range. I am informed that in Chile it is regarded as a significant forest pest. We have nothing like it in North America, and I would expect a much more serious economic impact from it than is stated in the manuscript. It is a near relative of Dendroctonus and, as such, its possible introduction should be taken seriously.

Pachycotes peregrinus is endemic to New Zealand, but it has been intercepted in Pinus radiata logs in other countries. It is another near relative of Dendroctonus, but it has radically different habits. I have not observed any species of this genus in nature and can only guess that without competition, diseases, or parasites an introduction into North America could be explosive. Since it has adapted from Araucaria to Pinus already, other shifts in host should be expected.

Ips grandicollis is not mentioned in the manuscript, although I have seen examples from New Zealand, Australia, Philippines, and South Africa. It has apparently not yet reached South America. In Australian and Philippine Pinus radiata plantations, it has been much more agressive than in the southeastern states and has been reported as killing healthy trees. If introduced into the U.S. west coast, I would not expect it to have a serious impact due to the presence of competing related species.

Among ambrosia beetles, an entirely different situation exists. Of the Platypodidae, I believe only one species, Platypus parallelus, constitutes a significant threat. It is without question the most destructive ambrosia beetle in the world; however, except for the extreme southern U.S. (including southern California) it is virtually unknown here. Our climate is apparently too cold for it. It is now in southern Asia and eastern Australia and is probably in New Zealand, but not yet reported from there. It has been introduced into England at least twice, but cannot maintain a population.

Of much greater concern to me is a vast number (1,400 species) of ambrosia beetle species in the Xyleborini. At least six species of this group have been introduced into the eastern U.S. within the past decade. Three species of Xylosandrus are having a serious impact there now and others have attained population the size to become threats. These are the species that can establish breeding populations from one female. While they will probably not devastate our national forests, they will seriouly impact the horticulture industry and urban forestry. Xyleborus dispar and Xyleborinus saxeseni fall into this category and have impacted east and west U.S. interests for a century. Xyleborus xylographus and X. californicas are recent introductions on the west coast that are still rare, but will soon be heard from. Due to sloppy inspection and an uncaring commercial industry, a dozen more species are now here and will have an impact.

In 1950, I found Xylosandrus compactus at Homstead, Florida. It is probably the most agressive scolytid known, with more than 1,000 recorded hosts. At the time, it was confined to an area of less than 10 square miles. When I reported the find personally to an assistant director of forest insect investigations in Washington, I was told to "keep if quiet, don't tell anyone. We have enough problems to worry about now." For a few thousand dollars, that population could have been eradicated with ease. That insect has now spread to Georgia and west to Texas and costs many millions of dollars per year to control. That lack of action was both fool-hardy and irresponsible. We cannot afford that kind of leadership in this country.

The suggested importation of unsawed timber into any country is foolish and loaded with potential for disaster. The Dutch elm disease should have taught us a lesson, but apparently it did not. When it costs more for us to clean up the mess than the total economic benefit derived from the importation, something is seriously wrong with the system. If the timber is needed, let it be at least debarked, or sawed, before shipment.

Sincerely,

Stephen L. Wood

Stephen L. Wood
Professor Emeritus

MESSAGE DISPLAY FOR WILLIAM B. WHITE

To W.White:w04a

From: Harold H. Burdsall:S32A
Postmark: Jul 09,92 8:08 AM Delivered: Jul 09,92 7:07 AM

Subject: Review draft

Message:
Bill, I have reviewed the draft. Just haven't had a chance to get the comments back to you. It really looks pretty well done. My concern is mainly that there is no mention that I fiound of the impact of the minor problems on P. radiata that could be major here on other species. I am a bit concerned that it doesn't recommend more caution than I read into it. The first samples that we got look well inhabited by some possible problem fungi (Ceratocystis??).

---------------X---------------

Pest Risk Assessment on the Importation of Pinus radiata and Douglas-fir Logs from

Comments are on the manuscript. 7/2/92

Robert L. Edmonds
Professor of Soil Microbiology
and Forest Pathology
College of Forest Resources, AR–10

University of Washington
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Seattle, Washington 98195
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DRAFT COPY

RELEASED JUNE 5, 1992

DEPARTMENT OF FOREST PRODUCTS
OREGON STATE UNIVERSITY
Forest Research Laboratory 105
Corvallis, Oregon 97331-5709

Telephone (503) 737-4222
FAX (503) 737-3385

June 18, 1992

Dr. William B. White
Assistant Director, FPM
3825 East Mulberry Street
Fort Collins, CO 80524

Dear Dr. White:

Enclosed you will find my copy of the "Pest risk assessment on the importation of Pinus radiata and Douglas-fir logs from New Zealand." I found the document to be well written and have made virtually no comments on the document. I would note, however, that Table 3, the list of possible quarantine fungi, does not include Amylostereum aerolatum, one of the fungi deemed important in the mitigation schemes.

In addition to this brief comment, I remain unconvinced that methyl bromide fumigation will have any effect on survival of fungi established more than a few cm into the wood. Therefore, arresting the entry of fungi such as A. aerolatum will require longer fumigation exposures or alternative control methods. These approaches will require the implementation of some controlled studies to assess efficacy of the various strategies, something which is woefully lacking at the present time.

Finally, I would comment that the document also notes that a previous APHIS panel recommended heat sterilization as an acceptable means for importing Siberian Larch, but noted that no documentation was included. The time temperature relationship in the earlier APHIS document was based upon previous studies of Chidester (Proceedings American Wood Preserver's Association 33:316-324, & 35:319-324) who studied survival of basidiomycetes exposed to higher temperatures and employed heating curves developed by McLean (U.S.D.A. Handbook 40, 1952) as modified by Sahle-Demessie et al. (Wood Science and Technology 26:227-240). A slightly higher temperature than normally employed for fungal control was recommended because of a report that the pine wood nematode could survive exposure to 155 F but not 160 F. I am including a copy of the last paper for reference purposes.

I hope my comments on the document are helpful and look forward to answering any additional inquiries in this matter.

Sincerely,

Jeffrey J. Morrell

Jeffrey J. Morrell
Assistant Professor

Encl

United States Department of Agriculture
Forest Service
Southeastern Forest Experiment Station
P.O. Box 12254, 3041 Cornwallis Road
Research Triangle Park, North Carolina 27709

Reply To:

Date: July 9, 1992

Mr. William B. White
Assistant Director, Forest Pest Management
USDA Forest Service
3825 East Mulberry Street
Fort Collins, Colorado 80524

Dear Mr. White:

In response to your letter of June 1, 1992 I have a few comments on the draft manuscript "Pest Risk Assessment on the Importation of Pinus radiata and Douglas-fir Logs from New Zealand". Let me cover my general comments first and then I will have a few specific things to say.

Overall, this document provides information that should prove useful in making a regulatory decision. My main concern is the lack of a description of how the information presented is to be used in a decision-making framework. Without a clear statement of the decision-making model, it is difficult to understand whether the information presented is relevant and complete. Consequently, it is not clear whether or not more effort should be spent collecting further specific information. As an economist, I think that information regarding such things as mitigation costs, the private economic benefits of importation (i.e. jobs), and the subjective probabilities associated with successful introduction of pests is important in assessing the potential costs and benefits of a regulatory action. Further, estimates of the cost of obtaining further information about pest risks need to be weighed against the expected value of searching for more information to decide whether or not this document is reasonably complete. Currently I am writing a paper with some of my colleagues that presents these concepts in a systematic way, and would be happy to share the approach with you.

My specific comments follow, and pertain to Chapter V. Evaluation of Economic Effects:

1. p.45-46. In the scenario regarding *Leptographium truncatum* it is not clear why a forest owner (in contrast to a yard or ornamental tree owner) would spend $400 to replace 0.75-1.5 trees per acre that die. Compensatory growth on neighboring trees could make up the volume loss (i.e. thinning effect), and it is stated that *P. radiata* is not a commercial species anyway. Are these estimates solely for damages to yard and ornamental tree owners? If so, that should be made clear upfront.

2. p.49. In the scenario regarding *Sirex noctilio*, it is not clear why timber producers are impacted to a greater degree than timber consumers. If timber supply and demand functions are inelastic and linear and if parallel supply shifts occur, then it seems that consumers would be relatively worse off than producers. This is because some of the loss to producers is offset by higher prices.

3. p.51, p.53. Comparing the worst case losses from *Prionoplus reticularis* and *Platypus* spp., it is not clear why the ratio of loss in product value from the former pest to the latter pest (.003/.005 = .6) does not equal the ratio of damages ($40.12 million/ $118.7 million = .34). Likewise in the best case scenario (.0006/.0005 = 1.2 $\neq$ $8.02/$11.87 = .68).

4. p.55. It is not clear where the comparative value of $2,600 million in potential commercial timber losses reported for the Asian Gypsy Moth comes from. Table 7-1 in the cited document indicates a worst-case scenario for all defoliators at $58,410 million.

I hope that these comments are useful in finalizing your document. If I can be of further assistance, please give me a call.

Sincerely yours,

Thomas P. Holmes

Thomas P. Holmes
Research Forester

18 June 1992

To: Richard Orr

Re: Critique of Pest Risk Assessment on the Importation of Pinus radiata and Douglas-fir Logs from New Zealand

I have reviewed the PRA of logs from New Zealand and comments were made directly on the draft copy in red felt tip marker. It was difficult to review single spaced text, especially for this lengthy document. Will it be possible to have document drafts double spaced in the future?

There are numerous problems with terminology. An example is the term "foreign" (p. 14). Authors are speaking of at least two countries and it is unclear if an organism is foreign or native (p. 102) to the U.S. or New Zealand. "Good flyers" should be changed to "efficient fliers" or "strong fliers". Another example of troubling terminology is "freshly killed logs" (p. 27).

In many cases there is an unconventional use of capital letters. Examples include: <u>F</u>ederal programs, <u>N</u>orthern Africa (p. 28), Western US (p. 30) and Regions (p. 44).

Unconventional punctuation is used throughout the draft such as the hyphenation of words. Examples include: best-case-scenario (hyphens not needed); 2-3 (should be 2 to 3 because 2-3 means "two through three"); miles-per-year, (should be miles/year); percent-per-year (should be percent/year). Why are quotes used in literature citations? Punctuation for citations to literature is inconsistent throughout the draft; particular problems are italics, commas and semicolons. Many of the inconsistencies here and elsewhere in the draft could be corrected by global commands (example: change all "XXX" to "xxx").

Although this is not specifically written for scientists, jargon such as "impacts" (p. 30) is used when "effects" and "affects" are suitable. Words such as regime (p. 9) should be deleted.

To whom goes this reviewed draft? I want to be acknowledged in Appendix G as a reviewer and want a copy of the completed publication.

Scott

Scott C. Redlin
Plant Pathologist
Biological Assessment and Taxonomic Support
18 June 1992
logs.scr

June 24, 1992

To: Richard Orr
PPD, PRAS

From: R. Griffin
PPQ, P&D

Subj: Draft New Zealand log risk assessment

Specific and editorial comments regarding the subject document are indicated in pencil on the document itself, herein returned for your review.

General comments are as follows:

1. Document needs overall editing for consistency in format, language, style, tone, and presentation. As it stands, it is obvious that the document is a compilation of contributions from different authors.

2. Ratings for each risk category need to be clearly stated and the use of ranges (i.e. "moderate to high") needs to be consistent (if use is really valid). In addition, all ratings require some short discussion of the rationale behind the decision and the overall rating needs to be linked to the component ratings through some justifying statement.

3. Document needs to stand independently, not measured against the PRA for Siberian logs or any other PRA. Although referencing the Siberian log PRA is useful, practical, and sometimes necessary, ratings and conclusions should be drawn from the specific situation described by the document at hand or it will be awkward for "outsiders" to use and understand.

4. Need a better way to handle pest/pest combinations as a single risk factor or somehow factor together the risks in another format without adding or detracting from an objective risk analysis of each pest.

5. According to the first statement on pg 39, the document is predicated upon NZ continuing with current mitigation activities (i.e. debarking, fumigation, etc.). This is in direct conflict with other statements (and the concept) which state that PRA's will assume <u>no</u> mitigation measures. Presumably, the "document" referred to on pg 39 is only the portion concerning mitigation and not the entire PRA (this needs to be clarified). However, in reading the assessments, it is obvious that assumptions are made in both directions. This causes significant confusion in understanding the PRA's and detracts considerably from the credibility of the document.

Shasta-Trinity
National Forests

NATIONAL FORESTS 1891 1991

Fax Transmittal Sheet

7-8-92
(date)

From: Fields W Cobb FAX (510) 642-3845

Shasta-Trinity National Forests
2400 Washington Avenue
Redding, CA 96001
(916) 246-5222

Fax Numbers: **Commercial (916) 246-5045**
FTS 450-5045

To: Bill White, FPM
Ft. Collins, CO

Number of pages to follow: 4

Fax Message:

Bill: These pages are in addition to several being typed in Berkeley & sent to you from there. Hope you can read my writing; Bill Otrosina was bouncing me around in the auto.

Fields

Notes from Fields Cobb
Shasta-Trinity National Forests

Page 43, section on ecological impacts: I think that this section is quite inadequate in addressing the potential ecological impacts of even the organisms covered. You mention the potentials for impacts on water, wildlife etc., in the introduction, but you do not deal with them in any real way. I strongly suggest that a strong effort be made to substantially improve the section. In doing so, you should not limit the coverage to these few organisms. There are many more on the list that could have major impacts.

Page 44, 1st paragraph: why have you made the decision not to "measure" the losses in areas such as wildlife, recreation and water? This is a major flaw and should be corrected before the assessment is considered acceptable.

Page 44, point No. 3, Research Areas: No proper assessment can exclude 7 million acres reserved for the spotted owl or for any other reason (e.g., National Parks). I do not understand the reasoning, nor can I accept it. You are reinforcing the opinion that most conservation groups have of the USFS (i.e., that it is in the pockets of the timber industry).

Point 4: Again, if this is going to be an assessment used in decision making, you <u>CAN NOT</u> exclude cost of IPM measures. Nor can you exclude addressing the extreme difficulties of effectively controlling or managing pests in forest ecosystems.

Page 45, general assumptions: (1) There are several weaknesses in this listing. Probably foremost is the long-term impact on national ecosystems. (2) It is not clear which of the long lists of pests that are being considered as "possible colonizers." If you are addressing only the 6-7 organisms considered under mitigation, your list is woefully inadequate. (4) Though I am not an economist, I must say that 4 years appears to be far too low to even consider.

Page 45, *L. truncatum*: Several of these assumptions appear to be off-the-wall, e.g., to assume that the fungus only kills *radiata* is totally unfounded. Also, your point "f" assumes an increasing rate for a couple of years, then reaching a maximum rate. This assumption is not based on current epidemiological concepts in the first place. In the second place, I hope that you are referring to a maximum <u>exponential</u> rate. Otherwise, the calculations are meaningless. Also, why was the analysis terminated at 30 years? The fungus is not likely to disappear at that point.

Page 57, paragraph 2: The statement that the probability of *Sirex* suppression is very high is based on an assumption that you can apply all (or most) of the strategies used in New Zealand in our natural forests. I do not think that the assumption is necessarily valid.

Page 60, summary: I strongly disagree with your conclusion that there are only 2 <u>pathogens</u> (not diseases) of concern here. There are several others on the complete list that are certainly potential problems. In addition, there are many, many unknowns that should be at least pointed out in this assessment. For example, the history of forest pests shows that often the pests that do major damage are unknown in their native habitats. I point out again that we do not yet know where *Discula* (on dogwood) or *Phytophthora* on Port-Orford-cedar originated. A proper assessment must consider these possibilities.

Some Specific Comments

P. 8, Background, Third Paragraph: The statement "--- proposes rational mitigation measures that significantly reduce the likelihood of introductions," concerns me. I believe that APHIS is charged with preventing such introductions - not significantly reducing the likelihood with a proposed mitigation measure that someone has deemed rational.

P. 8, Fourth Paragraph: It is unclear to me who classified the small volume imports from N.Z. as "low-risk." I am certain that some knowledgeable people would not agree with that assessment. One shipment had two or more species of Scolidial beetles as well as other insects. A second shipment of 6800 logs (not a small volume) was contaminated by several fungi, one of which has been identified as *Diplodia pinea* which is known as a rather virulent pathogen of pruning wounds in N.Z., killing some 10-12 inch diameter trees within a year of infection. Studies on this fungus are incomplete, but they indicate that the fungus is not the same as any of those currently identified in the U.S. or Canada. As far as I can learn, no mitigating measures were applied to these latter logs (beyond that applied in N.Z.) before they were released. Possibly, the authors of this report have more information than I do. If not, I believe that more investigation should have been done to establish the facts, especially when we are dealing with risks that could have major impacts upon North American resources valued in the trillions.

P. 10, First Paragraph: The implication here seems to be a supposition that only the forests of the Pacific Northwest are at risk. Not even the forests of Northern California and of Canada are being considered. Nor are all genera at risk in the NW forests indicated here; eg, hemlock and spruce.

P. 10, 2nd Paragraph: I did not realize that these assessments dealt only with immediate risks. Nor do I have total faith in "industry proposals." As for Point 3, I cannot agree that time to spread to Alaska and eastern U.S. "would be very long." Of course one could be defining very long in terms of a few years or a few decades. However, when we consider the potential of some of these pests to devastate whole ecosystems, even centuries become critically important.

P. 10, 4th Paragraph: I hope that the authors are not limiting this assessment only to the organisms causing damage to N.Z. commercial forests. I think that I should point out that the chestnut blight fungus was not noted for causing damage in its native habitat until it was introduced into the U.S.

Also in Paragraph 4, I wish to point out that there are more than just questions about genetic variability of organisms in the third category. We do have information on some of them. For example, in California and on the Oregon coast we have a "type" of *Dothistroma pini* with long conidia (even longer than *D.p.* var. *linearis*), but we do not have the short-spored *D.p.* var. *pini* which appears to be more virulent on ponderosa pine than does our long-spored one. A good, defensible assessment should deal with this type of information. I believe that anything less is unduly taking risks that should not be taken.

P. 10, 5th Paragraph: If the authors of this assessment wish to state that currently there are no major disease or insect epidemics marching through the N.Z. exotic plantations, I will agree with them. However, to say that "most of the forest --- are in a healthy condition" is an opinion that does not contribute to an unbiased assessment of the risks. Nor does it properly assess the costs of the changes in forest management practices, silviculture, tree breeding and extensive fungicide sprays to reduce losses. If we have to use all of the strategies that have been used in N.Z. to maintain our forests (especially our natural systems) in a healthy condition, we certainly will not have any more natural systems.

P. 12, Paragraph 6: How can pests noted as present in N.Z. but rare be eliminated from consideration? The *Discula* that causes a disease that is clearly threatening the existence of dogwood in many areas of both eastern and northwestern U.S. has not even been found in its habitat of origin; nor has *Phytophthora lateralis* which is a serious threat to the very existence of Port Orford cedar. Seriously, do we have enough information about forest pests to excluded anything from consideration? I and many others in our professions do not believe so.

P. 12, Paragraph 7: I am confused about the use of the term exotic. Are the authors stating that exotic pests are present in western U.S. or are absent? Why are you limiting this evaluation just to western U.S.? If i were the Canadians I'd be very upset to see my neighbors dismissing the risks to my resources. I wonder too why *Amylostereum* was omitted from Table II-3.

P. 13, The list: If you have listed these organisms because they present the most difficulty re mitigation and because any mitigation strategy effective against them will eliminate all other potentially damaging pathogens, insects, and other pests, I think that I may be able to accept the list. However, I will assume at this point that you are concluding that *Amylostereum* will invade to the very center of the logs. Otherwise, a better choice would be the *Armillaria* species.

P. 14, Table II-1: At this time, I believe strongly that we do not have enough knowledge of any of the fungi to categorize them as either 1D or 2B. Isozyme and molecular techniques now available will enable us to gain this knowledge more rapidly, but we will still need to do some sophisticated pathogenicity tests before we can make informed decisions.

P.15, Table II-2: I am concerned that the curculionids are considered such low risks. Possibly, it is explained later.

P.16, Table II-3: The reasons why the risks are low for such pathogens as *Cerotaystis*, *Fusarium*, the *Ganodermas*, *L. procerum* and the *Ophiostomas* may be stated later, but at this point I strongly disagree with that assessment.

P. 16, Table II-3: As I have stated earlier, I have very strong reservations about putting any of these organisms in a 2B category because we simply do not have enough information. However, the evidence that we do have apparently has not been used here. For example, *Ophiostoma piceae* is a binomial that appears to have been applied to a group of similarly appearing but different fungi one or more of which attack conifers and one or more of which attack hardwoods. In his 1990 publication in (I believe) Plant Pathology, Clive Brasier even presents evidence that *C. ulmi* is a recently evolved fungus out of this grouping. I strongly recommend the 2B category be used only after there is convincing evidence for the lack of variability with any of the pathogens.

P. 18, Paragraph 2: One of my major objections to this whole process is the assumption that we can arrive at any reasonable estimate of risk based on known biological (and technical?) information. This smacks of the old cliche "what we don't know won't hurt us." This is very clearly not so here. Unless we provide reasonable protections against the unknowns, we will be placing priceless resources in jeopardy. And when it comes to forest pathogens, we know very little; eg it's been less than 15 years since most of us recognized that *H. annosum* was more than a single fungus, even though there have been thousands of reports on various aspects of its biology, etc.

P. 20, Summary of natural history: Since *a. areolatum* does not yet occur in N.A., it is quite natural that none of our *Sirex* species vector it. This does not mean that if the fungus was to occur in the habitats with our sirids, an association would not develop. I think that the authors appreciate the fact that the measures listed in the last paragraph are not readily available to us in N.A., especially in natural forest ecosystems. If this fungus becomes established in our native radiata stands, it could be absolutely devastating in a relatively short time.

P. 20, Last paragraph: I am not familiar with any studies that offer reasonable evidence that "colonization will only occur if the associated *Sirex* is present." I hope that this conclusion is valid. There is too much at stake to guess.

P. 21, Spread potential: This assumption may be correct, but is there any evidence that our Siridæ, or Cerambycidæ, or Buprestidæ or Scolytidæ, or etc. could not serve as vectors, albeit maybe not as efficient as its normal associates. I frankly think that this is a dangerous assumption without solid evidence.

P.21, Consequences: How can this be (No. 5)? The fungus in fact kills the trees, does it not? If I am correct, the presentation is misleading.

P. 21, Additional Remarks: The last sentence is repetitious and potentially incorrect.

P. 24, No. 5 Control Options: First, *C. fagacearum* is not closely related to *L. truncatum* although Hunt had placed them together (Refer to Harrington). Second, we should not assume that fumigation treatments for a fungus that occurs in the outer growth ring of oak (with larger vessels) will be effective against a fungus that colonizes through the entire sapwood of pines (with relatively small tracheids and parenchyma cells.).

P. 24, No. 6: Other western hosts may not be known, but they are more than just possible. With a fungus that can be serious on both eastern white pine and radiata pine, I think that it's probable that most pines are potential hosts. I would not limit the last sentence in this paragraph to *radiata*.

P. 25, 1st Paragraph: The pathogenicity of *L. truncatum* should be evaluated not only on radiata but on several species of pines representative of the whole genus and on other genera as well.

P. 29, 1st Paragraph: This states nothing re the depth of tunneling and whether the insect penetrates into the heartwood.

P. 32, NZ Mitigation Activities: The first activity listed under "field" has nothing to do with mitigation. It is done in almost all logging operations and is a simple procedure in standard logging operations. The second activity also has essentially nothing to do with mitigation, and the third one is stretching the point. A lot of insects can attack unprotected logs within 10 days; no wonder they have arrived at U.S. ports so colonized by fungi.

While marking logs with a unique bar code might help in tracing things, it certainly is not a mitigation procedure.

P. 33, Section on hand debarking: Examination of the logs at the S.F. port strongly supported the absolute necessity of removing all bark. There were larvae in an attached bark piece less than the size of a quarter (1/4 dollar). I acknowledge that pest numbers would be significantly reduced by the N.Z. debarking; but is that the standard that we should be accepting? I do not think so.

Section on insecticides: The insecticide treatment was not effective on the shipment off-loaded in S.F. Nor were the fungicides. Mr Schmidtbauer told us that the S.F. logs were so full of staining fungi that he considered them worthless.

Section on fumigation: I was never given the opportunity to examine the fumigated shipment off-loaded in Sacramento, but I understand that it too was rather well colonized by fungi.

P. 35, Transportation considerations: All of this is predicated upon the success of the mitigation procedures outlined in previous pages. These have not proven to be effective. On the contrary, the evidence shows that they are not effective enough to be acceptable.

P. 36, Top of page: If one considers the resources that could be at risk and the fact that one or a few spores or insects are all that may be needed to get successful colonization, this suggested sampling level is, I strongly believe, inadequate.

P. 36, Paragraph 2: You state here that the logs will be transported directly to the mill; a good idea, but I'd like to point out that the load of logs in Sacramento was supposed to travel no farther than Marysville, CA. However, some were transported to Chico and some even to Arcata, CA. Once they have gotten over the dam, there seems to be little that the regulators can do.

P. 36, T31Z at bottom of page: I have pointed out that *C. fagacearum* is substantially different from organisms reported in radiata of Douglas-fir and that it colonizes the outer rings of wood only. The example is flawed.

P. 38, Table III-2: I am still bothered by the exclusion of *Armeilaria* from this assessment. Its inclusion would assure that you deal with at lease one organism that can be expected to occur in the center of the heartwood. A mitigation that can assure elimination of a pathogen at that depth in the largest log should eliminate all pathogens and pests unless there is a very resistant spore, resting structure, etc.

P. 39, Summary: Re your second point, I agree that more information might be helpful. However, at this point I believe that we must conclude that fumigation will not be effective enough as a mitigation procedure. I also believe that the necessary information that might allow mitigation through fumigation should be developed through a carefully designed series of experiments by a select group of scientists, not by APHIS-MOF tests on initial shipments. P.S. I continue to have the feeling that the authors are not viewing this issue with the gravity that I think it deserves. If we take a worst case scenario, which is quite possible when dealing with natural tree species (eg chestnut blight, Dutch Elm Disease, white pine blister rust) the impact can be incalculable especially over generations and centuries of time. The impact of chestnut blight on the tree as a forest product, wildlife food, esthetics, watershed protection and a major component of the eastern forests (eg possibly oak wilt would never have become so serious if there had been chestnuts) during the 90 years since its introduction probably measures in the hundreds of billions (possibly a trillion). And my children, and their children and their children's children will never see a natural forest with the beautiful chestnut as the dominant species. What a cost!

Re your seventh point, you suggest that APHIS personnel should inspect logs at U.S. Ports according the local policy. That will not work. The Siberian logs were stopped not by APHIS but the CA. Dept. of Food and Agriculture personnel. The APHIS inspections are woefully inadequate when it comes to "green rounds" (logs).

P. 39, I believe very strongly (and I hereby state this belief as strongly as I can) that there is no adequately tested mitigation procedure which will protect our forest resources from the introduction of potential dangerous (and even devastating) forest pests. Until we have a proven method, we should exclude the logs. At this time, moist heat treatment adequate to pasteurize logs to their centers appears to be the best option (possibly the only one).

P. 40, Section on *Amylostereum:* I agree with your reference to the specific pine-*radiata*, because it has so limited a natural range that it could be devastated quickly. However, this fungus with its insect vector probably can aggressively attack most if not all pine species in North America, as well as other genera. Hence, the threat is to all pines and possibly other genera as well.

P. 40, Section on *L. truncatum*: The statement "the wide separation between the 3 pine host will limit the opportunity for widespread dispersal of the fungus" seems to be quite unjustified.

These are 3 pines 1 each from 3 special sections of the genus *Pinus*. Hence, it indicates that the fungus will probably attack most of the pines not just a few. To claim that the current reports represent a true assessment of the host range is unrealistic and to base a statement such as the one in your report on such reports is less that unrealistic.

P. 41, Last statement under *Sirex*: You have absolutely no basis for making this statement. To the contrary, an exotic pest in a native stand can be devastating, eg chestnut blight.

P. 41, Ecological impacts, 2nd statement: Again you have no basis for making this statement. At this point, I must also object very strongly that you have omitted so many potentially important pathogens form this section of your assessment.

United States Department of Agriculture | Forest Service | RM

Reply to: 4000 Date: July 9, 1992

Subject: Importation of New Zealand Logs

To: Bill White, MAG

Below are a few items you may wish to consider as you develop the final draft of your report. These items are not in any particular order.

- It appears that your final report is not due until October. As such, you should have time to have someone do some additional evaluation on the organisms you have not yet analyzed. It would be prudent to do so. This should include organisms in New Zealand, but not recorded on radiata pine or Douglas-fir, such as Heterobasidion annosum.

- The economic evaluation bothers me in that it appears to assume that the probability of introduction of the various organisms is zero if we do not import any logs. This is probably not correct. For example, Dr. Peter Gadgil did a study some years ago on the possibility of introducing forest pests to New Zealand on camping gear. The same could happen in this direction as well.

- The document notes, but perhaps should emphasize even more, the taxonomic uncertainly of some of the organisms involved. The situation with Sphaeropsis (Diplodia) and Leptographium (Verticicladiella) are prime examples. In the absence of more definitive information, it would seem prudent to assume what exists in New Zealand is different from what is now here in the U.S.

- It seems reasonable that if New Zealand logs are allowed to enter the U.S., then they should be processed at a mill very close to the port of entry--not one several hundred miles away. Logs sent to Seattle should be milled in Seattle, not Portland, Sweet Home, or wherever. This action would reduce probable exposure of our forests to whatever organisms may be present.

- Insect transmission of fungal pathogens should be a major concern. Since some insects (Hylastes, Hylurgus) already have been detected on treated shipments, this concern is very real. These very insects likely transport Leptographium species. This aspect of the report deserves more attention.

- At present, the mention of nematodes on p. 33 is a "red herring." The subject needs a little more development.

- I do not believe it is appropriate to insinuate that Leptographium truncatus only infects wounded trees (p. 40). Transmitting insects can make a sufficient wound to establish the fungus.

- The schedule for log transport seems overly optimistic. On-wharf storage could be considerably longer as could time for various other activities. Exposure after treatment could be dangerous.

- The New Zealand exotic forestry system is highly developed. Would it be possible to reduce the risk of pest importation if stands ready for cutting were identified as "pest free" and then only logs from such stands went into the export avenue? Branding or some other mechanism would allow this to be done.

Having lived and worked in New Zealand pine forests as a research pathologist, I have a reasonable understanding of their pest problems. My recommendation is to require a greater level of processing in New Zealand (at least "cants") before shipment to the U.S., even with all treatments still being performed.

Sheila Ames
for

CHARLES G. "TERRY" SHAW III
Research Plant Pathologist
and Project Leader

Oregon

DEPARTMENT OF AGRICULTURE

July 2, 1992

William B. White
Assistant Director, FPM
USDA Forest Service
FPM Methods Application Group
3825 E. Mulberry
FORT COLLINS CO 80524

Dear Mr. White:

We have reviewed the "Pest Risk Assessment on the Importation of *Pinus radiata* and Douglas-fir Logs from New Zealand." We are impressed with the progress your team was able to make during their three weeks in New Zealand and think you and your team should be commended for your efforts. Our general concerns with the Assessment follow.

We are concerned to see the assessment "predicated on New Zealand continuing mitigation activities as currently proposed and practical". Since available or proposed mitigation measures may change at any time, we would have found it most useful for each pest risk to be first assessed without mitigation measures. Then mitigation measures could be evaluated singly or in combination as to their efficacy against particular pests or types of pests. New information as to efficacy (and economics) of various mitigation measures is both needed and expected as new studies are completed.

We are concerned at the large numbers of organisms eliminated from consideration without a detailed assessment. We believe a larger number of pests and pest types should have been subjected to specific evaluation. However, this pest risk assessment clearly shows that, as with Siberian logs, significant insect and pathogenic pest risks exist from the bark into the heartwood of New Zealand logs proposed for import into the United States.

We believe quarantine safety requires pest risk mitigation measures be demonstrated in scientifically sound studies to be effective against the pests (or pest types) under the conditions the mitigating measures would be applied. Efficacy of the current or proposed New Zealand mitigation activities has not been demonstrated to our knowledge against all the serious known pest risks cited in this draft assessment.

Since significant pest risks also occur from the bark to the inner wood of Siberian logs, recent evaluations of mitigating measures for Siberian log pest risks should be useful. "An Efficacy Review of Control Measures for Potential Pests of Imported Soviet Timber" (USDA Miscellaneous Publication No. 1496, 1991) is the most complete, recent review of log pest mitigation measures we know. The Scientific Panel Review of January 10, 1992, Proposed Test Shipment Protocol for Importing Siberian Larch Logs Final Report (USDA FS, April 15, 1992) should also be valuable and is enclosed. A major difference between the Science Panel's recommendations and the proposed protocol for importing New Zealand logs appears to be their substituting heat treatment for fumigation at origin and adding kiln-drying of all resulting lumber products; both protocols require debarking and insecticide/fungicide application. Detailed descriptions of procedures for handling non-lumber byproducts and sampling protocols are also included in the Final Report. We believe conclusions of both these two reviews should be seriously considered in the assessment and in developing log import regulations.

Barbara Roberts
Governor

STATE OF OREGON 1859

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Although evaluation of mitigating measures is not included among the purposes of this risk assessment, the mitigating measure issue is addressed. A clearer division between protocols proposed by New Zealand government/industry and by the Pest Risk Assessment Review Team would be helpful. The assessment's purpose with respect to evaluating mitigating measures should be clearly stated.

We believe comprehensive log import regulations covering logs of all tree species from all sources need to be implemented to provide a sound basis for Oregon's timber industry to import exotic logs while protecting Oregon's forests, agriculture, and ornamental plantings from exotic pests. Potential insect and disease pests can be expected to occur from the bark to the inner wood in logs from all sources; nematode pests may occur as well. Our experience with preliminary Siberian and New Zealand log shipments substantiates this concern. The general log importation protocol should require effective mitigating measures. Since milling does not necessarily control inner wood pests, the need for additional regulations to cover wood and wood products besides logs should be addressed as well. Such general regulations could be modified for special circumstances. For instance, if a detailed risk analysis or experience indicates that a particular species or source does not pose a risk for deep wood problems, then the regulations for that species/source could be relaxed as appropriate.

We believe research studies designed to determine and enhance the effectiveness of mitigation measures against pests from the bark surface to the inner wood of logs are critical. The costs of the research needed are relatively minor compared to the potential pest risk costs and trade delay costs.

Our more specific comments are summarized below and generally follow the organization of the draft report. Other comments are made in the margins of the text and those pages with changes are enclosed. We hope our comments are helpful to you as you complete this very important project.

Thank you for giving us the opportunity to review this document. We hope our comments are useful to you as you complete this important work. If you have any questions, please feel free to contact us at (503) 378-6458.

Sincerely,

Daniel J. Hilburn

Daniel Hilburn, Ph.D.
Entomologist

John Griesbach, Ph.D.
Plant Pathologist

Kathleen J.R. Johnson

Kathleen Johnson, Ph.D.
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Administrator, Plant Division

Analysis of "Pest Risk Assessment on the Importation of *Pinus radiata* and Douglas-fir Logs from New Zealand"

Acknowledgements

We recommend that USDA Miscellaneous Publication No. 1496, as the most complete, recent review of log pest mitigation measures, also be used extensively in this pest risk assessment of New Zealand logs wherever efficacy of mitigation measures are discussed. The Scientific Panel Review of January 10, 1992, Proposed Test Shipment Protocol for Importing Siberian Larch Logs Final Report (April 15, 1992) should also be valuable in discussing potential appropriate mitigation measures.

I. Introduction

Statement of Purpose

Part of the purpose of this risk assessment appears to be an assessment of pest risks in light of mitigating measures currently proposed by New Zealand. If so, for clarity please include it with other purposes under the Statement of Purpose.

Background

To our knowledge three shipments of New Zealand logs have been made into the United States. The first shipment of New Zealand logs to the United States apparently occurred in August 1991. Enclosed are two letters between the Oregon Department of Agriculture and APHIS in October 1991 documenting the occurrence of a shipment then.

During December 1991 Oregon Department of Agriculture personnel sampled New Zealand *Pinus radiata* logs off-loaded from the Washington Star in Seattle, WA. They also inspected logs in this ship's hold when the ship stopped in Portland, OR enroute to San Francisco (see enclosures). Black stain fungi and *Trichoderma* sp. (a generally non-pathogenic fungus) were found. A live Scolytid larva (*Hylurgus* sp.) was found as well as evidence of either cerambycid or Siricid larval activity. Live staphylinid beetle larvae, collembolans, and several families of mites were also collected from bark samples placed in Berlese funnels. Dead insects found in the pitch on the log butts included scolytid, cucujid, colydiid, cantharid, staphylinid, and lathridiid beetles and dipterans. No pinewood nematodes were recovered.

No inspections of New Zealand logs at Oregon milling sites have been made because timely notification of log release in Washington was not received by the Oregon Department of Agriculture. An opportunity to gain valuable information on potential pest risks was thus lost.

Information on numbers of logs imported, any mitigating measures taken in New Zealand and the U.S. on the logs (or resultant products e.g., kiln-drying of lumber), inspection results, and where, when, and using what procedures logs were stored and processed for each of these three shipments would be valuable to include in the Background section or Appendix C.

Characteristics of Proposed Importation

Terms including quality, ideal, and excellent are used to describe New Zealand timber. How does this compare with other sources of wood, e.g., the United States? Is the USFS endorsing these evaluations?

Resources at Risk

The forests, ornamental plantings, nurseries, and Christmas trees of all North America would be at risk within a relatively short time. Although industry may be proposing to import logs to west coast ports, the logs themselves would go to mills (typically in forested areas) throughout Oregon, Washington, and California. The wood products produced from these logs could then move through commerce and private household moves throughout North America. The time for artificial spread within the West and throughout North America could be <u>very</u> short. No natural barriers exist between the Pacific Northwest and Alaska.

Biological Considerations

What is the health of New Zealand's non-plantation forests and ornamental plantings compared to the health of the plantation forests? Could pests present in but not a significant problem of the plantation forests kill or injure trees in other settings, even in New Zealand?

Although information on pest infestation of conifer and hardwood species native to the United States and planted in New Zealand is valuable, its uses are limited when predicting a pest's impact on a tree species in the United States. The environment plays an important role in determining the balance between a host tree and a pest (insect, mite, nematode, or pathogen). Environments vary tremendously across the West and across the United States and between the United States and New Zealand. In addition, as the authors' point out, "some of the lesser pests in New Zealand may be favored by drier, warmer climates." Additionally, across the west, enormous areas of forests are under stress due to a continuing drought and may be at additional risk to invading insect, mite, nematode, and disease pests. Pine trees are actually dying due to drought conditions. How many more might die if attacked by a new pest?

II. Assessment of Organisms Posing Risk

Analysis Process

Rare pests were eliminated from the analysis. However, if enough logs are imported and an insect or pathogen is not mitigated against, then the insect or pathogen may establish in the United States even though it is relatively rare in New Zealand timber. Once established in the United States these pests may do well because of a different physical and biological environment. Rare pests should be included in the analysis.

Pests of trees in nurseries were eliminated from the analysis, yet they could cause significant losses in nurseries, in ornamental plantings, and perhaps of young trees in native and commercial stands. Note that replanting after logging is very dependent on the health of nurseries to provide quality tree seedlings in large quantities; these trees as well as ornamental nurseries are put at risk. Nursery pests should be included in the analysis.

Pests attacking parts of the tree other than bark, cambium or wood were eliminated from the analysis. Was this due to the assumption that debarking would occur and therefore needles would not be stuck in the bark? Just as insects were found stuck in the pitch at the end of the logs, needles with diseases and insects on them may become stuck in the pitch and be transported with the logs to the United States. Pests attacking other parts of the tree should be included in the analysis since they may be imported inadvertently as in the example above or may actually use the bark or de-barked surface to lay eggs or form a cocoon on or to hide in. The insecticide may not be as effective against them, especially during these quiescient stages. These pests attacking parts of the tree other than bark, cambium or wood should be included in the analysis.

Five pests deemed of moderate to high risk were not included in specific pest risk assessments since the authors felt the proposed mitigating measures would kill these pests. If mitigating measures were to change, however, these might become important. The reader needs this biological and ecological information about the pest(s) to begin to evaluate any potential mitigating measures.

According to Table II-2, *Arhopalus tristis* (Cerambycidae) and *Pachycotes peregrinus* (Scolytidae) are found in the wood. What evidence is there that the proposed mitigating measures will be effective against these insects boring in the wood?

Table II-2 - Summary of Possible Quarantine Insects...
Table II-3 - Summary of Possible Quarantine Fungi...

The "Estimated risk without mitigation" appears minimized in Table II-3 compared to the estimated risks for similar pathogens from Siberia (USDA Misc. Public. No. 1495). Note that 22 plant pathologists took part as key contributors or participants in developing the Siberian log pest risk assessment and considered the risks from these types of pathogens to be greater than the risks indicated by this New Zealand disease assessment. In Table II- 2, Cerambycids and Curculionids are also rated lower than in the Siberian log pest risk assessment.

For clarity, the names and organisms in Tables II-2 and 3 should be checked against the lists of organisms in Appendix A. For example, *Ophiostoma* spp., *Ganoderma* spp. and others occur in Table II-3 but not in Appendix A. A specific pest risk assessment is done for *Amylostereum areolatum*, but it is not listed in Table 3 or Appendix A. Where the same organism is cited in multiple lists, but using another name, this should be noted.

Summary of Specific Pest Risk Assessments
Estimated Risk for Pest

"The overall risk for each of the pests was estimated based on the assessment and the implementation of required mitigation measures." *Since available or proposed mitigation measures may change at any time, we would have found it most useful for the risk of each pest to be assessed without mitigation measures.* Then a pest's risk and associated mitigation measures could be evaluated as to their importance as well as efficacy against particular pests or types of pests. New information as to efficacy of various mitigation measures is expected as new studies are done and could be evaluated as it becomes available. In the meantime, "An Efficacy Review of Control Measures for Potential Pests of Imported Soviet Timber" (USDA Miscellaneous Publication No. 1496) is the most complete, recent review of log pest mitigation measures to our knowledge. Its conclusions could be more extensively used in this New Zealand log pest risk assessment wherever efficacy of mitigation measures are discussed against pests is discussed.

Risk Assessments of Specific Organisms

We observed that a full risk assessment was limited to only two diseases out of some 74 listed in a memo from the NZ Ministry of Forestry. While the chance of establishment of insect-carried diseases is extremely high, the chance of establishment of novel pathogens as facultative pathogens is high, a view which is expressed in USDA Misc. Public. No. 1495. We believe that there is a real possibility of the establishment of such diseases and they should be addressed in the risk assessments and by mitigation efforts.

Pinewood nematode (not included in assessment): One major concern for the importation of *Pinus* species is the pinewood nematode (*Bursaphelenchus spp.*). As was discussed in the Siberian larch risk assessment, this nematode could cause considerable damage if introduced to the Pacific Northwest. Publication no. 1495 put the loss at $33.35 million in the best case and $1.67 billion in the worst case.

The detection of the nematode is difficult and the mitigation measures with the exception of high heat are unproven (USDA Public. No. 1496). Mitigation measures outlined in the draft New Zealand pest risk assessment would not be adequate if pinewood nematode is in the timber under consideration. Because susceptible host material is involved, because phoretic hosts inhabit New Zealand, and because we have not seen any information on scientific surveys relative to the distribution of the nematode in New Zealand, we believe it is critical to have the *Pinus* shipments pretested using CDFA protocols in New Zealand by an official certifying agency. This would relieve APHIS of the cumbersome sampling and testing for nematodes and would eliminate port-of-entry quarantine for this organism. A scientific survey and pest risk assessment should also be done for pinewood nematode.

While it may be argued that there is no observable disease caused by the pinewood nematode in New Zealand, it should be remembered that temperature has been shown to be an important component in the pathogenicity of the disease. In Japan, where the disease has devastated much of the native pine forests, mean summer temperatures of 25 degrees C were correlated with the wide-spread tree decline in the presence of pinewood nematode. From our information, these temperatures are not reached for prolonged periods in New Zealand and could preclude a pathogenic response. Temperatures in Eastern Washington, Central, Eastern and Southern Oregon and Northern California are frequently high enough during the summer months to reach the thermal load which could lead to a pathogenic outcome if pinewood nematode were to be introduced and established.

Amylostereum areolatum (Fries) Boidin: While vigorous trees may resist attack from *A. areolatum*, stressed trees are susceptible. Vast acreages of forest trees are stressed in the western United States during a continuing drought. In Oregon pine trees are actually dying from drought stress. We can expect drought to re-occur in the future on these and other forested areas. Such stressed trees are particularly at risk from this as well as other exotic diseases and insects. We can not assume that trees will be growing vigorously throughout their life cycle.

Could other vectors besides *Sirex* (e.g., beetles) also carry this fungus? Cerambycids, scolytids, and curculionids are known carriers for other fungi. This could impact the colonization potential section; also its success would be less dependent on the success of *Sirex*.

Kalotermes brouni Froggatt (Kalotermitidae): What studies show that "methyl bromide fumigation would be effective" against this species in logs in the holds of ships? At what rate and time?

Since K. brouni "can attack dry untreated wood and furniture" and cause structural weakness, it could become a very important urban and structural pest in the United States (economic damage potential). Since it can move in lumber and furniture, it may spread fairly rapidly. Pesticide use (environmental damage potential) could also increase to protect structures. Our estimated risk for this pest: high.

Leptographium truncatum (Wing f. & Marasas) Wingf: Douglas fir is also reported to be a host (see p. 40).

Platypus apicalis White and *Platypus gracilis* Broun (Platypodidae): Timber value of Douglas fir and *Pinus* spp. for lumber or veneers could be reduced. Damage to eucalyptus could be a problem in California (economic damage potential). Beetle damage could impact riparian trees, especially those affected by the ongoing western drought (environmental damage potential). The risk for these pests could easily be placed as "high" "because of the large number of hosts they can attack" (estimated risk for pest). Documentation of the mitigation measures' efficacy against the various insect types is important.

Prionoplus reticularis White (Cerambycidae): Based on the information in the risk assessment as well as information provided by New Zealand, we would place the estimated risk for this pest as "high".

Sirex noctilio F. (Siricidae): We agree that the pest risk associated with *S. noctilio* is high. We expect biological control agents will not be uniformly effective across the United States due to varying environmental conditions, including stressful drought conditions in much of the west.

III. Pest Risk Mitigation

We suggest this section be moved to follow sections IV. Evaluation of Ecological Effects and V. Evaluation of Economic Effects.

We believe quarantine safety requires pest risk mitigation measures be demonstrated through sound studies to be effective against the pests (or pest types) under the conditions the mitigating measures would be applied. Efficacy of the "Current New Zealand Mitigation Activities" has not been demonstrated to our knowledge against all the serious known pest risks cited in this assessment. Live fungi and insects have been found on New Zealand logs imported into the United States.

The "Inventory of Proposed New Zealand Mitigation Measures" does not include steam heat or hot water dip although this was the only method described as effective against all classes of pests and in all log locations (on outer surface, in or under the bark, and in the wood) listed in "Efficacy Review of Control Measures for Potential Pests of Imported Soviet Timber" (USDA Misc. Public. No. 1496). The Scientific Panel Review of January 10, 1992 Proposed Test Shipment Protocol for Importing Siberian Larch Logs Final Report concludes that "it was not safe for APHIS to make exceptions to its mitigation report [USDA Public. No. 1496] based on TTE's proposal." The Test Shipment Advisory Panel incorporated their recommendations into a revised protocol document. Since similar significant pest risks occur in all the logs sites identified for Siberian logs, and additional studies have not been completed to our knowledge since this Final Report (April 15, 1992), *their recommendations should be seriously considered in the mitigation section of the New Zealand log pest risk assessment.* A major difference between their recommendations and the proposed protocol for importing New Zealand logs appears to be their substituting heat treatment for fumigation at origin and kiln drying of all resulting finished lumber products; both protocols require debarking. Detailed descriptions of procedures for handling non-lumber byproducts and sampling protocols are also included in the Final Report.

Is the Pest Risk Assessment Team proposing that mitigation measures in New Zealand be limited to those currently used there? Our review of the "Assessment of Mitigation Efficacy" section and of the "Efficacy Review..." (USDA Misc. Public. No. 1496) indicates that even with the addition of transportation mitigation procedures, quarantine sampling, and mill sanitation, significant pest risks still exist. Note the conclusions and protocol recommended by the Test Shipment Scientific Panel (see enclosure).

With the possible presence of pinewood nematode and the deep-wood habit of many pathogenic fungi, a fumigation rate of some 80 g per cubic meter as suggested would not provide sufficient lethal action. We believe that the oak wilt schedule is more realistic (if fumigation is to be done) but caution that further research is required to verify efficacy (see USDA Misc. Pub. No. 1496) and recommend that such evaluations be done prior to shipping any additional material to the United States.

Another concern is the thermal requirements for fumigation. Again from our information, there is a considerable amount of the year where temperatures, especially as modified by the temperature of a hull in ocean waters, will not reach and hold the minimum treatment temperature of 15 C. This will either preclude shipment in the cooler parts of the year, or will allow fumigation at less than prescribed thermal regimes.

One additional option for a mitigation measure is the application of steam heat. Recent work at the Oregon State University Forest Products Laboratories shows that the application of wet heat at 65-70 degrees C for 1.5 hours at the core is effective against deep wood fungi (Jeff Morrell, personal communication 1991). Work on the fungicidal effects of temperature by Chidester in the 1930s (Chidester, M.S. 1939. Further studies on temperatures necessary to kill fungi in wood. American Wood Preserver's Association 35:319-324) and heating curves developed by MacLean in the 1940s (McLean, J.D. 1946. Temperatures obtained in timbers when the surface temperatures changed after various periods of heating. Proceedings of the American Wood Preserver's Association 31:77-109) may be worth review. This treatment would also give effective control against insects and nematodes.

Table III-2 differs in its ratings of suspected efficacy of potential mitigation measures on pests of concern from a similar table in USDA Misc. Pub. No. 1496. Documentation for this different assessment is not given. Has fumigation been shown to be more efficacious that heat in killing termites and *Platypus*? Do insecticide treatments kill insect/mite eggs laid on surface of log? Additional review of work done at Oregon State University and by Chilester and MacLean may clarify relative efficacy of various methods.

IV. Evaluation of Ecological Effects

Amylostereum areolatum (Fries) Boidin: While vigorous trees may resist attack from *A. areolatum*, stressed trees are susceptible. Vast acreages of forest trees are stressed in the western United States during a continuing drought. Species shifts might occur under these conditions.

If vectors besides *Sirex* (e.g., cerambycid, scolytid, and curculionid beetles) also carried this fungus, the potential for its spread could be greatly enhanced or at least less dependent on the success of *Sirex.*

Kalotermes brouni Froggatt (Kalotermitidae): Since *K. brouni* "can attack dry untreated wood and furniture" and cause structural weakness, it could become a very important urban and structural pest in the United States . It could also be a competitor to native decomposers in forested areas (ecological impact). Since it can move in lumber and furniture, it may spread fairly rapidly (adaptability and aggressiveness). Pesticide use (ecological impact) could also increase to protect structures (ecological impact).

Leptographium truncatum (Wing f. & Marasas) Wingf: Since other *Pinus* spp.may be hosts, Douglas fir is reported as a host, and bark beetles probably serve as vectors, this disease is likely to spread rapidly. Note that on page 24, the assessment indicates that this species has "great potential to spread fast and far" (adaptability and aggressiveness). Since whole forests in the western United States are under stress, they are likely to be particularly susceptible. Protected and commercial timber stands are likely to be impacted in addition to ornamental plantings and Christmas trees. Tree species shifts are possible in *Pinus radiata* stands with subsquent impact on wildlife (ecological impacts) (see page 24).

Platypus apicalis White and *Platypus gracilis* Broun (Platypodidae): Timber value of Douglas fir and *Pinus* spp. for lumber or veneers could be reduced. Damage to eucalyptus could be a problem in California. Beetle damage could impact riparian trees, especially those affected by the ongoing western drought (ecological damage potential).

Prionoplus reticularis White (Cerambycidae): Since the huhu beetles are assumed to be good flyers, can probably fly several miles, and accepts a wide range of host material (pages 27-28), it possesses traits likely making it very adaptable to the United States (adaptability and aggressiveness). As a potential competitor with native beetles, it could affect the current ecology of decomposers in western forests (ecological impact).

Sirex noctilio F. (Siricidae): Mortality associated with *Sirex* in natural stands and in ornamental plantings of pine in the United States could be unusually high due to the stressful drought conditions in the western United States. We agree that the pest risk associated with *S. noctilio* is high. A biological control program would be expensive to implement and maintain as the pest spreads and may not be effective especially during droughts and new timber losses would be sustained even in presence of the biological agents.

Evaluation of Economic Effects

Adding "on Wood and Wood Products" to the title of this section would be appropriate.

General Assumptions for the Economic Evaluation:
1):
Including "reduced value of logs, including salvage timber" as another factor impacting economics losses would greatly expand the value of the economic evaluation.

Economic evaluation of *Leptographium truncatum* (*L. procerum*)

L. truncatum has also been reported from Douglas fir in New Zealand and may also affect other *Pinus* species in the United States. Drought stress may make them particularly susceptible. A worst case scenario could include Douglas fir and other major *Pinus* species. In any case, *P. strobus* and *P. taeda*, both important commercial species in the eastern United States, are clearly at risk and should be included in the analysis, even as a special case.

Economic evaluation of *Sirex noctilio* (wood wasp) and the related fungus *Amylostereum areolatum*.

New Zealand logs would likely go to mill sites throughout the west coast states. Therefore the rate of spread within the west coast states and to other western states is apt to be much more rapid than assumed by the economic analysis.

As with *L. truncatum*, clearly *Pinus* spp. (and fir and spruce?, see specific pest risk assessment) are also at risk across the United States and should be included in the analysis.

Economic evaluation of *Prionoplus reticularis* (huhu beetle)

Again, imported logs would be milled throughout the western states, not simply at coastal sites; therefore spread would occur from multiple nodes throughout these states. The specific assessment indicates that non-treated sawn wood can be damaged by the huhu beetle. Such lumber is commonly stored throughout the Pacific Northwest in lumber yards, sites easily accessible to the huhu beetle. Relatively damp conditions common in the Pacific Northwest (despite the drought) apparently make this lumber particularly susceptible (see specific pest risk assessment).

What tree species were included in these economic analyses? Were all *Pinus* and Douglas fir included? What about the impact on California eucalyptus, which is now being grown as a source of fiber?

Economic evaluation of *Kalotermes brouni*, a drywood termite

On what are the estimates of $75,000 to $500,000 in damage per year after 10-15 years of establishment along the west coast based? They seem very low for a worst case scenario given termite control and damage repair costs of about $1.5 billion annually in the United States with drywood termites causing about 5% ($75 million) of this damage. A drywood termite successfully establishing in the Pacific Northwest would not face competition from any other drywood termite species, although subterranean and dampwood termites and carpenter ants do cause structural damage.

VI. Potential Management of *Sirex noctilio* in the United States

Interesting information is presented in this section. The most progressive program for *Sirex* for the United States, however, would be not to introduce *S. noctilio* in the first place! As with gypsy moth, how much better to have never introduced the insect! Biological control may not work effectively across the varied environments at risk in the United States. Management with all its attendant annual expenses and damage sustained goes on forever. We believe it is better to set up a system that does not allow this mega-pest into the United States in the first place.

Under the heading of "Other Control Alternatives", insecticidal control of *S. noctilio* is discussed. What insecticides and what manner of application are being referred to as "may be used to treat infested timber at ports of entry", but are not practical or cost effective in forest stands? How effective are they? Would they be available for this use? More details are needed. Again, the risk of *Sirex* with the pathogen *Amylostereum areolatum* leaving the logs to establish in the United States prior to any treatment at ports of entry would needs to be mitigated. We believe it is better to control these organisms at origin.

VII. Discussion and Summary

We believe the risk assessment would be most valuable if handled independently of any mitigation measures application. Evaluation of mitigation measures against specific pests or types of pests should be handled as a separate section or a separate document.

We encourage research studies designed to determine and enhance the effectiveness of mitigation measures against pests from the bark surface to the inner wood of logs.

Since milling does not necessarily control inner wood pests, the need for additional regulations to cover wood and wood products besides logs should be addressed as well.

Appendix A Fungi and Insects of *P. radiata* and Douglas Fir

Note editorial changes made in the text.

Appendix B Pest Risk Assessment Forms

Specific comments are made in the text.

The following general comments are applicable to many of the pathogens and insects assessed:

Although "thorough individual log inspection is required to identify the presence of ... advanced decay" (Appendix B), this procedure is not called for in the proposed protocol. Infected trees in the early stages of decay (or insect infestation) and uninspected trees with advanced decay (or insect infestation) would very likely be imported.

Trucking of logs from Seattle (or Portland or Coos Bay) to local mill sites or to mill sites in the Willamette Valley of Oregon or to central Oregon may allow pathogens and insects to spread in transit.

See references to steam heat studies at Oregon State University for a control option for deep wood fungi and insects. Although bark removal, methyl bromide, anti-sapstain and insecticide treatments are cited as control options, how effective are they as control agents or protectants against re-infestation? For instance, the assessment states that fumigation may not be totally effective for the huhu beetle, a cerambycid beetle, yet lists bark removal and methyl bromide fumigation as a control option for *Hexatricha pulverulenta*, another cerambycid beetle. Also current port insecticide and anti-sapstain spray treatments, which are listed among the control options for *Hylurgus ligniperda*, are not effective against this pest, as evidenced by our finding a live *Hylurgus* spp. larva in a bark remnant on an imported New Zealand log.

Why wouldn't forests be subject to economic damage, as is the case with *Armillaria mellea* in Oregon? Also nurseries and ornamental plantings in urban areas could be impacted. Damage by bark beetles in Oregon is currently high profile to the public.

Attacks by pathogens and insects on cut logs and lumber (non tree killers) can create significant losses in log and lumber value; this is particularly a problem for salvage logging, which is more common now as drought and fires continue as problems in the western United States.

Losses from at least one fungus are minimized assuming "reasonable rotation ages." What about damage to old growth forests? "Reasonable rotation ages" and growing practices in the western United States likely vary markedly from the plantations grown in New Zealand. Forests in the United States are often subjected to multiple uses.

Stress is likely to be a factor in the susceptibility of trees in the United States to pathogens from New Zealand. Our current drought is a significant source of stress to our trees.

The estimated risks for pests appear typically low, especially when compared to similar fungi assessed in USDA Misc. Pub. No. 1495. Although the draft assessment indicates "economic damage potential from the introduction of a new blue-staining fungus would be minimal," the economic and environmental damage potential actually depends on the vector and the disease (USDA Misc. Pub. No. 1495, page I-68). Also because the Pacific Northwest has different environmental conditions than New Zealand and because of our current drought, a new blue-staining fungus could cause more damage in the Pacific Northwest or other parts of the United States than in New Zealand.

Information on the pest risk assessment forms are in some cases so brief that it is difficult to understand why the ratings given were made.

Appendix C Accounting of New Zealand *Pinus radiata* logs shipped to the United States prior to preparation of this report

A written summary and listing of the contents of Appendix C would facilitate understanding the contents of this section.

A full accounting should include the first shipment last August 1991 (see above) and should cover the following types of questions for all shipments. What mitigating measures were applied in New Zealand and in the United States and during what time frame? What happened to the logs in the United States. Where, when and under what conditions were they milled? Was the lumber kiln-dried? Was the debris burned or pulped? In what time frame?

What does a "piece" mean?--one log?

Enclosed are some additional documents which you may find appropriate for this section.

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June 29, 1992

Mr. William B. White
Methods Applications Group
USDA Forest Service
3825 East Mulberry St.
Fort Collins, CO 80524

Dear Mr. White:

Thank you for the opportunity to review a draft copy of "Pest Risk Assessment on the Importation of Pinus radiata and Douglas-fir Logs from New Zealand." For the past two years I have been actively involved in log imports and introduced pests into the Pacific Northwest. In March this year I wrote a report with Darrell Ross, entomologist, concerning insect and pathogenic fungi introductions on Douglas-fir logs from New Zealand to the U.S.

I would like to restrict my comments to introduced fungal pathogens especially on Douglas-fir logs. I have no experience with the insects and only limited knowledge of fungal pathogens on radiata pine. I have two important points that I would like to raise. All of my comments are general and will be addressed in this letter, so I have not included a revised copy of the report.

In general I find that the report does not adequately reflect the seriousness of introducing canker and stain fungi. Except for Leptographium truncatum, all species of stain or canker fungi are listed in the report as low or moderate risk without mitigation. These fungi would be difficult to eradicate from imported logs except possibly by fumigation. If not eradicated before shipping, stain and canker fungi could readily sporulate on logs within holds of ships. After infected logs are removed from ships and decked at U.S. ports, spores from infected logs could infect trees in the port area. Exotic stain and canker fungi historically have caused the most damage to North American tree species after accidental introduction. Such introductions include Dutch elm disease, chestnut blight, and white pine blister rust.

My second point is this. I believe that too much emphasis has been placed on the importance of Amylostereum areolatum as an introduced pathogen into the U.S. This species is already present in Oregon

Mr. William B. White

Oregon
State
University

and possibly other parts of North America. Part of the problem may be that the species is synonymous with *A. chailletii* according to Dingley (1969) and Pennycook (1989). I have personally isolated *A. chailletii* from infected *Abies* in Oregon where it causes an infrequent stem decay (Aho et al. 1987).

Again, I thank you for the opportunity to review the report. I hope that you will seriously consider my comments and revise the risk ratings for the potentially introduced canker and stain fungi.

Sincerely,

Gregory M. Filip

Gregory M. Filip
Associate Professor and
Forest Pathologist

GMF/cw

Comments on Pest Risk Assessment
William J. Otrosina, Research Plant Pathologist

Below are general comments on the Pest Risk Assesment document sent to me for review. I consider this issue very important to the health of forests of the United States and appreciate the opportunity to review this document.

In the beginning of the executive summary under Resources at Risk, discussion was limited to the Cascades and in general the Pacific Northwest. California, with its diverse timber types and heavy recreational and commercial uses of the forest represents a major resource at risk and this fact should be stated. Additioanlly, contiguous Canadian forests were not addressed as "at risk" and I consider this to be a major oversight in this document. I also disagree with, by extension, Alaskan forests (particularly southeastern Alaska) being listed as not involved in the immediate risk. Canadian forests are at risk because ports in Washington are quite close to the border and SE Alaska borders Canada. Also, the assumptions made based upon "natural spread" of insects and pathogens are weak. Interstate commerce, travel, etc., between United States and Canada and between states within the United States render "natural barriers" to spread of pathogens almost a moot point. Gypsy moth and dogwood anthracnose are examples of eastern pests beginning to spread westward in a relatively short period of time.

Biological considerations -- I agree with the high risk placed on the first two categories of organisms, however, the third category was regarded as least likeley to be injurious to United States (and Canadian) forests. I feel this is a dangerous assumption. The question of genetic variability and differences in virulence within a fungal or insect species is an important one. We are only beginning to recognize the variability within pathogen popoulations and the potential for increased virulence within a particular pathogen species. Large gaps exist in our knowledge, true, but nonetheless; our ignorance does not lessen the potential risk of introduction of new genetic varieties of a given "native pathogen".

Page 12- Analysis process- I assume that pests that were eliminated from risk consideration because they attack other tree parts also have all phases of their life cycle outside bark, cambium, and wood.

Page 14-Pest Characteristics- Category 2b. I regard this as a highly artificial classification because it is based on proving a negative or derived from insuffiicent data. For example, not exhibiting enough genetic difference, etc., may be a reflection of lack of data only, not lack of risk.

Table II-3- Amylostereum was omitted from list. Also, I believe that for most of the fungi listed, the estimated risk without mitigation is underestimated, and as stated above, category 2b gives a false sense of knowldege about potential risk or lack there of in these fungi. For example, O. ips has been associated with a wide variety of conifer hosts and the potential exists for at least moderate risk of genetic variability for virulence. Risks are also greater for Leptographium spp., Fusarium moniliforme fsp subglutinans, Melampsora sp, and others.

Ecological effects- Sirex noctilio p. 43. Due mention should be made of the vector relationship with Amylostereum and consequential risks associated with this relationship.

Economic effects- p 44. Timber loss--spotted owl 7 MM acres reduces amount of timber loss in stumpage-- what about intangible loss of owl habitat? In some circles this is more important than timber production although difficult to assess monitarily.

Table A-1 p. 68. Many fungi on this list can be potential pathogens, and some are not identified to species and may therefore contain known pathogenic species/strains. Eg., Alternaria, Cladosporium, Cephalosporium, Pesotum spp. Also, non-forest plant species (Ag crops, ornamentals, etc.) can be affected by fungi that may not be a major risk to forest tree species.

Agriculture Canada

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July 7, 1992

Mr. William B. White
Assistant Director FPM
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3825 East Mulberry Street
Fort Collins, CO 80524
U.S.A.

Dear Mr. White:

Thank you for the opportunity to review the document "Pest Risk Assessment on the Importation of Pinus radiata and Douglas-fir Logs from New Zealand." I have been interested and concerned about this subject since the issue of the importation of logs from Siberia first arose.

Because I feel the issue of log imports into the USA can have a serious effect on the Canadian industry, I have taken the liberty of asking for input from our Pest Risk Assessment Section, Agriculture Canada. A memo from the Program Entomologist is enclosed. A number of her concerns should be addressed.

My area of expertise is in the taxonomy of the Scolytidae and it is in this area that I direct my comments. In the years before 1985 very few exotic species of Scolytidae became established in the USA. A few of these species were extremely injurious such as the smaller European elm bark beetle which transmits Dutch elm disease. Between 1985 and 1989, at least six additional species became established, four more were reported in 1990 and three more were reported in 1991. Evidently (and fortunately) the recent introductions do not include the extremely dangerous exotic species such as Ips typographus or Tomicus spp. However, it seems that there are serious gaps in the plant inspection process and these cause me some concern.

I have the following comments and/or questions:

.../2

Page 10 - "Resources at Risk". I disagree with the comments under #2 and #3. There are no natural barriers to inhibit the spread of pests from the Pacific Northwest into Alaska. The same forest type occurs from Oregon and Washington through British Columbia into Alaska. The statement under #2 is probably correct for Eastern U.S. Under #3 - this is an assumption with no basis in fact. Bark beetles can fly considerable distances and natural spread of a pest, with no natural enemies to slow it, could be extremely rapid.

Page 39 - "Summary". I agree with the first statement that this report will have little relevance if untreated [or poorly treated] logs are shipped to the U.S. There is no way to guarantee that all pests are eliminated from all logs shipped into the U.S. The example of the two trial shipments should be proof of this. Since the ultimate responsibility for the success of this endeavor rests with New Zealand and upon the efficiency of the APHIS inspection after the logs reach the U.S., I am left with serious doubts. If my math is correct, only 43 logs out of 1000 will be examined by APHIS personnel, or 4.3% of the total shipment! Is this enough to ascertain that no pests are included on or in the logs?

Page 43 - *Sirex noctilio*. Up to 80% tree mortality has been recorded for this pest. Tree stress is considered the main factor contributing to this loss. Many of the *Pinus radiata* stands in California are off-site plantings and are often in stress. Native stands of this tree are often crowded and overstocked and also often in stress. All of these stands are at grave risk is *Sirex* is introduced and this report stresses that the risk of introducing this species is extremely high.

There are a number of additional arguments that could be brought forth which question the wisdom of importing logs into the U.S. I cannot go into each of them in this letter. I have serious doubts that any of the control procedures given in this report, or a combination thereof, can insure a pest-free importation. Mistakes happen and it would take only one shipment of improperly treated or untreated logs to start a series of events leading to a serious situation. Our forests are a great resource and they are under attack by a variety of introduced and native insect and fungal pests. We don't need any more and we would certainly get more if this activity is allowed to proceed.

I suggest that the way around this problem is to mill the logs in New Zealand and ship kiln-dried lumber to the U.S. This, however, will not provide employment for U.S. mill workers which is the main purpose for this endeavor.

.../3

I appreciate the fact that a tremendous amount of work went into the preparation of this pest risk assessment. I also appreciate the fact that every effort is being made to accomodate the log importing interests. I am grateful for being asked to review the document. I hope procedures can be developed that will allow the log imports to proceed without any risk to the U.S. and Canada's forests. As you can probably tell from this letter, I am very doubtful that this goal can be achieved.

Thank you for reading my comments and for the opportunity to participate in this review. Please send me a copy of the final document and please feel free to contact me for further information/comments etc. I apologize for my delay in getting these comments to you.

Sincerely,

D. E. Bright

Donald E. Bright
Research Scientist
Biological Resources Division

DEB/lr

Agriculture
Canada

Food Production
and Inspection Branch

Direction générale,
Production et inspection des aliments

Animal and Plant Health Directorate
Animal and Plant Health Diagnostic Services
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Your file Votre référence

Our file Notre référence

June 30, 1992

MEMORANDUM TO: Dr. D. Bright
Centre for Land and Biological
Resources Research
K.W. Neatby Building
Ottawa

SUBJECT: "Pest Risk Assessment on the Importation of *Pinus radiata* and Douglas-fir Logs from New Zealand"

Thank you for the opportunity to read this document, which is of great potential interest to our own Plant Protection Division.

I found the criteria for including a pest in the group to be considered in detail logical and sound. By and large I agreed with the estimates of risk, based on the information presented in the document. I would have rated *Leptographium truncatum* only a moderate risk myself, however, based on the text, since no data are presented to indicate that the organism frequently causes death of the host. The fact that it would arrive without its vectors, in material which would not attract local vectors, reduces its colonisation potential also. It has also been reported from Canada, which means it may be an A2 pest, not an A1.

I think that at least chapter IV and perhaps chapter V could be incorporated into the pest risk assessments in chapter II without losing anything. Indeed, it would reduce repetition and strengthen the flow of logic. I realise that the format was adopted from the Siberian larch study, but it would in this case be an improvement to modify it. Chapter VI, on the potential management of *Sirex noctilio* in the United States could also be incorporated into the PRA in chapter II. It is not possible to make a useful assessment of the economic impact of this pest without considering all the mitigation techniques already in existence.

However, I also think the cost of monitoring the spread of the pest and of putting its biological controls into the field is underestimated. The estimates do not seem to accurately reflect the labour costs which would be involved.

I found two flaws in the tables, which made interpretation more difficult. Table II-3 indicated in a foot note that the categories were explained in chapter two, but I could not pick out that explanation from the text. Table A-2 has an obvious problem with the last two columns, which does not occur in Table A-3.

I agreed with the writers that the entire value of the assessments must be based on the assumption that the protocol proposed by the New Zealand authorities is actually carried out as outlined. However, I am left with a little doubt in my mind about when and where fumigation would occur. I think it is proposed to fumigate in the holds of ships before the voyage, and to seal the holds after fumigation. Could this be done on the types of vessel currently used? I hope it is not proposed to sail with the methyl bromide still in the holds. I am sure this would not be permitted under New Zealand's Health and Safety codes.

There is a lot of work in this document and I appreciate having access to the information and the pest risk assessments without having to do all the research myself. Please feel free to use or ignore any of these comments.

Doreen Watler

Doreen Watler
Program Entomologist
Pest Risk Assessment Section

DW:dw

NZLOGS.MEM

c.c. Alina Stahevitch
Chief, PRA

United States Department of Agriculture

Forest Service

PNW, Portland

Reply to: 3400

Date: July 7, 1992

Subject: Review of Pest Risk Assessment

To: William White, FPM/Methods Application Group, Fort Collins, CO

As you requested, I have reviewed the Pest Risk Assesment on the importation of Pinus radiata and Dorfus-tin logs from New Zealand. Enclosed is my copy with typos marked on pages 45, 48, and Appendix G on page 6.

I have some other comments for page 45. First, under general assumption No. 1, increased mortality and reduced growth is really the same thing as most economic models use the concept of net growth. Second, you need to clearly state in assumption No. 4 that you are using real interest rates.

It would be helpful, I think, that you include a discussion at this point about the general approaches used in the economic analysis. Will, for example, a replacement cost analysis produce results similar to a study that estimates opportunity costs?

Please let me know if you would like further details on my comments.

Richard

RICHARD W. HAYNES
Program Manager
Social and Economic Values

Enclosure

cc:
M.Bellinger:W01C

3521-2(RS Hunt)

Pacific Forestry Centre

Dear Dr White,

I have quickly examined "Pest Risk Assessment ...from New Zealand". I note (p.8) that APHIS is "charged with preventing the introduction of exotic pests on plant material brought into the United States via international commerce". The document then proceeds to the what ifs of nasties potentially introduced into the Pacific Northwest from N.Z.; unfortunately the credibility of the importing country is totally lacking as its federal government seems to lack a similar mandate to considered the consequences of native nasties moving from elsewheres on continental USA to the PNW, nor has a federal agency apparently discussed with authorities of the potentially affected states and provinces methods to control such domestic pests. Diseases which quickly come to mind are: stem & cone rusts of pine, needle & cone rusts of hemlock, scleroderris canker, & pitch canker. The hosts of these can include oranamentals and Xmas trees which may be suddenly shipped to new markets in mass or hidden amoungst other plant material, and if necessary they can be trans-shiped to avoid their [illegible] it tells a little country like N.Z. what it will tolerate. In a similar self-centred vain, the importations do not consider their impact on Canada. The very least the economic analysis could do would be to state that many of the pests would not respect the 49 parallel, and since the USA is highly dependent on lumber imports from Canada, that losses suffered in Canada, would eventually result in higher lumber import costs.

In general, I found the report to be some what fixed on the idea that the major hosts in N.Z. would also be the main ones in the USA, which I find rather absurd, especially in the economic considerations. Also, I found apparent little inter-play between the entomologists and the pathologists. For the latter I am particularly concerned with the lack of stated information (yes or no) about maturation feeding of flying insects, as these could be vectors of fungi and/or nematodes, which the pathologists should have had the opportunity to comment upon.

Specific comments and examples are:

1) L. <u>truncatum</u> control option (p.24) stated as bark removal for vector control; however, the non-fumigated importation indicates this has already been ineffective. "The greatest loss would be in the native stands of P. <u>radiata</u> .." (p.24). However, since the known host range is distinctly different pines, ie. hard (P. <u>radiata</u>) and soft (P. <u>strobus</u>), the real host range is likely very broad, i.e. P. <u>ponderosa</u>, P. <u>monticola</u>, & P. <u>contorta</u>, which are far more important than P. <u>radiata</u>! This nonsence shows up again p. 40 & 42.

2) Sirex (p.30) The potential for greater damage in the south than the w USA is a conclusion totally inconsistent with the large host range listed p.28, which suggests that all western hard pines could be attacked.

3) p.87 economic damage improperly evaluated as only P. <u>radiata</u> considered; whereas, in the body of the text larch & D.fir are known hosts, and these genera would suggest that anything in the

Pinaceae would likely be a host. Also, other <u>Ganoderma</u> spp. are known for their broad host range.
4) p. 93 Contol options - "bark removal would reduce the (<u>immediate</u>) potential vectoring by bark beetles; however, these fungi are also known to be assoc. with weevils, thus these insects could pick-up the fungi from chip piles and sorts, later passing them on to Scolytids. The mating system of these fungi is largly unknown, so new strains and hybrids could possibly arrise.
5) Root munching Scolytids p.99-100. I believe the economic impact of these Scolytids is under estimated. Re "B-6", black stain root disease <u>already</u> <u>is</u> a problem, particularly to hosts the vector visits directly, such as hard pines and D-fir. A new direct vector to <u>Abies,</u> <u>Larix</u> or <u>Picea</u> (stated as hosts) would cause new disasters. Additionally, it is possible that these insects could find new infection courts, thus more efficiently vector native blue stain fungi compared to native insects; for instance, shifting from stems to roots.
6) p.102 4 spread potential, contrary to what is inferred - moist pine logs can be abundant under misting systems to control ambrosia beetles, water systems to reduce fire hazard, and in booms.
7) p.107 6 economic damage - could be high if it can vector <u>L. wageneri</u>, or a like pathogen.

Much of the control aspect, particularly for non-fumigated material, assumes that the imported logs will be utilized quickly, before much biological activity occurs; however, the practicality of the situation needs to consider delays, which occur with mecanical break downs, labour strife, fires, and eathquakes From the information supplied, it seems likely that if importations are to be permitted, that fumigation is the most promising control; however, it is obvious that a fool-proof protocol needs to be developed and a monitoring system put in place. Perhaps some type of bio-assay could be incorporated into a monitoring system. The effectiveness of such a protocol would need intensive testing before it was deemed fool-proof.

Sincerely,

Richard S. Hunt

Richard S. Hunt

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30 June 1992

Dr. William B. White
USDA Forest Service
3825 East Mulberry St.
Fort Collins, CO 80524

Dear Dr. White:

The following are my comments on the draft copy of "Pest Risk Assessment on the Importation of *Pinus radiata* and Douglas-fir Logs from New Zealand."

P. 10, para 2. "...natural barriers inhibit the spread" etc. What are these natural barriers? Any insects that colonize Monterey may be able to colonize lodgepole pine, i.e., *Pinus contorta contorta* (called shore pine). This species intermixes with *P. contorta murrayana* in southwestern Washington and then is distributed northward to British Columbia and the Yukon Territory. Lodgepole pine introgresses with jack pine in Alberta. Thus we have a bridge to forests of eastern U.S. and to our neighbor's forests to the north.

P.12, para 6. "...to eliminate from consideration those pests were noted as rare..." We should be cautious here. Our pinewood nematode was not a pest in the U.S. but when introduced to Japan, their native pine forests were devastated!

P. 18, para 2. "...non-monetary economic and environmental damage..." I believe it is important to note that native Monterey pine occurs only in 3 small, isolated, coastal populations in California. Furthermore, Torrey pine (*Pinus torreyana*) is a rare endemic pine species that occurs in San Diego County, CA, and on the adjacent Santa Rosa Island. This species has also been propagated in New Zealand. These very rare pine species would be at unusual risk (compared to a widely distributed pine species like ponderosa pine) should a pest like *Sirex noctilio* be introduced into California. Monterey pine has been planted extensively in central and southern California. The ports of Sacramento and San Francisco are surrounded with these urban plantings. Also native Digger pine (*P. sabiniana*) stands are within a few miles of the Port of Sacramento. Native ponderosa pine stands are less than 20 miles from this port. A case in point is the recent introduction of the pitch canker fungus, *Fusarium subglutinans*, from the southern U.S. to California. This fungus is especially damaging to Monterey pine in the Santa Cruz area. We have not found it yet in the nearby native stands. This discussion applies to p. 18, point 8.

P. 21, last line. "...an unlikely pest." It would be more accurate to state that the practices of cutting young trees and pruning would make this insect a less likely inhabitant of unprocessed logs. If introduced to the U.S. it would likely be a pest. Does this species infest wood-in-service, i.e., wooden buildings?

P. 21, mid-page following "Additional Remarks." References do not follow each pest analysis?

P. 23, last para. "...if vectors are present." Many potential vectors occur on the extensive urban plantings of Monterey and other species of pines. These species are largely in the Scolytidae, e.g., *Ips, Dendroctonus, Hylastes, Hylurgops*, etc. and Cerambycidae.

P. 24, para 1. "...have two or more generations per year..." *I. paraconfusus* has 4-5 generations/year in coastal California.

para 3, last sentence. See above comments re: very limited distribution of native Monterey pine stands. Also native ponderosa pine stands in the coast range and in the nearby Sierra Nevada would be at risk. Ponderosa pine and Douglas-fir are two key timber species in the western U.S.

P. 26, #7. "...readily perceived by the public as a major concern." I am sure private companies marketing furniture and timber products would be concerned about degrade caused by new species that may become more abundant in the U.S. because they may arrive without natural enemies.

Above "References." "...packed with <u>f</u>rass" not <u>g</u>rass.

P. 27, A.1. "...on freshly-killed logs..." Aren't all logs "killed"? Suggest freshly fallen logs or freshly cut logs.

P. 28, B.5. "...The Pacific Northwest" etc. Coastal California is also moist.

"Estimated Risk for Pest": What potential nematode associates becoming parasitic to trees in U.S.? (i.e., reverse flow of a pinewood nematode).

P. 29, l. 9. "...to assess the suitability for oviposition." Do we know to be true?

P. 30, para 3, last sentence. "The potential for damage..." etc. The damage could be <u>enormous</u> in the West. There is no reason not to expect this Siricid to colonize ponderosa and lodgepole pines. This would have disastrous consequences in these forests! We have every reason to believe that this insect <u>will be</u> imported into North America in these logs. This Siricid has found its way into every country growing U.S. species of pines on a large scale. Why would we expect to escape this fate?!

last sentence. Introduction into the western states should be the highest priority!! Once established on the continent it will inevitably be distributed throughout N.A.

P. 31. Additional Remarks: last sentence. This statement is misleading. Just as the European *S. noctilio* became a killer of California Monterey pine, so could an Asian species of *Sirex* cause tree mortality in North America. Because of our understanding of *S. noctilio*'s tree-killing habit in North America, we should expect the same from an Asian introduction!

P. 33. "Hand debarking" "...significantly reduces pest numbers." This is acceptable as a statistical statement. However, to prevent entry of a pest like *S. noctilio*, such a statement is not good enough!

P. 35, mid-page - fumigation procedures etc. Where are data that show dose needed to kill siricid and cerambycid larvae deep in the wood of logs up to ca. 3-4' in diameter.

P. 36, para 2, last line. "...or otherwise appropriately processed on site." This needs to be more specific.

para 3. "...an undefined depth of the log." This is not a sufficient recommendation! Are we going to put at risk the coniferous forests of North America with such imprecise treatment methods?

P. 37. "Lumber" - Fumigating lumber would be much preferred over debarked logs.

P. 38. "Pests in the wood" "Heat" Heat at >120° F for >48 hrs should kill bark and ambrosia beetles.

P. 39. Bullet 3. Canadians have conducted recent research on heat and fumigation treatments. This work was discussed by the Scientific Advisory Panel to the Forest Service at its meeting on March 12 and 13, 1992, in Sacramento, CA. That panel's recommendations should be part of the documentation cited here. Treatment of New Zealand logs for pathogens and insects "deep" in the wood should be no less than that recommended by this advisory panel for Siberian logs!

Bullet 8. "...or otherwise appropriately processed..." etc. This is not precise enough.

Bullet 9. This is closing the barn door after the horse has escaped.

P. 40, 2nd para up. "The wide separation between the three *Pinus* hosts..." etc. Sugar pine and western white pine occur in California and Oregon. WWP occurs throughout western N.A. Also ponderosa and lodgepole pine have a high probability of becoming hosts.

P. 41, 3rd para up. "...mortality in natural stands..." etc. One could argue that native stands would be just as susceptible as off-site plantations. These native stands are not co-evolved hosts of *S. noctilio*. Also unmanaged natural stands may be more susceptible than managed plantations. Native stands of Monterey pine are not managed and they are infected with western gall rust and dwarf mistletoe.

P. 42, para 2. This drywood termite would likely find California a very favorable habitat. Californians do not need another drywood termite to fumigate. The native species is a very serious pest of wooden structures.

P. 44, para 1. "...are not measured in this analysis." Although difficult to quantify, these effects are likely to be the most economically destructive. American chestnut and American elm are essentially lost to the North American flora. I would not want responsibility for another introduction. However, the difference between those introductions and the present is that we know the risks of such introductions today.

P. 57, para 2. "...successful prevention and/or suppression..." etc. Authors have not taken into account the likelihood that *S. noctilio* infestations will make trees more susceptible to tree-killing *Dendroctonus* spp. and *Ips* spp. I would expect the density of these bark beetles to increase.

para 4 and 5. In para 4 authors state that "...not significant outbreaks have been recorded after the nematode has suppressed a *S. noctilio* population..." In para 5 authors refer to a major outbreak in 1987. This is a contradictory statement.

P. 58, para 4. Why assume that in natural forests there is a lower risk of a damaging outbreak? Most damaging outbreaks of bark beetles in the West are in natural forests. We would expect the same for a *S. noctilio* infestation.

I appreciate the opportunity to comment on this draft. I hope that these suggestions are helpful.

Sincerely yours,

David L. Wood

David L. Wood
Professor of Entomology

DLW:mh

United States
Department of Agriculture

Forest Service

NC

Reply to: 1630 **Date:** June 19, 1992

Subject: Review of Document "Pest Risk Assessment on the Importation of Pinus radiata and Douglas-fir logs from New Zealand.

To: William B. White

I am returning your document, "Pest Risk Assessment on the Importation of Pinus radiata and Douglas-fir logs from New Zealand".

I was impressed with the detail that your team has put into this risk assessment. It appears to be a very complete assessment. I have made a few comments on the hard copy on pages 9, 10, and 40. One area that appears somewhat weak is the possibility of pest movement on Christmas trees shipped from the West Coast to other areas in the United States. This potential is very real and should be brought out in the assessment. In our work we found that Gremmeniella abietina could be spread on cut Christmas trees in New York. The fungus was able to survive in a heated room for 2 weeks and still produce viable spores the following spring. This was a foliage/canker pathogen but it is worth thinking about.

I also have serious concerns about bringing in different strains of Armillaria sp. and Sphaeropsis sapinea. Not only may these organisms be more virulent than existing strains but there is always the potential for hybridization with North American strains. We have seen this happen in New York with the European and North American strains of G. abietina. The hybrid stain had characteristics different from either of the parent strains. In both New York and Quebec, the European strain has now replaced the North American strain apparently due to better ability to compete.

If you have not already done so I would suggest that you contact Dr. Gerard Adams, Department of Botany and Plant Pathology at Michigan State University, phone number 517-355-0202. Dr. Adams has done considerable work with strains of S. sapinea and may have additional information for you.

Again this is an excellent assessment and I was happy to have the opportunity to review it.

Sincerely,

DARROLL D. SKILLING
Project Leader, Forest Disease Research

Enclosures

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William B. White
Asst. Director FPM
U.S. Forest Service
3825 E. Mulberry Street
Fort Collins CO 80524

June 23, 1992

Your ref: 3400

Dear Dr. White,

I have reviewed the manuscript " Pest risk assessement on the importation of Pinus radiata...", as requested, and have a couple of comments dealing with economic issues.

Firstly, it is should be noted that the 4 percent interest rate does not make allowance for uncertainty. In addition it is a real (inflation-free) rate. However, the authors apparently made no allowance for real rises in timber values or costs. This may compensate for the lack of allowance for uncertainty.

My second comment relates to effects on timber supply. The TAMM model was used to estimate the effect of reduction in timber inventories on timber prices due to pest attack. This information was used in computing losses only to timber producers, although the authors do make reference to consumer losses without trying to estimate them. A complete economic analysis would attempt to assess losses to consumers due to pest attack. However, a complete economic analysis would also look at the benefits to consumers and domestic <u>wood processors</u>, and losses to domestic timber <u>growers</u>, of increasing timber supply by importing logs. Undoubtedly, this goes beyond the objectives of the study, but it would be useful to readers if the study could be placed in the broader context.

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Sincerely

William McKillop

William McKillop
Professor of Forest Economics

Oregon

DEPARTMENT OF AGRICULTURE

Tuesday, June 23, 1992

Mr. William B. White
Assistant Director, Forest Pest Management
USDA Forest Service
Methods Application Group
3825 E. Mulberry
Fort Collins, CO 80524

Dear Mr. White:

I am in the process of reviewing the New Zealand log risk assessment put together by your team. I am very impressed with most of it. My suggested changes will be primarily in the way the mitigating measures section was handled. I'll send my complete comments soon.

In the meantime, I am very interested in the article by Yu cited in the references section. Can you please supply me with a copy? If not, who can?

Yu, K.Y., Chung, Y.W., Lee, H.H., Jae, J.W. 1984. Study on shipboard fumigation of the imported logs. Korean Journal of Plant Protection. 23(1):37-41.

Thank you.

Sincerely,
Daniel J. Hilburn

Daniel J. Hilburn
Entomologist

Barbara Roberts
Governor

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Reply to: 3400

Date: June 26, 1992

Subject: Review of Paper "Pest Risk Assessment on the Importation of Pinus radiata and Douglas-fir Logs from new Zealand"

To: Bill White

Your document on "Pest Risk Assessment on the Importation of Pinus radiata and Douglas-fir Logs from new Zealand" appears ready for publication. You and the risk assessment team are to be commended for the work you put into this project and the document to be published. I made several suggestions for rewording sentences and some editorial changes. Hopefully these suggestions will help to clarify the intent of the sentence.

Thanks for the opportunity to review the document; it was educational for me to read.

Skeeter Werner

RICHARD A. WERNER
Supervisory Research Entomologist

Oregon

DEPARTMENT OF FORESTRY

STATE FORESTERS OFFICE

"STEWARDSHIP IN FORESTRY"

2-0-8-200

July 1, 1992

Mr. William B. White
USDA Forest Service
3825 East Mulberry Street
Fort Collins, CO 80524

Dear Mr. White:

Thank you for the opportunity to comment on the "Pest Risk Assessment of Pinus radiata and Douglas-fir Logs From New Zealand" document. Dave Overhulser, entomologist; and Alan Kanaskie, pathologist; of my staff have each responded separately regarding their specialty areas. Thus, my comments will be more of a general, administrative nature.

I do not feel that the USDA Forest Service and APHIS should continue to spend time, energy, and funds assessing each tree species and country of origin on a case-by-case basis. The bottom line, in my opinion, is that no products (logs, chips, packing material, crates, containers, pallets, etc.) containing pests should be allowed to enter into the US. We should get on with the business of developing and enforcing comprehensive, proven mitigative measures that would allow the importation of various products and at the same time protect US resources.

Sincerely,

LeRoy Kline

LeRoy Kline
Insect and Disease Director

LK/blb
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June 29, 1992

Mr. William B. White
USDA Forest Service
FPM Methods Application Group
3825 East Mulberry Street
Fort Collins, CO 80524

Dear Mr. White:

Thank you for the opportunity to review the draft copy of the document entitled, "Pest Risk Assessment on the Importation of Pinus radiata and Douglas-fir Logs from New Zealand." I discovered several minor typographical errors which are marked on the enclosed copy (pgs. 10, 12, 15, 26, 30, and 40). Also, I believe that there is an error in the calculation of the number of Sirex noctilio trap trees in your example on page 58. I have identified that error directly on the enclosed copy.

In addition, I have several major concerns with the pest risk assessment process and the presentation of the information in this document. On page 8 of the document, there is a list of three objectives of the risk assessment. I question whether it is possible to accurately address the second and third objectives which are to "assess the potential of colonization by introduced organisms" and "assess the potential impacts of the organisms if they should become established." It is impossible to predict with any degree of certainty how exotic organisms will respond when introduced into an environment in which they have never been present. Basing these assessments on the behavior of the organisms in their native environments or other environments into which they have been introduced is inappropriate, since the organisms may respond very differently in a new environment that is unique from those in which they currently exist. It is highly possible that an organism which is rare in its native habitat may become a significant pest when introduced into a new environment. There are many such examples from past introductions. In spite of this fact, your risk assessment has focussed on a few major organisms that cause significant damage in New Zealand. I think that it is very important that this limitation of the pest risk assessment should be clearly stated at the beginning of the document. I am concerned that some people may have the impression after reading this document that there are only three insects and two pathogens in New Zealand which may be introduced and cause problems in the United States. This, of course, is not the case.

Following on the same point, you mention in paragraph six on page 10 that a "large number of other tree species" have been introduced into New Zealand and, therefore, have been exposed to potential pest organisms that exist there. It would be inappropriate to conclude that the interactions between these tree species and potential pests would be the same in North America as they are in New Zealand. Since the physical environment, natural enemies, competitors, and symbiotic organisms in North America and New Zealand are all different, it is likely that these tree species would be affected differently by potential pests in these two environments.

In short, there is no way to accurately predict how any of the potential pest organisms found in New Zealand will respond when introduced into North America. To do so would require data which can only be gathered after the introductions have occurred. Your pest risk assessment is based on many assumptions which may be highly inaccurate. For example, you mention that S. noctilio mortality in Pinus radiata stands in Australia was as high as 80%. However, in your evaluation of economic impact for S. noctilio you assume that tree mortality will be only 15% in the United States. What is the basis for this value? You could just as easily have chosen 50%, drastically altering the calculation of estimated losses.

I am glad that you have recognized the need for further research on the efficacy of mitigation measures. I would hope that before any mitigation measures are approved that the efficacy of those measures is thoroughly tested and proven. I would hope the approach to testing mitigation measures would involve a worst-case scenario. That is, a test in which infested logs are treated to determine whether the organisms are effectively eliminated.

I was also pleased to see that you recommended a monitoring program if log importation is approved. I think that a thorough monitoring program is absolutely necessary if log importation is to occur and, further, funding for this monitoring program should be the responsibility of the companies importing the logs.

I hope that you find my comments useful. If I can be of any further assistance, I would be glad to do so.

Sincerely,

Darrell W. Ross

Darrell W. Ross
Assistant Professor

Weyerhaeuser

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William B. White
Assistant Director, FPM
USDA Forest Service
3825 East Mulberry Street
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July 2, 1992

Dear Mr. White:

Thank you for the opportunity to review the **Pest Risk Assessment for Pinus radiata and Douglas-fir logs from New Zealand.** Overall, I found the document to be quite thorough and technically well written. I do not see major revisions in the document, but have suggested some minor changes.

One concern is that the scope of the pest risk assessment has been narrowed to that of PNW forests and forest trees in general. It has been mentioned at the April meeting in Corvallis, Oregon that a multi-billion dollar industry in agriculture and horticulture/Christmas trees etc. exists in Washington, Oregon and California. Much of this resource could be at risk if certain pests are introduced and trade embargoes were to become established. Another concern surrounds the analysis of pests which if introduced could result in loss of current intensive forest management practices such as thinning and pruning. Several of the pests listed fit this category (as noted in the report). Some of the salient points mentioned in my review include:

- "imported logs" : does this refer to logs only or could it be other wood products such as veneers, crates etc.

-"important industry at risk" : current estimates of potential damage do not include losses other than forestry, which greatly underestimates true potential losses.

-"trade patterns": little appears in document about trade patterns of NZ in wood products, if any, from other off-shore sources. Is it possible for pests to leap-frog via NZ which do not appear on the list?

-"probability of introduction" on page 12 conditions are stated that indicate that over time some probability of pest introduction will occur: however, on the first two shipments this was in fact demonstrated!

- " political and social influences": the full measure of political pressure brought on by a new pest are not covered in this document. An embargo on PNW products by other states, countries was not calculated in the loss section.

- "potential vectors" : many of our PNW insects appear to fit well with fungal borne diseases which could potentially be introduced, and this could negate the necessity for NZ insect vectors. (page 21) What U.S. vectors could be substituted ?

-"available infestation sites": several times the point is made that imported logs will be kept away from other log decks at the point of entry. This does not appear to feasible since insects can easily traverse the distance between decks (even if several miles apart).

-"Leptographium": I personally worry more about this type of pest with its unknown disease capability and seemingly perfect fit into our current insect vectored diseases like black-stain root disease.

-"log inventory management": little is mentioned about shipping logs when pest might not be present as during non-dispersal periods etc. Granted quick utilization seems the best method. Why was water misting of storage decks not mentioned?

-"current environmental conditions": many potential pests seem primed to hit pine species especially if they are stressed; the PNW is in the 4-5th year of a severe drought and it seems that we could be in a serious situation if a new pest is introduced at this time.

-"control costs": very little is mentioned as to who will pay for insect control once established; as I mentioned some 1.8 million $ to treat our SE Oregon timber land would be significant, but would the importer pay? or government? or land owner?

-"loss estimates": the loss estimates do not accurately show the potential for forest destruction <u>if</u> other pine species are impacted.

The mitigation of potential forest pests on imported logs is possible with existing methods and careful log inventory management and inspection. If certain NZ pests are judged as potential hazards, and I think this document has done so, then specific requirements (debarking, fumigation, sprays) to mitigate such hazards appear warranted.

I have returned my copy of the report with comments and would gladly answer any questions you might have concerning this issue. You can contact me directly at (206)330-1720 or through the main research office at (206)736-8241.

Sincerely Yours;

Willis R. Littke

Willis R. Littke PhD
Project Leader Forest Pest Management
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Reply To: 3400

Date: July 1, 1992

William B. White
Assistant Director, FPM
Fort Collins ,CO 80524

Dear Mr. White,

Further to our phone conversation of Monday, here are my major thoughts on the Risk Assessment of NZ logs.

A. Failure to devote a significant portion of the report to the risks associated with the beetles Hylurgus ligniperda and Hylastes ater is the major failure of this draft.

My observations of the relationship between these two beetles and the two Leptographium species they vector (in NZ) lead me to be very concerned. Especially; when I consider that on the West Coast of North America we have the potentially very destructive Leptographium wagneri, which, for lack of an adapted vector does not reach its destructive potential.

B. Supporting Evidence:

(1) Of 112 Hylurgus ligniperda beetles captured as they landed on freshly peeled posts 106 yielded Leptographium species. A vectoring rate of 95% . For Hylastes ater I estimate the rate to be 71%. These insects have a proven ability to vector Leptographium species and I anticipate that they will acquire L. wagneri soon after becoming established in the US.

(2) It is worthy of note that Hylurgus ligniperda was accidentally introduced into both South Africa and New Zealand. And in both countries Leptographium is known. Hylurgus ligniperda was first detected in NZ in 1974, the same year in which leptographium root disease was first reported.

(3) Hylurgus ligniperda and Hylastes ater are both known from South America and it has been suggested that at least one of then came from NZ, hence we should not under-estimate the hitch-hiking potential of these insects.

(4) My pathogenicity studies indicate that NZ leptographiums could only infect highly stressed Pinus radiata seedlings. However, field observations indicate that Pinus strobus, P.monticola, P.lambertiana and P.resinosa are more susceptible to the NZ leptographiums than is P.radiata.

(5) In the US, P.monticola and P.lambertiana are for the most part found in the WEST and Leptographium procerum is found in the EAST.Given the high vectoring rate of leptographiums by Hylurgus ligniperda, in

combination with the demonstrated hitch-hiking ability of this insect the Eastern White Pines may be at a greater risk from L.procerum via NZ (and Hylurgus) than from L.procerum via the NE (and Amtrak).

This would not be a new disease, just a new problem !

I have included a copy of the presentation I gave at the Oregon State University organised seminar ,LOG IMPORTS AND INTRODUCED FOREST PESTS INTO THE PACIFIC NORTHWEST , held in Corvalis Oregon , April 21-23 ,1992 .

Please contact me at (304) 285 1550 or DG :S24L08A if you feel I can be of any more help .

Sincerely ,

M. MacKenzie

Dr.Martin MacKenzie
Forest Pathologist

Enclosures

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July 2, 1992

William B. White
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USDA FS
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Dear Mr. White:

Below is my review of the draft copy of "Pest Risk Assessment on the Importation of Pinus radiata and Douglas-fir logs from New Zealand". I appreciate your giving me a chance to comment on this, and am willing to participate in similar reviews.

The text correctly identifies some potential problems. However, the Discussion and Summary section generally understates the risk to North American forest ecosystems. I have two major reasons for this conclusion: First, two smallscale trial shipments were conducted, and neither arrived without introduced organisms. These trials were conducted under best-case experimental conditions, whereas largescale operational conditions are typically far less rigid. Second, categorizing anticipated pest status in North America based on existing biologies in New Zealand does not provide a full picture of anticipated impact. Experience shows, and ecological understanding explains, that rare, innocuous organisms can cause severe damage in a new habitat. Even the designation of whether or not an organism is a "tree-killer" should only be assigned relative to habitat and host plant, as evidenced by experiences with pinewood nematode. Thus, statements such as "it is unknown if .. treatment will effectively control the seven pests of concern" (Summary point #2) both place insufficient emphasis on potential pests currently restrained by New Zealand conditions, and understate the failure rate of the preliminary treatment attempts. Likewise, the statement "Omission of any of the procedures would make the risk assessment invalid" (Summary point #1) is correct, but could be misinterpreted to mean that implementation of these procedures is not risky.

The proposal bears strong similiarities to last year's consideration of log importations from Siberia, reviewed in USDA APHIS Misc Publs. 1495 & 1496. So comments relating to that proposal are relevant. The major difference is that the New Zealand trees are native to North America, which in some ways could increase the risk. Among the more pertinent conclusions were: "This assessment clearly demonstrates that the risk of significant impacts to North American forests is great" (#1495: S-1), and "there are wide gaps in scientific data on the efficacy of various mitigation methods" (#1496: first sentence of the Conlusions, pg 27). There was also unanimous recommendation against raw log imports by the major entomological and plant pathological professional societies experienced in forest resource protection. Nothing about the current proposal allays these concerns, and so it must be presumed to pose a major risk.

I hope these comments are helpful in developing your policy. I also commend your scientists for providing such a large amount of useful data, evaluating the treatment trials, and conducting such a broad taxonomic analysis. Please feel free to call me if you would like to discuss any of these comments.

Sincerely,

Kenneth Raffa

Kenneth F. Raffa
Professor of Forest Entomology

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July 1, 1992

Mr. Bill White
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3825 East Mulberry Street
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Dear Mr. White,

I present to you the following correction and recommendations related to the draft document "Pest Risk Assessment on the Importation of Pinus radiata and Douglas-fir from New Zealand."

1. Page 9, paragraph 4, "New Zealand industry experts expect exports of logs to the United States to reach half a million cubic feet a year..."

Correction: The paragraph should read half a million cubic meters a year. As stated in the draft, half a million cubic feet equates to about 1400 mbf scribner scale, approximately the same size as the "M/V Balayan" shipment. I would expect that New Zealand industry experts estimate the annual export to be half a million cubic meters, or about 100,000 mbf annually.

Comment: I would recommend further review of demand in the United States and future U.S. participation in the global log market, as an importer. It is likely that the U.S. demand could change the structure of imports out of New Zealand by focusing on U.S. demand, rather than Pacific Rim demand. Volumes could easily be 3 or 4 times the New Zealand industry experts estimate of 100,000 mbf annually.

2. Page 30, Paragraph 6, Environmental Damage Potential.

Comment: The latter part of the paragraph is contradictory. It is stated that "If S.Noctilio became established and caused significant mortality, the impact could be severe in wilderness areas, cause deterioration in watersheds and threaten key environments of endangered species." The contradiction occurs in the next sentence, "Obviously, many of these impacts are unknown at this time..." It would be appropriate to qualify comments about specific environmental damage as "assumed" or as evidenced from prior damage in Australia and New Zealand.

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3. Page 33, Paragraph 6, Fumigation.

Comment: What requirements are in place for exports to destinations other than the United States, for example Japan? Why not reference information from other countries regarding known pest risks and mitigation measures?

4. Pages 39 and 60.

Comment: It is recommended that logs from several of the first shipments be checked for effectiveness of mitigation measures. In view of the fact that fumigation recommendations limit shipments to below deck only, I would recommend that extensive checks by the U.S.D.A. over a long period of time be done so that consideration for modification of mitigation measures can be addressed on an on going basis. For example, in the long term, it is not feasible to load partial shipments, and it is not likely that an on deck cargo other than logs is in demand from New Zealand for importation into the U.S. Therefore, it would be wise to consider a long term plan, in conjunction with New Zealand officials and export and import interests, to address mitigation measures for on deck log shipments recognizing that "The ultimate responsibility for the success of this program lies with New Zealand and its grower-exporter interests."

Thank you for giving me the opportunity to review the draft. If I can be of further assistance, please do not hesitate to call.

Sincerely,

Katie AmRhein

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Manager, Forest Operations CA

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22 June 1992

Dr. William B. White, Assistant Director
Forest Pest Management
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Dear Dr. White:

I have reviewed the document, "Pest risk assessment on the importation of _Pinus radiata_ and Douglas-fir logs from New Zealand." I am concerned that imports are recommended, on condition that they be treated with conventional mitigation methods, despite the likelihood of introduction of destructive pests and uncertainties regarding the efficacy of mitigation methods. Several points in the document itself argue against allowing log imports from New Zealand (or other Pacific Rim countries) into the western U.S.

First, _Leptographium truncatum_ is listed in Table II-3 as a pathogen of Douglas-fir, as well as _Pinus radiata_, in New Zealand, but consequences of establishment in Douglas-fir in the western U.S. are not discussed on p. 23. This genus of pathogens includes a number of species vectored by western bark beetles and other insects in several major conifer species. The current epidemic of black stain root disease, caused by _L. wageneri_, in coastal Douglas-fir and _Pinus_ forests is accelerated by insect vectors, especially _Hylastes nigrinus_ and _H. macer_. Although _Hylastes ater_ from New Zealand is not considered a likely immigrant in this document, the potential for successful colonization and spread of _L. tuncatum_ by native vectors, the serious ecological and economic consequences of establishment of this pathogen, and the lack of information on efficacy of fumigation or other mitigation techniques (pp. 38-39) warrant caution and further study before allowing log imports. The same argument can be made for _Sirex noctulio_.

Second, the executive summary concludes on p. 11 with recognition that minor pests in New Zealand may be favored by different environmental conditions. Although the document does not elaborate, favorable conditions for some of these species could be provided on ship or at ports of entry in the western U.S. In addition, species behavior can change and plants not recognized as potential hosts can be accepted as the pest adapts to conditions in a new environment. For example, the ability of gypsy moth to survive and reproduce on Douglas-fir and western hemlock was not appreciated prior to introduction of this species into western Oregon. Again, the lack of

Many North American species, both conifers + hardwoods are grown in New Zealand and the ability of indigenous pests to attack them has been tested. The point has been made on p. 10 (penultimate para) but obviously needs stressing.

information on the biology of minor species in New Zealand and the efficacy of mitigation methods for their elimination in exported logs warrant further study before allowing importation into the western U.S.

In summary, I believe that this document itself provides sufficient information to warrant restriction of log imports until the efficacy of mitigation methods has been satisfactorily documented.

Sincerely,

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June 19, 1992

Dr. W. B. White,
Assistant Director, FPM,
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UNITED STATES of AMERICA

Dear Bill,

I have read the report "Pest Risk Assessment on the Importation of *Pinus radiata* and Douglas-fir logs from New Zealand. In the light of my knowledge and experience (I am a New Zealander by origin) I find the report to be a fair assessment.

The schedule of pest mitigation activities as outlined in Figure 3.1 (p. 34) are very encouraging and demonstrate the stark contrast of this "hot-logging" situation with the protracted log extraction processes for Siberian logs that we have heard so much about.

The NZ hot-logging process from stands that have been well managed silviculturally, should result in a high comfort level from a quarantine point of view. The interceptions of bark beetles reinforces the need for debarking of logs in NZ. (I wish that the practice would become a world standard for all countries exporting logs - it would greatly reduce the quarantine risks for importing countries). It is going to be a challenge to reduce the growth of fungi on exposed sapwood surfaces.

The number 1 insect of concern is *Sirex noctilio*. I find that the report gives light mention to the greatly reduced risk of infestation in well managed stands. It is commonly accepted that the large outbreaks in the 40s were a result of a lack of spacing of stands which led to extreme stress on the trees. I understand that the current levels of *Sirex* are very low in NZ.

The debarking regime within weeks of felling will also reduce the availability for oviposition by the huhu beetle, *Prionoplus reticularis*. The early instar larvae spend some time in the phloem before boring into the sapwood. I am confident that the planned mitigation processes will be effective against *Prionoplus reticularis*. I agree with the comments on page 43.

The lead sentence about *Sirex noctilio* on page 43 fails to acknowledge that the stands suffering the high rates of mortality were unmanaged stands. The 30-80% mortality is historically accurate but it needs to be balanced by a statement about the conditions under which it happened. You would certainly not get much mortality at all in the highly managed *Pinus radiata* stands being harvested today.

On page 57, line 8, the pest status of *Sirex noctilio* in NZ is acknowledged as "infrequent or rare". The concern for what *Sirex* might do in unmanaged stands of *Pinus radiata* in the US is valid.

Page 60, line 4: "only two fungi and five insects were regarded . . . " yet it says "Three insects and two diseases . . . " in the first line of the summary. A typo?

I hope these comments are of some help.

Yours sincerely,

John A. McLean
Professor
Forest Entomology

Draft by separate post.

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17 June 1992

William B. White
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Dear Mr White

Thank you for the opportunity to review the 'Pest Risk Assessment on the Importation of *Pinus radiata* and Douglas fir Logs from New Zealand'.

The Pest Risk Assessment Team are to be congratulated on a thoroughly professional job. I find the process of assessment logical and rigorous and the arguments well reasoned. I have one or two specific comments on the entomological component of the risk assessments of specific organisms, a single comment on the evaluation of ecological effects, and finally a personal view on the conclusions of the assessment.

Specific Comments

Page 25, Line 12	'All four species of *Nothofagus* ...'
Page 26, Line 4-5	I do not believe it is reasonable to suggest damage could reduce the strength of structural timbers. Tunnels are very small in diameter, and I have never seen them at a density which could remotely be construed as a threat to structural integrity.
Page 30, Section B5	In my opinion to suggest 80% mortality could occur is misleading. Such high levels of mortality have only been associated with gross mismanagement on extremely difficult (usually drought-prone) sites. In particular mechanical thinning of over-stocked stands or very dense stands such as those naturally regenerated after fire. Even with no biological control I would expect losses in natural forest stands or managed plantations to be only a fraction of this figure.
Page 40, Paragraph 6	Although a worst case scenario is quoted I believe 80% is still an unreasonably high figure.

A Personal View

While acknowledging the difficulties of extrapolating from limited and incomplete data, and congratulating the team for a commendable effort, as a practising forest entomologist. I would have to observe that the cumulative estimate of potential damage from the insects assessed in this exercise is a remote possibility. Experience in New Zealand forests shows for example *Platypus* spp. to be rare in conifer plantations even in ideal moisture conditions. Surges in population are only seen following periodic damage to beech forests, a situation not emulated in logging debris in pine or fir forests. Likewise *Kalotermes* is almost never found in trees and logs of managed plantations, and is only common in isolated pockets of unpruned old trees under favourable climatic conditions.

I appreciate a risk assessment cannot be based on personal experience and prediction, but simply offer the observation that the integration of information resulting from experience i.e. what makes sense, is often closer to reality than the figures might suggest.

I hope these comments are of help and may in a small way improve even further a very good document.

Yours sincerely

Gordon

Gordon Hosking
for Director

Appendix K
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