GLOBAL INVASIVE SPECIES DATABASE

FULL ACCOUNT FOR: ***Pinus***

Pinus 简体中文 正體中文 **System:** Terrestrial

Kingdom	Phylum	Class	Order	Family
Plantae	Coniferophyta	Pinopsida	Pinales	Pinaceae

Common name Scots pine (*P. sylvestris*) (English, New Zealand), Monterrey pine (*P. radiata*) (English, Chile), remarkable pine (*P. radiata* (English), wilding pines (English, New Zealand), Ponderosa pine (*P. ponderosa*) (English, New Zealand), Austrian pine (*P. nigra* ssp. *nigra*) (English, New Zealand), lodgepole pine (*P. contorta*) (English, New Zealand), contorta (*P. contorta*) (English, New Zealand), bishop pine (*P. muricata*) (English, New Zealand), big cone pine (*P. coulteri*) (English, New Zealand), maritime pine (*P. pinaster*) (English, New Zealand), radiata pine (*P. radiata*) (English, New Zealand)

Synonym

Similar species

Summary Pinus spp.(pines) are considered to be the most ecologically and economically significant tree genus in the world, distinguished from other conifers in their role as an aggressive post-disturbance coloniser. The natural range for pines is in the northern hemisphere, but they have been cultivated in many parts of the world, forming the foundation of exotic forestry enterprises in many southern hemisphere countries. In many of these areas, pines have invaded the adjacent natural vegetation, and they are now amongst the most widespread and damaging invasive alien trees in the world.

view this species on IUCN Red List

Species Description
The genus *Pinus* is composed of a total of 111 species (Richardson, 1998). They are characterised by monopodial growth and large size. The largest species, *P. lambertiana* reaches over 75m in height and more than 5m in girth. Many Mexican pines grow in mountain areas with annual rainfalls of 1200-2000mm, but usually reach heights of only 20-50m. Pines can be shorter in stature in more extreme habitats. Form and morphology of the pine cone is highly variable. The greatest length occurs in *P. lambertiana* - up to 50cm. *P. coulteri* has cones which are 20-35cm diameter and weigh up to 2.3kg. About a third of pine species bear cones which are less than 5cm long. Generally, species associated with stressful environments have smaller cones. All pines possess pine needles, although there is wide variation in the size and form of display. Needles are arranged in bundles (fascicles or needle clusters) with the number of needles per fascicle being species-specific. Most pine species have two, three or five needles per fascicle. The longest needles are up to 45cm, in *P. palustris*. At the other extreme are species with needles which are 2-8cm. Needle longevity is strongly correlated with habitat water and nutrient relations, and/or stress. Tropical pines keep needles for no more than 2-3 years, whereas temperate forest pines keep needles for 4-6 years (Richardson, 1998).
The key features of pines which have been implicated in facilitating pine invasions, particularly in the southern hemisphere, include: low seed-wing loading, small seed mass, short juvenile period, high degree of serotiny (requiring heat from fire to release seed), low fire tolerance, short intervals between large seed crops, intermediate disturbance frequency, high latitudes, long residence times and a high degree of planting by humans (Higgins and Richardson, 1998).

Notes

The following species are considered to be invasive: *P. banksiana* (New Zealand), *P. canariensis* (Australia, South Africa), *P. caribaea* (Australia, New Caledonia), *P. contorta* (New Zealand), *P. elliottii* (South Africa, Argentina, Australia), *P. halepensis* (Australia, New Zealand, South Africa), *P. jeffreyi* (Australia), *P. mugo* (New Zealand), *P. muricata* (New Zealand), *P. nigra* (Australia, New Zealand), *P. patula* (Madagascar, Malawi, New Zealand, South Africa), *P. pinaster* (Australia, Chile, New Zealand, South Africa, Uruguay), *P. pinea* (Australia, South Africa), *P. ponderosa* (Argentina, Australia, Chile, New Zealand), *P. radiata* (Australia, Chile, New Zealand, South Africa), *P. roxburghii* (South Africa), *P. strobus* (New Zealand), *P. sylvestris* (New Zealand) and *P. taeda* (Argentina, Brazil, New Zealand, South Africa). Eight of these are currently widely planted in the southern hemisphere (Richardson, 1998).
Pines require the presence of mycorrhizal symbionts in the soil for growth. Barriers to the invasion of pines through the absence of these symbionts in the southern hemisphere have largely been overcome by the introduction of the appropriate fungi (Richardson and Rejmanek, 2004).

Lifecycle Stages

Many pine species are long-lived. *P. longaeva*, for example, has reached documented ages of nearly 5000 years (Currey, 1968; in Richardson, 1998). Pines become reproductive at approximately five years of age (Richardson and Bond, 1991; in Bustamante and Simonetti, 2005). *P. contorta* and *P. mugo* produce viable seed at eight years in New Zealand, *P. radiata* and *P. pinaster* at ten years, *P. sylvestris* and *P. muricata* at twelve years, and *P. nigra* and *P. ponderosa* at thirteen years (DOC, 2005). The rotation period of a pine plantation is about 25 years (Lara and Veblen, 1993; in Bustamante and Simonetti, 2005).

Uses

Pines are a valuable source of timber, pulp, nuts and resin. They feature in ancient myths and rituals, have influenced human history, and have been celebrated in the visual arts, prose, poetry and music. Pines have been widely used and planted by humans in the Mediterranean basin since prehistoric times, influencing the distribution of *P. brutia*, *P. halepensis*, *P. pinaster* and *P. pinea* (Richardson, 1998).
Large scale planting of pines started in the second half of the 19th century in Europe, although sustained large-scale forestry only became widespread in the early 20th century, and expanded to other parts of the world in the second half of the 20th century (Richardson and Petit, 2005). Pines were first introduced to the southern hemisphere in the 17th century, although it was not until the 1880s that large scale commercial forestry began. They have also been used for erosion control, as windbreaks and as ornamentals (Richardson, 1998). The main pine species planted in the tropics are *P. caribaea*, *P. elliottii*, *P. kesiya*, *P. oocarpa*, *P. patula*, *P. pinaster*, *P. radiata* and *P. taeda*. Several other Central American and Mexican pine species are also increasing in importance (Richardson, 1998a). The main reasons for the use of pines include their simple structural design, with straight trunks and an almost geometrical branching habitat that makes them ideal for timber production. They also grow faster than many other species, and are easier to manage in plantations (Richardson and Petit, 2005).

Habitat Description

Pines are found in a remarkably wide range of environments, from near the Arctic to the tropics. Some pine species form virtually monospecific forests over very large areas, while others form mixed forests with other conifers and broadleaved trees, or form savannas with open woodlands. The ranges of temperate pine species are generally much smaller than those of higher latitudes. In temperate regions, and even more so in the tropics, pines are usually associated with acidic, nutrient-poor soils. Pines have an ability to spread into more productive sites both within and outside of their natural ranges, following disturbances which reduce the competitive superiority of vigorous angiosperms. Fire is the driving force of succession in nearly all pine habitats (Richardson, 1998).
A temperate climate is favourable for growth outside of its natural range, with rainfall being one of the more important factors influencing growth rates. In its introduced range, *P. radiata*, for example, will grow on sand, and tolerate salt spray and several degrees of frost, hence it can flourish from coastal areas to high altitudes. It requires only 600mm of rain per year. The more favourable plant communities for the establishment of pine seedlings in New Zealand includes bare ground, grassland, and herbland, with shrubland less favourable and forest unfavourable. Some species may establish in openings in regenerating forest (DOC, 2005).

Reproduction

Pines have a mating system which favours genetic recombination and the creation of genetic variation (Ledig, 1998; in Richardson and Rejmanek, 2004). The seeds and pollen of pines are exceptionally well dispersed and isolated pioneers can give rise to colonies by selfing (Richardson, 1998). Pines are able to produce thousands of seeds by 8 to 13 years of age, which can disperse over 10km in favourable conditions (DOC, 2005). Seed will remain viable in the soil for about three years, although it can remain viable in cones for much longer (DOC, 2005).
Characters such as small seed mass (<50mg), a short juvenile period (<10 years), and short intervals between large seed crops (one to four years) were found to consistently separate invasive pines from non-invasive pine species (Rejmanek and Richardson, 1996; in Richardson and Petit, 2005). Many rare conifer species exhibit opposite characters. The invasion of conifers with seed mass <5 mg (eg. *P. banksiana*) is mostly limited to wet and preferably mineral substrates. Vertebrate dispersal is responsible for the spread of pines with otherwise non-invasive characters (eg. *P. pinea*, *P. strobus*) (Rejmanek and Richardson, undated; DOC, 2005).

General Impacts
At least 19 *Pinus* species can be considered invasive (Richardson, 1998a). The main impacts of invasive pines result from the increased abundance of trees in habitats where they were previously absent or less common (Richardson, 1998). Many pine species are superb colonisers, with a wide range of adaptations that enable them to become invaders (Hughes and Styles, 1989; Fagg and Stewart, 1994; Richardson *et al*., 1994; Richardson, 1998; in Richardson, 1998a). Large areas can be quickly colonised by wilding pines as a result of one significant dispersal event, such as strong winds whilst trees are coning (DOC, 2005). Global change, with rapidly changing climate patterns, altered disturbance and nutrient regimes, and increased fragmentation are likely to favour further expansion of pine invasions worldwide (Richardson and Rejmanek, 2004). Most invasions are currently in grassland and shrubland, with forests and woodlands generally only invaded following considerable disturbance. Increasing human disturbance in forests and woodlands is likely to leave these habitats more vulnerable to invasions by pines as well as other species (Richardson and Rejmanek, 2004). The range and density of pines has also increased in some areas within their native range (Richardson, 1998).
Invasive pines can cause major impacts to catchment hydrology by reducing water flows, which has effects both for the aquatic biota, and on water supplies for human populations. Changes to fire regimes occur in the *fynbos* ecosystem of South Africa, resulting in the transformation from grassland/shrubland to pine forest (Richardson, 1998). The invasive spread of pines is closely linked to fire and their adaptations to new fire regimes. Some introduced pine species can exploit the environmental conditions caused by wildfires. These pines are fire-resilient species with small seeds, low seed-wing loadings, short juvenile periods, moderate to high degrees of serotiny (requiring heat from fire to release seeds) and relatively poor fire tolerance as adults (Richardson, 1998). There is often little competition from native plants during the invasion window (Johnstone, 1986; in Richardson, 1998). Pine forest habitats generally offer less benefits to native wildlife than native vegetation, and contribute to an overall reduction in native biodiversity in many of the areas it has invaded (DOC, 2005; Richardson, 1998; Richardson, 1998a; Bustamante and Simonetti, 2005). Dense stands of pines in exotic environments can also cause changes in nutrient cycling and soil composition (Richardson, 1998). Invasive pines can have impacts on humans, by causing reductions in water supplies, affecting recreation, and altering the character of landscapes (DOC, 2005). \r\n
Click here for information about Potential future impacts of *Pinus* spp.

Management Info
Management of pine invasions requires the integration of a range of strategies, from selecting appropriate species for afforestation to the manipulation of environment features to impede invasion (Richardson, 1998). One of the most important management issues is the restoration or rehabilitation of infestation sites once wilding pines have been removed. Options include sowing seed of native shrub species, or to interplant infestations with native tree species, then removing the pines once the natives are well established (DOC, 2005).
\r\nThe most appropriate method for controlling wilding pines will depend upon factors such as the extent of the infestation, the density of trees, size and age of trees, species present, access to site, native vegetation within site, and the skills and resources available (DOC, 2005).
Please see *management options* for detailed information on management options.

Pathway
Pine trees were planted for erosion control in South Africa and New Zealand (Richardson, 1998).Pine trees form the basis of exotic forestry enterprises in many countries, especially in the southern hemisphere (Richardson, 1998).Pine trees were introduced to some areas for ornamental purposes (Bustamante and Simonetti, 2005).

Principal source: Richardson, D.M. (Ed.). 1998. Ecology and biogeography of *Pinus*.
Department of Conservation, New Zealand., 2005. South Island Wilding Conifer Strategy.

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ALIEN RANGE

[5] ARGENTINA
[13] AUSTRALIA
[1] BERMUDA
[1] BRAZIL
[2] CANADA
[3] CHILE
[1] CHINA
[3] FRANCE
[1] GIBRALTAR
[1] ITALY
[1] LAKE MICHIGAN
[1] MADAGASCAR
[1] MALAWI
[1] NEW CALEDONIA
[2] NEW ZEALAND
[1] SAINT HELENA
[5] SOUTH AFRICA
[1] UNITED KINGDOM
[2] UNITED STATES
[1] URUGUAY

Red List assessed species 30: CR = 4; EN = 7; VU = 12; NT = 2; LC = 5;

Africallagma cuneistigma **VU**
Amphilius natalensis **LC**
Anthocephala floriceps **VU**
Bomarea glaucescens **NT**
Bomarea lanata **VU**
Centropogon brachysiphoniatus **CR**
Chlorolestes draconicus **LC**
Didunculus strigirostris **EN**
Euastacus bindal **CR**
Gastrotheca pseustes **EN**
Gymnomyza samoensis **EN**
Harpyhaliaetus coronatus **EN**
Hirundo atrocaerulea **VU**
Lestinogomphus angustus **LC**
Melanophryniscus langonei **CR**
Nothura minor **VU**
Notogomphus zernyi **LC**
Proischnura polychromatica **CR**
Pseudagrion makabusiense **LC**
Pseudagrion vumbaense **VU**
Ropalopus insubricus **NT**
Sminthopsis butleri **VU**
Sporophila cinnamomea **VU**
Sporophila palustris **EN**
Syncordulia gracilis **VU**
Syncordulia venator **VU**
Taoniscus nanus **VU**
Telmatobius laticeps **EN**
Telmatobius pisanoi **EN**
Zaratornis stresemanni **VU**

BIBLIOGRAPHY

16 references found for **Pinus**

Managment information
Bustamante, R.O. and Simonetti, J.A. 2005. Is *Pinus radiata* invading the native vegetation in Central Chile? Demographic responses in a fragmented forest. Biological Invasions. 7: 243-249.
Summary: This paper outlines the history of pine plantations in Chile, and discusses whether *P. radiata* is invading natural ecosystems.
Department of Conservation (DOC) 2005. South Island Wilding Conifer Strategy.
Summary: The Department of Conservation provide a strategy for the control of wilding conifers in the South Island of New Zealand. Includes information about distributions and management techniques.
Available from: http://www.doc.govt.nz/templates/MultiPageDocumentTOC.aspx?id=40045 [Accessed 13 December 2006]
Diekmann, M., Sutherland, J.R., Nowell, D.C., Morales, F.J. and Allard, G. (editors). 2002. FAO/IPGRI Technical guidelines for the safe movement of germplasm. No. 21. *Pinus* spp. Food and Agriculture Organisation of the United Nations, Rome/International Plant Genetic Resources Institute, Rome.
Summary: This document provides details about the variety of pests and pathogens of *Pinus* spp., and gives guidelines for the safe movement of germplasm.
Environment Waikato. 2002. Pinus Contorta (*Pinus contorta*)
Ferintosh Retirement Area, Undated. Mackenzie District Council
Summary: Available from:
http://www.doc.govt.nz/Regional-Info/010~Canterbury/005~Publications/Canterbury-Conservation-Management-Strategy/002~Volume-Two/pdfs/Land%20Units%20G-H/H37017_FerintoshRetirmentArea.pdf [Accessed 19 October 2005]

Higgins, S.I. and Richardson, D.M. 1998. Pine invasions in the southern hemisphere: modelling interactions between organism, environment and disturbance. Plant Ecology. 135: 79-93.
Summary: This paper discusses and models the interactions between organism, environment and disturbance in pine invasions in the southern hemisphere, and how this may be used to enhance management of this problem.
Richardson, D.M. 1998. Forestry trees as invasive aliens. Conservation Biology. 12 (1): 18-26.
Summary: This article discusses the phenomenon of forestry trees which become invasive species, outlining their impacts and possible solutions.
Richardson, D.M. and Petit, R.J. 2005. Pines as invasive aliens: outlook on transgenic pine plantations in the southern hemisphere. Chapter 10 in: Williams, C.G. (ed.). 2005. Landscapes, genomics and transgenic conifer forests. Springer Press.
Summary: This chapter discusses the implications of the introduction of transgenic pine plantations on already invasive pine populations in the southern hemisphere.
Richardson, D.M. (Ed.). 1998. Ecology and biogeography of *Pinus*. Cambridge University Press, New York, NY. 527 pp. $155.00, hardcover.
Summary: A thorough review of scientific information about *Pinus*, on worldwide basis. Covers ecology, biogeography, phylogeny, systematics, macroecology, genetic variation, mycorrhizal relationships, insect and disease problems, and more. In short, a definitive reference volume for researchers. Well edited articles by leading researchers throughout the world. Extensive bibliography for each article. Interesting chapter on pines in Mexico and Central America.
Syrett, P. 2002. Biological control of weeds on conservation land: priorities for the Department of Conservation. New Zealand Department of Conservation: DOC SCIENCE INTERNAL SERIES 82.
Varnham, K. 2006. Non-native species in UK Overseas Territories: a review. JNCC Report 372. Peterborough: United Kingdom.
Summary: This database compiles information on alien species from British Overseas Territories.
Available from: http://www.jncc.gov.uk/page-3660 [Accessed 10 November 2009]

General information

Foxcroft, L.C. and Richardson, D.M. 2003. Managing alien plant invasions in the Kruger National Park, South Africa. *Plant Invasions: Ecological Threats and Management Solutions*. 385-403.
Summary: This paper gives details about the invasive plant species in the Kruger National Park.
Gargominy, O., Bouchet, P., Pascal, M., Jaffre, T. and Tourneu, J. C. 1996. Cons�quences des introductions d esp�ces animales et v�g�tales sur la biodiversit� en Nouvelle-Cal�donie.. Rev. Ecol. (Terre Vie) 51: 375-401.
Summary: Consequences to the biodiversity of New Caledonia of the introduction of plant and animal species.
Loope, L. and Kraftsow, E. 2001. Plant invasions, watersheds, and native ecosystems: Preliminary thoughts on the East Maui watershed.
Summary: This article discusses the impacts of invasive plants on watershed management, including the impacts of invasive pines on the fynbos ecosystem in South Africa.
Available from: http://www.hear.org/articles/pdfs/loopekraftsow20010319.pdf [Accessed 2 October 2005]
Rejmanek, M. and Richardson, D.M. Undated. Invasiveness of conifers: extent and possible mechanisms. In: ISHS Acta Horticulturae 615: IV International Conifer Conference.
Summary: This paper compares the characteristics of invasive conifers with non-invasive conifers.
Richardson, D.M. and Rejmanek, M. 2004. Conifers as invasive aliens: a global survey and predictive framework. Diversity and Distributions. 10: 321-331.
Summary: This paper summarises the information available about invasive conifers worldwide.