Family: ***Pinaceae***

Taxon: ***Pseudotsuga menziesii***

Synonym: *Abies menziesii Mirb. [≡ Pseudotsuga menzie*
Abies mucronata Raf. [= Pseudotsuga menzie

Common Name: Douglas fir
Coastal Douglas fir

Questionaire : current 20090513 **Assessor:** Chuck Chimera **Designation:** EVALUATE
Status: Assessor Approved **Data Entry Person:** Assessor **WRA Score** 5.5

101	**Is the species highly domesticated?**	**y=-3, n=0**	**n**
102	**Has the species become naturalized where grown?**	**y=1, n=-1**	
103	**Does the species have weedy races?**	**y=1, n=-1**	
201	**Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"**	**(0-low; 1-intermediate; 2-high) (See Appendix 2)**	**Low**
202	**Quality of climate match data**	**(0-low; 1-intermediate; 2-high) (See Appendix 2)**	**High**
203	**Broad climate suitability (environmental versatility)**	**y=1, n=0**	**y**
204	**Native or naturalized in regions with tropical or subtropical climates**	**y=1, n=0**	**n**
205	**Does the species have a history of repeated introductions outside its natural range?**	**y=-2, ?=-1, n=0**	**y**
301	**Naturalized beyond native range**	**y = 1*multiplier (see Appendix 2), n= question 205**	**y**
302	**Garden/amenity/disturbance weed**	**n=0, y = 1*multiplier (see Appendix 2)**	**n**
303	**Agricultural/forestry/horticultural weed**	**n=0, y = 2*multiplier (see Appendix 2)**	**n**
304	**Environmental weed**	**n=0, y = 2*multiplier (see Appendix 2)**	**y**
305	**Congeneric weed**	**n=0, y = 1*multiplier (see Appendix 2)**	**n**
401	**Produces spines, thorns or burrs**	**y=1, n=0**	**n**
402	**Allelopathic**	**y=1, n=0**	
403	**Parasitic**	**y=1, n=0**	**n**
404	**Unpalatable to grazing animals**	**y=1, n=-1**	**n**
405	**Toxic to animals**	**y=1, n=0**	**n**
406	**Host for recognized pests and pathogens**	**y=1, n=0**	
407	**Causes allergies or is otherwise toxic to humans**	**y=1, n=0**	**n**
408	**Creates a fire hazard in natural ecosystems**	**y=1, n=0**	**y**
409	**Is a shade tolerant plant at some stage of its life cycle**	**y=1, n=0**	**y**
410	**Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)**	**y=1, n=0**	**y**
411	**Climbing or smothering growth habit**	**y=1, n=0**	**n**

412	**Forms dense thickets**	**y=1, n=0**	**y**
501	**Aquatic**	**y=5, n=0**	**n**
502	**Grass**	**y=1, n=0**	**n**
503	**Nitrogen fixing woody plant**	**y=1, n=0**	**n**
504	**Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)**	**y=1, n=0**	**n**
601	**Evidence of substantial reproductive failure in native habitat**	**y=1, n=0**	**n**
602	**Produces viable seed**	**y=1, n=-1**	**y**
603	**Hybridizes naturally**	**y=1, n=-1**	**n**
604	**Self-compatible or apomictic**	**y=1, n=-1**	**y**
605	**Requires specialist pollinators**	**y=-1, n=0**	**n**
606	**Reproduction by vegetative fragmentation**	**y=1, n=-1**	**n**
607	**Minimum generative time (years)**	**1 year = 1, 2 or 3 years = 0, 4+ years = -1**	**>3**
701	**Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)**	**y=1, n=-1**	**n**
702	**Propagules dispersed intentionally by people**	**y=1, n=-1**	**y**
703	**Propagules likely to disperse as a produce contaminant**	**y=1, n=-1**	**n**
704	**Propagules adapted to wind dispersal**	**y=1, n=-1**	**y**
705	**Propagules water dispersed**	**y=1, n=-1**	**n**
706	**Propagules bird dispersed**	**y=1, n=-1**	
707	**Propagules dispersed by other animals (externally)**	**y=1, n=-1**	**y**
708	**Propagules survive passage through the gut**	**y=1, n=-1**	**n**
801	**Prolific seed production (>1000/m2)**	**y=1, n=-1**	
802	**Evidence that a persistent propagule bank is formed (>1 yr)**	**y=1, n=-1**	**y**
803	**Well controlled by herbicides**	**y=-1, n=1**	
804	**Tolerates, or benefits from, mutilation, cultivation, or fire**	**y=1, n=-1**	**y**
805	**Effective natural enemies present locally (e.g. introduced biocontrol agents)**	**y=-1, n=1**	

Designation: EVALUATE **WRA Score** 5.5

Supporting Data:

101	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 1: Conifers. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Is the species highly domesticated? No] "The genus Pseudotsuga includes two species (P. menziesii and P. macrocarpa) indigenous to North America and five species native to Asia. All except P. menziesii have a karyotype of 2N=24, the number of chromosomes characteristic of Pinaceae. But the Douglas-fir karyotype is 2N=26, a probable reason for the general failure of hybridization trials with this species (56)."
102	2012. WRA Specialist. Personal Communication.	NA
103	2012. WRA Specialist. Personal Communication.	NA
201	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Species suited to tropical or subtropical climate(s) 0-Low] "P. menziesii grows predominantly within temperate and mesothermal climates. P. menziesii var. menziesii (i.e. the coastal variety) grows in a maritime climate, while var. glauca (the interior variety) grows in a continental climate. The maritime climate is characterized by mild, wet winters and cool, relatively dry summers, a long frost free season, and narrow diurnal fluctuations in temperature (6° to 8°C). Precipitation, mostly as rain, is concentrated in the winter months. In the continental climate, winters are colder, frost-free seasons are shorter, and diurnal fluctuations in temperature are larger (10° to 16°C). Much of the precipitation is snow (Hermann and Lavender, 1990). "
202	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Quality of climate match data? 2-High] "P. menziesii grows predominantly within temperate and mesothermal climates. P. menziesii var. menziesii (i.e. the coastal variety) grows in a maritime climate, while var. glauca (the interior variety) grows in a continental climate. The maritime climate is characterized by mild, wet winters and cool, relatively dry summers, a long frost free season, and narrow diurnal fluctuations in temperature (6° to 8°C). Precipitation, mostly as rain, is concentrated in the winter months. In the continental climate, winters are colder, frost-free seasons are shorter, and diurnal fluctuations in temperature are larger (10° to 16°C). Much of the precipitation is snow (Hermann and Lavender, 1990). "
203	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 1: Conifers. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Broad climate suitability (environmental versatility)? Yes] "The latitudinal range of Douglas-fir is the greatest of any commercial conifer of western North America. Its native range, extending from latitude 19° to 55° N., resembles an inverted V with uneven sides. From the apex in central British Columbia, the shorter arm extends south along the Pacific Coast Ranges for about 2200 km (1,367 mi) to latitude 34° 44' N., representing the range of the typical coastal or green variety, menziesii; the longer arm stretches along the Rocky Mountains into the mountains of central Mexico over a distance of nearly 4500 km (2,796 mi), comprising the range of the other recognized variety, glauca- Rocky Mountain or blue." … "Douglas-fir grows under a wide variety of climatic conditions (table 1). The coastal region of the Pacific Northwest has a maritime climate characterized by mild, wet winters and cool, relatively dry summers, a long frost free season, and narrow diurnal fluctuations of temperature (6° to 8° C; 43° to 46° F). Precipitation, mostly as rain, is concentrated in the winter months. Climate in the Cascade Range and Sierra Nevada tends to be more severe." …"Generally, the variety glauca grows at considerably higher altitudes than the coastal variety of comparable latitude. Altitudinal limit for Douglas-fir in central British Columbia is about 760 m (2,500 ft) but rises to 1250 m (4,100 ft) on Vancouver Island. In Washington and Oregon, the species generally occurs from sea level to 1520 m (5,000 ft), although locally it may occur higher. In the southern Oregon Cascades and in the Sierra Nevada, the altitudinal range is between 610 and 1830 m (2,000 and 6,000 ft). In river valleys and canyon bottoms, the species may occasionally occur at elevations of 240 to 270 m (800 to 900 ft). Near the southern limit of its range in the Sierra Nevada, the species grows to elevations of 2300 m (7,500 ft). The inland variety grows at elevations from 550 to 2440 m (1,800 to 8,000 ft) in the northern part of its range. In the central Rocky Mountains, Douglas-fir grows mostly at elevations between 1830 and 2590 m (6,000 and 8,000 ft), and in the southern Rocky Mountains, between 2440 and 2900 m (8,000 and 9,500 ft). In some localities in southern and central Arizona, Douglas-fir may be found as low as 1550 m (5,100 ft) in canyon bottoms. The highest elevation at which Douglas-fir grows in the Rocky Mountains is 3260 m (10,700 ft) on the crest of Mount Graham in southeastern Arizona."
203	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Broad climate suitability (environmental versatility)? Yes] "- Altitude range: 0 - 3260 m"

204	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Native or naturalized in regions with tropical or subtropical climates? No] "P. menziesii grows predominantly within temperate and mesothermal climates. P. menziesii var. menziesii (i.e. the coastal variety) grows in a maritime climate, while var. glauca (the interior variety) grows in a continental climate. The maritime climate is characterized by mild, wet winters and cool, relatively dry summers, a long frost free season, and narrow diurnal fluctuations in temperature (6° to 8°C). Precipitation, mostly as rain, is concentrated in the winter months. In the continental climate, winters are colder, frost-free seasons are shorter, and diurnal fluctuations in temperature are larger (10° to 16°C). Much of the precipitation is snow (Hermann and Lavender, 1990). "
205	1980. Skolmen, R.G.. Plantings on the forest reserves of Hawaii: 1910–1960. Institute of Pacific Islands Forestry, Pacific Southwest Forest & Range Experiment Station, US Forest Service, Honolulu, HI	[Does the species have a history of repeated introductions outside its natural range? Yes] "Pseudotsuga menziesii … State Total = 1835" [16 planted on Maui at Waihou Springs in 1910 and 1930, 1819 planted on various locations of the Big Island]
205	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 1: Conifers. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Does the species have a history of repeated introductions outside its natural range? Yes] "Although the fossil record indicates that the native range of Douglas-fir has never extended beyond western North America, the species has been successfully introduced in the last 100 years into many regions of the temperate forest zone (31)."
205	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Does the species have a history of repeated introductions outside its natural range? Yes] "P. menziesii has been introduced to many countries, especially in Europe, where it is grown in forests, arboreta, and parks (Hermann, 1987). It is one of the most valuable conifers owing to its ecological and growth characteristics, and wood properties. " …"P. menziesii was first introduced to Europe after 1825. It was planted in arboreta, parks, and on a minor scale in forests. In 1880, it was included into a network of experimental plantations by the German Forest Research Institute. Plantations of P. menziesii exist today in 24 European countries. The countries with the largest share of the plantations are France, Germany, and the UK (Hermann, 1987). Bouchon (1982) estimated that about 220,000 ha of P. menziesii plantations were established in France from 1960 to 1980. There are now about 330,000 ha of P. menziesii in France (IFN, 2000). It has been planted on 47,000 ha of forest land in England, Wales and Scotland (Locke, 1987). In New Zealand it ranks as the second most important softwood species after Pinus radiata, and in 1994 occupied over 60,000 ha, about 5% of the total plantation forest area (Miller and Knowles, 1994). A species trial in the Canterbury high country area of New Zealand confirmed earlier reports that P. menziesii will grow well if planted on suitable sites (Ledgard, 1999). Streets (1962) reported that in Australia it had been planted mainly on an experimental basis, but was of some importance in New South Wales, Tasmania, Victoria and was under trial in South and Western Australia."
301	2004. Bellingham, P.J./Duncan, R.P./Lee, W.G./Buxton, R.P.. Seedling growth rate and survival do not predict invasiveness in naturalized woody plants in New Zealand. Oikos. 106: 308-316.	[Naturalized beyond native range? Yes] "Table 1. The 33 species included in this study listed by family, with year of first recorded naturalization in New Zealand, current number of ecological regions occupied, invasiveness ranking in New Zealand (see text: 1 = widespread, common weed, 2 = scattered, or local weed, and 3 = scarcely naturalized, very local), and invasion rate (measured as the slope of the regression of log[cumulative number of ecological regions occupied by a species] against time)." … "Pseudotsuga menziesii - Year first naturalized = 1925; No. regions occupied = 12; Invasiveness = 1; Invasion rate = 0.021]
301	2004. Richardson, D.M./Rejmánek, M.. Conifers as invasive aliens: a global survey and predictive framework. Diversity and Distributions. 10: 321–331.	[Naturalized beyond native range? Yes] "Appendix List of naturalized or invasive (in bold) conifers (Pinopsida), based on hundreds of published and unpublished sources and the unpublished data and personal observation of the authors over more than a decade." … "Pseudotsuga menziesii (Argentina; Austria, Bulgaria; Chile ; Czech Republic; Germany; Great Britain; Ireland; New Zealand; USA (New York))" [Considered invasive in Argentina; Austria, Bulgaria; Chile, Great Britain]
301	2005. Broncano, M.J./Vila, M./Boada, M.. Evidence of Pseudotsuga menziesii naturalization in montane Mediterranean forests. Forest Ecology and Management. 211: 257–263.	[Naturalized beyond native range? Yes] "Invasion of natural habitats by conifer species is a well-known phenomenon worldwide. Here, we describe naturalization by the American Pseudotsuga menziesii (Douglas fir) in Montseny Natural Park (Catalonia, NE Spain). Establishment of seedlings started 15 years after plantation. Seedling density was positively associated to low tree density, small plantation area, grazing and the presence of a shrubland understorey of intermediate cover. Seedling recruitment outside the plantations occurred at high altitudes (>1000 m). In less than 30 years after plantation, P. menziesii invaded adjacent areas 100 m far from the plantation. We conclude that at high altitudes, under disturbance, seedling establishment can take place as soon as planted trees produce cones. Therefore, the time-lag appears to be primarily related to propagule availability."

301	2010. Carrillo-Gavilan, M.A./Vila, M.. Little evidence of invasion by alien conifers in Europe. Diversity and Distributions. 16: 203–213.	[Naturalized beyond native range? Yes] "According to DAISIE, there are 54 alien conifer species in Europe. Pseudotsuga menziesii is the species recorded as naturalized in the most countries (12) and the UK is the country with the most naturalized species (18)."
301	2010. Simberloff, D. et al.. Spread and impact of introduced conifers in South America: lessons from other southern hemisphere regions. Austral Ecology. 35(5): 489-504.	[Naturalized beyond native range? Yes] "Six species (P. halepensis, P. radiata, P. pinaster, P. elliottii, P. contorta and Ps. menziesii) are considered invasive in certain locations, while P. ponderosa may be invasive in some regions, but in smaller areas than the above species. In particular, in Patagonia, P. contorta is already invading steppe vegetation and Ps. menziesii is invading forest dominated by Austrocedrus chilensis (Sarasola et al. 2006)."
302	2007. Randall, R.P.. Global Compendium of Weeds - Pseudotsuga menziesii [Online Database]. http://www.hear.org/gcw/species/pseudotsuga_menziesii/	[Garden/amenity/disturbance weed? No] No evidence
303	2007. Randall, R.P.. Global Compendium of Weeds - Pseudotsuga menziesii [Online Database]. http://www.hear.org/gcw/species/pseudotsuga_menziesii/	[Agricultural/forestry/horticultural weed? No] No evidence
304	2002. Simberloff, D./Relva, M.A./Nunez, M.. Gringos en el bosque: introduced tree invasion in a native Nothofagus/Austrocedrus forest. Biological Invasions. 4: 35–53.	[Environmental weed? Yes] "Douglas fir is reported to be among the most invasive of non-pine conifers (Rejmanek and Richardson 2000), and it is even known in its native range as invasive (e.g. Bai et al. 2000), but a close examination of regional accounts suggests this invasion is rarely into forest, especially closed forest. Douglas fir is reported to invade relatively intact native vegetation elsewhere near Bariloche (a personal communication to Richardson and Higgins 1998), a phenomenon we have not observed on Isla Victoria. However, we have visited the site on which the report is based (Arroye Goye) and found a situation similar to that in transects 201–210. A small Douglas fir plantation abuts an abandoned, cleared field, which stretches ca. 200m to native forest. In a gap at the edge of the native forest, 10m from a crumbling fence, are 12 Douglas fir trees ca. 6mtall. There is no invasion into closed forest here. Douglas fir was introduced to New Zealand in 1925 (Anonymous 1997) and now occupies ca. 60,000 ha (Anonymous 1992). It is viewed as invasive, but it is only substantially harmful in shrublands and tussock grasslands and in some disturbed native forests (Anonymous 1997). It occasionally gets into canopy gaps in Nothofagus forest (Maclaren 1996; Ralston 1997) but is not considered a threat in normal continuous forest cover (Maclaren 1996). Douglas fir is widespread as a forestry tree in Argentina (Schlichter and Laclau 1998) and Chile (Lara and Veblen 1993; Leslie 1997), but there are no published reports that it has yet become invasive (cf. Richardson and Higgins 1998). This species has been widely planted in Europe for forestry; by 1987 it occupied 24 nations (Hermann 1987). Just in France, Germany, and Great Britain, Douglas fir plantations totaled 348,000 ha. However, despite fears that Douglas fir would become invasive there (e.g. Weck 1950), invasion impacts have not been reported. In German forests Douglas fir appears to be a threat only in oak forests on poor, acidic soil (Knoerzer 1999). In its native North America, it is considered a pioneer species, frequently associated with early stages of succession (Spiess and Franklin 1989; Hermann and Lavender 1990). Where it is invasive is in grasslands, generally where fire has been suppressed; ponderosa pine has a similar status, though it is not excluded by fire (e.g. Bai et al. 2000)."
304	2007. Randall, R.P.. Global Compendium of Weeds - Pseudotsuga menziesii [Online Database]. http://www.hear.org/gcw/species/pseudotsuga_menziesii/	[Environmental weed? Yes] "casual alien, cultivation escape, environmental weed, naturalised, weed"

304	2010. Simberloff, D. et al.. Spread and impact of introduced conifers in South America: lessons from other southern hemisphere regions. Austral Ecology. 35(5): 489-504.	[Environmental weed? Yes] "All species have been shown to be able to establish outside plantations, and P. contorta and Ps. menziesii are considered invasive in particular types of ecosystems (Peña et al. 2007)." … "In some instances, they threaten to convert entire shrubland and grassland communities to conifer forests, with several native species in danger of at least local extirpation (Harding 2001). Pseudotsuga menziesii also invades shrublands in New Zealand (Anon. 1997; Ledgard 2002)." … "Introduced conifers have also invaded forests. Examples in New Zealand of conifers that invade seasonally or permanently open native forest include P. contorta in open forests at treeline in New Zealand (Wardle 1985a, b) and Pseudotsuga menziesii in canopy gaps in native Nothofagus forest (Maclaren 1996; Ralston 1997; Harding 2001, and references therein; Ledgard 2002).The invasion into gaps may threaten to replace native dominant trees (Harding 2001; Ledgard 2002)." …"Similarly, in Argentinean Patagonia Ps. menziesii is invading normal evergreen native forest dominated by N. dombeyi and Austrocedrus chilensis, but only slowly and, so far, not far from exotic plantations (Simberloff et al. 2002; Nuñez et al. 2008). Likewise, in southcentral Chile, Ps. menziesii is establishing more than 120 m from the edge of 30-year old plantations, in densities that depend on the nature of the vegetation and levels of disturbance (A. Pauchard et al., unpubl. data 2007)." … "In small mixed plantations of Pseudotsuga menziesii, P. radiata and P. sylvestris embedded in forests dominated by N. dombeyi in northwest Patagonia, Paritsis and Aizen (2008) found decreased species richness of understory vascular plants, epigeal beetles and birds, with a loss of rare and specialist species and an increase in introduced plant species aside from these three conifers."
304	2012. Carrillo-Gavilan, A./Espelta, J.M./Vila, M.. Establishment constraints of an alien and a native conifer in different habitats. Biological Invasions. DOI 10.1007/s10530-011-0155-z: .	[Environmental weed? Yes] "Pseudotsuga menziesii Mirb. Franco, the Douglas fir, is considered one of the most invasive forestry conifer species of the world (Richardson and Rejmanek 2004). Douglas fir is reported as invasive in areas close to plantations in New Zealand (Kay 1994), South Africa (Richardson and Higgins 1998), Argentina and Chile (Simberloff et al. 2010). For instance, Douglas fir invasion is facilitated by deer browsing on native plants (Relva et al. 2009) and by the presence of below ground mutualisms (Nunez et al. 2009) in Argentina. In Europe, it is naturalized in several countries (Carrillo- Gavilan and Vila` 2010). According to previous studies (Richardson and Bond 1991; Sarasola et al. 2006), the most suitable habitats to be invaded by this sort of alien conifers would be grasslands and shrublands followed by open forests and, finally, by closed forests."
305	2007. Randall, R.P.. Global Compendium of Weeds - Index [Online Database]. http://www.hear.org/gcw/	[Congeneric weed? No] No evidence. Only Pseudotsuga menziesii listed as naturalized and weedy
401	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Produces spines, thorns or burrs? No] "Foliage Needles: evergreen, remaining on the tree for 5 to 8 years, flat, flexible, 2 to 3 cm long, grooved above, often sharp-pointed, yellowish green in var. menziesii, bluish-green in var. glauca (Farrar, 1995). "
402	1985. Tinnin, R.O./Kirkpatrick, L.A.. The Allelopathic Influence of Broadleaf Trees and Shrubs on Seedlings of Douglas-fir. Forest Science. 31(4): 945-952.	[Allelopathic? Not reported in this paper] "The allelopathic potential of leaf litter from five species of broadleaf trees and shrubs found in southwestern Oregon on the germination and early growth of Pseudotsuga menziesii was examined. While each of these species showed significant allelopathic potential when tested in a highly artificial system against seeds of cucumber, the observed reductions in growth when tested against P. menziesii ranged from about 44 percent of control growth for Umbellularia californica to about 98 percent of control for Arbutus menziesii. No consistent expression of allelopathy was observed when bioassays, using field soil, were the basis of experimentation. The data show that allelopathy is of potential importance among the many ecological factors which operate under field conditions." [No evidence. Tested as the object of, rather than the cause of allelopathy.]
402	1999. Singh, H.P./Kohli, R.K./Batish, D.R./Kaushal, P.S.. Allelopathy of Gymnospermous Trees. Journal of Forest Research. 4: 245-254.	[Allelopathic? Potentially] "Table 1 Available reports on the allelopathy of gymnosperms." … "Pseudotsuga menziesii … Phenolics present in water leachates of litter inhibited germination." [Inhibits lettuce, Lactuca sativa, germination in experimental conditions]
403	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Parasitic? No] Family: Pinaceae

404	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 1: Conifers. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Unpalatable to grazing animals? No] "Browsing and clipping by hares, brush rabbits, mountain beaver, pocket gophers, deer, and elk often injure seedlings and saplings. Recent reports have indicated that such damage in western Oregon and Washington may strongly affect seedling survival in many plantations (7,61). In drier areas, domestic livestock have caused considerable damage to variety glauca plantations by grazing and trampling seedlings. In pole-sized timber, bears sometimes deform and even kill young trees by stripping off the bark and cambium."
404	1991. Uchytil, R.J.. Pseudotsuga menziesii var. menziesii. In: Fire Effects Information System, [Online]. USA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/tree/psemenm/all.html	[Unpalatable to grazing animals? No] "Coast Douglas-fir seedlings are not a preferred browse of black-tailed deer or elk, but can be an important food source for these animals during the winter when other preferred forages are lacking [12,14]." … "Coast Douglas-fir is a poor livestock browse and is generally avoided. In the Oregon Coast Range it was most palatable to herded domestic sheep in the spring soon after bud break but never comprised more than 3 percent of their diet [42]. New growth of seedlings and saplings is highly palatable to black-tailed deer in the spring and early summer. Douglas fir palatability to deer is low during the rest of the year [9]."
404	2010. Relva, M.A./Nunez, M.A./Simberloff, D.. Introduced deer reduce native plant cover and facilitate invasion of non-native tree species: evidence for invasional meltdown. Biological Invasions. 12: 303–311.	[Unpalatable to grazing animals? No] "Introduced deer had an important negative effect on height growth of both the dominant native and the main exotic tree species. However, the impact is stronger for native Austrocedrus than for exotic P. menziesii. This observation aligns with our previous study showing that deer preferred native over exotic foliage (Nunez et al. 2008a)." [But native species were preferred over Douglas Fir in this study conducted in Argentina]
405	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 1: Conifers. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Toxic to animals? No] "Browsing and clipping by hares, brush rabbits, mountain beaver, pocket gophers, deer, and elk often injure seedlings and saplings. Recent reports have indicated that such damage in western Oregon and Washington may strongly affect seedling survival in many plantations (7,61). In drier areas, domestic livestock have caused considerable damage to variety glauca plantations by grazing and trampling seedlings. In pole-sized timber, bears sometimes deform and even kill young trees by stripping off the bark and cambium."
406	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 1: Conifers. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Host for recognized pests and pathogens? Potentially] "Damaging Agents- From seed to maturity, Douglas-fir is subject to serious damage from a variety of agents. Douglas-fir is host to hundreds of fungi, but relatively few of these cause serious problems. Various species of Pythium, Rhizoctonia, Phytophthora, Fusarium, and Botrytis may cause significant losses of seedlings in nurseries (58,60), whereas Rhizina undulata, shoestring root rot (Armillaria mellea), and laminated root rot (Phellinus weirii) have caused significant damage in plantations. In fact, the latter two fungi represent a serious threat to management of young-growth stands of Douglas-fir, especially west of the summit of the Cascades. Trees die or are so weakened that they are blown over. Effective control measures are not available. Of the many heart rot fungi (more than 300) attacking Douglas-fir, the most damaging and widespread is red ring rot (Phellinus pini). Knots and scars resulting from fire, lightning, and falling trees are the main courts of infection. Losses from this heart rot far exceed those from any other decay. Other important heart rot fungi in the Pacific Northwest are Fomitopsis officinalis, F. cajanderi, and Phaeolus schweinitzii (28). In the Southwest, Echinodontium tinctorium, Fomitopsis cajanderi, and F. pinicola are important." … "Insects are generally not a severe problem for Douglas-fir regeneration, although both the strawberry root weevil (Otiorhynchus oratus) and cranberry girdler (Chrysoteuchia topiaria) may cause significant damage to seedlings in nurseries; damage to plantations by rain beetles (Pleocoma spp.) and weevils (Steremnius carinatus)- the latter particularly damaging to container-grown-plants-has been reported."
406	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Host for recognized pests and pathogens? Potentially] "Hundreds of species of fungi attack the various size classes of P. menzeisii. However, relatively few cause serious problems."
407	2008. Wagstaff, D.J.. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	[Causes allergies or is otherwise toxic to humans? No] No evidence
407	2012. Pollen Library. Douglas-Fir (Pseudotsuga menziesii). IMS Health Incorporated, http://www.pollenlibrary.com/Specie/Pseudotsuga+menziesii/	[Causes allergies or is otherwise toxic to humans? No] "Allergenicity: No allergy has been reported for Douglas-Fir (Pseudotsuga menziesii) species."

408	1991. Uchytil, R.J.. Pseudotsuga menziesii var. menziesii. In: Fire Effects Information System, [Online]. USA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/tree/psemenm/all.html	[Creates a fire hazard in natural ecosystems? Potentially] "Plant adaptations to fire: Coast Douglas-fir is more fire resistant than many of its associates and can survive moderately intense fires. Thick, corky bark on the lower bole and roots protects the cambium from heat damage. In addition, the tall trees have their foliage concentrated on the upper bole, which makes it difficult for fire to reach the crown [58]; however, it should be noted that trees are typically not free of lower branches up to a height of 33 feet (10 m) until they are more than 100 years old [31]. Moderately severe understory burns in 50- to 60-year-old mixed and pure stands near Mount Rainier caused little cambial injury to Douglas-fir but killed most of the thin-barked western redcedar [68]. Following the Hoh Fire in Olympic National Park, Douglas-fir's survival rate was considerably higher than Sitka spruce (Picea sitchensis), western redcedar, western hemlock, and bigleaf maple (Acer macrophyllum) [3]." [Not particularly fire prone in native ecosystems, but would likely increase fire risk in Hawaiian Islands]
408	2002. Steinberg, P.D.. Pseudotsuga menziesii var. glauca. In: Fire Effects Information System, [Online]. USA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/tree/psemeng/all.html	[Creates a fire hazard in natural ecosystems? Potentially] "Fire regimes: Fire regimes in moist Rocky Mountain Douglas-fir habitat types are mixed, ranging from low to moderate severity surface fires at relatively frequent intervals (7 to 20 years) to severe crown fires at long intervals (50 to 400 years) [149]. In some areas, large fires burn at several intensities, changing with shifts in stand structure, fuel loads, topography, and weather [16]. The result is a mosaic of burn patterns. Intense crown fires or repeat fires generally favor seral associates such as quaking aspen or Rocky Mountain lodgepole pine. In the Bob Marshall Wilderness in Montana, Rocky Mountain Douglas-fir-dominated sites were converted to Rocky Mountain lodgepole pine by 3 fires at 30- to 40-year intervals. Another site in the same area was converted from a Rocky Mountain Douglas-fir-western larch forest to a forest dominated by Rocky Mountain lodgepole pine as a result of a single severe fire [94]." Not particularly fire prone in native ecosystems, but would likely increase fire risk in Hawaiian Islands]
409	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 1: Conifers. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Is a shade tolerant plant at some stage of its life cycle? Yes] "Reaction to Competition- Except in its youth, when it is reasonably tolerant of shade, coastal Douglas fir is classed as intermediate in overall shade tolerance, below most of its common associates in tolerance to shade (42)."
409	1991. Uchytil, R.J.. Pseudotsuga menziesii var. menziesii. In: Fire Effects Information System, [Online]. USA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/tree/psemenm/all.html	[Is a shade tolerant plant at some stage of its life cycle? Yes] "First year seedlings survive and grow best in partial shade [31,35]. Shading is especially important on southerly aspects, where it lessens seedbed heating and drying. Seedling survival and growth on severe sites is generally best in 50 percent shade [76]. Douglas-fir cannot survive, however, under the dense shade cast by heavy logging slash or competing understory vegetation [53]. Once established, seedlings require full sunlight." …"On drier sites, Douglas-fir is more shade-tolerant and may assume climax dominance. It is more shade tolerant than ponderosa pine, sugar pine, western white pine (Pinus monticola), lodgepole pine (P. contorta), incense cedar, and noble fir (Abies procera) but less shade tolerant than white fir [36,54]."
409	2002. Steinberg, P.D.. Pseudotsuga menziesii var. glauca. In: Fire Effects Information System, [Online]. USA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/tree/psemeng/all.html	[Is a shade tolerant plant at some stage of its life cycle? Yes] "Rocky Mountain Douglas-fir is a shade tolerant climax species in dry to moist lower and middle elevation forests but is (relatively) shade intolerant in wetter forests [64,117]."
410	1991. Uchytil, R.J.. Pseudotsuga menziesii var. menziesii. In: Fire Effects Information System, [Online]. USA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/tree/psemenm/all.html	[Tolerates a wide range of soil conditions? Yes] "Soils: Douglas-fir grows on a wide variety of parent materials and soil textures but grows best on well-aerated, deep soils with a pH between 5 and 6 [31]. It grows poorly on oligotrophic soils where calcium, magnesium, nitrogen, phosphorus, and potassium are in low supply [39]."
410	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Tolerates a wide range of soil conditions? Yes] "P. menziesii tolerates a wide range of soil moisture and nutrient conditions in most localities, but the most productive growth occurs on fresh to moist, nutrient-rich soils (Klinka and Carter, 1990; Klinka et al., 1999a). It tolerates water- and nutrient-deficient soils, but not waterlogged (inundated) soils (Krajina, 1969; Klinka et al., 1999a). "

411	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Climbing or smothering growth habit? No] "One of the largest North American conifers, it is occasionally over 80 m tall, 200 cm in diameter at breast height, and 600 years old. Occasionally specimens may grow up to 100 m tall, 400 cm d.b.h., and to over 1300 years old (Earle, 1999). Mature trees are characterized by a long, branch free, cylindrical trunk and a short, columnar, flat topped crown; young trees by a narrowly conical crown that may extend to the ground. The principal branches are in irregular whorls at the annual nodes, lesser branches are in between. The bark is grey, smooth, thin, and resin-blistered when young; becoming deeply furrowed with irregular, broad, dark reddish brown ridges, up to 30 cm thick. The wood is moderately heavy, hard, and exceptionally strong; heartwood is reddish-brown; sapwood is yellowish-white (Farrar, 1995). "
412	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 1: Conifers. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Forms dense thickets? Yes] "Nearly pure stands of Douglas-fir continue south from their northern limit on Vancouver Island through western Washington, Oregon, and the Klamath and Coast Ranges of northern California as far as the Santa Cruz Mountains. In the Sierra Nevada, Douglas-fir is a common part of the mixed conifer forest as far south as the Yosemite region." …"Periodic recurrence of catastrophic wildfires created vast, almost pure stands of coastal Douglas-fir throughout its range north of the Umpqua River in Oregon." … "Rocky Mountain Douglas-fir grows in extensive pure stands, uneven- and even-aged, in southern Idaho and northern Utah and in western Montana as a broad belt between ponderosa pine and spruce-fir zones."
412	1991. Uchytil, R.J.. Pseudotsuga menziesii var. menziesii. In: Fire Effects Information System, [Online]. USA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/tree/psemenm/all.html	[Forms dense thickets? Yes] "Coast Douglas-fir is the most dominant tree species in the Pacific Northwest, occurring in nearly all forest series, from near sea level along the coast to above 5,000 feet (1,524 m) in the Cascades. It competes well on most parent materials, aspects, and slopes [6]. Pure stands are common north of the Umpqua River in Oregon [31]."
501	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Aquatic? No] "One of the largest North American conifers, it is occasionally over 80 m tall…" [Terrestrial]
502	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Grass? No] Family: Pinaceae
503	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Nitrogen fixing woody plant? No] Family: Pinaceae
504	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)? No] "One of the largest North American conifers, it is occasionally over 80 m tall, 200 cm in diameter at breast height, and 600 years old."
601	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 1: Conifers. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Evidence of substantial reproductive failure in native habitat? No] "Seed quality varies during the seedfall period. It is high in the fall but declines rapidly during winter and spring. This pattern probably reflects the fact that cone scales in the center of the cone, where the highest quality seed are borne, open early and scales at the tip and base of the cone, which bear generally poorly formed seeds, open late."
602	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 1: Conifers. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Produces viable seed? Yes] "Seedling Development- Douglas fir germination is epigeal. Seed germinates in mid-March to early April in the warmer portions of the range and as late as mid-May in the cooler areas. Seedling growth the first year is indeterminate but relatively slow and limited generally by moisture, which triggers initiation of dormancy in midsummer. The dormant period normally extends from midsummer until April or May of the following year (37)."
602	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Produces viable seed? Yes] "Propagation by seed is the only contemporary method for regenerating P. menziesii."
603	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 1: Conifers. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Hybridizes naturally? No] "The genus Pseudotsuga includes two species (P. menziesii and P. macrocarpa) indigenous to North America and five species native to Asia. All except P. menziesii have a karyotype of 2N=24, the number of chromosomes characteristic of Pinaceae. But the Douglas-fir karyotype is 2N=26, a probable reason for the general failure of hybridization trials with this species (56)."
604	1956. Orr-Ewing, A.L.. Investigation into the Effects of Self-pollination on Pseudotsuga menziesii (Mirb.) Franco. PhD Dissertation. The University of British Columbia, Vancouver, B.C.	[Self-compatible or apomictic? Yes] "A study of the inbred progeny shows that self pollination usually results in seedlings which are smaller and less vigorous than those from controlled cross-pollination. The seedlings from wind-pollination were intermediate and the small size of some suggests that self pollination may have occurred. The practical aspects of self-pollination in relation to both the natural and artificial regeneration of forest land are briefly discussed." [Not as effective as outcrossing]
605	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Requires specialist pollinators? No] "Anthesis and pollination of var. menziesii occur during March and April in the warmer part of the range and as late as May or early June in the colder areas. At low and middle elevations, " [Wind-pollinated]

606	2002. Steinberg, P.D.. Pseudotsuga menziesii var. glauca. In: Fire Effects Information System, [Online]. USA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/tree/psemeng/all.html	[Reproduction by vegetative fragmentation? No] "Asexual regeneration: Rocky Mountain Douglas-fir does not reproduce asexually under natural conditions [53]. Cuttings for regeneration purposes have had only limited success; only trees less than 10 years old have produced cuttings that could establish. Also, cuttings that do establish generally exhibit a trailing growth habit before growing upward [117]."
606	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Reproduction by vegetative fragmentation? No] "Propagation by seed is the only contemporary method for regenerating P. menziesii."
607	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 1: Conifers. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Minimum generative time (years)? 12+] "Flowering and Fruiting- Douglas-fir is monoecious; trees commonly begin to produce strobili at 12 to 15 years of age, although observations of younger seedlings bearing ovulate strobili have been reported."
701	1991. Uchytil, R.J.. Pseudotsuga menziesii var. menziesii. In: Fire Effects Information System, [Online]. USA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/tree/psemenm/all.html	[Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)? No] ""Dispersal: Douglas-fir seeds have a relatively large, single wing and are primarily dispersed by wind and gravity. Most fall within 110 yards (100 m) of the parent tree, but some may travel much greater distances. On rare occasions, sites more than 0.5 mile (0.8 km) from a seed source have reseeded after cutting [19]." [Not likely, although movement of soil could inadvertenly move seeds]
702	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 1: Conifers. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Propagules dispersed intentionally by people? Yes] "Douglas-fir is grown as a Christmas tree on rotations ranging from 4 to 7 years."
702	2011. Earle, C.J.. The Gymnosperm Database - Pseudotsuga menziesii. http://www.conifers.org/pi/Pseudotsuga_menziesii.php	[Propagules dispersed intentionally by people? Yes] "Pseudotsuga menziesii is one of the world's most important timber trees, valued in both the Old and New worlds (Burns and Honkala 1990, Lipscomb 1993). It has been widely planted in New Zealand and is there regarded as an invasive weed."
703	1991. Uchytil, R.J.. Pseudotsuga menziesii var. menziesii. In: Fire Effects Information System, [Online]. USA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/tree/psemenm/all.html	[Propagules likely to disperse as a produce contaminant? No] "Dispersal: Douglas-fir seeds have a relatively large, single wing and are primarily dispersed by wind and gravity. Most fall within 110 yards (100 m) of the parent tree, but some may travel much greater distances. " [Unlikley that such large seeds would inadvertently become contaminants of produce]
704	1991. Uchytil, R.J.. Pseudotsuga menziesii var. menziesii. In: Fire Effects Information System, [Online]. USA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/tree/psemenm/all.html	[Propagules adapted to wind dispersal? Yes] "Dispersal: Douglas-fir seeds have a relatively large, single wing and are primarily dispersed by wind and gravity. Most fall within 110 yards (100 m) of the parent tree, but some may travel much greater distances. On rare occasions, sites more than 0.5 mile (0.8 km) from a seed source have reseeded after cutting [19]."
704	2012. Carrillo-Gavilan, A./Espelta, J.M./Vila, M.. Establishment constraints of an alien and a native conifer in different habitats. Biological Invasions. DOI 10.1007/s10530-011-0155-z: .	[Propagules adapted to wind dispersal? Yes] "For instance, Douglas and Silver fir seeds are primarily dispersed by wind and gravity in autumn while in second stage, dispersal could be promoted by mice, chipmunks or squirrels (Hemstrom et al. 1987; Wolf 2003)."
705	1991. Uchytil, R.J.. Pseudotsuga menziesii var. menziesii. In: Fire Effects Information System, [Online]. USA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/tree/psemenm/all.html	[Propagules water dispersed? No] "Dispersal: Douglas-fir seeds have a relatively large, single wing and are primarily dispersed by wind and gravity." [Potential for some water dispersal of seeds, but wind and gravity are the main dispersal modes]
706	1991. Uchytil, R.J.. Pseudotsuga menziesii var. menziesii. In: Fire Effects Information System, [Online]. USA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/tree/psemenm/all.html	[Propagules bird dispersed? Potentially] "Clark's nutcrackers also disperse Douglas-fir seeds. Unretrieved seeds in Clark's nutcracker caches may have a better change of establishment than wind-dispersed seed [80,81]." [Not adapted for bird dispersal, but may be cached by bird seed predators, at least within native range]
707	1991. Uchytil, R.J.. Pseudotsuga menziesii var. menziesii. In: Fire Effects Information System, [Online]. USA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/tree/psemenm/all.html	[Propagules dispersed by other animals (externally)? Yes] "The Douglas squirrel harvests and caches great quantities of Douglas-fir cones for later use [5]. They also eat mature pollen cones, developing inner bark, terminal shoots, and tender young needles [49]." …"Mice, chipmunks, and squirrels disperse small amounts of seed [28]."
707	2012. Carrillo-Gavilan, A./Espelta, J.M./Vila, M.. Establishment constraints of an alien and a native conifer in different habitats. Biological Invasions. DOI 10.1007/s10530-011-0155-z: .	[Propagules dispersed by other animals (externally)? Yes] "For instance, Douglas and Silver fir seeds are primarily dispersed by wind and gravity in autumn while in second stage, dispersal could be promoted by mice, chipmunks or squirrels (Hemstrom et al. 1987; Wolf 2003)." [Seed caching animals may disperse seeds externally]

708	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 1: Conifers. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Propagules survive passage through the gut? No] "Consumption of Douglas-fir seeds by small forest mammals such as white-footed deer mice, creeping voles, chipmunks, and shrews, and birds such as juncos, varied thrush, blue and ruffed grouse, and song sparrows further reduces seed quantity. A single deer mouse may devour 350 Douglas-fir seeds in a single night. Mouse populations of 7 to 12/ha (3 to 5/acre) are not uncommon. Most seedfall occurs at least 150 days before the germination period, so this single rodent species has the capacity to destroy the great majority of natural seedfall." [Not adapted for internal dispersal. Seeds are consumed by seed predators]
708	1991. Uchytil, R.J.. Pseudotsuga menziesii var. menziesii. In: Fire Effects Information System, [Online]. USA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/tree/psemenm/all.html	[Propagules survive passage through the gut? No] "Douglas-fir seeds are an extremely important food for small mammals. Mice, voles, shrews, and chipmunks consumed an estimated 65 percent of a Douglas-fir seed crop following dispersal in western Oregon [26]. The seeds are also important in the diets of the winter wren, pine siskin, song sparrow, golden-crowned sparrow, white crowned sparrow, red crossbill, dark-eyed junco, and purple finch [5,10]." [Not adapted for internal dispersal. Seeds are consumed by seed predators]
801	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 1: Conifers. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Prolific seed production (>1000/m2)? Potentially] "Douglas-fir seed crops occur at irregular intervals- one heavy and one medium crop every 7 years on the average; however, even during heavy seed years, only about 25 percent of the trees produce an appreciable number of cones (34). Trees 200 to 300 years old produce the greatest number of cones. For example, a stand of old-growth Douglas-fir may produce 20 to 30 times the number of cones per hectare that a second growth stand 50 to 100 years old produces." …"Data describing the quantities of seeds that may fall vary widely, but most years are characterized by less than 2.2 kg/ha (2 lb/acre), of which no more than 40 percent is sound. Years with poor seed crops generally have a lower percentage of viable seeds, perhaps because the low incidence of fruiting trees may favor a higher level of selfing (25)."
801	1991. Uchytil, R.J.. Pseudotsuga menziesii var. menziesii. In: Fire Effects Information System, [Online]. USA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/tree/psemenm/all.html	[Prolific seed production (>1000/m2)? Potentially] "Cone and seed production: Appreciable seed production begins at 20- to 30-years of age in open-grown coast Douglas fir. Seed production is irregular. Over a 5- to 7-year period, stands usually produce one heavy crop, a few light or medium crops, and one crop failure [31]. Even during heavy seed crop years, only about 25 percent of trees in closed stands produce an appreciable number of cones [31]. Each cone contains 26 to 50 seeds [59]. Seed size varies greatly; average number of cleaned seeds per pound varies from 32,000 to 40,000 (70,400-88,000/kg) [59]. Seeds from the northern portion of coast Douglas-fir's range tend to be larger than seed from the south [31]."
801	2002. Steinberg, P.D.. Pseudotsuga menziesii var. glauca. In: Fire Effects Information System, [Online]. USA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/tree/psemeng/all.html	[Prolific seed production (>1000/m2)? Potentially] "Seed production: Douglas-fir (both varieties) produces abundant crops of seed approximately every 2 to 11 years. Seed is produced annually except for "about 1 year in any 4- to 5-year period" [197]. Age at first reproduction is 12 to 15 years (both varieties). The magnitude of the cone crop is affected by the number of primordia that develop rather than by the number formed. Accordingly, the current year's crop is in large part influenced by the abortion rate of the previous year's primordia. However, even with low rates of primordia abortion, frost and insect infestation can reduce cone production [53]. Finley [87] reported estimates of the size of Rocky Mountain Douglas-fir's cone crop: in Washington and Oregon the number of cones per tree averaged 1,126 and ranged from 151 to 6,000; in British Columbia the average was 1,300 with a range of 1,000 to 4,000. Each cone contains 20 to 30 seeds [197]."
802	1991. Uchytil, R.J.. Pseudotsuga menziesii var. menziesii. In: Fire Effects Information System, [Online]. USA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/tree/psemenm/all.html	[Evidence that a persistent propagule bank is formed (>1 yr)? Yes] "Seeds remain viable for only 1 or occasionally 2 years [35]."
802	2002. Steinberg, P.D.. Pseudotsuga menziesii var. glauca. In: Fire Effects Information System, [Online]. USA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/tree/psemeng/all.html	[Evidence that a persistent propagule bank is formed (>1 yr)? Yes] "Germination: Most germination occurs within 150 days of seedfall, but seeds remain viable for 1 or occasionally 2 years [53]."

802	2004. Bai, Y./Thompson, D./Broersma, K.. Douglas Fir and Ponderosa Pine Seed Dormancy as Regulated by Grassland Seedbed Conditions. Journal of Range Management. 57(6): 661-667.	[Evidence that a persistent propagule bank is formed (>1 yr)? Potentially] "Seeds of Douglas fir and ponderosa pine are readily germinable in the spring after the overwinter stratification. They may germinate given suitable temperature and moisture conditions, or lose viability rapidly by the end of the following growing season (< 20%, data not shown), indicating that most seeds remain viable in the soil for less than 1 year. This is consistent with the fact that the presence of conifers in the soil is very low (Frank and Safford 1970; Kramer and Johnson 1987; McGee and Feller 1993) despite the dormancy common in coniferous species (Edwards 1986)."
803	2012. WRA Specialist. Personal Communication.	[Well controlled by herbicides? Unknown] Despite records of invasiveness, no information was found on herbicide efficacy or chemical control of this species.
804	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Tolerates, or benefits from, mutilation, cultivation, or fire? Yes] "- Tolerates drought; fire; wind; shade - Ability to regenerate rapidly; self-prune"
805	2012. WRA Specialist. Personal Communication.	[Effective natural enemies present locally (e.g. introduced biocontrol agents)? Unknown]