

Taxon: <i>Ailanthus excelsa</i> Roxb.	Family: Simaroubaceae
Common Name(s): ardu Indian tree of heaven	Synonym(s): <i>Ailanthus wightii</i> Tiegh. <i>Pongelion excelsum</i> (Roxb.) Pierre

Assessor: Chuck Chimera	Status: Assessor Approved	End Date: 24 Aug 2016
WRA Score: 4.0	Designation: EVALUATE	Rating: Evaluate

Keywords: Naturalized, Tropical Tree, Fodder, Coppices, Wind-Dispersed

Qsn #	Question	Answer Option	Answer
101	Is the species highly domesticated?	y=-3, n=0	n
102	Has the species become naturalized where grown?		
103	Does the species have weedy races?		
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)	High
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	n
204	Native or naturalized in regions with tropical or subtropical climates	y=1, n=0	y
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)	n
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	y
401	Produces spines, thorns or burrs	y=1, n=0	n
402	Allelopathic		
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		
407	Causes allergies or is otherwise toxic to humans		
408	Creates a fire hazard in natural ecosystems		
409	Is a shade tolerant plant at some stage of its life cycle		

Qsn #	Question	Answer Option	Answer
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	n
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		
604	Self-compatible or apomictic		
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	y
607	Minimum generative time (years)		
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	y
706	Propagules bird dispersed	y=1, n=-1	n
707	Propagules dispersed by other animals (externally)	y=1, n=-1	n
708	Propagules survive passage through the gut	y=1, n=-1	n
801	Prolific seed production (>1000/m ²)		
802	Evidence that a persistent propagule bank is formed (>1 yr)	y=1, n=-1	n
803	Well controlled by herbicides	y=-1, n=1	y
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)		

Supporting Data:

Qsn #	Question	Answer
101	Is the species highly domesticated?	n
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	[No evidence of domestication] "A fast-growing multipurpose species, promising for soil conservation, and as a softwood timber resource in semi-arid and semi-moist situations. The timber is white and lustrous, very light, soft but fairly strong, easy to saw and work, but is not durable. It is used for plywood and for catamarans."
	Ravindranath, N. H., Bhat, D. M., & Swamy, V. S.. 2004. Nursery Manual for Forest Tree Species. Universities Press, Hyderguda, India	No evidence of domestication

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. 2016. Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. 2016. Personal Communication	NA

201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	High
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 22 Aug 2016]	"Native: Asia-Tropical Indian Subcontinent: India - Andhra Pradesh, - Bihar, - Gujarat, - Haryana, - Karnataka, - Kerala, - Madhya Pradesh, - Maharashtra, - Orissa, - Punjab, - Rajasthan, - Tamil Nadu, - Uttar Pradesh, - West Bengal; Sri Lanka North Indian Ocean: India - Andaman and Nicoba"

202	Quality of climate match data	High
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 22 Aug 2016]	

203	Broad climate suitability (environmental versatility)	n
	Source(s)	Notes

Qsn #	Question	Answer
	National Research Council (U.S.). Advisory Committee on Technology Innovation. 1983. Firewood crops: shrub and tree species for energy production : volume 2. National Academy Press, Washington, D.C.	"Altitude. It is grown at low altitudes."
	Orwa C., Mutua, A., Kindt R., Jamnadass, R, & Anthony, S. 2009 Agroforestry Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org . [Accessed 23 Aug 2016]	"BIOPHYSICAL LIMITS Altitude: 0-900 m, Mean annual temperature: 0-45 deg C, Mean annual rainfall: 500-2 500 mm."
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Climatic amplitude (estimates) - Altitude range: 0 - 900 m - Mean annual rainfall: 500 - 1900 mm - Mean maximum temperature of hottest month: 30 - 42°C - Mean minimum temperature of coldest month: 4 - 21°C"

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 22 Aug 2016]	"Native: Asia-Tropical Indian Subcontinent: India - Andhra Pradesh, - Bihar, - Gujarat, - Haryana, - Karnataka, - Kerala, - Madhya Pradesh, - Maharashtra, - Orissa, - Punjab, - Rajasthan, - Tamil Nadu, - Uttar Pradesh, - West Bengal; Sri Lanka North Indian Ocean: India - Andaman and Nicoba"

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes
	Jadalla, J. B., Khatir, A. A., Dawelbait, E. M. & Ali, S. A. M. 2014. Relationship between some Growth Parameters and Browse Biomass Produced from <i>Ailanthus excelsa</i> Tree in Kordofan, Sudan. Greener Journal of Agronomy, Forestry and Horticulture 2(1): 008-013	" <i>Ailanthus excelsa</i> was introduced to the country for its timber. In India, it is grown to be harvested or feed goats. The empirical observations have shown that <i>A. excelsa</i> is increasingly used for browse (Vogt, 1996). This fast growing naturalized species is not investigated in Sudan neither for determination of its production potential nor its nutritive value."
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 24 Aug 2016]	"Cultivated: Asia-Tropical Indian Subcontinent: India Indo-China: Thailand Malesia: Indonesia"
	Sheikh, M. I. 1993. Trees of Pakistan. Pictorial Printing (Pvt) Ltd., Islamabad	"The tree is native to India. In Pakistan it is occasionally planted in Sindh."
	Skolmen, R.G. 1980. 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	[No records of <i>A. excelsa</i> planting in the Hawaiian Islands. In 1937, 1,350 trees of <i>Ailanthus altissima</i> were planted in Honouliuli, Oahu & between 1924 - 1932, 390 trees were planted in Hamakua & Hilo, Hawaii]

301	Naturalized beyond native range	y
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Qsn #	Question	Answer
	Source(s)	Notes
	Jadalla, J. B., Khatir, A. A., Dawelbait, E. M. & Ali, S. A. M. 2014. Relationship between some Growth Parameters and Browse Biomass Produced from <i>Ailanthus excelsa</i> Tree in Kordofan, Sudan. <i>Greener Journal of Agronomy, Forestry and Horticulture</i> 2(1): 008-013	" <i>Ailanthus excelsa</i> was introduced to the country for its timber. In India, it is grown to be harvested or feed goats. The empirical observations have shown that <i>A. excelsa</i> is increasingly used for browse (Vogt, 1996). This fast growing naturalized species is not investigated in Sudan neither for determination of its production potential nor its nutritive value."
302	Garden/amenity/disturbance weed	n
	Source(s)	Notes
	Randall, R.P. 2012. <i>A Global Compendium of Weeds</i> . 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence
303	Agricultural/forestry/horticultural weed	n
	Source(s)	Notes
	Randall, R.P. 2012. <i>A Global Compendium of Weeds</i> . 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence
304	Environmental weed	n
	Source(s)	Notes
	Randall, R.P. 2012. <i>A Global Compendium of Weeds</i> . 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence
305	Congeneric weed	y
	Source(s)	Notes
	Planchuelo, G., Catalán, P., & Delgado, J. A. (2016). Gone with the wind and the stream: Dispersal in the invasive species <i>Ailanthus altissima</i> . <i>Acta Oecologica</i> , 73, 31-37	" <i>A. altissima</i> is a tree from the Simaroubaceae family native to China that is currently widespread across all continents except in Antarctica. It is classified as a "noxious weed" and invasive species in many regions for its rapid growth, allelopathic effects, extensive root system and ability to reproduce quickly via diaspores and clonal growth"

Qsn #	Question	Answer
	CABI, 2016. <i>Ailanthus altissima</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Prolific fruiting, ready germination, adaptability to infertile sites and rapid growth rate make <i>A. altissima</i> a noxious weed in many countries where it has been introduced (Feret, 1985; Shah, 1997). In the USA, it is declared invasive in Hawaii (University of Hawaii Botany Department, 1998) and several southern states, and monitored in 13 other states (Miller et al., 2003). However, the Invaders Database System (Rice, 2002) reports that it is not noxious in the five northwest states and that it is not listed on the US federal noxious weed list. In Australia, <i>A. altissima</i> is listed as a noxious weed with levels of control varying among states (Anon., 1998). In Victoria, it is designated a regionally controlled weed under the Catchment and Land Protection Act 1994 (CaLP Act), a category W2/W3 weed under the Noxious Weeds Act 1993 (NWA) in New South Wales, in Western Australia it is prohibited until assessed, and it is a declared weed in other states and territories (Anon., 1998). In South Africa it is a category 3 weed according to the Conservation of Agricultural Resources Act 1983, so landowners are responsible for curtailing its spread and it is prohibited within the vicinity of watercourses."
	Ding, J., Wu, Y., Zheng, H., Fu, W., Reardon, R., & Liu, M. (2006). Assessing potential biological control of the invasive plant, tree-of heaven, <i>Ailanthus altissima</i> . <i>Biocontrol Science and Technology</i> , 16(6), 547-566	"Tree-of-heaven, <i>Ailanthus altissima</i> , is a deciduous tree indigenous to China and introduced into North America and Europe. It is a serious threat to ecosystems in introduced areas, as the plant is very competitive, and also contains allelopathic chemicals that may inhibit growth of surrounding native plants. In addition, the plant contains secondary chemicals that make it unpalatable to some insects. In this paper we assess potential biological control of this plant by reviewing literature associated with natural enemies of the plant from both its native and introduced regions in the world."

401	Produces spines, thorns or burrs	n
	Source(s)	Notes
	Santapau, H. 1966. <i>Common Trees</i> . National Book Trust, New Delhi, India	[No evidence] "A fast-growing deciduous tree up to 25 m. high, with a whitish bark. Leaves pinnate, 25—75 cm. long; leaflets alternate or sub opposite, 6-12 pairs, variable in shape, irregularly toothed at the margins and unequal-sided at the base."

402	Allelopathic	
	Source(s)	Notes

Qsn #	Question	Answer
	<p>Bostan, C., Borlea, F., Mihoc, C., & Selesan, M. (2014). <i>Ailanthus altissima</i> species invasion on biodiversity caused by potential allelopathy. <i>Research Journal of Agricultural Science</i>, 46(1), 95-103</p>	<p>[Related species allelopathic] "This paper aims to highlight the direct and indirect allelopathic influences showed by species <i>Ailanthus altissima</i>, through morphological and biological investigations. An important factor in the success of <i>Ailanthus</i> species invasion is the release of allelopathic compounds that influence negatively the vegetation in habitats where it installs. Recent studies show that interactions between invasive species and native species based on allelopathy may be one of the mechanisms underlying the remarkable success of some of the most aggressive invasive plants. <i>Ailanthus</i> contains toxic allelopathic compounds to many woody and herbaceous plants, toxic compound called ailantona, identified and classified as the most effective phytotoxic component. Several studies have shown that extracts of <i>Ailanthus</i> inhibit germination and growth of several species of angiosperm and gymnosperm plants, in biotests and greenhouse experiments. Our studies included a laboratory experience in which we studied the germination of seeds treated with watery extracts obtained from <i>Ailanthus</i> species and behaviour of species under the influence of the same extracts treated containing allelopathic compounds. Based on research conducted in the laboratory, by studying the degree of externalization of the main morphological features, it was revealed that seed germination of <i>Sinapis alba</i> and <i>Brassica napus</i> treated extracts was 0%, compared with the control <i>Sinapis alba</i> 83% and <i>Brassica napus</i> 96,66%. Treated seeds were inhibited regardless of the concentration of watery extracts they have been treated with (Variant 1 - Standard substances; Variant 2 - obtained by dilution 1:1; Variant 3 - obtained by dilution 1:2.). The average length of hypocotyl and <i>Brassica napus</i> roots for the control was 3.36 cm and respectively 3.25 cm, and the hypocotyl of <i>Sinapis alba</i> root was 2.95 cm and 3.2 cm. Experiments carried out demonstrate that the allelopathic potential of the species is very powerful and can influence negatively the neighbouring species. Given the current climate, the species <i>Ailanthus altissima</i> is favoured over native species. This fact combined with the allelopathic effects demonstrated also by experiments carried out in the current paper may lead to future expansion of this species with major impacts on biodiversity."</p>
	<p>Fujii, Y., Parvez, S. S., Parvez, M., Ohmae, Y., & Iida, O. 2003. Screening of 239 medicinal plant species for allelopathic activity using the sandwich method. <i>Weed Biology and Management</i>, 3(4): 233-241</p>	<p>Possibly. <i>Ailanthus excelsa</i> may have allelopathic chemicals in leaves</p>

403	Parasitic	n
	Source(s)	Notes
	<p>National Research Council (U.S.). Advisory Committee on Technology Innovation. 1983. Firewood crops: shrub and tree species for energy production : volume 2. National Academy Press, Washington, D.C.</p>	<p>"Ardu is a large tree (18-24 m) with rough, grayish brown bark. The deciduous leaves are variable in shape with coarsely and irregularly toothed leaflets." [Simaroubaceae. No evidence]</p>

404	Unpalatable to grazing animals	n
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Qsn #	Question	Answer
	Source(s)	Notes
	Venkatesh, C. S. 1976. Our Tree Neighbours. National Council for Educational Research & Training, New Delhi, India	"It is a fast-growing tree which, in the drier areas, is lopped for fodder."
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"It is not readily browsed by sheep or goats, so providing a good species for use in landscape, shelterbelt and farm forestry."
	National Research Council (U.S.). Advisory Committee on Technology Innovation. 1983. Firewood crops: shrub and tree species for energy production : volume 2. National Academy Press, Washington, D.C.	"It provides valuable fodder and shade and makes good shelterbelts." ... "Twice a year this tree produces highly palatable and nutritive fodder. The leaves are commonly sold in the vegetable markets of Rajasthan, India, especially for nourishing stallfed goats. The leaves are also dried, ground, and added to concentrate mixtures for livestock feed, notably as a protein supplement to poor-quality roughages."

405	Toxic to animals	n
	Source(s)	Notes
	National Research Council (U.S.). Advisory Committee on Technology Innovation. 1983. Firewood crops: shrub and tree species for energy production : volume 2. National Academy Press, Washington, D.C.	"It provides valuable fodder and shade and makes good shelterbelts." ... "Twice a year this tree produces highly palatable and nutritive fodder. The leaves are commonly sold in the vegetable markets of Rajasthan, India, especially for nourishing stallfed goats. The leaves are also dried, ground, and added to concentrate mixtures for livestock feed, notably as a protein supplement to poor-quality roughages."
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	[Medicinal uses. No evidence of acute toxicity] "Veterinary medicine, bark paste given to ailing animals; powdered stem bark fed to livestock for strength and vigour; bark extract given in loss of appetite; stem bark paste applied for skin diseases; crushed bark given to cattle to dissolve iron pieces eaten by them; for body lice, leaves crushed and applied to the body of animal; leaves warmed and bandaged on swellings of the animals; leaves decoction for fever and tympany.)"

406	Host for recognized pests and pathogens	
	Source(s)	Notes
	Sheikh, M. I. 1993. Trees of Pakistan. Pictorial Printing (Pvt) Ltd., Islamabad	"It is moderately disease and insect free, subject to defoliation by caterpillars and attack by white ants (termites)."
	Orwa C., Mutua, A., Kindt R., Jamnadass, R, & Anthony, S. 2009 Agroforestry Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org . [Accessed 23 Aug 2016]	"PESTS AND DISEASES <i>Attveva fabriciella</i> , <i>A. niveigutta</i> and <i>Eligma narsissus</i> defoliate the tree. Borers include <i>Batocera rufomaculata</i> . Among the fungi are leaf spot fungi (<i>Cercospora glandulosa</i>) and <i>Alternaria</i> spp."

407	Causes allergies or is otherwise toxic to humans	
	Source(s)	Notes

Qsn #	Question	Answer
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	[Medicinal & edible uses] "(Used in Ayurveda and Sidha. Leaves antispasmodic, cardiac depressant, astringent; pounded leaves tied on wounds; leaf infusion a tonic during pregnancy; leaf juice mixed with coconut milk to cure rheumatism. Bark decoction used internally for ringworm and wounds, also applied for wounds; bark paste given in dysentery; bark febrifuge, a bitter tonic; bark paste mixed with water given for abortion; fresh stem bark chewed and the juice swallowed for immediate relief from stomach pain; leaves and bark applied on skin diseases; bark and leaf infusion given as a postpartum remedy. Pasted root used for driving out field rats from the paddy fields and food stores."
	Singh, A. B., & Shahi, S. (2008). Aeroallergens in Clinical Practice of Allergy in India - ARIA Asia Pacific Work-shop Report. Asian Pacific Journal of Allergy and Immunology, 26(4), 245-256	[Pollen may be allergenic to susceptible individuals] "Table 1 Common allergenic plants of different seasons in India" [Includes <i>Ailanthus excelsa</i>] ... "Shivpuri and Parkash ²⁰ observed <i>Prosopis juliflora</i> as a major cause of pollinosis with 12% patients showing a positive skin reaction. Later, important pollen allergens were identified for Delhi by Shivpuri and his colleagues. ²¹ They were: <i>Ageratum</i> , <i>Ailanthus</i> ,..." ... "At Chandigarh, skin sensitivity was highest against <i>Rumex acetosa</i> and <i>Ailanthus excelsa</i> (17.6%),..."

408	Creates a fire hazard in natural ecosystems	
	Source(s)	Notes
	National Research Council (U.S.). Advisory Committee on Technology Innovation. 1983. Firewood crops: shrub and tree species for energy production : volume 2. National Academy Press, Washington, D.C.	[May contribute to fuel load, but no evidence of increased fire risk in native habitats] "Distribution This species is native to central, southern, and western India and is often cultivated in various parts of that country. Use as Firewood The wood is fairly light (specific gravity 0.45) and therefore is not an ideal fuel; however, as already noted, it is used as fire wood."

409	Is a shade tolerant plant at some stage of its life cycle	
	Source(s)	Notes
	Sheikh, M. I. 1993. Trees of Pakistan. Pictorial Printing (Pvt) Ltd., Islamabad	"A moderately intolerant tree that will stand some shade."
	Orwa C., Mutua, A., Kindt R., Jamnadass, R, & Anthony, S. 2009 Agroforestry Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org . [Accessed 23 Aug 2016]	"A. excelsa has a strong light requirements. The recommended spacing is 6x 6m for Agroforestry and 3 x 3 m in block plantations. The seedlings are susceptible to frost and are easily suppressed by weeds as a result of shading."
	ENVIS Centre on Forestry. 2016. Common Trees of India. http://www.frienvic.nic.in/KidsCentre/Common-Trees-of-India_1499.aspx . [Accessed 24 Aug 2016]	"A. excelsa is a strong light demander. The seedlings get easily suppressed by weeds as a result of shading."

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	Notes
	Sheikh, M. I. 1993. Trees of Pakistan. Pictorial Printing (Pvt) Ltd., Islamabad	"It grows best on well drained soils. It does not do well on heavy soils or water logged sites."

Qsn #	Question	Answer
	Jadalla, J. B., Khatir, A. A., Dawelbait, E. M. & Ali, S. A. M. 2014. Relationship between some Growth Parameters and Browse Biomass Produced from <i>Ailanthus excelsa</i> Tree in Kordofan, Sudan. Greener Journal of Agronomy, Forestry and Horticulture 2(1): 008-013	"Similar to Anon,(1986),Vogot (1996), Elamin (1991) Wong and Sharudin (1986), the tree could grow well in different locations though Vogot (1996) reported that the tree could grow in a wide variety of soils, but thrived best in porous sandy loams that was similar to soil type in Dilling."
	Orwa C., Mutua, A., Kindt R., Jamnadass, R, & Anthony, S. 2009 Agroforestry Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org . [Accessed 23 Aug 2016]	"Soil type: Grows in a wide variety of soils, but thrives best in porous sandy loams. It avoids clayey soils with poor drainage and waterlogged areas. Its growth is poor on shallow dry soils."

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	National Research Council (U.S.). Advisory Committee on Technology Innovation. 1983. Firewood crops: shrub and tree species for energy production : volume 2. National Academy Press, Washington, D.C.	"a large tree (18-24 m) with rough, grayish brown bark. The deciduous leaves are variable in shape with coarsely and irregularly toothed leaflets."

412	Forms dense thickets	n
	Source(s)	Notes
	Orwa C., Mutua, A., Kindt R., Jamnadass, R, & Anthony, S. 2009 Agroforestry Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org . [Accessed 24 Aug 2016]	[No evidence] " <i>A. excelsa</i> grows well in semi-arid and semi-moist regions and has been found suitable for planting in dry areas with annual rainfall of about 400 mm. It is commonly found in mixed deciduous forests and some sal forests, but is rare in moist areas with high monsoons. Plant associations include <i>Acacia catechu</i> , <i>A. leucophloea</i> and <i>Azadirachta indica</i> . It is a relatively salt-tolerant species."
	CABI, 2016. <i>Ailanthus altissima</i> . In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	[No evidence] " <i>A. excelsa</i> is a large deciduous tree (to about 24 m tall) which occurs throughout the tropical and subtropical regions of the Indian peninsula, especially in drier areas."
	Venkatesh, C. S. 1976. Our Tree Neighbours. National Council for Educational Research & Training, New Delhi, India	[No evidence] "occurs wild in South India but is often widely planted in different parts of the country."
	Sheikh, M. I. 1993. Trees of Pakistan. Pictorial Printing (Pvt) Ltd., Islamabad	[No evidence] "The tree is native to India. In Pakistan it is occasionally planted in Sindh."

501	Aquatic	n
	Source(s)	Notes
	Orwa C., Mutua, A., Kindt R., Jamnadass, R, & Anthony, S. 2009 Agroforestry Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org . [Accessed 24 Aug 2016]	[Terrestrial] " <i>A. excelsa</i> grows well in semi-arid and semi-moist regions and has been found suitable for planting in dry areas with annual rainfall of about 400 mm. It is commonly found in mixed deciduous forests and some sal forests, but is rare in moist areas with high monsoons. Plant associations include <i>Acacia catechu</i> , <i>A. leucophloea</i> and <i>Azadirachta indica</i> . It is a relatively salt-tolerant species."

502	Grass	n
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Qsn #	Question	Answer
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 24 Aug 2016]	Family: Simaroubaceae
503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 24 Aug 2016]	Family: Simaroubaceae
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"A. excelsa is a large deciduous tree (to about 24 m tall) which occurs throughout the tropical and subtropical regions of the Indian peninsula"
601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	Ravindranath, N. H., Bhat, D. M., & Swamy, V. S.. 2004. Nursery Manual for Forest Tree Species. Universities Press, Hyderguda, India	[Some reproductive failure, but not substantial] "The natural reproduction of this tree is poor. probably due to the small size of the seeds and the sensitivity of seedlings to heavy weed growth. However. germination takes place early in the rainy season after the seeds fall to the ground. Natural regeneration through root suckers and coppice is also adequate. provided the trees are healthy."
602	Produces viable seed	y
	Source(s)	Notes
	Orwa C., Mutua, A., Kindt R., Jamnadass, R., & Anthony, S. 2009 Agroforestry Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org . [Accessed 24 Aug 2016]	"Fruit a 1-seeded samara, lance shaped, flat, pointed at ends, 5 cm long, 1 cm wide, copper red, strongly veined, twisted at the base." ... "Seeds are usually picked before maturity since fully mature fruits are liable to lose most of their seeds through wind dispersal as soon as attempts are made to collect them. Seed storage behaviour is probably orthodox; viability is maintained for 1 year in open storage. There are about 9500 seeds/kg."
	National Research Council (U.S.). Advisory Committee on Technology Innovation. 1983. Firewood crops: shrub and tree species for energy production : volume 2. National Academy Press, Washington, D.C.	"The plant is usually propagated by seed; however, it can be raised by shoot as well as by root cuttings."
603	Hybridizes naturally	

Qsn #	Question	Answer
	Source(s)	Notes
	WRA Specialist. 2016. Personal Communication	Unknown. No evidence of hybridization found

604	Self-compatible or apomictic	
	Source(s)	Notes
	Orwa C., Mutua, A., Kindt R., Jamnadass, R., & Anthony, S. 2009 Agroforestry Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org . [Accessed 24 Aug 2016]	[Unknown] "Male, female and bisexual flowers are intermingled on the same tree."

605	Requires specialist pollinators	n
	Source(s)	Notes
	Orwa C., Mutua, A., Kindt R., Jamnadass, R., & Anthony, S. 2009 Agroforestry Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org . [Accessed 24 Aug 2016]	"Flower clusters droop at leaf bases, shorter than leaves, much branched; flowers many, mostly male and female on different trees, short stalked, greenish-yellow; calyx 5 lobed; 5 narrow petals spreading 6 mm across; stamens 10; on other flowers, 2-5 separate pistils, each with elliptical ovary, 1 ovule, and slender style."
	Reddi, C. S., & Reddi, N. S. (1985). Relation of pollen release to pollen concentrations in air. <i>Grana</i> , 24(2), 109-113	"The activity of honey bees (<i>Apis ceraria indica</i>) was very brisk between 16.00 and 19.00 and between 07.00 and 10.00. These are the periods during which higher levels of pollen concentration are recorded. Certainly, the bee activity has had a major role in the dislodgement of pollen."

606	Reproduction by vegetative fragmentation	y
	Source(s)	Notes
	Ravindranath, N. H., Bhat, D. M., & Swamy, V. S.. 2004. <i>Nursery Manual for Forest Tree Species</i> . Universities Press, Hyderguda, India	"Natural regeneration through root suckers and coppice is also adequate. provided the trees are healthy."

607	Minimum generative time (years)	
	Source(s)	Notes
	National Research Council (U.S.). Advisory Committee on Technology Innovation. 1983. <i>Firewood crops: shrub and tree species for energy production : volume 2</i> . National Academy Press, Washington, D.C.	" <i>Ailanthus excelsa</i> is a fast-growing tree that regenerates well by coppicing." ...

Qsn #	Question	Answer
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	n
	Source(s)	Notes
	Orwa C., Mutua, A., Kindt R., Jamnadass, R., & Anthony, S. 2009 Agroforestry Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org . [Accessed 24 Aug 2016]	[No evidence. No means of external attachment] "Fruit a 1-seeded samara, lance shaped, flat, pointed at ends, 5 cm long, 1 cm wide, copper red, strongly veined, twisted at the base" ... "The seeds are very light and are dispersed far and wide by the wind."

702	Propagules dispersed intentionally by people	y
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 24 Aug 2016]	"Cultivated: Asia-Tropical Indian Subcontinent: India Indo-China: Thailand Malesia: Indonesia"
	rarepalmseeds.com. 2016. <i>Ailanthus excelsa</i> . http://www.rarepalmseeds.com/pix/AilExc.shtml . [Accessed 24 Aug 2016]	Seeds sold online

703	Propagules likely to disperse as a produce contaminant	n
	Source(s)	Notes
	Orwa C., Mutua, A., Kindt R., Jamnadass, R., & Anthony, S. 2009 Agroforestry Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org . [Accessed 24 Aug 2016]	[Unlikely. Relatively large fruit (samara) adapted for wind dispersal] "Fruit a 1-seeded samara, lance shaped, flat, pointed at ends, 5 cm long, 1 cm wide, copper red, strongly veined, twisted at the base" ... "The seeds are very light and are dispersed far and wide by the wind."

704	Propagules adapted to wind dispersal	y
	Source(s)	Notes
	Santapau, H. 1966. Common Trees. National Book Trust, New Delhi, India	"Fruit is a flat, papery pod or samara, 4–6 cm. long, 1 – 1.5 cm. broad, lance-shaped, acute at both ends; seed one."
	Venkatesh, C. S. 1976. Our Tree Neighbours. National Council for Educational Research & Training, New Delhi, India	"The fruit is a small, flat and winged one as in Sissoo with one seed."

Qsn #	Question	Answer
705	Propagules water dispersed	y
	Source(s)	Notes
	Planchuelo, G., Catalán, P., & Delgado, J. A. (2016). Gone with the wind and the stream: Dispersal in the invasive species <i>Ailanthus altissima</i> . <i>Acta Oecologica</i> , 73, 31-37	[Related species, with similar samara morphology, able to be dispersed by water] 'In conclusion, our results suggest that primary wind dispersal and secondary water dispersal are usually positively correlated in <i>A. altissima</i> since most morphological characteristics of samaras affect both dispersal modes in the same way. Samaras with low mass and a large side perimeter had larger dispersal potentials both by wind and bywater.'
706	Propagules bird dispersed	n
	Source(s)	Notes
	Orwa C., Mutua, A., Kindt R., Jamnadass, R., & Anthony, S. 2009 Agroforestry Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org . [Accessed 24 Aug 2016]	"Fruit a 1-seeded samara, lance shaped, flat, pointed at ends, 5 cm long, 1 cm wide, copper red, strongly veined, twisted at the base" ... "The fruits ripen just before the onset of the monsoon. The seeds are very light and are dispersed far and wide by the wind."
707	Propagules dispersed by other animals (externally)	n
	Source(s)	Notes
	Orwa C., Mutua, A., Kindt R., Jamnadass, R., & Anthony, S. 2009 Agroforestry Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org . [Accessed 24 Aug 2016]	"Fruit a 1-seeded samara, lance shaped, flat, pointed at ends, 5 cm long, 1 cm wide, copper red, strongly veined, twisted at the base" ... "The fruits ripen just before the onset of the monsoon. The seeds are very light and are dispersed far and wide by the wind."
708	Propagules survive passage through the gut	n
	Source(s)	Notes
	Orwa C., Mutua, A., Kindt R., Jamnadass, R., & Anthony, S. 2009 Agroforestry Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org . [Accessed 24 Aug 2016]	"Fruit a 1-seeded samara, lance shaped, flat, pointed at ends, 5 cm long, 1 cm wide, copper red, strongly veined, twisted at the base" ... "The fruits ripen just before the onset of the monsoon. The seeds are very light and are dispersed far and wide by the wind."
801	Prolific seed production (>1000/m²)	
	Source(s)	Notes
	Orwa C., Mutua, A., Kindt R., Jamnadass, R., & Anthony, S. 2009 Agroforestry Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org . [Accessed 24 Aug 2016]	"Seeds are usually picked before maturity since fully mature fruits are liable to lose most of their seeds through wind dispersal as soon as attempts are made to collect them. Seed storage behaviour is probably orthodox; viability is maintained for 1 year in open storage. There are about 9500 seeds/kg."
802	Evidence that a persistent propagule bank is formed (>1 yr)	n

Qsn #	Question	Answer
	Source(s)	Notes
	Murali, K. S. (1997). Patterns of Seed Size, Germination and Seed Viability of Tropical Tree Species in Southern India1. <i>Biotropica</i> , 29(3), 271-279	"APPENDIX 1. The list of species describing the time of flowering, fruiting date, seed weight (g), seed viability and days to germination. * indicate the species having seed dormancy." [Ailanthus excels seeds are viable for 30 days. This publication does not indicate that it has seed dormancy]
	Orwa C., Mutua, A., Kindt R., Jamnadass, R., & Anthony, S. 2009 <i>Agroforestry Database: a tree reference and selection guide</i> version 4.0. http://www.worldagroforestry.org . [Accessed 23 Aug 2016]	"Seeds are usually picked before maturity since fully mature fruits are liable to lose most of their seeds through wind dispersal as soon as attempts are made to collect them. Seed storage behaviour is probably orthodox; viability is maintained for 1 year in open storage."

803	Well controlled by herbicides	y
	Source(s)	Notes
	DiTomaso, J. M., & Kyser, G. B. (2007). Control of <i>Ailanthus altissima</i> using stem herbicide application techniques. <i>Arboriculture and Urban Forestry</i> , 33(1), 55-63	[Methods to control <i>A. altissima</i> would likely be effective on <i>A. excelsa</i>] "Three herbicides were tested using four stem application techniques for control of both single trunks and clumps of tree-of-heaven [<i>Ailanthus altissima</i> (Miller) Swingle]. Imazapyr, triclopyr, and glyphosate were applied using cut stump, stump injection, and stem injection techniques. Imazapyr and triclopyr were also applied as a basal bark treatment. Treatments were compared against manual cutting and untreated controls. Untreated cut stems did not provide control of tree-of-heaven. Cut stump treatment with imazapyr and triclopyr (20% v/v in oil) resulted in more than 90% reduction in both vigor ratings and resprouting of single stems and clumps. In contrast, stump injection applications were ineffective with all herbicides. For stem injection treatments, undiluted imazapyr gave the best results (>95% canopy reduction), but glyphosate also provided excellent control (92% canopy reduction). Removing stems 4, 8, or 12 months after treatment did not impact the level of control with imazapic. Imazapic at half the standard rate also gave good control of multistemmed clumps. Basal bark treatments with imazapyr or triclopyr (20% v/v in oil) gave equally good results, providing nearly complete control. Triclopyr is less selective than imazapyr and thus offers a better option when desirable vegetation surrounds the stems. These results provide several effective options for the control of tree-of heaven in both urban and riparian sites."

804	Tolerates, or benefits from, mutilation, cultivation, or fire	y
	Source(s)	Notes
	National Research Council (U.S.). Advisory Committee on Technology Innovation. 1983. <i>Firewood crops: shrub and tree species for energy production : volume 2</i> . National Academy Press, Washington, D.C.	" <i>Ailanthus excelsa</i> is a fast-growing tree that regenerates well by coppicing."
	Ravindranath, N. H., Bhat, D. M., & Swamy, V. S.. 2004. <i>Nursery Manual for Forest Tree Species</i> . Universities Press, Hyderabad, India	"Natural regeneration through root suckers and coppice is also adequate. provided the trees are healthy."

Qsn #	Question	Answer
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	WRA Specialist. 2016. Personal Communication	Unknown

Summary of Risk Traits:

High Risk / Undesirable Traits

- Grows in tropical climates
- Naturalized in Sudan
- *Ailanthus altissima* has become invasive
- Pollen may be allergenic to susceptible individuals
- Tolerates many soil types
- Reproduces by seeds & vegetatively by suckers
- Seeds dispersed by wind, water & intentionally by people
- Able to coppice & resprout after cutting

Low Risk Traits

- Unarmed (no spines, thorns or burrs)
- Provides fodder for livestock
- Ornamental
- Light demanding species (may be relatively shade intolerant)
- Seeds may lose viability in <1 year
- Herbicides may provide effective control

Second Screening Results for Tree/tree-like shrubs

(A) Shade tolerant or known to form dense stands?> No. Not known to form dense stands. A light demanding tree, & possibly shade intolerant

(B) Bird or clearly wind-dispersed?> Dispersed by wind

(C) Life cycle <4 years? Unknown

Outcome = Evaluate Further