

**Family:** *Cupressaceae*

**Taxon:** *Juniperus virginiana*

**Synonym:** *Juniperus silicicola* (Small) L. H. Bailey  
*Sabina silicicola* Small

**Common Name:** coast juniper  
coastal red cedar  
eastern red cedar  
pencil cedar  
red juniper  
red cedar  
Virginia juniper

Questionnaire :	current 20090513	Assessor:	Assessor	Designation:	H(HPWRA)
Status:	Assessor Approved	Data Entry Person:	Assessor	WRA Score	7
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)		y
304	Environmental weed		n=0, y = 2*multiplier (see Appendix 2)		y
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		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		y
407	Causes allergies or is otherwise toxic to humans		y=1, n=0		y
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	
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	y
604	Self-compatible or apomictic	y=1, n=-1	n
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	n
705	Propagules water dispersed	y=1, n=-1	n
706	Propagules bird dispersed	y=1, n=-1	y
707	Propagules dispersed by other animals (externally)	y=1, n=-1	
708	Propagules survive passage through the gut	y=1, n=-1	y
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	n
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y=1, n=-1	n
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	y=-1, n=1	

Designation: H(HPWRA)

WRA Score 7

## Supporting Data:

101	1990. Burns, R.M./Honkala, B.H.. <i>Silvics of North America. Volume 1: Conifers. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.</i>	[Is the species highly domesticated? No. Assessment for wild type] "Natural variation in the species may have been modified by past commercial exploitation of natural stands and by the selection, propagation, and distribution of clones (47)."
102	2013. WRA Specialist. Personal Communication.	NA
103	2013. WRA Specialist. Personal Communication.	NA
201	2003. Anderson, M.D.. <i>Juniperus virginiana</i> . In: Fire Effects Information System, [Online]. USA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, <a href="http://www.fs.fed.us/database/feis/plants/tree/junvir/all.html">http://www.fs.fed.us/database/feis/plants/tree/junvir/all.html</a> [Accessed 19 July 20]	[Species suited to tropical or subtropical climate(s) 0-Low] "Eastern redcedar's range extends from Nova Scotia west to Ontario, south through the northern Great Plains to eastern Texas, and east to northern Florida and the Atlantic coast [29,71,79,82]."
202	2003. Anderson, M.D.. <i>Juniperus virginiana</i> . In: Fire Effects Information System, [Online]. USA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, <a href="http://www.fs.fed.us/database/feis/plants/tree/junvir/all.html">http://www.fs.fed.us/database/feis/plants/tree/junvir/all.html</a> [Accessed 19 July 20]	[Quality of climate match data? 2-High]
203	1990. Burns, R.M./Honkala, B.H.. <i>Silvics of North America. Volume 1: Conifers. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.</i>	[Broad climate suitability (environmental versatility)? Yes] "The wide natural distribution of eastern redcedar clearly indicates its ability to grow under varying and extreme climatic conditions. Average annual precipitation varies from about 380 mm (15 in) in the northwestern section to 1520 mm (60 in) in the southern parts of its range (40). Throughout the eastern redcedar range, average precipitation from April through September measures from 380 mm (15 in) to 760 mm (30 in). This suggests that summer precipitation may be more limiting to the species than average annual precipitation. Average annual snowfall ranges from a trace to more than 254 cm (100 in). Average annual temperatures vary from about 4° C (40° F) in the north to 20° C (68° F) in the southern part of the botanical range. Average annual maximum temperature ranges only from about 32° C (90° F) to 41° C (105° F), but average minimum temperature ranges from -43° C (-45° F) to -7° C (20° F). The growing season varies from about 120 to 250 days."
203	2005. CAB International. <i>Forestry Compendium. CAB International, Wallingford, UK</i>	[Broad climate suitability (environmental versatility)? Yes] "Eastern redcedar is found most often growing between altitude 30 and 1070 m (Lawson, 1990)." [Elevation range exceeds 1000 m]
204	2004. Richardson, D.M./Rejmánek, M.. <i>Conifers as invasive aliens: a global survey and predictive framework. Diversity and Distributions. 10: 321–331.</i>	[Native or naturalized in regions with tropical or subtropical climates? No] No evidence
204	2012. Randall, R.P.. <i>A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia</i>	[Native or naturalized in regions with tropical or subtropical climates? No] No evidence [Naturalized in locations with temperate climates, such as Western US and South Africa]
205	2005. CAB International. <i>Forestry Compendium. CAB International, Wallingford, UK</i>	[Does the species have a history of repeated introductions outside its natural range? Yes] "J. virginiana has not been widely planted outside its native range, except for arboreta, ornamental cultivars, or in trial plantations, particularly in eastern and central Europe - e.g. Belarus (Antonava, 1993), Ukraine (Reva and Reva, 1972), Republic of Georgia (Chavchanidze and Kharebava, 1991), on the shores of the Caspian Sea in Kazakhstan (Gurina, 1991), Tajikistan (Gabisova, 1984), Poland (Chylarecki, 1985) and Romania (Traci, 1975). It has been much planted in central and northern China (Jiang and Wang, 1997)."
301	2004. Richardson, D.M./Rejmánek, M.. <i>Conifers as invasive aliens: a global survey and predictive framework. Diversity and Distributions. 10: 321–331.</i>	[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." ... "J. virginiana (USA (Idaho); South Africa)"
302	1990. Burns, R.M./Honkala, B.H.. <i>Silvics of North America. Volume 1: Conifers. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.</i>	[Garden/amenity/disturbance weed? Successional] "Eastern redcedar is among the first to invade abandoned fields and areas cleared for pasture (25)." [An environmental weed in areas outside its natural range in the western US. See 3.04]
303	1990. Burns, R.M./Honkala, B.H.. <i>Silvics of North America. Volume 1: Conifers. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.</i>	[Agricultural/forestry/horticultural weed? Possibly] "Eastern redcedar invasion of pastures is a problem on areas converted from poor hardwood sites in the Ozarks and western areas of its range (9,31), and the species is likely to persist for a long time if left to grow (7)."

303	2002. Redcedar Task Force. A Strategy for Control and Utilization of Invasive Juniper Species in Oklahoma. Oklahoma Dept. of Agriculture, Food and Forestry, Oklahoma City, Oklahoma www.forestry.ok.gov/websites/forestry/images/rcstf200.pdf	[Agricultural/forestry/horticultural weed? Yes] "Livestock/Forage Production. A juniper tree with a six-foot crown diameter on a shallow prairie range site will reduce forage by about six pounds (Stritzke and Bidwell 1989). Junipers will reduce forage production if left untreated. For example, a range site with the potential to produce 4,000 pounds per acre of forage may become infested with 200 juniper trees per acre. If not managed, this area can increase to 470 trees per acre in ten years and would produce less than 2,200 pounds per acre of forage in the tenth year (Engle and Stritzke 1992). The invasion of junipers into native rangeland shades out forage for wildlife and livestock and reduces stocking rates and carrying capacity (Bidwell et al. 1996). Increase of juniper canopy in pastures will reduce pasture visibility and increase labor during livestock handling (Weir, personal communication)."
304	2004. Horncastle, V.J./Hellgren, E.C./Mayer, P.M./Engle, D.M./Leslie Jr, D. Differential consumption of eastern red cedar ( <i>Juniperus virginiana</i> ) by avian & mammalian guilds: implications for tree invasion. The American Midland Naturalist. 152(2): 255-267	[Environmental weed? Yes] "Invasion by eastern red cedar impacts ecological and human health by homogenizing diversity, reducing wildlife habitat quality, increasing fire risk, altering hydrology and nutrient cycling and producing highly allergenic pollen (Engle et al., 1996; Norris et al., 2001)."
304	2005. Horncastle, V.J./Hellgren, E. C./Mayer, P. M. et al.. Implications of Invasion by <i>Juniperus virginiana</i> on Small Mammals in the Southern Great Plains. U.S. Environmental Protection Agency Papers. Paper 67: .http://digitalcommons.unl.edu/usepapapers/6	[Environmental weed? Yes] "Changes in landscape cover in the Great Plains are resulting from the range expansion and invasion of eastern red cedar ( <i>Juniperus virginiana</i> ). By altering the landscape and local vegetation, red cedar is changing the structure and function of habitat for small mammals." ... "Examination of our data suggests that an increase in overstory cover from 0% to 30% red cedar can change a species-rich prairie community to a depauperate community dominated by 1 species, <i>Peromyscus leucopus</i> . Losses in species diversity and changes in mammal distribution paralleled those seen in avian communities invaded by eastern red cedar. Our results highlight ecological effects of invasion by eastern red cedar on diversity and function at multiple trophic levels."
304	2010. Pierce, A.M./Reich, P.B.. The effects of eastern red cedar ( <i>Juniperus virginiana</i> ) invasion and removal on a dry bluff prairie ecosystem. Biol Invasions. 12: 241-252.	[Environmental weed? Potentially Yes] "Eastern red cedar ( <i>Juniperus virginiana</i> ) establishment increased dramatically in the tallgrass prairie biome of North America during the last 30 years." ... "Three years after eastern red cedar was removed, micro environmental factors and species composition became similar to the tree-free grass-dominated plots, indicating a significant capacity for recovery following possible cedar control. In a broader context, this study sheds light on the pathways and mechanisms driving the impacts of this biological invasion on dry, steep, nutrient poor systems and illustrates the capability of these systems to recover once the invading species is removed."
304	2011. Reiskind, M.H./Zarrabi, A.A.. The Importance of an Invasive Tree Fruit as a Resource for Mosquito Larvae. Journal of Vector Ecology. 36(1): 197-203.	[Environmental weed? May contribute to mosquito range expansion] "Invasive plants are common and may provide resources through litter for container mosquito larvae. Invasive plant reproductive parts can make up a substantial part of litter but have mostly been ignored as a resource for mosquito larvae. We hypothesized that the reproductive fruits of the invasive eastern red cedar, <i>Juniperus virginiana</i> , provide high quality resources for the invasive, container mosquito <i>Aedes albopictus</i> at the western margin of its invasive range in North America. To test this hypothesis, we performed two laboratory experiments. The first examined the response of individual larvae of <i>Ae. albopictus</i> to different amounts of <i>J. virginiana</i> leaf (fresh and senesced) and <i>J. virginiana</i> fruit (ripe and unripe), as well as to a control leaf ( <i>Quercus virginiana</i> , live oak). The second experiment examined the response of different densities of <i>Ae. albopictus</i> larvae to each litter type. We found significant differences in response by individual larvae to different amounts of litter and litter types. We also found <i>J. virginiana</i> litter components could support positive population growth rates as a function of initial larval density where the control leaf could not. We conclude that invasive plants may provide high quality resources, and that the reproductive parts (fruits, flowers, cones) may be an important and overlooked component in provisioning larval habitats. Therefore, the expansion of <i>J. virginiana</i> into grassland areas may contribute to the expansion of <i>Ae. albopictus</i> westward in North America"
304	2013. Wingate, D.B./Adams, R./Gardner, M.. <i>Juniperus bermudiana</i> . In: IUCN 2013. IUCN Red List of Threatened Species. Version 2013.1. <www.iucnredlist.org>. Downloaded on 20 July 2013. www.iucnredlist.org	[Environmental weed? Yes. Threatens <i>J. bermudiana</i> ] "To add to the problems, <i>J. virginiana</i> and <i>J. virginiana</i> var. <i>silicicola</i> have been introduced to Bermuda from Florida, USA. Both taxa are resistant to the scale insects. They readily hybridize with <i>J. bermudiana</i> causing a depletion of the germplasm through hybridization and introgression (Adams and Wingate 2008) ."
305	2012. Randall, R.P.. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	[Congeneric weed? Yes] [Congeneric weed? Yes] Multiple species listed as naturalized and/or invasive

305	2013. Wingate, D.B./Adams, R./Gardner, M.. <i>Juniperus bermudiana</i> . In: IUCN 2013. IUCN Red List of Threatened Species. Version 2013.1. <www.iucnredlist.org>. Downloaded on 20 July 2013. www.iucnredlist.org	[Congeneric weed? Yes] "Perhaps the biggest planting is in St Helena and on Ascension Island where seed was introduced during the mid 19th century to establish timber tree plantations (Adams 2008). Ironically on these islands <i>J. bermudiana</i> is now becoming an invasive problem. <i>Juniperus virginiana</i> has also been introduced on St. Helena so there is the potential for hybridization (Adams 2008). "
401	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Produces spines, thorns or burrs? No] "A tree to 20 (37) m in height, and up to 100 (160) cm stem diameter. Very varied in habit. Crown on young trees is elongated ovate, with later branches horizontally arranged or nodding. Older trees have wide, fluted, buttressed boles (Alden, 1995). Bark Grey to red-brown, thin, fibrous, shreds easily. Foliage On young plants always needle-like, these occasionally present on lower branches of adult trees, 3-6 mm long, prickly acuminate, whitish above, opposite, and on stout shoots and young plants in whorls of 3. Scale-like leaves decussate, 1-2 mm long with a sharp point, usually with a small dorsal gland (Vidakovic, 1991; Adams, 1993)."
402	1990. Burns, R.M./Honkala, B.H.. <i>Silvics of North America</i> . Volume 1: Conifers. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Allelopathic? Possibly] "However, clusters of eastern redcedar established beneath hardwoods have survived longer than the competing hardwood trees, possibly due to an allelopathic effect, or the species may be a better competitor for water and nutrients (34)."
402	2003. Anderson, M.D.. <i>Juniperus virginiana</i> . In: Fire Effects Information System, [Online]. USA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, <a href="http://www.fs.fed.us/database/feis/plants/tree/junvir/all.html">http://www.fs.fed.us/database/feis/plants/tree/junvir/all.html</a> [Accessed 19 July 20	[Allelopathic? Possibly Yes] "Eastern redcedar may produce allelochemicals that affect establishment of at least some prairie species. In a Nebraska study, establishment of finger coreopsis ( <i>Coreopsis palmata</i> ) from seed collected beneath eastern redcedar trees was significantly lower (95% confidence interval) than establishment from seed collected adjacent to the trees (84% germination v. 0%) [116]."
403	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Parasitic? No] "A tree to 20 (37) m in height, and up to 100 (160) cm stem diameter." [Cupressaceae]
404	1990. Burns, R.M./Honkala, B.H.. <i>Silvics of North America</i> . Volume 1: Conifers. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Unpalatable to grazing animals? No, but not preferred] "Mice and rabbits may damage young eastern redcedar seedlings. Livestock generally avoid biting seedlings or trees but may trample the plants and their roots while grazing. During times of scarce food, deer will heavily browse eastern redcedar and destroy most reproduction (11,20)."
404	2003. Anderson, M.D.. <i>Juniperus virginiana</i> . In: Fire Effects Information System, [Online]. USA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, <a href="http://www.fs.fed.us/database/feis/plants/tree/junvir/all.html">http://www.fs.fed.us/database/feis/plants/tree/junvir/all.html</a> [Accessed 19 July 20	[Unpalatable to grazing animals? No] "...eastern redcedar roots are damaged by the hooves of grazing animals and browsing may severely limit seedling and sapling height growth [46,132]. Some authors note that increased stocking rates of cattle may decrease eastern redcedar invasion. Mice, rabbits, and deer may also damage seedlings [29,79]."
405	1990. Burns, R.M./Honkala, B.H.. <i>Silvics of North America</i> . Volume 1: Conifers. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Toxic to animals? No evidence] "Mice and rabbits may damage young eastern redcedar seedlings. Livestock generally avoid biting seedlings or trees but may trample the plants and their roots while grazing. During times of scarce food, deer will heavily browse eastern redcedar and destroy most reproduction (11,20)."
405	2003. Anderson, M.D.. <i>Juniperus virginiana</i> . In: Fire Effects Information System, [Online]. USA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, <a href="http://www.fs.fed.us/database/feis/plants/tree/junvir/all.html">http://www.fs.fed.us/database/feis/plants/tree/junvir/all.html</a> [Accessed 19 July 20	[Toxic to animals? No evidence] "Mice, rabbits, and deer may also damage seedlings [29,79]."
406	1990. Burns, R.M./Honkala, B.H.. <i>Silvics of North America</i> . Volume 1: Conifers. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Host for recognized pests and pathogens? Possibly] "Eastern redcedar, especially when weakened by stress or insects, is very susceptible to damage by the root rot fungus, <i>Heterobasidion annosum</i> . This disease is thought to cause the greatest damage over much of its range. Cubical rot fungi ( <i>Fomes subroseus</i> and <i>Daedalea juniperina</i> ) and juniper pocket rot fungus ( <i>Pyrofungus demidoffii</i> ) enter eastern redcedars through dead branch stubs and attack the heartwood. Several other minor heart-rot fungi infect eastern redcedar (21). The major stem and foliage diseases of eastern redcedar are fungi known as cedar rusts in the genus <i>Gymnosporangium</i> . The most commonly known and widely spread species is cedar apple rust ( <i>G. juniperi-virginianae</i> ), which attacks trees in all stages of development. Because it is an alternate host to this disease, the presence of redcedar is a problem to apple growers. Other common species are <i>G. clavipes</i> , <i>G. globosum</i> , <i>G. effusum</i> , and <i>G. nidus-avis</i> . The latter fungus is widely distributed and produces witches' brooms (21). Important foliage diseases include <i>Phomopsis</i> blight ( <i>Phomopsis juniperovora</i> ) and <i>Cercospora sequoiae</i> blight, which also attack seedlings. <i>Phomopsis</i> blight has been difficult to control in nurseries, but newer developments show promise (12,32). Both blights can cause major losses to eastern redcedar in the field, but <i>Phomopsis</i> blight is not a serious problem after seedlings reach age 4."



406	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Host for recognized pests and pathogens? Yes] "J. virginiana is an alternate host to the cedar apple rust, <i>Gymnosporangium juniperi virginianae</i> ; thus the presence of eastern red cedar trees may be a problem for apple growers (Lawson, 1990)."
407	2002. Redcedar Task Force. A Strategy for Control and Utilization of Invasive Juniper Species in Oklahoma. Oklahoma Dept. of Agriculture, Food and Forestry, Oklahoma City, Oklahoma www.forestry.ok.gov/websites/forestry/images/rcstf.pdf	[Causes allergies or is otherwise toxic to humans? Yes]"Redcedar and other junipers can affect human health and air quality negatively in two ways: one, if no control is practiced, the increasing number of junipers creates additional pollen which causes allergic reactions and asthma type health problems in humans; and two, when junipers are burned, the resulting fire will have pollutants as by-products that can negatively affect human health."
408	2002. Redcedar Task Force. A Strategy for Control and Utilization of Invasive Juniper Species in Oklahoma. Oklahoma Dept. of Agriculture, Food and Forestry, Oklahoma City, Oklahoma www.forestry.ok.gov/websites/forestry/images/rcstf.pdf	[Creates a fire hazard in natural ecosystems? Yes] "Volatile juniper trees increase the complexity and cost of wildfire control and significantly increase the danger to firefighters." ... "With the increase in juniper infestation within the wildland/urban interface, the potential for catastrophic wildfire is greatly increased. The costs of wildfire suppression to fire departments and the state are immense. The safety risk to firefighters is increased when redcedars and other junipers are involved."
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? Possibly] "Eastern redcedar has been classified as intolerant to very intolerant of shade (11,30), but trees that have lived for decades beneath a full canopy of hardwoods or pines on medium- to low-quality sites have been observed."
410	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.	[Tolerates a wide range of soil conditions? Yes] "Eastern redcedar grows on a wide variety of soils, ranging from dry rock outcrops to wet swampy land (15). The most common soils fall within the soil orders Mollisols and Ultisols. No attempt will be made here to describe all of them. Like most species, eastern redcedar grows best on deep, moist, well-drained alluvial sites, where its height may reach 17 to 18 m (55 to 60 ft) in 50 years."
411	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Climbing or smothering growth habit? No] "A tree to 20 (37) m in height, and up to 100 (160) cm stem diameter."
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? Possibly Yes] "Eastern redcedar is important to wildlife. As an evergreen, it provides good nesting and roosting cover for many birds (18,39). Dense thickets provide good escape cover for deer, and the abundant foliage, although low in quality, provides emergency food for them during times of stress."
412	2003. Anderson, M.D.. Juniperus virginiana. In: Fire Effects Information System, [Online]. USA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, <a href="http://www.fs.fed.us/database/feis/plants/tree/junvir/all.html">http://www.fs.fed.us/database/feis/plants/tree/junvir/all.html</a> [Accessed 19 July 20	[Forms dense thickets? Yes] "Dense thickets of eastern redcedar provide good escape and hiding cover for deer and small mammals [17,63,79]. "
501	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.	[Aquatic? No] "Eastern redcedar grows on ridgetops, varying slopes, and flat land and is frequently found on dry, exposed sites and abandoned fields."
502	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Grass? No] Cupressaceae
503	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Nitrogen fixing woody plant? No] Cupressaceae
504	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)? No] "A tree to 20 (37) m in height, and up to 100 (160) cm stem diameter."
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] "Eastern redcedar ( <i>Juniperus virginiana</i> ), also called red juniper or savin, is a common coniferous species growing on a variety of sites throughout the eastern half of the United States."
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] "Mature eastern redcedar trees produce some seeds nearly every year, but good crops occur only every 2 or 3 years."
603	2003. Anderson, M.D.. Juniperus virginiana. In: Fire Effects Information System, [Online]. USA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, <a href="http://www.fs.fed.us/database/feis/plants/tree/junvir/all.html">http://www.fs.fed.us/database/feis/plants/tree/junvir/all.html</a> [Accessed 19 July 20	[Hybridizes naturally? Yes] "Hybrid swarms of eastern redcedar and creeping juniper ( <i>J. horizontalis</i> ) occur on the coast of Maine and in the Driftless Area according to morphological, terpene, electrophoretic, and cytological data analysis [44,96,106]. Based on morphological variation, hybrid swarms of eastern redcedar and Rocky Mountain juniper ( <i>J. scopulorum</i> ) occur in the Texas panhandle and the northern Great Plains [45,60,61,65]. Also based on studies of morphological characteristics, hybrid swarms of eastern redcedar and Ashe juniper ( <i>J. ashei</i> ) reportedly occur in Oklahoma, Texas, and Missouri [59,62,65]."

604	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.	[Self-compatible or apomictic? No] "Eastern redcedar is a dioecious species, and trees probably reach sexual maturity at about 10 years."
605	2013. Nature's Notebook. <i>Juniperus virginiana</i> . USA National Phenology Network, <a href="https://www.usanpn.org/nn/Juniperus_virginiana">https://www.usanpn.org/nn/Juniperus_virginiana</a> [Accessed 23 July 2013]	[Requires specialist pollinators? No] "This species is wind-pollinated."
606	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.	[Reproduction by vegetative fragmentation? No] "Vegetative Reproduction- Eastern redcedar does not reproduce naturally by sprouting or suckering, but the species may be propagated by grafting, by air-layering, or from cuttings (6,15,33,44)."
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)? 10+] "Eastern redcedar is a dioecious species, and trees probably reach sexual maturity at about 10 years."
701	2003. Anderson, M.D.. <i>Juniperus virginiana</i> . In: Fire Effects Information System, [Online]. USA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, <a href="http://www.fs.fed.us/database/feis/plants/tree/junvir/all.html">http://www.fs.fed.us/database/feis/plants/tree/junvir/all.html</a> [Accessed 19 July 20]	[Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)? No] "Eastern redcedar seeds are borne in small, fleshy, berrylike cones [8,29], with 1 to 4 seeds per cone [44,68,79,124]. Eastern redcedar cones or fruits range from 0.12 to 0.33 inch (3 8 mm) long, with most 0.14 to 0.22 inch (3.5 5.5 mm) long [44,63,68,129]. Within this range, <i>J.v. var. silicicola</i> generally has smaller cone sizes than <i>J.v. var. virginiana</i> [36]. Seeds are 0.08-0.16 inch (2-4 mm) long [63,129]." [No evidence, and no means of external attachment]
702	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Propagules dispersed intentionally by people? Yes] " <i>J. virginiana</i> has not been widely planted outside its native range..." ... "It is much grown in the USA for Christmas tree production, where it is among the top five species used (Lawson, 1985). Many varieties and cultivars of eastern redcedar are used as ornamental trees (Hall et al., 1979; Smith, 1977)."
703	2005. Horncastle, V.J./Hellgren, E. C./Mayer, P. M. et al.. Implications of Invasion by <i>Juniperus virginiana</i> on Small Mammals in the Southern Great Plains. U.S. Environmental Protection Agency Papers. Paper 67: <a href="http://digitalcommons.unl.edu/usepapapers/6">http://digitalcommons.unl.edu/usepapapers/6</a>	[Propagules likely to disperse as a produce contaminant? No] "Both birds and mammals likely contribute to the spread of eastern red cedar but at different scales." [No evidence]
704	1993. Gilman, E.F./Watson, D.G.. <i>Juniperus virginiana</i> - Eastern Redcedar. Fact Sheet ST-327. University of Florida IFAS Extension, Gainesville, FL <a href="http://hort.ifas.ufl.edu/database/documents/pdf/tree_fact_sheets/junvira.pdf">hort.ifas.ufl.edu/database/documents/pdf/tree_fact_sheets/junvira.pdf</a>	[Propagules adapted to wind dispersal? No] "The fruit is a blue berry on female trees and is ornamental when produced in quantity. Birds devour the fruit and 'plant' it along farm fences and in old abandoned fields."
705	2004. Horncastle, V.J./Hellgren, E.C./Mayer, P.M./Engle, D.M./Leslie Jr, D.. Differential consumption of eastern red cedar ( <i>Juniperus virginiana</i> ) by avian & mammalian guilds: implications for tree invasion. The American Midland Naturalist. 152(2): 255-267	[Propagules water dispersed? No] "Both birds and mammals likely contribute to the spread of eastern red cedar but at different scales. Limiting invasion of eastern red cedar in forests may require early detection and selective removal of pioneer seedlings in cross timbers and other habitats that attract a high diversity or density of frugivores."
706	1984. Holthuijzen, A.M.A./Sharik, T.L.. Seed Longevity and Mechanisms of Regeneration of Eastern Red Cedar ( <i>Juniperus virginiana</i> L.). Bulletin of the Torrey Botanical Club. 111(2): 153-158.	[Propagules bird dispersed? Yes] "Red cedar seeds are endogenously dispersed, i.e., the seeds pass through the digestive tract of the disperser. In birds, which are the principal dispersers of red cedar, seed passage may take tens of minutes to hours, depending on the species involved, and the seeds remain undamaged (Holthuijzen 1983). The mobility of the avian dispersers is likely to ensure that the seeds are transported away from the seed source, thus providing efficient dispersal of red cedar. Based on estimates of the total fruit crop and propagule shadow around four fruiting red cedar trees, 68% of red cedar fruit crops was probably deposited beyond the immediate surroundings (>15 m) of these fruit sources (Holthuijzen 1983)."
706	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 bird dispersed? Yes] "Fruits are eaten by birds and other animals, which are important vectors for seed dissemination (20). Seeds that pass through animal digestive tracts and those that remain on the ground beneath the trees may germinate the first or second spring." ... "Seedlings are commonly established in rather open hardwood stands, adjacent to older seedbearing eastern redcedar trees, as a result of birds eating the fruit and subsequent deposition of seeds (34)."

706	2004. Horncastle, V.J./Hellgren, E.C./Mayer, P.M./Engle, D.M./Leslie Jr, D.. Differential consumption of eastern red cedar ( <i>Juniperus virginiana</i> ) by avian & mammalian guilds: implications for tree invasion. <i>The American Midland Naturalist</i> . 152(2): 255-267	[Propagules bird dispersed? Yes] "Junipers ( <i>Juniperus</i> spp.), in general, are adapted for dispersal by frugivorous vertebrates, especially birds and mammals by virtue of their fleshy, fruit-like cones (Chambers et al., 1999). At least 71 species forage on eastern red cedar (Van Dersal, 1938) and seed dispersal apparently depends heavily upon birds and small mammals (Phillips, 1910; Livingston, 1972)."
707	2010. Adams, R.P./Thornburg, D.. Seed dispersal in <i>Juniperus</i> : A Review. <i>Phytologia</i> . 92(3): 424-434.	[Propagules dispersed by other animals (externally)?] "Horncastle and Hellgren (2004) reported opossums and deer mice removed <i>J. virginiana</i> berries from beneath trees. They remarked that rodents appear to be seed predators and are not effective in dispersal." [Adapted for internal dispersal by birds or other mammals, although cones and seeds may be carried by seed predators which may cache seeds and disperse a subset of those not destroyed by seed predation]
708	1984. Holthuijzen, A.M.A./Sharik, T.L.. Seed Longevity and Mechanisms of Regeneration of Eastern Red Cedar ( <i>Juniperus virginiana</i> L.). <i>Bulletin of the Torrey Botanical Club</i> . 111(2): 153-158.	[Propagules survive passage through the gut? Yes] "Red cedar seeds are endogenously dispersed, i.e., the seeds pass through the digestive tract of the disperser. In birds, which are the principal dispersers of red cedar, seed passage may take tens of minutes to hours, depending on the species involved, and the seeds remain undamaged (Holthuijzen 1983)."
708	1990. Burns, R.M./Honkala, B.H.. <i>Silvics of North America</i> . Volume 1: Conifers. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Propagules survive passage through the gut? Yes] "The cones do not open and will remain on the tree through the winter, although many are eaten and dispersed by animals." ... "Fruits are eaten by birds and other animals, which are important vectors for seed dissemination (20). Seeds that pass through animal digestive tracts and those that remain on the ground beneath the trees may germinate the first or second spring." ... "Fruits are high in crude fat and crude fiber, moderate in calcium, and very high in total carbohydrates. Eastern redcedar fruits are eaten by many wildlife species, including waxwings, bobwhite, quail, ruffed grouse, pheasant, wild turkeys, rabbits, foxes, raccoons, skunks, opossums, and coyotes (20)."
708	2004. Horncastle, V.J./Hellgren, E.C./Mayer, P.M./Engle, D.M./Leslie Jr, D.. Differential consumption of eastern red cedar ( <i>Juniperus virginiana</i> ) by avian & mammalian guilds: implications for tree invasion. <i>The American Midland Naturalist</i> . 152(2): 255-267	[Propagules survive passage through the gut? Yes] "Eastern red cedar seeds passed unharmed through the digestive tract of yellow-rumped warblers ( <i>Dendroica coronata</i> ) and cedar waxwings and showed a 1.5–3.5-fold greater germination rate than manually depulped seeds (Holthuijzen and Sharik, 1985)." ... "Red cedar cones and seeds have been found in feces of raccoons ( <i>Procyon lotor</i> ), foxes ( <i>Vulpes</i> spp.), bobcats ( <i>Lynx rufus</i> ) and small mammals (Phillips, 1910). In addition, mammal-dispersed seeds were left in slightly better condition for germination than those dispersed by birds (Phillips, 1910). Johnson (1962) reported that juniper seeds passed unharmed through digestive tracts of several species, such as woodrats ( <i>Neotoma</i> spp.), thus enhancing germination rates."
801	1990. Burns, R.M./Honkala, B.H.. <i>Silvics of North America</i> . Volume 1: Conifers. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Prolific seed production (>1000/m <sup>2</sup> )?] "Mature eastern redcedar trees produce some seeds nearly every year, but good crops occur only every 2 or 3 years."
802	1984. Holthuijzen, A.M.A./Sharik, T.L.. Seed Longevity and Mechanisms of Regeneration of Eastern Red Cedar ( <i>Juniperus virginiana</i> L.). <i>Bulletin of the Torrey Botanical Club</i> . 111(2): 153-158.	[Evidence that a persistent propagule bank is formed (>1 yr)? Yes. At least some seeds remain viable for >1 year] "Viability and fullness of buried seeds declined exponentially over time; only 5.5% of the seeds were viable after 14 months"
802	1990. Burns, R.M./Honkala, B.H.. <i>Silvics of North America</i> . Volume 1: Conifers. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Evidence that a persistent propagule bank is formed (>1 yr)? Presumably Yes] "Most of the natural germination of eastern redcedar seed takes place in early spring of the second year after dispersal."



803	2003. Anderson, M.D.. <i>Juniperus virginiana</i> . In: Fire Effects Information System, [Online]. USA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, <a href="http://www.fs.fed.us/database/feis/plants/tree/junvir/all.html">http://www.fs.fed.us/database/feis/plants/tree/junvir/all.html</a> [Accessed 19 July 20	[Well controlled by herbicides? No] "Eastern redcedar is resistant to most foliar herbicides, though soil-applied herbicides may provide effective control on small acreages [17,112]. Eastern redcedar is relatively insensitive to foliar application of 2,4,5-T and 2,4-D [25,46]. Indiscriminate spraying of these herbicides to reduce woody species and convert areas to grassland may eliminate hardwood associates from stands while releasing eastern redcedar and promoting eastern redcedar's dominance [46]. In studies at Leavenworth Barrens Nature Preserve, Indiana, eastern redcedar survived girdling combined with glyphosate application [1]. In an Oklahoma study, paraquat foliar herbicide killed up to 90% of the crown of small trees (2.5 to 5 feet (0.8 1.5 m) tall) but as little as 30% of the crown of large trees (8-16 feet (2.5-5.0 m) tall) [42]. Other studies have found that foliar stem treatments with picloram alone or in combination with 2,4,5-T or 2,4-D were effective in controlling eastern redcedar [25,95]. Soil applied herbicides, particularly picloram, may be more effective for eastern redcedar control [95]. In 1 study, soil spot applications of undiluted picloram achieved 48 to 100% mortality of eastern redcedar by 18 months posttreatment. However, the use of liquid picloram may be ineffective where trees are taller than 15 feet (5 m) or where excessive litter could prevent root zone penetration of the chemical [56]. A Nebraska study demonstrated variable control of eastern redcedar using soil applications of hexazinone (68-90% mortality), picloram (70 94% mortality), and tebuthiuron (71-90% mortality), based on application rate and tree height [112]. Soil-applied herbicides may be more effective when used as follow-up treatments to broadcast burning [93]."
804	1990. Burns, R.M./Honkala, B.H.. <i>Silvics of North America</i> . Volume 1: Conifers. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Tolerates, or benefits from, mutilation, cultivation, or fire? No] "Fire is probably the worst enemy of eastern redcedar. The thin bark and roots near the ground surface are easily injured by fires. Some natural protection against fire exists because its foliage does not burn well and litter accumulation is minimal under stands on thin soils (11,15)."
804	2003. Anderson, M.D.. <i>Juniperus virginiana</i> . In: Fire Effects Information System, [Online]. USA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, <a href="http://www.fs.fed.us/database/feis/plants/tree/junvir/all.html">http://www.fs.fed.us/database/feis/plants/tree/junvir/all.html</a> [Accessed 19 July 20	[Tolerates, or benefits from, mutilation, cultivation, or fire? No] "Mechanical treatments that sever or dig up eastern redcedar provide effective control due to eastern redcedar's inability to sprout [17,93]."
805	2013. WRA Specialist. Personal Communication.	[Effective natural enemies present locally (e.g. introduced biocontrol agents)? Unknown]

## **Summary of Risk Traits**

### **High Risk / Undesirable Traits**

- Naturalized outside native range in middle and Western US, and South Africa
- Broad climate suitability
- Invades cattle pasture and reduces available forage
- Environmental weed by homogenizing diversity, reducing wildlife habitat quality, and altering hydrology and nutrient cycling
- Related species are invasive
- Possibly allelopathic
- Alternate host to the cedar apple rust
- Increase fire risk
- Forms monocultures within native range
- Produces allergenic pollen
- Tolerates a wide range of soil conditions
- Seeds dispersed by frugivorous birds and mammals
- Some seeds persist in soil for over one year
- Herbicides not very effective in controlling this tree

### **Low Risk / Desirable Traits**

- Unarmed (no spines, thorns or burrs)
- Palatable to cattle
- Landscaping and ornamental value (used as a Christmas tree)
- A dioecious species
- Reaches maturity in 10+ years
- Will not spread vegetatively
- Killed by fire