

Taxon: <i>Liquidambar styraciflua L.</i>	Family: Altingiaceae
Common Name(s): alligatorwood American storax American sweetgum bilsted hazel pine redgum satin-walnut star-leaved gum	Synonym(s): <i>Liquidambar macrophylla</i> Oerst. <i>Liquidambar styraciflua f. rotundiloba</i>

Assessor: Chuck Chimera	Status: Assessor Approved	End Date: 4 Feb 2019
WRA Score: 7.0	Designation: H(HPWRA)	Rating: High Risk

Keywords: Pioneer Tree, Naturalized, Palatable, Wind-Dispersed, Orthodox Seeds

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	y
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)	y
303	Agricultural/forestry/horticultural weed		
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	n
305	Congeneric weed		
401	Produces spines, thorns or burrs	y=1, n=0	y
402	Allelopathic		
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals	y=1, n=-1	n

Qsn #	Question	Answer Option	Answer
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		
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	n
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	y
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	y
706	Propagules bird dispersed	y=1, n=-1	n
707	Propagules dispersed by other animals (externally)		
708	Propagules survive passage through the gut	y=1, n=-1	n
801	Prolific seed production (>1000/m2)		
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	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
	Flora of North America Editorial Committee, eds. 1997. Flora of North America: Volume 3: Magnoliophyta: Magnoliidae and Hamamelidae. Oxford University Press, Oxford, UK	[Cultivars exist. Not domesticated] "The leaves of <i>Liquidambar styraciflua</i> , fragrant when bruised, turn deep red to crimson in autumn. Although leaf variation is common in <i>L. styraciflua</i> , this deviation is randomly distributed and without any definable geographic correlation. <i>Liquidambar styraciflua</i> is often cultivated; a number of cultivars have been introduced in cultivation."
	Coladonato, M. (1992). <i>Liquidambar styraciflua</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/tree/liqsty/all.html . [Accessed 31 Jan 2019]	[Not domesticated] "The currently accepted scientific name for sweetgum is <i>Liquidambar styraciflua</i> L. [30]. Two forms of sweetgum are recognized in horticulture. The round-lobed American sweetgum, <i>L. styraciflua</i> forma <i>rotundiloba</i> Rehd., has three to five short, rounded lobes on the leaves. Weeping American sweetgum, <i>L. styraciflua</i> forma <i>pendula</i> Rehd., has pendulous branches forming an almost columnar head [44,45]. There are no recognized subspecies or varieties."

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. (2019). Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. (2019). 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

Qsn #	Question	Answer
	<p>USDA, ARS, Germplasm Resources Information Network. 2019. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 31 Jan 2019]</p>	<p>"Native Northern America NORTHEASTERN U.S.A.: United States [Connecticut (s.w.), Indiana (s.), New Jersey, New York (s.e.), Ohio, Pennsylvania (s.e.), West Virginia] NORTH-CENTRAL U.S.A.: United States [Illinois (s.), Missouri (s.e.), Oklahoma (http://www.biosurvey.ou.edu/shrub/list2.htm)] SOUTHEASTERN U.S.A.: United States [Alabama, Arkansas, Delaware, District of Columbia, Florida (http://www.plantatlas.usf.edu/main.asp?plantID=3559), Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, South Carolina, Tennessee (http://tenn.bio.utk.edu/vascular/database/vascular-database.asp?CategoryID=Dicots&FamilyID=Hamamelidaceae&GenusID=Liquidambar&SpeciesID=styraciflua), Virginia] SOUTH-CENTRAL U.S.A.: United States [Texas] NORTHERN MEXICO: Mexico [San Luis Potosi, Tamaulipas] SOUTHERN MEXICO: Mexico [Chiapas, Oaxaca, Veracruz] Southern America CENTRAL AMERICA: Belize, El Salvador, Guatemala, Honduras, Nicaragua"</p>

202	Quality of climate match data	High
	Source(s)	Notes
	<p>USDA, ARS, Germplasm Resources Information Network. 2019. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 31 Jan 2019]</p>	

203	Broad climate suitability (environmental versatility)	y
	Source(s)	Notes
	<p>Burns, R.M. & Honkala, B.H. 1990. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.</p>	<p>"Annual rainfall varies from 1020 mm (40 in) in the North to 1520 mm (60 in) in the South; the growing season rainfall is 510 to 610 mm (20 to 24 in). There are 180 frost-free days in the northern part of its range and up to 320 in the southern part. January temperatures are less than -1° C (30° F) in the North and about 10° C (50° F) in the South; minimum temperatures during the year are -21° C (-5° F) in the North and -4° C (25° F) in the South. Maximum temperature during the year is about 38° C (100° F) for most of the range of sweetgum."</p>
	<p>CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK</p>	<p>"Climatic amplitude (estimates) - Altitude range: 0 - 2000 m - Mean annual rainfall: 1000 - 1800 mm - Rainfall regime: summer; winter; bimodal - Dry season duration: 0 - 4 months - Mean annual temperature: 8 - 21°C - Mean maximum temperature of hottest month: 25 - 36°C - Mean minimum temperature of coldest month: -11 - 5°C - Absolute minimum temperature: -24 - 0°C"</p>

Qsn #	Question	Answer
	Dave's Garden. (2019). Liquidambar Species, Sweetgum, Red Gum, Liquid Amber - Liquidambar styraciflua. https://davesgarden.com/guides/pf/go/1033/ . [Accessed 31 Jan 2019]	"Hardiness: USDA Zone 6a: to -23.3 °C (-10 °F) USDA Zone 6b: to -20.5 °C (-5 °F) USDA Zone 7a: to -17.7 °C (0 °F) USDA Zone 7b: to -14.9 °C (5 °F) USDA Zone 8a: to -12.2 °C (10 °F) USDA Zone 8b: to -9.4 °C (15 °F) USDA Zone 9a: to -6.6 °C (20 °F) USDA Zone 9b: to -3.8 °C (25 °F) USDA Zone 10a: to -1.1 °C (30 °F) USDA Zone 10b: to 1.7 °C (35 °F)"

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	Burns, R.M. & Honkala, B.H. 1990. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	"Sweetgum grows from Connecticut southward throughout the East to central Florida and eastern Texas. It is found as far west as Missouri, Arkansas, and Oklahoma and north to southern Illinois. It also grows in scattered locations in northwestern and central Mexico, Guatemala, Belize, Salvador, Honduras, and Nicaragua."

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Although widely introduced and tested in trials (Streets, 1962; McCarter and Hughes, 1984), and commonly planted as an ornamental in parts of Europe, Australia and New Zealand (Streets, 1962), it has only been used as an exotic in plantations on a modest scale, e.g. in southern Africa - Zimbabwe (Barrett and Mullin, 1976), South Africa (Poynton, 1957, 1972) and some South American countries such as Brazil, Chile and Peru. Its commercial importance remains restricted to the native range."

301	Naturalized beyond native range	y
	Source(s)	Notes

Qsn #	Question	Answer
	Cameron, E. K. (2004). <i>Liquidambar</i> (<i>Liquidambar styraciflua</i>) beginning to move? <i>Auckland Botanical Society Journal</i> 59: 56-58	"During the 2003/04 summer in northern New Zealand there has been an increase in the number of <i>liquidambar</i> seedlings recorded. I'm sure with more observations this present known abundance and distribution would be increased. Time will tell if we are seeing the beginning of this important cultivated species becoming a problem in the natural environment or if it the result of a short-term suitable climate for seed-set and germination. So far there are only wild seedling and sapling records within 30m of cultivated adults, and no records invading native habitats. But as Lee et al. (1999) pointed out: plant invasions in urban environments are the key to limiting weeds in New Zealand. We should watch this species as its environmental tolerance seems to be wide, it is extensively planted and it has potentially good method of dispersal (i.e. the wind). Present evidence suggests that it will slowly fully naturalise and become a minor nuisance in modified habitats, including shrublands and open forest close to adult trees. Eradication could be complicated by the ability of this species to root sucker."
	Heenan, P. B., De Lange, P. J., Glenny, D. S., Breitwieser, I., Brownsey, P. J., & Ogle, C. C. (1999). Checklist of dicotyledons, gymnosperms, and pteridophytes naturalised or casual in New Zealand: additional records 1997–1998. <i>New Zealand Journal of Botany</i> , 37(4), 629-642	" <i>Liquidambar styraciflua</i> ... NOTES: Scattered seedlings collected from an overgrown basalt wall; the parent tree grows above the wall in an old garden."
	Gann, G.D., Stocking, C.G. and Collaborators. 2001-2018. Floristic Inventory of South Florida Database Online. The Institute for Regional Conservation. Delray Beach, Florida. https://www.regionalconservation.org . [Accessed 1 Feb 2019]	" <i>Liquidambar styraciflua</i> has been found in the following 2 conservation areas : Native Status = Not Native, Naturalized"; "Charlotte County ... Not Native, Naturalized"; "Martin County ... Not Native, Naturalized"
	Randall, R.P. (2017). <i>A Global Compendium of Weeds</i> . 3rd Edition. Perth, Western Australia. R.P. Randall	"Weed of: Vegetables References: New Zealand-UW-280, Australia-N-198, United States of America- W-218, United States of America-A-543, Canada and United States of America-N- 725, New Zealand-N-823, New Zealand-N- 824, New Zealand-U-919, Chile-A-931, France-N-1006, France-N-1006, Europe-N- 819, Cyprus-N-1174, Belgium-U-1220, Italy-U-251, La Reunion-W-1321, Global- W-1349, Chile-A-87, United States of America-A-87, Italy-U-1887, Mexico-R- 1935, New Zealand-U-2048, Belgium-W- 1977, Cyprus-W-1977, France-W-1977, India-W-1977, Italy-W-1977, Portugal-W- 1977."

302	Garden/amenity/disturbance weed	y
	Source(s)	Notes
	Gilman, E.F. & Watson, D.G. 1993. <i>Liquidambar styraciflua</i> . Sweetgum. Fact Sheet ST-358. Institute of Food and Agricultural Sciences, University of Florida, Gainesville FL. http://hort.ifas.ufl.edu/ . [Accessed 31 Jan 2019]	"Be careful when locating Sweetgum as a street tree since its large, aggressive roots may lift curbs and sidewalks."

Qsn #	Question	Answer
	Dave's Garden. (2019). Liquidambar Species, Sweetgum, Red Gum, Liquid Amber - Liquidambar styraciflua. https://davesgarden.com/guides/pf/go/1033/ . [Accessed 31 Jan 2019]	"On Oct 24, 2004, monocacy from Thurmont, MD wrote: This tree is an absolute pest, grows like a weed. I swore if I bought another house I'd remove every one of them. I bought a new house and never found one, thank heavens. I hate the spikey balls, I'm a 'bare foot' person. One redeeming factor, it generally has fabluous fall color. I guess if you keep it away frm people, it would be ok."... "On Mar 17, 2011, themikeman from Concord, NC (Zone 7a) wrote: I Live in a house in NC with a 1.5 acre front yard where 7 sweetgum trees were planted in 1942 when the house was built so they are now huge trees. Who in their right mind would plant 7 of these nasty sweetgum ball trees. We will have to rake up sweetgum balls from late January till the first week in May. It is back breaking and i am now disabled and can no longer rake them. yes, it is back breaking labor and they are exremely heavy in large piles to bag for even the healthiest grown man and they can be sharp like a razor if one of their spikes get under your finger nailbeds ouch!!. just a nasty buck eye ball like pod producing tree."
	Hicks, R.R. (1998). Ecology and Management of Central Gardwood Forests. John Wiley and Sons, New York, NY	"Sweetgum is a vigorous competitor on good sites where light, moisture, and nutrient resources are abundant. It often seeds into openings and may form pure stands."
	Coladonato, M. (1992). Liquidambar styraciflua. In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/tree/liqsty/all.html . [Accessed 4 Feb 2019]	[Controlled in forestry plantations. Severity of impacts unknown. This assessment conservatively classifies sweetgum as a general weed until further evidence is available] "Sweetgum's ability to sprout quickly and persistently makes it one of the most serious competitors of pine seedlings in southeastern forests. Silvicultural practices have called for the control of sweetgum in areas where it competes heavily with pine seedlings [49]. Basal applications of Garlon 4 top-killed 81 percent of 2 inch (5 cm) d.b.h or smaller stems [35,36]."

303	Agricultural/forestry/horticultural weed	
	Source(s)	Notes
	Coladonato, M. (1992). Liquidambar styraciflua. In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/tree/liqsty/all.html . [Accessed 31 Jan 2019]	"Sweetgum's ability to sprout quickly and persistently makes it one of the most serious competitors of pine seedlings in southeastern forests. Silvicultural practices have called for the control of sweetgum in areas where it competes heavily with pine seedlings [49]. Basal applications of Garlon 4 top-killed 81 percent of 2 inch (5 cm) d.b.h or smaller stems [35,36]."
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Weed of: Vegetables" [Impacts unknown and require verification]

304	Environmental weed	n
	Source(s)	Notes

Qsn #	Question	Answer
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	[Not categorized as an environmental weed in the cited literature] "References: New Zealand-UW-280, Australia-N-198, United States of America- W-218, United States of America-A-543, Canada and United States of America-N- 725, New Zealand-N-823, New Zealand-N- 824, New Zealand-U-919, Chile-A-931, France-N-1006, France-N-1006, Europe-N- 819, Cyprus-N-1174, Belgium-U-1220, Italy-U-251, La Reunion-W-1321, Global- W-1349, Chile-A-87, United States of America-A-87, Italy-U-1887, Mexico-R- 1935, New Zealand-U-2048, Belgium-W- 1977, Cyprus-W-1977, France-W-1977, India-W-1977, Italy-W-1977, Portugal-W- 1977."

305	Congeneric weed	
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	Liquidambar formosana and Liquidambar orientalis cited as weeds, but evidence of impacts has not been verifire

401	Produces spines, thorns or burrs	y
	Source(s)	Notes
	Leopold, D. J. (2003). Trees of New York State: Native and Naturalized. Syracuse University Press, Syracuse, NY	"fruit round, woody, and spiny"
	Dave's Garden. (2019). Liquidambar Species, Sweetgum, Red Gum, Liquid Amber - Liquidambar styraciflua. https://davesgarden.com/guides/pf/go/1033/ . [Accessed 31 Jan 2019]	"On Oct 24, 2004, monocacy from Thurmont, MD wrote: This tree is an absolute pest, grows like a weed. I swore if I bought another house I'd remove every one of them. I bought a new house and never found one, thank heavens. I hate the spikey balls, I'm a 'bare foot' person. One redeaming factor, it generally has fablious fall color. I guess if you keep it away frm people, it would be ok."... "On Mar 17, 2011, themikeman from Concord, NC (Zone 7a) wrote: I Live in a house in NC with a 1.5 acre front yard where 7 sweetgum trees were planted in 1942 when the house was built so they are now huge trees. Who in their right mind would plant 7 of these nasty sweetgum ball trees. We will have to rake up sweetgum balls from late January till the first week in May. It is back breaking and i am now disabled and can no longer rake them. yes, it is back breaking labor and they are extremely heavy in large piles to bag for even the healthiest grown man and they can be sharp like a razor if one of their spikes get under your finger nailbeds ouch!!. just a nasty buck eye ball like pod producing tree."

402	Allelopathic	
	Source(s)	Notes

Qsn #	Question	Answer
	Burns, R.M. & Honkala, B.H. 1990. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Unknown. Grows with other vegetation] "Sweetgum is a major component of four forest cover types (6): Pin Oak-Sweetgum (Society of American Foresters Type 65), Sweetgum-Willow Oak (Type 92), Sycamore-Sweetgum-American Elm (Type 94), and Sweetgum-Yellow-Poplar (Type 87). It is a minor component of at least 20 other cover types including Chestnut Oak (Type 44), White Oak-Black Oak-Northern Red Oak (Type 52), Black Oak (Type 110), Yellow-Poplar (Type 57), River Birch-Sycamore (Type 61), Silver Maple-American Elm (Type 62), Sassafras Persimmon (Type 64), Longleaf Pine (Type 70), Longleaf Pine-Slash Pine (Type 83), Shortleaf Pine (Type 75), Virginia Pine (Type 79), Loblolly Pine (Type 81), Loblolly Pine-Shortleaf Pine (Type 80), Pond Pine (Type 98), Willow Oak-Water Oak- Diamondleaf Oak (Type 88), Sugarberry-American Elm-Green Ash (Type 93), Baldcypress Tupelo (Type 102), Water Tupelo-Swamp Tupelo (Type 103), Sweetbay-Swamp Tupelo-Redbay ('Type 104), and Cabbage Palmetto (Type 74)."

403	Parasitic	n
	Source(s)	Notes
	Flora of North America Editorial Committee, eds. 1997. Flora of North America: Volume 3: Magnoliophyta: Magnoliidae and Hamamelidae. Oxford University Press, Oxford, UK	"Trees , to 41 m. Leaves : stipules linear-lanceolate, 3-4 mm, early deciduous, leaving 2 stipular scars adaxially near base of petiole; petioles (44-)60-100(-150) mm." [Altingiaceae. Formerly Hamamelidaceae. No evidence]

404	Unpalatable to grazing animals	n
	Source(s)	Notes
	Burns, R.M. & Honkala, B.H. 1990. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	"Damaging Agents- Few severe diseases are associated with sweetgum, but small mammals and grazing animals have caused isolated problems. Seedlings may be badly damaged by hogs, goats, or cattle in different areas. Rodents, particularly mice, and rabbits have caused considerable damage to young plantations in several areas (16). Beavers in the Georgia Piedmont cause impoundments and girdle healthy trees."
	Coladonato, M. (1992). <i>Liquidambar styraciflua</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/tree/liqsty/all.html . [Accessed 31 Jan 2019]	"Sweetgum has moderate value as a winter browse [5]. In the Oconee National Forest of Georgia, sweetgum was lightly to moderately browsed by white-tailed deer during the fall and winter [19]."

405	Toxic to animals	n
	Source(s)	Notes
	Burns, R.M. & Honkala, B.H. 1990. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[No evidence] "Damaging Agents- Few severe diseases are associated with sweetgum, but small mammals and grazing animals have caused isolated problems. Seedlings may be badly damaged by hogs, goats, or cattle in different areas. Rodents, particularly mice, and rabbits have caused considerable damage to young plantations in several areas (16). Beavers in the Georgia Piedmont cause impoundments and girdle healthy trees."

Qsn #	Question	Answer
	Coladonato, M. (1992). <i>Liquidambar styraciflua</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/tree/liqsty/all.html . [Accessed 4 Feb 2019]	[No evidence] "Sweetgum has moderate value as a winter browse [5]. In the Oconee National Forest of Georgia, sweetgum was lightly to moderately browsed by white-tailed deer during the fall and winter [19]."

406	Host for recognized pests and pathogens	
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Pests recorded Insects: Coptotermes formosanus (Formosan termite) Hyphantria cunea (mulberry moth) Lymantria dispar (gypsy moth) Malacosoma americanum (eastern tent caterpillar) Malacosoma disstria (forest tent caterpillar) Orgyia leucostigma (white-marked tussock moth) Otiornychus sulcatus (vine weevil) Reticulitermes flavipes (eastern subterranean termite) Xylosandrus crassiusculus (Asian ambrosia beetle) Fungus diseases: Armillaria tabescens (armillaria root rot) Botryosphaeria ribis (canker: apple) Ganoderma lucidum (basal stem rot: Hevea spp.) Bacterial diseases: Xylella fastidiosa (Pierce's disease of grapevines) Pests recorded at the generic level (<i>Liquidambar</i>): Insects: Diaspidiotus perniciosus (San José scale)"
	Hicks, R.R. (1998). Ecology and Management of Central Gardwood Forests. John Wiley and Sons, New York, NY	"Sweetgum has few major insect and disease pests."

Qsn #	Question	Answer
	<p>Burns, R.M. & Honkala, B.H. 1990. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.</p>	<p>"The four most common decay organisms reported in the Mississippi River Delta were Fomes geotropus, Pleurotus ostreatus, Lentinus trigrinus, and Ganoderma lucidum (16). Other diseases of sweetgum that may be important occasionally are an abiotic leader dieback or blight, twig canker, and trunk lesion caused by Botryosphaeria ribis, and bleeding necrosis, which may be a combination of sweetgum blight and B. ribis trunk lesion (8). Of these, only sweetgum blight is widely distributed and has caused heavy mortality in several States. It has received intensive study in Maryland and Mississippi. Drought appears to be the primary cause. In the lower Mississippi River flood plain, blight severity was found to be correlated with soil properties affecting moisture supply. Severity of dieback was reduced by 68 percent in 2 years by irrigating when soil moisture dropped below 40 percent of field capacity (16). There is a good possibility that sweetgum blight is most common in stands of root sprout origin. In the Georgia Piedmont and Coastal Plain of South Carolina, many groups of trees are composed of stems that are of root sprout origin and depend on a single root system complex for water uptake. During prolonged droughts such as occurred in the 1950's, this limited root system may not be adequate to satisfy the water requirements of the sprout complex, and many of the stressed trees may suffer blight. Except for leaffeeders, insects usually attack only trees that are already damaged, decadent, or dead. These include the bark beetles (<i>Dryocoetes betulae</i> and <i>Pityophthorus liquidambarus</i>), the ambrosia beetles, which include <i>Platypus compositus</i>, and the darkling beetles (<i>Strongylium</i> spp.). The leaffeeders include the forest tent caterpillar (<i>Malacosoma disstria</i>) and the luna moth (<i>Actias luna</i>) (1). In addition, a treehopper (<i>Strictocephala militaris</i>) is known to spend its entire life cycle on sweetgum in northeast Georgia but is not considered to be harmful (5)."</p>

407	Causes allergies or is otherwise toxic to humans	
	Source(s)	Notes
	<p>Pollen Library. (2019). Sweet-Gum (<i>Liquidambar styraciflua</i>). http://www.pollenlibrary.com/Specie/Liquidambar+styraciflua/. [Accessed 1 Feb 2019]</p>	<p>"Allergenicity: Sweet-Gum (<i>Liquidambar styraciflua</i>) is a mild allergen."</p>
	<p>Coladonato, M. (1992). <i>Liquidambar styraciflua</i>. In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/tree/liqsty/all.html . [Accessed 31 Jan 2019]</p>	<p>"Medicinally, sweetgum is known as "copalm balsam" and the resinous gum is used extensively in Mexico and Europe as a substitute for storax. Various ointments and syrups are prepared from the resinous gum and are used in the treatment of dysentery and diarrhea. The gum is sometimes chewed by children, and it is also used as a perfuming agent in soap [45]. The beautiful red and yellow color variations of sweetgum's autumn foliage make it highly prized as an ornamental [33,45]."</p>
	<p>Esch, R. E., Hartsell, C. J., Crenshaw, R., & Jacobson, R. S. (2001). Common allergenic pollens, fungi, animals, and arthropods. <i>Clinical Reviews in Allergy & Immunology</i>, 21 (2-3), 261-292</p>	<p>"Most species are in Asia and only the sweetgum (<i>Liquidambar styraciflua</i>) is both common and of allergenic importance in North America."</p>

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	[Possibly allergenic] "Gum, bark and root, antidiarrheal, sedative, febrifuge. Gum used for catarrh, coughs, dysentery, sores, and wounds of both humans and domestic animals. Mixture of sap, hot water, garlic and onions taken as a treatment for intestinal worms; sap mixed with honey consumed by women before, during and after childbirth, also drunk for stomach infections, a postpartum remedy. Storax is known to be allergenic."

408	Creates a fire hazard in natural ecosystems	
	Source(s)	Notes
	Coladonato, M. (1992). <i>Liquidambar styraciflua</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/tree/liqsty/all.html . [Accessed 1 Feb 2019]	"Fire is one of the major agents of damage to sweetgum. Its relatively thin bark make it highly susceptible to fire [21]. Following top-kill by fire, sweetgum sprouts from the stump or root crown [41,48]."
	Hicks, R.R. (1998). Ecology and Management of Central Gardwood Forests. John Wiley and Sons, New York, NY	"It often seeds into openings and may form pure stands." [Ability to form pure stands could increase fire risk in fire prone habitats]
	Tasmanian Fire Research Fund. (2006). Fire retardant garden plants for the urban fringe and rural areas. https://www.fire.tas.gov.au . [Accessed]	"Moderate Flammability These plants should be avoided in the Building Protection Zone. They should not be allowed dominate your garden and should be well maintained, being especially careful to remove dead material before it accumulates." [Includes <i>Liquidambar styraciflua</i>]
	WRA Specialist. (2019). Personal Communication	Conflicting information on fire risk is available. Several publications include <i>Liquidambar styraciflua</i> in lists of plants for fire-wise landscaping. Others cited in this assessment list the potential flammability of this species. Fire risk could be increased in drought, or fire-prone areas.
	OSU Extension Service. (2006). Fire-Resistant Plant Materials for Ashland. https://www.ashland.or.us/Files/Plant%20List.pdf . [Accessed 1 Feb 2019]	<i>Liquidambar styraciflua</i> included on list of fire-resistant plants

409	Is a shade tolerant plant at some stage of its life cycle	
	Source(s)	Notes
	Gilman, E.F. & Watson, D.G. 1993. <i>Liquidambar styraciflua</i> . Sweetgum. Fact Sheet ST-358. Institute of Food and Agricultural Sciences, University of Florida, Gainesville FL. http://hort.ifas.ufl.edu/ . [Accessed 31 Jan 2019]	"Light requirement: tree grows in part shade/part sun; tree grows in full sun"
	Coladonato, M. (1992). <i>Liquidambar styraciflua</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/tree/liqsty/all.html . [Accessed 31 Jan 2019]	"Sweetgum is classified as shade intolerant [7]. In pure stands on bottomland sites, young sweetgum is able to endure some shade and crowding. With increase in age the tree becomes less tolerant of competition. Following natural decrease in the canopy, enough sunlight reaches the ground to permit an understory stand to develop [12,24]."

Qsn #	Question	Answer
	Burns, R.M. & Honkala, B.H. 1990. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	"Sweetgum is most accurately classed as intolerant of shade. It must have adequate sunlight to reach its potential. Young sweetgum are able to endure some crowding in pure stands on bottom lands. With increasing age, however, they become less able to endure competition and may respond poorly to release because crown regeneration capacity is reduced."

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Soil descriptors - Soil texture: medium; heavy - Soil drainage: free; seasonally waterlogged - Soil reaction: neutral; alkaline"
	Burns, R.M. & Honkala, B.H. 1990. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	"Sweetgum is perhaps one of the most adaptable hardwood species in its tolerance to different soil and site conditions. As is characteristic of most hardwood species, it grows best on the moist alluvial clay and loamy soils of river bottoms, but its growth rate is commercially acceptable on a wide range of Piedmont and Coastal Plain soils."
	Coladonato, M. (1992). <i>Liquidambar styraciflua</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/tree/liqsty/all.html . [Accessed 31 Jan 2019]	"Sweetgum is very tolerant of different soils and sites but grows best on the rich, moist, alluvial clay and loamy soils of river bottoms [28]. Throughout the Piedmont Plateau, sweetgum shows good growth on river and stream bottoms and shows considerable potential on many upland sites [24,34]."

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	Flora of North America Editorial Committee, eds. 1997. Flora of North America: Volume 3: Magnoliophyta: Magnoliidae and Hamamelidae. Oxford University Press, Oxford, UK	"Trees , to 41 m. Leaves : stipules linear-lanceolate, 3-4 mm, early deciduous, leaving 2 stipular scars adaxially near base of petiole; petioles (44-)60-100(-150) mm."

412	Forms dense thickets	y
	Source(s)	Notes
	Immel, D. L. (2006). Plant Plant Guide for Sweetgum <i>Liquidambar styraciflua</i> . USDA, NRCS, National Plant Data Center. https://plants.sc.egov.usda.gov . [Accessed 31 Jan 2019]	"Habitat: Sweetgum trees occur in moist or wet woods, tidal swamps, along streambanks, in clearings and old fields, and in low swampy bottomlands where they often form pure stands."
	Hicks, R.R. (1998). Ecology and Management of Central Gardwood Forests. John Wiley and Sons, New York, NY	"It often seeds into openings and may form pure stands."
	Gilman, E.F. & Watson, D.G. 1993. <i>Liquidambar styraciflua</i> . Sweetgum. Fact Sheet ST-358. Institute of Food and Agricultural Sciences, University of Florida, Gainesville FL. http://hort.ifas.ufl.edu/ . [Accessed 31 Jan 2019]	"The seeds provide food for wildlife and will often readily germinate in shrub and groundcover beds, requiring their removal to maintain a neat landscape appearance. Tree thickets form in this manner, creating dense monocultures of Sweetgum."

Qsn #	Question	Answer
501	Aquatic	n
	Source(s)	Notes
	Flora of North America Editorial Committee, eds. 1997. Flora of North America: Volume 3: Magnoliophyta: Magnoliidae and Hamamelidae. Oxford University Press, Oxford, UK	"Trees , to 41 m." ... "Fields, woodlands, flood plains, low hammocks, swamps, riverbanks; 0-800 m"
502	Grass	n
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2019. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 31 Jan 2019]	"Family: Altingiaceae Alternate family(ies): Hamamelidaceae"
503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2019. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 31 Jan 2019]	"Family: Altingiaceae Alternate family(ies): Hamamelidaceae"
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	Burns, R.M. & Honkala, B.H. 1990. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	"Trees , to 41 m."
601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	Beech, E., Crowley, D., Rivers, M.C. & Wilson, B. 2018. <i>Liquidambar styraciflua</i> . The IUCN Red List of Threatened Species 2018: e.T33966A67700725. http://dx.doi.org/10.2305/IUCN.UK.2018-1.RLTS.T33966A67700725.en . [Accessed 4 Feb 2019]	"This tree species is widespread in the eastern United States, south through Mexico to Nicaragua. It has a widespread range, and is considered common and abundant. It grows in a wide range of habitat types. Although there are some identified threats, these are not thought to cause a significant decline. It is listed as Least Concern."
	Coladonato, M. (1992). <i>Liquidambar styraciflua</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/tree/liqsty/all.html . [Accessed]	[No evidence. Wide distribution] "Sweetgum grows from Connecticut southward throughout the East to central Florida and eastern Texas. It is found as far west as Missouri, Arkansas, and Oklahoma and as far north as southern Illinois. It also grows in scattered locations in northeastern and central Mexico, Guatemala, Belize, El Salvador, Honduras, and Nicaragua [14,24,42]."

Qsn #	Question	Answer
602	Produces viable seed	y
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	- Seed storage orthodox - Stand establishment using natural regeneration; planting stock
	Burns, R.M. & Honkala, B.H. 1990. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	"Trees begin to produce seeds when 20 to 30 years old and continue production until at least 150 years of age. Seed production varies widely depending on climatic conditions during the growing season. Under optimum conditions, seed balls may average as many as 56 sound seeds per ball, or as few as 7 or 8 under less favorable conditions (16,17)."

603	Hybridizes naturally	n
	Source(s)	Notes
	Burns, R.M. & Honkala, B.H. 1990. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	"No hybrids of sweetgum are known to exist. There is considerable evidence, however, that differences between ecotypes, such as swamps and uplands, should play an important role in selection of mother trees for artificial regeneration programs (15)."

604	Self-compatible or apomictic	n
	Source(s)	Notes
	Seavey, S., & Bawa, K. (1986). Late-Acting Self-Incompatibility in Angiosperms. Botanical Review, 52(2), 195-219	"In <i>Liquidambar styraciflua</i> (Hamamelidaceae) self-fertilized ovules uniformly abort when the embryo sac contains 4-6 celled embryos and 8-10 free endosperm nuclei (Schmitt & Perry, 1964). Following cross pollination, 75-100 free endosperm nuclei are produced before the cellular stage of endosperm development is reached. The uniform early failure of selfed ovules may be evidence for an active self-rejection. (Schmitt & Perry, following Mather (1950), use the term "self-sterility" to describe this ovular reaction.)"
	Kubitzki, K., Rohwer, J.G. & Bittrich, V. (eds.). 1993. The Families and Genera of Vascular Plants: Volume II. Flowering Plants. Dicotyledons: Magnoliid, Hamamelid and Caryophyllid Families. Springer-Verlag, Berlin, Heidelberg, New York	"Self-incompatibility has been recorded from <i>Liquidambar styraciflua</i> ,"

Qsn #	Question	Answer
605	Requires specialist pollinators	n
	Source(s)	Notes
	Morris, A. B., Ickert-Bond, S. M., Brunson, D. B., Soltis, D. E., & Soltis, P. S. (2008). Phylogeographical structure and temporal complexity in American sweetgum (<i>Liquidambar styraciflua</i> ; Altingiaceae). <i>Molecular Ecology</i> , 17(17), 3889-3900	"It is a monoecious species, with wind-pollinated flower production in mid- to late spring and fruit production in late fall."
	Flora of North America Editorial Committee, eds. 1997. <i>Flora of North America: Volume 3: Magnoliophyta: Magnoliidae and Hamamelidae</i> . Oxford University Press, Oxford, UK	"Staminate flowers in pedunculate clusters, 3-6 cm; perianth absent; stamens 4-8(-10) per flower, 150-176(-300) per cluster, falling after anthesis. Pistillate flowers without perianth; hypanthium disclike, with 5-8 staminodes around cycle of disc lobes; ovary (1-)2-locular; styles 2; stigmas introrsely curved. Capsular heads brown at maturity, globose, 2.5-4 cm diam. (including indurate styles)."

606	Reproduction by vegetative fragmentation	y
	Source(s)	Notes
	Cameron, E. K. (2004). <i>Liquidambar</i> (<i>Liquidambar styraciflua</i>) beginning to move? <i>Auckland Botanical Society Journal</i> 59: 56-58	"Eradication could be complicated by the ability of this species to root sucker."
	Burns, R.M. & Honkala, B.H. 1990. <i>Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654</i> . U.S. Department of Agriculture, Forest Service, Washington, DC.	"The importance of root sprout formation with sweetgum regeneration is evident from observations made in natural stands of mixed pines and hardwoods in the Georgia Piedmont that have been logged for sawtimber. In most of the stands examined, advance reproduction of sweetgum was clearly evident, accounting for 10 to 60 percent of all hardwood production. The invasion of such stands by young sweetgum has usually been attributed to natural seeding, but most of the young, vigorously growing stems observed in the Georgia Piedmont were of sprout origin. It is not uncommon to find as many as 40 or more stems from seedling to sapling size on the root systems of a single parent tree. Additional work with root sprouts in the Coastal Plain of South Carolina showed that sprout height after 8 years was directly correlated with the diameter of the lateral root from which the sprout originated; the larger the root the taller the sprout."

607	Minimum generative time (years)	>3
	Source(s)	Notes
	Bonner, F.T. & Karrfalt, R.P. (eds.). 2008. <i>The Woody Plant Seed Manual</i> . USDA FS Agriculture Handbook 727. Government Printing Office, Washington, D.C.	"Some trees have been known to flower and bear fruit 4 and 5 years after planting (Mohn and Randall 1970), but good crops are not common until the trees reach 20 to 30 years of age (Bonner 1974)."
	Burns, R.M. & Honkala, B.H. 1990. <i>Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654</i> . U.S. Department of Agriculture, Forest Service, Washington, DC.	"Trees begin to produce seeds when 20 to 30 years old and continue production until at least 150 years of age."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	n
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Qsn #	Question	Answer
	Source(s)	Notes
	Flora of North America Editorial Committee, eds. 1997. Flora of North America: Volume 3: Magnoliophyta: Magnoliidae and Hamamelidae. Oxford University Press, Oxford, UK	[Unlikely. Capsules and seeds lack means of external attachment] "Capsular heads brown at maturity, globose, 2.5-4 cm diam. (including indurate styles). Seeds apically winged, 8-10 mm, marked with resin ducts"

702	Propagules dispersed intentionally by people	y
	Source(s)	Notes
	Hicks, R.R. (1998). Ecology and Management of Central Gardwood Forests. John Wiley and Sons, New York, NY	"Sweetgum is a large, fast-growing tree of bottomlands and uplands of the southeastern states. The wood is used for lumber and veneer, seed are eaten by several species of wildlife, and it is widely planted as an ornamental."

703	Propagules likely to disperse as a produce contaminant	n
	Source(s)	Notes
	Burns, R.M. & Honkala, B.H. 1990. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	"Trees begin to produce seeds when 20 to 30 years old and continue production until at least 150 years of age." [No evidence. Unlikely due to capsule and seed size and time to reproduction]

704	Propagules adapted to wind dispersal	y
	Source(s)	Notes
	Burns, R.M. & Honkala, B.H. 1990. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	"The lustrous green color of the fruiting heads fades to yellow as maturity is reached in September to November. The beaklike capsules open at this time, and the small winged seeds, one or two per capsule, are then readily disseminated by wind." ... "The maximum distance of seed dispersal recorded is 183 m (600 ft), but ordinarily 96 percent of the seed falls within 61 m (200 ft) of the point of release (16)."

Qsn #	Question	Answer
705	Propagules water dispersed	y
	Source(s)	Notes
	Schneider, R., & Sharitz, R. (1988). Hydrochory and Regeneration in A Bald Cypress-Water Tupelo Swamp Forest. <i>Ecology</i> , 69(4), 1055-1063	"Additionally, elevated water levels of 1-2 m caused by short-term, high-discharge floods scoured seeds of <i>Nyssa sylvatica</i> var. <i>biflora</i> , <i>Quercus</i> spp., <i>Liquidambar styraciflua</i> , <i>Pinus taeda</i> , and other species from adjacent bottomland hardwood communities and transported them into the bald cypress-water tupelo forest." ... "Increases in species richness, and particularly the numbers, of seeds in water-dispersed seed collectors often followed rises in water level of 50 cm or more in the swamp forest. These pulses introduced seeds of <i>Liquidambar styraciflua</i> , <i>Pinus taeda</i> , <i>Ulmus alata</i> , <i>Nyssa sylvatica</i> var. <i>biflora</i> , <i>Quercus</i> spp., and 1/ex spp., which predominate in mixed bottomland hardwood communities."
	Flora of North America Editorial Committee, eds. 1997. <i>Flora of North America: Volume 3: Magnoliophyta: Magnoliidae and Hamamelidae</i> . Oxford University Press, Oxford, UK	[Riparian distribution indicates possibility of secondary water dispersal of primarily wind-dispersed seeds] "Fields, woodlands, flood plains, low hammocks, swamps, riverbanks; 0-800 m"

706	Propagules bird dispersed	n
	Source(s)	Notes
	Coladonato, M. (1992). <i>Liquidambar styraciflua</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/tree/liqsty/all.html . [Accessed 31 Jan 2019]	"The seeds are eaten by birds, squirrels, and chipmunks [33]." [Birds act as seed predators, but could possibly disperse some seeds that escape predation. Primarily wind-dispersed]

707	Propagules dispersed by other animals (externally)	
	Source(s)	Notes
	Burns, R.M. & Honkala, B.H. 1990. <i>Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654</i> . U.S. Department of Agriculture, Forest Service, Washington, DC.	"The small seeds are eaten by birds, squirrels, and chipmunks." [Seed predators could potentially cache or disperse seeds that escape destruction]

708	Propagules survive passage through the gut	n
	Source(s)	Notes
	Burns, R.M. & Honkala, B.H. 1990. <i>Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654</i> . U.S. Department of Agriculture, Forest Service, Washington, DC.	"The small seeds are eaten by birds, squirrels, and chipmunks." [No evidence. Animals that consume seeds are seed predators and unlikely to internally disperse viable seeds]

801	Prolific seed production (>1000/m2)	
	Source(s)	Notes

Qsn #	Question	Answer
	Coladonato, M. (1992). <i>Liquidambar styraciflua</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/tree/liqsty/all.html . [Accessed 31 Jan 2019]	"Sweetgum produces an abundance of lightweight seed. The tree begins to produce seed when 20 to 30 years old, and crops remain abundant for 150 years. Fair seed crops are produced each year, with bumper crops every 2 to 3 years [2,24]. Under conditions of full sunlight and rich moist soil, each fruit may average as many as 50 sound seeds."
	Burns, R.M. & Honkala, B.H. 1990. <i>Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654.</i> U.S. Department of Agriculture, Forest Service, Washington, DC.	[Densities unspecified] "Fair seed crops occur every year and bumper crops about every 3 years." ... "Seed production varies widely depending on climatic conditions during the growing season. Under optimum conditions, seed balls may average as many as 56 sound seeds per ball, or as few as 7 or 8 under less favorable conditions (16,17)."

802	Evidence that a persistent propagule bank is formed (>1 yr)	y
	Source(s)	Notes
	CAB International, 2005. <i>Forestry Compendium.</i> CAB International, Wallingford, UK	"- Seed storage orthodox"
	Royal Botanic Gardens Kew. (2019) <i>Seed Information Database (SID).</i> Version 7.1. Available from: http://data.kew.org/sid/ . [Accessed 4 Feb 2019]	"Storage Behaviour: Orthodox Storage Conditions: (The fruit is a beaklike capsule containing 1 or 2 winged seeds) No loss in viability during 9 years hermetic storage at 3°C with 5-10% mc (Bonner, 1987); initial viability maintained for at least 4 years in hermetic storage at 4°C with 10-15% mc (Bonner, 1974f); seed tolerate desiccation to 3.2% mc, no loss in viability occurs after 10 years hermetic storage at -18°C with 3.2-13.6% mc, at 10°C with 3.2% mc, 30% viability lost at 10°C with 8.4% mc, considerable loss (80%) at 4°C with 3.2% and 8.4% mc, and complete loss at 4°C, 10°C with 13.6% mc; CW= 5.3434 (Bonner, 1994). Seeds are maintained at ESNACIFOR, Honduras"
	Cameron, E. K. (2004). <i>Liquidambar (Liquidambar styraciflua) beginning to move?</i> <i>Auckland Botanical Society Journal</i> 59: 56-58	"There is the potential of a seed bank held in the fruit hanging on the tree and on the ground. Brown fruit on the ground in autumn from the previous season (c.1 year old) contained a few seeds with what appeared to be good endosperm (viability not tested)."

803	Well controlled by herbicides	y
	Source(s)	Notes

Qsn #	Question	Answer
	Shore, T. (2019). "How to Kill a Sweet Gum Tree." Home Guides SF Gate, http://homeguides.sfgate.com/kill-sweet-gum-tree-45634.html . [Accessed 4 Feb 2019]	[Glyphosate used to treat stumps] "1. Wear safety glasses, gloves and closed-toe shoes for protection. Remove any ground clutter such as limbs from the base of the sweetgum tree. 2. Cut a sweetgum tree with a trunk that is 6 inches or smaller in diameter with a hand saw. Make one cut through the trunk with the saw to fell the tree. 3. Cut sweetgum trees with trunks larger than 6 inches with a chainsaw. Follow the manufacturer's instructions for properly mixing fuel and operating the saw. Consider wearing a hard hat and leg protection such as chaps when operating the saw. 4. Make a V-shaped undercut one-quarter the depth of the tree with the saw on the side of the tree in the direction you want it to fall. Make a back cut on the opposite side of the tree above the undercut to release the tree and allow it to fall. 5. Drill holes into the top and sides of the tree stump with a hand drill. Dip a paint brush into glyphosate herbicide and paint the stump and holes. Allow the herbicide to run down into the drill holes. 6. Watch the sweetgum stump for new growth. Remove the growth with pruners and apply glyphosate herbicide to the cuts."
	Coladonato, M. (1992). <i>Liquidambar styraciflua</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/tree/liqsty/all.html . [Accessed 31 Jan 2019]	[Smaller diameter stems effectively controlled by Garlon 4] "Sweetgum's ability to sprout quickly and persistently makes it one of the most serious competitors of pine seedlings in southeastern forests. Silvicultural practices have called for the control of sweetgum in areas where it competes heavily with pine seedlings [49]. Basal applications of Garlon 4 top-killed 81 percent of 2 inch (5 cm) d.b.h or smaller stems [35,36]."

804	Tolerates, or benefits from, mutilation, cultivation, or fire	y
	Source(s)	Notes
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"- Ability to sucker; self-prune; coppice"
	Coladonato, M. (1992). <i>Liquidambar styraciflua</i> . In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.fed.us/database/feis/plants/tree/liqsty/all.html . [Accessed 31 Jan 2019]	"Following top-kill by fire, sweetgum sprouts from the stump or root crown [41,48]." ... "Sweetgum generally sprouts prolifically when top-killed by fire. Repeated annual summer burns, however, will eventually deplete carbohydrate reserves and kill the plant [41,48]."

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	WRA Specialist. (2019). Personal Communication	Unknown

Summary of Risk Traits:

High Risk / Undesirable Traits

- Elevation range exceeds 1000 m and broad climate suitability, demonstrating environmental versatility
- Grows in tropical climates
- Naturalized in New Zealand, and possibly elsewhere outside native range (but no evidence in Hawaiian Islands to date)
- A fast-growing pioneer tree that can become a nuisance in landscaping due to the spikey fruiting capsules, aggressive roots and potential to form dense stands
- A possible forestry weed
- Spiny fruiting capsules can be a landscaping hazard
- Tolerates many soil types
- Forms pure stands in native range
- Reproduces by seeds and vegetatively by root suckers
- Seeds dispersed by wind, secondarily by water and intentionally by people
- Orthodox seeds may form a seed bank that persists for one or more years
- Able to coppice and resprout after cutting and fire

Low Risk Traits

- Provides fodder for livestock
- Mostly shade intolerant (could limit spread into intact forests)
- Self-incompatible
- Long time to reproductive maturity (20-30 years typical, although some trees could reach maturity in 4-5 years)
- Herbicides may provide effective control