

**Family:** *Magnoliaceae*

**Taxon:** *Liriodendron tulipifera*

**Synonym:** *Liriodendron tulipifera* f. *aureomarginatum* (L.) **Common Name:** canary whitewood  
*Liriodendron tulipifera* f. *integrifolium* (G. K.) tulip poplar  
tuliptree  
yellow poplar

Questionnaire Status:	current 20090513 Assessor Approved	Assessor:	Chuck Chimera	Designation:	EVALUATE
Status:		Data Entry Person:	Chuck Chimera	WRA Score	2
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)		Intermediate
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)		y
303	Agricultural/forestry/horticultural weed		n=0, y = 2*multiplier (see Appendix 2)		
304	Environmental weed		n=0, y = 2*multiplier (see Appendix 2)		n
305	Congeneric weed		n=0, y = 1*multiplier (see Appendix 2)		n
401	Produces spines, thorns or burrs		y=1, n=0		n
402	Allelopathic		y=1, n=0		n
403	Parasitic		y=1, n=0		n
404	Unpalatable to grazing animals		y=1, n=-1		n
405	Toxic to animals		y=1, n=0		n
406	Host for recognized pests and pathogens		y=1, n=0		
407	Causes allergies or is otherwise toxic to humans		y=1, n=0		n
408	Creates a fire hazard in natural ecosystems		y=1, n=0		n
409	Is a shade tolerant plant at some stage of its life cycle		y=1, n=0		n
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	
604	Self-compatible or apomictic	y=1, n=-1	y
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	n
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	>3
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y=1, n=-1	n
702	Propagules dispersed intentionally by people	y=1, n=-1	y
703	Propagules likely to disperse as a produce contaminant	y=1, n=-1	n
704	Propagules adapted to wind dispersal	y=1, n=-1	y
705	Propagules water dispersed	y=1, n=-1	n
706	Propagules bird dispersed	y=1, n=-1	n
707	Propagules dispersed by other animals (externally)	y=1, n=-1	
708	Propagules survive passage through the gut	y=1, n=-1	n
801	Prolific seed production (>1000/m2)	y=1, n=-1	n
802	Evidence that a persistent propagule bank is formed (>1 yr)	y=1, n=-1	y
803	Well controlled by herbicides	y=-1, n=1	
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y=1, n=-1	y
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	y=-1, n=1	

Designation: EVALUATE

WRA Score 2

**Supporting Data:**

101	2008. Bonner, F.T./Karrfalt, R.P.. The Woody Plant Seed Manual. Government Printing Office, Washington, D.C.	[Is the species highly domesticated? No] "The wood is very valuable for lumber and veneer. It is a good honey tree and is planted extensively as an ornamental. Tuliptree has been cultivated since 1663 (Bonner and Russell 1974)." [Despite long history of cultivation, no evidence that tree is highly domesticated]
102	2011. WRA Specialist. Personal Communication.	NA
103	2011. WRA Specialist. Personal Communication.	NA
201	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Species suited to tropical or subtropical climate(s) 0-Low] "Seedling Development- Yellow-poplar seeds must overwinter under natural conditions, or be stratified under controlled conditions, to overcome dormancy. Under controlled conditions, stratification in moist sand within a temperature range of 0° to 10° C (32° to 50° F) for periods of 70 to 90 days resulted in satisfactory germination. However, seedling yield increases with increasing time of stratification."
201	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Species suited to tropical or subtropical climate(s) 0-Low] "between 45°N and 28°N" [Species has a broad natural distribution, but seeds require cold stratification]
202	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Quality of climate match data? 1-intermediate]
202	2005. Kota, N.L.. Comparative seed dispersal, seedling establishment and growth of exotic, invasive <i>Ailanthus altissima</i> (Mill.) Swingle and native <i>Liriodendron tulipifera</i> (L.). MSc Thesis.. West Virginia University, Morgantown, West Virginia	[Quality of climate match data? 1-intermediate] Seeds require cold-stratification
203	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Broad climate suitability (environmental versatility)? Yes] "Because of its wide geographic distribution, yellow-poplar grows under a variety of climatic conditions. Low temperature extremes vary from severe winters in southern New England and upper New York with a mean January temperature of 7.2° C (19° F) to almost frost-free winters in central Florida with a mean January temperature of 16.1° C (61° F). Average July temperature varies from 20.6° C (69° F) in the northern part of the range to 27.2° C (81° F) in the southern. Rainfall in the range of yellow-poplar varies from 760 mm (30 in) to more than 2030 mm (80 in) in some areas of the southern Appalachians. Average number of frost-free days varies from 150 to more than 310 days within the north-to south range of yellow-poplar."
203	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Broad climate suitability (environmental versatility)? Yes] "Climatic amplitude (estimates) - Altitude range: 200 - 1400 m - Mean annual rainfall: 700 - 2000 mm - Rainfall regime: winter; bimodal - Dry season duration: > 1 months - Mean annual temperature: 3 - 22°C - Mean maximum temperature of hottest month: 20 - 27°C - Mean minimum temperature of coldest month: -7 - 16°C - Absolute minimum temperature: > -40°C"
203	2008. Bonner, F.T./Karrfalt, R.P.. The Woody Plant Seed Manual. Government Printing Office, Washington, D.C.	[Broad climate suitability (environmental versatility)? Yes] "It grows under a variety of climatic conditions from sea level to 1,370 m elevation in the Appalachian Mountains and to 300 m in the northern part of its range."
204	2007. Randall, R.P.. Global Compendium of Weeds - <i>Liriodendron tulipifera</i> [Online Database]. <a href="http://www.hear.org/gcw/species/liriodendron_tulipifera/">http://www.hear.org/gcw/species/liriodendron_tulipifera/</a>	[Native or naturalized in regions with tropical or subtropical climates? No] No evidence

205	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Does the species have a history of repeated introductions outside its natural range? Yes] "List of countries: Europe; Austria - planted; Belgium - planted; Bosnia and Herzegovina - planted; Bulgaria - planted; Croatia - planted; Cyprus - planted; Czech Republic - planted; Denmark - planted; Estonia - planted; Faroe Islands - planted; Finland - planted; Former Yugoslavia - planted; France - planted; Germany - planted; Gibraltar - planted; Hungary - planted; Iceland - planted; Ireland - planted; Italy - planted; Liechtenstein - planted; Luxembourg - planted; Moldova - planted; Monaco - planted; Netherlands - planted; Norway - planted; Poland - planted; Portugal - planted; Romania - planted; Russian Federation - planted; Southern Russia - planted; San Marino - planted; [Serbia and Montenegro]; Serbia - planted; Slovakia - planted; Slovenia - planted; Spain - planted; Sweden - planted; Switzerland - planted; Ukraine - planted; United Kingdom - planted; Channel Islands - planted; Asia; China - planted; Japan - planted; Korea, Republic of - planted; Africa; South Africa - planted; North America; [Canada] Alberta - planted; British Columbia - planted; Manitoba - planted; Ontario - natural; Quebec - planted - [USA]; Alabama - natural; Arkansas - natural; Connecticut - natural; Delaware - natural; Florida - natural; Georgia (USA) - natural; Illinois - natural; Indiana - natural; Kentucky - natural; Louisiana - natural; Maine - natural; Maryland - natural; Massachusetts - natural; Michigan - natural; Mississippi - natural; Missouri - natural; New Jersey - natural; New York - natural; North Carolina - natural; North Dakota - planted; Ohio - natural; Oklahoma - planted; Oregon - planted; Pennsylvania - natural; Rhode Island - natural; South Carolina - natural; South Dakota - planted; Tennessee - natural; Vermont - natural; Virginia - natural; Washington - planted; West Virginia - natural; Wisconsin -planted"
301	1998. Heenan, P.B./Breitwieser, I./Glenny, D./De Lange, P.J./Brownsey, P.J.. Checklist of dicotyledons and pteridophytes naturalised or casual in New Zealand: Additional records 1994–1996. New Zealand Journal of Botany. 36(2): 155-162.	[Naturalized beyond native range? Possibly not New Zealand] "NOTES: The record for <i>L. tulipifera</i> given in Webb et al. (1995, p. 170) is based on a plant that was deliberately planted."
301	2005. Wagner, W.L./Herbst, D.R./Lorence, D.H.. Flora of the Hawaiian Islands website. Smithsonian Institution, Washington, D.C. <a href="http://botany.si.edu/pacificislandbiodiversity/hawaiianflora/index.htm">http://botany.si.edu/pacificislandbiodiversity/hawaiianflora/index.htm</a>	[Naturalized beyond native range? No evidence from Hawaiian Islands]
301	2006. Domingues de Almeida, J./Freitas, H.. Exotic naturalized flora of continental Portugal – A reassessment. Botanica Complutensis. 30: 117-130.	[Naturalized beyond native range? Yes] "Table 2. Exotic vascular plant species (invasive, potentially invasive or more or less naturalized) in continental Portugal." Year of first reported naturalization of exotic species = 1943 for <i>Liriodendron tulipifera</i> in Portugal]
301	2006. Howell, C.J./Sawyer, J.W.D.. New Zealand naturalised vascular plant checklist. New Zealand Plant Conservation Network, Wellington, NZ <a href="http://www.nzpcn.org.nz">www.nzpcn.org.nz</a>	[Naturalized beyond native range? Possibly] " <i>Liriodendron tulipifera</i> ... Naturalised plant status = Casual"
302	1979. Holm, L. G./Pancho, J.V./Herberger, J.P./Plucknett, D.L.. A Geographical Atlas of World Weeds. John Wiley and Sons, New York, NY	[Garden/amenity/disturbance weed? Yes] Rated as X for North America [the species is present and behaves as a weed, but its rank of importance is unknown]
302	1998. Hicks, R.R.. Ecology and management of central hardwood forests. John Wiley and Sons, New York, NY	[Garden/amenity/disturbance weed? Yes. Ecologically functions as an invader of disturbed areas] "Yellow-poplar is an excellent example of a species that employs an exploitative ecological strategy. It often functions as an invader of disturbed sites, has light, windborne seed with the ability to remain stored in the litter for several years, displays rapid excurrent height growth, and often develops in pure even-aged stands."
302	2007. Randall, R.P.. Global Compendium of Weeds - <i>Liriodendron tulipifera</i> [Online Database]. <a href="http://www.hear.org/gcw/species/liriodendron_tulipifera/">http://www.hear.org/gcw/species/liriodendron_tulipifera/</a>	[Garden/amenity/disturbance weed? Yes] Listed as a weed in numerous references, but of unknown significance or impact
303	2007. Randall, R.P.. Global Compendium of Weeds - <i>Liriodendron tulipifera</i> [Online Database]. <a href="http://www.hear.org/gcw/species/liriodendron_tulipifera/">http://www.hear.org/gcw/species/liriodendron_tulipifera/</a>	[Agricultural/forestry/horticultural weed? Potentially] Listed as an agricultural weed, but no evidence of impacts were found in subsequent literature searches

304	2007. Randall, R.P.. Global Compendium of Weeds - <i>Liriodendron tulipifera</i> [Online Database]. <a href="http://www.hear.org/gcw/species/liriodendron_tulipifera/">http://www.hear.org/gcw/species/liriodendron_tulipifera/</a>	[Environmental weed? No] No evidence
305	2007. Randall, R.P.. Global Compendium of Weeds - Index [Online Database]. <a href="http://www.hear.org/gcw/">http://www.hear.org/gcw/</a>	[Congeneric weed? No] No evidence
401	2011. eFloras. Flora of North America Vol. 3 - <i>Liriodendron tulipifera</i> . <a href="http://www.efloras.org/florataxon.aspx?flora_id=1&amp;taxon_id=200008463">http://www.efloras.org/florataxon.aspx?flora_id=1&amp;taxon_id=200008463</a>	[Produces spines, thorns or burrs? No] "Trees , single-trunked, to 45 m. Bark light gray, thick, deeply furrowed. Stipules paired, light green, elliptic to oblanceolate, 20-45mm; petiole 5-11.5 cm. Leaf blade commonly with 2 shallow upper lobes and 2 lateral lobes at broadest part, or sometimes squarrose and barely lobed, (6.5-)7.5-15(-23.5) × (8.5-)12.5-18.5(-25.5) cm; surfaces abaxially glaucous, adaxially bright green."
402	1990. Burns, R.M./Honkala, B.H.. <i>Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654.</i> U.S. Department of Agriculture, Forest Service, Washington, DC.	[Allelopathic? No. No evidence, & co-occurs with several other species] "On bottom lands and on the better drained soils of the Coastal Plain, yellow-poplar grows in mixture with the tupelos ( <i>Nyssa</i> spp.), baldcypress ( <i>Taxodium distichum</i> ), oaks <i>Quercus</i> spp.), red maple ( <i>Acer rubrum</i> ), sweetgum ( <i>Liquidambar styraciflua</i> ), and loblolly pine ( <i>Pinus taeda</i> ). In the Piedmont, associated species include oaks, sweetgum, blackgum ( <i>Nyssa sylvatica</i> ), red maple, loblolly pine, shortleaf pine ( <i>Pinus echinata</i> ), Virginia pine ( <i>P. virginiana</i> ), hickories ( <i>Carya</i> spp.), flowering dogwood ( <i>Cornus florida</i> ), sourwood ( <i>Oxydendrum arboreum</i> ), and redcedar ( <i>Juniperus virginiana</i> )."
403	2011. eFloras. Flora of North America Vol. 3 - <i>Liriodendron tulipifera</i> . <a href="http://www.efloras.org/florataxon.aspx?flora_id=1&amp;taxon_id=200008463">http://www.efloras.org/florataxon.aspx?flora_id=1&amp;taxon_id=200008463</a>	[Parasitic? No] "Trees , single-trunked, to 45 m." [Magnoliaceae]
404	1990. Burns, R.M./Honkala, B.H.. <i>Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654.</i> U.S. Department of Agriculture, Forest Service, Washington, DC.	[Unpalatable to grazing animals? No] "The leaves, twigs, and branches of yellow poplar are tender and palatable to livestock and white-tailed deer, and young trees are often heavily browsed. Seedlings are grazed to the ground, small saplings are trimmed back, and even large saplings may be ridden down and severely damaged. In areas where animals are concentrated, young yellow-poplar is frequently eliminated. Rabbits also eat the bark and buds of seedlings and saplings and can be quite destructive at times."
404	1998. Hicks, R.R.. <i>Ecology and management of central hardwood forests.</i> John Wiley and Sons, New York, NY	[Unpalatable to grazing animals? No] "Deer will browse yellow-poplar seedlings, but it is intermediate in browse preference."
405	1990. Burns, R.M./Honkala, B.H.. <i>Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654.</i> U.S. Department of Agriculture, Forest Service, Washington, DC.	[Toxic to animals? No evidence] "The leaves, twigs, and branches of yellow poplar are tender and palatable to livestock and white-tailed deer, and young trees are often heavily browsed. Seedlings are grazed to the ground, small saplings are trimmed back, and even large saplings may be ridden down and severely damaged. In areas where animals are concentrated, young yellow-poplar is frequently eliminated. Rabbits also eat the bark and buds of seedlings and saplings and can be quite destructive at times."
406	1990. Burns, R.M./Honkala, B.H.. <i>Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654.</i> U.S. Department of Agriculture, Forest Service, Washington, DC.	[Host for recognized pests and pathogens? Potentially] "Damaging Agents- Yellow-poplar is unusually free from damage by pests compared with many other commercially important species. While more than 30 species of insects attack yellow-poplar, only 4 species are considered to have significant economic impact (8). The tuliptree scale ( <i>Toumeyella liriodendri</i> ) causes loss of vigor by removing large quantities of phloem sap. Scale attacks often kill leaders of seedlings and saplings causing them to be overtopped by competitors. The yellow poplar weevil ( <i>Odontopus calceatus</i> ) feeds on buds and foliage and may occur in outbreaks over large areas. The rootcollar borer ( <i>Euzophera ostricolorella</i> ) attacks the phloem tissue at the base of the tree and provides entry points for rots and other pathogens. Attacks by the Columbian timber beetle ( <i>Corthylus columbianus</i> ) do not kill the tree but may degrade the wood. The defect consists of black stained burrows and discolored wood called "calico poplar.""

406	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Host for recognized pests and pathogens? Potentially] "Pests recorded Insects: Anoplophora glabripennis (Asian longhorned beetle) Corthylus columbianus Euzophera ostricolorella Illinoia liriodendri (tuliptree, aphid) Odontopus calceatus Orgyia leucostigma (white-marked tussock moth) Toumeyella liriodendri Nematodes: Helicotylenchus dihystra (common spiral nematode) Pratylenchus brachyurus (root lesion nematode) Pratylenchus penetrans (nematode, northern root lesion) Trichodorus (stubby root nematodes) Fungus diseases: Armillaria mellea (armillaria root rot) Ceratocystis pluriannulata Cylindrocladium scoparium (sheath net blotch) Flammulina velutipes Nectria galligena (Nectria canker (apple, pear)) Nectria haematococca (dry rot of potato) Pests recorded at the generic level (Liriodendron): Insects: Diaspidiotus perniciosus (San José scale) Xyleborus dispar (pear blight beetle)"
407	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Causes allergies or is otherwise toxic to humans? No evidence. Widely used tree] "Yellow-poplar is an extremely versatile wood with a multitude of uses...Yellow-poplar, with its shiny green leaves, distinctive flower, and statuesque appearance, is an excellent ornamental for park and garden where there is adequate space to accommodate its large size. It has distinctive value as a honey tree (25)."
408	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Creates a fire hazard in natural ecosystems? No evidence] "Even a light ground fire is usually fatal to small stems up to 2.5 cm (1 in) in diameter. These stems resprout after fire, but repeated fires may eliminate yellow-poplar from a site. When the bark becomes thick enough to insulate the cambium (about 1.3 cm; 0.5 in), yellow poplar becomes extremely fire resistant."
408	1998. Hicks, R.R.. Ecology and management of central hardwood forests. John Wiley and Sons, New York, NY	[Creates a fire hazard in natural ecosystems? No] "It is prone to fire damage, although the pure yellow-poplar type is not as likely to burn as oak forests due to the difference in type of litter and moisture conditions between the two types."
409	1986. Armesto, J.J./Mitchell, J.D./Villagran, C.. A Comparison of Spatial Patterns of Trees in Some Tropical and Temperate Forests. Biotropica. 18(1): 1-11.	[Is a shade tolerant plant at some stage of its life cycle? No] "Results from this study show that forests from Bryn Athyn and Chiloe have the greatest proportion of random spatial patterns. These forests are dominated by tree species whose regeneration seems to depend on the occurrence of large-scale disturbances. Such is the case of Liriodendron tulipifera and Quercus spp. at Bryn Athyn, which are highly shade- intolerant (Romme & Martin 1982),..."
409	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Is a shade tolerant plant at some stage of its life cycle? Yes, but only at seedling stage] "Reaction to Competition- Although classed as intolerant of shade, yellow-poplar can overcome much competition because it produces numerous seedlings and sprouts, and grows very rapidly."
409	1998. Hicks, R.R.. Ecology and management of central hardwood forests. John Wiley and Sons, New York, NY	[Is a shade tolerant plant at some stage of its life cycle? No] "Yellow-poplar is classes as shade intolerant and needs nearly full sunlight to grow well. As a result of its intolerance, yellow-poplar trees tend to lose their lower branches in closed stands with the live crown occurring in the upper portion of the bole."
409	2005. Kota, N.L.. Comparative seed dispersal, seedling establishment and growth of exotic, invasive Ailanthus altissima (Mill.) Swingle and native Liriodendron tulipifera (L.). MSc Thesis.. West Virginia University, Morgantown, West Virginia	[Is a shade tolerant plant at some stage of its life cycle? No. Described as "shade-intolerant"] "Liriodendron tulipifera L. (tulip poplar) is a native tree often found in the same habitat as Ailanthus, likely due to the ecological and reproductive similarities between the species, including a 'preference' for mesic temperate environments and high light typical of early succession (Beck, 1990)...Even though mean light availability was highest in the clearcut sites in both years (Fig. 3.4) plant growth response of 'shade-intolerant' Ailanthus and L. tulipifera (Daniel et. al., 1979; Miller, 1990) were greater in the selective cut forest (Tab. 3.2)."
410	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Tolerates a wide range of soil conditions? Yes] "Yellow-poplar thrives on many soil types with various physical properties, chemical composition, and parent material. Within the major portion of the range of yellow poplar, these soils fall in soil orders Inceptisols and Ultisols. Exceptionally good growth has been observed on alluvial soils bordering streams, on loam soils of mountain coves, on talus slopes below cliffs and bluffs, and on well watered, gravelly soils. In general, where yellow-poplar grows naturally and well, the soils are moderately moist, well drained, and loose textured; it rarely does well in very wet or very dry situations."
410	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Tolerates a wide range of soil conditions? Yes] "Soil descriptors - Soil texture: light; medium; heavy - Soil drainage: free - Soil reaction: acid; neutral; alkaline - Soil types: alluvial soils; gravelly soils; limestone soils; ultisols"
411	2011. eFloras. Flora of North America Vol. 3 - Liriodendron tulipifera. <a href="http://www.efloras.org/florataxon.aspx?flora_id=1&amp;taxon_id=200008463">http://www.efloras.org/florataxon.aspx?flora_id=1&amp;taxon_id=200008463</a>	[Climbing or smothering growth habit? No] "Trees , single-trunked, to 45 m. "

412	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Forms dense thickets? Yes, but may only form on abandoned agricultural fields] "Pure stands of yellow-poplar occupy only a small percentage of the total land within the range of the species, but they are usually on productive sites that include some of the most valuable timber producing forests in eastern North America. It has been repeatedly observed in the southern Appalachians that the percentage of yellow-poplar increases noticeably with increasing quality of the site. Where yellow-poplar grows in pure, or nearly pure, stands on medium and lower quality sites, it probably originated on abandoned old fields..."It is often a pioneer on abandoned old fields or clearcut land and may form essentially pure stands on very good sites. More often it regenerates as a mixed type with other species, and it commonly persists in old growth stands as scattered individuals." [unknown if it can invade forests & exclude other vegetation]
412	1998. Hicks, R.R.. Ecology and management of central hardwood forests. John Wiley and Sons, New York, NY	[Forms dense thickets? Yes] "It often functions as an invader of disturbed sites, has light, windborne seed with the ability to remain stored in the litter for several years, displays rapid excurrent height growth, and often develops in pure even-aged stands."
501	2011. eFloras. Flora of North America Vol. 3 - Liriodendron tulipifera. <a href="http://www.efloras.org/florataxon.aspx?flora_id=1&amp;taxon_id=200008463">http://www.efloras.org/florataxon.aspx?flora_id=1&amp;taxon_id=200008463</a>	[Aquatic? No] "Trees , single-trunked, to 45 m." [Terrestrial]
502	2011. eFloras. Flora of North America Vol. 3 - Liriodendron tulipifera. <a href="http://www.efloras.org/florataxon.aspx?flora_id=1&amp;taxon_id=200008463">http://www.efloras.org/florataxon.aspx?flora_id=1&amp;taxon_id=200008463</a>	[Grass? No] "Trees or shrubs , deciduous or evergreen, aromatic." [Magnoliaceae]
503	2011. eFloras. Flora of North America Vol. 3 - Liriodendron tulipifera. <a href="http://www.efloras.org/florataxon.aspx?flora_id=1&amp;taxon_id=200008463">http://www.efloras.org/florataxon.aspx?flora_id=1&amp;taxon_id=200008463</a>	[Nitrogen fixing woody plant? No] Magnoliaceae
504	2011. eFloras. Flora of North America Vol. 3 - Liriodendron tulipifera. <a href="http://www.efloras.org/florataxon.aspx?flora_id=1&amp;taxon_id=200008463">http://www.efloras.org/florataxon.aspx?flora_id=1&amp;taxon_id=200008463</a>	[Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)? No] "Trees , single-trunked, to 45 m."
601	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Evidence of substantial reproductive failure in native habitat? No] No evidence
601	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Evidence of substantial reproductive failure in native habitat? No] No evidence
602	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Produces viable seed? Yes] "- Stand establishment using natural regeneration; direct sowing; planting stock"
602	2005. Kota, N.L.. Comparative seed dispersal, seedling establishment and growth of exotic, invasive <i>Ailanthus altissima</i> (Mill.) Swingle and native <i>Liriodendron tulipifera</i> (L.). MSc Thesis.. West Virginia University, Morgantown, West Virginia	[Produces viable seed? Yes] "L. tulipifera seed viability is much lower (5 to 20% throughout the dispersal season; Beck, 1990), possibly due to inefficient pollination (Boyce, 1961)."
602	2008. Bonner, F.T./Karrfalt, R.P.. The Woody Plant Seed Manual. Government Printing Office, Washington, D.C.	[Produces viable seed? Yes] "The large, perfect, greenish-yellow flowers of tuliptree open from April to June (Little and Delisle 1962). The fruit is an elongated cone composed of closely overlapped carpels that are dry, woody, and winged (figure 1). Each carpel (samara) contains 1 or 2 seeds (figure 2). The cones turn from green to yellow to light brown as they ripen; they mature from early August in the northern part of the range (Guard 1943) to late October in the South (Bonner and Russell 1974). As the mature cones dry on the trees, they break apart and the samaras are scattered by the wind. Peak dissemination occurs in October and November, but a few samaras fall as late as the following March (Carvell and Korstian 1955; Whipple 1968). In South Carolina, seedfall is usually at least 90% complete by early December (Goebel and McGregor 1973)."
603	1983. He, Shan-An/Santamour, Jr., F.S.. Isoenzyme Verification of American-Chinese Hybrids of Liquidambar and Liriodendron. Annals of the Missouri Botanical Garden. 70(4): 748-749.	[Hybridizes naturally? Possibly] "Control-pollinated interspecific hybrids between <i>Liquidambar styraciflua</i> and <i>L. formosana</i> and between <i>Liriodendron tulipifera</i> and <i>L. Chinese</i> were verified by comparison of isoperoxidase banding patterns developed by starch gel electrophoresis of cambial extracts."
603	2011. eFloras. Flora of North America Vol. 3 - Liriodendron tulipifera. <a href="http://www.efloras.org/florataxon.aspx?flora_id=1&amp;taxon_id=200008463">http://www.efloras.org/florataxon.aspx?flora_id=1&amp;taxon_id=200008463</a>	[Hybridizes naturally? Possibly] " <i>Liriodendron tulipifera</i> is widely cultivated; a few cultivars have been introduced to horticulture, and the hybrid <i>L. tulipifera</i> x <i>L. chinense</i> is known." [Unknown if plants can hybridize naturally if planted together]

604	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Self-compatible or apomictic? Yes, but not as effective as cross-pollination] "...uncontrolled insect pollinations do not result in effective pollination of all stigmas, and a great deal of selfing occurs (7). Higher percentages of filled seed result from cross-pollination and crosses among widely separated trees (37). By controlled cross-pollination, as many as 90 percent filled seed per cone was obtained; the highest percentage for an open-pollinated tree was 35 percent. Cross-pollinated seedlings tended to be more vigorous than seedlings obtained from open pollination."
605	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Requires specialist pollinators? No] "Insects are important pollinators; flies, beetles, honey bees, and bumble bees (in decreasing order of abundance) were observed on opened flowers. However, uncontrolled insect pollinations do not result in effective pollination of all stigmas, and a great deal of selfing occurs (7)."
605	2008. Bonner, F.T./Karrfalt, R.P.. The Woody Plant Seed Manual. Government Printing Office, Washington, D.C.	[Requires specialist pollinators? No. Although pollination is often insufficient] "Tuliptree is pollinated by insects, and the number of filled samaras per cone is very low in natural stands (Boyce and Kaeiser 1961). There is considerable variation among trees, but a general average seems to be about 10% (Bonner and Russell 1974; Carvell and Korstian 1955; Heit 1942; Limstrom 1959; Sluder 1964; Swingle 1939; Whipple 1968) ... Some seed orchard managers have placed hives of honeybees in their orchards to increase seed production; results have been varied."
606	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Reproduction by vegetative fragmentation? No, but resprouts after cutting] "Vegetative Reproduction- Yellow poplar sprouts arise chiefly from preexisting dormant buds situated near the base of dead or dying stems, or near the soil line on stumps. Sprouts may occur as high as 30 to 38 cm (12 to 15 in) on high stumps, but more than 80 percent arise at or below the soil line (44). The percentage of stumps sprouting and the number of sprouts per stump decrease with increasing stump size. Stumps as large as 66 to 76 cm (26 to 30 in) sprouted 40 percent of the time, however, with an average of eight sprouts per stump. Yellow-poplar of the age and size harvested in second-growth stands sprouts prolifically."
607	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Minimum generative time (years)? 4+] "Yellow-poplars usually produce their first flowers at 15 to 20 years of age and may continue production for 200 years (29,31)."
607	2008. Bonner, F.T./Karrfalt, R.P.. The Woody Plant Seed Manual. Government Printing Office, Washington, D.C.	[Minimum generative time (years)? 4+] "Although trees as young as 9 years old have been reported to bear fruit, the normal commercial seed bearing age of tuliptree is 15 to 20 years (Bonner and Russell 1974)."
701	2011. eFloras. Flora of North America Vol. 3 - Liriodendron tulipifera. <a href="http://www.efloras.org/florataxon.aspx?flora_id=1&amp;taxon_id=200008463">http://www.efloras.org/florataxon.aspx?flora_id=1&amp;taxon_id=200008463</a>	[Propagules likely to be dispersed unintentionally ? No] "Samaracetums 4.5-8.5 cm, with numerous (1-) 2-seeded, imbricate samaras 3-5.5 x 0.5-1 cm, falling separately at maturity; receptacles with basal pistil persistent. Seeds (1-)-2." [Seeds and fruit with no means of external attachment]
702	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Propagules dispersed intentionally by people? Yes] "Products: 1. Wood: Descriptors: fuelwood; sawn or hewn building timbers; for light construction; carpentry/joinery; furniture; veneers; wood based materials; plywood; laminated wood; laminated veneer lumber; wood cement; pulp 2. Non-wood Descriptors: medicinal products; food; dyestuffs; honey" [See Question 2.05 for the extensive list of countries in which Liriodendron tulipifera has been planted]
702	2005. Staples, G.W./Herbst, D.R.. A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	[Propagules dispersed intentionally by people? Yes] "Rare in Hawaii, Tulip Tree or Yellow-Poplar, Liriodendron tulipifera Linnaeus, may be encountered at higher elevations on the Big Island and Maui."
703	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Propagules likely to disperse as a produce contaminant? No] "The individual, winged samaras may be scattered by the wind to distances equal to four or five times the height of a tree." [No evidence that species is grown with or has become a contaminant of produce]
704	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Propagules adapted to wind dispersal? Yes] "The individual, winged samaras may be scattered by the wind to distances equal to four or five times the height of a tree. In southern Indiana, a seedfall pattern was shown to be oval, with the center north of the seed tree. Prevailing south and southwest winds occasionally carried seeds more than 183 m (600 ft). Distribution of filled seeds occurred in satisfactory numbers 2,470 to 24,700/ha (1,000 to 10,000/acre)-as far as 60 m (200 ft) from a good seed tree in the direction of the prevailing wind and 30 m (100 ft) in all other directions."

704	2005. Kota, N.L.. Comparative seed dispersal, seedling establishment and growth of exotic, invasive <i>Ailanthus altissima</i> (Mill.) Swingle and native <i>Liriodendron tulipifera</i> (L.). MSc Thesis.. West Virginia University, Morgantown, West Virginia	[Propagules adapted to wind dispersal? Yes] "Reproduction occurs from wind-dispersed samaras that must overwinter prior to germination, and seedlings grow rapidly in high light and mesic temperate environments (Della-Bianca, 1983; Beck, 1990; Kavanagh, 1990)."
705	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Propagules water dispersed? Probably not. Seeds adapted for wind dispersal, & seedlings killed by flooding] "Yellow-poplar seedlings normally survive dormant-season flooding, but it was found that 1- year-old seedlings were usually killed by 4 days or more of flooding during the growing season (23). This vulnerability during the growing season explains why yellow poplar does not grow on flood plains of rivers that flood periodically for several days at a time."
706	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Propagules bird dispersed? Unlikely. Wind-adapted seeds are eaten by birds] "The individual, winged samaras may be scattered by the wind to distances equal to four or five times the height of a tree...its seeds are eaten by quails, purple finches, rabbits, gray squirrels, and white-footed mice."
707	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Propagules dispersed by other animals (externally)? Seeds potentially moved and cached by seed predators] "...its seeds are eaten by quails, purple finches, rabbits, gray squirrels, and white-footed mice."
708	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Propagules survive passage through the gut? Probably not] "...its seeds are eaten by quails, purple finches, rabbits, gray squirrels, and white-footed mice."
801	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Prolific seed production (>1000/m <sup>2</sup> )? No] "Measurement of the 1966 seed crop in 19 southern Appalachian stands showed an average of 3.7 million seeds per hectare (1.5 million/acre)." [3.7 million seeds/hectare = 370 seeds/sq. meter]
801	2008. Bonner, F.T./Karrfalt, R.P.. The Woody Plant Seed Manual. Government Printing Office, Washington, D.C.	[Prolific seed production (>1000/m <sup>2</sup> )? No] "In North Carolina, 1 large tree produced 29,000 sound seeds, and seedfall of 1.5 million seeds/ha is not uncommon (Beck 1990)." [1.5 million seeds/ha = 150 seeds/sq. meter]
802	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Evidence that a persistent propagule bank is formed (>1 yr)? Yes] "Yellow-poplar seeds retain their viability in the forest floor from 4 to 7 years (11). Large quantities of seeds in the forest floor are capable of producing seedlings when suitable environmental conditions exist."
802	2005. Kota, N.L.. Comparative seed dispersal, seedling establishment and growth of exotic, invasive <i>Ailanthus altissima</i> (Mill.) Swingle and native <i>Liriodendron tulipifera</i> (L.). MSc Thesis.. West Virginia University, Morgantown, West Virginia	[Evidence that a persistent propagule bank is formed (>1 yr)? Yes] "Although <i>L. tulipifera</i> may retain a seed bank for up to 7 years (Clark and Boyce, 1964), lack of germination may be a serious constraint in areas where seeds are dispersed for the first time after a disturbance; however, if given a chance, this highly-regarded native tree may thrive even in the presence of a noxious invader."
802	2008. Bonner, F.T./Karrfalt, R.P.. The Woody Plant Seed Manual. Government Printing Office, Washington, D.C.	[Evidence that a persistent propagule bank is formed (>1 yr)? Yes] "Tuliptree seeds are orthodox in storage behavior; they may be stored at low seed moisture contents (6 to 10%) and low temperatures (2 to 5 °C). No long-term storage data are available, but storage for several years under these conditions without loss of viability is common (Bonner and Russell 1974). Excellent results have also been reported for 3 to 4 years of moist storage in outdoor soil pits (Paton 1945; Williams and Mony 1962) or in drums of moist sand held in cold storage at 2 °C (Bonner and Russell 1974)."
803	2011. WRA Specialist. Personal Communication.	[Well controlled by herbicides? Unknown] No information on chemical control or herbicide efficacy on this species
804	1990. Burns, R.M./Honkala, B.H.. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.	[Tolerates, or benefits from, mutilation, cultivation, or fire? Yes] "Vegetative Reproduction- Yellow poplar sprouts arise chiefly from preexisting dormant buds situated near the base of dead or dying stems, or near the soil line on stumps. Sprouts may occur as high as 30 to 38 cm (12 to 15 in) on high stumps, but more than 80 percent arise at or below the soil line (44). The percentage of stumps sprouting and the number of sprouts per stump decrease with increasing stump size. Stumps as large as 66 to 76 cm (26 to 30 in) sprouted 40 percent of the time, however, with an average of eight sprouts per stump. Yellow-poplar of the age and size harvested in second-growth stands sprouts prolifically."
804	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Tolerates, or benefits from, mutilation, cultivation, or fire? Yes] "- Ability to sucker; regenerate rapidly; coppice; pollard"
805	2011. WRA Specialist. Personal Communication.	[Effective natural enemies present locally? Unknown]

