

CLIMATE CHANGE VULNERABILITY OF URBAN TREES WASHINGTON, D.C.





This list was developed to aid Washington, D.C. community forestry practitioners in selecting trees to reduce climate change vulnerability of their urban forests. It is meant to be a complement to other tree selection resources. Other factors may also need to be considered, such as aesthetics, local site conditions, wildlife value, or nursery availability. It is also important to note that some species may have climate benefits but may not be suitable for planting for other reasons, such as having invasive potential or susceptibility to pests or pathogens.

Vulnerability: Trees can be vulnerable to a variety of climate-related stressors such as intense heat, drought, flooding, and changing pest and disease patterns. Climate vulnerability is a function of the impacts of

climate change on a species and its adaptive capacity. Species with negative impacts on habitat suitability and low adaptive capacity will have high vulnerability and vice versa. The following factors were used to determine climate vulnerability:

Urban adaptability: Adaptability scores were generated for each species based on literature describing its tolerance to disturbances such as drought, flooding, pests, and disease, as well as its growth requirements such as shade tolerance, soil needs, and ease of nursery propagation. Scores were assigned to species using methods developed in an urban forest vulnerability assessment for Chicago for trees planted in developed sites. A positive score indicates that a species is tolerant to a wide range of disturbances and can be planted on a variety of sites. A negative score indicates a species is highly susceptible to disturbances and/or is limited to specific planting sites.

Hardiness and heat zone suitability: Tree species ranges were recorded from government, university, and arboretum websites. Species tolerance ranges were compared to current and projected heat and hardiness zones for Washington, D.C. using downscaled climate models under low emissions (RCP 4.5) and high emissions (RCP 8.5) scenarios for changes in greenhouse gases. Trees were considered to have suitable zone suitability if the species' tolerance was within the range of current and projected hardiness and heat zone through the end of the 21st century.

NOTE: This list was primarily created for species planted in developed sites, such as streets, yards, boulevards, and parks. If you are interested in projected changes in habitat suitability for native species in natural areas, see the Climate Change Tree Atlas at <u>www.fs.fed.us/nrs/atlas/</u>.

Current and projected USDA Hardiness Zones and AHS Heat Zones for Washington, D.C. Hardiness zone is determined by the average lowest temperature over a 30 year period. Heat zones are determined by the number of days above 86°F.

Time Period	Hardiness Z	Cone Range	Heat Zone Range		
1980–2010	-	7	7		
	Low Emissions	High Emissions	Low Emissions	High Emissions	
2010–2039	7	8	7 to 8	8	
2040-2069	7 to 8	8	8	9	
2070–2099	8	8 to 9	8	9 to 10	



SOURCE: Adaptability scores were assigned using methods developed in an urban forest vulnerability assessment for Chicago by Brandt et al. 2017 (<u>https://www.fs.fed.us/nrs/pubs/gtr/gtr_nrs168.pdf</u>). Future heat and hardiness zone information were provided from: <u>https://usfs.maps.arcgis.com/apps/MapSeries/index.</u> <u>html?appid=96088b1c086a4b39b3a75d0fd97a4c40</u>.

www.forestadaptation.org

URBAN ADAPTABILITY:

ZONE SUITABILITY:

- + **High:** Species may perform better than modeled
- Medium
- Low: Species may perform worse than modeled

✓ Suitable

× Not Suitable

VULNERABILITY:

- Low: Suitable zone, high adaptability
- *Low-moderate:* Suitable zone, medium adaptability
- *Moderate- high:* Zone not suitable, medium adaptability
- *High:* Zone not suitable, low adaptability
- *Moderate:* Suitable zone, low adaptability or zone not suitable, high adaptability

*Invasive species

		LOW EM	ISSIONS	HIGH EM	ISSIONS			LOW EM	ISSIONS	HIGH EM	ISSIONS
		ZONE		ZONE				ZONE		ZONE	
COMMON NAME	ADAPT	SUIT	VULN	SUIT	VULN	COMMON NAME	ADAPT	SUIT	VULN	SUIT	VULN
Alleghany serviceberry	+	v		×	Θ	Honeylocust*	•	 Image: A second s	•	×	0
American linden, Basswood	•	~	•	×	0	Ironwood	+	v		~	
American sweetgum, fruitless	+	~	▼	v	▼	Japanese flowering cherry	-	×	Δ	×	Δ
American beech	•	~	٠	~	•	Japanese pagoda tree	•	 Image: A second s	٠	×	0
American elm	•	~	٠	~	•	Japanese tree lilac	+	X	Θ	×	θ
American sycamore	•	~	•	~	•	Japanese zelkova	+	v	•	×	θ
Amur corktree*	+	×	Θ	×	θ	Jefferson elm	+	v	•	~	•
Amur maackia	+	×	Θ	×	Θ	Katsura tree	_	 Image: A second s	Θ	×	Δ
Amur maple*	•	×	0	×	0	Kentucky coffeetree	+	 Image: A second s	•	×	θ
Bald cypress	+	~		~	▼	Kousa dogwood	+	 Image: A second s	•	×	Θ
Bipinnate goldenrain tree	+	~	•	~	•	Lacebark elm	+	 Image: A second s	•	~	▼
Black alder	•	×	0	×	0	Littleleaf linden	+	X	Θ	×	θ
Black locust	•	~	•	×	0	London planetree	•	 Image: A second s	•	×	0
Black oak	•	~	•	×	0	Musclewood	+	 Image: A second s	•	~	▼
Black tupelo, Black gum	+	 Image: A set of the set of the	•	~	▼	New Harmony elm	+	¥	•	~	▼
Black walnut	_	 	θ	~	θ	Northern red oak	+	¥	•	×	θ
Blackjack oak	_	 	θ	~	θ	Northern white cedar, Arborvitae	•	X	0	×	0
Boxelder	•	~	•	×	0	Norway maple*	+	X	Θ	×	θ
Bur oak	•	~	•	×	0	Norway spruce	•	X	0	×	0
Callery pear*	•	~	•	×	0	Nutall oak	+	v	•	~	▼
Carolina silverbell	•	×	0	×	0	Okame cherry	+	v	•	×	θ
Chestnut oak	+	~	•	×	θ	Osage-orange	+	v	•	~	▼
Chinese fringetree	+	~	•	~	▼	Overcup oak	•	~	•	×	0
Chinese magnolia	+	×	θ	×	θ	Paperbark maple	_	v	Θ	×	Δ
Chinese pistachio	•	~	•	~	•	Persian parrotia	+	v	•	×	θ
Chokecherry	•	×	0	×	0	Pin oak	•	X	0	×	0
Common hackberry	+	~	•	~	▼	Post oak	_	v	θ	~	θ
Common horsechestnut	•	~	•	×	0	Princess tree*	+	~	•	×	θ
Crapemyrtle	+	~	•	~	▼	Princeton elm	+	v	•	~	▼
Dawn redwood	•	~	•	×	0	Red buckeye	•	v	•	~	•
Downy serviceberry	+	~	•	~	•	Red horsechesnut	•	~	•	×	0
Eastern hemlock	_	×	Δ	×	Δ	Red maple	•	v	•	~	•
Eastern redbud	•	~	•	×	0	River birch	•	~	•	~	•
Eastern redcedar	+	~	▼	~	▼	Sawtooth oak*	+	~	•	×	θ
Eastern serviceberry	•	×	0	×	0	Scarlet oak	+	~	•	~	▼
Eastern white pine	_	×	Δ	×	Δ	Shingle oak	+	~	▼	×	θ
English oak	•	~	•	×	0	Shumard oak	+	~	•	~	•
European hornbeam	+	~	•	×	θ	Siberian elm*	•	~	•	~	•
European mountain ash	+	×	θ	×	θ	Silver linden	•	×	0	×	0
Flowering dogwood	•	~	•	~	•	Silver maple	•	v	•	×	0
Ginkgo	+	~	•	×	θ	Smoothleaf elm	+	~	•	~	▼
Goldenrain tree*	+	~	▼	~	V	Sour cherry	•	~	•	×	0
Green ash	•	~	•	~	•	Sourwood	+	~	▼	 Image: A start of the start of	▼
Hardy rubbertree	+	X	θ	×	θ	Southern live oak	+	~	▼	~	▼
Hedge maple	+	 V 	V	×	.	Southern magnolia	+	~	▼	~	▼
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		LOW EMISSIONS		HIGH EMISSIONS		
		ZONE		ZONE		
COMMON NAME	ADAPT	SUIT	VULN	SUIT	VULN	
Sugar maple	•	~	•	×	0	
Sugarberry	•	~	•	~	٠	
Swamp white oak	+	~	▼	×	Θ	
Sweetbay magnolia	•	~	٠	~	٠	
Sweetgum	•	~	٠	~	•	
Tree of heaven*	+	~	▼	×	Θ	
Trident maple	+	~	▼	~	▼	
Tuliptree	-	×	Δ	×	Δ	
Washington hawthorn	•	~	٠	×	0	
Water oak	•	~	•	~	•	
White mulberry*	•	~	٠	×	0	
White oak	•	~	•	×	0	
Yellowwood	+	~	▼	×	Θ	
Yoshino cherry	+	~	V	×	Θ	