

CLIMATE CHANGE PROJECTIONS FOR INDIVIDUAL TREE SPECIES RIDGE AND VALLEY (PENNSYLVANIA SUBREGION 4)

Pennsylvania's forests will be affected by a changing climate during this century. A team of forest managers and researchers created an assessment that describes the vulnerability of forests in the Mid-Atlantic region (<https://forestadaptation.org/mid-atlantic/vulnerability-assessment>). This handout is summarized from the full assessment, but focuses on one region in Pennsylvania. Model results for additional regions can be found online at (<https://forestadaptation.org/PA-DISTRIB>).



TREE SPECIES INFORMATION:

The DISTRIB model of the Climate Change Tree Atlas uses inputs of tree abundance, climate, and environmental attributes to simulate current and future species habitat under two climate scenarios. Results for "low" and "high" climate scenarios can be compared on page 2 of this handout.

Remember that models are just tools, and they're not perfect. Output from DISTRIB does not consider many biological or disturbance factors which favor or limit tree establishment, growth, or mortality. For example, the susceptibility of ash species to emerald ash borer is causing widespread mortality and it will likely do even worse than the model suggests. For the 30 most common species, we present such factors not included in the model that may cause species to do better or worse than models suggest.

Despite their limitations, models provide useful information about future expectations. It's important to think of these projections as indicators of potential change in the amount of suitable habitat for a species, but that human choices and other factors will continue to influence tree distribution, movement, and forest composition at individual sites.

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SPECIES	ADDITIONAL CONSIDERATIONS
LIKELY TO DECREASE	
American basswood	Tolerates shade, susceptible to fire
American beech	Susceptible to beech diseases, very shade tolerant
American mountain-ash	Requires specific habitat, intolerant of fire and shade
Atlantic white-cedar	Requires specific habitat, intolerant of fire and drought
Balsam poplar	Vegetative resprout following fire
Bigtooth aspen	Early-sucessional colonizer, susceptible to drought
Black ash	Narrow requirements; Emerald ash borer causes mortality
Black spruce	Prone to sawfly and budworm attacks, drought-sensitive
Butternut	Prone to butternut canker, drought-sensitive
Chokecherry	Shade intolerant, sensitive to browsing and competition
Eastern hemlock	Hemlock woolly adelgid causes widespread mortality
MAY DECREASE	
Black cherry	Susceptible to insects and fire, somewhat drought-tolerant
Chestnut oak	Establishes from seed or sprout, adapted to fire
Cucumber tree	Susceptible to fire topkill
NO CHANGE	
Black locust	Early colonizer, but susceptible to locust borer & heart rot
MIXED MODEL RESULTS	
American chestnut	prone to chestnut blight; intolerant of fire
American hornbeam	Tolerates shade, susceptible to fire and drought
Black willow	Intolerant of shade, fire, and drought
Bur oak	Drought-tolerant, fire-resistant, adaptS to a variety of sites
Eastern cottonwood	Intolerant of shade, fire, defoliators and cankers
MAY INCREASE	
American elm	Grows on a variety of sites, Dutch elm disease
Black oak	Drought tolerant, susceptible to insect pests and diseases
Boxelder	Widespread and tolerant of drought and shade
Chinkapin oak	Tolerates a gradient of temperatures, very adaptable species
Eastern hophornbeam	Grows across a variety of sites, tolerates shade
LIKELY TO INCREASE	
Bear oak: scrub oak	Shade intolerant, susceptible to fire topkill and flood
Bitternut hickory	Drought-tolerant, susceptible to insects and fire topkill
Black walnut	Good disperser, but intolerant of shade and drought
Blackgum	Shade tolerant, fire adapted
Persimmon	Shade tolerant

SOURCE: Prasad, AM; Iverson, LR; Peters, MP; Matthews, SN. 2014. Climate change tree atlas. Northern Research Station, U.S. Forest Service, Delaware, OH. <http://www.nrs.fs.fed.us/atlas>.

FUTURE PROJECTIONS

The DISTRIB model uses Forest Inventory and Analysis (FIA) data to calculate an Importance Value (IV) for each species on the landscape in order to evaluate potential IV's at the end of this century (2070 – 2099). Those changes are classified in the table below as:

▲ INCREASE

Projected increase of >20% by 2100

● NO CHANGE

Little change (<20%) projected by 2100

▼ DECREASE

Projected decrease of >20% by 2100

★ NEW HABITAT

Tree Atlas projects new habitat for species not currently present

ADAPTABILITY

Factors not included in the Tree Atlas model, such as the ability to respond favorably to disturbance, may make a species more or less able to adapt to future stressors. Specific considerations are provided on page 1 for the 30 most abundant species.

+ high

Species may perform better than modeled

o medium

- low

Species may perform worse than modeled

SPECIES	FIA IV	MODEL RELIABILITY	CLIMATE CHANGE		ADAPT	SPECIES	FIA IV	MODEL RELIABILITY	CLIMATE CHANGE		ADAPT
			LOW (PCM B1)	HIGH (GFDL A1FI)					LOW (PCM B1)	HIGH (GFDL A1FI)	
American basswood	98	M	▼	▼	o	Northern red oak	881	H	●	▼	+
American beech	286	H	▼	▼	o	Osage-orange	1	M	●	▲	+
American chestnut	55	M	▲	●	o	Paper birch	11	H	▼	▼	o
American elm	87	M	●	▲	o	Pawpaw	5	L	●	●	o
American hornbeam	56	M	▼	▲	o	Persimmon	2	M	▲	▲	+
American mountain-ash	1	M	▼	▼	-	Pignut hickory	128	H	▲	▲	o
Atlantic white-cedar	1	L	▼	▼	-	Pin cherry	43	M	▼	▼	o
Balsam poplar	2	H	▼	▼	o	Pin oak	17	L	●	▲	-
Bear oak; scrub oak	111	L	▲	▲	o	Pitch pine	96	H	●	●	o
Bigtooth aspen	123	H	▼	▼	o	Quaking aspen	54	H	▼	▼	o
Bitternut hickory	27	L	▲	▲	+	Red maple	2021	H	●	▼	+
Black ash	1	H	▼	▼	-	Red mulberry	6	L	●	▲	o
Black cherry	1129	H	●	▼	-	Red pine	40	M	▼	▼	o
Black locust	217	L	●	●	o	Red spruce	9	H	▼	▼	-
Black maple	1	L	▼	▼	-	River birch	7	L	●	▲	o
Black oak	361	H	●	▲	o	Sassafras	449	H	▲	●	o
Black spruce	4	H	▼	▼	o	Scarlet oak	187	H	▲	▲	o
Black walnut	90	M	▲	▲	o	Serviceberry	166	M	●	▼	o
Black willow	4	L	▼	▲	-	Shagbark hickory	45	M	●	▲	o
Blackgum	352	H	▲	▲	+	Shellbark hickory	1	L	▼	▲	o
Boxelder	79	M	●	▲	+	Shingle oak	4	M	●	▲	o
Bur oak	2	M	▼	▲	+	Shortleaf pine	2	H	●	▲	o
Butternut	15	L	▼	▼	-	Silver maple	27	M	▼	▲	+
Chestnut oak	1160	M	●	▼	+	Slippery elm	94	M	●	▲	o
Chinkapin oak	2	M	●	▲	o	Sourwood	0	H	★	★	+
Chokecherry	57	L	▼	▼	o	Southern red oak	1	H	●	▲	+
Cucumbertree	13	L	●	▼	o	Striped maple	220	H	●	▼	o
Eastern cottonwood	367	H	▼	▲	-	Sugar maple	515	H	●	▼	+
Eastern hemlock	134	M	▼	▼	+	Swamp white oak	12	L	●	▼	o
Eastern hophornbeam	26	M	●	▲	o	Sweet birch	826	H	●	▼	-
Eastern redbud	49	M	▲	▲	o	Sweetgum	1	H	●	▲	o
Eastern redcedar	274	H	▲	▼	o	Sycamore	38	M	▲	▲	o
Eastern white pine	203	H	●	▼	o	Table mountain pine	7	M	▼	●	+
Flowering dogwood	59	M	▲	▼	o	Tamarack (native)	16	H	●	▼	-
Gray birch	51	M	●	●	o	Virginia pine	117	H	●	▲	o
Green ash	23	M	●	▲	+	White ash	844	H	●	▼	-
Hackberry	2	L	●	▲	+	White oak	502	H	●	▲	+
Honeylocust	2	H	●	▲	o	White spruce	17	M	●	●	o
Jack pine	114	H	▼	▼	+	Yellow birch	81	H	▼	▼	o
Mockernut hickory	2	H	▲	▲	+	Yellow-poplar	224	H	▲	▼	+