

CLIMATE CHANGE PROJECTIONS FOR INDIVIDUAL TREE SPECIES

NORTHERN ALLEGHENY PLATEAU (PENNSYLVANIA SUBREGION 3)

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 beech	Susceptible to beech diseases, very shade tolerant
Quaking aspen	Early-successional colonizer, susceptible to heat and drought
Striped maple	Shade tolerant and easily established, susceptible to drought
Sugar maple	Grows across a variety of sites, tolerates shade
MAY DECREASE	
Bigtooth aspen	Early-successional colonizer, susceptible to drought
Black cherry	Susceptible to insects and fire, somewhat drought-tolerant
Eastern hemlock	Hemlock woolly adelgid causes widespread mortality
Eastern white pine	Good disperser, but susceptible to drought and insects
Red maple	Competitive colonizer in many sites, disturbance-tolerant
Serviceberry	Competative colonizer, susceptible to drought
Sweet birch	Susceptible to drought, fire topkill, and insects
White ash	Emerald ash borer causes widespread mortality
Yellow birch	Good disperser, susceptible to fire, insects, and disease
NO CHANGE	
American basswood	Tolerates shade, susceptible to fire
American hornbeam	Tolerates shade, susceptible to fire and drought
Eastern hophornbeam	Grows across a variety of sites, tolerates shade
Northern red oak	Susceptible to insect pests
MIXED MODEL RESULTS	
American elm	Grows on a variety of sites, Dutch elm disease
Chestnut oak	Establishes from seed or sprout, adapted to fire
Gray birch	Susceptible to leaf miners, cankers, and fire topkill
LIKELY TO INCREASE	
Bear oak: scrub oak	Shade intolerant, susceptible to fire topkill and flood
Black oak	Drought tolerant, susceptible to insect pests and diseases
Blackgum	Shade tolerant, fire adapted
Flowering dogwood	Shade tolerant
Mockernut hickory	Susceptible to fire topkill
Pignut hickory	Susceptible to bark beetles and drought
Sassafras	Early-successional colonizer, susceptible to fire topkill
Scarlet oak	Establishes from seed/sprout, susceptible to fire/disease
White oak	Fire-adapted, grows on a variety of sites
Yellow-poplar	Competitive colonizer tolerant of diverse sites

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 (GFDL)		ADAPT	SPECIES	FIA IV	MODEL RELIABILITY	CLIMATE CHANGE (GFDL)		ADAPT
			LOW CHANGE (PCM B1)	HIGH CHANGE (A1FI)					LOW CHANGE (PCM B1)	HIGH CHANGE (A1FI)	
American basswood	108	M	●	●	o	Mountain maple	8	H	▼	▼	+
American beech	1402	H	▼	▼	o	Northern catalpa	1	L	▼	●	o
American chestnut	32	M	▲	▲	o	Northern red oak	574	H	●	●	+
American elm	53	M	▼	▲	o	Northern white-cedar	0	H	▼	▼	o
American hornbeam	166	M	●	●	o	Osage-orange	1	M	▼	▲	+
American mountain-ash	4	M	▼	▼	-	Paper birch	45	H	▼	▼	o
Balsam fir	0	H	▼	▼	-	Pignut hickory	60	H	▲	▲	o
Balsam poplar	6	H	▼	▼	o	Pin cherry	38	M	▼	▼	o
Bear oak; scrub oak	58	L	▲	▲	o	Pin oak	9	L	●	●	-
Bigtooth aspen	167	H	●	▼	o	Pitch pine	46	H	▲	▲	o
Bitternut hickory	9	L	●	▲	+	Quaking aspen	199	H	▼	▼	o
Black ash	2	H	▼	▼	-	Red maple	2194	H	●	▼	+
Black cherry	845	H	●	▼	-	Red pine	38	M	▼	▼	o
Black hickory	0	H	NA	★	o	Red spruce	12	H	▼	▼	-
Black locust	25	L	▲	▲	o	River birch	3	L	▼	▼	o
Black oak	123	H	▲	▲	o	Sassafras	123	H	▲	▲	o
Black spruce	1	H	▼	▼	o	Scarlet oak	86	H	▲	▲	o
Black walnut	17	M	▲	▲	o	Serviceberry	235	M	●	▼	o
Black willow	16	L	▼	▲	-	Shagbark hickory	20	M	●	▲	o
Blackgum	75	H	▲	▲	+	Shingle oak	3	M	▼	▲	o
Boxelder	6	M	●	▲	+	Shortleaf pine	0	H	★	★	o
Bur oak	1	M	▼	▲	+	Shumard oak	0	H	NA	★	+
Butternut	13	L	●	▼	-	Silver maple	27	M	▼	▲	+
Chestnut oak	383	M	▲	●	+	Slippery elm	29	M	▲	▲	o
Chinkapin oak	2	M	▼	▲	o	Sourwood	1	H	▲	▲	+
Chokecherry	32	L	●	▼	o	Southern red oak	0	H	NA	★	+
Cucumbertree	34	H	●	▼	o	Striped maple	234	H	▼	▼	o
Eastern cottonwood	3	L	▼	▲	o	Sugar maple	1037	H	▼	▼	+
Eastern hemlock	502	H	●	▼	-	Swamp white oak	4	L	●	●	o
Eastern hophornbeam	229	M	●	●	+	Sweet birch	543	H	●	▼	-
Eastern redbud	1	M	▲	▲	o	Sweetgum	1	H	▲	▲	o
Eastern redcedar	11	M	●	▲	o	Sycamore	23	M	▲	▲	o
Eastern white pine	300	H	●	▼	o	Tamarack (native)	20	H	▼	▼	-
Flowering dogwood	64	H	▲	▲	o	Virginia pine	12	H	▼	▲	o
Gray birch	61	M	▲	▼	o	White ash	738	H	●	▼	-
Green ash	11	M	●	▲	o	White oak	444	H	▲	▲	+
Hackberry	1	M	●	▲	+	White spruce	8	M	▼	▼	o
Honeylocust	2	L	▼	▲	+	Winged elm	1	H	▼	▲	o
Jack pine	1	H	▼	▼	o	Yellow birch	171	H	●	▼	o
Mockernut hickory	52	H	▲	▲	+	Yellow-poplar	49	H	▲	▲	+