

CLIMATE CHANGE PROJECTIONS FOR INDIVIDUAL TREE SPECIES PIEDMONT (PENNSYLVANIA SUBREGION 5)

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	
Black cherry	Establishes from seed or sprout, adapted to fire
Eastern white pine	Good disperser, but susceptible to drought and insects
Sweet birch	Susceptible to drought, fire topkill, and insects
White ash	Emerald ash borer causes widespread mortality
MAY DECREASE	
American beech	Susceptible to beech diseases, very shade tolerant
Black locust	Susceptible to fire topkill
Black walnut	Drought-tolerant, susceptible to insects and fire topkill
Chestnut oak	Widespread and tolerant of drought and shade
Eastern hemlock	Intolerant of shade, fire, and drought
Flowering dogwood	Shade tolerant
Northern red oak	Susceptible to insect pests
Pignut hickory	Susceptible to bark beetles and drought
Red maple	Competitive colonizer in many sites, disturbance-tolerant
Scarlet oak	Establishes from seed or sprout, susceptible to fire and disease
Sugar maple	Grows across a variety of sites, tolerates shade
Virginia pine	Intolerant of shade and pollution
Yellow-poplar	Competitive colonizer tolerant of diverse sites
NO CHANGE	
Blackgum	Shade tolerant, fire adapted
MIXED MODEL RESULTS	
American elm	Requires specific habitat, intolerant of fire and drought
Pawpaw	Shade tolerant; susceptible to drought
Sassafras	Early-successional colonizer, susceptible to fire topkill
Silver maple	Early-successional colonizer, susceptible to fire topkill and drought
MAY INCREASE	
Black oak	Early colonizer, but susceptible to locust borer & heart rot
Boxelder	Shade tolerant
Pin oak	Susceptible to insect pests and disease
LIKELY TO INCREASE	
Eastern redcedar	Drought tolerant, shade intolerant, susceptible to fire and insects
Mockernut hickory	Susceptible to fire topkill
Sweetgum	Establishes by seed or sprouting, susceptible to fire and drought
Sycamore	Generally tolerant of a wide range of soils
White oak	Fire-adapted, grows on a variety of 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	10	M	▼	▼	o	Nuttall oak	0	H	●	●	+
American beech	152	H	●	▼	o	Osage-orange	1	M	▼	▲	+
American chestnut	15	M	●	●	o	Paper birch	1	H	▼	▼	o
American elm	60	M	▼	▲	o	Pawpaw	49	L	▲	▼	o
American holly	0	H	★	★	o	Persimmon	4	M	▲	▲	+
American hornbeam	44	M	●	●	o	Pignut hickory	108	H	●	▼	o
Balsam poplar	0	H	▼	▼	o	Pin cherry	8	M	●	▼	o
Bear oak; scrub oak	27	L	▲	▲	o	Pin oak	47	L	▲	●	-
Bigtooth aspen	30	H	▼	▼	o	Pitch pine	37	H	▼	▼	o
Bitternut hickory	12	L	▲	▲	+	Quaking aspen	3	H	▼	▼	o
Black cherry	472	H	▼	▼	-	Red maple	727	H	●	▼	+
Black hickory	0	H	★	★	o	Red mulberry	8	L	●	▲	o
Black locust	51	L	●	▼	o	Red pine	14	M	▼	▼	o
Black oak	217	H	●	▲	o	Red spruce	2	H	▼	▼	-
Black walnut	85	M	●	▼	o	River birch	8	L	●	▲	o
Black willow	13	L	▼	▲	-	Sassafras	200	H	▲	▼	o
Blackgum	189	H	●	●	+	Scarlet oak	90	H	●	▼	o
Boxelder	119	M	▲	●	+	Serviceberry	21	M	●	▼	o
Butternut	34	L	▼	▼	-	Shagbark hickory	22	M	▲	▲	o
Chestnut oak	365	M	●	▼	+	Shortleaf pine	1	H	▲	▲	o
Chinkapin oak	1	M	▲	▲	o	Shumard oak	0	H	NA	★	+
Chokecherry	18	L	●	▼	o	Silver maple	46	M	▼	▲	+
Cucumbertree	1	H	●	▼	o	Slippery elm	33	M	●	●	o
Eastern cottonwood	8	L	▼	▲	o	Sourwood	0	H	★	★	+
Eastern hemlock	70	H	●	▼	-	Southern red oak	1	H	▲	▲	+
Eastern hophornbeam	32	M	●	▲	+	Striped maple	6	H	▼	▼	o
Eastern redbud	13	M	▲	▲	o	Sugar maple	125	H	●	▼	+
Eastern redcedar	94	M	▲	▲	o	Swamp white oak	14	L	●	▼	o
Eastern white pine	61	H	▼	▼	o	Sweet birch	161	H	▼	▼	-
Flowering dogwood	189	H	●	▼	o	Sweetgum	68	H	▲	▲	o
Gray birch	9	M	▼	●	o	Sycamore	45	M	▲	▲	o
Green ash	25	M	▼	▲	o	Tamarack (native)	9	H	▼	▼	-
Hackberry	24	M	●	▲	+	Virginia pine	45	H	●	▼	o
Honeylocust	1	L	▼	▲	+	Water tupelo	10	M	●	▲	-
Loblolly pine	2	H	▲	▲	o	White ash	619	H	▼	▼	-
Mockernut hickory	93	H	▲	▲	+	White oak	202	H	▲	▲	+
Mountain maple	1	H	●	▼	+	White spruce	15	M	●	●	o
Northern catalpa	12	L	▼	●	o	Winged elm	0	H	★	★	o
Northern red oak	303	H	●	▼	+	Yellow birch	16	H	▼	▼	o
Northern white-cedar	0	H	▼	▼	o	Yellow-poplar	325	H	●	▼	+