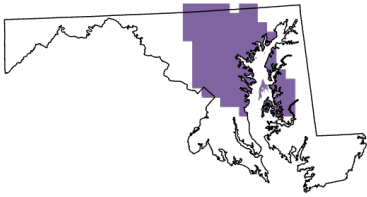# CLIMATE CHANGE PROJECTIONS FOR INDIVIDUAL TREE SPECIES
GREATER BALTIMORE, MARYLAND

This list was developed to aid Greater Baltimore 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.

The Landscape Change Research Group recently updated the Climate Change Tree Atlas, and this handout summarizes information for the Greater Baltimore region. Full Tree Atlas results are available online at www.fs.fed.us/nrs/atlas/. Two climate scenarios are presented to "bracket" a range of possible futures. These future climate projections (2070 to 2099) provide information about how individual tree species may respond to a changing climate. Results for "low" and "high" emissions scenarios can be compared on the reverse side of this handout.

The updated Tree Atlas presents additional information helpful to interpret tree species changes:

- *Suitable habitat* - calculated based on 39 variables that explain where optimum conditions exist for a species, including soils, landforms, and climate variables.

- *Adaptability* - based on life-history traits that might increase or decrease tolerance of expected changes, such as the ability to withstand different forms of disturbance.

- *Capability* - a rating of the species' ability to cope or persist with climate change in this region based on suitable habitat change (statistical modeling), adaptability (literature review and expert opinion), and abundance (FIA data). The capability rating is modified by abundance information; ratings are downgraded for rare species and upgraded for abundant species.

- *Migration Potential Model* - when combined with habitat suitability, an estimate of a species' colonization likelihood for new habitats. This rating can be helpful for assisted migration or focused management (see the table section: "New Habitat with Migration Potential").

Remember that models are just tools, and they're not perfect. Model projections can't account for all factors that influence future species success. If a species is rare or confined to a small area, model results may be less reliable. These factors, and others, could cause a particular species to perform better or worse than a model projects. Human choices will also continue to influence forest distribution, especially for tree species that are projected to increase. Despite these limits, models provide useful information about future expectations. It's perhaps best to think of these projections as indicators of possibility and potential change.

CLIMATE CHANGE CAPABILITY

POOR CAPABILITY

Bigtooth aspen	Pin oak
Black ash	Quaking aspen
Eastern white pine	Shingle oak
Pawpaw	Swamp white oak

FAIR CAPABILITY

American beech	Eastern cottonwood
Bitternut hickory	Red mulberry
Black locust	Sassafras
Black walnut	Scarlet oak
Chestnut oak	Virginia pine

GOOD CAPABILITY

American elm	Northern red oak
American holly	Pignut hickory
American hornbeam	Red maple
Black cherry	Shagbark hickory
Black oak	Southern red oak
Blackgum	Sugar maple
Boxelder	Swamp chestnut oak
Cherrybark oak	Sweetbay
Eastern hophornbeam	Sweetgum
Eastern redcedar	Sycamore
Flowering dogwood	White ash
Green ash	White oak
Hackberry	Willow oak
Loblolly pine	Yellow Poplar
Mockernut hickory	

MIXED RESULTS

Silver maple	Common persimmon
Slippery elm	Black willow

NEW HABITAT WITH MIGRATION POTENTIAL

Bald cypress	River birch
Blackjack oak	Shortleaf pine
Eastern redbud	Sourwood
Laurel oak	Sugarberry
Longleaf pine	Swamp tupelo
Overcup oak	Water oak
Pond cypress	Water tupelo
Post oak	Winged elm
Redbay	

www.forestadaptation.org

ADAPTABILITY: Life-history factors, such as the ability to respond favorably to disturbance, that are not included in the Tree Atlas model and may make a species more or less able to adapt to future stressors.

- **+ HIGH** *Species may perform better than modeled*
- **· MEDIUM**
- **− LOW** *Species may perform worse than modeled*

HABITAT CHANGE: Projected change in suitable habitat between current and potential future conditions.

- **▲ INCREASE** *Projected increase of >20% by 2100*
- **● NO CHANGE** *Projected change of <20% by 2100*
- **▼ DECREASE** *Projected decrease of >20% by 2100*
- **★ NEW HABITAT** *Tree Atlas projects new habitat for species not currently present*

ABUNDANCE: Based on Forest Inventory Analysis (FIA) summed Importance Value data, calibrated to a standard geographic area.

- **+ ABUNDANT**
- **· COMMON**
- **− RARE**

CAPABILITY: An overall rating that describes a species' ability to cope or persist with climate change based on suitable habitat change class (statistical modeling), adaptability (literature review and expert opinion), and abundance within this region.

- **△ GOOD** *Increasing suitable habitat, medium or high adaptability, and common or abundant*
- **○ FAIR** *Mixed combinations, such as a rare species with increasing suitable habitat and medium adaptability*
- **▽ POOR** *Decreasing suitable habitat, medium or low adaptability, and uncommon or rare*

SPECIES	ADAPT	ABUN	LOW CLIMATE CHANGE (RCP 4.5) HABITAT CHANGE	CAPABILITY	HIGH CLIMATE CHANGE (RCP 8.5) HABITAT CHANGE	CAPABILITY
American beech	·	·	▼	○	▼	○
American elm	·	−	▲	△	▲	△
American holly	·	−	▲	△	▲	△
American hornbeam*	·	−	▲	△	▲	△
Bald cypress	·		★		★	
Bigtooth aspen	·	−	▼	▽	▼	▽
Bitternut hickory*	+	−	●	○	●	○
Black ash	−	−	▼	▽	▼	▽
Black cherry	−	·	●	△	●	△
Black locust*	·	·	▼	○	▼	○
Black oak	·	·	▲	△	▲	△
Black walnut*	·	·	▼	○	▼	○
Black willow*	−	−	●	○	▲	△
Blackgum	+	·	●	△	▲	△
Blackjack oak	+		★		★	
Boxelder*	+	·	●	△	●	△
Cherrybark oak	·	·	●	△	●	△
Chestnut oak	+	·	▼	○	▼	○
Common persimmon*	+	−	●	○	▲	△
Eastern cottonwood*	·	·	▼	○	▼	○
Eastern hophornbeam*	+	−	▲	△	▲	△
Eastern redbud*	·		★		★	
Eastern redcedar	·	−	▲	△	▲	△
Eastern white pine	−	·	▼	▽	▼	▽
Flowering dogwood	·	−	▲	△	▲	△
Green ash*	·	−	▲	△	▲	△
Hackberry	+	−	▲	△	▲	△
Laurel oak	·		★		★	
Loblolly pine	·	·	▲	△	▲	△
Longleaf pine	·		★		★	
Mockernut hickory	+	·	▲	△	▲	△
Northern red oak	+	·	●	△	●	△
Overcup oak	−		★		★	
Pawpaw*	·	−	▼	▽	▼	▽

SPECIES	ADAPT	ABUN	LOW CLIMATE CHANGE (RCP 4.5) HABITAT CHANGE	CAPABILITY	HIGH CLIMATE CHANGE (RCP 8.5) HABITAT CHANGE	CAPABILITY
Pignut hickory	·	·	●	△	●	△
Pin oak*	−	−	▼	▽	▼	▽
Pond cypress	·		★		★	
Post oak	+		★		★	
Quaking aspen	·	−	▼	▽	▼	▽
Red maple	+	+	▼	△	▼	△
Red mulberry*	·	−	●	○	●	○
Redbay*	+		★		★	
River birch*	·		★		★	
Sassafras*	·	·	▼	○	▼	○
Scarlet oak	·	·	▼	○	▼	○
Shagbark hickory	·	−	▲	△	▲	
Shingle oak	·	−	▼	▽	▼	▽
Shortleaf pine	·		★		★	
Silver maple*	+	−	▼	▽	●	○
Slippery elm*	·	−	▼	▽	●	○
Sourwood	+		★		★	
Southern red oak	+	−	▲	△	▲	△
Sugar maple	+	−	▲	△	▲	△
Sugarberry	·		★		★	
Swamp chestnut oak*	·	−	▲	△	▲	△
Swamp tupelo	−		★		★	
Swamp white oak*	·	−	▼	▽	▼	▽
Sweetbay	·	−	▲	△	▲	△
Sweetgum	·	·	▲	△	▲	△
Sycamore*	·	·	▲	△	▲	△
Virginia pine	·	·	▼	○	▼	○
Water oak	·		★		★	
Water tupelo	−		★		★	
White ash	−	·	●	△	●	△
White oak	+	·	▲	△	▲	△
Willow oak*	·	−	▲	△	▲	
Winged elm	·		★		★	
Yellow Poplar	+	+	▼	△	▼	△

Species with low model reliability based on five statistical metrics of the habitat models that affect change class. See maps and tables for more information (www.fs.fed.us/nrs/atlas/combined/resources/summaries).

Created December 2021.