# ua 47719

**U.S. Census Bureau Urban Areas**
Climate Change Atlas Tree Species
Current and Potential Future Habitat, Capability, and Migration

**USDA Forest Service**
**Northern Research Station**
**Landscape Change Research Group**
**Iverson, Peters, Prasad, Matthews**

| | sq. km | sq. mi | FIA Plots |
|---|---|---|---|
| Area of Region | 8,000.0 | 3,088.8 | 68 |

## Species Information

The columns below provide breif summaries of the species associated with the region and described in the table on the next pages. Definitions are provided in the Excel file for this region.

| Genus | Species |
|---|---|
| Ash | 3 |
| Hickory | 3 |
| Maple | 4 |
| Oak | 6 |
| Pine | 2 |
| Other | 21 |
| | **39** |

| Abundance | |
|---|---|
| Abundant | 1 |
| Common | 18 |
| Rare | 20 |
| Absent | 15 |
| | **54** |

| | Model Reliability | Adaptability |
|---|---|---|
| High | 11 | 19 |
| Medium | 18 | 26 |
| Low | 21 | 7 |
| FIA | 4 | |
| | **54** | **52** |

| Potential Change in Habitat Suitability | Scenario RCP45 | Scenario RCP85 |
|---|---|---|
| Increase | 13 | 12 |
| No Change | 7 | 9 |
| Decrease | 15 | 14 |
| New | 15 | 15 |
| Unknown | 4 | 4 |
| | **54** | **54** |

| Capability to Cope or Persist | Scenario RCP45 | Scenario RCP85 |
|---|---|---|
| Very Good | 6 | 5 |
| Good | 6 | 6 |
| Fair | 8 | 8 |
| Poor | 6 | 9 |
| Very Poor | 7 | 3 |
| FIA Only | 2 | 2 |
| Unknown | 0 | 0 |
| | **35** | **33** |

| Migration Potential | SHIFT RCP45 | SHIFT RCP85 |
|---|---|---|
| Likely | 2 | 2 |
| Infill | 16 | 14 |
| Migrate | 3 | 6 |
| | **21** | **22** |

## Potential Changes in Climate Variables

**Temperature (°F)**

| | Scenario | 2009 | 2039 | 2069 | 2099 |
|---|---|---|---|---|---|
| Annual Average | CCSM45 | 47.7 | 49.6 | 52.5 | 52.5 |
| | CCSM85 | 47.7 | 50.3 | 53.1 | 56.4 |
| | GFDL45 | 47.7 | 52.2 | 53.4 | 54.4 |
| | GFDL85 | 47.7 | 50.8 | 54.4 | 58.9 |
| | HAD45 | 47.7 | 51.0 | 54.4 | 56.2 |
| | HAD85 | 47.7 | 51.1 | 55.7 | 61.0 |
| Growing Season May—Sep | CCSM45 | 65.2 | 67.1 | 69.6 | 69.8 |
| | CCSM85 | 65.2 | 67.9 | 70.3 | 74.3 |
| | GFDL45 | 65.2 | 70.8 | 72.2 | 73.7 |
| | GFDL85 | 65.2 | 69.2 | 73.5 | 78.6 |
| | HAD45 | 65.2 | 68.9 | 71.3 | 73.7 |
| | HAD85 | 65.2 | 68.4 | 73.4 | 78.9 |
| Coldest Month Average | CCSM45 | 20.8 | 22.4 | 25.2 | 25.0 |
| | CCSM85 | 20.8 | 23.4 | 25.5 | 27.5 |
| | GFDL45 | 20.8 | 23.7 | 25.0 | 25.4 |
| | GFDL85 | 20.8 | 24.3 | 25.6 | 27.5 |
| | HAD45 | 20.8 | 22.6 | 26.4 | 26.3 |
| | HAD85 | 20.8 | 24.7 | 27.6 | 31.1 |
| Warmest Month Average | CCSM45 | 71.2 | 73.6 | 75.1 | 75.5 |
| | CCSM85 | 71.2 | 74.8 | 76.4 | 78.5 |
| | GFDL45 | 71.2 | 74.5 | 76.2 | 77.3 |
| | GFDL85 | 71.2 | 75.4 | 77.5 | 80.6 |
| | HAD45 | 71.2 | 75.4 | 77.0 | 78.6 |
| | HAD85 | 71.2 | 75.9 | 79.1 | 83.1 |

**Precipitation (in)**

| | Scenario | 2009 | 2039 | 2069 | 2099 |
|---|---|---|---|---|---|
| Annual Total | CCSM45 | 33.3 | 32.7 | 32.0 | 33.3 |
| | CCSM85 | 33.3 | 33.3 | 33.2 | 33.8 |
| | GFDL45 | 33.3 | 35.9 | 39.7 | 39.6 |
| | GFDL85 | 33.3 | 36.3 | 40.3 | 41.8 |
| | HAD45 | 33.3 | 33.9 | 36.1 | 35.5 |
| | HAD85 | 33.3 | 35.7 | 33.4 | 36.6 |
| Growing Season May—Sep | CCSM45 | 16.9 | 16.8 | 16.2 | 16.5 |
| | CCSM85 | 16.9 | 16.5 | 16.6 | 15.8 |
| | GFDL45 | 16.9 | 17.7 | 19.4 | 19.7 |
| | GFDL85 | 16.9 | 18.5 | 19.0 | 19.4 |
| | HAD45 | 16.9 | 16.3 | 15.5 | 16.1 |
| | HAD85 | 16.9 | 16.6 | 13.4 | 14.6 |

**NOTE:** For the six climate variables, four 30-year periods are used to indicate six potential future trajectories. The period ending in 2009 is based on modeled observations from the PRISM Climate Group and the three future periods were obtained from the NASA NEX-DCP30 dataset. Future climate projections from three models under two emission scenarios show estimates of each climate variable within the region. The three models are CCSM4, GFDL CM3, and HadGEM2-ES and the emission scenarios are the 4.5 and 8.5 RCP. The average value for the region is reported, even though locations within the region may vary substantially based on latitude, elevation, land-use, or other factors.

**Cite as:** Iverson, L.R.; Prasad, A.M.; Peters, M.P.; Matthews, S.N. 2019. Facilitating Adaptive Forest Management under Climate Change: A Spatially Specific Synthesis of 125 Species for Habitat Changes and Assisted Migration over the Eastern United States. Forests. 10(11): 989. https://doi.org/10.3390/f10110989.

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| Common Name | Scientific Name | Range | MR | %Cell | FIAsum | FIAiv | ChngCl45 | ChngCl85 | Adap | Abund | Capabil45 | Capabil85 | SHIFT45 | SHIFT85 | SSO | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| American elm | Ulmus americana | WDH | Medium | 66.3 | 615.9 | 18.8 | Sm. dec. | No change | Medium | Abundant | Fair | Good | | | 1 | 1 |
| red maple | Acer rubrum | WDH | High | 31.3 | 442.0 | 22.1 | Sm. dec. | Sm. dec. | High | Common | Fair | Fair | | | 1 | 2 |
| black cherry | Prunus serotina | WDL | Medium | 61.3 | 421.5 | 17.6 | No change | Sm. dec. | Low | Common | Poor | Poor | | | 0 | 3 |
| green ash | Fraxinus pennsylvanica | WSH | Low | 55 | 418.2 | 15.4 | No change | No change | Medium | Common | Fair | Fair | | | 1 | 4 |
| silver maple | Acer saccharinum | NSH | Low | 26.3 | 306.6 | 21.0 | Sm. inc. | Sm. inc. | High | Common | Very Good | Very Good | | | 1 | 5 |
| eastern cottonwood | Populus deltoides | NSH | Low | 22.5 | 258.6 | 24.7 | No change | No change | Medium | Common | Fair | Fair | Infill + | Infill + | 1 | 6 |
| black oak | Quercus velutina | WDH | High | 21.2 | 202.0 | 13.7 | No change | No change | Medium | Common | Fair | Fair | Infill + | Infill + | 1 | 7 |
| sugar maple | Acer saccharum | WDH | High | 30 | 175.2 | 12.0 | Sm. inc. | Sm. inc. | High | Common | Very Good | Very Good | Infill ++ | Infill ++ | 1 | 8 |
| white ash | Fraxinus americana | WDL | Medium | 40 | 122.0 | 9.0 | Sm. inc. | Sm. inc. | Low | Common | Fair | Fair | | | 1 | 9 |
| northern red oak | Quercus rubra | WDH | Medium | 25 | 111.3 | 9.5 | Sm. inc. | Sm. inc. | High | Common | Very Good | Very Good | | | 1 | 10 |
| bitternut hickory | Carya cordiformis | WSL | Low | 20 | 90.3 | 10.9 | No change | No change | High | Common | Good | Good | Infill ++ | Infill ++ | 1 | 11 |
| white oak | Quercus alba | WDH | Medium | 21.3 | 90.0 | 10.1 | Lg. inc. | Lg. inc. | High | Common | Very Good | Very Good | Infill ++ | Infill ++ | 1 | 12 |
| slippery elm | Ulmus rubra | WSL | Low | 10 | 73.2 | 10.8 | Sm. dec. | Sm. dec. | Medium | Common | Poor | Poor | Infill + | Infill + | 2 | 13 |
| swamp white oak | Quercus bicolor | NSL | Low | 15 | 69.8 | 9.5 | Sm. inc. | No change | Medium | Common | Good | Fair | Infill ++ | Infill + | 1 | 14 |
| quaking aspen | Populus tremuloides | WDH | High | 13.8 | 67.2 | 10.0 | Lg. dec. | Lg. dec. | Medium | Common | Poor | Poor | Infill + | Infill + | 0 | 15 |
| American beech | Fagus grandifolia | WDH | High | 18.8 | 66.0 | 5.8 | Sm. dec. | Lg. dec. | Medium | Common | Poor | Poor | Infill + | | 2 | 16 |
| American basswood | Tilia americana | WSL | Medium | 37.5 | 59.0 | 5.5 | Lg. inc. | Sm. inc. | Medium | Common | Very Good | Good | | | 1 | 17 |
| bur oak | Quercus macrocarpa | NDH | Medium | 12.5 | 53.8 | 11.1 | Lg. inc. | Lg. inc. | High | Common | Very Good | Very Good | Infill ++ | Infill ++ | 2 | 18 |
| tamarack (native) | Larix laricina | NSH | High | 1.2 | 50.4 | 36.8 | Sm. dec. | Sm. dec. | Low | Common | Poor | Poor | Infill + | | 2 | 19 |
| black walnut | Juglans nigra | WDH | Low | 31.3 | 48.9 | 7.9 | Lg. inc. | Lg. inc. | Medium | Rare | Good | Good | Infill ++ | Infill ++ | 1 | 20 |
| shagbark hickory | Carya ovata | WSL | Medium | 25 | 20.8 | 3.2 | Lg. inc. | Sm. inc. | Medium | Rare | Good | Fair | Infill ++ | Infill + | 1 | 21 |
| bigtooth aspen | Populus grandidentata | NSL | Medium | 13.7 | 16.3 | 4.0 | Lg. dec. | Very Lg. dec. | Medium | Rare | Very Poor | Lost | | | 0 | 22 |
| sassafras | Sassafras albidum | WSL | Low | 3.8 | 16.0 | 3.9 | Sm. inc. | No change | Medium | Rare | Fair | Poor | | | 1 | 23 |
| eastern hophornbeam; ironw | Ostrya virginiana | WSL | Low | 18.7 | 14.2 | 2.3 | No change | Sm. dec. | High | Rare | Fair | Poor | Infill + | | 1 | 24 |
| black willow | Salix nigra | NSH | Low | 11.3 | 14.2 | 5.3 | Sm. dec. | Lg. inc. | Low | Rare | Very Poor | Fair | | Infill + | 2 | 25 |
| boxelder | Acer negundo | WSH | Low | 13.8 | 13.2 | 3.9 | Lg. inc. | Lg. inc. | High | Rare | Good | Good | Infill ++ | Infill ++ | 1 | 26 |
| American hornbeam; muscle | Carpinus caroliniana | WSL | Low | 10 | 12.2 | 2.0 | Sm. dec. | Sm. dec. | Medium | Rare | Very Poor | Very Poor | | | 0 | 27 |
| red pine | Pinus resinosa | NSH | Medium | 6.3 | 11.2 | 5.9 | Lg. dec. | Very Lg. dec. | Low | Rare | Very Poor | Lost | | | 0 | 28 |
| Scots pine | Pinus sylvestris | NSH | FIA | 5 | 9.9 | 28.9 | Unknown | Unknown | NA | Rare | NNIS | NNIS | | | 0 | 29 |
| serviceberry | Amelanchier spp. | NSL | Low | 7.5 | 8.7 | 2.2 | Lg. dec. | Lg. dec. | Medium | Rare | Very Poor | Very Poor | | | 0 | 30 |
| pignut hickory | Carya glabra | WDL | Medium | 11.3 | 8.2 | 2.2 | Lg. inc. | Lg. inc. | Medium | Rare | Good | Good | Infill ++ | Infill ++ | 2 | 31 |
| white mulberry | Morus alba | NSL | FIA | 6.2 | 7.8 | 8.0 | Unknown | Unknown | NA | Rare | NNIS | NNIS | | | 0 | 32 |
| peachleaf willow | Salix amygdaloides | NSLX | FIA | 1.2 | 5.6 | 4.1 | Unknown | Unknown | Medium | Rare | FIA Only | FIA Only | | | 0 | 33 |
| black ash | Fraxinus nigra | WSH | Medium | 1.2 | 5.3 | 3.9 | Sm. dec. | Sm. dec. | Low | Rare | Very Poor | Very Poor | | | 0 | 34 |
| chokecherry | Prunus virginiana | NSLX | FIA | 6.3 | 5.0 | 2.1 | Unknown | Unknown | Medium | Rare | FIA Only | FIA Only | | | 0 | 35 |
| paper birch | Betula papyrifera | WDH | High | 1.2 | 2.5 | 1.8 | Very Lg. dec. | Very Lg. dec. | Medium | Rare | Lost | Lost | | | 0 | 36 |
| northern pin oak | Quercus ellipsoidalis | NSH | Medium | 1.2 | 2.1 | 1.5 | Very Lg. dec. | Very Lg. dec. | High | Rare | Lost | Lost | | | 0 | 37 |
| red mulberry | Morus rubra | NSL | Low | 5 | 1.9 | 5.5 | No change | No change | Medium | Rare | Poor | Poor | | | 0 | 38 |
| yellow birch | Betula alleghaniensis | NDL | High | 5 | 0.6 | 1.9 | Lg. dec. | No change | Medium | Rare | Very Poor | Poor | | | 0 | 39 |
| eastern redcedar | Juniperus virginiana | WDH | Medium | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate ++ | Migrate ++ | 3 | 40 |
| black hickory | Carya texana | NDL | High | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | | | 3 | 41 |
| hackberry | Celtis occidentalis | WDH | Medium | 0 | 0 | 0 | New Habitat | New Habitat | High | Absent | New Habitat | New Habitat | Likely + | Likely + | 3 | 42 |
| eastern redbud | Cercis canadensis | NSL | Low | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | | | 3 | 43 |
| common persimmon | Diospyros virginiana | NSL | Low | 0 | 0 | 0 | New Habitat | New Habitat | High | Absent | New Habitat | New Habitat | | Migrate + | 3 | 44 |
| honeylocust | Gleditsia triacanthos | NSH | Low | 0 | 0 | 0 | New Habitat | New Habitat | High | Absent | New Habitat | New Habitat | | | 3 | 45 |
| yellow-poplar | Liriodendron tulipifera | WDH | High | 0 | 0 | 0 | New Habitat | New Habitat | High | Absent | New Habitat | New Habitat | | | 3 | 46 |
| Osage-orange | Maclura pomifera | NDH | Medium | 0 | 0 | 0 | New Habitat | New Habitat | High | Absent | New Habitat | New Habitat | | Migrate + | 3 | 47 |

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| Common Name | Scientific Name | Range | MR | %Cell | FIAsum | FIAiv | ChngCl45 | ChngCl85 | Adap | Abund | Capabil45 | Capabil85 | SHIFT45 | SHIFT85 | SSO | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| blackgum | Nyssa sylvatica | WDL | Medium | 0 | 0 | 0 | New Habitat | New Habitat | High | Absent | New Habitat | New Habitat | | | 3 | 48 |
| sycamore | Platanus occidentalis | NSL | Low | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate + | Migrate + | 3 | 49 |
| blackjack oak | Quercus marilandica | NSL | Medium | 0 | 0 | 0 | New Habitat | New Habitat | High | Absent | New Habitat | New Habitat | | | 3 | 50 |
| pin oak | Quercus palustris | NSH | Low | 0 | 0 | 0 | New Habitat | New Habitat | Low | Absent | New Habitat | New Habitat | Migrate + | Migrate + | 3 | 51 |
| Shumard oak | Quercus shumardii | NSL | Low | 0 | 0 | 0 | New Habitat | New Habitat | High | Absent | New Habitat | New Habitat | | Migrate + | 3 | 52 |
| post oak | Quercus stellata | WDH | High | 0 | 0 | 0 | New Habitat | New Habitat | High | Absent | New Habitat | New Habitat | | | 3 | 53 |
| black locust | Robinia pseudoacacia | NDH | Low | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Likely + | Likely + | 3 | 54 |