

**National Park**  
 Climate Change Atlas Tree Species  
 Current and Potential Future Habitat, Capability, and Migration

|                |         |         |           |
|----------------|---------|---------|-----------|
|                | sq. km  | sq. mi  | FIA Plots |
| Area of Region | 8,600.0 | 3,320.5 | 330       |

**Species Information**

The columns below provide brief 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   | Abundance |           | Model       |              | Potential Change in Habitat Suitability |           | Capability to Cope or Persist |           | Migration Potential |           |         |   |    |
|---------|-----------|-----------|-----------|-------------|--------------|---|-----------|-------------------------------|-----------|---------------------|-----------|---------|---|----|
|         |           |           |           | Reliability | Adaptability | Scenario                                | Scenario  | Scenario                      | Scenario  | SHIFT               | SHIFT     |         |   |    |
|         |           |           |           | High        | Low          | RCP45                                   | RCP85     | RCP45                         | RCP85     | RCP45               | RCP85     |         |   |    |
| Ash     | 3         |           |           | 15          | 23           | Increase                                | 30        | 34                            | Very Good | 12                  | 13        | Likely  | 0 | 0  |
| Hickory | 5         |           |           | 27          | 38           | No Change                               | 7         | 4                             | Good      | 17                  | 19        | Infill  | 4 | 8  |
| Maple   | 4         | Abundant  | 5         | 27          | 10           | Decrease                                | 16        | 15                            | Fair      | 7                   | 7         | Migrate | 4 | 6  |
| Oak     | 13        | Common    | 17        | 3           |              | New                                     | 13        | 14                            | Poor      | 9                   | 5         |         | 8 | 14 |
| Pine    | 1         | Rare      | 34        |             |              | Unknown                                 | 6         | 5                             | Very Poor | 7                   | 7         |         |   |    |
| Other   | 30        | Absent    | 16        |             |              |   |           |                               | FIA Only  | 2                   | 2         |         |   |    |
|         | <b>56</b> |           | <b>72</b> | <b>72</b>   | <b>71</b>    |   | <b>72</b> | <b>72</b>                     | Unknown   | 3                   | 2         |         |   |    |
|         |           |           |           |             |              |   |           |                               |           | <b>57</b>           | <b>55</b> |         |   |    |

**Potential Changes in Climate Variables**

**Temperature (°F)**

|                          | Scenario | 2009 | 2039 | 2069 | 2099 |  |
|--------------------------|----------|------|------|------|------|--|
| Annual Average           | CCSM45   | 55.9 | 57.8 | 59.9 | 60.2 |  |
|                          | CCSM85   | 55.9 | 58.2 | 60.8 | 63.8 |  |
|                          | GFDL45   | 55.9 | 58.7 | 61.1 | 62.0 |  |
|                          | GFDL85   | 55.9 | 58.8 | 61.8 | 65.6 |  |
|                          | HAD45    | 55.9 | 58.6 | 61.6 | 63.1 |  |
|                          | HAD85    | 55.9 | 58.9 | 63.6 | 67.4 |  |
| Growing Season (May-Sep) | CCSM45   | 71.9 | 73.9 | 75.6 | 76.3 |  |
|                          | CCSM85   | 71.9 | 74.5 | 77.0 | 80.9 |  |
|                          | GFDL45   | 71.9 | 75.1 | 78.1 | 79.6 |  |
|                          | GFDL85   | 71.9 | 75.6 | 79.1 | 83.8 |  |
|                          | HAD45    | 71.9 | 75.1 | 77.8 | 79.5 |  |
|                          | HAD85    | 71.9 | 75.4 | 81.5 | 84.9 |  |
| Coldest Month Average    | CCSM45   | 30.8 | 32.9 | 34.4 | 34.7 |  |
|                          | CCSM85   | 30.8 | 33.7 | 34.7 | 36.4 |  |
|                          | GFDL45   | 30.8 | 35.3 | 35.4 | 35.7 |  |
|                          | GFDL85   | 30.8 | 33.0 | 34.3 | 35.0 |  |
|                          | HAD45    | 30.8 | 32.0 | 34.3 | 34.5 |  |
|                          | HAD85    | 30.8 | 33.4 | 35.6 | 37.5 |  |
| Warmest Month Average    | CCSM45   | 78.1 | 80.2 | 81.2 | 81.6 |  |
|                          | CCSM85   | 78.1 | 80.7 | 82.0 | 83.9 |  |
|                          | GFDL45   | 78.1 | 82.3 | 83.6 | 84.7 |  |
|                          | GFDL85   | 78.1 | 82.3 | 83.9 | 87.0 |  |
|                          | HAD45    | 78.1 | 81.8 | 83.7 | 84.4 |  |
|                          | HAD85    | 78.1 | 83.2 | 86.7 | 88.2 |  |

**Precipitation (in)**

|                          | Scenario | 2009 | 2039 | 2069 | 2099 |  |
|--------------------------|----------|------|------|------|------|--|
| Annual Total             | CCSM45   | 46.3 | 45.4 | 51.0 | 48.5 |  |
|                          | CCSM85   | 46.3 | 48.4 | 49.2 | 50.5 |  |
|                          | GFDL45   | 46.3 | 52.2 | 54.2 | 54.0 |  |
|                          | GFDL85   | 46.3 | 52.0 | 58.6 | 59.0 |  |
|                          | HAD45    | 46.3 | 45.3 | 49.3 | 49.3 |  |
|                          | HAD85    | 46.3 | 48.8 | 45.0 | 48.0 |  |
| Growing Season (May-Sep) | CCSM45   | 20.0 | 18.8 | 20.9 | 19.4 |  |
|                          | CCSM85   | 20.0 | 20.4 | 18.7 | 19.6 |  |
|                          | GFDL45   | 20.0 | 22.6 | 22.1 | 23.1 |  |
|                          | GFDL85   | 20.0 | 22.7 | 24.3 | 24.5 |  |
|                          | HAD45    | 20.0 | 18.8 | 19.0 | 18.4 |  |
|                          | HAD85    | 20.0 | 19.6 | 16.0 | 16.0 |  |

**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.

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Current and Potential Future Habitat, Capability, and Migration

| Common Name                | Scientific Name              | Range | MR     | %Cell | FIAsum | FIAiv | ChngCl45  | ChngCl85  | Adap   | Abund    | Capabil45 | Capabil85 | SHIFT45   | SHIFT85   | SSO | N  |
|----------------------------|------------------------------|-------|--------|-------|--------|-------|-----------|-----------|--------|----------|-----------|-----------|-----------|-----------|-----|----|
| white oak                  | Quercus alba                 | WDH   | Medium | 97.7  | 2643.3 | 27.1  | Lg. dec.  | Lg. dec.  | High   | Abundant | Good      | Good      |           |           | 1   | 1  |
| black oak                  | Quercus velutina             | WDH   | High   | 98.8  | 1500.8 | 15.2  | Sm. dec.  | Sm. dec.  | Medium | Abundant | Fair      | Fair      |           |           | 0   | 2  |
| shortleaf pine             | Pinus echinata               | WDH   | High   | 79.1  | 1108.2 | 14.0  | No change | Sm. inc.  | Medium | Abundant | Good      | Very Good |           |           | 1   | 3  |
| scarlet oak                | Quercus coccinea             | WDL   | Medium | 70.9  | 954.1  | 13.5  | Lg. dec.  | Lg. dec.  | Medium | Abundant | Fair      | Fair      |           |           | 0   | 4  |
| post oak                   | Quercus stellata             | WDH   | High   | 86    | 943.9  | 11.0  | Sm. inc.  | Sm. inc.  | High   | Abundant | Very Good | Very Good |           |           | 1   | 5  |
| black hickory              | Carya texana                 | NDL   | High   | 83.7  | 386.1  | 4.6   | Sm. inc.  | Sm. inc.  | Medium | Common   | Good      | Good      |           |           | 1   | 6  |
| mockernut hickory          | Carya alba                   | WDL   | Medium | 84.9  | 342.8  | 4.0   | Sm. inc.  | Sm. inc.  | High   | Common   | Very Good | Very Good |           |           | 1   | 7  |
| blackgum                   | Nyssa sylvatica              | WDL   | Medium | 80.2  | 266.4  | 3.3   | Sm. inc.  | Sm. inc.  | High   | Common   | Very Good | Very Good |           |           | 1   | 8  |
| pignut hickory             | Carya glabra                 | WDL   | Medium | 46.5  | 233.7  | 5.0   | Sm. dec.  | Sm. dec.  | Medium | Common   | Poor      | Poor      |           |           | 0   | 9  |
| flowering dogwood          | Cornus florida               | WDL   | Medium | 72.1  | 158.5  | 2.2   | No change | No change | Medium | Common   | Fair      | Fair      |           |           | 1   | 10 |
| blackjack oak              | Quercus marilandica          | NSL   | Medium | 39.5  | 154.3  | 3.9   | Lg. inc.  | Lg. inc.  | High   | Common   | Very Good | Very Good |           |           | 1   | 11 |
| eastern redcedar           | Juniperus virginiana         | WDH   | Medium | 34.9  | 142.4  | 4.1   | Lg. inc.  | Lg. inc.  | Medium | Common   | Very Good | Very Good |           |           | 1   | 12 |
| northern red oak           | Quercus rubra                | WDH   | Medium | 26.7  | 108.1  | 4.0   | Lg. inc.  | Lg. inc.  | High   | Common   | Very Good | Very Good |           |           | 1   | 13 |
| red maple                  | Acer rubrum                  | WDH   | High   | 48.8  | 95.7   | 2.0   | Lg. inc.  | Lg. inc.  | High   | Common   | Very Good | Very Good |           |           | 1   | 14 |
| black walnut               | Juglans nigra                | WDH   | Low    | 36    | 91.1   | 2.5   | Lg. inc.  | Lg. inc.  | Medium | Common   | Very Good | Very Good |           |           | 1   | 15 |
| chinkapin oak              | Quercus muehlenbergii        | NSL   | Medium | 30.2  | 85.7   | 2.8   | Sm. inc.  | Sm. inc.  | Medium | Common   | Good      | Good      |           |           | 1   | 16 |
| black cherry               | Prunus serotina              | WDL   | Medium | 46.5  | 77.3   | 1.7   | Lg. inc.  | Lg. inc.  | Low    | Common   | Good      | Good      |           |           | 1   | 17 |
| American elm               | Ulmus americana              | WDH   | Medium | 31.4  | 67.9   | 2.2   | Lg. inc.  | Lg. inc.  | Medium | Common   | Very Good | Very Good |           |           | 1   | 18 |
| sycamore                   | Platanus occidentalis        | NSL   | Low    | 16.3  | 65.4   | 4.0   | Lg. inc.  | Lg. inc.  | Medium | Common   | Very Good | Very Good |           |           | 1   | 19 |
| sassafras                  | Sassafras albidum            | WSL   | Low    | 47.7  | 62.9   | 1.3   | Lg. dec.  | Lg. dec.  | Medium | Common   | Poor      | Poor      |           |           | 0   | 20 |
| sugar maple                | Acer saccharum               | WDH   | High   | 18.6  | 55.2   | 3.0   | Sm. inc.  | Sm. inc.  | High   | Common   | Very Good | Very Good | Infill ++ | Infill ++ | 1   | 21 |
| slippery elm               | Ulmus rubra                  | WSL   | Low    | 26.7  | 52.6   | 2.0   | Lg. inc.  | Lg. inc.  | Medium | Common   | Very Good | Very Good |           |           | 1   | 22 |
| bitternut hickory          | Carya cordiformis            | WSL   | Low    | 23.3  | 41.2   | 1.8   | Lg. inc.  | Lg. inc.  | High   | Rare     | Good      | Good      |           |           | 1   | 23 |
| southern red oak           | Quercus falcata              | WDL   | Medium | 15.1  | 36.5   | 2.4   | Lg. inc.  | Lg. inc.  | High   | Rare     | Good      | Good      | Infill ++ | Infill ++ | 1   | 24 |
| white ash                  | Fraxinus americana           | WDL   | Medium | 29.1  | 34.7   | 1.2   | Lg. inc.  | Lg. inc.  | Low    | Rare     | Fair      | Fair      |           |           | 1   | 25 |
| winged elm                 | Ulmus alata                  | WDL   | Medium | 24.4  | 30.7   | 1.3   | Lg. inc.  | Lg. inc.  | Medium | Rare     | Good      | Good      |           |           | 1   | 26 |
| pin oak                    | Quercus palustris            | NSH   | Low    | 1.2   | 23.3   | 20.1  | Sm. dec.  | Sm. dec.  | Low    | Rare     | Very Poor | Very Poor |           |           | 2   | 27 |
| green ash                  | Fraxinus pennsylvanica       | WSH   | Low    | 14    | 19.6   | 1.4   | Lg. inc.  | Lg. inc.  | Medium | Rare     | Good      | Good      | Infill ++ | Infill ++ | 1   | 28 |
| eastern redbud             | Cercis canadensis            | NSL   | Low    | 15.1  | 18.8   | 1.2   | Lg. inc.  | Lg. inc.  | Medium | Rare     | Good      | Good      |           |           | 1   | 29 |
| honeylocust                | Gleditsia triacanthos        | NSH   | Low    | 5.8   | 18.2   | 3.1   | Sm. inc.  | Lg. inc.  | High   | Rare     | Good      | Good      |           |           | 1   | 30 |
| shingle oak                | Quercus imbricaria           | NDH   | Medium | 4.7   | 17.7   | 3.8   | Sm. dec.  | Sm. dec.  | Medium | Rare     | Very Poor | Very Poor |           |           | 0   | 31 |
| red mulberry               | Morus rubra                  | NSL   | Low    | 16.3  | 17.3   | 1.1   | No change | Sm. inc.  | Medium | Rare     | Poor      | Fair      |           |           | 1   | 32 |
| common persimmon           | Diospyros virginiana         | NSL   | Low    | 16.3  | 15.7   | 1.0   | Lg. inc.  | Lg. inc.  | High   | Rare     | Good      | Good      |           |           | 1   | 33 |
| boxelder                   | Acer negundo                 | WSH   | Low    | 7     | 11.8   | 1.7   | No change | Lg. inc.  | High   | Rare     | Fair      | Good      |           |           | 1   | 34 |
| Shumard oak                | Quercus shumardii            | NSL   | Low    | 8.1   | 11.3   | 1.4   | No change | No change | High   | Rare     | Fair      | Fair      |           | Infill +  | 1   | 35 |
| river birch                | Betula nigra                 | NSL   | Low    | 2.3   | 9.7    | 4.2   | No change | No change | Medium | Rare     | Poor      | Poor      |           | Infill +  | 2   | 36 |
| hackberry                  | Celtis occidentalis          | WDH   | Medium | 11.6  | 9.6    | 0.8   | Lg. inc.  | Lg. inc.  | High   | Rare     | Good      | Good      |           |           | 1   | 37 |
| wild plum                  | Prunus americana             | NSLX  | FIA    | 3.5   | 9.0    | 2.6   | Unknown   | Unknown   | Medium | Rare     | FIA Only  | FIA Only  |           |           | 0   | 38 |
| eastern hophornbeam; ironw | Ostrya virginiana            | WSL   | Low    | 9.3   | 8.7    | 0.9   | Sm. inc.  | Lg. inc.  | High   | Rare     | Good      | Good      |           |           | 1   | 39 |
| serviceberry               | Amelanchier spp.             | NSL   | Low    | 8.1   | 7.2    | 0.9   | Lg. dec.  | Lg. dec.  | Medium | Rare     | Very Poor | Very Poor |           |           | 0   | 40 |
| American basswood          | Tilia americana              | WSL   | Medium | 1.2   | 5.3    | 4.6   | Lg. dec.  | Lg. dec.  | Medium | Rare     | Very Poor | Very Poor |           |           | 0   | 41 |
| Osage-orange               | Maclura pomifera             | NDH   | Medium | 1.2   | 5.0    | 4.3   | Sm. dec.  | Lg. inc.  | High   | Rare     | Poor      | Good      |           |           | 2   | 42 |
| American hornbeam; musclev | Carpinus caroliniana         | WSL   | Low    | 8.1   | 4.8    | 0.6   | Sm. inc.  | Lg. inc.  | Medium | Rare     | Fair      | Good      |           |           | 1   | 43 |
| cittamwood/gum bumelia     | Sideroxylon lanuginosum ssp. | NSL   | Low    | 3.5   | 4.7    | 1.4   | Lg. inc.  | Lg. inc.  | High   | Rare     | Good      | Good      |           | Infill ++ | 1   | 44 |
| blue ash                   | Fraxinus quadrangulata       | NSL   | Low    | 2.3   | 3.9    | 1.7   | Sm. dec.  | Sm. dec.  | Low    | Rare     | Very Poor | Very Poor |           |           | 0   | 45 |
| butternut                  | Juglans cinerea              | NSLX  | FIA    | 2.3   | 3.9    | 1.7   | Unknown   | Unknown   | Low    | Rare     | FIA Only  | FIA Only  |           |           | 0   | 46 |
| shagbark hickory           | Carya ovata                  | WSL   | Medium | 3.5   | 3.8    | 1.1   | No change | No change | Medium | Rare     | Poor      | Poor      | Infill +  | Infill +  | 2   | 47 |

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| Common Name                  | Scientific Name         | Range | MR     | %Cell | FIAsum | FIaiv | ChngCl45      | ChngCl85      | Adap   | Abund  | Capabil45   | Capabil85   | SHIFT45    | SHIFT85    | SSO | N  |
|------------------------------|-------------------------|-------|--------|-------|--------|-------|---------------|---------------|--------|--------|-------------|-------------|------------|------------|-----|----|
| ailanthus                    | Ailanthus altissima     | NSL   | FIA    | 1.2   | 2.9    | 2.5   | Unknown       | Unknown       | NA     | Rare   | NNIS        | NNIS        |            |            | 0   | 48 |
| pawpaw                       | Asimina triloba         | NSL   | Low    | 3.5   | 2.9    | 0.8   | Very Lg. dec. | Very Lg. dec. | Medium | Rare   | Lost        | Lost        |            |            | 0   | 49 |
| silver maple                 | Acer saccharinum        | NSH   | Low    | 1.2   | 2.4    | 2.0   | Sm. dec.      | Very Lg. dec. | High   | Rare   | Poor        | Lost        |            |            | 0   | 50 |
| sugarberry                   | Celtis laevigata        | NDH   | Medium | 1.2   | 1.7    | 1.4   | Lg. inc.      | Lg. inc.      | Medium | Rare   | Good        | Good        |            |            | 2   | 51 |
| sweetgum                     | Liquidambar styraciflua | WDH   | High   | 1.2   | 1.7    | 1.4   | Lg. inc.      | Lg. inc.      | Medium | Rare   | Good        | Good        |            |            | 2   | 52 |
| black willow                 | Salix nigra             | NSH   | Low    | 1.2   | 1.4    | 1.2   | Sm. inc.      | Lg. inc.      | Low    | Rare   | Poor        | Fair        | Infill +   |            | 2   | 53 |
| bur oak                      | Quercus macrocarpa      | NDH   | Medium | 1.2   | 0.5    | 0.4   | Lg. dec.      | Lg. dec.      | High   | Rare   | Poor        | Poor        |            |            | 0   | 54 |
| water tupelo                 | Nyssa aquatica          | NSH   | Medium | 1.2   | 0.4    | 0.4   | Lg. dec.      | Lg. dec.      | Low    | Rare   | Very Poor   | Very Poor   |            |            | 0   | 55 |
| swamp chestnut oak           | Quercus michauxii       | NSL   | Low    | 1.2   | 0.4    | 0.3   | Lg. dec.      | Lg. dec.      | Medium | Rare   | Very Poor   | Very Poor   |            |            | 0   | 56 |
| ashe juniper                 | Juniperus ashei         | NDH   | High   | 0     | 0      | 0     | New Habitat   | New Habitat   | Medium | Absent | New Habitat | New Habitat |            |            | 0   | 57 |
| longleaf pine                | Pinus palustris         | NSH   | Medium | 0     | 0      | 0     | New Habitat   | New Habitat   | Medium | Absent | New Habitat | New Habitat |            |            | 3   | 58 |
| loblolly pine                | Pinus taeda             | WDH   | High   | 0     | 0      | 0     | New Habitat   | New Habitat   | Medium | Absent | New Habitat | New Habitat | Migrate ++ | Migrate ++ | 3   | 59 |
| Ohio buckeye                 | Aesculus glabra         | NSL   | Low    | 0     | 0      | 0     | Unknown       | Unknown       | Medium | Absent | Unknown     | Unknown     |            |            | 0   | 60 |
| pecan                        | Carya illinoensis       | NSH   | Low    | 0     | 0      | 0     | New Habitat   | New Habitat   | Low    | Absent | New Habitat | New Habitat | Migrate +  |            | 3   | 61 |
| shellbark hickory            | Carya laciniosa         | NSL   | Low    | 0     | 0      | 0     | Unknown       | Unknown       | Medium | Absent | Unknown     | Unknown     |            |            | 0   | 62 |
| American beech               | Fagus grandifolia       | WDH   | High   | 0     | 0      | 0     | New Habitat   | New Habitat   | Medium | Absent | New Habitat | New Habitat |            |            | 3   | 63 |
| black ash                    | Fraxinus nigra          | WSH   | Medium | 0     | 0      | 0     | Unknown       | New Habitat   | Low    | Absent | Unknown     | New Habitat |            |            | 3   | 64 |
| yellow-poplar                | Liriodendron tulipifera | WDH   | High   | 0     | 0      | 0     | New Habitat   | New Habitat   | High   | Absent | New Habitat | New Habitat | Migrate +  |            | 3   | 65 |
| sourwood                     | Oxydendrum arboreum     | NDL   | High   | 0     | 0      | 0     | New Habitat   | New Habitat   | High   | Absent | New Habitat | New Habitat |            |            | 3   | 66 |
| cherrybark oak; swamp red o. | Quercus pagoda          | NSL   | Medium | 0     | 0      | 0     | New Habitat   | New Habitat   | Medium | Absent | New Habitat | New Habitat | Migrate ++ |            | 3   | 67 |
| water oak                    | Quercus nigra           | WDH   | High   | 0     | 0      | 0     | New Habitat   | New Habitat   | Medium | Absent | New Habitat | New Habitat | Migrate +  | Migrate ++ | 3   | 68 |
| chestnut oak                 | Quercus prinus          | NDH   | High   | 0     | 0      | 0     | New Habitat   | New Habitat   | High   | Absent | New Habitat | New Habitat |            |            | 3   | 69 |
| live oak                     | Quercus virginiana      | NDH   | High   | 0     | 0      | 0     | New Habitat   | New Habitat   | Medium | Absent | New Habitat | New Habitat |            |            | 0   | 70 |
| black locust                 | Robinia pseudoacacia    | NDH   | Low    | 0     | 0      | 0     | New Habitat   | New Habitat   | Medium | Absent | New Habitat | New Habitat | Migrate +  | Migrate +  | 3   | 71 |
| cedar elm                    | Ulmus crassifolia       | NDH   | Medium | 0     | 0      | 0     | New Habitat   | New Habitat   | Low    | Absent | New Habitat | New Habitat | Migrate ++ |            | 3   | 72 |