

**One x One Degree**  
**Climate Change Atlas Tree Species**  
 Current and Potential Future Habitat, Capability, and Migration

Area of Region    sq. km    sq. mi    FIA Plots  
 10,188    3,933.4    271

**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	27	RCP45	RCP85	RCP45	RCP85	RCP45	RCP85			
Ash	2			19	27	Increase	30	37	Very Good	15	19			
Hickory	7			33	51	No Change	13	5	Good	17	17			
Maple	5	Abundant	5	Low	36	12	Decrease	27	28	Fair	12	9		
Oak	17	Common	36	FIA	5		New	14	14	Poor	13	13		
Pine	3	Rare	34			Unknown	9	9	Very Poor	13	11			
Other	41	Absent	16					FIA Only	3	3	Migrate	6	8	
										Unknown	4	4		
										<b>77</b>	<b>76</b>	<b>14</b>	<b>18</b>	

**Potential Changes in Climate Variables**

**Temperature (°F)**

Scenario	2009	2039	2069	2099	
Annual	60.3	62.0	64.2	64.4	
Average	60.3	62.4	65.0	67.7	
GFDL45	60.3	63.2	65.1	65.9	
GFDL85	60.3	62.9	66.1	69.5	
HAD45	60.3	62.7	65.8	67.1	
HAD85	60.3	63.1	67.6	71.3	
Growing Season	74.6	76.1	78.0	78.6	
May—Sep	74.6	77.8	79.8	81.2	
GFDL45	74.6	77.4	81.2	85.1	
GFDL85	74.6	77.4	81.2	85.1	
HAD45	74.6	78.0	80.8	82.2	
HAD85	74.6	78.2	84.7	88.0	
Coldest Month	38.7	40.8	41.9	42.0	
Average	38.7	42.4	42.4	42.7	
GFDL45	38.7	42.4	42.4	42.7	
GFDL85	38.7	40.4	41.7	42.0	
HAD45	38.7	38.9	40.9	41.4	
HAD85	38.7	40.2	41.6	43.2	
Warmest Month	79.4	80.9	81.8	82.0	
Average	79.4	82.8	83.8	84.7	
GFDL45	79.4	82.8	83.8	84.7	
GFDL85	79.4	82.4	84.4	86.5	
HAD45	79.4	84.1	86.4	86.9	
HAD85	79.4	84.8	89.3	90.5	

**Precipitation (in)**

Scenario	2009	2039	2069	2099	
Annual	57.4	59.6	64.3	62.5	
Total	57.4	60.9	62.1	68.1	
GFDL45	57.4	65.2	68.4	71.0	
GFDL85	57.4	65.3	68.4	71.9	
HAD45	57.4	54.7	61.2	61.6	
HAD85	57.4	58.6	53.2	58.4	
Growing Season	22.4	21.8	22.2	22.9	
May—Sep	22.4	26.3	27.6	28.1	
GFDL45	22.4	27.1	28.6	29.9	
GFDL85	22.4	27.1	28.6	29.9	
HAD45	22.4	20.6	22.4	21.1	
HAD85	22.4	22.5	16.5	18.2	

**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>.

One x One Degree  
Climate Change Atlas Tree Species

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

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
loblolly pine	Pinus taeda	WDH	High	73.6	2395.1	24.3	Sm. inc.	Sm. inc.	Medium	Abundant	Very Good	Very Good			1	1
white oak	Quercus alba	WDH	Medium	70.4	774.8	7.4	No change	Sm. dec.	High	Abundant	Very Good	Good			1	2
sweetgum	Liquidambar styraciflua	WDH	High	72.2	748.9	8.0	Sm. inc.	Sm. inc.	Medium	Abundant	Very Good	Very Good			1	3
yellow-poplar	Liriodendron tulipifera	WDH	High	67.4	564.5	5.8	Sm. dec.	Sm. dec.	High	Abundant	Good	Good			1	4
Virginia pine	Pinus virginiana	NDH	High	50.8	510.6	9.7	Sm. dec.	Sm. dec.	Medium	Abundant	Fair	Fair			0	5
pignut hickory	Carya glabra	WDL	Medium	68.6	386.0	4.2	Sm. dec.	Lg. dec.	Medium	Common	Poor	Poor			0	6
chestnut oak	Quercus prinus	NDH	High	42	385.2	6.7	Sm. dec.	Sm. dec.	High	Common	Fair	Fair			1	7
mockernut hickory	Carya alba	WDL	Medium	58.5	315.4	3.5	Sm. inc.	Sm. inc.	High	Common	Very Good	Very Good			1	8
red maple	Acer rubrum	WDH	High	62.6	289.7	3.3	Sm. inc.	Sm. inc.	High	Common	Very Good	Very Good			1	9
southern red oak	Quercus falcata	WDL	Medium	52.9	279.4	3.8	Lg. inc.	Lg. inc.	High	Common	Very Good	Very Good			1	10
black cherry	Prunus serotina	WDL	Medium	68.9	270.8	3.0	Sm. inc.	Sm. inc.	Low	Common	Fair	Fair			1	11
blackgum	Nyssa sylvatica	WDL	Medium	66.3	242.7	2.2	Sm. inc.	Lg. inc.	High	Common	Very Good	Very Good			1	12
winged elm	Ulmus alata	WDL	Medium	49.8	219.8	4.3	Lg. inc.	Lg. inc.	Medium	Common	Very Good	Very Good			1	13
sugarberry	Celtis laevigata	NDH	Medium	28.7	200.8	7.6	Sm. inc.	Lg. inc.	Medium	Common	Good	Very Good			1	14
green ash	Fraxinus pennsylvanica	WSH	Low	37.4	185.0	4.3	Sm. inc.	Sm. inc.	Medium	Common	Good	Good			1	15
post oak	Quercus stellata	WDH	High	45.3	176.5	2.5	Lg. inc.	Lg. inc.	High	Common	Very Good	Very Good			1	16
eastern redcedar	Juniperus virginiana	WDH	Medium	42.7	173.0	4.3	Lg. inc.	Lg. inc.	Medium	Common	Very Good	Very Good			1	17
sourwood	Oxydendrum arboreum	NDL	High	41.7	164.4	2.4	No change	Sm. dec.	High	Common	Good	Fair			1	18
shortleaf pine	Pinus echinata	WDH	High	35.4	158.9	3.8	Lg. inc.	Lg. inc.	Medium	Common	Very Good	Very Good			1	19
water oak	Quercus nigra	WDH	High	29.5	153.4	3.2	Lg. inc.	Lg. inc.	Medium	Common	Very Good	Very Good			1	20
boxelder	Acer negundo	WSH	Low	16.2	140.9	8.7	No change	No change	High	Common	Good	Good			1	21
scarlet oak	Quercus coccinea	WDL	Medium	30.8	139.8	2.8	Sm. dec.	Sm. dec.	Medium	Common	Poor	Poor			0	22
northern red oak	Quercus rubra	WDH	Medium	38.2	125.7	2.6	No change	No change	High	Common	Good	Good			1	23
black oak	Quercus velutina	WDH	High	40.5	118.8	1.8	Sm. inc.	Sm. inc.	Medium	Common	Good	Good			1	24
shagbark hickory	Carya ovata	WSL	Medium	25.6	110.1	3.3	Lg. dec.	Lg. dec.	Medium	Common	Poor	Poor			0	25
American beech	Fagus grandifolia	WDH	High	32.5	100.6	2.1	Lg. inc.	Lg. inc.	Medium	Common	Very Good	Very Good			1	26
eastern hophornbeam; ironw	Ostrya virginiana	WSL	Low	37.9	94.6	2.3	Sm. inc.	Sm. inc.	High	Common	Very Good	Very Good			1	27
florida maple	Acer barbatum	NSL	Low	21.3	91.5	2.6	Lg. dec.	Sm. dec.	High	Common	Fair	Fair			1	28
hackberry	Celtis occidentalis	WDH	Medium	17.9	88.6	4.8	No change	Sm. inc.	High	Common	Good	Very Good			1	29
flowering dogwood	Cornus florida	WDL	Medium	39.3	88.6	1.3	Sm. inc.	Sm. inc.	Medium	Common	Good	Good			1	30
bigleaf magnolia	Magnolia macrophylla	NSL	Low	26.3	84.8	2.9	Sm. dec.	Sm. dec.	Medium	Common	Poor	Poor			0	31
common persimmon	Diospyros virginiana	NSL	Low	30.9	80.9	1.9	No change	Sm. inc.	High	Common	Good	Very Good			1	32
cherrybark oak; swamp red o	Quercus pagoda	NSL	Medium	12.1	77.9	4.0	Sm. inc.	Sm. inc.	Medium	Common	Good	Good			1	33
willow oak	Quercus phellos	NSL	Low	10	72.6	8.7	No change	Sm. inc.	Medium	Common	Fair	Good			1	34
black walnut	Juglans nigra	WDH	Low	11.6	67.4	3.4	Lg. dec.	Lg. dec.	Medium	Common	Poor	Poor			0	35
American elm	Ulmus americana	WDH	Medium	24.6	64.9	2.3	Lg. inc.	Lg. inc.	Medium	Common	Very Good	Very Good			1	36
sassafras	Sassafras albidum	WSL	Low	35	63.6	1.9	Sm. inc.	Lg. inc.	Medium	Common	Good	Very Good			1	37
eastern hemlock	Tsuga canadensis	NSH	High	7.9	60.5	7.7	Sm. dec.	Sm. dec.	Low	Common	Poor	Poor			0	38
white ash	Fraxinus americana	WDL	Medium	17.9	60.5	3.0	Sm. inc.	Lg. inc.	Low	Common	Fair	Good			1	39
chinkapin oak	Quercus muehlenbergii	NSL	Medium	17.1	53.3	2.7	Sm. dec.	Lg. dec.	Medium	Common	Poor	Poor			0	40
sycamore	Platanus occidentalis	NSL	Low	10.3	50.7	4.6	Sm. inc.	Lg. inc.	Medium	Common	Good	Very Good	Infill ++	Infill ++	1	41
American hornbeam; musclev	Carpinus caroliniana	WSL	Low	22.1	39.2	1.0	Lg. inc.	Lg. inc.	Medium	Rare	Good	Good			1	42
river birch	Betula nigra	NSL	Low	3.7	34.2	5.1	No change	Sm. inc.	Medium	Rare	Poor	Fair	Infill +	Infill +	1	43
black willow	Salix nigra	NSH	Low	7.9	30.2	3.0	No change	Sm. inc.	Low	Rare	Very Poor	Poor			1	44
red mulberry	Morus rubra	NSL	Low	14.4	28.8	2.3	Lg. dec.	No change	Medium	Rare	Very Poor	Poor			1	45
Osage-orange	Maclura pomifera	NDH	Medium	2	28.7	14.6	No change	No change	High	Rare	Fair	Fair	Infill +	Infill +	2	46
paulownia	Paulownia tomentosa	NSL	FIA	3.2	25.9	6.5	Unknown	Unknown	NA	Rare	NNIS	NNIS			0	47



One x One Degree  
Climate Change Atlas Tree Species

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

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
eastern redbud	Cercis canadensis	NSL	Low	16.5	24.4	1.3	Lg. dec.	Sm. dec.	Medium	Rare	Very Poor	Very Poor				0 48
bitternut hickory	Carya cordiformis	WSL	Low	2.9	17.1	5.8	Sm. dec.	Sm. dec.	High	Rare	Poor	Poor	Infill +	Infill +		2 49
slippery elm	Ulmus rubra	WSL	Low	9.2	15.3	0.9	No change	No change	Medium	Rare	Poor	Poor				1 50
serviceberry	Amelanchier spp.	NSL	Low	10.7	14.9	0.9	Lg. dec.	Lg. dec.	Medium	Rare	Very Poor	Very Poor				0 51
black locust	Robinia pseudoacacia	NDH	Low	3.9	13.2	3.4	Lg. dec.	Lg. dec.	Medium	Rare	Very Poor	Very Poor				0 52
yellow buckeye	Aesculus flava	NSL	Low	4.2	12.9	2.1	Sm. dec.	Sm. dec.	Low	Rare	Very Poor	Very Poor				0 53
overcup oak	Quercus lyrata	NSL	Medium	2.9	12.8	4.3	Lg. dec.	Lg. dec.	Low	Rare	Very Poor	Very Poor				0 54
honeylocust	Gleditsia triacanthos	NSH	Low	1.8	11.1	5.2	No change	Sm. inc.	High	Rare	Fair	Good		Infill ++		2 55
sugar maple	Acer saccharum	WDH	High	3.4	10.9	0.9	Lg. dec.	Very Lg. dec.	High	Rare	Poor	Lost				0 56
nuttall oak	Quercus texana	NSH	Medium	1	10.5	10.7	Sm. dec.	Sm. dec.	High	Rare	Poor	Poor				0 57
blackjack oak	Quercus marilandica	NSL	Medium	5.8	10.3	1.1	Lg. inc.	Lg. inc.	High	Rare	Good	Good	Infill ++	Infill ++		1 58
sand hickory	Carya pallida	NSL	FIA	1	8.0	8.1	Unknown	Unknown	NA	Rare	FIA Only	FIA Only				0 59
cucumbertree	Magnolia acuminata	NSL	Low	5.1	7.5	0.8	Sm. dec.	Sm. dec.	Medium	Rare	Very Poor	Very Poor				0 60
butternut	Juglans cinerea	NSLX	FIA	2	7.5	3.8	Unknown	Unknown	Low	Rare	FIA Only	FIA Only				0 61
swamp tupelo	Nyssa biflora	NDH	Medium	0.2	5.0	1.0	Lg. inc.	Lg. inc.	Low	Rare	Fair	Fair	Infill +	Infill +		2 62
American basswood	Tilia americana	WSL	Medium	2.9	4.9	1.7	Sm. dec.	Sm. dec.	Medium	Rare	Very Poor	Very Poor				0 63
shellbark hickory	Carya laciniosa	NSL	Low	2	4.9	2.5	Sm. dec.	Sm. dec.	Medium	Rare	Very Poor	Very Poor				0 64
pin cherry	Prunus pensylvanica	NSL	Low	1	4.6	4.7	Sm. dec.	Sm. dec.	Medium	Rare	Very Poor	Very Poor				0 65
American holly	Ilex opaca	NSL	Medium	2.9	3.5	1.2	Sm. inc.	Lg. inc.	Medium	Rare	Fair	Good		Infill ++		1 66
laurel oak	Quercus laurifolia	NDH	Medium	2.2	3.2	0.8	Lg. inc.	Lg. inc.	Medium	Rare	Good	Good				2 67
silver maple	Acer saccharinum	NSH	Low	4.6	2.4	1.4	Sm. dec.	Lg. dec.	High	Rare	Poor	Poor				0 68
Shumard oak	Quercus shumardii	NSL	Low	2	2.3	1.2	No change	Sm. inc.	High	Rare	Fair	Good				2 69
pecan	Carya illinoensis	NSH	Low	4.9	2.2	1.5	Lg. inc.	Lg. inc.	Low	Rare	Fair	Fair	Infill +	Infill +		2 70
swamp chestnut oak	Quercus michauxii	NSL	Low	5.9	1.9	0.8	Sm. dec.	Sm. dec.	Medium	Rare	Very Poor	Very Poor				0 71
ailanthus	Ailanthus altissima	NSL	FIA	1	1.8	1.9	Unknown	Unknown	NA	Rare	NNIS	NNIS				0 72
sweetbay	Magnolia virginiana	NSL	Medium	0.1	1.3	0.1	Lg. inc.	Lg. inc.	Medium	Rare	Good	Good	Infill ++	Infill ++		2 73
sweet birch	Betula lenta	NDH	High	1	0.9	0.9	Lg. dec.	Lg. dec.	Low	Rare	Very Poor	Very Poor				0 74
wild plum	Prunus americana	NSLX	FIA	6.5	0.5	0.8	Unknown	Unknown	Medium	Rare	FIA Only	FIA Only				0 75
ashe juniper	Juniperus ashei	NDH	High	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat				0 76
slash pine	Pinus elliottii	NDH	High	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat	Migrate ++	Migrate ++		3 77
spruce pine	Pinus glabra	NSL	Low	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat				3 78
longleaf pine	Pinus palustris	NSH	Medium	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat	Migrate ++	Migrate ++		3 79
Table Mountain pine	Pinus pungens	NSL	Low	0	0	0	Unknown	New Habitat	High	Absent	Unknown	New Habitat				3 80
black maple	Acer nigrum	NSH	Low	0	0	0	Unknown	Unknown	High	Modeled	Unknown	Unknown				0 81
striped maple	Acer pensylvanicum	NSL	Medium	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat				3 82
pawpaw	Asimina triloba	NSL	Low	0	0	0	Unknown	Unknown	Medium	Absent	Unknown	Unknown				0 83
cittamwood/gum bumelia	Sideroxylon lanuginosum ssp.	NSL	Low	0	0	0	New Habitat	New Habitat	High	Absent	New Habitat	New Habitat		Migrate +		3 84
black hickory	Carya texana	NDL	High	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat	Migrate +	Migrate +		3 85
black ash	Fraxinus nigra	WSH	Medium	0	0	0	New Habitat	New Habitat	Low	Absent	New Habitat	New Habitat				3 86
loblolly-bay	Gordonia lasianthus	NSH	Medium	0	0	0	Unknown	Unknown	Medium	Modeled	Unknown	Unknown				0 87
silverbell	Halesia spp.	NSL	Low	0	0	0	New Habitat	Unknown	Medium	Absent	New Habitat	Unknown				3 88
southern magnolia	Magnolia grandiflora	NSL	Low	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat	Migrate +	Migrate +		3 89
turkey oak	Quercus laevis	NSH	Medium	0	0	0	New Habitat	New Habitat	High	Absent	New Habitat	New Habitat				3 90
live oak	Quercus virginiana	NDH	High	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat	Migrate ++	Migrate ++		3 91
bluejack oak	Quercus incana	NSL	Low	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat		Migrate +		3 92
cedar elm	Ulmus crassifolia	NDH	Medium	0	0	0	New Habitat	New Habitat	Low	Absent	New Habitat	New Habitat	Migrate +	Migrate ++		3 93