

**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  
 10,066    3,886.5    283

**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	24	RCP45	RCP85	RCP45	RCP85	RCP45	RCP85
Ash	2					Increase	27	36	Very Good	10	19
Hickory	7			Medium	34	No Change	16	11	Good	19	16
Maple	5	Abundant	6	Low	34	Decrease	29	25	Fair	16	11
Oak	19	Common	34	FIA	6	New	11	11	Poor	10	12
Pine	5	Rare	38			Unknown	9	9	Very Poor	16	13
Other	40	Absent	14						FIA Only	3	3
	<b>78</b>		<b>92</b>		<b>92</b>		<b>92</b>	<b>92</b>	Unknown	3	3
										<b>77</b>	<b>77</b>

**Potential Changes in Climate Variables**

**Temperature (°F)**

	Scenario	2009	2039	2069	2099	
Annual Average	CCSM45	59.4	61.2	63.4	63.7	
	CCSM85	59.4	61.6	64.3	67.2	
	GFDL45	59.4	62.4	64.3	65.1	
	GFDL85	59.4	62.1	65.3	68.7	
	HAD45	59.4	62.0	65.1	66.4	
HAD85	59.4	62.4	67.0	70.8		
Growing Season (May—Sep)	CCSM45	74.4	76.1	77.9	78.5	
	CCSM85	74.4	76.5	79.4	83.1	
	GFDL45	74.4	78.0	79.9	81.4	
	GFDL85	74.4	77.5	81.3	85.4	
	HAD45	74.4	77.9	80.9	82.3	
HAD85	74.4	78.2	84.9	88.3		
Coldest Month (Average)	CCSM45	36.4	38.5	39.9	40.1	
	CCSM85	36.4	39.5	40.6	42.2	
	GFDL45	36.4	40.0	40.0	40.3	
	GFDL85	36.4	37.9	39.2	39.6	
	HAD45	36.4	37.2	39.3	39.6	
HAD85	36.4	38.2	40.0	41.7		
Warmest Month (Average)	CCSM45	79.7	81.0	82.1	82.2	
	CCSM85	79.7	81.5	82.9	84.8	
	GFDL45	79.7	83.5	84.3	85.2	
	GFDL85	79.7	83.0	84.9	87.3	
	HAD45	79.7	84.3	86.8	87.2	
HAD85	79.7	85.4	89.9	91.2		

**Precipitation (in)**

	Scenario	2009	2039	2069	2099	
Annual Total	CCSM45	54.3	55.6	60.9	59.2	
	CCSM85	54.3	58.6	59.8	63.2	
	GFDL45	54.3	61.6	65.6	67.7	
	GFDL85	54.3	62.4	66.2	69.9	
	HAD45	54.3	51.0	56.7	57.0	
HAD85	54.3	54.0	49.8	54.8		
Growing Season (May—Sep)	CCSM45	21.5	20.6	21.2	21.3	
	CCSM85	21.5	21.5	19.7	21.4	
	GFDL45	21.5	24.6	25.8	26.7	
	GFDL85	21.5	25.7	26.8	28.1	
	HAD45	21.5	19.1	19.9	18.7	
HAD85	21.5	20.2	15.3	16.2		

**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>.

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
sweetgum	Liquidambar styraciflua	WDH	High	92.4	1231.1	11.4	No change	Sm. inc.	Medium	Abundant	Good	Very Good			1	1
loblolly pine	Pinus taeda	WDH	High	52.5	1171.0	16.0	Lg. inc.	Lg. inc.	Medium	Abundant	Very Good	Very Good			1	2
white oak	Quercus alba	WDH	Medium	68	673.8	7.5	No change	No change	High	Abundant	Very Good	Very Good			1	3
yellow-poplar	Liriodendron tulipifera	WDH	High	78.3	580.1	6.5	Lg. dec.	Lg. dec.	High	Abundant	Good	Good			1	4
southern red oak	Quercus falcata	WDL	Medium	75.9	578.7	6.4	Sm. inc.	Sm. inc.	High	Abundant	Very Good	Very Good			1	5
red maple	Acer rubrum	WDH	High	83	570.7	6.0	Sm. dec.	No change	High	Abundant	Good	Very Good			1	6
eastern redcedar	Juniperus virginiana	WDH	Medium	71.4	450.5	5.1	Sm. inc.	Sm. inc.	Medium	Common	Good	Good			1	7
shortleaf pine	Pinus echinata	WDH	High	28.7	387.2	10.1	Sm. inc.	Lg. inc.	Medium	Common	Good	Very Good			1	8
post oak	Quercus stellata	WDH	High	63.7	362.4	4.4	Lg. inc.	Lg. inc.	High	Common	Very Good	Very Good			1	9
winged elm	Ulmus alata	WDL	Medium	72.9	303.6	3.3	Sm. inc.	Lg. inc.	Medium	Common	Good	Very Good			1	10
pignut hickory	Carya glabra	WDL	Medium	56.8	281.4	3.6	Lg. dec.	Lg. dec.	Medium	Common	Poor	Poor			0	11
black cherry	Prunus serotina	WDL	Medium	64.9	270.0	3.2	No change	No change	Low	Common	Poor	Poor			0	12
blackgum	Nyssa sylvatica	WDL	Medium	69.4	248.8	2.8	Sm. inc.	Sm. inc.	High	Common	Very Good	Very Good			1	13
American beech	Fagus grandifolia	WDH	High	45.8	241.1	3.7	No change	No change	Medium	Common	Fair	Fair			1	14
green ash	Fraxinus pennsylvanica	WSH	Low	48.8	202.4	3.1	Sm. inc.	Sm. inc.	Medium	Common	Good	Good			1	15
black oak	Quercus velutina	WDH	High	50.6	189.3	2.9	Sm. inc.	Sm. inc.	Medium	Common	Good	Good			1	16
cherrybark oak; swamp red o	Quercus pagoda	NSL	Medium	35.9	166.5	3.4	Sm. inc.	Sm. inc.	Medium	Common	Good	Good			1	17
sycamore	Platanus occidentalis	NSL	Low	35.1	148.6	3.7	No change	Sm. inc.	Medium	Common	Fair	Good			1	18
mockernut hickory	Carya alba	WDL	Medium	46.1	144.9	2.4	Lg. inc.	Lg. inc.	High	Common	Very Good	Very Good			1	19
sourwood	Oxydendrum arboreum	NDL	High	31.7	138.3	3.4	Lg. dec.	Lg. dec.	High	Common	Fair	Fair			1	20
American hornbeam; muscle	Carpinus caroliniana	WSL	Low	36.7	112.4	2.7	Sm. inc.	Lg. inc.	Medium	Common	Good	Very Good			1	21
sugar maple	Acer saccharum	WDH	High	28.3	111.8	3.5	Lg. dec.	Lg. dec.	High	Common	Fair	Fair			1	22
eastern hophornbeam; ironw	Ostrya virginiana	WSL	Low	38.1	110.3	2.2	No change	Sm. inc.	High	Common	Good	Very Good			1	23
scarlet oak	Quercus coccinea	WDL	Medium	26.9	107.2	3.2	Lg. dec.	Lg. dec.	Medium	Common	Poor	Poor			0	24
flowering dogwood	Cornus florida	WDL	Medium	59.7	102.6	1.4	No change	Sm. inc.	Medium	Common	Fair	Good			1	25
shagbark hickory	Carya ovata	WSL	Medium	29.3	97.7	2.8	Lg. dec.	Lg. dec.	Medium	Common	Poor	Poor			0	26
American elm	Ulmus americana	WDH	Medium	32.2	96.3	1.9	Lg. inc.	Lg. inc.	Medium	Common	Very Good	Very Good			1	27
river birch	Betula nigra	NSL	Low	23.6	92.3	4.4	No change	Sm. inc.	Medium	Common	Fair	Good			1	28
sugarberry	Celtis laevigata	NDH	Medium	14.5	88.8	5.1	Lg. inc.	Lg. inc.	Medium	Common	Very Good	Very Good	Infill ++	Infill ++	1	29
chestnut oak	Quercus prinus	NDH	High	9.3	82.0	4.3	Sm. dec.	Sm. dec.	High	Common	Fair	Fair	Infill +	Infill +	1	30
slippery elm	Ulmus rubra	WSL	Low	26.8	68.4	1.4	Sm. inc.	Sm. inc.	Medium	Common	Good	Good			1	31
water tupelo	Nyssa aquatica	NSH	Medium	4.5	67.7	11.1	Lg. dec.	Lg. dec.	Low	Common	Very Poor	Very Poor			0	32
black willow	Salix nigra	NSH	Low	13.6	66.8	3.3	Lg. inc.	Lg. inc.	Low	Common	Good	Good			1	33
boxelder	Acer negundo	WSH	Low	16.9	66.3	4.0	No change	Sm. inc.	High	Common	Good	Very Good			1	34
northern red oak	Quercus rubra	WDH	Medium	20.7	64.3	1.9	Sm. dec.	Sm. dec.	High	Common	Fair	Fair			1	35
black locust	Robinia pseudoacacia	NDH	Low	6.9	63.9	6.8	Lg. dec.	Lg. dec.	Medium	Common	Poor	Poor			0	36
willow oak	Quercus phellos	NSL	Low	11.6	62.1	2.8	Lg. inc.	Lg. inc.	Medium	Common	Very Good	Very Good			1	37
common persimmon	Diospyros virginiana	NSL	Low	30.7	55.4	1.1	Sm. dec.	Sm. inc.	High	Common	Fair	Very Good			1	38
sassafras	Sassafras albidum	WSL	Low	29.6	50.8	1.4	Sm. inc.	Lg. inc.	Medium	Common	Good	Very Good			1	39
water oak	Quercus nigra	WDH	High	16.6	50.5	2.5	Lg. inc.	Lg. inc.	Medium	Common	Very Good	Very Good	Infill ++	Infill ++	1	40
white ash	Fraxinus americana	WDL	Medium	27.3	48.1	1.5	Lg. inc.	Lg. inc.	Low	Rare	Fair	Fair			1	41
bald cypress	Taxodium distichum	NSH	Medium	8.2	44.5	3.8	Sm. dec.	Sm. dec.	Medium	Rare	Very Poor	Very Poor			0	42
bitternut hickory	Carya cordiformis	WSL	Low	5.2	29.5	4.7	Lg. dec.	Lg. dec.	High	Rare	Poor	Poor		Infill +	1	43
blackjack oak	Quercus marilandica	NSL	Medium	8	28.4	2.3	Lg. inc.	Lg. inc.	High	Rare	Good	Good	Infill ++	Infill ++	1	44
black walnut	Juglans nigra	WDH	Low	10.7	22.8	1.7	Lg. dec.	Lg. dec.	Medium	Rare	Very Poor	Very Poor			0	45
Shumard oak	Quercus shumardii	NSL	Low	5.6	20.1	2.6	No change	No change	High	Rare	Fair	Fair	Infill +	Infill +	1	46
eastern redbud	Cercis canadensis	NSL	Low	10.3	16.7	1.3	Lg. dec.	Sm. dec.	Medium	Rare	Very Poor	Very Poor			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
chinkapin oak	Quercus muehlenbergii	NSL	Medium	6.9	16.7	1.4	Sm. dec.	Sm. dec.	Medium	Rare	Very Poor	Very Poor				0 48
honeylocust	Gleditsia triacanthos	NSH	Low	2.8	15.8	1.9	No change	No change	High	Rare	Fair	Fair		Infill +		2 49
swamp chestnut oak	Quercus michauxii	NSL	Low	7.1	14.7	1.3	Sm. dec.	No change	Medium	Rare	Very Poor	Poor		Infill +		1 50
shellbark hickory	Carya laciniosa	NSL	Low	6.6	14.4	1.9	Lg. dec.	Lg. dec.	Medium	Rare	Very Poor	Very Poor				0 51
ailanthus	Ailanthus altissima	NSL	FIA	3.9	14.3	3.5	Unknown	Unknown	NA	Rare	NNIS	NNIS				0 52
American holly	Ilex opaca	NSL	Medium	7.9	11.7	1.3	No change	No change	Medium	Rare	Poor	Poor				1 53
silver maple	Acer saccharinum	NSH	Low	6.1	11.0	2.4	Sm. dec.	Sm. dec.	High	Rare	Poor	Poor				0 54
eastern cottonwood	Populus deltoides	NSH	Low	2	10.1	5.1	Sm. dec.	Sm. dec.	Medium	Rare	Very Poor	Very Poor				0 55
red mulberry	Morus rubra	NSL	Low	7.8	9.0	0.8	Sm. dec.	No change	Medium	Rare	Very Poor	Poor				1 56
Virginia pine	Pinus virginiana	NDH	High	3	8.6	2.9	No change	No change	Medium	Rare	Poor	Poor	Infill +	Infill +		2 57
shingle oak	Quercus imbricaria	NDH	Medium	2.2	8.4	1.3	Sm. dec.	Sm. dec.	Medium	Rare	Very Poor	Very Poor				0 58
sand hickory	Carya pallida	NSL	FIA	3.7	8.2	1.4	Unknown	Unknown	NA	Rare	FIA Only	FIA Only				0 59
pin oak	Quercus palustris	NSH	Low	1	5.8	5.9	Sm. dec.	Sm. dec.	Low	Rare	Very Poor	Very Poor				0 60
sweetbay	Magnolia virginiana	NSL	Medium	1	5.7	5.7	Sm. inc.	Lg. inc.	Medium	Rare	Fair	Good	Infill +	Infill ++		2 61
hackberry	Celtis occidentalis	WDH	Medium	3.8	4.8	1.2	No change	Sm. inc.	High	Rare	Fair	Good	Infill +	Infill ++		2 62
serviceberry	Amelanchier spp.	NSL	Low	5.4	4.6	0.7	Lg. dec.	Lg. dec.	Medium	Rare	Very Poor	Very Poor				0 63
paulownia	Paulownia tomentosa	NSL	FIA	1	3.9	3.9	Unknown	Unknown	NA	Rare	NNIS	NNIS				0 64
overcup oak	Quercus lyrata	NSL	Medium	2	3.7	1.9	No change	Lg. inc.	Low	Rare	Very Poor	Fair		Infill +		2 65
swamp white oak	Quercus bicolor	NSL	Low	1	2.5	2.5	Sm. dec.	Sm. dec.	Medium	Rare	Very Poor	Very Poor				0 66
florida maple	Acer barbatum	NSL	Low	1	2.0	2.0	No change	No change	High	Rare	Fair	Fair		Infill +		2 67
Osage-orange	Maclura pomifera	NDH	Medium	4	1.9	7.7	Lg. inc.	Lg. inc.	High	Rare	Good	Good	Infill ++	Infill ++		2 68
rock elm	Ulmus thomasii	NSLX	FIA	2	1.9	1.0	Unknown	Unknown	Low	Rare	FIA Only	FIA Only				0 69
swamp tupelo	Nyssa biflora	NDH	Medium	3.1	1.8	1.0	Sm. inc.	Sm. inc.	Low	Rare	Poor	Poor				0 70
pecan	Carya illinoensis	NSH	Low	6.1	1.3	2.4	Lg. inc.	Lg. inc.	Low	Rare	Fair	Fair	Infill +	Infill +		2 71
laurel oak	Quercus laurifolia	NDH	Medium	1	1.0	1.0	Lg. inc.	Lg. inc.	Medium	Rare	Good	Good				0 72
wild plum	Prunus americana	NSLX	FIA	0.7	0.8	0.5	Unknown	Unknown	Medium	Rare	FIA Only	FIA Only				0 73
American basswood	Tilia americana	WSL	Medium	0.6	0.6	0.4	Very Lg. dec.	Very Lg. dec.	Medium	Rare	Lost	Lost				0 74
white mulberry	Morus alba	NSL	FIA	1	0.6	0.6	Unknown	Unknown	NA	Rare	NNIS	NNIS				0 75
pawpaw	Asimina triloba	NSL	Low	1	0.5	0.5	Lg. dec.	Lg. dec.	Medium	Rare	Very Poor	Very Poor				0 76
slash pine	Pinus elliottii	NDH	High	0.3	0.4	0.1	Lg. inc.	Lg. inc.	Medium	Rare	Good	Good				2 77
eastern white pine	Pinus strobus	WDH	High	1	0.3	0.3	Lg. dec.	Lg. dec.	Low	Rare	Very Poor	Very Poor				0 78
ashe juniper	Juniperus ashei	NDH	High	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat				0 79
longleaf pine	Pinus palustris	NSH	Medium	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat		Migrate +		3 80
striped maple	Acer pensylvanicum	NSL	Medium	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat	Likely +	Likely +		3 81
Ohio buckeye	Aesculus glabra	NSL	Low	0	0	0	Unknown	Unknown	Medium	Absent	Unknown	Unknown				0 82
yellow buckeye	Aesculus flava	NSL	Low	0	0	0	Unknown	Unknown	Low	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
southern magnolia	Magnolia grandiflora	NSL	Low	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat				3 87
pin cherry	Prunus pensylvanica	NSL	Low	0	0	0	Unknown	Unknown	Medium	Absent	Unknown	Unknown				0 88
nuttall oak	Quercus texana	NSH	Medium	0	0	0	New Habitat	New Habitat	High	Absent	New Habitat	New Habitat				0 89
live oak	Quercus virginiana	NDH	High	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat		Migrate ++		3 90
bluejack oak	Quercus incana	NSL	Low	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat		Migrate +		3 91
cedar elm	Ulmus crassifolia	NDH	Medium	0	0	0	New Habitat	New Habitat	Low	Absent	New Habitat	New Habitat		Migrate ++		3 92