

	sq. km	sq. mi	FIA Plots
Area of Region	59,230	22,869	480

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 RCP45	Scenario RCP85	Scenario RCP45	Scenario RCP85	SHIFT RCP45	SHIFT RCP85				
Ash	4			High	16	25	Increase	28	31	Very Good	8	11	Likely	2	2
Hickory	8			Medium	35	56	No Change	23	22	Good	17	16	Infill	49	51
Maple	5	Abundant	0	Low	40	13	Decrease	24	22	Fair	15	14	Migrate	3	4
Oak	19	Common	24	FIA	8		New	10	11	Poor	15	16			
Pine	2	Rare	59				Unknown	14	13	Very Poor	20	18			
Other	45	Absent	16							FIA Only	5	5			
	83		99		99	94		99	99	Unknown	6	5			
											86	85			

Potential Changes in Climate Variables

Temperature (°F)

	Scenario	2009	2039	2069	2099
Annual Average	CCSM45	61.2	62.9	64.9	65.3
	CCSM85	61.2	63.3	65.9	68.7
	GFDL45	61.2	66.2	66.0	66.9
	GFDL85	61.2	64.0	67.1	70.6
	HAD45	61.2	63.8	66.8	68.1
HAD85	61.2	64.1	68.7	72.4	
Growing Season May—Sep	CCSM45	76.6	78.2	79.8	80.4
	CCSM85	76.6	78.8	81.4	84.9
	GFDL45	76.6	82.8	82.1	83.8
	GFDL85	76.6	80.0	83.5	87.9
	HAD45	76.6	80.0	82.8	84.1
HAD85	76.6	80.3	86.6	90.0	
Coldest Month Average	CCSM45	37.7	39.9	41.2	41.4
	CCSM85	37.7	40.3	41.5	43.0
	GFDL45	37.7	41.6	41.7	41.9
	GFDL85	37.7	39.3	40.5	41.1
	HAD45	37.7	38.7	40.7	41.0
HAD85	37.7	39.9	41.6	43.3	
Warmest Month Average	CCSM45	81.9	83.3	84.3	84.5
	CCSM85	81.9	84.2	85.3	87.1
	GFDL45	81.9	86.1	86.6	87.8
	GFDL85	81.9	85.6	87.2	90.0
	HAD45	81.9	86.1	88.1	88.5
HAD85	81.9	87.2	91.2	92.4	

Precipitation (in)

	Scenario	2009	2039	2069	2099
Annual Total	CCSM45	50.4	51.1	56.8	54.3
	CCSM85	50.4	53.2	55.0	57.4
	GFDL45	50.4	56.4	60.8	60.2
	GFDL85	50.4	56.3	60.7	62.9
	HAD45	50.4	48.7	53.3	55.1
HAD85	50.4	52.5	47.1	52.1	
Growing Season May—Sep	CCSM45	18.3	17.6	18.4	18.0
	CCSM85	18.3	17.8	16.6	17.3
	GFDL45	18.3	20.6	21.8	21.9
	GFDL85	18.3	21.5	22.9	23.4
	HAD45	18.3	16.5	17.1	16.2
HAD85	18.3	17.7	13.4	13.5	

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>.

Section 234D

EcoMap 2007

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
sugarberry	Celtis laevigata	NDH	Medium	48.5	280.6	14.1	No change	Sm. inc.	Medium	Common	Fair	Good	Infill +	Infill ++	1	1
sweetgum	Liquidambar styraciflua	WDH	High	38.5	208.8	9.4	Sm. inc.	Sm. inc.	Medium	Common	Good	Good	Infill ++	Infill ++	1	2
green ash	Fraxinus pennsylvanica	WSH	Low	57.5	181.1	8.0	Sm. inc.	Sm. inc.	Medium	Common	Good	Good	Infill ++	Infill ++	1	3
black willow	Salix nigra	NSH	Low	29.2	173.9	15.6	Sm. inc.	Sm. inc.	Low	Common	Fair	Fair	Infill +	Infill +	1	4
boxelder	Acer negundo	WSH	Low	26.8	152.4	8.6	Sm. dec.	Sm. dec.	High	Common	Fair	Fair	Infill +	Infill +	1	5
Nuttall oak	Quercus texana	NSH	Medium	27.2	114.1	11.4	Sm. dec.	Sm. dec.	High	Common	Fair	Fair			0	6
overcup oak	Quercus lyrata	NSL	Medium	30.9	108.6	7.8	Sm. inc.	Sm. inc.	Low	Common	Fair	Fair	Infill +	Infill +	1	7
willow oak	Quercus phellos	NSL	Low	29.5	98.7	8.4	Sm. inc.	Lg. inc.	Medium	Common	Good	Very Good	Infill ++	Infill ++	1	8
winged elm	Ulmus alata	WDL	Medium	32.2	97.9	4.3	Lg. inc.	Lg. inc.	Medium	Common	Very Good	Very Good	Infill ++	Infill ++	1	9
American elm	Ulmus americana	WDH	Medium	46.1	95.1	4.8	Sm. inc.	Lg. inc.	Medium	Common	Good	Very Good	Infill ++	Infill ++	1	10
water oak	Quercus nigra	WDH	High	24.6	85.2	7.7	Lg. inc.	Lg. inc.	Medium	Common	Very Good	Very Good	Infill ++	Infill ++	2	11
red maple	Acer rubrum	WDH	High	27.9	79.6	6.0	No change	Sm. inc.	High	Common	Good	Very Good	Infill ++	Infill ++	1	12
post oak	Quercus stellata	WDH	High	12.3	78.3	7.2	Lg. inc.	Lg. inc.	High	Common	Very Good	Very Good	Infill ++	Infill ++	2	13
water tupelo	Nyssa aquatica	NSH	Medium	11.1	75.0	20.2	Lg. dec.	Sm. dec.	Low	Common	Very Poor	Poor		Infill +	2	14
white oak	Quercus alba	WDH	Medium	20.6	73.1	6.2	Sm. inc.	Sm. inc.	High	Common	Very Good	Very Good	Infill ++	Infill ++	2	15
loblolly pine	Pinus taeda	WDH	High	7.3	64.4	14.2	Lg. inc.	Lg. inc.	Medium	Common	Very Good	Very Good	Infill ++	Infill ++	2	16
cherrybark oak; swamp red o	Quercus pagoda	NSL	Medium	18.3	63.9	6.4	Lg. inc.	Lg. inc.	Medium	Common	Very Good	Very Good	Infill ++	Infill ++	1	17
pecan	Carya illinoensis	NSH	Low	19.2	63.7	7.8	Lg. inc.	Lg. inc.	Low	Common	Good	Good	Infill ++	Infill ++	2	18
bald cypress	Taxodium distichum	NSH	Medium	17	61.0	9.5	Lg. inc.	Lg. inc.	Medium	Common	Very Good	Very Good	Infill ++	Infill ++	2	19
water hickory	Carya aquatica	NSL	Medium	28	56.6	7.9	Sm. inc.	Sm. inc.	Medium	Common	Good	Good	Infill ++	Infill ++	1	20
southern red oak	Quercus falcata	WDL	Medium	10.3	54.3	6.8	Lg. inc.	Lg. inc.	High	Common	Very Good	Very Good	Infill ++	Infill ++	2	21
sycamore	Platanus occidentalis	NSL	Low	16.7	52.9	5.0	Sm. inc.	Sm. inc.	Medium	Common	Good	Good	Infill ++	Infill ++	2	22
eastern cottonwood	Populus deltoides	NSH	Low	15.7	50.4	9.0	No change	No change	Medium	Common	Fair	Fair	Infill +	Infill +	2	23
black hickory	Carya texana	NDL	High	10.4	50.2	7.1	No change	Sm. inc.	Medium	Common	Fair	Good	Infill +	Infill ++	2	24
slippery elm	Ulmus rubra	WSL	Low	38.1	48.0	2.9	Lg. inc.	Lg. inc.	Medium	Rare	Good	Good	Infill ++	Infill ++	1	25
silver maple	Acer saccharinum	NSH	Low	13.8	45.4	6.2	Lg. dec.	Lg. dec.	High	Rare	Poor	Poor	Infill +	Infill +	2	26
black oak	Quercus velutina	WDH	High	10.9	42.2	3.9	No change	No change	Medium	Rare	Poor	Poor	Infill +	Infill +	2	27
common persimmon	Diospyros virginiana	NSL	Low	36.3	38.7	2.8	Sm. inc.	Lg. inc.	High	Rare	Good	Good	Infill ++	Infill ++	1	28
shortleaf pine	Pinus echinata	WDH	High	3.1	33.9	7.6	No change	No change	Medium	Rare	Poor	Poor	Infill +	Infill +	2	29
eastern redcedar	Juniperus virginiana	WDH	Medium	9	33.5	3.6	No change	No change	Medium	Rare	Poor	Poor	Infill +	Infill +	2	30
yellow-poplar	Liriodendron tulipifera	WDH	High	5	32.4	3.1	Sm. dec.	Sm. dec.	High	Rare	Poor	Poor	Infill +	Infill +	2	31
pignut hickory	Carya glabra	WDL	Medium	10.1	30.9	3.0	Sm. dec.	Sm. dec.	Medium	Rare	Very Poor	Very Poor			2	32
black cherry	Prunus serotina	WDL	Medium	12.3	30.1	3.7	No change	No change	Low	Rare	Very Poor	Very Poor			0	33
black locust	Robinia pseudoacacia	NDH	Low	3	29.8	9.8	Sm. dec.	Sm. dec.	Medium	Rare	Very Poor	Very Poor			2	34
mockernut hickory	Carya alba	WDL	Medium	16.4	29.3	3.0	Lg. inc.	Lg. inc.	High	Rare	Good	Good	Infill ++	Infill ++	1	35
water elm	Planera aquatica	NSL	Low	12.2	25.6	5.6	Sm. inc.	Sm. inc.	Medium	Rare	Fair	Fair	Infill +	Infill +	2	36
eastern hophornbeam; ironw	Ostrya virginiana	WSL	Low	7.4	25.1	2.6	No change	No change	High	Rare	Fair	Fair	Infill +	Infill +	2	37
hackberry	Celtis occidentalis	WDH	Medium	11	24.0	6.3	No change	No change	High	Rare	Fair	Fair	Infill +	Infill +	2	38
American beech	Fagus grandifolia	WDH	High	4.9	23.2	3.7	No change	No change	Medium	Rare	Poor	Poor	Infill +	Infill +	2	39
honeylocust	Gleditsia triacanthos	NSH	Low	16.9	22.9	3.2	Lg. inc.	Lg. inc.	High	Rare	Good	Good	Infill ++	Infill ++	2	40
blackgum	Nyssa sylvatica	WDL	Medium	13.9	19.2	3.0	Lg. inc.	Lg. inc.	High	Rare	Good	Good	Infill ++	Infill ++	2	41
sassafras	Sassafras albidum	WSL	Low	15.5	17.7	2.1	No change	No change	Medium	Rare	Poor	Poor	Infill +	Infill +	1	42
American hornbeam; muscle	Carpinus caroliniana	WSL	Low	6.1	17.7	2.1	No change	No change	Medium	Rare	Poor	Poor	Infill +	Infill +	2	43
white ash	Fraxinus americana	WDL	Medium	7.9	17.0	2.9	No change	No change	Low	Rare	Very Poor	Very Poor			2	44
shagbark hickory	Carya ovata	WSL	Medium	12	16.6	3.7	No change	No change	Medium	Rare	Poor	Poor	Infill +	Infill +	2	45
chinkapin oak	Quercus muehlenbergii	NSL	Medium	6.3	14.2	2.1	Sm. dec.	Sm. dec.	Medium	Rare	Very Poor	Very Poor			2	46
bitternut hickory	Carya cordiformis	WSL	Low	5.7	13.4	1.9	No change	No change	High	Rare	Fair	Fair	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
florida maple	Acer barbatum	NSL	Low	6.3	13.2	4.3	Sm. dec.	Sm. dec.	High	Rare	Poor	Poor	Infill +	Infill +	2	48
sugar maple	Acer saccharum	WDH	High	4.5	11.2	3.2	No change	No change	High	Rare	Fair	Fair	Infill +	Infill +	2	49
Shumard oak	Quercus shumardii	NSL	Low	5.7	10.9	3.3	No change	No change	High	Rare	Fair	Fair	Infill +	Infill +	2	50
flowering dogwood	Cornus florida	WDL	Medium	8.2	10.8	1.9	No change	No change	Medium	Rare	Poor	Poor	Infill +	Infill +	1	51
pin oak	Quercus palustris	NSH	Low	1.2	10.7	5.7	Sm. dec.	Sm. dec.	Low	Rare	Very Poor	Very Poor			2	52
swamp chestnut oak	Quercus michauxii	NSL	Low	9.7	10.5	3.1	No change	No change	Medium	Rare	Poor	Poor	Infill +	Infill +	2	53
red mulberry	Morus rubra	NSL	Low	10.7	10.1	1.6	Sm. dec.	Sm. dec.	Medium	Rare	Very Poor	Very Poor			2	54
northern red oak	Quercus rubra	WDH	Medium	6.7	9.9	3.2	No change	No change	High	Rare	Fair	Fair	Infill +	Infill +	2	55
cedar elm	Ulmus crassifolia	NDH	Medium	4.9	9.7	3.4	Lg. inc.	Lg. inc.	Low	Rare	Fair	Fair	Infill +	Infill +	2	56
waterlocust	Gleditsia aquatica	NSLX	FIA	7.1	8.4	2.6	Unknown	Unknown	Medium	Rare	FIA Only	FIA Only			0	57
swamp tupelo	Nyssa biflora	NDH	Medium	0.5	7.7	12.8	Sm. dec.	Sm. dec.	Low	Rare	Very Poor	Very Poor			2	58
blackjack oak	Quercus marilandica	NSL	Medium	2.1	6.7	2.8	Lg. inc.	Lg. inc.	High	Rare	Good	Good			2	59
black walnut	Juglans nigra	WDH	Low	4.1	6.3	2.3	No change	No change	Medium	Rare	Poor	Poor	Infill +	Infill +	2	60
river birch	Betula nigra	NSL	Low	4.5	6.0	3.9	No change	No change	Medium	Rare	Poor	Poor	Infill +	Infill +	2	61
pawpaw	Asimina triloba	NSL	Low	5.3	5.7	2.4	Lg. dec.	Lg. dec.	Medium	Rare	Very Poor	Very Poor			0	62
eastern redbud	Cercis canadensis	NSL	Low	8.6	3.6	1.2	Sm. dec.	No change	Medium	Rare	Very Poor	Poor		Infill +	2	63
bigleaf magnolia	Magnolia macrophylla	NSL	Low	0.1	3.0	1.2	Lg. dec.	Lg. dec.	Medium	Rare	Very Poor	Very Poor			0	64
scarlet oak	Quercus coccinea	WDL	Medium	0.8	2.4	1.6	Sm. dec.	Sm. dec.	Medium	Rare	Very Poor	Very Poor			2	65
shellbark hickory	Carya laciniosa	NSL	Low	1.4	2.4	4.7	Sm. dec.	Sm. dec.	Medium	Rare	Very Poor	Very Poor			2	66
cucumbertree	Magnolia acuminata	NSL	Low	0.9	2.4	1.0	Sm. dec.	Sm. dec.	Medium	Rare	Very Poor	Very Poor			2	67
cittamwood/gum bumelia	Sideroxylon lanuginosum ssp.	NSL	Low	1.5	1.8	2.2	Lg. inc.	Lg. inc.	High	Rare	Good	Good			2	68
serviceberry	Amelanchier spp.	NSL	Low	0.3	1.8	2.7	Lg. dec.	Lg. dec.	Medium	Rare	Very Poor	Very Poor			0	69
shingle oak	Quercus imbricaria	NDH	Medium	0.1	0.9	0.9	Lg. dec.	Lg. dec.	Medium	Rare	Very Poor	Very Poor			0	70
Osage-orange	Maclura pomifera	NDH	Medium	0.3	0.9	1.3	Lg. inc.	Lg. inc.	High	Rare	Good	Good			2	71
swamp white oak	Quercus bicolor	NSL	Low	0.1	0.7	2.8	Sm. dec.	Sm. dec.	Medium	Rare	Very Poor	Very Poor			0	72
paulownia	Paulownia tomentosa	NSL	FIA	0.6	0.6	0.8	Unknown	Unknown	NA	Rare	NNIS	NNIS			0	73
American basswood	Tilia americana	WSL	Medium	0.9	0.5	1.2	Sm. dec.	Sm. dec.	Medium	Rare	Very Poor	Very Poor			0	74
sourwood	Oxydendrum arboreum	NDL	High	0.9	0.4	1.4	Sm. dec.	No change	High	Rare	Poor	Fair			0	75
white mulberry	Morus alba	NSL	FIA	0	0.3	0.4	Unknown	Unknown	NA	Rare	NNIS	NNIS			0	76
pumpkin ash	Fraxinus profunda	NSH	FIA	0.4	0.2	2.9	Unknown	Unknown	NA	Rare	FIA Only	FIA Only			0	77
butternut	Juglans cinerea	NSLX	FIA	0.6	0.2	3.4	Unknown	Unknown	Low	Rare	FIA Only	FIA Only			0	78
laurel oak	Quercus laurifolia	NDH	Medium	0	0.2	0.1	Lg. inc.	Lg. inc.	Medium	Rare	Good	Good			2	79
Carolina ash	Fraxinus caroliniana	NSL	FIA	0.7	0.1	2.1	Unknown	Unknown	NA	Rare	FIA Only	FIA Only			0	80
ailanthus	Ailanthus altissima	NSL	FIA	1.2	0.1	0.7	Unknown	Unknown	NA	Rare	NNIS	NNIS			0	81
northern catalpa	Catalpa speciosa	NSHX	FIA	0.7	0.0	1.0	Unknown	Unknown	Medium	Rare	FIA Only	FIA Only			0	82
Ohio buckeye	Aesculus glabra	NSL	Low	0.6	0.0	0.4	Lg. dec.	Lg. dec.	Medium	Rare	Very Poor	Very Poor			0	83
Atlantic white-cedar	Chamaecyparis thyoides	NSH	Low	0	0	0	Unknown	Unknown	Low	Absent	Unknown	Unknown			0	84
ashe juniper	Juniperus ashei	NDH	High	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat			0	85
slash pine	Pinus elliottii	NDH	High	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat	Likely +	Likely +	3	86
longleaf pine	Pinus palustris	NSH	Medium	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat	Migrate +	Migrate +	3	87
striped maple	Acer pensylvanicum	NSL	Medium	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat			3	88
yellow buckeye	Aesculus flava	NSL	Low	0	0	0	Unknown	Unknown	Low	Absent	Unknown	Unknown			0	89
black ash	Fraxinus nigra	WSH	Medium	0	0	0	Unknown	Unknown	Low	Absent	Unknown	Unknown			0	90
silverbell	Halesia spp.	NSL	Low	0	0	0	Unknown	Unknown	Medium	Absent	Unknown	Unknown			0	91
American holly	Ilex opaca	NSL	Medium	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat	Migrate +	Migrate +	3	92
southern magnolia	Magnolia grandiflora	NSL	Low	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat	Likely +	Likely +	3	93
sweetbay	Magnolia virginiana	NSL	Medium	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat		Migrate +	3	94



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Common Name	Scientific Name	Range	MR	%Cell	FIAsum	FIAiv	ChngCl45	ChngCl85	Adap	Abund	Capabil45	Capabil85	SHIFT45	SHIFT85	SSO	N
redbay	Persea borbonia	NSL	Low	0	0	0	New Habitat	New Habitat	High	Absent	New Habitat	New Habitat			3	95
pin cherry	Prunus pensylvanica	NSL	Low	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat			3	96
chestnut oak	Quercus prinus	NDH	High	0	0	0	Unknown	Unknown	High	Absent	Unknown	Unknown			0	97
live oak	Quercus virginiana	NDH	High	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat	Migrate ++	Migrate ++	3	98
bluejack oak	Quercus incana	NSL	Low	0	0	0	Unknown	New Habitat	Medium	Absent	Unknown	New Habitat			3	99