

	sq. km	sq. mi	FIA Plots
Area of Region	87,599	33,822	2,320

**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	18	27	Increase	30	35	Very Good	12	16	Likely	2	2
Hickory	7			Medium	34	55	No Change	19	17	Good	16	17	Infill	17	19
Maple	5	Abundant	4	Low	37	12	Decrease	19	16	Fair	15	12	Migrate	3	5
Oak	17	Common	28	FIA	9		New	12	13	Poor	11	12			
Pine	3	Rare	45				Unknown	18	17	Very Poor	14	11			
Other	41	Absent	20							FIA Only	6	6			
	<b>77</b>		<b>97</b>		<b>98</b>	<b>94</b>		<b>98</b>	<b>98</b>	Unknown	9	8			
											<b>83</b>	<b>82</b>			

**Potential Changes in Climate Variables**

**Temperature (°F)**

Scenario	2009	2039	2069	2099	
Annual	55.8	57.6	59.6	60.0	
Average	55.8	58.1	60.6	63.7	
GFDL45	55.8	59.1	60.9	61.9	
GFDL85	55.8	58.7	61.7	65.5	
HAD45	55.8	58.4	61.4	62.9	
HAD85	55.8	58.7	63.4	67.2	
Growing Season	72.0	74.1	75.6	76.3	
May—Sep	72.0	74.7	77.2	81.1	
GFDL45	72.0	75.9	78.2	79.8	
GFDL85	72.0	75.6	79.2	84.0	
HAD45	72.0	75.0	77.7	79.4	
HAD85	72.0	75.4	81.3	84.7	
Coldest Month	30.3	32.4	33.8	34.2	
Average	30.3	33.2	34.3	36.0	
GFDL45	30.3	34.7	35.0	35.2	
GFDL85	30.3	32.7	34.0	34.8	
HAD45	30.3	31.5	34.0	34.1	
HAD85	30.3	33.1	35.3	37.2	
Warmest Month	78.2	80.4	81.5	81.9	
Average	78.2	81.2	82.5	84.3	
GFDL45	78.2	82.4	83.8	84.9	
GFDL85	78.2	82.4	84.1	87.3	
HAD45	78.2	81.7	83.5	84.3	
HAD85	78.2	83.0	86.4	88.0	

**Precipitation (in)**

Scenario	2009	2039	2069	2099	
Annual	45.0	43.7	48.3	46.7	
Total	45.0	46.1	47.3	47.9	
GFDL45	45.0	50.0	51.8	51.5	
GFDL85	45.0	49.8	56.3	56.3	
HAD45	45.0	44.7	47.6	47.7	
HAD85	45.0	47.4	43.8	46.9	
Growing Season	20.7	19.4	21.3	20.1	
May—Sep	20.7	20.7	19.7	20.0	
GFDL45	20.7	23.1	22.4	23.1	
GFDL85	20.7	23.0	25.0	24.6	
HAD45	20.7	19.9	20.0	19.8	
HAD85	20.7	20.7	17.0	17.5	

**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>.

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	73.8	1353.1	18.8	Sm. dec.	Sm. dec.	High	Abundant	Good	Good			1	1
black oak	Quercus velutina	WDH	High	79.9	1193.1	15.8	Sm. dec.	Sm. dec.	Medium	Abundant	Fair	Fair			0	2
post oak	Quercus stellata	WDH	High	76.7	1141.2	15.6	Sm. inc.	Sm. inc.	High	Abundant	Very Good	Very Good			1	3
eastern redcedar	Juniperus virginiana	WDH	Medium	60.1	663.3	12.1	Sm. inc.	Sm. inc.	Medium	Abundant	Very Good	Very Good			1	4
shortleaf pine	Pinus echinata	WDH	High	22	279.3	12.8	Sm. inc.	Lg. inc.	Medium	Common	Good	Very Good			1	5
black hickory	Carya texana	NDL	High	62.1	274.0	4.6	Sm. inc.	Sm. inc.	Medium	Common	Good	Good			1	6
northern red oak	Quercus rubra	WDH	Medium	43.9	254.3	5.9	No change	No change	High	Common	Good	Good			1	7
black walnut	Juglans nigra	WDH	Low	48.8	248.4	5.6	No change	No change	Medium	Common	Fair	Fair			1	8
mockernut hickory	Carya alba	WDL	Medium	56.1	236.1	4.4	Sm. inc.	Sm. inc.	High	Common	Very Good	Very Good			1	9
American elm	Ulmus americana	WDH	Medium	55.4	224.4	4.6	Sm. inc.	Sm. inc.	Medium	Common	Good	Good			1	10
scarlet oak	Quercus coccinea	WDL	Medium	24.1	202.6	8.5	Lg. dec.	Lg. dec.	Medium	Common	Poor	Poor			0	11
blackjack oak	Quercus marilandica	NSL	Medium	32.6	174.0	5.1	Lg. inc.	Lg. inc.	High	Common	Very Good	Very Good			1	12
chinkapin oak	Quercus muehlenbergii	NSL	Medium	34.9	156.3	4.6	No change	No change	Medium	Common	Fair	Fair			1	13
sugar maple	Acer saccharum	WDH	High	25.5	137.8	5.3	No change	Sm. inc.	High	Common	Good	Very Good	Infill ++	Infill ++	1	14
shagbark hickory	Carya ovata	WSL	Medium	33.6	129.5	4.5	Sm. dec.	Sm. dec.	Medium	Common	Poor	Poor			0	15
white ash	Fraxinus americana	WDL	Medium	42.8	122.8	3.1	Sm. inc.	Lg. inc.	Low	Common	Fair	Good			1	16
hackberry	Celtis occidentalis	WDH	Medium	33.4	117.2	4.2	Sm. inc.	Lg. inc.	High	Common	Very Good	Very Good			1	17
bitternut hickory	Carya cordiformis	WSL	Low	28.5	103.3	4.1	Sm. inc.	Sm. inc.	High	Common	Very Good	Very Good			1	18
pignut hickory	Carya glabra	WDL	Medium	22.9	102.4	4.5	Sm. dec.	Sm. dec.	Medium	Common	Poor	Poor			0	19
sassafras	Sassafras albidum	WSL	Low	42.3	101.8	2.6	Sm. dec.	Sm. dec.	Medium	Common	Poor	Poor			0	20
blackgum	Nyssa sylvatica	WDL	Medium	29.2	100.7	3.3	Sm. inc.	Lg. inc.	High	Common	Very Good	Very Good			1	21
black cherry	Prunus serotina	WDL	Medium	39.5	99.7	2.8	Sm. inc.	Sm. inc.	Low	Common	Very Good	Fair			1	22
sycamore	Platanus occidentalis	NSL	Low	16.9	93.3	5.3	Lg. inc.	Lg. inc.	Medium	Common	Very Good	Very Good			1	23
flowering dogwood	Cornus florida	WDL	Medium	46.7	92.8	2.0	No change	No change	Medium	Common	Fair	Fair			1	24
slippery elm	Ulmus rubra	WSL	Low	39.1	90.8	2.4	Sm. inc.	Lg. inc.	Medium	Common	Good	Very Good			1	25
honeylocust	Gleditsia triacanthos	NSH	Low	22.2	78.8	4.5	Sm. inc.	Lg. inc.	High	Common	Very Good	Very Good			1	26
winged elm	Ulmus alata	WDL	Medium	23.4	61.7	2.5	Lg. inc.	Lg. inc.	Medium	Common	Very Good	Very Good	Infill ++	Infill ++	1	27
common persimmon	Diospyros virginiana	NSL	Low	25.6	58.5	2.4	Lg. inc.	Lg. inc.	High	Common	Very Good	Very Good			1	28
Shumard oak	Quercus shumardii	NSL	Low	14.9	57.0	4.3	No change	Sm. inc.	High	Common	Good	Very Good			1	29
red mulberry	Morus rubra	NSL	Low	31.1	52.8	1.9	No change	No change	Medium	Common	Fair	Fair			1	30
shingle oak	Quercus imbricaria	NDH	Medium	14.8	50.9	4.2	Lg. dec.	Lg. dec.	Medium	Common	Poor	Poor	Infill +	Infill +	0	31
red maple	Acer rubrum	WDH	High	22.2	50.0	2.2	Lg. inc.	Lg. inc.	High	Common	Very Good	Very Good			1	32
boxelder	Acer negundo	WSH	Low	8.6	49.7	5.3	No change	No change	High	Rare	Fair	Fair	Infill +	Infill +	1	33
green ash	Fraxinus pennsylvanica	WSH	Low	14.9	44.1	3.2	Lg. inc.	Lg. inc.	Medium	Rare	Good	Good			1	34
southern red oak	Quercus falcata	WDL	Medium	6.6	41.6	5.2	Sm. inc.	Lg. inc.	High	Rare	Good	Good	Infill ++	Infill ++	2	35
silver maple	Acer saccharinum	NSH	Low	4.7	39.5	7.9	No change	No change	High	Rare	Fair	Fair	Infill +	Infill +	2	36
eastern redbud	Cercis canadensis	NSL	Low	23.8	34.5	1.4	Sm. inc.	Lg. inc.	Medium	Rare	Fair	Good			1	37
Osage-orange	Maclura pomifera	NDH	Medium	10.8	29.9	5.0	Lg. inc.	Lg. inc.	High	Rare	Good	Good	Infill ++	Infill ++	1	38
black willow	Salix nigra	NSH	Low	2.9	29.1	10.2	No change	No change	Low	Rare	Very Poor	Very Poor			2	39
eastern hophornbeam; ironw	Ostrya virginiana	WSL	Low	10.6	17.5	1.6	Lg. inc.	Lg. inc.	High	Rare	Good	Good			1	40
eastern cottonwood	Populus deltoides	NSH	Low	2.3	16.6	6.5	Sm. dec.	No change	Medium	Rare	Very Poor	Poor		Infill +	2	41
sweetgum	Liquidambar styraciflua	WDH	High	1.9	16.4	5.5	Lg. inc.	Lg. inc.	Medium	Rare	Good	Good			2	42
pin oak	Quercus palustris	NSH	Low	1.7	11.8	4.3	No change	No change	Low	Rare	Very Poor	Very Poor			2	43
bur oak	Quercus macrocarpa	NDH	Medium	3.5	10.7	4.3	Sm. dec.	Sm. dec.	High	Rare	Poor	Poor		Infill +	2	44
American basswood	Tilia americana	WSL	Medium	3.1	10.6	3.6	Lg. dec.	Lg. dec.	Medium	Rare	Very Poor	Very Poor			0	45
black locust	Robinia pseudoacacia	NDH	Low	1.6	10.1	5.5	Sm. inc.	Lg. inc.	Medium	Rare	Fair	Good	Infill +	Infill ++	2	46
wild plum	Prunus americana	NSLX	FIA	3.3	8.7	2.6	Unknown	Unknown	Medium	Rare	FIA Only	FIA Only			0	47

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
Ohio buckeye	Aesculus glabra	NSL	Low	3.3	7.6	2.3	Sm. dec.	Sm. dec.	Medium	Rare	Very Poor	Very Poor			0	48
serviceberry	Amelanchier spp.	NSL	Low	9.6	7.5	0.8	Lg. dec.	Lg. dec.	Medium	Rare	Very Poor	Very Poor			0	49
river birch	Betula nigra	NSL	Low	1.3	6.6	3.8	No change	No change	Medium	Rare	Poor	Poor	Infill +	Infill +	2	50
American hornbeam; muscle	Carpinus caroliniana	WSL	Low	3.9	6.1	1.4	No change	Sm. inc.	Medium	Rare	Poor	Fair	Infill +	Infill +	1	51
cittamwood/gum bumelia	Sideroxylon lanuginosum ssp.	NSL	Low	5.5	5.2	1.0	Lg. inc.	Lg. inc.	High	Rare	Good	Good	Infill ++	Infill ++	1	52
yellow-poplar	Liriodendron tulipifera	WDH	High	1.2	5.1	3.5	No change	Sm. inc.	High	Rare	Fair	Good	Infill +		2	53
pecan	Carya illinoensis	NSH	Low	1.1	4.7	2.7	Lg. inc.	Lg. inc.	Low	Rare	Fair	Fair	Infill +	Infill +	2	54
pawpaw	Asimina triloba	NSL	Low	3	4.2	1.1	Lg. dec.	Lg. dec.	Medium	Rare	Very Poor	Very Poor			0	55
blue ash	Fraxinus quadrangulata	NSL	Low	2.9	4.1	1.9	Sm. dec.	Sm. dec.	Low	Rare	Very Poor	Very Poor			0	56
cherrybark oak; swamp red o	Quercus pagoda	NSL	Medium	0.5	3.9	2.0	No change	Sm. inc.	Medium	Rare	Poor	Fair	Infill +	Infill +	2	57
overcup oak	Quercus lyrata	NSL	Medium	0.5	3.7	4.6	No change	No change	Low	Rare	Very Poor	Very Poor			2	58
white mulberry	Morus alba	NSL	FIA	1.6	3.5	2.0	Unknown	Unknown	NA	Rare	NNIS	NNIS			0	59
Kentucky coffeetree	Gymnocladus dioicus	NSLX	FIA	0.8	2.9	3.1	Unknown	Unknown	Medium	Rare	FIA Only	FIA Only			0	60
eastern white pine	Pinus strobus	WDH	High	0.2	2.4	10.7	Lg. dec.	Lg. dec.	Low	Rare	Very Poor	Very Poor			0	61
Virginia pine	Pinus virginiana	NDH	High	0.7	2.3	6.6	Sm. dec.	No change	Medium	Rare	Very Poor	Poor		Infill +	2	62
sugarberry	Celtis laevigata	NDH	Medium	0.9	2.2	1.1	Lg. inc.	Lg. inc.	Medium	Rare	Good	Good			2	63
swamp white oak	Quercus bicolor	NSL	Low	0.4	1.9	3.7	Lg. dec.	Lg. dec.	Medium	Rare	Very Poor	Very Poor			0	64
willow oak	Quercus phellos	NSL	Low	0.3	1.6	3.1	Sm. inc.	Lg. inc.	Medium	Rare	Fair	Good	Infill +		2	65
ailanthus	Ailanthus altissima	NSL	FIA	0.7	1.3	2.8	Unknown	Unknown	NA	Rare	NNIS	NNIS			0	66
butternut	Juglans cinerea	NSLX	FIA	0.6	0.9	1.2	Unknown	Unknown	Low	Rare	FIA Only	FIA Only			0	67
Siberian elm	Ulmus pumila	NDH	FIA	0.1	0.9	7.7	Unknown	Unknown	NA	Rare	NNIS	NNIS			0	68
shellbark hickory	Carya laciniosa	NSL	Low	1.1	0.8	4.0	Sm. dec.	No change	Medium	Rare	Very Poor	Poor			0	69
northern catalpa	Catalpa speciosa	NSHX	FIA	0.1	0.5	4.1	Unknown	Unknown	Medium	Rare	FIA Only	FIA Only			0	70
florida maple	Acer barbatum	NSL	Low	0.1	0.5	0.7	No change	No change	High	Rare	Fair	Fair	Infill +	Infill +	2	71
American beech	Fagus grandifolia	WDH	High	0.4	0.5	2.4	Lg. inc.	Lg. inc.	Medium	Rare	Good	Good			2	72
bald cypress	Taxodium distichum	NSH	Medium	0	0.5	0.7	No change	No change	Medium	Rare	Poor	Poor	Infill +	Infill +	2	73
pumpkin ash	Fraxinus profunda	NSH	FIA	0.3	0.5	1.6	Unknown	Unknown	NA	Rare	FIA Only	FIA Only			0	74
water tupelo	Nyssa aquatica	NSH	Medium	0.4	0.4	3.7	Sm. dec.	Sm. dec.	Low	Rare	Very Poor	Very Poor			0	75
swamp chestnut oak	Quercus michauxii	NSL	Low	0.2	0.2	0.8	No change	No change	Medium	Rare	Poor	Poor		Infill +	2	76
peachleaf willow	Salix amygdaloides	NSLX	FIA	0.1	0.0	0.4	Unknown	Unknown	Medium	Rare	FIA Only	FIA Only			0	77
ashe juniper	Juniperus ashei	NDH	High	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat			0	78
longleaf pine	Pinus palustris	NSH	Medium	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat			3	79
loblolly pine	Pinus taeda	WDH	High	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat	Likely +	Likely +	3	80
black maple	Acer nigrum	NSH	Low	0	0	0	Unknown	Unknown	High	Absent	Unknown	Unknown			0	81
striped maple	Acer pensylvanicum	NSL	Medium	0	0	0	Unknown	New Habitat	Medium	Absent	Unknown	New Habitat			3	82
mountain maple	Acer spicatum	NSL	Low	0	0	0	Unknown	Unknown	High	Absent	Unknown	Unknown			0	83
yellow birch	Betula alleghaniensis	NDL	High	0	0	0	Unknown	Unknown	Medium	Modeled	Unknown	Unknown			0	84
water hickory	Carya aquatica	NSL	Medium	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat		Migrate +	3	85
black ash	Fraxinus nigra	WSH	Medium	0	0	0	New Habitat	New Habitat	Low	Absent	New Habitat	New Habitat			3	86
silverbell	Halesia spp.	NSL	Low	0	0	0	Unknown	Unknown	Medium	Absent	Unknown	Unknown			0	87
American holly	Ilex opaca	NSL	Medium	0	0	0	Unknown	New Habitat	Medium	Absent	Unknown	New Habitat		Migrate +	3	88
cucumbertree	Magnolia acuminata	NSL	Low	0	0	0	Unknown	Unknown	Medium	Absent	Unknown	Unknown			0	89
bigleaf magnolia	Magnolia macrophylla	NSL	Low	0	0	0	New Habitat	Unknown	Medium	Absent	New Habitat	Unknown			3	90
sourwood	Oxydendrum arboreum	NDL	High	0	0	0	New Habitat	New Habitat	High	Absent	New Habitat	New Habitat	Migrate +	Migrate +	3	91
bigtooth aspen	Populus grandidentata	NSL	Medium	0	0	0	Unknown	Unknown	Medium	Absent	Unknown	Unknown			0	92
pin cherry	Prunus pensylvanica	NSL	Low	0	0	0	Unknown	Unknown	Medium	Absent	Unknown	Unknown			0	93
water oak	Quercus nigra	WDH	High	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat	Likely +	Likely +	3	94

# CentralHardwood MO

## NIACS EVAS Region 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
nuttall oak	Quercus texana	NSH	Medium	0	0	0	New Habitat	New Habitat	High	Absent	New Habitat	New Habitat			0	95
chestnut oak	Quercus prinus	NDH	High	0	0	0	New Habitat	New Habitat	High	Absent	New Habitat	New Habitat	Migrate +	Migrate +	3	96
live oak	Quercus virginiana	NDH	High	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat			3	97
cedar elm	Ulmus crassifolia	NDH	Medium	0	0	0	New Habitat	New Habitat	Low	Absent	New Habitat	New Habitat	Migrate ++	Migrate ++	3	98