HUC 040500 Southeastern Lake Michigan

HUC 6 Watershed

Climate Change Atlas Tree Species

Current and Potential Future Habitat, Capability, and Migration

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

	sq. km	sq. mi	FIA Plots
Area of Region	33,487	12,929	416

Species Information

The columns below provide breif 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
Ash	4
Hickory	5
Maple	6
Oak	10
Pine	5
Other	41
	71

Abundance	
Abundant	2
Common	26
Rare	43
Absent	18
	89

	Model Reliability	Adaptability
High	18	23
Medium	30	48
Low	32	13
FIA	10	
	90	**84**

Potential Change in Habitat Suitability	Scenario RCP45	Scenario RCP85
Increase	16	17
No Change	12	13
Decrease	33	31
New	13	13
Unknown	16	16
	90	**90**

Capability to Cope or Persist	Scenario RCP45	Scenario RCP85
Very Good	3	3
Good	13	15
Fair	13	10
Poor	11	14
Very Poor	21	19
FIA Only	4	4
Unknown	6	6
	71	**71**

Migration Potential	SHIFT RCP45	SHIFT RCP85
Likely	1	1
Infill	17	19
Migrate	4	6
	22	**26**

Potential Changes in Climate Variables

Temperature (°F)

	Scenario	2009	2039	2069	2099
Annual Average	CCSM45	45.7	47.3	49.7	49.7
	CCSM85	45.7	47.9	50.2	52.9
	GFDL45	45.7	48.3	50.4	51.3
	GFDL85	45.7	48.3	51.3	55.0
	HAD45	45.7	48.4	51.3	52.8
	HAD85	45.7	48.6	52.5	56.9
Growing Season May—Sep	CCSM45	60.4	61.9	64.0	64.3
	CCSM85	60.4	62.6	64.7	68.0
	GFDL45	60.4	63.4	66.2	67.5
	GFDL85	60.4	63.7	67.3	71.6
	HAD45	60.4	63.4	65.6	67.6
	HAD85	60.4	63.1	67.5	72.2
Coldest Month Average	CCSM45	23.2	24.6	26.8	26.7
	CCSM85	23.2	25.4	27.1	28.8
	GFDL45	23.2	25.6	26.7	27.0
	GFDL85	23.2	26.0	27.1	28.6
	HAD45	23.2	24.6	27.7	27.7
	HAD85	23.2	26.4	28.8	31.6
Warmest Month Average	CCSM45	65.4	67.3	68.5	68.9
	CCSM85	65.4	68.3	69.7	71.4
	GFDL45	65.4	68.1	69.6	70.5
	GFDL85	65.4	69.0	70.7	73.2
	HAD45	65.4	68.9	70.4	71.7
	HAD85	65.4	69.4	72.3	75.5

Precipitation (in)

	Scenario	2009	2039	2069	2099
Annual Total	CCSM45	30.6	30.0	29.6	30.4
	CCSM85	30.6	30.6	30.4	31.1
	GFDL45	30.6	32.8	36.2	36.4
	GFDL85	30.6	33.3	37.2	38.4
	HAD45	30.6	31.3	33.2	32.6
	HAD85	30.6	32.9	30.8	33.5
Growing Season May—Sep	CCSM45	15.2	15.3	14.9	14.8
	CCSM85	15.2	14.8	14.9	14.2
	GFDL45	15.2	15.9	17.5	17.8
	GFDL85	15.2	16.7	17.4	17.8
	HAD45	15.2	14.9	14.2	14.7
	HAD85	15.2	15.1	12.3	13.2

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.

HUC 040500 Southeastern Lake Michigan

HUC 6 Watershed

Climate Change Atlas Tree Species

Current and Potential Future Habitat, Capability, and Migration

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

Common Name	Scientific Name	Range	MR	%Cell	FIAsum	FIAiv	ChngCl45	ChngCl85	Adap	Abund	Capabil45	Capabil85	SHIFT45	SHIFT85	SSO	N
black cherry	Prunus serotina	WDL	Medium	60.4	874.3	17.4	Sm. dec.	Sm. dec.	Low	Abundant	Fair	Fair			0	1
red maple	Acer rubrum	WDH	High	45.7	686.4	15.9	Sm. dec.	Sm. dec.	High	Abundant	Good	Good			1	2
American elm	Ulmus americana	WDH	Medium	61.1	488.9	9.9	No change	Sm. inc.	Medium	Common	Fair	Good			1	3
green ash	Fraxinus pennsylvanica	WSH	Low	40	406.1	12.7	Sm. inc.	Sm. inc.	Medium	Common	Good	Good			1	4
black oak	Quercus velutina	WDH	High	29.2	378.2	12.2	Sm. inc.	Sm. inc.	Medium	Common	Good	Good			1	5
silver maple	Acer saccharinum	NSH	Low	21.9	355.0	18.4	Sm. inc.	Sm. inc.	High	Common	Very Good	Very Good			1	6
sugar maple	Acer saccharum	WDH	High	29	308.7	11.4	No change	No change	High	Common	Good	Good			1	7
northern red oak	Quercus rubra	WDH	Medium	30.7	226.5	7.7	Sm. inc.	No change	High	Common	Very Good	Good			1	8
white oak	Quercus alba	WDH	Medium	23.8	199.5	9.0	Lg. inc.	Sm. inc.	High	Common	Very Good	Very Good			1	9
Scots pine	Pinus sylvestris	NSH	FIA	11	173.4	19.6	Unknown	Unknown	NA	Common	NNIS	NNIS			0	10
sassafras	Sassafras albidum	WSL	Low	24.5	167.2	7.5	No change	Sm. dec.	Medium	Common	Fair	Poor			1	11
eastern white pine	Pinus strobus	WDH	High	12.5	163.7	10.0	Lg. dec.	Lg. dec.	Low	Common	Very Poor	Very Poor			0	12
white ash	Fraxinus americana	WDL	Medium	28	155.9	7.6	Sm. inc.	Sm. inc.	Low	Common	Fair	Fair			1	13
eastern cottonwood	Populus deltoides	NSH	Low	12.5	142.3	15.3	Sm. inc.	Lg. inc.	Medium	Common	Good	Very Good			1	14
red pine	Pinus resinosa	NSH	Medium	9.1	139.5	12.2	Sm. dec.	Lg. dec.	Low	Common	Poor	Very Poor	Infill +		0	15
American basswood	Tilia americana	WSL	Medium	22.1	135.9	7.5	No change	No change	Medium	Common	Fair	Fair			1	16
black walnut	Juglans nigra	WDH	Low	22.7	132.4	8.7	Sm. inc.	Sm. inc.	Medium	Common	Good	Good			1	17
bigtooth aspen	Populus grandidentata	NSL	Medium	14.4	117.2	8.7	Lg. dec.	Lg. dec.	Medium	Common	Poor	Poor			0	18
quaking aspen	Populus tremuloides	WDH	High	11.1	115.1	11.3	Lg. dec.	Lg. dec.	Medium	Common	Poor	Poor	Infill +	Infill +	0	19
bitternut hickory	Carya cordiformis	WSL	Low	15.5	102.2	7.7	Sm. dec.	No change	High	Common	Fair	Good			1	20
slippery elm	Ulmus rubra	WSL	Low	14.2	79.9	8.1	Lg. dec.	Lg. dec.	Medium	Common	Poor	Poor	Infill +	Infill +	0	21
American beech	Fagus grandifolia	WDH	High	16.1	76.2	5.0	Sm. dec.	Lg. dec.	Medium	Common	Poor	Poor	Infill +	Infill +	0	22
black ash	Fraxinus nigra	WSH	Medium	9.5	72.6	7.9	Lg. dec.	Lg. dec.	Low	Common	Very Poor	Very Poor			0	23
shagbark hickory	Carya ovata	WSL	Medium	19.6	69.6	4.4	Sm. inc.	Sm. dec.	Medium	Common	Good	Poor			1	24
black willow	Salix nigra	NSH	Low	6.6	68.7	10.4	Sm. dec.	No change	Low	Common	Poor	Poor	Infill +	Infill +	0	25
swamp white oak	Quercus bicolor	NSL	Low	8.7	56.3	8.5	No change	No change	Medium	Common	Fair	Fair	Infill +	Infill +	1	26
hackberry	Celtis occidentalis	WDH	Medium	9.2	55.3	6.9	No change	No change	High	Common	Good	Good	Infill ++	Infill ++	2	27
black locust	Robinia pseudoacacia	NDH	Low	6.1	54.0	9.8	No change	No change	Medium	Common	Fair	Fair	Infill +	Infill +	1	28
tamarack (native)	Larix laricina	NSH	High	2.3	48.9	19.7	Lg. dec.	Lg. dec.	Low	Rare	Very Poor	Very Poor			2	29
pignut hickory	Carya glabra	WDL	Medium	11.2	45.8	5.0	Sm. inc.	Sm. inc.	Medium	Rare	Fair	Fair	Infill +	Infill +	1	30
boxelder	Acer negundo	WSH	Low	13.2	43.0	5.9	Lg. inc.	Lg. inc.	High	Rare	Good	Good	Infill ++	Infill ++	1	31
yellow-poplar	Liriodendron tulipifera	WDH	High	8.3	41.4	6.7	No change	No change	High	Rare	Fair	Fair	Infill +	Infill +	2	32
yellow birch	Betula alleghaniensis	NDL	High	4.7	39.4	8.2	Lg. dec.	Lg. dec.	Medium	Rare	Very Poor	Very Poor			0	33
northern catalpa	Catalpa speciosa	NSHX	FIA	1.8	33.5	21.6	Unknown	Unknown	Medium	Rare	FIA Only	FIA Only			0	34
scarlet oak	Quercus coccinea	WDL	Medium	0.3	32.3	12.4	Lg. dec.	Lg. dec.	Medium	Rare	Very Poor	Very Poor			2	35
jack pine	Pinus banksiana	NSH	Medium	3.4	32.3	4.5	Sm. dec.	Sm. dec.	High	Rare	Poor	Poor	Infill +	Infill +	2	36
northern pin oak	Quercus ellipsoidalis	NSH	Medium	3.5	31.3	6.9	Sm. dec.	Sm. dec.	High	Rare	Poor	Poor	Infill +	Infill +	2	37
Norway spruce	Picea abies	NSH	FIA	2	29.6	12.4	Unknown	Unknown	NA	Rare	NNIS	NNIS			0	38
eastern hophornbeam; ironw	Ostrya virginiana	WSL	Low	14.9	28.4	2.5	Lg. dec.	Lg. dec.	High	Rare	Poor	Poor	Infill +	Infill +	1	39
Siberian elm	Ulmus pumila	NDH	FIA	2.3	28.0	11.7	Unknown	Unknown	NA	Rare	NNIS	NNIS			0	40
pin oak	Quercus palustris	NSH	Low	5.2	21.5	6.0	No change	Sm. inc.	Low	Rare	Very Poor	Poor		Infill +	2	41
white mulberry	Morus alba	NSL	FIA	7.2	21.4	5.1	Unknown	Unknown	NA	Rare	NNIS	NNIS			0	42
white spruce	Picea glauca	NSL	Medium	1.4	21.1	13.0	Sm. dec.	Sm. dec.	Medium	Rare	Very Poor	Very Poor			0	43
paper birch	Betula papyrifera	WDH	High	3	20.0	3.7	Lg. dec.	Lg. dec.	Medium	Rare	Very Poor	Very Poor			0	44
eastern hemlock	Tsuga canadensis	NSH	High	1	19.8	9.6	Sm. dec.	Lg. dec.	Low	Rare	Very Poor	Very Poor			2	45
bur oak	Quercus macrocarpa	NDH	Medium	7.2	18.8	4.9	No change	No change	High	Rare	Fair	Fair	Infill +	Infill +	2	46
red mulberry	Morus rubra	NSL	Low	7.3	17.5	4.2	Sm. dec.	Sm. dec.	Medium	Rare	Very Poor	Very Poor			0	47

HUC 040500 Southeastern Lake Michigan

HUC 6 Watershed

Climate Change Atlas Tree Species

Current and Potential Future Habitat, Capability, and Migration

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

Common Name	Scientific Name	Range	MR	%Cell	FIAsum	FIAiv	ChngCl45	ChngCl85	Adap	Abund	Capabil45	Capabil85	SHIFT45	SHIFT85	SSO	N
American hornbeam; muscle	Carpinus caroliniana	WSL	Low	9.8	12.9	1.5	Sm. dec.	Sm. dec.	Medium	Rare	Very Poor	Very Poor			0	48
sycamore	Platanus occidentalis	NSL	Low	3.6	11.5	3.9	Sm. inc.	Sm. inc.	Medium	Rare	Fair	Fair	Infill +	Infill +	2	49
serviceberry	Amelanchier spp.	NSL	Low	3.8	9.5	1.8	Lg. dec.	Lg. dec.	Medium	Rare	Very Poor	Very Poor			0	50
ailanthus	Ailanthus altissima	NSL	FIA	1.9	8.4	6.2	Unknown	Unknown	NA	Rare	NNIS	NNIS			0	51
flowering dogwood	Cornus florida	WDL	Medium	3.2	7.3	2.1	Lg. dec.	Lg. dec.	Medium	Rare	Very Poor	Very Poor			2	52
blackgum	Nyssa sylvatica	WDL	Medium	2.8	6.0	4.1	No change	Sm. inc.	High	Rare	Fair	Good	Infill +	Infill ++	2	53
Norway maple	Acer platanoides	NSL	FIA	0.6	5.4	9.1	Unknown	Unknown	NA	Rare	NNIS	NNIS			0	54
loblolly pine	Pinus taeda	WDH	High	0.3	5.1	17.2	No change	Lg. inc.	Medium	Rare	Poor	Good			2	55
northern white-cedar	Thuja occidentalis	WSH	High	0.6	4.9	4.8	Lg. dec.	Lg. dec.	Medium	Rare	Very Poor	Very Poor			0	56
Osage-orange	Maclura pomifera	NDH	Medium	0.5	4.4	5.9	Sm. inc.	Lg. inc.	High	Rare	Good	Good			2	57
rock elm	Ulmus thomasii	NSLX	FIA	0.2	4.2	10.6	Unknown	Unknown	Low	Rare	FIA Only	FIA Only			0	58
chokecherry	Prunus virginiana	NSLX	FIA	3.9	3.4	1.9	Unknown	Unknown	Medium	Rare	FIA Only	FIA Only			0	59
eastern redcedar	Juniperus virginiana	WDH	Medium	2.5	2.9	1.2	Lg. inc.	Lg. inc.	Medium	Rare	Good	Good			2	60
peachleaf willow	Salix amygdaloides	NSLX	FIA	0.6	2.1	3.5	Unknown	Unknown	Medium	Rare	FIA Only	FIA Only			0	61
shellbark hickory	Carya laciniosa	NSL	Low	0.2	2.1	4.7	Sm. dec.	Sm. dec.	Medium	Rare	Very Poor	Very Poor			0	62
eastern redbud	Cercis canadensis	NSL	Low	0.2	1.7	3.9	Sm. dec.	No change	Medium	Rare	Very Poor	Poor		Infill +	2	63
blue ash	Fraxinus quadrangulata	NSL	Low	0.8	1.7	0.9	Sm. dec.	Sm. dec.	Low	Rare	Very Poor	Very Poor			0	64
black maple	Acer nigrum	NSH	Low	0.9	1.6	1.8	Lg. dec.	Lg. dec.	High	Rare	Poor	Poor			0	65
pawpaw	Asimina triloba	NSL	Low	1.3	1.4	1.3	Sm. dec.	Sm. dec.	Medium	Rare	Very Poor	Very Poor			0	66
shingle oak	Quercus imbricaria	NDH	Medium	0.3	1.4	4.6	Sm. dec.	Sm. dec.	Medium	Rare	Very Poor	Very Poor			0	67
mockernut hickory	Carya alba	WDL	Medium	0.3	0.9	3.2	Sm. inc.	Lg. inc.	High	Rare	Good	Good			2	68
chinkapin oak	Quercus muehlenbergii	NSL	Medium	1.5	0.6	1.5	Sm. dec.	No change	Medium	Rare	Very Poor	Poor		Infill +	2	69
honeylocust	Gleditsia triacanthos	NSH	Low	0.3	0.5	1.8	Sm. inc.	No change	High	Rare	Good	Fair			0	70
Ohio buckeye	Aesculus glabra	NSL	Low	1.1	0.5	0.6	Sm. dec.	Lg. dec.	Medium	Rare	Very Poor	Very Poor			0	71
shortleaf pine	Pinus echinata	WDH	High	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat		Migrate +	3	72
Virginia pine	Pinus virginiana	NDH	High	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat	Migrate +		3	73
pecan	Carya illinoinensis	NSH	Low	0	0	0	New Habitat	New Habitat	Low	Absent	New Habitat	New Habitat			3	74
black hickory	Carya texana	NDL	High	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat			3	75
sugarberry	Celtis laevigata	NDH	Medium	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat			3	76
common persimmon	Diospyros virginiana	NSL	Low	0	0	0	New Habitat	New Habitat	High	Absent	New Habitat	New Habitat	Migrate +	Migrate +	3	77
sweetgum	Liquidambar styraciflua	WDH	High	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat	Migrate +	Migrate +	3	78
cucumbertree	Magnolia acuminata	NSL	Low	0	0	0	Unknown	Unknown	Medium	Absent	Unknown	Unknown			0	79
bigleaf magnolia	Magnolia macrophylla	NSL	Low	0	0	0	New Habitat	Unknown	Medium	Absent	New Habitat	Unknown			3	80
balsam poplar	Populus balsamifera	NSH	Medium	0	0	0	Unknown	Unknown	Medium	Modeled	Unknown	Unknown			0	81
pin cherry	Prunus pensylvanica	NSL	Low	0	0	0	Unknown	Unknown	Medium	Absent	Unknown	Unknown			0	82
southern red oak	Quercus falcata	WDL	Medium	0	0	0	New Habitat	New Habitat	High	Absent	New Habitat	New Habitat		Migrate +	3	83
laurel oak	Quercus laurifolia	NDH	Medium	0	0	0	Unknown	New Habitat	Medium	Absent	Unknown	New Habitat			0	84
blackjack oak	Quercus marilandica	NSL	Medium	0	0	0	New Habitat	New Habitat	High	Absent	New Habitat	New Habitat			3	85
Shumard oak	Quercus shumardii	NSL	Low	0	0	0	New Habitat	New Habitat	High	Absent	New Habitat	New Habitat	Likely +	Likely +	3	86
post oak	Quercus stellata	WDH	High	0	0	0	New Habitat	New Habitat	High	Absent	New Habitat	New Habitat	Migrate ++	Migrate ++	3	87
bluejack oak	Quercus incana	NSL	Low	0	0	0	Unknown	Unknown	Medium	Absent	Unknown	Unknown			0	88
American mountain-ash	Sorbus americana	NSL	Low	0	0	0	Unknown	Unknown	Low	Absent	Unknown	Unknown			0	89
winged elm	Ulmus alata	WDL	Medium	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat		Migrate ++	3	90