Section 222H

EcoMap 2007
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	74,881	28,912	668

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	5
Oak	13
Pine	6
Other	44
	77

Abundance	
Abundant	0
Common	18
Rare	59
Absent	19
	96

	Model Reliability	Adaptability
High	18	28
Medium	30	47
Low	37	16
FIA	11	
	96	**91**

Potential Change in Habitat Suitability	Scenario RCP45	Scenario RCP85
Increase	17	19
No Change	22	18
Decrease	27	29
New	14	14
Unknown	16	16
	96	**96**

Capability to Cope or Persist	Scenario RCP45	Scenario RCP85
Very Good	5	4
Good	12	14
Fair	12	14
Poor	17	12
Very Poor	19	20
FIA Only	6	6
Unknown	5	5
	76	**75**

Migration Potential	SHIFT RCP45	SHIFT RCP85
Likely	2	2
Infill	38	36
Migrate	6	9
	46	**47**

Potential Changes in Climate Variables

Temperature (°F)

	Scenario	2009	2039	2069	2099
Annual Average	CCSM45	51.4	53.1	55.5	55.7
	CCSM85	51.4	53.8	56.3	59.3
	GFDL45	51.4	57.2	57.0	57.9
	GFDL85	51.4	54.5	58.0	62.2
	HAD45	51.4	54.2	57.8	59.3
	HAD85	51.4	54.6	59.3	63.9
Growing Season May—Sep	CCSM45	68.5	70.2	72.3	72.9
	CCSM85	68.5	71.0	73.5	77.3
	GFDL45	68.5	75.7	75.2	76.6
	GFDL85	68.5	72.3	76.5	81.4
	HAD45	68.5	71.8	75.1	77.1
	HAD85	68.5	72.0	77.9	82.8
Coldest Month Average	CCSM45	24.3	25.8	27.6	27.9
	CCSM85	24.3	27.1	28.2	29.9
	GFDL45	24.3	28.1	28.7	29.4
	GFDL85	24.3	27.5	28.7	29.7
	HAD45	24.3	25.6	28.5	28.5
	HAD85	24.3	27.1	29.6	32.0
Warmest Month Average	CCSM45	74.1	75.8	77.1	77.8
	CCSM85	74.1	77.0	78.8	80.7
	GFDL45	74.1	77.2	79.1	80.1
	GFDL85	74.1	78.0	80.3	83.3
	HAD45	74.1	77.8	80.5	81.6
	HAD85	74.1	79.3	83.4	86.6

Precipitation (in)

	Scenario	2009	2039	2069	2099
Annual Total	CCSM45	39.9	40.4	41.7	41.8
	CCSM85	39.9	41.2	41.7	43.6
	GFDL45	39.9	43.8	46.9	48.5
	GFDL85	39.9	42.2	47.8	50.1
	HAD45	39.9	41.5	42.7	42.5
	HAD85	39.9	42.0	39.6	43.0
Growing Season May—Sep	CCSM45	19.3	19.5	19.4	19.1
	CCSM85	19.3	18.5	18.5	18.3
	GFDL45	19.3	20.9	21.0	21.8
	GFDL85	19.3	20.0	21.0	21.2
	HAD45	19.3	19.8	17.8	18.9
	HAD85	19.3	19.1	16.0	16.3

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.

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Common Name	Scientific Name	Range	MR	%Cell	FIAsum	FIAiv	ChngCl45	ChngCl85	Adap	Abund	Capabil45	Capabil85	SHIFT45	SHIFT85	SSO	N
sugar maple	Acer saccharum	WDH	High	62.2	309.2	12.4	Sm. dec.	Sm. dec.	High	Common	Fair	Fair	Infill +	Infill +	1	1
white ash	Fraxinus americana	WDL	Medium	72.8	245.3	10.7	Sm. dec.	Sm. dec.	Low	Common	Poor	Poor	Infill +	Infill +	0	2
black walnut	Juglans nigra	WDH	Low	61.9	157.9	9.1	No change	No change	Medium	Common	Fair	Fair	Infill +	Infill +	1	3
American elm	Ulmus americana	WDH	Medium	72.2	135.1	6.4	Sm. inc.	Sm. inc.	Medium	Common	Good	Good	Infill ++	Infill ++	1	4
black cherry	Prunus serotina	WDL	Medium	60.9	123.6	6.6	No change	Sm. dec.	Low	Common	Poor	Poor	Infill +	Infill +	0	5
yellow-poplar	Liriodendron tulipifera	WDH	High	15.5	79.8	5.9	Sm. dec.	Lg. dec.	High	Common	Fair	Fair	Infill +	Infill +	2	6
hackberry	Celtis occidentalis	WDH	Medium	52.3	77.7	5.8	Sm. inc.	Sm. inc.	High	Common	Very Good	Very Good	Infill ++	Infill ++	1	7
red maple	Acer rubrum	WDH	High	23.4	76.1	7.9	Sm. dec.	Sm. dec.	High	Common	Fair	Fair	Infill +	Infill +	2	8
black locust	Robinia pseudoacacia	NDH	Low	14	72.0	8.7	Sm. dec.	No change	Medium	Common	Poor	Fair	Infill +	Infill +	1	9
shagbark hickory	Carya ovata	WSL	Medium	38.6	71.9	6.7	No change	No change	Medium	Common	Fair	Fair	Infill +	Infill +	1	10
bitternut hickory	Carya cordiformis	WSL	Low	36	68.8	5.2	No change	No change	High	Common	Good	Good	Infill ++	Infill ++	1	11
boxelder	Acer negundo	WSH	Low	40.2	63.0	6.8	Sm. inc.	Sm. inc.	High	Common	Very Good	Very Good	Infill ++	Infill ++	1	12
northern red oak	Quercus rubra	WDH	Medium	37.6	59.7	5.7	Sm. inc.	No change	High	Common	Very Good	Good	Infill ++	Infill ++	1	13
honeylocust	Gleditsia triacanthos	NSH	Low	28.3	56.9	7.2	No change	No change	High	Common	Good	Good	Infill ++	Infill ++	1	14
sycamore	Platanus occidentalis	NSL	Low	21.6	56.5	6.9	Sm. inc.	Sm. inc.	Medium	Common	Good	Good	Infill ++	Infill ++	2	15
Osage-orange	Maclura pomifera	NDH	Medium	19.9	56.0	9.1	Sm. inc.	Sm. inc.	High	Common	Very Good	Very Good	Infill ++	Infill ++	2	16
green ash	Fraxinus pennsylvanica	WSH	Low	41.2	55.4	8.1	Lg. inc.	Lg. inc.	Medium	Common	Very Good	Very Good	Infill ++	Infill ++	1	17
slippery elm	Ulmus rubra	WSL	Low	40.4	51.2	3.2	No change	Sm. inc.	Medium	Common	Fair	Good	Infill +	Infill ++	1	18
eastern redcedar	Juniperus virginiana	WDH	Medium	9.4	44.4	6.0	No change	Sm. inc.	Medium	Rare	Poor	Fair	Infill +	Infill +	2	19
white oak	Quercus alba	WDH	Medium	26.3	42.5	4.9	Lg. inc.	Sm. inc.	High	Rare	Good	Good	Infill ++	Infill ++	2	20
American beech	Fagus grandifolia	WDH	High	19.3	39.5	3.4	Lg. dec.	Lg. dec.	Medium	Rare	Very Poor	Very Poor			2	21
sassafras	Sassafras albidum	WSL	Low	10.7	38.6	4.0	No change	Sm. dec.	Medium	Rare	Poor	Very Poor	Infill +		2	22
American basswood	Tilia americana	WSL	Medium	28.3	38.6	4.8	Lg. dec.	Lg. dec.	Medium	Rare	Very Poor	Very Poor			0	23
silver maple	Acer saccharinum	NSH	Low	16.7	31.7	9.3	Sm. inc.	Lg. inc.	High	Rare	Good	Good	Infill ++	Infill ++	2	24
pin oak	Quercus palustris	NSH	Low	11.5	28.4	7.3	No change	No change	Low	Rare	Very Poor	Very Poor			2	25
black oak	Quercus velutina	WDH	High	11.4	26.6	3.5	Lg. inc.	Lg. inc.	Medium	Rare	Good	Good	Infill ++	Infill ++	2	26
eastern cottonwood	Populus deltoides	NSH	Low	16.5	25.8	6.7	Sm. inc.	Sm. inc.	Medium	Rare	Fair	Fair	Infill +	Infill +	2	27
Ohio buckeye	Aesculus glabra	NSL	Low	24.5	25.6	3.7	Sm. dec.	Sm. dec.	Medium	Rare	Very Poor	Very Poor			0	28
pignut hickory	Carya glabra	WDL	Medium	18.4	25.0	2.9	No change	Sm. dec.	Medium	Rare	Poor	Very Poor	Infill +		2	29
chinkapin oak	Quercus muehlenbergii	NSL	Medium	17.1	22.0	2.5	Sm. inc.	Sm. inc.	Medium	Rare	Fair	Fair	Infill +	Infill +	2	30
black willow	Salix nigra	NSH	Low	10.1	15.7	9.2	Lg. dec.	Lg. inc.	Low	Rare	Very Poor	Fair		Infill +	2	31
eastern white pine	Pinus strobus	WDH	High	4.2	13.9	11.0	Lg. dec.	Very Lg. dec.	Low	Rare	Very Poor	Lost			0	32
eastern hophornbeam; ironw	Ostrya virginiana	WSL	Low	19.5	13.3	2.2	No change	No change	High	Rare	Fair	Fair	Infill +	Infill +	2	33
eastern redbud	Cercis canadensis	NSL	Low	13.6	12.3	1.8	No change	No change	Medium	Rare	Poor	Poor	Infill +	Infill +	2	34
white mulberry	Morus alba	NSL	FIA	12.2	11.7	5.4	Unknown	Unknown	NA	Rare	NNIS	NNIS			0	35
mockernut hickory	Carya alba	WDL	Medium	12.1	10.6	3.0	Sm. inc.	Lg. inc.	High	Rare	Good	Good	Infill ++	Infill ++	2	36
bur oak	Quercus macrocarpa	NDH	Medium	12.8	10.0	5.0	Sm. inc.	Lg. inc.	High	Rare	Good	Good			2	37
swamp white oak	Quercus bicolor	NSL	Low	7.6	9.8	7.3	No change	Sm. dec.	Medium	Rare	Poor	Very Poor	Infill +		2	38
blue ash	Fraxinus quadrangulata	NSL	Low	8	9.3	2.9	Sm. dec.	Sm. dec.	Low	Rare	Very Poor	Very Poor			2	39
red mulberry	Morus rubra	NSL	Low	10.7	9.0	5.3	No change	No change	Medium	Rare	Poor	Poor	Infill +	Infill +	2	40
shingle oak	Quercus imbricaria	NDH	Medium	5.7	7.9	3.8	No change	No change	Medium	Rare	Poor	Poor	Infill +	Infill +	2	41
yellow buckeye	Aesculus flava	NSL	Low	2.6	7.2	7.5	Lg. dec.	Lg. dec.	Low	Rare	Very Poor	Very Poor			0	42
red pine	Pinus resinosa	NSH	Medium	1.6	7.1	8.3	Lg. dec.	Lg. dec.	Low	Rare	Very Poor	Very Poor			2	43
blackgum	Nyssa sylvatica	WDL	Medium	2.8	6.4	2.1	No change	No change	High	Rare	Fair	Fair	Infill +	Infill +	2	44
black maple	Acer nigrum	NSH	Low	1.6	6.3	2.7	Lg. dec.	Lg. dec.	High	Rare	Poor	Poor			0	45
American hornbeam; muscle	Carpinus caroliniana	WSL	Low	11.8	5.5	1.0	Sm. dec.	No change	Medium	Rare	Very Poor	Poor		Infill +	2	46
bigtooth aspen	Populus grandidentata	NSL	Medium	4.5	5.4	2.8	Lg. dec.	Lg. dec.	Medium	Rare	Very Poor	Very Poor			0	47

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pawpaw	Asimina triloba	NSL	Low	4.7	4.9	1.0	Lg. dec.	Sm. dec.	Medium	Rare	Very Poor	Very Poor			0	48
flowering dogwood	Cornus florida	WDL	Medium	8.3	3.9	1.0	No change	No change	Medium	Rare	Poor	Poor	Infill +	Infill +	2	49
Norway spruce	Picea abies	NSH	FIA	0.7	3.2	12.8	Unknown	Unknown	NA	Rare	NNIS	NNIS			0	50
chestnut oak	Quercus prinus	NDH	High	0.1	3.1	1.6	No change	No change	High	Rare	Fair	Fair	Infill +	Infill +	2	51
northern catalpa	Catalpa speciosa	NSHX	FIA	2.8	2.7	6.0	Unknown	Unknown	Medium	Rare	FIA Only	FIA Only			0	52
Kentucky coffeetree	Gymnocladus dioicus	NSLX	FIA	1.8	2.6	4.8	Unknown	Unknown	Medium	Rare	FIA Only	FIA Only			0	53
scarlet oak	Quercus coccinea	WDL	Medium	2.9	2.6	3.5	No change	Sm. dec.	Medium	Rare	Poor	Very Poor	Infill +		2	54
Scots pine	Pinus sylvestris	NSH	FIA	1.2	2.5	14.4	Unknown	Unknown	NA	Rare	NNIS	NNIS			0	55
ailanthus	Ailanthus altissima	NSL	FIA	1.6	2.5	3.0	Unknown	Unknown	NA	Rare	NNIS	NNIS			0	56
sweet birch	Betula lenta	NDH	High	0	2.3	4.4	Lg. dec.	Lg. dec.	Low	Rare	Very Poor	Very Poor			0	57
sweetgum	Liquidambar styraciflua	WDH	High	0.9	2.3	1.6	Lg. inc.	Lg. inc.	Medium	Rare	Good	Good			2	58
Siberian elm	Ulmus pumila	NDH	FIA	2.6	1.5	2.2	Unknown	Unknown	NA	Rare	NNIS	NNIS			0	59
Virginia pine	Pinus virginiana	NDH	High	0.9	1.4	1.8	No change	Sm. dec.	Medium	Rare	Poor	Very Poor	Infill +		2	60
pin cherry	Prunus pensylvanica	NSL	Low	0.1	1.2	1.1	Lg. dec.	Lg. dec.	Medium	Rare	Very Poor	Very Poor			0	61
rock elm	Ulmus thomasii	NSLX	FIA	2.8	1.1	2.8	Unknown	Unknown	Low	Rare	FIA Only	FIA Only			0	62
black ash	Fraxinus nigra	WSH	Medium	3.3	1.0	1.6	Lg. dec.	Lg. dec.	Low	Rare	Very Poor	Very Poor			0	63
post oak	Quercus stellata	WDH	High	1.1	0.6	2.9	Lg. inc.	Lg. inc.	High	Rare	Good	Good			2	64
waterlocust	Gleditsia aquatica	NSLX	FIA	0.1	0.4	2.9	Unknown	Unknown	Medium	Rare	FIA Only	FIA Only			0	65
sourwood	Oxydendrum arboreum	NDL	High	0.4	0.3	1.3	No change	No change	High	Rare	Fair	Fair	Infill +	Infill +	2	66
common persimmon	Diospyros virginiana	NSL	Low	0.7	0.3	0.4	Lg. inc.	Lg. inc.	High	Rare	Good	Good			2	67
northern pin oak	Quercus ellipsoidalis	NSH	Medium	2.3	0.3	1.4	Lg. dec.	Lg. dec.	High	Rare	Poor	Poor			0	68
cucumbertree	Magnolia acuminata	NSL	Low	0	0.2	0.3	Sm. dec.	Sm. dec.	Medium	Rare	Very Poor	Very Poor			0	69
serviceberry	Amelanchier spp.	NSL	Low	0.6	0.2	0.5	Lg. dec.	Lg. dec.	Medium	Rare	Very Poor	Very Poor			0	70
butternut	Juglans cinerea	NSLX	FIA	0.5	0.1	3.5	Unknown	Unknown	Low	Rare	FIA Only	FIA Only			0	71
shellbark hickory	Carya laciniosa	NSL	Low	1.1	0.1	1.7	No change	No change	Medium	Rare	Poor	Poor			0	72
chokecherry	Prunus virginiana	NSLX	FIA	0.5	0.1	2.9	Unknown	Unknown	Medium	Rare	FIA Only	FIA Only			0	73
pitch pine	Pinus rigida	NSH	High	0	0.1	0.2	Very Lg. dec.	Very Lg. dec.	Medium	Rare	Lost	Lost			0	74
river birch	Betula nigra	NSL	Low	0.5	0.1	1.5	Lg. dec.	No change	Medium	Rare	Very Poor	Poor		Infill +	2	75
overcup oak	Quercus lyrata	NSL	Medium	0.5	0.1	1.6	Lg. dec.	Lg. dec.	Low	Rare	Very Poor	Very Poor			0	76
jack pine	Pinus banksiana	NSH	Medium	0.5	0.0	0.7	Lg. dec.	Lg. dec.	High	Rare	Poor	Poor			0	77
Atlantic white-cedar	Chamaecyparis thyoides	NSH	Low	0	0	0	Unknown	Unknown	Low	Absent	Unknown	Unknown			0	78
ashe juniper	Juniperus ashei	NDH	High	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat			0	79
shortleaf pine	Pinus echinata	WDH	High	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat	Likely +	Likely +	3	80
loblolly pine	Pinus taeda	WDH	High	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat		Migrate ++	3	81
mountain maple	Acer spicatum	NSL	Low	0	0	0	Unknown	Unknown	High	Absent	Unknown	Unknown			0	82
cittamwood/gum bumelia	Sideroxylon lanuginosum ssp.	NSL	Low	0	0	0	New Habitat	New Habitat	High	Absent	New Habitat	New Habitat			3	83
pecan	Carya illinoinensis	NSH	Low	0	0	0	New Habitat	New Habitat	Low	Absent	New Habitat	New Habitat	Migrate +	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
sugarberry	Celtis laevigata	NDH	Medium	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat	Migrate +	Migrate ++	3	86
bigleaf magnolia	Magnolia macrophylla	NSL	Low	0	0	0	Unknown	Unknown	Medium	Absent	Unknown	Unknown			0	87
redbay	Persea borbonia	NSL	Low	0	0	0	Unknown	Unknown	High	Absent	Unknown	Unknown			0	88
southern red oak	Quercus falcata	WDL	Medium	0	0	0	New Habitat	New Habitat	High	Absent	New Habitat	New Habitat	Migrate +	Migrate +	3	89
cherrybark oak; swamp red o	Quercus pagoda	NSL	Medium	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat		Migrate +	3	90
blackjack oak	Quercus marilandica	NSL	Medium	0	0	0	New Habitat	New Habitat	High	Absent	New Habitat	New Habitat	Migrate ++	Migrate ++	3	91
water oak	Quercus nigra	WDH	High	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat		Migrate ++	3	92
Shumard oak	Quercus shumardii	NSL	Low	0	0	0	New Habitat	New Habitat	High	Absent	New Habitat	New Habitat	Likely +	Likely +	3	93
bluejack oak	Quercus incana	NSL	Low	0	0	0	Unknown	Unknown	Medium	Absent	Unknown	Unknown			0	94

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winged elm	Ulmus alata	WDL	Medium	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat	Migrate ++	Migrate ++	3	95
cedar elm	Ulmus crassifolia	NDH	Medium	0	0	0	New Habitat	New Habitat	Low	Absent	New Habitat	New Habitat			0	96