Sleeping Bear Dunes

National Park
Climate Change Atlas Tree Species
Current and Potential Future Habitat, Capability, and Migration

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Iverson, Peters, Prasad, Matthews

	sq. km	sq. mi	FIA Plots
Area of Region	8,225.5	3,175.9	289

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	3
Hickory	0
Maple	5
Oak	4
Pine	4
Other	23
	39

Abundance	
Abundant	6
Common	21
Rare	12
Absent	24
	63

	Model Reliability	Adaptability
High	21	17
Medium	22	33
Low	18	11
FIA	2	
	63	**61**

Potential Change in Habitat Suitability	Scenario RCP45	Scenario RCP85
Increase	13	9
No Change	5	11
Decrease	19	17
New	21	22
Unknown	5	4
	63	**63**

Capability to Cope or Persist	Scenario RCP45	Scenario RCP85
Very Good	8	7
Good	5	6
Fair	9	7
Poor	6	8
Very Poor	8	7
FIA Only	0	0
Unknown	3	2
	39	**37**

Migration Potential	SHIFT RCP45	SHIFT RCP85
Likely	1	1
Infill	5	5
Migrate	9	10
	15	**16**

Potential Changes in Climate Variables

Temperature (°F)

	Scenario	2009	2039	2069	2099
Annual Average	CCSM45	45.2	47.0	50.1	50.0
	CCSM85	45.2	47.7	50.8	54.2
	GFDL45	45.2	48.3	51.1	52.4
	GFDL85	45.2	48.6	52.3	57.1
	HAD45	45.2	48.6	51.8	53.8
	HAD85	45.2	48.8	53.1	59.0
Growing Season May—Sep	CCSM45	62.5	64.1	66.5	66.7
	CCSM85	62.5	64.7	67.4	71.2
	GFDL45	62.5	66.7	70.3	72.3
	GFDL85	62.5	67.1	71.8	77.3
	HAD45	62.5	66.2	68.4	70.9
	HAD85	62.5	65.7	70.1	76.2
Coldest Month Average	CCSM45	19.3	21.2	24.2	23.6
	CCSM85	19.3	22.3	24.6	26.9
	GFDL45	19.3	20.9	22.8	23.3
	GFDL85	19.3	21.8	23.4	25.9
	HAD45	19.3	21.1	24.9	25.1
	HAD85	19.3	23.3	25.9	30.4
Warmest Month Average	CCSM45	68.6	70.6	72.0	72.4
	CCSM85	68.6	71.5	73.2	75.2
	GFDL45	68.6	72.6	74.4	75.7
	GFDL85	68.6	73.4	75.7	78.5
	HAD45	68.6	72.6	73.6	75.5
	HAD85	68.6	72.8	75.2	79.6

Precipitation (in)

	Scenario	2009	2039	2069	2099
Annual Total	CCSM45	32.9	33.2	32.1	33.2
	CCSM85	32.9	34.0	32.9	34.1
	GFDL45	32.9	35.2	37.6	37.0
	GFDL85	32.9	36.2	38.6	39.2
	HAD45	32.9	34.1	35.6	35.4
	HAD85	32.9	35.5	35.5	37.9
Growing Season May—Sep	CCSM45	16.1	16.8	15.6	16.2
	CCSM85	16.1	16.9	15.7	15.3
	GFDL45	16.1	16.8	18.1	17.7
	GFDL85	16.1	17.9	17.5	17.6
	HAD45	16.1	15.9	15.0	15.4
	HAD85	16.1	16.5	14.1	14.9

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	65.4	1982.9	24.2	Sm. dec.	Lg. dec.	High	Abundant	Good	Good			1	1
red pine	Pinus resinosa	NSH	Medium	48.6	1016.4	20.0	Sm. dec.	Sm. dec.	Low	Abundant	Fair	Fair			0	2
red maple	Acer rubrum	WDH	High	65.5	784.5	11.2	Sm. inc.	No change	High	Abundant	Very Good	Very Good			1	3
eastern white pine	Pinus strobus	WDH	High	52.5	612.9	9.6	Sm. dec.	Lg. dec.	Low	Abundant	Fair	Poor			0	4
northern white-cedar	Thuja occidentalis	WSH	High	32.9	527.4	12.1	Lg. dec.	Sm. dec.	Medium	Abundant	Fair	Fair			0	5
northern red oak	Quercus rubra	WDH	Medium	42.6	522.0	10.4	No change	No change	High	Abundant	Very Good	Very Good			1	6
bigtooth aspen	Populus grandidentata	NSL	Medium	50.2	484.3	8.6	Sm. dec.	Sm. dec.	Medium	Common	Poor	Poor			0	7
American beech	Fagus grandifolia	WDH	High	54.6	381.7	5.2	No change	No change	Medium	Common	Fair	Fair			1	8
white oak	Quercus alba	WDH	Medium	27.6	373.9	13.4	Sm. inc.	Sm. inc.	High	Common	Very Good	Very Good			1	9
white ash	Fraxinus americana	WDL	Medium	48.9	358.0	5.5	Sm. dec.	No change	Low	Common	Poor	Poor			0	10
quaking aspen	Populus tremuloides	WDH	High	41.1	351.7	8.1	No change	No change	Medium	Common	Fair	Fair			1	11
black cherry	Prunus serotina	WDL	Medium	53.9	319.3	5.7	Sm. inc.	Sm. inc.	Low	Common	Fair	Fair			1	12
Scots pine	Pinus sylvestris	NSH	FIA	12.1	236.8	19.5	Unknown	Unknown	NA	Common	NNIS	NNIS			0	13
jack pine	Pinus banksiana	NSH	Medium	29.2	194.7	6.7	Sm. inc.	Sm. inc.	High	Common	Very Good	Very Good			1	14
American basswood	Tilia americana	WSL	Medium	37.6	187.6	4.7	Sm. inc.	No change	Medium	Common	Good	Fair			1	15
black oak	Quercus velutina	WDH	High	18.5	149.6	7.5	Lg. inc.	Lg. inc.	Medium	Common	Very Good	Very Good	Infill ++	Infill ++	1	16
green ash	Fraxinus pennsylvanica	WSH	Low	22.8	130.0	4.7	Lg. inc.	Lg. inc.	Medium	Common	Very Good	Very Good			1	17
black ash	Fraxinus nigra	WSH	Medium	24.2	113.0	4.1	Sm. dec.	Lg. dec.	Low	Common	Poor	Very Poor			0	18
eastern hophornbeam; ironw	Ostrya virginiana	WSL	Low	42.6	112.9	2.4	Lg. dec.	Lg. dec.	High	Common	Fair	Fair			1	19
northern pin oak	Quercus ellipsoidalis	NSH	Medium	15.8	104.0	6.6	Sm. inc.	No change	High	Common	Very Good	Good	Infill ++	Infill ++	1	20
paper birch	Betula papyrifera	WDH	High	29.8	102.4	2.5	Sm. inc.	Sm. inc.	Medium	Common	Good	Good			1	21
eastern hemlock	Tsuga canadensis	NSH	High	25.4	92.0	3.0	Sm. inc.	No change	Low	Common	Fair	Poor			1	22
American elm	Ulmus americana	WDH	Medium	29.3	86.0	2.7	Lg. inc.	Lg. inc.	Medium	Common	Very Good	Very Good			1	23
silver maple	Acer saccharinum	NSH	Low	6.1	85.3	14.0	No change	No change	High	Common	Good	Good	Infill ++	Infill ++	1	24
white spruce	Picea glauca	NSL	Medium	6	78.5	12.9	Lg. dec.	Lg. dec.	Medium	Common	Poor	Poor			0	25
balsam fir	Abies balsamea	NDH	High	15.9	77.5	4.1	Lg. dec.	Lg. dec.	Low	Common	Very Poor	Very Poor			0	26
tamarack (native)	Larix laricina	NSH	High	10.8	67.1	6.1	Lg. dec.	Lg. dec.	Low	Common	Very Poor	Very Poor			0	27
black locust	Robinia pseudoacacia	NDH	Low	1.2	35.8	29.5	Sm. inc.	Lg. inc.	Medium	Rare	Fair	Good	Infill +	Infill ++	2	28
yellow birch	Betula alleghaniensis	NDL	High	15.4	27.3	1.6	Sm. dec.	No change	Medium	Rare	Very Poor	Poor			1	29
balsam poplar	Populus balsamifera	NSH	Medium	8	20.4	1.9	Lg. dec.	Lg. dec.	Medium	Rare	Very Poor	Very Poor			0	30
pin cherry	Prunus pensylvanica	NSL	Low	5.8	20.0	3.3	Very Lg. dec.	Very Lg. dec.	Medium	Rare	Lost	Lost			0	31
black spruce	Picea mariana	NSH	High	7.2	18.2	2.5	Lg. dec.	Lg. dec.	Medium	Rare	Very Poor	Very Poor			0	32
slippery elm	Ulmus rubra	WSL	Low	4.7	7.3	1.5	Sm. dec.	Sm. dec.	Medium	Rare	Very Poor	Very Poor			0	33
American hornbeam; muscle	Carpinus caroliniana	WSL	Low	3.6	3.7	1.0	Sm. dec.	Lg. dec.	Medium	Rare	Very Poor	Very Poor			0	34
Norway spruce	Picea abies	NSH	FIA	2.4	3.2	1.3	Unknown	Unknown	NA	Rare	NNIS	NNIS			0	35
sassafras	Sassafras albidum	WSL	Low	3.6	1.3	0.4	Lg. inc.	Lg. inc.	Medium	Rare	Good	Good	Infill ++	Infill ++	2	36
mountain maple	Acer spicatum	NSL	Low	1.2	1.0	0.8	Lg. dec.	Lg. dec.	High	Rare	Poor	Poor			0	37
striped maple	Acer pensylvanicum	NSL	Medium	0.9	0.9	0.6	Lg. dec.	Very Lg. dec.	Medium	Rare	Very Poor	Lost			0	38
serviceberry	Amelanchier spp.	NSL	Low	2.4	0.6	0.2	No change	No change	Medium	Rare	Poor	Poor			1	39
eastern redcedar	Juniperus virginiana	WDH	Medium	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat	Migrate +	Migrate ++	3	40
shortleaf pine	Pinus echinata	WDH	High	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat			0	41
Virginia pine	Pinus virginiana	NDH	High	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat			0	42
boxelder	Acer negundo	WSH	Low	0	0	0	New Habitat	New Habitat	High	Absent	New Habitat	New Habitat	Likely +	Likely +	3	43
sweet birch	Betula lenta	NDH	High	0	0	0	New Habitat	New Habitat	Low	Absent	New Habitat	New Habitat			0	44
bitternut hickory	Carya cordiformis	WSL	Low	0	0	0	New Habitat	New Habitat	High	Absent	New Habitat	New Habitat			3	45
pignut hickory	Carya glabra	WDL	Medium	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat	Migrate +	Migrate +	3	46
shagbark hickory	Carya ovata	WSL	Medium	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat	Migrate +	Migrate +	3	47

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mockernut hickory	Carya alba	WDL	Medium	0	0	0	New Habitat	New Habitat	High	Absent	New Habitat	New Habitat			3	48
flowering dogwood	Cornus florida	WDL	Medium	0	0	0	Unknown	New Habitat	Medium	Absent	Unknown	New Habitat		Migrate +	3	49
black walnut	Juglans nigra	WDH	Low	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat	Migrate +	Migrate +	3	50
sweetgum	Liquidambar styraciflua	WDH	High	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat			0	51
yellow-poplar	Liriodendron tulipifera	WDH	High	0	0	0	New Habitat	New Habitat	High	Absent	New Habitat	New Habitat	Migrate +	Migrate +	3	52
bigleaf magnolia	Magnolia macrophylla	NSL	Low	0	0	0	Unknown	Unknown	Medium	Absent	Unknown	Unknown			0	53
blackgum	Nyssa sylvatica	WDL	Medium	0	0	0	New Habitat	New Habitat	High	Absent	New Habitat	New Habitat	Migrate +	Migrate +	3	54
eastern cottonwood	Populus deltoides	NSH	Low	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat	Migrate +	Migrate +	3	55
swamp white oak	Quercus bicolor	NSL	Low	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat	Migrate +		3	56
scarlet oak	Quercus coccinea	WDL	Medium	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat		Migrate +	3	57
blackjack oak	Quercus marilandica	NSL	Medium	0	0	0	New Habitat	New Habitat	High	Absent	New Habitat	New Habitat			0	58
chestnut oak	Quercus prinus	NDH	High	0	0	0	New Habitat	New Habitat	High	Absent	New Habitat	New Habitat			0	59
post oak	Quercus stellata	WDH	High	0	0	0	New Habitat	New Habitat	High	Absent	New Habitat	New Habitat			0	60
live oak	Quercus virginiana	NDH	High	0	0	0	New Habitat	New Habitat	Medium	Absent	New Habitat	New Habitat			0	61
black willow	Salix nigra	NSH	Low	0	0	0	New Habitat	New Habitat	Low	Absent	New Habitat	New Habitat	Migrate +	Migrate +	3	62
American mountain-ash	Sorbus americana	NSL	Low	0	0	0	Unknown	Unknown	Low	Absent	Unknown	Unknown			0	63