Forest Vulnerability

Project Brief

National Park Service
U.S. Department of the Interior

Natural Resource Stewardship & Science
Climate Change Response Program

Climate, Trees, Pests, and Weeds: Change, Uncertainty, and Biotic Stressors at Chickasaw National Recreation Area

Background

Climate change and nonnative tree pests and plants affect forest composition, structure, and function, and the coming decades will likely bring accelerating changes due to these multiple global change factors. We investigated potential forest change in response to climate, differences in projections of change among climate scenarios (uncertainty), and levels of nonnative biotic stressor (tree pests and invasive plants) at 121 national park units in the eastern U.S. (see Fisichelli et al. 2014 for the full article and the project brief for a synthesis). For Chickasaw National Recreation Area, we provide here park-specific climate (Table 1) and tree habitat suitability projections (Table 2) for 2100 under two climate scenarios ("least change" and "major change"). These scenarios bracket a range of plausible future conditions based on greenhouse gas emissions and global climate model projections and facilitate assessment of uncertainty in future projections. We also report nonnative tree insects and diseases ("pests") with infestation areas that include the park (Table 3). Park-level nonnative vascular plant ("weeds") information is available from NPSpecies.

Adaptation to ongoing climate change requires revising existing strategies to meet traditional goals and will increasingly require revising goals and developing new strategies. Data presented here is intended to inform managers of potential future change (climate and forests) and exacerbating factors (nonnative species).

More Information

This project is part of ongoing work of the NPS Climate Change Response Program to support park adaptation to changing conditions (websites: for managers, for the public).

Source Publication

Fisichelli, N. A., S. R. Abella, M. P. Peters, and F. J. Krist Jr. 2014. Climate, trees, pests, and weeds: change, uncertainty, and biotic stressors in eastern U.S. national park forests. Forest Ecology and Management 327:31-39.

Contact

Nicholas Fisichelli, Ph.D.
Ecologist, Climate Change Response Program
National Park Service
970-225-3578
Nicholas_Fisichelli@nps.gov

Table 1. Baseline (1961-1990) and future (2070-2099) climates used in tree habitat suitability models for Chickasaw National Recreation Area. Future projections for the two climate scenarios ("Least Change" and "Major Change") illustrate a plausible range of future conditions and are shown as departures from baseline values. The Least Change scenario includes a major decrease in future greenhouse gas emissions while the Major Change scenario is a continuation of historical increases in emissions. Climate data are averaged across a roughly 6200 mi^2 (16000 km^2) area centered on the park.

Climate Variable	Baseline (1961-1990)	Least Change (2070-2099)	Major Change (2070-2099)
mean annual temperature	16.3 °C (61.4 °F)	+2.3 °C (+4.1 °F)	+7.2 °C (+12.9 °F)
mean January temperature	3.5 °C (38.3 °F)	+2.1 °C (+3.7 °F)	+5.9 °C (+10.7 °F)
mean July temperature	27.8 °C (82 °F)	+2.5 °C (+4.5 °F)	+8.8 °C (+15.8 °F)
seasonality (July-January temp.)	24.3 °C (43.7 °F)	+0.4 °C (+0.8 °F)	+2.8 °C (+5.1 °F)
mean May-September temp.	24.8 °C (76.7 °F)	+2.4 °C (+4.2 °F)	+8.6 °C (+15.5 °F)
annual precipitation	961 mm (37.9 in)	-1 %	+2.8 %
May-September precipitation	474 mm (18.7 in)	+2.1 %	+5 %

Table 2. Potential changes in habitat suitability (2100 compared with 1990) for tree species in Chickasaw National Recreation Area. Species are grouped into decreasing, no change, increasing, mixed results, and new habitat groups based on change class designations for two future climate scenarios (the "least change" scenario represents strong cuts in greenhouse gas emissions and modest climatic changes and the "major change" scenario represents continued increasing greenhouse gas emissions and rapid warming). Change class designations are based on the ratio of future (2100) to baseline (1990) habitat suitability and baseline habitat values, e.g., for common species, large decrease is ≤ 0.5, small decrease is > 0.5 and ≤ 0.8, no change is > 0.8 and ≤ 1.2, small increase is > 1.2 and ≤ 2.0, and large increase is > 2.0. Note: table below uses finer change classes (n=8) than was used in the original article (n=3) to designate uncertainty in habitat projections. Habitat suitability models from the US Forest Service Climate Change Tree Atlas. Contact author for further details on change class definitions.

Decreases in Potential Habitat

Scientific Name	Common Name	Least Change	Major Change
Gleditsia aquatica	waterlocust	large decrease	large decrease
Quercus velutina	black oak	large decrease	large decrease

No Change in Potential Habitat

Scientific Name	Common Name	Least Change	Major Change
No Species			

Increases in Potential Habitat

Scientific Name	Common Name	Least Change	Major Change
Carya illinoinensis	pecan	small increase	large increase
Pinus taeda	loblolly pine	small increase	small increase
Ulmus alata	winged elm	small increase	small increase

Mixed Results

Scientific Name	Common Name	Least Change	Major Change
Acer negundo	boxelder	small decrease	no change
Carya texana	black hickory	no change	large increase
Carya tomentosa	mockernut hickory	extirpated	small increase
Celtis laevigata	sugarberry	large decrease	small increase
Celtis occidentalis	hackberry	large decrease	small increase
Diospyros virginiana	common persimmon	large decrease	large increase
Fraxinus americana	white ash	small decrease	small increase
Fraxinus pennsylvanica	green ash	small decrease	small increase
Gleditsia triacanthos	honeylocust	extirpated	large increase
Juniperus virginiana	eastern redcedar	small decrease	small increase
Maclura pomifera	osage-orange	small decrease	small increase
Morus rubra	red mulberry	large decrease	large increase
Populus deltoides	eastern cottonwood	extirpated	large increase
Quercus macrocarpa	bur oak	small decrease	large increase
Quercus marilandica	blackjack oak	small decrease	small increase
Quercus nigra	water oak	no change	large increase
Quercus shumardii	Shumard oak	small decrease	small increase
Quercus stellata	post oak	no change	small increase
Salix nigra	black willow	no change	large increase
Ulmus americana	American elm	small decrease	large increase

New Potential Habitat

Scientific Name	Common Name	Least Change	Major Change
Acer saccharinum	silver maple	--	new entry
Carya cordiformis	bitternut hickory	--	new entry
Taxodium distichum var. nutans	pondcypress	--	new entry

Table 3. Nonnative tree insects and diseases ("tree pests") with infestation areas that include Chickasaw National Recreation Area. Detection scale is the finest spatial scale at which infestation data were available for the park area. Data derived from the US Forest Service Alien Forest Pest Explorer (AFPE) Database.

Scientific Name	Common Name	Detection Scale
Anarsia lineatella	peach twig borer	state
Caliroa cerasi	pear sawfly	state
Carulaspis juniperi	juniper scale	state
Cryptodiaporthe populea	Dothichiza canker of poplar	state
Diaspidiotus perniciosus	San Jose scale	state
Eulecanium cerasorum	calico scale	state
Homadaula anisocentra	mimosa webworm	state
Kaliofenusa ulmi	elm leafminer	state
Lepidosaphes ulmi	oystershell scale	state
Ophiostoma novo-ulmi	Dutch elm disease	state
Orchestes alni	European elm flea weevil	state
Periphyllus lyropictus	Norway maple aphid	state
Phytophthora cinnamomi	littleleaf disease / phytophthora root rot	state
Popillia japonica	Japanese beetle	state
Scolytus multistriatus	smaller European elm bark beetle	county
Scolytus schevyrewi	banded elm bark beetle	state
Trichiocampus viminalis	poplar sawfly	state
Xanthogaleruca luteola	elm leafbeetle	state