TACCIMO
Template for Assessing Climate Change Impacts and Management Options

TACCIMO Climate Change Tree Atlas Report

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Report Contents

This report is based on Iverson et al.'s 2008 publication entitled *Estimating potential habitat for 134 eastern US tree species under six climate scenarios*, which provides an overview of potential impacts of climate change on forests. The intent is to recreate the results described in the published paper for user defined areas of interest. Additional analysis and species-by-species results and maps for all scenarios can be found at http://www.nrs.fs.fed.us/atlas.

Climate Change Tree Atlas baseline habitat estimates are available for FIA-based estimate of historic abundance, termed 'actual,' and modeled historic conditions, termed 'modeled.' In order to examine change from current to future time periods, the modeled baseline has been selected. Climate change impacts on potential habitat are estimated using three downscaled climate models (HadleyCM3, CFDL CM2.1, and PCM; see Hayhoe et al. 2006) and two SRES emissions scenarios, A1fi, abbreviated 'hi,' and B1, abbreviated 'lo' (Raupach et al. (2007) states that emissions since 2000 were closest to the A2 scenario trajectory, with the rate of increase exceeding the highest of all SRES scenarios, A1fi).

Results are available for each climate model and emissions scenario combination, along with multiple model averages. Tree Atlas results include a measure of model reliability, because not all tree species can be modeled with equal accuracy. Less common species are more error-prone, but there can still be errors for high reliability models.

Baseline		Climate Model & Scenario		Model Reliability	
Historic (FIA)		GCM3HI (Average)	X	High	X
Historic (Modeled)	X	GCM3LO (Average)		Medium	X
		GFDLHI		Low	X
		GFDLLO			
		HADHI			
		HADLO			
		PCMHI			
		PCMLO			

Tree species of interest can be identified by scientific name (e.g., Pinus echinata), common name (e.g., shortleaf pine), or both.

Species Summary	
Scientific Name	X
Common Name	X

Climate Change Tree Atlas summaries are available across several geographic scales, ranging from the coarsest, national scale, down to state, region, county, or national forest. Summaries will differ at different scales. For example, percentage occupancy would be higher for the nation than the state of South Carolina or Berkeley county.

Geographic Scale		
National		
State		
Region		
County		
National Forest	X	Francis Marion National Forest

OVERVIEW

Results for the following approaches to analyzing the Climate Change Tree Atlas are included in this report:

Percentage occupancy and change in percentage of the region occupied—This tabulation allows a quick assessment of the species that likely would have gains or losses in the area of suitable habitat.

Area-weighted importance values —This statistic incorporates both area and the relative abundance of each species, so it is a better indicator of suitable habitat gains or losses. Because all cells occupy the same area (400 km2), it is simply a sum of the importance values (Importance Value) values for all pixels in the area of interest. The ratio of future to present modeled condition provides insight into the relative increase of decrease of Importance Value across the area of interest: a value <1 indicates a decrease in area-weighted importance and a value >1 indicates an increase.

RESULTS

The user-defined area of interest for this report is the Francis Marion National Forest (FMNF). Tree Atlas results were summarized for the 62 grid cells (highlighted in cyan) centered on the FMNF boundaries and buffered to include a minimum of 50 grid cells, which is considered to be the minimum number representing a statistically valid sample size (Iverson 2012).

Figure 1—Overview of the Francis Marion National Forest boundaries, Tree Atlas grid cells, and South Carolina state boundary

Estimates and changes in area of suitable habitat

Random Forest model outputs yielded estimates of percentage of the Francis Marion National Forest for each species for the historic time period and for year 2100 according to the high emission ensemble (table 1; figure 1). Results generally indicate that:

- 14 species show increases in suitable habitat area of at least 10%
- 5 species show decreases in suitable habitat area of at least 10%
- 33 species show less than 10% change in suitable habitat area

Table 1—Percentage of the Francis Marion National Forest and surrounding area containing potentially suitable for each species based on historic (1961-1990) and future (2100) according to the average of the high emissions scenario models

Common Name	Scientific Name	Reliability	GCM3HI	Historic	Difference
winged elm	Ulmus alata	High	95.2%	3.2%	91.9%
turkey oak	Quercus laevis	High	96.8%	41.9%	54.8%
shortleaf pine	Pinus echinata	High	79.0%	30.6%	48.4%
blackgum	Nyssa sylvatica	High	96.8%	83.9%	12.9%
redbay	Persea borbonia	High	96.8%	90.3%	6.5%
post oak	Quercus stellata	High	96.8%	93.5%	3.2%
sweetbay	Magnolia virginiana	High	96.8%	93.5%	3.2%
American beech	Fagus grandifolia	High	8.1%	6.5%	1.6%
pond pine	Pinus serotina	High	90.3%	88.7%	1.6%
laurel oak	Quercus laurifolia	High	96.8%	96.8%	0.0%
loblolly pine	Pinus taeda	High	96.8%	96.8%	0.0%
longleaf pine	Pinus palustris	High	96.8%	96.8%	0.0%
pitch pine	Pinus rigida	High	1.6%	1.6%	0.0%
red maple	Acer rubrum	High	96.8%	96.8%	0.0%
slash pine	Pinus elliottii	High	96.8%	96.8%	0.0%
sweetgum	Liquidambar styraciflua	High	96.8%	96.8%	0.0%
water oak	Quercus nigra	High	96.8%	96.8%	0.0%
sourwood	Oxydendrum arboreum	High	1.6%	3.2%	-1.6%
scarlet oak	Quercus coccinea	High	1.6%	3.2%	-1.6%
American holly	Ilex opaca	High	93.5%	95.2%	-1.6%
sassafras	Sassafras albidum	High	3.2%	6.5%	-3.2%
black oak	Quercus velutina	High	1.6%	4.8%	-3.2%
black cherry	Prunus serotina	High	79.0%	82.3%	-3.2%
flowering dogwood	Cornus florida	High	87.1%	91.9%	-4.8%
white oak	Quercus alba	High	87.1%	93.5%	-6.5%
sweet birch	Betula lenta	High	4.8%	12.9%	-8.1%
mockernut hickory	Carya tomentosa	High	72.6%	87.1%	-14.5%
yellow-poplar	Liriodendron tuliperfia	High	66.1%	83.9%	-17.7%
pignut hickory	Carya glabra	High	48.4%	90.3%	-41.9%
bluejack oak	Quercus incana	Moderate	79.0%	12.9%	66.1%
lImportance Valuee oak	Quercus virginiana	Moderate	96.8%	33.9%	62.9%
green ash	Fraxinus pennsylvanica	Moderate	64.5%	12.9%	51.6%
American elm	Ulmus americana	Moderate	45.2%	3.2%	41.9%
sugarberry	Celtis laevigata	Moderate	48.4%	12.9%	35.5%
sand pine	Pinus clausa	Moderate	35.5%	3.2%	32.3%
loblolly-bay	Gordonia lasianthus	Moderate	66.1%	33.9%	32.3%
common persimmon	Diospyros virginiana	Moderate	62.9%	33.9%	29.0%
eastern redcedar	Juniperus virginiana	Moderate	24.2%	4.8%	19.4%
water hickory	Carya aquatica	Moderate	21.0%	3.2%	17.7%
eastern hophornbeam	Ostrya virginiana	Moderate	17.7%	9.7%	8.1%
sycamore	Platanus occidentallis	Moderate	14.5%	9.7%	4.8%
southern magnolia	Magnolia grandiflora	Moderate	11.3%	8.1%	3.2%
willow oak	Quercus phellos	Moderate	96.8%	96.8%	0.0%
baldcypress	Taxodium distichum	Moderate	95.2%	95.2%	0.0%
American	Carpinus caroliniana	Moderate	90.3%	95.2%	-4.8%
overcup oak	Quercus lyrata	Moderate	33.9%	40.3%	-6.5%
boxelder	Acer negundo	Moderate	4.8%	11.3%	-6.5%
water tupelo	Nyssa aquatica	Moderate	83.9%	93.5%	-9.7%
blackjack oak	Quercus marilandica	Moderate	9.7%	35.5%	-25.8%
swamp chestnut oak	Quercus michauxii	Moderate	8.1%	80.6%	-72.6%
eastern cottonwood	Populus deltoides	Low	12.9%	11.3%	1.6%
water-elm	Planera aquatica	Low	3.2%	8.1%	-4.8%

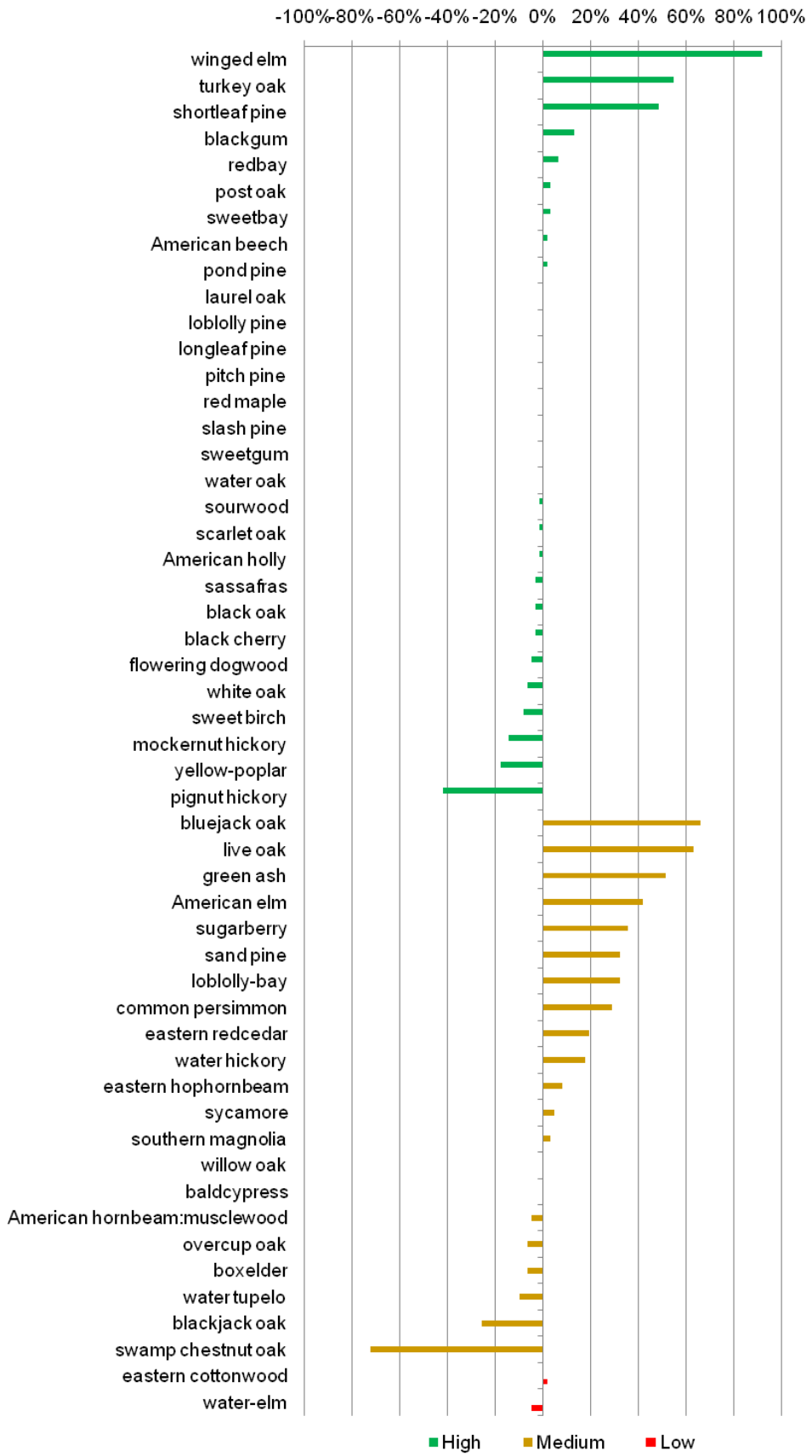

Figure 2—Difference in percent occupancy as calculated by subtracting historic from future

Species importance values weighted by area

Area weighted importance values simultaneously includes species area and species importance, yielding a better indicator of potential change in overall species habitat under various scenarios of climate change. Ratios of future to historic area-weighted importance value for each species and scenario further aid in interpretation (fig. 4). As compared to the historic modeled distribution, the high emissions ensemble results show:

- 24 species showed increases in area weighted importance value of at least 10% (table 2; fig. 3)
- 22 species showed decreases in area weighted importance value of at least 10% (table 2; fig. 3)
- 6 species showed a change in area weighted importance value of less than 10% (table 2; fig. 3)
- 5 species with historic importance value greater than zero declined to zero (table 3)
- 10 species with historic importance value of zero showed an increase of importance value above zero (table 3)

Table 2—Species area weighted importance value under the historic and future according to the average of the high emissions scenario models

Common Name	Scientific Name	Reliability	GCM3HI	Historic	Ratio
winged elm	Ulmus alata	High	81	2	40.50
slash pine	Pinus elliottii	High	736	227	3.24
turkey oak	Quercus laevis	High	82	30	2.73
shortleaf pine	Pinus echinata	High	63	28	2.25
blackgum	Nyssa sylvatica	High	129	65	1.98
post oak	Quercus stellata	High	103	67	1.54
sweetbay	Magnolia virginiana	High	146	95	1.54
longleaf pine	Pinus palustris	High	228	160	1.43
American beech	Fagus grandifolia	High	5	4	1.25
redbay	Persea borbonia	High	99	90	1.10
laurel oak	Quercus laurifolia	High	248	227	1.09
black cherry	Prunus serotina	High	64	59	1.08
American holly	Ilex opaca	High	60	64	0.94
flowering dogwood	Cornus florida	High	62	67	0.93
mockernut hickory	Carya tomentosa	High	48	58	0.83
water oak	Quercus nigra	High	342	439	0.78
white oak	Quercus alba	High	55	71	0.77
red maple	Acer rubrum	High	309	462	0.67
yellow-poplar	Liriodendron tuliperfia	High	46	74	0.62
sweetgum	Liquidambar styraciflua	High	427	775	0.55
loblolly pine	Pinus taeda	High	781	1427	0.55
pignut hickory	Carya glabra	High	31	58	0.53
pond pine	Pinus serotina	High	79	154	0.51
sassafras	Sassafras albidum	High	2	4	0.50
scarlet oak	Quercus coccinea	High	1	2	0.50
sourwood	Oxydendrum arboreum	High	1	2	0.50
pitch pine	Pinus rigida	High	1	2	0.50
sweet birch	Betula lenta	High	3	8	0.38
black oak	Quercus velutina	High	1	3	0.33
American elm	Ulmus americana	Moderate	28	2	14.00
sand pine	Pinus clausa	Moderate	23	2	11.50
bluejack oak	Quercus incana	Moderate	53	8	6.63
eastern redcedar	Juniperus virginiana	Moderate	16	3	5.33
green ash	Fraxinus pennsylvanica	Moderate	45	9	5.00
lImportance Valuee oak	Quercus virginiana	Moderate	188	41	4.59
water hickory	Carya aquatica	Moderate	13	3	4.33
sugarberry	Celtis laevigata	Moderate	31	8	3.88
eastern hophornbeam	Ostrya virginiana	Moderate	11	6	1.83
common persimmon	Diospyros virginiana	Moderate	40	22	1.82
loblolly-bay	Gordonia lasianthus	Moderate	43	24	1.79
baldcypress	Taxodium distichum	Moderate	124	77	1.61
sycamore	Platanus occidentallis	Moderate	9	6	1.50
southern magnolia	Magnolia grandiflora	Moderate	7	5	1.40
American	Carpinus caroliniana	Moderate	77	80	0.96
willow oak	Quercus phellos	Moderate	87	100	0.87
overcup oak	Quercus lyrata	Moderate	21	26	0.81
water tupelo	Nyssa aquatica	Moderate	67	102	0.66
boxelder	Acer negundo	Moderate	3	7	0.43
blackjack oak	Quercus marilandica	Moderate	7	23	0.30
swamp chestnut oak	Quercus michauxii	Moderate	5	51	0.10
eastern cottonwood	Populus deltoides	Low	8	7	1.14
water-elm	Planera aquatica	Low	2	6	0.33

Table 3—Species area weighted Importance Value under the modeled historic and ensemble species with no historic Importance Value (new) and species whose Importance Value drop to zero (extirpation)

Common Name	Scientific Name	Reliability	GCM3HI	Historic
northern red oak	Quercus rubra	High	0	2
balsam fir	Abies balsamea	High	0	1
osage-orange	Maclura pomifera	Moderate	0	2
bear oak:scrub oak	Quercus ilicifolia	Low	0	1
Atlantic white-cedar	Chamaecyparis	Low	0	1
black hickory	Carya texana	High	24	0
white ash	Fraxinus americana	High	7	0
slippery elm	Ulmus rubra	Moderate	1	0
shagbark hickory	Carya ovata	Moderate	1	0
hackberry	Celtis occidentalis	Moderate	1	0
Florida maple	Acer barbatum	Moderate	1	0
cedar elm	Ulmus crassifolia	Low	23	0
waterlocust	Gleditsia aquatica	Low	8	0
Shumard oak	Quercus shumardii	Low	4	0
honeylocust	Gleditsia triacanthos	Low	2	0
northern red oak	Quercus rubra	High	0	2

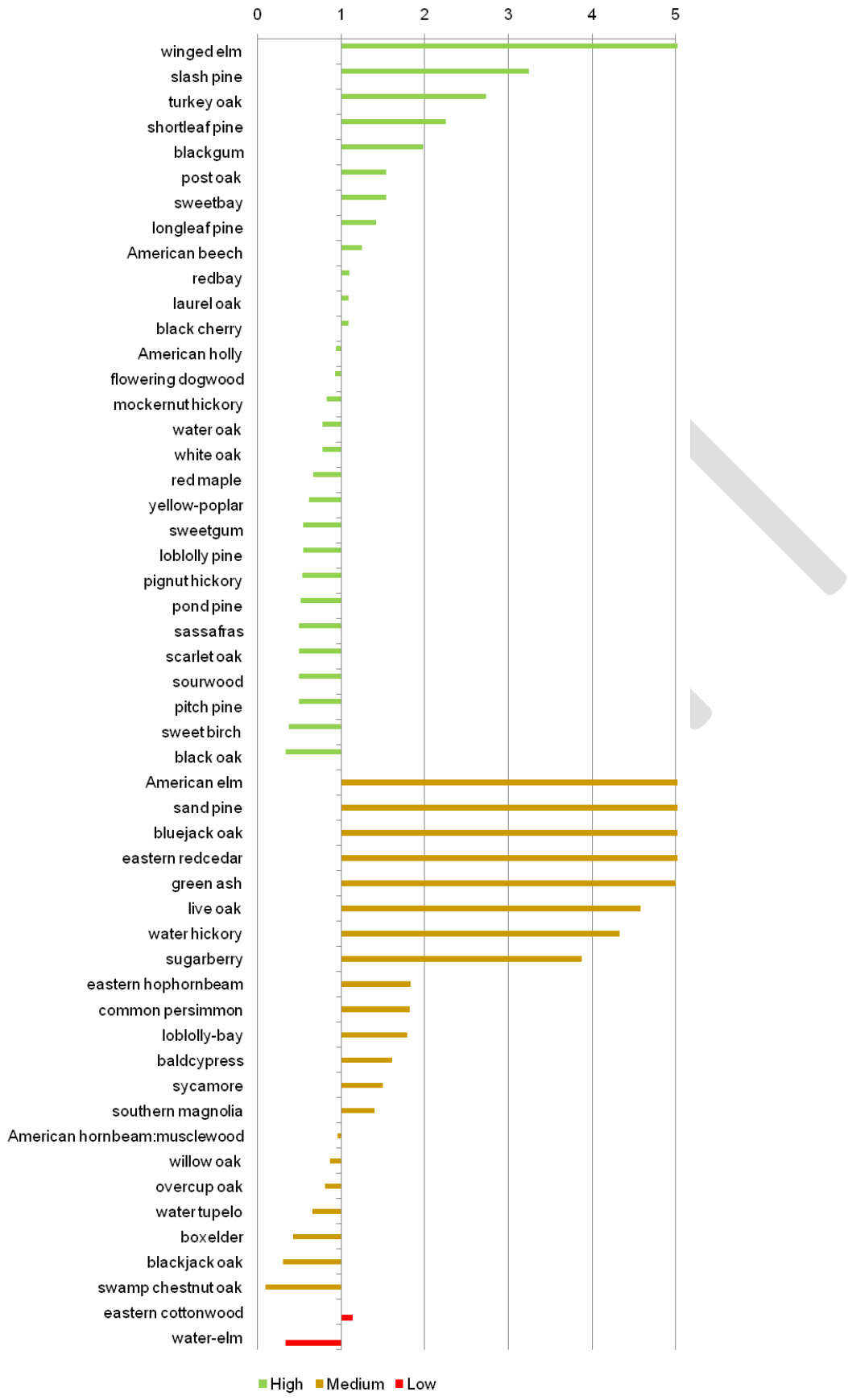

Figure 4—The ratio of ensemble high and historic modeled species area weighted importance values

Species-level maps
Maps for each species based are available online at http://www.nrs.fs.fed.us/atlas.

Forest-type maps
Maps for each species based are available online at http://www.nrs.fs.fed.us/atlas.

INTERPRETIVE GUIDANCE

This section includes important interpretive guidance that is reproduced directly from the following publication: Iverson, L.R., A.M. Prasad, S.N. Matthews, and M. Peters. 2008. Estimating potential habitat for 134 eastern US tree species under six climate scenarios. Forest Ecology and Management 254: 390-406. http://www.treesearch.fs.fed.us/pubs/13412.

Scope and limitations
Our modeling and analysis should be interpreted in the context of data limitations and our assumptions. It should be stressed that we are not trying to model the actual future distributions as that would be beyond the scope of our study. Our models show how future potential suitable habitats could change if climate were to change according to the GCM models. These changes in suitable habitat would impact primarily the regeneration, rather than mature growth, phase of a tree's life cycle. It should be borne in mind that we are modeling the potential niche space that would be available for the species in the future climates, and not the realized niche. Therefore any disturbances would be operating within this future suitable habitat. It should also be noted that the FIA data that we use are integrating the results of past disturbances and climate events, and are thus based on at least a partial realized niche for individual species. Because of genetic plasticity and potential changes in the biotic controls on species ranges, species could expand northward (or southward) even without climate change. Comprehensive modeling of the realized niche would require data on future disturbances, including fires, exotics, severe storms, and human-induced land-use and land management changes, as well as mortality, growth, and competition for each species – all out at least 100 years which of course is impossible to achieve. Indeed, the spatial and temporal patterns of these factors are impossible to predict even under the current climate regime, though simulations using the variation of historical data can provide course-level indications of potential future conditions, at least for fire (Keane et al. 2004; Cary et al. 2006; Scheller and Mladenoff 2007).However, it will never be possible to predict major events such as the invasion of the next emerald ash borer, recently introduced and threatening all native ashes (Fraxinus spp.) on the continent (Iverson et al. in press-a).Under future altered climates, these factors can manifest themselves in novel and unexpected ways; our models (nor any model), therefore, cannot take these into account. However, the potential future habitats that we do model for each species can be used to investigate further the effect of possible outcomes with respect to modeled disturbances or competition. For example, we have built a spatially explicit cellular model with built-in stochasticity called SHIFT to examine the effects of habitat fragmentation on the future colonization probabilities using the outputs of our models (Iverson et al. 1999b, 2004c, d). It is also possible to combine simulation modeling of future species dynamics with the potential future niche space for various species from our model to achieve a realistic species list that can be modeled forward (e.g., Chaing et al. 2006). Finer scale studies can also be conducted to test our model for species of interest in places where our model is predicting drastic changes (e.g., hotspots). Therefore, our predictions of increase in range (potential future suitable habitat) are very likely to be overestimates of the actual ranges that would be achieved by the end of this century, as migration of most species will not keep up with relatively abrupt changes in climate, unless humans get seriously involved in moving species.

The RF model is a highly robust model for predictions as it uses thousands of trees with resampled data and randomized subset of predictors. As we have emphasized in our modeling section, this makes it highly resistant to overfitting. However, there is concern that when modeling the future climate by swapping the current with the GCM predicted future, we are sometimes making predictions into novel parameter space through extrapolation. Our investigations into the nature of RF predictions (Prasad et al., 2006) and the fact that RF uses tree-based step-functions rather than splines (e.g., models using adaptive splines such as general additive models or multiple adaptive regression splines) gives us confidence that our extrapolations are not wild projections in future parameter space but are suitably constrained by the robustness of our current modeled response. We do provide model reliability estimates using a tri-model approach (see next section on model reliability) for identifying problematic species.

How to cite the Climate Change Tree Atlas:

Prasad, A.M., L.R. Iverson, S. Matthews, M. Peters. 2007-ongoing. A Climate Change Atlas for 134 Forest Tree Species of the Eastern United States [database]. http://www.nrs.fs.fed.us/atlas/tree, Northern Research Station, USDA Forest Service, Delaware, Ohio.

Important citations relevant to Tree Atlas:

Iverson, L.R., A.M. Prasad, S.N. Matthews, and M. Peters. 2008. Estimating potential habitat for 134 eastern US tree species under six climate scenarios. Forest Ecology and Management. 254:390-406. http://www.treesearch.fs.fed.us/pubs/13412

Prasad, A.M., L.R. Iverson, and A. Liaw. 2006. Newer classification and regression tree techniques: bagging and random forests for ecological prediction. Ecosystems 9:181-199. http://www.treesearch.fs.fed.us/pubs/22432

Important related publications:

Hayhoe, K., C.P. Wake, T.G. Huntington, L. Luo, M.D. Schwartz, et al. 2006. Past and future changes in climate and hydrological indicators in the U.S. Northeast. Climate Dyn. 28: 381-407.

Iverson, L., A.M. Prasad, S. Matthews, and M. Peters. 2011. Lessons learned while integrating habitat, dispersal, disturbance, and life-history traits into species habitat models under climate change Ecosystems 14:1005-1020. http://treesearch.fs.fed.us/pubs/38757

Matthews, S.N., L.R. Iverson, A.M. Prasad, M.P. Peters, and P.G. Rodewald. 2011. Modifying climate change habitat models using tree species-specific assessments of model uncertainty and life history factors. Forest Ecology and Management 262:1460-1472. http://treesearch.fs.fed.us/pubs/38643

Species Level Maps

American beech
Fagus grandifolia
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_531.png
American elm
Ulmus americana
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_972.png
American holly
Ilex opaca
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_591.png
American hornbeam:musclewood
Carpinus caroliniana
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_391.png
Atlantic white-cedar
Chamaecyparis thyoides
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baldcypress
Taxodium distichum
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balsam fir
Abies balsamea
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bear oak:scrub oak
Quercus ilicifolia
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bitternut hickory
Carya cordiformis
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black cherry
Prunus serotina
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black hickory
Carya texana
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black locust
Robinia pseudoacacia
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black oak
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black walnut
Juglans nigra
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blackgum
Nyssa sylvatica
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blackjack oak
Quercus marilandica
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bluejack oak
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boxelder
Acer negundo
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cedar elm
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chinkapin oak
Quercus muehlenbergii
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common persimmon
Diospyros virginiana
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eastern cottonwood
Populus deltoides
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Ostrya virginiana
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eastern redbud
Cercis canadensis
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eastern redcedar
Juniperus virginiana
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eastern white pine
Pinus strobus
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Florida maple
Acer barbatum
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flowering dogwood
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Fraxinus pennsylvanica
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hackberry
Celtis occidentalis
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honeylocust
Gleditsia triacanthos
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laurel oak
Quercus laurifolia
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live oak
Quercus virginiana

http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_838.png

loblolly pine
Pinus taeda
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loblolly-bay
Gordonia lasianthus
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longleaf pine
Pinus palustris
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mockernut hickory
Carya tomentosa
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northern red oak
Quercus rubra
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osage-orange
Maclura pomifera
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overcup oak
Quercus lyrata
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pignut hickory
Carya glabra
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pitch pine
Pinus rigida
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pond pine
Pinus serotina
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post oak
Quercus stellata
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red maple
Acer rubrum
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red mulberry
Morus rubra
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_682.png

redbay
Persea borbonia
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_721.png

sand pine
Pinus clausa
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_107.png

sassafras
Sassafras albidum
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_931.png

scarlet oak

Quercus coccinea
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_806.png

shagbark hickory
Carya ovata
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_407.png

shortleaf pine
Pinus echinata
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_110.png

Shumard oak
Quercus shumardii
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_834.png

silver maple
Acer saccharinum
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_317.png

slash pine
Pinus elliottii
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_111.png

slippery elm
Ulmus rubra
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_975.png

sourwood
Oxydendrum arboreum
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_711.png

southern magnolia
Magnolia grandiflora
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_652.png

spruce pine
Pinus glabra
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_115.png

sugarberry
Celtis laevigata
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_461.png

swamp chestnut oak
Quercus michauxii
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_825.png

swamp white oak
Quercus bicolor
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_804.png

sweet birch
Betula lenta
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_372.png

sweetbay
Magnolia virginiana
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_653.png

sweetgum
Liquidambar styraciflua
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_611.png

sycamore
Platanus occidentallis
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_731.png

turkey oak
Quercus laevis
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_819.png
water hickory
Carya aquatica
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_401.png
water oak
Quercus nigra
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_827.png
water tupelo
Nyssa aquatica
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_691.png
water-elm
Planera aquatica
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_722.png
waterlocust
Gleditsia aquatica
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_551.png
white ash
Fraxinus americana
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_541.png
white oak
Quercus alba
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_802.png
willow oak
Quercus phellos
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_831.png
winged elm
Ulmus alata
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_971.png
yellow buckeye
Aesculus octandra
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_332.png
yellow-poplar
Liriodendron tuliperfia
http://www.nrs.fs.fed.us/atlas/tree/RFmod_6pp_621.png