A Multi-Phase Approach to Assessing Potential Changes in Eastern U.S. Tree Distributions

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Eleven indicators that the climate is changing



State of the climate 2009, NOAA

Outline

- **GOAL:** Help managers understand and adapt to changes due to climate change
- Model habitat suitability changes with climate change, using species distribution models (DISTRIB)
- Model potential for newly suitable habitat to get colonized within 100 years, using spatially explicit, cell-based model (SHIFT)
- Modify DISTRIB model outputs to include more biology, disturbance, and modeling issues with 28 Modifying Factors







best for prediction without overfitting



You are here: NRS Home / Tools & Applications / Climate Change Atlas / Tree Atlas

Change Tree Atlas (A Spatial Database of 134 Tree Species of the Eastern USA) nantha M Prasad. Louis R Iverson. Steve Matthews. Matt Peters

Atlas Background What's New Elitations Eliterity Atlas Help 🗄 Other Links (DropDownMenu)

Table of 134 Tree Species:

Model Reliability: 🔵 High 🦳 Medium 🛑 Low

	(Ulick I	able-Header-Link to Sort by that Column	- Ascending/Descending)
Reliability	Spp. #	Lommon Name	Scientific Name
0	12	balsam fir	Abies balsamea
	43	Atlantic white-cedar	Chamaecyparis thyoides
\bigcirc	68	eastern redcedar	Juniperus virginiana
0	71	tamarack (native)	Larix laricina
\bigcirc	94	white spruce	Picea glauca
9	95	black spruce	Picea mariana
۲	97	red spruce	Picea rubens
0	105	jack pine	Pinus banksiana
\bigcirc	107	sand pine	Pinus clausa
۲	110	shortleaf pine	Pinus echinata
۲	111	slash pine	Pinus elliottii
0	115	spruce pine	Pinus glabra
	121	longleaf pine	Pinus palustris



http://www.nrs.fs.fed.us/atlas or Google "Climate Tree Atlas" Climate Change

Tree Atlas 134 species

Climate Change **Bird** Atlas 147 species

Climate Change

Bird Atlas

USDA United States Department of Agriculture **Forest Service**

6450 Nashville Warbler

Yellow-throated Vireo

4 A.

Vireo flavifrons

Vermivora ruficapilla

'ou are her	e: NRS	Home / Tools & Applications / Climat	e Change Atlas / Bird Atlas					
Clima Iteve M IRS-4151	ate (atthew USDA	Change Bird Atla ws, Louis R Iverson, Anar Forest Service, Northern Resea	IS (A Spatial Database of 7 htha M Prasad, Matt Peters rch Station, Delaware, Ohio	147 Bird Species of the Eastern USA)				
22222222	2222222	Atlas Background Wha	t's New Citations Credits A	tlas Help Other Links (DropDownMenu)				
Intable Table of 147 Bird Species:								
eliability	Spp. #	Common Name	Scientific Name	147 Species Combined/Compared				
0	5580	White-throated Sparrow	Zonotrichia albicollis	147 Species combined/ compared				
\bigcirc	3160	Mourning Dove	Zenaida macroura					
0	4970	Yellow-headed Blackbird	Xanthocephalus xanthocephalus	Combined Species				
0	6840	Hooded Warbler	Wilsonia citrina	Outputs				
0	6860	Canada Warbler	Wilsonia canadensis	Cuputo				
0	6290	Blue-headed Vireo	Vireo solitarius					
	6240	Red-eyed Vireo	Vireo olivaceus	Summany of				
0	6310	White-eyed Vireo	Vireo griseus	Predictors				
0	6270	Warbling Vireo	Vireo ailvus					









Brown-headed Nuthatch





Important!

- The DISTRIB model projects potential suitable habitat by year 2100. It does NOT project where the species will be at that time, as great lag times are involved in tree species migrations (Thus, need for SHIFT).
- The DISTRIB model does not account for biotic interactions or human or natural disturbances (Thus, the need for Modifying Factors).

Potential changes for tree species in northern Wisconsin

- Evaluated 73 species from the ecoregion
- Put in to 8 classes of impacts
 - Class I: extirpated (I sp)
 - Class 2: large decrease (12 spp)
 - Class 3: small decrease (6 spp)
 - Class 4: no change (6 spp)
 - Class 5: small increase (4 spp)
 - Class 6: large increase (17 spp)
 - Class 7: new entry-high and low emissions (11 spp)
 - Class 8: new entry-high emissions (16 spp)



		Clas	ss I Class	2	Class 3			
		Mountair	Maple BlackSpruce	E	Butternut			
		~	BalsamFir	E	astern White Pi	ne		
			PaperBirch	F	RedMaple			
		osers)	YellowBirch	F	RockElm	Lege	nd:	
			EasternHeml	lock J	ackPine	Class	I: extirpated (I sp)	
			QuakingAspe	en B	BalsamPoplar	Class	2: large decrease (12 s	PP)
~			NorthernWh	iteCedar		Class	3: small decrease (6 sp	ν Ρ)
10	5		BigtoothAspe	en		Class	4: no change (6 spp)	
120	2		SugarMaple			Class	5: small increase (4 sp))
des la		The	WhiteSpruce	`		Class	6: large increase (17 sp) (qc
Carlon 1	- 4	the same	BlackAsh			Class	ions (LL spp)	w
X		SALL F	Tamarack			Class	e now ontry high omig	scions
Emeral 1	VA .	12 5.4			Class 4			2210112
1	-	- FA		Chok	echerry	(10 3	(۲ ۲	
407 4	mot	1 81		RedP	Pine			
The second		Les Stave	ers)	Nort	hernRedOak			
5		4		Nort	hernPinOak	(Nou	Migrants)	
	A		Class 6	Ame	rican Basswood			
E.	and the	and the second sec	BlackCherry	Gree	nAsh		Class 8	
1	and the second second	States 1	BurOak				Pecan	
6	F.I.	(62 2 C	AmericanBeech				PeachleafWillow	
	P.C.		WhiteOak			Class 7	BlackHickory	
17		Class 5	BitternutHickory			PinOak	WildPlum	
IN		WhiteAsh	BlackOak			OhioBuckeye	NorthernCatalpa	
//		EasternHophornbeam	Boxelder			RiverBirch	ScarletOak	
(Gain	arc)	AmericanHornbeam	SwampWhiteOak			BlackLocust	Sycamore	
(AmericanElm	ShagbarkHickory			Sassafras	Sugarberry	
			SilverMaple			PignutHickory	ChinkapinOak	
	7		BlackWillow			MockernutHickory	ShingleOak	
			SlipperyElm			FloweringDogwood	EasternRedbud	
			EasternCottonwood			Honeylocust	PostOak	
			OsageOrange			YellowPoplar	BlackjackOak	
			EasternRedCedar			Redmulberry	CommonPersimmon	
			BlackWalnut				Blackgum	

Hackberry

ChestnutOak

Overall habitat change for the 7 major species groups in N Wisconsin by GCM/emission

	Current Habitat	% Chang PCMI0	e in Habitat Hadhi
<mark>spe</mark> cies	habitat total	(mild)	(harsh)
<mark>bal</mark> sam fir	4.8	-3.6	-4.4
aspen	16.8	-8.2	-14.3
paper birch	6	-3.3	-5.4
<mark>jac</mark> k pine	3.1	-0.8	-1.5
white and red pine	4.7	0	-2.9
all oak	10.5	6.8	11.3
northern hardwood	17	-3.1	-10





Only forested, unoccupied cells can be colonized

Black oak potential migration by 2100



Forest Density (NLCD data 2000)

Shift (Preliminary)Output on Current Black Oak IV



Modifying factors

- DISTRIB + SHIFT model potential suitable habitats under current fragmented landscapes
- Many other factors (biological and disturbance) come in to play to determine more likely outcomes
- We rate biological and disturbance factors for positive or negative impacts
- Goal is to evaluate more realistic outcomes at regional and local levels







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		osers)	YellowBirch	F	RockElm	Lege	nd:	
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			BlackWalnut				Blackgum	

Hackberry

ChestnutOak

Large Decreasers (Cl. 2)

Future:Current Ratio

Modification Factors



Large Increasers (CI. 6)

Future: Current Ratio

Modification Factors

BurOak Boxelder OsageOrange Bitter.Hick. WhiteOak Hackberry Sw.WhiteOak E.RedCedar BlackOak BlackWalnut Cottonwood SilverMaple SlipperyElm Shag.Hickory BlackWillow Am.Beech BlackCherry





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An indicator of tree migration in forests of the eastern United States

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37 of 40 species have general tendencies in agreement with our models



Thank you!

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