HABITAT SUITABILITY MODELS: RESEARCH AND MANAGEMENT

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> **George Box (1976)** All models are wrong but some are useful

David Hand (2014)

...when building statistical models, we must not forget that the aim is to understand something about the real world... not an abstract mathematical world...



POTENTIAL HABITAT MODELS

SPECIES DATA \rightarrow ENVIRONMENTAL VARIABLES \rightarrow ALGORITHM \rightarrow POTENTIAL HABITAT

Likelihood . Low . Medium • ٠ algorithm . . **Species** locations Land cover Soil Topography Potential habitat model Canopy cover

(Not occupancy)



GENERAL MODEL TYPES

Model	Classification	Complexity	Process	Result
Habitat Affinity	Binary (0,1)	Simple	Descriptive	Index
Fuzzy Logic	Continuous (0-1)	Intermediate	Descriptive statistics	State or extent of event
Predictive*	Continuous (0-1)	Complex	Statistical model**	Probability/Likelihood

* Presence-only, presence/absence, abundance

** Algorithms:

- Resource Selection Function (GLM (Logistic Regression))
- Machine Learning (Maxent, Random Forest, Boosted Regression Trees)
- Neural Networks
- Envelope (BIOCLIM)
- Occupancy
- Model Averaging / Ensemble Models







INCREASING INFORMATION:

[Unsampled areas]









CONTINUOUS SCALE OUTPUT

BINARY SCALE OUTPUT





Threshold = 0.231

MODEL VALIDATION



VARIABLE IMPORTANCE







MODEL FIT TO LOCATION DATA

Refine post model?-Min patch size Connectivity



















UPDATING MODELS

UPDATE WHCNIF 2009 AFFINITY MODELS TO CURRENT (2016) DATA

- SIMILAR METHODS
- UPDATED DATA LAYERS:

LAND COVER FROM FWC 2003 (30M) TO CLC 2016 (10M)

SPECIES	2003 model (ha)	2016 model (ha)	Area Diff ** (ha)			
Scott's seaside sparrow	65,446	67,469	2,023			
Louisiana seaside sparrow	192	2,367	2,175			
MacGillivray's seaside sparrow	20,241	21,107	866			
Short-tailed hawk	1,696,174	1,650,411	-45,763			
Swallow-tailed kite	3,749,343	3,714,812	-34,531			

****Most differences not from true LC change but from refining LC mapping methods**



MODELS TO DATE

BIRDS											
American oystercatcher	Cuban snowy plover		Mang	Mangrove cuckoo		Reddish egret			Cape Sable seaside sparrow		
Black Rail	Everglade snail kite		Maria	Marian's marsh wren		Roseate spoonbill			Least tern		
Burrowing owl	FL snail kite		North	Northern bobwhite quail		Scott	Scott's seaside sparrow			Painted bunting	
Limpkin	Florida grassho	pper sparrow	Ospre	Osprey		Short	-tailed hawk		Red-cockaded woodpecker		
Snowy plover	Florida scrub-ja	У	Pipin	Pipingplover		Snow	Snowy egret			Crested caracara	
Wild turkey	Little blue heron		Wort	Worthington's marsh wren		Southern bald eagle			Florida sandhill crane		
Southeastern American kestrel	Louisiana seaside sparrow		Audu	Audubon's crested caracara		Swallow-tailed kite			Woodstork		
Bachman's sparrow	Louisiana waterthrush		Black	Blackskimmer		Tricolored heron					
Brown pelican	MacGillivray's seaside sparrow		Black	Black-whiskered vireo		White ibis					
Brown-headed nuthatch	Mottled duck		Соор	Cooper's hawk		White	e-crowned pigeon				
MAMMAL											
Florida mouse	Anastasia Island beach mouse		Perdi	Perdido Key beach mouse		Eastern chipmunk			Black Bear		
Rafinesque's Big-eared Bat	Big Cypress fox s	quirrel	Shern	nan's short-taile	dshrew	Everg	Everglades mink		Key deer		
Homosassa shrew	Tava		1			1					
Sherman's fox squirre	Таха										
Florida panther Model	Bird	Mamm	าลไ	Hern	Fig	sh	Invert	wert Toto			
HERP	Dira	TVIGITITI	iui	пстр		,,,,	mvere	1011			
Eastern indigo snake Affinity	41	19		26				86	ro	g	
Flatwoods salamand	1	1					1	2	rl	Key mole skink	
Florida bogfrog		1						5	/0	ods salamander	
Florida pine snake Predictive	5	2		10	2	9	22	68	da	Keys mole skink	
Bine barrens treafres Total	17	22		26	20	C	22	15	7		
Short tailed spake	47		Alliga	JU		Tigor		15/			
Southern hognese spake	Atlantic calt ma	rehenako	Amor	ican alligator	lie	String	a nowt				
FISH	Atlantic saltina	1311 311d KC	Amer	Ican anigator		Istribe	u newi				
Alabama shad	Ironcolor shine		Faste	rn mudminnow		South	ernstarbead topr	ninnow	Bluest	ine shiner	
Alligator gar	Mountain mullet		Elorid	Elorida/Speckled Chub		Southern striped shiner			Cypress darter		
Bandfin shiner	Okaloosa darter		Goldstripe Darter		Speckled darter			Cypress minnow			
Blackmouth shiner	Boughshiner		Grevfin redhorse		Spotted bullhead			Shoal bass			
Bluehead chub	Saddleback darter		Gulfsturgeon		Suwannee bass			Snail bullhead			
Bluenose shiner	Saltmarshtopminnow		Harlequin darter		Southernlogperch						
INVERT	1		1			1			1		
Apalachicola Floater	Panama City cravfish		Florida Floater		Shinyrayed pocketbook (mussel)			Elkhorn coral			
Chipola slabshell (mussel)	Purple bankclimber (mussel)		Fluted Elephantear		Southern Pocketbook			Fat threeridge (mussel)			
Delicate Spike	Round ebonyshell		Fuzzv	Fuzzy pigtoe		Staghorn coral			Say's si	piketail (dragonfly)	
Downy Rainbow	Round Pearlshell		Inflated Spike		Washboard						
Sculptured Pigtoe	Oval pigtoe (mussel)		Narro	Narrow pigtoe		Black Creek crayfish					

















OCCURRENCE DATA



POTENTIAL HABITAT MODELS





SPECIES WITH LIMITED RANGE



GENERAL TAXA INFORMATION

Birds Fish Herps

Mammals

1-5

6 - 7

8-9





Habitat Model Uses

- FWC Management Plans
- FWC/FWRI Research
- USFWS Species Status Reviews
- FNAI Critical Lands and Waters Identification Project
- Military Lands Natural Resource Management
- Development Plans/Permitting (Environmental Consultants)

FWC Management Plans

The Wildlife Conservation Prioritization and Recovery (WCPR) program

Species management on FWC-managed lands

- Statewide potential habitat models
 - Consultation of species experts
 - Knowledge of local staff
 - Review of area-specific natural community maps

200-2014 Likelihood -vALUE> 0 505-6 221 0 922 0 das (gtar-init hate)



Quantity vs Quality

- fire interval
- invasive species
- predation
- competition
- hydrology
- disturbance proximity







TIME PERIOD: data collected \rightarrow model layers \rightarrow model development \rightarrow model validation/review \rightarrow model used

THE TREACHERY OF IMAGES







http://myfwc.com/

http://myfwc.com/research/gis/

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