Risk assessment of invasive wildlife species in south Florida

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Photos: Mike Rochford (UF)

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Invasion biology and risk assessment

History and progress of invasion biology

1958: The ecology of invasions by animals and plants (Charles Elton)

- Faunal history
- Ecology
- Conservation

1983: SCOPE invasion program

- Factors to be invader
- Environmental characteristics
- Use knowledge to develop management strategy

} Three major questions

Invasion biology and risk assessment

Risk assessment methodology and applications

❖ Objectives

- Taxonomic
  - Determine factors for successful invasions
  - Prediction
  - Potential impacts of invasion
- Geographic
  - Determining geographic factors affecting invasions
  - Identify high risk area

❖ Methodology

- GLM, regression tree, discriminant analysis
- Species distribution model (e.g. Maxent, Bioclimate)

❖ Applications

- Screening of imported species (plants)

Taxonomic risk assessment: example of exotic reptiles

Number of imported reptiles through Miami and St. Petersburg ports 2000-2005 (Source: USFWS LEMIS)

	Known		Unknown		Total	
	Species	Quantity	Species	Quantity	Species	Quantity
Crocodile	7	11,409	1	60	8	11,469
Lizard	314	3,570,738	116	808,602	430	4,378,800
Snake	229	650,749	67	11,869	296	662,618
Turtle	106	124,505	35	24,694	141	149,199
Unknown	--	--	3	50,116	3	50,116
Total	**656**	**4,357,401**	**222**	**894,801**	**878**	**5,252,202**

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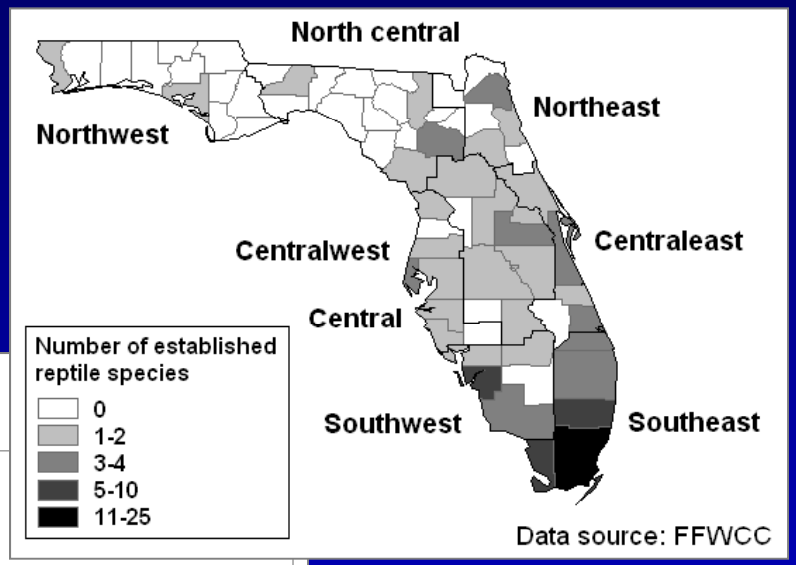
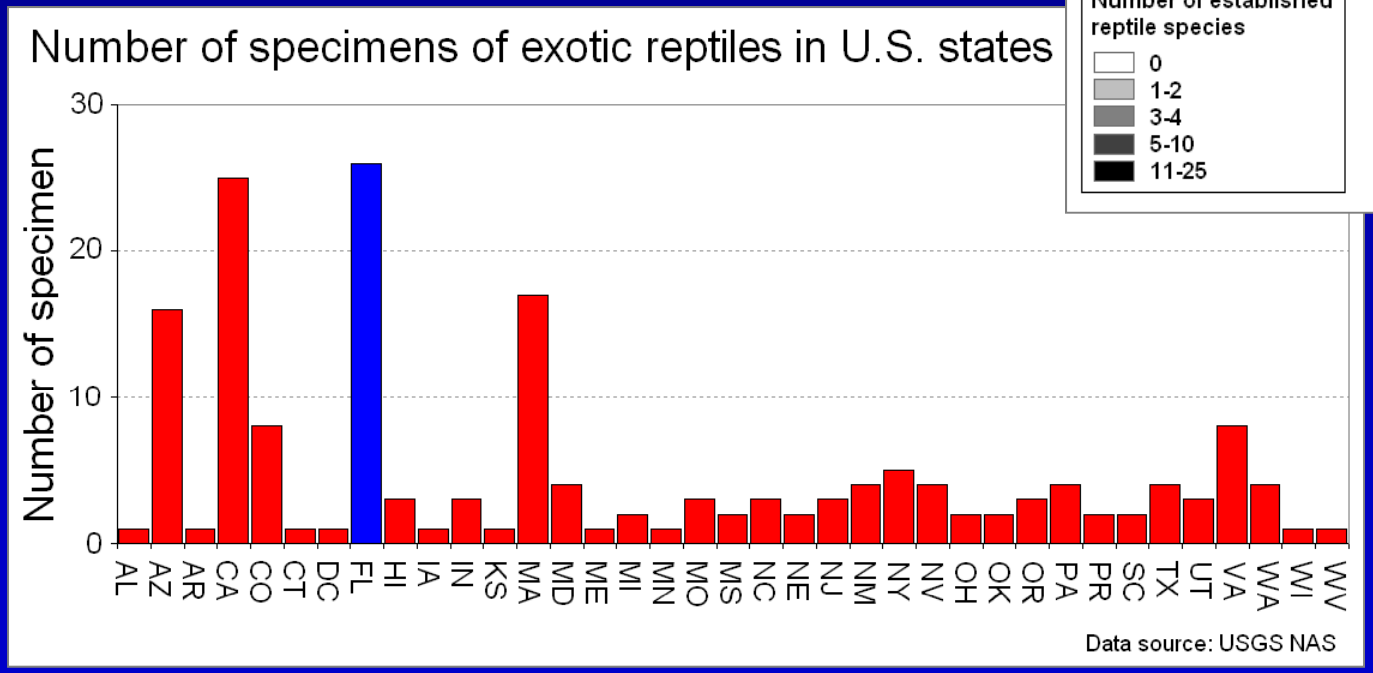
Taxonomic risk assessment: example of exotic reptiles

Exotic reptiles in Florida

- Subtropical climate
- Natural and urban areas
- Peninsula effect

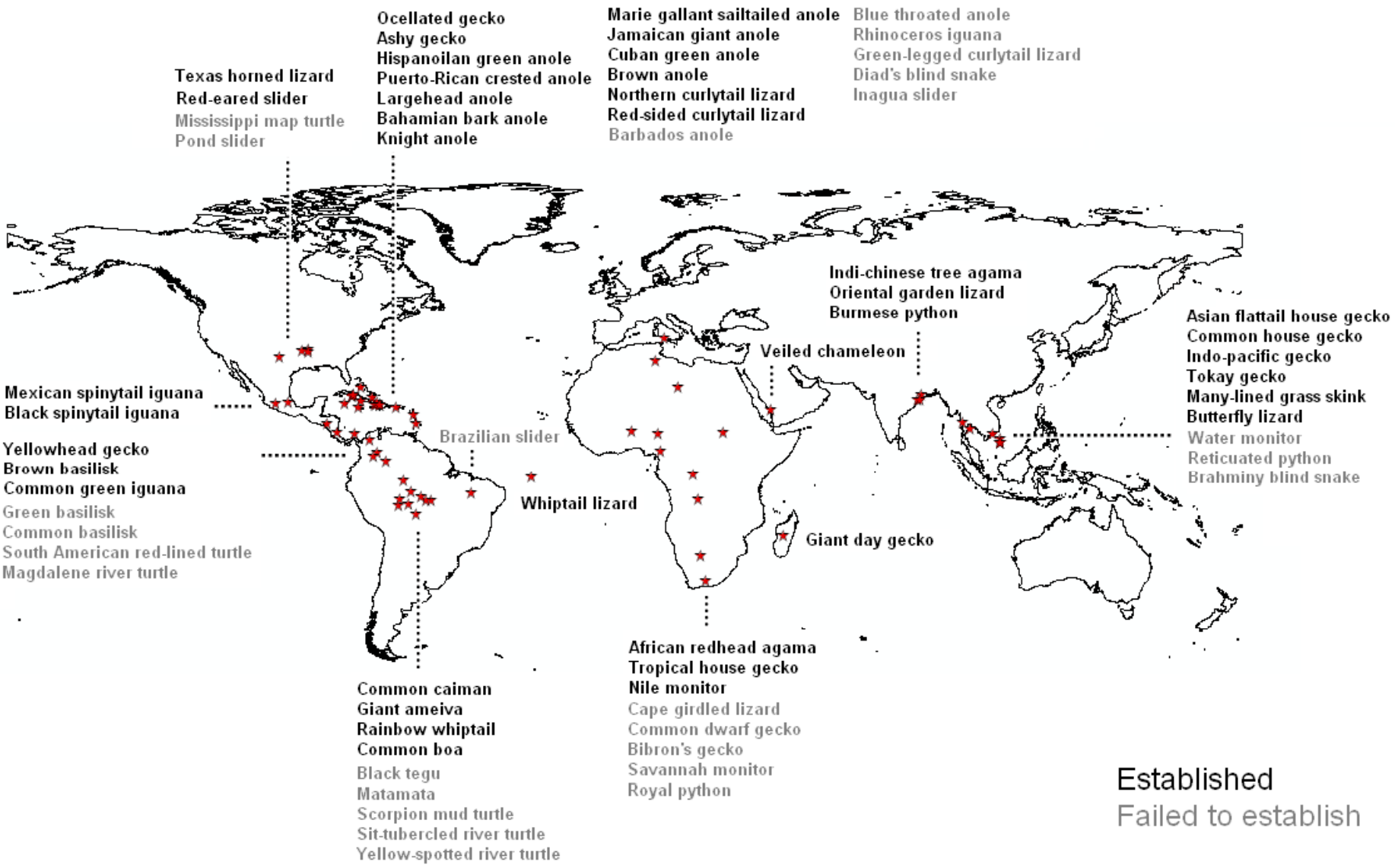




Impact

- Ecological
- Economic
- Social

Exotic reptiles in Florida with known status

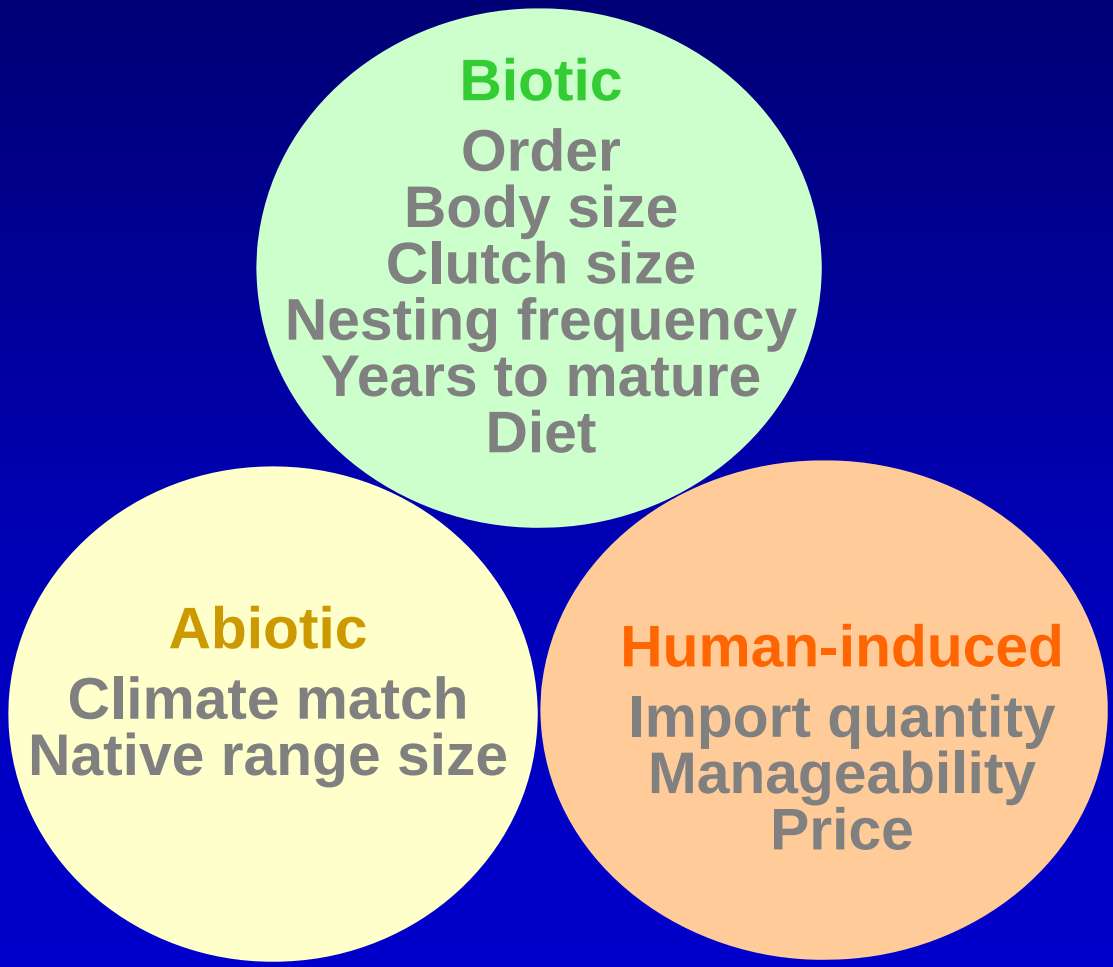


Taxonomic risk assessment: example of exotic reptiles

What are important factors for successful establishment?

Predicting potential invasive species

Factors affect establishment

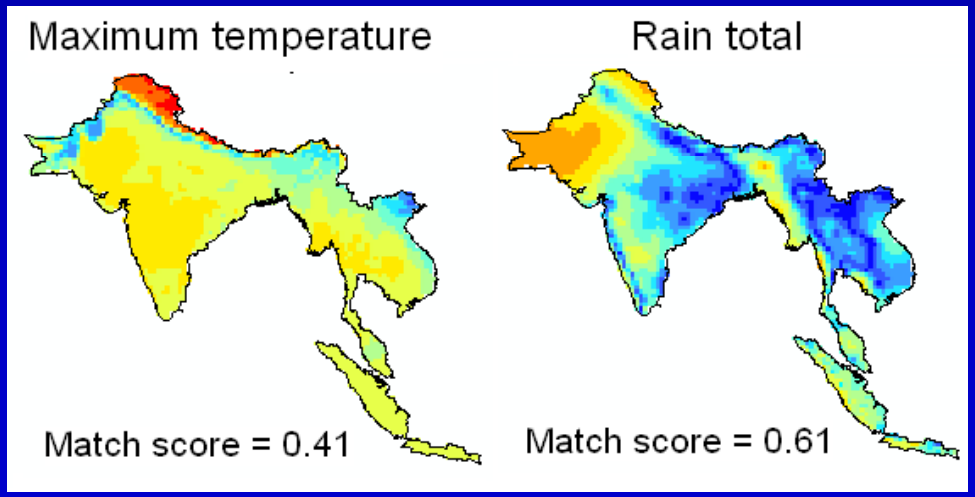


Taxonomic risk assessment: example of exotic reptiles

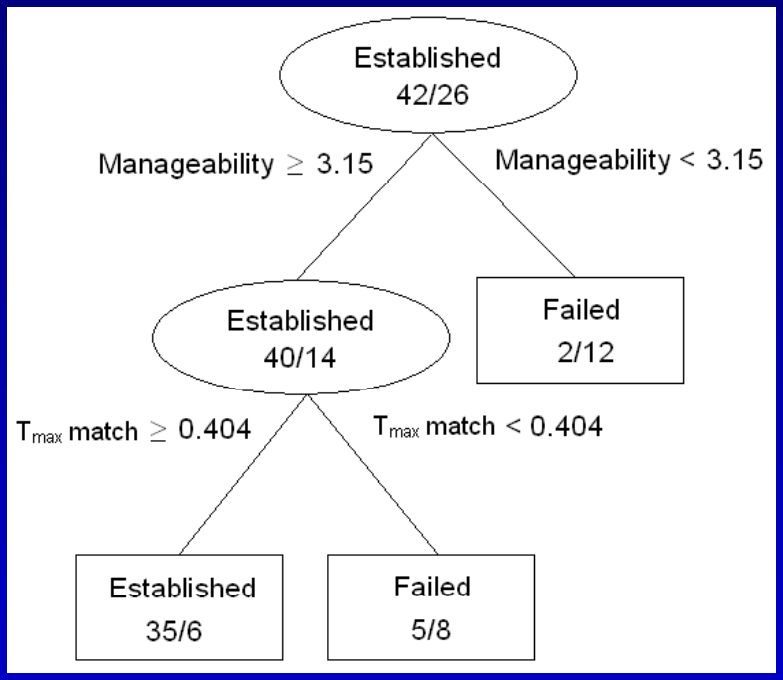
Climate match: Burmese python example

Native range ►

▼Climate match

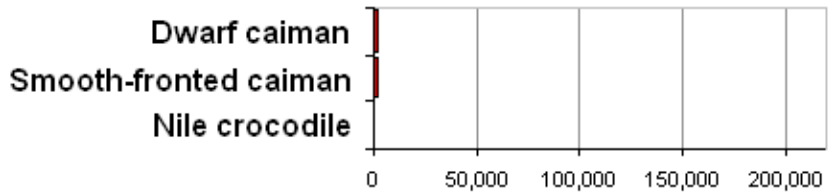


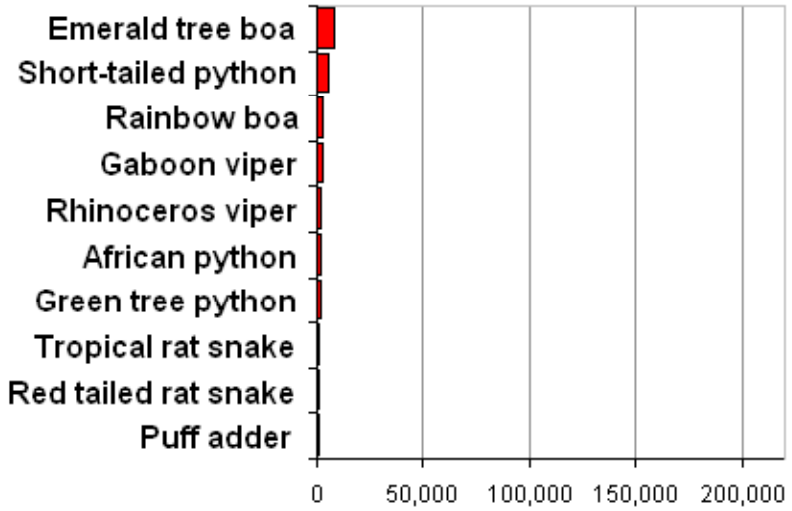
Model: regression tree example

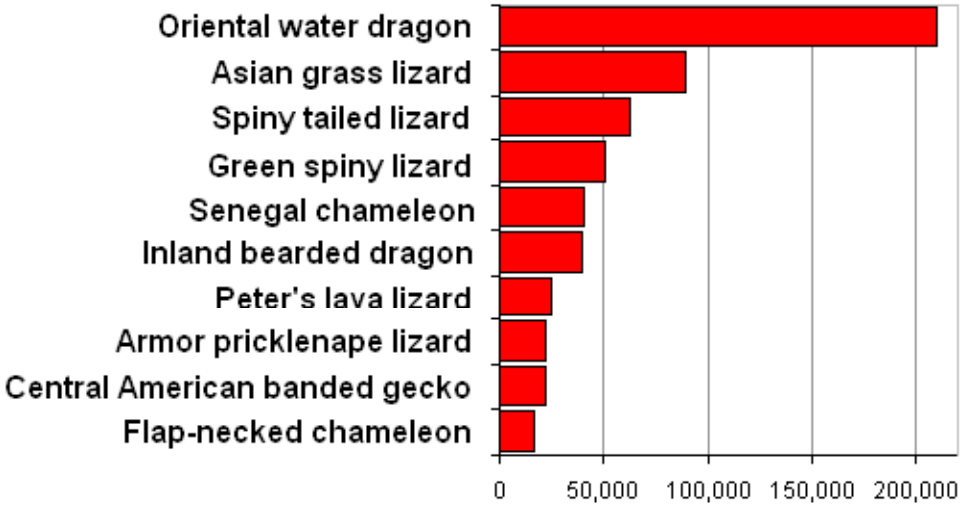


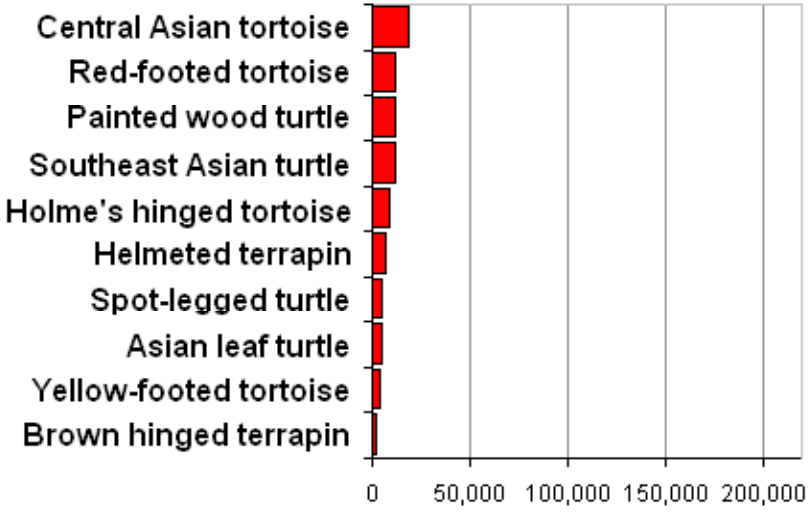
Model selection

- 12 variables
- Variable selection









Frequently imported reptiles through Miami and St. Petersburg ports 2000-2005 (Source: USFWS LEMIS)

Taxonomic risk assessment: example of exotic reptiles

Predicted invasive reptiles and risks if they establish

Common name
Oriental water dragon (lizard)
Asian grass lizard (lizard)
Spiny tail lizard (lizard)
Green spiny lizard (lizard)
Senegal chameleon (lizard)
Peter's lave lizard (lizard)
Central American banded gecko (lizard)
Flap-necked chameleon (lizard)
African python (snake)
Puff adder (snake)

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Reptiles of Concern

Taxonomic risk assessment: example of exotic reptiles

Predicted invasive reptiles and risks if they establish

Common name	Danger to human	Upper predator	Fast spread
Oriental water dragon (lizard)		X	
Asian grass lizard (lizard)			X
Spiny tail lizard (lizard)			
Green spiny lizard (lizard)			
Senegal chameleon (lizard)			X
Peter's lave lizard (lizard)			
Central American banded gecko (lizard)			
Flap-necked chameleon (lizard)			
African python (snake)	X	X	
Puff adder (snake)	X	X	

Taxonomic risk assessment: example of exotic reptiles

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Peter's lave lizard (lizard)			
Central American banded gecko (lizard)			
Flap-necked chameleon (lizard)			
African python (snake)	X	X	
Puff adder (snake)	X	X	

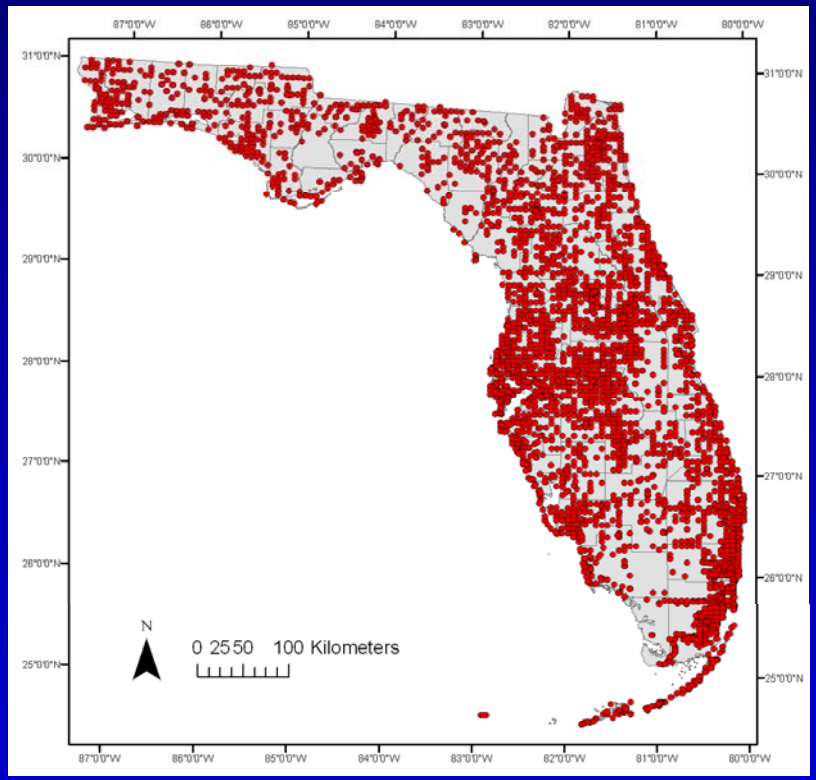
Found breeding in Miami-Dade county

Geographic risk assessment

Where are high risk areas?

- Latitude/longitude
- Land cover type
  - Forest
  - Grassland
  - Cropland
  - Wetland
  - Urban
- Landscape characteristics
  - Diversity
  - Connectivity
- Human population

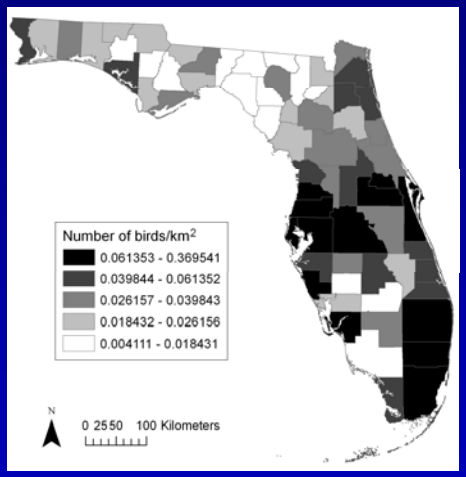
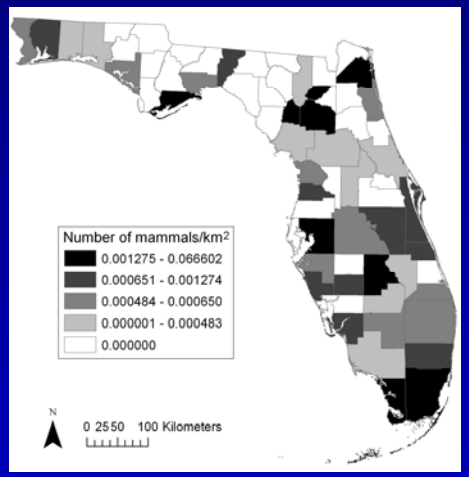
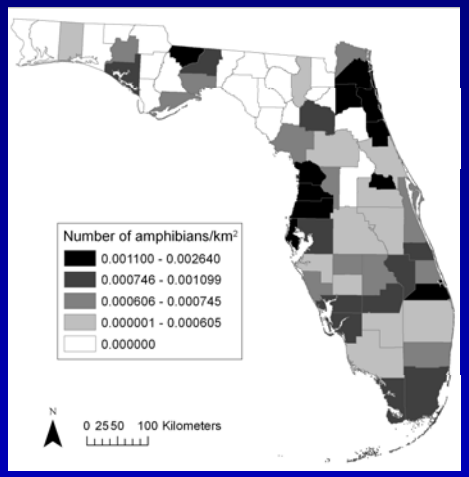
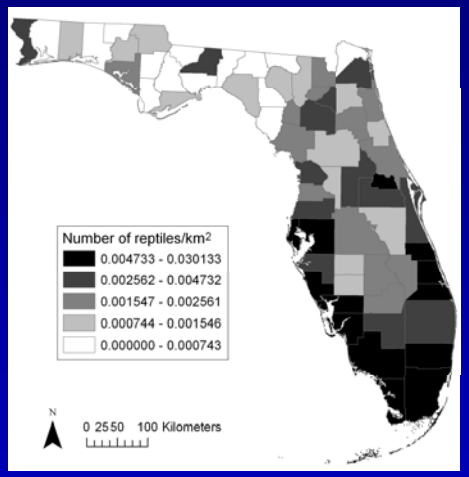
Reported exotic animals
(Source: FFWCC)



7,430 records

Geographic risk assessment

Reported number of exotic animals (Source: FFWCC)

Bird	Mammal	Amphibian	Reptile
			
Population (p<0.001) (+) Connectivity (p=0.05) (-) Diversity (p=0.016) (-) R^2 = 0.89	Population (p=0.003) (-) Forest (p=0.012) (-) Wetland (p=0.008) (+) Cropland (p=0.019) (-) Connectivity (p=0.001) (-) Diversity (p<0.0001) (-) R^2 = 0.63	Latitude (p=0.030) (-) Population (p<0.0001) (+) Connectivity (p=0.067) (-) R^2 = 0.32	Latitude (p<0.001) (-) Population (p=0.004) (+) Wetland (p<0.0001) (+) Urban (p=0.024) (-) R^2 = 0.68

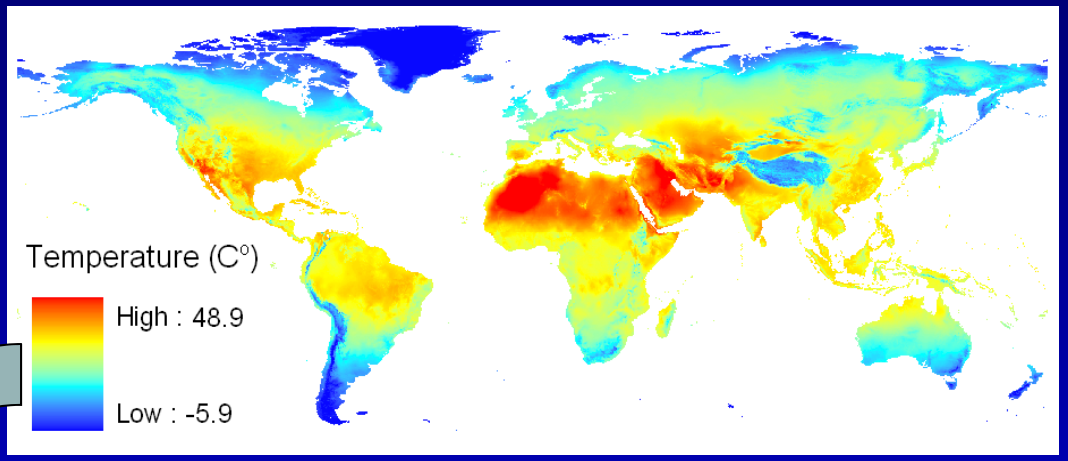
Future study: climate change and invasive species

Potential impacts of climate change

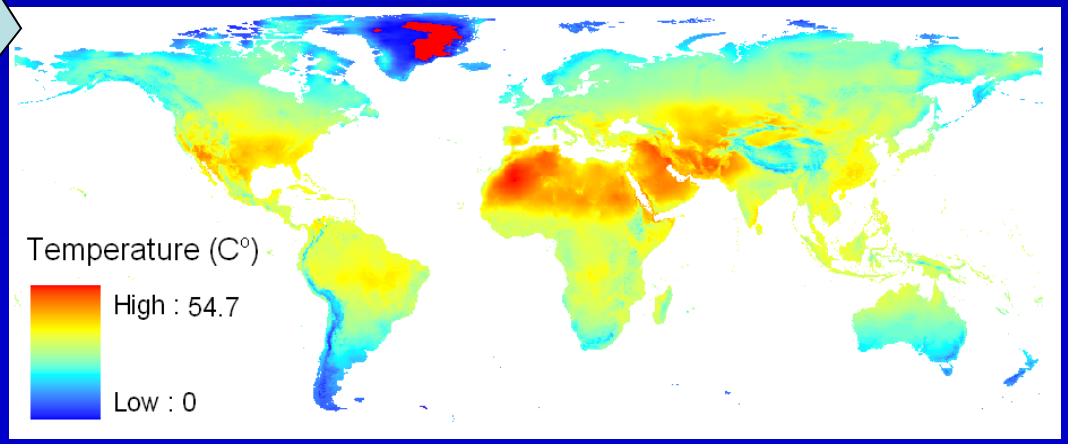
- Land cover change
- Range shift of natives
- Establishment of exotics from different climate regime/habitat

Maximum temperature

Current



2080 (CCMA model)

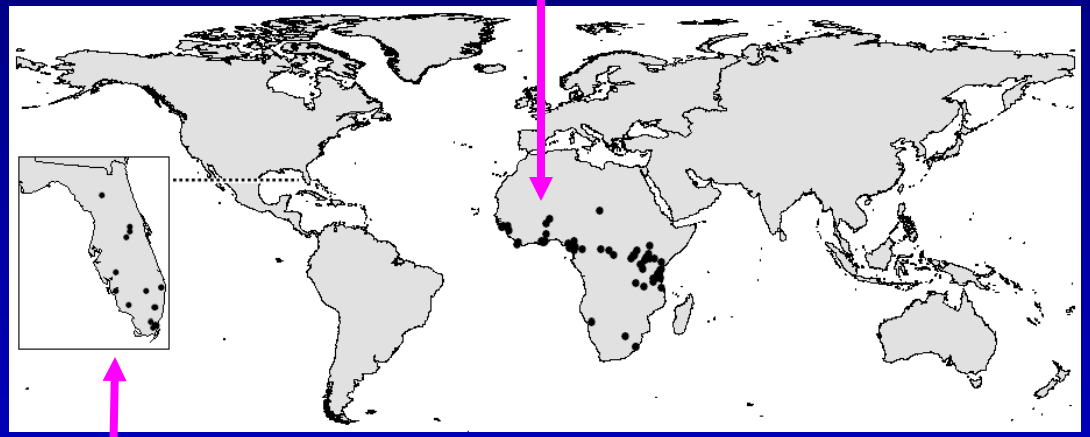


Source: Worldclim

Future study: climate change and invasive species

Example of exploratory analysis: Nile monitor (*Varanus niloticus*)

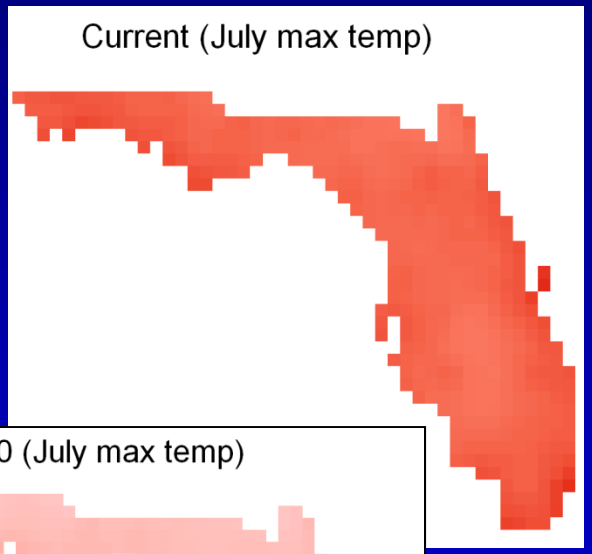
Native locations

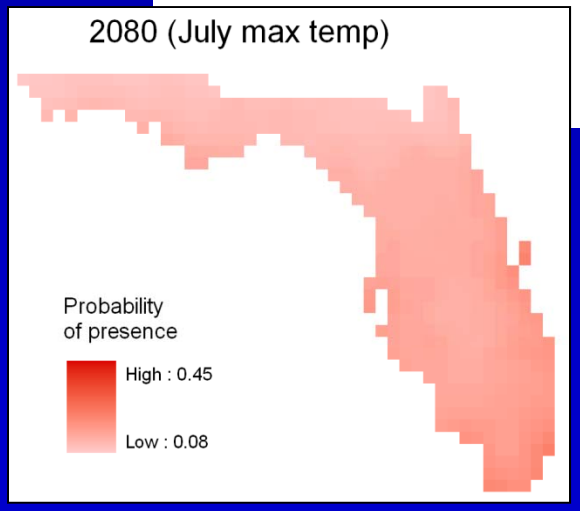


Source: FFWCC, BGMI

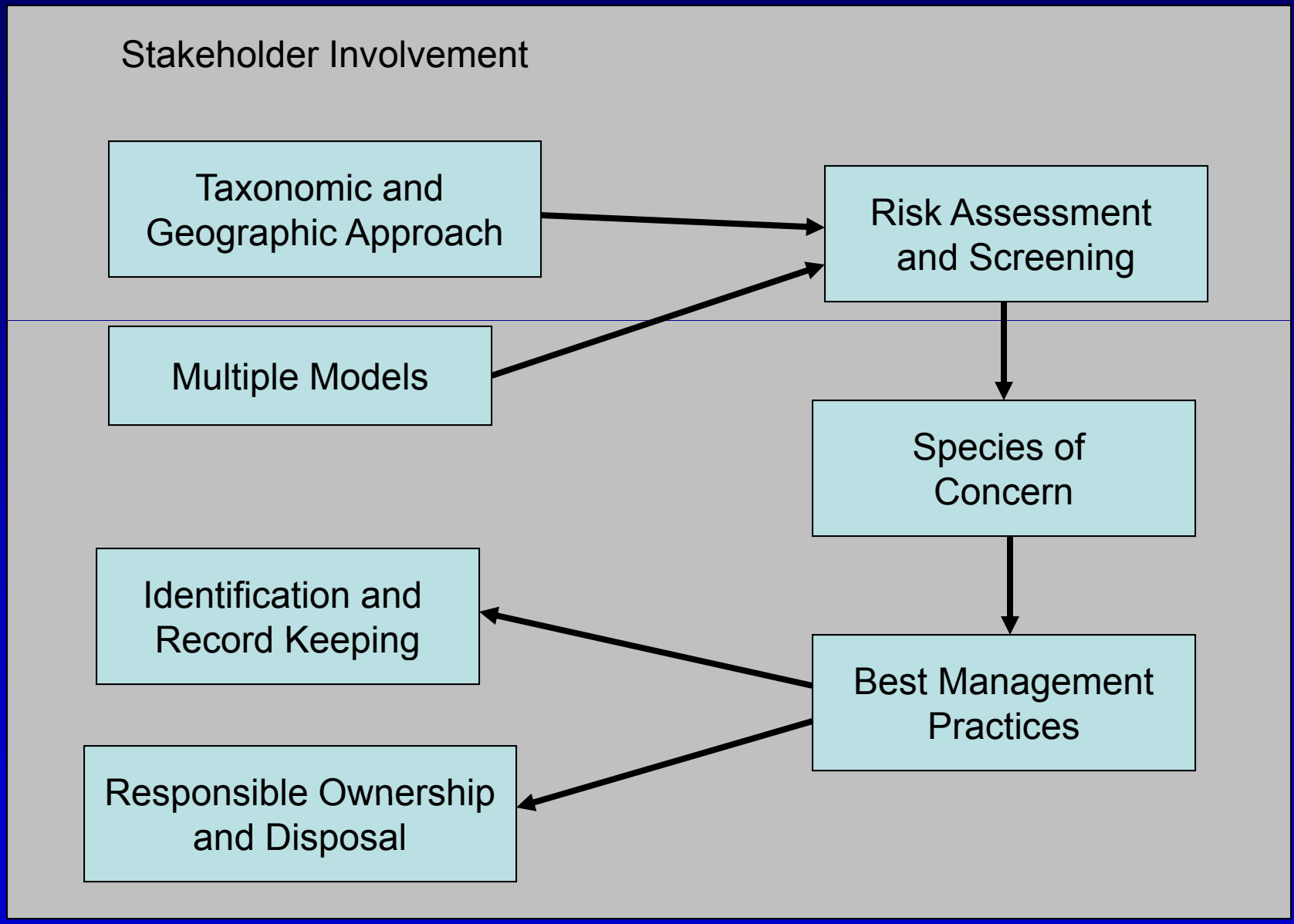
Observed locations in Florida

Predicted probability of presence using climate envelope model (Maxent)





Synthesis and management applications



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- Technical support
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  - Kevin Enge (FFWCC)
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  - Pam Fuller (USGS)
  - Larry Conner (FFWCC)
  - Yesenia Escribano (UF)
  - James Watling (UF)

Reference

Fujisaki, I., K.M. Hart, F.J. Mazzotti, K.G. Rice, S. Snow, M. Rochford. 2010. Risk assessment of potential invasiveness of exotic reptiles imported to south Florida. *Biological Invasions*.