



DoD Environmental Planning and Conservation Webinar Series



Species Habitat Models to Guide Stewardship of DoD Mission Priority Species

Dr. Max Tarjan, NatureServe

June 13, 2023

Please mute your phones




Audio Dial-In: 410-874-6749

Participant Code: 821-835-315#

www.denix.osd.mil/nr/

Twitter: @DoDNatRes



1974-1989
Heritage Networks

NatureServe



What is it?



How is it doing?



What can we do?

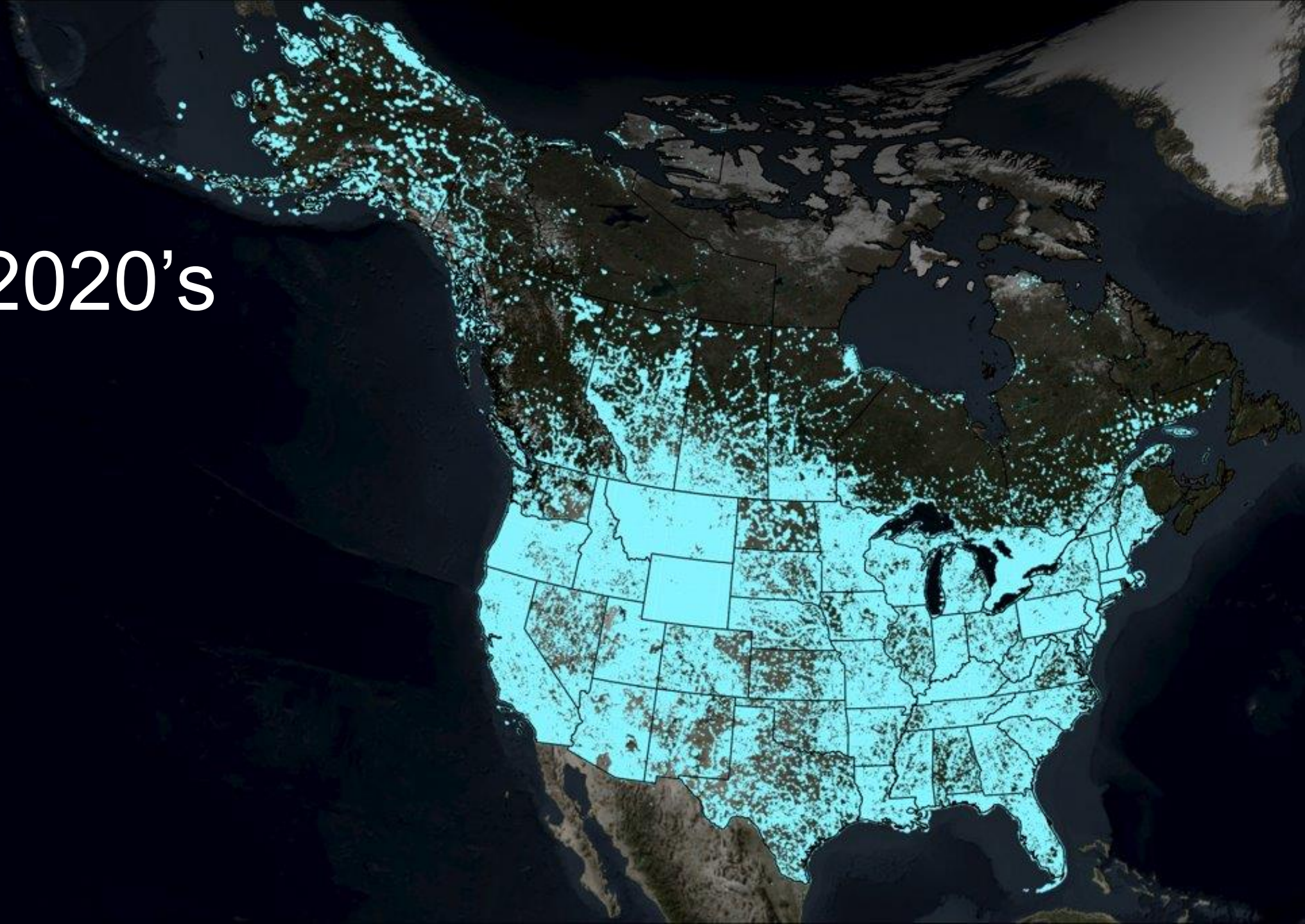


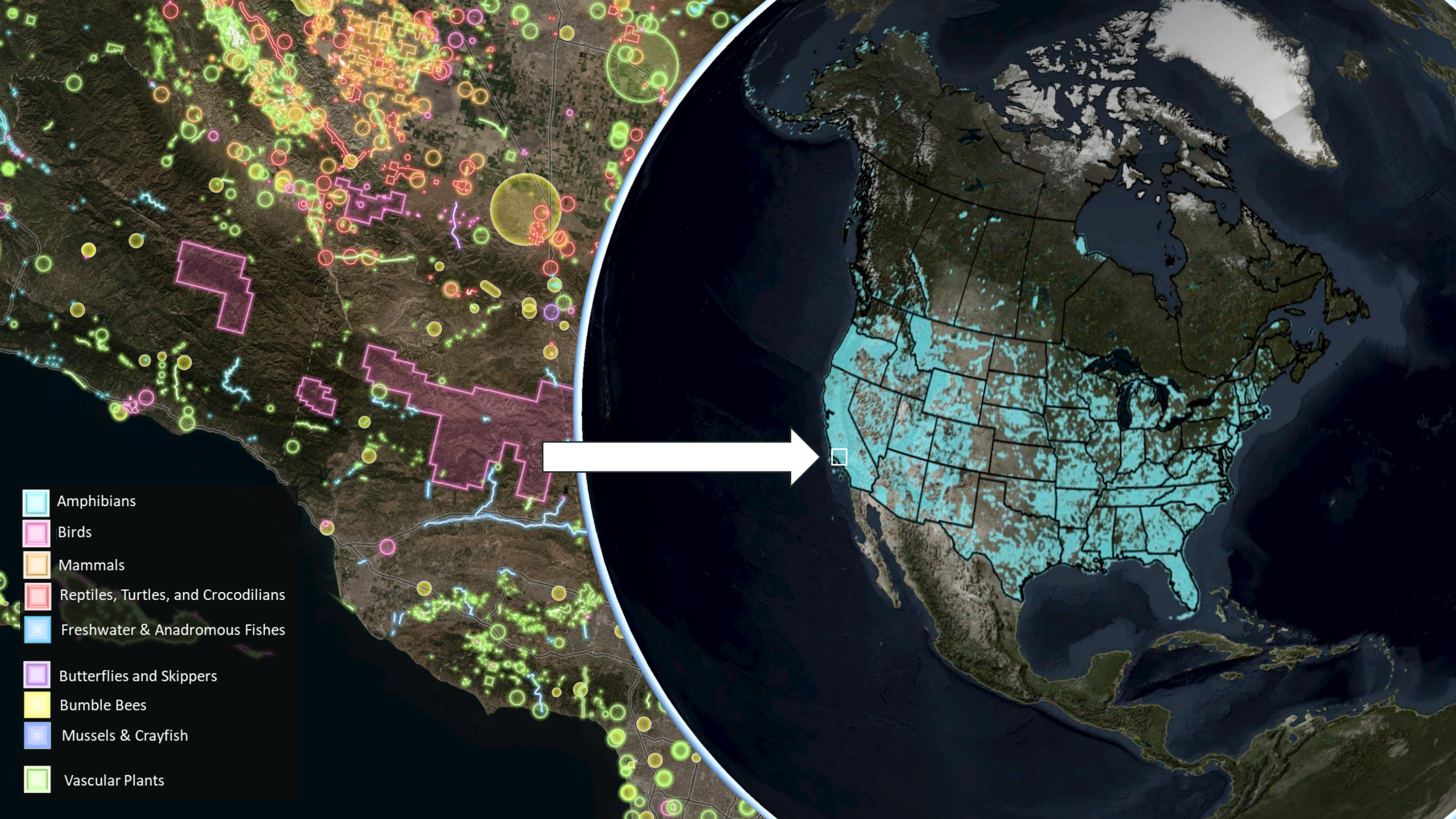
Where is it?



How is it changing?

2020's





- Amphibians
- Birds
- Mammals
- Reptiles, Turtles, and Crocodilians
- Freshwater & Anadromous Fishes
- Butterflies and Skippers
- Bumble Bees
- Mussels & Crayfish
- Vascular Plants

Commonly Used Species Distribution Data Sources

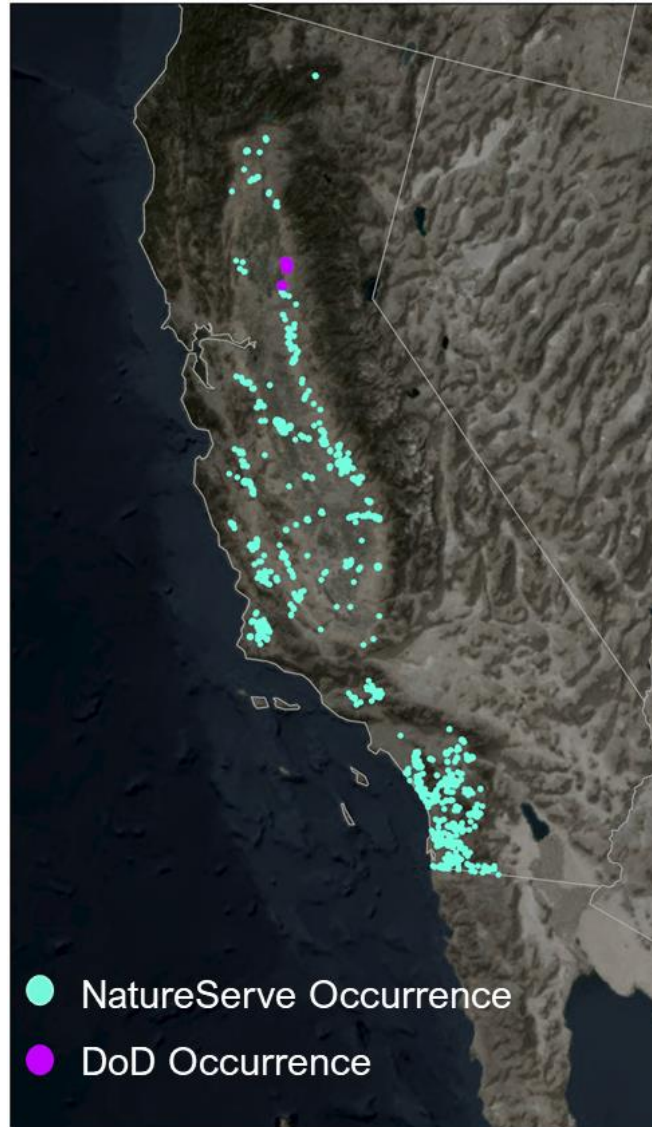
Documented Occurrences
Underestimate True Distribution

Coarse Range Maps
Overestimate True Distribution

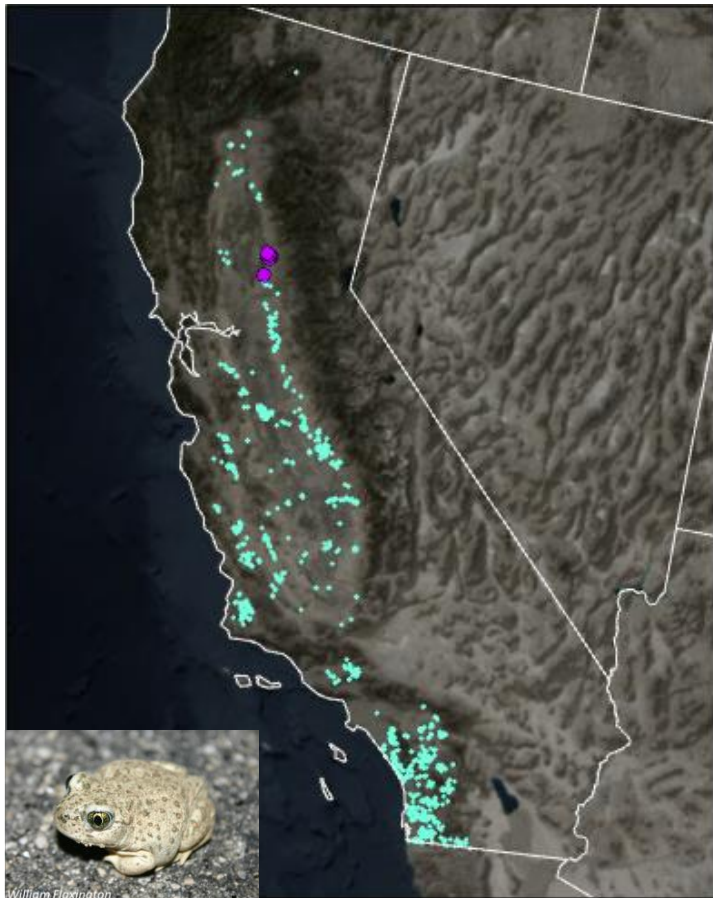
Western Spadefoot *Spea hammondi*

G2
Imperiled

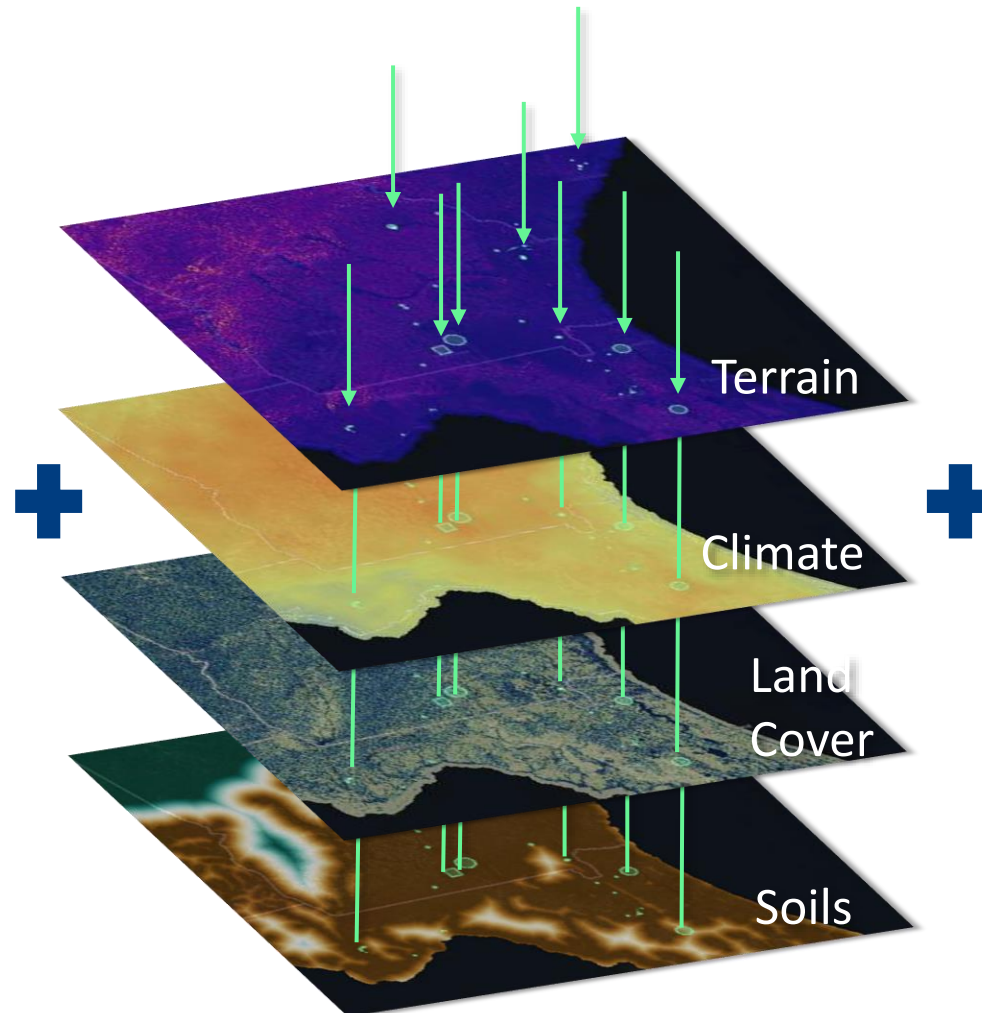
ESA Listing Status:
Under Review



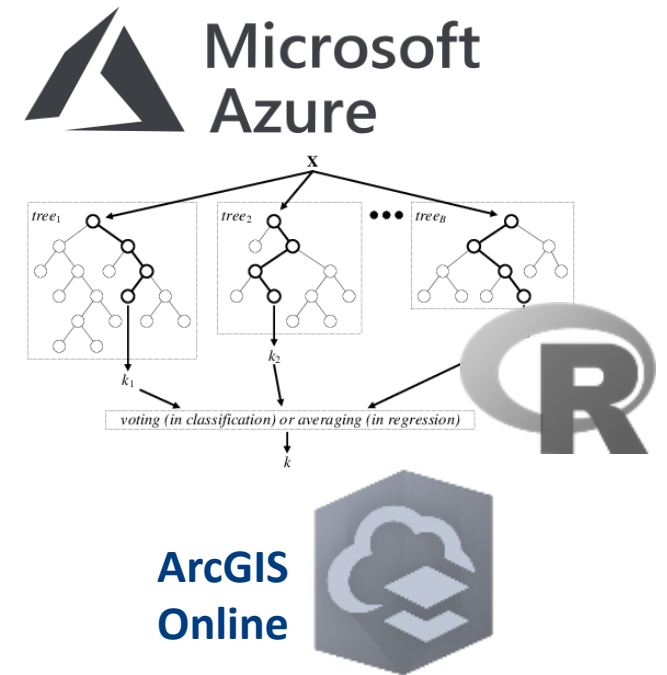
Cutting-edge predictive algorithms



Species Occurrence Data

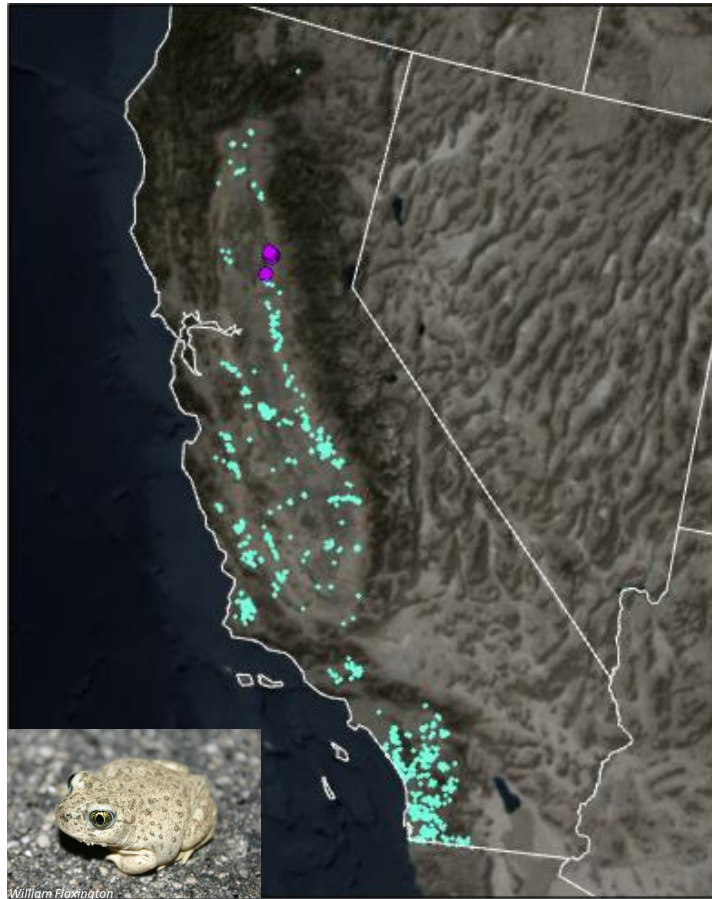


Environmental Predictor Library

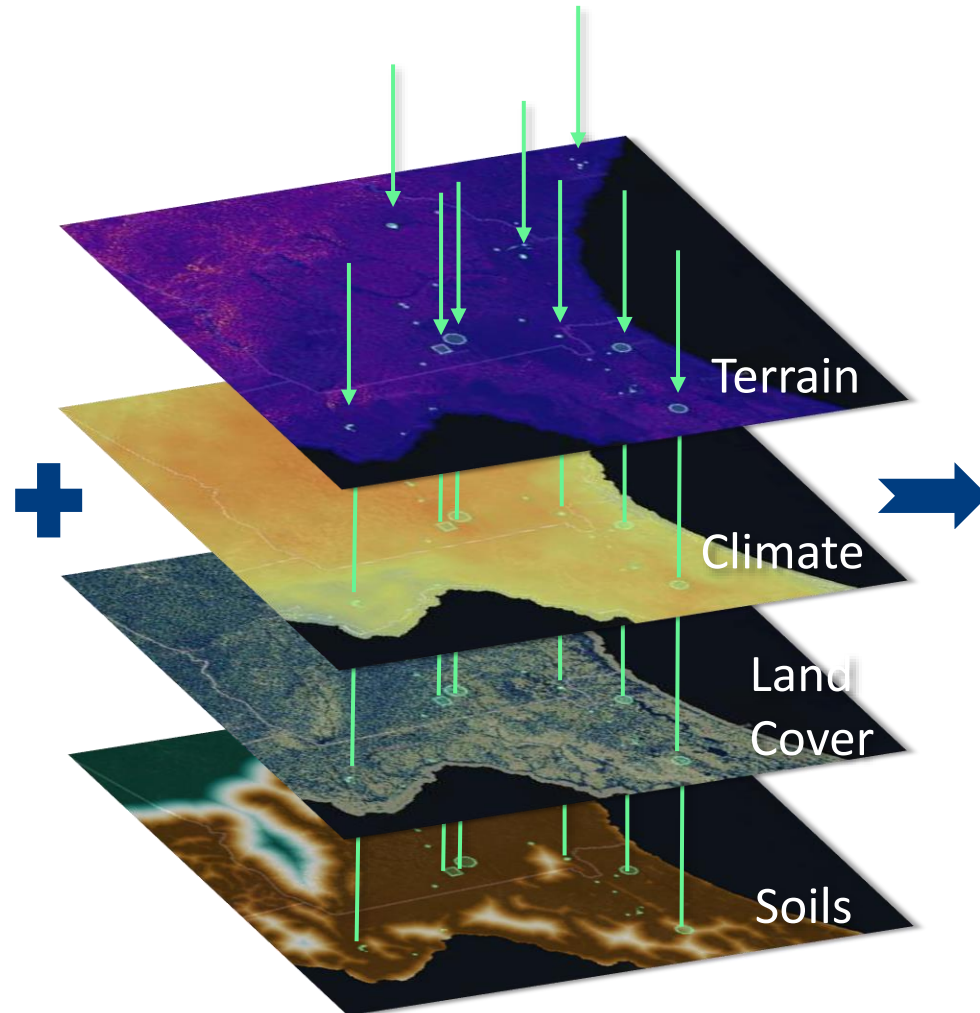


Machine Learning

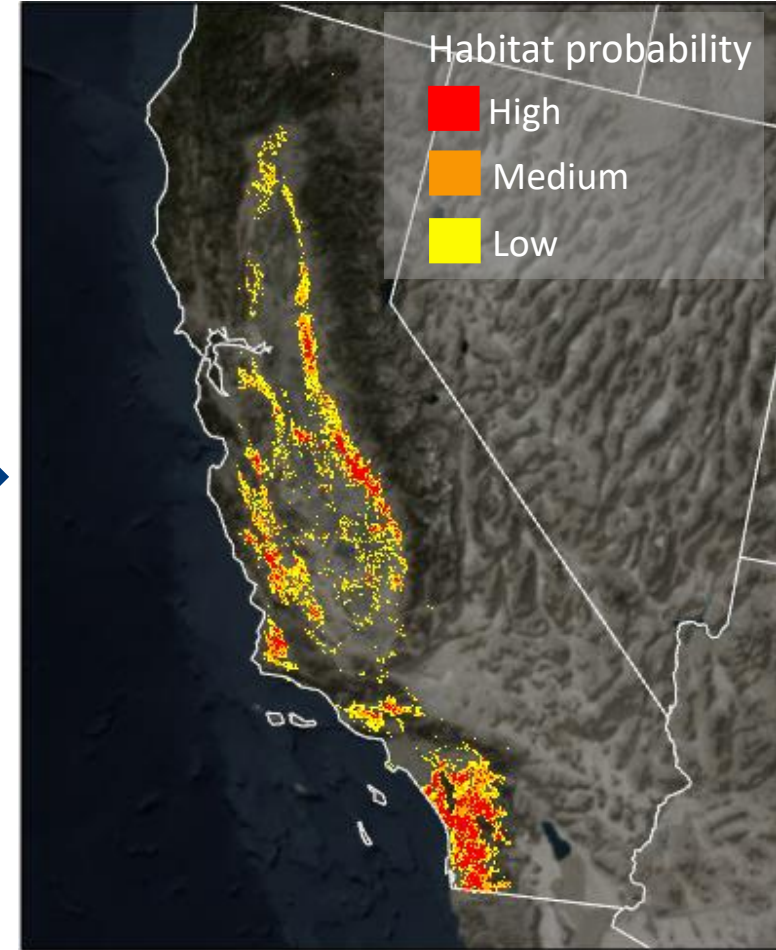
Cutting-edge predictive algorithms



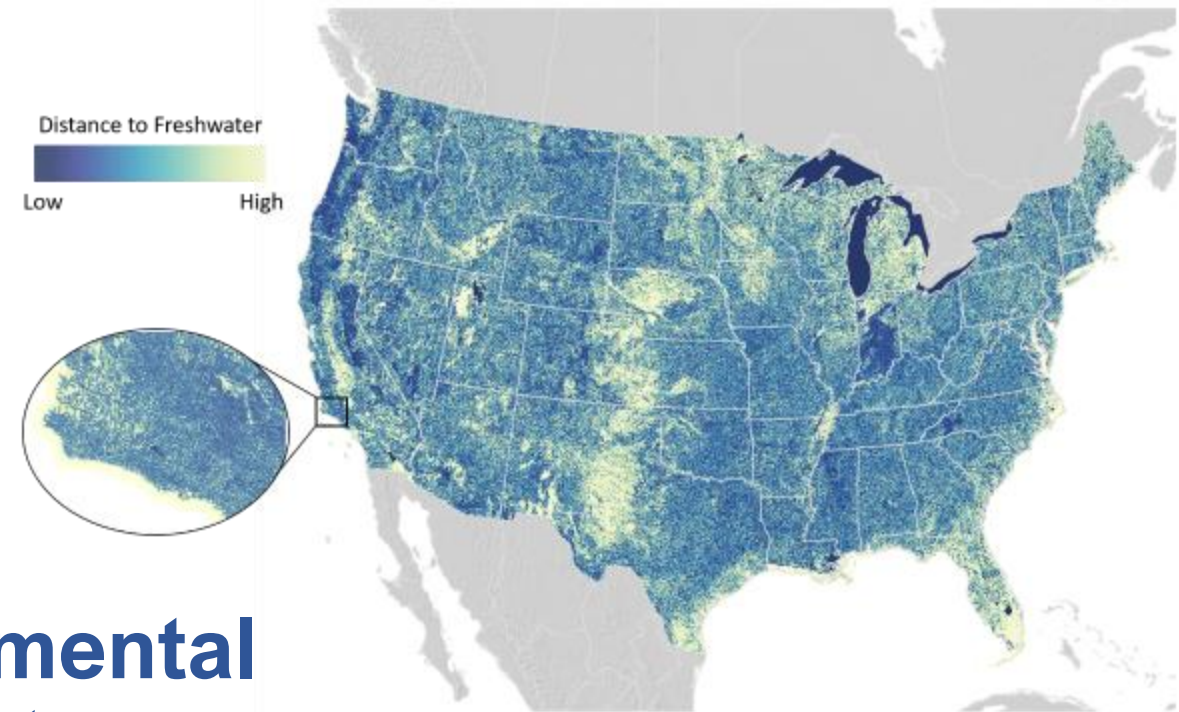
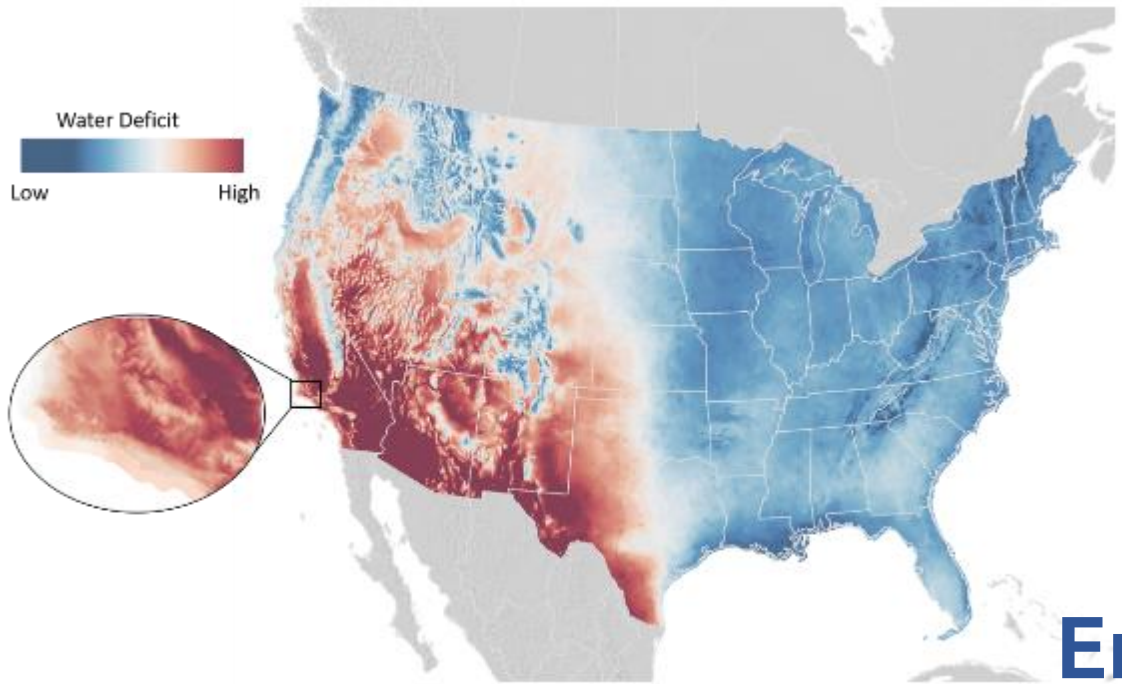
Species
Occurrence Data



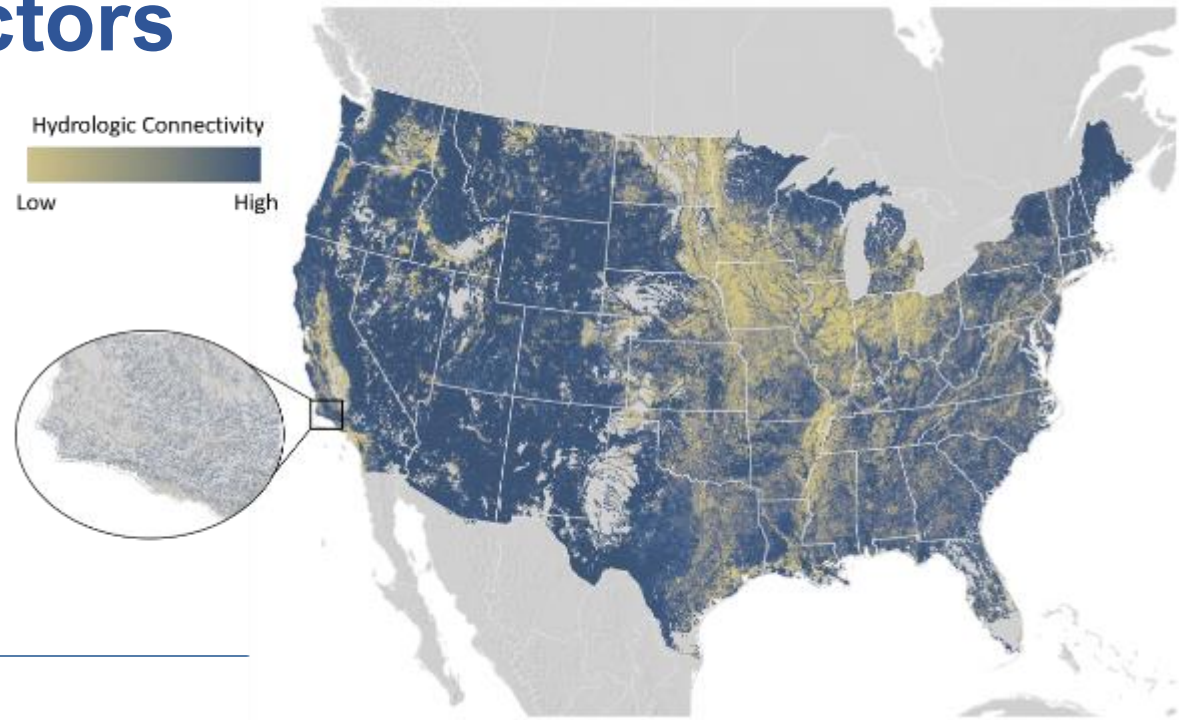
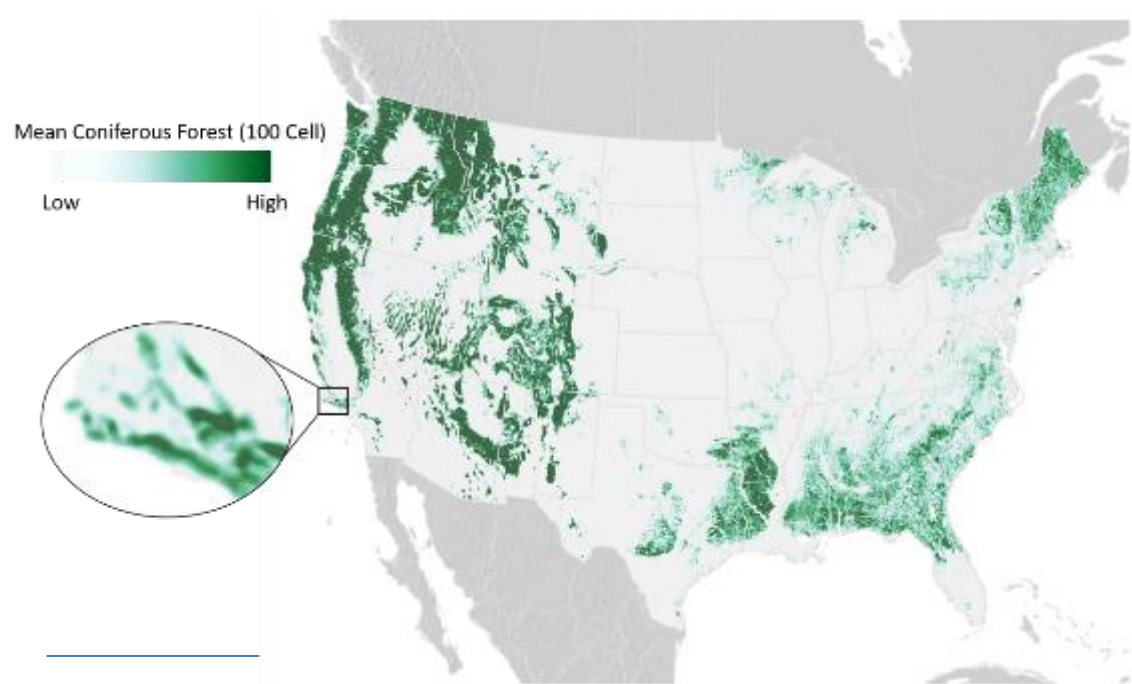
Environmental
Predictor Library



Machine
Learning



Environmental Predictors



NatureServe's Collaborative Species Habitat Modeling Process

Natural Heritage Program Engagement

Model Building

Model Review

Model Delivery

Model Application

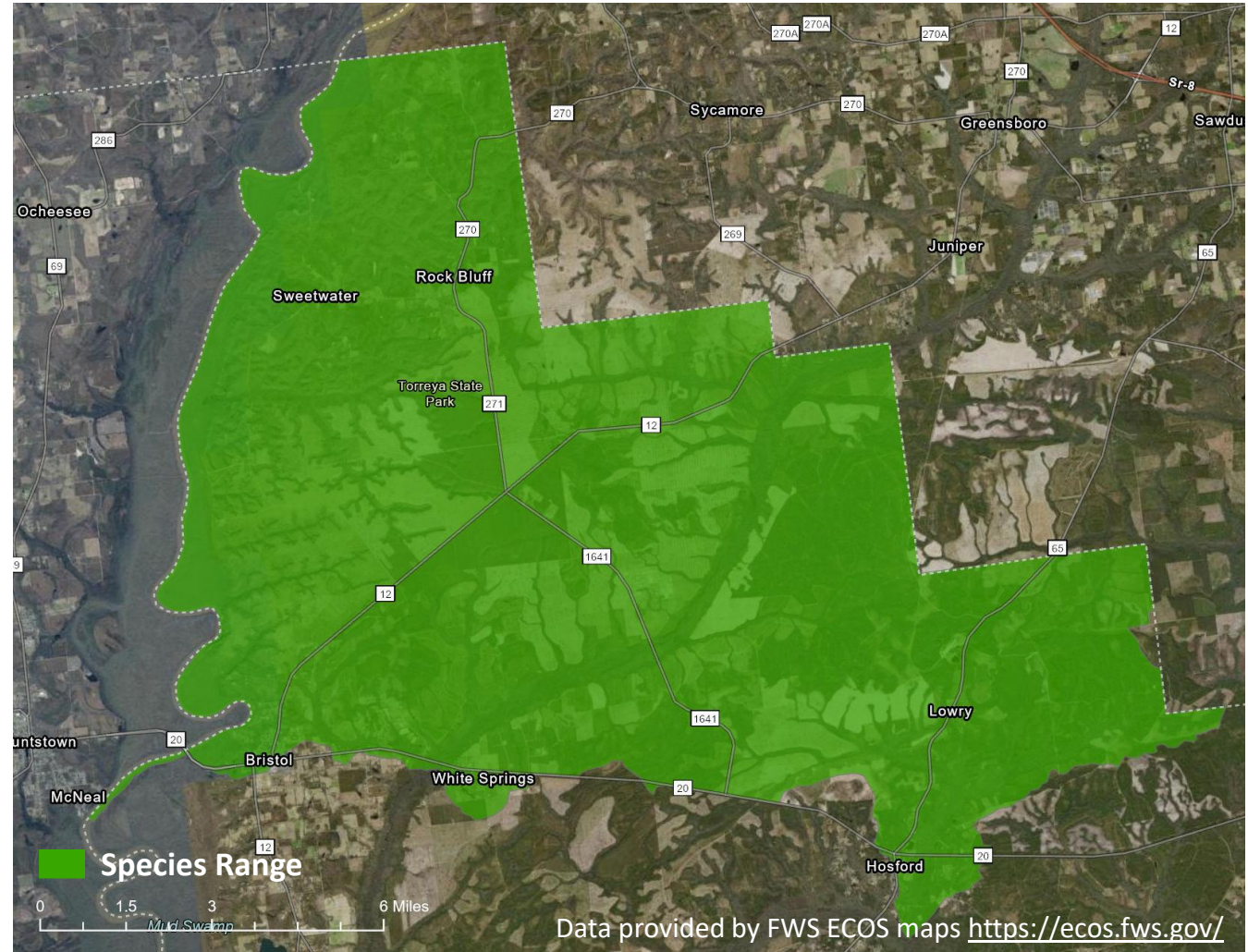
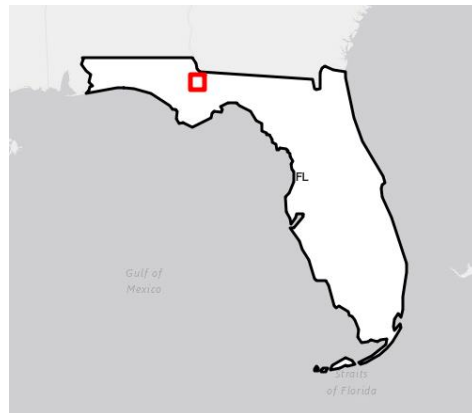
Partner Engagement

Apalachicola False Rosemary

Conradina glabra

G1
Critically Imperiled

ESA Listing Status:
Endangered





Model Reviewer Sign Up Form

About you

First name:

Last name:

Email address:

Affiliation:

Select species to review

Filter by taxon

Filter by state

Crayfishes

AR

Click on all species you wish to review by selecting one or more rows:

Taxon	Scientific Name	Common Name	Rounded G Rank	States Intersected	Client
Crayfishes	Fallicambarus harpi	Ouachita Burrowing Crayfish	G2	AR	USFWS
Crayfishes	Procambarus reimeri	Irons Fork Burrowing Crayfish	G1	AR	USFWS

Sign up for the next available trainings

We will be holding regular 30-minute trainings to help you gain familiarity with the Model Reviewer Tool; find the next trainings below

None



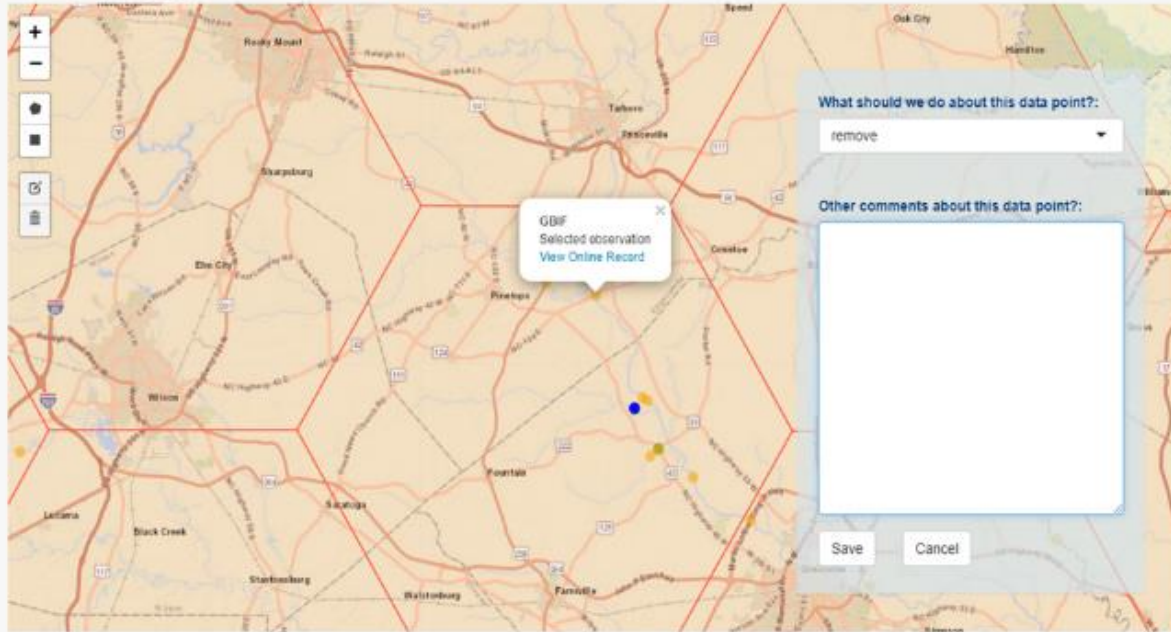
NATURESERVE Model Inputs Review Tool

3. Review input species occurrence data

Reliable species occurrence data are key to building robust models. More data are not necessarily better if they are subject to high spatial, temporal, or taxonomic uncertainty. Help us by vetting species occurrence data for this species from a number of sources.

Instructions: You can provide feedback on potential input species occurrence data displayed by navigating the map below and clicking on the relevant polygon or point. A window will pop up to allow you to provide detailed comments on the clicked shape or point, including whether it should be removed, included, or double-checked. For some shapes or points, such as ones corresponding to observations from iNaturalist, GBIF, or HerpMapper, a hyperlink may allow you to navigate to the webpage for the underlying observation to assess additional details about the observation. In addition, you can use the two shape icons on the left of the map window (the pentagon and the square below the zoom buttons) to provide comments on broader geographical areas, such as areas for which you know more data should be available or areas where all occurrence data are unlikely to represent the species' true habitat.

NOTE: When commenting on data points from sources other than NatureServe's Biodiversity Location Data (e.g. iNaturalist or GBIF), please pay particular attention on whether the observation accurately (i) reflects the focal species itself and (ii) reflects suitable habitat for the focal species. You can navigate to the underlying observation webpage using the hyperlink that pops up on the map upon clicking on a relevant shape or point. If you are drawing shapes, do not worry about drawing them exactly, and err on the side of drawing more inclusive than less inclusive shapes. Please add any important geographical details in the Comments box.



4. Select key environmental predictors

Identifying the key environmental predictors driving the survival and growth of a species is key to biologically accurate models which go beyond statistical exercises. Help us by sharing your knowledge of the most important environmental drivers for this species.

Select the key variables you would use as predictors to model this species.

Drag variables from this long list...

- Elevation
- Slope
- Slope curvature
- Elevation variation
- Slope direction
- Distance to ocean
- Topographic moisture
- Canopy cover
- Impervious surface
- Coniferous forest cover
- Open cover
- Shrub cover
- Water cover
- Woody wetland cover
- Distance to wetland
- Soil type
- Beach dune coastal grassland cover

...to the subset of key predictors for this species (in order of importance from top to bottom)

- Solar radiation
- Deciduous forest cover
- Distance to freshwater

Drag variables from this long list...

Canopy cover



Climatic Water Deficit

Coniferous forest cover

Deciduous forest cover

Distance to freshwater

Distance to wetland

Elevation

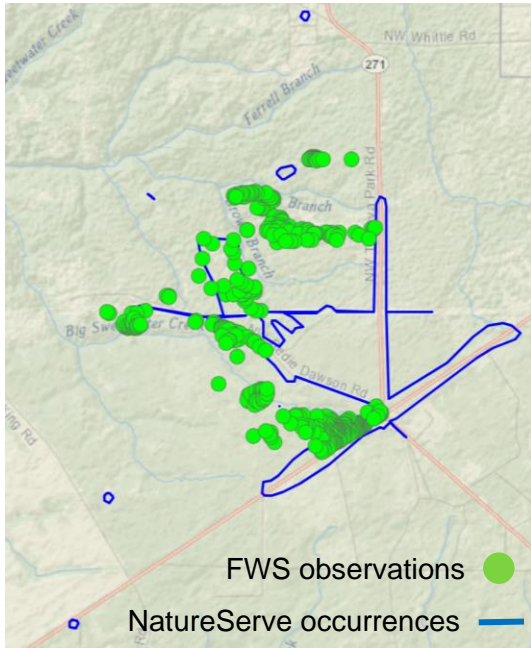
Elevation variation

Growing Degree Days

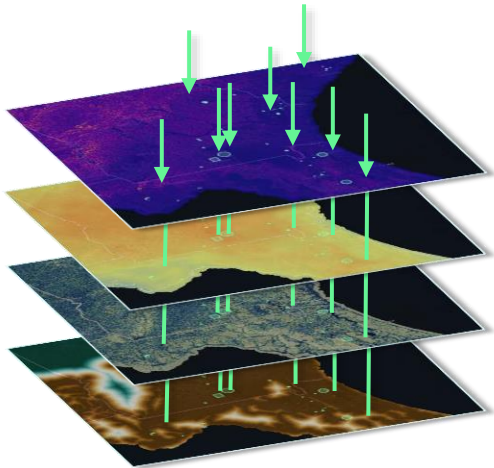
Impervious surface

...to the subset of key predictors for this species (in order of importance from top to bottom)

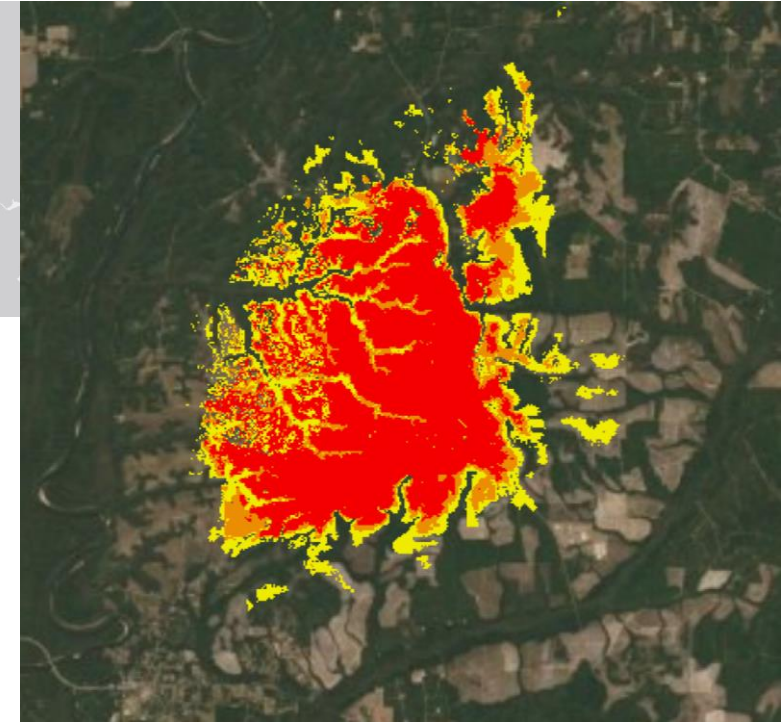
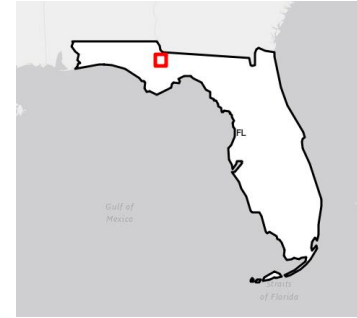
Species Occurrence Data



Environmental Predictors



Modeling Engine



Predicted habitat probability

- High
- Medium
- Low

NATURESERVE Model Outputs Review Tool Current Version Revision History

Apalachicola False Rosemary (*Conradina glabra*) View model details

Species Occurrence Data
Model Extent

- Esri World Street Map
- Esri World Imagery
- Open Street Map
- Stamen Terrain
- Habitat probability
- Model extent
- NatureServe Element Occurrences
- Species observations

1. Adjust habitat probability thresholds

Low threshold
0 1 Reset

Low threshold comment:

Medium threshold
0 1 Reset

Medium threshold comment:

High threshold
0 1 Reset

High threshold comment:

Next step

NATURESERVE Model Outputs Review Tool Current Version Revision History

Apalachicola False Rosemary (*Conradina glabra*) View model details

Map Legend:

- Species Occurrence Data
- Model Extent
- Esri World Street Map
- Esri World Imagery
- Open Street Map
- Stamen Terrain
- Habitat probability
- Model extent
- NatureServe Element Occurrences
- Species observations

3. Review Environmental Predictors

Predictor	Importance
Precipitation of Driest Quarter	High
Elevation	High
Dist to Carbonate Residual Material	Medium-High
Precipitation of Wettest Quarter	Medium-High
Dist to Non-Carbonate Residual Material	Medium
Coniferous forest cover 100-cell mean	Low-Medium
Dist to Peat and Muck	Low-Medium

Comments on predictors:

Previous step Next step

NATURESERVE Model Outputs Review Tool Current Version Revision History

Apalachicola False Rosemary (*Conradina glabra*) View model details

- Species Occurrence Data
- Model Extent

- Esri World Street Map
- Esri World Imagery
- Open Street Map
- Stamen Terrain

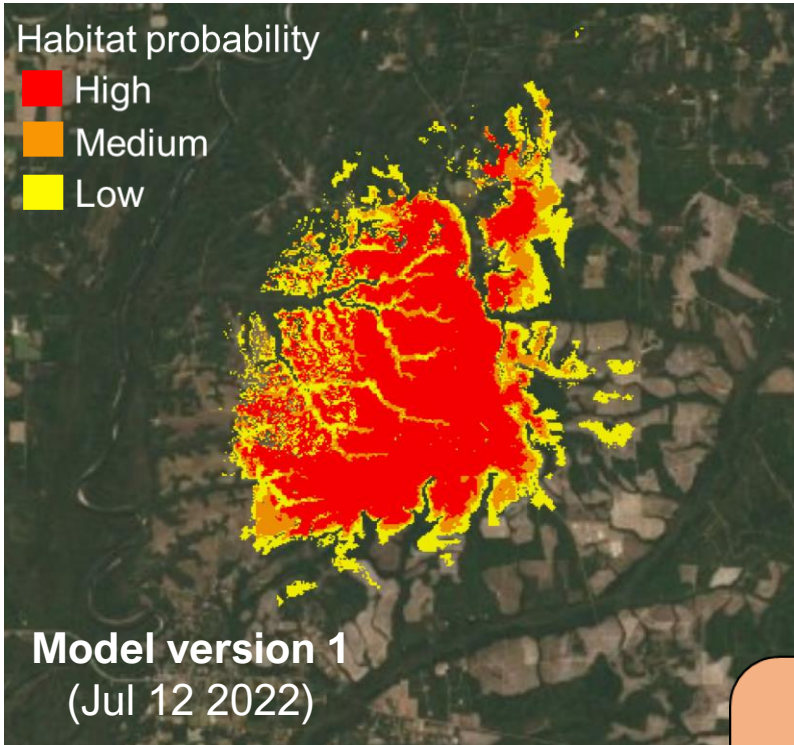
- Habitat probability
- Model extent
- NatureServe Element Occurrences
- Species observations

4. Rate Model and Submit

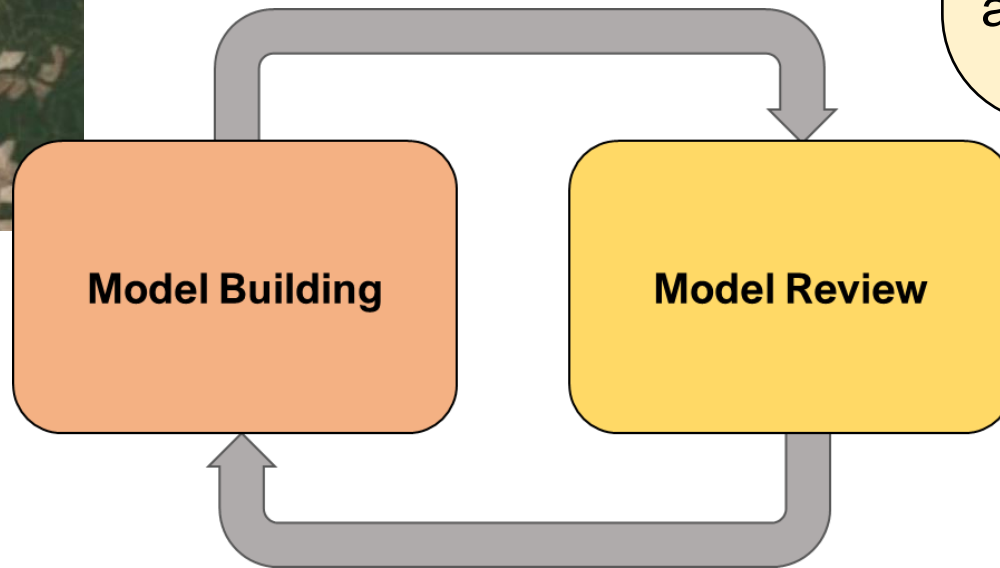
Model rating: ★★★★★

Rating comments:

Previous step Submit



Model Cycle 1



“I think this model does fairly well at predicting suitable habitat within a reasonable range for the species [...]. But I would be interested to see what it does in the HUC to the north I indicated in the map should be added to the extent.”

Reviewer 2

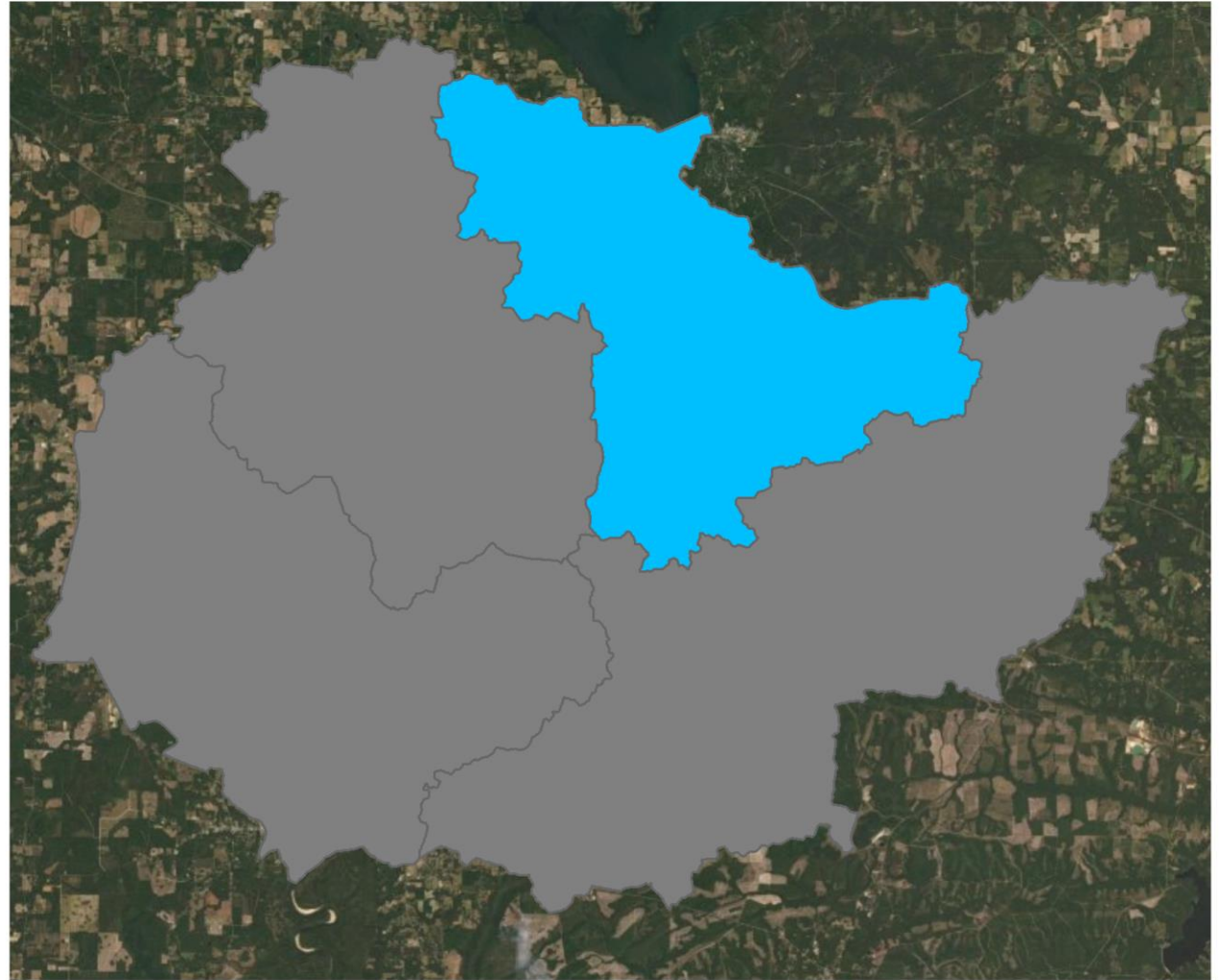
Model rating



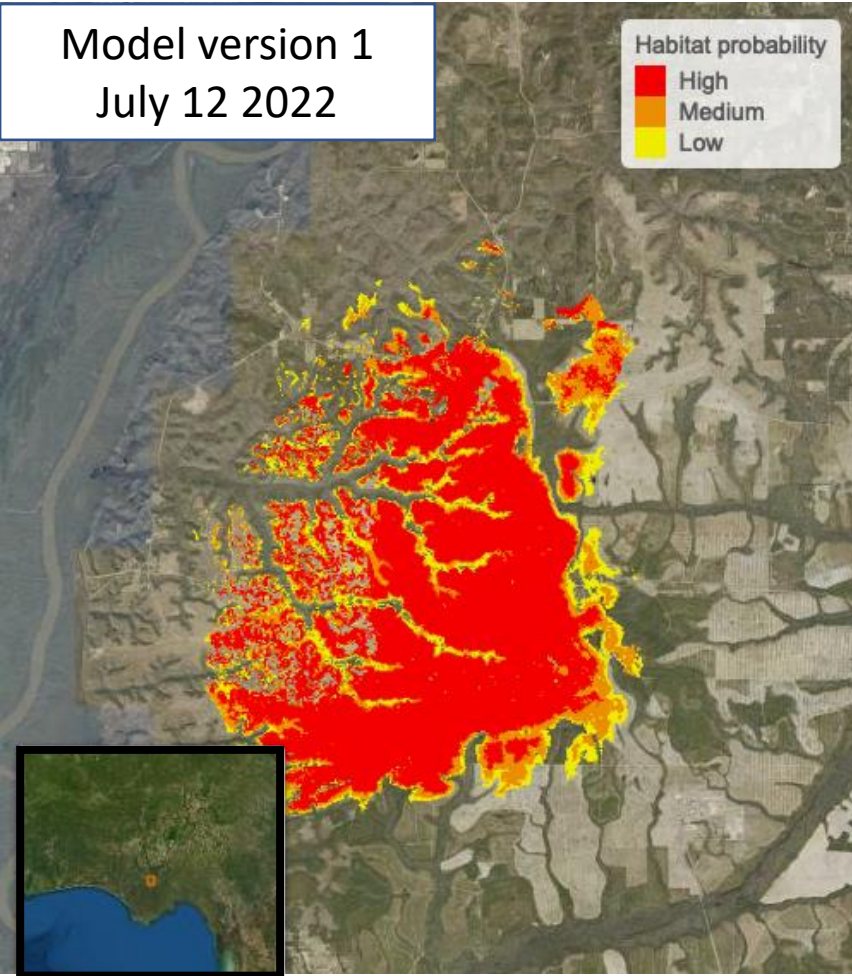
Model Revision 1

Reviewer 2: “But I would be interested to see what it does in the HUC to the north I indicated in the map should be added to the extent.”

- Areas kept from previous model extent
- Areas added to previous model extent
- Areas removed from previous model extent



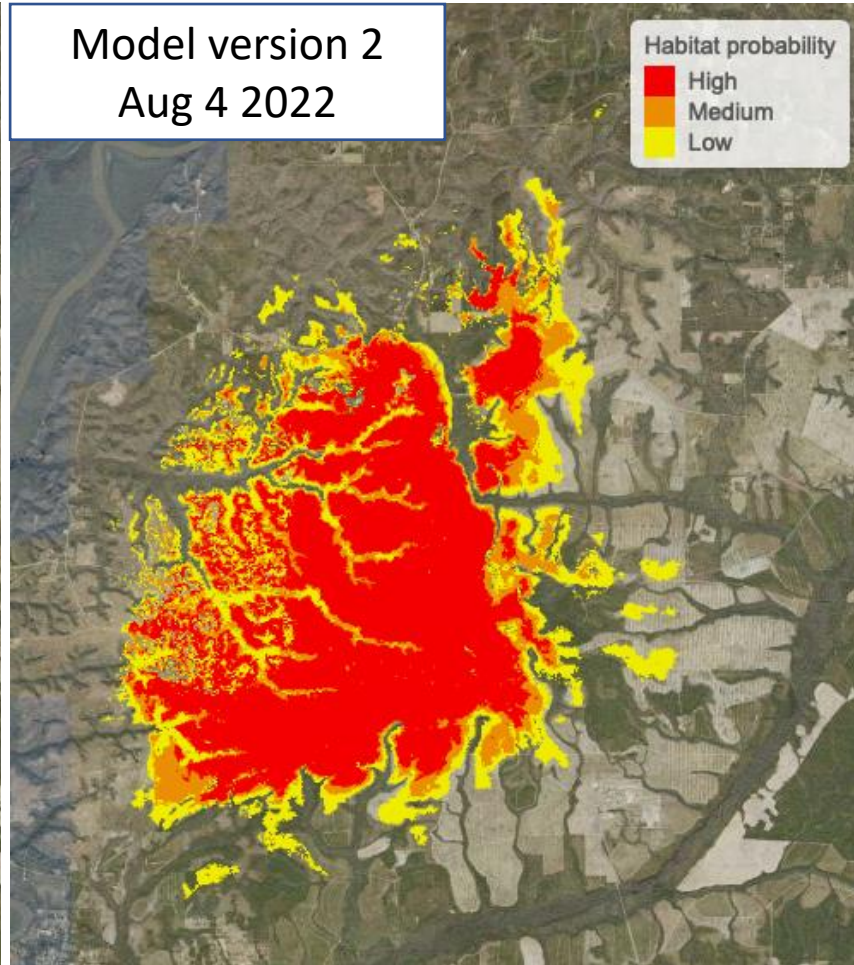
Model version 1
July 12 2022



Model rating



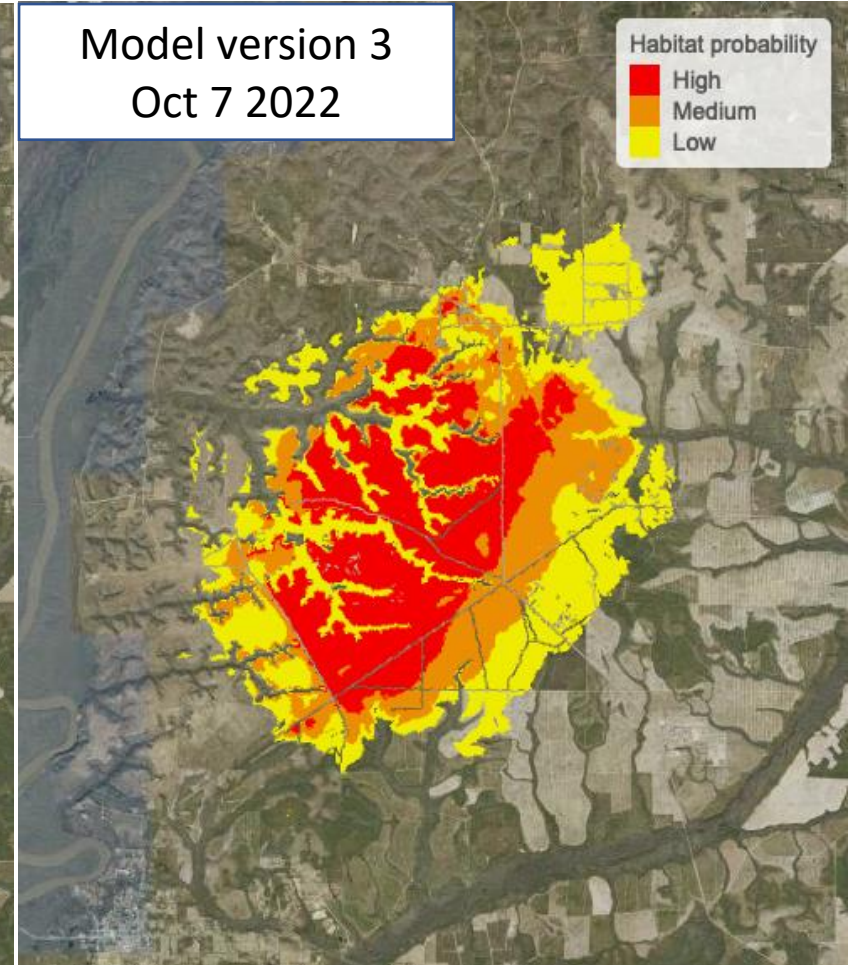
Model version 2
Aug 4 2022



Model rating



Model version 3
Oct 7 2022



Model rating



Integrity of Inputs and Methods



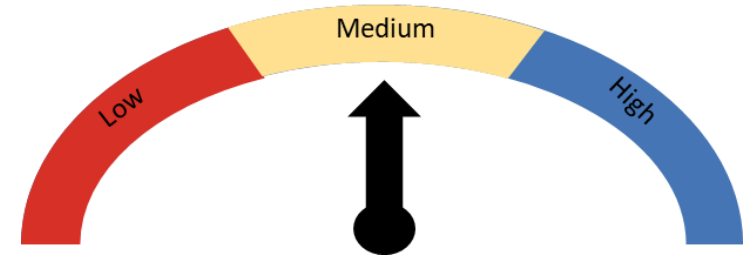
Model Validation Statistics



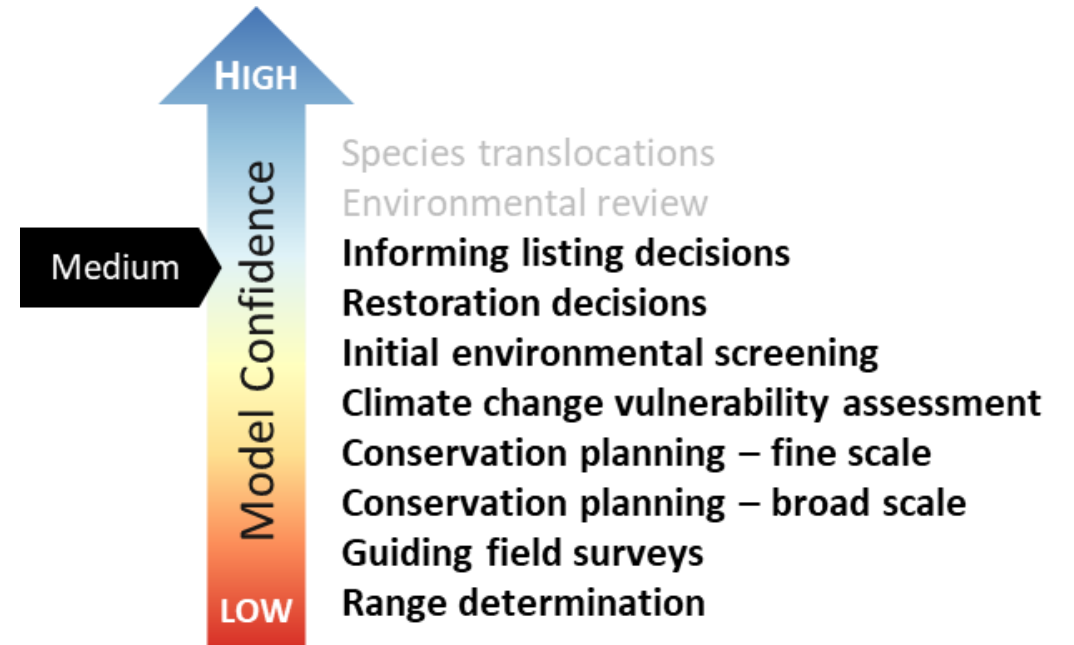
Expert Review



Model Confidence



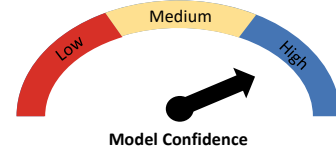
Recommended Uses





Conradina glabra Apalachicola False Rosemary

NatureServe Element Global ID:
[ELEMENT_GLOBAL.2.159260](#)
NatureServe Global Conservation Rank: **G1**
Model Creation Date: **2022-10-07**
Model Algorithm: **Random Forest**
Model Version: **Cglab_159260_rf_20221007**



General Information

This species habitat model was produced for NatureServe to predict the NatureServe habitat distribution for *Conradina glabra* (Apalachicola False Rosemary). Species habitat models identify the environmental predictors associated with known occurrences of a species to generate predictions of the potential geographical distribution of habitat for the species across broad landscapes. Geographical maps generated using these models indicate areas of likely habitat based on quantified species/environment relationships. Habitat probabilities are correlated with the occurrence and/or abundance of the species across the modeled area; however, habitat probabilities do not provide direct estimates of species presence or absence. For more information about this model, please contact vratika_chaudhary@natureserve.org. For more information on how model confidence was assessed, see the [NatureServe Network Habitat Model Standard](#).

Recommended Uses

This species habitat model has been assessed to have an overall confidence level of **high**.

Based on the overall confidence level for this model, we conclude that the model is appropriate for the recommended uses in bold in the figure on the right. However, we cannot recommend that this model be used for the applications in light grey.



Environmental Predictors

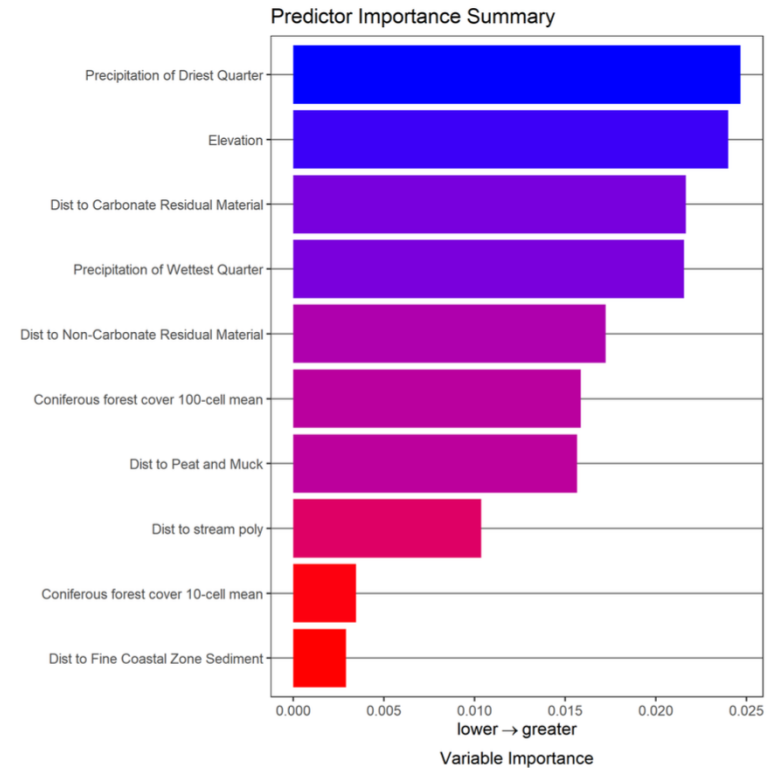
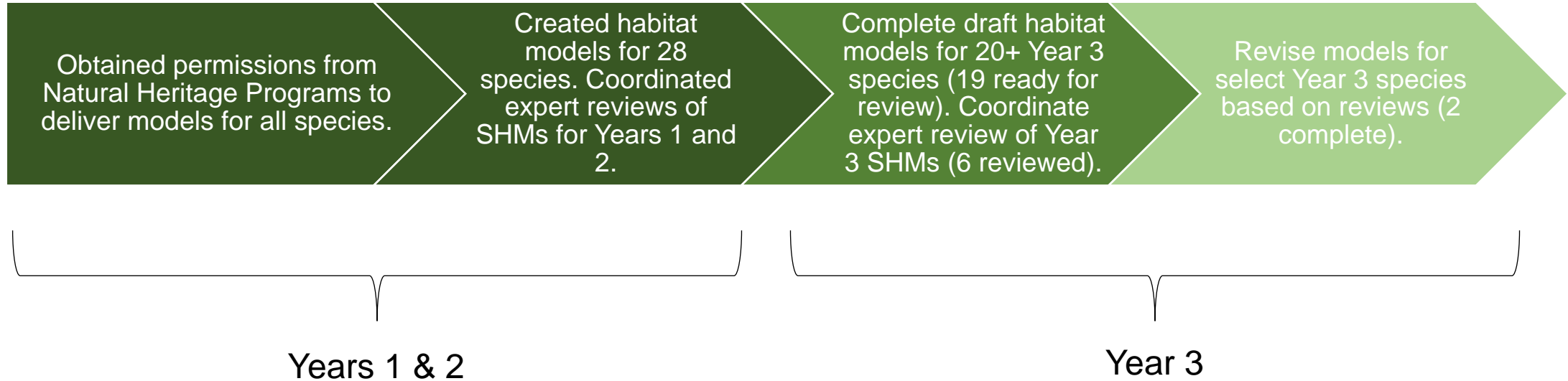


Figure 2. Relative importance of environmental predictors included in the full model. Variable importance of each variable was assessed by the decrease in accuracy caused by the removal of that variable from the model. See Appendix 1 for detailed descriptions of environmental predictors.

Progress on Species Habitat Models for DoD



Species Habitat Models Years 1 & 2

1. Panamint Alligator Lizard
2. Florida Pinesnake
3. Escambia Map Turtle
4. Florida Scrub Lizard
5. Desert Massasauga
6. Western Spadefoot Toad
7. Yuman Desert Fringe-toed Lizard
8. Gulf Sturgeon
9. Saltmarsh Sparrow
10. Sonoran Pronghorn
11. Eastern Arogos Skipper
12. San Diego Fairy Shrimp
13. Frosted Elfin
14. Santa Lucia Purple Amole
15. Monterey Spineflower
16. Salt Marsh Bird's Beak
17. Southwestern Willow Flycatcher
18. San Diego Button-celery
19. Northern Aplomado Falcon
20. Whooping Crane
21. Carolina Gopher Frog
22. Karner Blue
23. Light-footed Clapper Rail
24. California Least Tern
25. Riverside Fairy Shrimp
26. Least Bell's Vireo
27. San Joaquin Kit Fox
28. Preble's Meadow Jumping Mouse

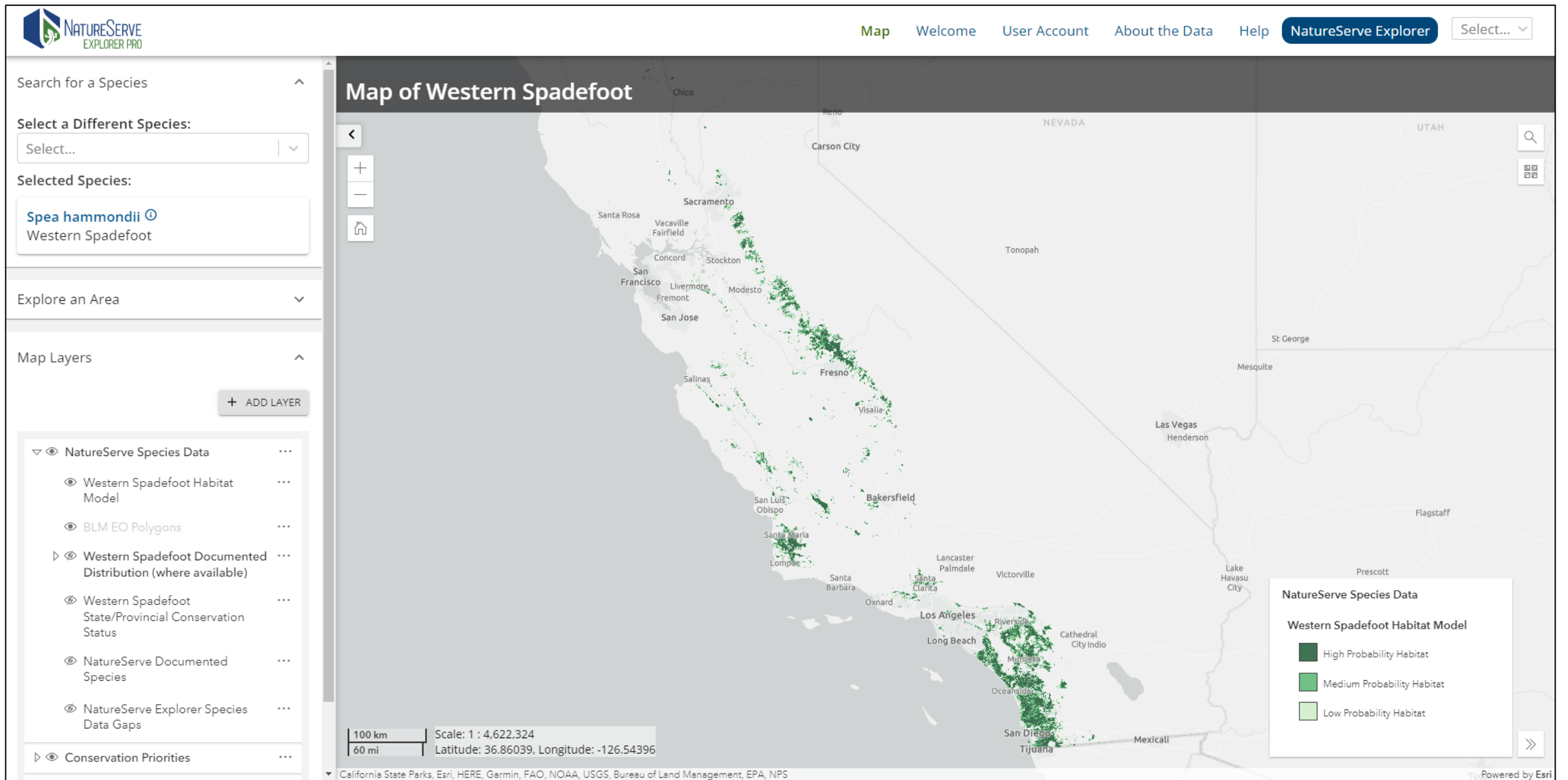


Figure 3. Species Habitat Model for Western Spadefoot (*Spea hammondi*) on NatureServe Explorer Pro. This SHM was developed in year 1 and then revised in year 2 following expert review of the draft model.

Year 3 Model Status

In Progress

1. Spotted Turtle
2. Monarch
3. Pinyon Jay
4. Little Brown Myotis
5. Northern Long-eared Bat
6. Tricolored Bat

Drafted

1. Arroyo Toad

Ready to Review

1. White Sands Pupfish
2. Louisiana Quillwort
3. Pondberry
4. Bog Spicebush
5. Roughleaf Loosestrife
6. California Orcutt Grass
7. Louisiana Pinesnake
8. San Diego Mesamint
9. Threadleaf Brodiaea
10. Palos Verdes Blue
11. Todsens False Pennyroyal
12. Willowy Monardella

Reviewed

1. Reticulated Flatwoods Salamander
2. Lane Mountain Milkvetch
3. Eastern Indigo Snake
4. Hairy-peduncled Beakrush
5. Florida Scrub-Jay
6. Eastern Diamond-backed Rattlesnake

Revised or Ready to Publish

1. Frosted Flatwoods Salamander
2. Florida Hartwrightia

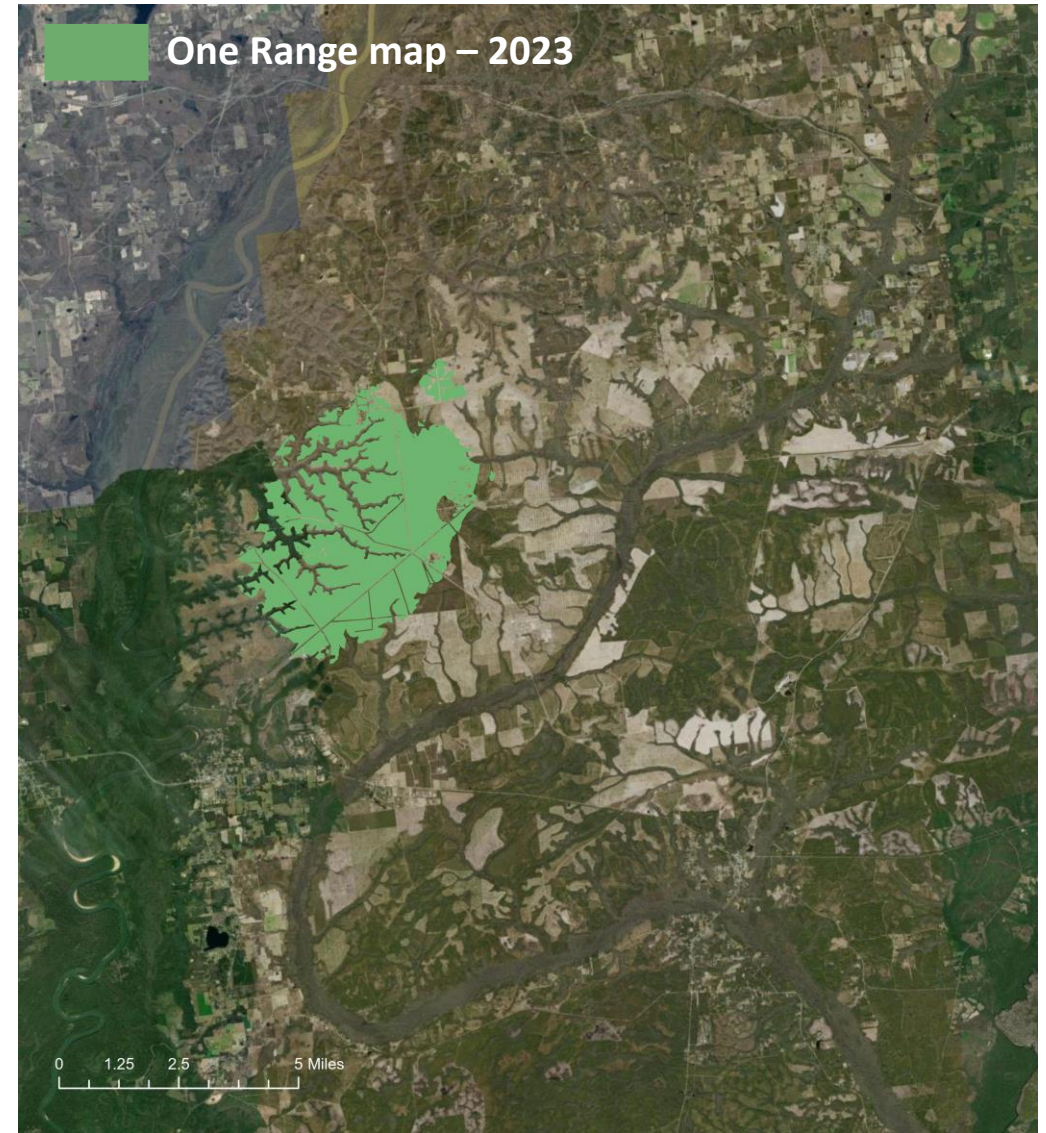
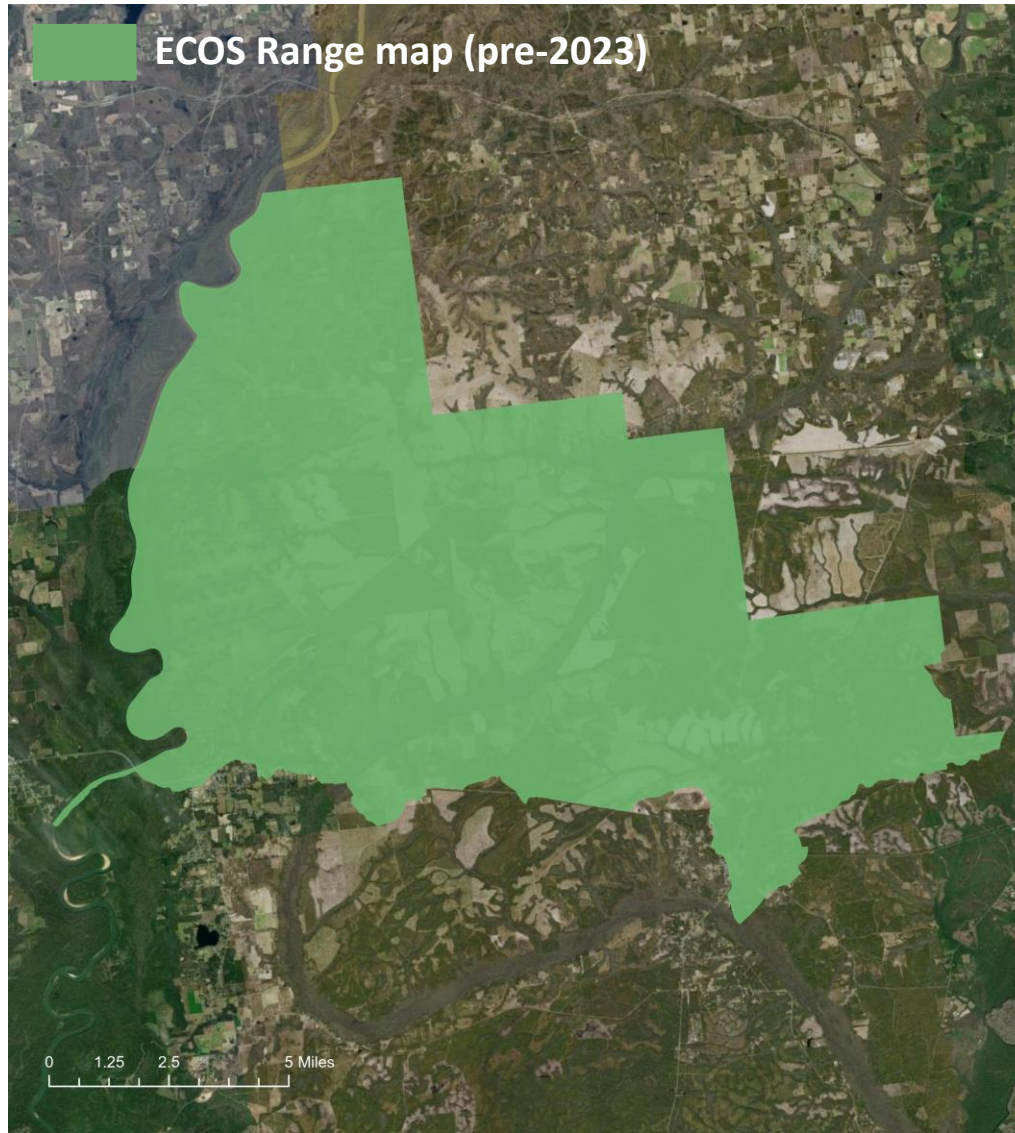
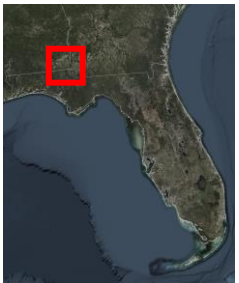
Model Applications: Generating refined habitat maps

Apalachicola False Rosemary (*Conradina glabra*)

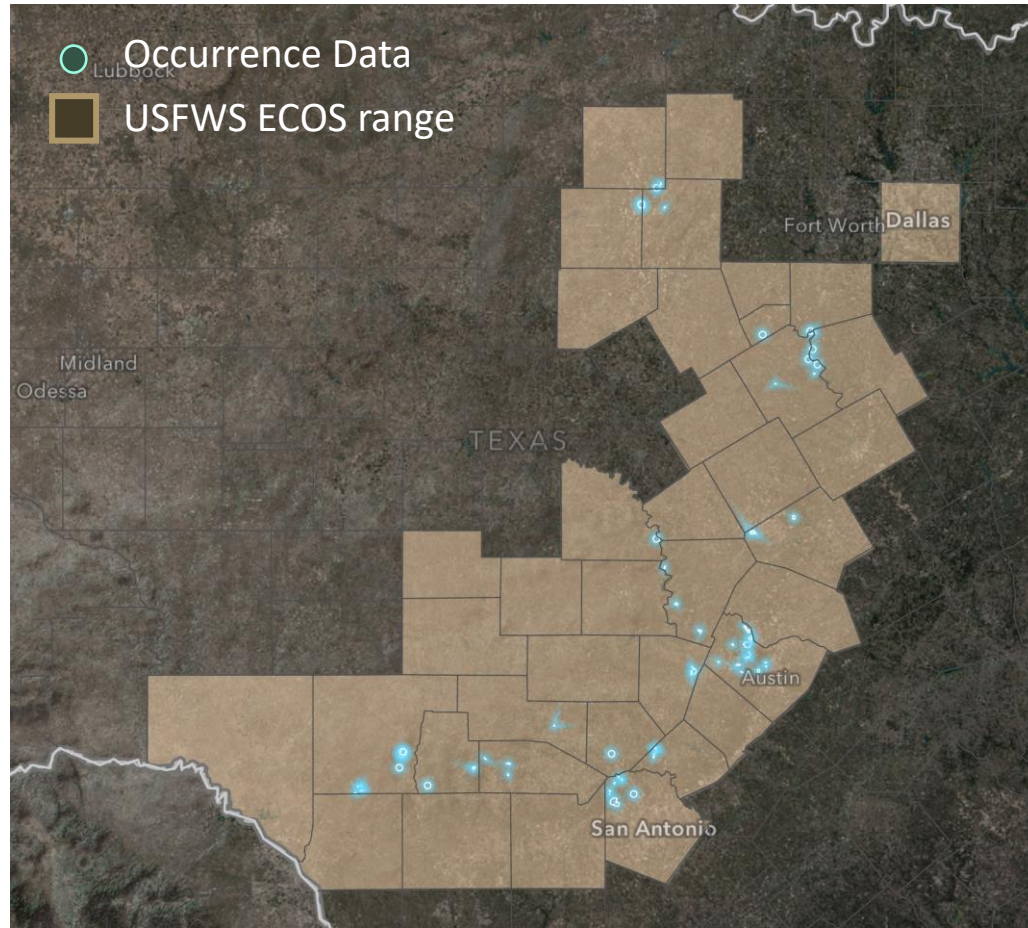
G1

Critically
Imperiled

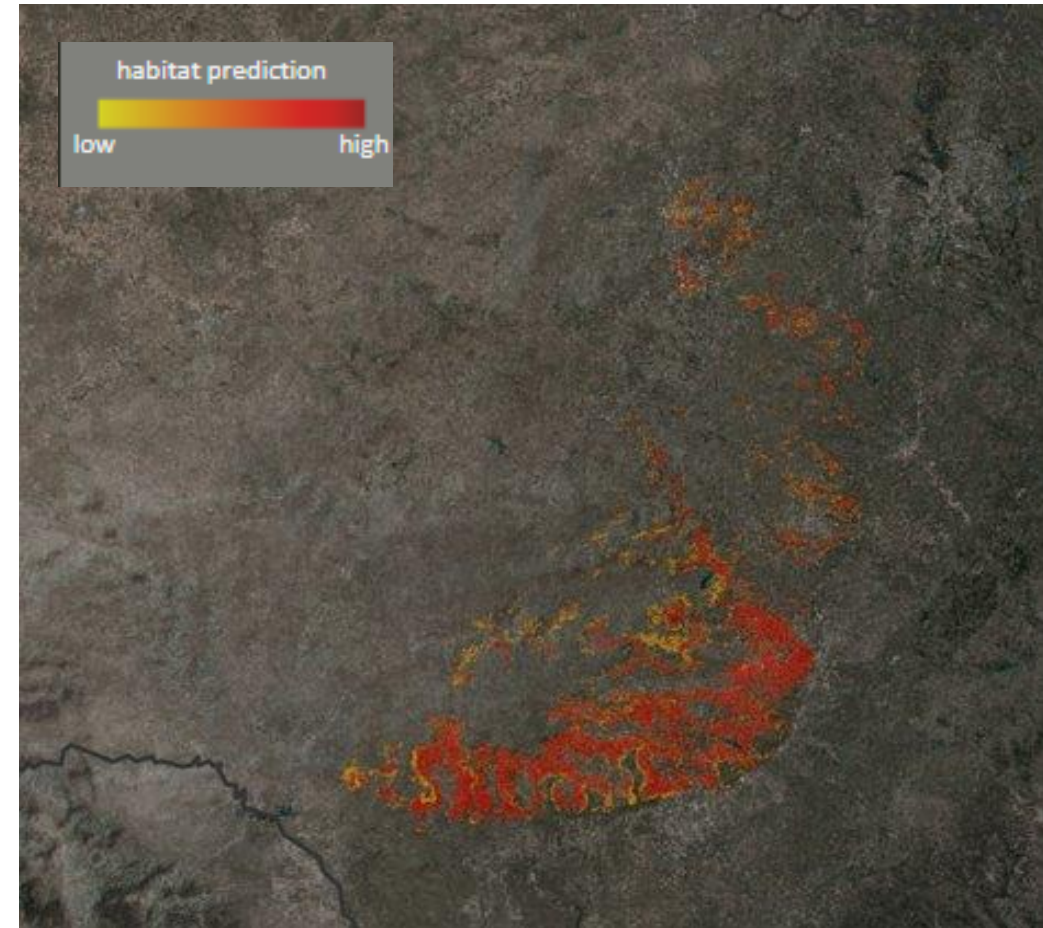
ESA Status:
Endangered



Model Applications: Generating refined habitat maps



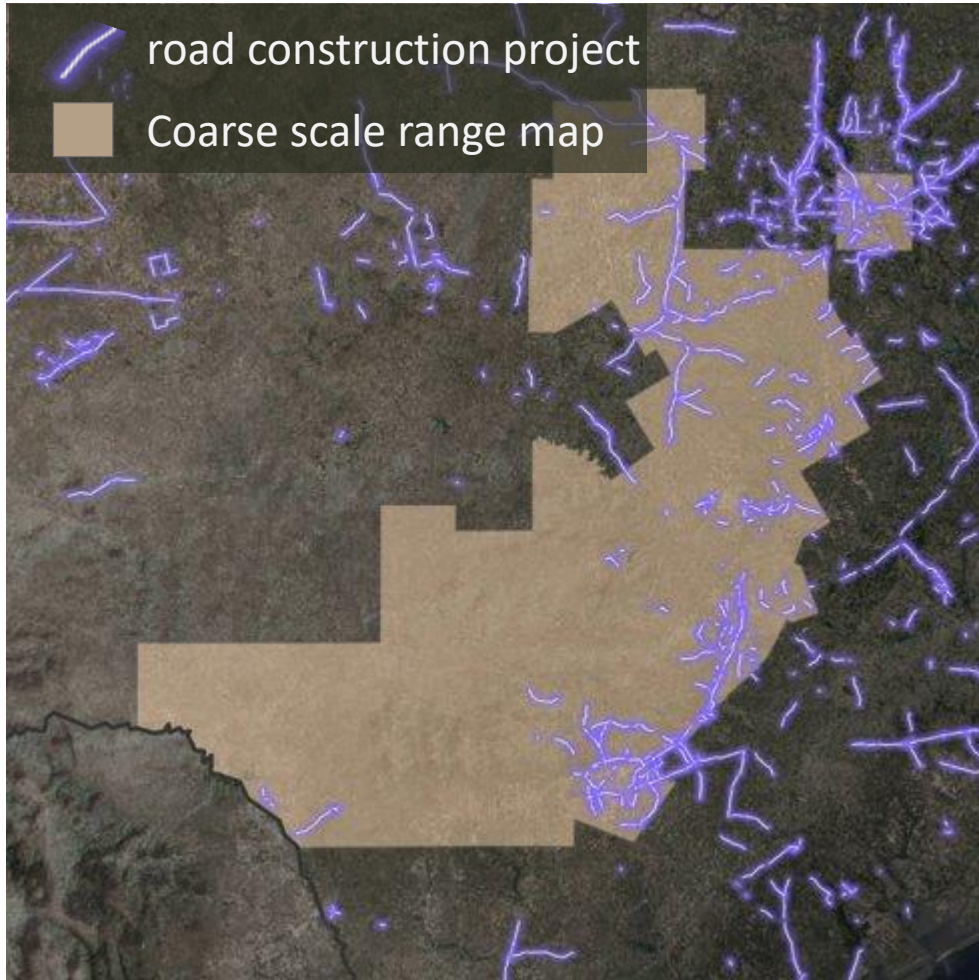
Previously Available Data



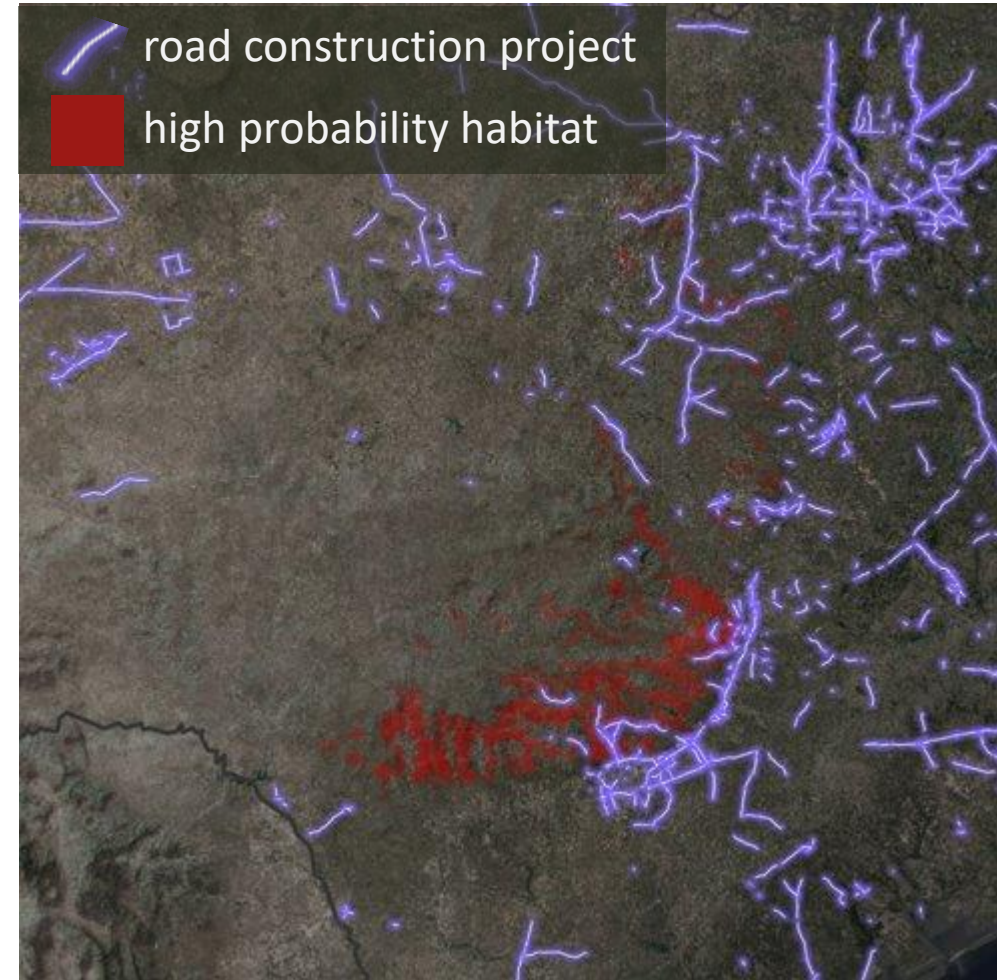
Predicted Habitat



Model Applications: Generating refined habitat maps



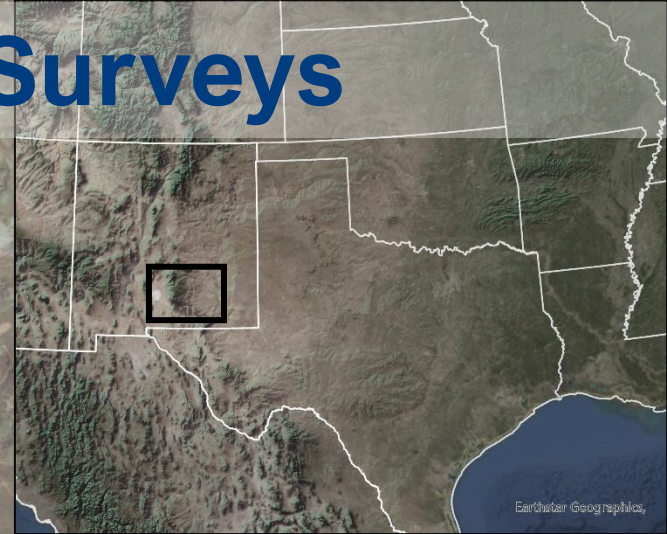
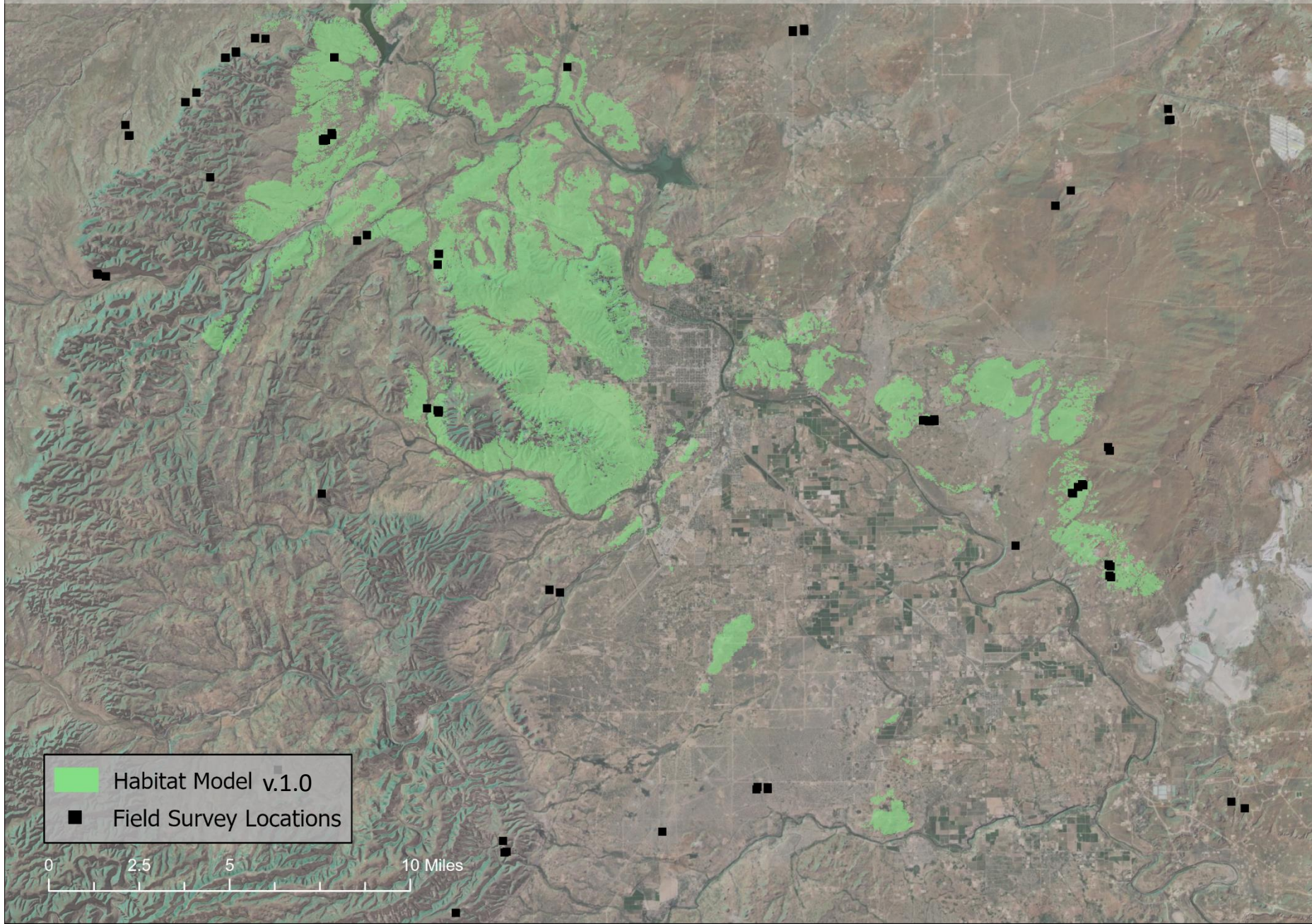
Previously Available Data



Predicted Habitat

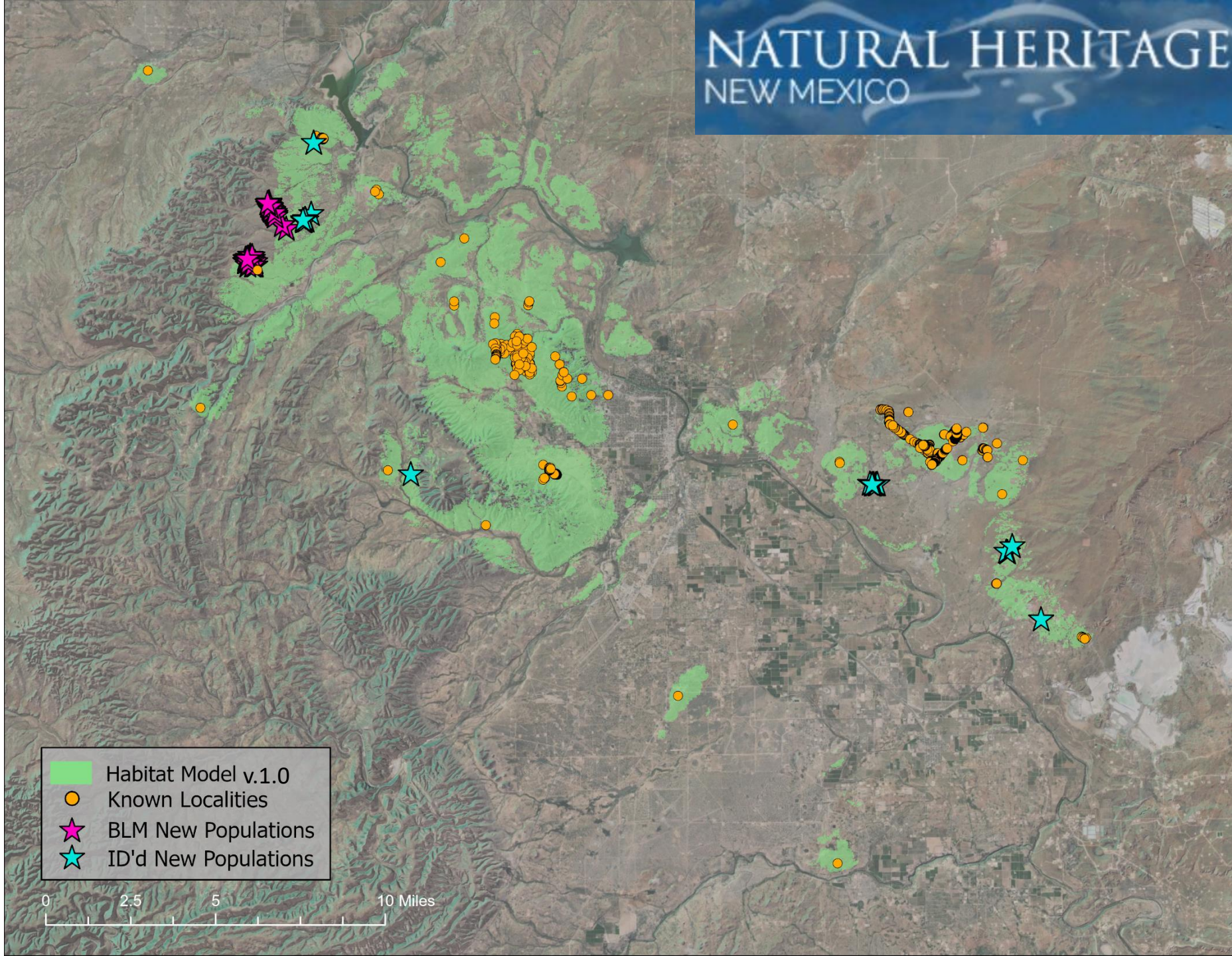
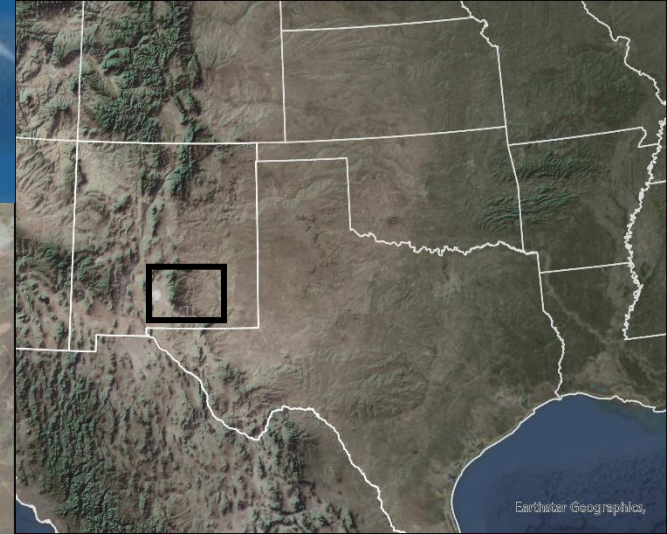


Model Applications: Guiding Field Surveys



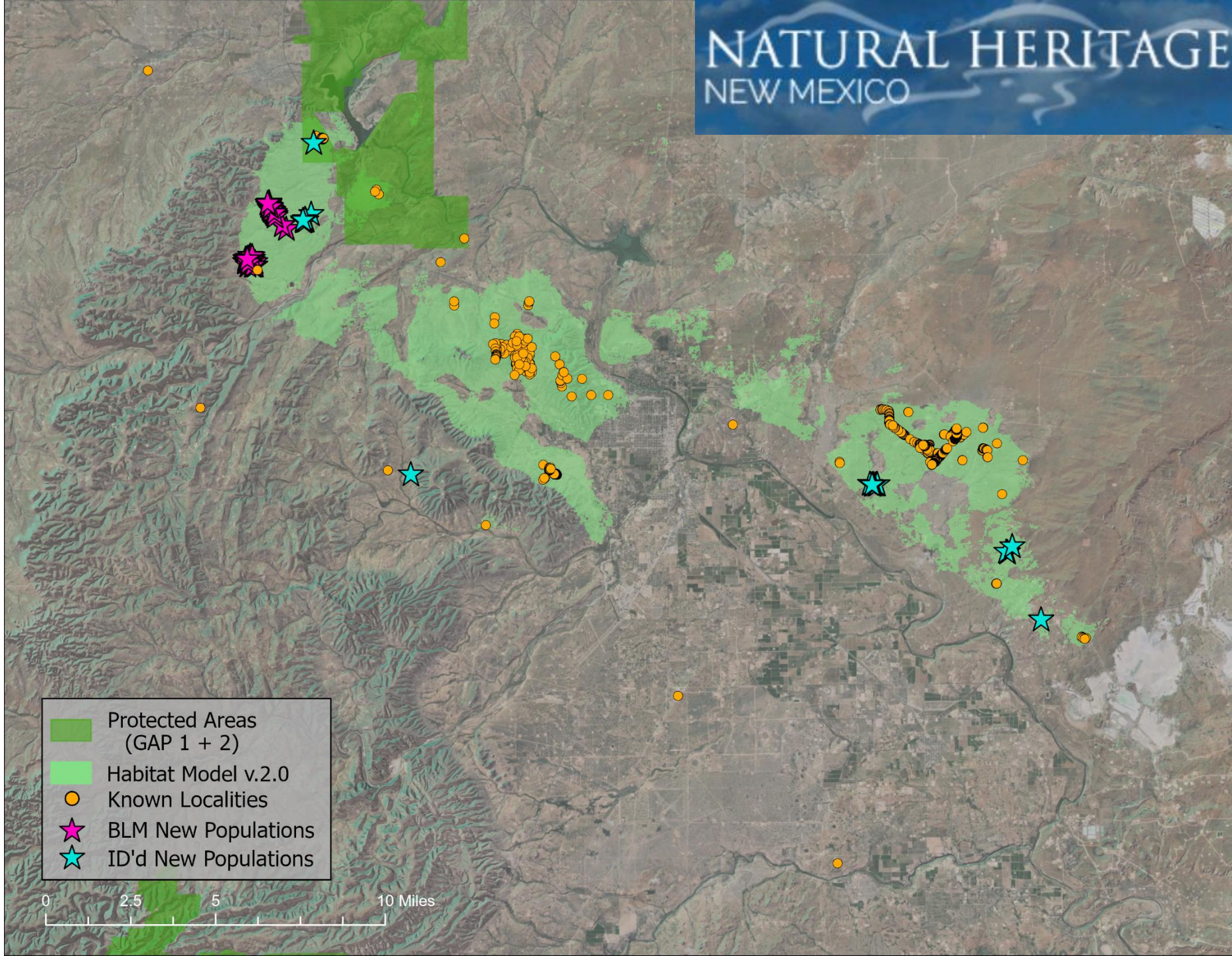
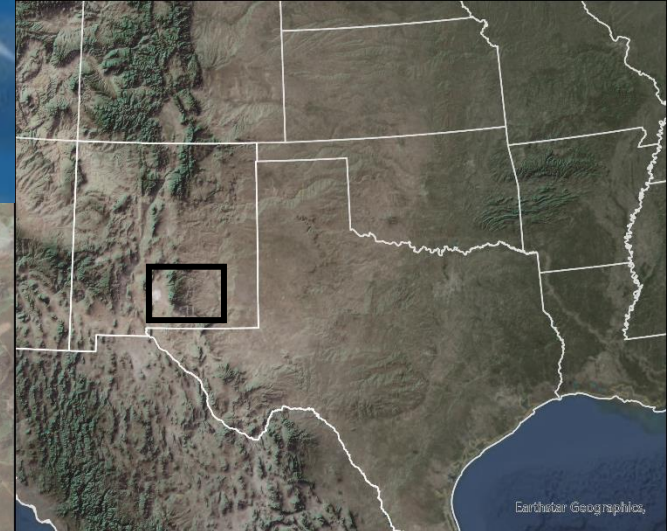
Justicia wrightii
G2 – Globally
imperiled.
NM, TX

NATURAL HERITAGE NEW MEXICO



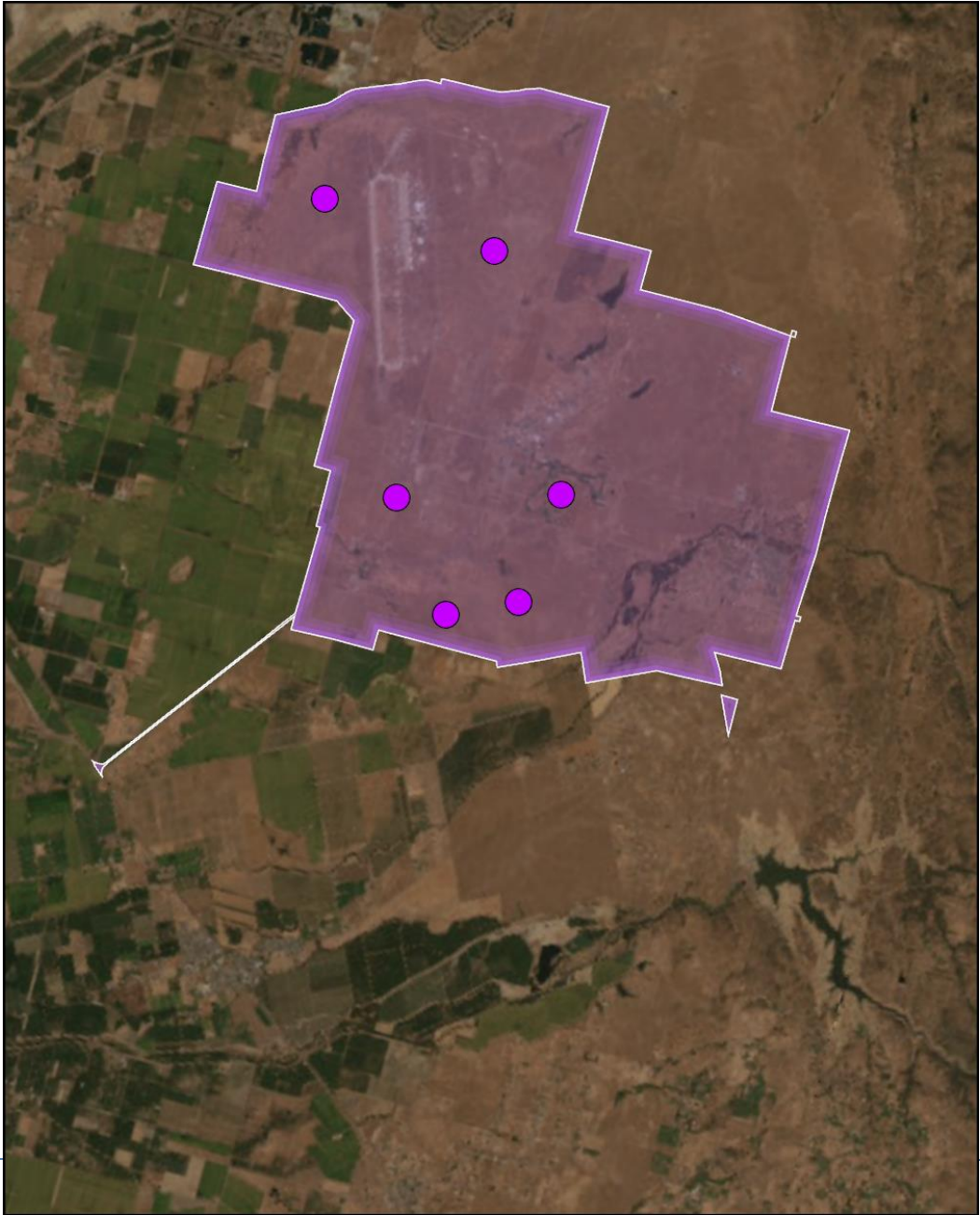
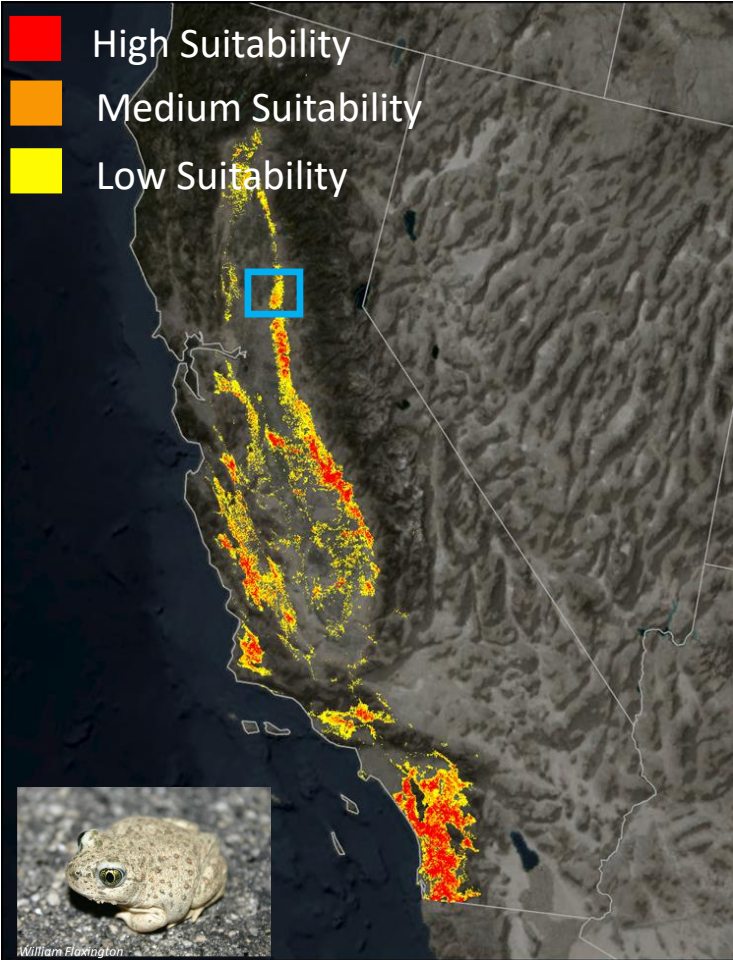
Justicia wrightii
G2 – Globally
imperiled.
NM, TX

NATURAL HERITAGE NEW MEXICO

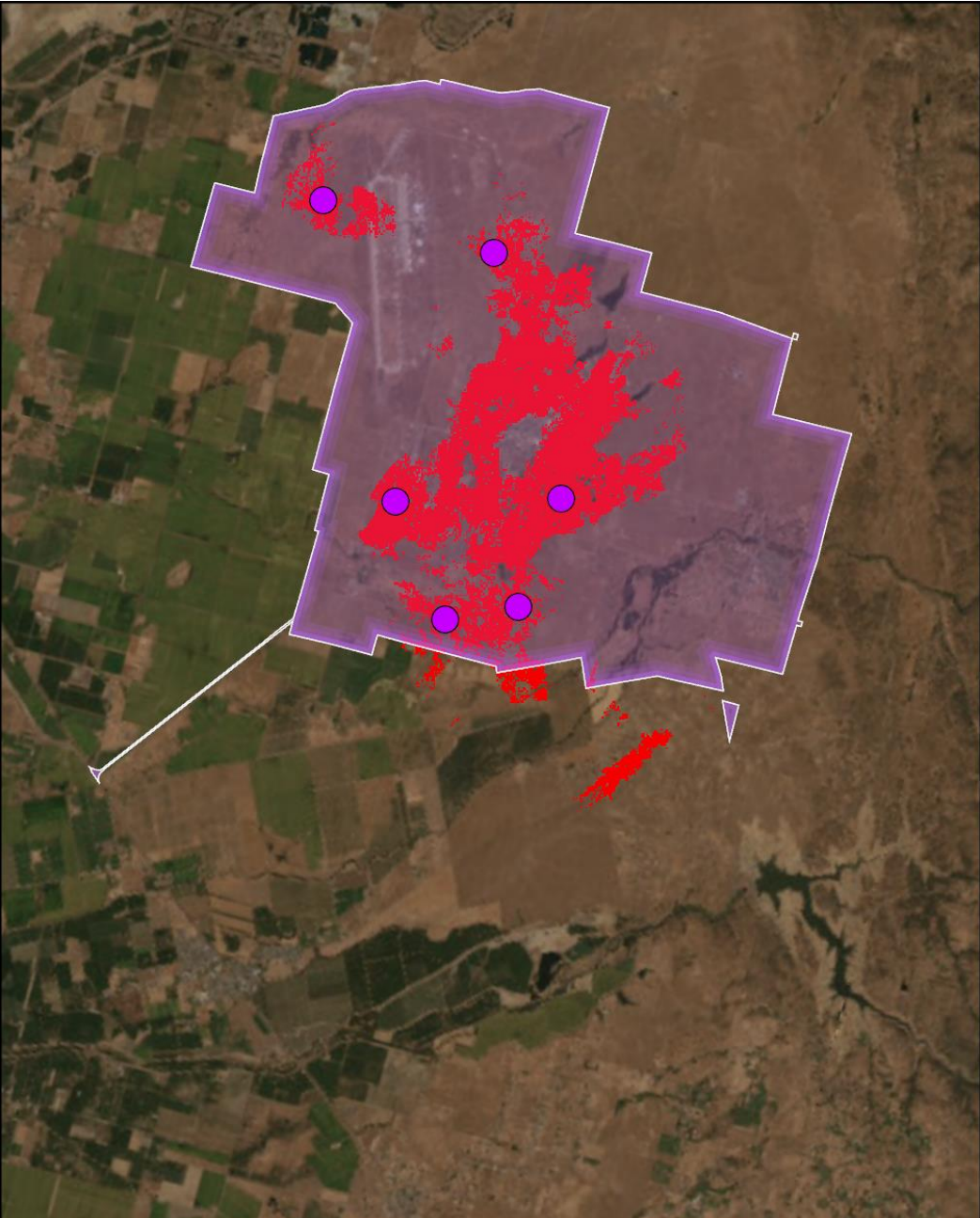
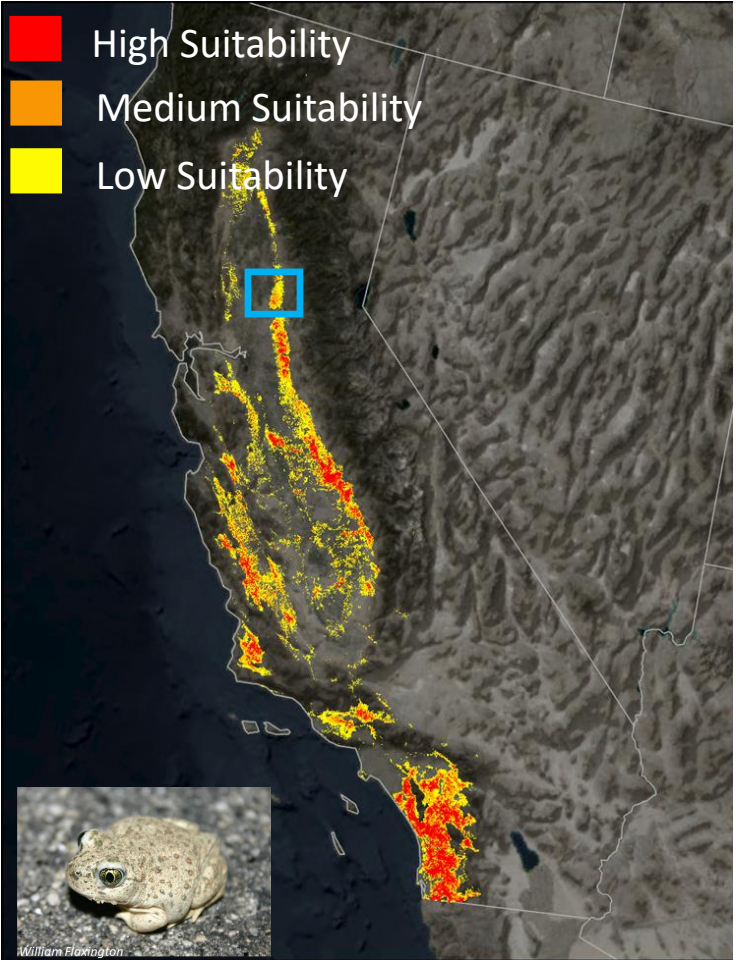


Justicia wrightii
G2 – Globally
imperiled.
NM, TX

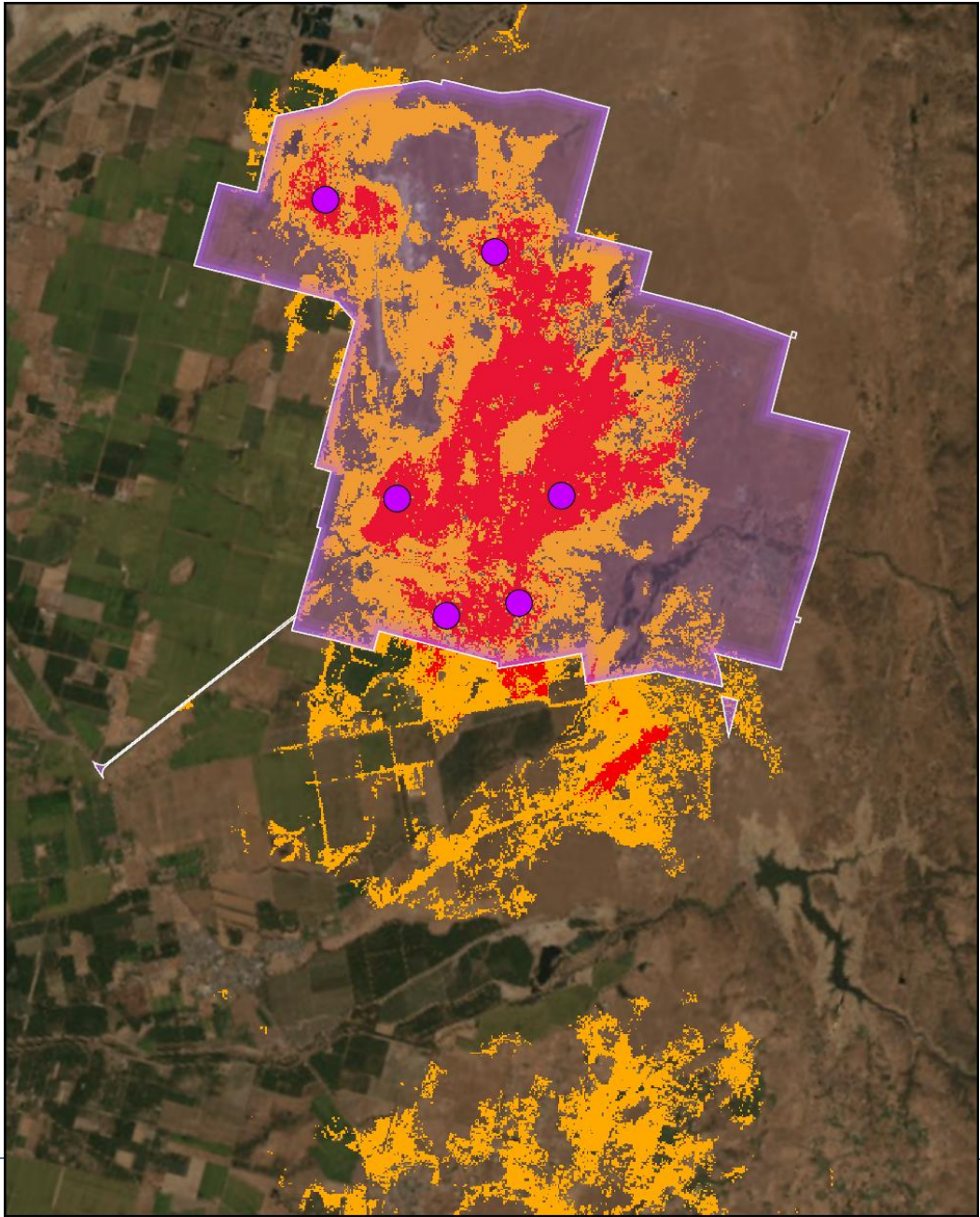
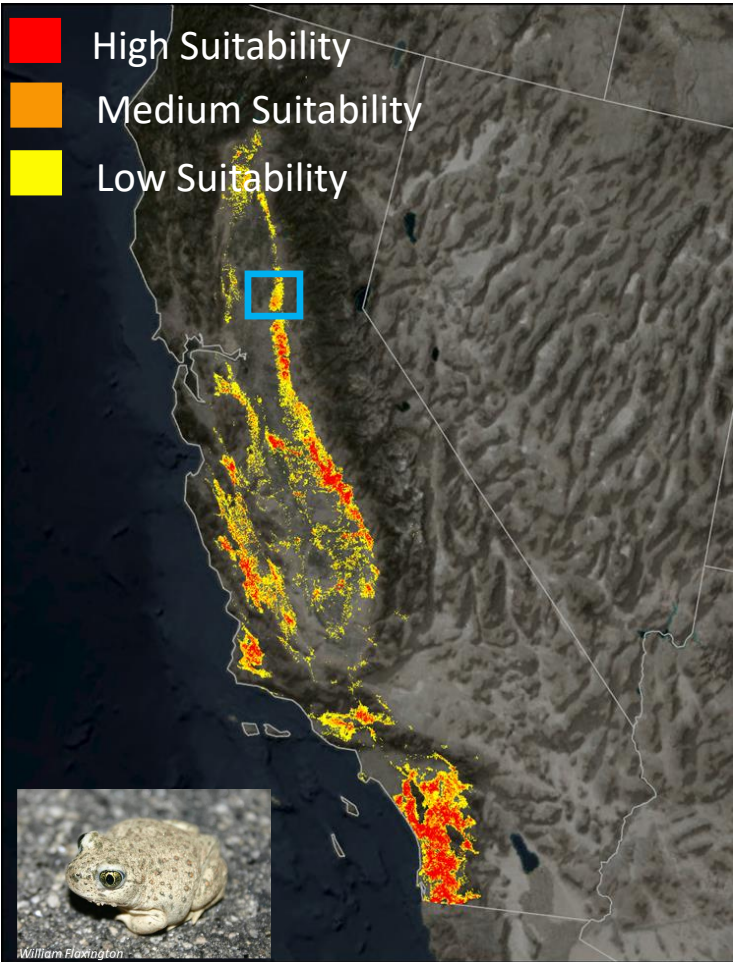
Model Applications: Identifying Stewardship Responsibility



Model Applications: Identifying Stewardship Responsibility



Model Applications: Identifying Stewardship Responsibility



Model Applications: Identifying Stewardship Responsibility

Occurrences



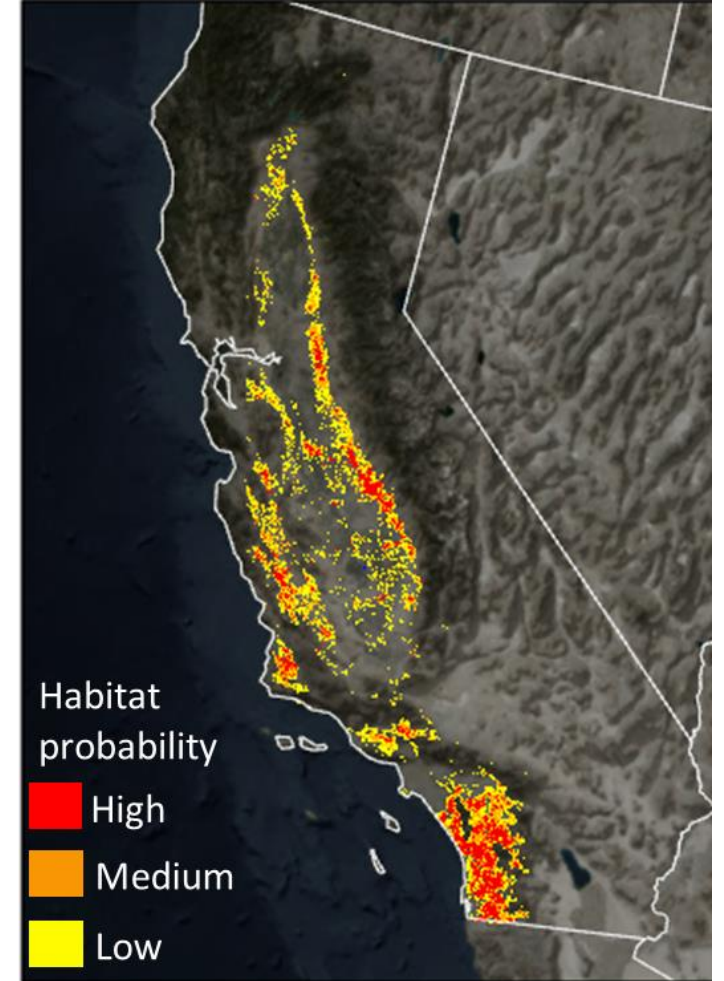
12

IUCN range map



27

Habitat model predictions



16



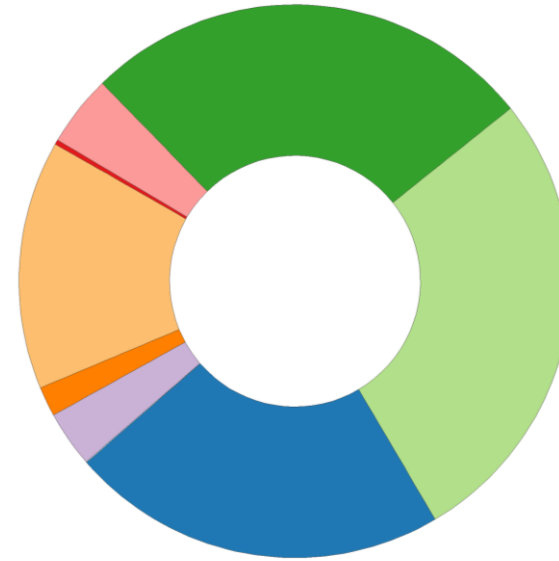
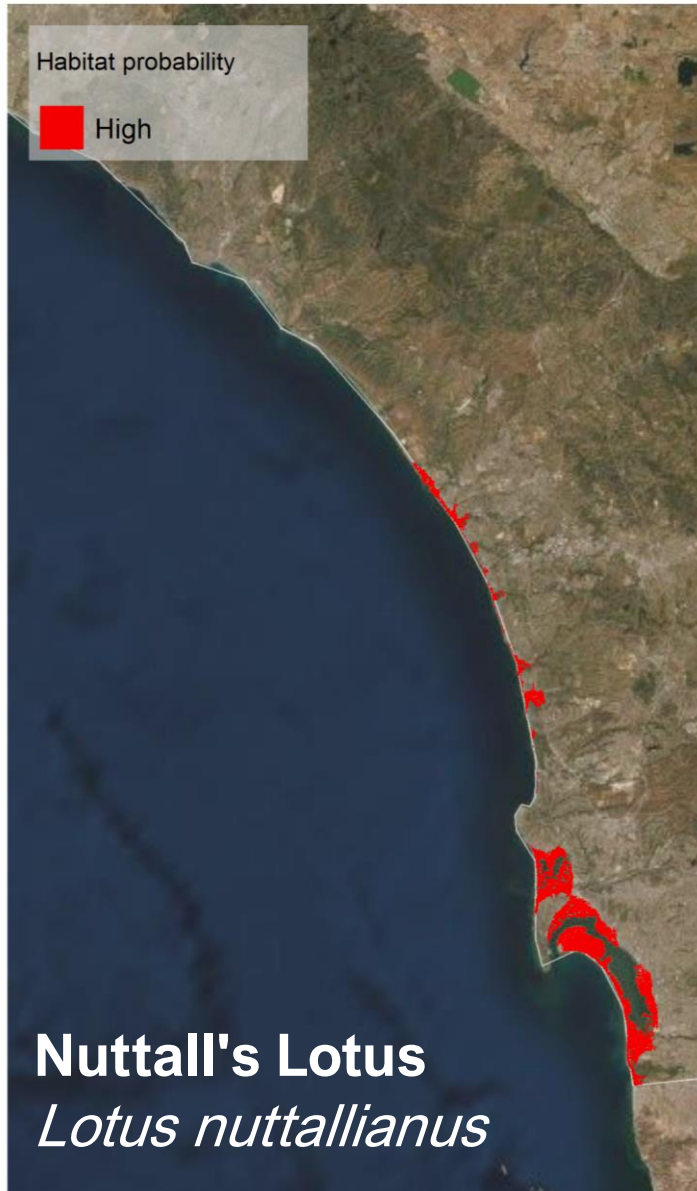
installations
on which
species occurs

Model Applications: Identifying Partners in Conservation

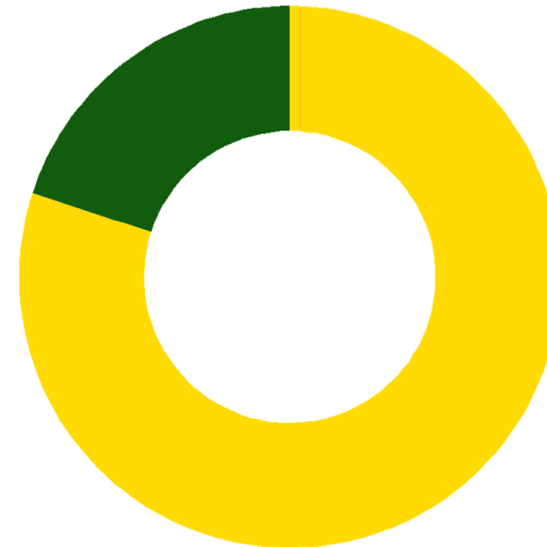
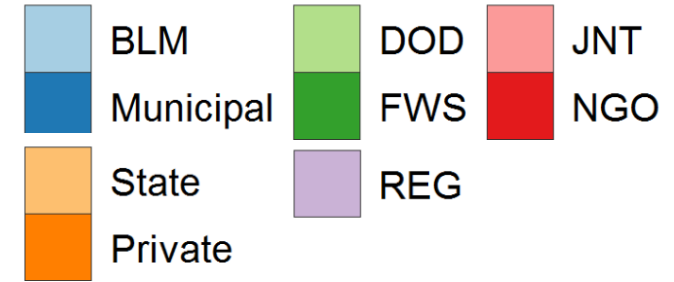


G1
Critically Imperiled

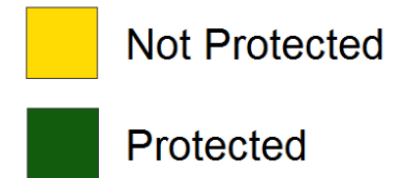
ESA Status:
Not Listed



Managing Agency:



Protection Status:



NatureServe

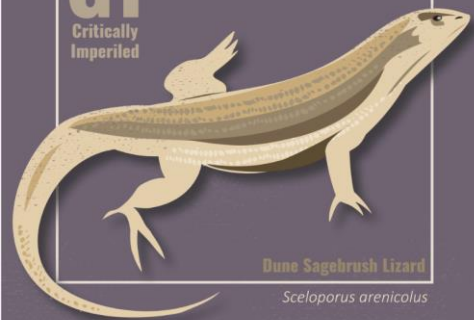
G1
Critically Imperiled



Lost River Sucker
Deltistes luxatus

NatureServe

NatureServe
Global Status
G1
Critically Imperiled



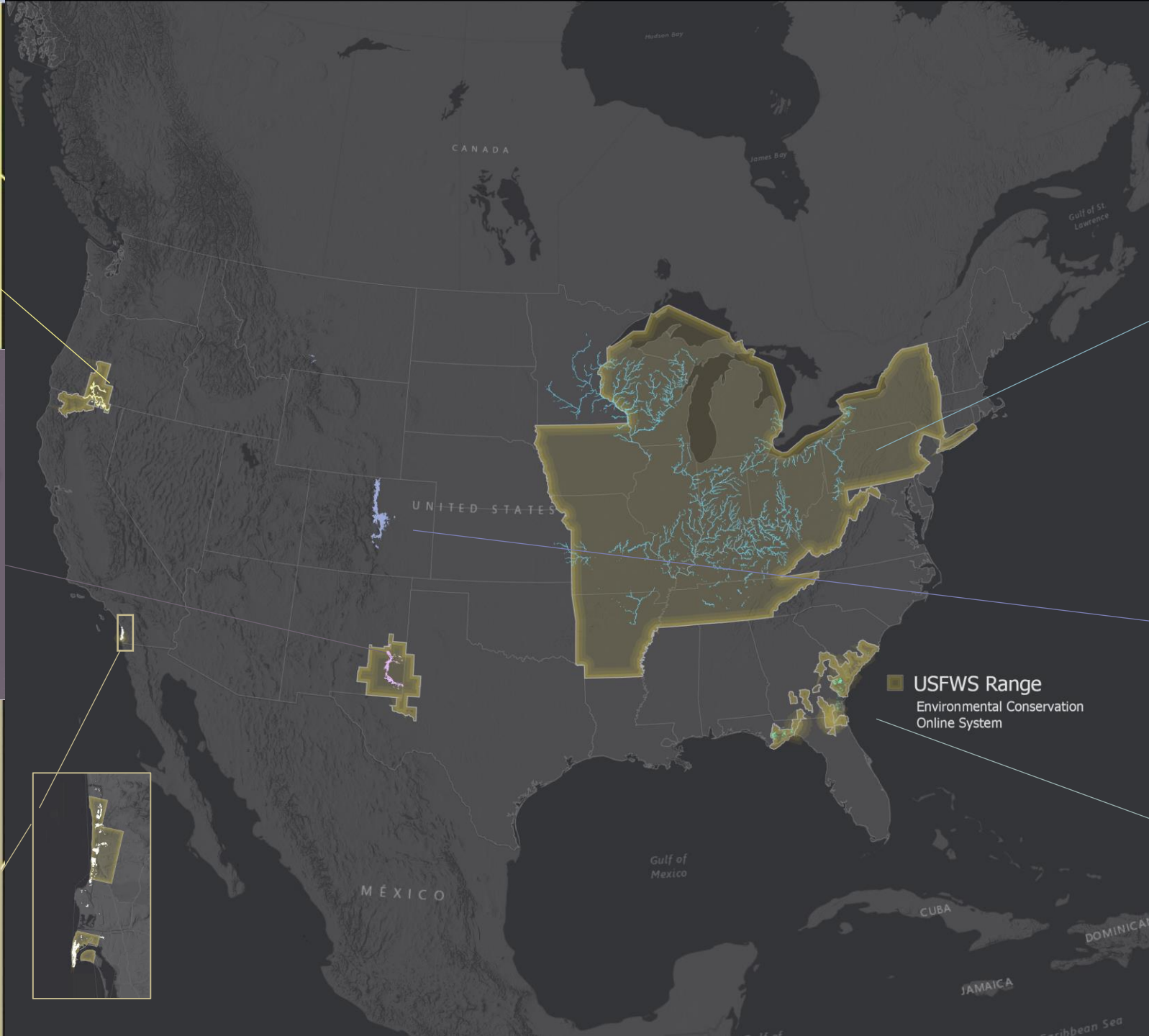
Dune Sagebrush Lizard
Sceloporus arenicolus

NatureServe

G1
Critically Imperiled



Orcutt's Spineflower
Chorizanthe orcuttiana



NatureServe

G3
Vulnerable



Salamander Mussel
Simpsonia ambigua

NatureServe

G2
Imperiled



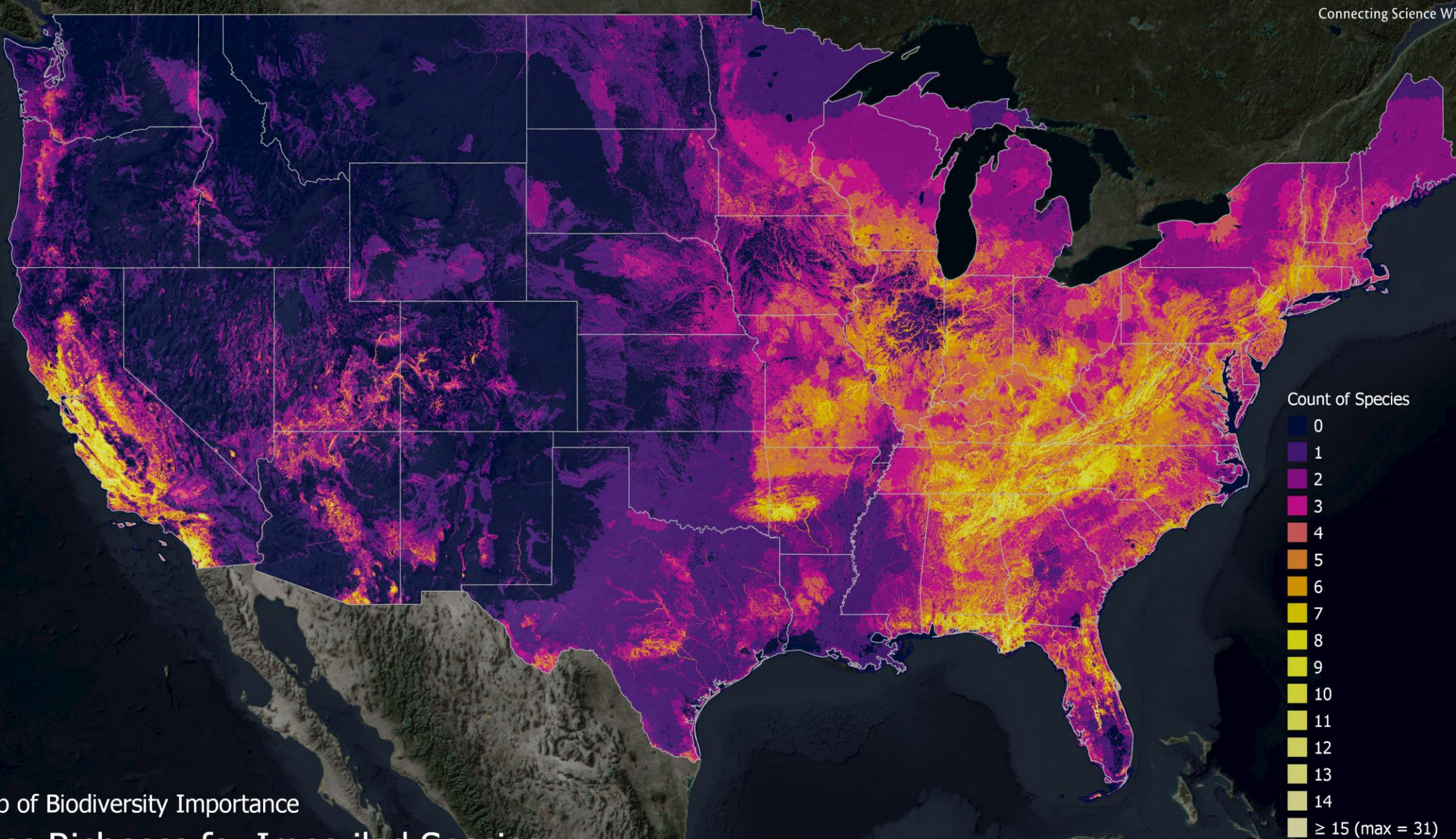
Hops Azure Butterfly
Celastrina humulus

NatureServe

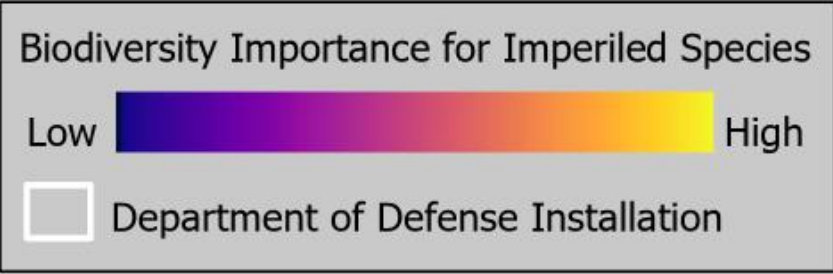
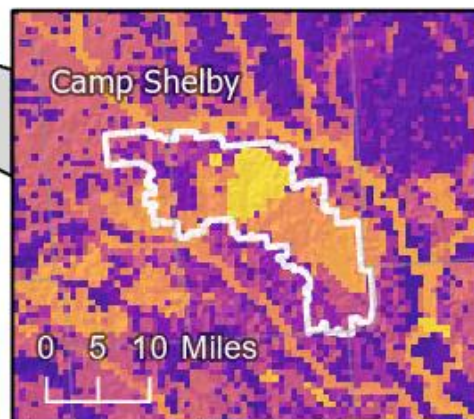
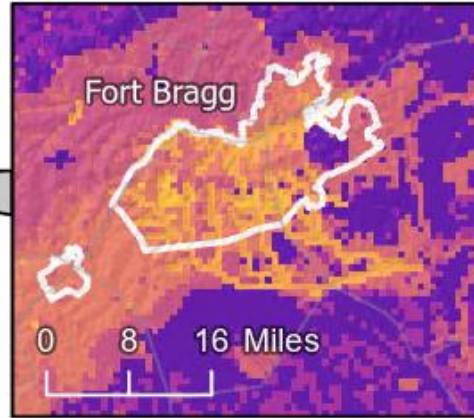
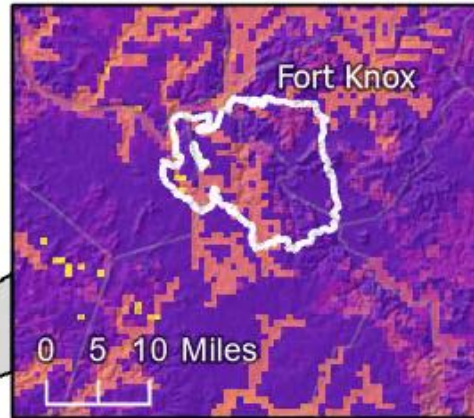
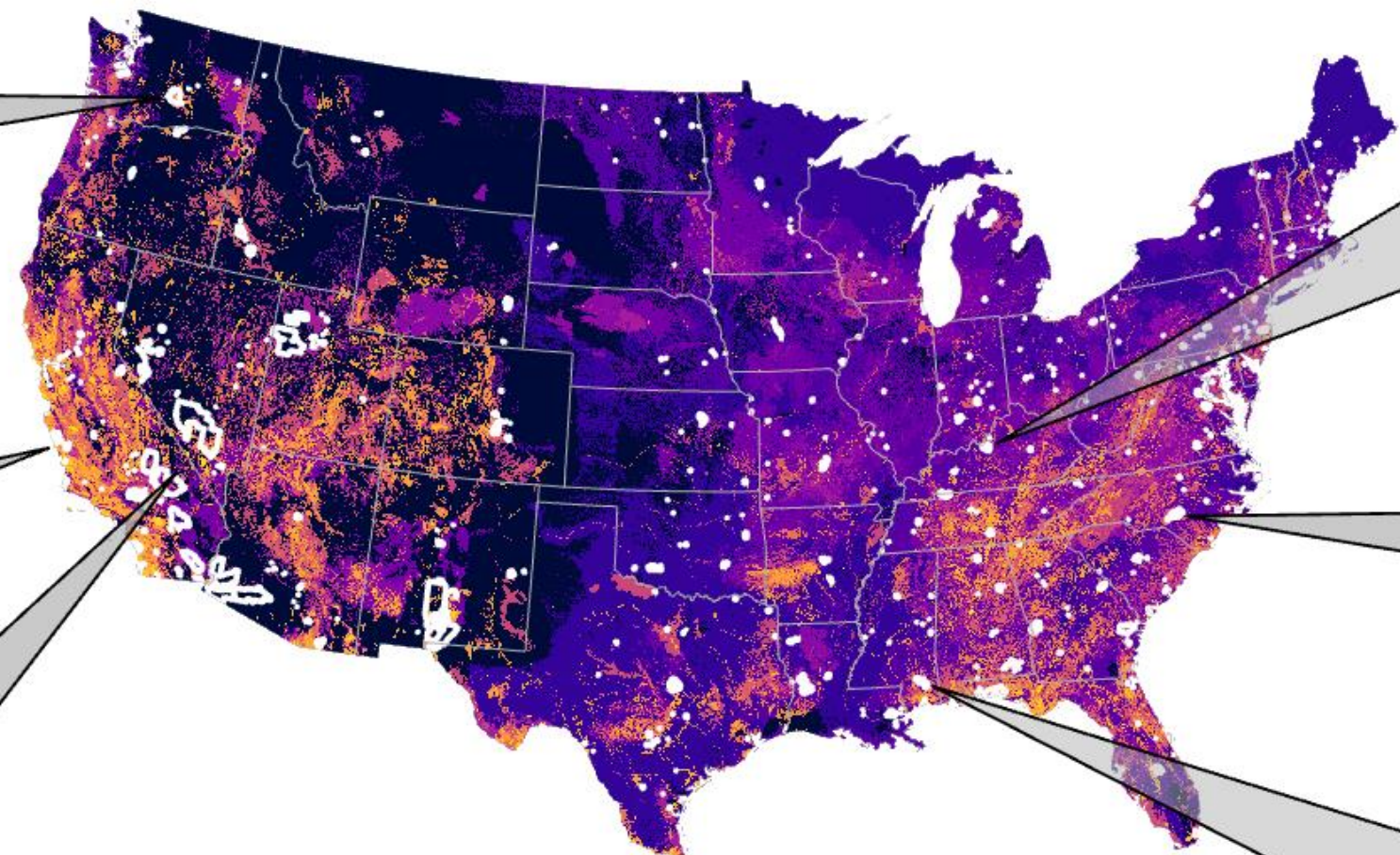
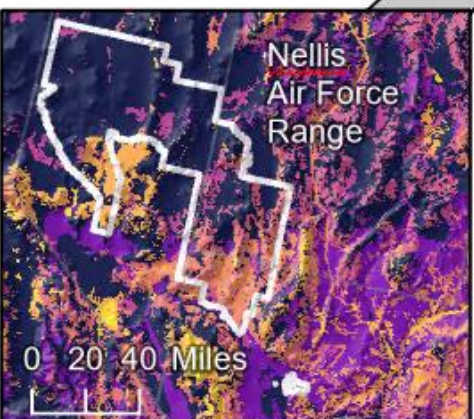
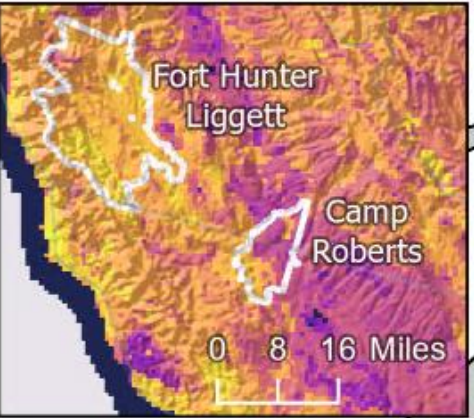
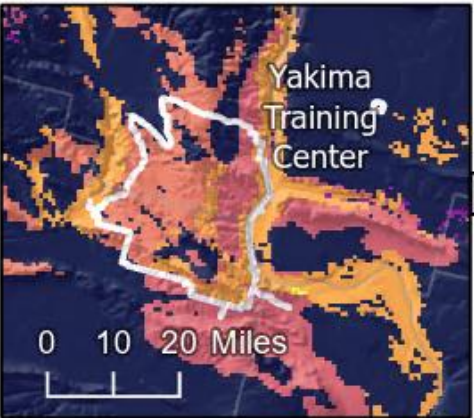
G2
Imperiled



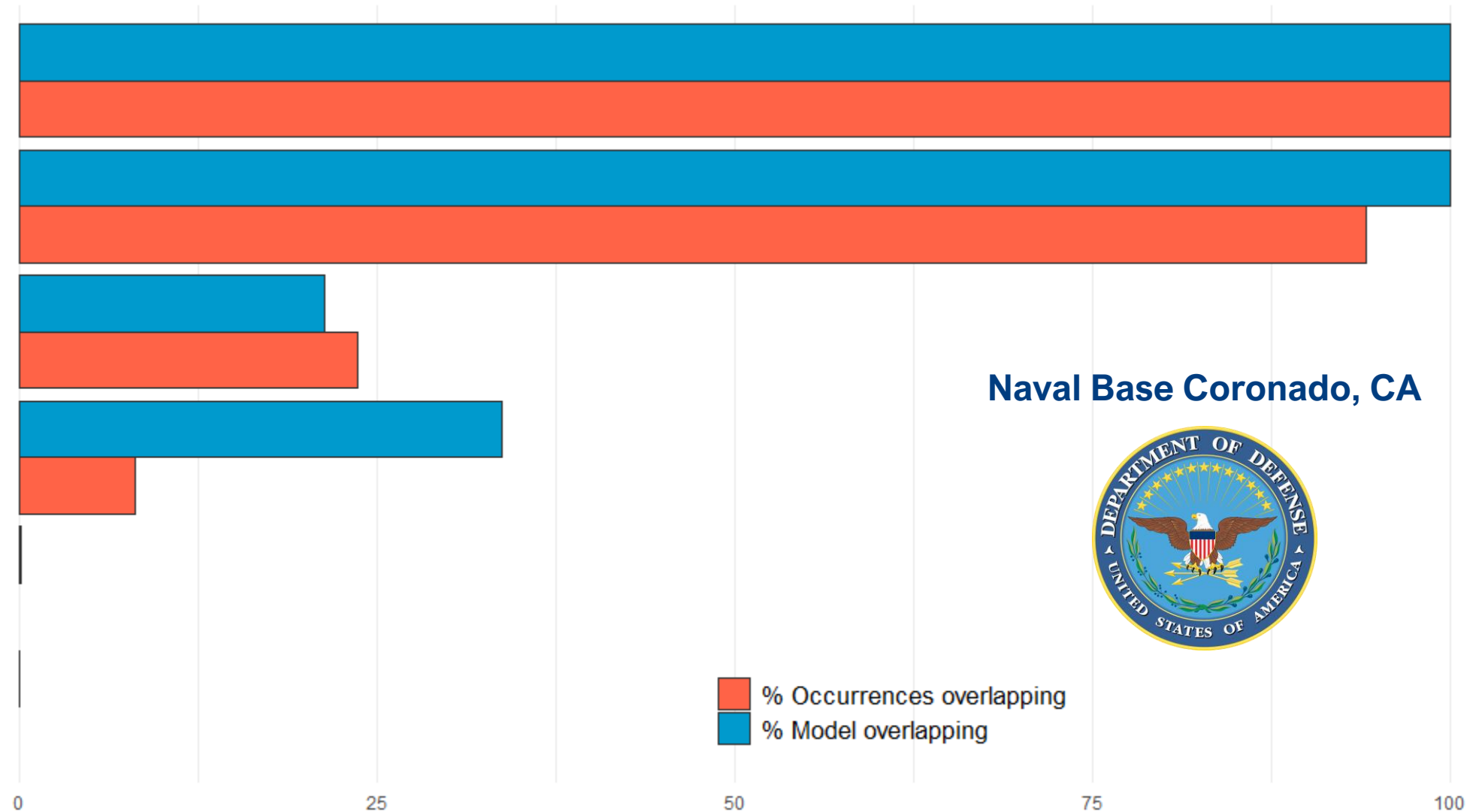
Frosted Flatwoods Salamander
Ambystoma cingulatum



The Map of Biodiversity Importance
Species Richness for Imperiled Species





Hazardia cana
Brodiaea kinkiensis
Lotus nuttallianus
Orcuttia californica
Symphyotrichum defoliatum
Malacothrix squalida

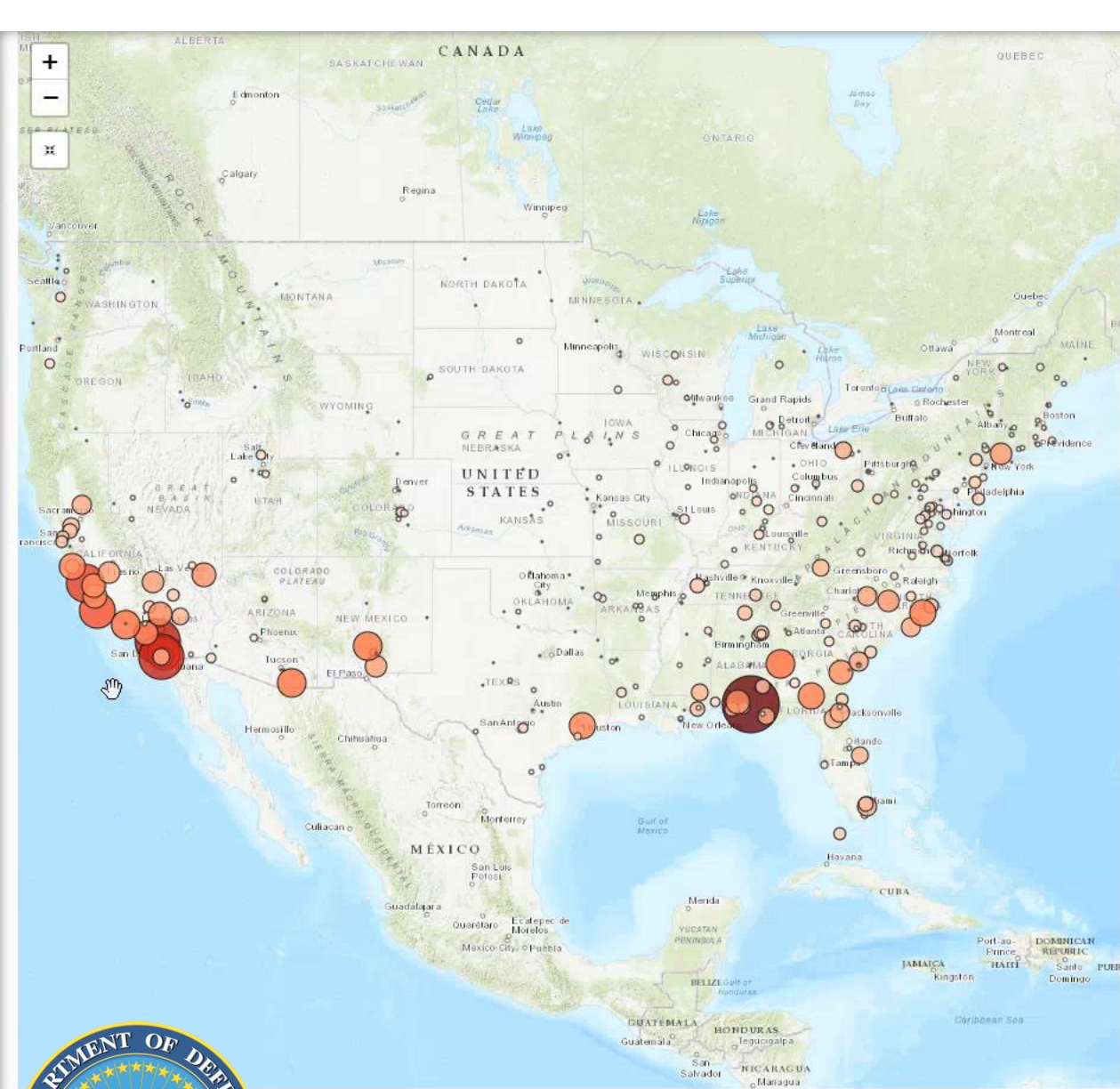


Naval Base Coronado, CA



 % Occurrences overlapping
 % Model overlapping

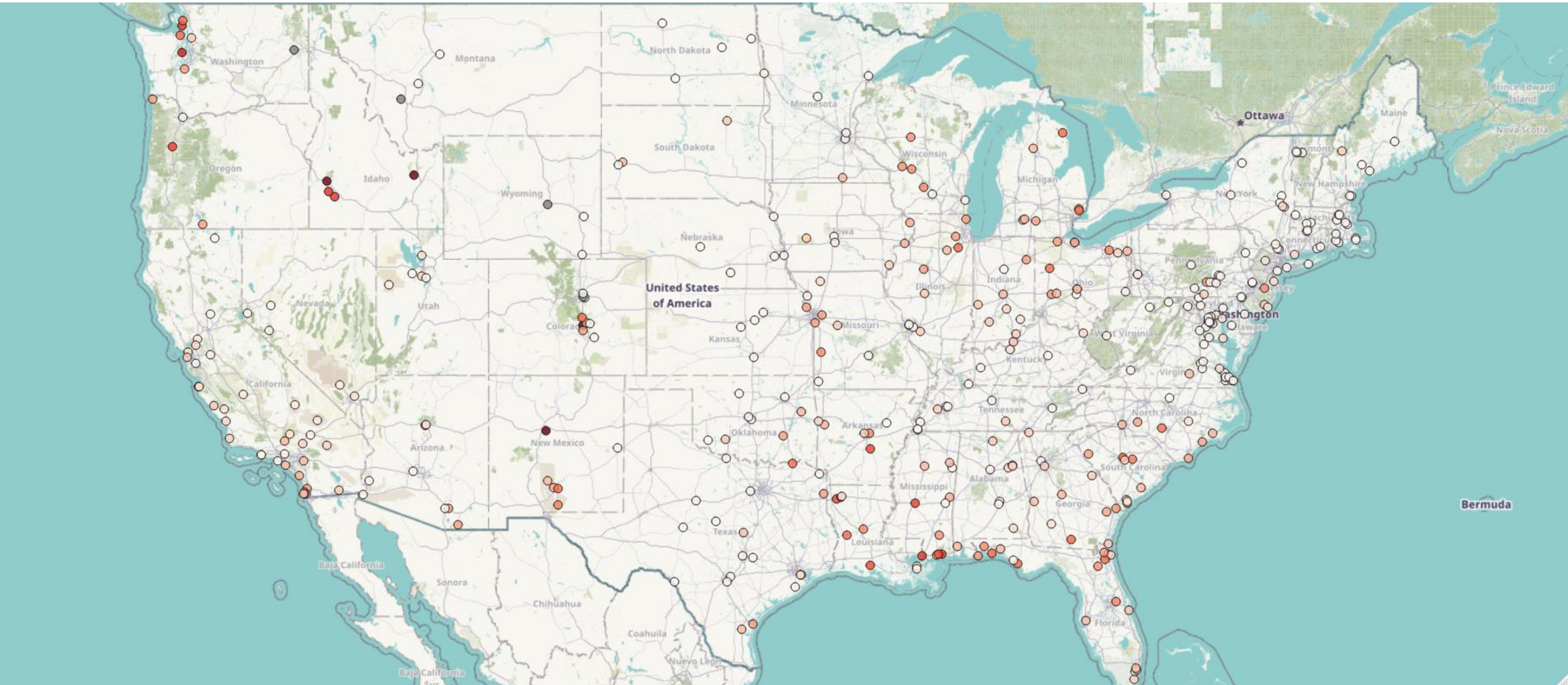
% estimated distribution overlapping DoD installations



Request access to NatureServe DoD TER-S Explorer by emailing gjo@natureserve.org



Proportion of potential TER-S vulnerable to wildfire



Accessing Species Habitat Modeling Outputs: NatureServe Explorer Pro



View Single Species ^

Select a Different Species:

Select... | v

Selected Species:

Arabis falcifracta ⓘ
Elko Rockcress

View All Species in Area v

View Layers ^

+ ADD LAYER

Elko Rockcress Habitat Model ...

Elko Rockcress ...

NatureServe Number of Tracked Species ...

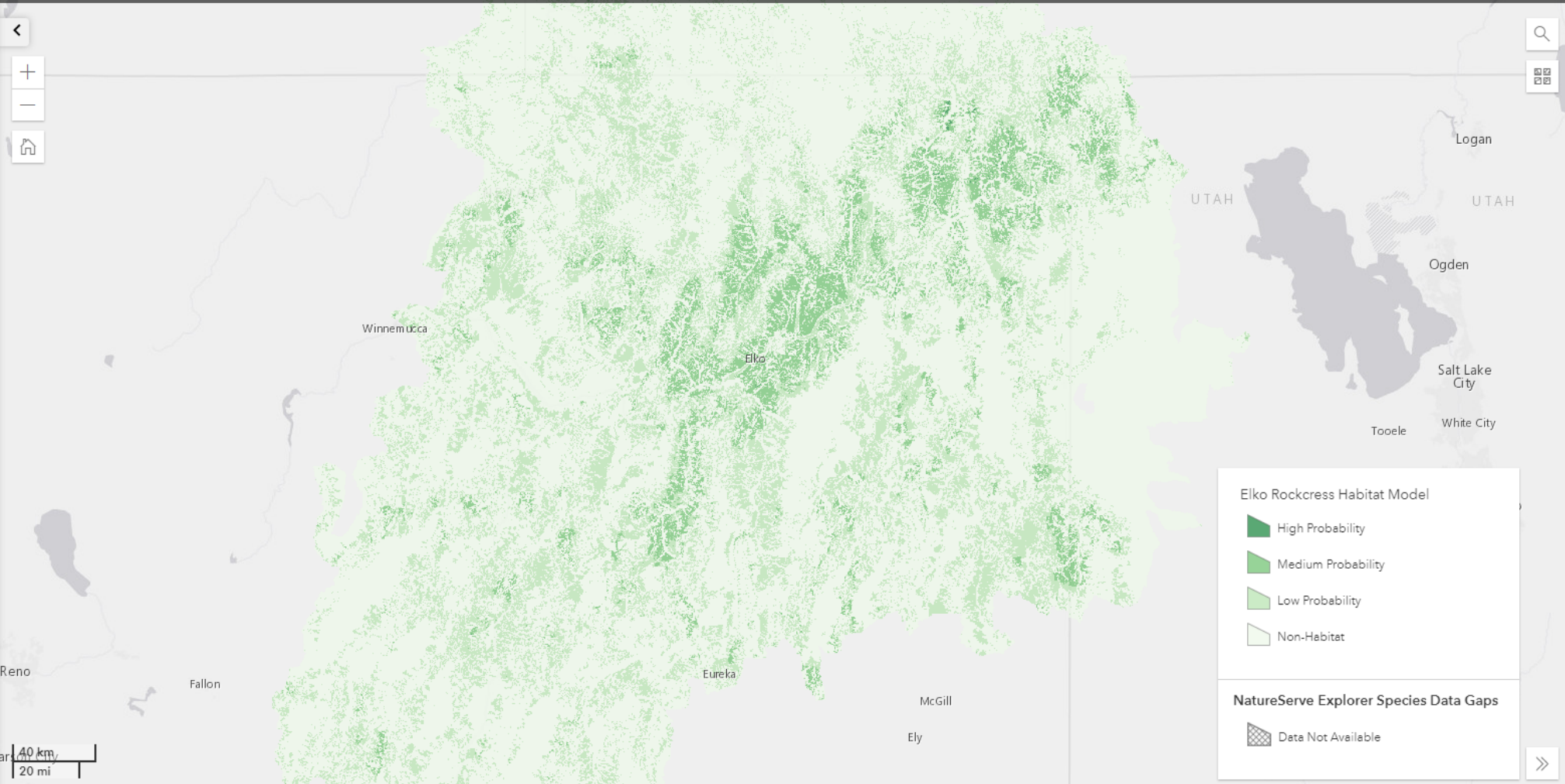
North American Major Lakes ...

North American Ecoregions - Level III ...

Provinces and Territories of Canada ...

States of the United States ...

Map of Elko Rockcress



Opportunities to engage with us following this webinar

- Sign up for access to models in NatureServe Explorer Pro (email max_tarjan@natureserve.org)
- Sign up to review and share your expertise on models for particular species (email data_science@natureserve.org)
- Any additional questions or thoughts, please email (email max_tarjan@natureserve.org)