



DoD Environmental Planning and Conservation Webinar Series



Species Habitat Models to Guide Stewardship of
DoD Mission Priority Species

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April 18, 2024

Please mute your phones



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Management of Species and Habitats

- Making decisions about species and habitats requires knowing **where** they are found
- Location information not comprehensive due to:
 - Resource limitations
 - Difficult-to-access areas
 - Private lands
 - Etc.

Commonly Used Species Distribution Data Sources

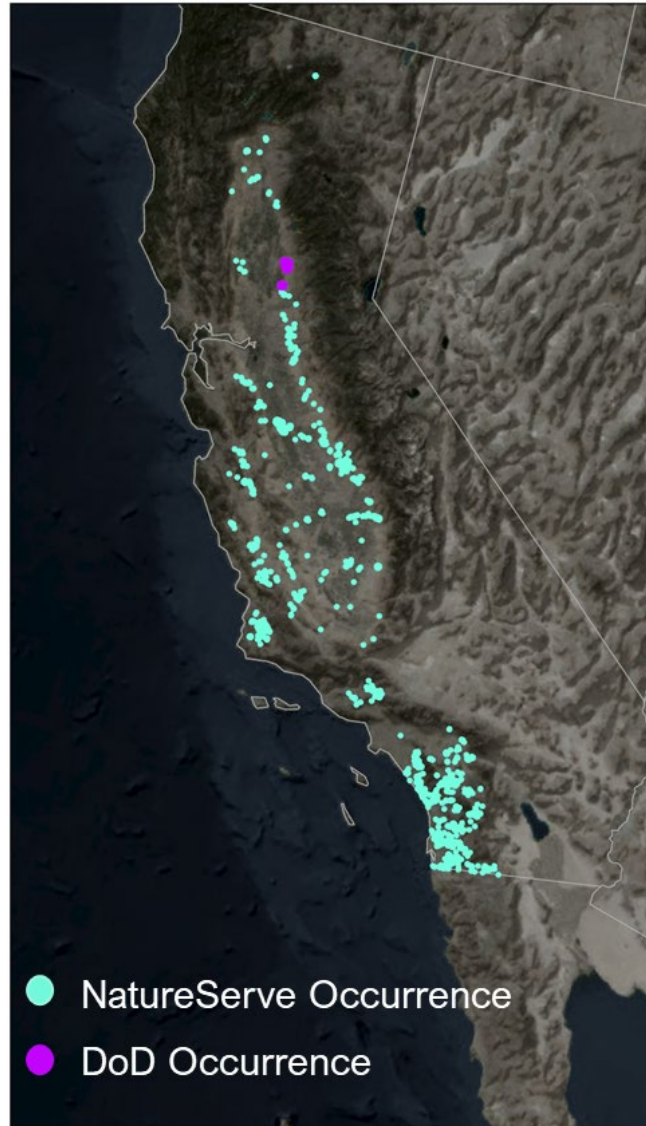
Documented Occurrences
Underestimate True Distribution

Coarse Range Maps
Overestimate True Distribution

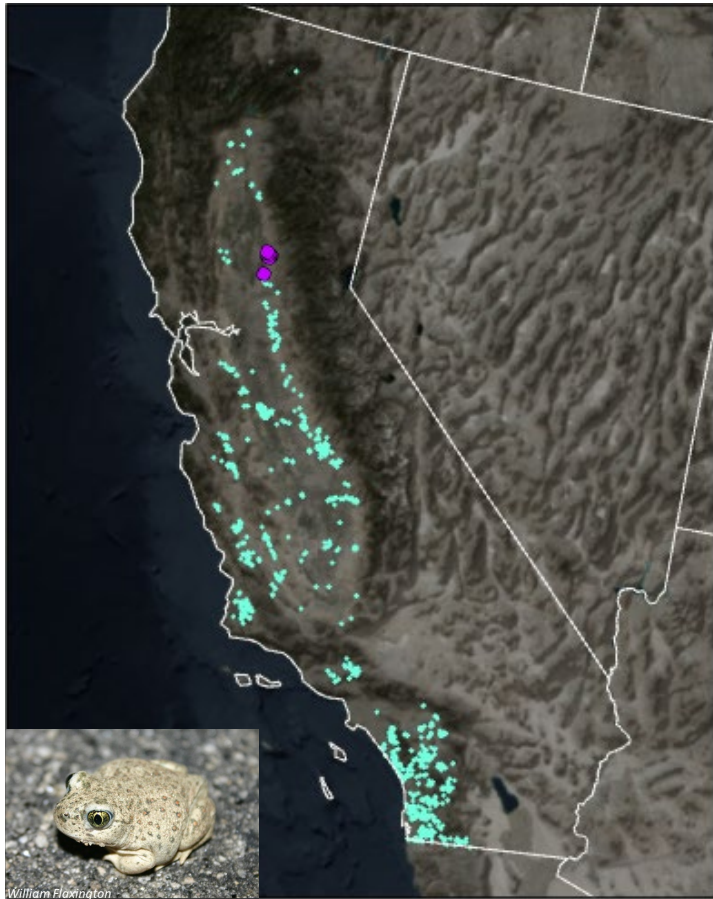
Western Spadefoot *Spea hammondi*



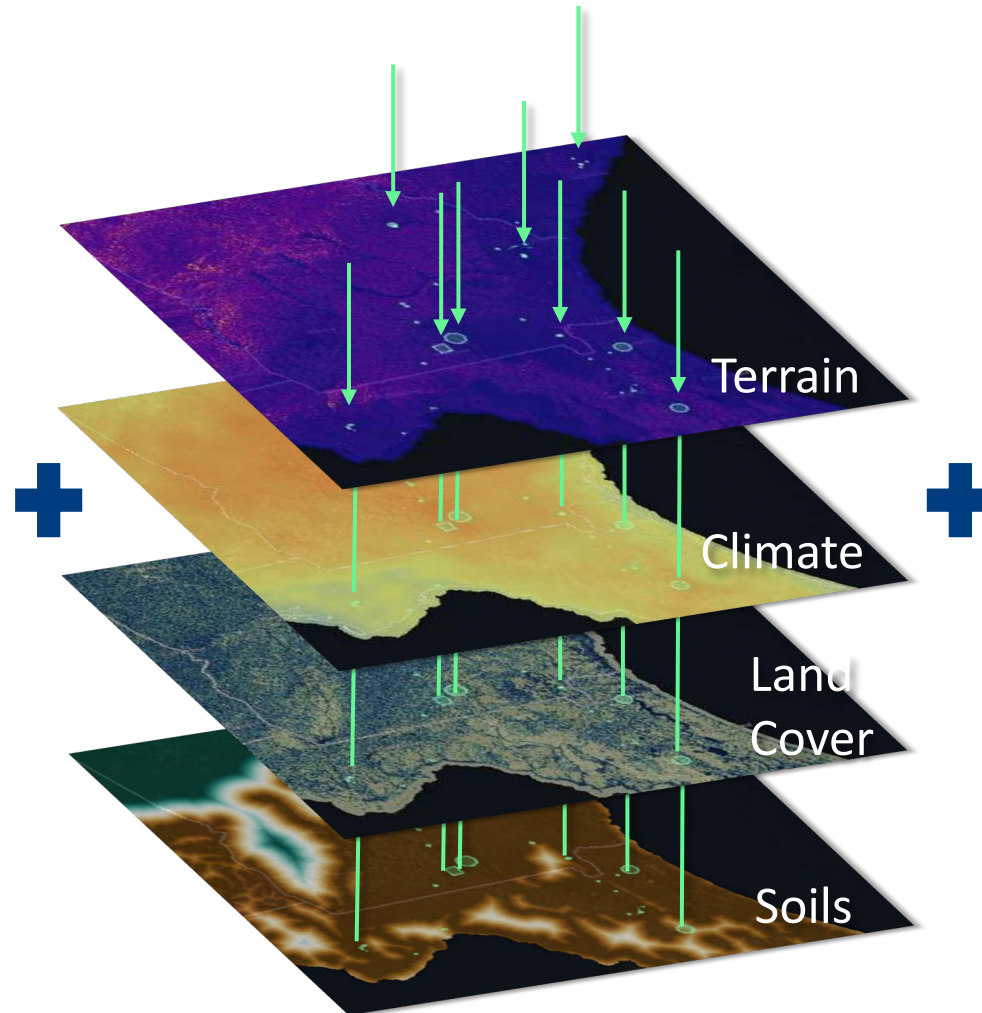
ESA Listing Status:
Under Review



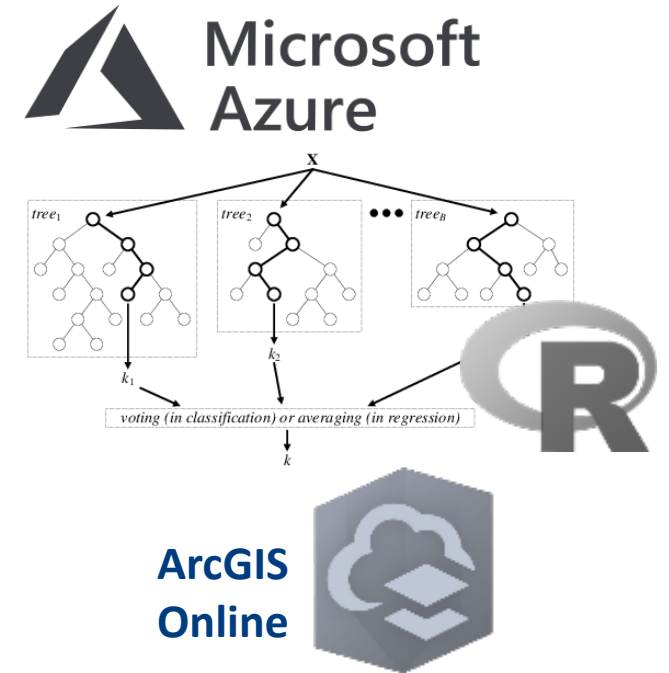
Cutting-edge predictive algorithms



Species Occurrence Data

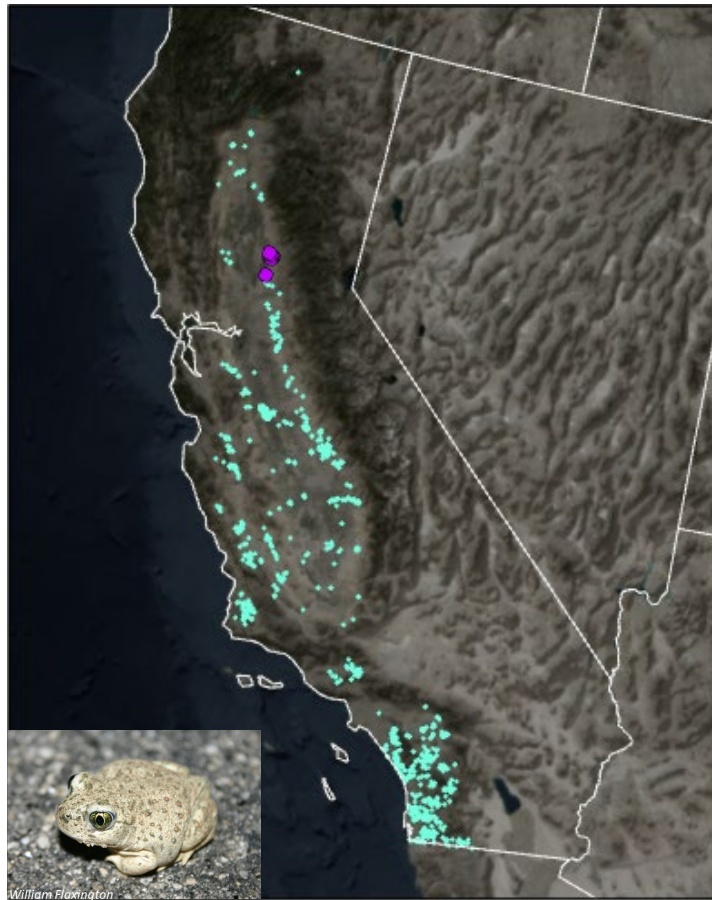


Environmental Predictor Library

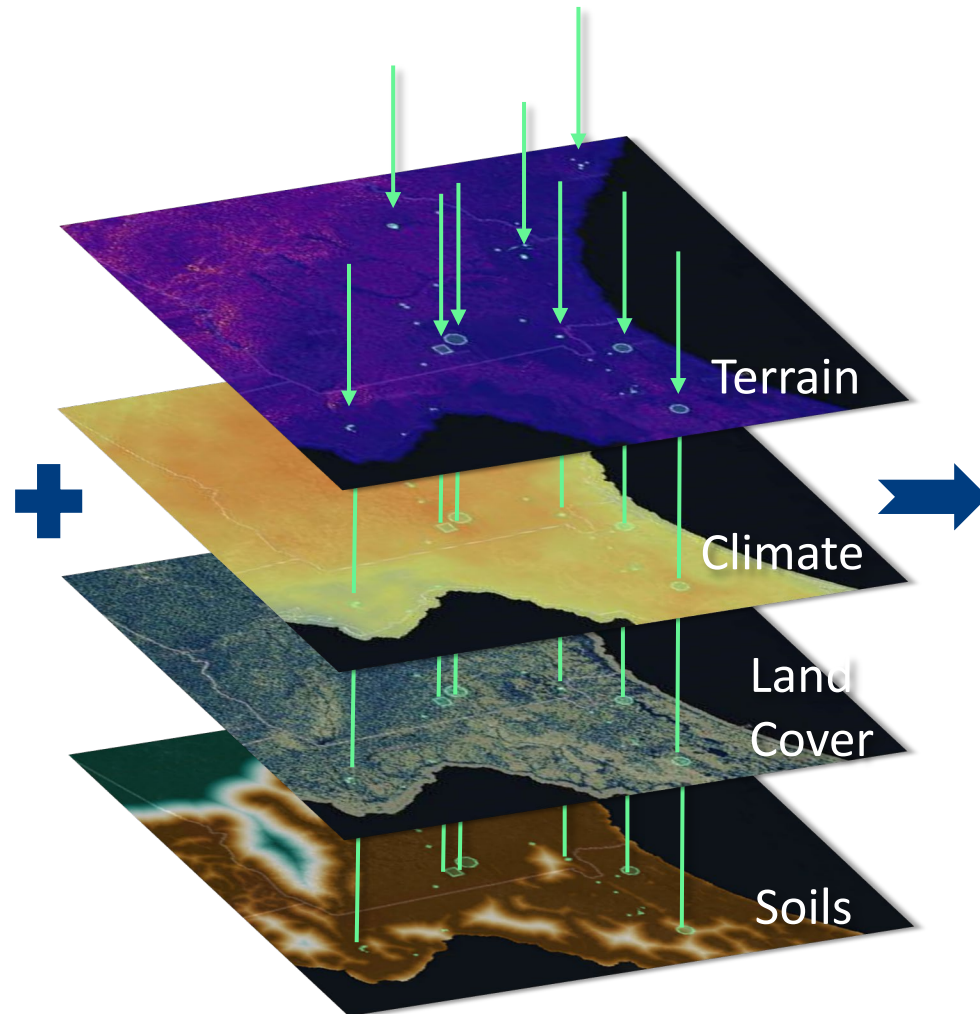


Machine Learning

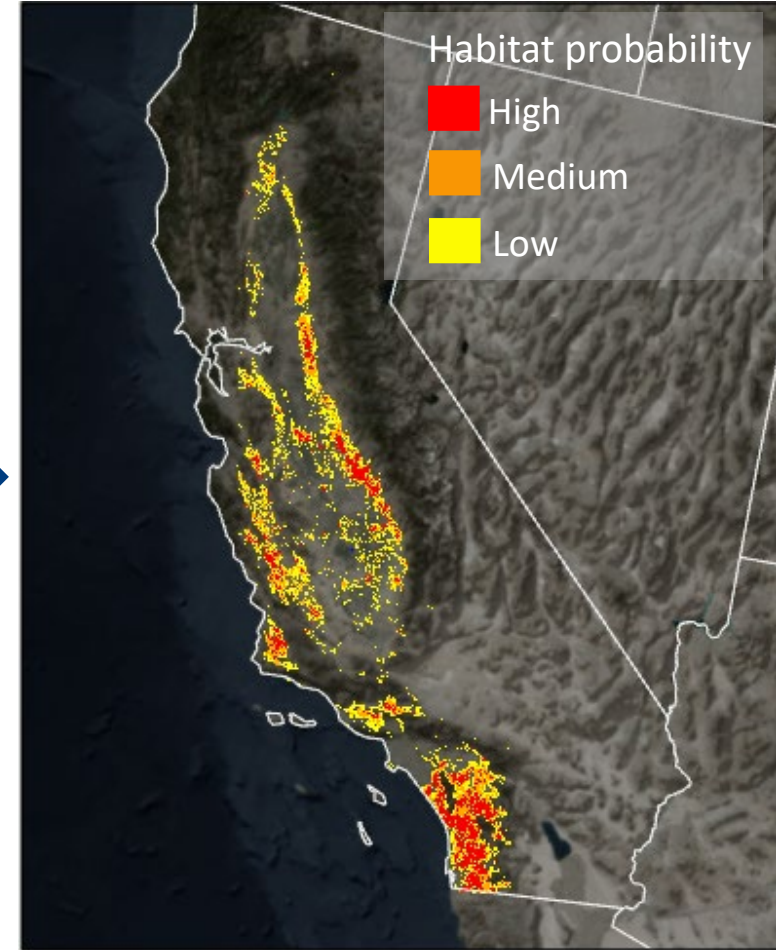
Cutting-edge predictive algorithms



Species
Occurrence Data



Environmental
Predictor Library

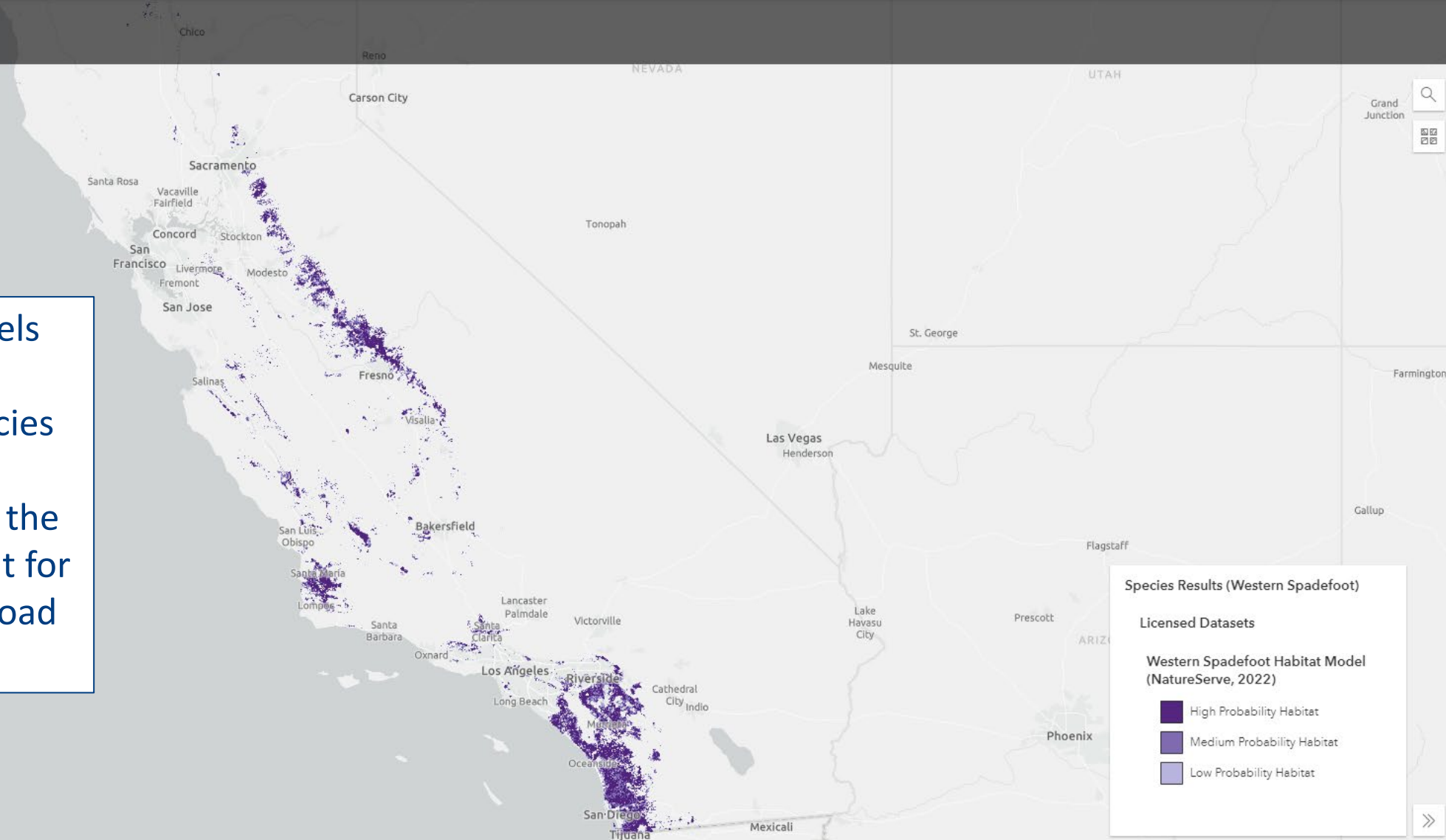


Machine
Learning

What is a Species Habitat Model?

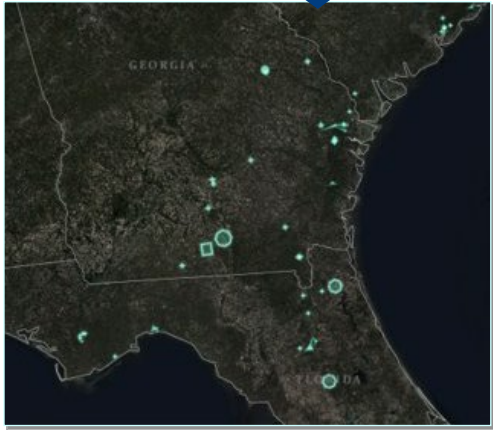
Map of Western Spadefoot

Species Habitat Models associate known occurrences of a species with environmental conditions to predict the distribution of habitat for the species across broad landscapes

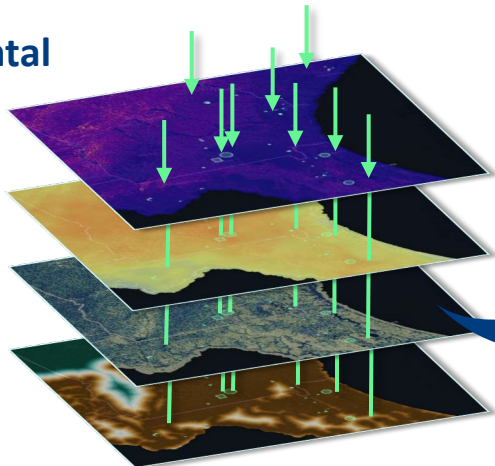


Species Habitat Modeling

1. Occurrence Data



2. Environmental Predictors



5. Field Validation



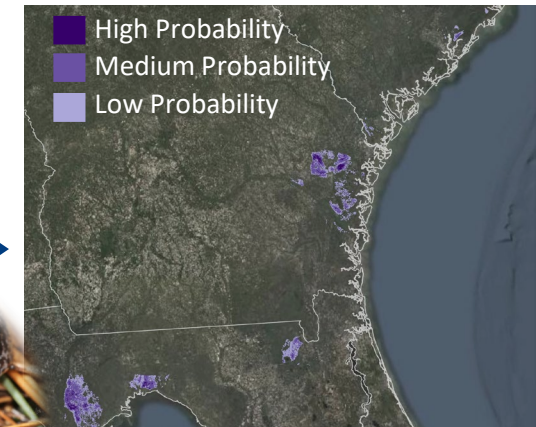
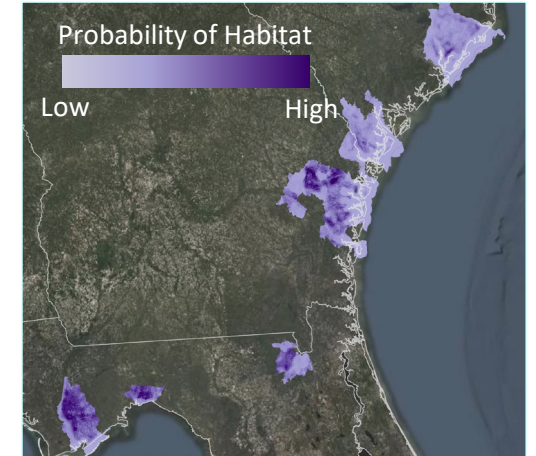
4. Expert Review



3. Modeling Engine



5. Model Products





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

Select model

Amphibians

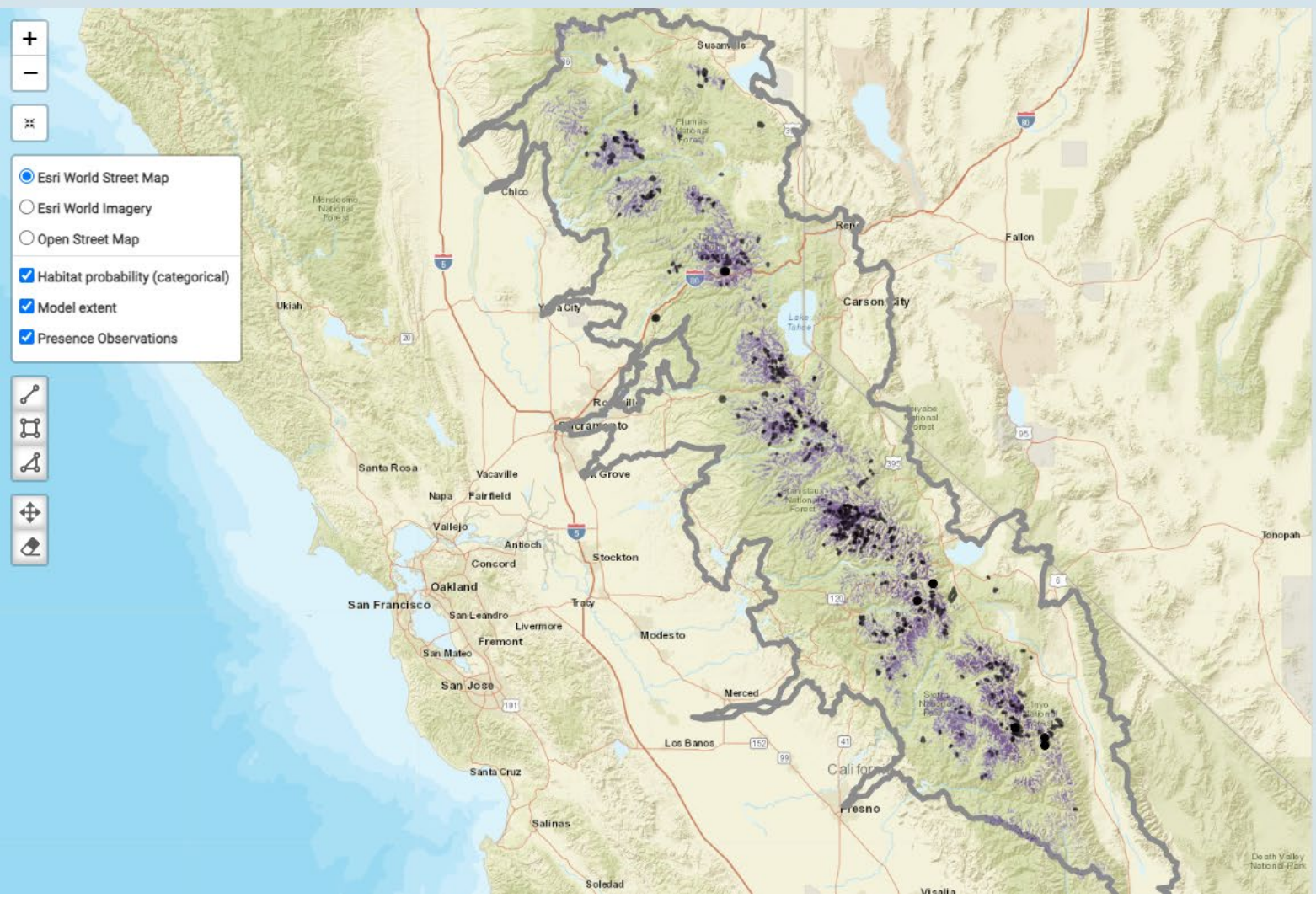
Sierra Nevada Yellow-legged Frog (*Rana sierrae*)

version 1 (2024-03-22)

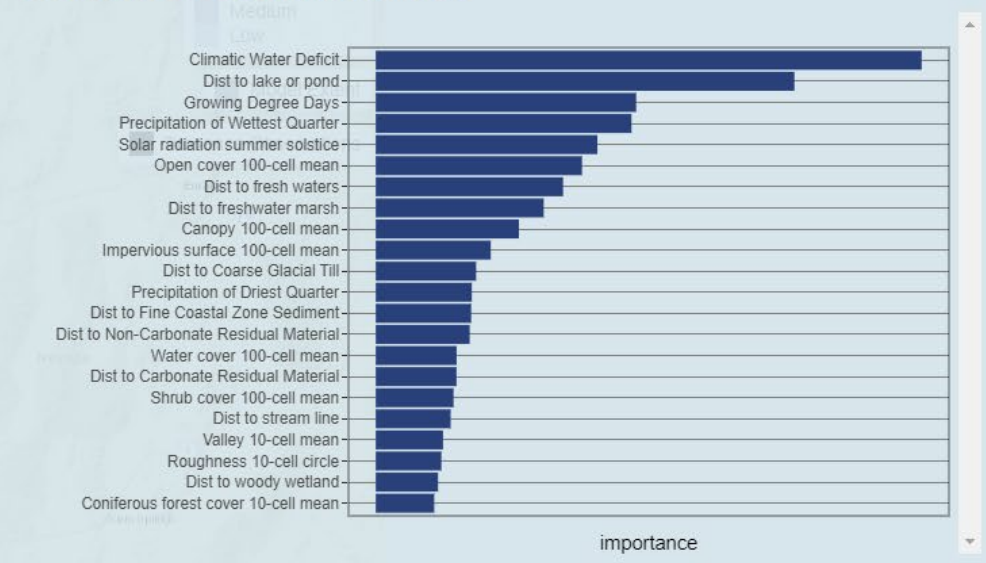
View model details

Load other reviews

Edit previous review

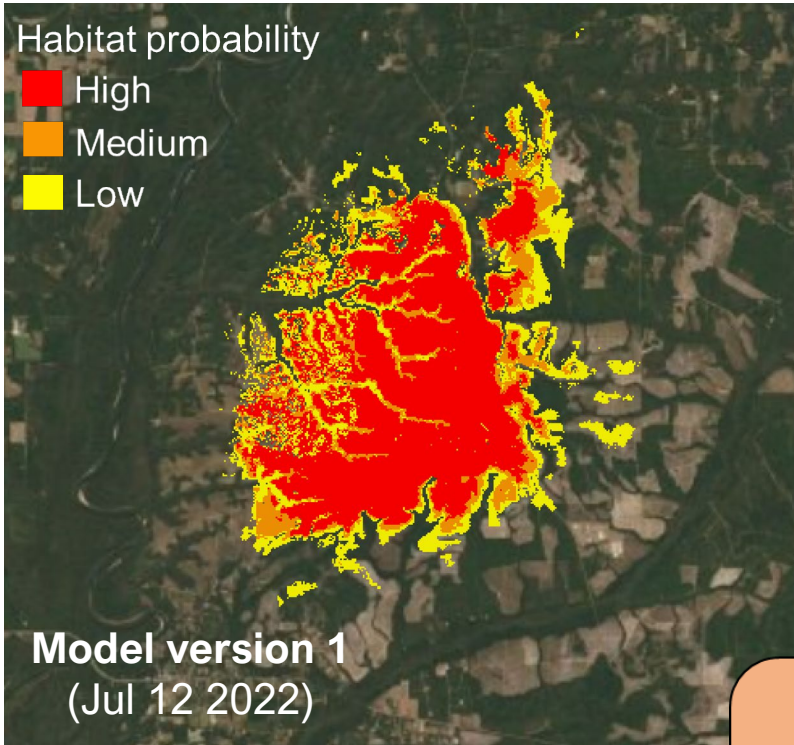


3. Review Environmental Predictors

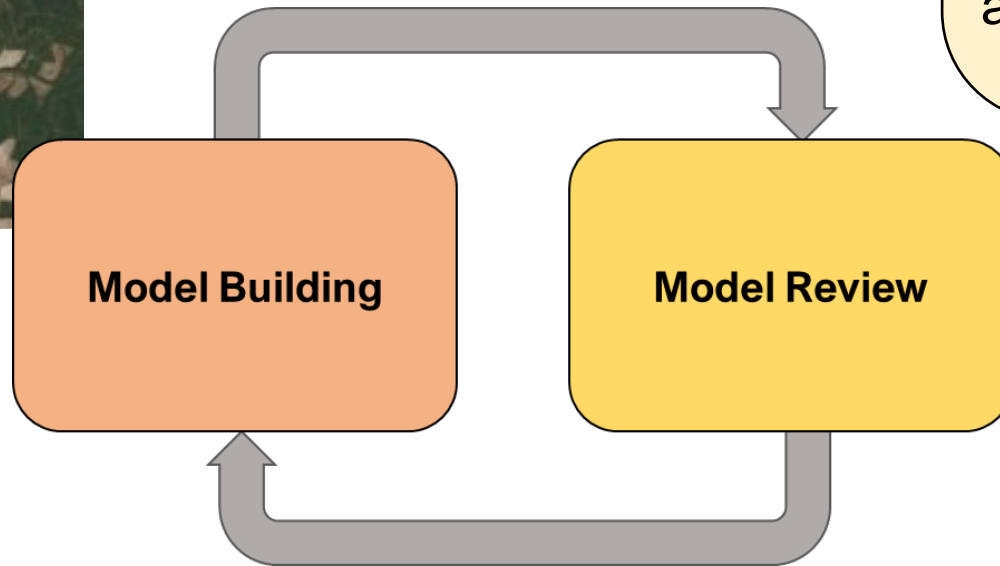


Previous step

Next step



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

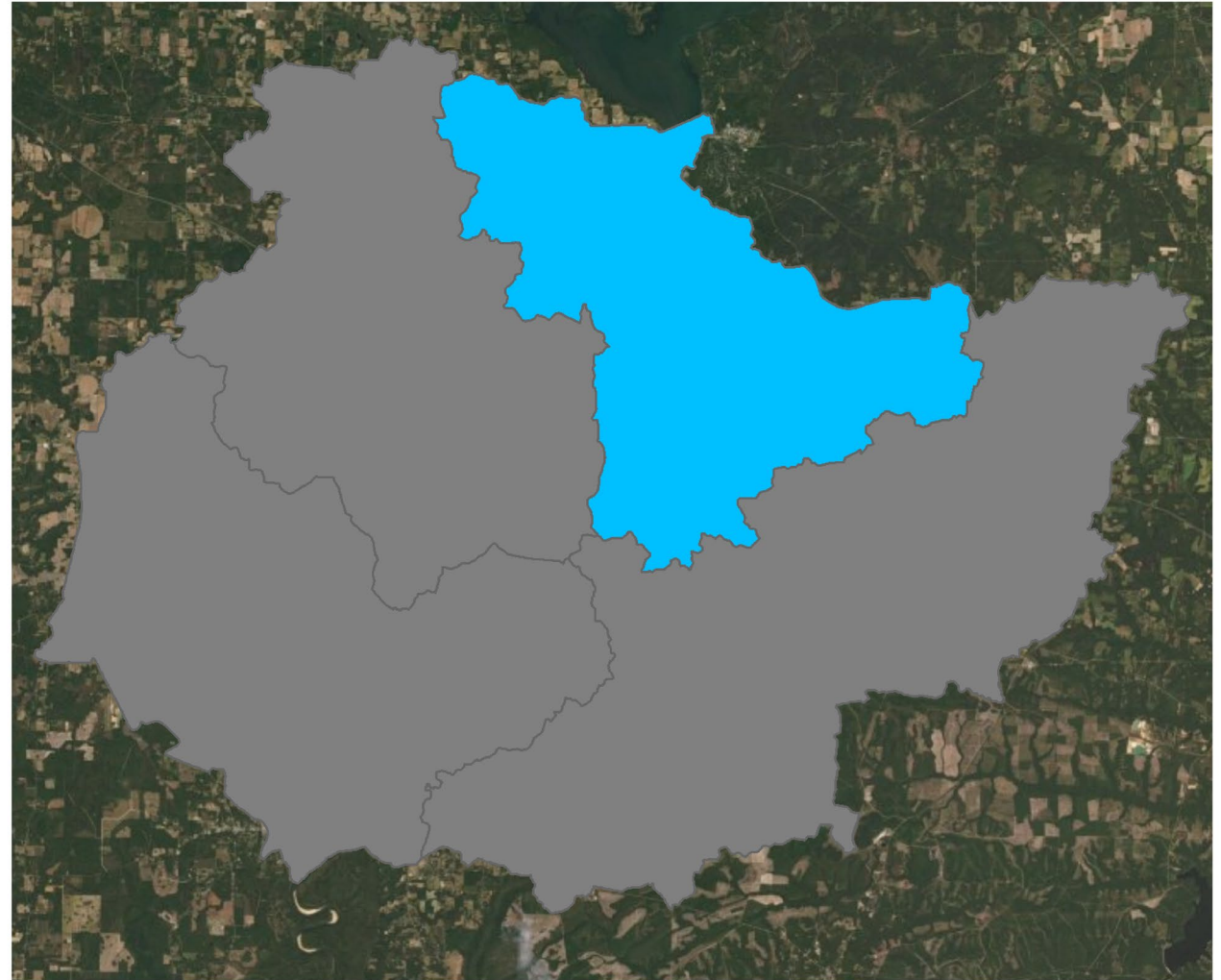
Model rating



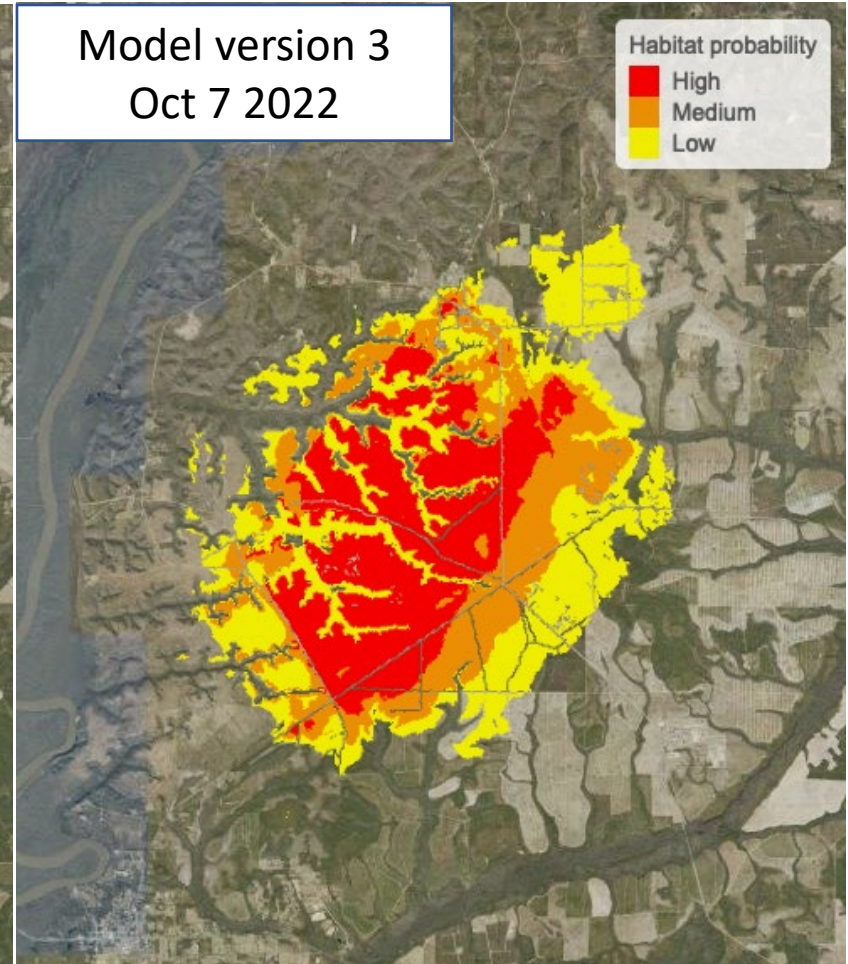
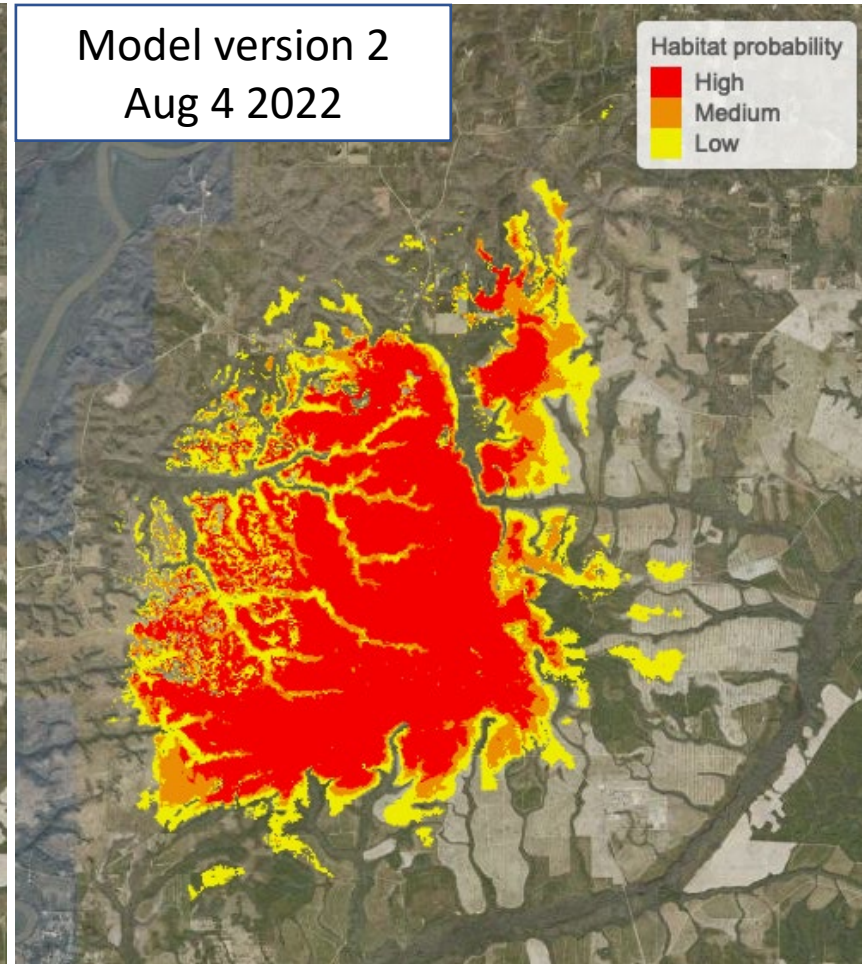
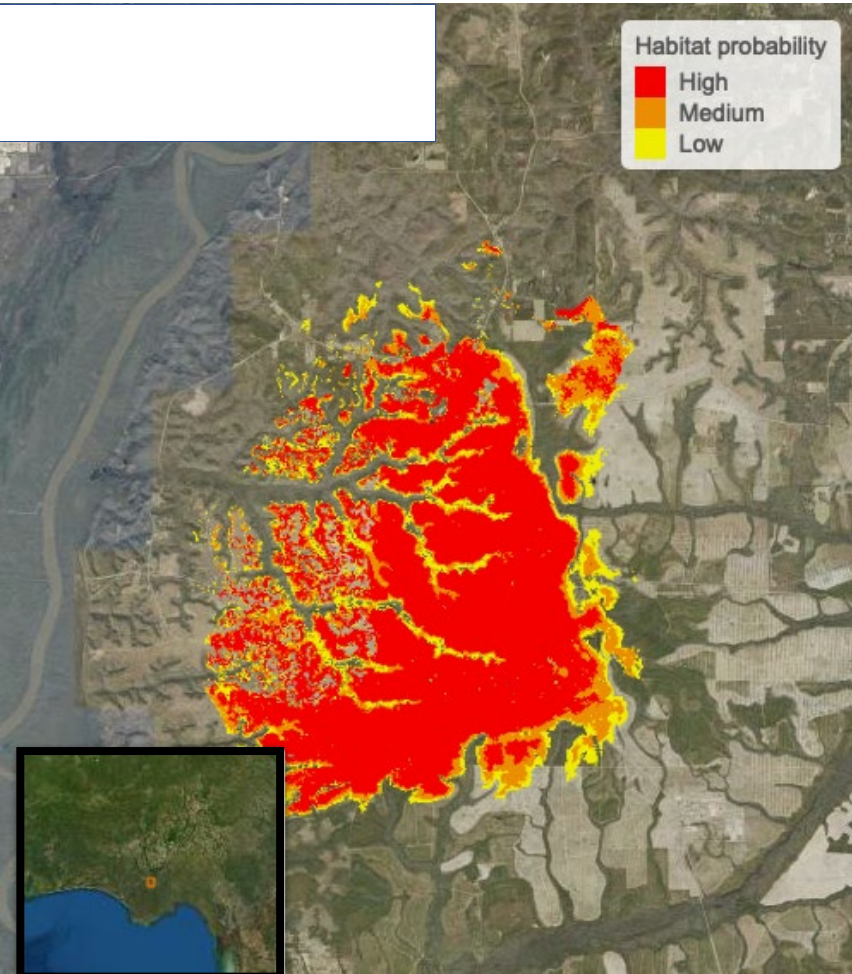
Model Revision 1

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



Revise model outputs to address expert reviews



Model rating



Model rating



Model rating



Integrity of Inputs and Methods



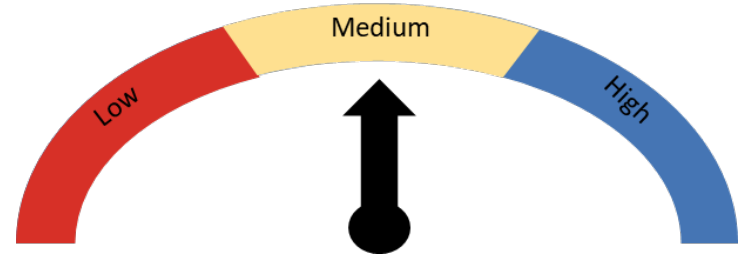
Model Validation Statistics



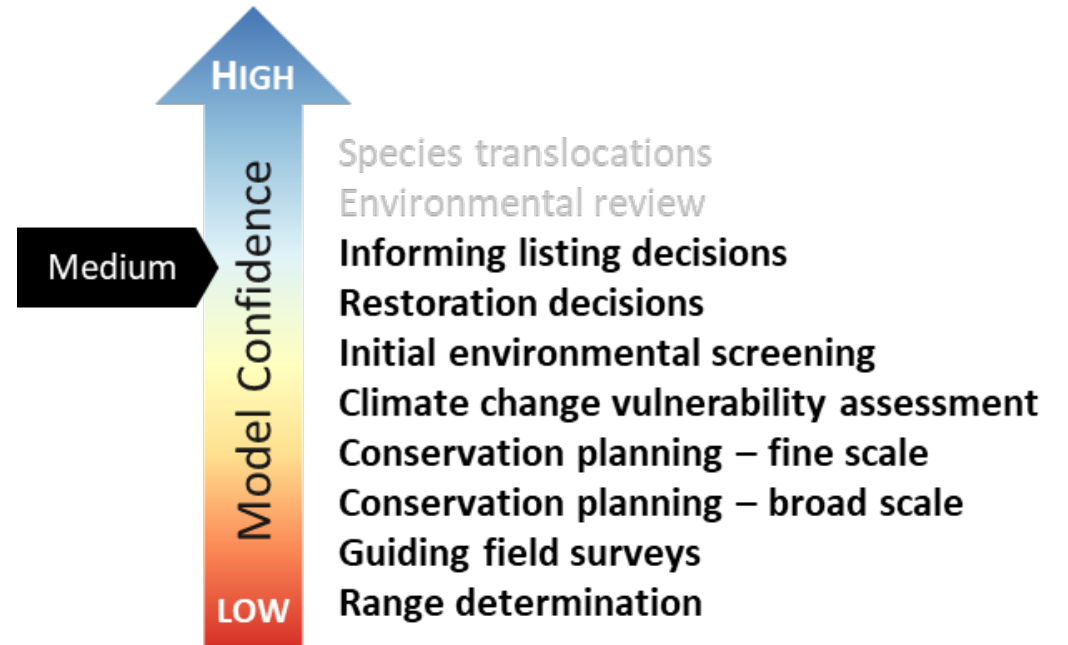
Expert Review



Model Confidence



Recommended Uses



Species Habitat Model: *Anaxyrus canorus* Yosemite Toad

NatureServe Profile: [ELEMENT_GLOBAL.2.105396](#)

Model Creation Date: 2024-03-22

Model Algorithm: Random Forest

General Information

This species habitat model (SHM) was produced by NatureServe to predict the habitat distribution for *Anaxyrus canorus* (Yosemite Toad).

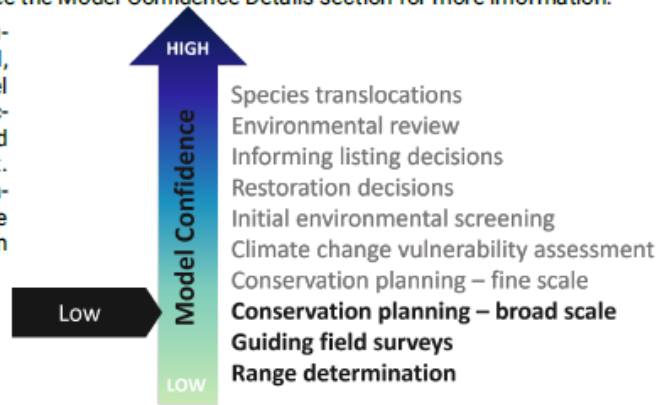
Depending on their design, SHMs may be used to guide field surveys for new populations, prioritize areas for conservation and management, or inform regulatory decisions [1,2]. SHMs associate known occurrences of a species with environmental predictors to generate predictions of the potential distribution of habitat for the species across broad landscapes. Maps generated using these models indicate likely habitat. Habitat probabilities correlate with the species occurrence across the modeled area; however, habitat probabilities are not direct estimates of species presence or absence.

For more information about this model, please contact data_science@natureserve.org. To learn more about modeling standards, see the [NatureServe Network Habitat Model Standard](#).

Recommended Uses

The degree to which habitat model predictions accurately capture habitat may be impacted by many factors including data availability and species traits. Here, we provide a measure of model confidence to inform appropriate model use. This SHM has been assessed to have an overall confidence level of **low**. See the Model Confidence Details section for more information.

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

Environmental predictors for model fitting were selected from a library of 100+ variables describing climatic conditions, land use and land cover, topography, and various other aspects of the landscape. This list was reduced to remove highly collinear variables.

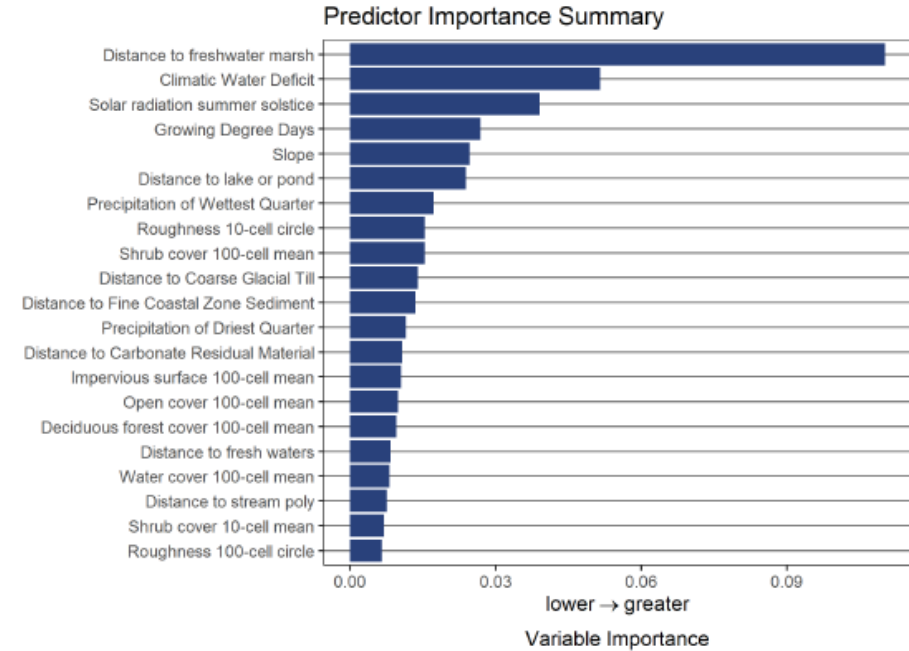


Figure 2. Relative importance of the top 50% of environmental predictors included in the full model. Variable importance of each variable was assessed by the decrease in accuracy caused by the removal of that variable from the model. See Appendix 1 for detailed descriptions of all environmental predictors and Appendix 2 for partial dependence plots for these variables.

Welcome to NatureServe Explorer Pro

NatureServe Explorer Pro extends the capabilities of NatureServe Explorer, the definitive source of information for rare and endangered species and ecosystems in North America. Through interactive maps and place-based reporting, Explorer Pro allows users to explore where at-risk species have been documented, including through Element Occurrence and observation data, and where they may occur based on habitat models.

EXPLORE DATA ON THE EXPLORER PRO MAP

Welcome natureserve.data.science+dod@gmail.com!

In addition to exploring your licensed dataset on the Explorer Pro map, you can stream or download your data via the NatureServe geodata portal.

DOD MODEL ACCESS GROUP

Requirements for All NatureServe Data Users

Everyone accessing NatureServe's precise species locations (documented locations and predicted habitat) is doing so under a License Data Agreement. Because this data is sensitive and confidential, all users must:

- Complete NatureServe's [Data Use Training](#)
- Review and adhere to your organization's data license agreement. NatureServe licensed data, in whole or in part, can not be distributed to, or accessed, by other agencies, organizations, companies, or individuals that are not defined as Data Users within your organization's data license agreement. For a copy of your organization's unique data license agreement, email datasupport@natureserve.org.

Your Model Library

Show rows Showing 1 to 10 of 49 models

Filter by Name

Model Name [↑]	Scientific Name [↑]	Model Confidence [↑]	Links
Escambia Map Turtle	<i>Graptemys ernsti</i>	Medium	Open in Explorer Pro Metadata
Florida Pinesnake	<i>Pituophis melanoleucus mugitus</i>	Medium	Open in Explorer Pro Metadata
Florida Scrub Lizard	<i>Sceloporus woodi</i>	Medium	Open in Explorer Pro Metadata
Yuman Desert Fringe-toed Lizard	<i>Uma rufopunctata</i>	Medium	Open in Explorer Pro Metadata
Western Spadefoot	<i>Spea hammondi</i>	Medium	Open in Explorer Pro Metadata

Current Search Criteria CLEAR ALL X

Species *Spea hammondi* Western Spadefoot X

VIEW SPECIES LIST

Species Search and Filter

Filter by Area

Map Layers

Species Results (Western Spadefoot)

Licensed Datasets

- Western Spadefoot Habitat Model (NatureServe, 2022)

Public Datasets

- Public Element
- Occurrences (NatureServe, 2024)
- Public Observations
- Documented Distribution (NatureServe, 2024)
- State/Provincial Conservation Status (NatureServe, 2024)
- NatureServe Explorer Species Data Gaps (NatureServe, 2024)

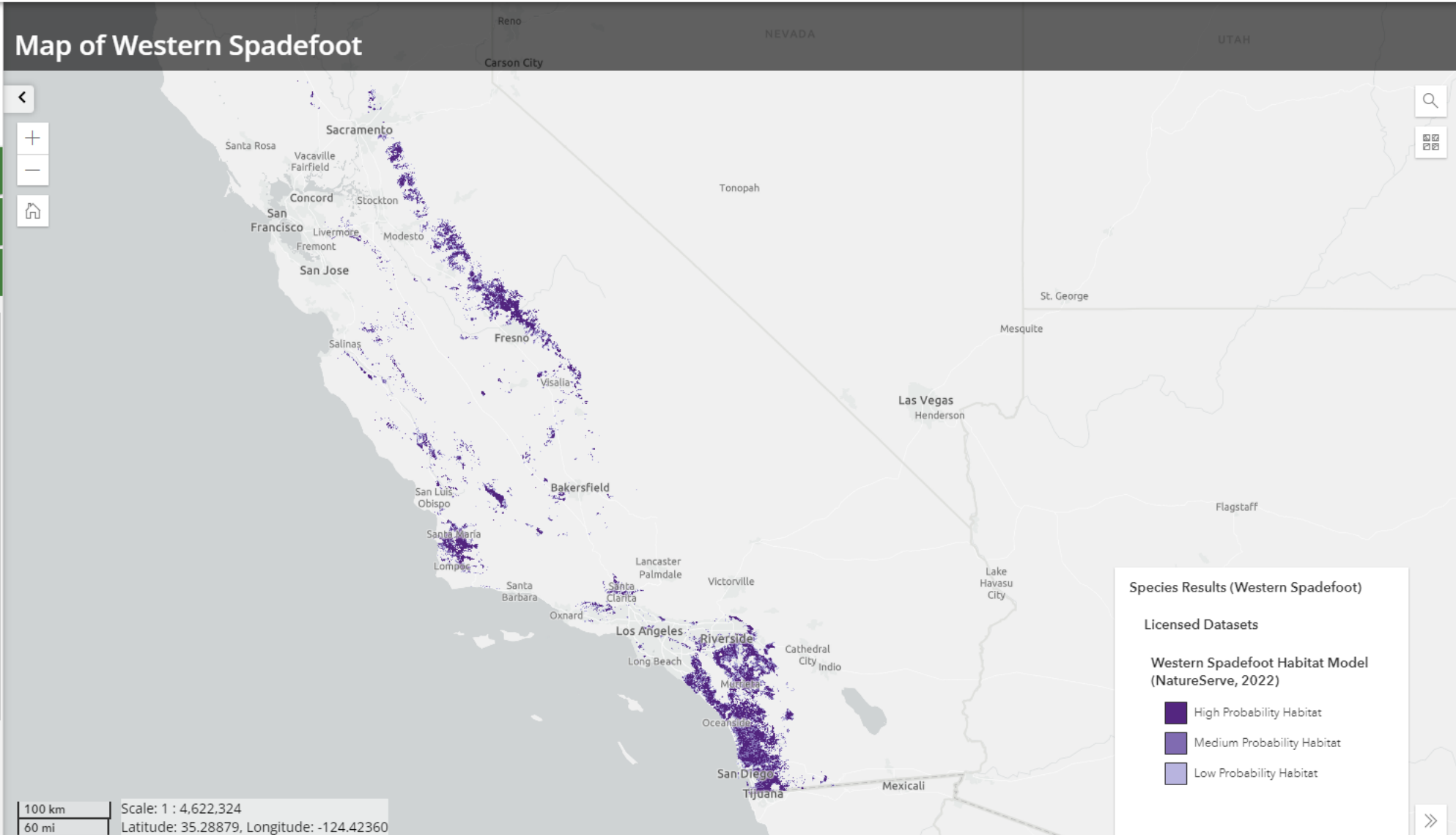


Figure 3. Species Habitat Model for Western Spadefoot (*Spea hammondi*) on NatureServe Explorer Pro. This SHM was developed in year 1 and then revised in year 2 following expert review of the draft model.

Species Habitat Models for DoD

Birds

1. Southwestern Willow Flycatcher
2. Least Bell's Vireo
3. Light-footed Ridgway's Rail
4. California Least Tern
5. Saltmarsh Sparrow
6. Northern Aplomado Falcon
7. Florida Scrub-Jay

Amphibians

1. Gopher Frog
2. Western Spadefoot
3. Reticulated Flatwoods Salamander
4. Arroyo Toad
5. Frosted Flatwoods Salamander

Mammals

1. Preble's Meadow Jumping Mouse
2. Kit Fox - San Joaquin Valley Population
3. Little Brown Myotis
4. Northern Myotis
5. Indiana Myotis

Reptiles

1. Panamint Alligator Lizard
2. Florida Pinesnake
3. Desert Massasauga
4. Yuman Desert Fringe-toed Lizard
5. Florida Scrub Lizard
6. Louisiana Pinesnake
7. Eastern Indigo Snake
8. Eastern Diamond-backed Rattlesnake
9. Escambia Map Turtle

Species Habitat Models for DoD

Dicots

1. Southwestern Willow Flycatcher
2. Least Bell's Vireo
3. Light-footed Ridgway's Rail
4. California Least Tern
5. Saltmarsh Sparrow
6. Northern Aplomado Falcon
7. Florida Scrub-Jay

Monocots

1. Purple Amole
2. California Orcutt Grass
3. Hairy-peduncled Beakrush
4. Threadleaf Brodiaea

Spikemosses and Quillworts

1. Louisiana Quillwort

Butterflies and Skippers

1. Karner Blue
2. Frosted Elfin
3. Eastern Arogos Skipper
4. Monarch (western population - multiple models)
5. Palos Verdes Blue

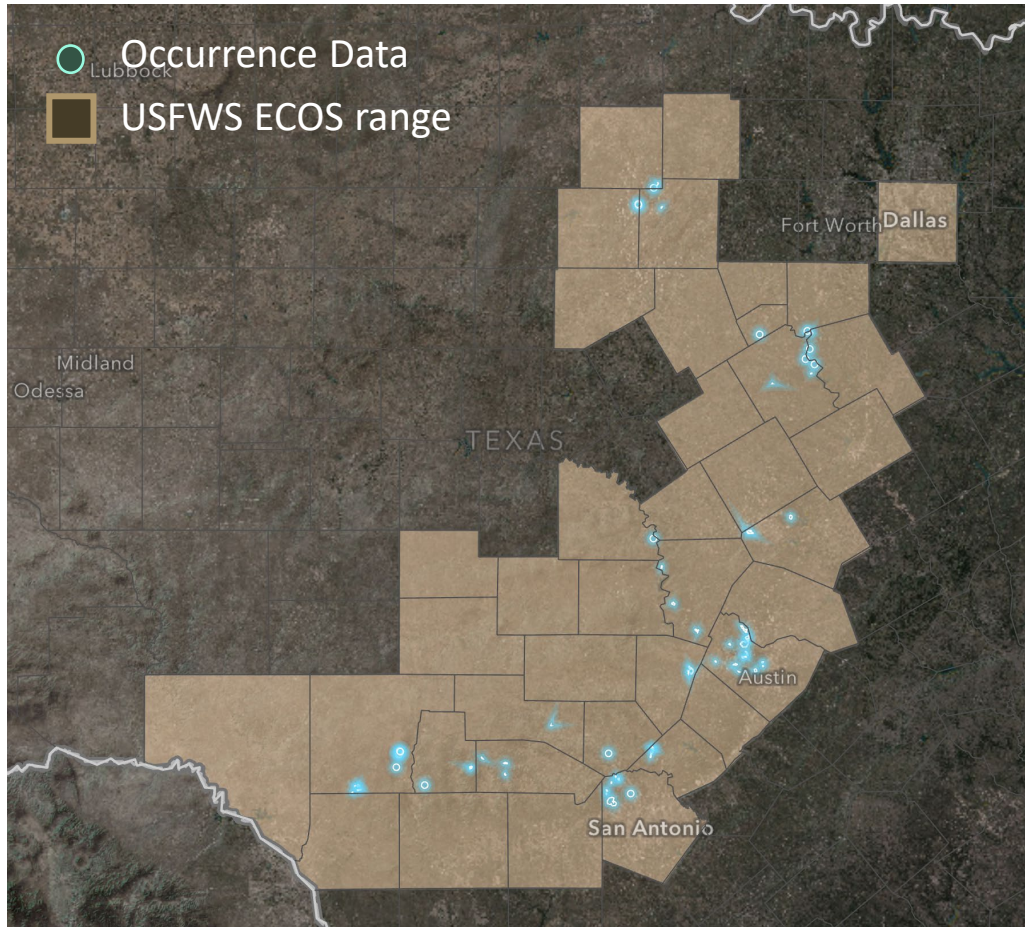
Shrimps and Fishes

1. San Diego Fairy Shrimp
2. Riverside Fairy Shrimp
3. Gulf Sturgeon
4. White Sands Pupfish

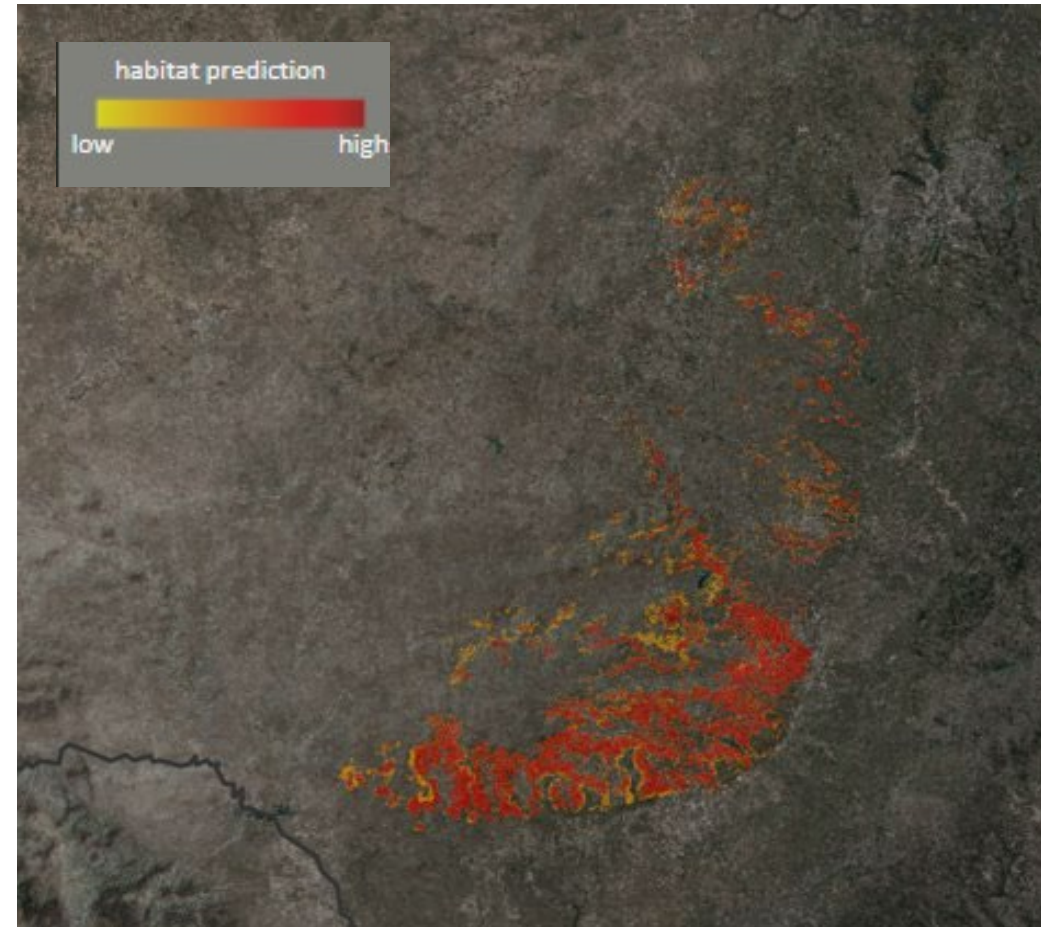
Model Applications at DoD

- Guiding field surveys
 - PARC and PIF using USFWS models
 - DoD information is coarse scale (county level), so habitat models improve information
- Determine potential species that could be impacted by change in operations
 - Guidance on what might be impacted and where to survey
- Evidence for stewardship responsibility to justify funding
- Justification for species de-listing
- Overlay climate change models with habitat models to understand where habitat will be valuable (climate section of INRMP)
- Useful for species-specific management in INRMP
- Stewardship assessments allow for coordination across bases

Model Applications: Generating refined habitat maps



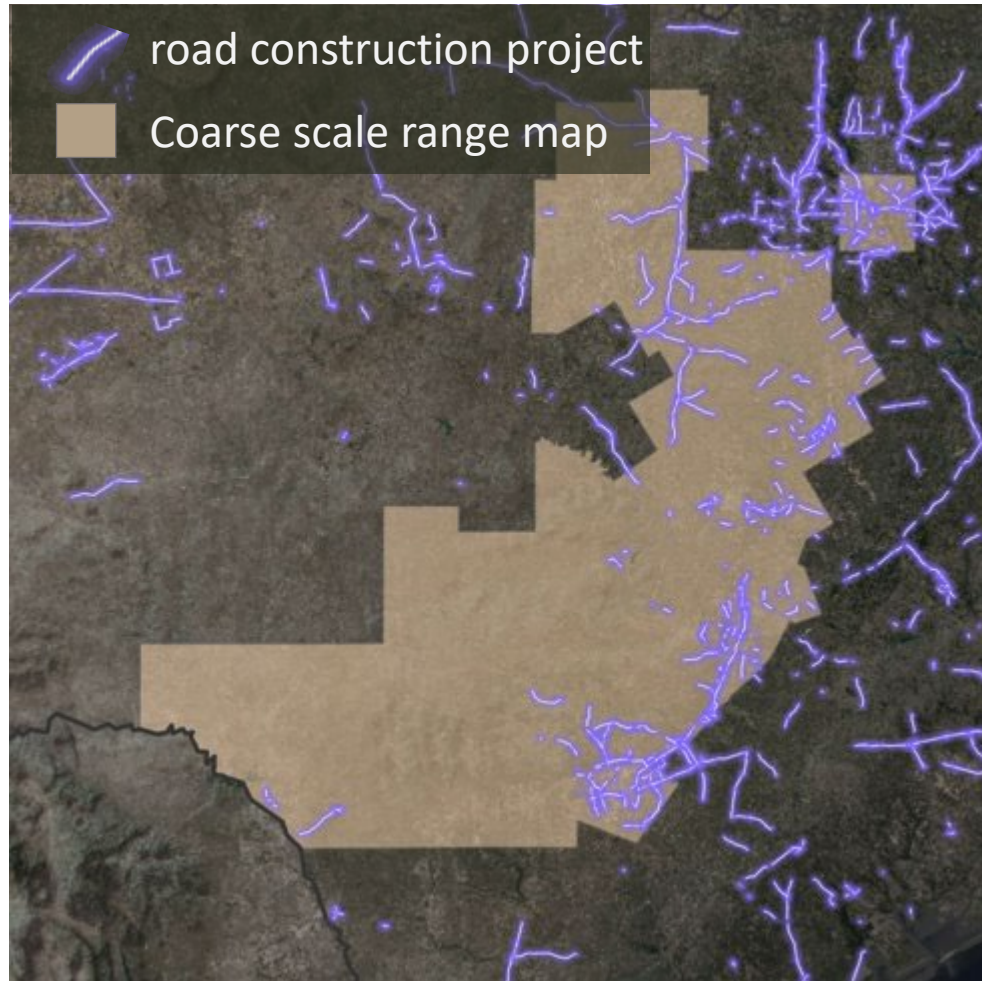
Previously Available Data



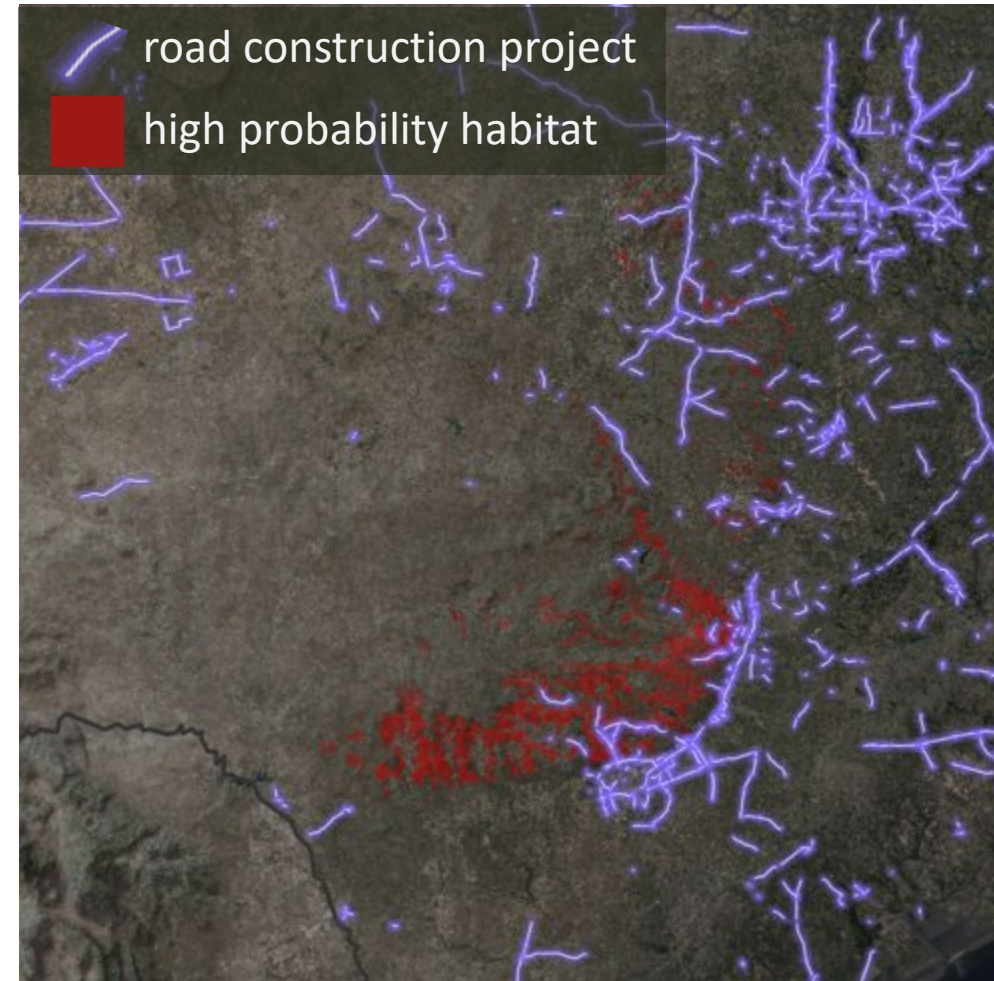
Predicted Habitat



Model Applications: Generating refined habitat maps



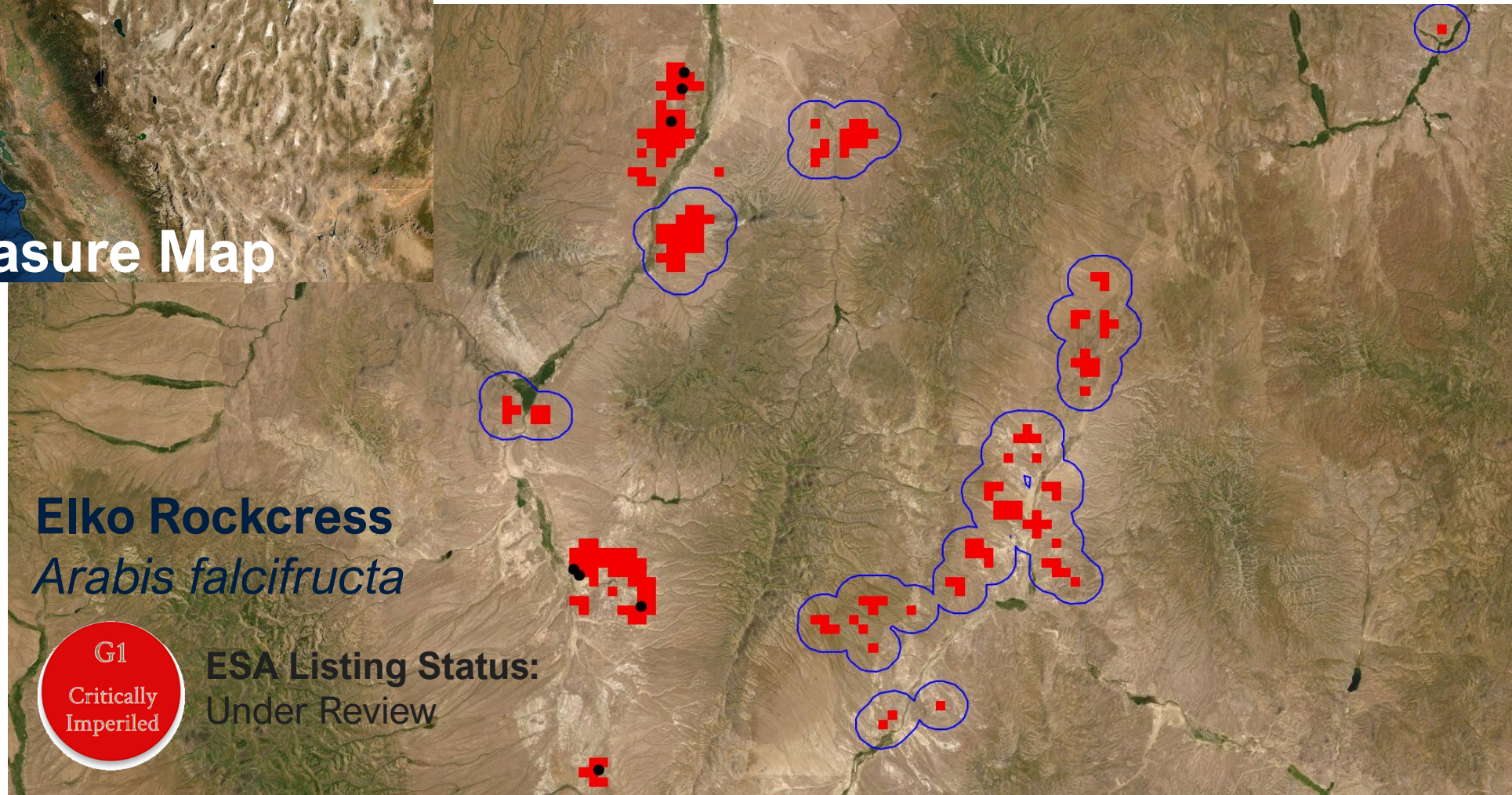
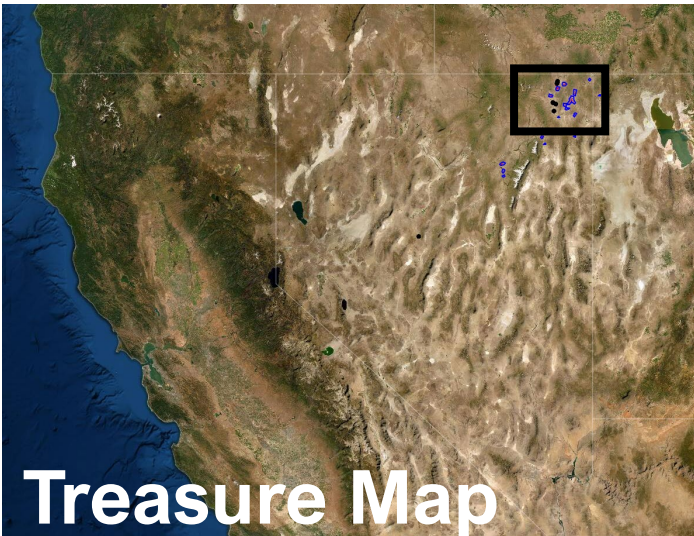
Previously Available Data






Predicted Habitat

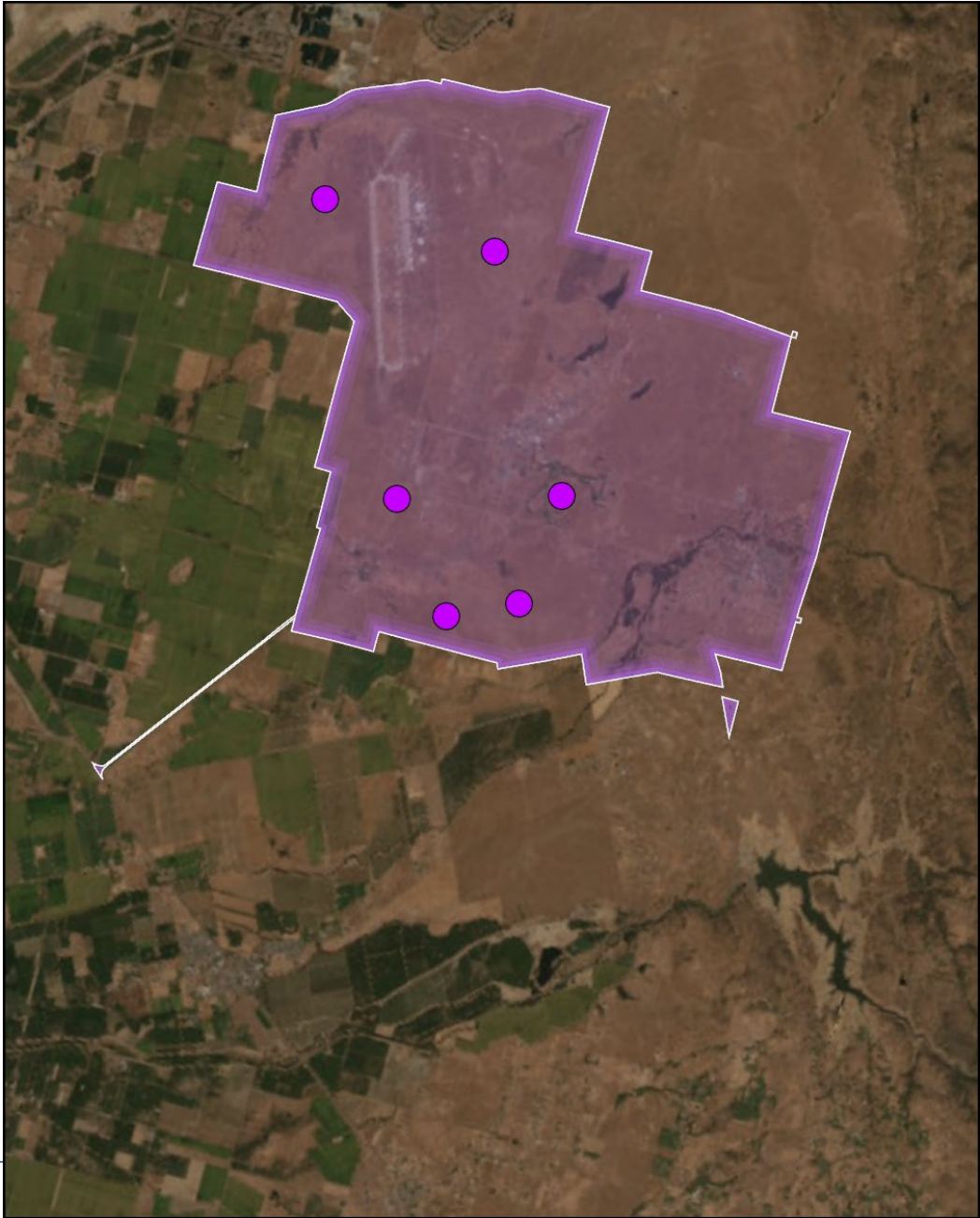
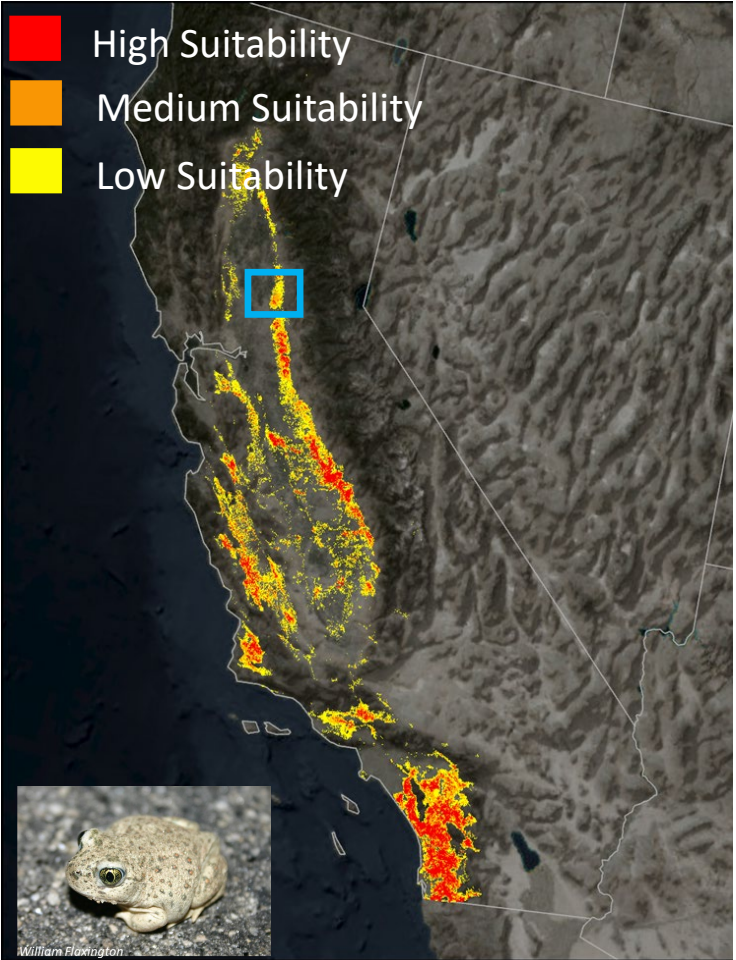


Model Applications: Guiding Field Surveys

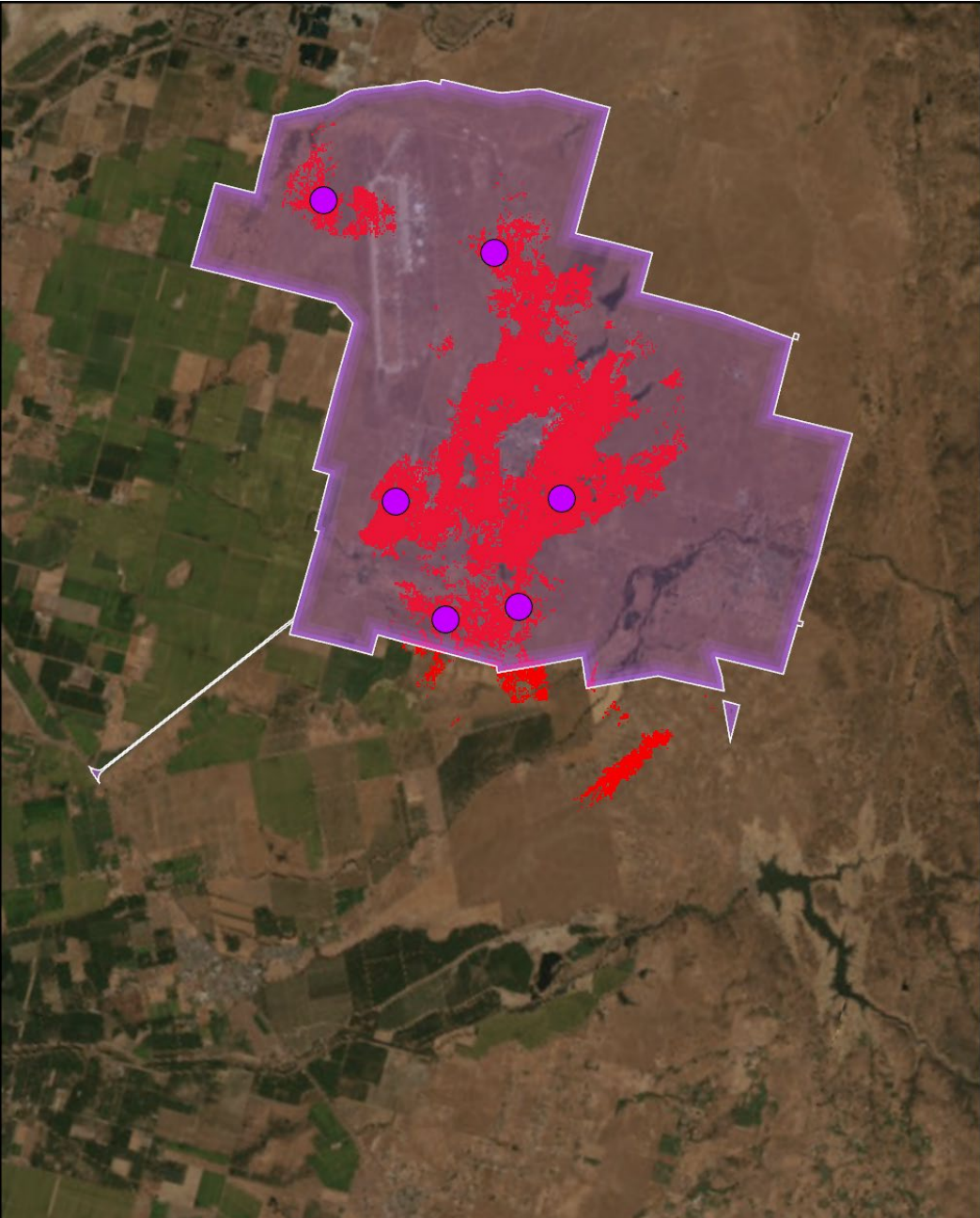
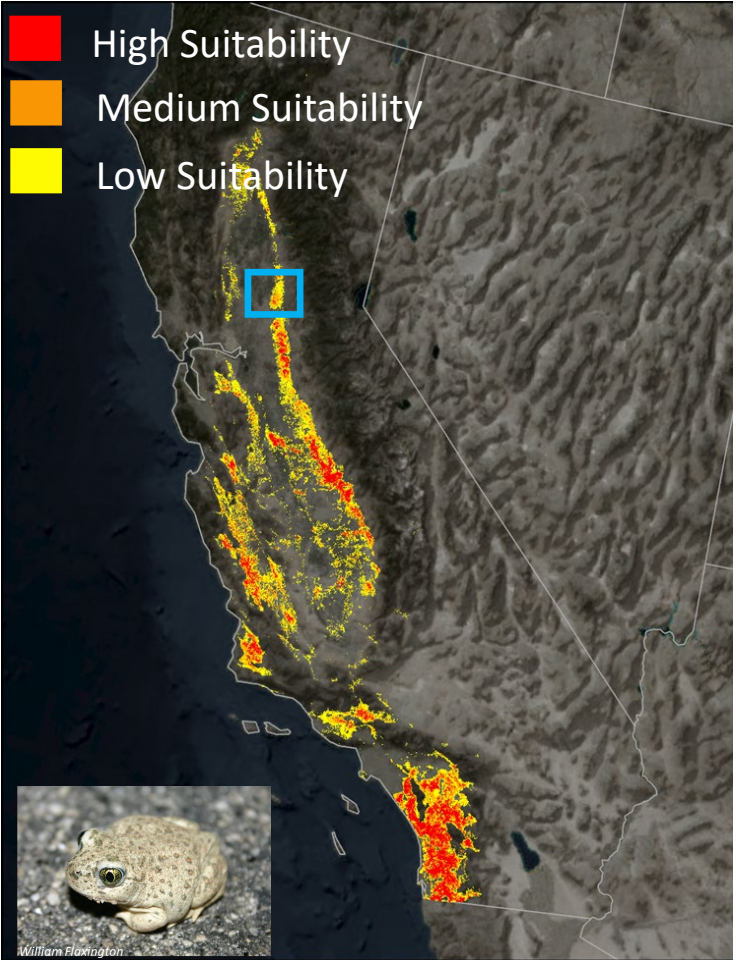


-  High Habitat Suitability
-  NatureServe Biodiversity Location Data
-  Priority Targets for Field Inventory

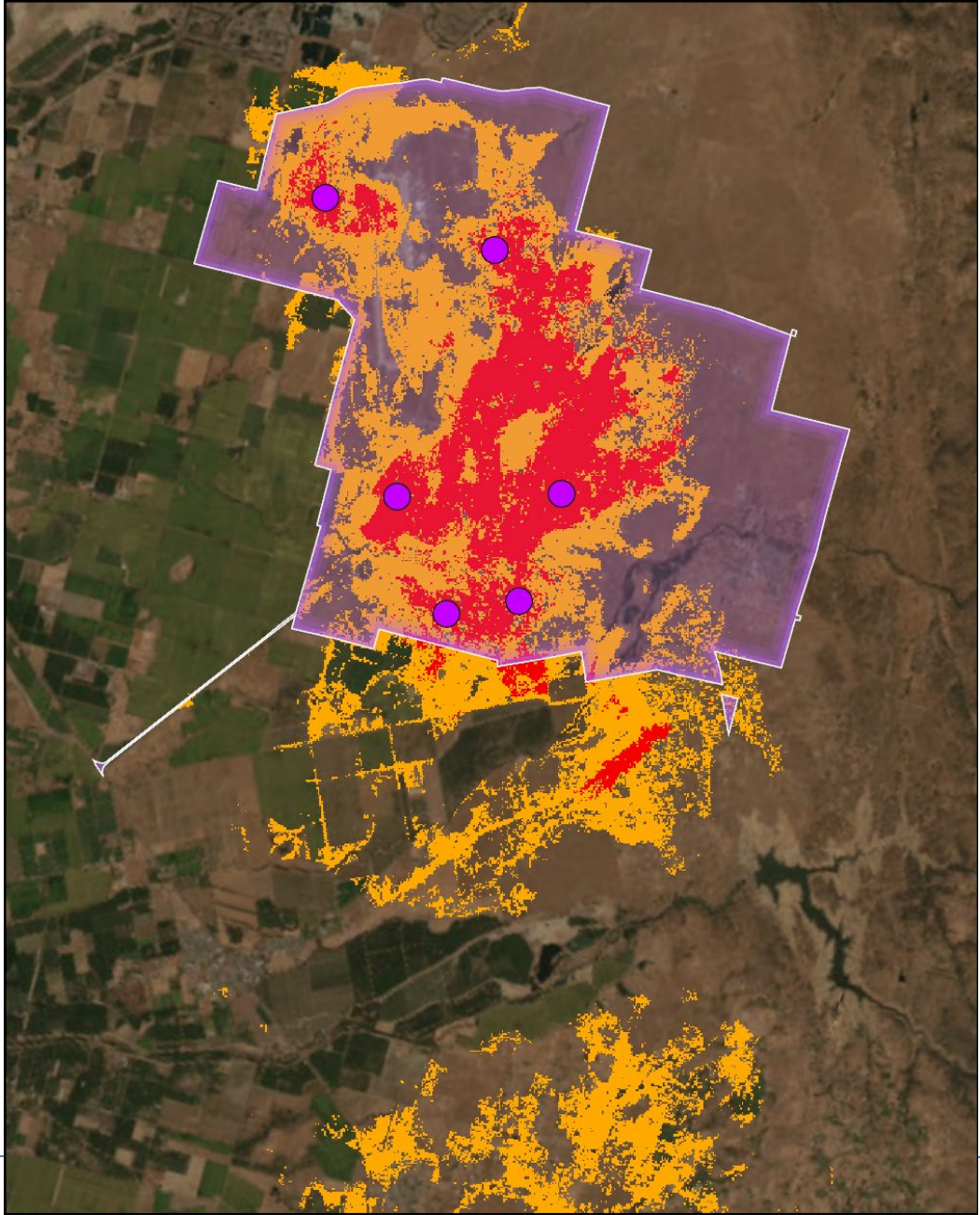
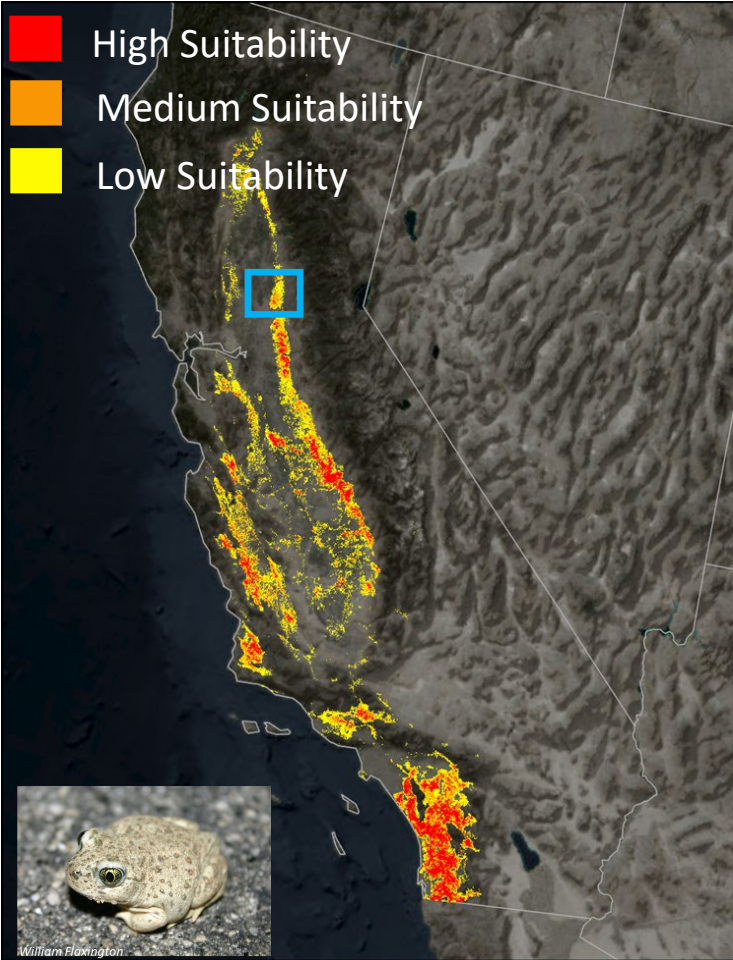
Model Applications: Identifying Stewardship Responsibility



Model Applications: Identifying Stewardship Responsibility



Model Applications: Identifying Stewardship Responsibility



Model Applications: Identifying Stewardship Responsibility

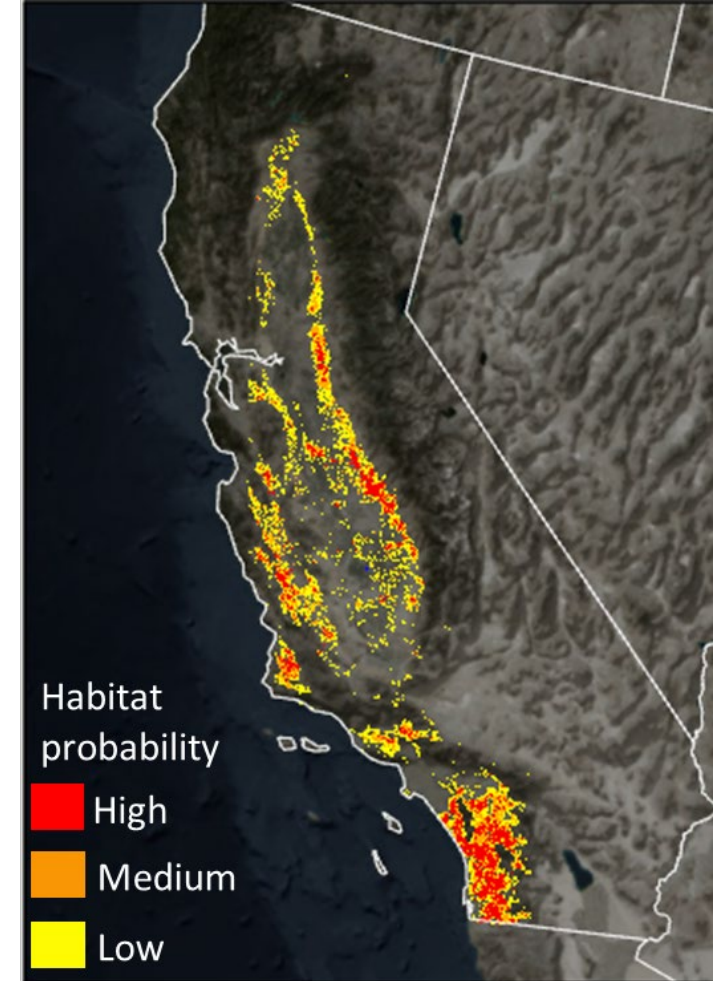
Occurrences



IUCN range map



Habitat model predictions



installations
on which
species occurs

12

27

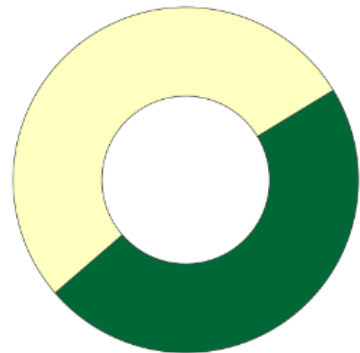
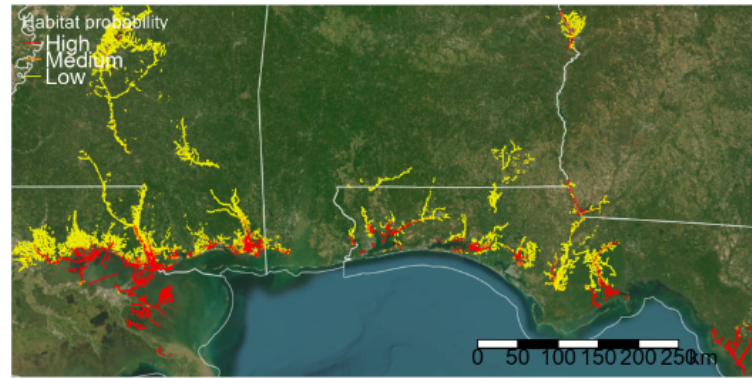
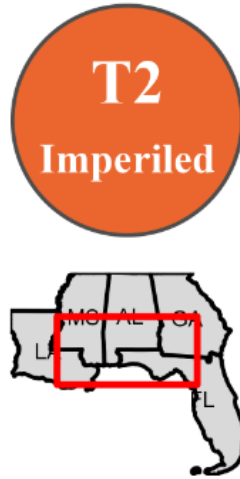
16

Model Applications: Identifying Partners in Conservation

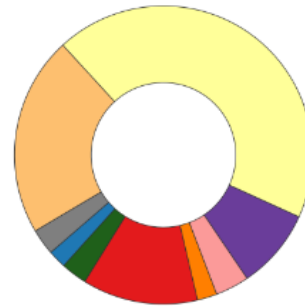
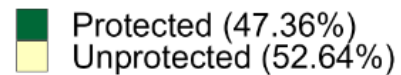
Gulf Sturgeon (*Acipenser oxyrinchus desotoi*)

Species Profile

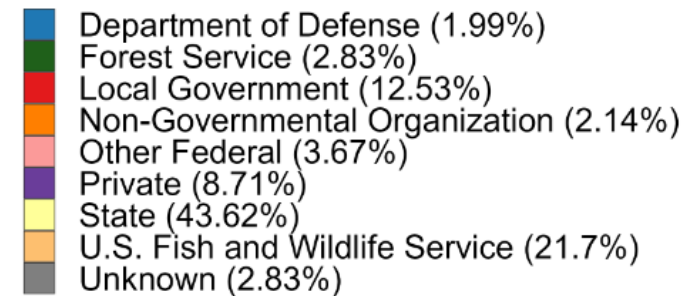
Gulf Sturgeon (*Acipenser oxyrinchus desotoi*)



Protection Status



Management Organization



Installations List

Installations where taxon is known or predicted to occur

1 CBC GULFPORT MS

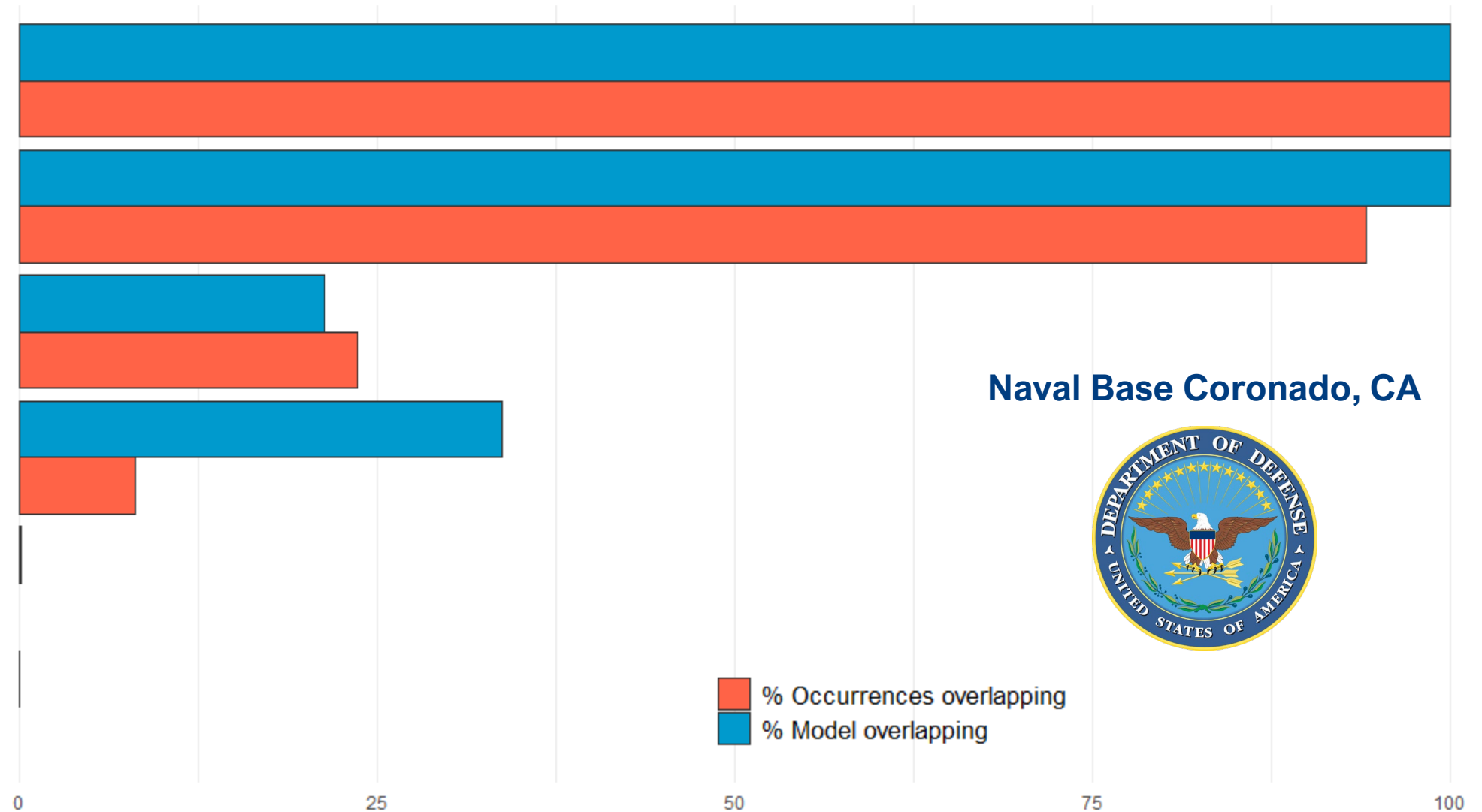
[Download Data For This Species](#)



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





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



Naval Base Coronado, CA

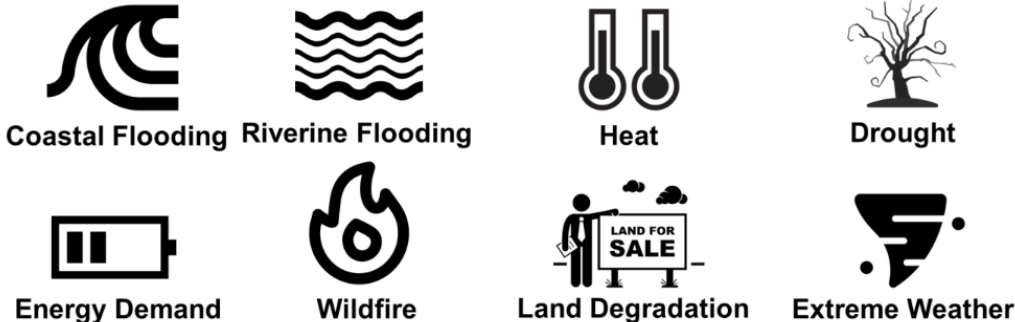


 % Occurrences overlapping
 % Model overlapping

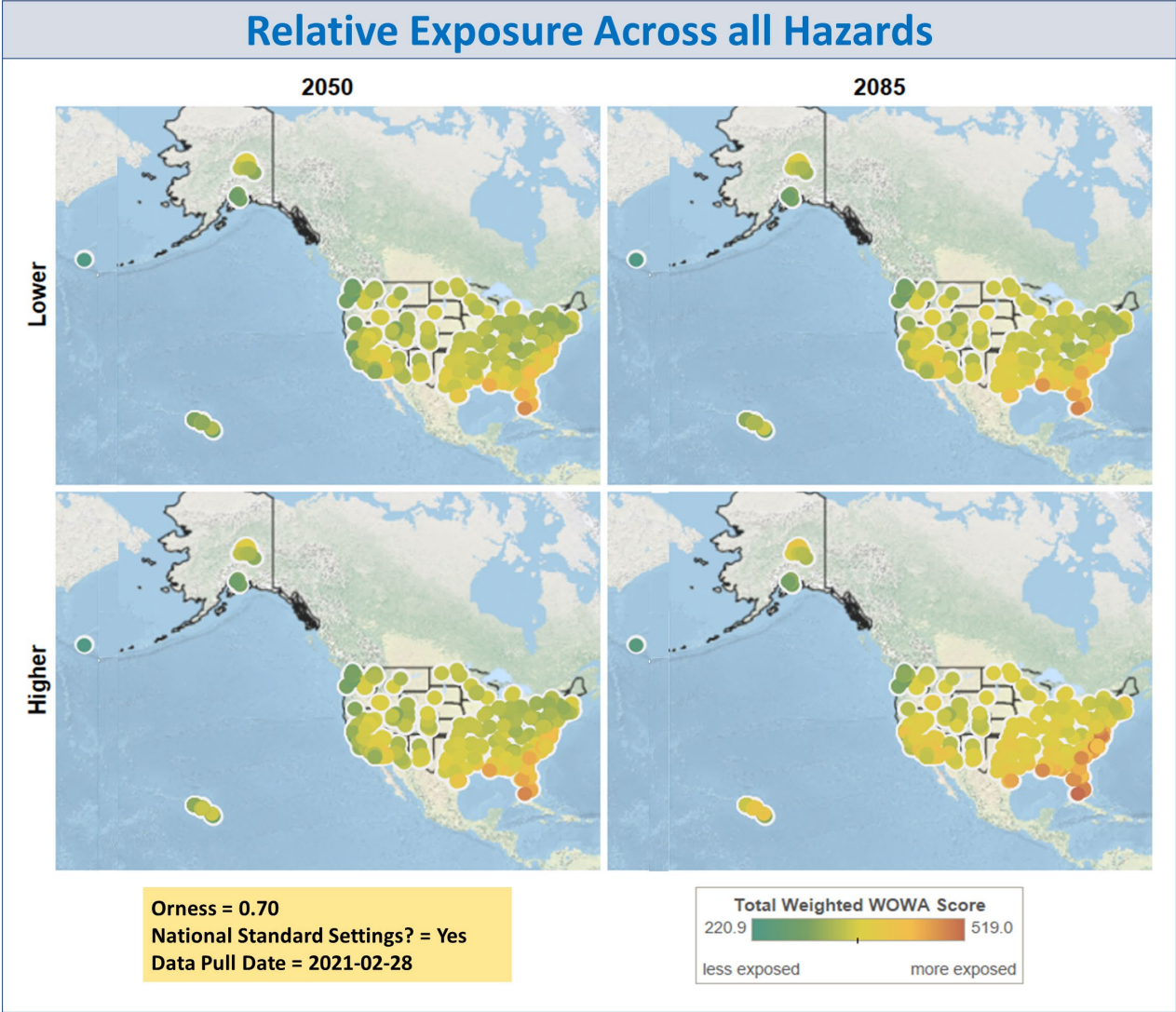
% estimated distribution overlapping DoD installations

Defense Climate Assessment Tool (DCAT)

- The DCAT is a secure, online tool for assessing asset exposure to climate change hazards.
- Summarizes exposure of built infrastructure to eight climate hazards

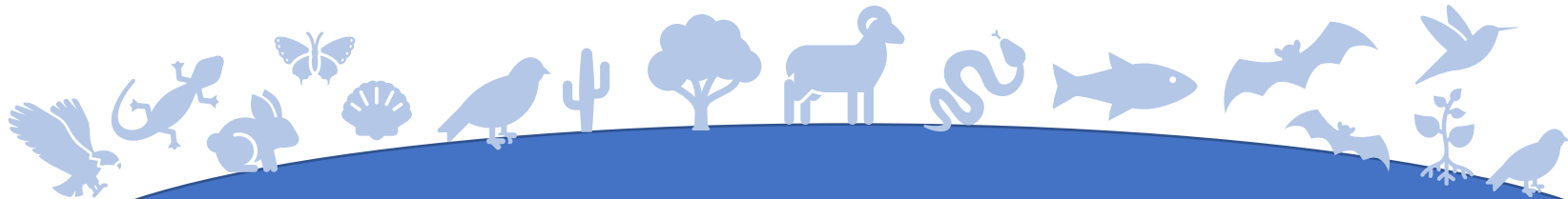


Source: DoD Climate Action Team



Objectives

- Incorporate **spatially-explicit biodiversity data** into the Department of Defense Climate Assessment Tool (DCAT) to assess climate change vulnerability and mitigation strategies for both built infrastructure and **natural resources** combined
- Assess the vulnerability of potential TER-S to each climate-related hazard addressed by the DCAT based on taxonomy, habitat relationships, ecology and/or life history



Taxa considered

67,761



Taxa of conservation concern

6,710



Potential TER-S:
Taxa of conservation concern
overlapping DoD installations

1,002

STEP 1: Identify “traits” for characterizing species as vulnerable/not vulnerable to each hazard

Heat

Threats

Species sensitive to heat are those that have *Temperature Extremes* (code 11.3) listed as a threat factor.

Habitats

Terrestrial habitats: Desert, savanna, grassland/herbaceous

Notes

Any animal is sensitive to high heat, although perhaps cave species are fairly well buffered from heat waves. Desert species are the most threatened because they are already very near their upper thermal tolerance. Species inhabiting open habitats may also be under greater threat because they have fewer long-term refugia than closed habitats.

STEP 2: Code vulnerability “traits” from NatureServe database for each of the species overlapping DoD installations (1,002 species)

Drought traits

Some traits reflect IUCN threat category

Some traits reflect NatureServe habitat classification

Taxon associated with habitats vulnerable to drought

Group	Scientific Name	Common Name	“Drought” is a threat factor for this taxon	Terrestrial	Subterranean	Riverine
Amphibians	<i>Anaxyrus californicus</i>	Arroyo Toad	TRUE	TRUE	FALSE	TRUE
Amphibians	<i>Anaxyrus canorus</i>	Yosemite Toad	TRUE	FALSE	FALSE	TRUE
Amphibians	<i>Anaxyrus williamsi</i>	Dixie Valley Toad	FALSE	FALSE	FALSE	TRUE
Amphibians	<i>Lithobates capito</i>	Gopher Frog	FALSE	FALSE	FALSE	FALSE
Amphibians	<i>Lithobates chiricahuensis</i>	Chiricahua Leopard Frog	TRUE	FALSE	FALSE	TRUE
Amphibians	<i>Rana draytonii</i>	California Red-legged Frog	TRUE	FALSE	FALSE	TRUE
Amphibians	<i>Rana muscosa</i>	Southern Mountain Yellow-legged Frog	TRUE	FALSE	FALSE	TRUE
Amphibians	<i>Rana sierrae</i>	Sierra Nevada Yellow-legged Frog	TRUE	FALSE	FALSE	TRUE
Amphibians	<i>Spea hammondi</i>	Western Spadefoot	FALSE	FALSE	FALSE	TRUE

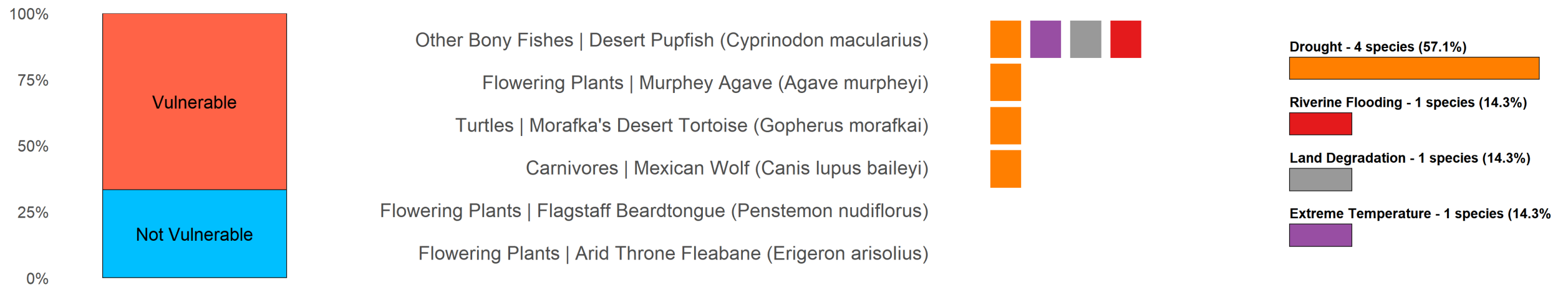
STEP 3: Combine vulnerability “traits” to determine vulnerability to each hazard for each species

Drought traits

Group	Scientific Name	Common Name	“Drought” is a threat factor for this taxon	Taxon associated with habitats vulnerable to drought			Drought Vulnerable
				Terrestrial	Subterranean	Riverine	
Amphibians	<i>Anaxyrus californicus</i>	Arroyo Toad	TRUE	TRUE	FALSE	TRUE	TRUE
Amphibians	<i>Anaxyrus canorus</i>	Yosemite Toad	TRUE	FALSE	FALSE	TRUE	TRUE
Amphibians	<i>Anaxyrus williamsi</i>	Dixie Valley Toad	FALSE	FALSE	FALSE	TRUE	TRUE
Amphibians	<i>Lithobates capito</i>	Gopher Frog	FALSE	FALSE	FALSE	FALSE	FALSE
Amphibians	<i>Lithobates chiricahuensis</i>	Chiricahua Leopard Frog	TRUE	FALSE	FALSE	TRUE	TRUE
Amphibians	<i>Rana draytonii</i>	California Red-legged Frog	TRUE	FALSE	FALSE	TRUE	TRUE
Amphibians	<i>Rana muscosa</i>	Southern Mountain Yellow-legged Frog	TRUE	FALSE	FALSE	TRUE	TRUE
Amphibians	<i>Rana sierrae</i>	Sierra Nevada Yellow-legged Frog	TRUE	FALSE	FALSE	TRUE	TRUE
Amphibians	<i>Spea hammondi</i>	Western Spadefoot	FALSE	FALSE	FALSE	TRUE	TRUE

STEP 4: Based on species by installation list, summarize the species vulnerable to each hazard on each installation

ARIZONA NATIONAL GUARD (RPSUID: 3983) - Climate Change Vulnerability of Natural Resources (6 potential TER-S)



STEP 4: Based on species by installation list, summarize the species vulnerable to each hazard on each installation

ALABAMA NATIONAL GUARD (RPSUID: 3691) - Climate Change Vulnerability of Natural Resources (12 potential TER-S)



Mock-up of Upcoming Installation Reports on the DCAT



Questions?

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data_science@natureserve.org to access:

- models on NatureServe Explorer Pro
- NatureServe DoD TER-S Explorer

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April 18, 2024