Creating an Installation-wide Library of Improved Distribution Maps to Guide Stewardship of Priority Species

Healy Hamilton | Chief Scientist, NatureServe
Gio Rapacciuolo | Director of Applied Science Programs, NatureServe

NatureServe

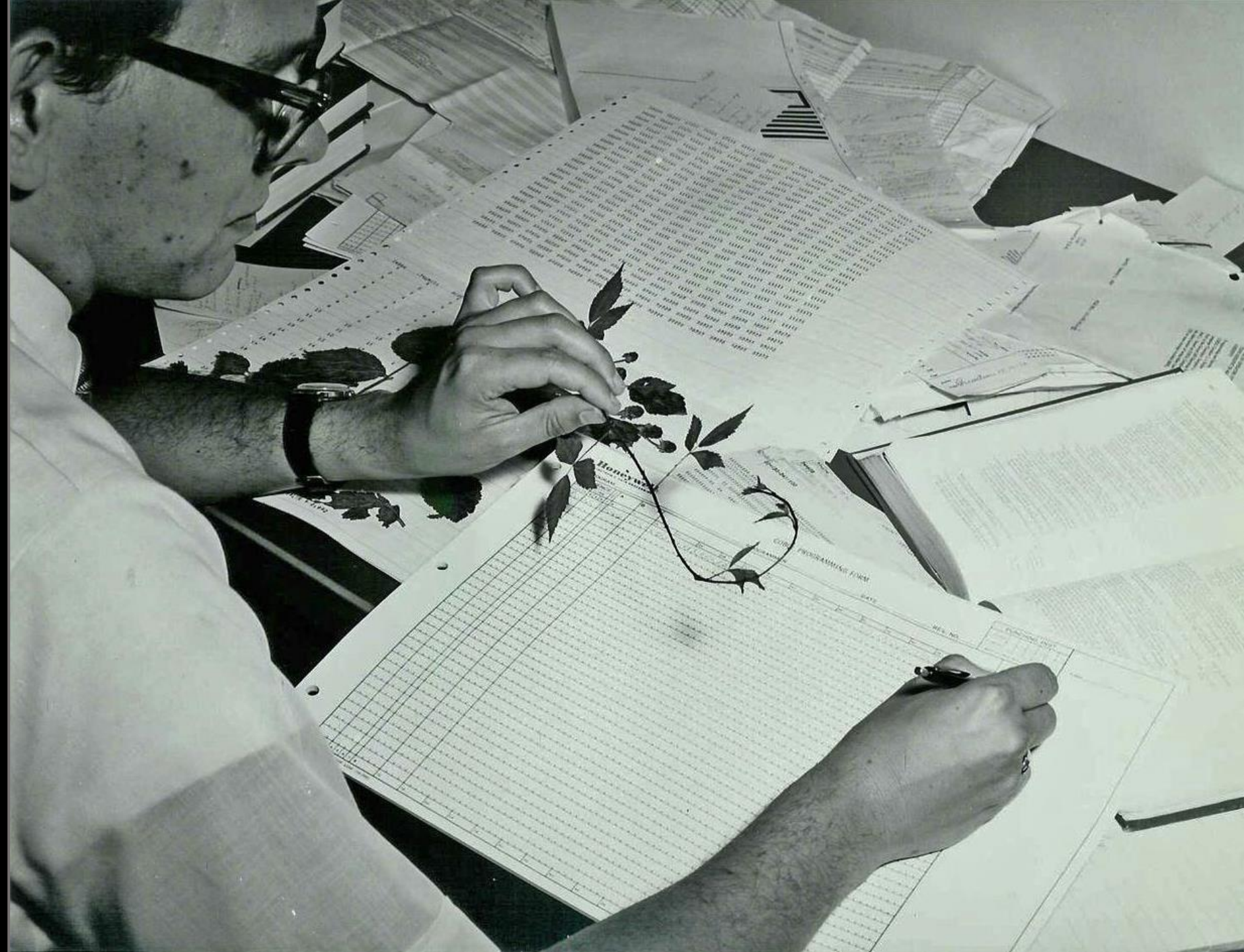
DEPARTMENT OF DEFENSE · UNITED STATES OF AMERICA

Dec 24, 1968
Earthrise
William Anders
Apollo 8


Difficulty discerning fact from fiction? SCIENCE!
SCIENTIFIC LITERACY MATTERS
SCIENCE IS ACTUALLY USEFUL
#ScienceShed
Stop The Denials

1974

The Nature Conservancy begins to mobilize the worlds first biodiversity information network




1/2/1974 3/31/1974
NatureServe
Connecting Science With Conservation
1974-2019
NatureServe Heritage Programs
0
3,000
Miles
N
POWERED BY esri

What is it?

How is it doing?

What can we do?

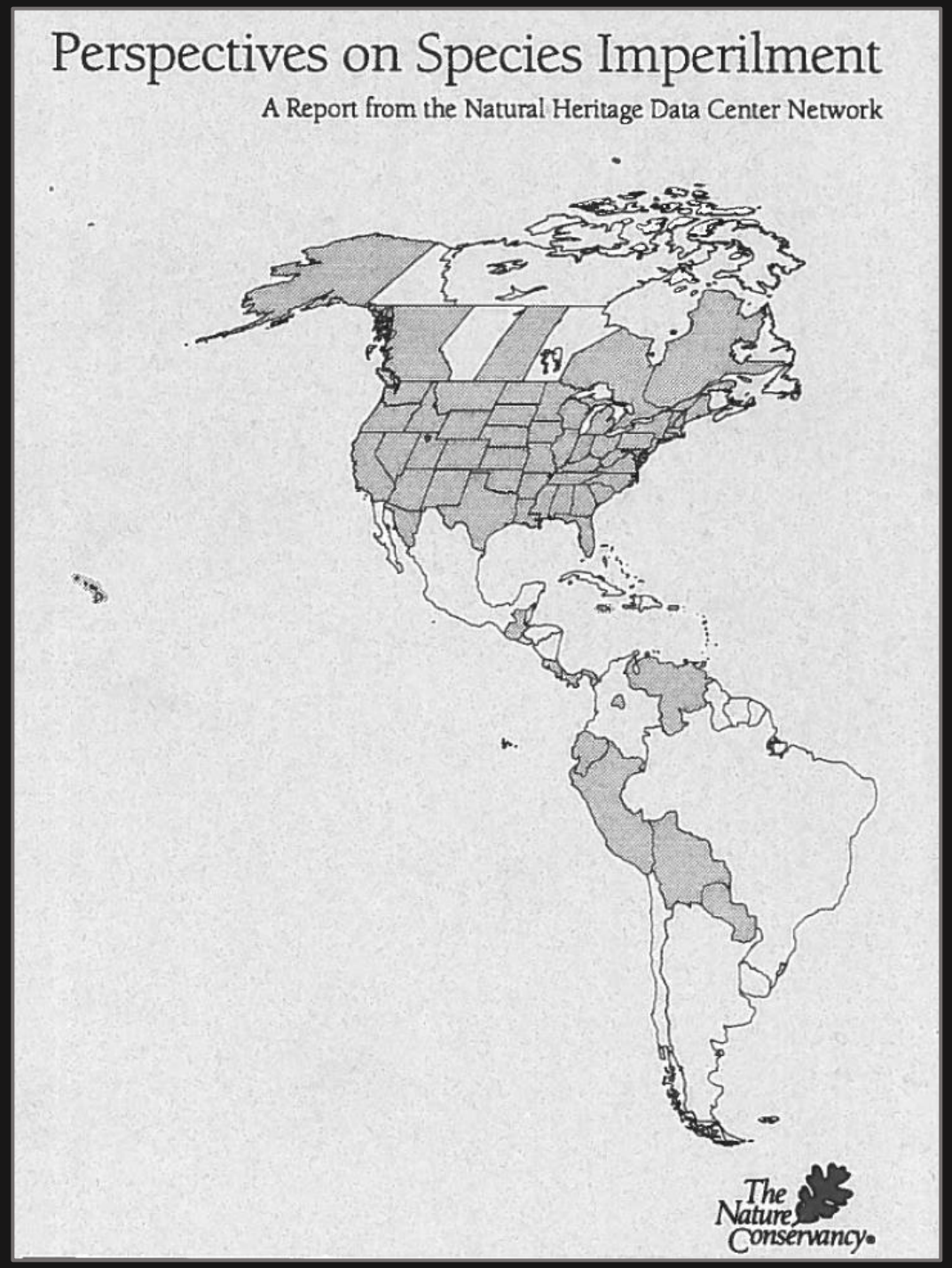
Where is it?

How is it changing?

1975
Computerizing biodiversity records with punch cards

1980
PC-based dBASE III data management systems

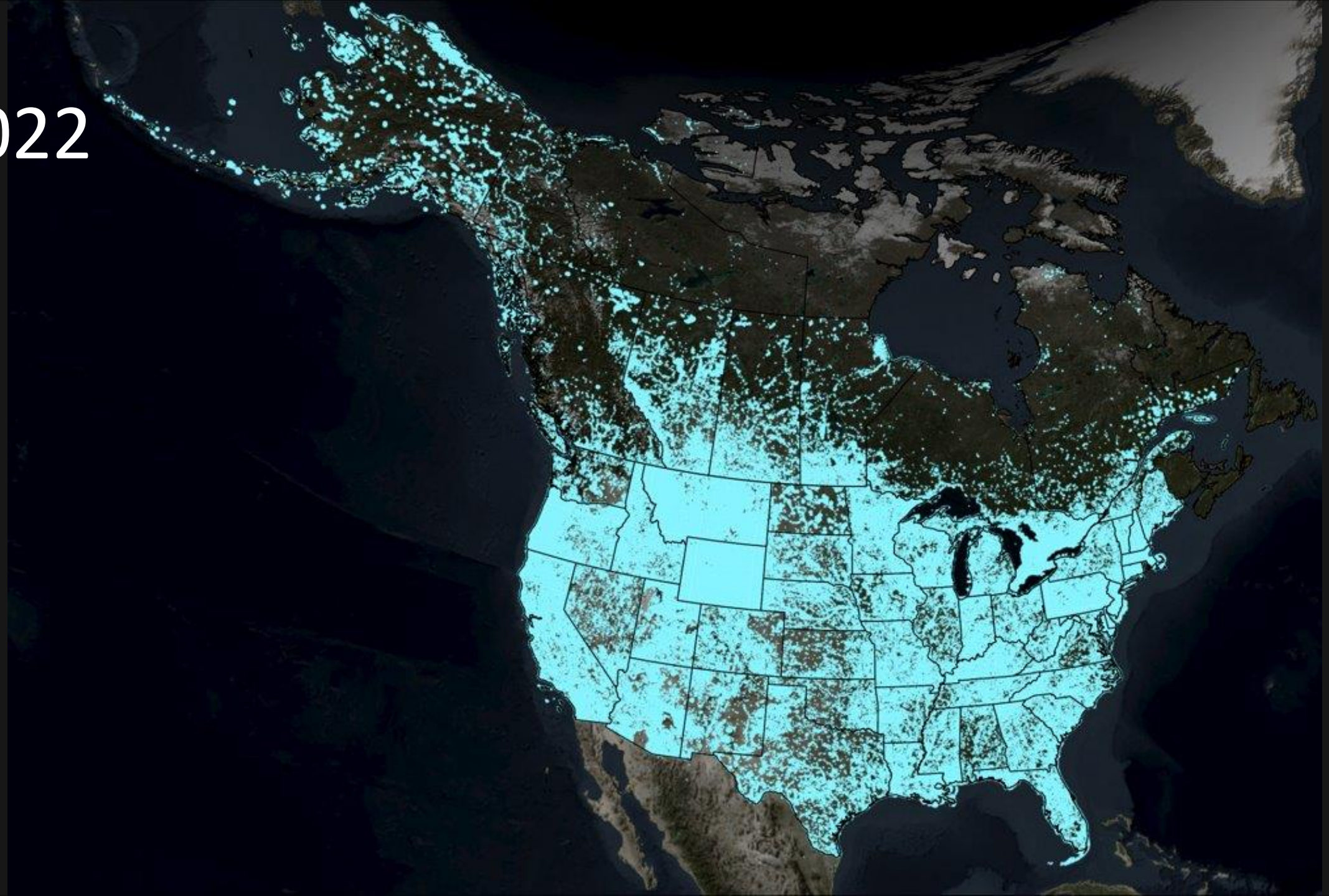
1988
Biological and Conservation Data (BCD) System

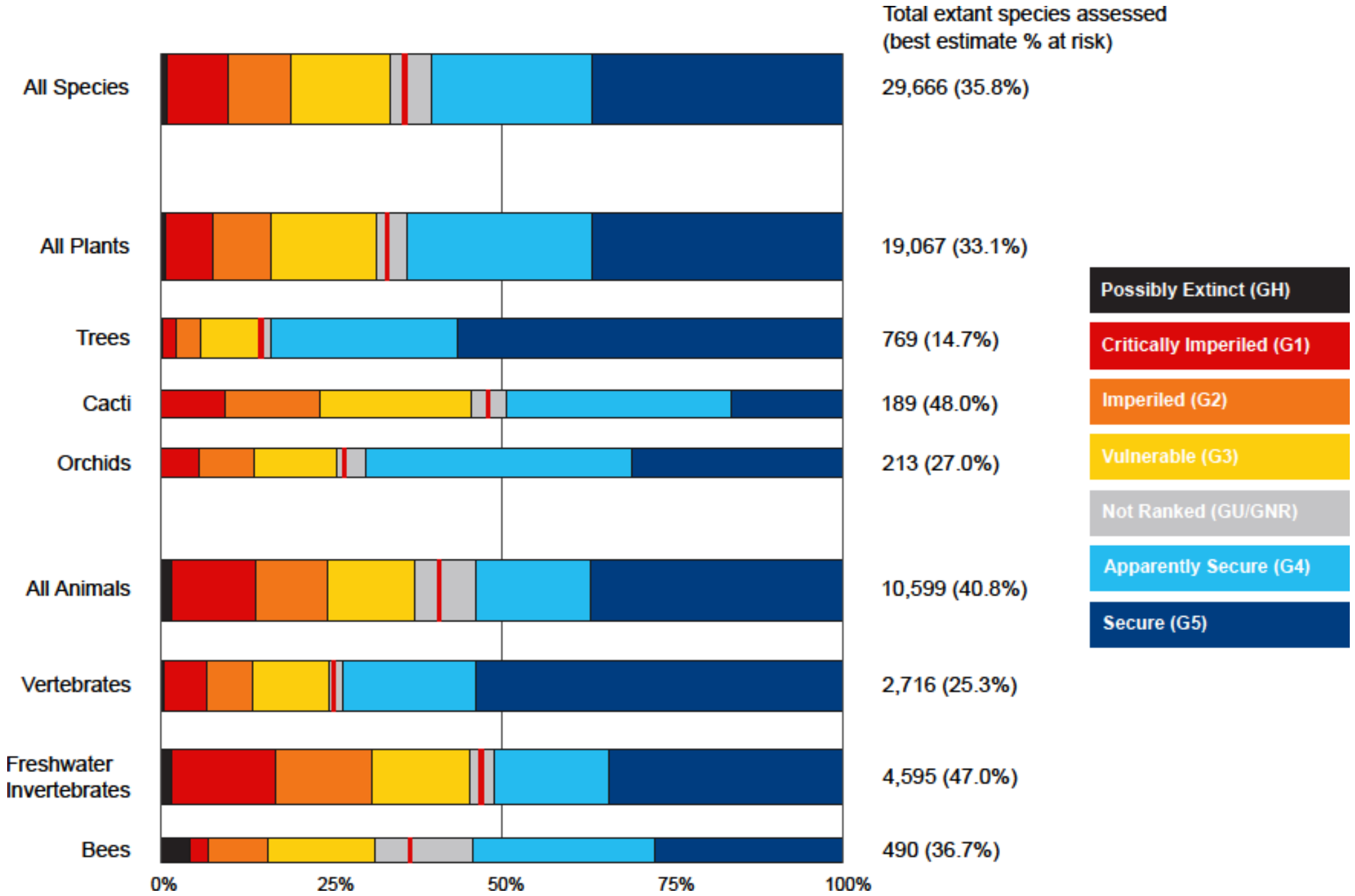


1993

The first time that data are compiled from all Natural Heritage Programs to offer a network-wide perspective.

Shared data standards and data management systems make this analysis possible


2022


Total extant species assessed
(best estimate % at risk)
All Species
29,666 (35.8%)
All Plants
19,067 (33.1%)
Trees
769 (14.7%)
Cacti
189 (48.0%)
Orchids
213 (27.0%)
All Animals
10,599 (40.8%)
Vertebrates
2,716 (25.3%)
Freshwater Invertebrates
4,595 (47.0%)
Bees
490 (36.7%)
0%
25%
50%
75%
100%
Possibly Extinct (GH)
Critically Imperiled (G1)
Imperiled (G2)
Vulnerable (G3)
Not Ranked (GU/GNR)
Apparently Secure (G4)
Secure (G5)

Welcome to the New NatureServe Explorer!

NatureServe is the definitive source for information on rare and endangered species and ecosystems in the Americas. This online guide provides information on the 100,000 species and ecosystems that we track.

on Species
on Ecosystems

...Search for species and ecosystems

Additional Search Options

Search by location, taxonomic group, and conservation status.





Donate Make a difference! Protect biodiversity and support NatureServe today. As a charitable nonprofit, NatureServe depends on the support of users like you to keep the reliable, scientific information you find on NatureServe Explorer free and unlimited for the general public. Help us help biodiversity and contribute today!

History

1996: Original publication

"Conserving Biodiversity on Military Lands - A Handbook for Natural Resources Managers"

- Lead organization – The Nature Conservancy

2008: Update

"Conserving Biodiversity on Military Lands: A Guide for Natural Resources Managers, 2008 Edition"

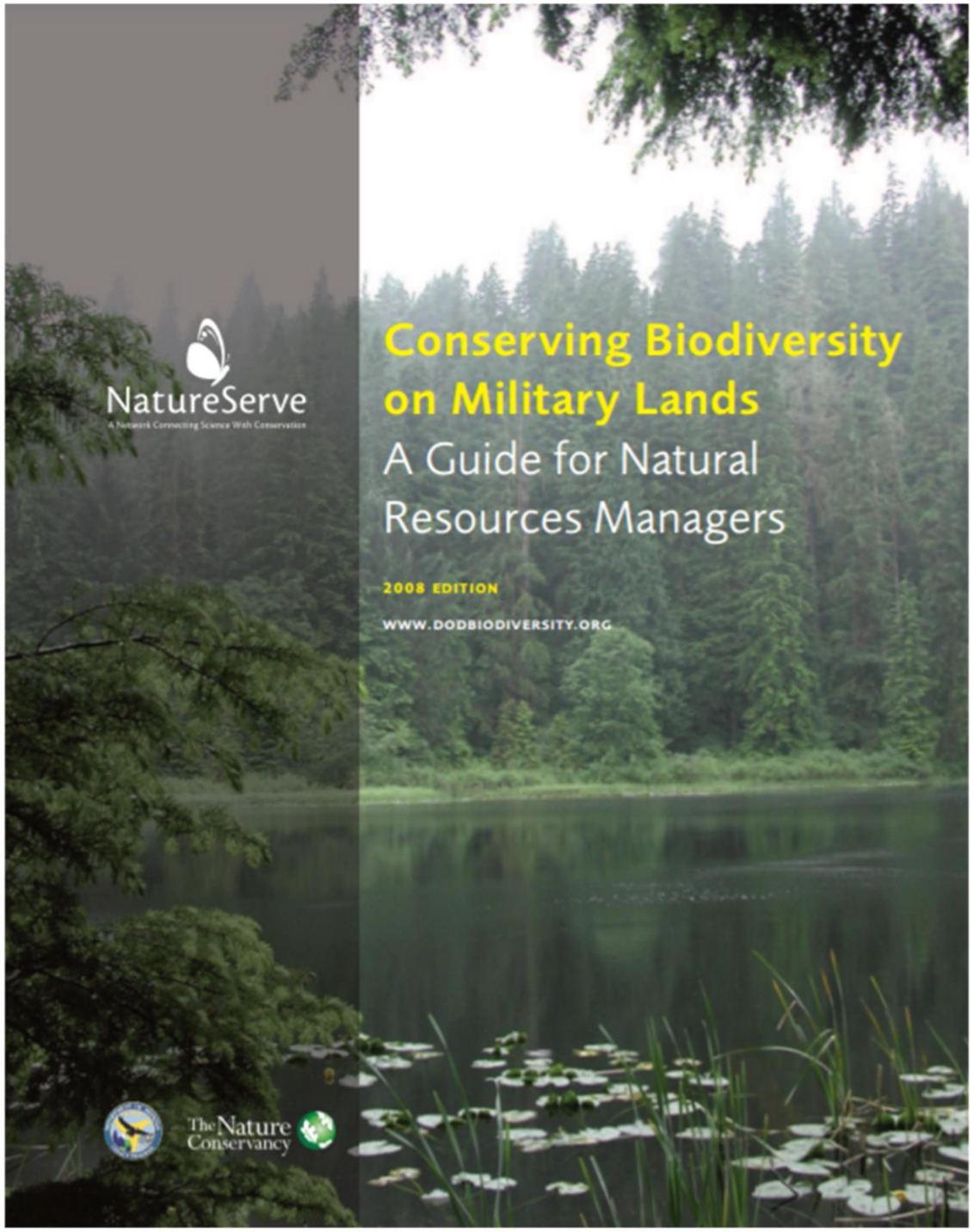
- Lead organization - NatureServe

2021: Update

"Conserving Biodiversity on Military Lands: A Guide for Natural Resource Managers, 3rd Edition"

- Lead organization – NatureServe

All publications supported by DoD Legacy Program






Goals and Objectives

Goal: To support the health of ecosystems on and around military lands, that allows continued use of these lands for military testing and training.

Objectives:

- Gather input from DoD installation staff on needs to support biodiversity conservation on and around military lands
- Update 2008 handbook content and create new content to address priority topics identified by DoD staff

Primary Contributors:

NatureServe

National Wildlife Federation

σ^2 Sound Science
For Better Decisions

Center for Environmental Management
MILITARY LANDS
COLORADO STATE UNIVERSITY

Highlights from 2021 Handbook

- ecosystem condition assessment
- climate change
- landscape management
- monitoring – see Chapter 8.
- T&E species management
- conservation successes
- partnerships
- role of Integrated Natural Resource Management Plans

Conserving Biodiversity on Military Lands: A Guide for Natural Resource Managers 3rd Edition

≡ Menu

DENIX / Conserving Biodiversity on Military Lands: A Guide for Natural Resource Managers 3rd Edition / Chapter 1 / A Geography of Imperilment

A Geography of Imperilment

As any outdoors lover knows, wildlife are not distributed uniformly across the landscape, but individual species have very particular habitat needs. Climate is the principal determinant of a region's flora and fauna: Palm trees don't grow outdoors in Alaska, nor do caribou wander around Florida. Although as a rule, the diversity of species increases as one moves south towards the equator, the natural diversity of species in any given region is dependent on a host of factors. These include the complexity of terrain, type of soils, interconnections with other regions, and even the lingering effects of Pleistocene glaciers. The states with the greatest number of species are for the most part clustered along the nation's southern edge (Figure 1.4). The top-ranking states for total number of species are California and Texas followed by Arizona, Alabama, Georgia, and North Carolina (NatureServe 2021). Looking instead at the levels of risk (that is, the proportion of a state's species that are vulnerable, imperiled, or extinct), Hawai`i and California dominate all others (Figure 1.5). Indeed, an extraordinary 83 percent of Hawai`i's native species are at increased risk of extinction (NatureServe Network 2021).

Figure 1.4. Species diversity by state. This map represents the number of species in each state for taxonomic groups comprehensively assessed by the NatureServe Network (see Fig. 1.3). Species diversity— or richness—is highest along the Pacific Coast, and more generally along the nation's southern edge. (Source: NatureServe Network 2021).

Figure 1.5. State patterns of risk. This map displays the percent of species with elevated risk levels (GH - G3) for taxonomic groups comprehensively assessed by the NatureServe Network (see Figure 1.3). Hawai'i displays by far the highest levels of extinction risk among its species, followed by California (Source: NatureServe Network 2021).

Search Conserving Biodiversity

Author

Bruce Stein, Ph.D, Chief Scientist and Associate Vice President
National Wildlife Federation

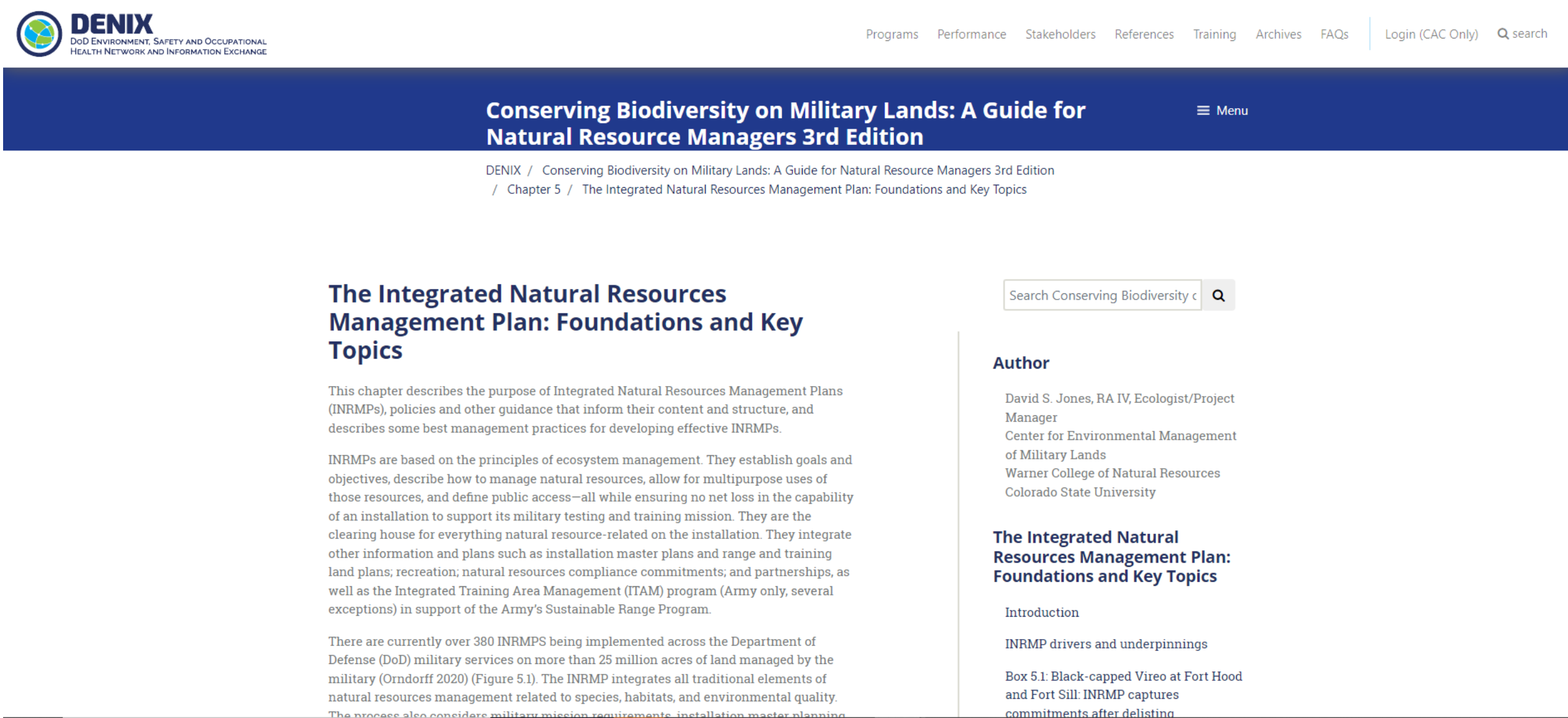
A Geography of Imperilment Sections

A Geography of Imperilment
Causes of Declines
Habitat Loss
Invasive Species
Climate Change

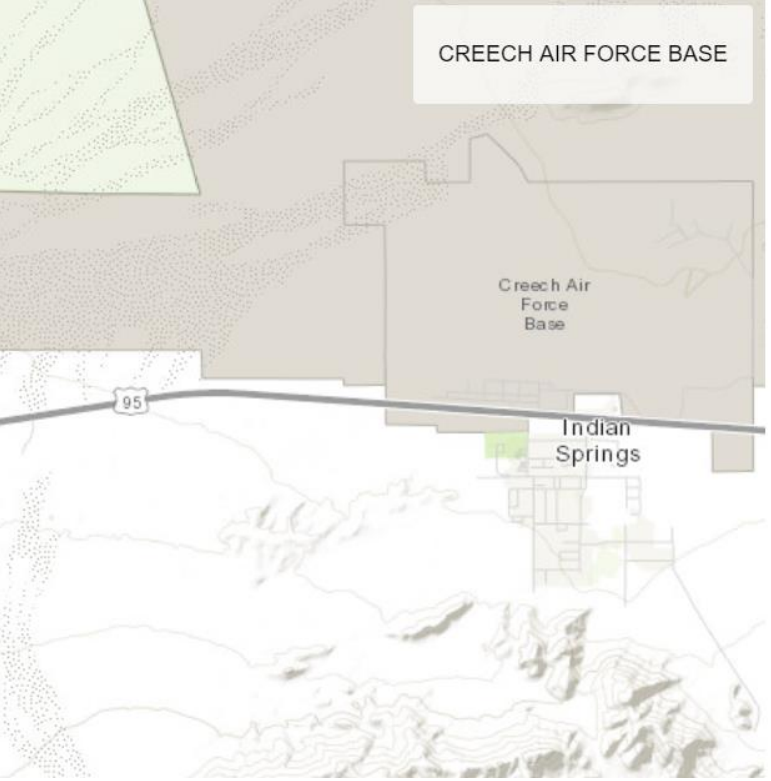
Chapter 1 - Full Index

NATURESERVE

Final content available on DoD Legacy Program's DENIX site: https://www.denix.osd.mil/biodiversity/

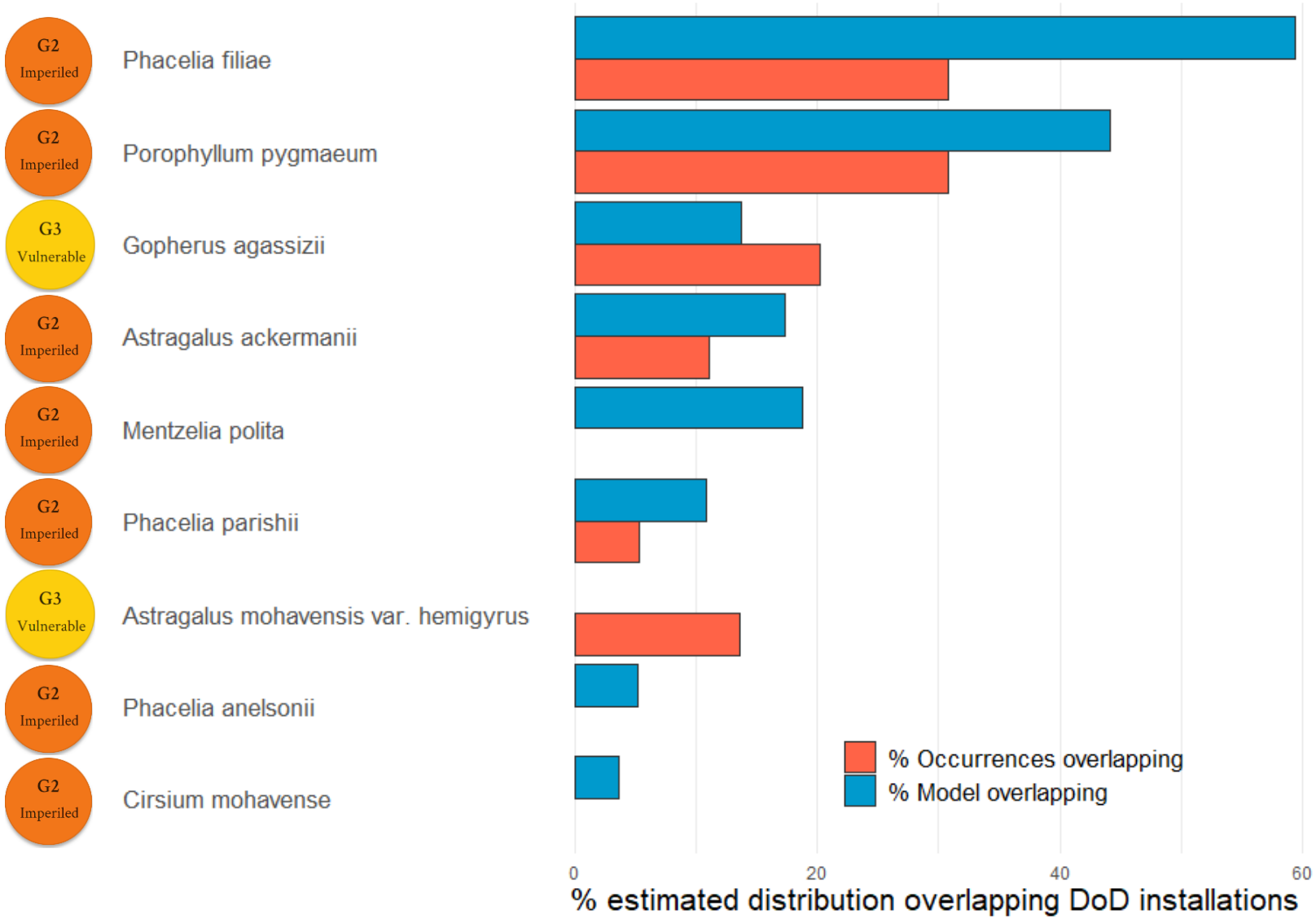


A repeatable framework to identify and locate TER-S



Creech Air Force Base
Indian Springs, NV

Potential Threatened, Endangered, and At-Risk Species Summary

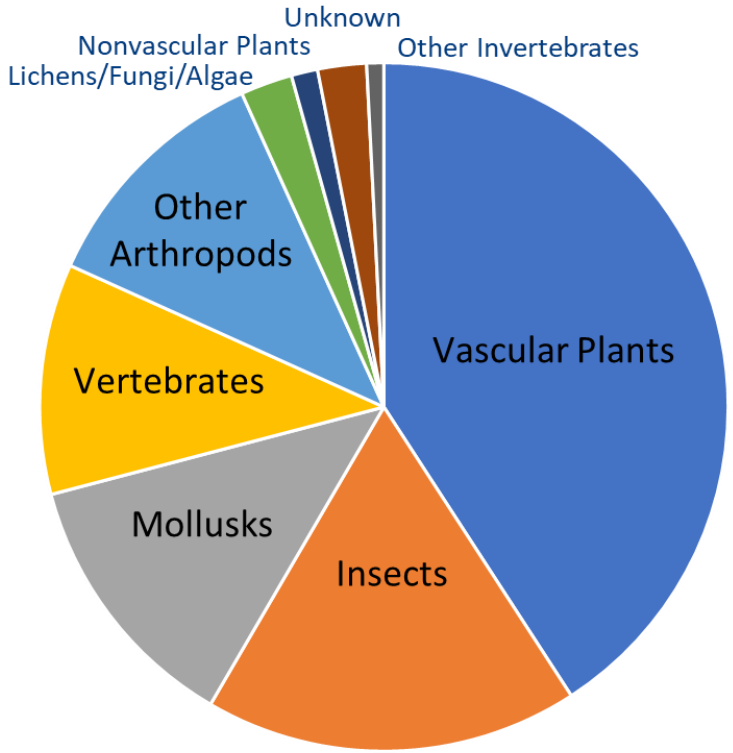


NatureServe

How did we get there?

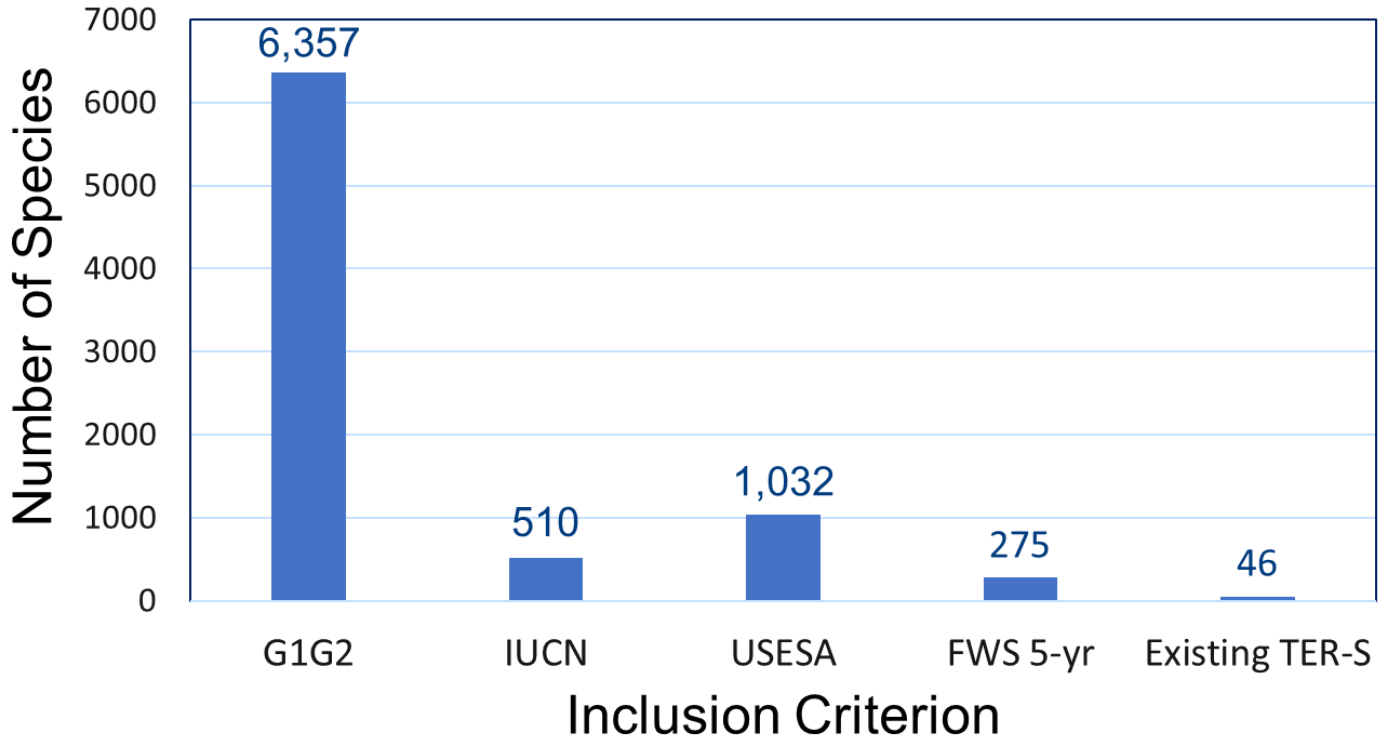
1. Taxonomy Data

What are they?



2. Conservation Status Data

How are they doing?



6,710 Species/Subspecies Species of Conservation Concern

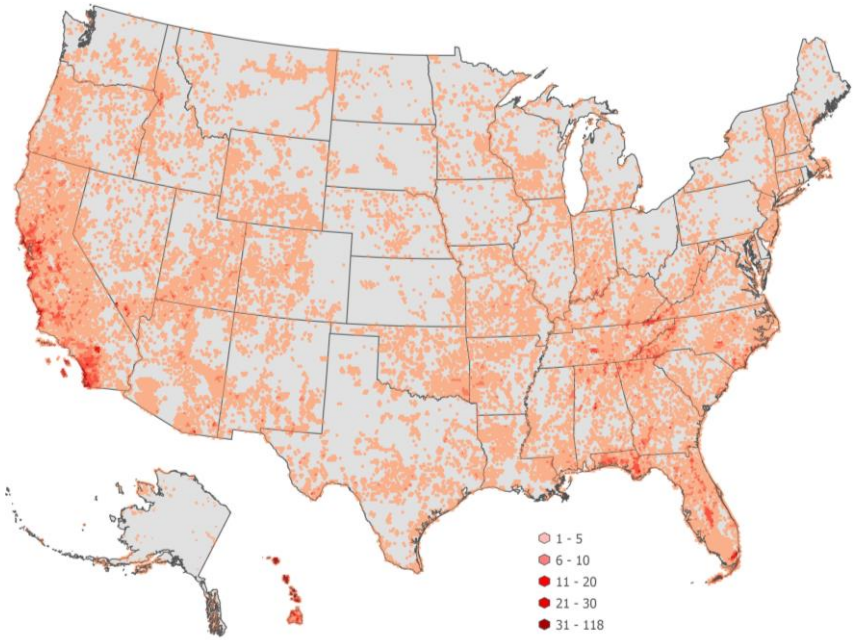
NatureServe

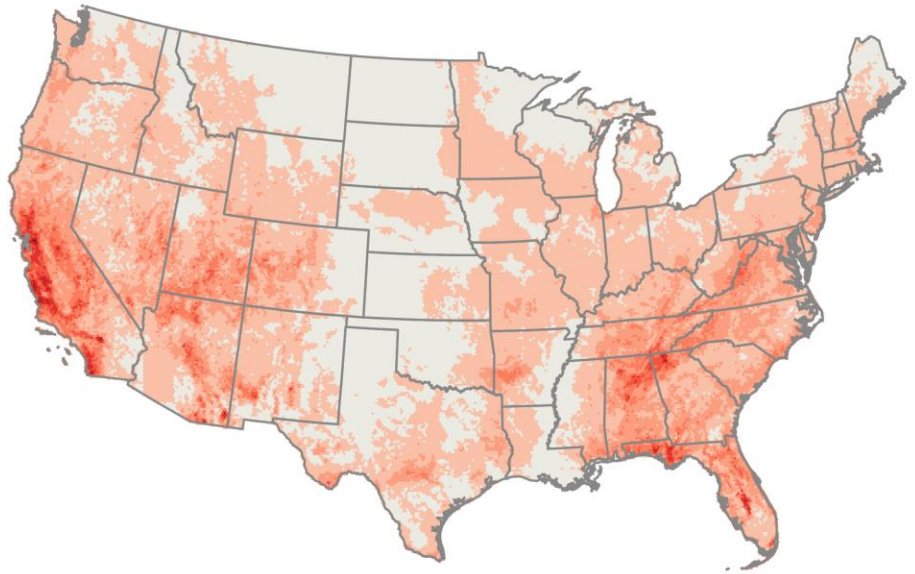
How did we get there?

3. Distribution Data

Where are they?

- NatureServe Element Occurrence Data
- NatureServe Map of Biodiversity Importance Species Maps
- NatureServe Collaborative Species Habitat Models
- Locality Data from HerpMapper Observations





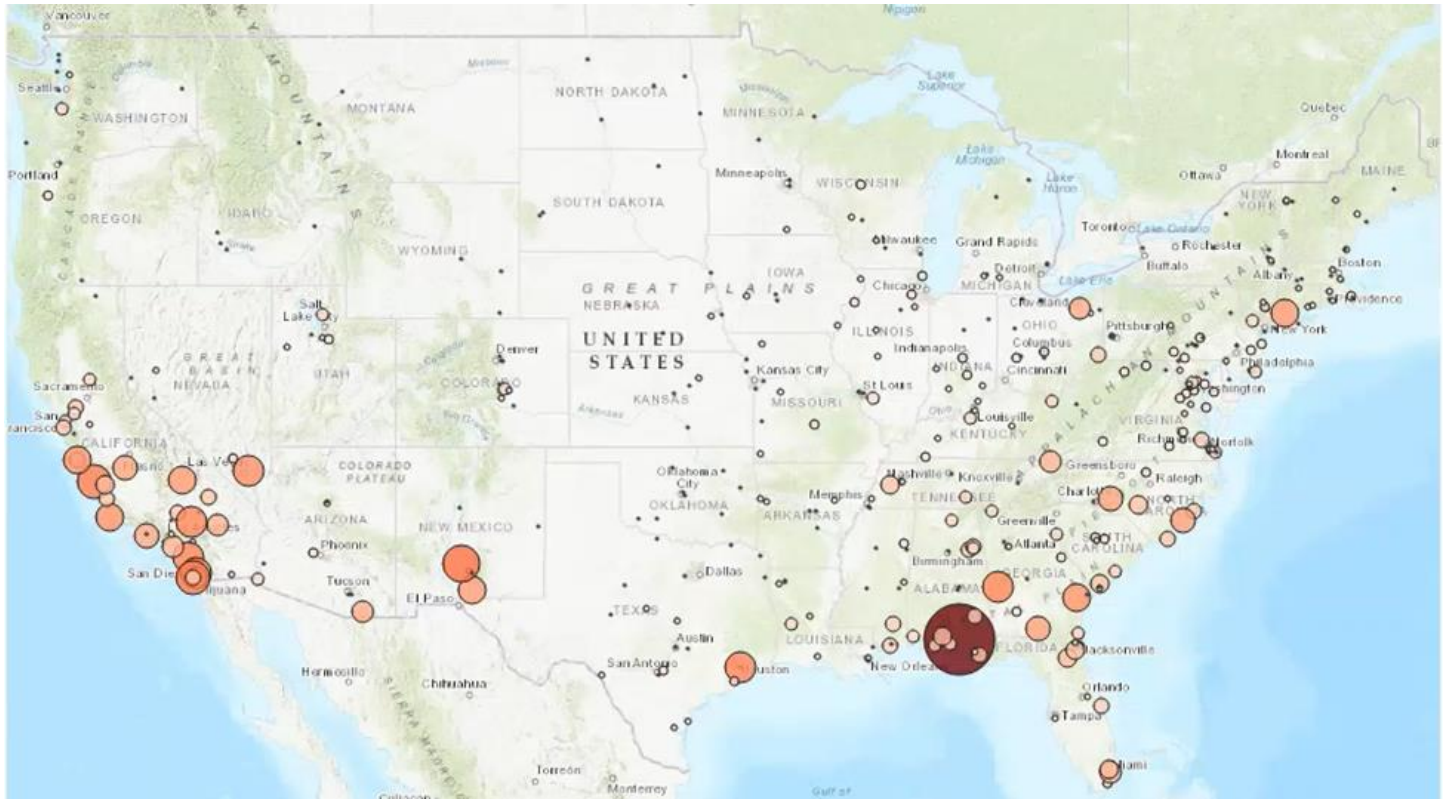
How did we get there?

4. Jurisdictional Data

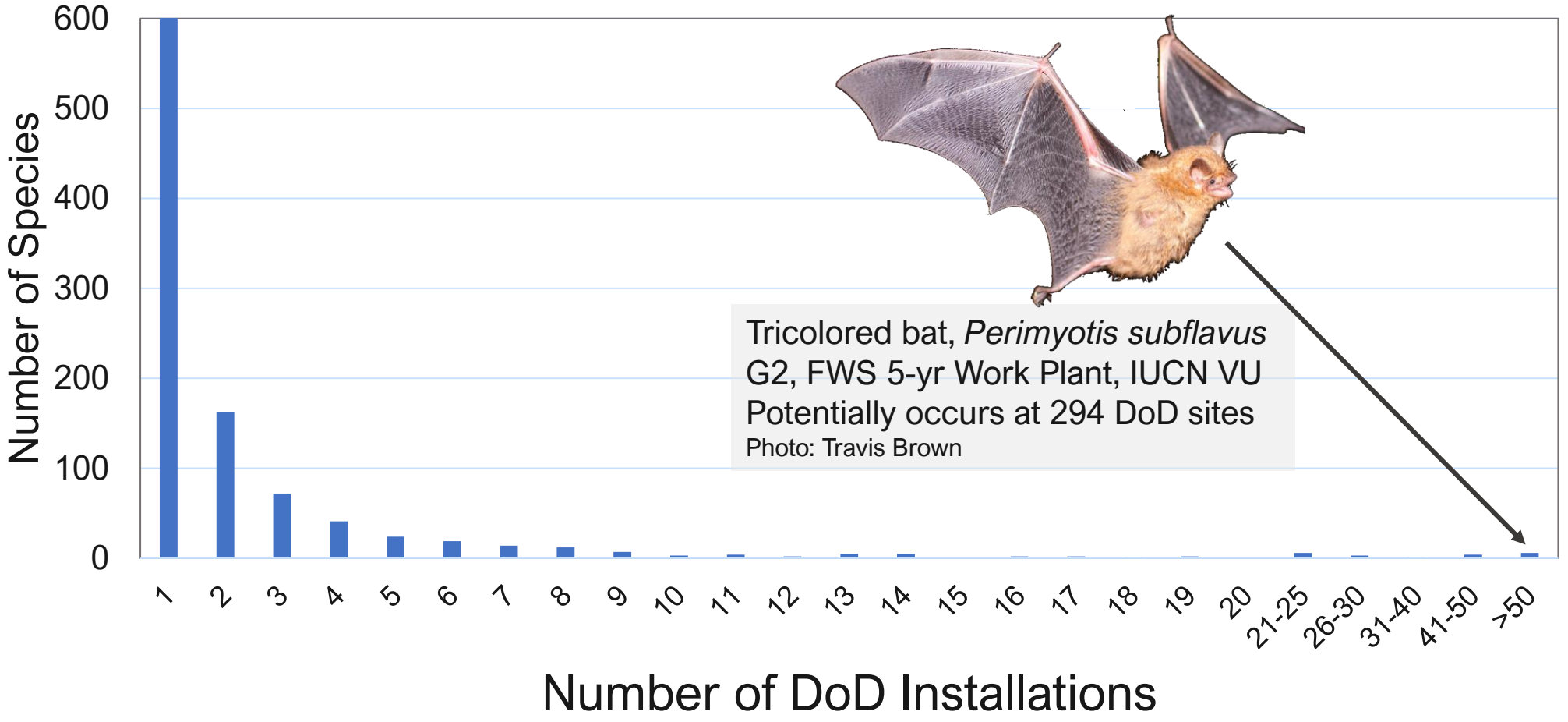
Whose responsibility are they?

- Defense Installations Spatial Data Infrastructure (DISDI) FY20 DoD Site Location dataset

- Crosswalked with INRMPs



Potential TER-S

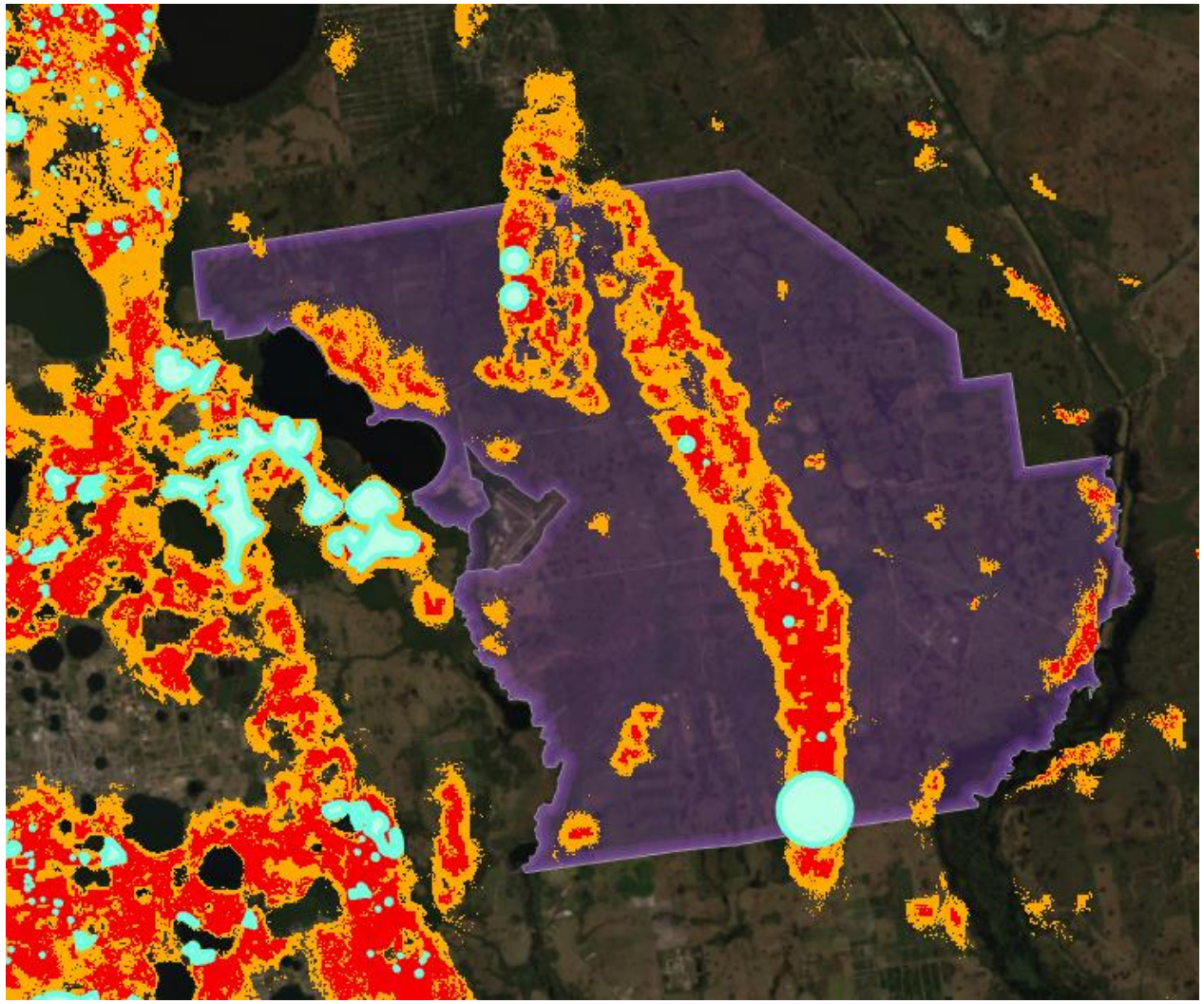


Florida Scrub Lizard
Sceloporus woodi

G2
Imperiled

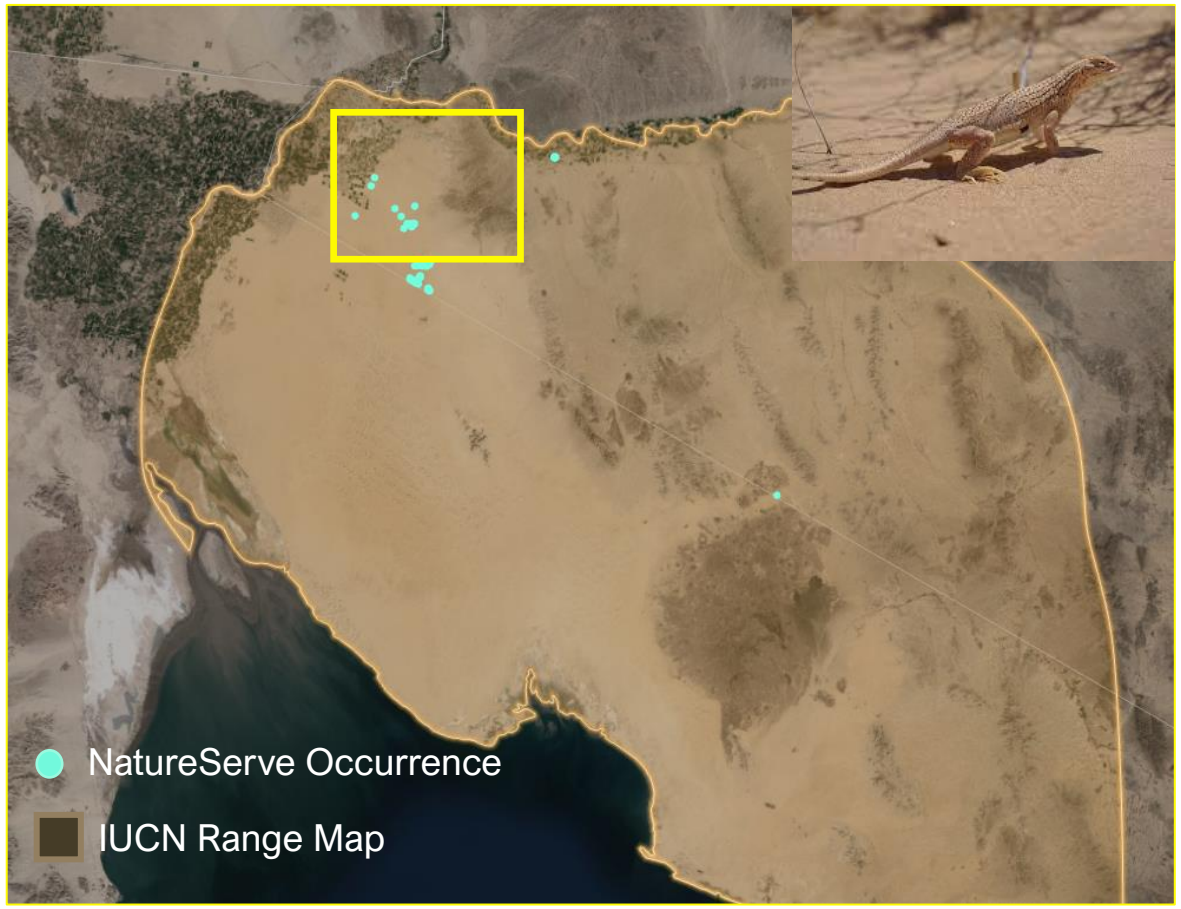
ESA Listing Status: Under Review

Arbuckle Airfield (Avon Park, FL)

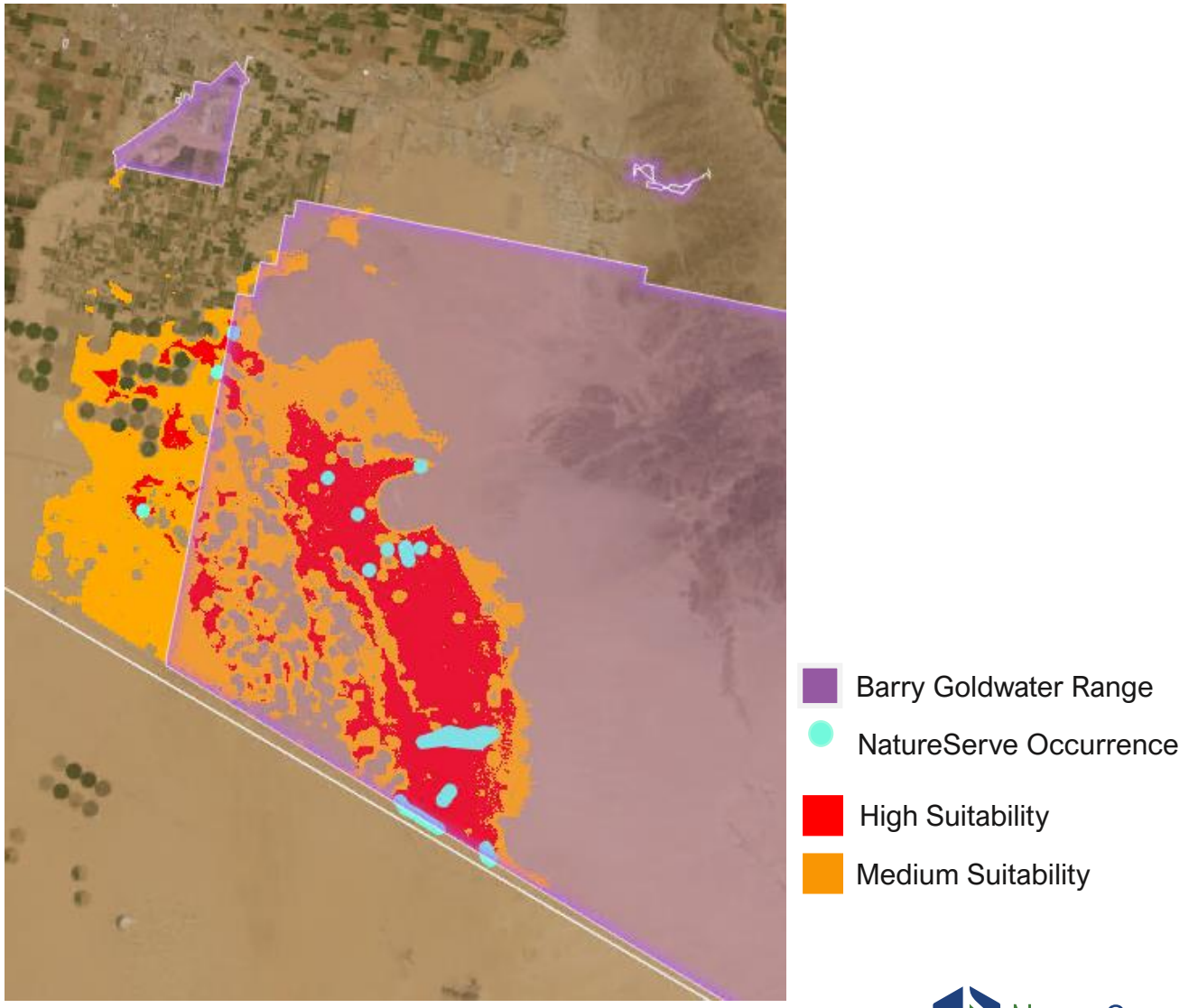


Yuman Desert Fringe-toed lizard
Uma rufopunctata

NatureServe S2 (Imperiled) in AZ
ESA Listing Status: Under Review

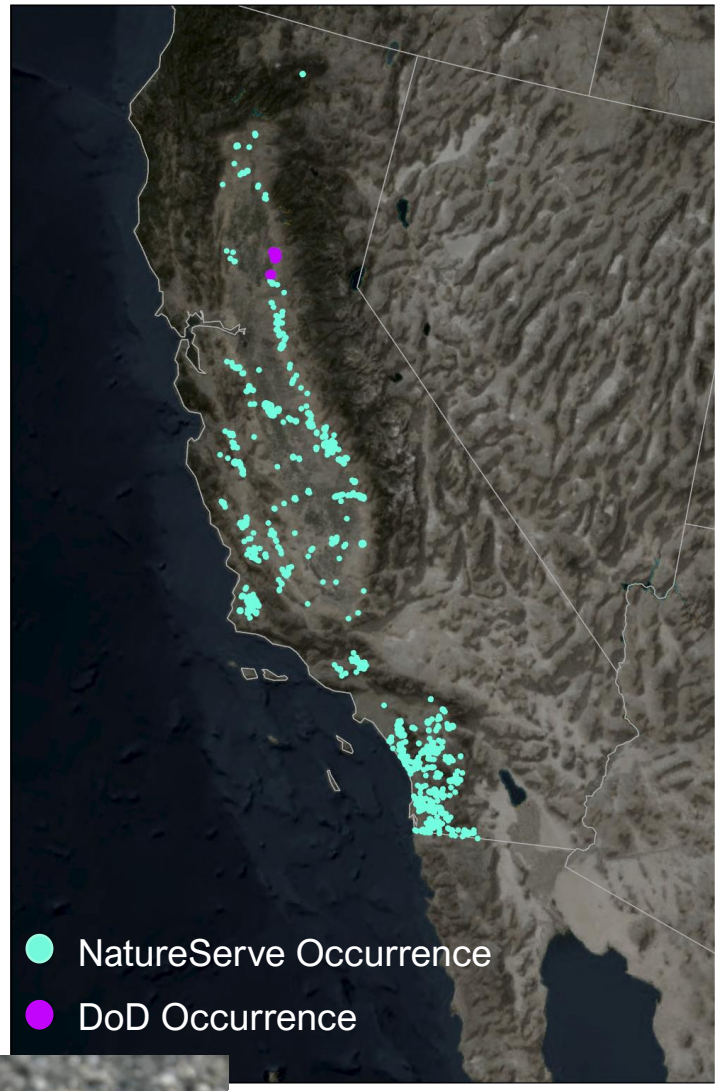


Barry Goldwater Range, AZ



NatureServe

Refining Species Distribution Data



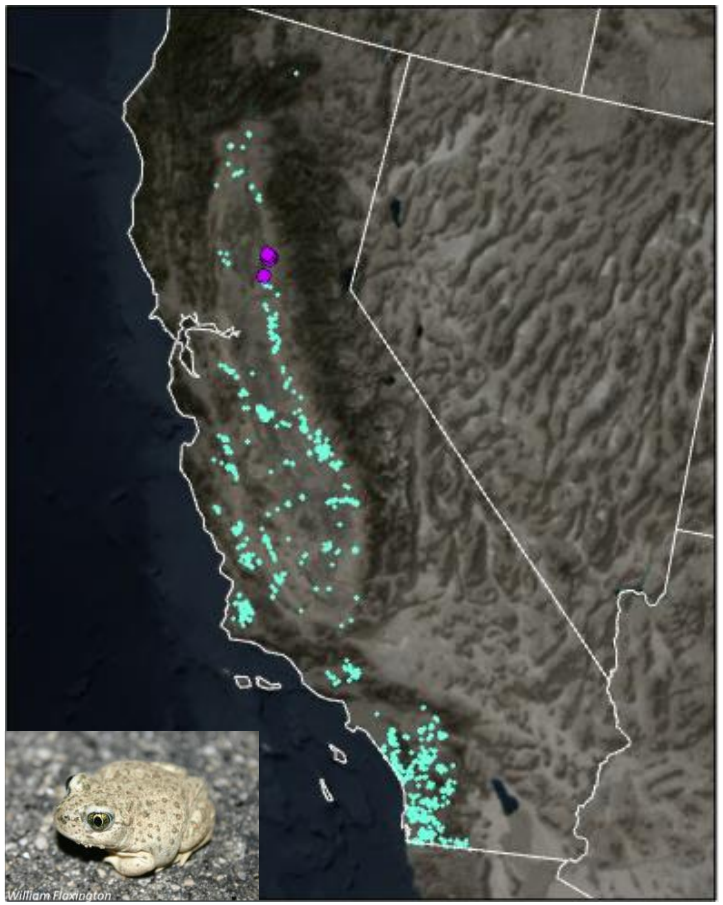
Western Spadefoot
Spea hammondii

G2
Imperiled

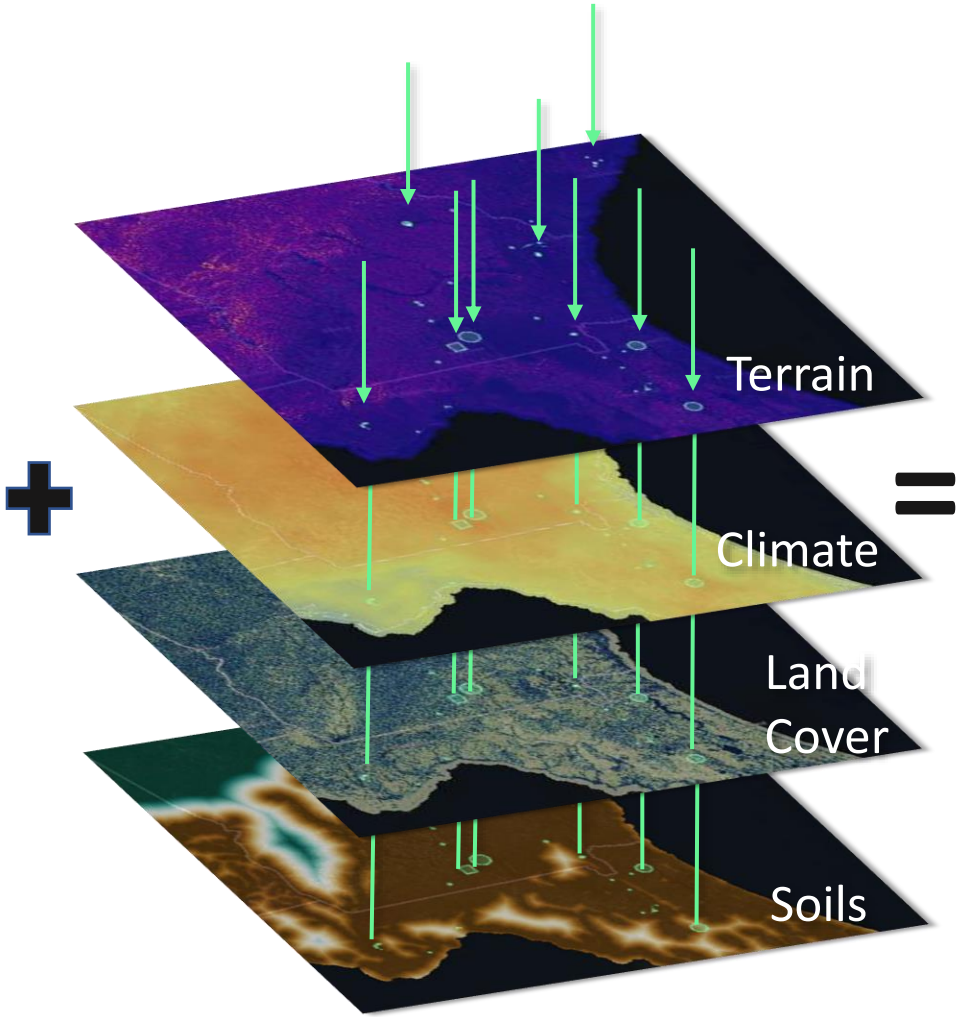
ESA Listing Status: Under Review

NatureServe

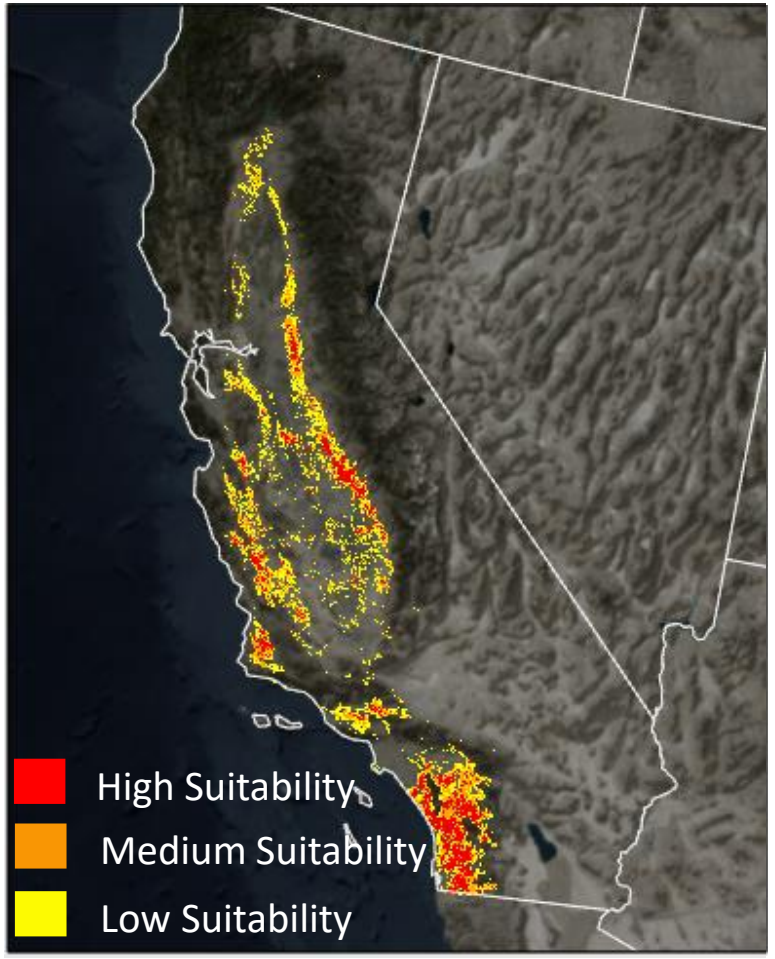
Cutting-edge tools for predictive modeling



Species Occurrence Data



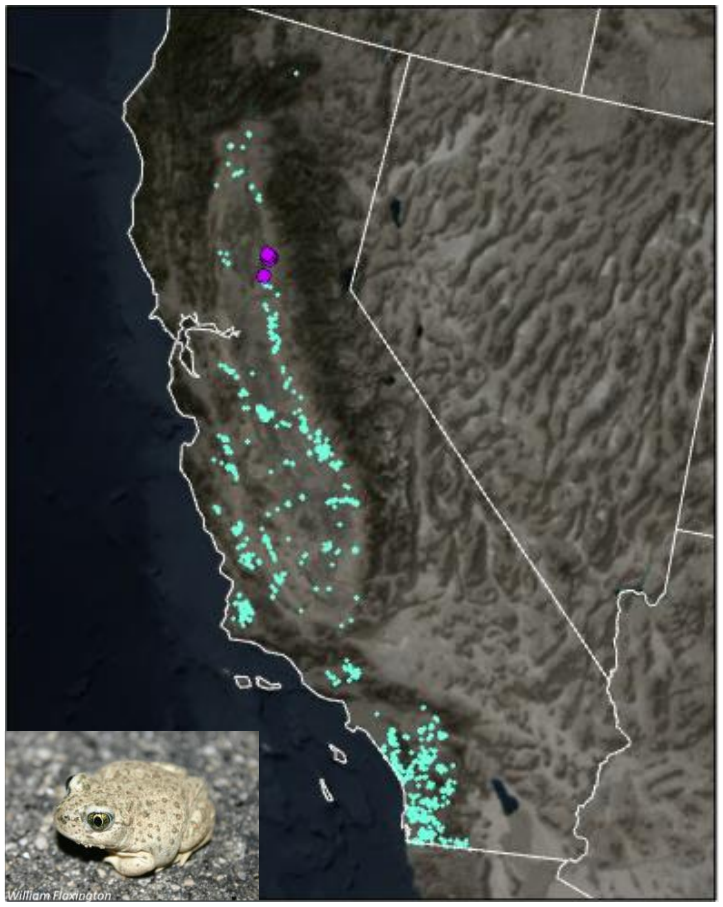
Environmental Predictor Library



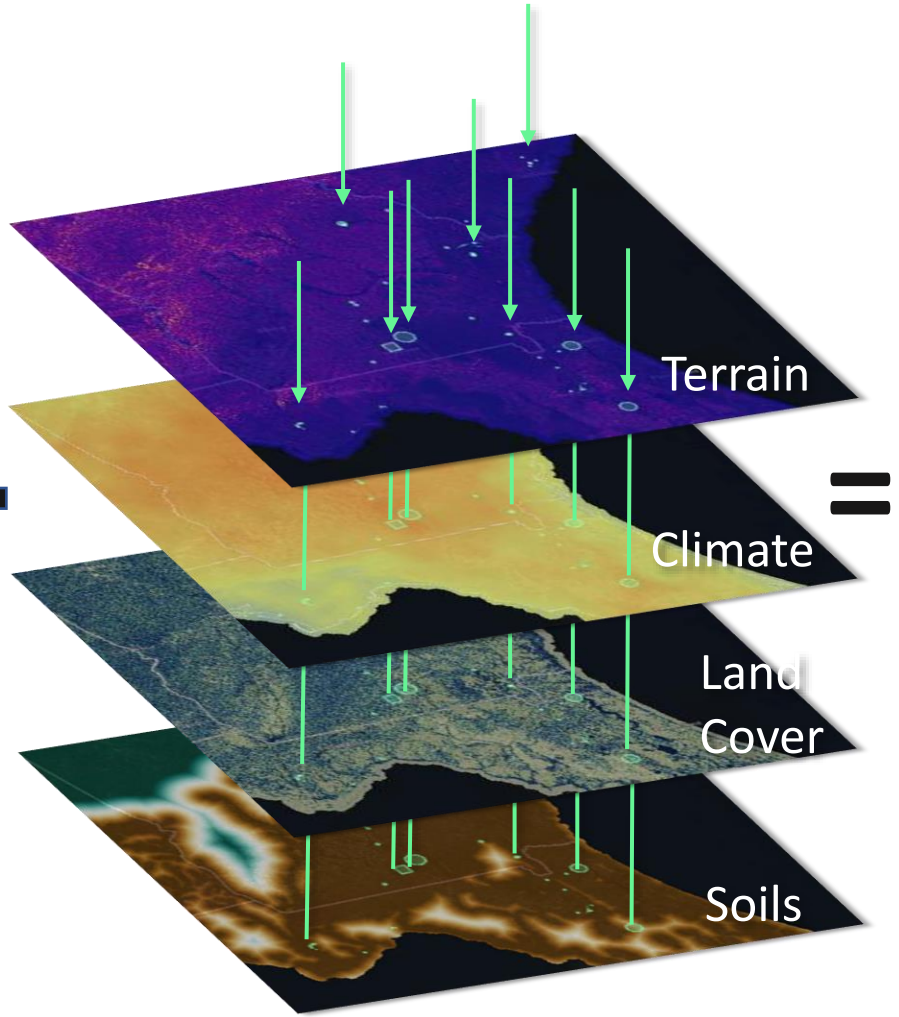
Machine Learning

NatureServe

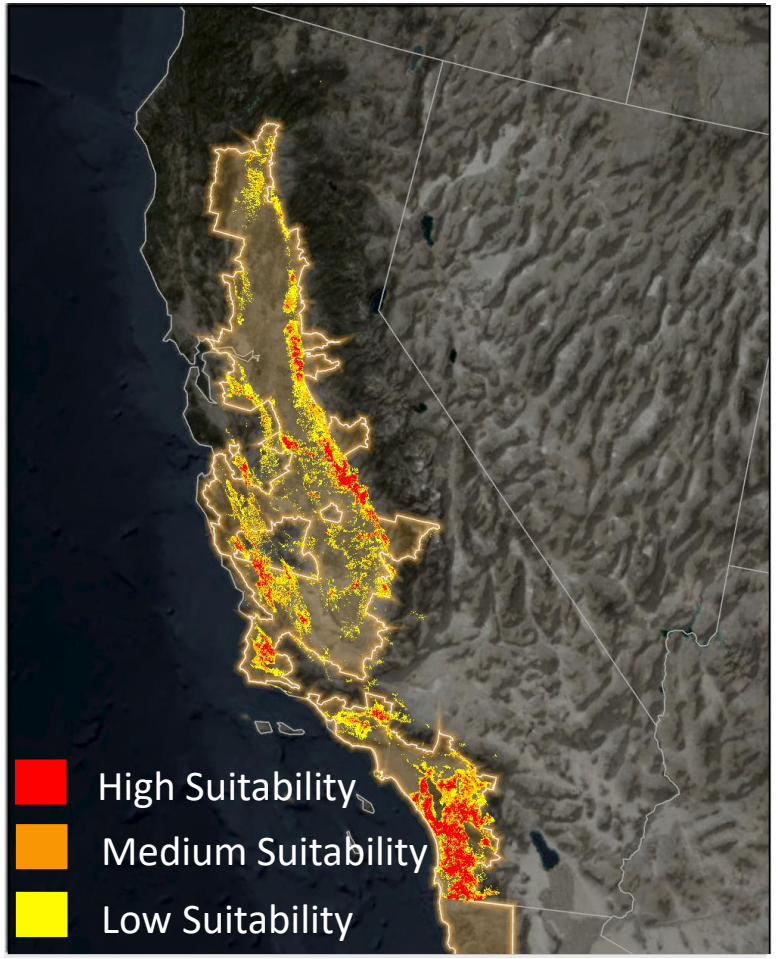
Cutting-edge tools for predictive modeling



Species Occurrence Data



Environmental Predictor Library



Machine Learning

NatureServe

The Map of Biodiversity Importance (MoBI)

Conservation priorities based on habitat maps for 2000+ imperiled species

1,654 Vascular Plants

Photo by Z. Loughman

144 Tetrapods

Photo by J. Trick

236 Aquatic Invertebrates

Photo by Z. Loughman

Photo by M. Klein

43 Pollinating Insects

168 Freshwater Fishes

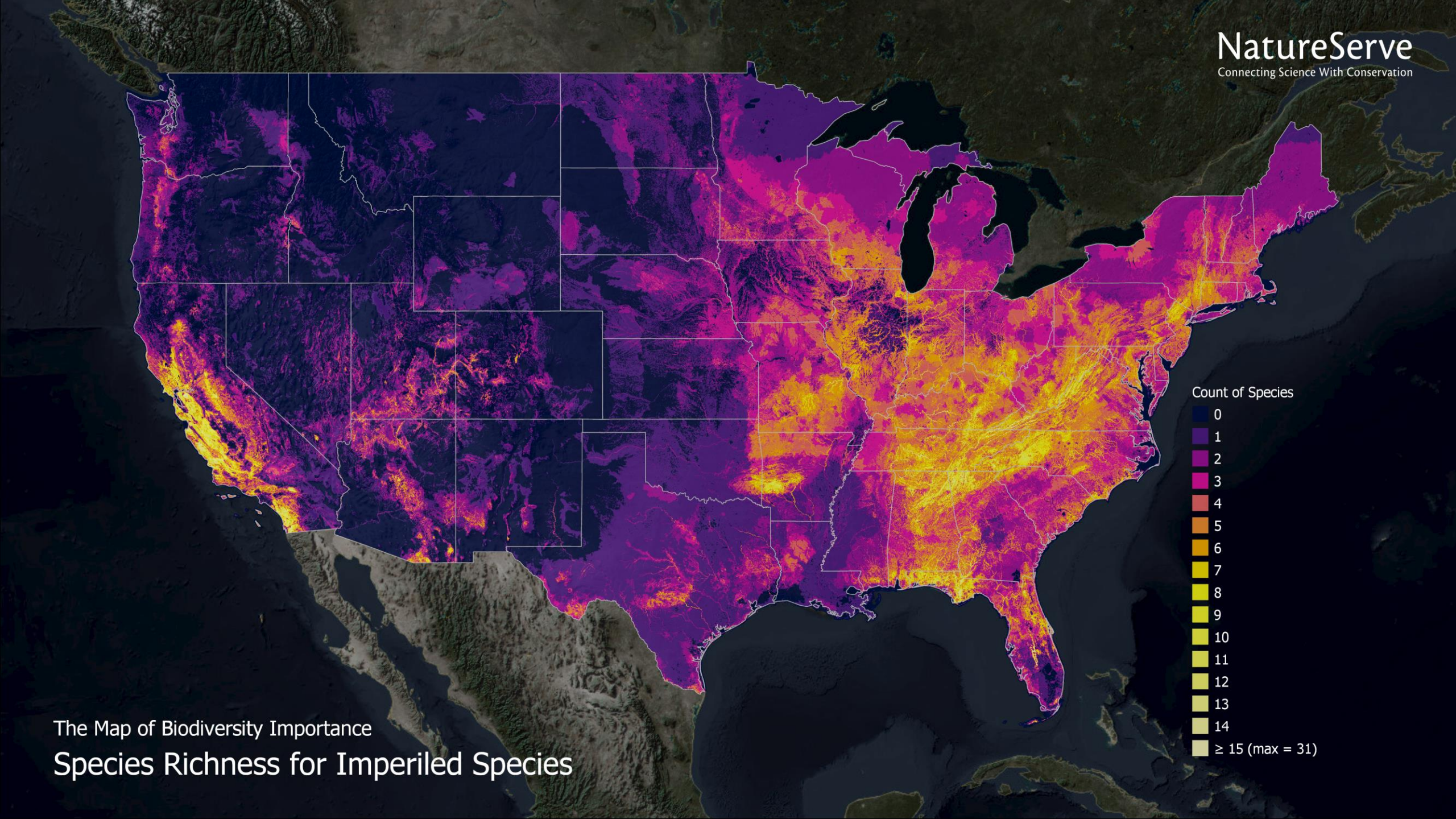
Photo by G. Peeples, DNR, Konrad P. Schmidt

esri

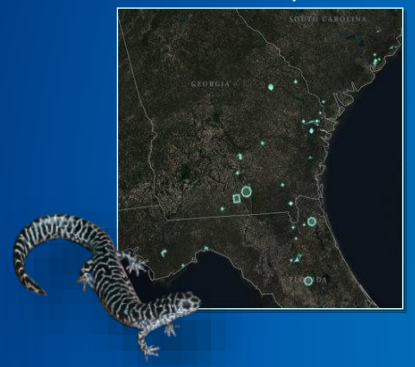
The Nature Conservancy

Microsoft

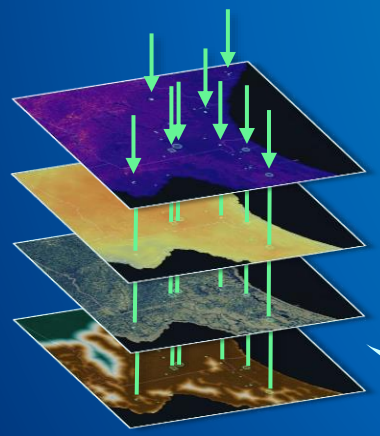
NatureServe Network


NatureServe
Connecting Science With Conservation
Count of Species
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
≥ 15 (max = 31)
The Map of Biodiversity Importance
Species Richness for Imperiled Species

NatureServe's Collaborative Species Habitat Models



1. Species Occurrence Data



2. Environmental Predictors

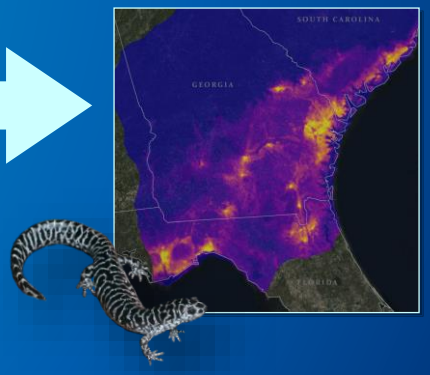
3. Modeling Engine

Microsoft Azure

ArcGIS Online

5. Expert Review

6. Field Validation



4. Model Products

This process, built on decades of natural heritage data, machine learning, and deep local knowledge, allows for models to be constantly refined and improved, thus creating better outcomes for conservation.

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Model Targets Identified Collaboratively

Western Spadefoot

Florida Scrub Lizard

Desert Massasauga

Florida Pinesnake

Panamint Alligator Lizard

Yuman Fringe-Toed Lizard

Escambia Map Turtle

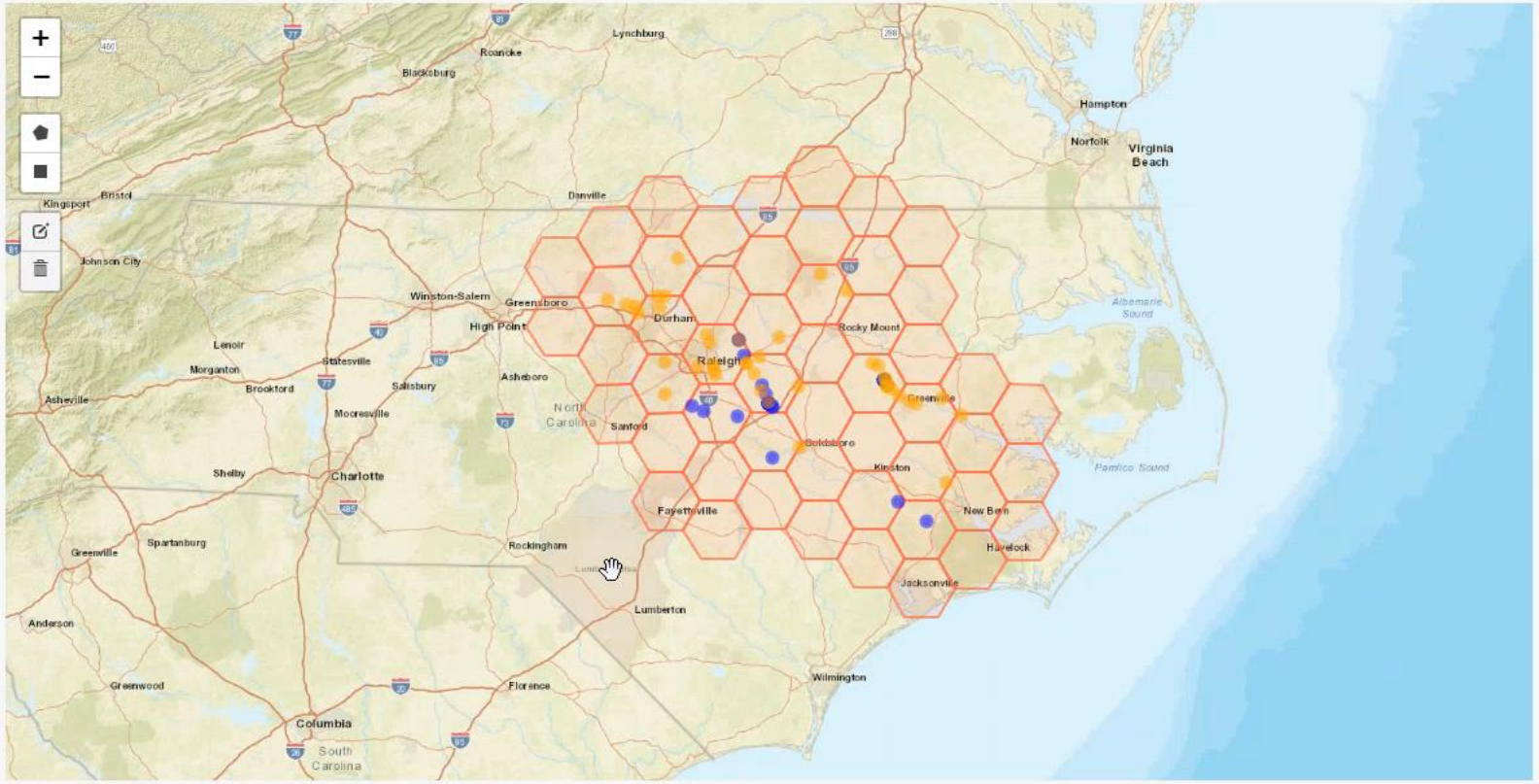
NatureServe Model Inputs Review Tool

3. Review input species occurrence data

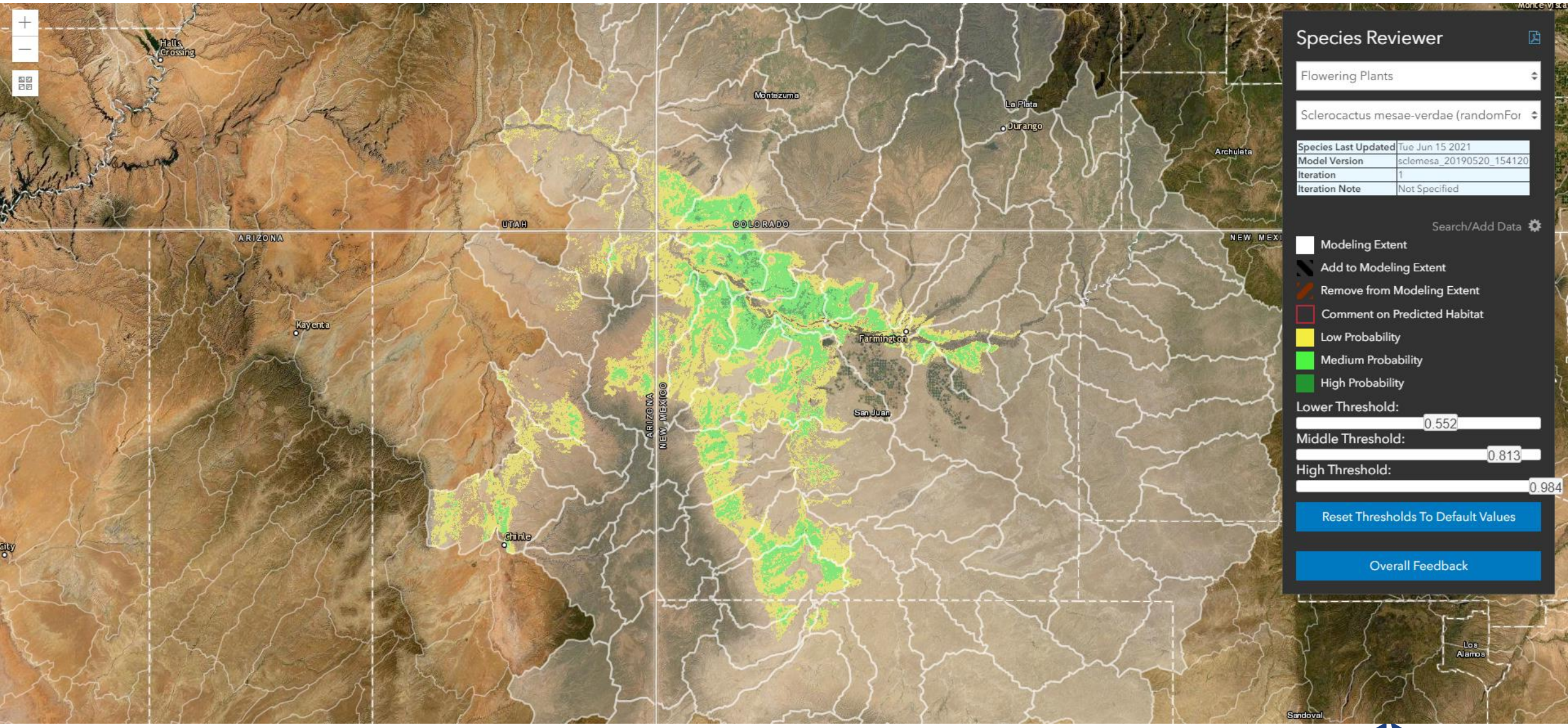
Reliable species occurrence data are key to building robust models. More data are not necessarily better if they are subject to high spatial, temporal, or taxonomic uncertainty. Help us by vetting species occurrence data for this species from a number of sources.

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 exaclty, and err on the side of drawing more inclusive than less inclusive shapes. Please add any important geographical details in the Comments box.

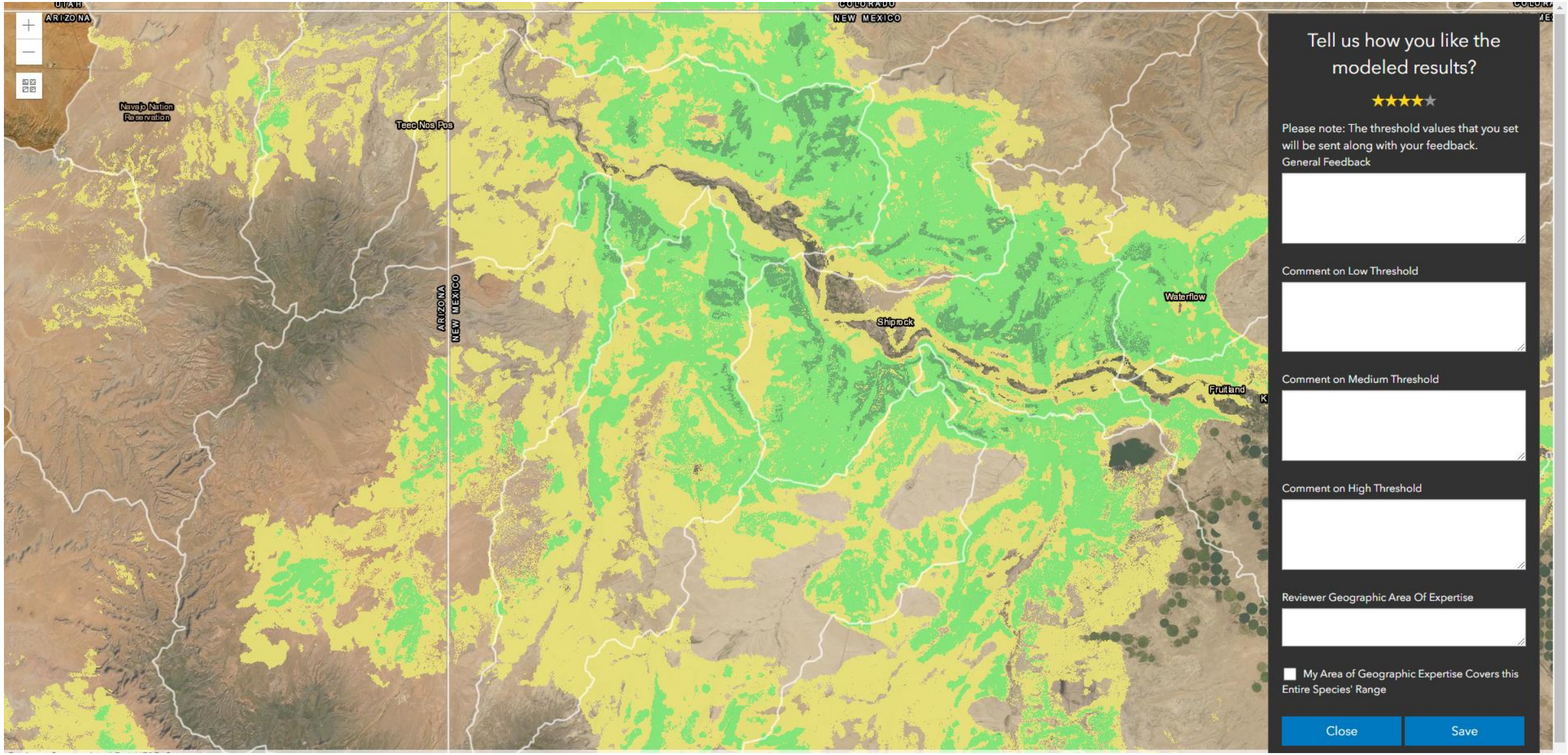


NatureServe Model Review Tool



NatureServe

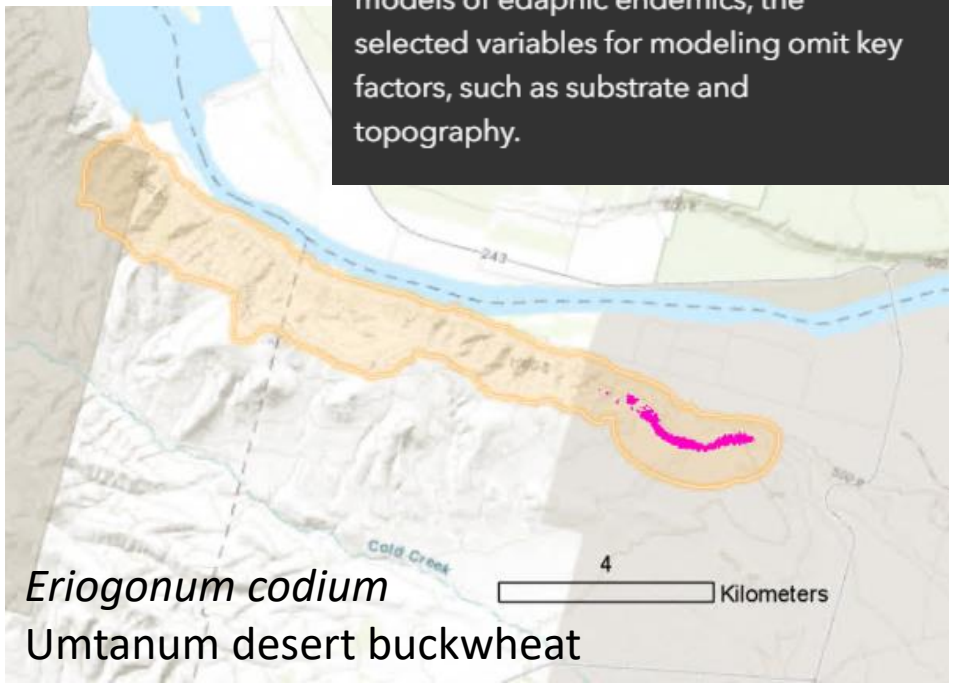
NatureServe Model Review Tool



NatureServe

★★★★★

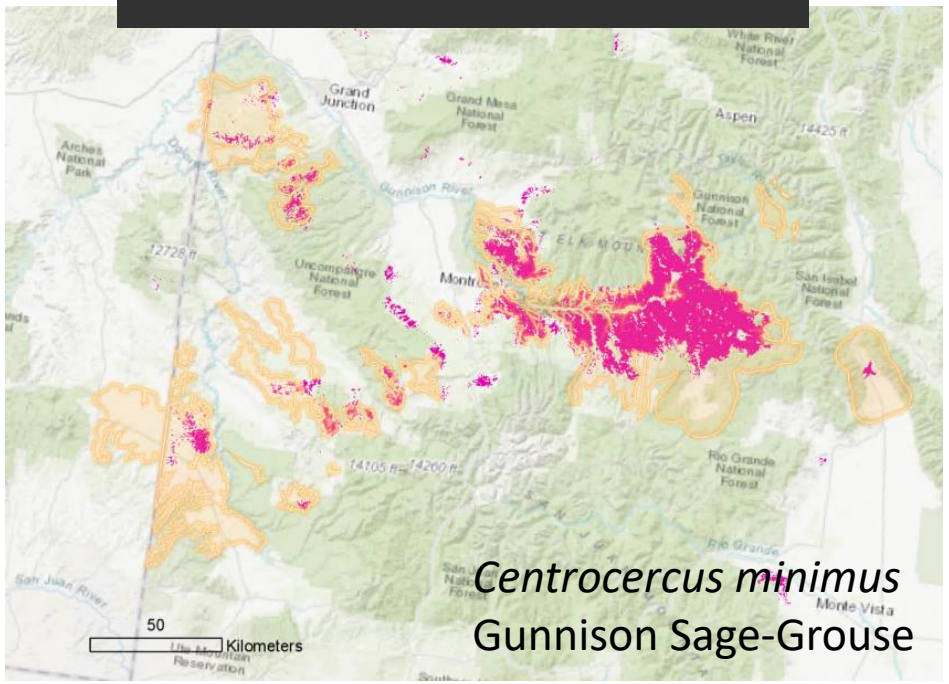
Yellow modeled area is very accurate, based on known extent of geologic substrate where species occurs. I removed the additional HUCs where suitable bedrock, soil, or topographic conditions are not present. As with most models of edaphic endemics, the selected variables for modeling omit key factors, such as substrate and topography.



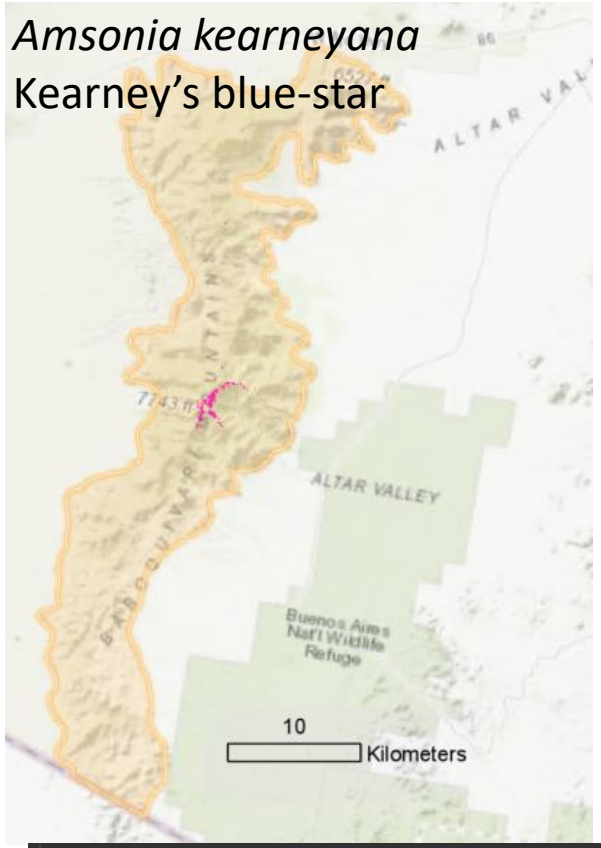
Eriogonum codium
Umtanum desert buckwheat

★★★★★

The model seems to perform well in areas of know occupied habitat. Some of the small patches of predicted habitat that are a significant distance away from known locations are unlikely to be occupied given the great extent to which this species has been surveyed.



Centrocercus minimus
Gunnison Sage-Grouse



Amsonia kearneyana
Kearney's blue-star

★★★★★

Limited knowledge of species - review based on occurrence data. Overpredicts suitable habitat.

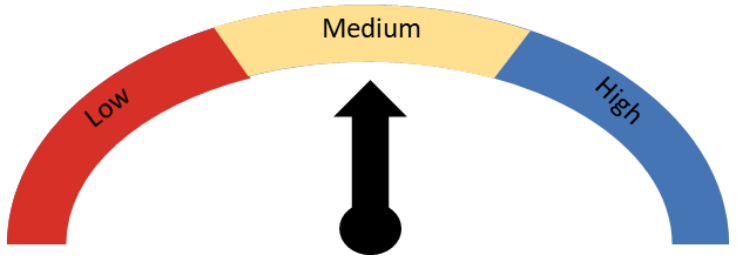
USFWS ECOS range
Species Habitat Model

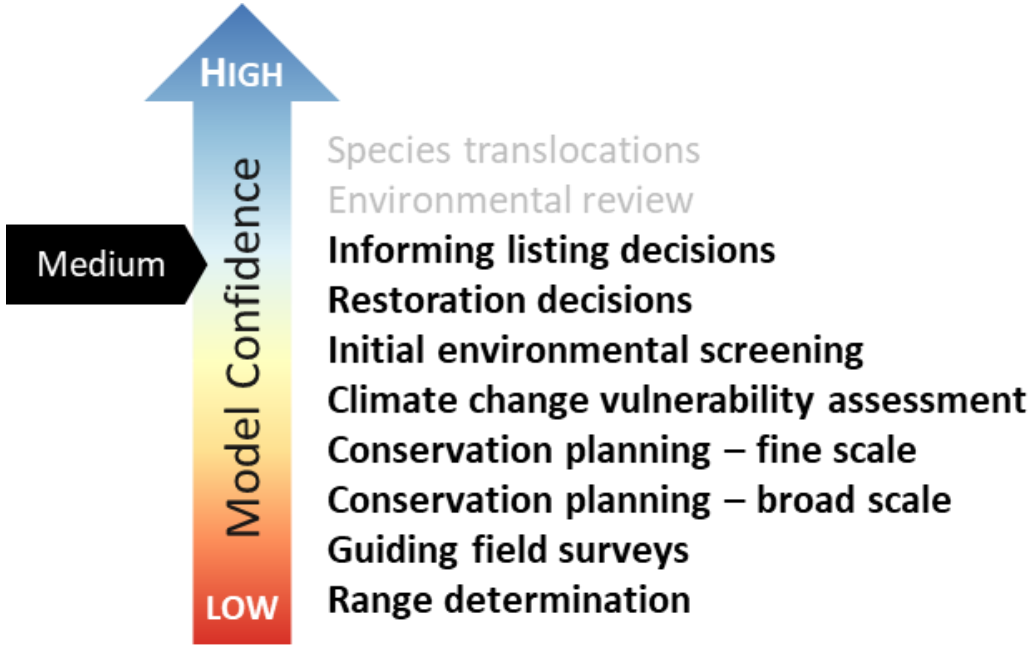
Sofaer *et al.* (2019) *BioScience*

Category	Metric	Score	Notes
Species Data	Presence data quality	Acceptable	Heritage Network data augmented with outside data which may or may not be vetted for accuracy or weighted for spatial representation.
	Absence/Background Data	Acceptable	Background points randomly placed throughout study area excluding species locations.
	Evaluation Data	Acceptable	Models are validated by jackknifing (i.e. leave-one-out).
Environmental Predictors	Ecological and predictive relevance	Acceptable	Selection of predictor variables were based on previous modeling experience by the Natural Heritage Network. Time constraints of this project prevented making species specific selections.
	Spatial and temporal alignment	Acceptable	Reasonable attempts to align predictor and presence data were made.
Modeling Process	Algorithm choice	Acceptable	Random Forest is highly rated classification model that is well documented as suitable for modeling rare species.
	Sensitivity	Acceptable	Settings for Random Forest were adjusted to best model the species; however, different models/parameters were not tested within one model run.
	Statistical rigor	Acceptable	Collinearity of predictors recognized and addressed; presence points grouped to minimize sample bias and minimize spatial autocorrelation boost during validation; other assumptions recognized and considered.
	Performance	Acceptable	Model TSS $\geq$ 0.6. Mapped model output is evaluated for ecological plausibility by expert review.
	Model review	Ideal	Model reviewed by regional, taxonomic experts and given high marks. (2 reviewers)
Model Products	Mapped products	Acceptable	Single calculated threshold selected for all final models to be integrated into MoBI.
	Interpretation support products	Ideal	All standards met.
	Reproducibility	Ideal	All standards met.
	Iterative	Interpret with Caution	Model not revised.

Mean Star Rating	Number of reviews	Max rating	Min rating	Median rating
★★★★★ (4)	2	4	4	4

Model Confidence Assessment and Recommended Uses





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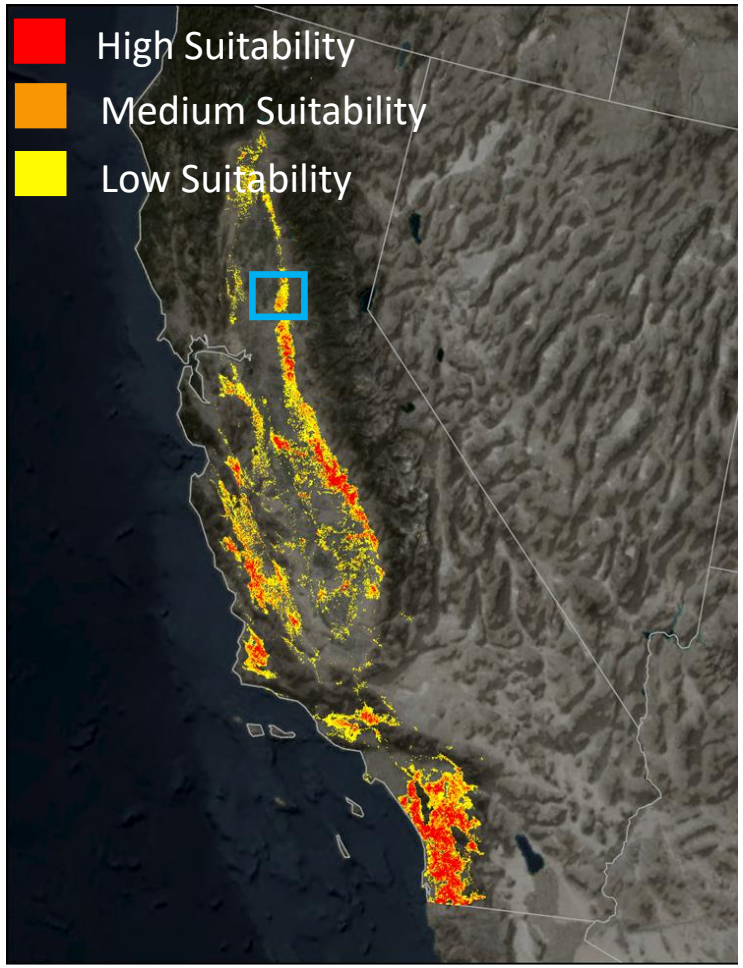
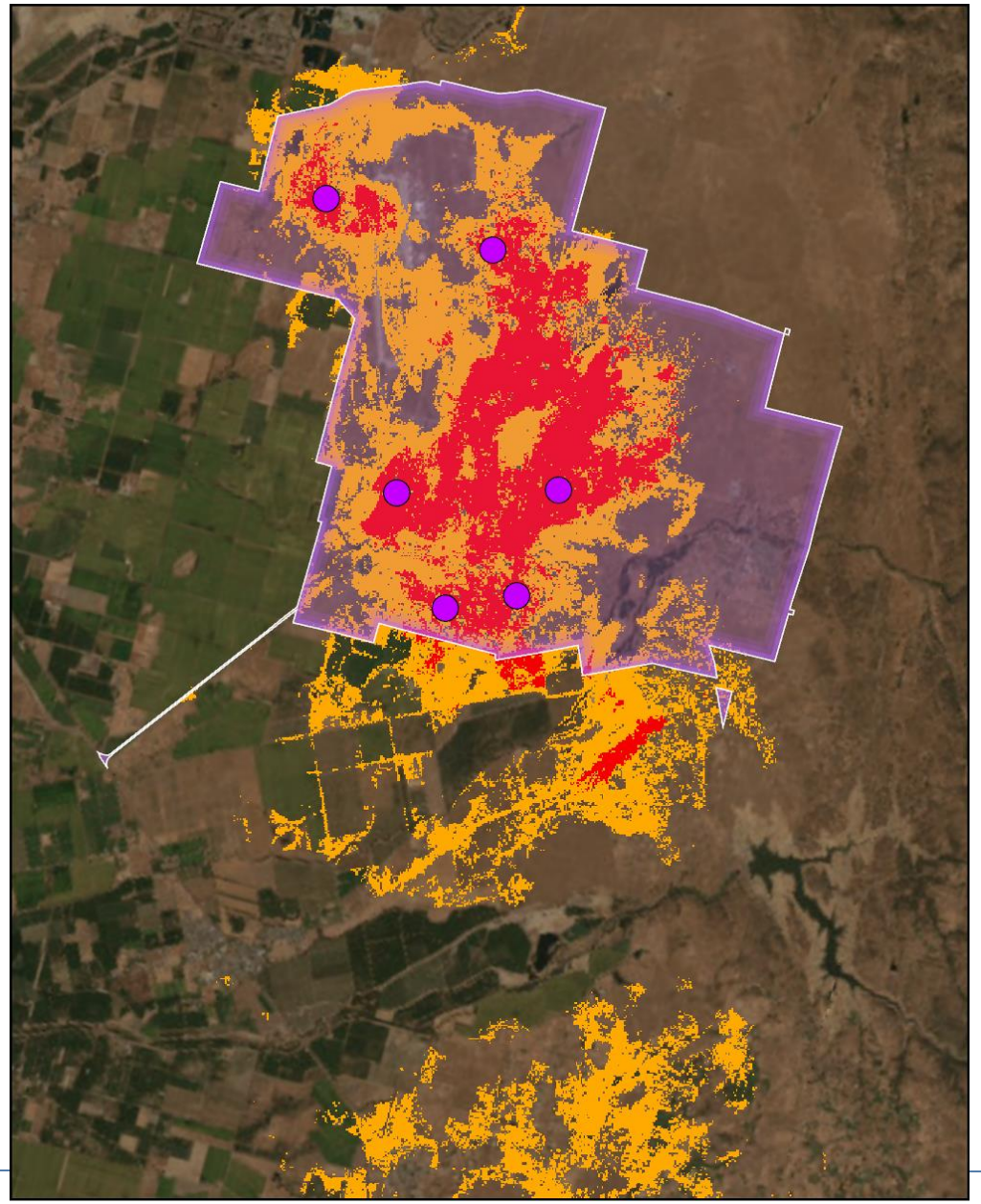
The value of high-resolution Species Habitat Models



Western Spadefoot
Spea hammondii



Beale Air Force Base
DoD Occurrence
High Suitability
Medium Suitability

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The value of high-resolution Species Habitat Models

More precise, cost-efficient, and effective management decisions

Western Spadefoot
Spea hammondii

	IUCN Range Map	Mapped Records	High Suitability	Medium Suitability
No. of Installations:	**27**	**12**	**14**	**16**

8% of all high probability habitat predicted on DoD installations

- One installation accounts for half of this (306 sq km, Camp Pendleton)

The value of high-resolution Species Habitat Models

More efficient field inventory and monitoring

Elko Rockcress
Arabis falcifructa

G1
Critically Imperiled

ESA Listing Status:
Under Review

High Habitat Suitability

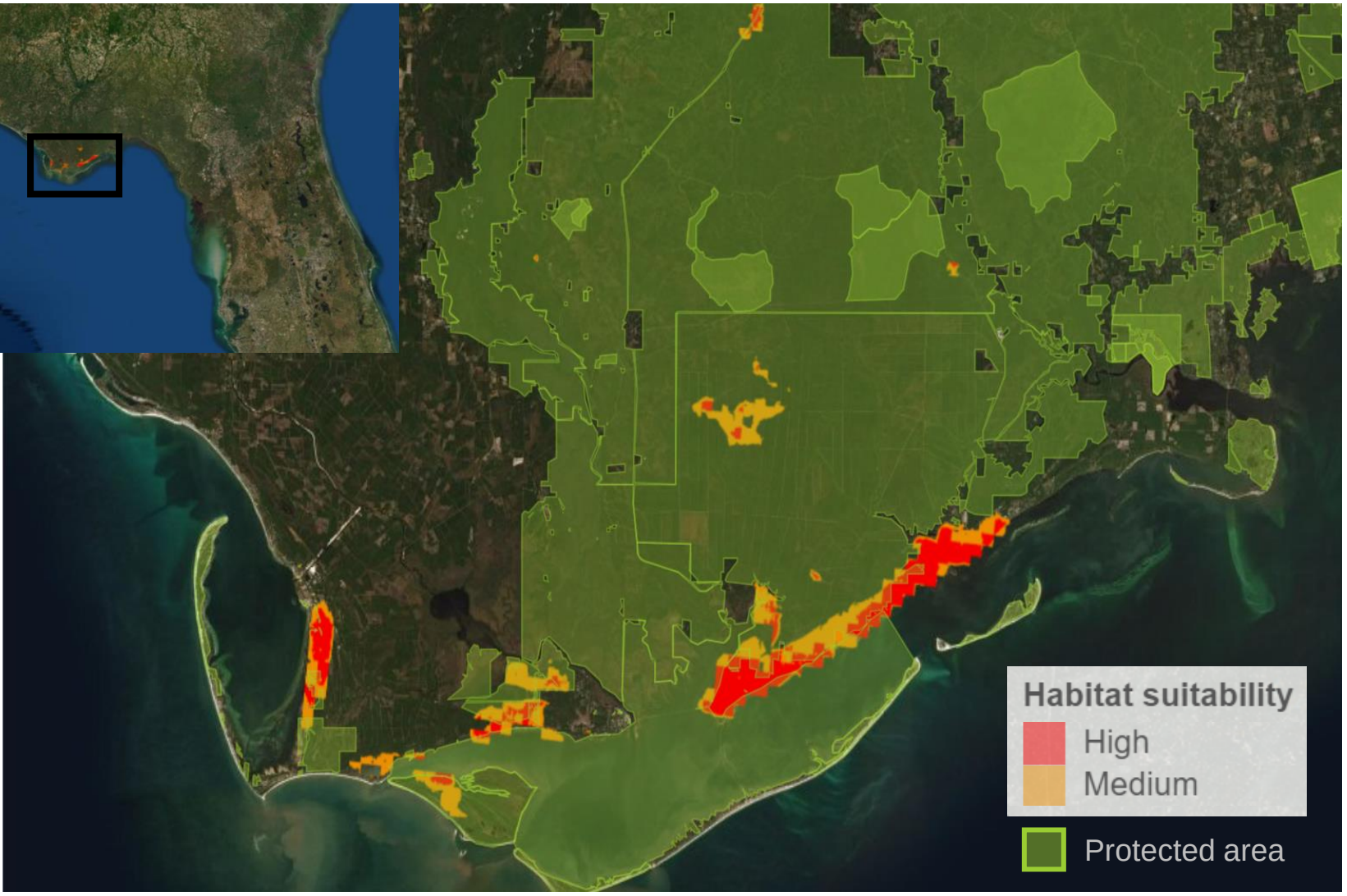
NatureServe Biodiversity Location Data

Priority Targets for Field Inventory

NatureServe

The value of high-resolution Species Habitat Models

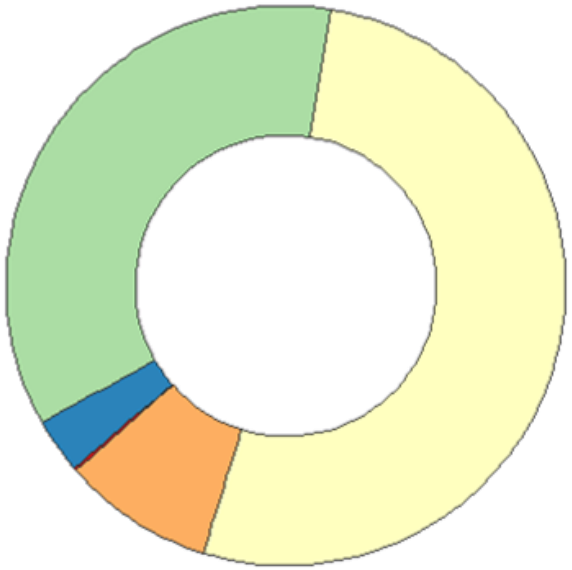
Detailed assessment of partners in conservation



Apalachicola Kingsnake
(*Lampropeltis meansi*)

G2
Imperiled

ESA Listing Status:
Under Review



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Next Step: Climate Change Vulnerability of Natural Resources on DoD Lands

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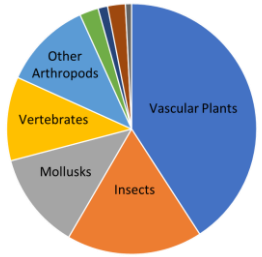
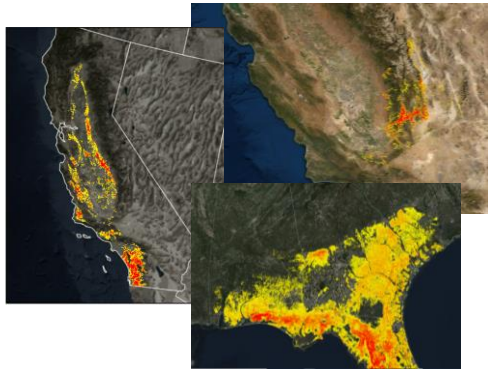
Taxonomy



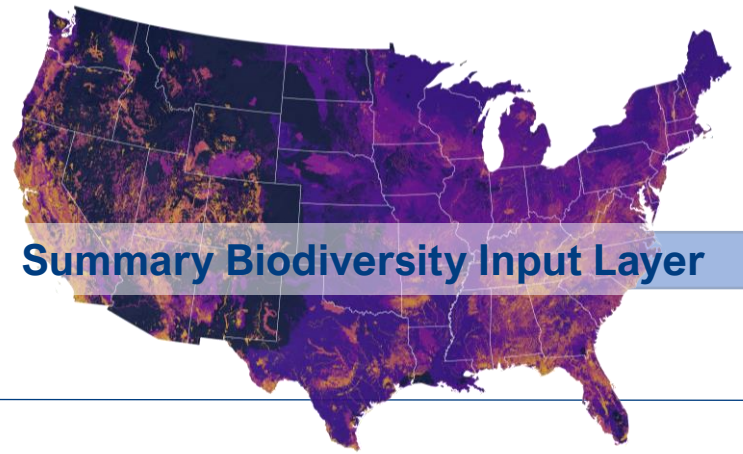
Conservation Status

Occurrence Data

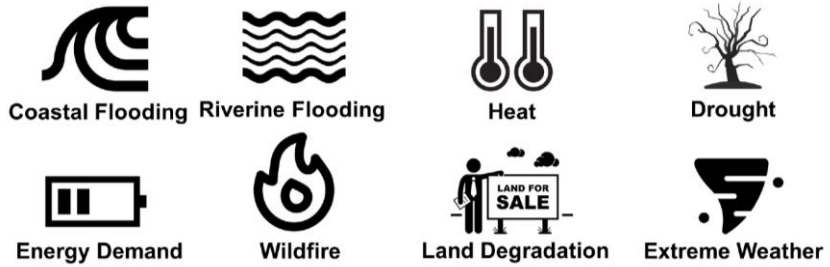
Species Habitat Models



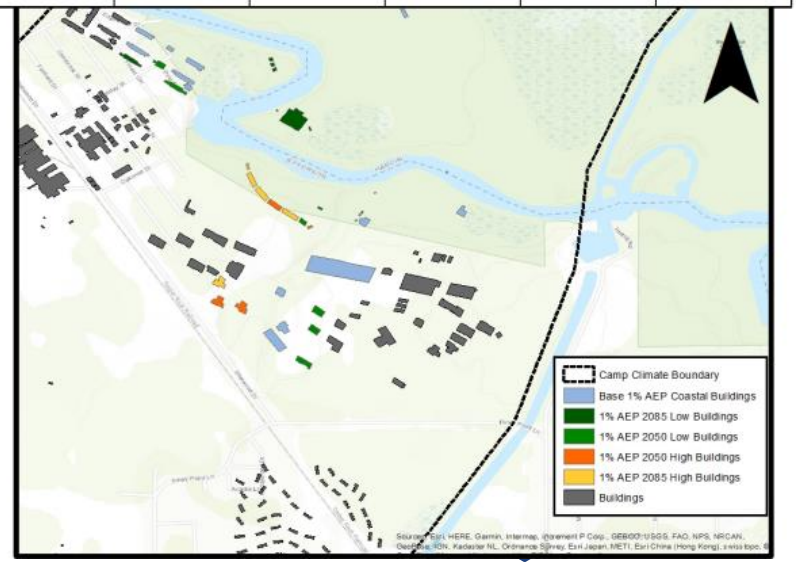
Summary Biodiversity Input Layer



Defense Climate Assessment Tool (DCAT)



Camp Climate		Percent of Total (and Number of) Buildings with Partial or Full Coastal Inundation per Scenario				
Site #	Total # of Buildings	Base 1% AEP	2050 LOW	2050 HIGH	2085 LOW	2085 HIGH
C555	183	11% (21)	15% (28)	22% (40)	20% (36)	25% (45)



Creating an Installation-wide Library of Improved Distribution Maps to Guide Stewardship of Priority Species

Healy Hamilton | Chief Scientist, NatureServe
Gio Rapacciuolo | Director of Applied Science Programs, NatureServe

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