



**Department of Defense**  
**Legacy Resource Management Program**

Legacy Project # NR 22-010

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

Year 2 Final Report

Dr. Healy Hamilton, Dr. Gio Rapacciuolo  
& Dr. Max Tarjan

NatureServe

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## ACRONYMS AND ABBREVIATIONS USED IN THIS REPORT

<b>BISON</b>	'Biodiversity Information Serving Our Nation' database. A federal database and mapping service covering the US, its territories, and Canada.
<b>BLD</b>	NatureServe's Biodiversity Location Data
<b>DCAT</b>	DoD Climate Action Tool
<b>DoD</b>	Department of Defense
<b>DOI</b>	The Department of the Interior
<b>ESA</b>	Endangered Species Act
<b>FWS</b>	US Fish and Wildlife Service
<b>G1/G2</b>	NatureServe conservation statuses of Globally Critically Imperiled (G1) and Globally Imperiled (G2)
<b>IUCN</b>	International Union for Conservation of Nature
<b>MoBI</b>	Map of Biodiversity Importance (An extensive species habitat modeling and mapping project conducted by the NatureServe network)
<b>PARC</b>	Partners in Amphibian and Reptile Conservation
<b>PIF</b>	Partners in Flight
<b>SHM</b>	Species Habitat Model. NatureServe has adopted the term "Species Habitat Model" or 'SHM' to refer to the type of models and modeling efforts represented in this project. The term "Species Distribution Model" or 'SDM' appears in earlier documents and is equivalent to SHM.
<b>TER-S</b>	Threatened, Endangered, and At-Risk Species
<b>USDA</b>	United States Department of Agriculture
<b>USGS</b>	The United States Geological Survey

## PROJECT SUMMARY

The Department of Defense (DoD) requires accurate information on the identity, conservation status and distribution of at-risk species that occur on its installations. If these species are listed under the Endangered Species Act (ESA), the DoD's ability to perform training and other activities could be curtailed, compromising the military mission. To date, species of potential management concern have been identified as a limited set of Threatened, Endangered, and At-Risk Species (TER-S) or through prioritization exercises conducted by collaborative efforts such as Partners in Flight (PIF) and Partners in Amphibian and Reptile Conservation (PARC). Before this project, a standardized assessment of species on DoD installations with the potential to be listed had never been conducted.

In this project, NatureServe is providing DoD with foundational information on the identity, distribution, and conservation status of at-risk species which are currently included or could potentially be considered as DoD mission priority TER-S. Specifically, this project will: 1) develop a science-based and repeatable framework to identify and prioritize species that may qualify for inclusion as DoD mission priority TER-S based on the extent of their occurrence on DoD installations and their conservation status; and 2) create a library of fine-scale range-wide high-resolution species habitat models and maps for current and potential TER-S, which will provide DoD staff with consistent, defensible, refined information on the extent and location of sensitive habitat for at-risk species on DoD installations. Range-wide high-resolution species habitat distribution maps can transform the effectiveness of stewardship decision-making, increasing mission flexibility by minimizing conflict with TER-S, improving mitigation outcomes both on installations and offsite, and contribute to conservation actions that may preclude Endangered Species Act listing.

The species habitat model library resulting from this project will consist of vetted, standardized habitat distribution maps for DoD Priority Species, accompanied by guidance on their interpretation and application. The library will contain both newly modeled habitat maps and existing models that fulfill quality requirements defined by a peer-reviewed model assessment rubric authored by USGS, DOI, USDA, and NatureServe scientists (Sofaer et al. 2019). The new models will leverage advances in ecological modeling, computational infrastructure, and the data holdings and experience of the NatureServe Network of State Natural Heritage Programs, the premier source for sensitive locality information for at-risk species. Engagement with Legacy Program and other DoD staff will ensure relevancy of products to meet Legacy Program information needs. Overall, this project will provide DoD with a set of data and tools for better informed decisions about management of Threatened, Endangered, and At-Risk Species on DoD installations and will demonstrate a process that can be applied to virtually all ESA-listed and at-risk species.

This is the second annual report prepared for the Legacy Project/NatureServe Contract/Agreement, "Creating an Installation-wide Library of Improved Distribution Maps to Guide Stewardship of Priority Species" covering the period from September 16, 2021 through September 17, 2022.

**Progress on Year 2 objectives by project activity**

All Year 2 objectives were accomplished.

Table 1: Project activities, Year 2 objectives, and progress in Year 2.

Activity	Year 2 Objectives	Progress on Year 2 Objectives
1. Species assessment framework	<ul style="list-style-type: none"> <li>Finalize assessment framework</li> </ul>	<ul style="list-style-type: none"> <li><b>Task completed.</b> Incorporated feedback from BLM to finalize an objective framework to identify and prioritize 1,002 species that meet a suite of criteria warranting their consideration as DoD mission priority Threatened, Endangered, and At-Risk Species (TER-S). Delivered refined prioritization results as an Excel Workbook.</li> </ul>
2. Prioritize species for habitat suitability modeling	<ul style="list-style-type: none"> <li>Final list of Year 2 target species, and a draft list of Year 3 target species, for advancing to habitat model development/refinement stage</li> </ul>	<ul style="list-style-type: none"> <li><b>Task completed.</b> Identified 21 species as Year 2 target (Table 2). Worked with DoD to develop a list of species to model in Year 3 that meets the needs of DoD.</li> </ul>
3. Compile existing SHMs	<ul style="list-style-type: none"> <li>For the target species for modeling in Year 2, compile and evaluate existing SHMs</li> </ul>	<ul style="list-style-type: none"> <li><b>Task completed.</b> Assembled information about existing models for target species and used existing NatureServe models as version 1 when applicable.</li> </ul>
4. Generate and/or refine SHMs	<ul style="list-style-type: none"> <li>New or refined species habitat models that meet minimum standards, are consistent in spatial data and metadata, and are prepared to be served via the spatial data library</li> </ul>	<ul style="list-style-type: none"> <li><b>Task completed.</b> Refined species habitat distributions created for 21 target species, exceeding the initial goal of 20 species. Refined draft models from Year 1.</li> </ul>

Activity	Year 2 Objectives	Progress on Year 2 Objectives
5. Generate Biodiversity Data Inputs for potential use in the DoD Climate Assessment Tool	<ul style="list-style-type: none"> <li>• Analytical framework that is suitable for inclusion in the DCAT for the assessment of natural resources sensitivity to climate change at military installations</li> <li>• Methodologies that will enable users to leverage the DCAT workflow and tool to obtain meaningful estimates of climate change vulnerability</li> <li>• Tabular data on climate hazard sensitivity for each TER-S</li> <li>• Spatially explicit sensitivity scores and/or other GIS layers, as outlined in the framework, for potential inclusion in the DCAT</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Tasks completed.</b> NatureServe coordinated regular meetings with the DoD Climate Action Team and the DoD Legacy Program and agreed on using the Installation Reports as the preliminary vehicle for incorporating biodiversity information into the DCAT. NatureServe proposed an analytical framework for assessing species vulnerability to climate hazards and assessed species vulnerability by applying the framework to 1,002 potential TER-S across all DoD installations. NatureServe generated climate change vulnerability scores for each potential TER-S and summarized spatially explicit results in a series of figures.</li> </ul>
6. Spatial data library	<ul style="list-style-type: none"> <li>• Addition of at least 20 newly generated SHMs, refined SHMs, and externally sourced SHMs to spatial data library</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Task completed.</b> Year 2 models served on updated Model Outputs Review Tool and Year 1 models (7 species) uploaded to NatureServe Explorer Pro.</li> </ul>
7. Outreach and communication	<ul style="list-style-type: none"> <li>• Draft interpretive materials</li> <li>• Support ongoing communication with DoD as necessary for the success of the project and uptake of outputs.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Task completed.</b> Developed draft interpretive materials to provide guidance on how to access and work with model outputs and metadata. Held virtual meetings and regular communications as necessary to obtain data, solicit feedback on deliverables, and share products. Presented results during a technical session at National Military Fish and Wildlife Association conference in March 2022, and contributed to other talks and publications about the project.</li> </ul>

## PROGRESS ON ACTIVITIES AND PRODUCTS

This project comprises 7 activities. The following sections describe the rationale and intended outcomes for each activity over the course of the three years of this project, as well as the specific objectives for Year 2 and the progress made towards those objectives.

### Activity 1. Species Assessment Framework

#### Activity Description

Develop an assessment framework to review and expand as needed the list of priority species for which DoD needs high quality distribution information. The goal of this activity is to develop an assessment framework with a suite of collaboratively determined criteria to systematically identify potential species of management and conservation concern likely to occur on installations. The framework accounts for conservation status, distribution, occurrence on the FWS Seven-year Listing Decision database, and other factors to identify species that are potential management risks. The framework leverages existing SHMs from NatureServe’s [Map of Biodiversity Importance](#) (MoBI) project and other data sources, such as NatureServe’s Biodiversity Location Data (BLD), to determine which at-risk species potentially occur on DoD installations and are not currently on the DoD TER-S list.

#### Year 2 Objectives

- Finalize assessment framework and list of species to consider for inclusion on DoD TER-S list (i.e., candidate TER-S).

#### Progress in Year 2

- NatureServe finalized the assessment framework and applied it to create a list of recommended species to be added to the DoD TER-S list.
- This list was provided to DoD as an Excel Workbook via email on 7/18/2022.

### Activity 2. Prioritize Species for SHMs

#### Activity Description

Based on results of Activity 1, prioritize focal species for habitat suitability modeling. Activity 1 and Activity 2 help to systematically identify candidate TER-S and aid in the feasibility of improving existing distribution data for these species. This activity, conducted in collaboration with the DoD Legacy Program, determines which species to pursue for inclusion in a library of SHMs of at-risk species. Proposed criteria include species that are not yet ESA listed, those with upcoming FWS listing decisions, those that are likely to produce robust SHMs, and those that occur on multiple DoD installations.

#### Year 2 Objectives

- Based on results of Activity 1, prioritize focal species for habitat suitability modeling.



## Progress in Year 2

- NatureServe used the results of Activity 1 and consultation with relevant DoD programs to identify additional species for development of Species Habitat Models (SHMs). A list of species for modeling in Years 2 and 3 was finalized and provided to DoD. NatureServe exceeded the original goal of creating new or refined models for at least 20 species that were selected as priorities for Project Year 2 (see Activity 4, Table 2).

## Activity 3. Compile existing SHMs

### Activity Description

For the focal species identified in Activity 2, compile and evaluate existing SHMs. This activity involves obtaining digital versions of existing SHMs and accompanying metadata and evaluating them for (a) geographic completeness and (b) credibility for decision-making, using the NatureServe-USGS SHM assessment rubric designed for this purpose (Soafer et al. 2019, BioScience 69:544).

### Year 2 Objectives

- For the focal species identified in Activity 2, compile and evaluate existing SHMs.

### Progress in Year 2

- NatureServe compiled relevant existing SHMs of species identified in Activity 2. NatureServe conducted a search for existing models prior to creating new models for each species. When available, MoBI models were used as model version 1 and then refined based on expert reviews.

## Activity 4. Generate and/or refine SHMs

### Activity Description

Generate new SHMs for focal species identified in Activity 2 without suitable or geographically complete SHMs. In this activity, NatureServe will build SHMs of previously identified focal species. In determining how many SHMs to carry out, more emphasis can be placed on producing the highest quality models possible than on producing large quantities of models.

Species locality input data comes primarily from NatureServe's BLD—the aggregated database of verified occurrences collected by state Natural Heritage Programs. In addition, other occurrence record data sets (BISON, iNaturalist, HerpMapper, etc.) are consulted. Environmental predictor data, such as those describing climate, topography, soils, hydrology, and land cover, relies primarily on the national library of over 250 high resolution digital environmental data layers for the conterminous U.S. developed for the MoBI project.

Once species locality data and environmental predictor data are assembled, models are coded and run in the R programming environment. NatureServe produced models for the 7 species selected as targets in Year 1 using a random forest algorithm. Outputs are produced at a 30-m resolution for narrow-ranging species and, occasionally, at 330-m resolution for wide-ranging species (this only applied to the

desert massasauga model in Year 1). Model statistical performance is evaluated using the True Skill Statistic, which quantifies matches and mismatches between observations and predictions, and Area Under the Curve, a measure of the ability of a classifier to distinguish between classes. Performance statistics and other model information, such as the relative contributions of environmental parameters to model predictions, are automatically summarized in a metadata pdf file. This metadata .pdf file is made accessible in the Spatial Data Library together with the species habitat distribution maps generated by the model.

After initial model runs, NatureServe’s model review tool acts as a platform by which species experts from natural heritage programs, as well as DoD, PARC, PIF, and other experts as appropriate, can provide feedback and identify, for example, areas of over and underprediction or areas where additional species locality data might be available. Models are rerun iteratively to address review comments.

### **Year 2 Objectives**

- Addition of at least 20 newly generated Species Habitat Models (SHMs), refined SHMs, and externally sourced SHMs to spatial data library.
- Revise SHMs developed in Year 1 where applicable based on expert reviews.

### **Progress in Year 2**

- Pursued network permissions for Species Habitat Modeling. Use of NatureServe Network data and sharing of data products (such as Species Habitat Models) with government entities requires permission from each applicable Natural Heritage Program. The NatureServe team sent out surveys and followed up with individual programs to obtain permissions for creating, reviewing, and sharing models for species in Project Year 2.
- Generated New SHMs: NatureServe generated models for 21 new species (Table 2).
  - Twenty of the new models are currently undergoing review by experts within the NatureServe Network (Figure 1).
  - The additional draft model for the Whooping Crane (*Grus americana*) only had moderate statistical performance because it is a wide-ranging species, so the model is undergoing revision prior to review.
- In addition to producing models for new species, NatureServe obtained expert reviews for the 7 species modeled in Project Year 1 (Table 3). Using all reviews that suggested model improvements, NatureServe produced revised models for 5 species, and consulted with experts to harmonize the SHM with the current taxonomy for the Desert Massasagua (*Sistrurus terrgeminus edwardsii*).
- The 7 species modeled in Year 1 were uploaded to the permanent spatial data library.
- NatureServe migrated the Species Habitat Modeling workflow to a new, more efficient cloud-based environment.

Table 2: The 21 species identified as priorities and modeled in Year 2.

<b>Taxonomic Group</b>	<b>Scientific Name</b>	<b>Common Name</b>
Freshwater and Anadromous Fishes	<i>Acipenser oxyrinchus desotoi</i>	Gulf Sturgeon
Birds	<i>Ammospiza caudacuta</i>	Saltmarsh Sparrow
Mammals	<i>Antilocapra americana sonoriensis</i>	Sonoran Pronghorn
Butterflies and Skippers	<i>Atrytone arogos arogos</i>	Eastern Arogos Skipper
Arthropods	<i>Branchinecta sandiegonensis</i>	San Diego Fairy Shrimp
Butterflies and Skippers	<i>Callophrys irus</i>	Frosted Elfin
Plant	<i>Chlorogalum purpureum var. purpureum</i>	Santa Lucia Purple Amole
Flowering Plants	<i>Chorizanthe pungens var. pungens</i>	Monterey Spineflower
Plant	<i>Cordylanthus maritimus ssp. maritimus</i>	Salt Marsh Bird's Beak
Plant	<i>Empidonax traillii extimus</i>	Southwestern Willow Flycatcher
Plant	<i>Eryngium aristulatum var. parishii</i>	San Diego Button-celery
Birds	<i>Falco femoralis septentrionalis</i>	Northern Aplomado Falcon
Birds	<i>Grus americana</i>	Whooping Crane
Amphibians	<i>Lithobates capito</i>	Carolina Gopher Frog
Butterflies and Skippers	<i>Plebejus samuelis</i>	Karner Blue
Birds	<i>Rallus obsoletus levipes</i>	Light-footed Clapper Rail
Birds	<i>Sternula antillarum browni</i>	California Least Tern
Arthropods	<i>Streptocephalus woottoni</i>	Riverside Fairy Shrimp
Birds	<i>Vireo bellii pusillus</i>	Least Bell's Vireo
Mammals	<i>Vulpes macrotis mutica</i>	San Joaquin Kit Fox
Mammals	<i>Zapus hudsonius preblei</i>	Preble's Meadow Jumping Mouse

Table 3: The 7 species modeled in Year 1 and uploaded to the permanent spatial data library in Year 2. \*Species with models that were revised in Year 2 based on expert reviews.

Taxonomic Group	Scientific Name	Common Name
Reptiles	<i>Elgaria panamintina</i>	Panamint Alligator Lizard*
Reptiles	<i>Pituophis melanoleucus mugitus</i>	Florida Pinesnake
Reptiles	<i>Graptemys ernsti</i>	Escambia Map Turtle*
Reptiles	<i>Sceloporus woodi</i>	Florida Scrub Lizard*
Reptiles	<i>Sistrurus tergeminus edwardsii</i>	Desert Massasauga
Amphibians	<i>Spea hammondi</i>	Western Spadefoot Toad*
Reptiles	<i>Uma rufopunctata</i>	Yuman Desert Fringe-toed Lizard*

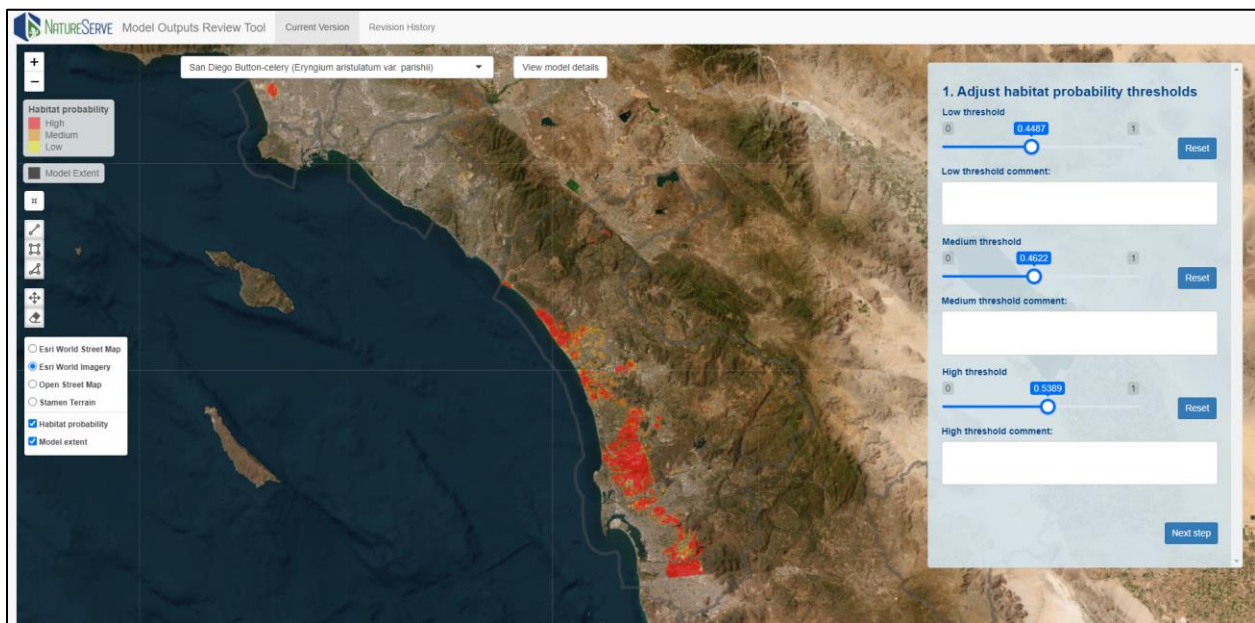


Figure 1. San Diego Button-celery (*Eryngium aristulatum var. parishii*) on NatureServe’s Model Outputs Review Tool. Expert reviews from the NatureServe Network and DoD give feedback on the suitable habitat probability threshold, the model extent, and environmental predictors, enabling for refined estimates of suitable habitat.

## Activity 5. Generate Biodiversity Data Inputs for potential use in the DoD Climate Assessment Tool

### Activity Description

Year 2 of the project will include an additional Climate Change task in collaboration with the DoD Climate Action Team. This task emerged as a newly identified priority by the DoD Legacy Program. In Year 2, this work focused on two overarching objectives: (1) to develop the most suitable and up-to-date biodiversity data layers to be considered for input into the Department of Defense Climate Assessment Tool (DCAT), and (2) to recommend appropriate methodologies to incorporate biodiversity data into the DCAT workflow for the purpose of addressing sensitivity to climate exposure in support of climate change vulnerability and adaptation.

### Year 2 Objectives

- Propose Analytical Framework: A mutually acceptable analytical framework that is suitable for inclusion in the DCAT for the assessment of natural resources sensitivity to climate change at military installations. Associated NatureServe-DoD Climate Action Team Working Group Meetings as needed (at least monthly).
- Propose Workflows for DoD Climate Assessment Tool: A mutually acceptable set of methodologies that will enable users to leverage the DCAT workflow and tool to obtain meaningful estimates of climate change vulnerability. Associated NatureServe-DoD Climate Action Team Working Group Meetings as needed.
- Assess Species Sensitivity: Tabular data on climate hazard sensitivity for each TER-S
- Generate Biodiversity Data Inputs for potential use in the DoD Climate Assessment Tool.
- Spatially explicit sensitivity scores and/or other GIS layers, as outlined in the framework, for potential inclusion in the DCAT. A minimum of 1 data layer per hazard will be produced.

### Progress in Year 2

- NatureServe coordinated regular meetings with the DoD Climate Action Team to gain information about the DoD Climate Assessment Tool and to work together to create biodiversity products that would benefit the DCAT.
  - Kick-off meeting with DoD Climate Action Team (March 1, 2022)
  - Working meeting with DoD Climate Action Team (May 31, 2022)
- NatureServe proposed workflows for the DoD Climate Assessment Tool; the DoD Climate Action Team and the DoD Legacy Program agreed on using the Installation Reports on the DCAT as the preliminary vehicle for incorporating biodiversity information into the DCAT.
- NatureServe proposed an analytical framework for assessing species vulnerability to climate hazards, which was reviewed by the Climate Action Team and the Legacy Program.
- NatureServe then assessed species vulnerability by applying the framework to 1,002 potential TER-S across all DoD installations.

- NatureServe generated biodiversity products by adding climate change vulnerability scores for each potential TER-S to the assessment framework excel workbook and summarizing results in a series of figures, which were then revised and consolidated following feedback from the DoD Climate Action Team and other DoD programs (Figure 2).

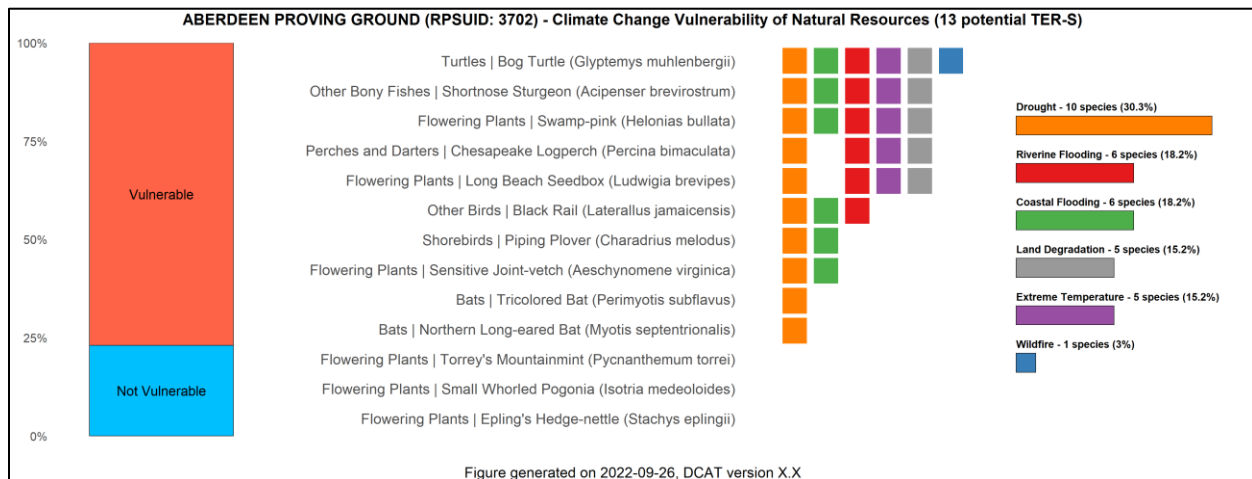


Figure 2. A figure summarizing the vulnerability of natural resources on a DoD installation. NatureServe generated one figure per DoD installation to be added to the installation reports on the DoD Climate Assessment Tool. The figure shows the proportion of all potential DoD TER-S occurring on the given installation which have been identified as vulnerable versus not vulnerable to one or more of the climate hazards in the DCAT (left); each potential TER-S occurring on the installation and the hazard(s) to which each is vulnerable (center); the number of species that have been identified as vulnerable to each of the climate hazards in the DCAT (right). Colors match the colors currently associated with each hazard in the DCAT.

## Activity 6. Spatial Data Library

### Activity Description

Compile outputs from suitable existing and newly generated SHMs into a licensed, DoD-accessible online spatial data library. The final project library contains output products for SHMs compiled in Activity 4 and generated in Activity 5. The library includes (a) probability surfaces of suitable habitat, (b) binary habitat/non-habitat maps generated using statistical thresholds tailored to a common range of DoD species management decisions, and (c) summary metadata designed to guide end users in application of the SHM outputs. The models are available both as spatial data (raster datasets) and static maps. The metadata includes information on the data used in modeling, the influence of individual environmental variables on the output, model performance (including both statistical measures and field validation information, where available), thresholding options, scoring of model credibility applying the model assessment rubric, and recommended uses. Finally, the SHM product outputs are assembled into a secure spatial data library with licensed access for DoD personnel via an ArcGIS online platform.

## Year 2 Objectives

- Addition of at least 20 newly generated SHMs, refined SHMs, and externally sourced SHMs to spatial data library

## Progress in Year 2

- NatureServe has prepared all new and revised models for the spatial data library by generating the following outputs for each model: (a) continuous probability surfaces of suitable habitat, (b) binary habitat/non-habitat maps generated using statistical thresholds, and (c) metadata summarizing the methods used and validation statistics for each model.
- NatureServe also created a DoD access group for NatureServe Explorer Pro, which will allow DoD staff to gain access to models as they are added to the library (Figure 3). SHMs will be added to the spatial data library upon completion of expert model review.
- Project Year 2 models are available on NatureServe’s updated Model Outputs Review Tool and undergoing review by the NatureServe Network. DoD agreed that models should be reviewed internally and by DoD staff prior to uploading models to NatureServe Explorer Pro.

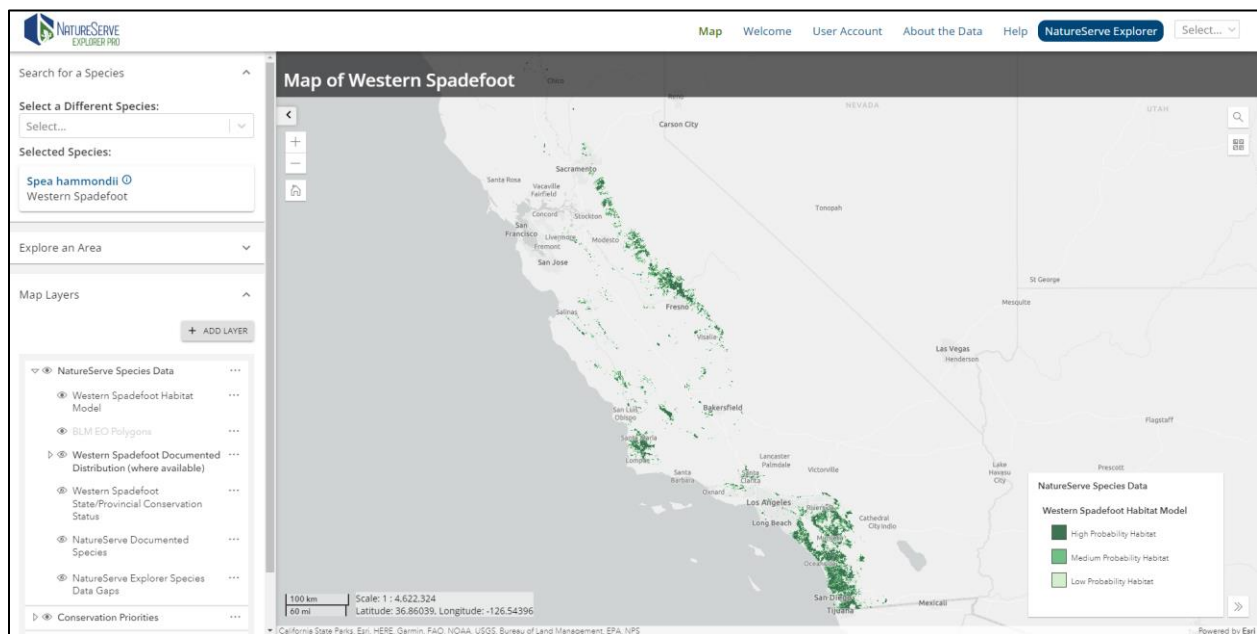


Figure 3. Species Habitat Model for Western Spadefoot (*Spea hammondi*) on NatureServe Explorer Pro. This SHM was developed in year 1 and then revised in year 2 following expert review of the draft model.

## Activity 7. Outreach and Communication

### Activity Description

Provide guidance on model interpretation and application for DoD resource stewardship needs. After consultation with DoD about specific needs for the personnel that will be working with the models, interpretive material will be developed to supplement the metadata and facilitate appropriate use of the model data. These materials may take the form of illustrated manuals, webinars, or other interpretive vehicles determined to be most effective for the target audience.

### Year 2 Objectives

- Draft interpretive materials.
- Support ongoing communication with DoD as necessary for the success of the project and uptake of outputs.

### Progress in Year 2

- NatureServe developed draft interpretative materials to provide guidance on how to access and work with model outputs and metadata. Interpretative materials include: 1) an instructional video on [how to use NatureServe Explorer Pro](#), 2) a written guide on how to sign up for NatureServe Explorer Pro and view and download SHMs, and 3) metadata documents for each model, which describe the modeling methods, model confidence, and suggested uses of the model for management.
- NatureServe held virtual meetings and regular communications as necessary to obtain data, solicit feedback on deliverables, and share products.
  - Coordinated check-in meetings between NatureServe and DoD staff (January 13, 2022; March 9, 2022; June 9, 2022; June 29, 2022; July 26, 2022)
  - Invited DoD PARC and PIF for feedback on project progress and plans.
  - Hosted DoD Natural Resource Program Webinar about the project (January 18, 2022).
  - Coordinated and led a webinar for DoD staff to review species habitat models delivered in Project Year 1 (November 15, 2021; 14 participants).
  - Presented project outcomes at DoD Partners in Flight Annual Meeting at Camp Pendleton on August 4, 2022.
- NatureServe held a two-hour technical session at the National Military Fish and Wildlife Association (NMFWA) conference on March 14, 2022, entitled *A Science-based repeatable assessment framework to identify priority species*. The session was well attended, with 42 attendees from the Army, Navy, Air Force, US Marine Corps, US Fish and Wildlife Service, Space Force, San Diego Zoo Wildlife Alliance, Conservation Without Conflict, National Bobwhite Conservation Initiative, multiple universities, and other agencies. NatureServe shared the project objectives and progress to date, including the assessment framework, NatureServe DoD TER-S Explorer application, and the collaborative modeling process. Participants were highly engaged and interested in understanding the decisions underlying the assessment framework and how the tools could meet needs at their installations and regions.



- Published an article in DoD’s newsletter, *Natural Selections*. Authored an article about NatureServe’s tools to support management of imperiled species on DoD lands for publication in the Summer 2022 edition.
- Submitted abstracts for two sessions at NMFWA 2023 titled “Assessing climate change vulnerability of imperiled species on DoD installations” and “NatureServe’s Collaborative Species Habitat Modeling Process: Improved Distribution Maps to Guide Stewardship of DoD Mission Priority Species.” Both abstracts were accepted and will be given as talks by NatureServe staff in March 2023.

### **Military Mission Benefits**

This project benefits the military mission in numerous ways:

- Improved species distribution information allows natural resource managers on installations to know more precisely where key habitats for at-risk species are located to increase flexibility in the use of remaining lands for military missions and readiness activities.
- With habitat suitability models, instead of much coarser range maps as a basis for decision making, endangered species regulations will apply to a more limited area and therefore free up more land for military training and other missions.
- Improved range-wide species distributional information helps base managers work more effectively in regional approaches to land management that involve neighboring landowners and other stakeholders to improve conservation outcomes and reduce the need to restrict activities on installations.
- Improved species distribution information can better direct onsite and offsite crediting and mitigation activities to improve the prospects of TER-S and reduce the need to restrict on-base activities.
- The increased precision of species habitat locations makes on-the-ground monitoring and surveying of sensitive species more efficient.
- Data in the library of habitat suitability models will be of value to up to 133 installations located in up to 31 states, with the exact list of installations dependent on the final selection of focal species.
- The library of suitability models will become an important resource for DoD programs supporting regional land management, including the Joint Land Use Study (JLUS), the Southeast Regional Partnership for Planning and Sustainability (SERPPAS), the Western Regional Partnership (WRP), and the Readiness and Environmental Protection Integration Program (REPI).
- The addition of biodiversity information into the DoD Climate Assessment Tool will allow managers to assess strategies to mitigate the effects of climate change for both built and natural infrastructure combined.

### **Timeliness of Deliverables**

Year 2 objectives and deliverables were met within the expected timeframe of one year. Our work in Year 2 laid the foundations for success in project Year 3 by: 1) gathering permissions and inputs for a subset of the species that will be modeled in Year 3, 2) creating a DoD access group and providing training materials for DoD staff to get access to species habitat models on NatureServe Explorer Pro, and

3) establishing regular communications with the DoD Climate Action Team, and creating refined figures for the installation reports on the DoD Climate Assessment Tool.

Although all of the Year 2 objectives were completed, some challenges arose with particular species habitat models. Specifically, the Whooping Crane is a wide-ranging species, and the model had only moderate statistical performance. Next steps for this species in year 3 may include obtaining additional occurrence data or investigating alternative methods to provide the best available distribution information for the species.

## NEXT STEPS

The accomplishments of Project Years 1 and 2 have set the stage for the upcoming work in Project Year 3 (Option Year 2). Developing and implementing the Species Assessment Framework (Activity 1) in Year 1 has systematically identified a large suite of candidate TER-S, providing a criteria-based starting point for TER-S identification and prioritization. The Assessment Framework also laid the groundwork for improving the species distribution information that underpins prioritization, management, and conservation actions on DoD-managed lands. In Year 2, NatureServe finalized the Assessment Framework results and engaged with relevant DoD programs, including DoD PARC and DoD PIF, to identify the priority suite of species for which refined range-wide distribution data are most needed. The collaborative species habitat modeling process was successfully implemented in Year 2 by generating SHMs (Activity 5) and engaging DoD staff in the review process through two workshops that took place in November 2021 (Activity 7). The resulting expert reviews led to revisions of five of the seven species habitat models developed in year 1 of the project. NatureServe refined the Model Outputs Review Tool in Year 2, which is enabling NatureServe Network staff and DoD staff to review 20 models developed in Year 2. This model refinement will lead to high-resolution distribution maps that will support DoD in successfully managing the species that are their most significant concern.

Finally, NatureServe made significant progress on a task that was introduced in Year 2 of the project that addresses climate-change impacts to at-risk species, while also integrating Legacy Program efforts with those of the DoD Climate Action Team (Activity 5). This new task focuses on two overarching objectives: (1) to develop the most suitable and up-to-date biodiversity data for input into the Department of Defense Climate Assessment Tool (DCAT), and (2) to develop the most appropriate methodology to incorporate biodiversity data into the DCAT workflow and assess climate change vulnerability and mitigation strategies for both built and natural infrastructure combined. NatureServe completed an assessment of the sensitivity of biodiversity to climate change on all DoD installations and worked with DoD Legacy and the DoD Climate Action Team to identify an initial venue for delivering this information within the DoD Climate Assessment Tool. Wrapping up these activities in project year 3 will provide DoD with a set of data and tools for better informed decisions about management of Threatened, Endangered, and At-Risk Species on DoD installations in a period of climate change.

## WORKS CITED

Sofaer, H. et al. 2019. Development and Delivery of Species Distribution Models to Inform Decision-Making. *BioScience*. 69(7): 544–557. <https://doi.org/10.1093/biosci/biz045>