Improved ESA Implementation through Species Distribution Modeling

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Karner Blue Butterfly
Lycaeides melissa samuelis, Listed Endangered

Decurrent False Aster
Boltonia decurrens Listed Threatened

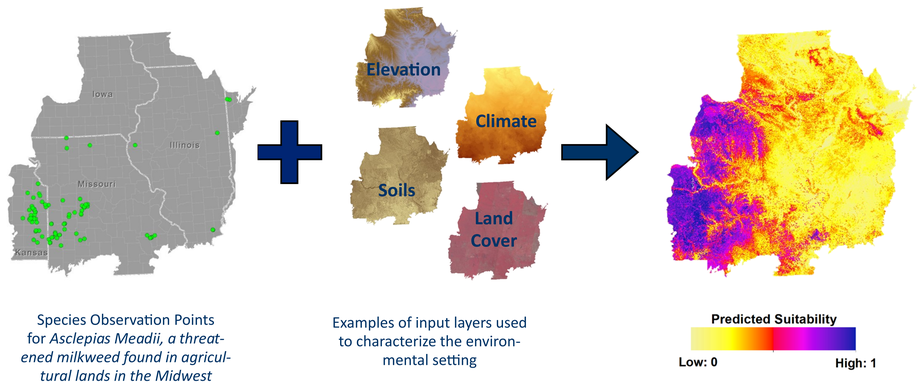
The Problem

A lack of precise information on where federally listed species occur inhibits effective species conservation and creates unnecessary regulatory burdens. The status quo of using broad range maps to identify impacts to listed species results in many "may affect" or "likely to adversely affect" determinations. Although FWS provides refined maps for some species, the data are inconsistent across taxa and not transparent for the regulated community or conservationists. Without consistent, predictable, up-to-date, and scale-appropriate information to guide ESA decisions, significant funding is spent analyzing effects that may never occur on the ground.

An example of the coarse range data currently being used for ESA screenings.

The Solution

Advances in ecological modeling make the current lack of precise distribution maps a tractable problem to solve. A nationally consistent, verifiable, multi-jurisdictional library of modeled distributions for listed, candidate, and petitioned species can now be achieved by applying scientifically robust species distribution modeling (SDM) techniques. SDM combines species observation data with environmental predictors to map areas of likely occurrence.



Species Observation Points for *Asclepias Meadii, a threatened milkweed found in agricultural lands in the Midwest*

Examples of input layers used to characterize the environmental setting

Products include maps of habitat suitability and probable habitat/non-habitat.

Maps of Habitat Suitability

From low to high across the landscape (above right)

In areas of low suitability, confidence that the species is not present is high, while areas of high suitability can guide priorities for survey, protective measures, and restoration.

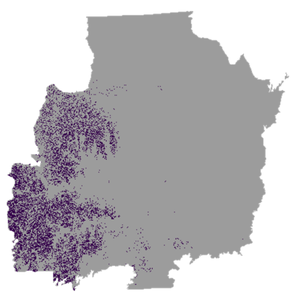
Habitat Maps

Binary map of habitat/non-habitat (below right)

Created from modeled probabilities based on scientific standards and user-defined risk tolerance, habitat maps can be tailored to regulatory needs.

Asclepias meadii habitat map

- Suitable Habitat
- *Not* Suitable Habitat



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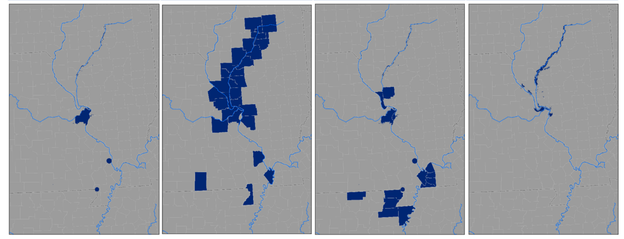
Pilot Outcomes

Today, input data are readily available, and modeling procedures are standardized. **It is now entirely feasible to generate refined maps of the distribution of suitable habitat for almost all T & E species** through a vetted, dynamic, and transparent scientific process, and **pilot projects** have demonstrated the potential of SDM to streamline environmental reviews, including aspects of the pesticide consultation process.

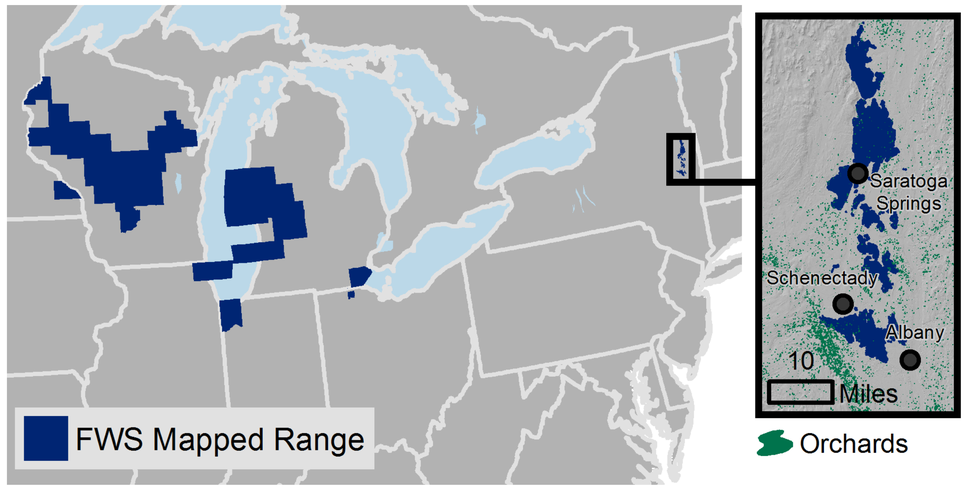
A project assessing the potential of SDM to improve the pesticide consultation process found that for *Boltonia decurrens*, a threatened plant found in agricultural landscapes along the Illinois River floodplain, using an SDM resulted in 10,000,000 fewer acres of identified habitat than the species range used by FWS. **This represents a 95% reduction in the area used to determine potential pesticide impacts.** The same model demonstrated to ease regulatory burdens is being used to advance conservation efforts. The Partners for Fish and Wildlife in Illinois plan to use the model to prioritize outreach and financial assistance to landowners in an initiative to increase high-quality, native waterfowl food and habitat for the species. Without the new map, directing those resources to areas of high impact would be a significant challenge.

Where models exist, FWS field offices have accepted them as the best available science, but elsewhere, data remain coarse. A comparison of FWS range data for the Karner blue butterfly (*Lycaeides melissa*), which has been modeled in New York but not in other states, makes clear the discrepancy in data precision with and without models. When potential pesticide application areas are overlaid on the model, the consequences for regulatory compliance become clear: areas of conflict between likely species presence and use areas are relatively few.

EOs	FWS Range	FESTF Range	Model
461, 463 ac	10,982,468 ac	4,098,825 ac	568,575 ac



Comparison of the total area, in acres, of habitat mapped for *Boltonia decurrens,* (1) by using NatureServe current and historic element occurrence (EO) records, (2) as maintained by FWS, (3) as maintained by the Federal Endangered Species Task Force, and (4) with a species distribution model using a protective threshold.



The FWS mapped range for the Karner blue butterfly. In New York, where the New York Natural Heritage Program modeled habitat for the species, the mapped range is precise (inset) while elsewhere, broad county boundaries define habitat. In the inset, orchards, a proxy for pesticide use areas, are shown in green.

Next Steps

NatureServe has identified 325 listed or petitioned species in the lower 48 states that are ideally suited for SDM given current data availability, and over 500 more that are good candidates for modeling provided some additional investment in data development (right). In addition to streamlining ESA consultations, completing models for these species can:

- Inform listing decisions
- Guide avoidance and mitigation strategies
- Support species recovery efforts
- Focus conservation initiatives
- Direct inventories and locate new populations