INHABIT for Broad-Scale Assessment of Invasive Terrestrial Vegetation Species

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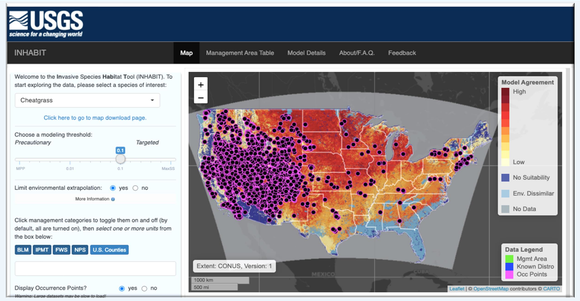
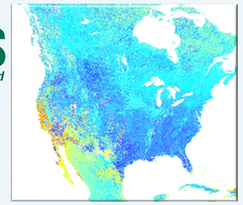
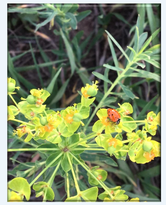
Introduction

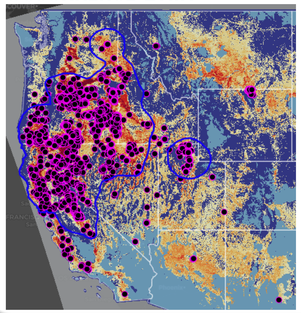
- Invasive species of terrestrial vegetation pose economic and ecological risks, and management practices often focus on prevention of spread and early intervention (eradication of established populations can be difficult and expensive)
- The **I**nvasive **S**pecies **H**abitat **T**ool, **INHABIT**, is a publicly available webtool developed by the U.S. Geological Survey at the Fort Collins Science Center in Colorado.
- It was developed as a decision support tool for the National Park Service to provide information about habitat suitability for **140 invasive species** of interest (list is still growing, *version 2 to be released late 2022*)
- Habitat suitability maps cover the contiguous U.S. at a **90-meter spatial resolution** using four different thresholds, from more **conservative estimates** of suitability **to more prolific potential ranges**







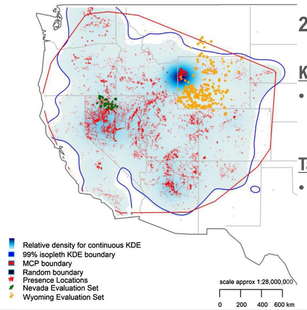
Occurrence Data



- **30 years of occurrence data** from multiple sources (BISON/gbif, EDDmaps, calflora, etc.)
- Address spatial autocorrelation (SAC) by incorporating **additional spatial thinning of 900m** between occurrences (in addition to SAHM)
  - Why care about SAC?
    - Sampling biases impact model predictions
    - Leads to inflated accuracy

Generally want more occurrences, but marginal improvements after 10,000 (tradeoff with more complex models, longer run time, more computationally intensive)

Background Data

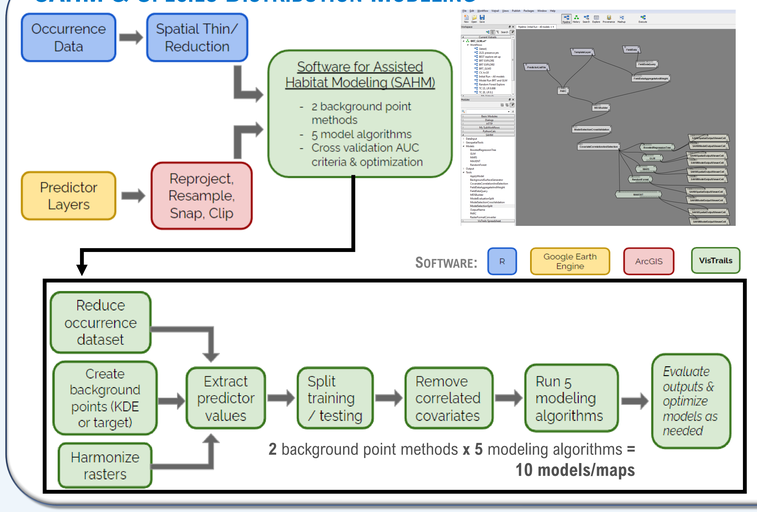


2 METHODS:

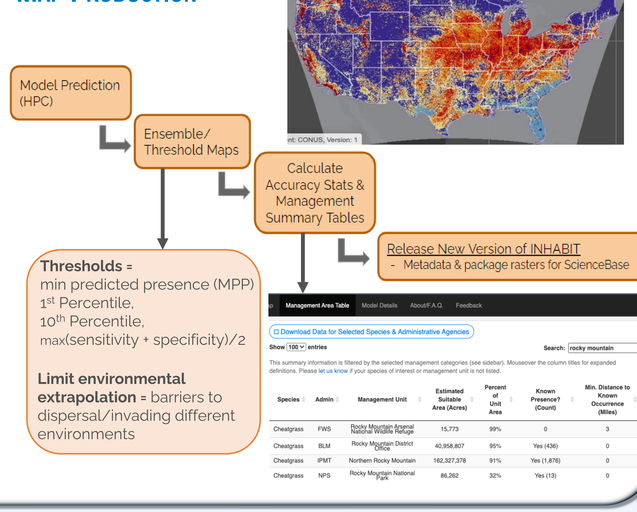
Kernel Density Estimator (KDE):
- Generate "absence" data by using areas near the occurrence data

Target Background (target):
- Use occurrence data from species that are the same lifeform (e.g. forb, graminoid, shrub, tree) as the species of interest as a set of "absence" locations

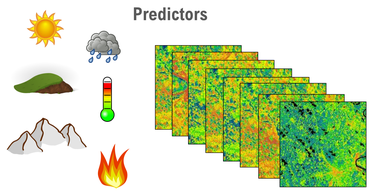
SAHM & Species Distribution Modeling



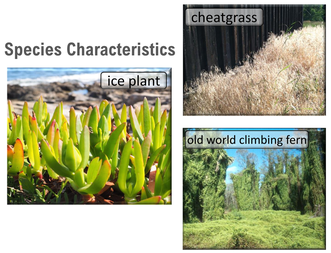
Map Production



Predictors and Invasive Species Ecology



Summarized characteristics & spectral information related to environmental conditions (60+ layers describing temperature, precipitation, evapotranspiration, distance to water bodies, soil characteristics, topography, human landscape modification/disturbances, water content, fire, land cover, etc.)

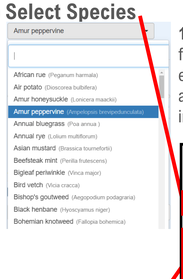


Generalist vs Specialist? What drives rate of invasion? Date of first known occurrence? **What influences abundance?**

Balance Human Input & Automation – Removing one predictor out of each highly correlated pair, selecting the variable to retain based on ecology and traits of species

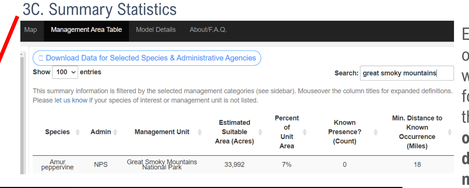
INHABIT webtool

1) Select Species

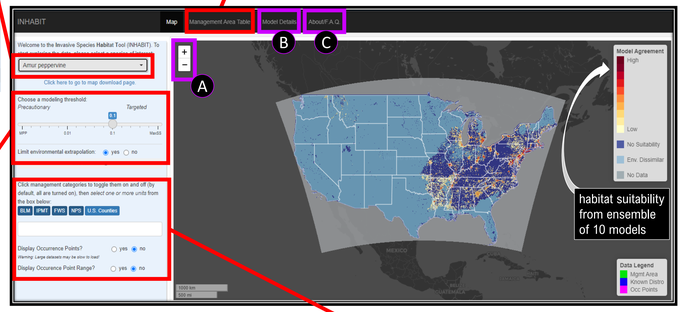


140 species to choose from, including well established invaders as well as new/early invaders

3C. Summary Statistics



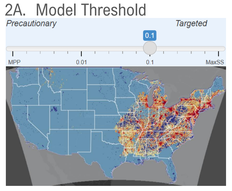
Explore percentage of management area with **suitable habitat** for selected species, the **number of known occurrences**, and the **distance to the nearest occurrence**



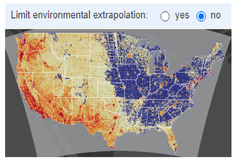
A) **Zoom in/out** of map display, or use mouse wheel
B) **Model Details -** Explore predictor variables included, data sources, accuracy assessment, and model confidence
C) **About/F.A.Q –** check for updates and changes

2) Select Parameters

2A. Model Threshold

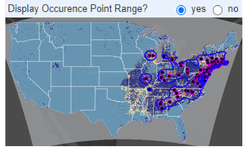


2B. Limit Extrapolation

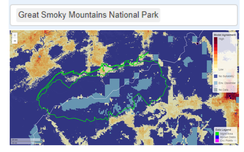


3) Explore Data

3A. Occurrence Data



3B. Management Areas



Applications

Early Detection and Rapid Response - Joshua Tree National Park
- NPS used suitability maps to inform fountain grass elimination efforts
- Identified new satellite population of fountain grass in park
- Existing fountain grass occurrences matched with expected

Future Avenues - Building Upon Methods
- Species distribution models / habitat suitability modeling to support landscape-scale ecological risk assessment

Data Use

- All habitat suitability maps and resulting data can be accessed through the INHABIT webtool, or the comprehensive raster datasets can be downloaded through ScienceBase
- Version 2 and additional species coming later this year

Jarnevich, C.S., LaRoe, J., Engelstad, P., and Sullivan, J., 2021, INHABIT species potential distribution across the contiguous United States: U.S. Geological Survey data release, https://doi.org/10.5066/P92476V6

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To access INHABIT, visit https://gis.usgs.gov/inhabit/

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