Predicting the potential spatial distribution of invasive alien plants with niche modeling

Concepts and Applications

by

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Overview

- What is species distribution modeling?
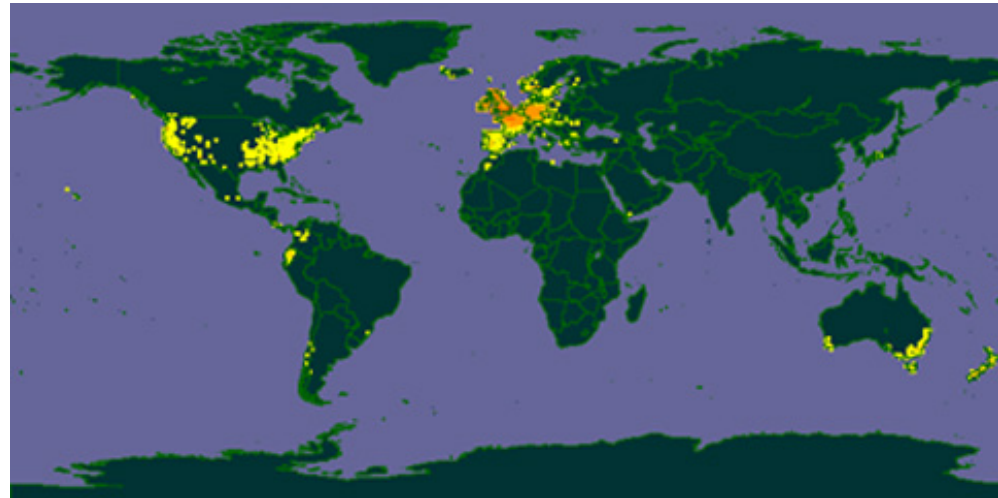
- Challenges

- Applications

Study system

Step 1: Species distribution data
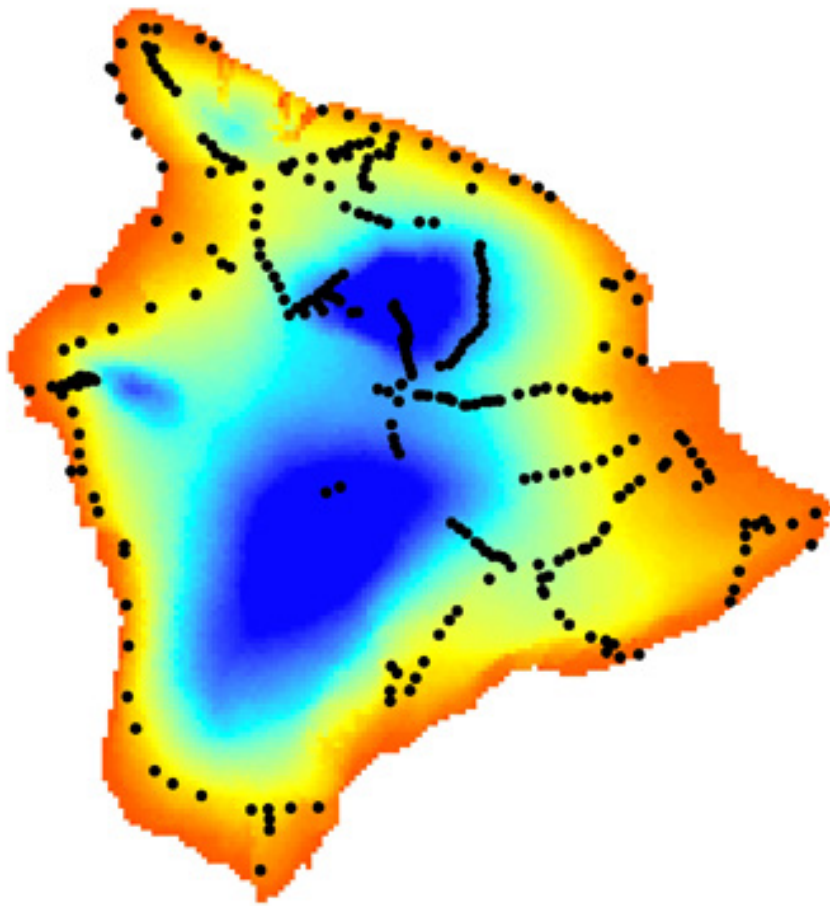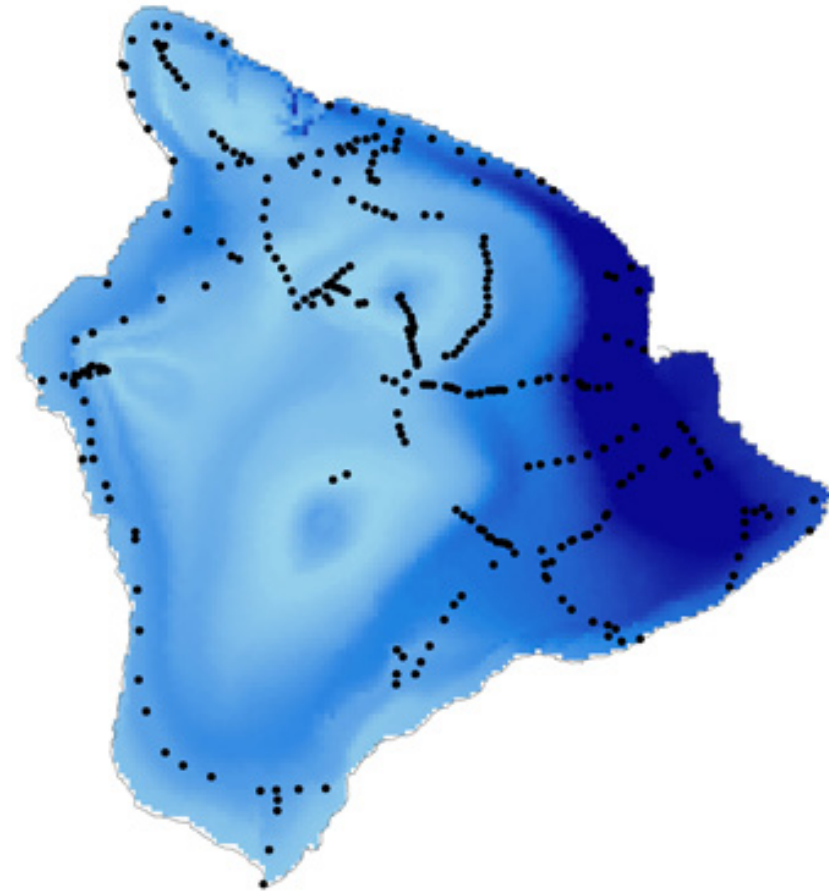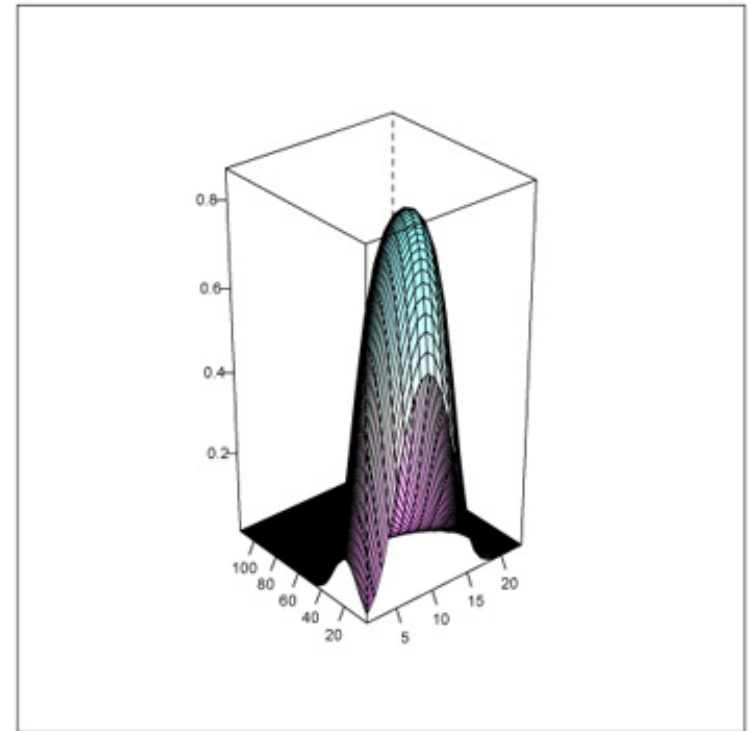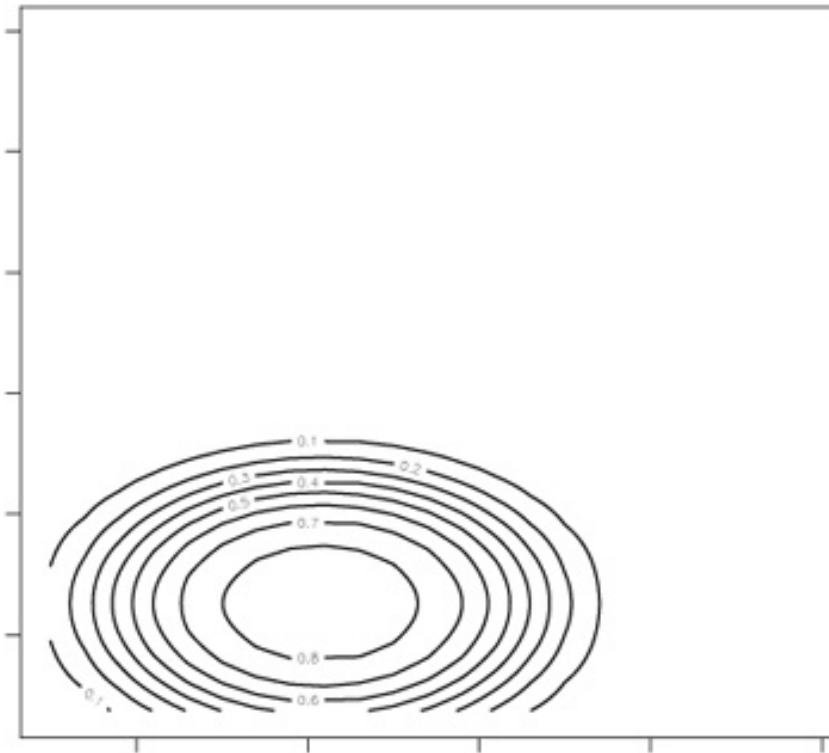

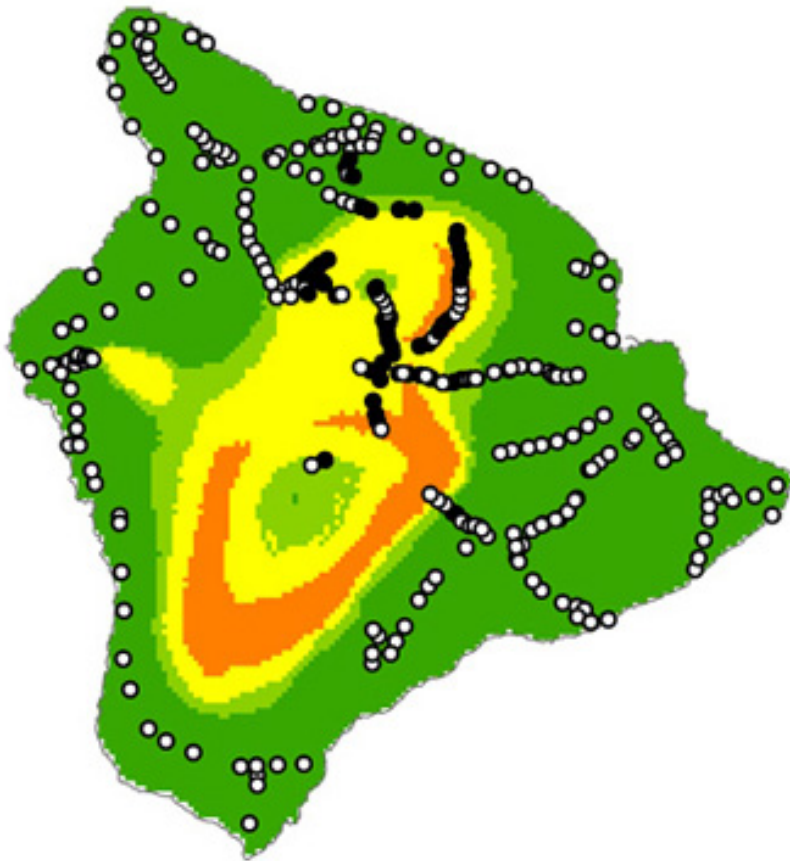presence-only

presence-absence

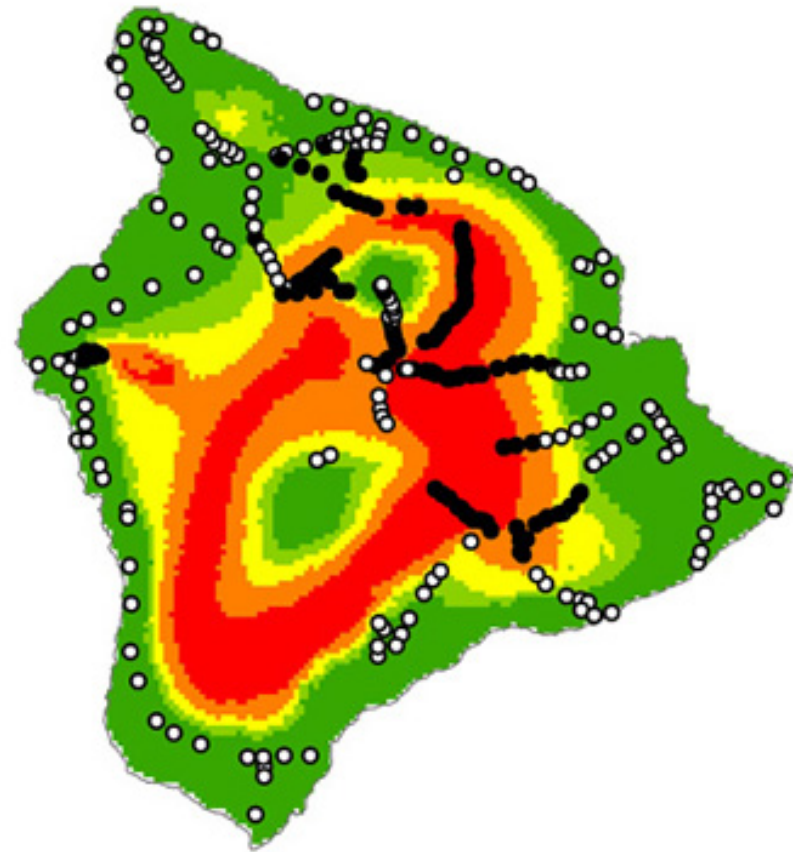www.gbif.org

Step 2: Predictors

Temperature
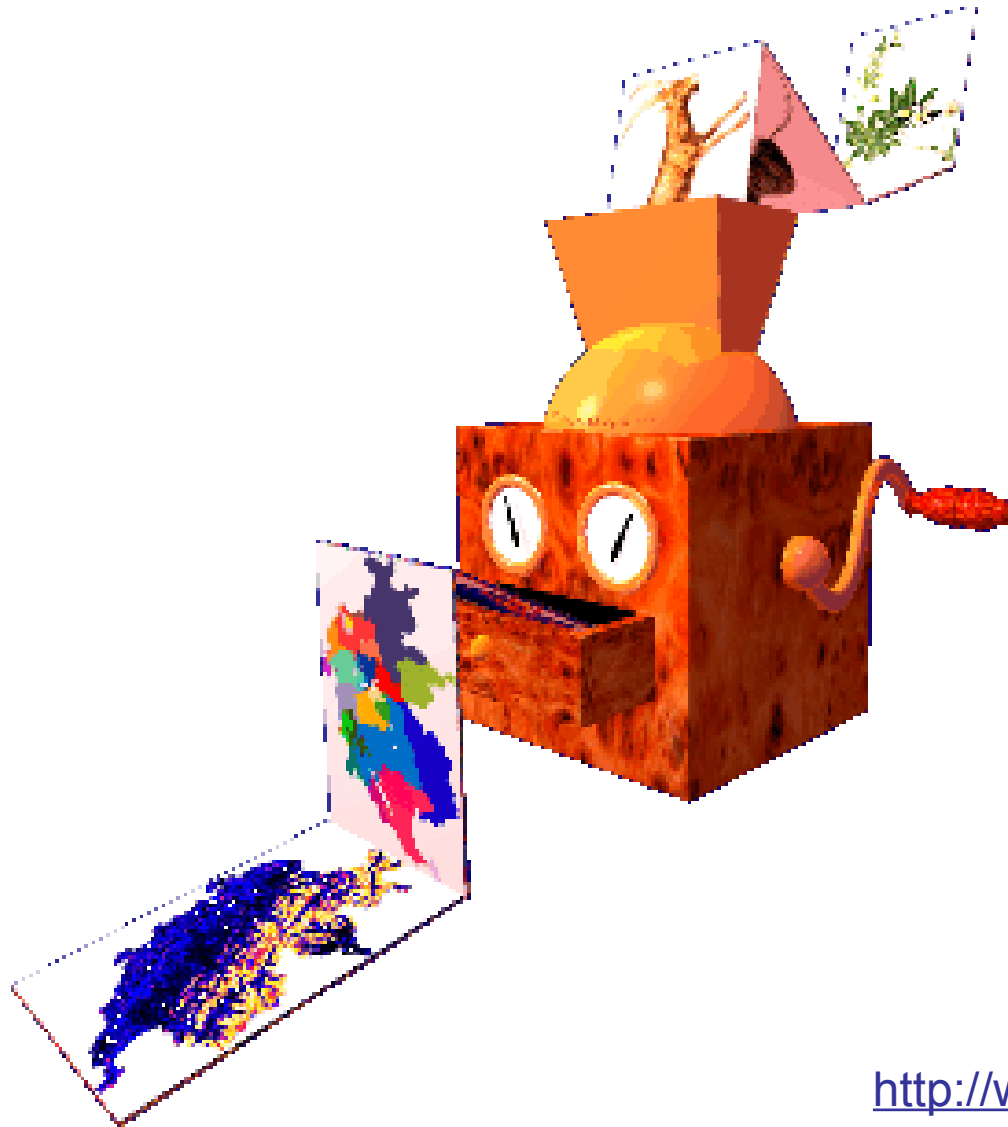
Rainfall

Step 3: Modeling

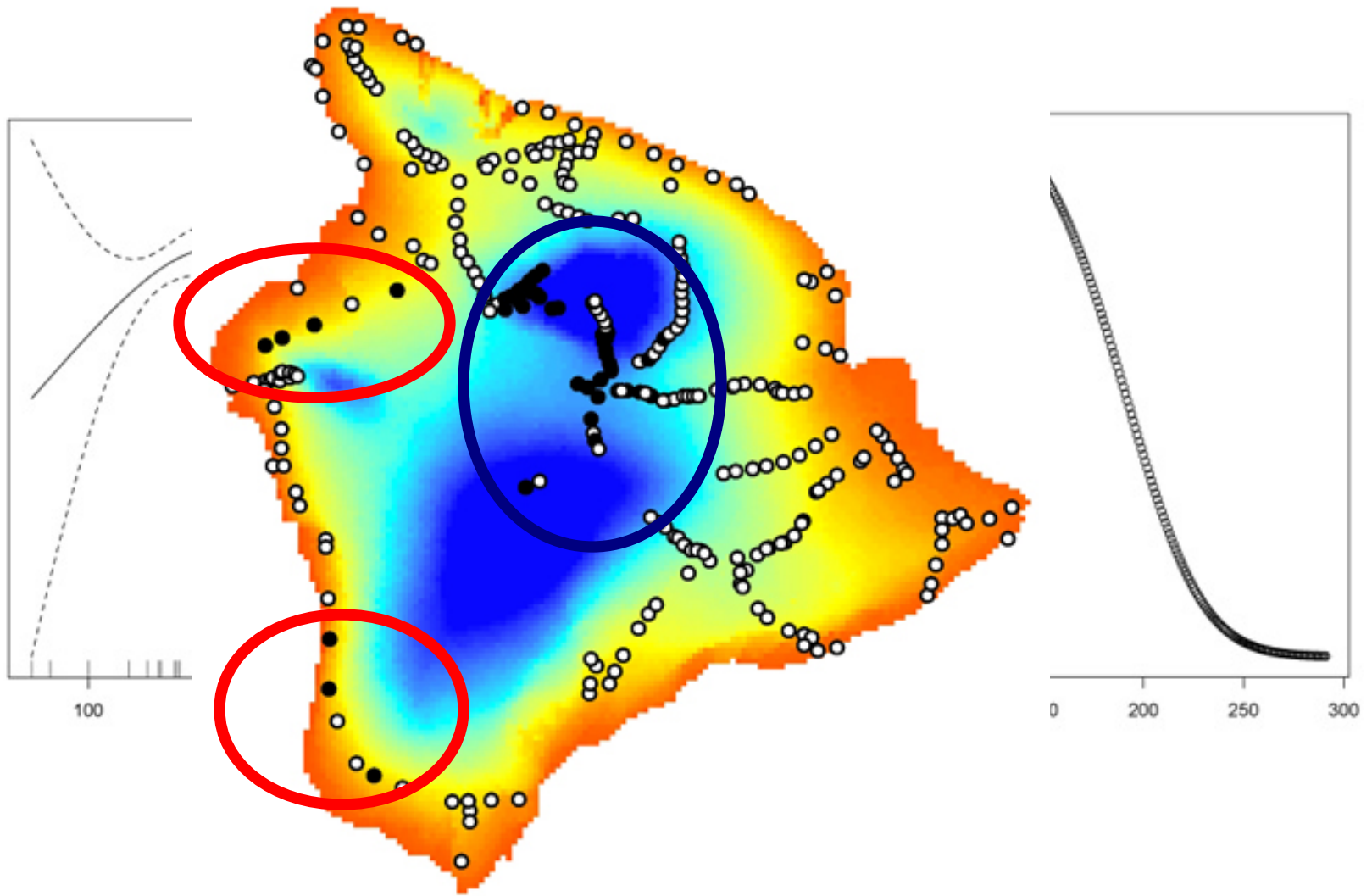*Rumex acetosella*

Rumex acetosella

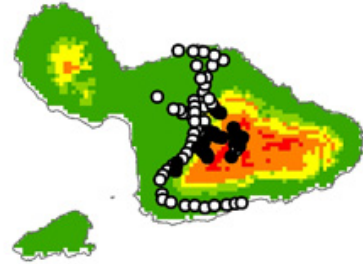*Holcus lanatus*

Black Box

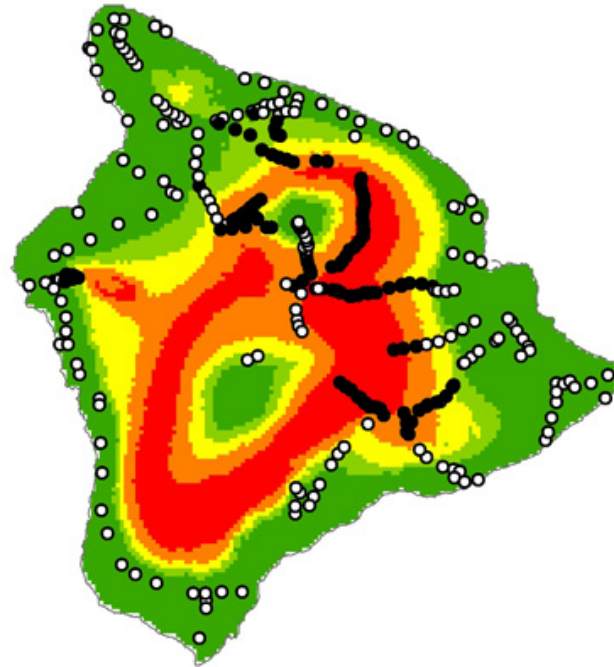# Look into the Black Box

Challenge 1: Transferability

- IN SPACE:

  from native range to areas of introduction

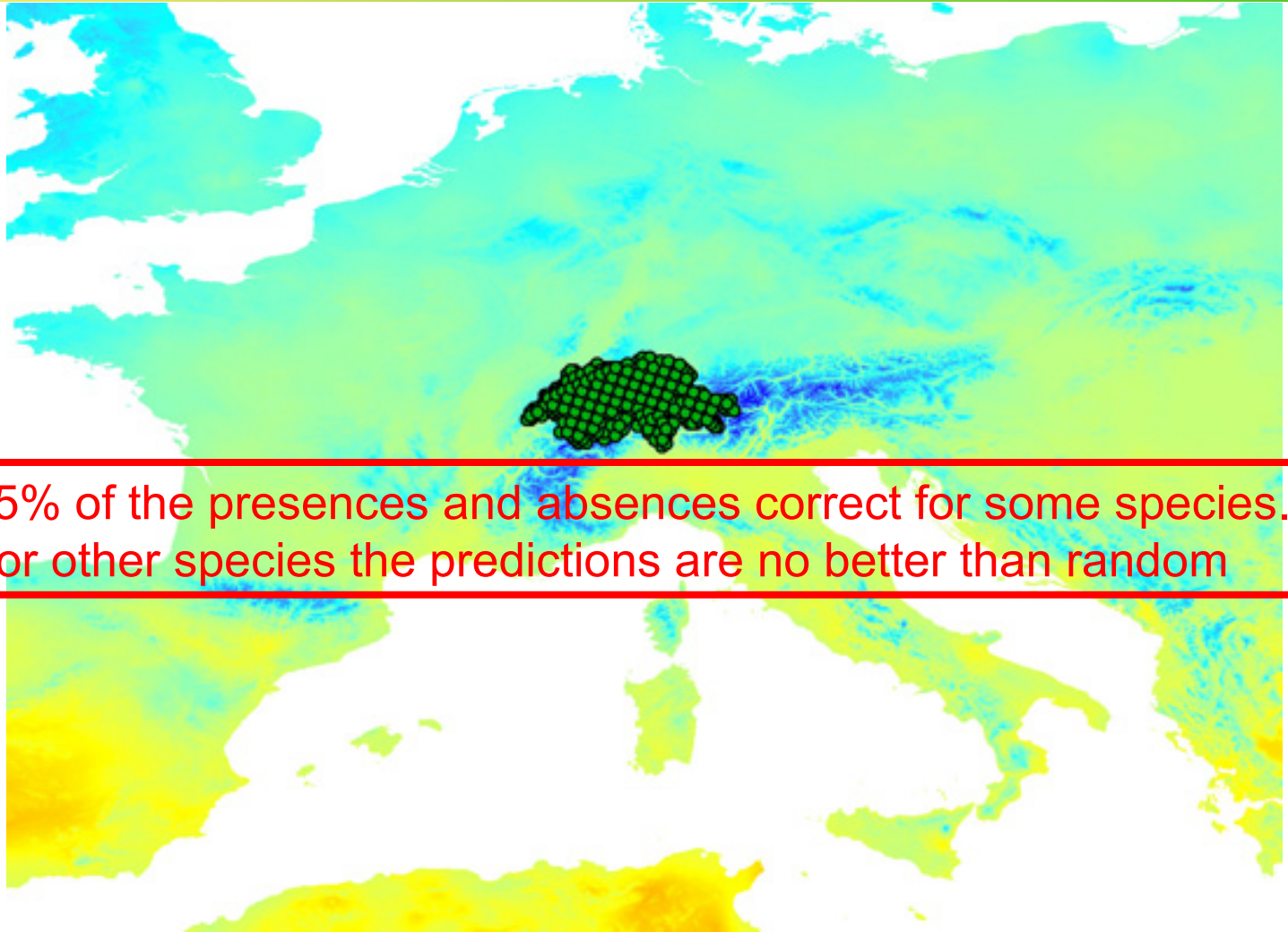- IN TIME:

  climate change

Between islands

Typically 80%-90% of presences and absences correctly predicted
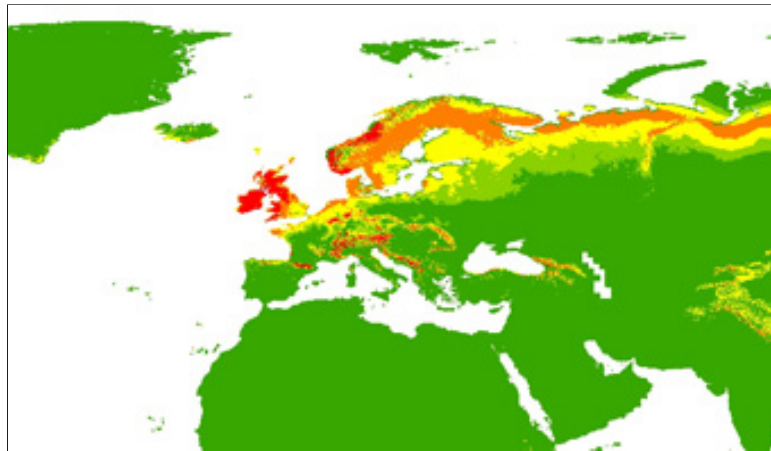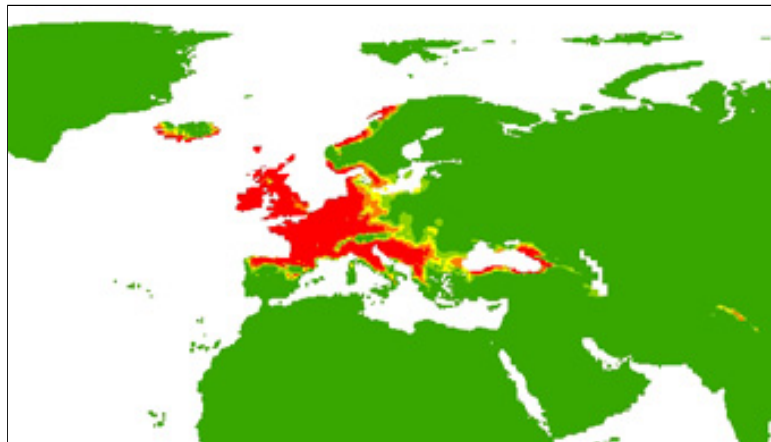
Native to introduced range

75% of the presences and absences correct for some species. For other species the predictions are no better than random
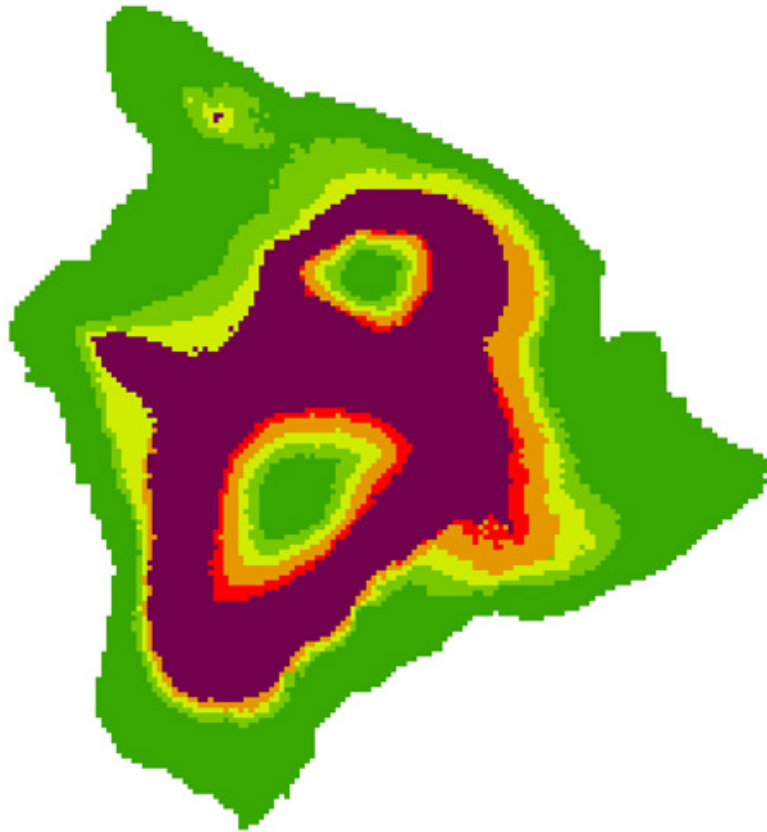
Native range

Hawaii model

Swiss model

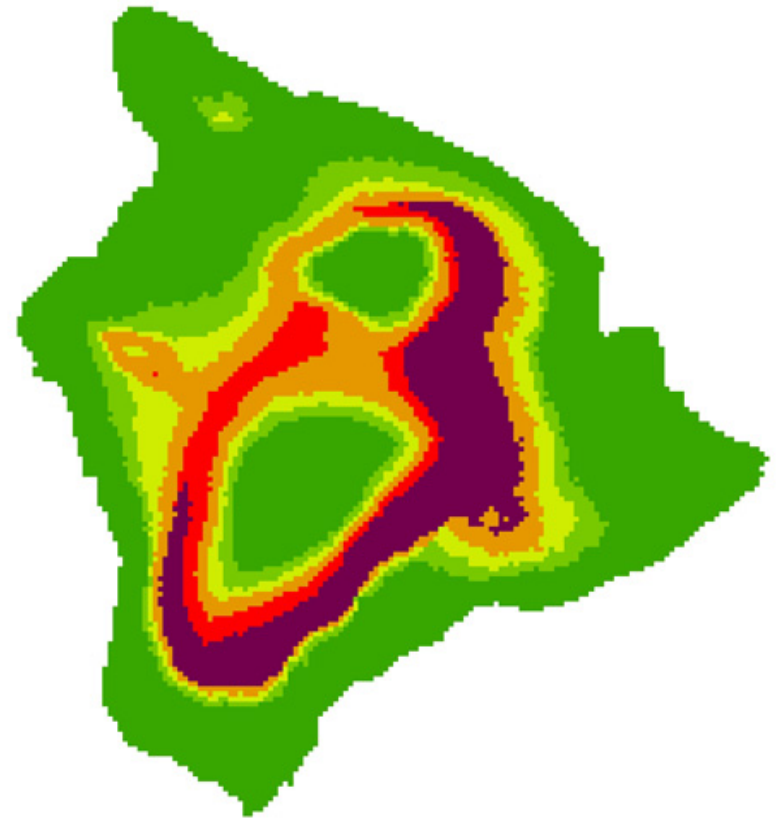# Main issues with transferability

1. Biased and incomplete data

2. Ecology implicit in model

3. Equilibrium assumption

4. Shift of (realized) niches

   – Biotic interactions

   – Rapid evolution
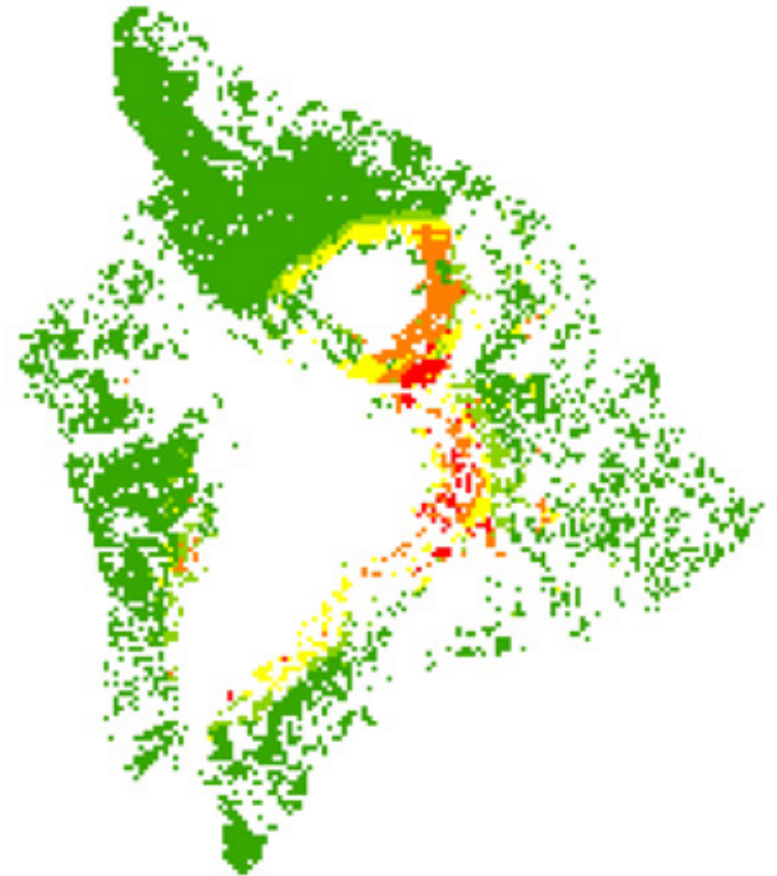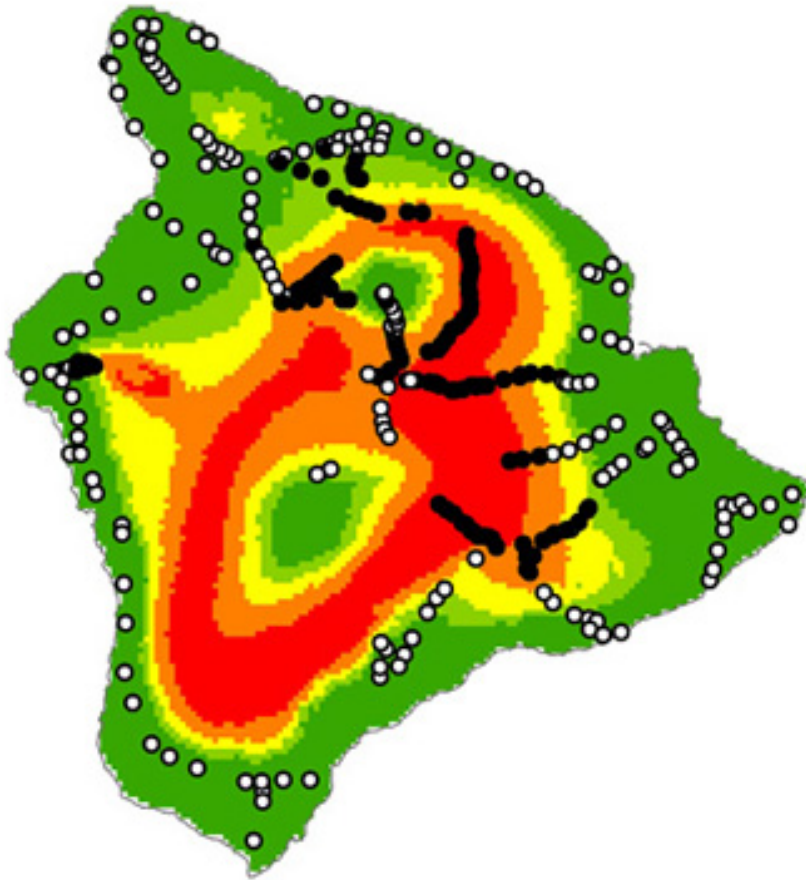
Challenge 2: predict impacts

Holcus lanatus

Anthoxanthum odoratum

Habitat effect

Holcus lanatus

Prevention

- Climate matching

- Soil matching?

- Awareness building and social marketing
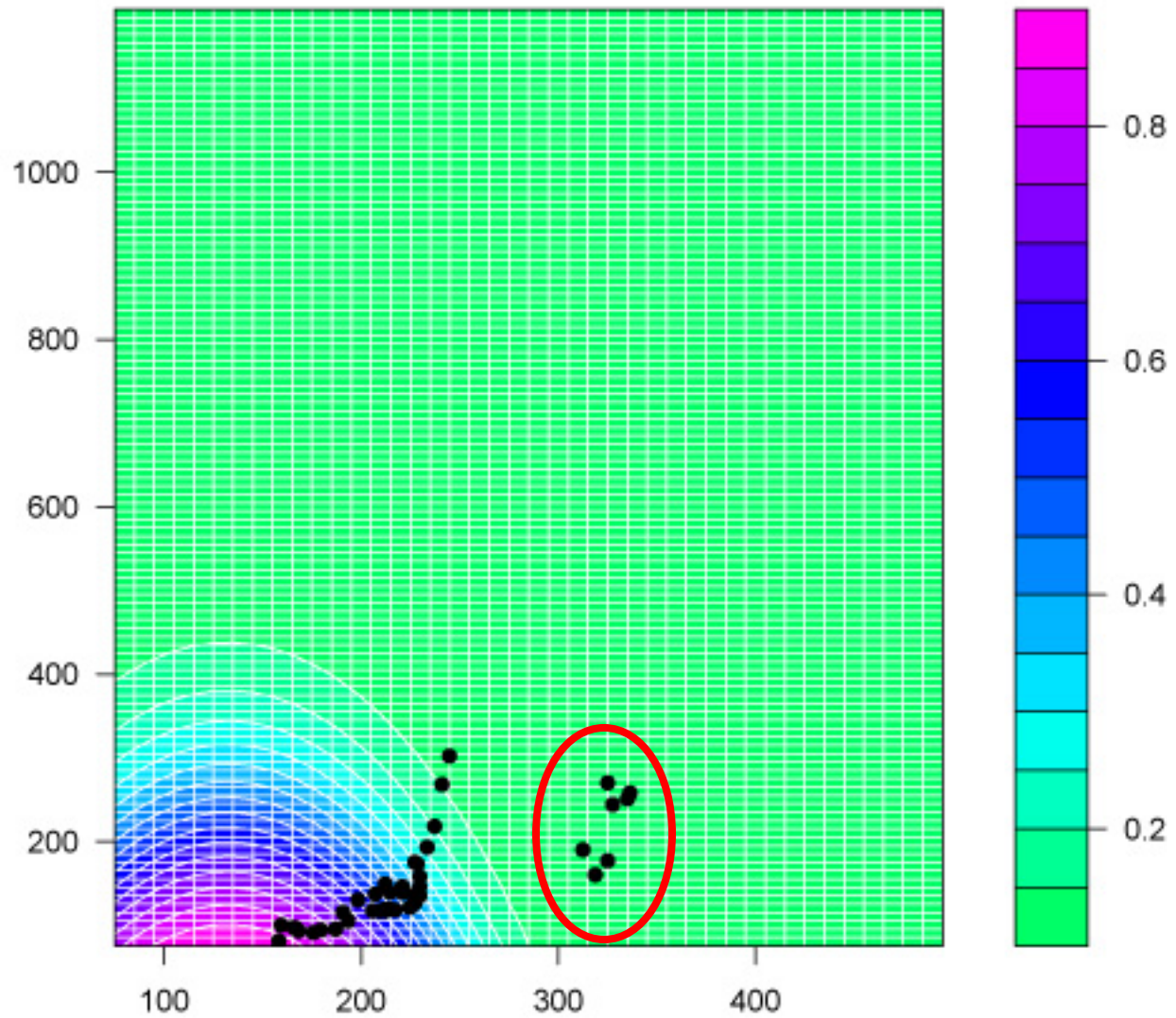
Early Detection & Eradication

- Predict high probability of occurrence

- Estimate search effectiveness and costs

  However, this needs transferable and reliable models

- Tracking occurrences in environmental space

Verbascum thapsus

Containment

- Plan target areas and boundary zones

- Estimate management costs

- Document management efforts in environmental space

Acknowledgements

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- Swiss Biodiversity Monitoring

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Species x Habitat

Species

Genotypes
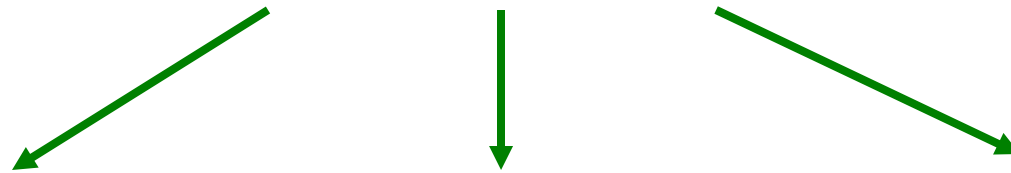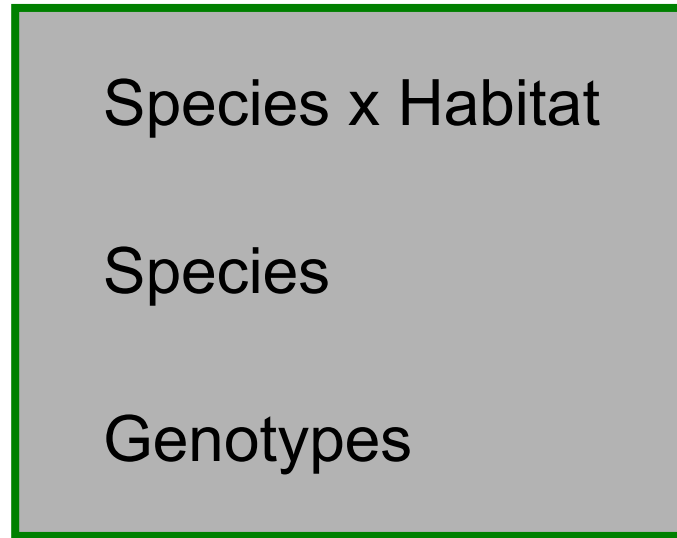
Prevention –> Early Detection –> Containment