Predicting the Spread of Invasive Plants in the Sierra Nevada with Climate Change

Elizabeth Brusati, Cal-IPC
Doug Johnson, Dana Morawitz, Falk Schuetzenmeister, Cynthia Powell, Suzanne Harmon, Tony Morosco
Introduction

- **Goal:** Provide land managers with tools to improve effectiveness of invasive plant management
- Are there restoration opportunities if climate change decreases the competitiveness of some invasive plants? (Bradley et al. 2009)
- Potential for other projects similar to Yellow Starthistle Leading Edge?
- Sierra Nevada region is pilot for rest of state
Climate Change and the Sierra

- Snow may shift to rain with more interannual variability (Coats 2010)

- Grassland likely to expand at the expense of woodland and shrubland (Lenihan et al. 2008)

- Changes likely constant north-south but will vary east-west, by elevation, and with topography (PRBO 2011)

- Invasive plants moving up in elevation in other ranges (Kelly and Gouldon 2008, Pauchard et al. 2009)
Previous Project (2006-08)

• Mapped 35 species by county and Jepson Floristic Region
• Modeled suitable range based on estimates of current range and environmental tolerances
• A good first estimate, but imprecise
Methods: Current Distribution

- Expert knowledge by USGS 7.5” quadrangles
  - Supplemented by compiled GIS datasets
  - 204 species for statewide project
  - ~100 spp. on Inventory are in the Sierra
- Recorded abundance in categories and whether eradicated, spreading, or under management
- Combined a few species due to taxonomy changes or identification problems

Cardaria draba & C. chalepensis
**Methods: Suitable Range**

- 31 spp. modeled so far
- Ecological niche modeling (Maxent) predicts suitable range based on current locations and environmental data
- Results reviewed by invasive plant experts
- Data:
  - 25 datasets from California
  - 19 climate variables from Bioclim (temp. and precip).
  - Climate change: Downscaled CCCMA A2 scenario for 2050
- Caveats:
  - Depends upon good representative coverage in data points
  - Only one climate change scenario so far
yellow toadflax (Linaria vulgaris)
Suitable Range: yellow toadflax

Photo: Joe DiTomaso
Central Sierra Partnership WMA
Calaveras and Tuolumne Counties

Abundance
- low
- medium
- high
- GIS data only

Trend
- spreading
- managed
- eradicated

Suitability
- low
- medium
- high

Abundance and trend by USGS 7.5-minute quadrangle. Full details on map symbology in Appendix 2.

yellow toadflax (Linaria vulgaris)

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yellow toadflax (*Linaria vulgaris*)

Photo: Joe DiTomaso

eradicated

Under mgmt.
Rush skeletonweed (*Chondrilla juncea*)

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Suitability
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Photo: Joe DiTomaso
Suitable Range: Rush skeletonweed

Photo: Joe DiTomaso
El Dorado WMA

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spreading
Spanish broom’s suitable range may increase...

2010

2050

+40%
... while dyer’s woad’s suitable range may contract slightly.

Photo: Bob Case
Change in amount of suitable range

13 spp. increase (>10%)

13 spp. no change (-10 – 10%)

5 spp. decrease
Range Shifts

“The retreat of once intractable invasive species could create restoration opportunities across millions of hectares (acres).” (Bradley et al. 2009)

What will happen as new (“no-analog”) communities form? (Strahlberg et al. 2009)
Management Opportunities

Intended to be used with existing local priorities and projects. Based mostly on current distribution and prioritized by Cal-IPC statewide rating.

**Surveillance:** Survey to detect new infestations of species not yet present (may be nearby)

**Eradication:** Complete removal of infestations (isolated quads)

**Containment:** Limit spread from existing populations (larger areas)
What We Learned

• Land managers have a large amount of knowledge that isn’t reflected in formal datasets.
  – However, they don’t always identify plants to species

• Compiling GIS data is limiting factor for modeling.
  – Few large (agency) datasets
  – No standardization in collection
  – Incomplete data even for common species

• Expert opinion and GIS may not agree.
  – Currently working to vet data and fill in gaps
What’s Next

• Model more species
  – Increase data from California
  – Incorporate data from outside California
  – Incorporate multiple climate scenarios

• Visit WMAs and agencies to discuss results
  – National Park Service, USFWS refuges, and State Parks interested in applying results on the ground

• Incorporate more information on habitat types and other conservation targets
Download the report:

www.cal-ipc.org/ip/mapping/sierra
Introducing CalWeedMapper!

- A partnership between Cal-IPC and Calflora, this new site contains data from Cal-IPC’s statewide mapping effort and is hosted through Calflora.
- Cal-IPC’s mapping effort compiled expert knowledge data and occurrence (GIS) data into one system.
- Currently in beta (testing) version. Send your comments!
Major increase in spatial data

- 204 species mapped in nearly 2700 quads
- GIS datasets nearly doubled the number of data points for invasive plants in Calflora
  - More than 50 datasets contributed (and more coming in!)

Before: 108,000
Now: 198,000
http://calweedmapper.calflora.org

CalWeedMapper enables natural resource managers, scientists and others to:

- Create maps and reports of invasive plant distribution
- Identify management opportunities in a county, WMA or region
- Update species distribution data

Submit Spatial Data
Contribution your GIS or observation data to Calflora for plant occurrences. Learn more about submitting spatial data and how our systems work together.

News and Events
- 20th Annual Cal-IPC Symposium
- We’re in Beta! Send us feedback.
- Strategic Planning Meetings
BASIC MODE: View maps and reports
Regional Species Map Report

How To Use This Report

This report provides distribution and suitability maps that can be used in conjunction with the Regional
Planning Focal Points for ecological zone planning. The maps show the spatial factors
that determine suitability, eradication, and conservation opportunities.

Suitability maps can be used to identify the potential for an invasive species to spread into a new
area. The risk of the species spreading or becoming established in a new area or ecosystem may
be used to evaluate the priority of a particular species in a particular area.

For current distribution, we interviewed local experts to determine abundance. Species are mapped by
the California Native Plant Society and other ecological groups.

Suitable Range

For invasive species, we use a 2.5 mile extent from the species distribution data from California.

The Preferred vegetation types for each species are shown on the maps. The range is
based on community types from the National Vegetation Information System.

2010

2050

Based on community types"
Regional Report

INVASIVE SPECIES MANAGEMENT OPPORTUNITIES IN
Placer County

Top Opportunities:

Surveillance:
- Monitoring
- Early detection
- Information

Eradication:
- Chemical application
- Mechanical control
- Biological control

Containment:
- Physical barriers
- Chemical treatments
- Monitoring

Below is a sample of top-ranked opportunities in Placer County. This information should be combined with local knowledge to set local priorities (see “Using the Report” at the end of the document). Click on a plant’s name below to view a map of that species.

Eradication Opportunities

Containment opportunities

The regional report summarizes invasive plant management opportunities in Placer County. Opportunities are determined from maps of each species’ current distribution and suitable range. Species are listed by three types of management opportunity:

- Surveillance: monitoring for new infestations
- Eradication: complete removal of infestations
- Containment: controlling further spread of infestations

The regional report provides information on the risk level of each species, including the potential for spread and the effectiveness of control measures. This information can be used to prioritize management actions and allocate resources effectively.
ADVANCED: View occurrence info
Thank you
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Cal-IPC is an equal-opportunity provider.