



CalWeedMapper

Mapping the Spread of Invasive Plant Species

Karsten Vennemann



TERRA GIS
TERRESTRIAL ENVIRONMENT REGIONAL ANALYSIS

Seattle

■ The CalWeedMapper Project

this presentation is about these 2 parts:

- expert online editing tool and
- the follow-up public tool

■ Approach

- Organizational
- Technical Tools ⇒ design

■ Technical make-up: online tools

CalWeedMapper

Project by CAL-IPC

„map the spread to stop the spread“

Multiple (non-profit) Partners

CALIPC, CALFLORA, BAEDN,
Sonoma Ecology Center

Funding

American Reinvestment and Recovery Act (ARRA)
and others...

USDA Forest Service, State and Private Forestry Program,
California Department of Food & Agriculture, National Fish and
Wildlife, Resources Legacy Fund, Richard and Rhoda Goldman
Fund




California Invasive Plant Council

Cal-IPC

Protecting California's wildlands through science, education, and policy

CALIPC - a non profit with the goal to protect California's wildlands



Calflora

information on **wild California plants** for conservation, education, and appreciation

1700 Shattuck Ave. #198, Berkeley, CA 94709 • 510 528-5426 • [Send Us Email](#)




Bay Area Early Detection Network

BAEDN


Alameda • Contra Costa • Marin • Napa • San Francisco
San Mateo • Santa Clara • Solano • Sonoma

Bay Area Early Detection Network

Revolutionizing invasive plant management in the San Francisco Bay Area



SONOMA
ECOLOGY
CENTER



SONOMA
ECOLOGY
CENTER

■ Internal Tool Approach

- Organizational
- Technical tools ⇒ design
- Goal: data collection

Data collection efforts

- schedule field staff for interviews
edit sessions with plant species experts
- reference USGS mapping quad
boundaries
- 200 plant species (4 priority levels)
- many to many relationships
over time many records per
species / quad combination
- supported by online tools

California Weed Management Areas (WMA)

California Department of Food and Agriculture

Interview partners

mostly biologists & land managers

NPS, USFS, BLM, Military

US Fish and Wild Life Service

Caltrans

Agriculture Departments

CA Fish & Game

Cattlemen associations & some tribes

University of California University Extension

some private contractors working for these orgs



Workflow data entry

- Define work area
(pre-selection)
- Enter session information
- Enter species information :
observation values
- Records are saved in
PostGIS database
- Session submitted
- **Map Layer is updated
according to priorities**
-> multiple options

5 low increasing (despite treatment)

0 absent

1 low, stable

2 low, increasing

3 medium, rapidly increasing

4 high, stable

5 low increasing (despite treatment)

6 low stable or decreasing (because of treatment)

7 medium increasing (despite treatment)

8 medium, stable or decreasing (bc of treatment)

9 high, increasing (despite treatment)

10 high stable or decreasing (bc of treatment)

11 absent, monitoring (eradicated)

13 absent, super null

20 might be present

30 present no specific










33 planted, horticultural not escaped

97 know the species but do not know whether present

98 I do not know the species

99 I do not know

Legend

Abundance		Spread	
	absent		stable
	low abundance		increasing
	medium abundance		rapidly increasing
	high abundance		low stable or decreasing
	do not know		
Treatment			
yes: hatched (in respective color)			
no: no symbol			

CALIPSO QUAD MAPPING

Log In

Username:

Password:

Invasive Species

Species Group:

Invasive Species:

Species names: ☒ Scientific Name ☐ Common Name

Legend

Boundaries

- Mapping Quad
- Watershed
- Preselection
- County Boundary
- Quadselection

Invasive Species

Abundance

- absent
- low abundance
- medium abundance
- high abundance
- do not know

Spread

- stable
- increasing
- rapidly increase
- low stable or decreasing

Treatment

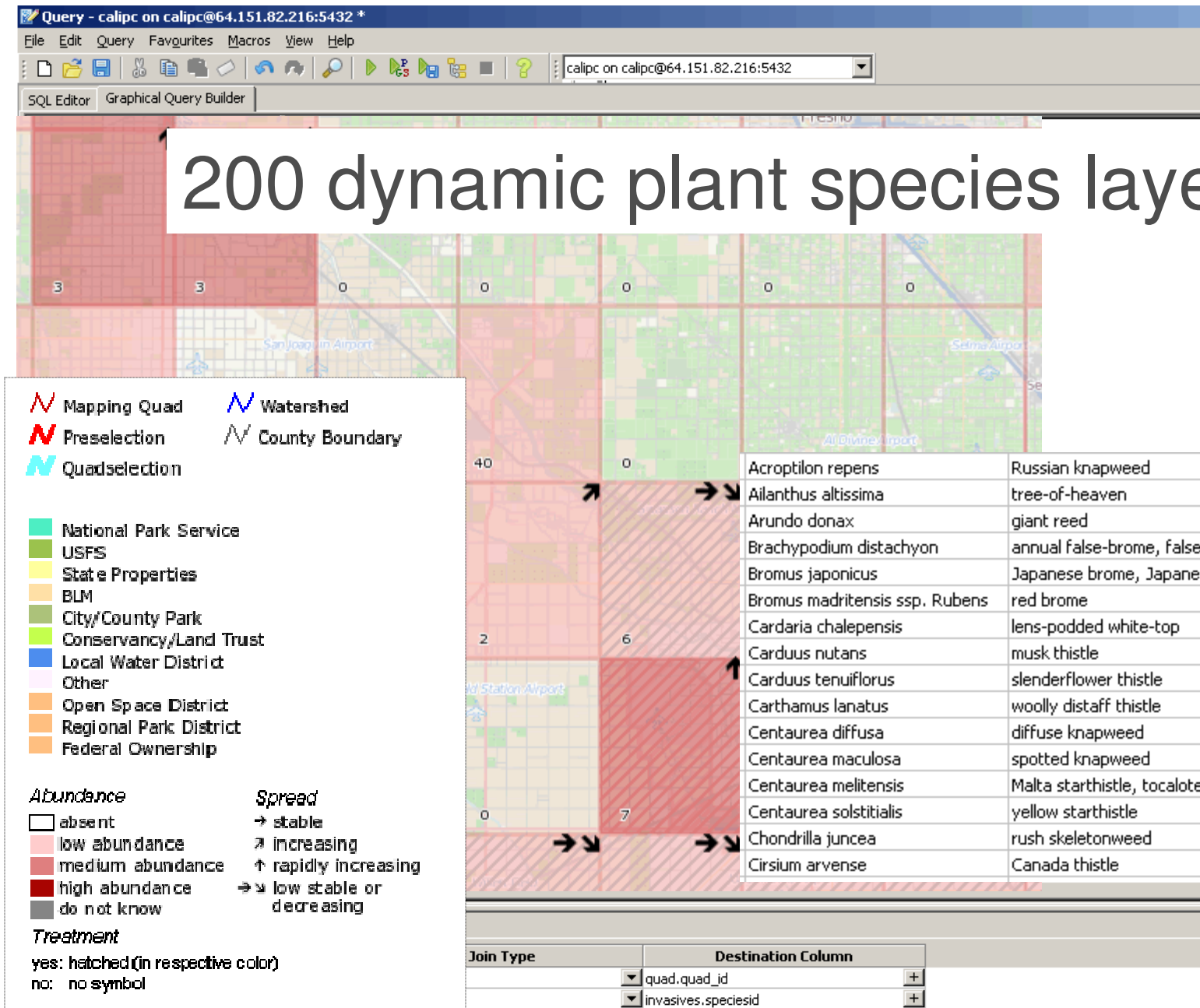
yes: hatched (in respective color)

no: no symbol

Public lands

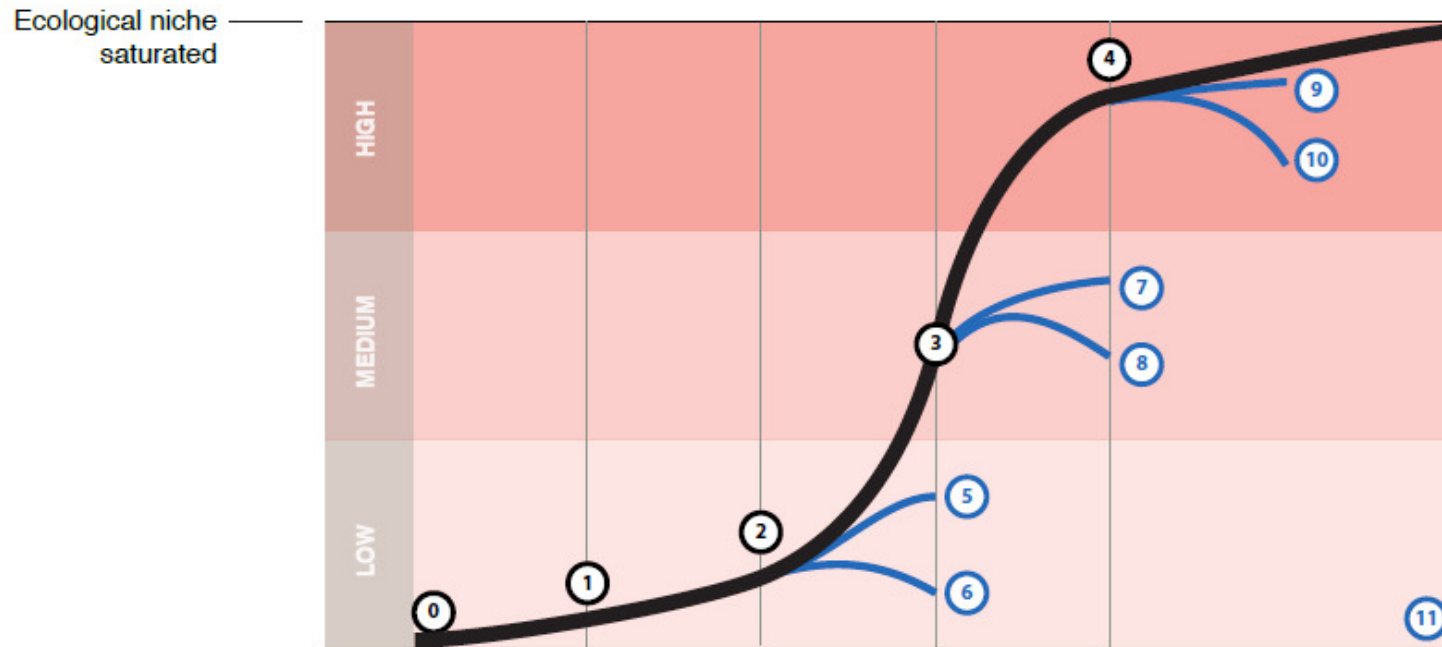
- National Park Service
- USFS
- State Properties
- BLM
- City/County Park
- Conservancy/Land Trust

TERRA GIS
TERRESTRIAL ENVIRONMENT REGIONAL ANALYSIS



Qualitative Data Collection Tool

Source: CALIPC 2011/2012



No management

Below descriptions are for abundance, spread

- ① Suspected absent
- ② Low, stable
- ③ Low, increasing
- ④ Medium, increasing rapidly (doubling in ten years)
- ⑤ High, stable (saturated ecological niche)

Under management

Below descriptions are for abundance, spread

- ⑥ Low, increasing
- ⑦ Low, stable or decreasing
- ⑧ Medium, increasing
- ⑨ Medium, stable or decreasing
- ⑩ High, increasing
- ⑪ High, stable or decreasing

Other

- ⑫ Suspect that it is present
- ⑬ Present, no specific information



public web site

Map the Spread

CalWeedMapper provides a dynamic tool for mapping invasive plant distribution at the landscape level using expert knowledge. [Learn more about how to use maps >>](#)

Submit Spatial Data

Contribute your GIS or observed data to Calflora for plant occurrences. [Learn more about submitting spatial data and how our systems work together >>](#)

News and Events

- » Planning regional strategy on CalWeedMapper
- » Interested in an online training on CalWeedMapper?
- » 21st Annual Cal-IPC Symposium

Goals

- involve public in data collection
 - make results available to experts and the public
- ⇒ weed management recommendations

BETA

basic

advanced

SEARCH BY COMMON NAME ▾

SEARCH BY SCIENTIFIC NAME ▾


 indicates suitable range map is available in advanced mode



Photo courtesy of David Chang

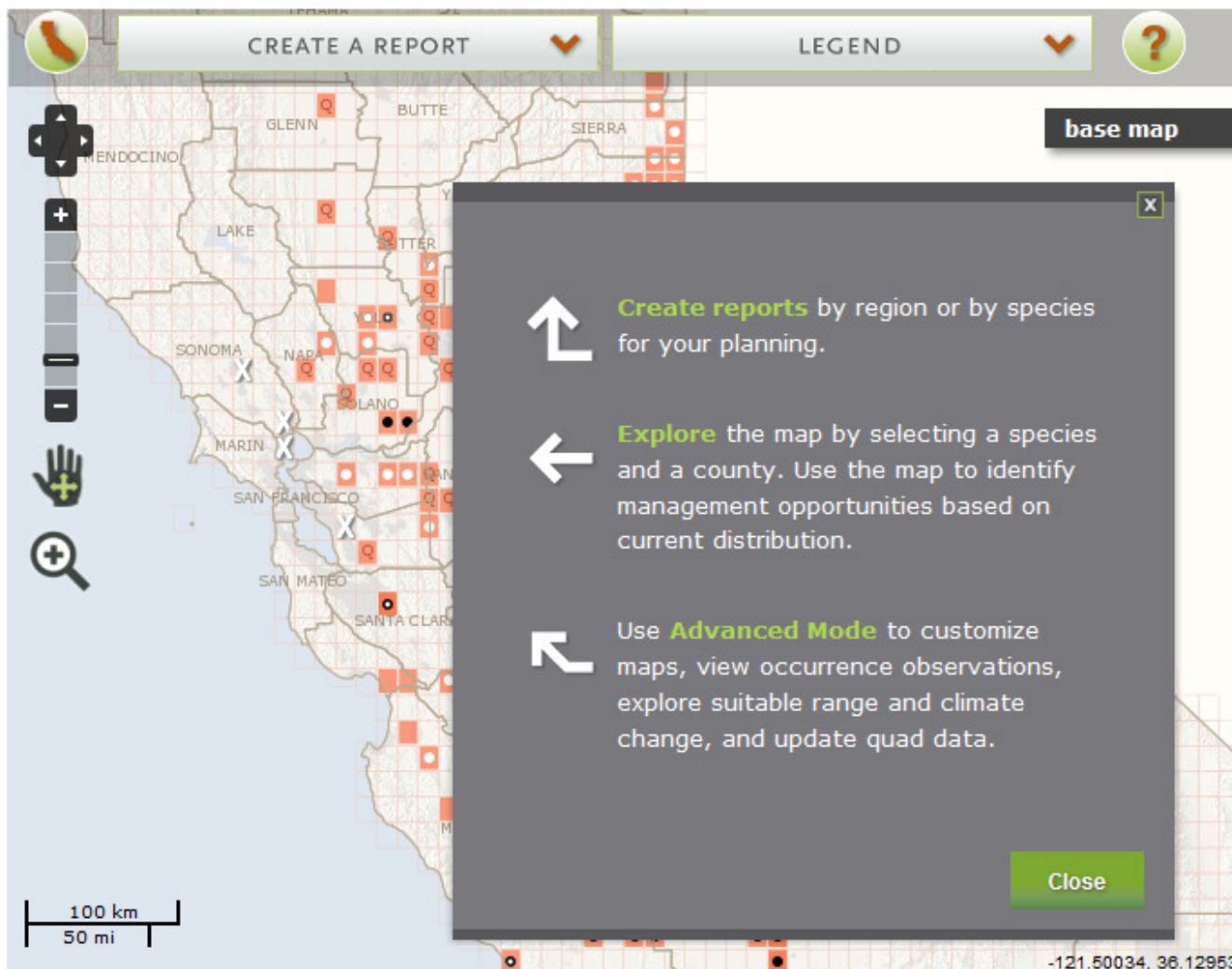
Acroptilon repens **(Russian knapweed)**

Cal-IPC Rating: **Moderate**

Other Ratings: CDFA B, BAEDN

species description

Get Species Map Report



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Weed Management Recommendations

prioritization &
regional management measures



Picture source: CALIPC March 2011
Prioritizing Regional Response to Invasive
Plants in the Sierra Nevada

BETA

basic

advanced

SEARCH BY COMMON NAME

SEARCH BY SCIENTIFIC NAME

indicates suitable range map is available in advanced mode



Photo courtesy of

Acroptilon repens (Russian knapweed)

Cal-IPC Rating
Other Rating

species description

Get Species Data

Quad Info

Occurrence Info

Quad: Allendale

Taxon: *Acroptilon repens* (Russian knapweed)

Value: The species is marked present based **only** on occurrence data, while expert knowledge of presence. This should be investigated and abundance/spread evaluated.

Management: It is **unknown** if the species is managed in this quad.

[Show Source](#)

[Show Quad History](#)

Observation Notes: none

Comment

Edit

Show all comments

SELECT REGION

SELECT REGION

CREATE A REPORT

editing quads & commenting

Login using your Calflora Account

Email:

Password:

Log In

If you do not already have a Calflora account, register as a data contributor and request to become a CalWeedMapper Contributor for permission to edit. Forgot your Calflora password?



CalWeedmapper features

reports



management opportunities
by region



map report by species

The screenshot displays the CalWeedMapper web application. At the top, a navigation bar includes links for home, maps, how to, spatial data, plant profiles, about, and contact. The main content area is divided into several sections. On the left, there is a sidebar with a photo of a plant, a section for 'Acrop' (Russian knapweed) with its Cal-IPC rating and other ratings, and a 'species description' section. Below this is a 'WMA's' section with a 'SELECT REGION' dropdown menu. The main map area shows a map of California with various regions labeled, including El Dorado WMA and Tahoe Basin WMA. A legend on the right side of the map indicates different range types: Suitable range, Expanded range, and Reduced range. A 'Change 2010 - 2050' checkbox is also present. Below the map, there is a section for 'Management Opportunities' with a table showing the number of species for different management levels: Surveillance (61 species), Eradication (11 species), Containment (39 species), and Managed (16 species). A 'Get Management Opportunities Report' button is located below the table. On the right side of the map, there is a 'Surveillance Opportunities in Alpine WMA' section with a 'Cal-IPC rating: High' and a list of species including *Aegilops triuncialis* (barb goatgrass), *Ulex europaeus* (gorse), and *Ulex europaeus* (gorse). A 'Get Species Map Report' button is also present. The bottom of the page features a copyright notice: 'Copyright © 2012 California Invasive Plant Council. Developed with Calflora, TerraGIS, and other partners. Cal-IPC is an equal opportunity provider. More info >>'.

BETA



Photo courtesy of David Chang

Acroptilon repens (Russian knapweed)

Cal-IPC Rating: **Moderate**

Other Ratings: CDFA B, BAEDN

species description

[Get Species Map Report](#)

WMAs SELECT REGION

Alpine WMA Management Opportunities

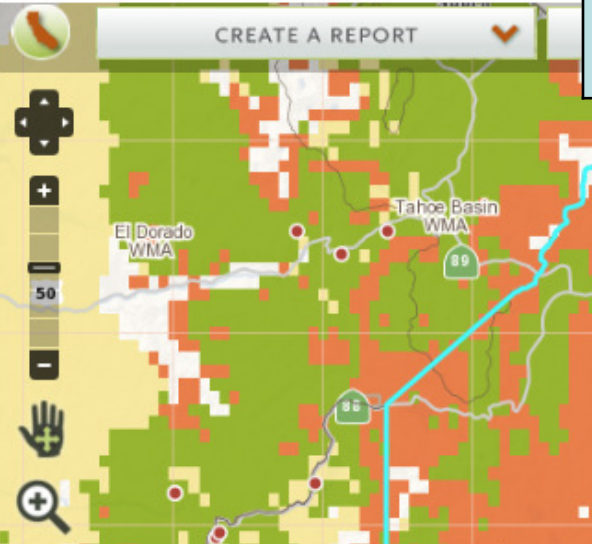
Surveillance: ? 61 species >>

Eradication: ? 11 species >>

Containment: ? 39 species >>

Managed: ? 16 species >>

[Get Management Opportunities Report](#)



Adjust transparency:

SUITABLE RANGE

☐ 2010

☐ 2050

☒ Change 2010 - 2050

☒ OCCURRENCE OBSERVATIONS

Consortium of California

reports

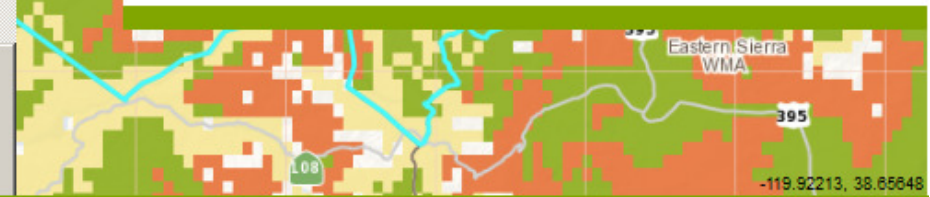
Surveillance Opportunities in Alpine WMA:

(click plant name to change the species in the map or click pdf icon to get a Species Map Report)

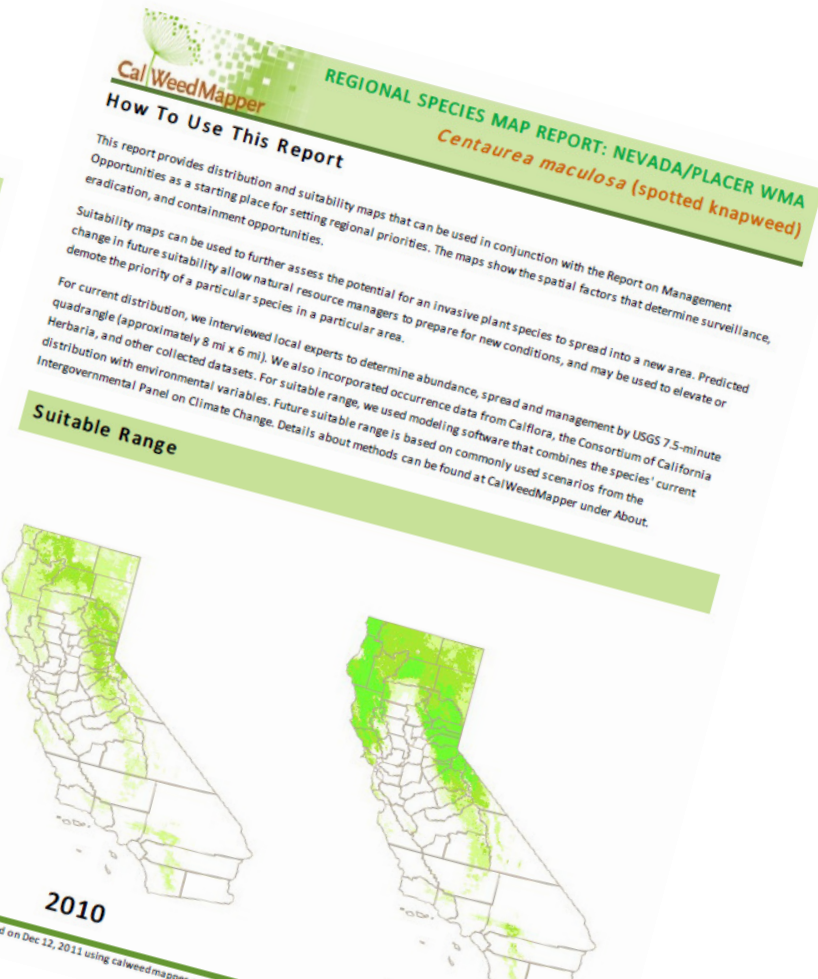
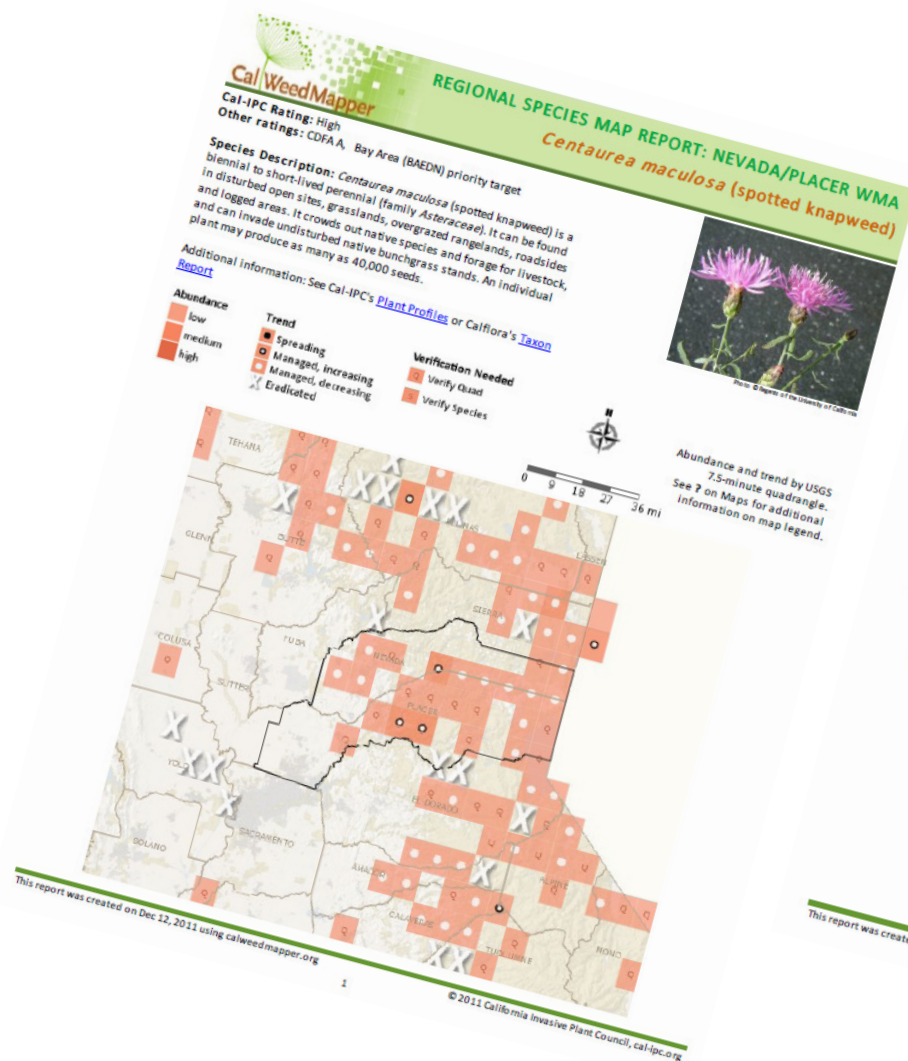
Cal-IPC rating: High

- Aegilops triuncialis* (barb goatgrass)
- Arundo donax* (giant reed)
- Brassica tournefortii* (Saharan mustard, African mustard)
- Cortaderia selloana* (pampasgrass)
- Egeria densa* (Brazilian egeria)
- Euphorbia virgata* (= *Euphorbia esula*) (leafy spurge)
- Hedera helix* and *H. canariensis* (English ivy, Algerian ivy)
- Ludwigia hexapetala* and *L. peploides* (Uruguay and creeping water-primrose)
- Tamarix ramosissima* (saltcedar, tamarisk)
- Ulex europaeus* (gorse)

Cal-IPC rating: Moderate



Regional Species Map Report



Source: Cynthia Powell, CALIPC 2012, Introducing CalWeedMapper! Slides

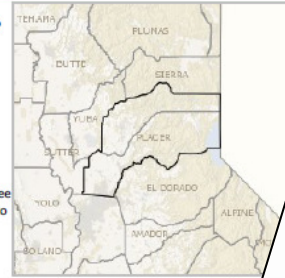
Regional Report

INVASIVE SPECIES MANAGEMENT OPPORTUNITIES IN Nevada/Placer WMA

This report summarizes invasive plant management opportunities in Nevada/Placer WMA. Opportunities are determined from maps of each species' current distribution and suitable range. Species are listed by three types of management opportunity:

- **Surveillance** – surveying to detect new infestations
- **Eradication** – complete removal of infestations
- **Containment** – limiting further spread of infestations

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



Top Opportunities:

This is a summary of some top-ranked opportunities in Nevada/Placer WMA. This report contains details on a complete list of invasive plant management opportunities.

Surveillance:

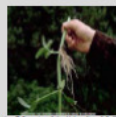


Photo: © Regents of the University of California
Alternanthera philoxeroides
alligator weed

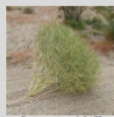


Photo: © Regents of the University of California
Brassica tournefortii
Saharan mustard, African mustard



Photo: © Regents of the University of California
Cordieria jubata
jubatagrass



Photo: © Regents of the University of California
Euphorbia esula
leafy spurge



Photo: © Regents of the University of California
Salvinia

Eradication:



Photo: © Regents of the University of California
Ulex europaeus
gorse

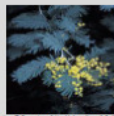


Photo: © Regents of the University of California
Acacia dealbata
silver wattle



Photo: © Regents of the University of California
Carthamus lanatus
woolly daisy



Photo: © Regents of the University of California
Cynara cardunculus
artichoke thistle

Containment:

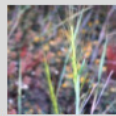


Photo: © Regents of the University of California
Bromus diandrus
barb goatgrass



Photo: © Regents of the University of California
Bromus diandrus
barb goatgrass



Photo: © Regents of the University of California
Bromus diandrus
barb goatgrass

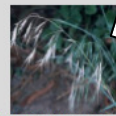


Photo: © Regents of the University of California
Bromus diandrus
barb goatgrass

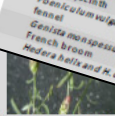


Photo: © Regents of the University of California
Bromus diandrus
barb goatgrass

This report was created on Dec 12, 2011 using calweedmapper.caiprc.org

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CalWeedMapper

INVASIVE SPECIES MANAGEMENT OPPORTUNITIES IN Nevada/Placer WMA

Surveillance Opportunities

These opportunities entail regular surveys to detect new infestations of species not known to be present in the region. The strategic potential depends on the proximity of nearby infestations and the suitability of the area. The table below includes species occurring within 50 miles of the selected region.

Plant Species:

Grouped by Statewide Cal-IPC Rating

Suitable Range
2010 2050

CalWeedMapper

INVASIVE SPECIES MANAGEMENT OPPORTUNITIES IN Nevada/Placer WMA

Eradication Opportunities

Eradication entails complete removal of all infestations in the area. These opportunities result from a small number of isolated infestations. The strategic importance of an eradication opportunity can be further assessed based on the degree of isolation as well as the suitability of the surrounding area. Determining the feasibility of eradication requires surveying infestations in the field.

CalWeedMapper

INVASIVE SPECIES MANAGEMENT OPPORTUNITIES IN Nevada/Placer WMA

Containment Opportunities

Containment entails limiting the spread from existing infestations. These opportunities result from larger groups of infested quads. The strategic importance of a containment opportunity can be further assessed based on how distinct the boundaries of the infestation are, how isolated it is, and the suitability of the surrounding area. Determining the feasibility of containment requires surveying infestations in the field.

Plant Species:

Grouped by Statewide Cal-IPC Rating

High (26 species)

Agropyron trisetaceus

barb goatgrass

Arundo donax

elephant reed

Bromus madritensis ssp. rubens

red brome

Bromus tectorum

downy brome, cheatgrass

Centrosema maculosa

spotted knapweed

Yellowstar thistle

Cortaderia setacea

pampasgrass

Cytisus scoparius

Scotch broom

Gerardia densa

Brazilian spurge

Richthyma erigeri

water hyacinth

Conium maculatum

poison hemlock

Genista monspeliensis

French broom

Medicago lupulina

black locust

Current Species Distribution
(number of quads out of 62 total)

Infested Spreading Managed Eradicated

Suitable Range

2010 Infested 2050

33 14 29 3 0 0

51 39 4 0 0

25 51 0 0 0

40 3 0 0 39 % 41 %

21 27 14 0 49 % 100 %

36 0 42 3 76 % 48 %

8 28 2 0 88 % 79 %

4 0 19 0 10 % 100 %

7 0 0 0 60 % 67 %

18 3 0 0 55 % 40 %

11 3 6 0 0

0 0 0 0 0

0 0 0 0 0

0 0 0 0 0

0 0 0 0 0

0 0 0 0 0

0 0 0 0 0

0 0 0 0 0

0 0 0 0 0

0 0 0 0 0

0 0 0 0 0

Mapping Invasive Plant Species

Source: Cynthia Powell, CALIPC 2012, Introducing CalWeedMapper! Slides

CalWeedmapper features


Data

Photo co
Acro
(Russian knapweed)

Cal-IPC Rating: **Moderate**
Other Ratings: **CDFA B, BAEDN**

species description

[Get Species Map Report](#)

WMAs 

SELECT REGION 

Alpine WMA
Management Opportunities

Surveillance: ? 61 species >>

Eradication: ? 11 species >>

Containment: ? 39 species >>

Managed: ? 16 species >>

[Get Management Opportunities Report](#)



automatic updates from
CALFLORA database &
CCH point data



data entry – public tool
prioritization & display rules



automatic map generation &
records prioritization

CalWeedmapper features

Models



Climate change models + GIS layers based on CA climate baseline averaging the 1970 to 2009 climates + projections into 2050.



2010 and 2050 + change layer

Acroptilon repens
(Russian knapweed)

Cal-IPC Rating: Moderate

Other Ratings:

species descr

Get Spe

WMAs

SELECT REGIO

Alpine WM
Manageme

Surveillance:

Eradication: ?

Containment:

Managed: ?

Get Management
Opportunities Report

☒ OCCURRENCE OBSERVATIONS

● Consortium of California
Herbaria

Surveillance Opportunities in Alpine WMA:

(click plant name to change the species in the map or click pdf icon to get a Species Map Report)

Cal-IPC rating: High

Aegilops triuncialis (barb goatgrass)

BETA

CREATE A REPORT

LEGEND / CHOOSE LAYERS



Technical Framework of the tools

Acr...
(Russian knapweed)

Cal-IPC Rating: **Moderate**
Other Ratings: CDFA B, BAEDN

species description

Get Species Map Report

WMAs

SELECT REGION

**Alpine WMA
Management Opportunities**

Surveillance: ? 61 species >>

Eradication: ? 11 species >>

Containment: ? 39 species >>

Managed: ? 16 species >>

Get Management
Opportunities Report



Very Species

Adjust transparency:



SUITABLE RANGE

☐ 2010

☐ 2050

☒ Change 2010 - 2050

☐ Suitable range

☐ Expanded range

☐ Reduced range

☒ OCCURRENCE OBSERVATIONS

☐ Consortium of California

☐ Herbaria

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Tamarix ramosissima (saltcedar, tamarisk)

Ulex europaeus (gorse)

Cal-IPC rating: Moderate




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■ Technical Framework

■ Server running Apache on HostGIS Linux (Slackware)

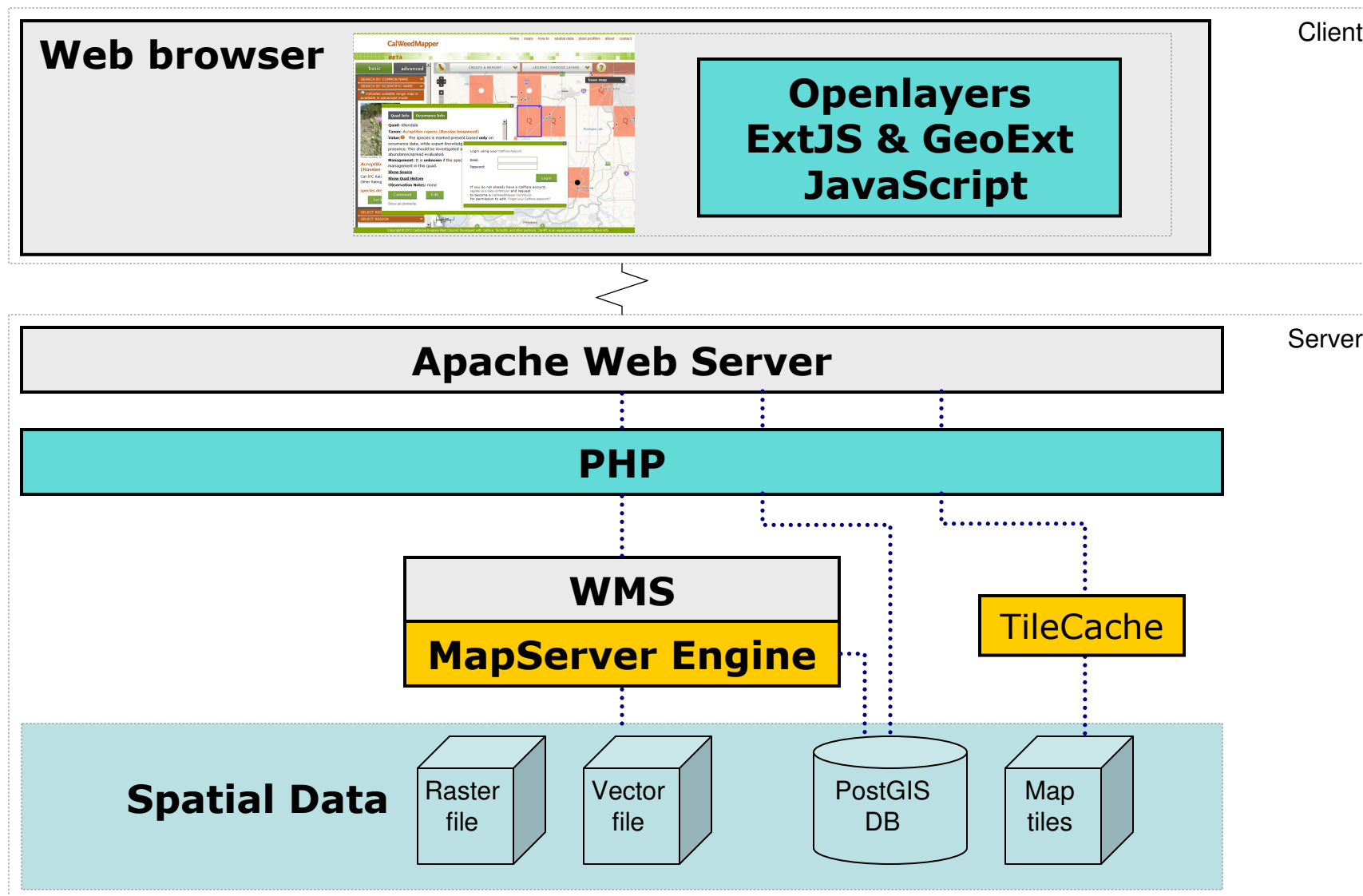
■ PostGIS database  

■ MapServer (University of Minnesota)
Map rendering engine  **MapServer**
open source web mapping

■ OpenLayers Viewer  OpenLayers

■ ExtJS + GeoExt JavaScript libraries for GUI

CalWeedMapper Public Web Tool



■ Map rendering Engine **MapServer** open source web mapping

Originally developed at the University of Minnesota (UMN), short “MapServer”

- one of the most mature open source projects
- written in C

Main Focus

- rendering spatial data
- development environment for spatially-enabled internet applications

Map output

- CGI mapserv (Linux) and mapserv.exe (windows)
- MapScript API available for Python, PHP, Perl, and Java
- Map/Layer configuration text file .map

Formats

- In: PostGIS, Oracle Spatial ArcSDE, WMS, GDAL and OGR formats
- Out: GIF, JPG, PNG, all GDAL formats, WFS and WMS



PostGIS – Spatial Database

- PostGIS is an extension for PostgreSQL
- adds support for geographic objects to PostgreSQL
- enables PostgreSQL server to be used as a backend spatial database for GIS
- Spatial operations and analysis simply mean running a (spatial) SQL query in the database
- Similar functions as SDE and much more

■ Open Layers OpenLayers

Main supporter “MetaCarta”

- object-oriented JavaScript library (using Prototype.js and Rico library)

Lets you add maps to any web page by embedding OpenLayer.js

- no server-side dependencies
- Easily reusable component
...similar to Google Maps and MSN Virtual Earth Web Mapping APIs
- “Slippy map style”

Input Formats

- Tile sources: Bing, Worldwind, Yahoo & Google Maps, WMS
- Vector layer input: KaMap, MapServer, GeoRSS, WFS, [KML]

Standard Tools

- Google-like zoom bar, standard functions like zoom in/out pan

