Science –Based Criteria for Developing California's Invasive Plant Inventory

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The CalEPPC List:
Exotic Pest Plants of Greatest Ecological Concern in California

October, 1999

The CalEPPC list is based on information submitted by our members and by land managers, botanists and researchers throughout the state, and on published sources. The list highlights non-native plants that are serious problems **in wildlands** (natural areas that support native ecosystems, including national, state and local parks, ecological reserves, wildlife areas, national forests, BLM lands, etc.).

List categories include:

List A: Most Invasive Wildland Pest Plants; documented as aggressive invaders that displace natives and disrupt natural habitats. Includes two sub-lists; List A-1: Widespread pests that are invasive in more than 3 Jepson regions (see page 3), and List A-2: Regional pests invasive in 3 or fewer Jepson regions.

List B: Wildland Pest Plants of Lesser Invasiveness; invasive pest plants that spread less rapidly and cause a lesser degree of habitat disruption; may be widespread or regional.

Red Alert: Pest plants with potential to spread explosively; infestations currently small or localized. If found, alert CalEPPC, County Agricultural Commissioner or California Department of Food and Agriculture.

Need More Information: Plants for which current information does not adequately describe nature of threat to wildlands, distribution or invasiveness. Further information is requested from knowledgeable observers.

Annual Grasses: New in this edition; a preliminary list of annual grasses, abundant and widespread in California, that pose significant threats to wildlands. Information is requested to support further definition of this category in next List edition.

Considered But Not Listed: Plants that, after review of status, do not appear to pose a significant threat to wildlands.

1999 List Review Committee:

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What is the old Cal-IPC list?

- List A: Most Invasive Wild land Pest Plants
  - A-1 Widespread (20)
  - A-2 Regional (19)
- List B: Wildland Pest Plants of Lesser Invasiveness   (34)
- Red Alert: Species with potential to spread explosively; currently restricted (16)
- Need More Information   (49)

Total of 89 species on list

List users

- Land managers/owners
- Environmental consultants
- Weed Management Areas (WMA's)
- Researchers
- Legislators

Impetus for Developing a Set of Weed List Criteria

"Weed List" has become quasi-regulatory

- management plans, environmental compliance documents, etc.

- questions about decision-making process for listing and categorizing non-native plants

- Cal-IPC Board recognized the need for more clear and defensible justification for placing species on the list and ranking them within the list (i.e. a common set of criteria)

Desire to develop a common system for use in neighboring states

Criteria for Categorizing Invasive Non-native Plants that Threaten Wildlands

- Provides a ***uniform methodology*** for evaluating and ranking invasive non-native plants that threaten wildlands.

- Overall goal was to create a ranked inventory of the state's invasive weeds that will:
  - be scientifically defensible
  - contain (and connect to) extensive information useful to land managers
  - provide transparent ranking criteria that are accessible to the user.

The criteria system will not be used to:

- evaluate economic impacts

- consider management challenges, costs

- evaluate predominantly agricultural weeds

- pre-screen species not yet introduced to a given state or region

Criteria for Categorizing Invasive Non-Native Plants that Threaten Wildlands

Cal-IPC.org

These criteria have been designed to support categorized lists of invasive plants by ranking each plant's level of threat to the ecological health of wildlands through evaluation of its ecological impact, ability to invade natural vegetation communities, and current extent of its invasion. Evaluators use an associated "Plant Assessment Form" to score species using the criteria and to document supporting evidence.

Developed for use in California, Arizona, and Nevada, these criteria can be adapted for use in other states or regions by substituting appropriate ecological types for that state or region.

Contents

Criteria Format: Protocol Sections

I. **Ecological Impact**

   Actual or potential effects on ecosystem processes, plant communities, higher tropic levels, and genetic integrity of native plants

II. **Invasive Potential**

   Potential to establish, spread, and develop self-sustaining populations in wildlands

III. **Ecological Amplitude and Distribution**

   Number and percentages of different ecological types invaded

IV. **Rating Documentation Reliability**

Section 1. Ecological Impact

- **1.1**   Impact on abiotic ecosystem processes (e.g. hydrology, fire, nutrient cycling)

- **1.2**   Impact on native plant community composition, structure, and interactions

- **1.3**   Impact on higher trophic levels, including vertebrates and invertebrates

- **1.4**   Impact on genetic integrity of native species (i.e. potential for hybridization)

Impact on abiotic ecosystem processes

- Consider the impact on the natural range and variation of abiotic ecosystem processes and system-wide parameters in ways that significantly diminish the ability of native species to survive and reproduce. Alterations that determine the types of communities that can exist in a given area are of greatest concern. Examples of abiotic processes include:
  - ☐ fire occurrence, frequency, and intensity;
  - ☐ geomorphological changes such as erosion and sedimentation rates;
  - ☐ hydrological regimes, including soil water table;
  - ☐ nutrient and mineral dynamics, including salinity, alkalinity, and pH;
  - ☐ light availability (e.g. when an aquatic invader covers an entire water body that would otherwise be open).
- *Select the one letter below that best describes this species' most severe impact on an abiotic ecosystem process:*
  - A. Severe, possibly irreversible, alteration or disruption of an ecosystem process.
  - B. Moderate alteration of an ecosystem process.
  - C. Minor alteration of an ecosystem process.
  - D. Negligible perceived impact on an ecosystem process.
  - U. Unknown.

Section 1 Scoring Matrix				
Q 1.1	**Q 1.2**	**Q 1.3**	**Q 1.4**	**Score**
A	A	Any	Any	A
A	B	A,B	Any	A
A	B	C,D,U	Any	B
A	C,D,U	Any	Any	B
B	A	A	Any	A
B	A	B	A	A
B	A	B,C	B-D,U	B
B	A	C,D,U	A	A
B	A	C,D,U	B-D,U	B
B	B	A	A	A
B	C,D,U	A	A	B
B	B-D	A	B-D,U	B
B	B-D	B-D,U	Any	B
B	D,U	C,D,U	A-B	B
B	D,U	C,D,U	C,D,U	C
C-D,U	A	A	Any	A
C	B	A	Any	B
C	A,B	B-D,U	Any	B
C	C,D,U	Any	Any	C
D	A,B	B	Any	B
D	A,B	C,D,U	Any	C
D	C	Any	Any	C
D	D,U	Any	Any	D
U	A	B,C	Any	B
U	B,C	A,B	Any	B
U	B,C	C,D,U	Any	C
U	U	Any	Any	U

Scoring matrix for Impacts Section

Section 2. Invasive Potential

- **2.1** Ability to establish without anthropogenic or natural disturbance
- **2.2** Local rate of spread with no management
- **2.3** Recent trend in total area infested within state
- **2.4** Innate reproductive potential (based on multiple characteristics)
- **2.5** Potential for human-caused dispersal
- **2.6** Potential for natural long-distance (>1 km) dispersal
- **2.7** Other regions invaded worldwide that are similar to California

For Section 2: Use the information and matrix below to calculate the section score based on answers to questions 2.1 – 2.7.

questions answered A: ____ x 3 = ____ pts
questions answered B: ___ x 2 = ____ pts
questions answered C: ___ x 1 ____ pts
questions answered D: ___
questions answered U: ___

Total = ____ pts

Section 2 Scoring Matrix	
Total points	**Score**
17-21	A
11-16	B
5-10	C
0-4	D
More than two U's	U

Scoring matrix for Invasiveness Section

Section 3. Distribution

- **3.1** Ecological amplitude (ecological types invaded in California)
- **3.2** Ecological intensity (highest extent of infestation in any one ecological type)

Worksheet C - California Ecological Types
(sensu Holland 1986)

Major Ecological Types	Minor Ecological Types	Code
Marine Systems	marine systems	score
Freshwater and Estuarine Aquatic Systems	lakes, ponds, reservoirs	score
	rivers, streams, canals	score
	estuaries	score
Dunes	coastal	score
	desert	score
	interior	score
Scrub and Chaparral	coastal bluff scrub	score
	coastal scrub	score
	Sonoran desert scrub	score
	Mojavean desert scrub (incl. Joshua tree woodland)	score
	Great Basin scrub	score
	chenopod scrub	score
	montane dwarf scrub	score
	Upper Sonoran subshrub scrub	score
Grasslands, Vernal Pools, Meadows, and other Herb Communities	coastal prairie	D. presen
	valley and foothill grassland	D. presen
	Great Basin grassland	C. 5-20%
	vernal pool	score
	meadow and seep	D. presen
	alkali playa	score
	pebble plain	score
Bog and Marsh	bog and fen	score
	marsh and swamp	score
Riparian and Bottomland	riparian forest	D. presen
	riparian woodland	D. presen
	riparian scrub (incl. desert washes)	score
Woodland	cismontane woodland	score
	piñon and juniper woodland	score
	Sonoran thorn woodland	score
Forest	broadleaved upland forest	D. presen
	North Coast coniferous forest	D. presen
	closed cone coniferous forest	D. presen
	lower montane coniferous forest	D. presen
	upper montane coniferous forest	D. presen
	subalpine coniferous forest	score
Alpine Habitats	alpine boulder and rock field	score
	alpine dwarf scrub	score

* A. means >50% of type occurrences are invaded; B means >20% to 50%; C. means >5% to 20%; D. means present but ≤5%; U. means unknown (unable to estimate percentage of occurrences invaded).

Section 3 Scoring Matrix		
Q 3.1	**Q 3.2**	**Score**
A	A, B	**A**
A	C,D,U	**B**
B	A	**A**
B	B,C	**B**
B	D	**C**
C	A,B	**B**
C	C,D	**C**
D	A	**B**
D	B,C	**C**
D	D	**D**
A,B	U	**C**
C,D	U	**D**
U	U	**U**

Scoring matrix for Ecological Amplitude Section

Documentation Levels

Assessed as highest level of documentation for each criterion

- 4 = Reviewed scientific publications
- 3 = Other published material (reports or other non-peer-reviewed documents)
- 2 = Observational (unpublished information confirmed by a professional in the field)
- 1 = Anecdotal (unconfirmed information)
- 0 = No information

Overall Ranking Procedure

[ranking is weighted with *IMPACTS* as the main driver]

Overall Scoring Matrix				
Sec. 1	**Sec. 2**	**Sec. 3**	**Overall Score**	**Alert Status**
A	*A,B*	*A,B*	**High**	
A	*A,B*	*C,D*	**High**	**Alert**
A	*C,D*	*A-D*	**Med**	
B	*A,B*	*A,B*	**Med**	
B	*A,B*	*C,D*	**Med**	**Alert**
B	*C,D*	*A-D*	**Low**	
C	*A*	*A,B*	**Med**	
C	*A*	*C,D*	**Low**	
C	*B*	*A*	**Med**	
C	*B*	*B-D*	**Low**	
C	*C*	*A-D*	**Low**	
D	*A-D*	*A-D*	**Not listed**	

What do categories mean?

- **High** –severe ecological impacts on physical processes, plant and animal communities, and vegetation structure. Biology and conducive to moderate to high rates of dispersal and establishment. Most are widely distributed ecologically.

- **Moderate** –substantial and apparent—but generally not severe—ecological impacts on physical processes, plant and animal communities, and vegetation structure. Biology conducive to moderate to high rates of dispersal, though establishment generally dependent upon ecological disturbance. Ecological amplitude and distribution may range from limited to widespread.

- **Limited** –invasive but ecological impacts minor on a statewide level or not enough information to justify a higher score. Biology suggests low to moderate rates of invasiveness. Ecological amplitude and distribution generally limited, but may be locally persistent and problematic

Alert	Scientific Name	Common Name	Rating	Impacts	Invasiveness	Distribution	Doc. Level	Ecological Types Invaded and Other Comments	Regions Invaded
◆	Asparagus asparagoides	bridal creeper	Moderate	B	B	D	2.6	Riparian woodland	CW, SW
◆	Asphodelus fistulosus	onionweed	Moderate	B	A	C	2.9	Coastal dunes, prairie, grasslands. Invasive in Australia. High invasiveness but limited distribution in CA.	GV, SW
	Atriplex semibaccata	Australian saltbush	Moderate	B	B	B	2.9	Coastal grasslands, scrub, upper salt marsh. Limited distribution, but can be very invasive regionally.	CA except CaR and SN
	Avena barbata	slender wild oat	Moderate	B	B	A	3.5	Coastal scrub, grasslands, oak woodland, forest. Very widespread, but impacts more severe in desert regions.	CA-FP, MP, DMoj
	Avena fatua	wild oat	Moderate	B	B	A	3.2	Coastal scrub, chaparral, grasslands, woodland, forest. Very widespread, but impacts more severe in desert regions.	CA-FP, MP, DMoj
	Bassia hyssopifolia	fivehook bassia	Limited	C	C	B	2.7	Alkaline habitats. Weed of agriculture or disturbed sites. Impacts minor in wildlands.	CA except NW
	Bellardia trixago	bellardia	Limited	C	C	C	1.9	Grasslands, including serpentine. Impacts and invasiveness appear to be minor.	NW, CW
◆	Brachypodium sylvaticum	perennial false-brome	Moderate	B	A	D	2.5	Redwoods and mixed evergreen forest in Santa Cruz Mtns. Expanding range rapidly in OR, potentially very invasive.	CW
	Brassica nigra	black mustard	Moderate	B	B	A	2.0	Widespread. Primarily a weed of disturbed sites, but can be locally a more significant problem in wildlands.	CA-FP
	Brassica rapa	birdsrape mustard, field mustard	Limited	C	B	B	1.8	Coastal scrub, grasslands meadows, riparian. Primarily in disturbed areas. Impacts appear to be minor or unknown in wildlands.	CA-FP
	Brassica tournefortii	Saharan mustard, African mustard	High	A	A	B	2.3	Desert dunes, desert and coastal scrub	SW, D
	Briza maxima	big quakinggrass, rattlesnakegrass	Limited	B	C	B	2.3	Grasslands. Widespread in coast range. Impacts generally minor, but locally can be higher.	NW, SN, CW, SW
	Bromus diandrus	ripgut brome	Moderate	B	B	A	3.3	Dunes, scrub, grassland, woodland, forest. Very widespread, but monotypic stands uncommon.	CA

Scientific names based on *The Jepson Manual*. For each species, the first common name is based on the Weed Science Society of America's "Composite List of Weeds" (www.wssa.net), followed by other names used in California. Scores: A = Severe, B = Moderate, C = Limited, D = None, U = Unknown. Documentation level averaged. Regions invaded based on Jepson geographic regions. Plant assessment forms, literature citations, and full rating criteria available at www.cal-ipc.org.

California Invasive Plant Council

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

Invasive Plant Inventory

Eucalyptus, July 2014: We are taking comments on a revised assessment of bluegum eucalyptus, *Eucalyptus globulus*. Read the updated assessment here and submit comments by July 31, 2014.

Our database of Plant Assessment Forms was moved to www.cal-ipc.org/paf in 2013. Please update your links!

Jump to section below:

- The Inventory
- Definitions
- Criteria for Listing
- Inventory Categories
- Uses and Limitations
- Providing Input for Future Revisions
- Summary of the Criteria
- References
- Inventory Review Committee
- Acknowledgments
- Financial Support
- Related Links

The California Invasive Plant Inventory categorizes non-native invasive plants that threaten the state's wildlands. Categorization is based on an assessment of the ecological impacts of each plant. The Inventory represents the best available knowledge of invasive plant experts in the state. However, it has no regulatory authority, and should be used with full understanding of the limitations described below.

California is home to 4,200 native plant species, and is recognized internationally as a "biodiversity hotspot." Approximately 1,800 non-native plants also grow in the wild in the state. A small number of these, approximately 200, are the ones that this Inventory considers invasive. Improved understanding of their impacts will help those working to protect California's treasured biodiversity.
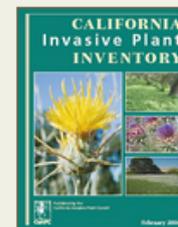
Download 2006 Inventory (pdf)

Teasel
Dipsacus fullonum

	Overall Score ? **Moderate**	Alert Status ? **No Alert**	Documentation ? **3.8** out of 5

		Score	Documentation	
1.1	Impact on abiotic ecosystem processes ?	C. Minor	Reviewed Scientific Publication	**Impact** ?
1.2	Impact on plant community ?	B. Moderate	Reviewed Scientific Publication	Four-part score **CBCD**
1.3	Impact on higher trophic levels ?	C. Minor	Reviewed Scientific Publication	Total Score **B**
1.4	Impact on genetic integrity ?	D. None	Reviewed Scientific Publication	
2.1	Role of anthropogenic and natural disturbance in establishment ?	B. Moderate	Reviewed Scientific Publication	**Invasiveness** ?
2.2	Local rate of spread with no management ?	B. Increases less rapidly	Reviewed Scientific Publication	Total Points **12**
2.3	Recent trend in total area infested within state ?	C. Stable	Observational	Total Score **B**
2.4	Innate reproductive potential (see Worksheet A) ?	B. Moderate	Reviewed Scientific Publication	
2.5	Potential for human-caused dispersal ?	A. High	Reviewed Scientific Publication	
2.6	Potential for natural long-distance dispersal ?	C. Rare	Reviewed Scientific Publication	
2.7	Other regions invaded ?	C. Already invaded	Reviewed Scientific Publication	
3.1	Ecological amplitude/Range (see Worksheet C) ?	A. Widespread	Reviewed Scientific Publication	**Distribution** ?
3.2	Distribution/Peak frequency (see Worksheet C) ?	C. Low	Reviewed Scientific Publication	Total Score **B**

basic | advanced

SEARCH BY COMMON NAME ⌄

SEARCH BY SCIENTIFIC NAME ⌄

🌐 *indicates suitable range map is available in advanced mode*

Photo © Regents of the University of California

Dipsacus fullonum and *D. sativus* (common and Fuller's teasel)

Cal-IPC Rating: **Moderate**
Other Ratings:

species description

Get Species Map Report

SELECT COUNTY ⌄

CREATE A REPORT ⌄ | LEGEND

EXPERT KNOWLEDGE BY QUAD

Abundance
- Low
- Medium
- High

Trend
- ● Spreading
- ◉ Managed, spreading
- ◻ Managed, decreasing
- ✕ Eradicated

Verification Needed
- Q Verify Quad
- S Verify Species
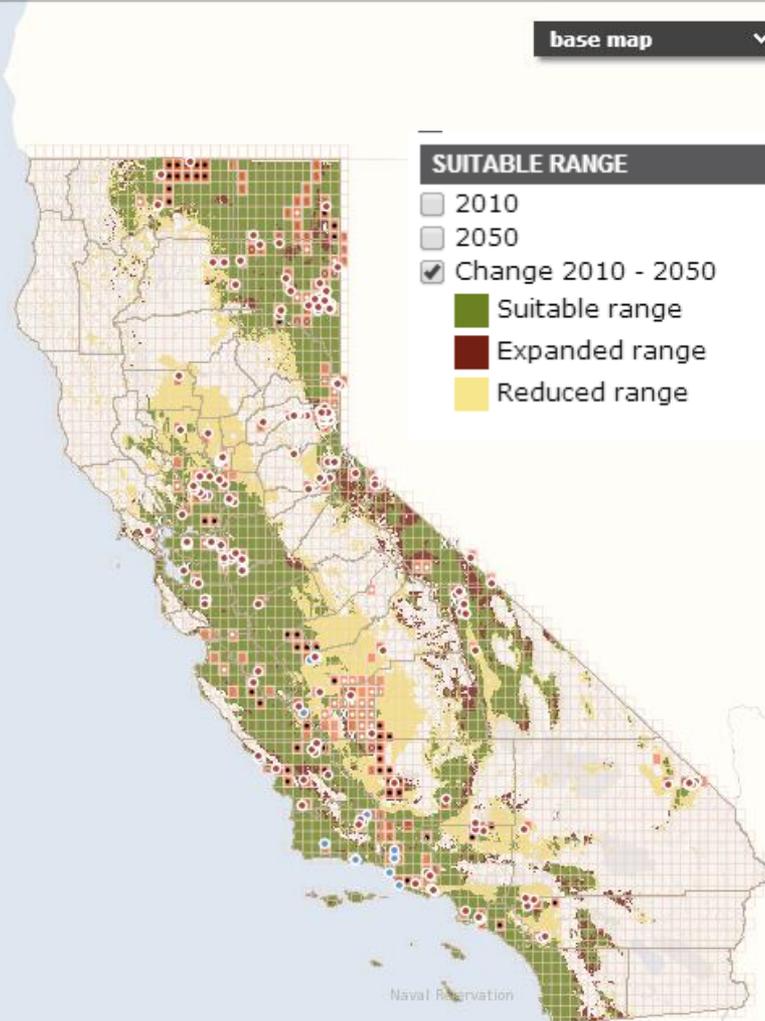
Naval Reservation

100 km
100 mi

Comparison of invasive and noxious weed by CDFA and Cal-IPC

	No. of Species
CDFA	
A list	62
B list	84
C list	30
Q and H list	4
Total	180
Cal-IPC (alerts in parentheses)	
High	42 (10)
Moderate	93 (25)
Limited	79
Total	214

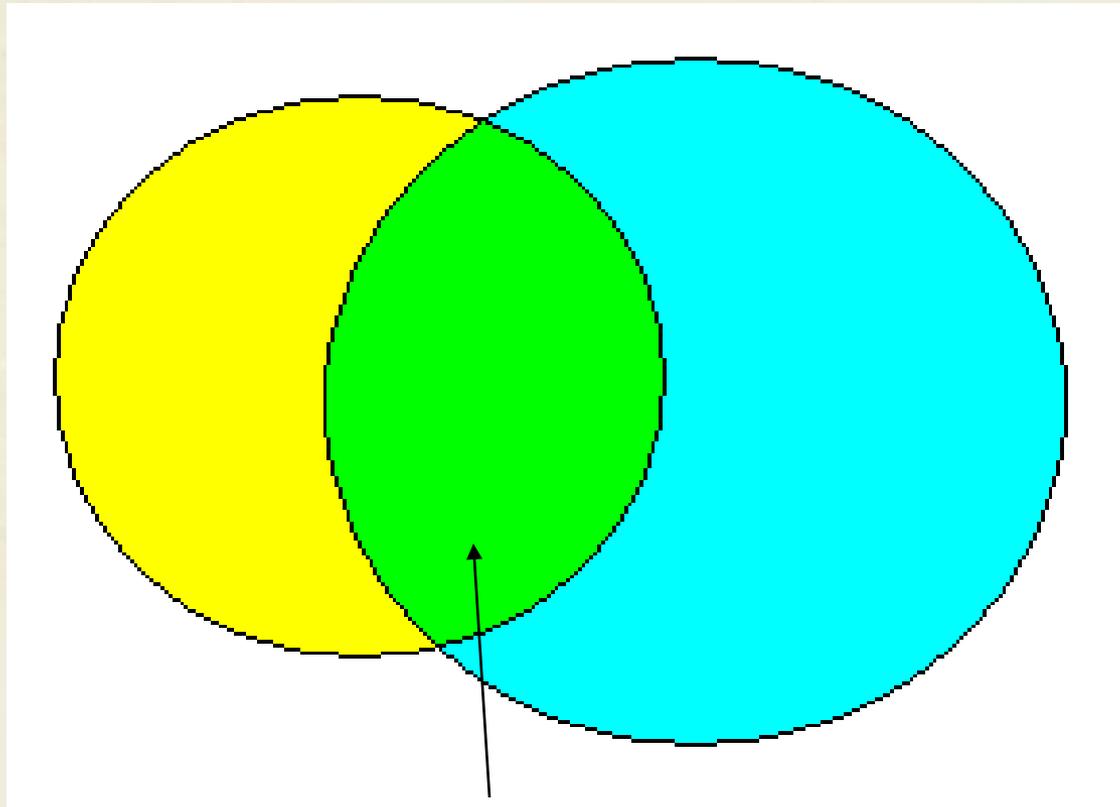There are 1500 non-native plants that are established outside of cultivation in California

CDFA 180 species **Cal-IPC 214 species**

**72 species overlap
between the two lists**

Benefits of new ranking criteria that is a post-introduction Weed Assessment

- Provides a ***uniform methodology*** for evaluating and ranking invasive non-native plants that threaten wildlands or natural areas
- Includes clear definitions
- More objective and scientifically defensible
- Provides transparent ranking criteria that are accessible to the user
- Contains (and is connect to) extensive information useful to land managers
- Highlights data gaps
- Flexible
  - Available in a web-based format that can be updated