

State of the Bay 2010

A Conference about Tomales Bay and its Watershed



Photograph: © KathleenGoodwin.net 2010

Friday, October 22 and Saturday October 23, 2010

presented by the Tomales Bay Watershed Council



Conference web-page - <http://www.tomalesbaywatershed.org/stateofthebay2010.shtml>

Abstract:

Invasive Plants and their Impact on the Watershed

Andrea Williams, Vegetation Ecologist, Marin Municipal Water District.

Exotic or non-native species are essential to our lives, comprising over 98% of our food supply and generally much of our gardens as well. Some of these non-native species can become harmful to human health or the economy, or to the environment; these are termed invasive species. “Invasive” can also refer to native species which spread in an aggressive manner, but “invasive species” is an official term for harmful exotics. Invasive species arrive and spread in a variety of ways, and follow a predictable growth curve which is met by different management responses at different stages—often too late to be effective. The Bay Area Early Detection Network hopes to shift the paradigm to early action, matching the prevention and detection efforts found in human health. Early detection species and weeds of the watershed are discussed in the talk, as are specific effects of weeds; reasons they may be present in an area; and tools for dealing with them.

See video of this presentation at: <http://vimeo.com/16911466>

Complete proceedings, individual presentations, and links to video from the 2010 State of the Bay Conference are available on the Tomales Bay Watershed Council's website:

<http://www.tomalesbaywatershed.org/stateofthebay2010.shtml>

Speaker Biography:

Andrea Williams received her B.S. in Biology from Lewis and Clark College in Portland, Oregon in 1996. As Vegetation Ecologist for the Marin Municipal Water District, she works to implement the District's Vegetation Management Plan on watershed lands and develop long-term vegetation monitoring in light of climate change, Sudden Oak Death, and other landscape-level changes. Prior to her work with MMWD, Ms. Williams worked for the National Park Service at Redwood National & State Parks and the San Francisco Bay Area Inventory & Monitoring Network managing and monitoring invasive plants, rare plants, and plant communities. She co-founded the Bay Area Early Detection Network and is an expert in early detection of invasive plant species.



**Marin Municipal
Water District**

Invasive plants and their impact on the watershed

**Andrea Williams
Vegetation Ecologist
Marin Municipal Water District**

**State of the Bay 2010 Conference
October 22, 2010
Inverness, CA**

Exotic Species vs. Invasive Species

- **Not all invasives are exotic.**



- **Not all exotics are invasive.**



- **Invasive species is an official term.**



Invasive species are second only to habitat destruction as a threat to biodiversity

The Invasion "S" Curve

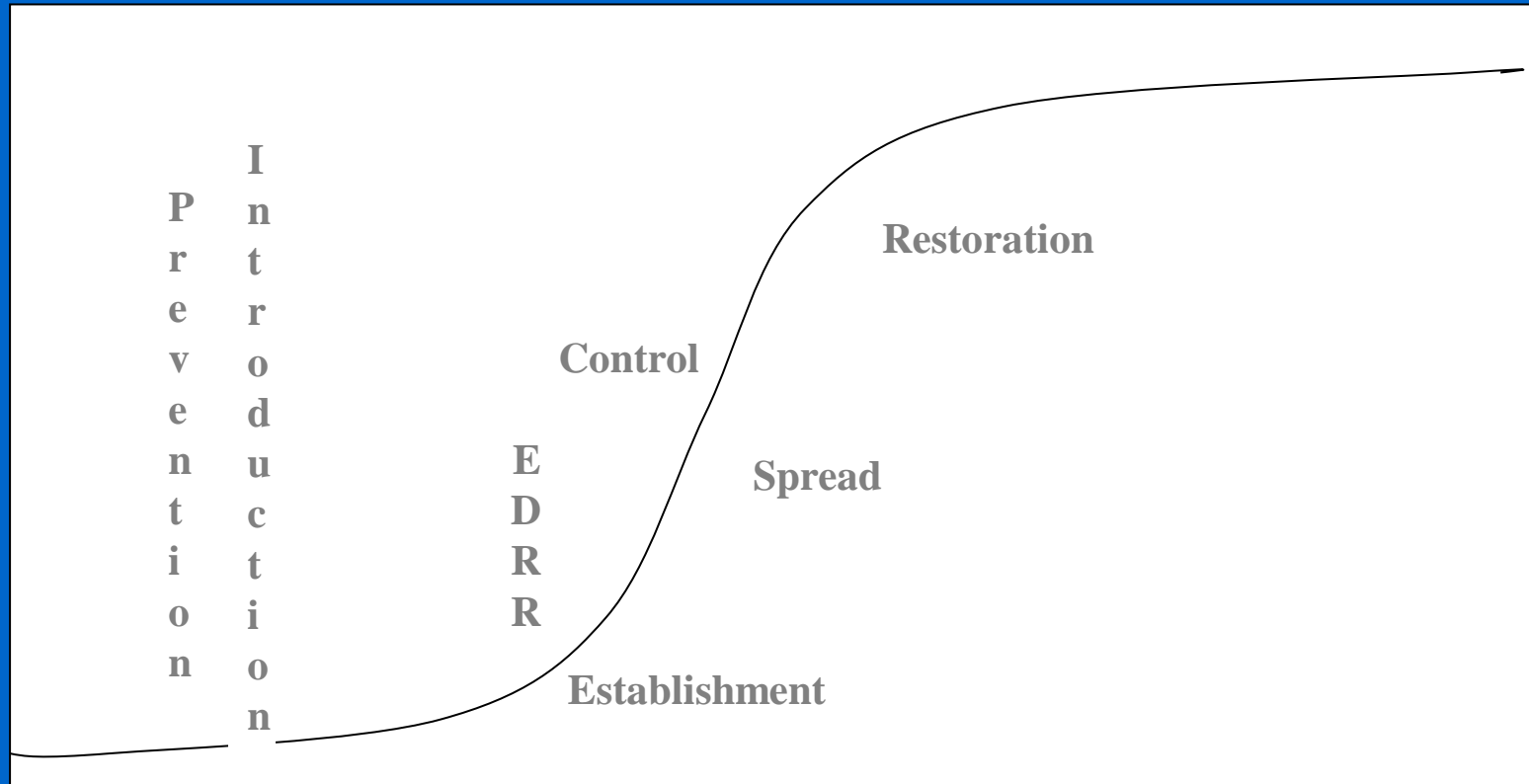




Photo by Andy Cohen



Photo by Christiana Conser



Photo by Andy Cohen



Photo by CDFA



Photo courtesy of Invasive Spartina Project



- 4,600 Western wildland acres/day are lost to invasive plants.
- Over 3,300 non-native plant species have naturalized in the lower 48.
- At least 60 of these species cause major ecological/economic impact.
- **San Francisco Bay is one of the most invaded aquatic ecosystems in the world. As of 2003 at least 167 species have been introduced and established into its marine and brackish waters. Today's # might be closer to 200.**

-C. L. Duncan and J. K. Clark. 2005. Invasive Plants of Range and Wildlands, and Their Environmental, Economic, and Societal Impacts
-Westbrooks, R. 1998. Invasive Plants Fact Book. Federal Interagency Committee for the Management of Noxious and Exotic Weeds
- Cohen, A., Carlton, J. Accelerating Invasion Rate in a Highly Invaded Estuary. Science Vol. 279 23 January 1998, pp555-558
- Andrew Cohen, Director of the Biological Invasions Program, San Francisco Estuary Institute. Personal communication October 15, 2009.



"There are places around here so choked with pampas grass you can't use the land to grow anything anymore."

— E.J. BURNS
Fourth-generation farmer



Photo by Paolo Vescia

- **\$143 billion/year in U.S. economic impacts.**
- **Over \$82 million/year spent in California.**
- **Early detection, control, and eradication yields a cost-to-benefit of \$17-\$34 for every \$1 invested.**



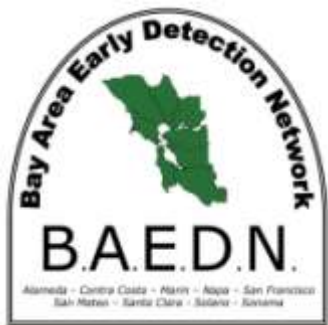
www.BAEDN.org

Photo by Andrea Williams



The Bay Area Early Detection Network:





BAEDN Partners:

Acterra
Alameda County Department of Agriculture
Audubon Canyon Ranch
BAELIN Inc.
Bay Area Open Space Council*
Calflora Database*
California Association of Resource Conservation Districts
California Department of Fish and Game Bay Delta Region
California Department of Fish and Game Invasive Species Program, Habitat Conservation Branch
California Department of Fish and Game Central Coast Region
California Department of Fish and Game Environmental Scientist, Aquatic Nuisance Species, Region 3
California Department of Food and Agriculture Plant - Integrated Pest Control
California Department of Food and Agriculture Plant Pest Diagnostics Laboratory, CDA Herbarium
California Department of Pesticide Regulation
California Invasive Plant Council *
California Native Plant Society East Bay Chapter
California Native Plant Society State Office
California State Coastal Conservancy
California State Parks
Caltrans District 4 District 4
City and County of San Francisco
City of Walnut Creek Open Space - Borges Ranch and Shell Ridge Open Space
Claremont Canyon Conservancy
Conservation Value, Inc
Contra Costa County Department of Agriculture
Contra Costa Resource Conservation District
Creekside Center for Earth Observations
East Bay Regional Parks District
Friends of 5 Creeks

Friends of Corte Madera Creek
Garcia and Associates
Gold Ridge Resource Conservation District
Golden Gate National Parks Conservancy
Invasive Spartina Project
Jasper Ridge Biological Preserve - Stanford University
Laguna de Santa Rosa Foundation*
Land Trust of Napa County
LSA Associates and CNPS
Marin Audubon
Marin County Open Space District
Marin Municipal Water District
Midpeninsula Regional Open Space District
Napa Botanical Survey Services
Napa County
National Park Service - California Exotic Plant Management Team
National Park Service Muir Woods National Monument
National Park Service - Golden Gate National Recreation Area
National Park Service - Point Reyes National Seashore
National Park Service - San Francisco Bay Area Network *
Nature in the City
North Hills Landscape Committee
Peninsula Open Space Trust Cloverdale
Pepperwood Preserve
PG&E
Presidio Trust
Regional Water Quality Control Board
San Francisco Estuary Invasive Spartina Project*
San Francisco Natural Areas Program

San Francisco Parks Trust
San Francisco Public Utilities Commission
San Mateo Co Parks & Rec Fdn
San Mateo County Ag. Dept
Santa Clara County Department of Agriculture
Santa Clara County Open Space Authority
Save the Bay
Shelterbelt Builders INC
Solano Agricultural Commissioner
Solano Resource Conservation District
Sonoma Ecology Center
Sonoma Land Trust
Stanford
University of California Berkeley Botanical Garden
University of California Cooperative Extension
University of California Davis
University of California Santa Cruz
USFWS Coastal Program
USFWS San Pablo and Marin Islands NWR
USFWS SF Refuge Complex
USFWS Aquatic Invasive Species Program
USFWS Region 8. Aquatic Nuisance Species Program, Pacific Southwest Region
Weed Management Area - Alameda/Contra Costa, Contra Costa Ag Commissioner office
Weed Management Area - Marin/Sonoma
Weed Management Area - Napa
Weed Management Area - San Francisco
Weed Management Area - San Mateo
Weed Management Area - Santa Clara
Weed Management Area - Solano

The List (for now)

Bay Area Early Detection Network's Early Detection & Rapid Response Target Species

Species Name	Common Name	Family	U.S. Department of Agriculture Code	California Department of Food and Agriculture (CDFA) or Federal Weed Rating
<i>Acacia paradoxa</i>	kangaroo thorn	Fabaceae	ACPA8	CDFA B
<i>Acaena novae-zelandiae</i>	biddy-biddy	Rosaceae	ACNO7	CDFA A
<i>Achnatherum brachychaetum</i>	punagrass	Poaceae	ACBR5	CDFA A
<i>Aegilops triuncialis</i>	barbed goatgrass	Poaceae	AETR	CDFA B
<i>Ambrosia trifida</i>	giant or great ragweed	Asteraceae	AMTR	CDFA B
<i>Araujia sericifera</i>	bladderflower	Asclepiadaceae	ARSE8	CDFA B
<i>Arctotheca calendula</i>	Capeweed (fertile only)	Asteraceae	ARCA45	CDFA A
<i>Arrhenatherum elatius</i>	tall oatgrass	Poaceae	AREL3	not rated
<i>Asparagus asparagoides</i>	African asparagus fern	Liliaceae	ASAS4	not rated
<i>Asphodelus fistulosus</i>	onionweed	Liliaceae	ASF12	federal noxious
<i>Brachypodium sylvaticum</i>	slender false brome	Poaceae	BR5Y	CDFA A
<i>Buddleja davidii</i>	orange eye butterflybush	Buddlejaceae	BUDA2	not rated
<i>Cardaria pubescens</i>	globe-podded hoary cress	Brassicaceae	CAPU6	CDFA B
<i>Carduus acanthoides</i>	spiny plumeless thistle	Asteraceae	CAAC	CDFA A
<i>Carex pendula</i>	hanging sedge	Cyperaceae	CAPE45	not rated
<i>Carthamus leucocaulos</i>	whitestem distaff thistle	Asteraceae	CALE52	CDFA A
<i>Centaurea diffusa</i>	diffuse knapweed	Asteraceae	CEDI3	CDFA A
<i>Centaurea iberica</i>	Iberian knapweed	Asteraceae	CEIB	CDFA A
<i>Centaurea maculosa</i>	spotted knapweed	Asteraceae	CESTM	CDFA A
<i>Centaurea repens</i>	Russian knapweed	Asteraceae	ACRE3	CDFA B
<i>Centaurea sulphurea</i>	sulphur knapweed; Sicilian starthistle	Asteraceae	CESU	CDFA B
<i>Cestrum parqui</i>	Chilean jessamine	Solanaceae	CEPA9	not rated
<i>Chondrilla juncea</i>	rush skeletonweed	Asteraceae	CHJU	CDFA A
<i>Cirsium undulatum</i>	wavyleaf thistle	Asteraceae	CIUN	CDFA A
<i>Coprosma repens</i>	creeping mirrorplant	Rubiaceae	CORE4	not rated
<i>Crupina vulgaris</i>	common crupina	Asteraceae	CRVU2	CDFA A
<i>Cuscuta japonica</i>	Japanese dodder	Cuscutaceae	CUJA	CDFA A
<i>Cytisus striatus</i>	striated broom	Fabaceae	CYST7	not rated
<i>Danthonia pilosa</i>	hairy wallaby grass	Poaceae	RYPI	not rated
<i>Echium plantagineum</i>	salvation jane	Boraginaceae	ECPL	not rated
<i>Euphorbia esula</i>	leafy spurge	Euphorbiaceae	EUES	CDFA A
<i>Euphorbia terracina</i>	Geraldton carnation weed	Euphorbiaceae	EUTE10	CDFA Q
<i>Festuca pratensis</i>	meadow fescue	Poaceae	SCPR4	not rated
<i>Gaura drummondii</i>	Drummond's beeblossom	Onagraceae	GADR	CDFA B
<i>Gaura sinuata</i>	wavyleaf beeblossom	Onagraceae	GASI	CDFA B
<i>Gazania linearis</i>	treasureflower	Asteraceae	GALI4	not rated
<i>Gunnera tinctoria</i>	Chilean gunnera	Gunneraceae	GUTI	not rated
<i>Halimodendron halodendron</i>	common salttree	Fabaceae	HAHAB	CDFA A
<i>Helichrysum petiolare</i>	licorice-plant	Asteraceae	HEPE8	not rated
<i>Hypericum canariense</i>	Canary Island St. Johnswort	Hypericaceae	HYCA11	CDFA B

BAEDN EDRR Species list (continued)

Species Name	Common Name	Family	U.S. Department of Agriculture Code	California Department of Food and Agriculture (CDFA) or Federal Weed Rating
<i>Isatis tinctoria</i>	Dyer's woad	Brassicaceae	ISTI	CDFA B
<i>Lepidium campestre</i>	field pepperweed	Brassicaceae	LECA5	not rated
<i>Ligustrum lucidum</i>	glossy privet	Oleaceae	LILU2	not rated
<i>Ligustrum ovalifolium</i>	California privet	Oleaceae	LIOV	not rated
<i>Limonium ramosissimum</i>	Algerian sea lavender	Plumbaginaceae	LIRA2	not rated
<i>Linaria genitifolia ssp. dalmatica</i>	Dalmatian toadflax	Scrophulariaceae	LIDAD	CDFA A
<i>Linaria vulgaris</i>	butter and eggs	Scrophulariaceae	LIVU2	not rated
<i>Lonicera japonica</i>	Japanese honeysuckle	Caprifoliaceae	LOJA	not rated
<i>Lythrum salicaria</i>	purple loosestrife	Lythraceae	LYSA2	CDFA B
<i>Nassella formicarum/manicata</i>	tropical needlegrass	Poaceae	NAMA7	not rated
<i>Nassella tenuissima</i>	finestem needlegrass	Poaceae	NATE3	CDFA C
<i>Onopordum acanthium</i>	Scotch thistle	Asteraceae	ONAC	CDFA A
<i>Onopordum illyricum</i>	illyrian thistle	Asteraceae	ONIL	CDFA A
<i>Paspalum urvillei</i>	Vasey's grass	Poaceae	PAUR2	not rated
<i>Polygonum aubertii</i>	Bukhara fleecflower	Polygonaceae	POBA3	not rated
<i>Polygonum cuspidatum</i>	Japanese knotweed	Polygonaceae	POCU6	CDFA B
<i>Polygonum polystachyum</i>	cultivated knotweed	Polygonaceae	POPO5	CDFA B
<i>Pyracantha coccinea</i>	scarlet firethorn	Rosaceae	PYCO2	not rated
<i>Pyracantha crenulata</i>	Nepalese firethorn	Rosaceae	PYCR7	not rated
<i>Ricinus communis</i>	castorbean	Euphorbiaceae	RICO3	not rated
<i>Rubus laciniatus</i>	cutleaf blackberry	Rosaceae	RULA	not rated
<i>Rumex dentatus</i>	toothed dock	Polygonaceae	RUDE3	not rated
<i>Saccharum ravennae</i>	ravennagrass	Poaceae	SARA3	not rated
<i>Sapium sebiferum</i>	Chinese tallowtree	Euphorbiaceae	TRSE6	not rated
<i>Scolymus hispanicus</i>	goldenthistle	Asteraceae	SCHI	CDFA A
<i>Senecio jacobaea</i>	tansy ragwort; stinking willie	Asteraceae	SEJA	CDFA B
<i>Senna multiglandulosa</i>	glandular senna	Fabaceae	SEMU14	not rated
<i>Sesbania punicea</i>	red sesbania; rattlebox	Fabaceae	SEPU7	CDFA B
<i>Solanum carolinense</i>	Carolina horsenettle	Solanaceae	SOCA3	CDFA B
<i>Solanum rostratum</i>	buffalobur nightshade	Solanaceae	SORO	not rated
<i>Spartina alterniflora (hybrids)</i>	hybrid smooth cord grass	Poaceae	SPAL	CDFA B
<i>Spartina densiflora</i>	denseflower cordgrass	Poaceae	SPDE2	CDFA B
<i>Spartina patens</i>	saltmeadow cordgrass	Poaceae	SPPA	CDFA B

This Early Detection & Rapid Response (EDRR) Target Species List presents 73 plant species that are the current focus of detection and eradication efforts for Bay Area Early Detection Network (BAEDN) partners.



Weeds of the Watershed

Calflora - Search for Plants - Windows Internet Explorer

http://www.calflora.org

File Edit View Favorites Tools Help

Calflora - Search for Plants

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

Help Support Calflora

Calflora

Search for Plants

Common Names: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
Scientific Names: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
Family Names: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

plant name NAME WIZARD

Enter part of a name, scientific or common:
dandelion, Delphinium, or Dryopteridaceae

county (multiple)

lifeform All plants
 Ferns & Relatives
 Grass & Grass-like plants
 Annual Wildflowers
 Perennial Wildflowers
 Shrubs
 Trees

native / non-native All plants
 Plants native to California
 Plants not native to California
 Cal-IPC Invasive Plants

rarity All plants
 Rare plants
 Non-rare plants
 ...with an affinity to serpentine soil

elevation below feet, above feet

plant community any
Coastal Strand
Coastal Salt Marsh
Freshwater Wetlands
Northern Coastal Scrub

result format No photos Species names in plain text Order by taxon

SEARCH TIPS

My Calflora

About Calflora

Observation Library

Plant Name Library

Places to view Native Plants

What Grows Here?

NRCS California eVegGade

Add Observations

Data Contributor Hall of Fame

REGISTER

Calflora • 1700 Shattuck Av #198, Berkeley, CA 94709 • 510.528-5425 • CONTACT



Weeds of the Watershed

Calflora: What Grows Here - Windows Internet Explorer

http://www.calflora.org/app/wgh?page=entry

File Edit View Favorites Tools Help

Calflora: What Grows Here

Calflora
What Grows Here

What grows in my

- Town
- Zip Code
- County
- Watershed
- Park, Reserve or Open Space
- Named Location
- Quadrangle
- I will pick the location on a map

Go

starting in any county

- any
- Alameda
- Alpine
- Amador
- Butte
- Calaveras
- Contra Costa
- Colusa
- Del Norte
- El Dorado
- Fresno
- Glen
- Humboldt
- Imperial
- Inyo
- Kings
- Kern
- Lake
- Lassen
- Los Angeles
- Madera
- Mariposa**
- Mariposa
- Merced
- Merced
- Monterey
- Modoc
- Napa
- Nevada

About What Grows Here • FAQ • Find a Location in California • About the Map Viewer • Contributing Observations

Done

Internet 100%



Weeds of the Watershed

Calflora: What Grows Here Detail - Marin County - Windows Internet Explorer

http://www.calflora.org/app/wgh?npom=w&page=detail&cc=MRN&pomi=2201.1&pom=w&wsd=c&submit=t&cx=122.7506&cy=38.1131&nwsd=c&pomia=2201.120104&s=2.0&

File Edit View Favorites Tools Help

Calflora: What Grows Here Detail - Marin County

Calflora What Grows Here

WATERSHEDS: Tomales Bay 2201.1

Marin County 38.1131, -122.7506

About this Watershed

Watershed Resolution: Mouse over the map to see watershed names - Click to select a watershed. Drag to re-position the map.

San Francisco Bay
Marin Coastal
Tomales Bay
Point Reyes
Bolinas

Map Attributes

Zoom	Relief	Roads	Names
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> Towns
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/> Streams
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Mountains

Plant Selection

Within entire map selected watershed

Status: Lifeform:

Community:

Genus:


Output: Group by:

Minimum observation count:

[search for plants](#)

Points indicate observations - Mouse over or click points for observation details.

Found 279 plants in the selected watershed (632 points). Many of these records are provided by the participants of the Consortium of California Herbaria (CCH).

Scientific Names / Common Names	Nativity / Lifeform	Photo	Observations - click for details
Acacia dealbata silver wattle	not native, WEED Tree, Shrub		2 from CCH



Weeds of the Watershed

- Thistles (★ ★ , distaff, plumeless, Italian, milk, bull; teasel; natives)
- Jubata grass, panic veldtgrass, beachgrass
- Brooms (French, Scotch, Spanish); gorse
- “Everywhere” weeds: geraniums/filarees; mustards/radishes; annual grasses
- Vines and groundcovers: periwinkle, English and cape ivy, iceplants
- Early detection/eradication targets: purple loosestrife, Chilean gunnera, giant plumeless thistle, butterfly bush



Impacts (Definitions)

Competition: The mutual struggle of two or more plants for some growth factor (water, light, or nutrients) that has become limiting (i.e. in short supply)

Allelopathy: The inhibition of the growth of nearby plants through the production of biological toxins by another plant

Interference: The total impact of one plant on another (competition + allelopathy)



Factors Influencing Competition

1-Timing of Weed emergence

a- first plants established have advantage

b- competition greatest against young plants

2-Growth form / physiology of the weed

a- extent of root development

b- height

c- leaf area

d- amount of branching

e- plant growth rate (C3,C4, etc)

f- environmental tolerance (drought, cold, heat, shade)

3-Density of the Weeds

> Weed density = > Effect on crop



Allelopathy

Reduces the development of sensitive plants more than is normally expected from just competition for water, light, and nutrients.

Examples:

Black Walnut

Tree of Heaven

Crabgrass

Johnsongrass

Yellow Nutsedge

Canada Thistle

Sunflower

Acacia

Russian Knapweed

(At least 80 other genera)



Results of Interference

- Death of desirable plants (especially young seedlings)
- Vigor and yield of surviving plants are drastically reduced.
- Weakened plants become more vulnerable to disease, winter damage, drought, etc.



Other Impacts of Weeds

- Loss of land value (forage, habitat, scenery)
- Altered wildlife population levels and associated impacts (prey/predator, pollinator, seed-eaters)
- Altered fire dynamics
- Altered soil characteristics: water, nutrients and cycling
- Finding more impacts every time we look...



French broom increases fuel load and need for maintenance, alters soil chemistry



Jimfbleak

Butterfly bush, commonly planted for butterflies, invades riparian areas



Purple starthistle decreases pasture and grassland value



Steve Kroiss/WUSTL

Deer mouse eating endangered lupine because of European beachgrass



UGA1380419

**Periwinkle
decreases
riparian
habitat
structure
and value**



Invasive Spartina Project

Invasive cordgrass changes tidal flow and shore height



Stan Shebs

**Chilean gunnera is a huge
problem in New Zealand—will it
be one here? Why wait to find
out?**



Weed Introduction

- Are there other plants of this species nearby?
- Did you import mulch or compost (or fill dirt) from another area?
- Is there bare ground, or an open canopy?
- Is your mowing regime encouraging spread?
- Are birds perching and dropping weed seeds?
- Did you plant it?
- Other reasons?



Weed ID Basics

- Use a weed book. “Weeds of the West” is not very inclusive, but “Weeds of California” is amazing (and expensive)! Several Bay Area floras also include weeds.
- Grab a pamphlet. Local Weed Management Areas have pamphlets with weeds of your area.
- Go online. The third URL below is an online identification tool for most California weeds.
- Grab a sample. If you take a specimen (preferably a whole flowering plant with roots intact) down to your County Ag or Extension (in Marin, both in Novato) they will identify it for you.



Useful California Weed Websites

- http://www.cdfa.ca.gov/phpps/ipc/encycloweedia/encycloweedia_hp.htm
- <http://wric.ucdavis.edu/>
- <http://weedid.wisc.edu/ca/weedid.php>
- <http://www.cal-ipc.org/>
- <http://calphotos.berkeley.edu/flora/>
- <http://baedn.org/>