

The development & refinement of a Plant Risk Evaluation (PRE) tool for assessing the invasive potential of ornamental plants

Christiana Conser & Joseph DiTomaso

University of California, Davis, Dept. of Plant Sciences

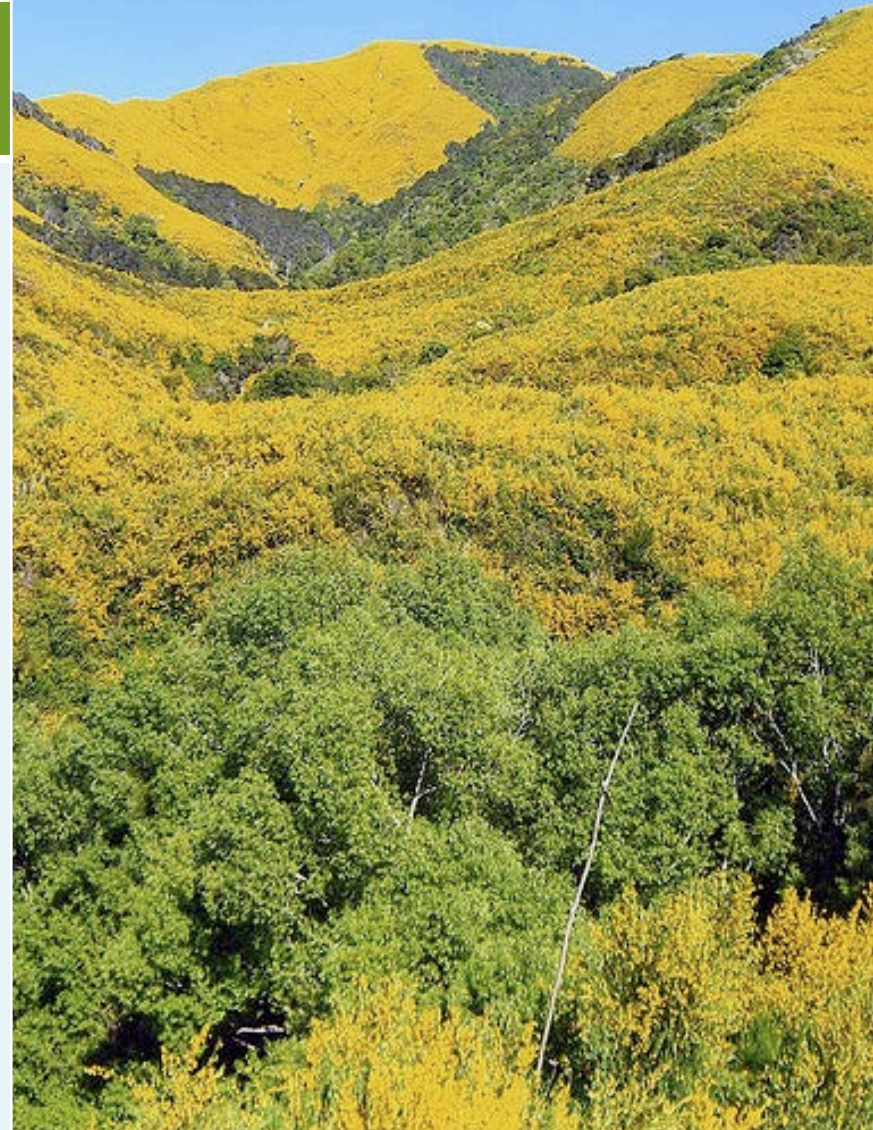


2014 Cal-IPC Symposium
October 10, 2014



Objective

Use a science-based and systematic process to develop a highly accurate Plant Risk Evaluation tool (PRE) for screening ornamental plants as part of a *prevention strategy*

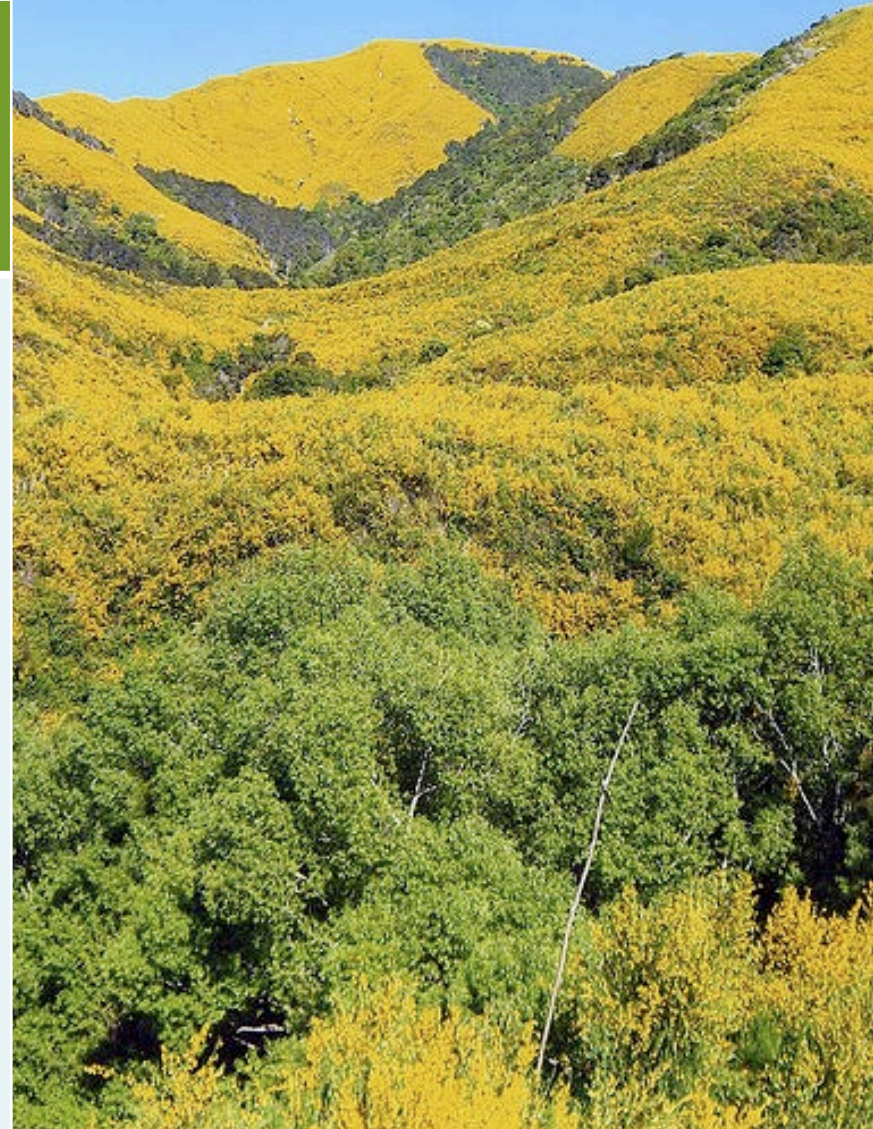


PRE Features for ornamental plants

Accuracy	<ul style="list-style-type: none">• 95% > for non-invasive
Regionality	<ul style="list-style-type: none">• Evaluates risk for any region
Screening specificity	<ul style="list-style-type: none">• Species (Wildtype) or Subspecies (Cultivars/Hybrids)
Sterility	<ul style="list-style-type: none">• Sterile & Non-sterile Species
Prevention	<ul style="list-style-type: none">• Early in R&D
Rapid screenings	<ul style="list-style-type: none">• Quick results
Lag Phase	<ul style="list-style-type: none">• Updated when new info available


Weed Risk Assessment

A systematic process that uses available evidence to estimate the risk of a plant species becoming invasive in a given region



Types of Questions

- Taxonomy
- Cultivar Names
- Global & Regional Invasive History
- Climate Match
- Difficulty of Control
- Environmental Impacts
- Reproduction
- Dispersal
- Growth

PLANT RIGHT Seebacher Weed Risk Assessment (WRA) form for comparison tests (not for distribution) 

Section A) Evaluator Info		Section B) Grower Info	
Evaluator's Name:	Christiana Conser	Grower's Name:	n/a
Affiliation:	Sustainable Conservation	Title:	n/a
Telephone:	415-977-0380	Company:	n/a
Email:	cconser@suscon.org	Telephone:	n/a
Date of Evaluation:	3/3/2011	Email:	n/a
Evaluation Time (hrs):	9:25 AM to 9:51 AM = 26 minutes	Address:	n/a

Section C) Plant Taxonomic Info:	Answer	Confidence Level (1-10)	Source(s) of Information
Scientific Name (Genus + species):	<i>Carpobrotus edulis</i>	9	Tropicos
Synonyms (list any):	<i>Carpobrotus edule</i> , <i>Mesembryanthemum edule</i>	9	Tropicos
Common Name(s):	Highway iceplant, hottentot-fig, freeway iceplant, sea-fig	-	Weeds of California and Other Western States
Family:	Aizoaceae	9	Tropicos
Variety/Cultivar:	Unknown	-	-
Are there other varieties or cultivars, how many?	<i>C. edulis</i> var. <i>chrysophthalmus</i> , <i>C. edulis</i> subsp. <i>flaviflorus</i>	9	Tropicos

Section D) Plant Pre-screening Info:	Answer	Confidence Level (1-10)	Source/Notes/Comments
Has the taxon been assessed with WRA in California or in the biogeographical region?	Yes	9	CISAC, Cal-IPC
Is the taxon on an established invasive plant or noxious weed list for California?	Yes	9	CISAC, Cal-IPC
What plant materials are being evaluated? (seeds, tissue cultures, whole plants, cuttings or bulbs):	Plant	-	-
What country or region is the plant material from?	Unknown	-	-
What is the plant's native country or range?	Native to South Africa	9	Weeds of California and Other Western States
Is the plant present in California?	Yes-naturalized throughout coastal CA, Channel Islands, mostly to 100m.	9	Weeds of California and Other Western States
Is the plant commercially available in California?	Yes	9	Sunset Western Garden Book

4) Impacts on Native Plants/Animals					
5g) Length of flowering - Seed production continues for more than 3 months each year? (or more than one time per year)	Y	1	Weeds of California and Other Western States	9	Flowers from April to October, so year-round, but peaks in spring.

- **Koop et al. 2011**
- **Pheloung et al. 1999**
- **Caley & Kuhnert 2006**
- **Reichard 2001**
- **Virtue et al. 2008**

Literature Review

- Primary research
- Books
- Online DBs
- Fact Sheets



PLYMPT RIGHT Sustainable Conservation

Seebacher Weed Risk Assessment (WRA) form for comparison tests (not for distribution)

Section A) Evaluator Info		Section B) Grower Info	
Evaluator's Name:	Christiana Conser	Grower's Name:	n/a
Affiliation:	Sustainable Conservation	Title:	n/a
Telephone:	415-977-0380	Company:	n/a
Email:	cconser@suscon.org	Telephone:	n/a
Date of Evaluation:	3/3/2011	Email:	n/a
Evaluation Time (hrs):	9:25 AM to 9:51 AM = 26 minutes	Address:	n/a

Section C) Plant Taxonomic Info:	Answer	Confidence Level (1-10)	Source(s) of Information
Scientific Name (Genus + species):	<i>Carpobrotus edulis</i>	9	Tropicos
Synonyms (list any):	<i>Carpobrotus edule</i> , <i>Mesembryanthemum edule</i>	9	Tropicos
Common Name(s):	Highway iceplant, hottentot-fig, freeway iceplant, sea-fig		Weeds of California and Other Western States
Family:	Aizoaceae	9	Tropicos
Variety/Cultivar:	Unknown	-	-
Are there other varieties or cultivars, how many:	<i>C. edulis</i> var. <i>chrysophthalmus</i> , <i>C. edulis</i> subsp. <i>parviflorus</i>	9	Tropicos

Section D) Plant Pre-screening Info:	Answer	Confidence Level (1-10)	Source/Notes/Comments
Has the taxon been assessed with WRA in California or in the biogeographical region?	Yes	9	CISAC, Cal-IPC
Is the taxon on an established invasive plant or noxious weed list for California?	Yes	9	CISAC, Cal-IPC
What plant materials are being evaluated? (seeds, tissue cultures, whole plants, cuttings or bulbs)	Plant	-	-
What country or region is the plant material from?	Unknown	-	-
What is the plant's native country or range?	Native to South Africa	9	Weeds of California and Other Western States
Is the plant present in California?	Yes-naturalized throughout coastal CA, Channel Islands, mostly to 100m.	9	Weeds of California and Other Western States
Is the plant commercially available in California?	Yes	9	Sunset Western Garden Book

4) Impacts on Native Plants/Animals					
Eg) Length of flowering - Seed production continues for more than 3 months each year? (or more than one time per year)	Y	1	Weeds of California and Other Western States	9	Flowers from April to October, sometimes year-round, but peaks in spring.

Question

Which questions are most appropriate and highly predictable for ornamental plants?



WRA's Evaluated

- USDA-APHIS
(Koop et al. 2011)
- Australian AQIS (Pheloung et al. 1999)
- Australian-trees
(Caley & Kuhnert 2006)
- General WRA
(Reichard 2001)
- Australian Botanic Gardens
(Virtue et al. 2008)

Section A) Evaluator Info		Section B) Grower Info	
Evaluator's Name:	Christiana Conser	Grower's Name:	n/a
Affiliation:	Sustainable Conservation	Title:	n/a
Telephone:	415-977-0380	Company:	n/a
Email:	cconser@suscon.org	Telephone:	n/a
Date of Evaluation:	3/3/2011	Email:	n/a
Evaluation Time (hrs):	9:25 AM to 9:51 AM = 26 minutes	Address:	n/a
Section C) Plant Taxonomic Info:		Answer	Confidence Level (1-10)
Scientific Name (Genus + species):		<i>Carpobrotus edulis</i>	9
			Tropicos

Q Predictability

Screen Species

- IP
- non-IP

Data Analysis

- Score ranges
- % Q answered

Q Elimination Criteria

- Fischer's (two-tailed) $P < 0.05$
- Answered < 20%
- Irrelevant/Biased

Result

- Remove non-predictive Q's

Section A) Evaluator Info		Section B) Grower Info		
Evaluator's Name:	Christiana Conser	Grower's Name:	n/a	
Affiliation:	Sustainable Conservation	Title:	n/a	
Telephone:	415-977-0380	Company:	n/a	
Email:	cconser@suscon.org	Telephone:	n/a	
Date of Evaluation:	3/3/2011	Email:	n/a	
Evaluation Time (hrs):	9:25 AM to 9:51 AM = 26 minutes	Address:	n/a	
Section C) Plant Taxonomic Info:		Answer	Confidence Level (1-10)	Source(s) of Information
Scientific Name (Genus + species):		<i>Carpobrotus edulis</i>	9	Tropicos

PRE Tool Accuracy

Screen Species

- IP
- non-IP

Data Analysis

- Score ranges
- % of Q answered
- Fischer's Exact Test (two-tailed)

Tool Performance

- Misclassification (false +/-)
- Accuracy
- Sensitivity/Specificity

RESULTS

Section A) Evaluator Info		Section B) Grower Info	
Evaluator's Name:	Christiana Conser	Grower's Name:	n/a
Affiliation:	Sustainable Conservation	Title:	n/a
Telephone:	415-977-0380	Company:	n/a
		Telephone:	n/a

56Q Predictability

**Screen 35
Species**

- 21 IP
- 14 non-IP

- Cal-IPC
- Plant-Right

**Data
Analysis**

- Score ranges
- % Q answered

- IP 21-44
- Non-IP 5-14
- Range 5-100%

**Q
Elimination**

- Fischer's $P < 0.05$
- Answered < 20%
- Irrelevant/Biased

- Removed 27 Q's

Result

Reduced from 56Q > 29 Q

RESULTS

Section A) Evaluator Info		Section B) Grower Info		
Evaluator's Name:	Christiana Conser	Grower's Name:	n/a	
Affiliation:	Sustainable Conservation	Title:	n/a	
Telephone:	415-977-0380	Company:	n/a	
Email:	cconser@suscon.org	Telephone:	n/a	
Date of Evaluation:	3/3/2011	Email:	n/a	
Evaluation Time (hrs):	9:25 AM to 9:51 AM = 26 minutes	Address:	n/a	
Section C) Plant Taxonomic Info:		Answer	Confidence Level (1-10)	Source(s) of Information
Scientific Name (Genus + species):	<i>Carpobrotus edulis</i>		9	Tropicos
Synonyms (list any):	<i>Carpobrotus edule</i> , <i>Mesembryanthemum edule</i>		9	Tropicos
Common Name(s):	Highway iceplant, hottentot-fig, freeway iceplant, sea-fig			Weeds of California and Other Western States
Family:	Aizoaceae		9	Tropicos

19-Q PRE Tool Accuracy

Screen 94
Species

- 57 IP
- 47 non-IP
- Score ranges
- % of Q answered
- Fischer's

- Cal-IPC
- Plant-Right
- IP 12-21
- Non-IP 2-13
- Range 54-100%
- Avg 97%
- 16 Q w/ $P > 0.05$

RESULTS

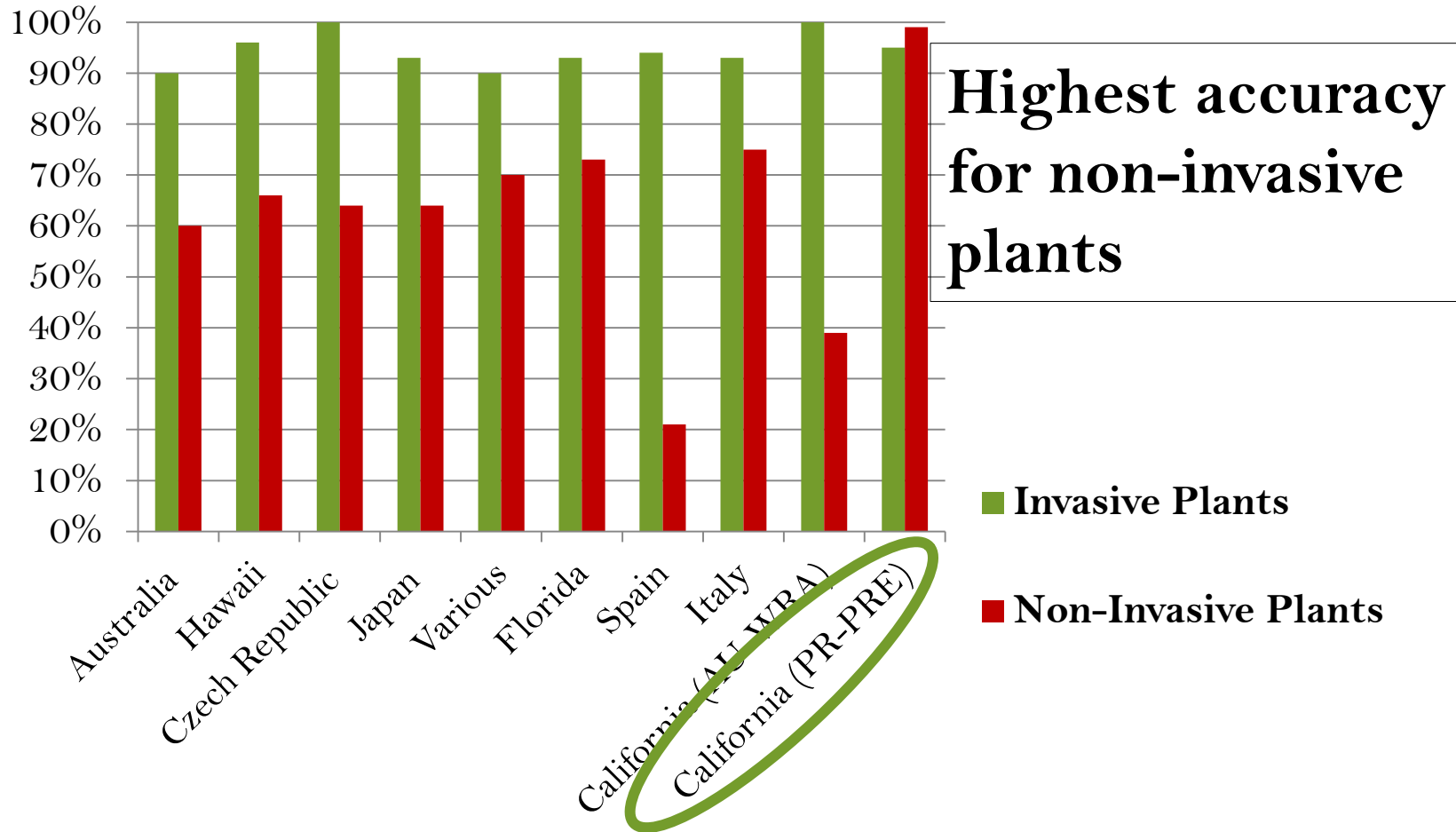
Section A) Evaluator Info		Section B) Grower Info		
Evaluator's Name:	Christiana Conser	Grower's Name:	n/a	
Affiliation:	Sustainable Conservation	Title:	n/a	
Telephone:	415-977-0380	Company:	n/a	
Email:	cconser@suscon.org	Telephone:	n/a	
Date of Evaluation:	3/3/2011	Email:	n/a	
Evaluation Time (hrs):	9:25 AM to 9:51 AM = 26 minutes	Address:	n/a	
Section C) Plant Taxonomic Info:		Answer	Confidence Level (1-10)	Source(s) of Information
Scientific Name (Genus - species):		<i>Caryophytus aralis</i>	9	Tropicos

Tool Performance

	w/EF		w/o EF	
	<u>IP</u>	<u>Non-IP</u>	<u>IP</u>	<u>Non-IP</u>
True +	53	-	53	-
True -	-	36	-	36
False +	-	1	-	0
False -	4	-	0	-
Accuracy	93%	97%	100%	100%

RESULTS

Global Comparison – PRE vs. WRA



CONCLUSIONS

Section A) Evaluator Info		Section B) Grower Info	
Evaluator's Name:	Christiana Conser	Grower's Name:	n/a
Affiliation:	Sustainable Conservation	Title:	n/a
Telephone:	415-977-0380	Company:	n/a
Email:	cconser@suscon.org	Telephone:	n/a
Date of Evaluation:	3/3/2011	Email:	n/a
Evaluation Time (hrs):	9:25 AM to 9:51 AM = 26 minutes	Address:	n/a
Section C) Plant Taxonomic Info:	Answer	Confidence Level (1-10)	Source(s) of Information
Scientific Name (Genus + species):	<i>Carpobrotus edulis</i>	9	Tropicos
Synonyms (list any):	<i>Carpobrotus edule</i> , <i>Mesembryanthemum edule</i>	9	Tropicos
Common Name(s):	Highway iceplant, hottentot-fig, freeway iceplant, sea-fig		Weeds of California and Other Western States
Family:	Aizoaceae	9	Tropicos
Variety/Cultivar:	Unknown	-	-
Are there other varieties or cultivars, how many:	<i>C. edulis</i> var. <i>chrysophthalmus</i> , <i>C. edulis</i> subsp. <i>parviflorus</i>	9	Tropicos
Section D) Plant Pre-screening Info:	Answer	Confidence Level (1-10)	Source/Notes/Comments

PRE Benefits for Nursery Industry

- Accurate for screening ornamentals for invasive risk
- Additional useful plant information (taxonomy, reproduction, ethnobotany, patents)
- Most potential introductions are low risk

NEXT STEPS

Section A) Evaluator Info		Section B) Grower Info	
Evaluator's Name:	Christiana Conser	Grower's Name:	n/a
Affiliation:	Sustainable Conservation	Title:	n/a
Telephone:	415-977-0380	Company:	n/a
Email:	cconser@suscon.org	Telephone:	n/a

bluffs,

PlantRight PRE

- PLOS One publication submission
- Beta-test PRE for national & international deployment
- Convert to web-based process & database
- Climate modeling for more regional accuracy
- Develop abbreviated “Rapid Screening” tool to screen bulk inventories

Collaborators

Christiana Conser	UC Davis, Dept. of Plant Sciences
Lizbeth Seebacher	Washington Dept. of Ecology
Sarah Reichard	UW, College of Forest Resources
Joseph M. DiTomaso	UC Davis, Dept. of Plant Sciences

PRE Screeners

Christiana Conser	UC Davis, Dept. of Plant Sciences
Lizbeth Seebacher	Washington Dept. of Ecology
Rachel Brownsey	UC Davis, Dept. of Plant Sciences
Kristina Wolf	UC Davis, Dept. of Plant Sciences
Casey Erickson	UC Davis, Dept. of Plant Sciences
John Short	UC Davis, Dept. of Plant Sciences



University of Washington
BOTANIC GARDENS

QUESTIONS?

Section A) Evaluator Info		Section B) Grower Info		
Evaluator's Name:	Christiana Conser	Grower's Name:	n/a	
Affiliation:	Sustainable Conservation	Title:	n/a	
Telephone:	415-977-0380	Company:	n/a	
Email:	cconser@suscon.org	Telephone:	n/a	
Date of Evaluation:	3/3/2011	Email:	n/a	
Evaluation Time (hrs):	9:25 AM to 9:51 AM = 26 minutes	Address:	n/a	
Section C) Plant Taxonomic Info:		Answer	Confidence Level (1-10)	Source(s) of Information
Scientific Name (Genus + species):	<i>Carpobrotus edulis</i>		9	Tropicos
Synonyms (list any):	<i>Carpobrotus edule</i> , <i>Mesembryanthemum edule</i>		9	Tropicos
Common Name(s):	Highway iceplant, hottentot-fig, freeway iceplant, sea-fig			Weeds of California and Other Western States
Family:	Alzooaceae		9	Tropicos
Variety/Cultivar:	Unknown		-	-
	<i>C. edulis</i> var. <i>chrysanthalmus</i> , <i>C. edulis</i>		-	-

Funding

Sustainable Conservation

PlantRight program

University of California

Agriculture and Natural Resources Division (UCANR)

American Hort

Horticultural Research Institute (HRI)

