Assessing emerging invasive plants in California

Elizabeth Brusati [1,2], Mona Robison[3], Doug Johnson[1], and Dana Morawitz[1]. [1]California Invasive Plant Council, Berkeley, CA; [2]Current address: California Dept. of Fish and Wildlife, Sacramento, CA, Elizabeth.brusati@wildlife.ca.gov; [3]California Botany, Sacramento, CA, mona@calbotany.com

INTRODUCTION

Which non-native plants in California wildlands have the most potential to cause harm to our ecosystems in the future? Cal-IPC aims to answer this question by evaluating 200 species from the Cal-IPC Watchlist to develop a list of "Potentially Invasive" plants. Not all non-native, naturalized plants will become invasive; this project will identify those that pose the highest risk to help land managers prioritize their removal.

Currently, listing in Cal-IPC's Inventory is based on assessing known impacts in California. The Inventory and its Plant Assessment Form (PAF) do not predict potential future impact of non-native plants not already having an impact. The Inventory contains approximately 200 species. In addition, the informal Cal-IPC Watchlist contains another 300 species that land managers have reported as potential concerns from their observations. This project assessed which Watchlist species have the highest risk of becoming invasive in California.

We used the PRE (Plant Risk Evaluation) tool developed by UC Davis, the University of Washington, and PlantRight (Conser et al. 2015) to screen 202 Watchlist species. PRE uses 20 questions assessing invasiveness in other regions, impacts, reproductive biology, and dispersal characteristics to classify a species as "Reject" (high risk to become invasive in California) or "Accept" (low risk) (Table 1). An intermediate category of "Evaluate Further" indicates species whose results are uncertain. PRE is a shorter, faster screening method derived from the 49-question Australian Weed Risk Assessment that has been used around the globe since 1999. PRE was developed to help the horticulture industry identify new cultivars that are likely to become invasive in order to avoid those plants. Tests have shown that PRE is 95% accurate at classifying species as invasive or non-invasive (Conser et al. 2015). Cal-IPC's project expands the application of PRE to non-horticultural species.

Taro (*Colocasia esculenta*) is spreading in the Delta and Chinese pistache (*Pistachia chinensis*) may be spread by wildlife. Both were assessed by PRE.

Table 1: PRE Questions and Values
Questions are answered "Yes" or "No" for full points or zero points. Unanswered questions do not count towards the final score. 16 questions (80%) must be answered for a valid score.

Q#	Question	Points
1)	Has the species (or cultivar or variety, if applicable) become naturalized where it is not native?	1
2)	Is the species noted as being naturalized in the US or world in a similar climate?	2
3)	Is the species noted as being invasive elsewhere in the U.S. or world?	2
4)	Is the species noted as being invasive elsewhere in the US or world in a similar climate?	3
5)	Are other species of the same genus (or very closely related genera that may have been within the same genus at one time) invasive species in other areas with a similar climate?	1
6)	Is the species found predominantly in a climate matching those within the region of consideration?	2
7)	Does this plant displace native plants and dominate (overtop or smother) the plant community in areas where it has established?	1
8)	Is the plant noted as promoting fire and/or changing fire regimes?	1
9)	Is the plant a health risk to humans or animals/fish? Has the species been noted as impacting grazing systems?	1
10)	Does the plant produce impenetrable thickets, blocking or slowing movement of animals, livestock, or humans?	1
11)	Does this species reproduce and spread vegetatively?	1
12)	Are naturally detached fragments from this plant capable of producing new plants?	1
13)	Does the species produce viable seed?	1
14)	Does this plant produce copious viable seeds each year (>1000)?	1
15)	Does this plant produce seeds in which there is significant germination (>25%) the next growing season, as opposed to species that require an infrequent environmental condition to germinate (e.g., fire) or the bulk of the seed requires a long dormancy period before it can germinate?	1
16)	Does this plant produce viable seed within the first three years (herbaceous) to five years (woody) after germination?	1
17)	Does this plant produce seed for >3 months each year or does seed production occur more than one a year?	1
18)	Are the plant's propagules dispersed long distance (>100 m) by mammals or birds or via domestic animals?	1
19)	Are the plant's propagules frequently dispersed long distance (>100 m) by wind or water?	1
20)	Are the plant's propagules frequently dispersed via contaminated seed (agriculture or wildflower packets), equipment, vehicles, boats or clothing/shoes?	1
	Total points	25

Ratings
< 13 pts = Accept (low risk of invasiveness)   13 – 15 pts = Evaluate Further   > 15 pts = Reject (high risk of invasiveness)

Figure 1. Examples of answers for butterfly bush (*Buddleja davidii*) PRE.

Butterfly bush is a serious problem in riparian areas of Washington and Oregon and has begun spreading in several areas in coastal California. *Photo: Tim Miller, King Co., Washington*

METHODS

We chose 202 plant species to evaluate from the Cal-IPC Watchlist, prioritizing species that are present in ≤10 counties in California based on the Calflora Database (www.calflora.org), since these are more feasible to control than widespread plants. A few species, such as *Alyssum murale* (yellowtuft alyssum), are not yet in California but were chosen because they are serious problems in adjacent states.

We provided screeners with detailed instructions on how to interpret questions in order to maintain consistency. The instructions listed which questions should default to a "No" answer when information was lacking and which should be left unanswered. At least 16 questions (80%) must be answered for a valid score. Screeners based their answers on scientific literature, unpublished reports, and online databases, and cited all references. While scoring each question, screeners also rated their level of confidence in the answer. A technical advisory committee reviewed draft evaluations and resolved questions.

Several PRE questions refer to regions "with similar climate to California." To develop a consistent method for these questions, we consulted with the US Department of Agriculture's weed risk assessment staff and developed a variation on their method. Global locations are classified based on three factors: USDA Plant Hardiness zones, average annual precipitation, and Global Ecological Zones (from the United Nations). Regions that count as similar to California must have a combination of those three factors that match a combination found within California. Screeners were provided with maps that defined "similar" regions for the purpose of this project.

Figure 2. Regions with climate similar to California (green shading) based on USDA Plant Hardiness zones, average annual precipitation, and Global Ecological Zones.
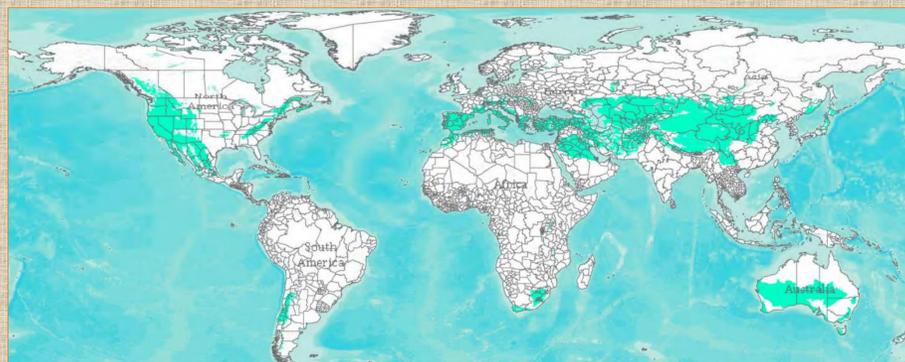
RESULTS AND CONCLUSIONS

A summary of results for the 202 species assessed are shown in Table 2. (See our handout for completed PREs so far). These represent preliminary results and may change after the public comment period. It should be noted that these are not a random sample of non-native or even naturalized plants in California; many are already showing invasive tendencies. Therefore, our results should not be used to estimate the proportion of non-native plants that are high-risk for invasiveness.

Table 2.

PRE Result	# spp.
Reject (high risk)	90
Evaluate Further	45
Accept (low risk)	67
Total	**202**

Garlic mustard (*Alliaria petiolata*)

Cal-IPC will make evaluations available for public comment in early 2017. Once results are finalized, species determined to be high risk will be added to the Cal-IPC Inventory in a new "Potentially Invasive" category.

The results of this project will help land managers prioritize species for control and provide data to inform conversations with the horticultural community about avoiding invasive plants in landscaping. The detailed information and references within the PREs provide justification for calling a species invasive and transparency about which aspects of a plant's biology or invasion history contribute to the final score. Species that end as "Evaluate Further" should be examined in more detail. Cal-IPC will also publicize the PRE process to other invasive plant councils (IPCs), encouraging them to conduct their own evaluations. While many IPCs have lists of invasive plants, and some list potential invasive species, we know of none that have completed an extensive evaluation such as PRE.

Chrysanthemoides monilifera (bitou bush)
PRE Score = 19 (Reject)

Tradescantia fluminensis (spiderwort)
PRE Score = 15 (Evaluate Further)

Onopordum tauricum (Taurian thistle)
PRE Score = 14 (Evaluate Further)

Brassica oleracea (cabbage)
PRE Score = 7 (Accept)

LITERATURE CITED
Brusati E., D. Johnson, and J. M. DiTomaso. 2014. Predicting invasive plants in California. *California Agriculture*. 68(3):89-95.

Conser C., L. Seebacher, D. W. Fujino, S. Reichard, and J. M. DiTomaso. 2015. The development of a Plant Risk Evaluation (PRE) tool for assessing the invasive potential of ornamental plants. *PLoS ONE* 10(3): e0121053.

Pheloung ,P. C., P. A. Williams, S. R. Halloy. 1999. A weed risk assessment model for use as a biosecurity tool evaluating plant introductions. *Journal of Environmental Management*. 57: 239–251.