

A Plant Risk Evaluation Tool for Assessing the Invasive Potential of Ornamental Plants[©]

Christiana Conser and Joseph M. DiTomaso
 University of California, Davis, Department of Plant Sciences, 209 Robbins Hall, MS-4,
 Davis, California 95616, USA
 Email: jmditomaso@ucdavis.edu

Weed Risk Assessment (WRA) methods for evaluating invasiveness in plants have evolved rapidly in the last two decades, but none were specifically designed to screen ornamental plants prior to being released into the landscape. For a WRA tool to be accepted as an evaluation tool by the nursery industry, it must be able to accurately predict non-invasiveness without falsely categorized them as invasive. We used a science-based and systematic process to develop a new Plant Risk Evaluation (PRE) tool for screening ornamental plants as part of a prevention strategy. The final PRE tool included 19 questions, which was narrowed down from 56 original questions obtained from other existing WRA tools. We evaluated the 56 WRA questions by screening 21 known invasive and 14 known non-invasive ornamental plants. After statistically comparing the predictability of each question and the frequency the question could be answered for both invasive and non-invasive species, we eliminated questions that provided no predictive power, were irrelevant in our current model, or could not be answered reliably at a high enough percentage. We also combined many similar questions. The 19 question PRE tool was further evaluated for accuracy using 57 additional known invasive and 37 known non-invasive ornamental plant species. The resulting evaluation demonstrated that when “needs further evaluation” classifications were not included, the accuracy of the model was 100% for both predicting invasiveness and non-invasiveness. When “needs further evaluation” classifications were included as either false positive or false negative, the model was still 93% accurate in predicting invasiveness and 97% accurate in predicting non-invasiveness, with an overall accuracy of 95%. We conclude that our new PRE tool (Table 1) should provide growers with a method to accurately screen their current stock and potential new introductions. It is our hope that the tool will be accepted for use by the industry as the basis for a nursery certification program.

Table 1. PRE tool questions and their statistical predictability in separating known invasive and non-invasive species. Fisher's Exact Test compared the 57 invasive species against the 37 non-invasive species for each question. Percent of each question (Q) answered is also included. Brackets after question indicate citation were question is included in WRA model. From Conser et al. (2015). PLOS ONE (in press).

#	Question in PRE tool	Fisher's exact test (2-tail)	% Q was answered for invasive plants	% Q was answered for non-invasive plants	Point values Yes/No
1	Has the species become naturalized where it is not native?	$P < 0.0001$	100	100	1/0
2	Is the species noted as being invasive elsewhere in the US or world?	$P < 0.0001$	100	100	2/0
3	Is the species noted as being invasive elsewhere in the US or world in a similar climate?	$P < 0.0001$	100	100	3/0
4	Are other species of the same genus invasive in other areas with a similar climate?	$P < 0.0001$	100	100	1/0

Table 1. Continued.

#	Question in PRE tool	Fisher's exact test (2-tail)	% Q was answered for invasive plants	% Q was answered for non-invasive plants	Point values Yes/No
5	Is the species found predominately in a climate that matches those within the region of introduction?	-	96	100	2/0
6	Dominates in areas this species has already invaded (displaces natives). Can overtop and/or smother surrounding vegetation.	$P<0.0001$	100	100	1/0
7	Is the plant noted as being highly flammable and/or promotes fire and/or changes fire regimes?	$P<0.0001$	79	97	1/0
8	Is the plant a health risk to humans or animals/fish? (Toxic tendencies) Has the species been noted as impacting agricultural/grazing systems?	$P=0.0001$	100	100	1/0
9	Does the plant produce impenetrable thickets, blocking or slowing movement?	$P=0.0002$	93	100	1/0
10	Reproduces vegetatively via root sprouts/suckers or stem/trunk sprouts/coppicing.	$P=0.0314$	98	100	1/0
11	Plant fragments are capable of producing new plants.	$P=0.0002$	100	100	1/0
12	Does the plant produce viable seed?	$P=0.0001$	100	100	1/0
13	Produces copious viable seeds each year (>1000).	$P<0.0001$	86	78	1/0
14	Seeds quick to germinate.	$P=0.1296$	75	68	1/0
15	Short juvenile period. Produces seeds in first 3 years (herbaceous) or produces seeds in first 5 years (woody).	$P=0.0078$	89	54	1/0
16	Long flowering period with seeds produced for more than 3 months each year.	$P=0.2320$	86	86	1/0
17	Propagules dispersed by mammals/insects or birds or via domestic animals.	$P<0.0001$	100	97	1/0
18	Propagules dispersed by wind or water.	$P<0.0001$	98	97	1/0
19	Propagules dispersed via agriculture, contaminated seed, farm equipment, vehicles or boats, or clothing/shoes.	$P<0.0001$	100	94	1/0
Average			97	97	Range of 23/0

Literature Cited

Conser, C., Seebacher, L., Fujino, D.W., Reichard, S. and DiTomaso, J.M. 2015. The development of a plant risk evaluation (pre) tool for assessing the invasive potential of ornamental plants. *PloS one* 10(3). DOI: 10.1371/journal.pone.0121053.