Objective assessment of invasive plant risks and impacts: How and Why

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Terminology can be confusing

Imported from abroad

non-native
non-indigenous
exotic
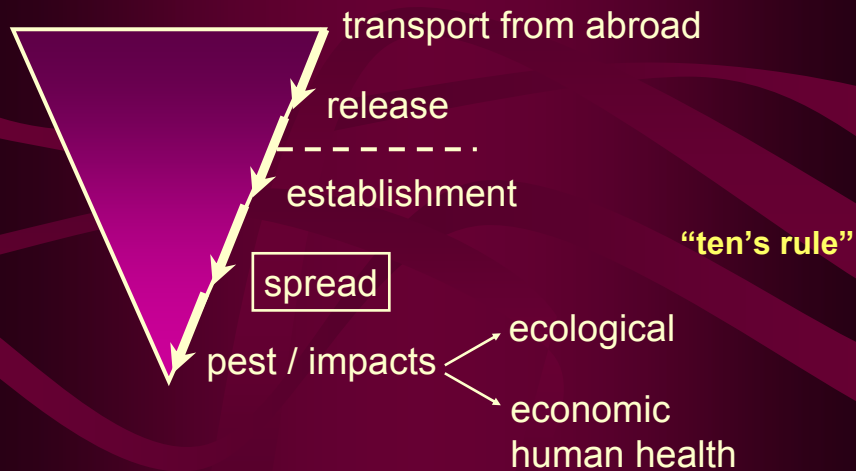alien
neophyte

Spreads on its own

naturalized
escaped

invasive

Unwanted Ecological
Economic
Human health

weed

noxious

pest

Invasion as a multi-staged process

transport from abroad

release

establishment

spread

pest / impacts

ecological

economic
human health

"ten's rule"

Plant invasion pathways and problems

• Federal noxious weed list
  – temperate species

• Hawaii noxious weed list
  -- mainly crop weeds
  -- accidental introductions

• ~ 8000 introduced plants

 • New species each year

deliberate

accidental
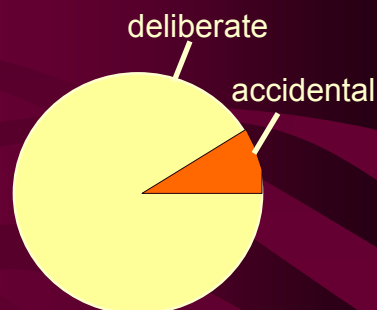
Invasive species
of natural areas

Smith 1985

Invasive species problems

Liability and compliance issues

Executive order 13112

federal agencies shall "not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species…unless the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm… and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions.

Invasive species problems

Liability and compliance issues

What are "feasible and prudent measures to minimize risk"?

Objective: Risk minimization

Develop a weed risk assessment (WRA) that identifies plants likely to become invasive pests

Species not yet present
- assist with importation choices

Species already present
- allow informed planting decisions
- assist in prioritizing control targets

Developing a WRA

Characteristics of an ideal WRA system
- objective
- transparent
- science-based
- repeatable / reliable
- accurate

Developing a WRA for Hawai'i (H-WRA)

Examined several systems
- North America
- South Africa
- Australia

• The Australian WRA system was most promising after simple modifications

Developing a WRA for Hawai'i (H-WRA)

History of the Australian WRA system

1994 Developed and tested in Australia
1995 Modified and tested in New Zealand

1998 Modified and tested for use in Hawai'i
2001-2004 Further testing for use in Hawai'i
and other Pacific Islands

Hawaii -Weed Risk Assessment System
(base on Australia/New Zealand)

49 questions
- climate/distribution
- domestication
- weed elsewhere
- undesirable traits
- plant type
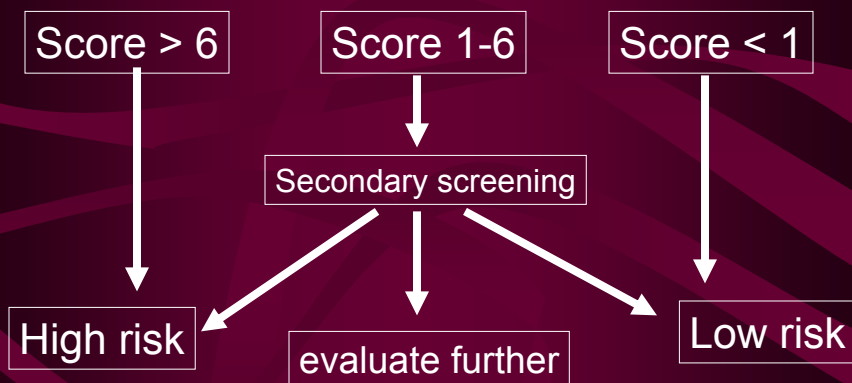- reproduction
- dispersal
- persistence attributes

Assessment

Score
- < 1   **low risk**
- 1-6   **evaluate (?)**
- > 6   **high risk**

(Many ways to be high risk)

Hawai'i Weed Risk Assessment

Assign species score based on 49 questions

| Score > 6 | Score 1-6 | Score < 1 |

Secondary screening

High risk   evaluate further   Low risk

Daehler et al. 2004. Conservation Biology 18:360-368

Example: WRA for *Miconia calvescens*

Miconia calvescens
Melastomataceae
Clifford W. Smith

Score: 14
Decision: High Risk

Risk factors

• Environmental weed of Tahiti
• Broad range (0-6000 ft elevation)
• Shade-tolerance
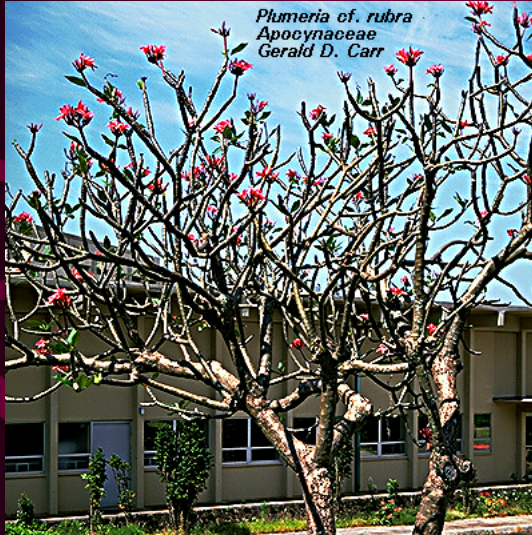• Re-growth after mutilation

Example: WRA for *Miconia calvescens*

Miconia calvescens
Melastomataceae
Clifford W. Smith

Score: 14
Decision: High Risk

Risk factors

• Self-compatible
• > 1000 seeds per m^2
• Bird-dispersed
• Easy accidental dispersal by humans

Example WRA for *Plumeria rubra* (frangipani)

Plumeria cf. rubra
Apocynaceae
Gerald D. Carr

WRA Score: -5
Decision: Low Risk

Risk-reducing factors

• not a recognized pest elsewhere
• poor shade tolerance
• does not form dense thickets
• specialist pollinator
• lacking natural vegetative spread

Example WRA for *Plumeria rubra* (frangipani)

Plumeria cf. rubra
Apocynaceae
Gerald D. Carr

WRA Score: -5
Decision: Low Risk

Risk factors

• toxic/allergenic sap
• tolerates a wide range of soil conditions

Features: Hawai'i Weed Risk Assessment System

• Designed to identify all types of pest plants
  -- grasses, herbs, woody plants
  -- invaders of natural areas
  -- weeds of agriculture and forestry
  -- nuisance species

• Don't need to answer all 49 questions

• Assessment can be done quickly (within a day)

• The WRA system is NOT a field evaluation of current distribution and current impact

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Goal and Purpose
Provide best available information

Issues for plants already in Hawaii

H-WRA misses a few major pests (~ 5%)

H-WRA rates some non-pests as 'low risk' (~ 20%)

H-WRA still rates some species as "evaluate" (~15%)

Daehler et al. 2004. Conservation Biology 18:360-368

Reducing error rates for species already present

H-WRA Results <u>plus</u>

- How long has it been grown?
- How widely is it grown?
- What are its current impact in the field?

Hawaii Exotic Plant Evaluation Protocol (HEPEP)

HEPEP. V8 Draft Score Sheet

Species name Caesalpinia decapetala   HPWRA score

Evaluator   Forest Starr & Kim Starr   Date March 23, 2005

BACKGROUND INFORMATION

All entries in this form should be supported by documentation as described in Appendix 1.

I. Current naturalization status priority natural and agricultural/forestry areas.

    YES/NO

If NO then no further evaluation is necessary. Go to **Committee Action.**

II -a. Current Impacts. Natural Communities. See text for description of critera and documentation requirements. Mark H or M; otherwise leave blank

	Wet/moist <3000 ft elev.	Dry <3000 ft elev.	Montane >3000 ft elev
i. Ecosystem processes			
ii. T&E or Rare Native Species			
iii. Native Vegetation	HIGH (1)		
iv. Community Structure			
v. Hybridizes with native sp			
vi. Hybridizes with pest sp			

II-b. Current Impacts. Agricultural and Forestry Communities. See text for description of criteria and documentation requirements. Mark H or M; otherwise leave blank.

	Wet/moist <3000 ft elev.	Dry <3000 ft elev.	Montane >3000 ft elev
i. Ecosystem processes			
ii. Control Costs			
iii. Production	HIGH (2)		
iv. Pests and Pathogens			
v. Hybridization			
vi. Toxicity			

II.-c. Quality-of-life impacts. See text for description of criteria and documentation. H or M; otherwise leave blank.

i. Noxious plants in areas frequented by humans	HIGH (3)
ii. Variously toxic	
iii. Produces allergens	
iv. Resources expended for control in public areas	

III. Potential for expansion of range. H, M, L

a. Native habitats	HIGH (4)
b. Agriculture and Forestry habitats	HIGH (5)
c. Observed rate of spread	HIGH (6)

IV. Difficulty of Management. H; otherwise leave blank.

i. No treatments available	
ii. Control causes significant damage to natives	
iii. Costs of known control are high	HIGH (7)
iv. Frequent retreatment required	HIGH (8)
v. Accessibility to control area is poor	HIGH (9)

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COMMITTEE ACTION

Species Status: Based on information in Section II (Impacts). Indicate one.

Documented invasive species in Hawaii
Predicted to be invasive, but current evidence insufficient
No evidence of invasiveness.

Significant Findings: Based on information in Sections II-IV

(1) *C. decapetala* has invaded about 150 acres of remnant lowland native mesic / wet forest in Halehaku Gulch near Haiku Maui where it reaches densities over 75% from the ground to the canopy. *C. decapetala* can be found along the Hana Hwy. at Halehaku gulch, close to sea level. Average annual rainfall in this area is 60-80 in (152- 203 cm) (Juvik and Juvik 1998). The yellow flowered vine can be seen growing on the walls and flat surfaces of the valley. The greatest density is found near the bridge on Hana highway. The density drops off on either side, but *C. decapetala* can be found all the way to the ocean and almost a mile upslope of the Hana highway. The upper extent in the gulch is

Status of H-WRA

- **Over 600 species have been screened**

- **Complete evaluation of these species can be downloaded from the Botany Dept website:**

http://www.botany.hawaii.edu/faculty/daehler/wra/default2.htm

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Weed Risk Assessments for Hawaii and Pacific Islands

Hawaii-Pacific Weed Risk Assessment [HP-WRA] is a research project by Curt Daehler (University of Hawaii) and Julie Denslow (USDA Forest Service) that has been supported by funding from the USDA Forest Service and from the Hawaii Division of Forestry and Wildlife Urban and Community Forestry program. The WRA scoring system was originally developed in Australia and New Zealand for the evaluation of plants being imported. The intent of the HP-WRA research project is to identify plants that pose a high weed risk in Hawaii and other Pacific Islands.

The HP-WRA score does not measure actual invasiveness or economic or ecological harm in the field. Rather, a designation of H(HPWRA) is a prediction that a species will become invasive . The HP-WRA does not measure species benefits in terms of economic, ecological, public health, medicinal, historic, community, cultural, tourism, and esthetic value; nor does it determine if a suitable alternative species exists.

The HP-WRA only considers published information on invasiveness in Hawaii or elsewhere and it does not include an actual "in-the field" evaluation of current impacts in Hawaii. Another evaluation protocol called the Hawaii Exotic Plant Evaluation Protocol (HEPEP) is being developed to provide a current field evaluation of species that have been designated H(HPWRA).

The HP-WRA ratings have no regulatory authority and the HP-WRA "list" is not an official State list of invasive plants. By statute, the Hawaii Department of Agriculture is solely responsible for determining which plant and animal species are prohibited or permitted into the State (Hawaii Administrative Rules 4:68:1 - 'Noxious Weed Rules'). To determine which species are prohibited in Hawaii, please consult the official State of Hawaii List of Plant Species Designated as Noxious Weeds.

WRA designation	Meaning
L	Not currently recognized as invasive in Hawaii, and not likely to have major ecological or economic impacts on other Pacific Islands based on the HP-WRA screening process.
L(Hawai'i)	Not currently recognized as invasive in Hawaii based on a track record of not becoming naturalized despite being widely planted in Hawaii for at least 40 years.
H(HPWRA)	Likely to be invasive in Hawaii and on other Pacific Islands as determined by the HP- WRA screening process., which is based on published sources describing species biology and behavior in Hawaii and/or other parts of the world.
H(Hawai'i)	Documented to cause significant ecological or economic harm in Hawaii, as determined from published information on the species' current impacts in Hawaii. [more details]
EVALUATE	The species has been assessed using the HP-WRA system; however, no assessment of risk can be provided at this time because 1)important information is missing from the assessment or 2)the species possesses a combination of traits and characteristics that make its likely behavior difficult to assess using the WRA system.

To download the **full assessment** for any species, please use our search interface.
Completed assessments sorted by Genus

Family	Preferred_species_name	Common name	WRA score	WRA designation
Caprifoliaceae	*Abelia x grandiflora*	glossy Abelia	-13	**L**
Fabaceae	*Acacia auriculiformis*	Darwin Black Wattle	13	**H (HPWRA)**
Fabaceae	*Acacia confusa*	Formosan koa	10	**H (Hawai'i)**
Fabaceae	*Acacia crassicarpa*	northern wattle	7	**H (HPWRA)**
Fabaceae	*Acacia farnesiana*	sweet acacia	14	**H (HPWRA)**
Fabaceae	*Acacia longifolia*	Sidney goldern wattle	10	**H (HPWRA)**
Fabaceae	*Acacia mearnsii*	Australian acacia	15	**H (Hawai'i)**
Fabaceae	*Acacia melanoxylon*	Australian blackwood	12	**H (HPWRA)**
Fabaceae	*Acacia nilotica*	gum arabic tree	14	**H (HPWRA)**
Fabaceae	*Acacia parramattensis*	Parrmatta green wattle	9	**H (HPWRA)**
Euphorbiaceae	*Acalypha godseffiana*	Acalypha	-7	**L**
Euphorbiaceae	*Acalypha hispida*	chenille plant	2	**L**
Euphorbiaceae	*Acalypha wilkesiana*	beefsteak plant	-2	**L**
Arecaceae	*Acoelorraphe wrightii*	everglades palm	2	**EVALUATE**

Current Status of H-WRA

- State has funded a 1-year position to make additional assessments
- Species are being screened at Lyon Arboretum

  ➢ Focusing on species suggested by growers, importers and other plant professionals
  ➢ Species suggested by Island Invasive Species Councils (ISCs)

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Current Status of HEPEP

• 69 species rated as "high risk" by H-WRA have been evaluated

➢ 43 species categorized as "Documented Invasive"

➢ Public release of findings pending review by HEPEP committee

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Acknowledgements

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