# Increasing the Consistency of Tests and Implementation of the Australian Weed Risk Assessment

Daphne Onderdonk[1], Doria Gordon[1,2],
Alison Fox[1], and Randall Stocker[1]

[1]University of Florida, [2]The Nature Conservancy

*Schinus terebinthifolius*

# Outline

- Implementation of the WRA
  - Testing the WRA
    - *A priori* species categories
    - Geographic source of data
    - Other potential for inconsistency
  - Answering the questions
  - Scoring 'weed elsewhere'
- Reporting WRA results
- Suggestions for workshop discussion

# *A priori* species categories

- Tests have used different categories
- Definition of *a priori* categories of species influences accuracy of WRA test
- Inevitable inconsistency within categories

| Australia | Hawaii | Hawaii & Pacific | Czech Republic | Bonin Islands | Florida |
|---|---|---|---|---|---|
| non-weed | non-invader | non-pest | not escaped casual | non-pest | non-invader |
| minor weed | | minor pest | naturalized | minor pest | minor invader |
| serious weed | invader | major pest | invasive | major pest | major invader |
| Pheloung et al. 1999 | Daehler & Carino 2000 | Daeher et al. 2004 | Křivánek & Pyšek 2006 | Kato et al. 2006 | Gordon et al. in review |

# Geographic source of weed elsewhere data for non-island tests

- Immediately outside defined test region boundaries

- Outside buffered test region boundaries

- Continents or islands beyond test region

- Florida test:
  – Compared results using data from anywhere outside of Florida to data only from outside North America
    - 16 out of 158 scores different
    - 5 outcomes differed before secondary screen
    - 3 outcomes differed after secondary screen
  – Could find data from outside North America in most cases

→ Geographic source had insignificant influence

# Other potential for inconsistency

- Balance of families across categories

- Balance of life forms across categories

- Method of *a priori* classification of species

- Potential bias of assessor

- Climate matching approach

*Lygodium microphyllum*

# Differentiating between 'no' and 'don't know' responses

- Most criteria define the positive case

- When does no evidence = 'no' versus 'don't know'?
  - When positive evidence is likely to have been reported?
    - Toxic to animals
    - Dispersed as a produce contaminant

- 18 questions have different scores for 'no' than 'don't know'
  - Examples:
    - Reproduction by vegetative fragmentation
    - Dispersed intentionally by people
    - Self-compatible or apomictic
    - Prolific seed production

# Clarifying definitions

- 1.01 Is the species highly domesticated?

  – Previous definitions assume that selection has reduced weediness

  – But selection can be for weedy traits, such as reduced generation time or more seeds (e.g., *Ardisia crenata*)

  – Intent of question:

    1) Selection through cultivation for > 20 generations;

    if yes,

    2) selection during domestication has
    resulted in reduced weediness  (often no evidence)

  – 'yes' answer to this question gives -3 points

# Clarifying definitions

- 7.06 Propagules bird dispersed
  - 'yes' if:
    - small, fleshy fruit?
    - evidence that fruit is eaten by birds?
    - evidence of post-dispersal viability?
  - 'no' if:
    - not a small, fleshy fruit?
    - evidence of wind or external dispersal?
    - evidence that species is not bird dispersed? (rarely given)
  - Assume 'no' for certain families (ferns, grasses)?

# Clarifying definitions

- 8.01 Prolific seed production
  - Most definitions give quantitative cutoff
  - What if there is qualitative evidence describing copious seed production?

- Weed elsewhere section (3.01 – 3.05)
  - Criteria vary across WRA efforts

*Pueraria lobata*

# Impact of strict versus less strict data requirements

Questions answered differently for strict version:

- 4.02  Allelopathic?
- 4.04  Unpalatable to grazing animals?
- 5.03  Nitrogen fixing woody plant?
- 6.07  Minimum generative time?
- 7.05  Propagules water dispersed?
- 7.06  Propagules bird dispersed?
- 7.08  Propagules dispersed by other animals?
- 8.01  Prolific seed production?

# Impact of strict versus less strict data requirements

## Results*:

| | Assumption from general statements or traits | | | Explicit data required | | |
|---|---|---|---|---|---|---|
| | major invader | minor invader | non-invader | major invader | minor invader | non-invader |
| accept | 2% | 36% | 73% | 2% | 27% | 71% |
| evaluate | 6% | 6% | 19% | 6% | 8% | 21% |
| reject | 92% | 58% | 8% | 92% | 65% | 8% |

- Scores generally higher when more rigorous data required

- Without secondary screen, fewer non-invaders accepted using strict data requirements – differences largely erased with secondary screen

* Secondary screen applied

# Three versions of look-up table for Section 3

**1**

| | | Yes to questions 3.01-3.05 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| inputs | 2.01 | 0 | 0 | 0 | 1 | 1 | 1 | 2 | 2 | 2 |
| | 2.02 | 0 | 1 | 2 | 0 | 1 | 2 | 0 | 1 | 2 |
| results | 3.01 | 2 | 1 | 1 | 2 | 2 | 1 | 2 | 2 | 2 |
| | 3.02 | 2 | 1 | 1 | 2 | 2 | 1 | 2 | 2 | 2 |
| | 3.03 | 3 | 2 | 1 | 4 | 3 | 2 | 4 | 4 | 4 |
| | 3.04 | 3 | 2 | 1 | 4 | 3 | 2 | 4 | 4 | 4 |
| | 3.05 | 2 | 1 | 1 | 2 | 2 | 1 | 2 | 2 | 2 |

**3**

| | | Yes to questions 3.01-3.05 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| inputs | 2.01 | 0 | 0 | 0 | 1 | 1 | 1 | 2 | 2 | 2 |
| | 2.02 | 0 | 1 | 2 | 0 | 1 | 2 | 0 | 1 | 2 |
| results | 3.01 | 2 | 1 | 1 | 2 | 2 | 1 | 2 | 2 | 2 |
| | 3.02 | 2 | 1 | 1 | 2 | 2 | 1 | 2 | 2 | 2 |
| | 3.03 | **4** | 2 | 1 | 4 | 3 | 2 | 4 | 4 | 4 |
| | 3.04 | **4** | 2 | 1 | 4 | 3 | 2 | 4 | 4 | 4 |
| | 3.05 | 2 | 1 | 1 | 2 | 2 | 1 | 2 | 2 | 2 |

**2**

| | | Yes to questions 3.01-3.05 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| inputs | 2.01 | 0 | 0 | 0 | 1 | 1 | 1 | 2 | 2 | 2 |
| | 2.02 | 0 | 1 | 2 | 0 | 1 | 2 | 0 | 1 | 2 |
| results | 3.01 | 2 | 1 | **0.5** | 2 | **1.5** | 1 | 2 | 2 | 2 |
| | 3.02 | 2 | 1 | **0.5** | 2 | **1.5** | 1 | 2 | 2 | 2 |
| | 3.03 | **4** | 2 | 1 | 4 | 3 | 2 | 4 | 4 | 4 |
| | 3.04 | **4** | 2 | 1 | 4 | 3 | 2 | 4 | 4 | 4 |
| | 3.05 | 2 | 1 | **0.5** | 2 | **1.5** | 1 | 2 | 2 | 2 |

- Version used rarely reported

- Irrelevant if use default climate scores

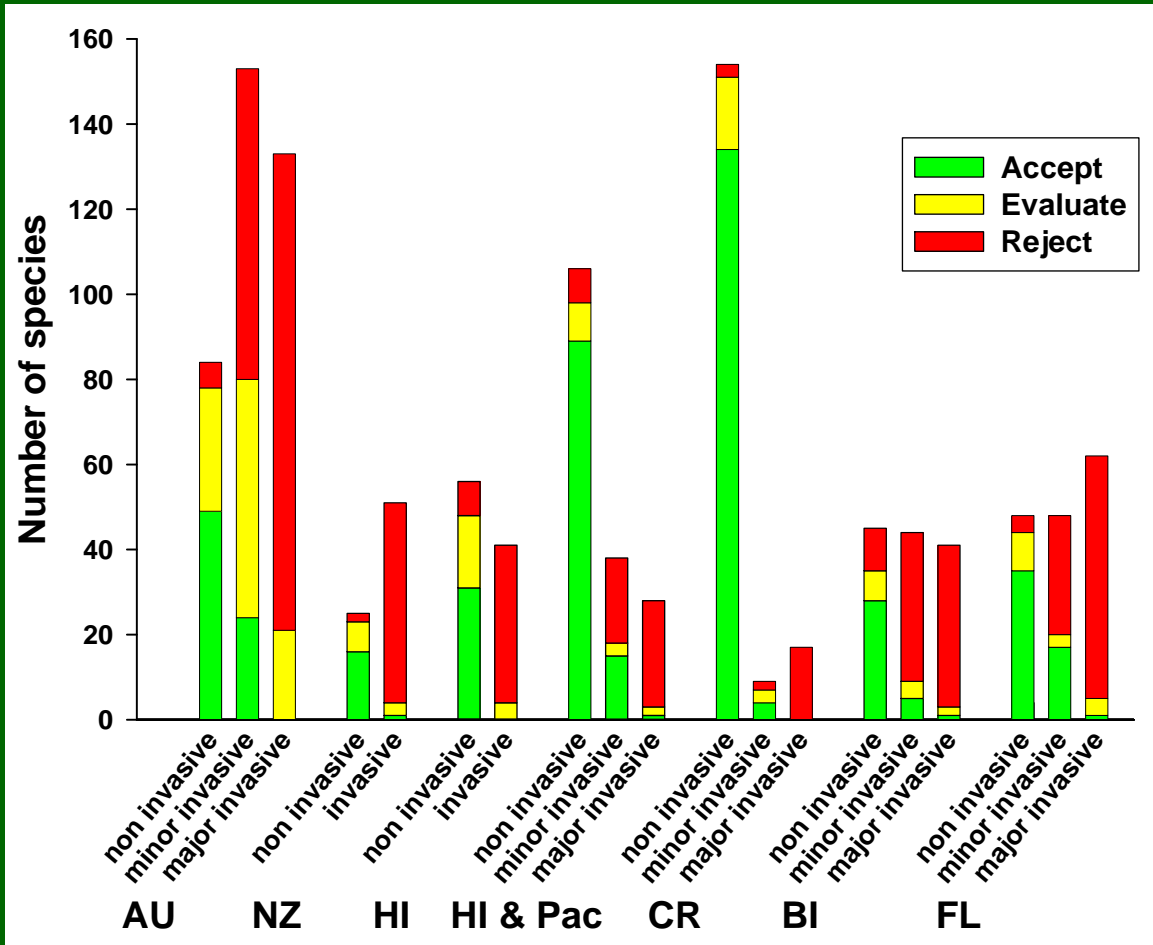- No evidence of consistently higher scores when the default scoring was used

# Reporting WRA results

- Variation and partial reporting make comparison of tests difficult
- Comparison critical for policy arguments



*Melaleuca quinquenervia* invading native
*Cladium jamaicense* prairie in Florida Everglades

# Reporting WRA results



- Minimally, report accept, evaluate, and reject for all *a priori* species categories

- Helpful to report actual numbers along with %

AU:          Pheloung et al. 1999
NZ, HI:     Daehler & Carino 2000
HI & Pac: Daehler et al. 2004

CR:  Křivánek & Pyšek 2006
BI:   Kato et al. 2006
FL:   Gordon et al. in review

# Suggestions for Workshop Discussion

- Can we develop consistent criteria on question definition and data needed for answering questions?  For:

  – Comparisons of tests to evaluate the accuracy of the WRA across geographies

  – Comparisons of accuracy of new methodologies with that of the WRA

  – Consistent implementation of the WRA to harmonize intra- and inter-national decisions on prohibited or restricted plant species

- What experience exists on WRA implementation on infraspecific taxa (cultivars, varieties)?

- Should there be a central web-based dataset of WRA results across geographies (e.g., Pacific Islands Ecosystems at Risk)?

- Are there higher accuracy or abridged screening approaches that are likely to replace this WRA?

# Rarely answered questions

- Would be useful if questions that were rarely answered were reported – potentially can reduce number of questions

  – 9 questions we answered ≤30% of the time:
    - 1.02  Naturalized where grown?  } answered only when
    - 1.03  Weedy races?                 domestication = 'yes'

    - 2.03  Broad climate suitability?
    - 4.04  Unpalatable to grazing animals?
    - 6.01  Substantial reproductive failure in native habitat?*
    - 6.03  Hybridizes naturally?
    - 7.01  Likely dispersed unintentionally?
    - 8.04  Tolerates disturbance?
    - 8.05  Effective natural enemies present?*

*Almost never answered

# Rarely answered questions

When rarely answered questions are removed

- All 158 species still satisfied the minimum number of questions answered

- 86 scores changed (16 increased, 70 decreased)

- 6 outcomes changed without secondary screen

- 4 outcomes changed with secondary screen

➤ Some questions could likely be removed without significantly altering the accuracy of the WRA

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