

WeedSearch: A New Tool for Estimating Time and Cost of Eradication

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Overview

- Eradication: How much time? At what cost?
- WeedSearch
- *Sesbania punicea* Case Study
- Model Results
- Conclusions



Why Use a Model?

- Time to eradication is unknown at start
- Eradication projects are expensive
- Will there be enough resources to complete the task?
- Model is low cost way to estimate time and costs



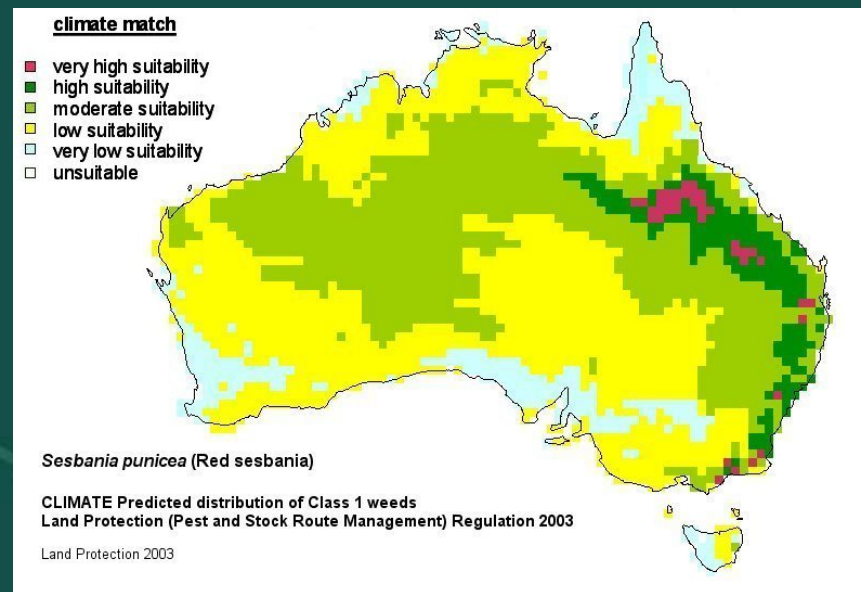
Salt cedar (*Tamarisk* sp.) in the desert Southwest



Scotch broom (*Cytisus scoparius*) in the Pacific Northwest

WeedSearch

- Developed in Australia
- Microsoft Excel 2003 Spreadsheet
- Free on the Web
- Here's how it works...



Structure of WeedSearch

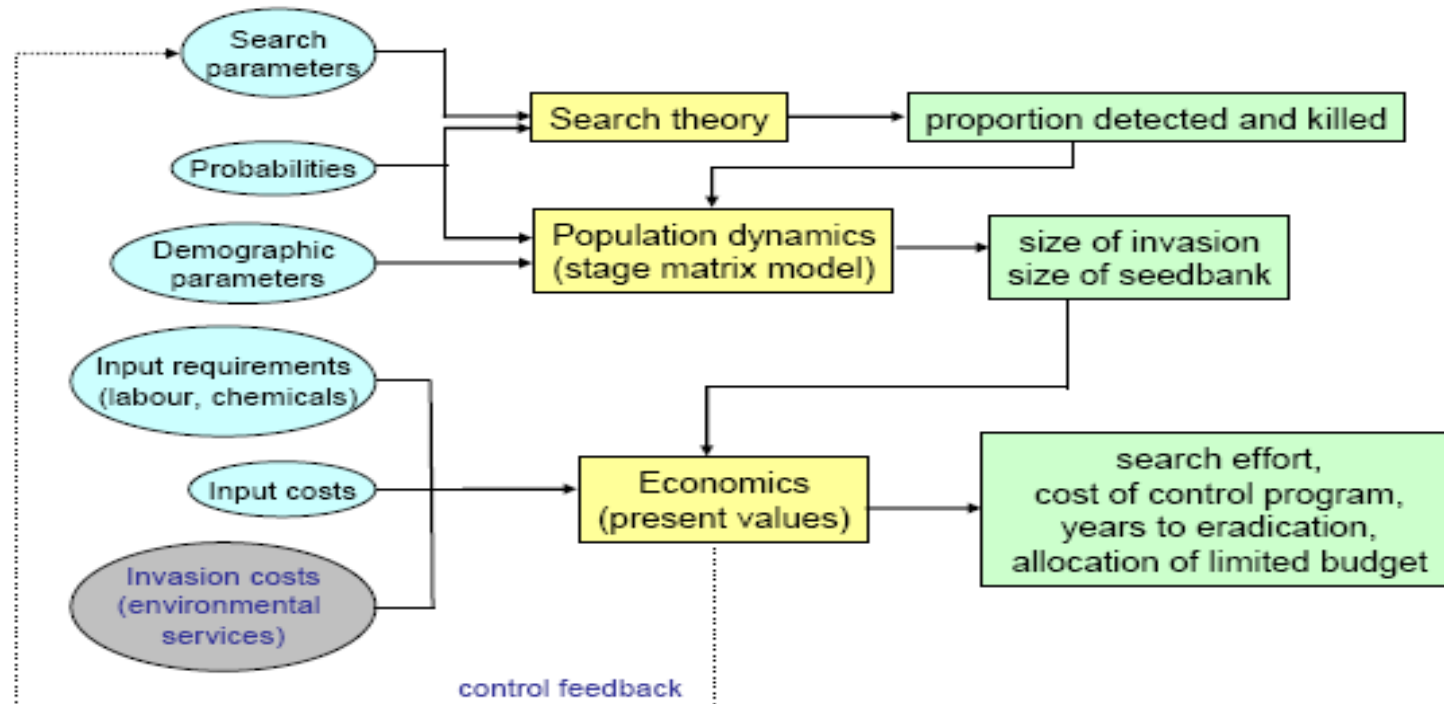


Figure 1. Structure of WeedSearch

Model Inputs

- Initial Conditions
- Biology
- Economics
- Management



We Used Sesbania as a Test of the Model

Initial Conditions

WeedSearch

Select saved analysis:

Initial Conditions | Biology | Economics | Management

INITIAL CONDITIONS

Total search area (ha):

Density of mature plants/ha:

Simulation control:

Maximum years:

Eradication criterion (seeds/ha):

N random iterations:

Random seed:

Advanced

Biology

WeedSearch [X]

Select saved analysis: Save settings to SA

Sesbania punicea [v] Save Rename
Save As Delete

Initial Conditions | **Biology** | Economics | Management

Biology

| | | |
|---|-----------------------------------|----|
| Duration of pre-reproductive period (years): | <input type="text" value="1"/> | B1 |
| Maximum longevity of seeds (years): | <input type="text" value="10"/> | B2 |
| Seed per square meter: | <input type="text" value="8800"/> | B3 |
| Mortality of first-year juveniles: | <input type="text" value="0.95"/> | B4 |
| Perennial species: | <input type="text" value="1"/> | B5 |
| Size of mature plant (square meter surface area): | <input type="text" value="1.5"/> | B6 |
| Plant longevity (years): | <input type="text" value="10"/> | B7 |
| Population growth rate (lambda): | <input type="text" value="1.2"/> | B8 |

Advanced Stochastic Deterministic

Economics

WeedSearch

Select saved analysis: Save settings to SA

Sesbania punicea Save As

Initial Conditions | **Biology** | **Economics** | Management

ECONOMICS

Discount factor (%):

Fixed Costs

Administration (\$/yr):

Transport to site (\$ / visit):

Variable Costs

| | Cost \$/hr | Input hr/plant |
|------------------|---------------------------------|-----------------------------------|
| Labour input: | <input type="text" value="35"/> | <input type="text" value="0.01"/> |
| | \$/L | L/plant |
| Chemical input: | <input type="text" value="24"/> | <input type="text" value="0.01"/> |
| | \$/hr | hr/plant |
| Machinery input: | <input type="text" value="0"/> | <input type="text" value="0"/> |

Advanced

Management

WeedSearch

Select saved analysis: Save settings to SA

Sesbania punicea Save Rename
Save As Delete

Initial Conditions | **Biology** | Economics | Management

MANAGEMENT

Search Mode
 Random
 Parallel

Searches / year: Coverage / visit:

Search time hrs / ha:

Detectability

ESW Adults (m):

Juvenile ESW (relative):

Logistic considerations

Speed m/hr:

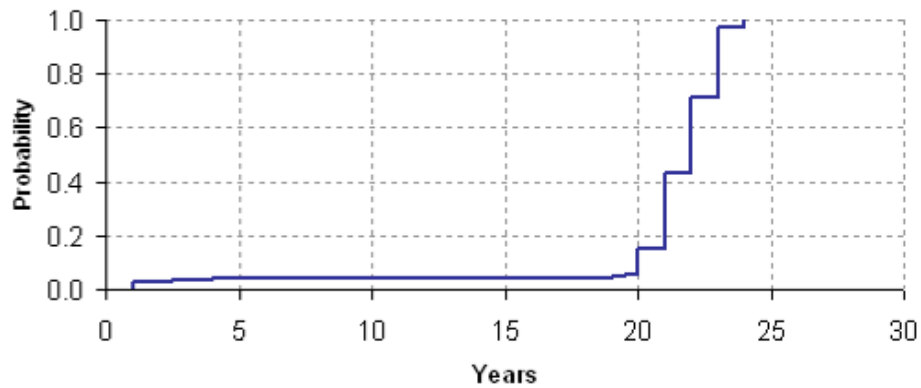
Efficiency of control (% killed):

Advanced Stochastic Deterministic

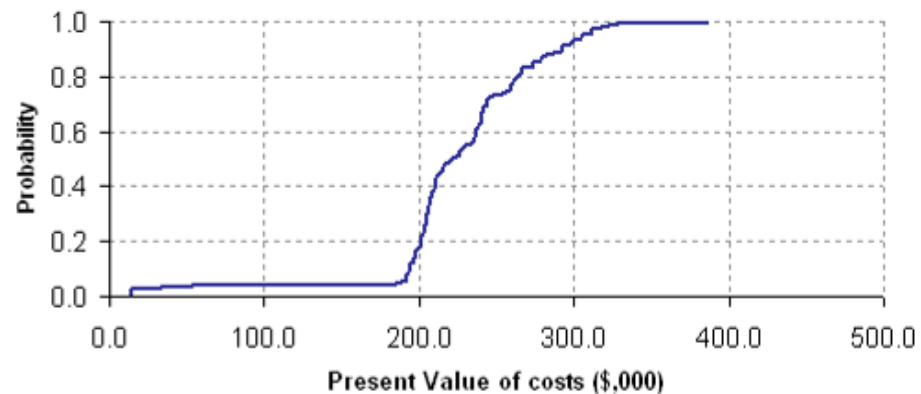
RESULTS

| | 1,000 | Percentiles | | | | | |
|--------------------------|---------|-------------|-------|-------|-------|-------|-------|
| Variable | Mean | SD | 10 | 25 | 50 | 75 | 90 |
| Prop. successful | 1,000 | | | | | | |
| Time to eradication (yr) | 21.0 | 4.1 | 20.0 | 21.0 | 22.0 | 23.0 | 23.0 |
| Search hours | 2,058.0 | 402 | 1,960 | 2,058 | 2,156 | 2,254 | 2,254 |
| Control hours | 923.9 | 688 | 302 | 414 | 716 | 1,390 | 1,937 |
| Cost (\$000, PV) | 226.8 | 56.3 | 194.6 | 204.0 | 222.0 | 258.2 | 292.5 |

Time to eradication CDF



Cost of eradication CDF



Advanced Features

- Sensitivity Analysis
- Projection Matrix
- Probability Settings
- Annual Results

Reality Check

Comparison of amount spent on Dry Creek Sesbania project, projected costs and model prediction

| Dry Creek Sesbania Program Economics (US Dollars) | |
|---|----------------|
| Initial DWR Grant 2004 to 2006 | 372,000 |
| Yearly Program Costs (2007 to 2016) | 298,250 |
| <i>Project out to 24 years based on WeedSearch model Prediction</i> | 180,000 |
| <i>(12 more years after 2016 at \$15,000/year)</i> | |
| Total 30 year projected cost INCLUDING initial DWR removal grant | 850,250 |
| WeedSearch Total Cost Prediction | 292,000 |
| Total cost 30 year project EXCLUDING initial DWR removal grant | 478,250 |

Conclusions

- WeedSearch is a useful tool for predicting cost and time to eradication
- Model output is more realistic with more accurate inputs
- More feedback from field testing will improve the model
- Available online:

<http://www-personal.une.edu.au/~ocacho/weedsearch.htm>

Acknowledgements

- Australian Developers: Oscar Cacho, Paul Pheloung, Dane Panetta
- Sacramento Weed Warriors
- Dry Creek Sesbania Program
- John Hoffmann, University of Cape Town



Sesbania stem boring weevil,
Neodiplogrammus quadrivittatus
Observed in South Africa

Questions?

