Evaluating Progress in Weed Eradication Programs

Dane Panetta[1,2], Simon Brooks[1,2] and Roger Lawes[1,3]

[1]CRC for Australian Weed Management

[2]Biosecurity Queensland, Department of Primary Industries and Fisheries

[3]CSIRO Sustainable Ecosystems

Eradication: definition

The elimination of every single individual of a species from an area in which recolonisation is unlikely to occur

Impetus

There is a need to evaluate progress towards the eradication objective in order to distinguish programs that are ‘on track’ from those that are destined to fail to meet this objective

Evaluating progress: Criteria

- Delimitation
- Containment
- Extirpation

The extirpation criterion

Two phases:

- *Active control* (must prevent reproductive escape)
- *Monitoring* (begins when weed has not been detected for 12 months)
- Infestations revert from monitoring to active upon further detection

Reproductive escape: Effects of further input into seed banks

Crupina vulgaris: persistence v. seed input

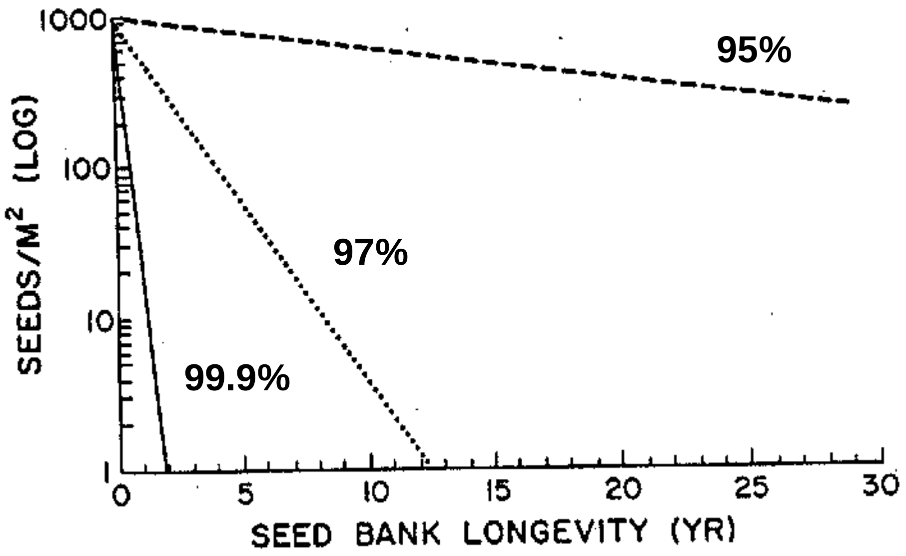
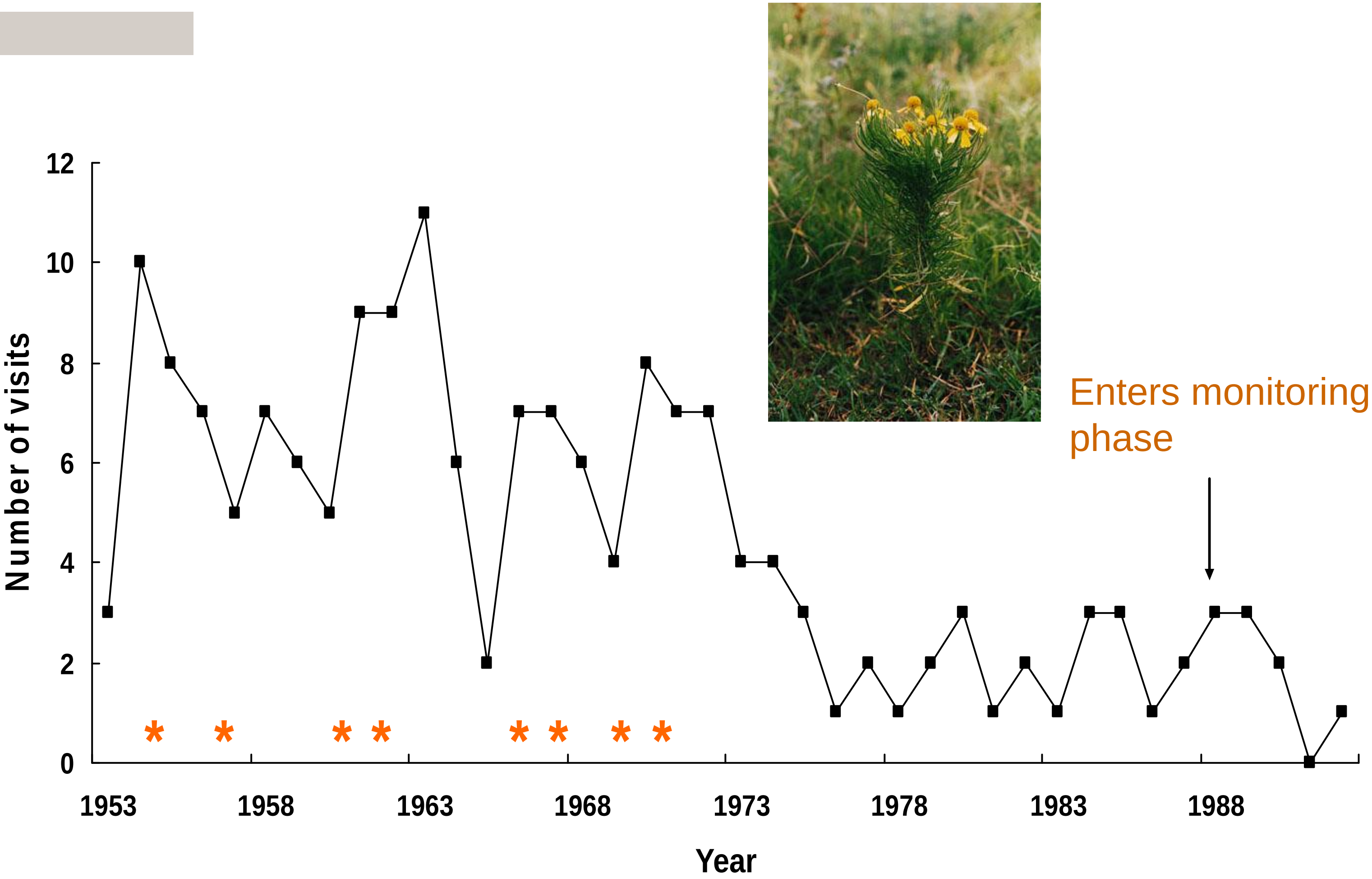


Figure 2. Years required to deplete viable common crupina achenes from the soil with 99.9% (—), 97% (• • •), and 95% (— —) annual control.

Zamora et al. 2000

Helenium amarum reproductive escape (*)



Evaluating progress towards eradication

Because containment failure difficult to prove, model focuses on conformity with delimitation and extirpation criteria

Delimitation measure for year *n* (D_n)

Newly detected area

$$D_n = \frac{A_d}{P_n + \log(A_s + 1)}$$

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Newly detected area

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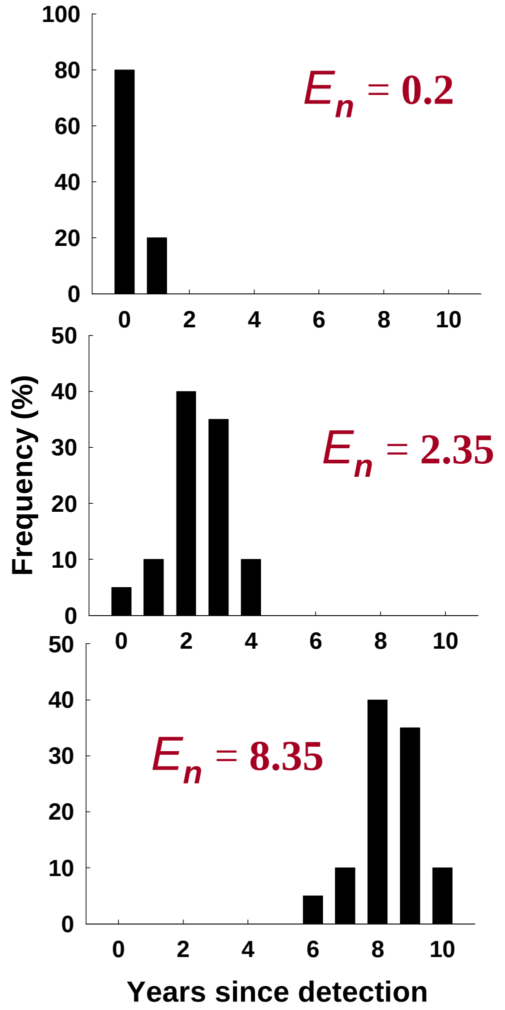
Proportional change in infested area between year *n*-1 and year *n*

Area searched

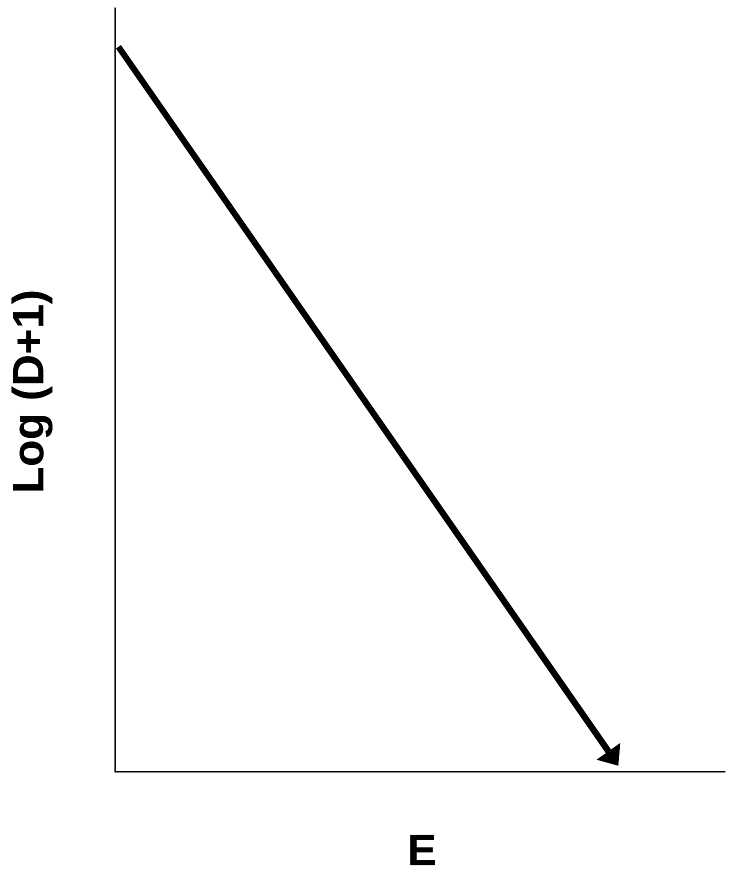
Extirpation measure for year n (E_n)

E_n = mean of frequency distribution of time since last detection (monitoring profile)

E_n should be interpreted in terms of maximum seed longevity

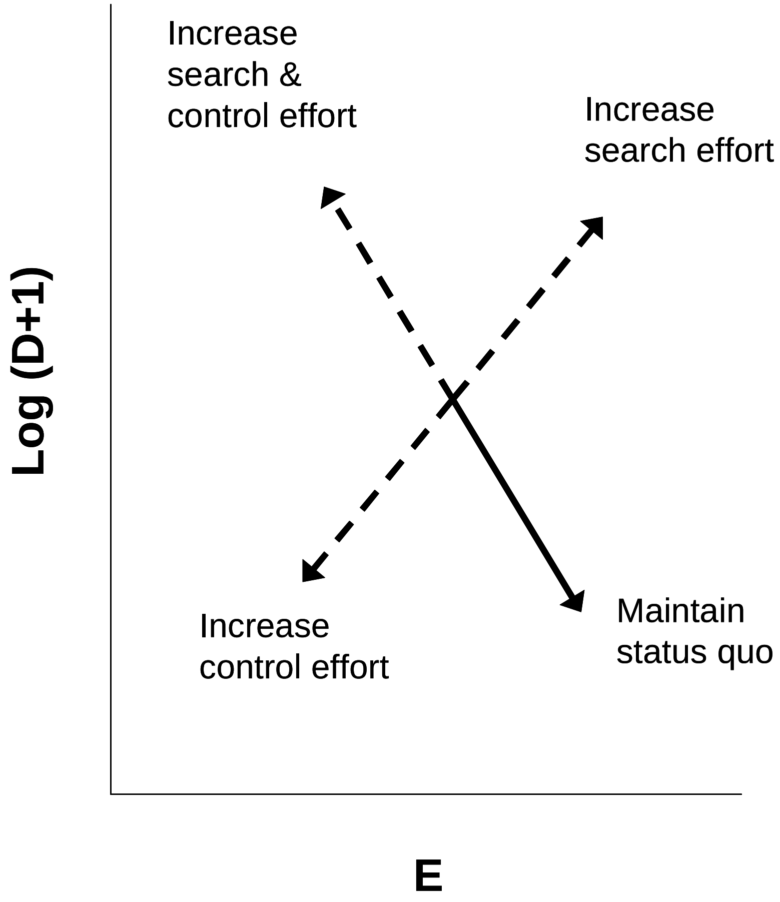


Eradograph (ideal situation)



Panetta and Lawes, in press

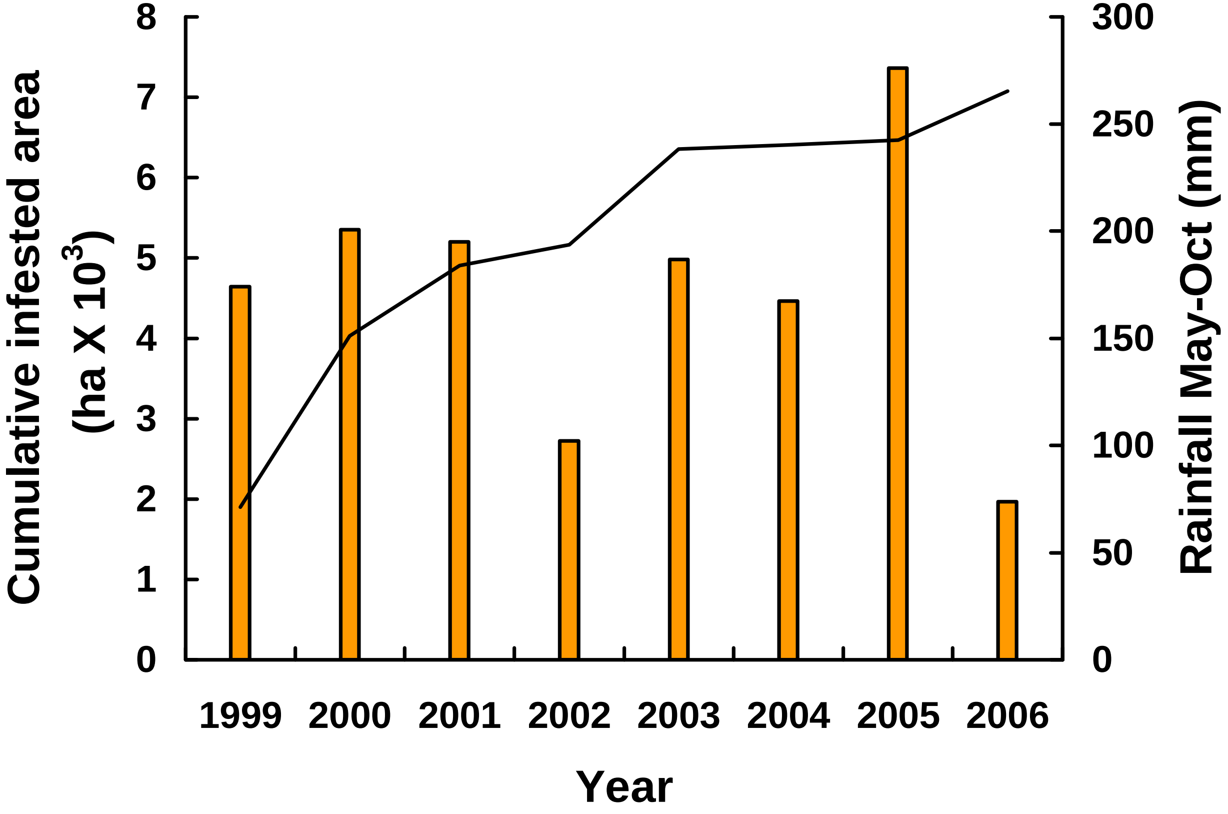
Deviations from the ideal: appropriate responses



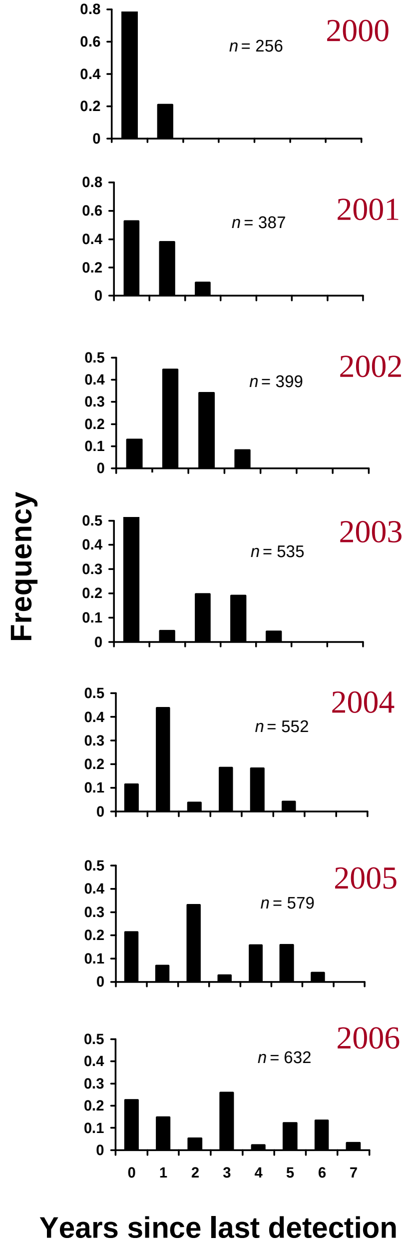
Application:
Branched broomrape (*Orobanche ramosa*) in South Australia

- Serious root parasite that threatens export markets
- Detected in 1992; a 70 x 70 km quarantine zone declared in 1999
- Seeds persist 10-15 yrs
- Dispersal by wind, machinery and stock
- Program expenditure to date $23 M

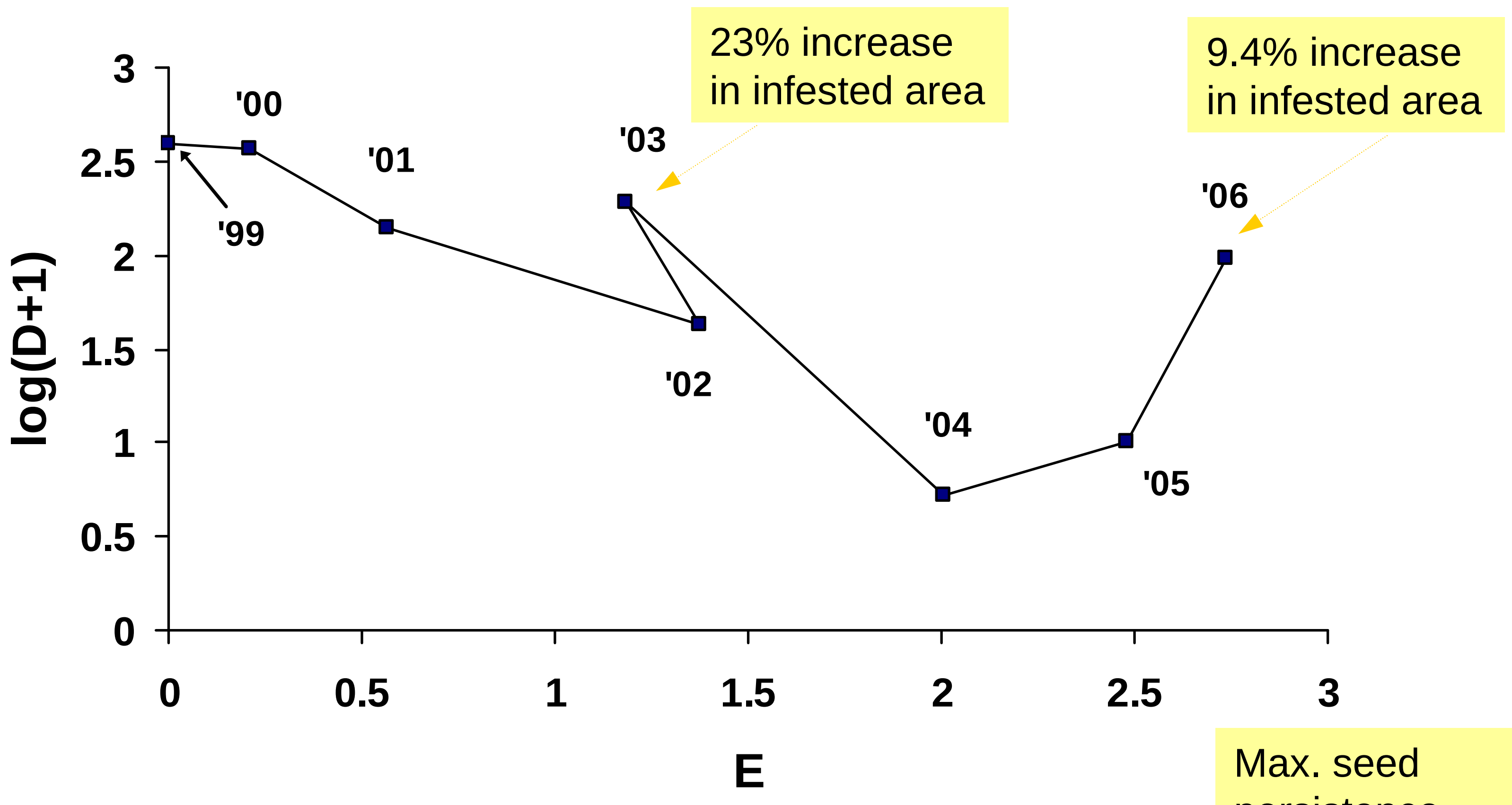
Total infested area



Monitoring profiles

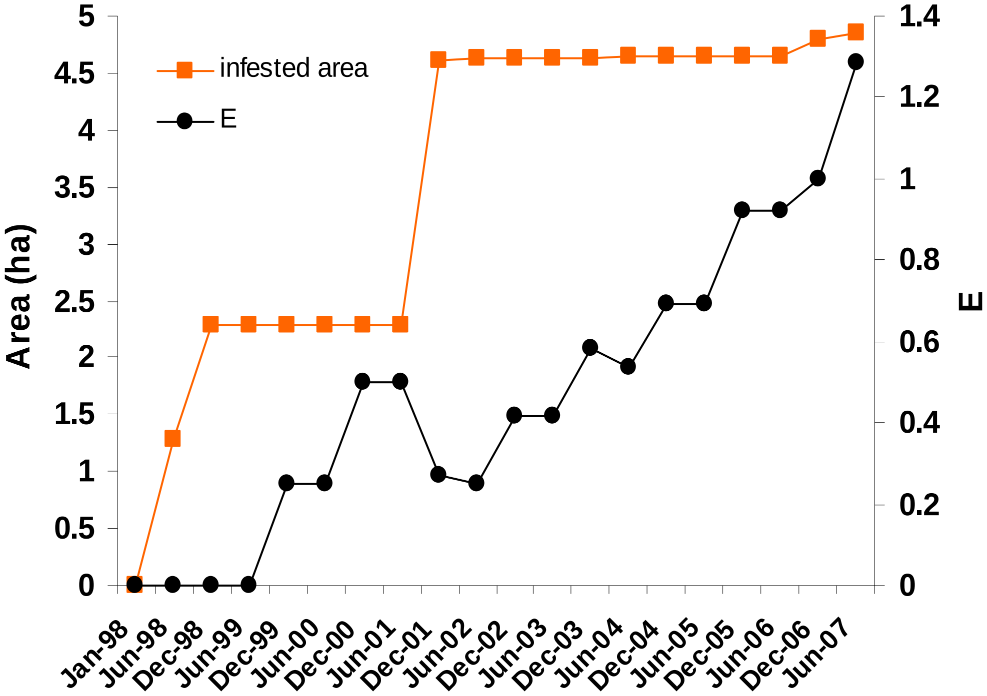


Eradograph

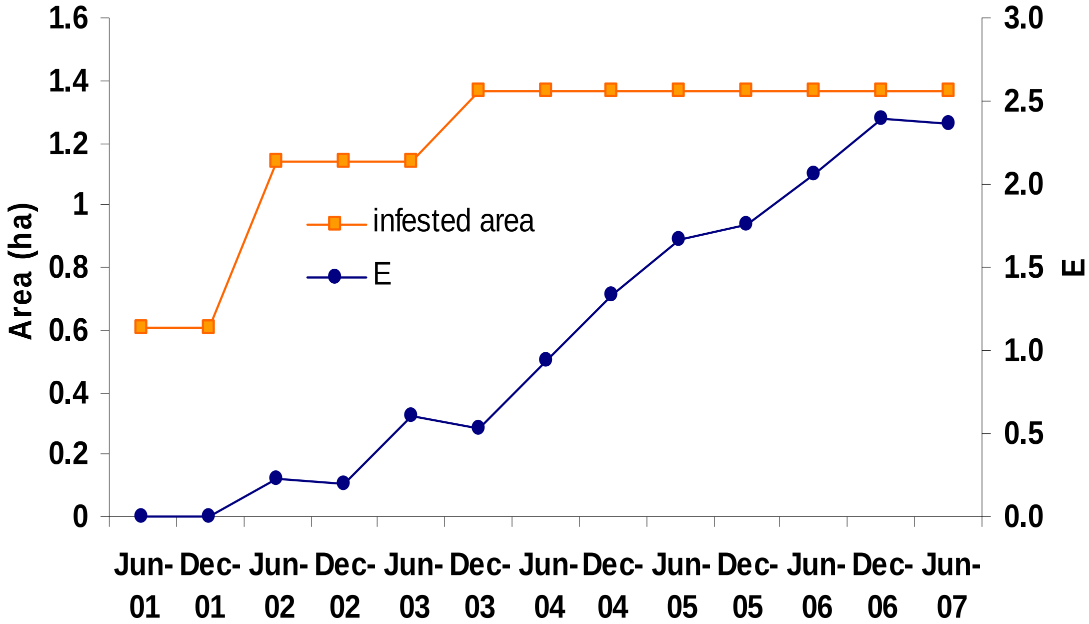


Max. seed persistence ~12 y

Eradication progress – *Mikania micrantha*



Eradication progress – *Limnocharis flava*



Source of detection of infestations of mikania and limnocharis

	Tracing information	Targeted search	Non-targeted search	Extension
Mikania	3	6	4	1
%	21.4	42.8	28.6	7.1
Limnocharis	4	0	8	6
%	22.2	0	44.4	33.3
Total	7	6	12	7
%	21.9	18.8	37.5	21.9

When to stop looking?

- If stop too early, run risk that target will escape and cause damage
- If continue for too long, incur unnecessary expense
- Minimise net expected cost (NEC)

Optimal number of consecutive zero surveys (n*)

cost of survey

cost of escape

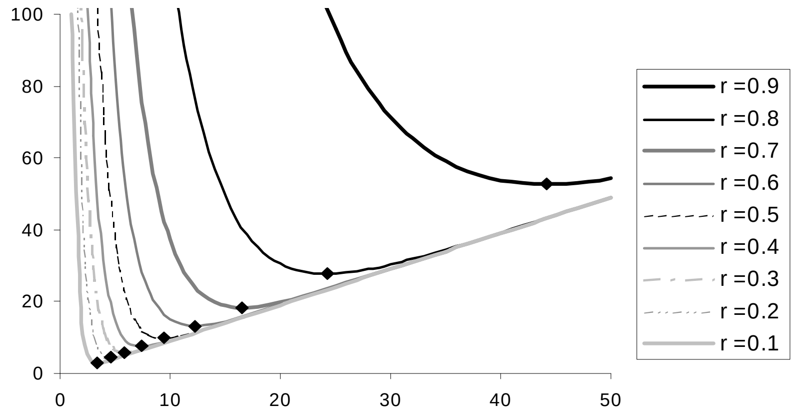
$$n^* = \frac{\ln\left(\frac{-C_s}{(C_e \times \ln(r))}\right)}{\ln(r)}$$

probability not detected but present

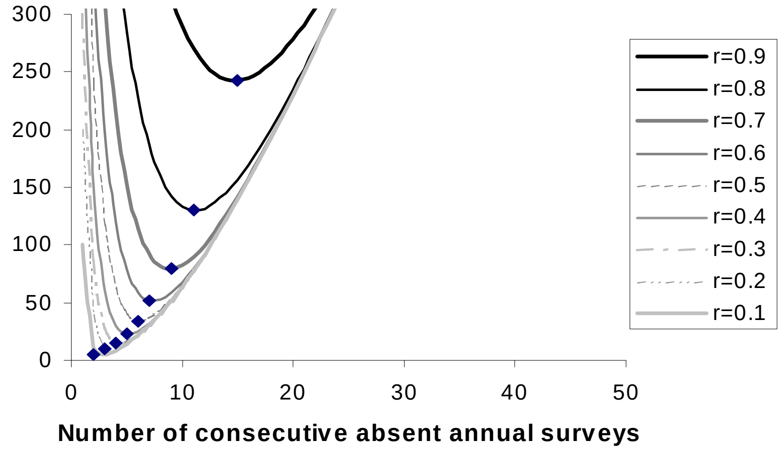
Regan et al. 2006

NEC as a function of the number of consecutive absent annual surveys for *Cs/Ce* = 1/1000

undiscounted



5% discount rate



Conclusions

- Data needs fairly simple to evaluate progress towards eradication objective
- Timely delimitation important - not possible if inadequate investment in detection (active and passive)
- Must prevent seed production consistently if extirpation criterion is to be met

Thanks

- Weeds CRC for funding support
- Nick Secomb of SA Animal and Plant Control Group for provision of BBR data
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