Natural Born Weed Killers: a Key Weapon for the War on Weeds

Lynley Hayes

hayesl@landcareresearch.co.nz

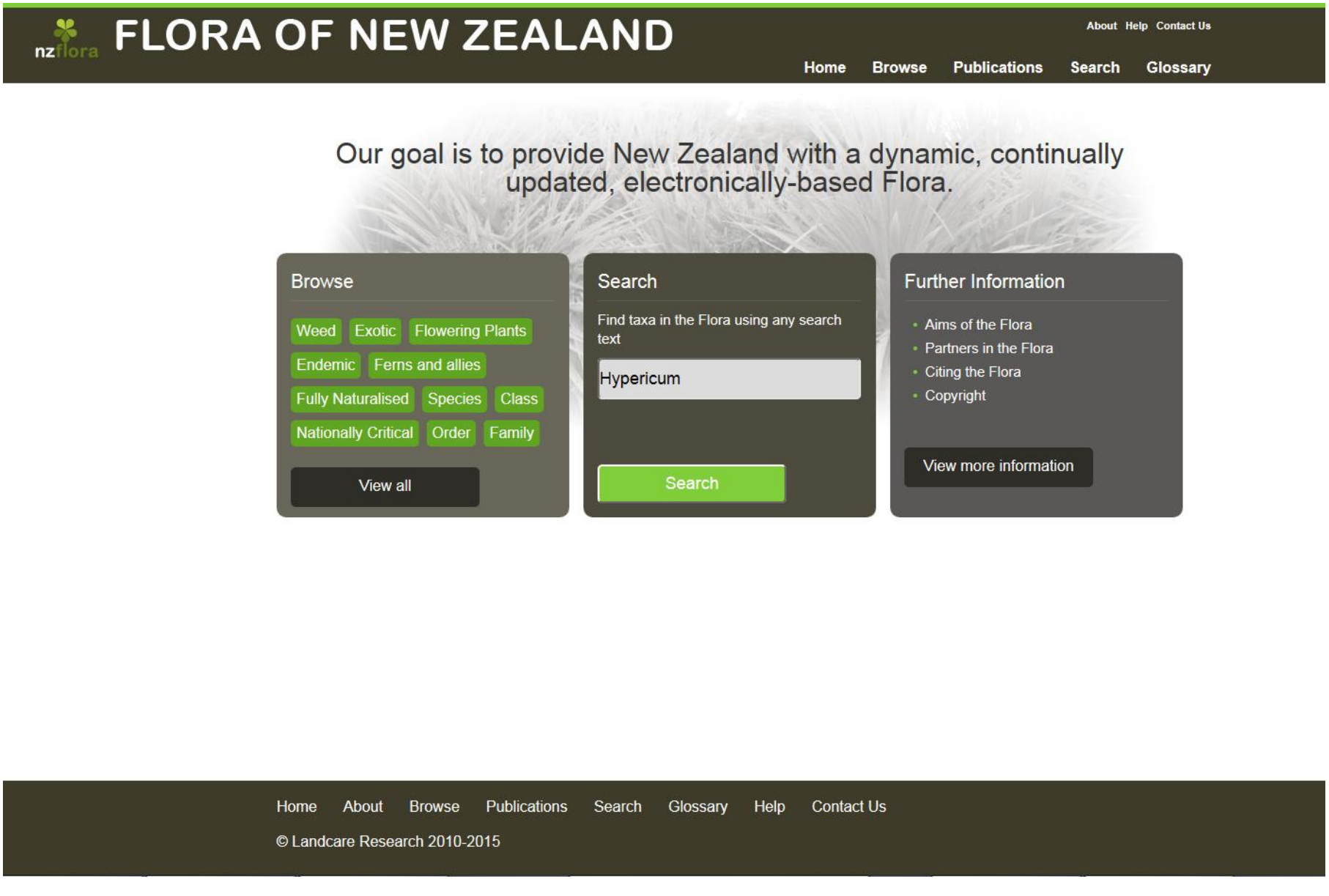
LANDCARE RESEARCH
MANAAKI WHENUA

Weeds in NZ

- Since 1769, at least 25,000 exotic species introduced (10% of world's flora), 90% deliberately.
- A species naturalises every 39 days.
- Now more naturalised than native species.
- ~500 species considered weeds at present.


CHR 617640
Sophora

eFlora (http://www.nzflora.info/index.html)



Weed Profile

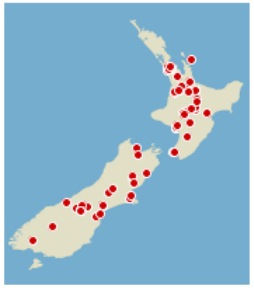
Other Profiles

Taxon

Hypericum perforatum L.

Habitat: bank, clay, coast, dry, flat , grassland, gravel, hill, lake margin, margin, moist, open, pasture, riparian, roadside, rock outcrop, sand, shrubland, slope, terrace, track, wasteland

Dispersal: Seed



Distribution from the NZ Virtual Herbarium. Copyright

Image: Trevor James © Trevor James

Recognition

- an upright and long-lived herbaceous plant usually growing 30-70 cm tall.
- it usually produces several stems each year from a woody rootstock.
- these stems are somewhat woody near the base and have paired branches in their upper halves.
- its relatively small leaves are oppositely arranged, stalkless, hairless and light green in colour.
- its bright yellow flowers (1-3 cm across) often have small black dots along the edges of their petals.
- its reddish-brown capsules (5-10 mm long) split open when mature.

[From: Environmental Weeds of Australia]

Image: Trevor James © Trevor James

Links

Weeds Key – interactive key to the weed species of New Zealand

References

Biosecurity New Zealand 2012: Regional Pest Management Strategies Database. http://www.biosecurityperformance.maf.govt.nz/

Connor, H.E. 1977: The Poisonous Plants in New Zealand. Edition 2. Government Printer, Wellington.

Howell, C. 2008: Consolidated list of environmental weeds in New Zealand. DOC Research & Development Series 292: 42.

PLANTS

- Key to flowering plant genera
- Weeds Key
- Coprosma key
- Cotoneaster key
- Grass key
- Native orchid key
- Native plants of schools & marae
- Styx Mill biodiversity guide
- Weedy daisy key
- Lucid help
- Plant identification services

RELATED CONTENT

- Plant systematics
- Allan Herbarium (CHR)

PLANT IDENTIFICATION AND INTERACTIVE KEYS

Interactive keys provide rapid and accurate identification of plants.

These keys are powerful but easy to use identification tools, multi-access and incorporate many images. Several online keys have been developed by Landcare Research and our contributors. Most were funded by the Terrestrial & Freshwater Biodiversity Information System (TFBIS) Programme. In addition, a Key to Australasian Liverwort and Hornwort Genera (by David Glenny and Bill Malcolm) is available as a CD-ROM.

Key to flowering plant genera of New Zealand

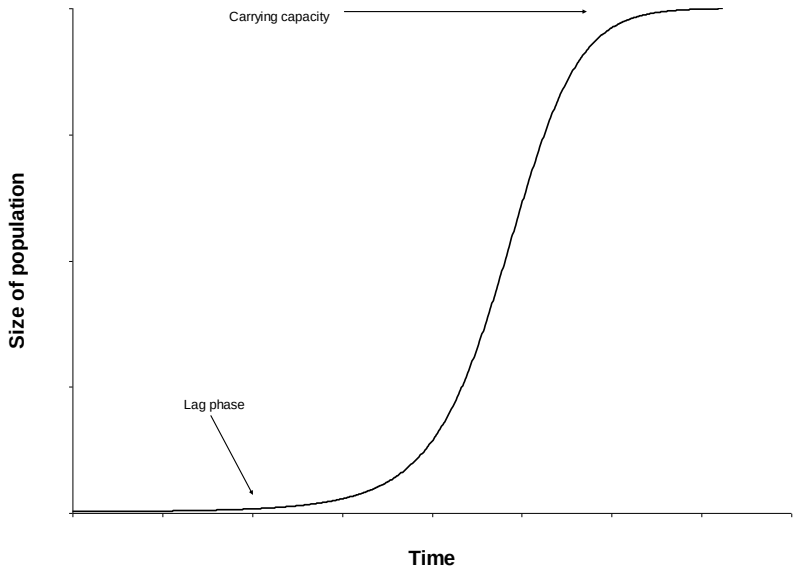
Key to the weed species of New Zealand

Key to Coprosma species of New Zealand

Key to Cotoneaster species present in New Zealand

The Future

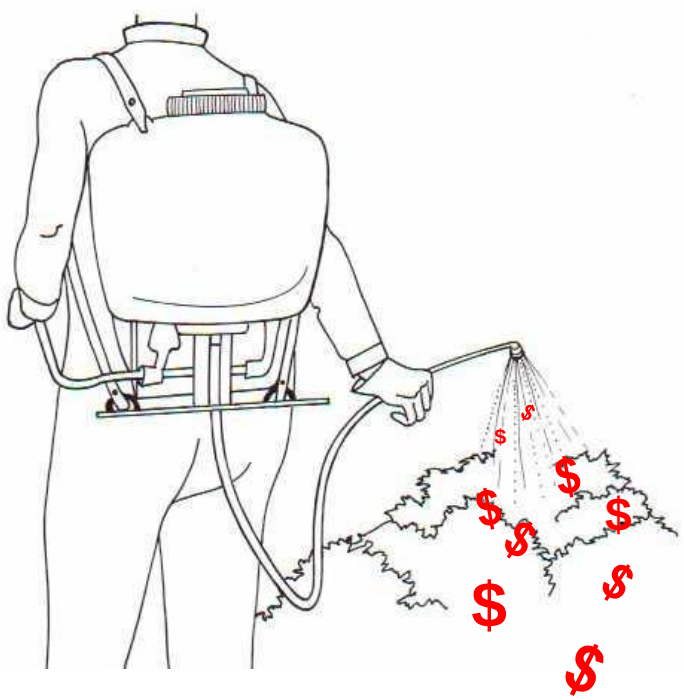
- Border largely shut, but horse has bolted.
- Few species have reached their full potential.
- Long-lived species have long lag phases.
- Weeds are going to get worse.
- It is going to be a hard battle to win!



Why Worry?

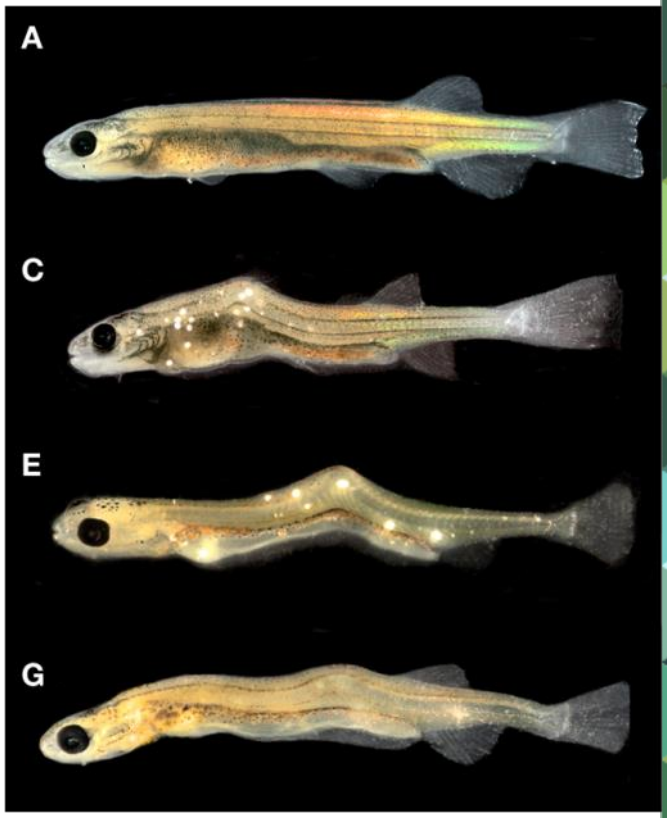
The Cost

- Pastoral weeds cost ~$1.1 billion/yr (2005).
- Ecosystem service losses ~$2.52 billion/yr (2008).
- DOC & regional councils spend ~$18m/yr to reduce biodiversity losses from weeds but are failing to contain many populations.



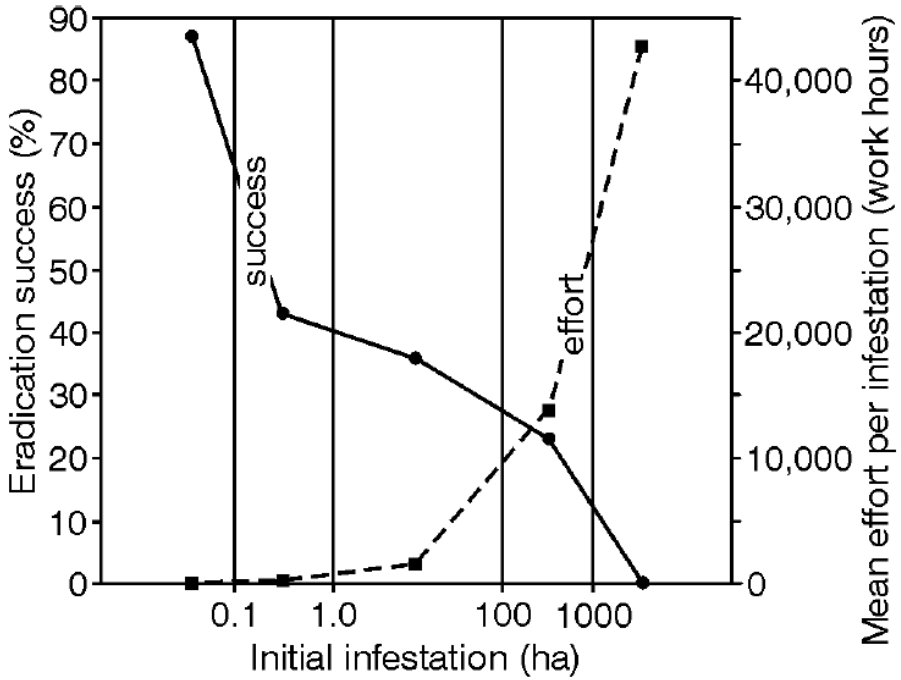
Herbicides

- Often quick and effective but can be too expensive.
- Can be unintended consequences of use.
- Restrictions on usage likely to increase.
- Resistance can develop.



Eradication

- Most cost effective strategy when weeds are low incidence.
- Usually possible for infestations <1 ha.
- 33% success when 1-100 ha.
- 25% success when 100-1000 ha.



When Eradication Is Not Feasible:

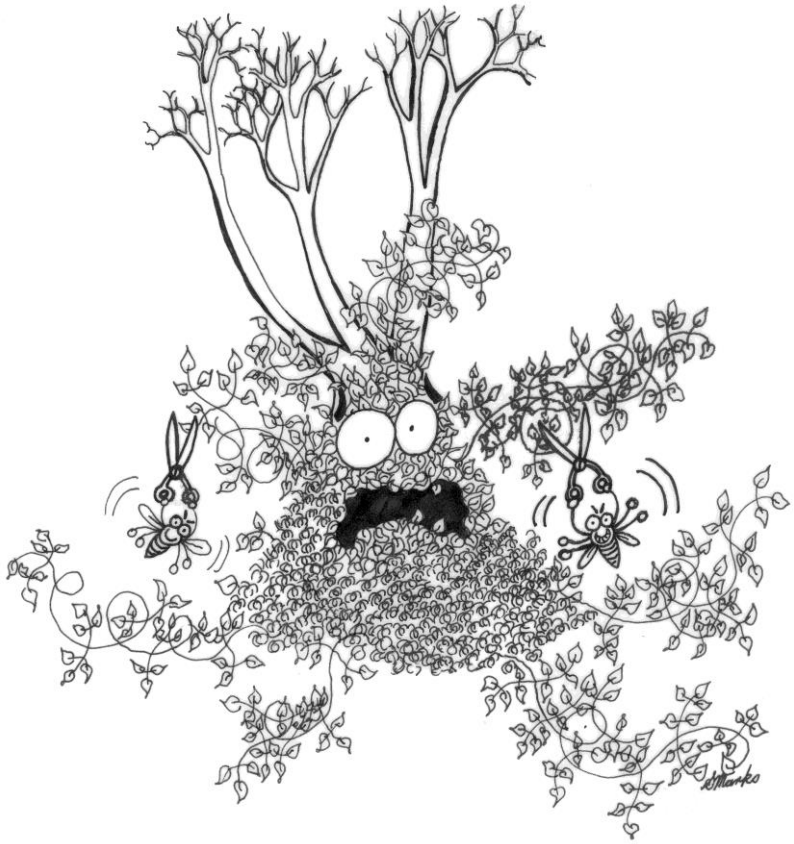
- In many situations biocontrol is the best or least damaging control method & probably the only sustainable one.
- Successful biocontrol can provide enormous benefits to communities.


Angkor Wat Bakery
& Coffee Shop
CALTEX

Heather (*Calluna vulgaris*)

What is Biological Control?

“ A technique used worldwide where we attempt to restore the balance between a weed & the environment by reuniting it with some of its key natural enemies.”

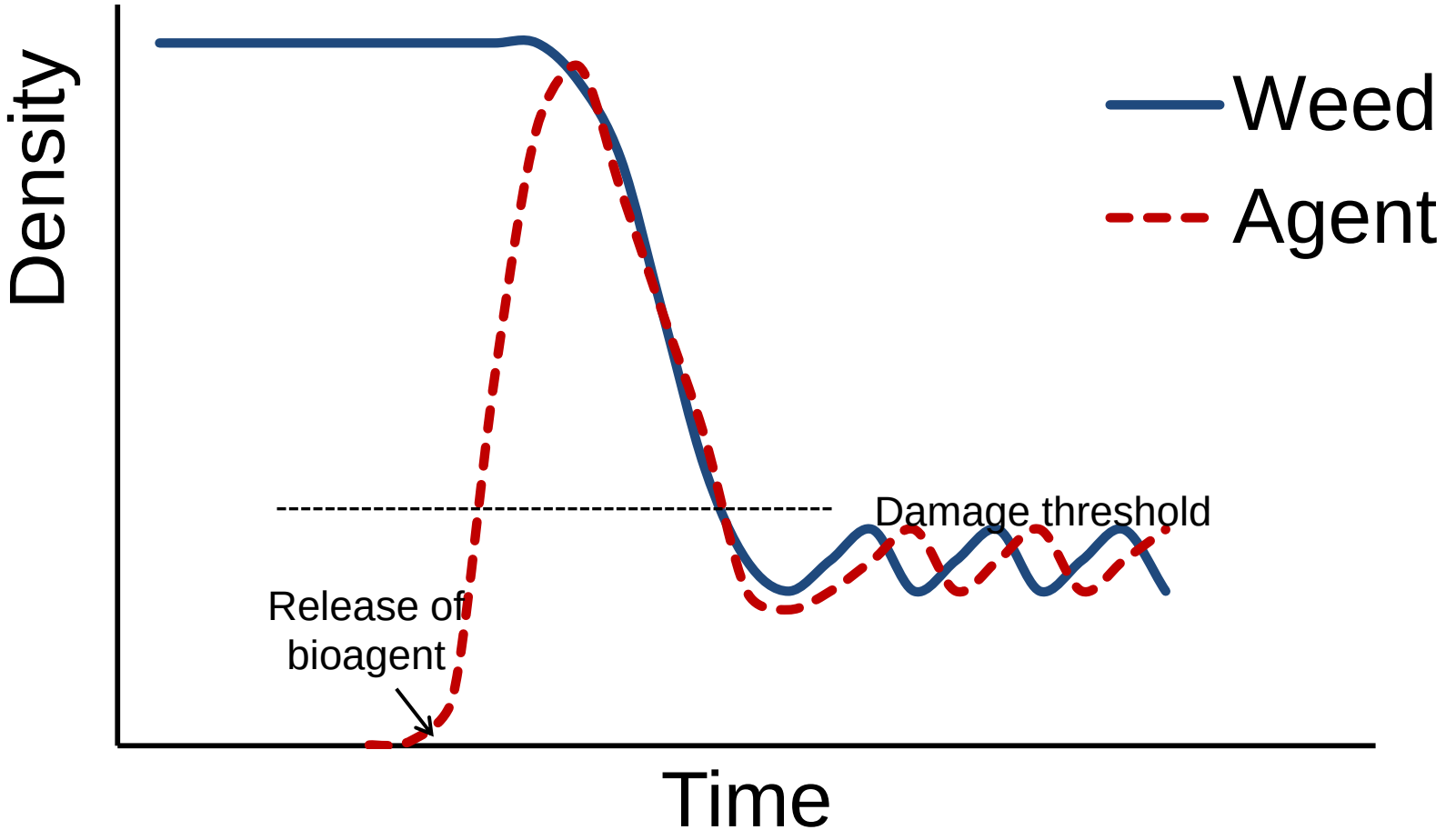


Isn’t Biocontrol Risky?

Excellent Safety Record

- NZ: ~90 yr history. 59 agents released. No significant non-target attack.
- Worldwide: 512 agents released. Only 4 (0.8%) have serious non-target impacts: all on plants in same genus as target weed & *all predictable.*
- Lower standards of biosafety in past, some releases would not be allowed today.
- Host-range testing has been improved to reduce potential risks still further.

What Will They Eat Next?



Should We Release Exotic Species?

- Insect biocontrol agents represent 1.1% of all introduced species and about 0.1% of all insects in NZ.
- Greatest threat is from the thousands of plant species already in NZ and continuous stream of accidental introductions.
- Process to import new organisms is rigorous and public are invited to participate in decision-making.

Does it Work?

- ~$^1/_3$ of programmes so successful other control options are no longer required.
- ~$^1/_2$ are partially successful (e.g. biocontrol effective in some habitats, but not in others).
- ~$^1/_6$ are failures (no impact).
- We are working on improving success rate/cost-effectiveness!

Boneseed

(*Chrysanthemoides monilifera monilifiera*)

Alligator Weed
(*Alternanthera philoxeroides*)

Nodding thistle (*Carduus nutans*)

St John's Wort
(*Hypericum perforatum*)

Economics

- Recent NPV calculated for SJW beetle introduction is between $140m (slow spread) and $1,490 m (faster spread).
- Benefit:cost ratios are 10:1 and 100:1.
- Savings provided by SJW programme, have more than paid for all weed biocontrol programmes undertaken in NZ to date!

Ragwort (*Jacobaea vulgaris*)

Ragwort

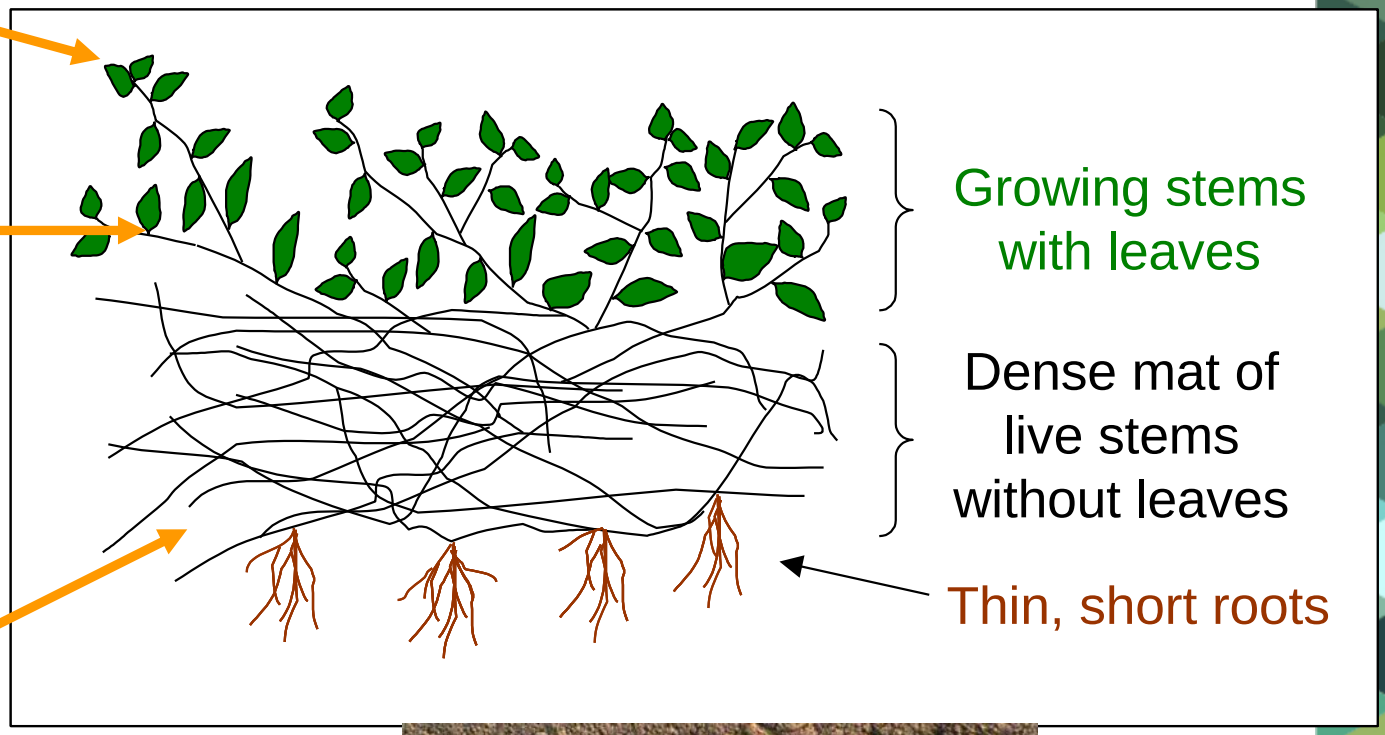
- Current annual saving in herbicide use alone for the dairy industry from the ragwort flea beetle estimated to be NZ$44m.
- Benefit to cost ratio of $14:1.
- Potential for further savings of $20m p.a with the plume moth.
- Decision to not proceed with the flea beetle in the 1920s cost NZ $8.6b!

Mist Flower

(*Ageratina riparia*)

Californian Thistle (*Cirsium arvense*)

Tradescantia
(*Tradescantia fluminensis*)



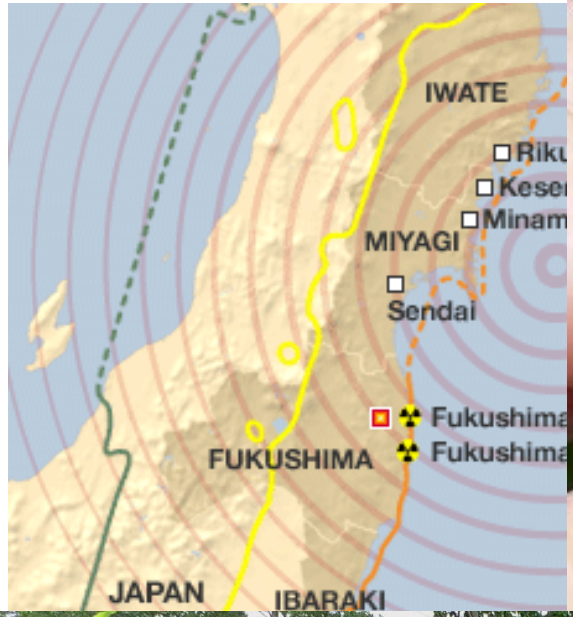
Woolly Nightshade
(*Solanum mauritianum*)

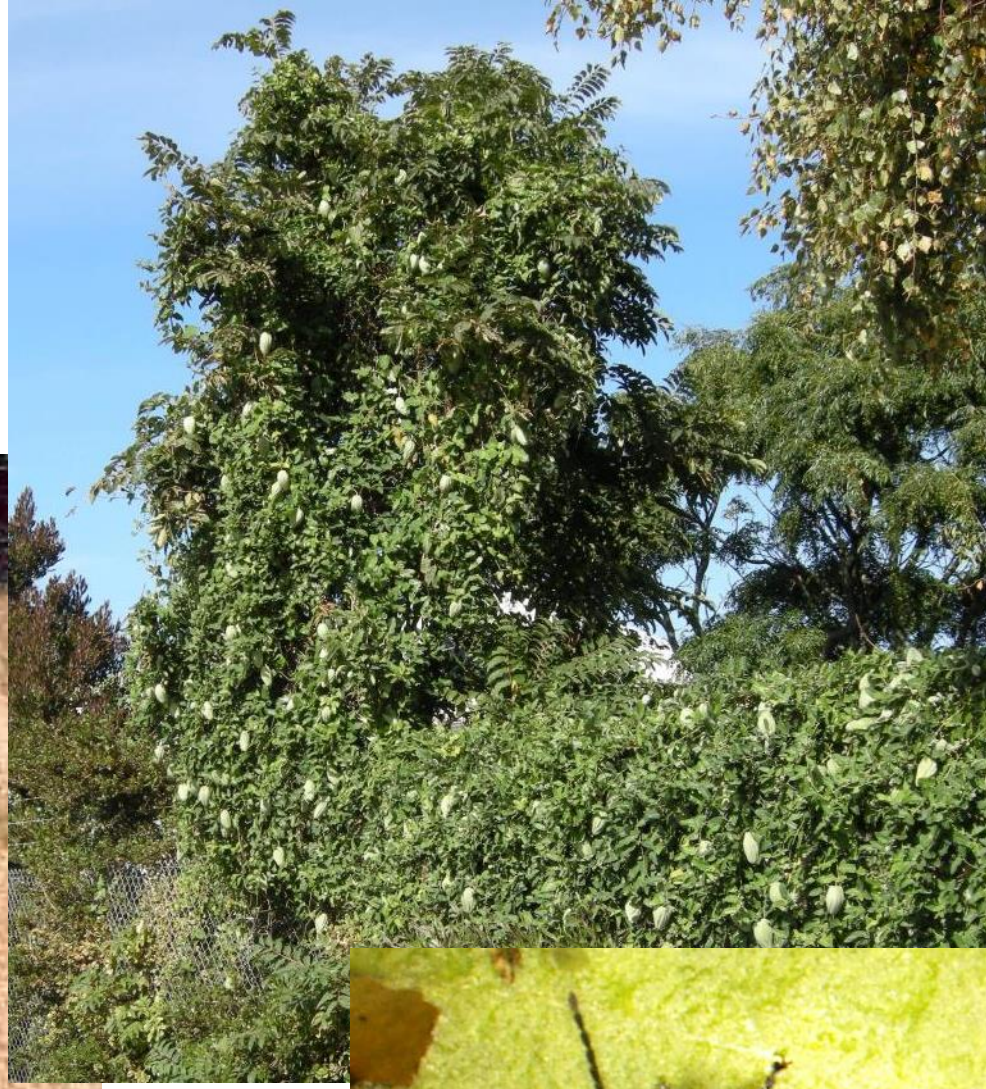
Reality Check!

- Not all weeds are suitable targets.
- Level of control can vary.
- May only result in stopping further spread.
- Will not eliminate weeds.
- Projects are not reversible, should not be undertaken lightly (follow international best practice).
- Many challenges!

Old Man's Beard
(*Clematis vitalba*)

Japanese Honeysuckle (*Lonicera japonica*)


IWATE
MIYAGI
Sendai
FUKUSHIMA
JAPAN
IBARAKI



Funding

- MBIE - underpinning science to maximise success and safety of biocontrol, plus scientific papers.
- End-users - operational research to develop biocontrol programmes, plus information for lay people.
- End-users involved at all levels.
- Good continued public support for biocontrol.

National Biocontrol Collective

- 14 key organisations pool resources.
- Undertake collective decision-making.
- Take into account NZ Inc.
- Meet annually.
- Support development of biocontrol for multiple weed targets.

Collective Targets

- Alligator weed
- Banana passionfruit
- Boneseed
- Chilean needle grass
- Darwin’s barberry
- Japanese honeysuckle
- Lagarosiphon
- Lantana
- Moth plant
- Old man's beard
- Pampas
- Privet
- Tradescantia
- Tutsan
- Wild ginger
- Woolly nightshade

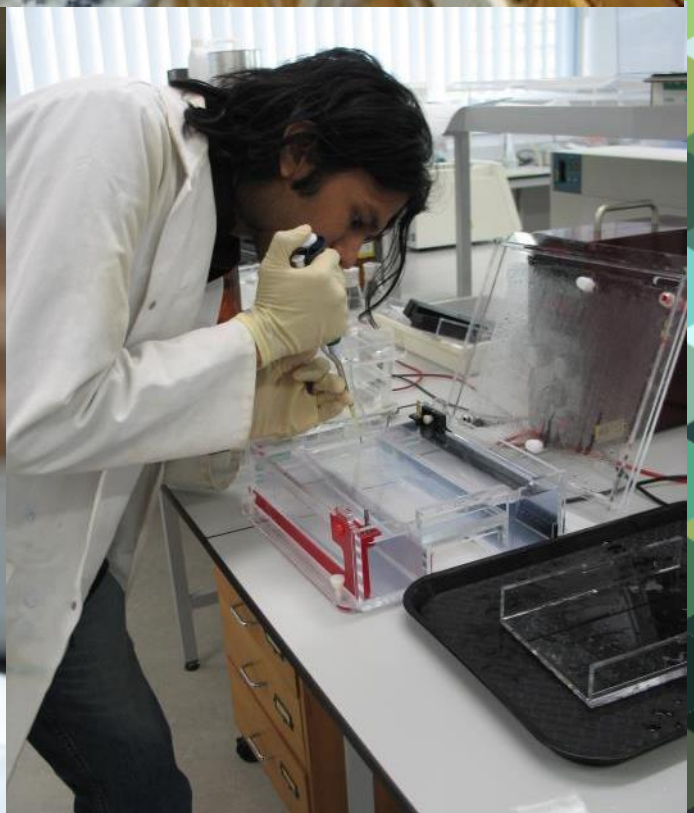
How Do We Do It?

- Step 1 – Is project feasible?
- Step 2 – Survey weed in NZ
- Step 3 – Seek agents and study them
- Step 4 – Gain permission to import/release
- Step 5 – Mass rear and release
- Step 6 – Monitoring and assessment

Is the Project Feasible?

Survey Weed in NZ

Seek Agents



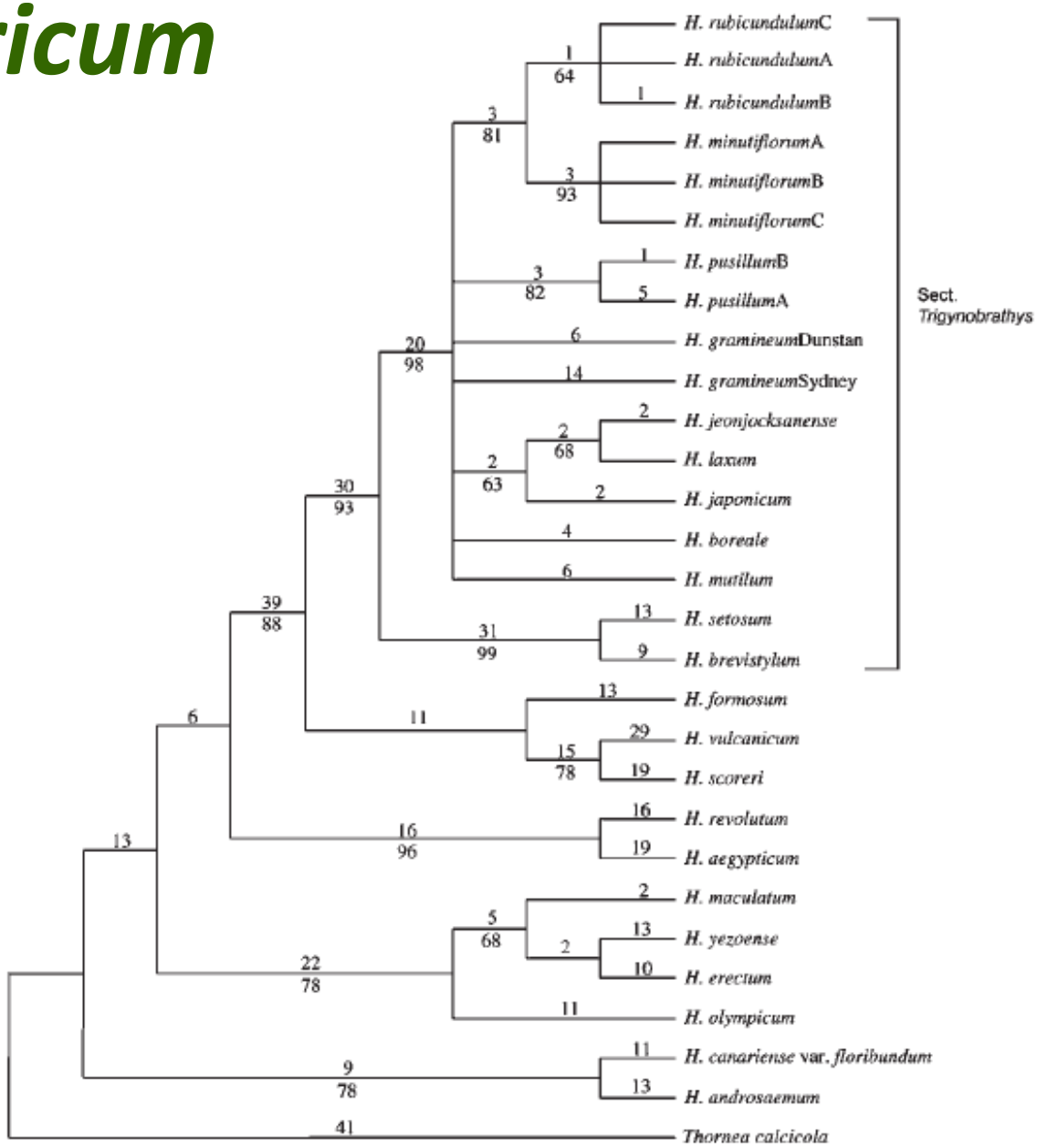
Study Potential Agents

- Host specificity is common in insects and pathogens.
- Related plants use similar chemicals for defense. Most insects and pathogens can only attack a single plant or groups of closely-related plants.

Host Range Testing

- Internationally accepted guidelines.
- Based on phylogeny.
- Number of plant species tested varies.
- Methods used depend on how agents disperse and seek out host plants.

Hypericum


H. rubicundulumC
H. rubicundulumA
H. rubicundulumB
H. minutiflorumA
H. minutiflorumB
H. minutiflorumC
H. pusillumB
H. pusillumA
H. gramineumDunstan
H. gramineumSydney
H. jeonjocksanense
H. laxum
H. japonicum
H. boreale
H. mutilum
H. setosum
H. brevistylum
H. formosum
H. vulcanicum
H. scoreri
H. revolutum
H. aegypticum
H. maculatum
H. yezoense
H. erectum
H. olympicum
H. canariense var. floribundum
H. androsaemum
Thornea calcicola
Sect. Trigynobrathys

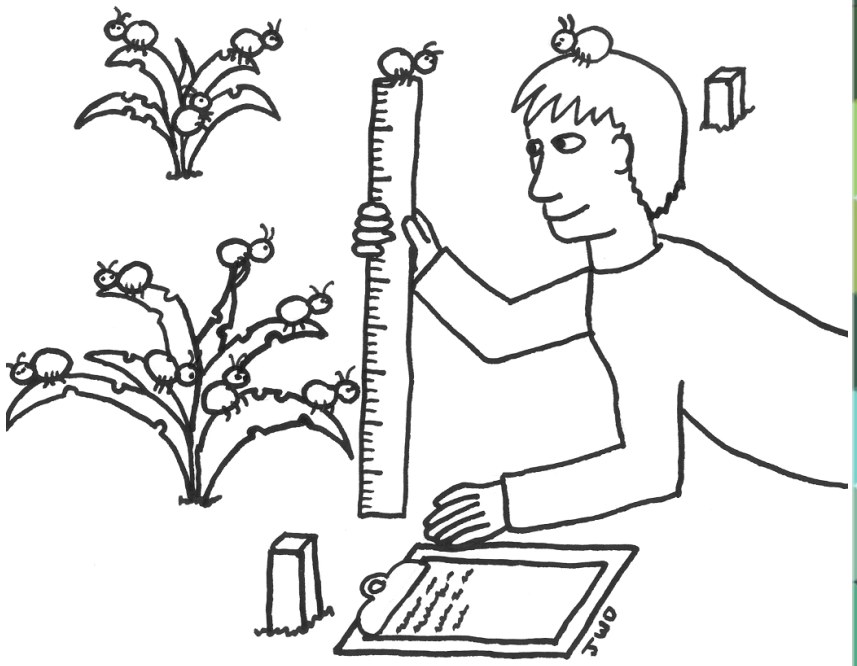

BEEVER PLANT PATHOGEN
CONTAINMENT FACILITY
DANGER

Gain Permission to Release

- EPA Process is extremely thorough, and probably the best in the world.
- Based on risks, costs and benefits.
- No applications for biocontrol agents have been rejected.
- Not a stumbling block for biocontrol as it is in other countries.

Mass Rear and Release

Monitoring and Assessment



BIOCONTROL & ECOLOGY OF WEEDS

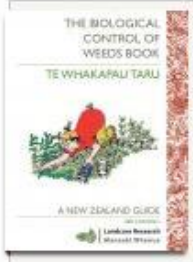
- Research
- Using biocontrol
  - The Biological Control of Weeds Book
  - Weed biocontrol projects
- Weed biocontrol education resources
- Approvals
- Videos
- Weed Biolocontrol

KEY CONTACT

Lynley Hayes
Science Team Leader
Location: Lincoln
Tel: +64 3 321 9694
Contact Lynley
View profile

USING BIOCONTROL IN NEW ZEALAND

Information to help land managers control invasive weeds.



The Biological Control of Weeds Book

Weed biocontrol projects in New Zealand

DOWNLOADABLE CONTENT & LINKS

NEWSLETTERS

- Weed Biocontrol
- Discovery
- Drylands Newsletters
- Information in formation
- IMI
- Kararehe Kino
- Landcare Research e-News
- NZAC News
- Plant Press
- Soil Horizons Newsletter
- Te Kaahu o Tuawhenua

RELATED CONTENT

- Biocontrol & ecology of weeds

SUBSCRIBE TO WEED BIOCONTROL ALERTS

via email

First Name: *

Last Name: *

Email Address: *

Weed Biocontrol

Landcare Research produces a newsletter about weeds: Weed Biocontrol (previously *What's new in the biocontrol of weeds?*), published 4 times a year.

This newsletter is published to keep clients, stakeholders, and research colleagues informed about progress towards developing sustainable biological control solutions for weed problems, and other associated relevant research about invasive weeds.

We have refreshed the look of this newsletter, but the content, style and purpose (to keep you updated and informed about weed biocontrol research) remain unchanged. Thanks to our many loyal readers who regularly send feedback after each issue. It is always wonderful to receive this and please keep it coming. If you still receive a hard copy and are ready to make the move to an electronic version, please let me know.

Happy reading! Lynley.

AVAILABLE ISSUES

Weed Biocontrol Issue 73

August 2015

In a Nutshell

- Slow
- Safe
- Selective
- Sustainable
- Successful

Broom (*Cytisus scoparius*)

Thank You!