Forest Research
The Research Agency of the Forestry Commission

Prioritising sites for *Rhododendron* control.

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Survey of Rhododendron in woodlands in mainland Argyll and Bute: FCS

Data was compiled from a wide range of sources:

- high resolution survey maps,
- hand drawn maps,
- anecdotal accounts,
- gardens and estates in Argyll and Bute,
- Supplemented and verified by drive-by surveys.

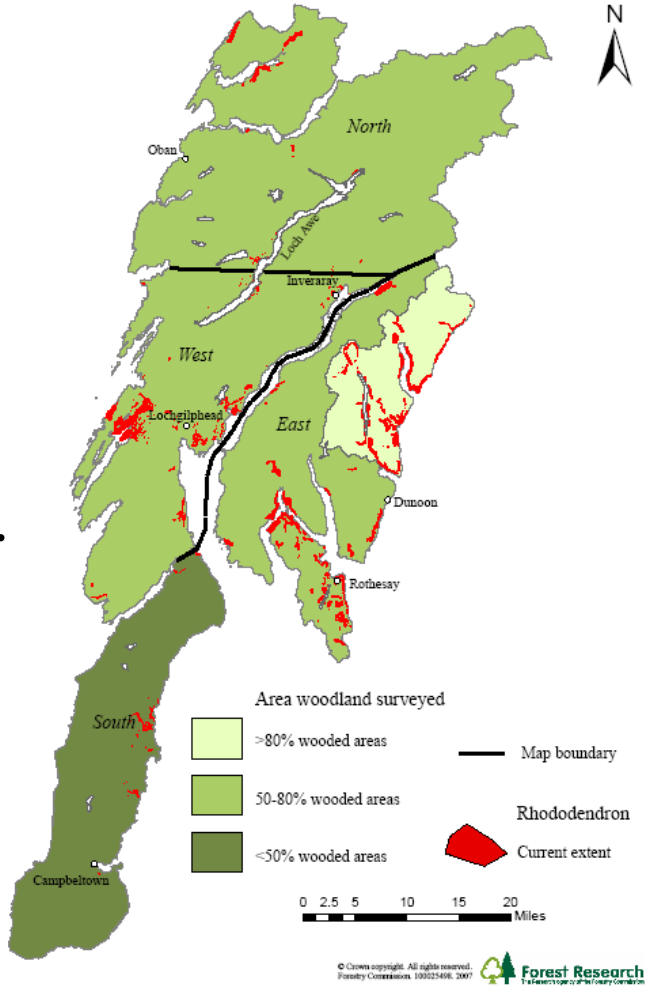
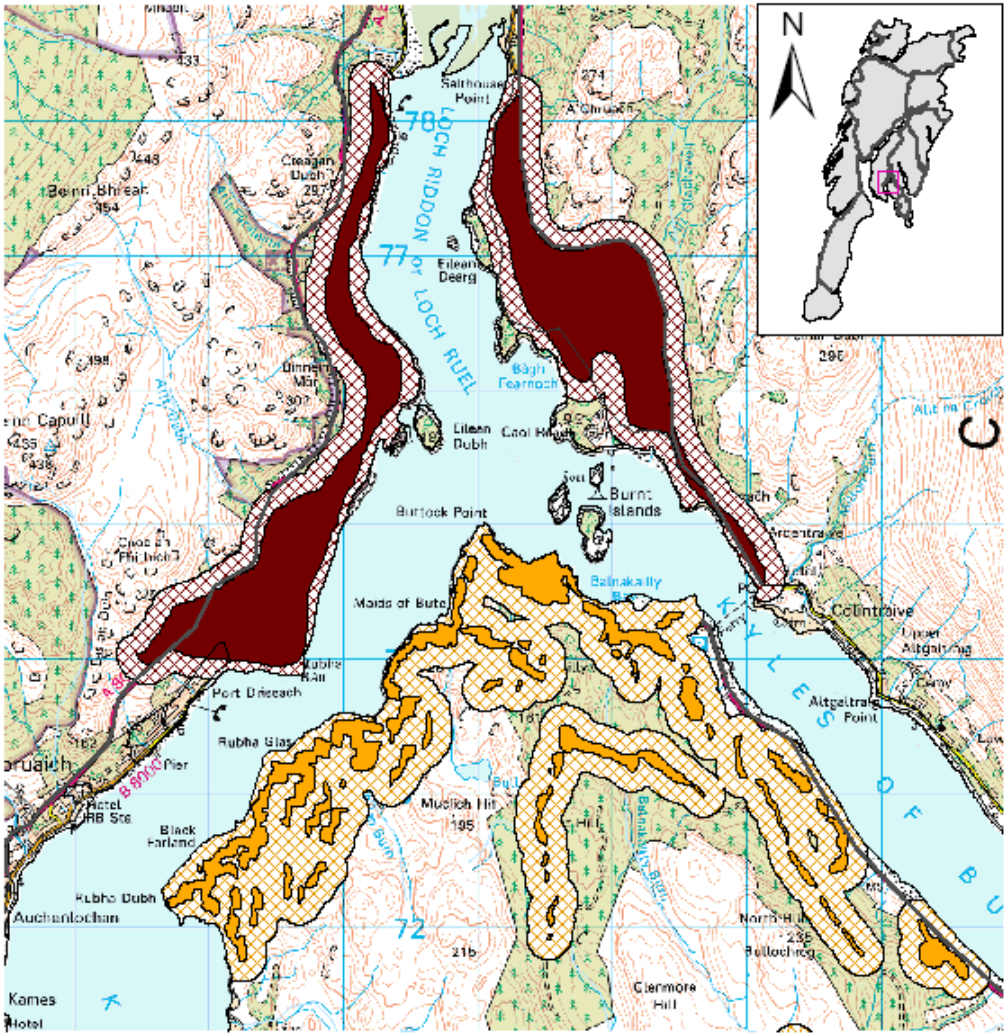


Table 2. Current extent of rhododendron by habitat type in Argyll and Bute.

Habitat type [a]	Rhododendron area (ha) by type of bush cover					Land area [c] (%)
	Dense	Sporadic	Scattered	Control [b]	All	
Commercial woodland	358.1	667.2	1745.0	530.7	3301.0	2.9
Native broadleaved woodland	245.3	74.4	235.2	108.2	663.0	4.7
Agricultural	181.4	35.2	213.3	46.5	476.4	0.4
Heathland/mountain	13.6	14.4	91.6	0.1	119.8	0.1
Coastal	1.0	0.9	11.9	18.4	32.2	4.6
Unknown	4.5	21.9	5.6	0.0	31.9	1.1
Non-habitat	7.9	2.1	16.2	0.1	26.3	0.2
Gardens	0.0	0.4	2.0	0.0	2.3	0.4
Bog	0.0	0.0	1.3	0.0	1.3	0.0
All habitats combined	811.8	816.4	2322.0	704.0	4654.2	1.0

Potential expansion



- Modified the landscape ecology habitat network analysis model (BEETLE) to predict future expansion (seed dispersal and stem layering).

- We predict a 23% increase in area by 2028 (additional £3 million to control) assuming no major disturbances.

- We calculate that 15,000 ha of land is under threat of invasion from current populations.

- There are indications that faster seed movement occurs along linear transport routes; probably by increased air currents caused by vehicles or the dislodging of mud and debris containing rhododendron seeds.

- Priority should be placed on rapidly expanding populations, or those that have ability to invade sensitive habitats (assessed through analysis of landscape connectivity).

Comparison with SNP: expansion & cost of control.

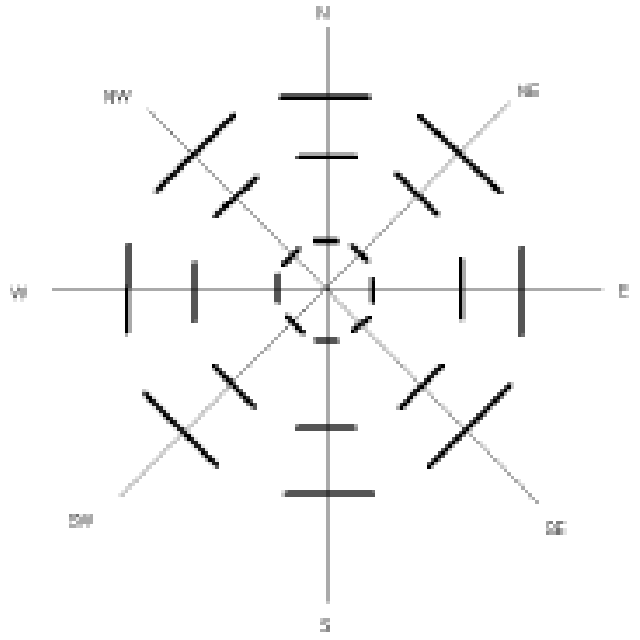
Area of rhododendron in Snowdonia Nation Park.

Area occupied in 1986 survey	Area successfully controlled since 1986	Area occupied in 2007 survey	Increase in area (21 years)
1,921 ha	-230 ha	2,075 ha	384 ha (18.2 ha yr^{-1}) 20 % increase cf 1986 figure

Cost of control estimated to be £11 million (Jackson, 2007).

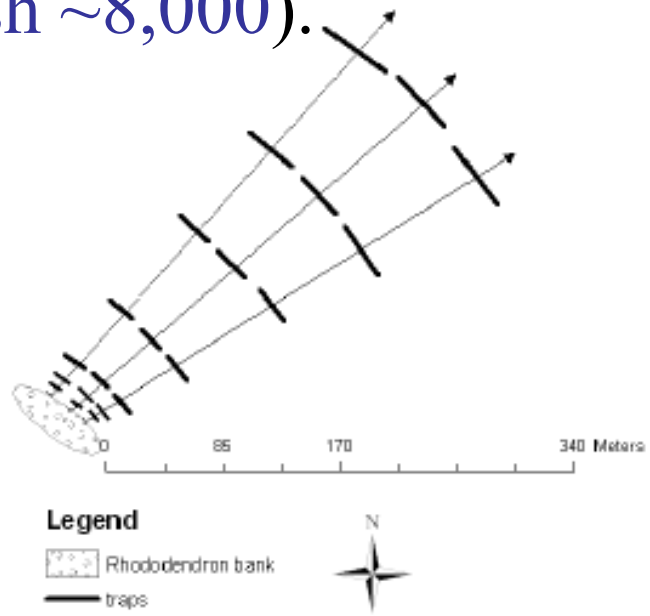
Seed dispersal – capture/release

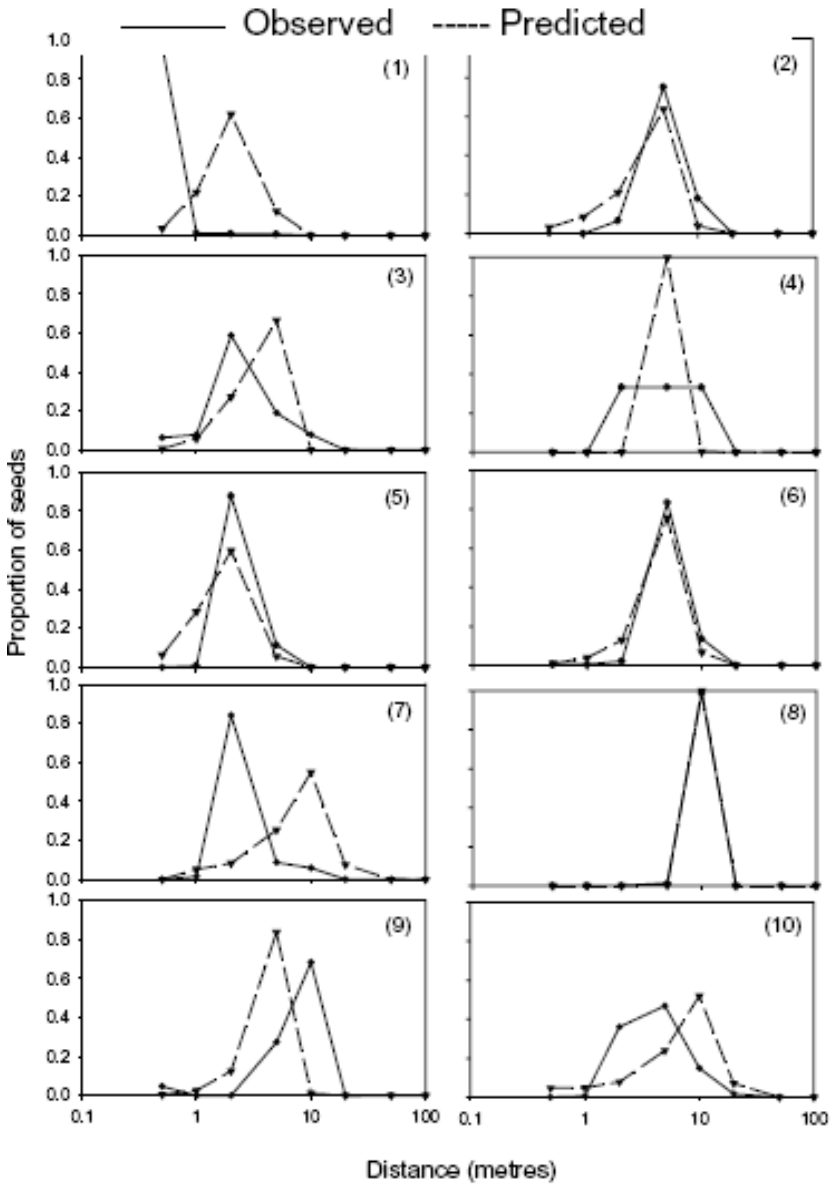
- 99.8% of seeds captured were on traps ≤ 10m from the release point
- greatest number of seeds captured at 5m.
- Only 0.001% recorded travelling 50m or more.



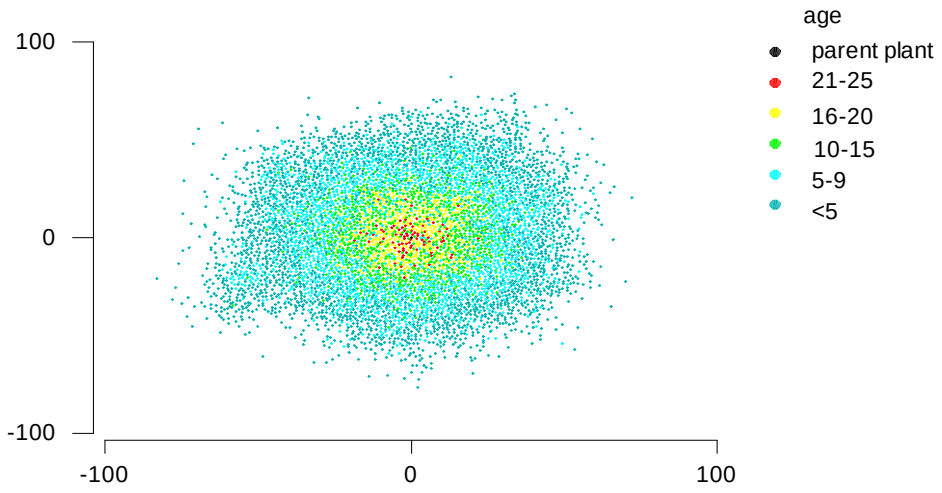
Seed dispersal – natural population

- 97.1% of captured seeds were found on traps ≤ 10m from the source…
- …the greatest number at 1m.
- Only 0.02% travelled 50m or more,
- Only 0.01% were captured at 100 m (from mature bush ~8,000).





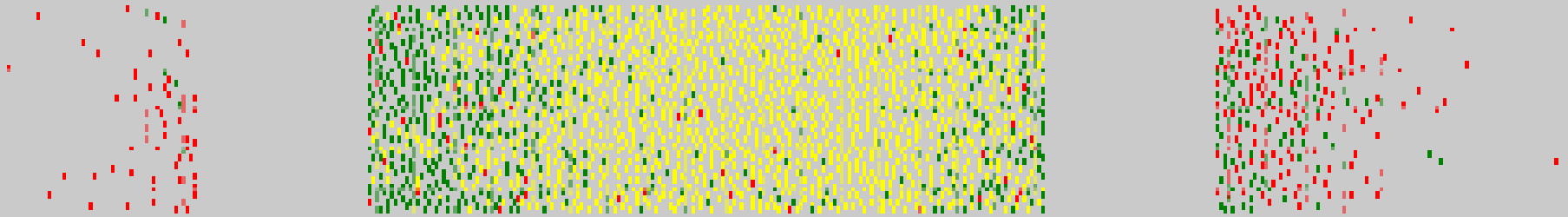
Control strategies tested



Used a stochastic, individual-based, spatially- and temporally-explicit model, to predict the spread of *R. ponticum* through a homogeneous landscape, and to investigate the efficacy of a range of control strategies.

- Size of *cordon sanitaire* to prevent expansion from seed source.
- Control effort concentrated on the expanding front…
- Control effort concentrated on the individuals close to the point of introduction (core)…
- both above ± return for new seedlings each year.
- All individuals were ranked by age and the oldest plants removed each year.

Effective cordon size



- With a 150m *cordon sanitaire* no plants escaped and established outside of the *cordon* within the 40 to 80 years that data was collected following the invasion reaching the edge of the containment area.

- However, this fails to take into account long distance assisted seed dispersal, transport routes or linear features.

Results – prioritising control effort

- In older established populations, the strategy that required the least amount of effort to achieve eradication was to start at the core without returning for new seedlings.
- Starting at the edge and returning for seedlings never achieved eradication within the range of plant removal effort investigated.
- Regardless of the year that control was initiated, removing the oldest plants each year proved to be a much more efficient strategy than any of the other strategies tested.

Conclusions

- Predicting a 20% increase in area over 20 year period (no disturbance to habitats).
- Calculate minimum of 15,000 ha habitat at risk from invasion (if disturbed).
- For eradication projects to be successful, prioritise tackling oldest (tallest) bushes first; don't return to cleared habitats for new seedlings until seed source eradicated.
- Control mature seed producing bushes along transport routes to avoid or mitigate the potential effects of assisted long distance dispersal.

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