Rhododendron survey

Sarah L. Taylor
Keele University

Technical Seminar
11th June 2008.
Inveraray, Argyll.

Introduction

Project aim:

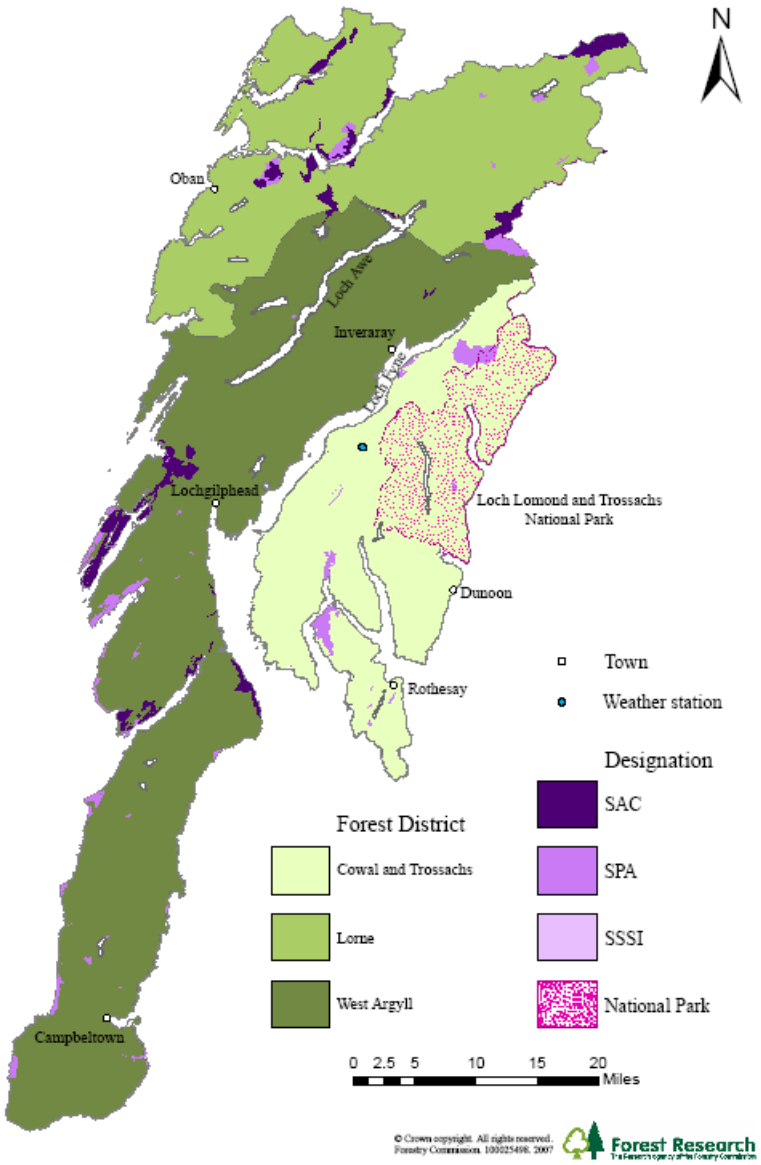
- To develop a strategical approach to control management of rhododendron on Argyll and Bute mainland

Step 1. Know where current populations are (mapping)

Step 2. Identify areas under threat of invasion (models)

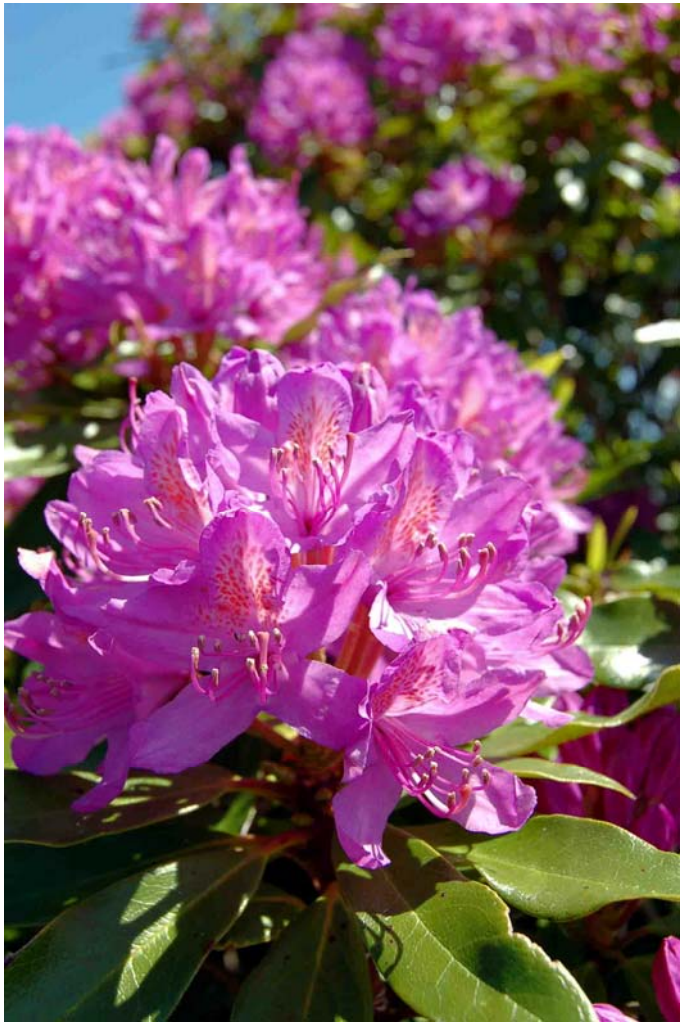
Step 3. Characterise rhododendron metapopulations (impact)

Step 4. Prioritise control at metapopulation level (strategy)



Talk contents

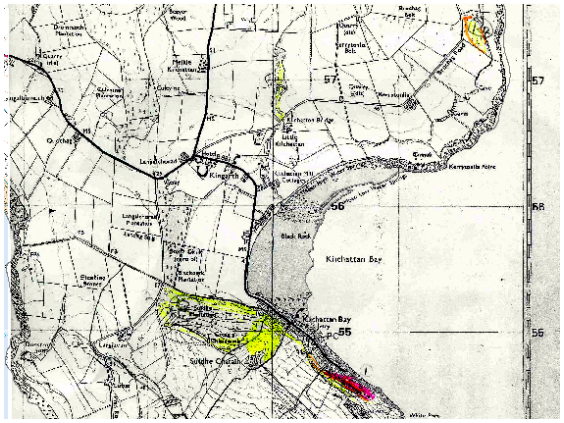
- Survey methodology
- Rhododendron invasion model
  - BEETLE
- Current mapped extent
  - Habitat types, bush sizes, slopes
- Areas under threat from rhododendron invasion
  - Conservative - vs - worse case scenario
- Future work
  - Ecological Site Classification
  - Remote sensing
  - Dispersal mechanisms

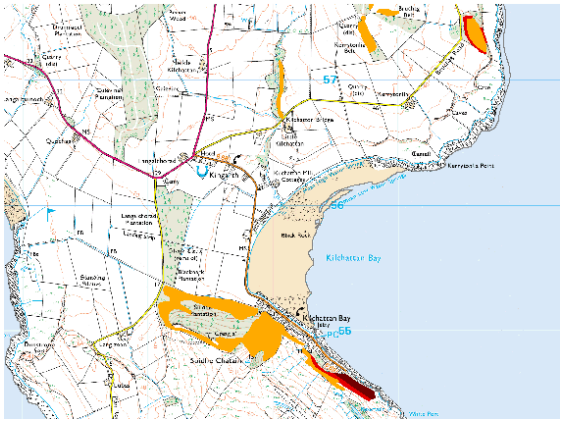


Survey methodology

TYPE OF DATA SOURCES: High resolution survey maps, drive-by surveys, hand drawn maps, anecdotal accounts – four bush cover types

DATA COMPILATION: Data digitised and collated into GIS database





CONTRIBUTORS: Cowal and Trossachs Forest District, Forest Research, Lorne Forest District, West Argyll Forest District, SNH Species Action Framework, Arduaine Garden, Bute Conservation Trust, Crarae Garden, Knapdale Scottish Wildlife Trust, Loch Lomond and The Trossachs National Park, Achnacloich Garden, Ardkinglas Estate Nurseries, J Dixon Management Consultant, Duntrune Castle, Farming and Wildlife Advisory Group, UPM Tillhill

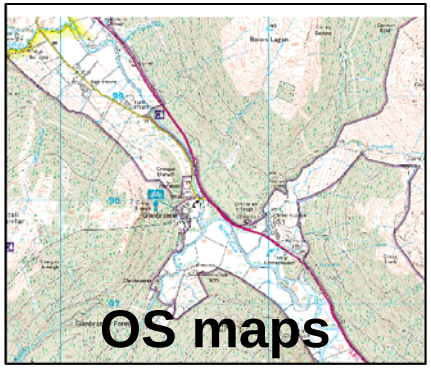
Rhododendron invasion model

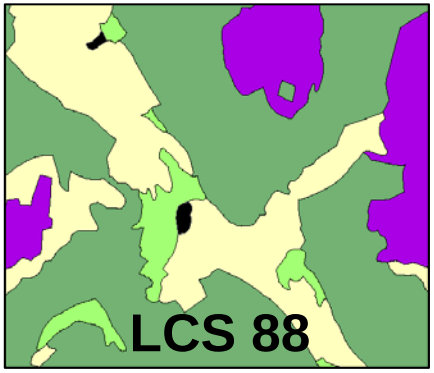
BEETLE (Biological and Environmental Evaluation Tools for Landscape Ecology)

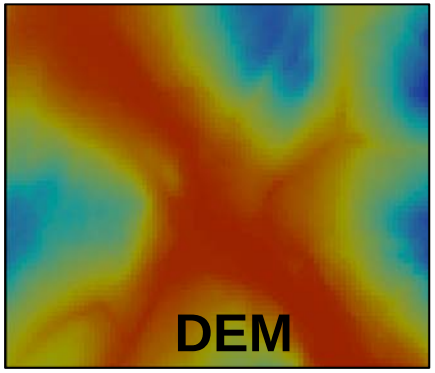
- Used to assess functional connectivity of suitable rhododendron habitat across the wider landscape

Required GIS resources:

- Rhododendron survey maps - bush cover types
- Ordnance survey maps - transport routes
- Land Cover Scotland (LCS) - habitat types
- Digital elevation model (DEM) – 400 m threshold

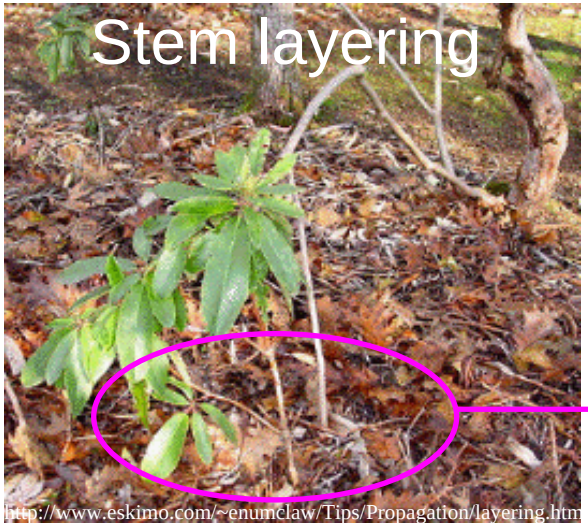






Modes of invasion

1. Vegetative stem layering
   - Average rate of 2 m/year in broadleaf habitat
   - Restricted to habitat adjacent to source populations
2. Wind-assisted seed dispersal
   - Seed dispersal in February to June
   - Max distance of 100 m in open conditions in prevailing wind



Rhododendron invasion model

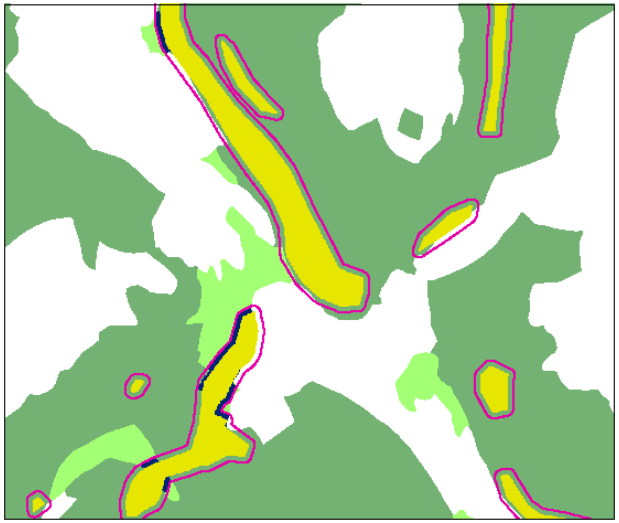
Bog barrier to stem layering, but not to seed dispersal…

Chartley Moss, courtesy of P.A. Thomas 2008

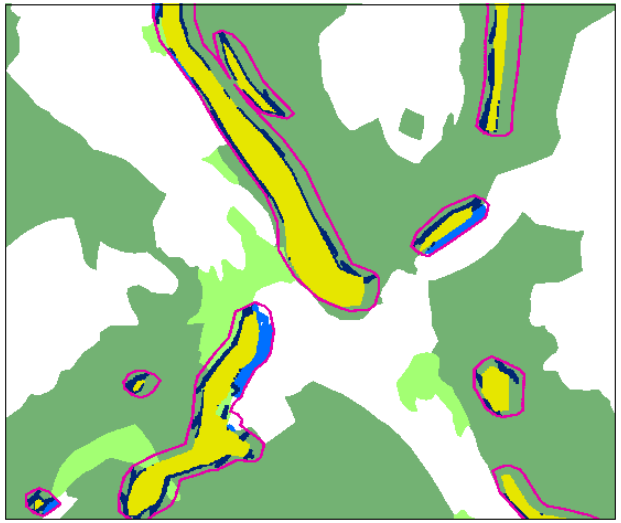
Rhododendron invasion model

Conservative scenario

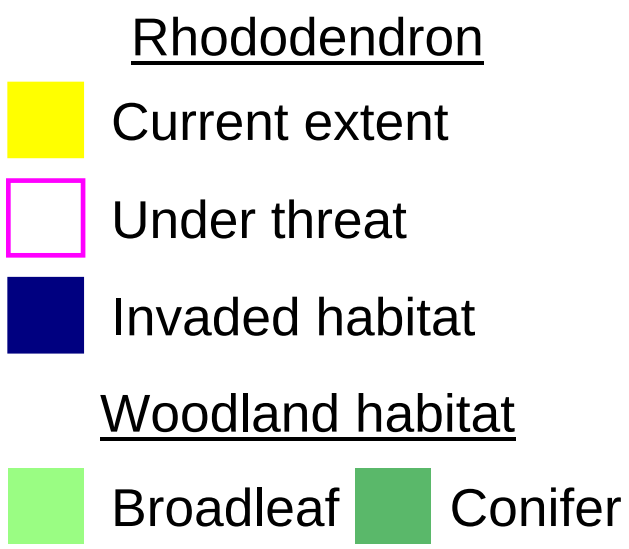
- Past control 100% successful
- Invasion restricted by landscape barriers, wind direction, etc.
  - E.g., Seed dispersal reduced to 5 m in woodland
- Only rhododendron-suitable habitat under threat from invasion
  - E.g., Layering will not occur in coniferous woodland



Stem layering model

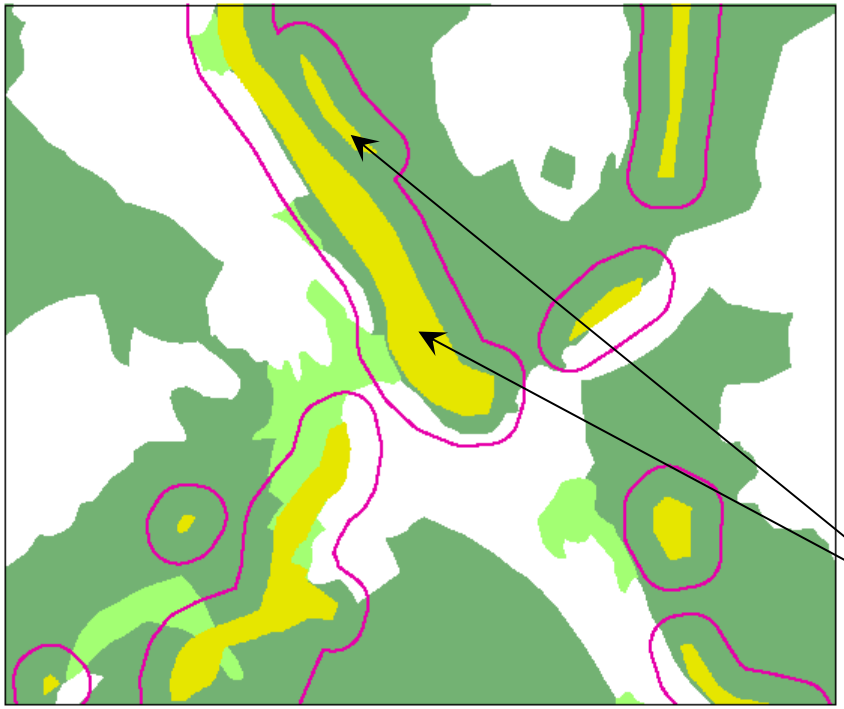


Seed dispersal model



Worse case scenario

- Past control was 100% unsuccessful
- Dispersal unrestricted by wind direction or landscape barriers
- All habitat (except waterbodies) within 150 m buffer under threat from invasion – *metapopulation*



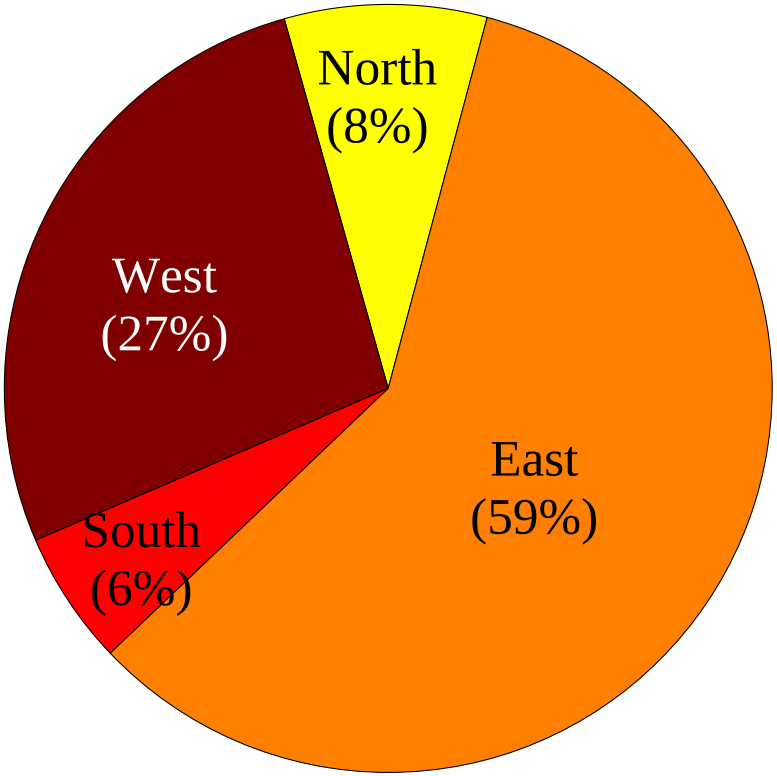
Rhododendron
Current extent
Cordon sanitaire (150 m)

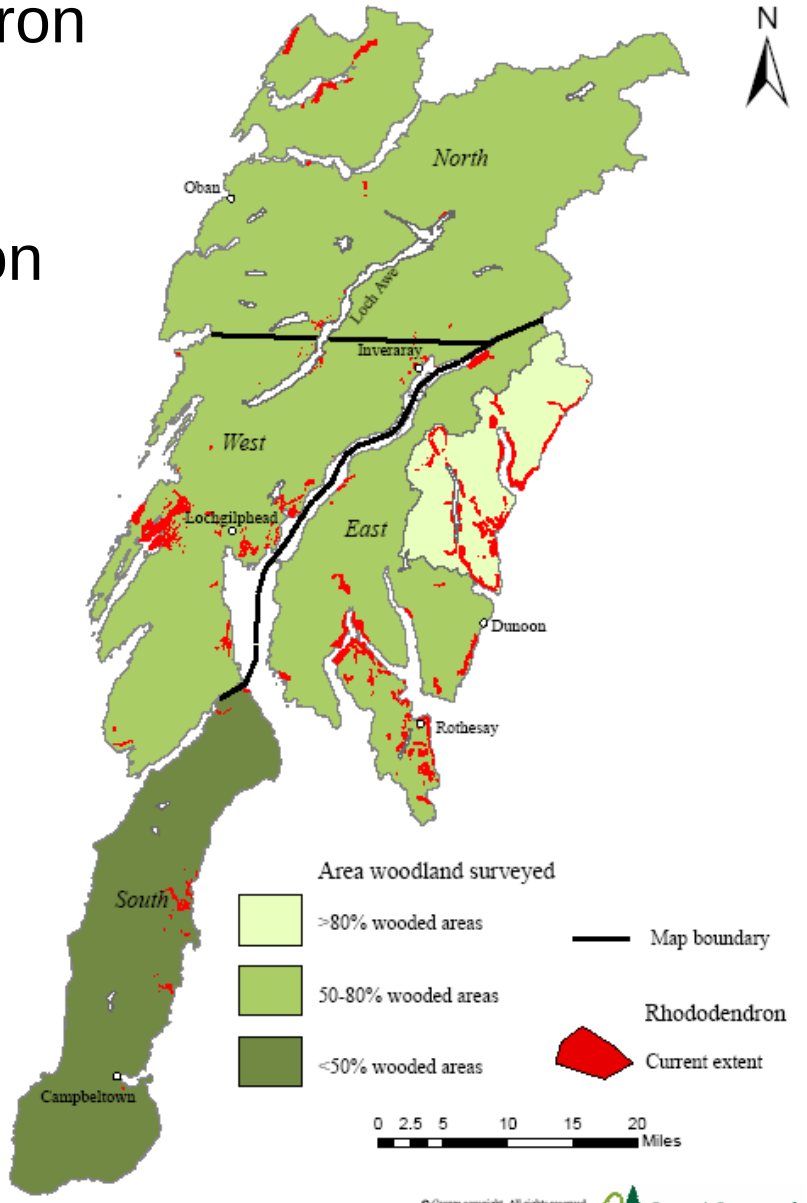
Woodland habitat
Broadleaf
Conifer

Individual populations in the same metapopulation

Current mapped extent

- Patchy distribution of rhododendron
- Rhododendron covers 4,654 ha, equivalent to 1% of land area
- Most abundant in east map region





Current mapped extent

Dense

- Bushes > 2.5 height
- 80-100% density cover
- High reproductive capacity

Sporadic

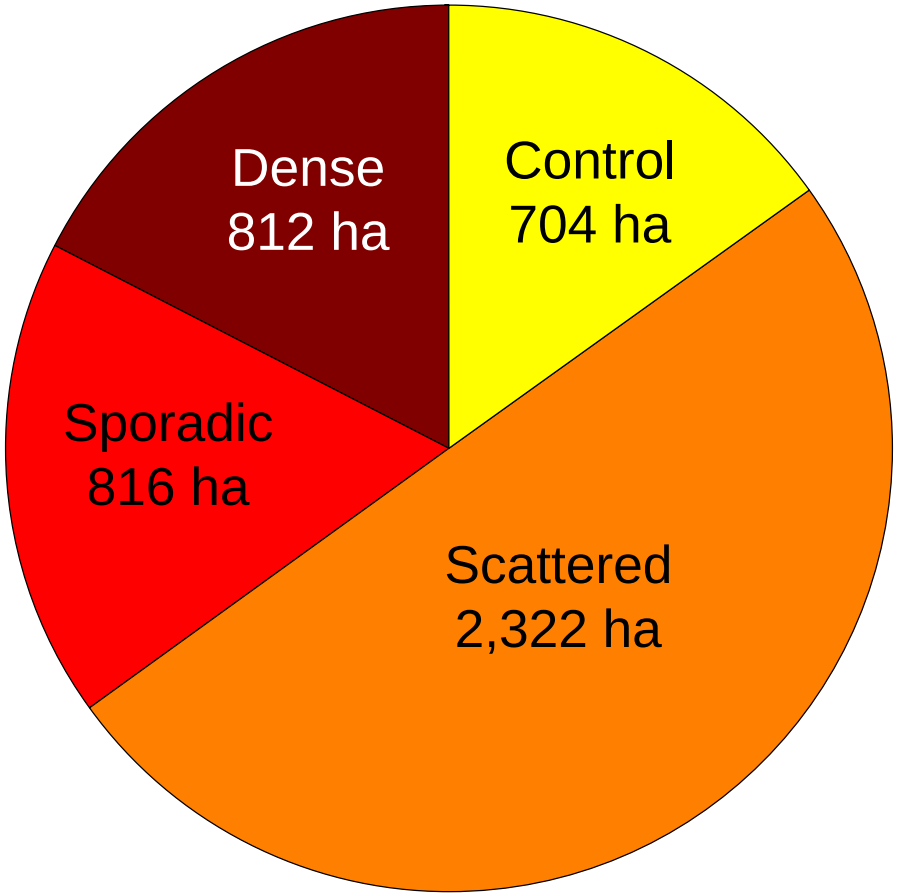
- 1.5 – 2.5 m height
- 50-80% density cover
- Moderate seed production

Scattered

- < 1.5 m height
- <50% density cover
- Low seed production

Control

- Status before control unknown

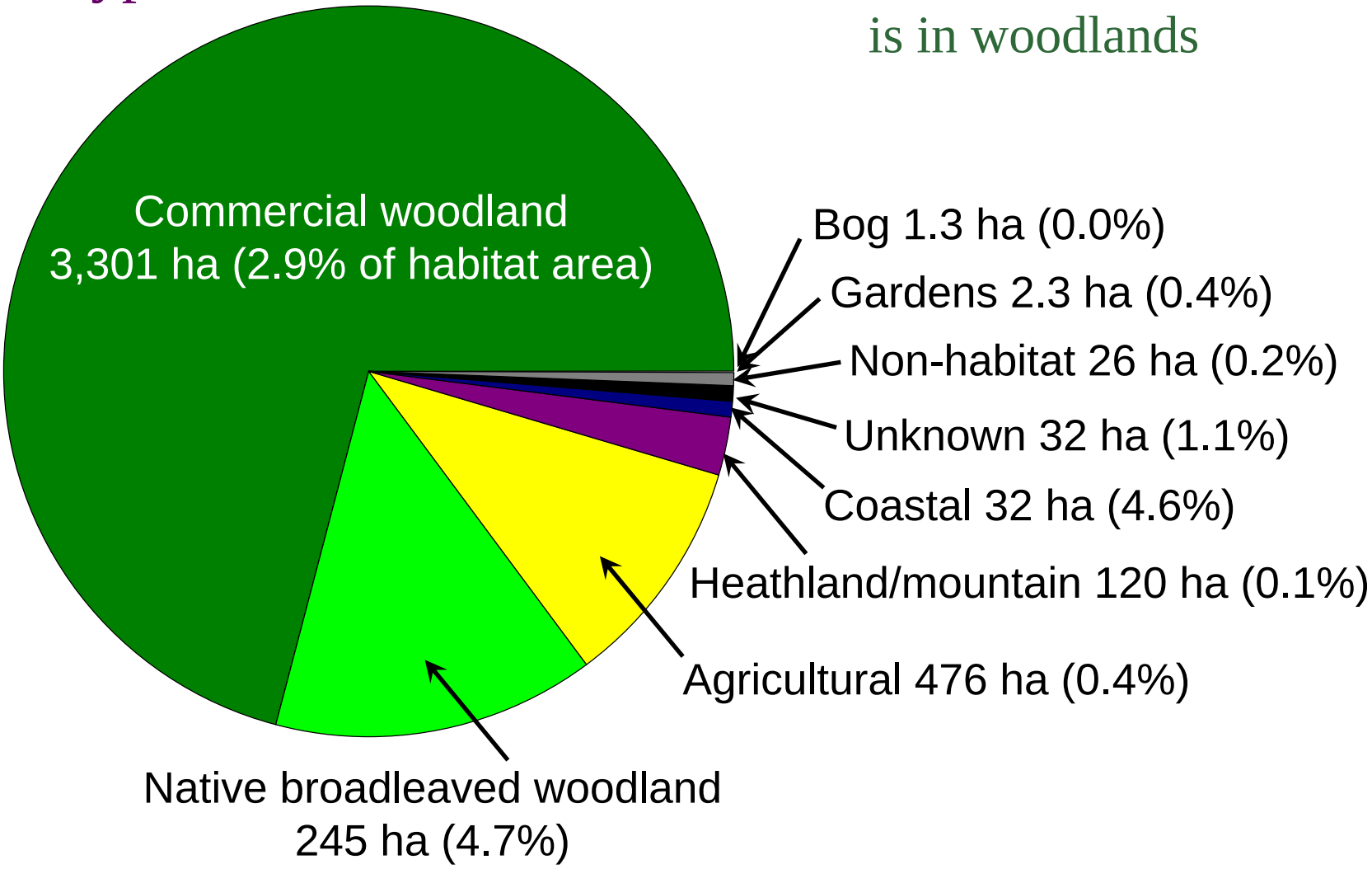


Bush cover type

Current mapped extent

Habitat type

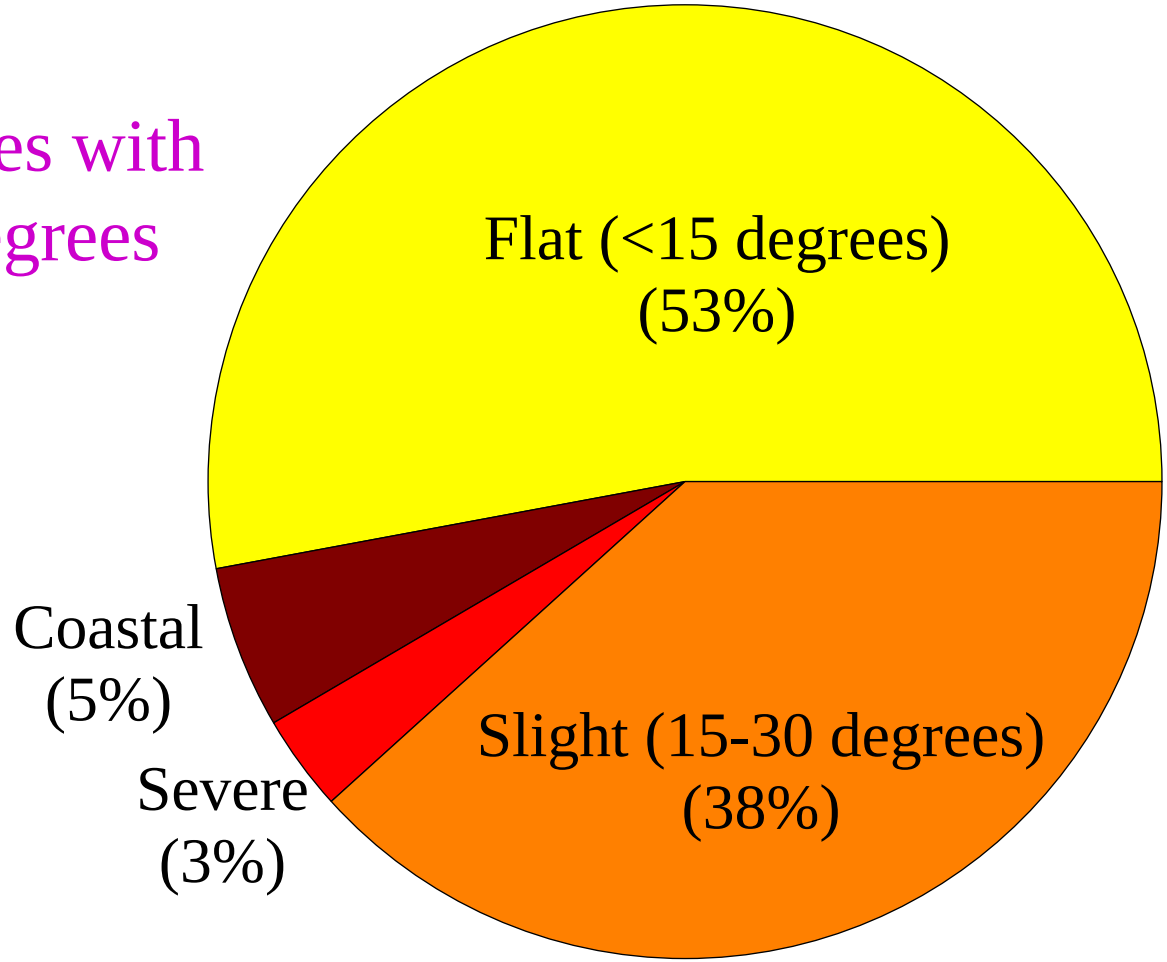
85% of rhododendron is in woodlands



Current mapped extent

Slope

Majority on sites with slopes <30 degrees



Surveyor bias?

1. Transport routes

- Drive-by surveys commonly used to map rhododendron
  - 9% of area within 10 m of transport route
- Transport routes may be acting as dispersal conduits
  - Cars/trains carry rhododendron seeds on wheels

2. Habitat types

- Rhododendron surveys part of woodland management
  - 85% of area in woodland (commercial + native)
  - Lack of surveys for heathland/mountain habitat

3. Site designation (e.g., Ancient Woodland)

- Site condition monitoring programs (SAC, SSSI)
  - 59% of area in east map region (includes LLT NP)

Areas under threat from invasion

Summary statistics	Current	Conservative (20 years)	Worse case
Control success	(704 ha)	100%	0%
Landscape barriers		Yes	No
Habitat specificity		Yes	No
Total area (ha)	4,654.2	4,851.1	15,308.4
Land area (%)	1.0	1.1	3.5
Worst hit habitat by % area	Native bf wood 4.7	Native bf wood 5.7	Coastal 49%

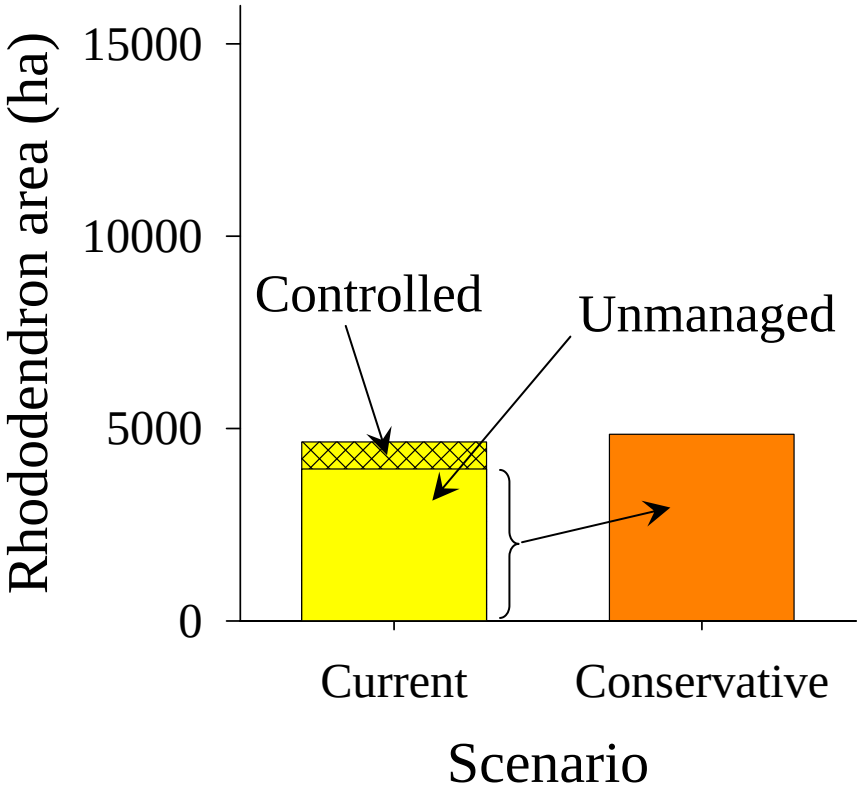
Areas under threat from invasion

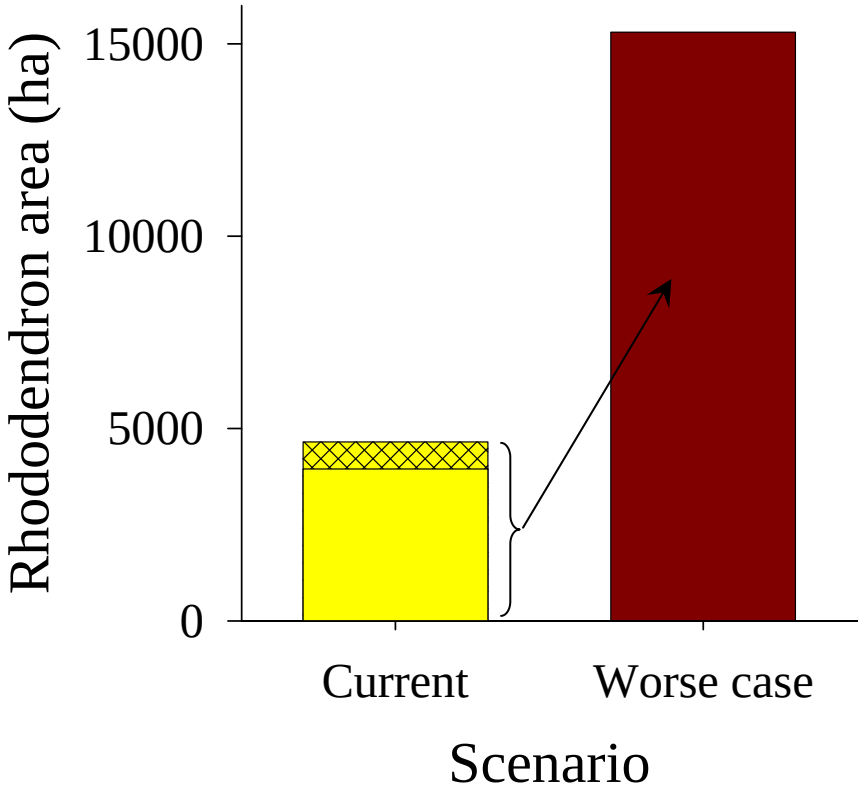
Conservative scenario

- Pre-control levels in 20 yrs

Worst case scenario

- Potential for 3-fold increase

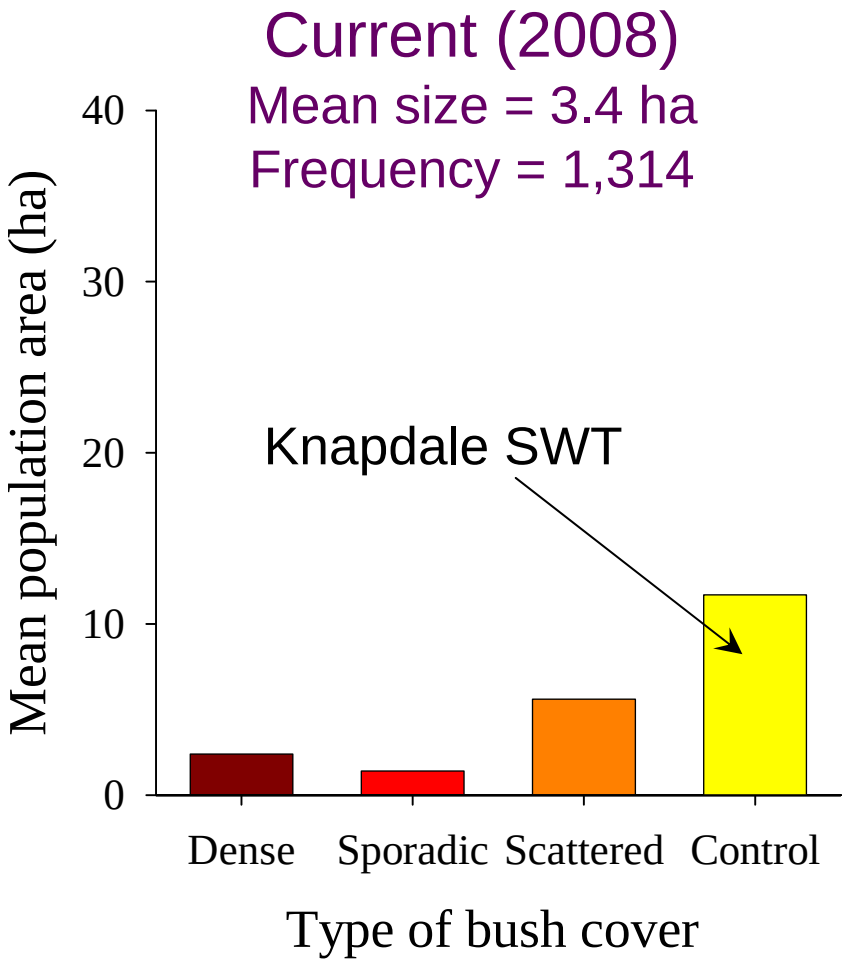


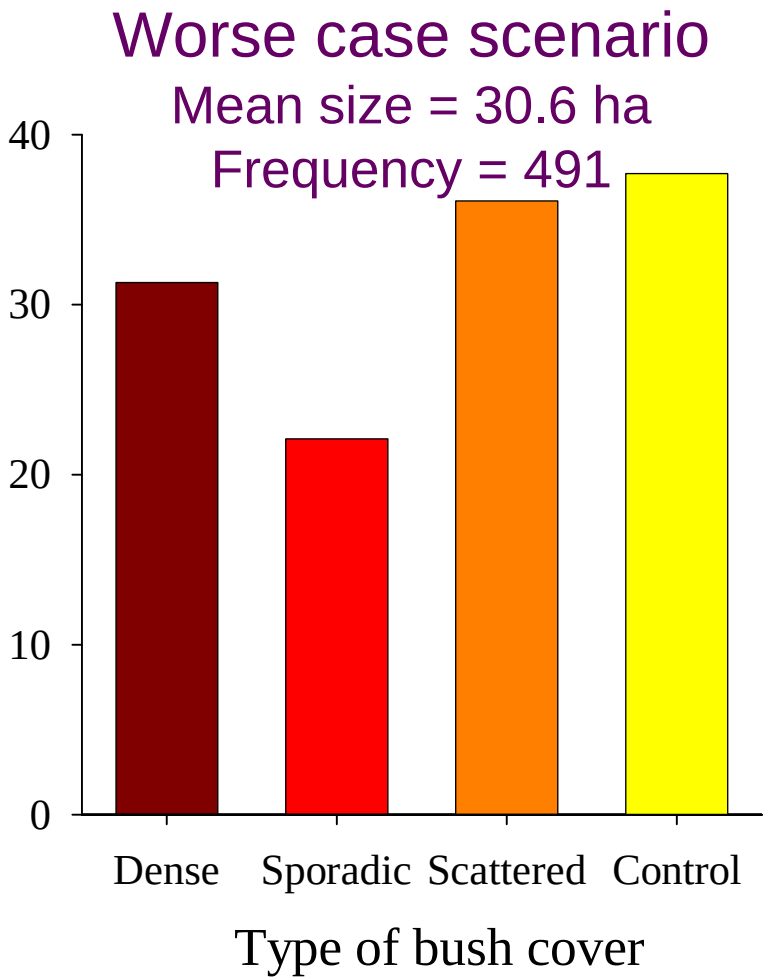


Areas under threat from invasion

Changes in population characteristics:

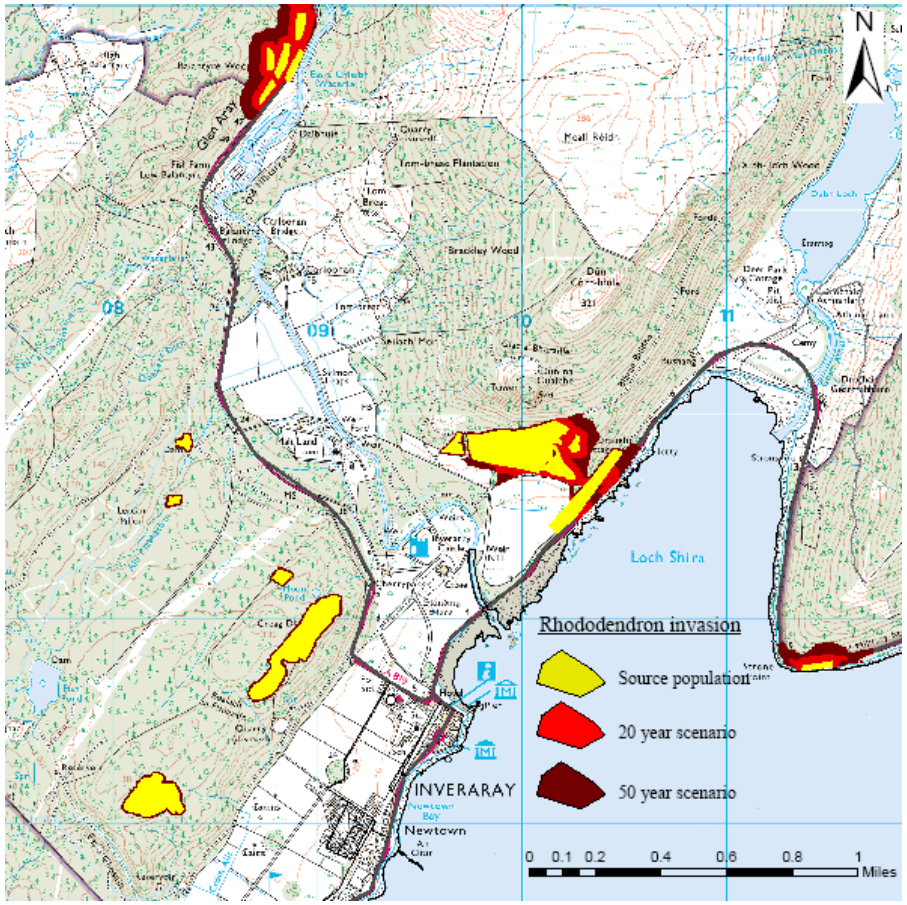
Populations coalesce to form fewer larger area invasions



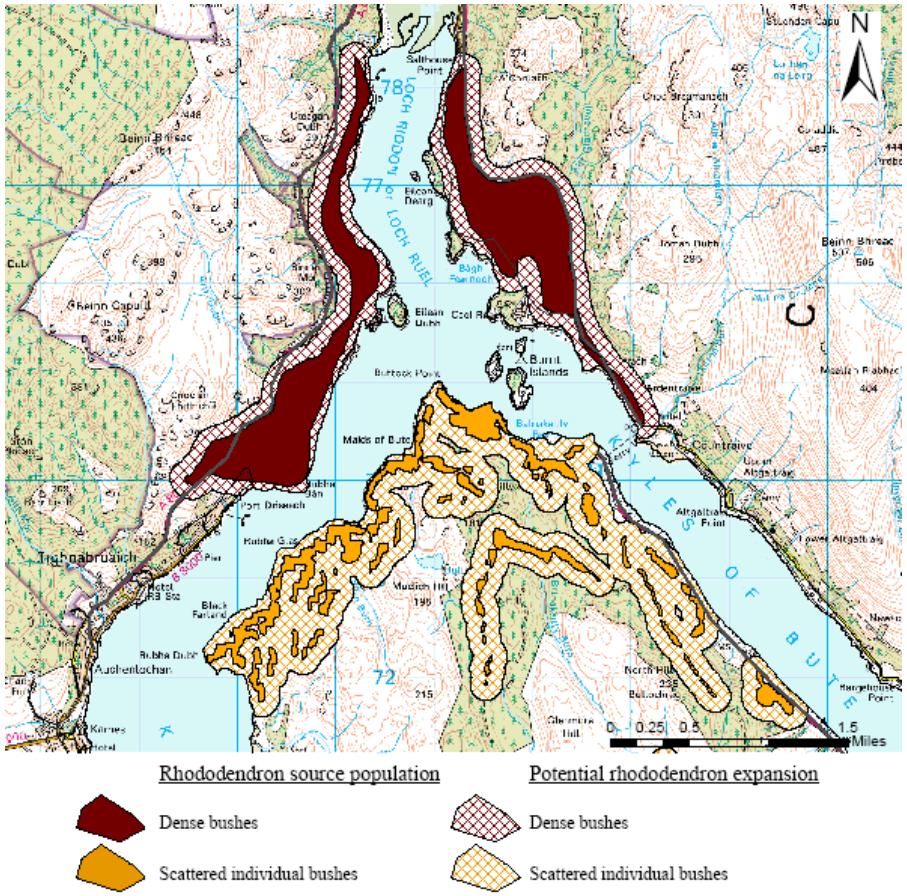


Areas under threat from invasion

Examples of rhododendron invasion model output:



Conservative scenario
for area around Inveraray



Worse case scenario
for the Kyles of Bute

Areas under threat from invasion

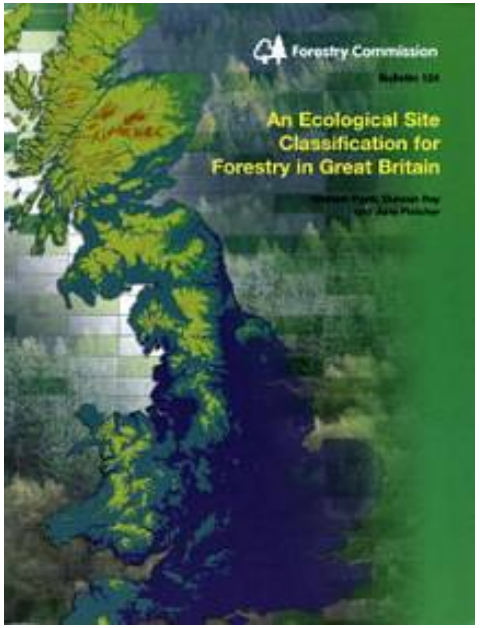
Implications

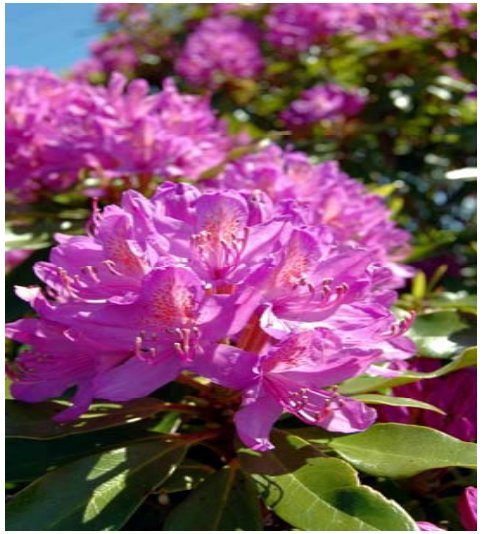
- 10,654 ha under threat of invasion if receptive to seed (worse case)
- Changes in management could make site receptive to rhododendron seed
- Need to minimise disturbance within 150 m *cordon sanitaire*

Future work

Ecological Site Classification (ESC)

- Assesses a site in terms of its climate and soil quality
  - Accumulated temperature, moisture deficit, windiness and continentality
  - Soil moisture regime, soil nutrient regime
- Match key site factors and ecological requirements for a species
  - 24 species, 20 NVC habitat types
- Potential to develop rhododendron specific model that will account for effect of climate change





Future work

Sitka spruce ESC model

- Rhododendron bush cover associated with sitka spruce site suitability
  - Site suitability: dense 0.767, sporadic 0.744
- Could be used to predict site suitability to rhododendron invasion

Problem…

- Bush cover type confounded by length of site occupancy
  - Vegetative layering increases site occupancy over time > scattered to sporadic after 50 years

http://en.wikipedia.org/wiki/Sitka_Spruce

Future work – model improvements

Potential improvements to the invasion model

- Survey data
  - Remote sensing could remove surveyor bias
- Habitat specificity for seedling establishment
  - Ecological Site Classification
  - LCM 2000, ongoing woodland inventory
- Seed dispersal mechanisms
  - Dispersal of seed by vehicles along transport routes
  - Probability weighted model for wind-assisted seed dispersal

www.lancs.ac.uk/fass/ihr/images/fandmcar.jpg

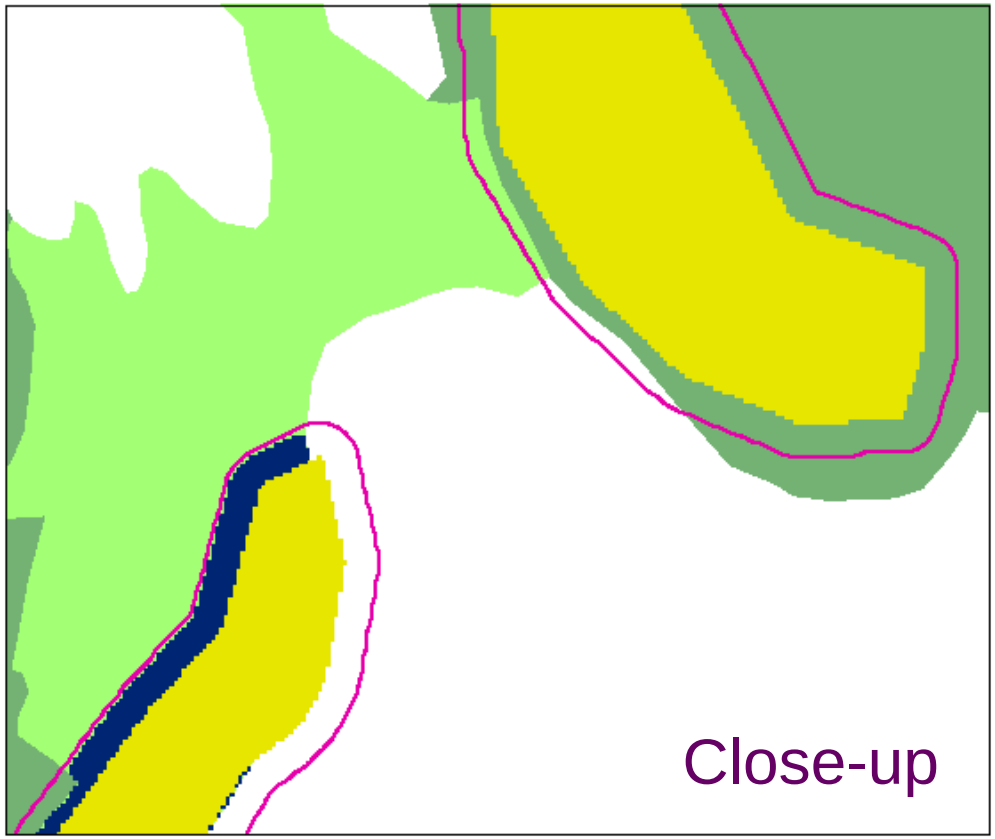
Preventing spread of Foot and mouth

Acknowledgements

Thanks to…

- Sam Catchpole (TSU) for field surveys
- Lucy Sumsion (FWAG), Marina Curran-Colthart (Argyll and Bute Local Council), Keith Millar (Perth and Argyll Conservancy), Helen Watt (FCS) for contact information
- Rural and Urban Landscape Ecology Group for access to BEETLE
- Jordan Chetcuti, Michal Petr, and Christine Brown (Forest Research) for assistance with computing

BEETLE model – stem layering



1. Current unmanaged rhododendron
2. Stem layering buffer (max 40 m)
3. Landscape permeability
4. Invasion by stem layering

Rhododendron

Current extent

Stem layering buffer

Invasion

Woodland habitat

Broadleaf

Conifer

Landscape permeability

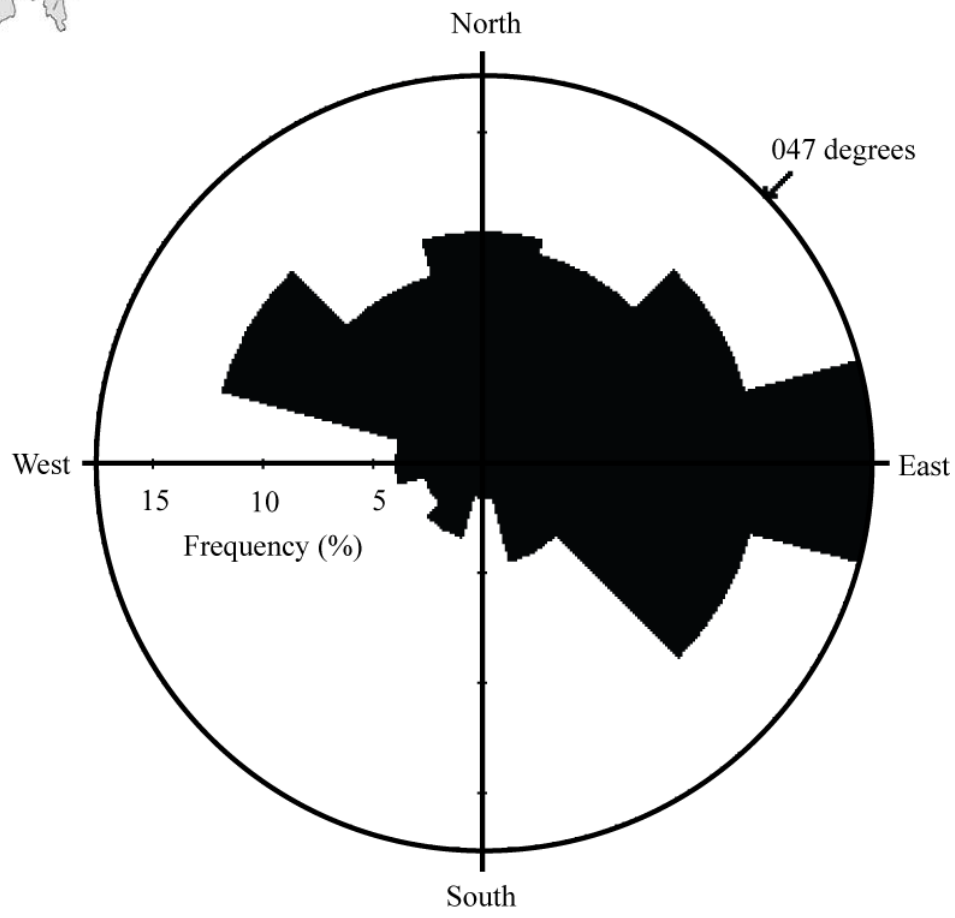
Broadleaf (40 m)

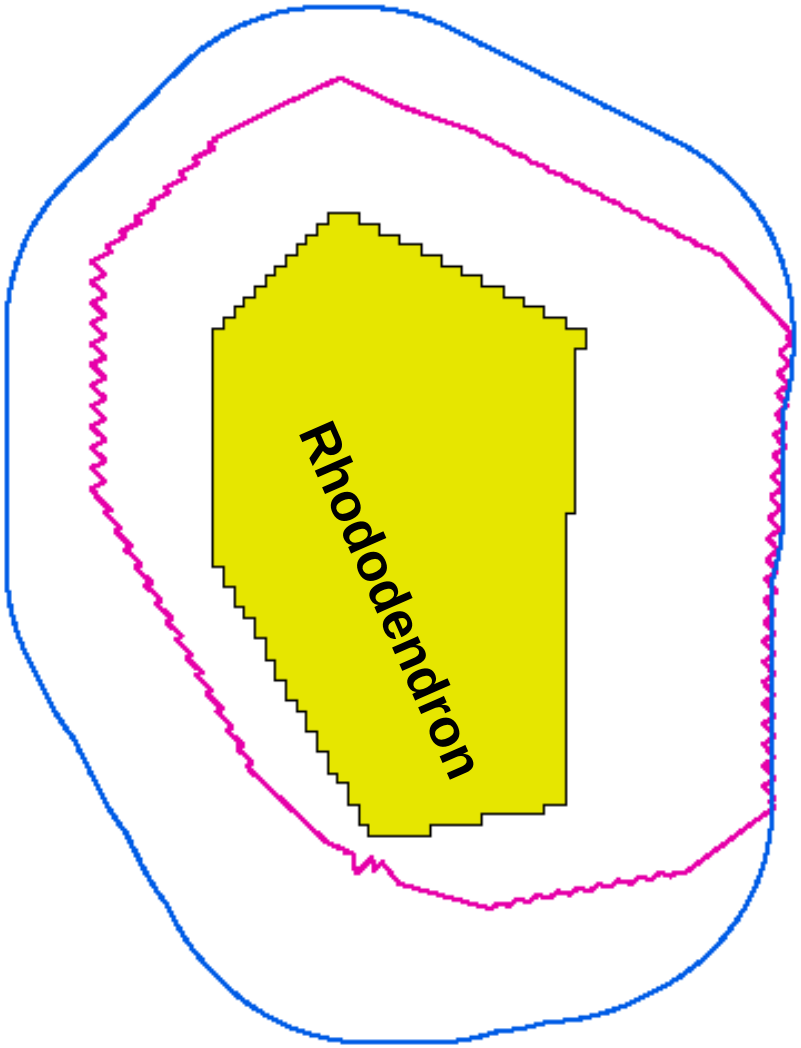
Broadleaf with bog (8 m)

All other habitat (0 m)

Rhododendron invasion model

Wind Rose
Strathlachlan weather station
Feb-June 1988-2006





Variable width buffer used to capture effect of prevailing wind

BEETLE model – seed dispersal

Rhododendron

- Current extent
- Wind buffer (100 m)
- Seed dispersal zone
- Seedling establishment

Woodland habitat

- Broadleaf
- Conifer

Landscape permeability

- Open habitat (100 m)
- Recently felled (20 m)
- Young plantation (10 m)
- Woodland (5 m)

1. Current unmanaged rhododendron
2. Wind buffer (max 100 m)
3. Seed dispersal
4. Seedling establishment