Restoration and Offsetting 1

BR33420 Global Biodiversity Conservation

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Hambler & Canney – Sections 8.1-8.3

Restoration

- Definition (Welch & Cooke 1987):

  "… any active attempt to return an ecosystem to an earlier condition following degradation resulting from any kind of disturbance"

- Minimizing impacts in land-use change scenarios e.g. agriculture:
  - "Rewilding"
  - Offsetting
  - Mitigation

Restoration

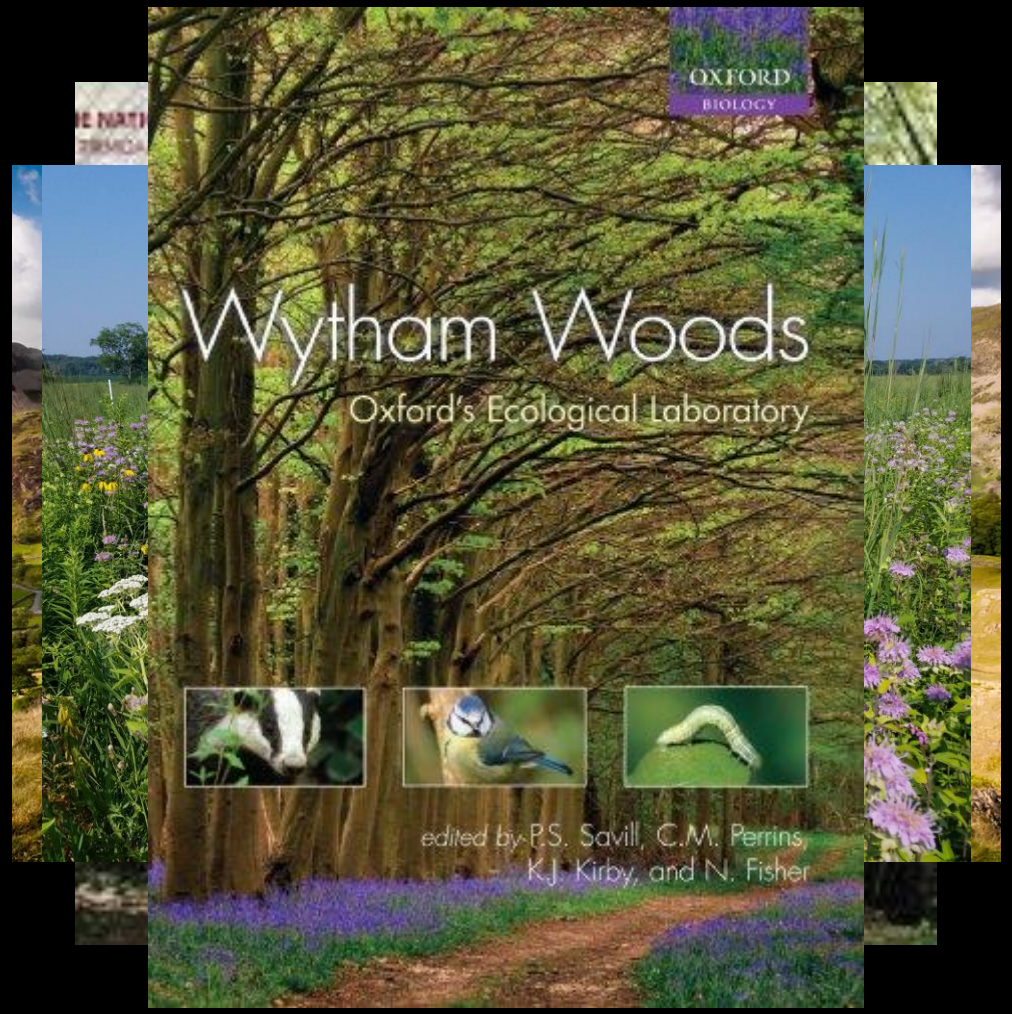
- Conservation priorities:
  - Reduce extinction rates
  - Protect high-quality sites, particularly natural sites
- Environmental changes may make identification of targets difficult:
  - Ongoing / previous extinctions
  - Climate change
  - Invasive species
  - Lack of habtat / space
- Once ecosystem thresholds have been passed, only novel ecosystems may be possible

Restoration commitments

- Convention on Biological Diversity (CBD)
- EU Habitats Directive (1992)

Historical restoration

- Reforestation of Trinidad and Tobago (C18th) with exotic bamboo to ameliorate soil erosion
- Wordsworth (Early C19th) - release of lakeside habitats and replanting of native trees
- Recreation of tallgrass prairie in 1930s USA
- Elton – rewilding of parts of Wytham woods:
  - Retention of dead wood
  - Minimal intervention



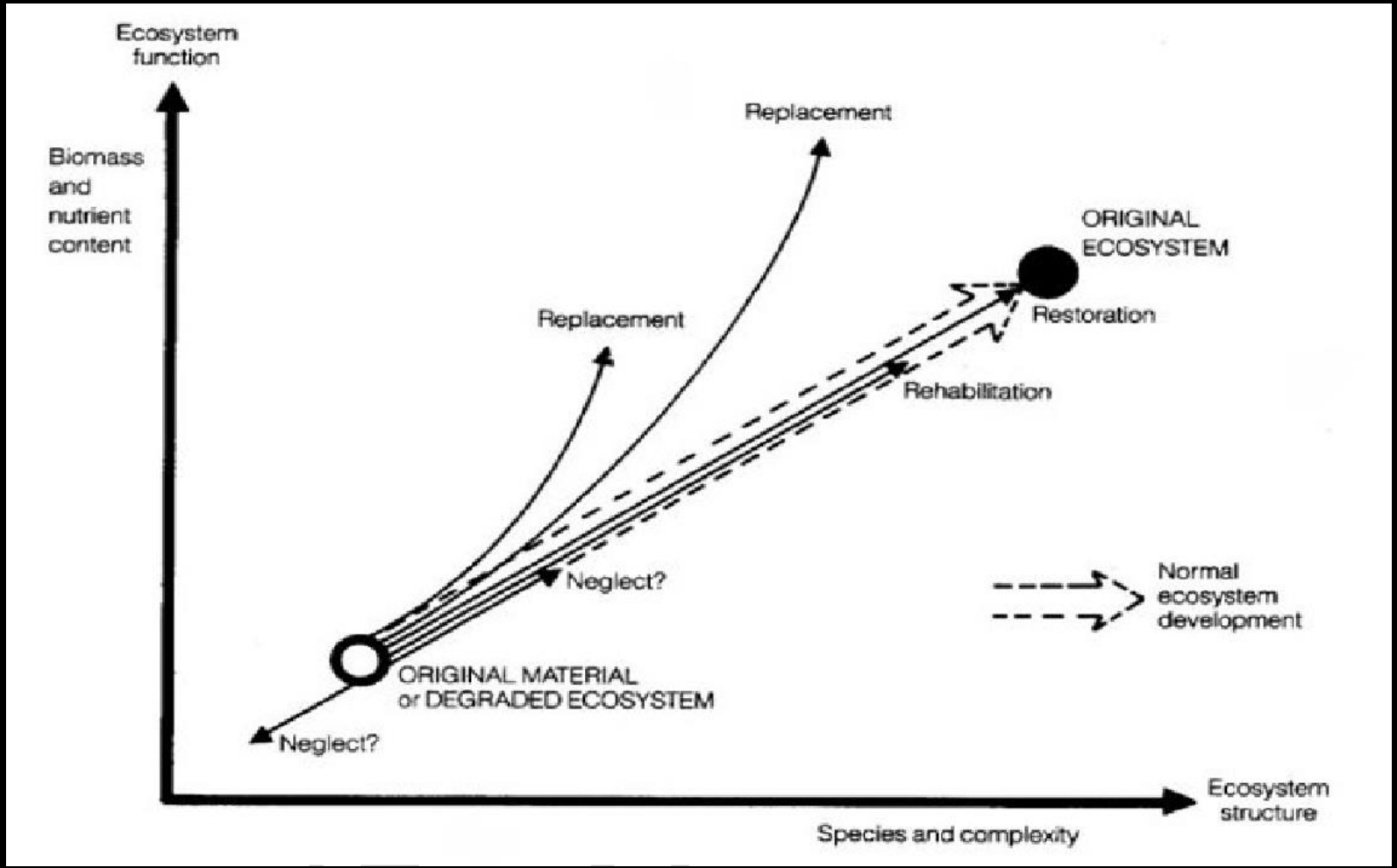
The value of restoration

- Benefits of restoration:
  - Provision of major ecosystem services
  - Enlarging habitat fragments and improving population viability
  - Supporting species with large ranges
  - Improved connectivity
  - Aesthetics
- Three-stage process:
  - Recognising what is wrong with the system
  - Taking appropriate action
  - Demonstrating that the system has returned to a desirable target state

Targets in restoration

- Targets deduced by comparing current site value with desirable conditions
- Possible objectives:
  - Species composition and diversity
  - Ecosystem functions:
    - Productivity
    - Stabilisation of land surfaces
    - Pollution control
    - Visual improvement
- Enhancement of resilience and cohesion → “more, bigger, better, and joined” (Lawton *et al.* [2010] *Making Space For Nature*)

“True” restoration



More natural states

Aims in restoration

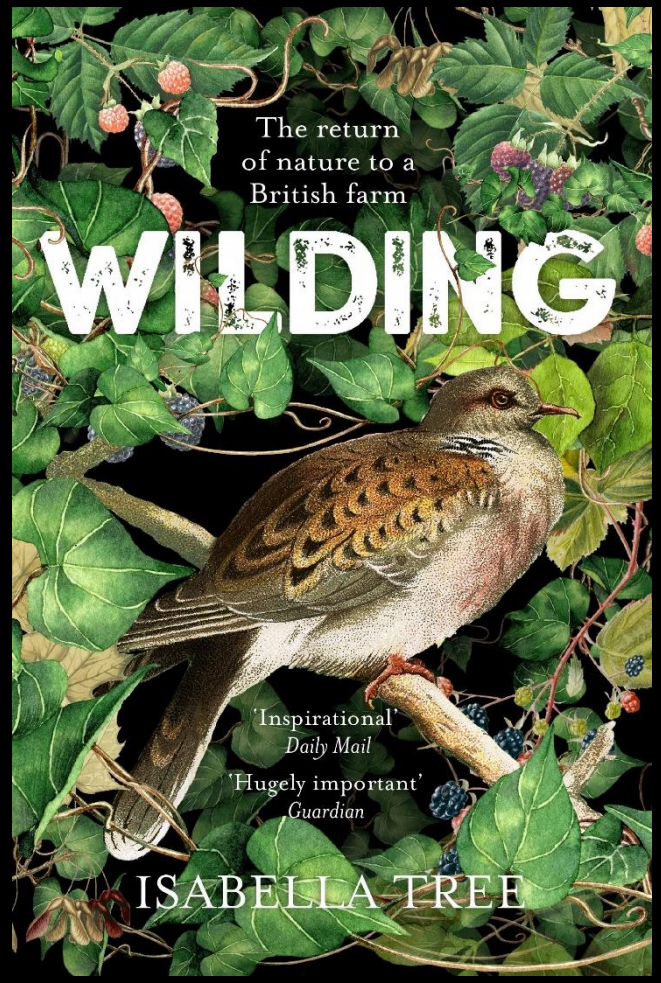
- “Restoration” to natural habitat or semi-natural habitat?
  - Consideration of regional biological and cultural values
  - Wet *Eucalytpus* forest to rainforest in eastern Australia
  - Savanna to forest in west Africa
  - Grassland, heathland and coppice to forest in Europe
  - Relative values of two habitats for globally threatened species
- Must achieve maximum conservation benefit
- Important ecologically and ethically that “historical” baselines do not become arbitrarily and culturally fixed

Baselines in restoration

- Subjectivity:
  - How is “naturalness” measured?
  - Natural sites change
- Target usually to fall within recorded range of natural variation
- Aim for ecosystem states relatively similar to natural baseline states in the region:
  - Many species extirpated
  - Numerous species introduced
  - Increased public access

Rewilding - Oostverdersplassen

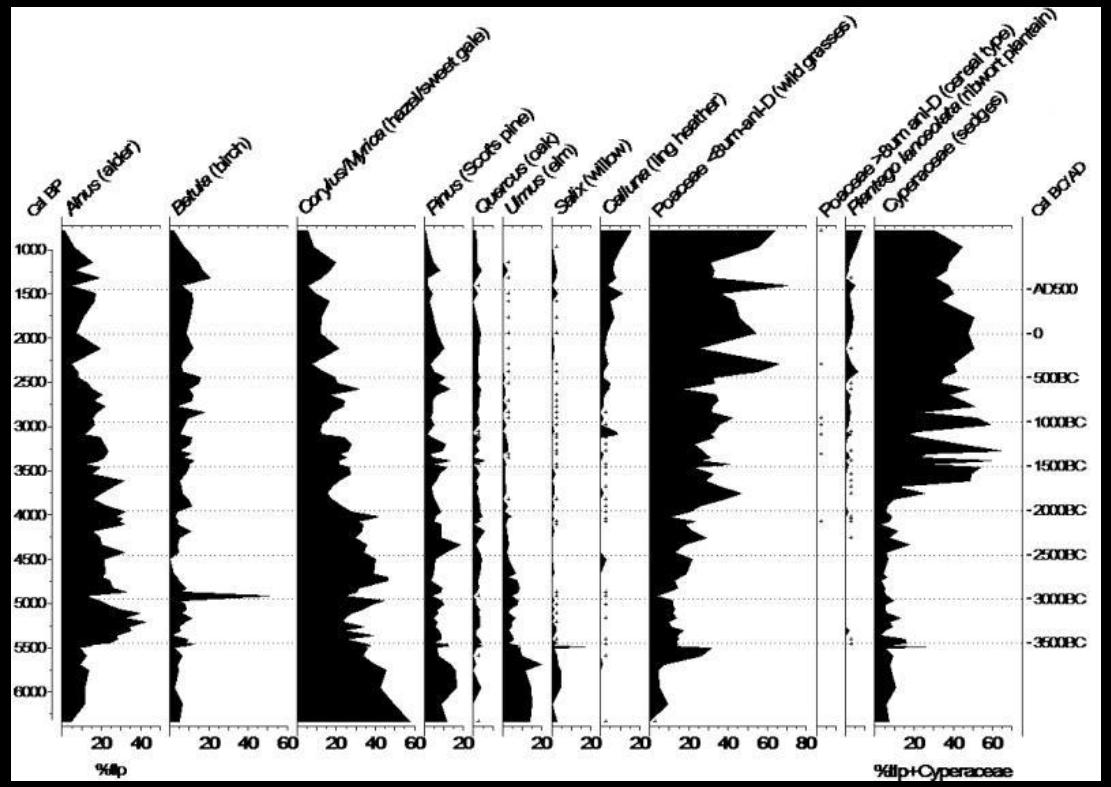
Rewilding – UK style



Rewilding – Siberian style

Rewilding – the species problem

- Shifting baselines – what “should” be on a site?
  - Palaeoecological evidence
  - Archaeological evidence
  - Historical records
- Limitations of preservation / confirmation bias
- What species can realistically be replaced / removed?



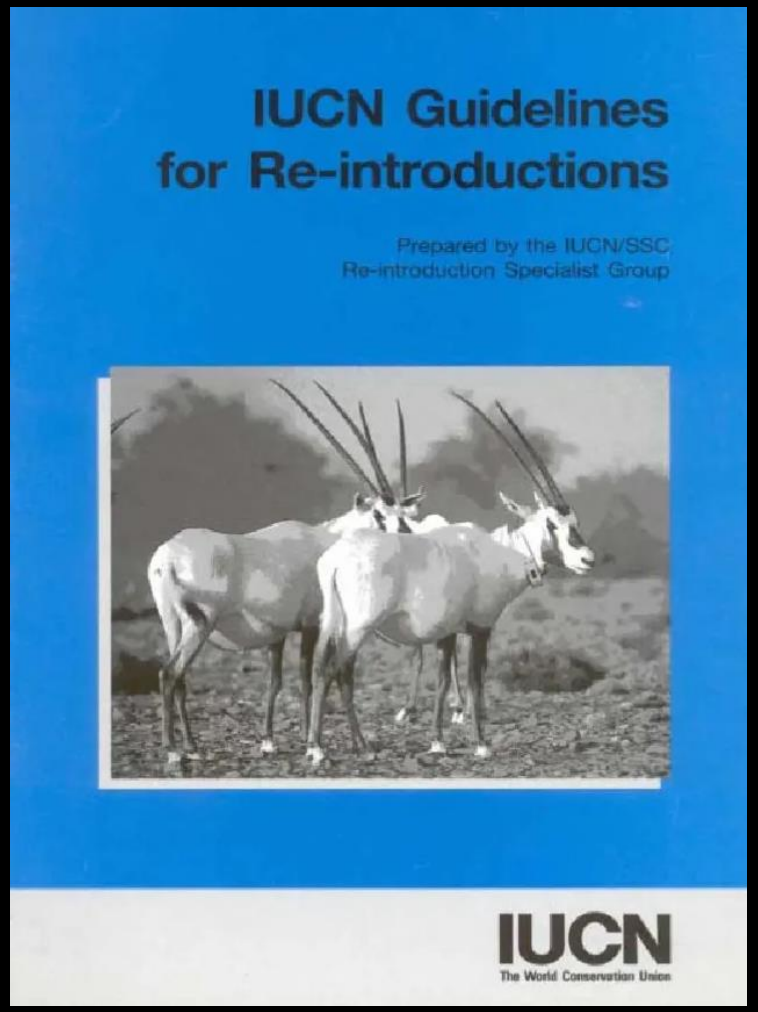
Reintroduction

Early 1800s ☠

Early 1800s ☠

Early 1970s ☠

IUCN guidelines for reintroduction



- A feasibility study should examine taxonomic, ecological and behavioural characteristics of the species
- The effect of the re-introduced species on the receptor ecosystem should be considered
- The fate of previous re-introductions of the same or similar species should be assessed
- The release site should be within the former natural habitat and historic range
- The re-introduction site should have assured, long-term protection
- Suitable habitat must be available for a viable population, ideally where the species occurred recently
- The original causes for extirpation must have been identified and reduced to a sufficient level
- The source animals should ideally come from wild populations
- Re-introduced organisms must be genetically suitable and screened for disease
- The donor population must not be threatened by removing individuals
- Stock should, as far as possible, be prepared for the wild environment and protected from diseases
- There should be thorough consultation with stakeholders and minimal impact on local people
- There should be careful planning, a detailed post-release strategy and education for long-term support
- There should be involvement of local people where possible, and compensation for losses
- The welfare of animals should be paramount
- The released individuals (or a sample) should be monitored
- Mortalities should be collected and investigated
- The population should be monitored, studied and managed over the long term
- Cost-effectiveness and success should be evaluated
- The results should be published regularly in scientific and popular literature
- A conservation introduction should be undertaken only as a last resort when no opportunities for re-introduction exist and only when a significant contribution to the conservation of the species will result

IUCN definitions

- “Re-introduction” – an attempt to establish a species in an area that was once part of its historical range
- “Re-inforcement” (“augmentation”) – the addition of individuals to an existing population
- “Re-establishment” – successful re-introduction
- “Conservation introduction” – attempt to establish a species for the purpose of conservation, outside its recorded distribution but within an appropriate habitat
- “Assisted colonization” – facilitation of movement of species to sites that are likely to become climatically suitable as an attempt to help them survive climate change in a fragmented landscape
- “Translocation” – deliberate and mediated movement of wild individuals or populations from one part of their range to another

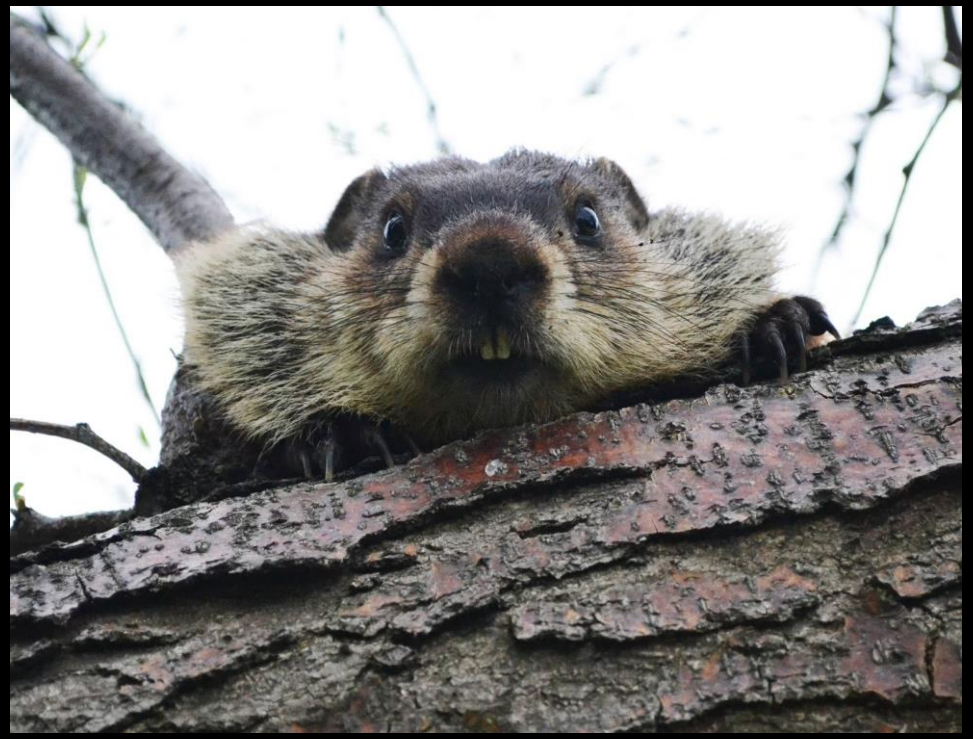
Reintroduction

- Need to determine native status and assessment of practicality
- Will the population succumb to the same pressures that caused regional extinction in the first place?
  - Detailed information on species decline useful if causal factors still operate
  - Changes in landscape / habitat
  - Might not be until reintroduction fails that causes of regional extinction become clear

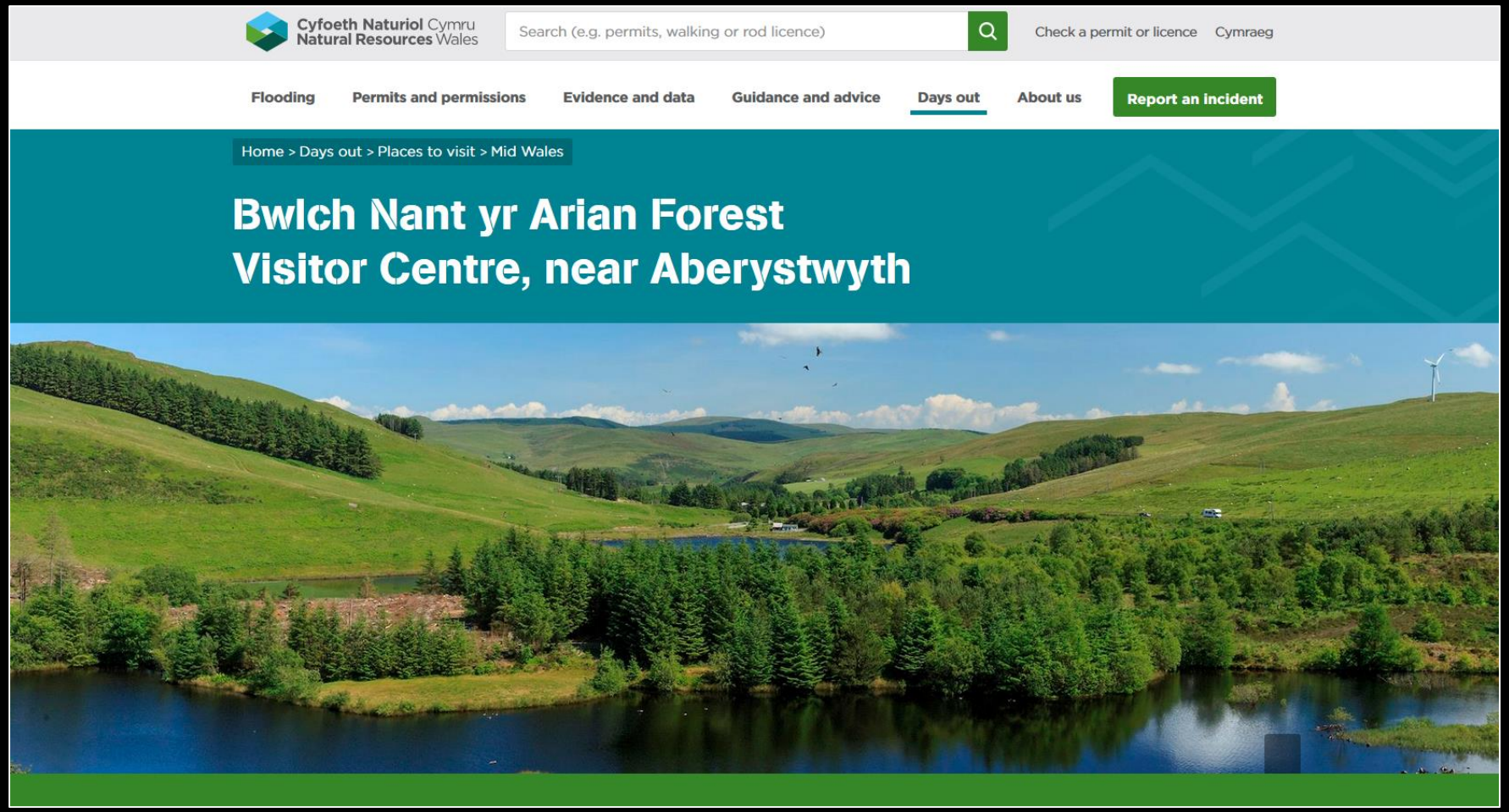
Holocene regional extinctions

Species	Last record	Likely reason	Reintroduction prospects
Hazel grouse	*ca*. 10,000 BP	Habitat loss / climate?	Possible
Reindeer	*ca*. 8,300 BP	Hunting for food	Already successful
Aurochs	*ca*. 3,250 BP	Hunting for food	Globally extinct
Brown bear	*ca*. 500 BP	Persecution	Poor – perceived dangerous
Wild boar	1295	Hunting for food / persecution	Accidental success
Grey wolf	1786	Persecution	Possible – semi-wild
Atlantic sturgeon	1800s	Weirs / fishing	Possible, if accepted as native

Living together



Living together

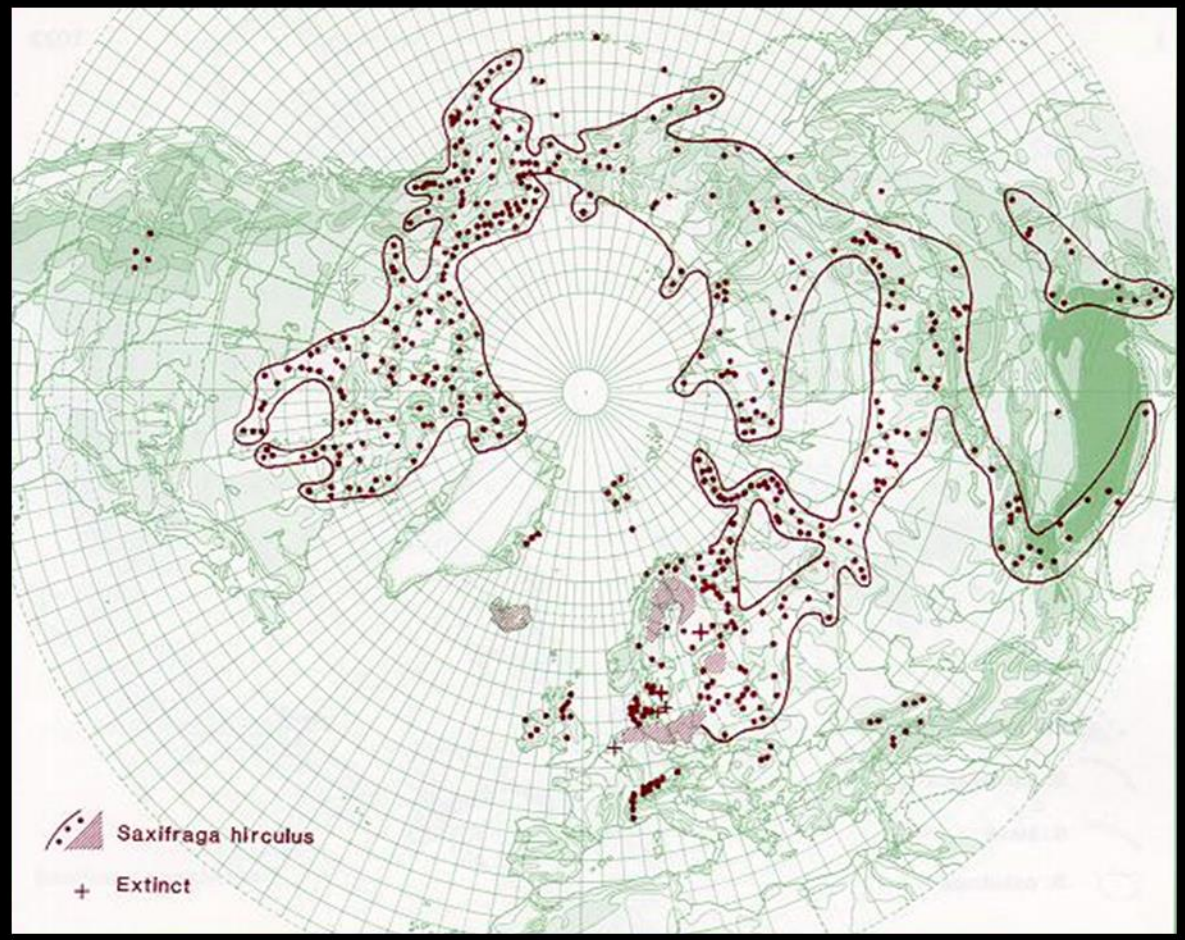


Successful reintroduction

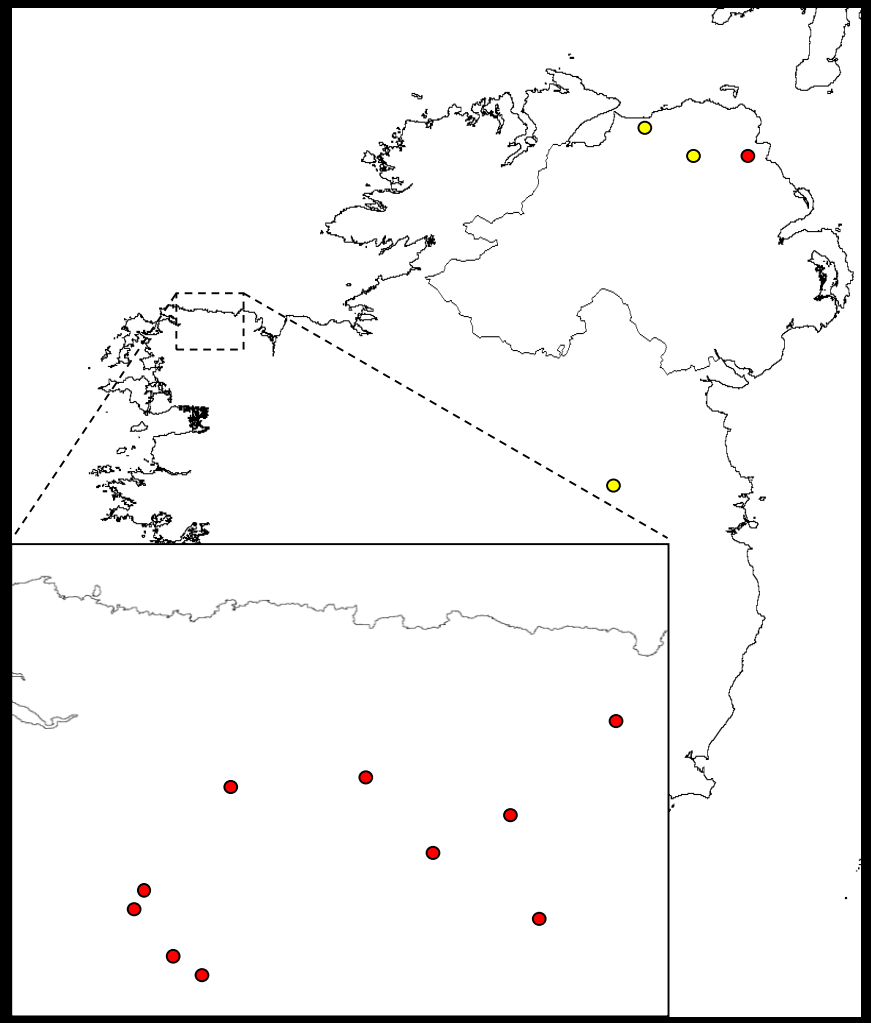
- Donor population should be genetically similar to original population
- Parasites and parasitoids should be co-introduced
- “Propagule pressure”
- Translocation to core of range
- Ecological similarity of donor and receptor site
- Active – physical translocation / assisted colonization
- Passive – corridors

- “Conventional” conservation strategies (e.g. enlargement / improvement of reserves) should be attempted first

Saxifraga hirculus

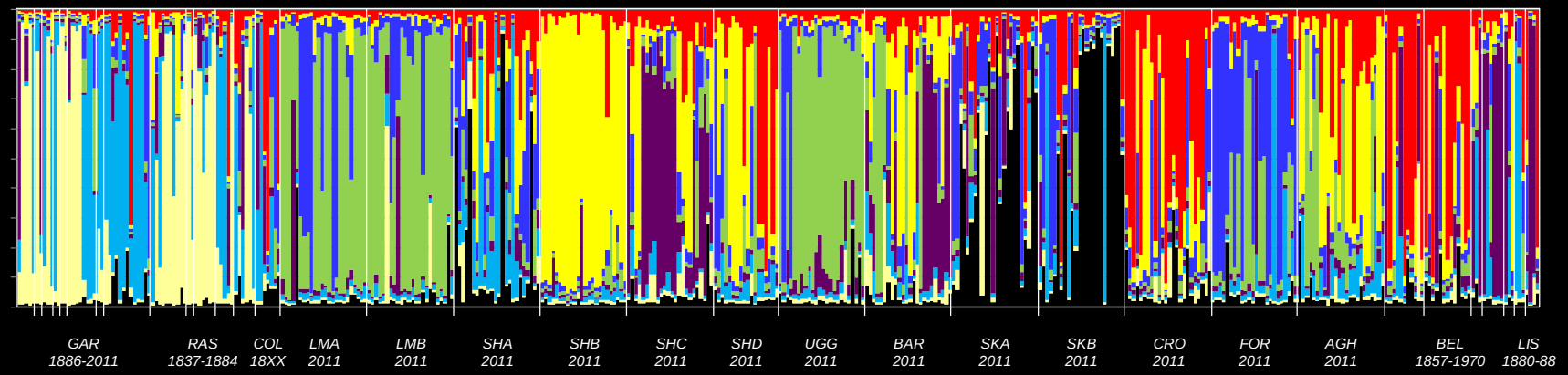


Saxifraga hirculus in Ireland



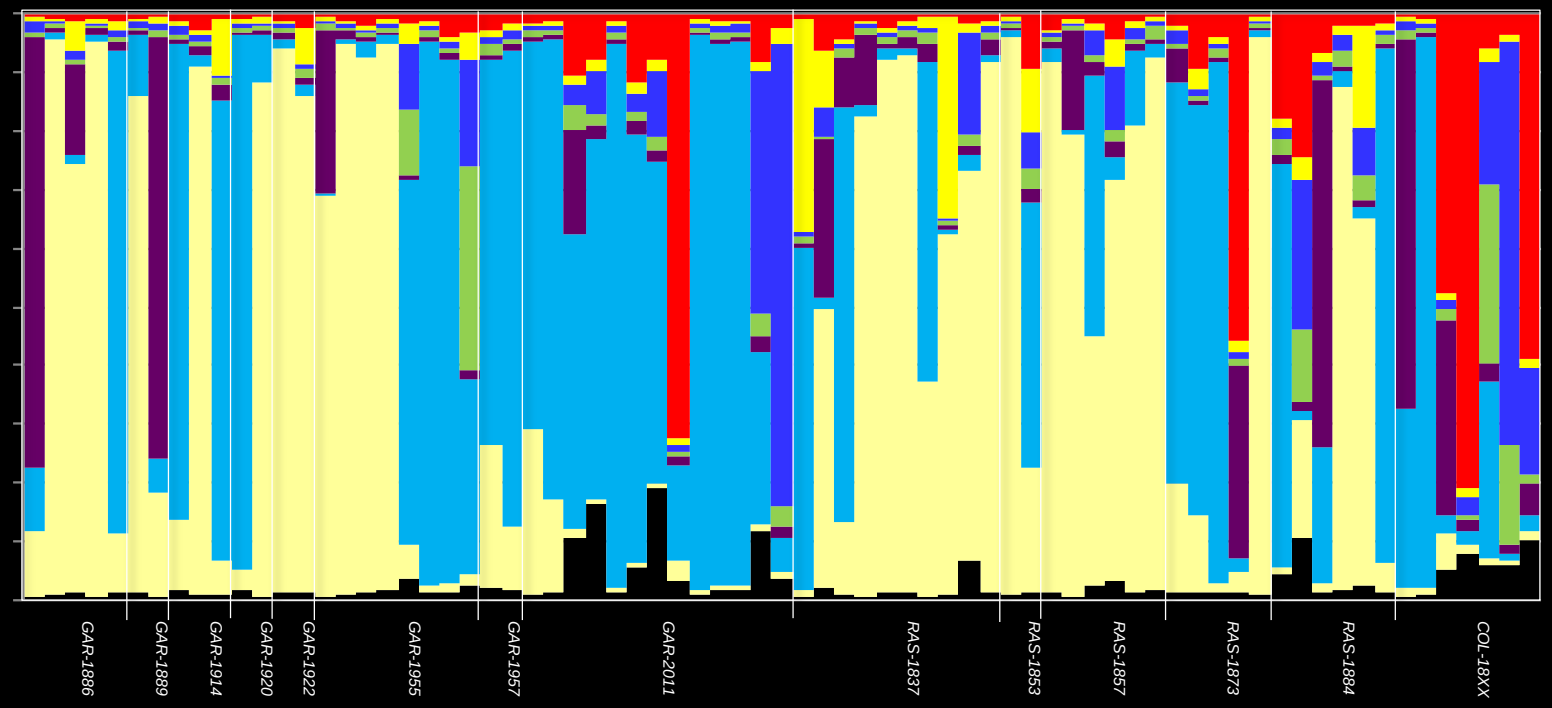
Saxifraga hirculus – historical samples

Saxifraga hirculus – genetic analysis

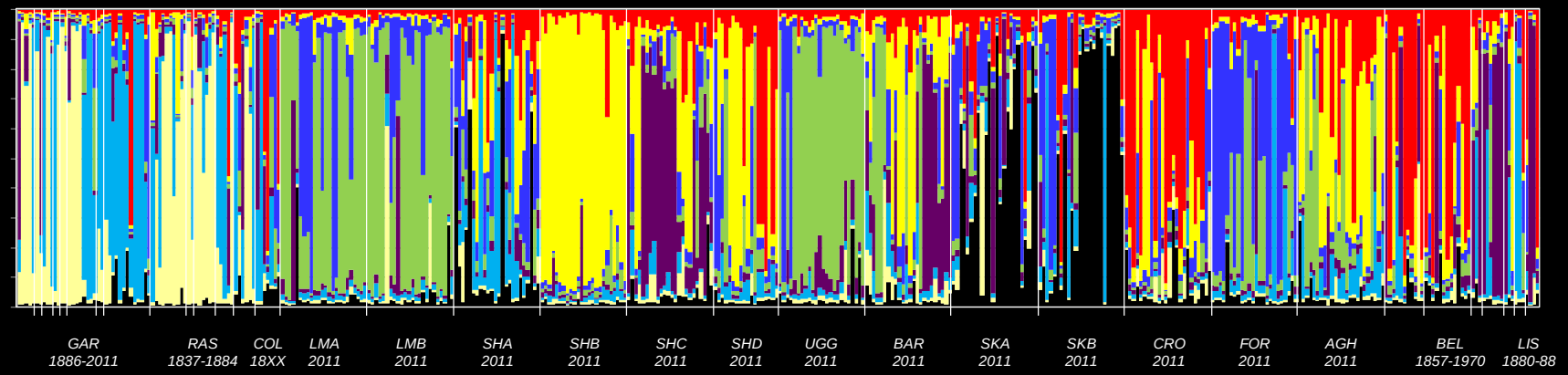


K = 8

Saxifraga hirculus – genetic analysis



Saxifraga hirculus – genetic analysis



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Introduced (invasive) species

Control of introduced species

Control of introduced species

- Proportion of a population that must be culled each year for eradication is substantial:
  - 90% feral goats in Egmont National Park, NZ annually → 12 years
  - 50% a year would have taken over 50 years, if successful at all
- Most common examples in Pacific Islands, Australia and New Zealand:
  - Many deliberately stocked with pigs, goats, rabbits etc → food in case of shipwreck
  - Inadvertent introduction of rats, mice and snakes:
    - Cats (e.g. Marion Island) and mongooses (e.g. Mauritius) to control rats
    - Stoats and ferrets introduced to New Zealand to control rabbits
    - All predators increased rapidly and exterminated much of the native fauna
  - Ongoing programs to eradicate many of these species

Biological control

- Very effective against insects, but poor record against pest wildlife
- One success has been use of *Myxomavirus* against rabbits in Australia:
  - Holds density to around 20% of uncontrolled density
  - Still working despite:
    - Decline in *Myxomavirus* virulence
    - Decline in susceptibility of rabbits
- Chances of finding an agent low:
  - Must be highly host-specific
  - Must be highly contagious

Control by indirect methods

- Exclusion:
  - Can be achieved via fencing, chemical repellents, deterrents etc.
  - Great Wall of China
  - Australian Barrier Fence:
    - Keep dingoes out of sheep country
    - 8614 km at its greatest extent
    - Unlike rabbit fences, successful
- Sonic deterrents
- Habitat / food manipulation:
  - Diversionary feeding
  - Density of provision