

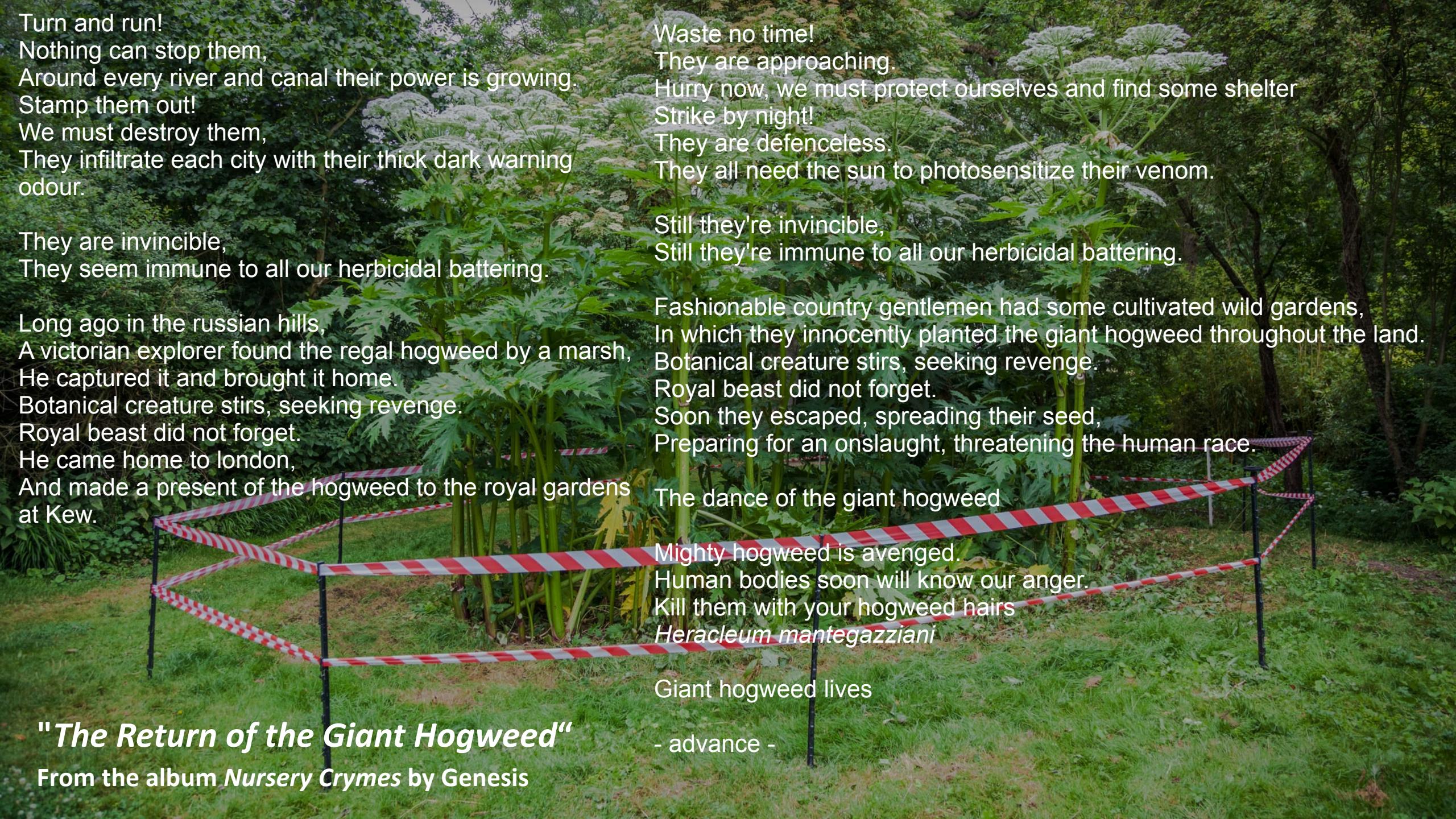
# Invasive alien species

→ What are non-native invasive species?

What damage are they causing?

What makes non-native species invasive?

What do we need to do?



Turn and run!  
Nothing can stop them,  
Around every river and canal their power is growing.  
Stamp them out!  
We must destroy them,  
They infiltrate each city with their thick dark warning  
odour.

They are invincible,  
They seem immune to all our herbicidal battering.

Long ago in the russian hills,  
A victorian explorer found the regal hogweed by a marsh,  
He captured it and brought it home.  
Botanical creature stirs, seeking revenge.  
Royal beast did not forget.  
He came home to london,  
And made a present of the hogweed to the royal gardens  
at Kew.

Waste no time!  
They are approaching.  
Hurry now, we must protect ourselves and find some shelter  
Strike by night!  
They are defenceless.  
They all need the sun to photosensitize their venom.

Still they're invincible,  
Still they're immune to all our herbicidal battering.

Fashionable country gentlemen had some cultivated wild gardens,  
In which they innocently planted the giant hogweed throughout the land.  
Botanical creature stirs, seeking revenge.  
Royal beast did not forget.  
Soon they escaped, spreading their seed,  
Preparing for an onslaught, threatening the human race.

The dance of the giant hogweed

Mighty hogweed is avenged.  
Human bodies soon will know our anger.  
Kill them with your hogweed hairs  
*Heracleum mantegazzianii*

Giant hogweed lives

- advance -

**"The Return of the Giant Hogweed"**

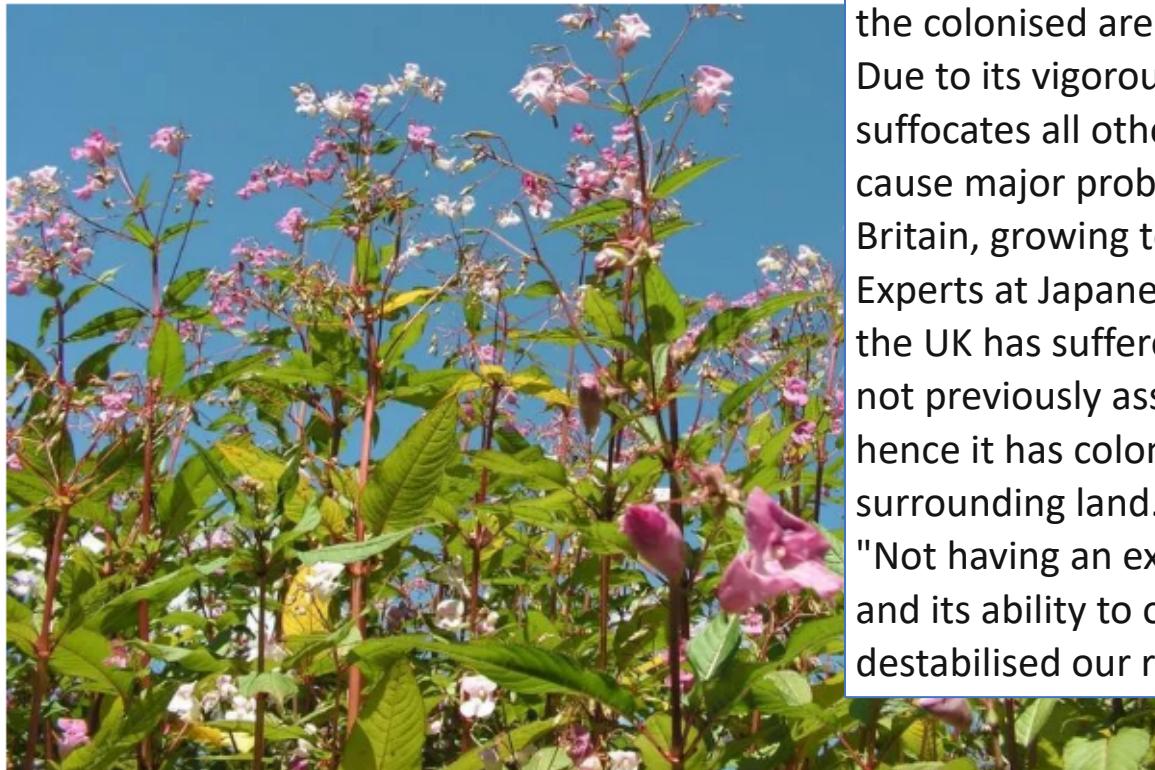
From the album *Nursery Crymes* by Genesis

# 'Do not touch' warning issued over 'exploding' plant that will spread fast across UK this spring

Environmental experts are urging Brits to watch out

**NEWS**By **Phoebe Jobling** Property Writer

11:56, 19 MAR 2024



 The plant germinates in spring (Image: Japanese Knotweed Ltd)

All seeds germinate in early spring, and their stems which are predominantly green will turn red as the year progresses. Flowering is most intensive from July to August but it can begin in June and can last till the end of October or beginning of November. In the winter months Himalayan balsam dies off, leaving a "hay like mat" within the colonised area.

Due to its vigorous growth, Himalayan balsam soon dominates and suffocates all other plants within its vicinity. On riverbanks this can cause major problems of erosion. It is the tallest annual weed in Britain, growing to more than three metres in height.

Experts at Japanese Knotweed Ltd say: "With the increased flooding the UK has suffered recently, we are seeing balsam cluster in areas not previously associated with the plant. It thrives in moist soil hence it has colonised in more of the UK's riverbanks, creeping onto surrounding land.

"Not having an extensive root system that binds river banks together, and its ability to overtake perennial plants that do have root systems destabilised our river banks, has led to flooding.

# Himalayan Balsam

## *Impatiens glandulifera*

- Aka “Policeman’s helmet”
- One of the “big four” introduced in the 180s by the Victorians from Asia (also Giant Hogweed, Japanese Knotweed, Rhododendron)
- “Herculean proportions and splendid invasiveness”
- Colonises riverbanks and wet woodlands rapidly; spreads with explosive seedpods
- *Excellent nectar and pollen source*



# What is an invasive species?

- Native species have existed in their ecosystem for a long time and have co-evolved with many other species in it.
- Non-native species (aka exotic, alien, non-indigenous species) live outside their native range and have been introduced via human activity. If they establish in their new range, they are naturalized.
- Invasive species are alien species that spread after introduction and cause harm to their environment.

# How do invasives cause harm?

Invasives as **disease vectors and competitors:**



Grey squirrels compete against red in the UK; transmits squirrelpox virus



Harlequin ladybugs predate natives and transmit microsporidian parasites



Signal crayfish predate natives and transmit crayfish plague

# How do invasives cause harm?

Invasives as aggressive predators:



American mink escaped from fur farms; caused 95% decline of water voles in the UK



“Killer shrimp” preys on aquatic invertebrates and larvae, fish and their eggs; “overkill”



Feral cats are responsible for extinctions of most mammals (ca. 20) and several bird species in Australia

# How do invasives cause harm?

Invasives causing **economic damage**:



Floating pennyworth: rapid growth, smothers natives, oxygen depletion; impact on fishing & recreation



Rabbits: in the UK for centuries; burrowing & grazing damages trees, changes ecosystems, £170m crop losses annually!

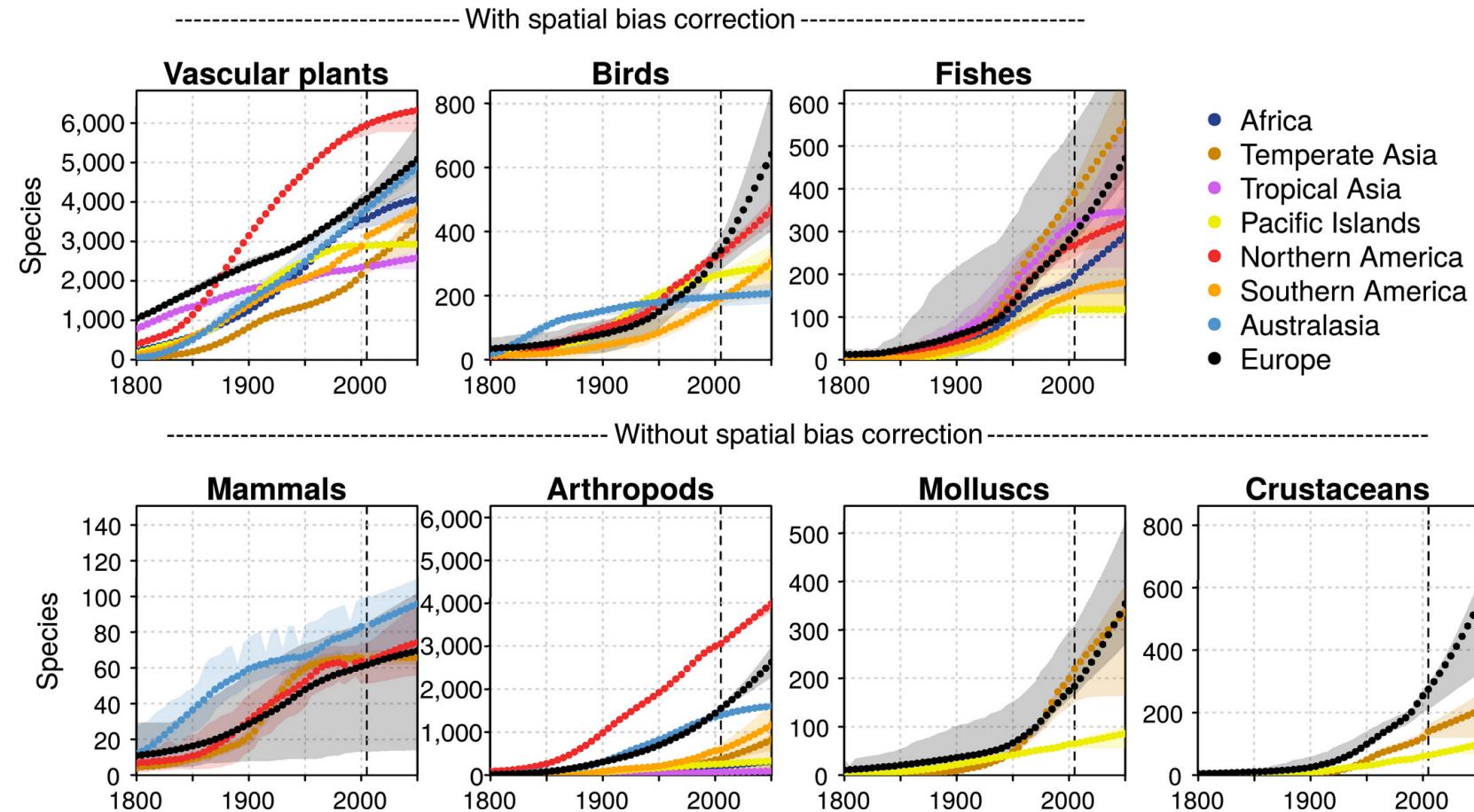


Japanese knotweed:  
Eradication legally required,  
cost £250m annually.  
Ecological and structural  
damage limited (!)

# Invasives are a growing global threat

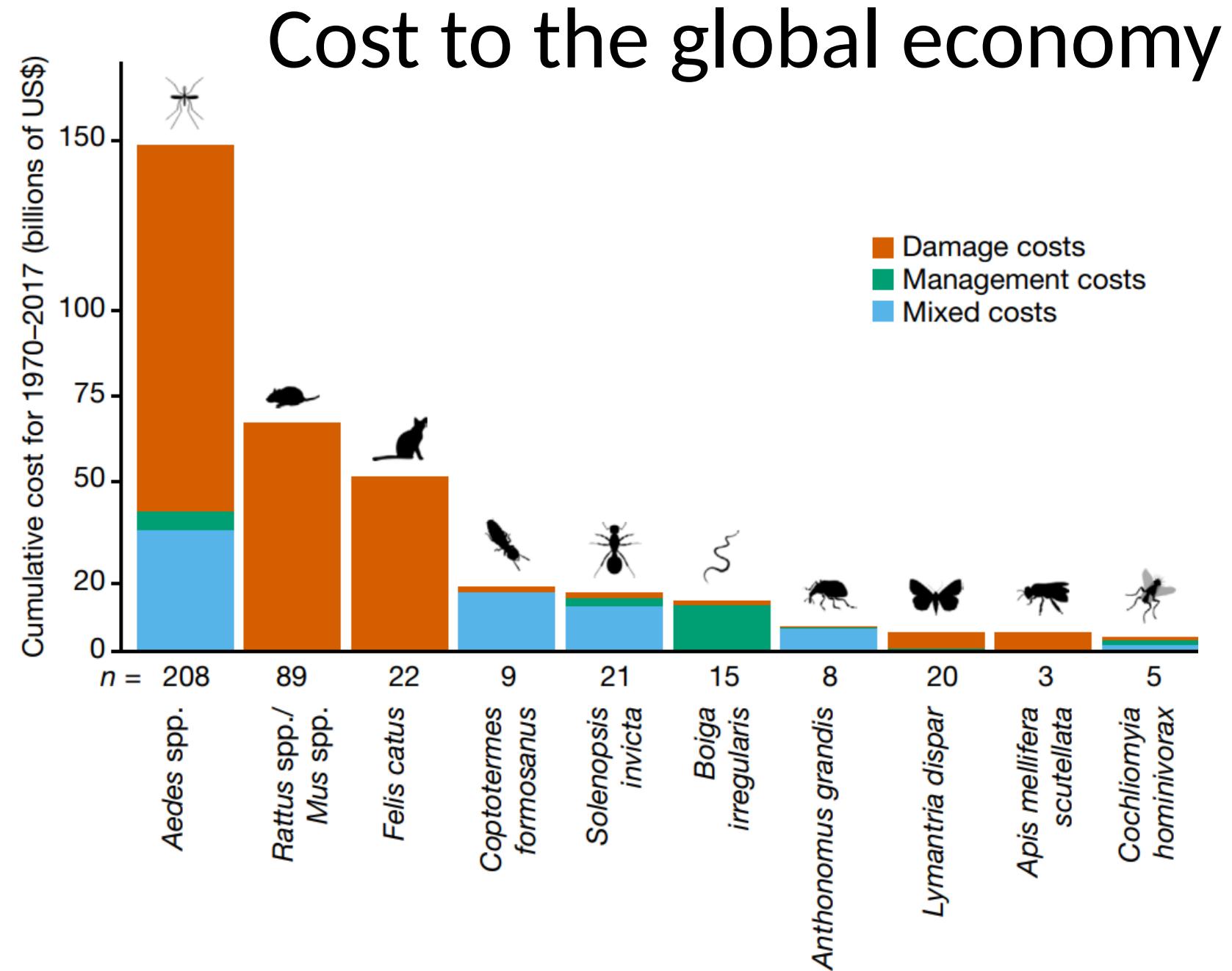
The speed at which alien species establish themselves globally accelerates and is driven by

- Increased movement of goods and people around the world
- Land degradation
- Increasing trade in exotic pets and house plants
- Climate change

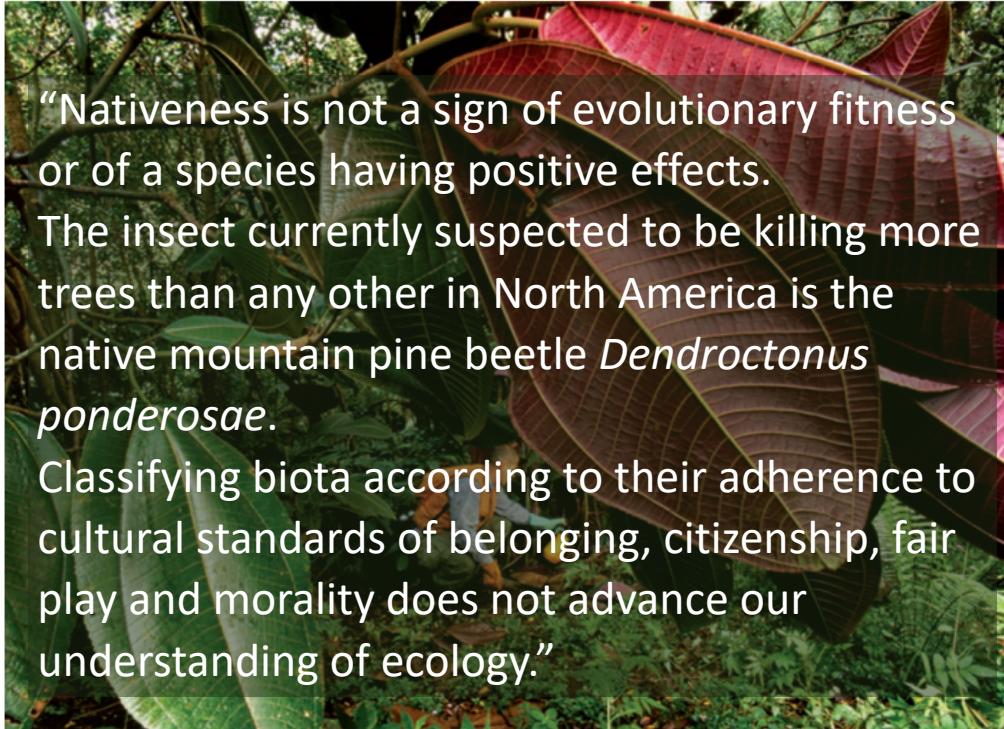




Invacost database

<https://invacost.fr/en/accueil/>

# Is the concern over non-native species xenophobic?



A forester engages in efforts to eradicate the velvet tree *Miconia calvescens* in Hawaii.

## Don't judge species on their origins

Conservationists should assess organisms on environmental impact rather than on whether they are natives, argue **Mark Davis** and 18 other ecologists.

## CORRESPONDENCE

### **Non-natives: 141 scientists object**

We the undersigned feel that in advocating a change in the environmental management of introduced species (*Nature* **474**, 153–154; 2011), Mark Davis and colleagues assail two straw men.

First, most conservation biologists and ecologists do not oppose non-native species per se — only those targeted by the Convention on Biological Diversity as threatening “ecosystems, habitats or species”. [...] Davis and colleagues downplay the severe impact of non-native species that may not manifest for decades after their introduction [...] Pronouncing a newly introduced species as harmless can lead to bad decisions about its management.

can lead to bad decisions about its management. A species added to a plant community that has no evolutionary experience of that organism should be carefully watched.

For some introductions, eradication is possible. For example, 27 invasive species have been eradicated from the Galapagos Islands, mitigating

First, most conservation biologists and ecologists do not oppose non-native species per se — only those targeted by the Convention on Biological Diversity as threatening “ecosystems, habitats or species”. [...] Davis and colleagues downplay the severe impact of non-native species that may not manifest for decades after their introduction [...] Pronouncing a newly introduced species as harmless can lead to bad decisions about its management.

impact. Unrestrained growth and environmental damage follow when there are no natural enemies in newly colonized areas. This is not necessarily a sign of an invader’s superior evolutionary fitness: it may lead to a population collapse due to overexploitation of resources.

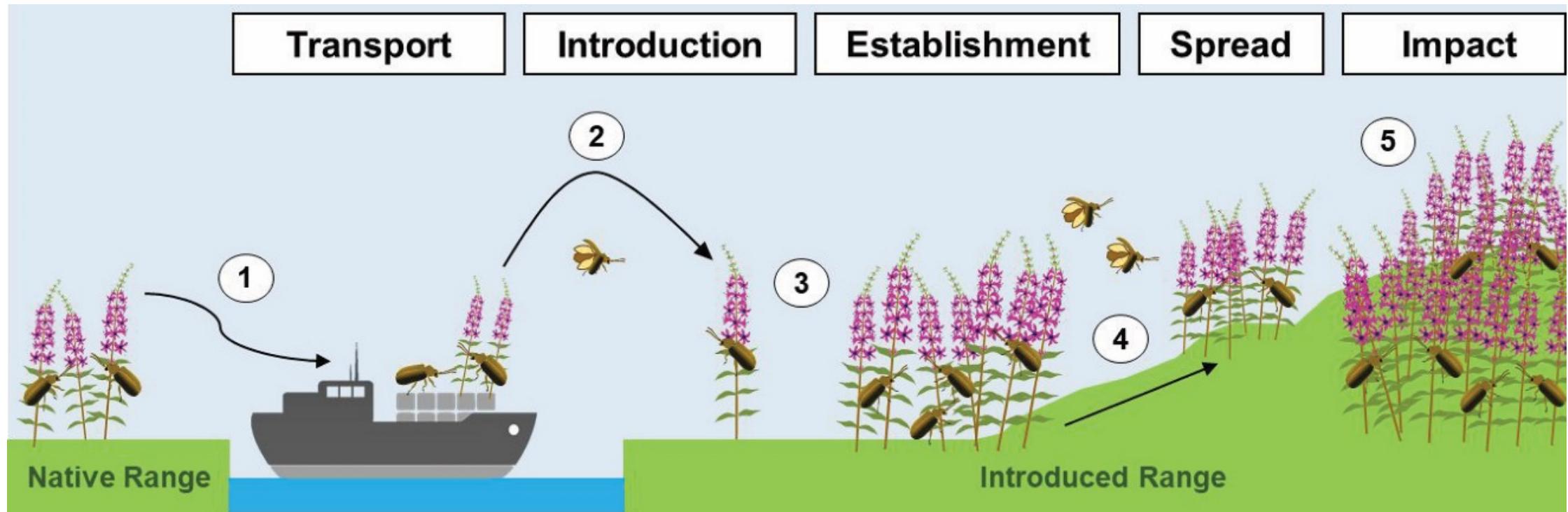
Non-native species can increase the variety of species

# Why do non-native species become invasive?



“Over 2,000 plants and animals have been introduced to Britain from all over the world by people. These are known as non-native species. **Most are harmless**, but around **10-15% spread** and become invasive non-native species which **harm wildlife** and the environment, **are costly to the economy** and can even impact on our health and way of life.”

# Non-natives can fail at every step



(1) : easy- people and goods travel around the world.

(2) : Surviving transport

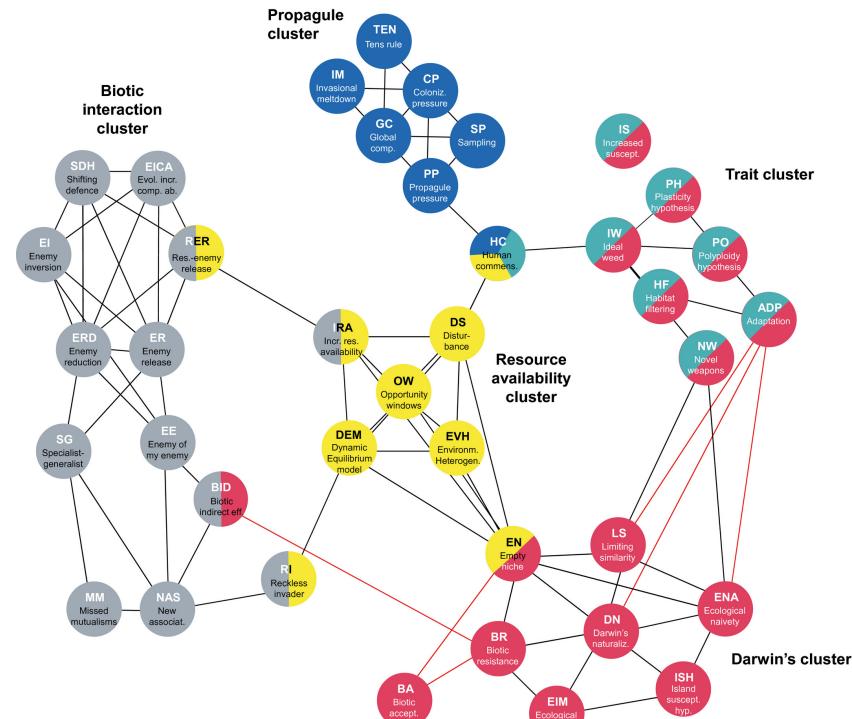
(3) : Surviving competition and antagonism; finding food

(4) : Spreading

(5) : Impact on local ecosystems  
("invasive" means harmful)

# Invasion Biology Theory: What makes some non-natives successful invaders?

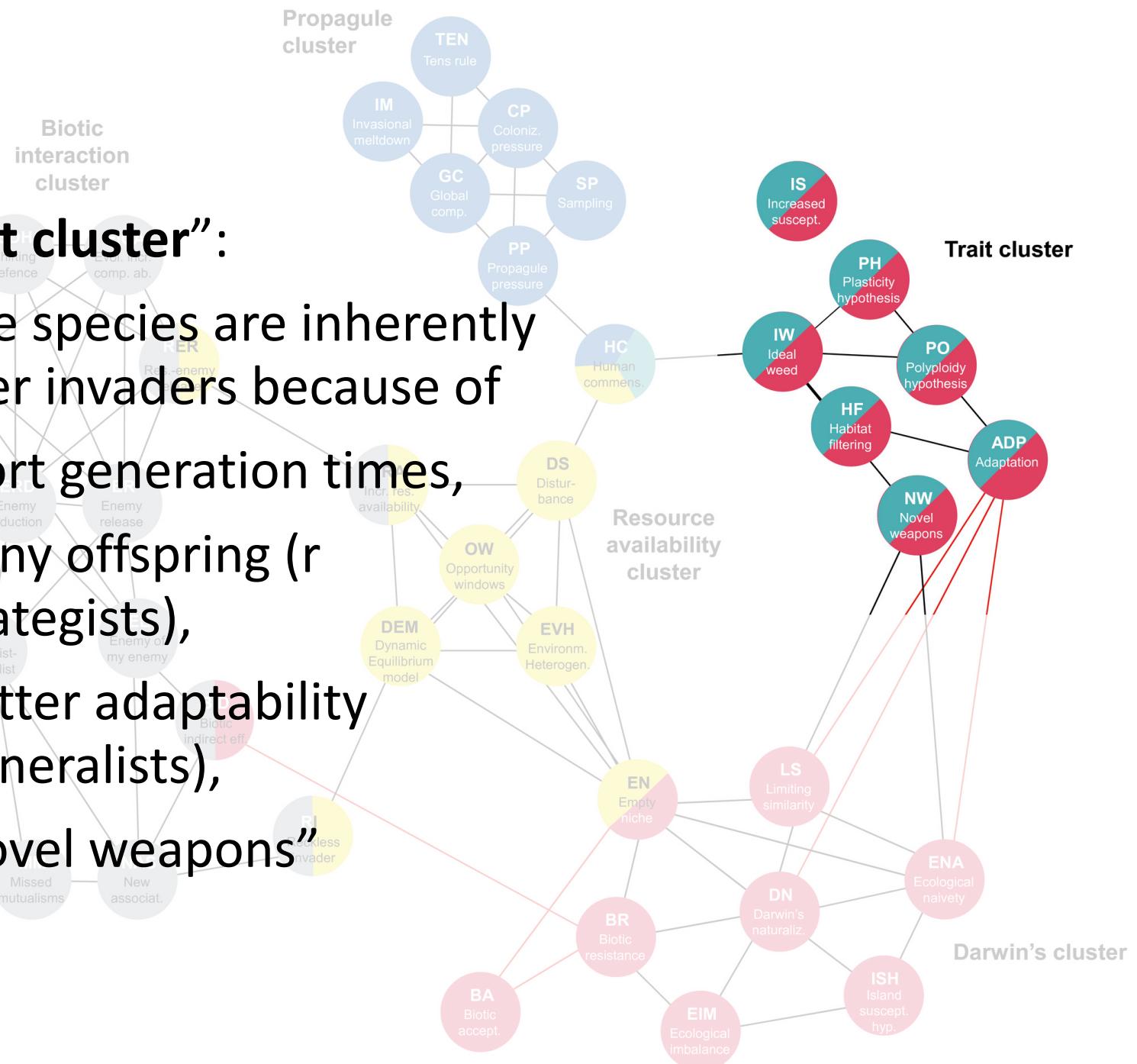
- Dozens of theories have been proposed!
- Varying impact of factors surrounding introduction itself, traits of the species on its own, and interaction between species and new environment.
- Enders *et al.* (2020): “conceptual map of invasion biology” to find 5 **concept clusters** = related ideas that explain a species’ invasiveness via similar causes



## “Trait cluster”:

Some species are inherently better invaders because of

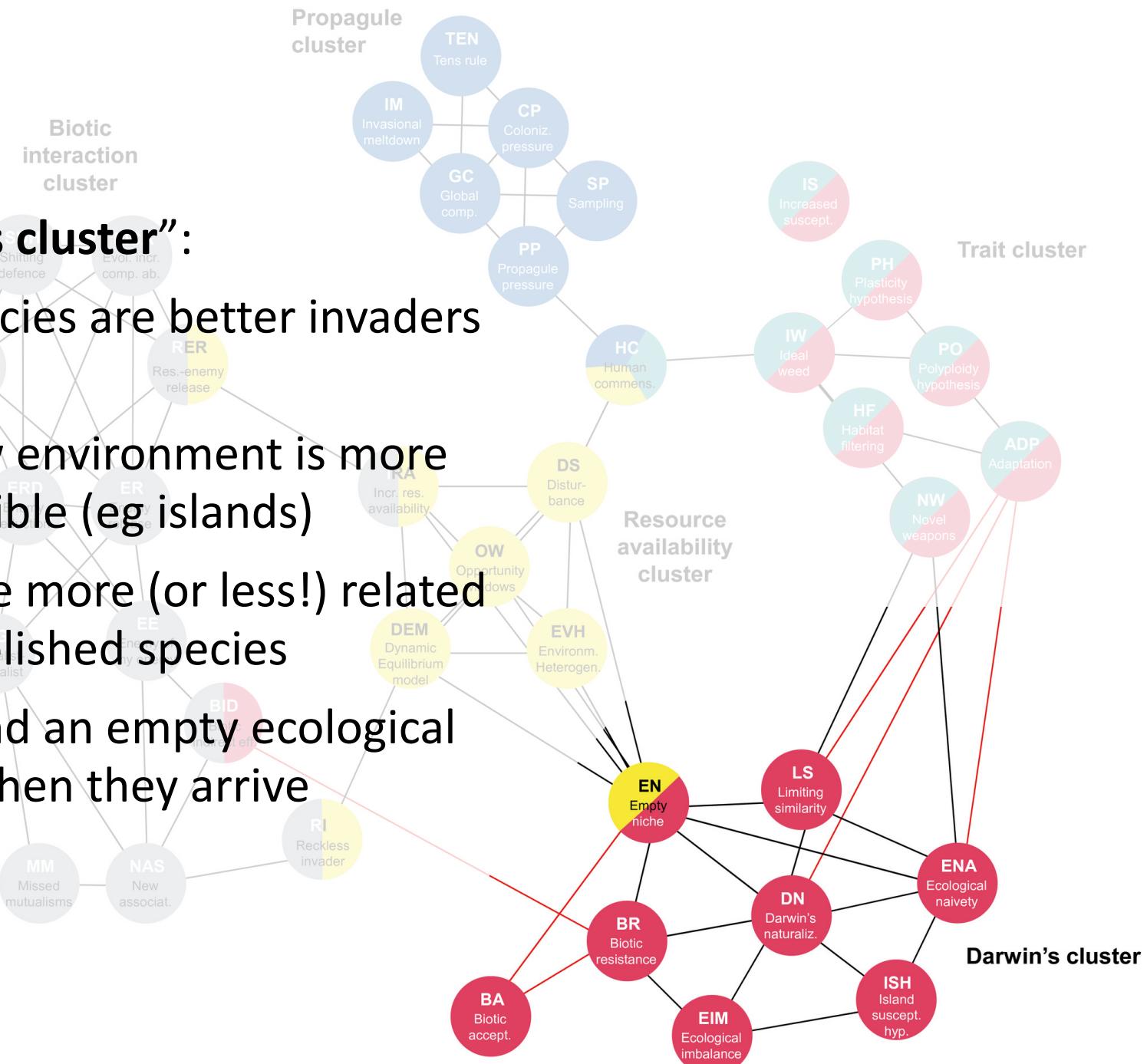
- short generation times,
- many offspring (r strategists),
- better adaptability (generalists),
- “novel weapons”

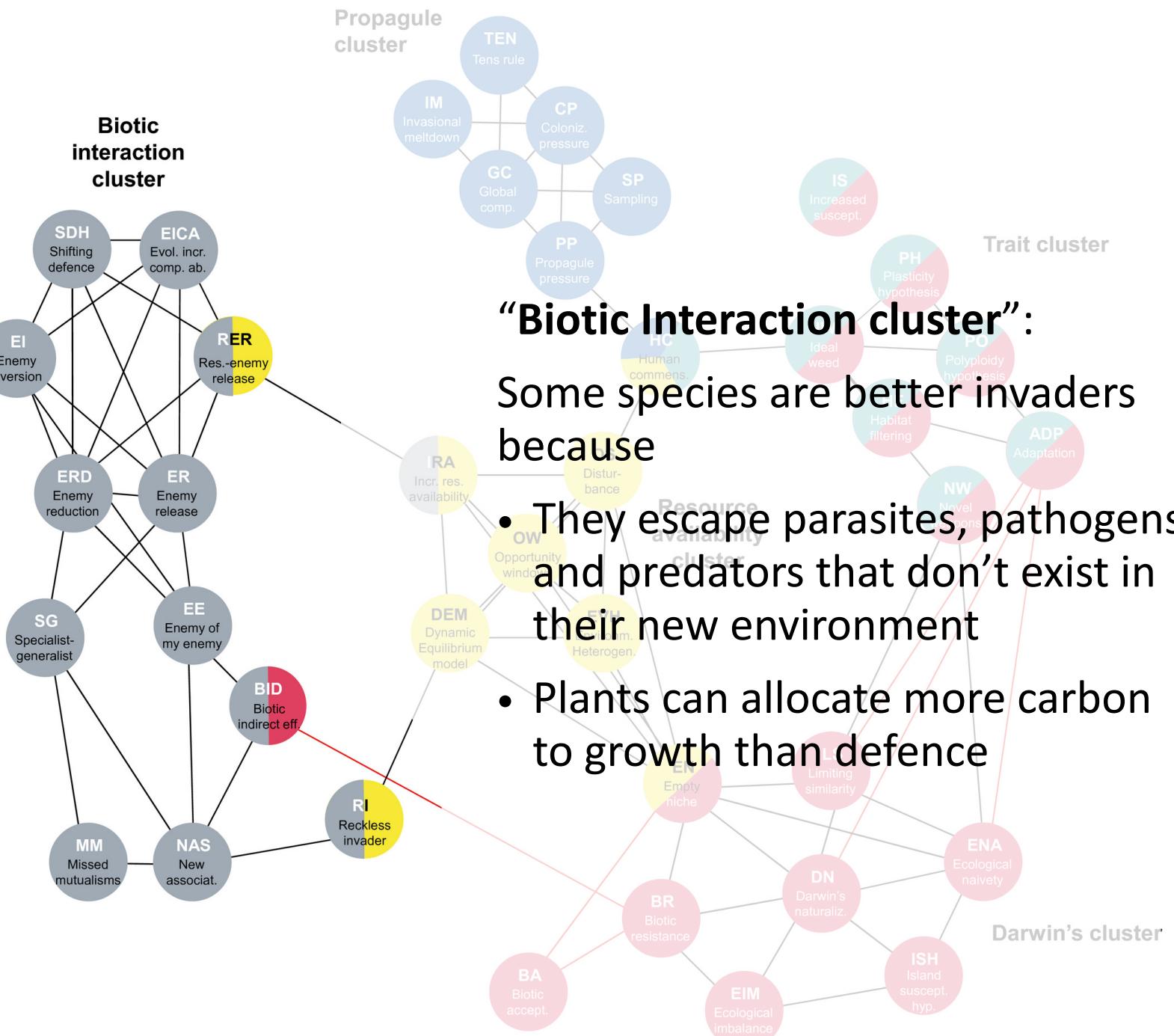


## “Darwin’s cluster”:

Some species are better invaders because

- the new environment is more susceptible (eg islands)
- They are more (or less!) related to established species
- they find an empty ecological niche when they arrive

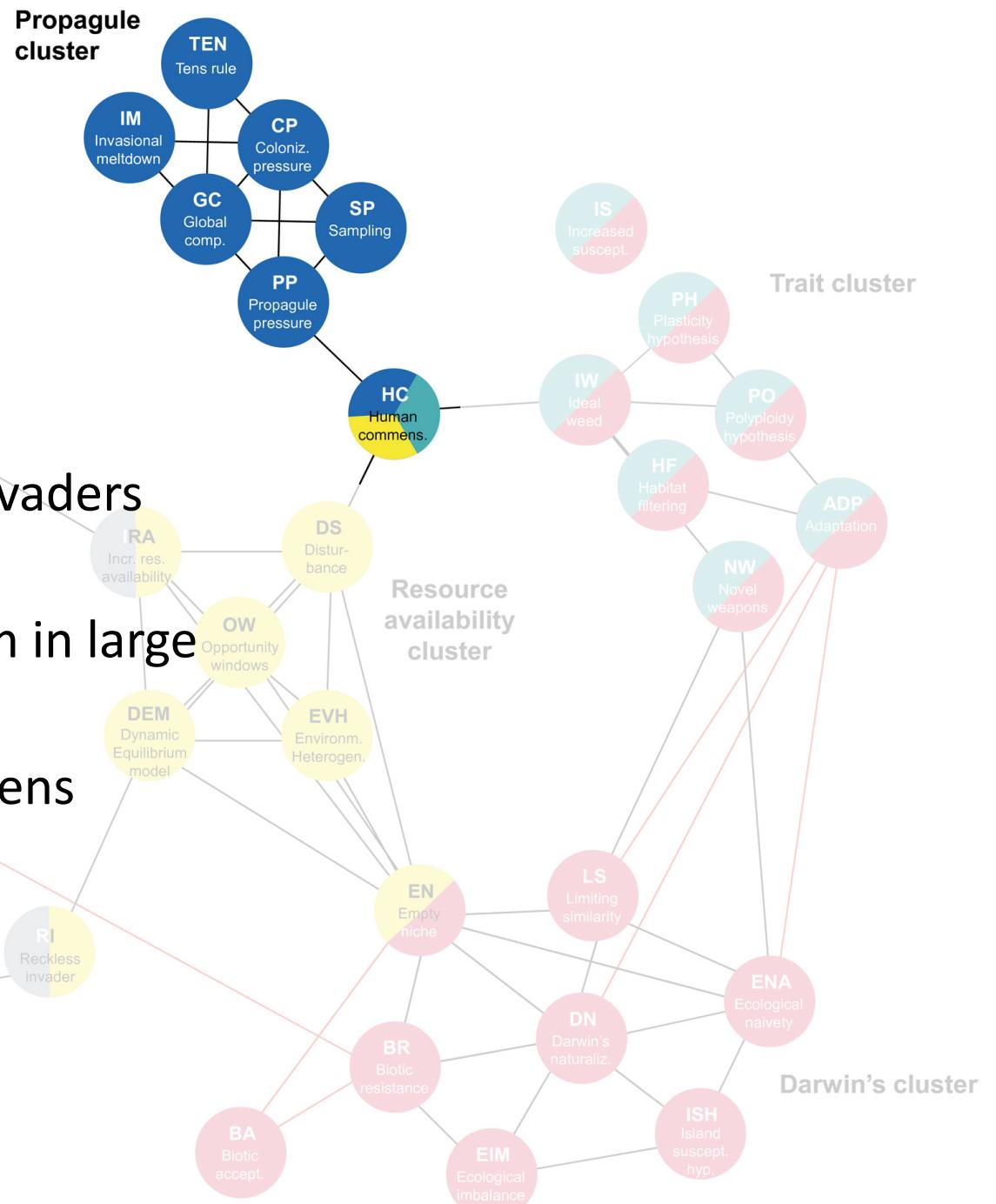




## “Propagule cluster”:

Some species are better invaders because

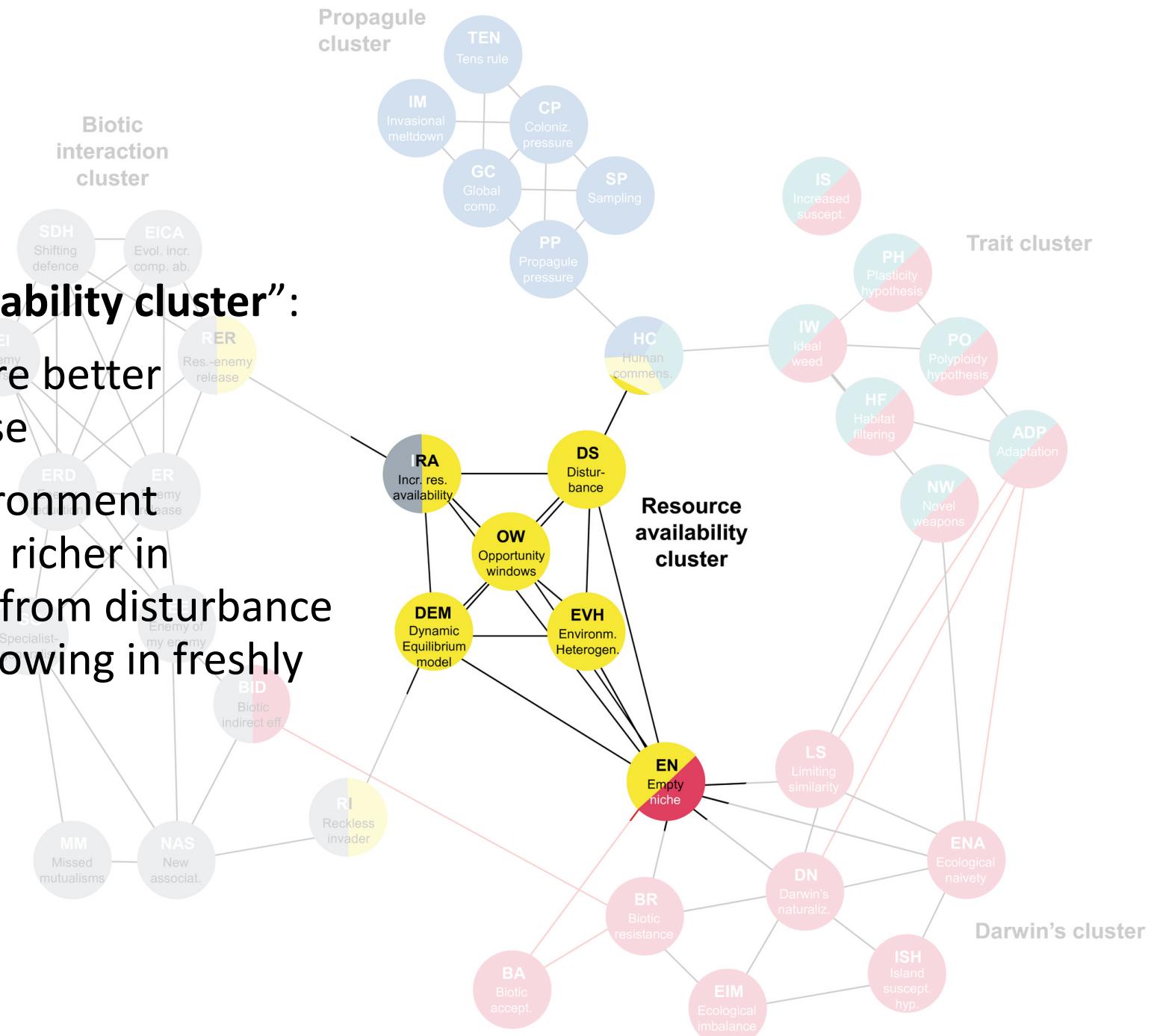
- Humans introduced them in large numbers and/ or often
- Previously introduced aliens “pave the way”



## “Resource availability cluster”:

Some species are better invaders because

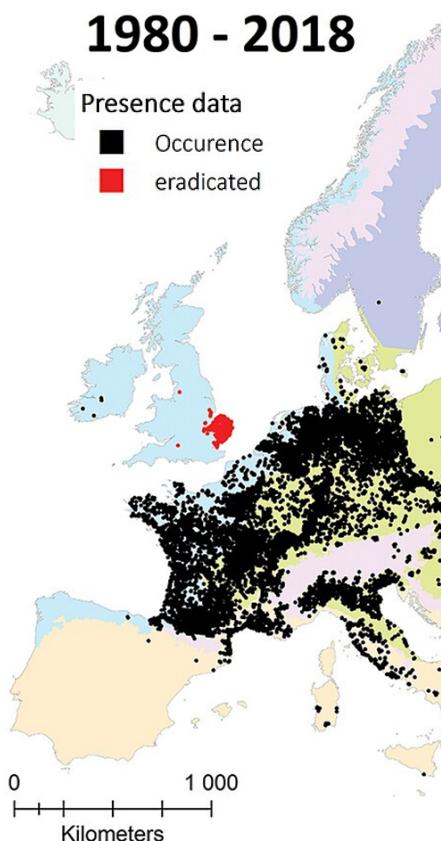
- The new environment temporarily is richer in resources, eg from disturbance (like weeds growing in freshly tilled soil)



# What to do about invasives?

Trap and kill them:

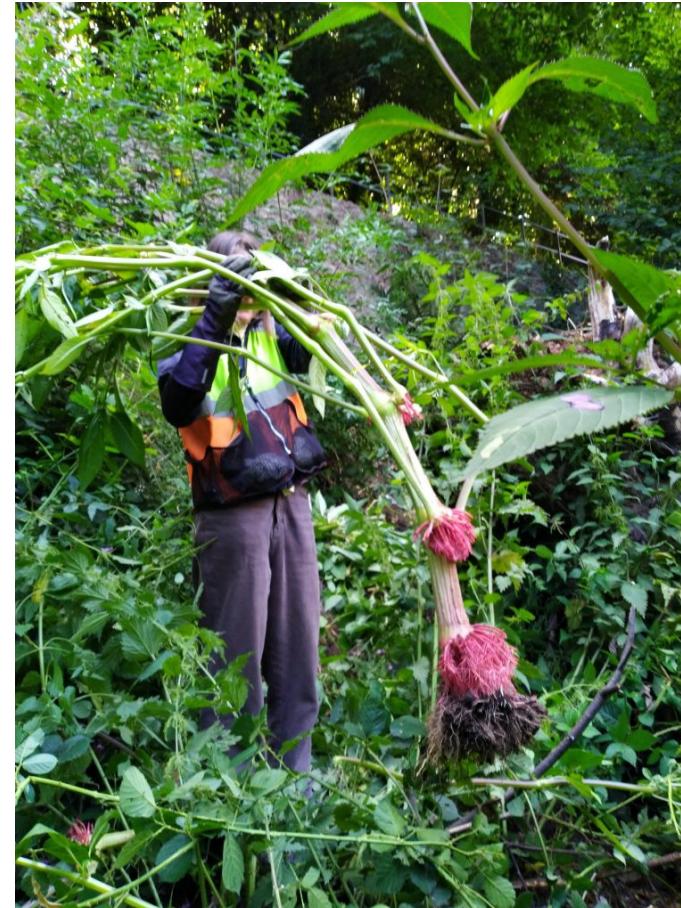
- Coypus (=Nutrias) once common in SE England; major damage to waterways
- Eradication by trapping (1960-1989) successful- no sightings since



# What to do about invasives?

## Apply pesticides:

- “Balsam bashing” (manually ripping out Himalayan balsam, snapping the stem) is very satisfying but has little change in the long term
- Herbicide application (eg glyphosate) legally required for Japanese knotweed. Little else is effective



# What to do about invasives?

## Biological control with natural enemies:

- Knotweed sap-sucking psyllids promising, but insects don't survive UK climate well. New species (Murakami psyllid) being tested
- Leaf-spot fungus *Mycosphaerella polygoni-cuspidati* also attacks some UK plants. Use as mycoherbicide?



# Beware Biological control



Cane toads (*Rhinella marina*): originally Mesoamerican; successful in fighting sugarcane beetles in Hawaii. Introduction to Australia since 1935 has devastated native reptiles and the quoll.



Harlequin ladybug (*Harmonia axyridis*): native to Asia. Introduced to America and Europe as highly effective biocontrol against aphids and scale insects in greenhouses. Now globally one the most invasive insects.

# Monitoring and prevention

Invasive plants and animals harm the environment and wildlife, and block waterways making paddling difficult. They can be small and hard to spot so are easily spread on damp equipment and clothing.

Protect the environment and sport you enjoy by keeping your kit free of invasive plants and animals.

**Remember to check these places**

**CHECK**

**CLEAN**

**DRY**

**Check** boats, equipment and clothing after leaving the water for mud, aquatic animals or plant material. Remove anything you find and leave it at the site.

**Clean** everything thoroughly as soon as you can, paying attention to the inside of your boat and areas that are damp and hard to access. Use hot water if you can.

**Dry** - drain water from every part of your boat and dry with a sponge or towel before leaving the site. Dry everything thoroughly for as long as possible before using elsewhere as some invasive plants and animals can survive for two weeks in damp conditions.

Watch out for:

SIGNAL CRAYFISH      QUAGGA MUSSEL      FLOATING PENNYWORT



# Monitoring and prevention



For the UK, check the *Great Britain Non-native Species Secretariat (NNNS)* [website](#) and the [CABI](#) Invasive Species Compendium.



## Species alerts!

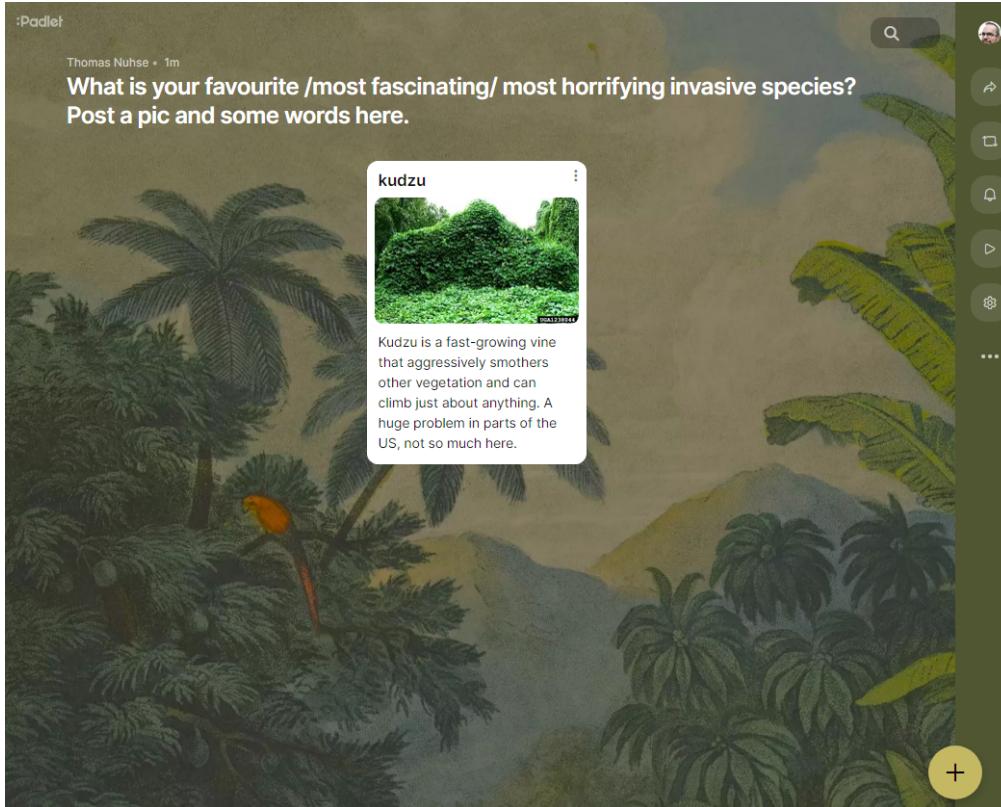
View a list of current alert species to lookout for and record.



## Record non-native species

Find information on identifying non-native species and where to record your sightings.

# For workshop: find your own favourite invasive species and post on Padlet (see Blackboard for instructions!)



Access the padlet [here](#),  
Then double click anywhere, click on the  
“+” sign bottom right, or drag a file onto the  
board.