



Applied insect ecology 2017 – 7

Invaze // Insect invasions

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a

oddělení ekofyziologie

Entomologický ústav BC AV ČR



Terms in invasion ecology

- Adventive
- Alien
- Exotic
- Foreign
- Non-indigenous
- Non-native
- Escaped
- Imported
- Introduced
- Established
- Naturalized
- Spreading
- Expansion
- Impact
- Noxious
- Nuisance
- Pest
- Invasive



Ways of spread

- Vector
- Pathway
- Donor vs. Recipient region
- Intentional transport
- Unintentional transport
 - Goods, ware
 - Seedlings
 - Balast water
 - Animals (horses)
- Intentional transport
 - Food
 - Herbs (medicinal, spices)
 - Game animals
 - Ornamental plants, birds
 - Biocontrol
 - Science
 - Known properties
 - Guarded against release



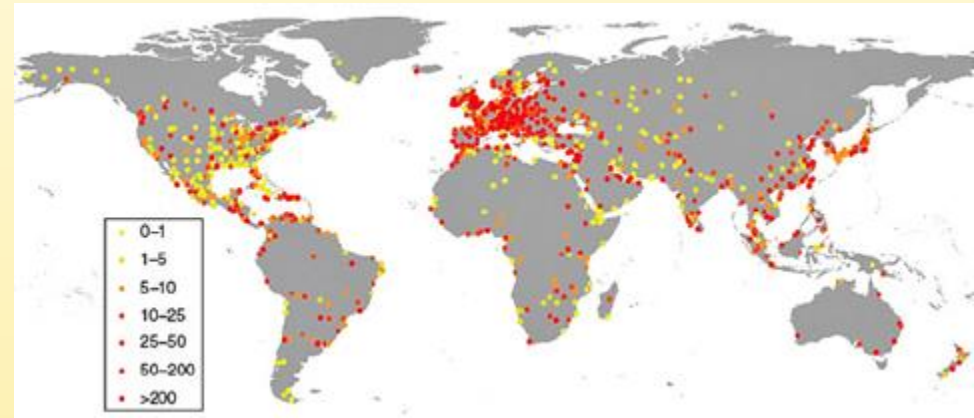
Applikovaná ekologie čimyžu



Ways of spread

– Air transportation

- Similarity of climate
- Synchrony of climate



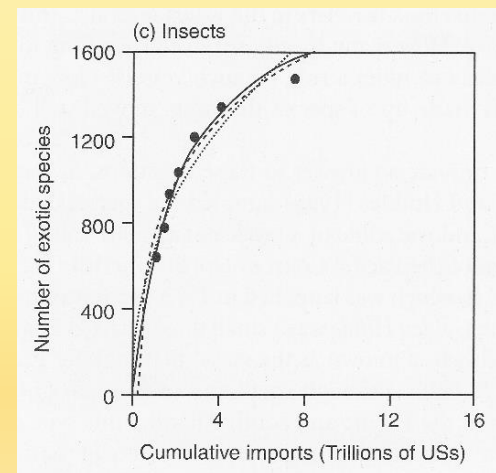
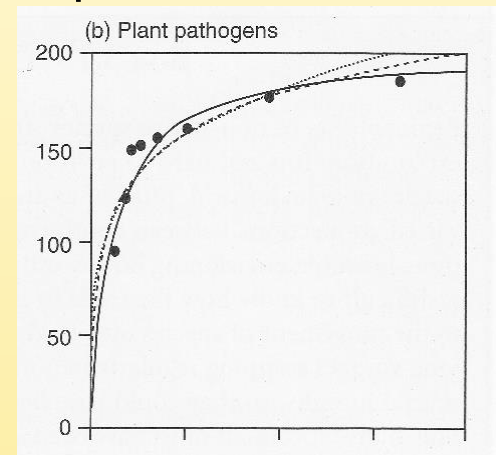
Establishment

– Established

- Reproduction outside human dwellings
- Exponential cumulative increase of number of species
- Now linear
- Earlier intentional introduction
- Now unintentional escapes
- Earlier beneficial
- Later ornamental
- Wars

– Intensity of trade

- Species accumulation curve



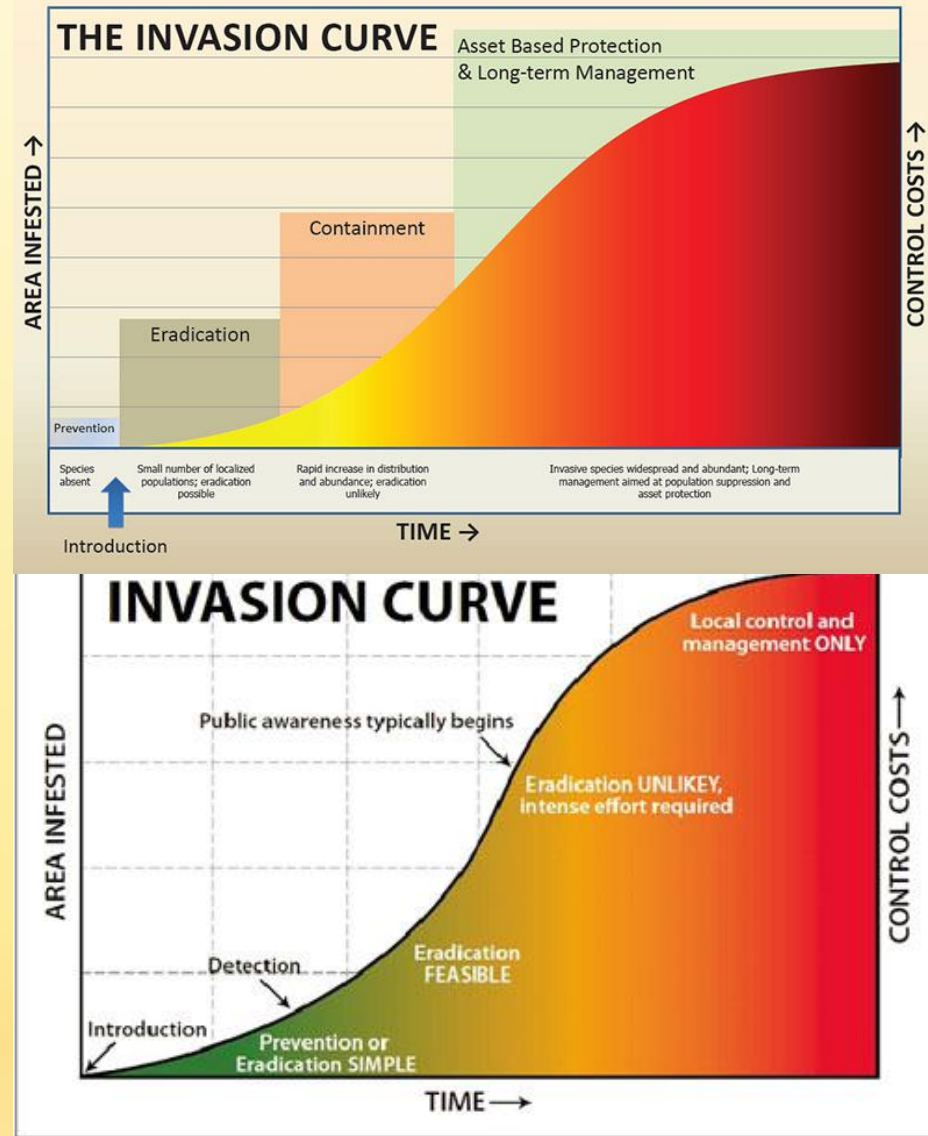
Establishment

- Biotic interactions
 - Resistance
 - Facilitation
 - Competition
 - Predation
 - Mutualism



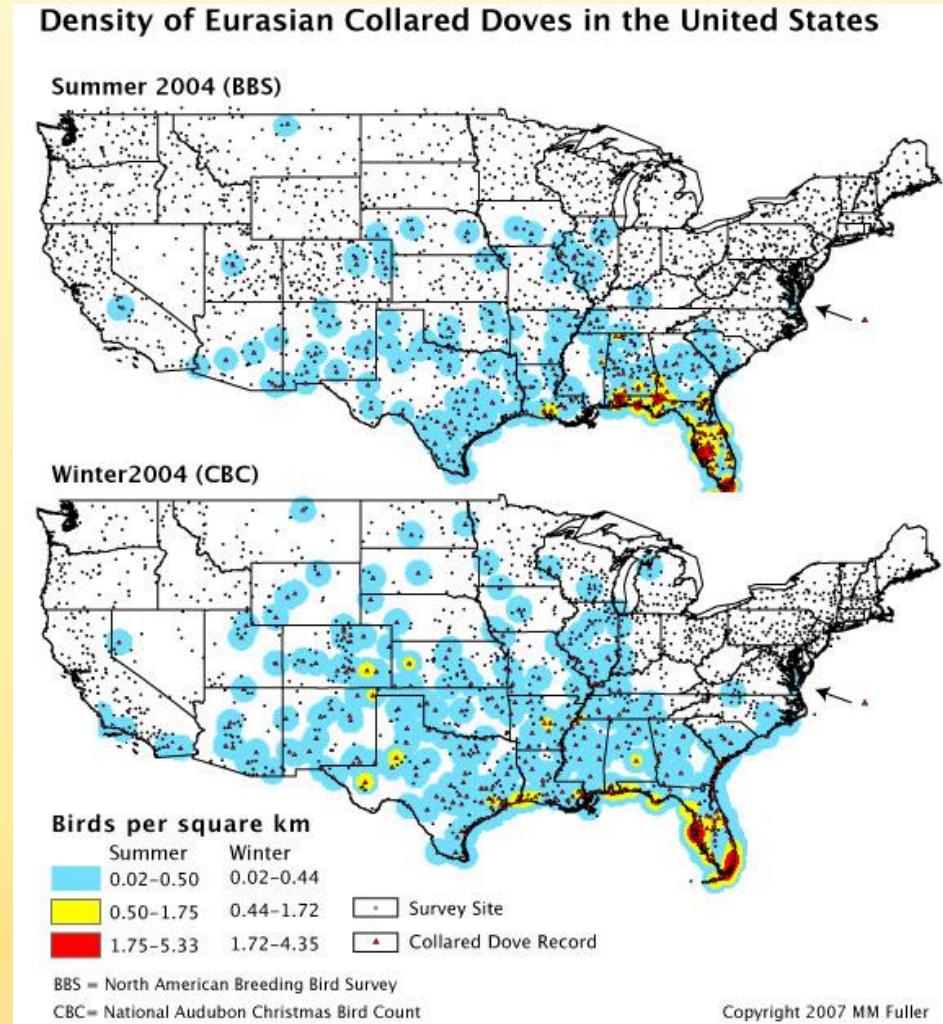
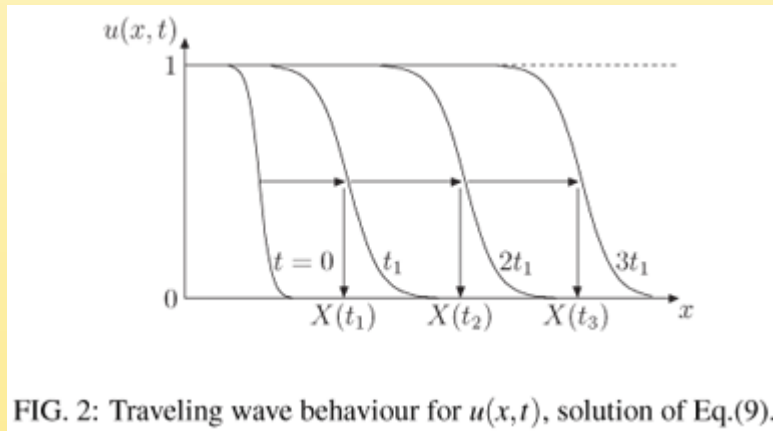
Spread

- Detection
- Spread
- Control costs



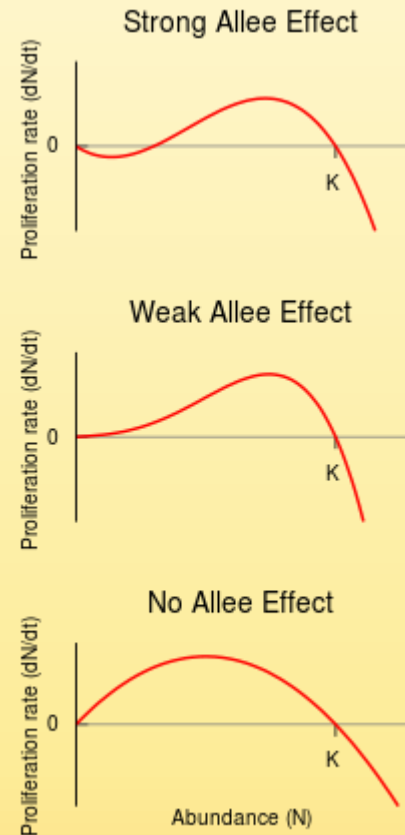
Spread

- Wave and satellites
 - Stratified dispersal
- Travelling wave front



Factors vzniku invaznosti

- Propagule pressure
- Minimum viable population size
 - Alee efekt
- Lag period
 - Local x unnoticed
 - Genetic adaptation
 - Bridgehead effect
- Climatic conditions



Propagule

- Propagule pressure
 - Size
 - Number
 - Health
 - Frequency or sites
 - $10 \times 100 > 1 \times 1000$
- Active individuals
- Seeds, spores

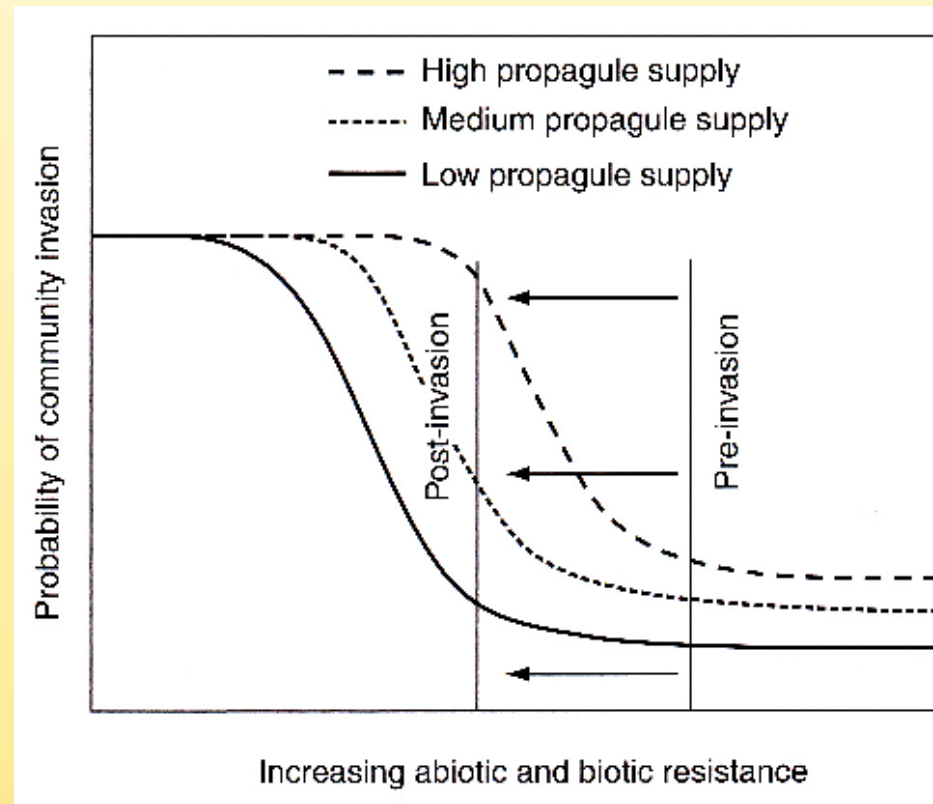


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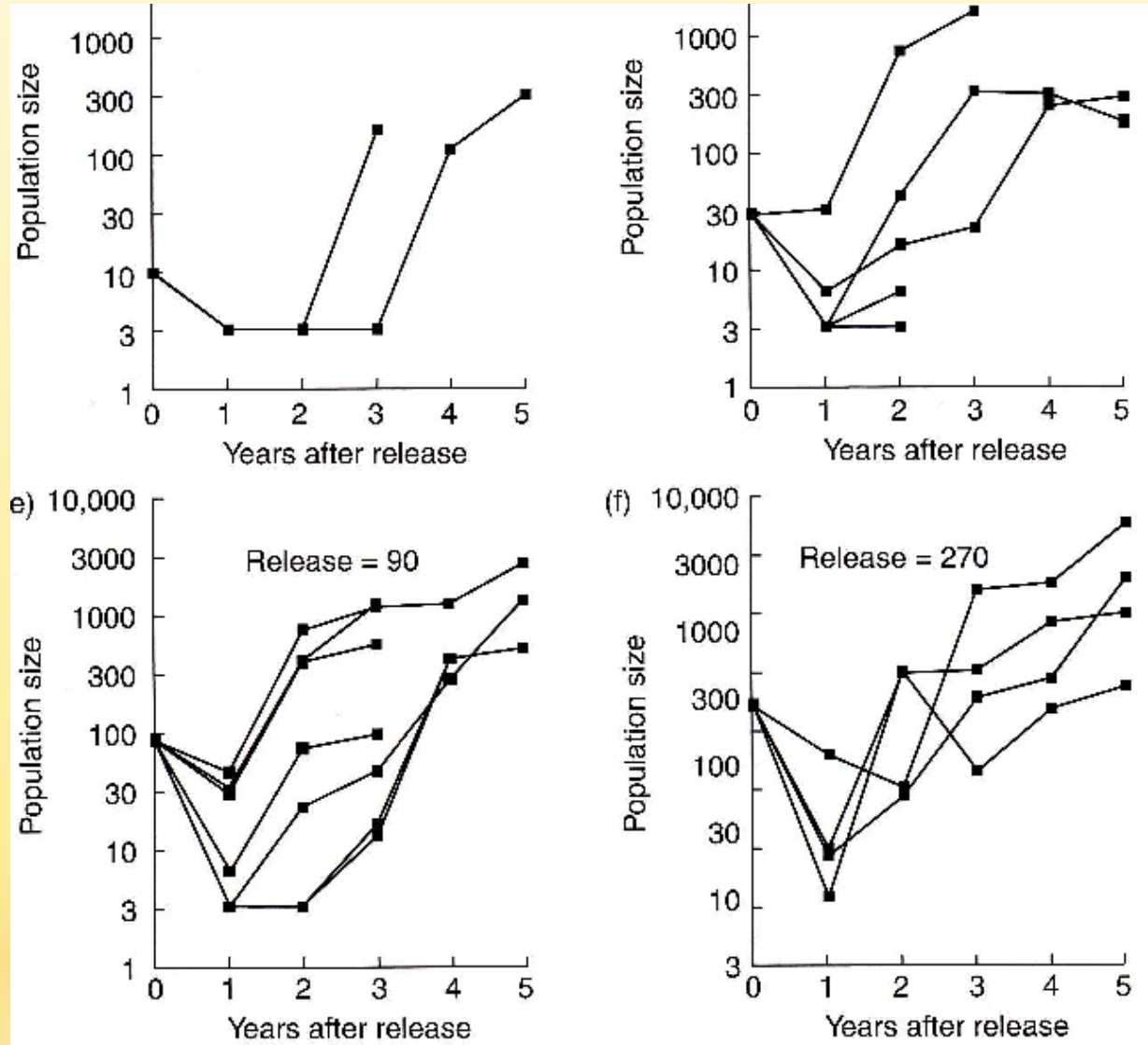
Invasion facilitation

- Biotic resistance
- Synergistic interaction

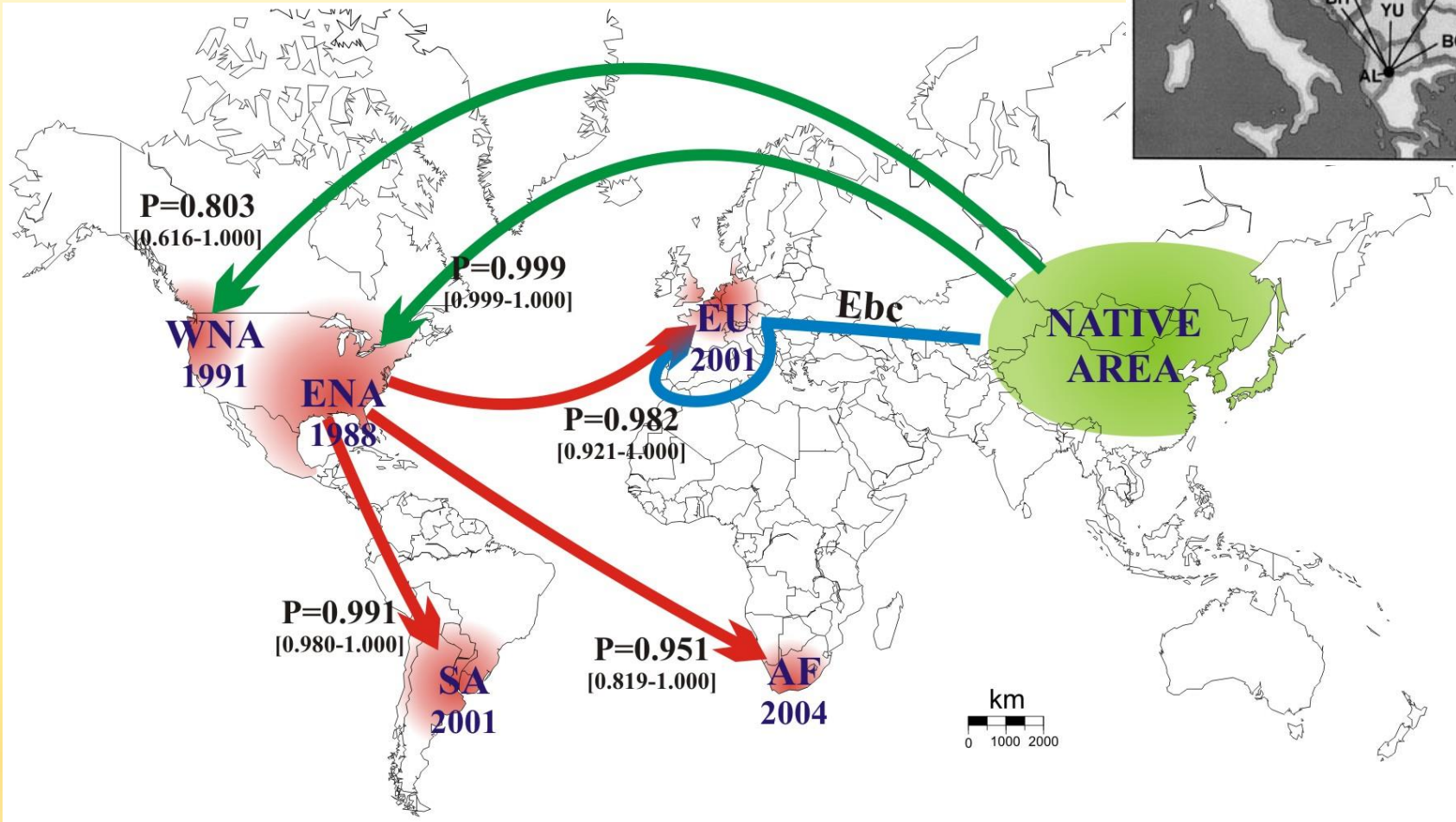
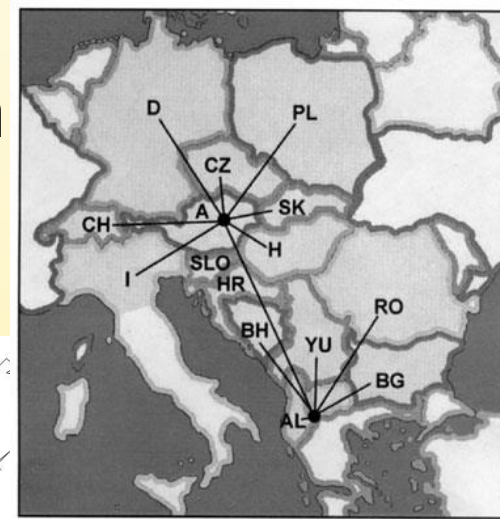


Populační dynamika

- Lag period

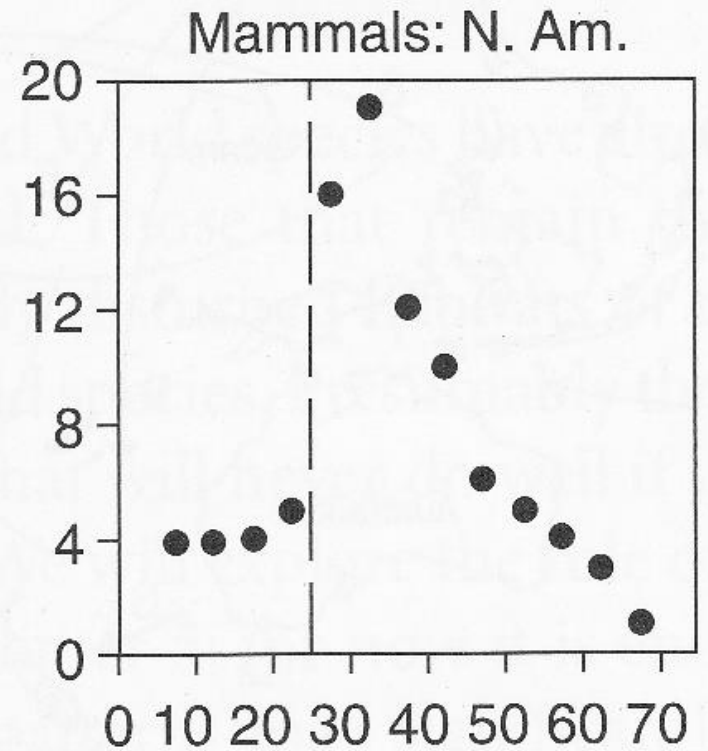
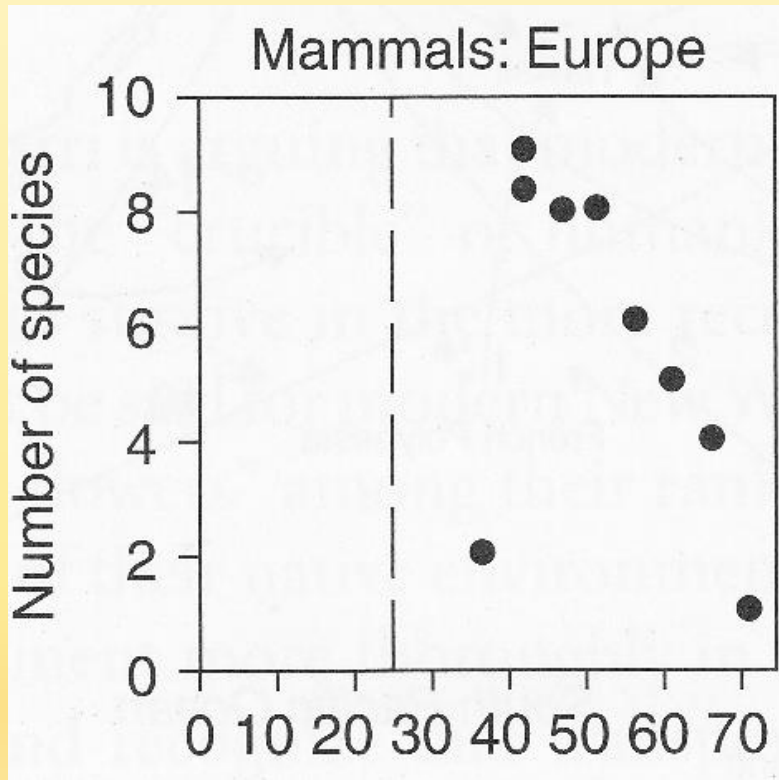
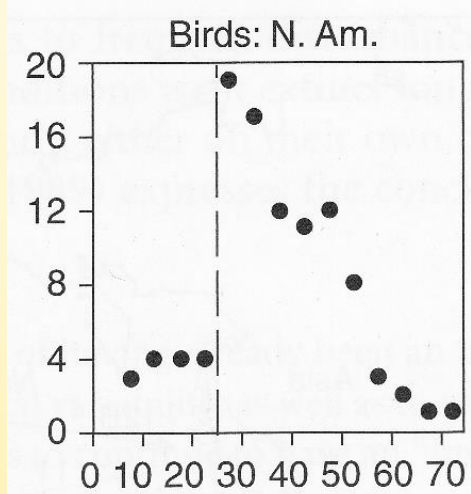


Bridgehead effect and hybridization



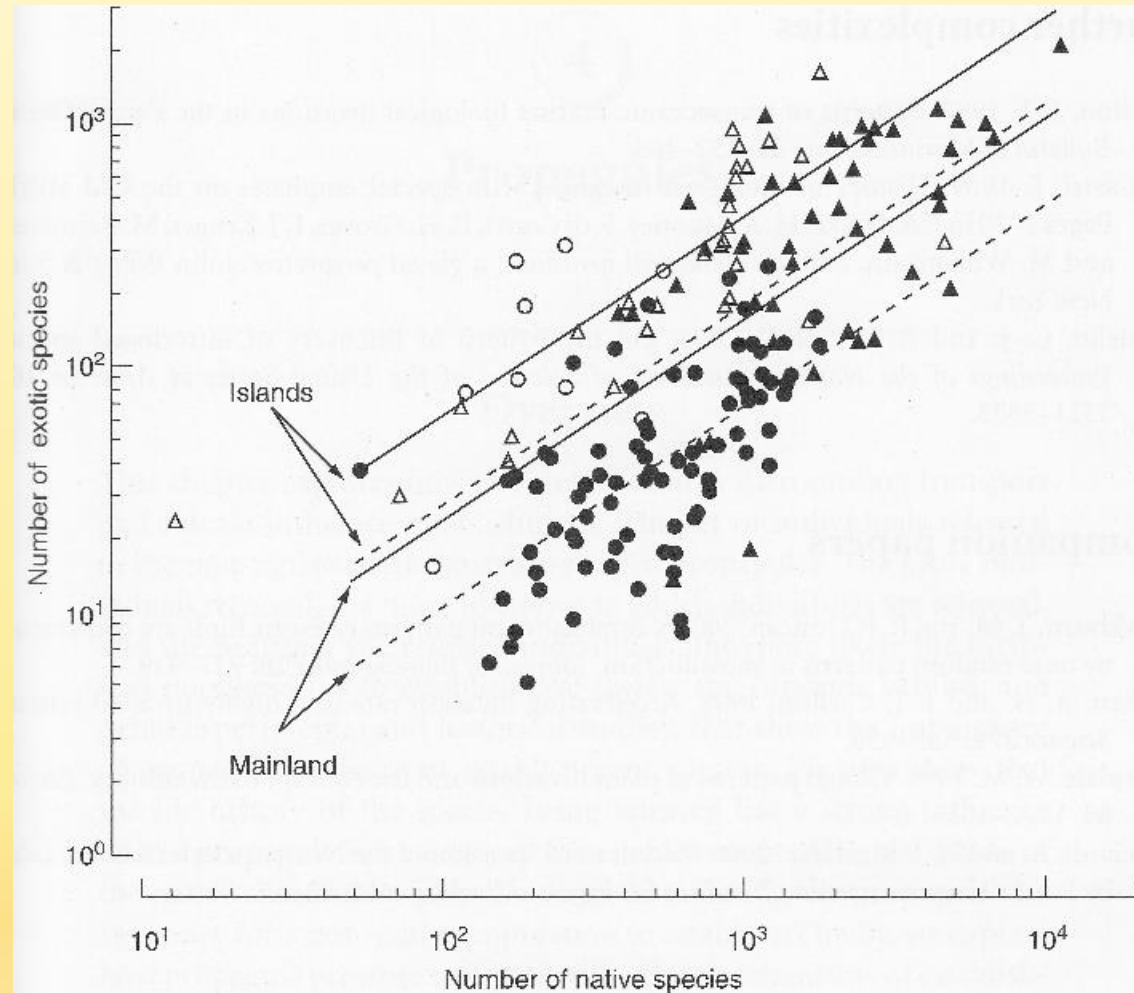
Climatic conditions

- Geographic latitude of target area



Geographic conditions

- Oslands vs. continent



Reasons for origin of invasiveness

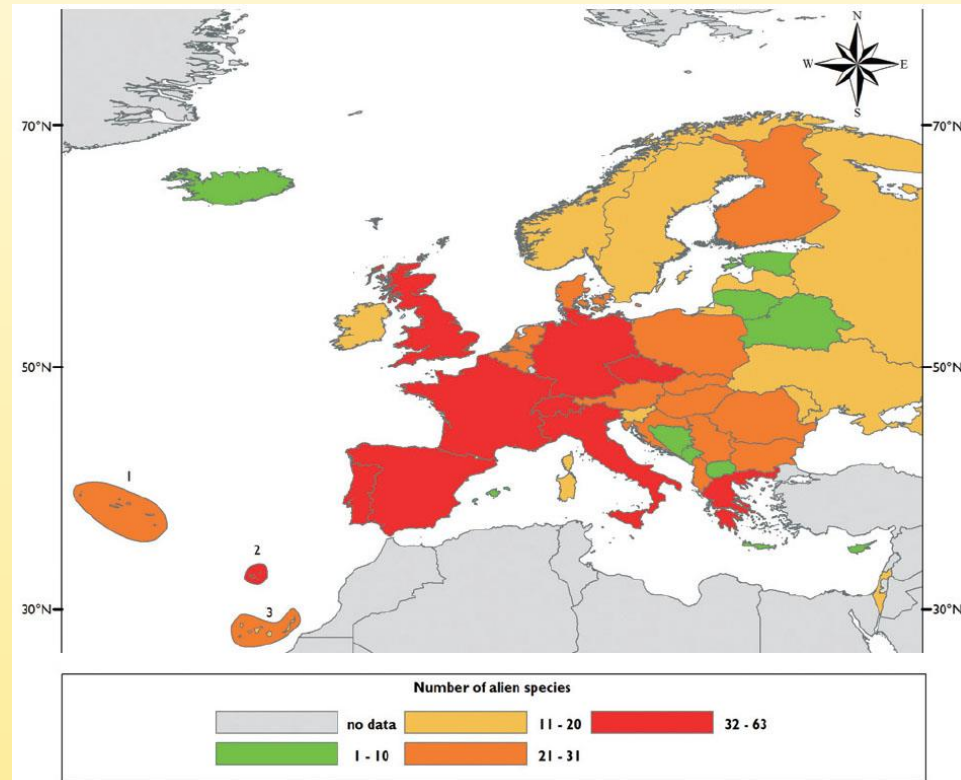
- Hypotheses

- Free niche
- Enemy free space
- Superorganism
 - Fertility
 - Developmental time
 - Generalists
 - Synanthropy
 - Competitiveness
- Origin
 - continental
- Spread abilities



Invasive aphids

- The European aphid fauna currently includes 1,373 species and about 7.4 % of them are invasive species originating from another continent. Most of the alien aphid species in Europe originate from temperate regions of the world and in particular Asia and North America have contributed the largest numbers. Only few alien aphid species in Europe are of African origin and no alien aphids has yet been introduced into Europe from Australasia or South America.



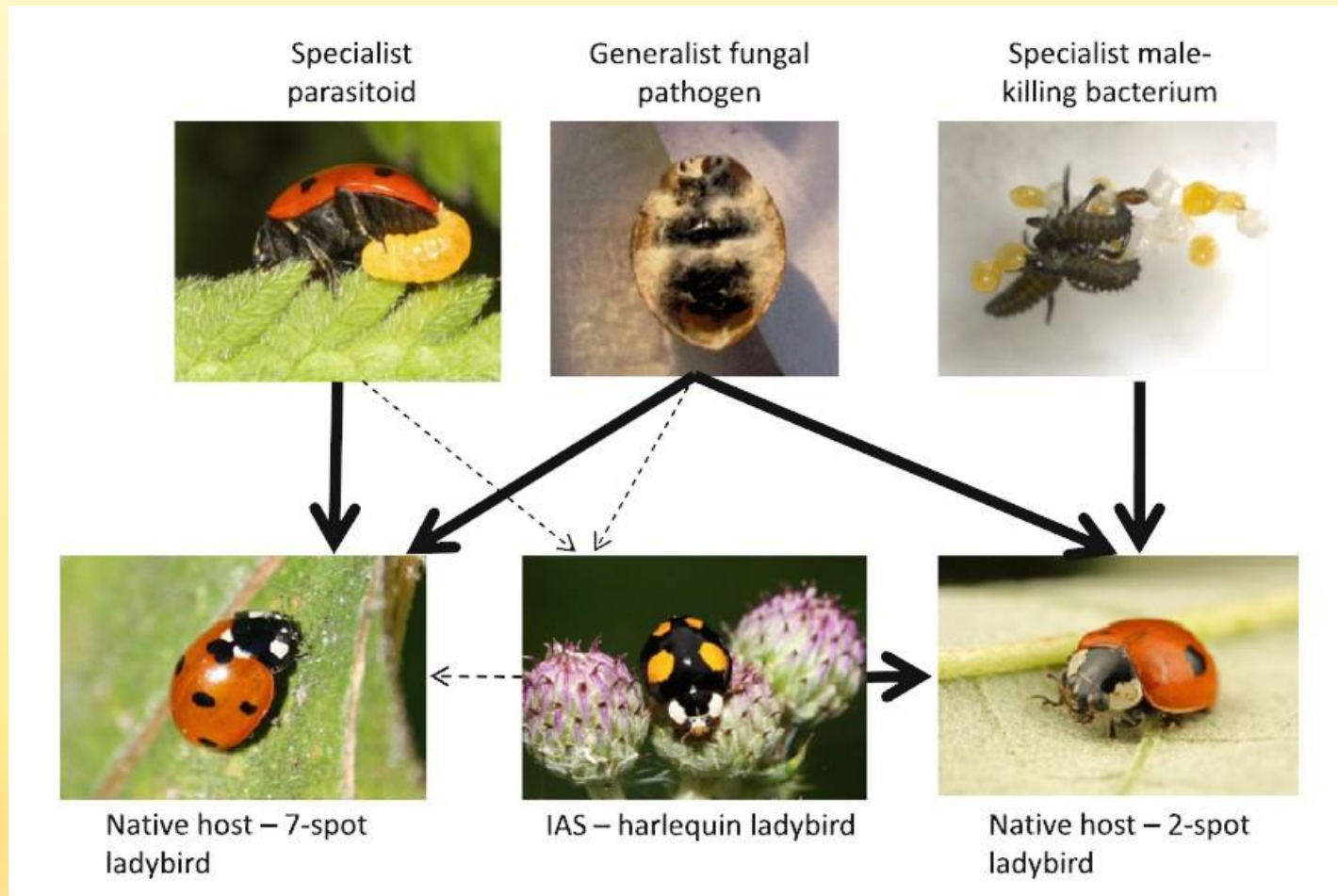
Origin of aliens

– In Czech Republic

- Europe
- Americas
- Asia
- Australia
- Africa
- = number and time
- Cryptogenic

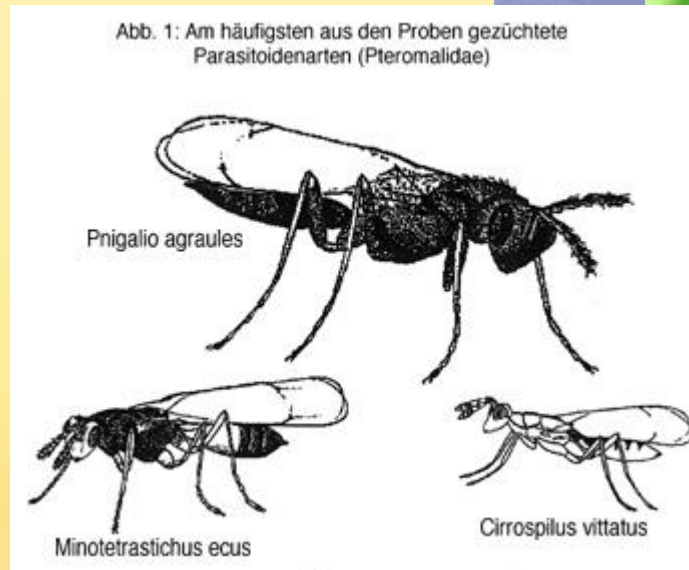


Enemy release hypothesis



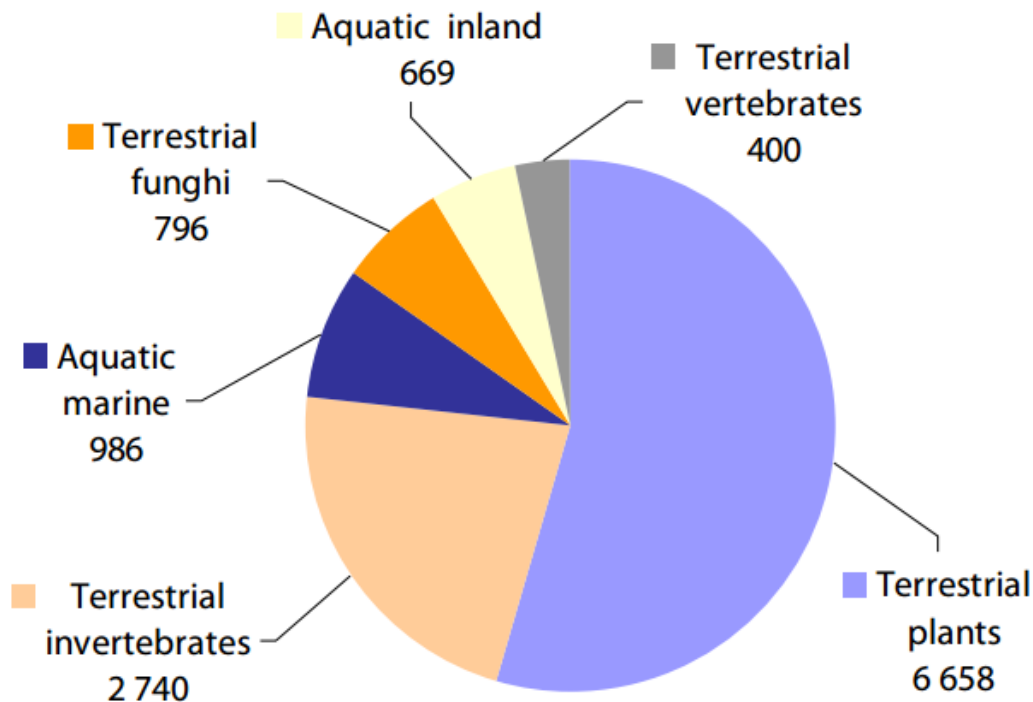
Enemy release hypothesis

- Horse chestnut leafminer
- Natural enemies
 - Only generalists and aliens, secondarily adapted parasitoids
 - Mostly 5-15 %, after years
 - Non-appealing kairomons and allomons
 - immunity against paralyzing compounds?
 - Escaping from ovipositor
 - Tits can take larvae from mines



Taxonomy of aliens

Alien species in Europe (2012)



Data source: [DAISIE](#) (Delivering Alien Invasive Species Inventories for Europe), research project funded by the European Commission, and the Centre for Ecology and Hydrology ([CEH](#)).



Control costs

Estimated economic losses due to invasive species across the globe

Country	Estimated losses
Globally	€1 trillion/year
US	€90 billion/year
EU	€12 billion/year
China	€11 billion/year
New Zealand	€2 billion/year
UK	€2 billion/year

Data source: [European Commission](#) (2013)

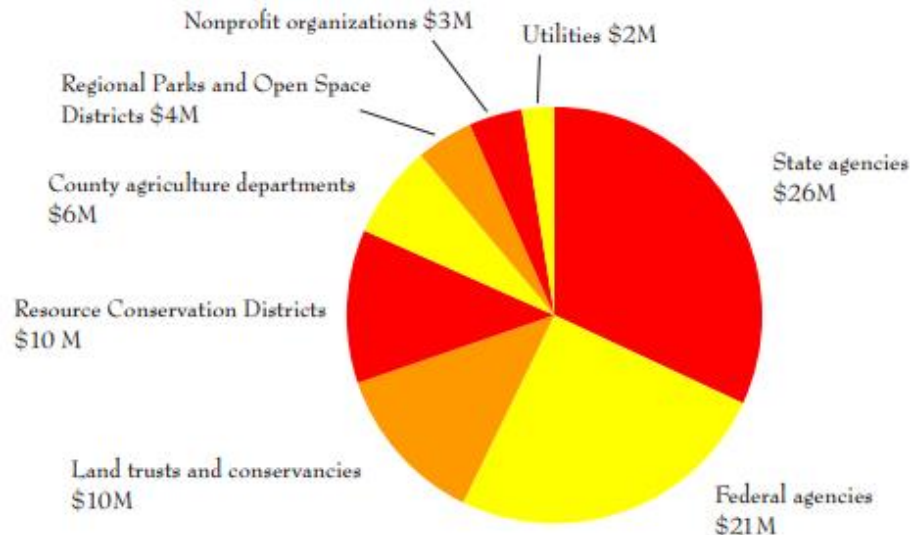


Invasive Plants Cost California \$82 Million Every Year.

At least. Estimates of actual impacts reach into the \$ billions. \$82 million represents current costs of control, monitoring, and outreach. This investment repays itself many times over by addressing major impacts. Invasive plants:

- Increase wildfire potential
- Reduce water resources
- Accelerate erosion and flooding
- Threaten wildlife
- Degrade range-, crop- and timberland
- Diminish outdoor recreation opportunities

Estimated Annual Cost of Invasive Plant Work in California



Management and control

- Proactive management
 - Prevention
 - Exclusion
 - Early eradication
 - *Caulerpa taxifolia*
 - Evaluation of invasiveness
- Reactive management
 - Do nothing
 - National parks
 - Cultural control
 - Resistant cultivars
 - Chemical control
 - Repeated
 - Large areas
 - Biological control
 - Permanent control
 - Another invader
 - IPM



Evaluation of invasiveness

- Ecological impact assesment
- Spread x Effect
- Spread = invasion potential
 - Lifetime
 - Expansion rate
- Ecological effects
 - Native sp.
 - Landscape changes
 - Transmitting diseases

