

Zoogeography

Lesson 12



The Heaven tree,
Ailanthus altissima

New emerging invasive species



Photo: CC Image courtesy of Danel Solabarieta on Flickr

The Asian hornet (*Vespa velutina*), introduced to western Europe in 2004, preys on other species of insect, particularly honey bees. This has led to major losses in honey bee colonies, decreasing beekeeping production and therefore impacting local economies. The species is also a threat to public health and incidences of anaphylactic shock due to people being stung have been reported. The full impact of the species invasion as as yet unknown.

Invasion



- The success of a species can, in part, be measured by its geographical distribution, and the ability to move into new areas.
- Introduced into Central Park, New York, in 1891. Since then, it has spread widely and is now present throughout the United States
- It has partially displaced the bluebird (*Sialia sialis*) and the yellow-shafted subspecies of the northern flicker (*Colaptes auratus*).

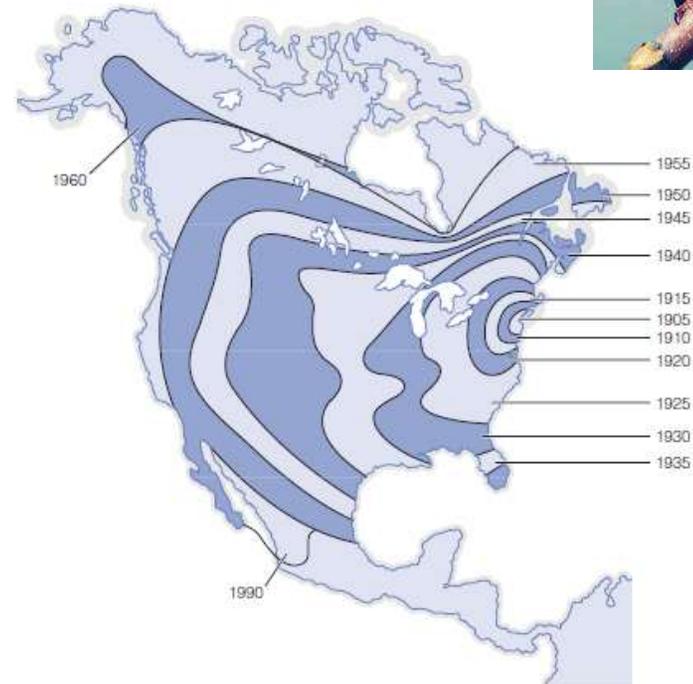


Figure 2.43 Map of North America showing the range extension of the European starling (*Sturnus vulgaris*) following its introduction to the continent late in the nineteenth century. Adapted from Baughman [12].

Invasion

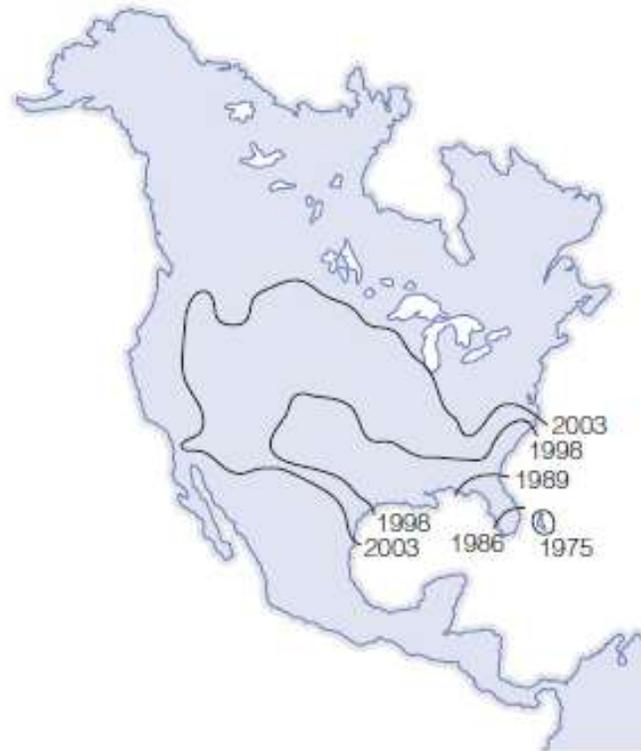


Figure 2.44 Map of North America showing the range extension of the Eurasian collared dove (*Streptopelia decaocto*) since its introduction to the Bahamas in the 1970s. Its spread in North America follows a similarly rapid extension of range in Europe over the last century.

Invasion



- An example is the American grey squirrel (*Sciurus carolinensis*), which was introduced into the British Isles in the nineteenth century.
- Between 1920 and 1925 the native red squirrel (*Sciurus vulgaris*) suffered a dramatic decline in numbers in Britain, largely due to disease.

! The invader must be able to survive the **pressures of predation** and **parasitism** in its new environment and to face biotic resistance of **local populations**.

Do not underevaluate the effects of an invader in a new ecosystem!!!

The poster is a colorful collage with a red and white geometric design. It features several photographs of red squirrels in various settings. The text is arranged in a structured layout with different background colors for each section.

M'AMMALIA LA SETTIMANA DEI MAMMIFERI
27_28_29 OTTOBRE 2017
DERUTA_PERUGIA

ALLA SCOPERTA DELLO SCOIATTOLO ROSSO

Venerdì 27 ottobre dalle ore 9,00 alle 10,00
Percorso verde di Pian di Massiano, Perugia
A testa in su per osservare scoiattoli. Passeggiata alla scoperta dello scoiattolo rosso per osservare gli animali, imparare a riconoscere i loro segni di presenza e scoprire diverse curiosità su questa specie, che sta ora tornando a popolare i parchi urbani della città di Perugia. Appuntamento nei pressi del bocciodromo.

Sabato 28 ottobre dalle ore 16,00 alle 18,00
Galleria di Storia Naturale Casalina, Deruta
Incontro divulgativo sul tema della conservazione dello scoiattolo rosso e la minaccia delle specie alloctone. Laboratorio per bambini e ragazzi dai 6 agli 11 anni. Visita guidata alle collezioni della Galleria di Storia Naturale di Casalina.

Domenica 29 ottobre dalle ore 7,30
Museo delle Acque e i Conservari, Perugia
Safari fotografico. Una passeggiata di 2 km fino alla sorgente del Faggeto per conoscere e fotografare lo scoiattolo rosso in una delle aree naturalistiche più belle di Perugia. Appuntamento nel parcheggio del Museo.

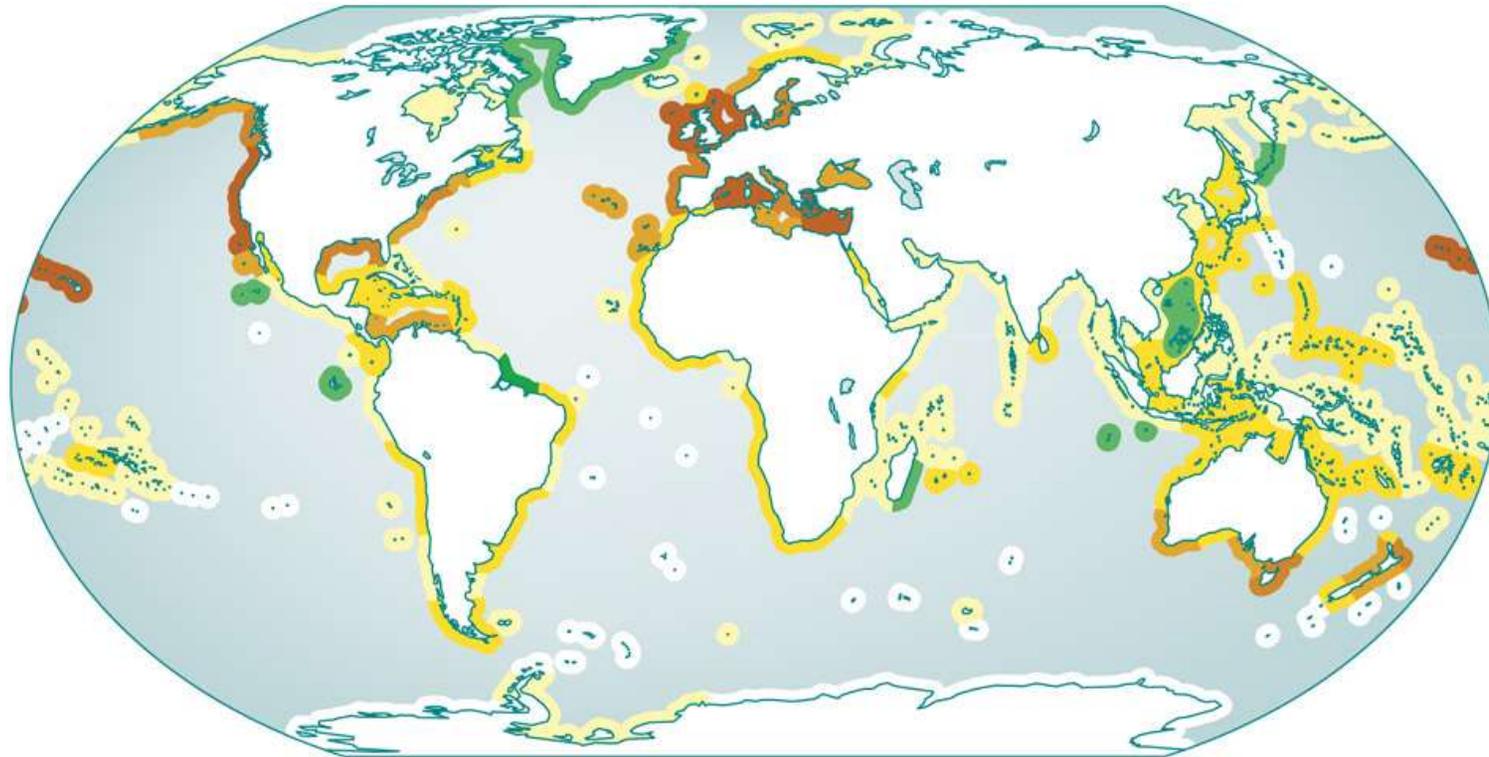
In occasione della IX edizione di **Mammalia**, **La Settimana dei Mammiferi**, promossa dall'Associazione Zoologica Italiana onlus (AZI) e dall'Associazione Nazionale Musei Scientifici (ANMS), il Progetto **LIFE U-SAVERDES**, in collaborazione con il Centro d'Ateneo per i Musei Scientifici dell'Università degli Studi di Perugia (CAMS) e la Galleria di Storia Naturale di Casalina, propone un fine settimana per **far conoscere lo scoiattolo rosso**, i problemi legati alla sua salvaguardia e gli ecosistemi in cui vive.

Find us on Facebook

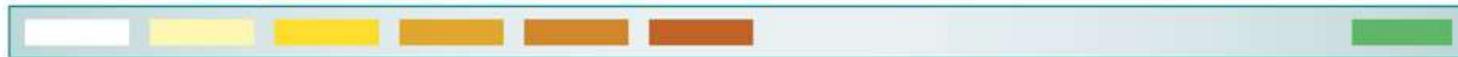
www.usaverdes.eu

Foto: @GiuseppeDeSocio LIFE13 BIOD000204 U-SAVERDES Project realized with the contribution of the LIFE financial instrument of EC

Alien and Invasive species



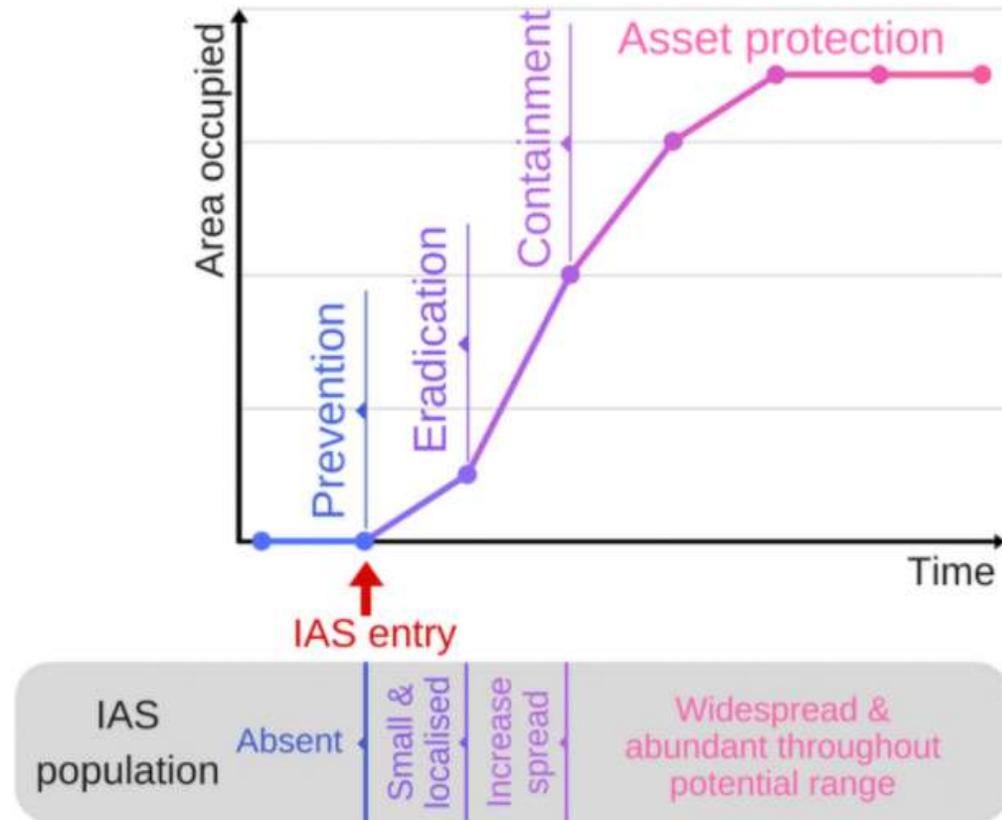
Number of invasive species



Introduction with no impact on native species

Invasion

- Eradication
- Biological control
- GMOs



What you can do

- When boating, clean your boat thoroughly before transporting it to a different body of water.
- Clean your boots before you hike in a new area to get rid of hitchhiking weed seeds and pathogens.
- Don't move firewood (it can harbour forest pests like emerald ash borer).
- Don't release aquarium fish and plants, live bait or other exotic animals into the wild. If you plan to own an exotic pet, do your research and plan ahead to make sure you can commit to looking after it.
- Volunteer at your local park, refuge or other wildlife area to help remove invasive species. Help educate others about the threat.
- Stay educated about emerging threats to native flora and fauna so that you can be as aware as possible about how to help combat these pests.
- Report sightings of emergent species to the proper authorities to help monitor their spread and/or control efforts.



a quarter of a billion people around the world suffer from malaria each year.



Genetics and Genomics

Simple genetic modification aims to stop mosquitoes spreading malaria

Genetically modifying mosquitoes to express antimalarial genes and pass them on to their offspring is being tested as a new strategy to eliminate malaria.



Research Article

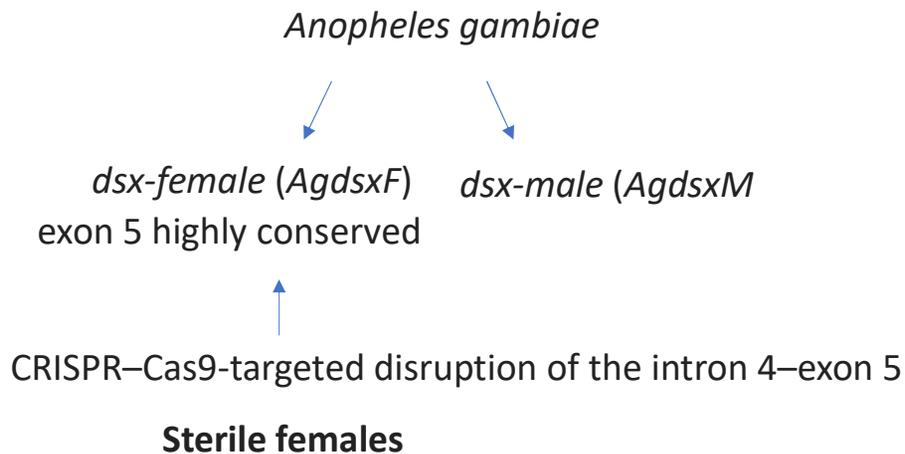
Genetics and Genomics

<https://www.nature.com/articles/nbt.4245>

Converting endogenous genes of the malaria mosquito into simple non-autonomous gene drives for population replacement

Astrid Hoermann, Sofia Tapanelli, Paolo Capriotti, Giuseppe Del Corsano, Ellen KG Masters, Tibebe Habtewold, George K Christophides, Nikolai Windbichler

Department of Life Sciences, Imperial College London, United Kingdom



Together, with better education and increased awareness

**Invasive Species Education
ACTIVITIES & GAMES**

CONNECT TO PLACE
and nature with active outdoor learning for many ages and curricular subjects.

Enhance student **OBSERVATIONS AND REFLECTIONS** of native and invasive species.

COPY AND OBSERVATION SHEETS provided to use with minimal additional prep and materials needed.

Play 'on-the-spot' **ACTIVE GAMES** while learning about invasive and native species.

JAPANESE KNOTWEED **COMMON BURDOCK**

GIANT HOGWEED **JAPANESE BEETLE**

BCINVASIVES.ca **isc** Invasive Species Council of BC

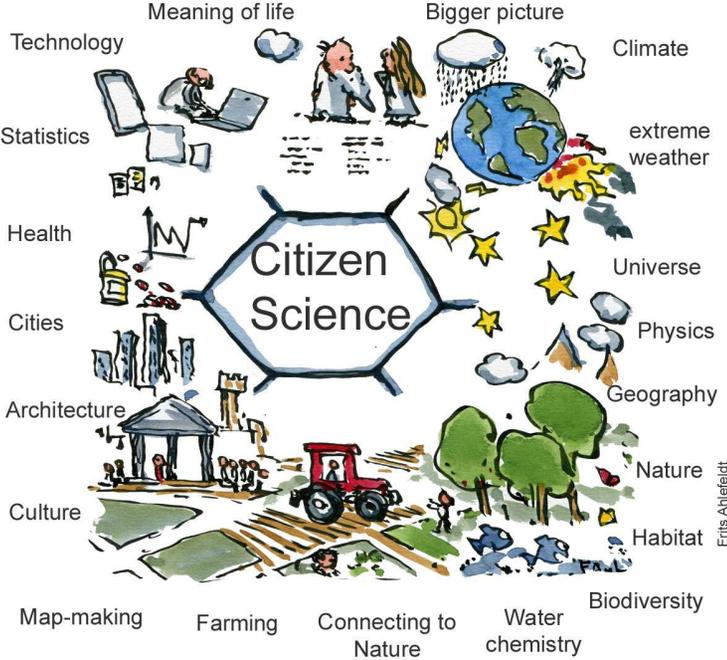
CITIZEN SCIENTIST

BETTERING THE COMMUNITY THROUGH SCIENCE

**Thursdays in April
5:30 pm
All ages**

zoom with the library **McKinneyPublicLibrary.org**

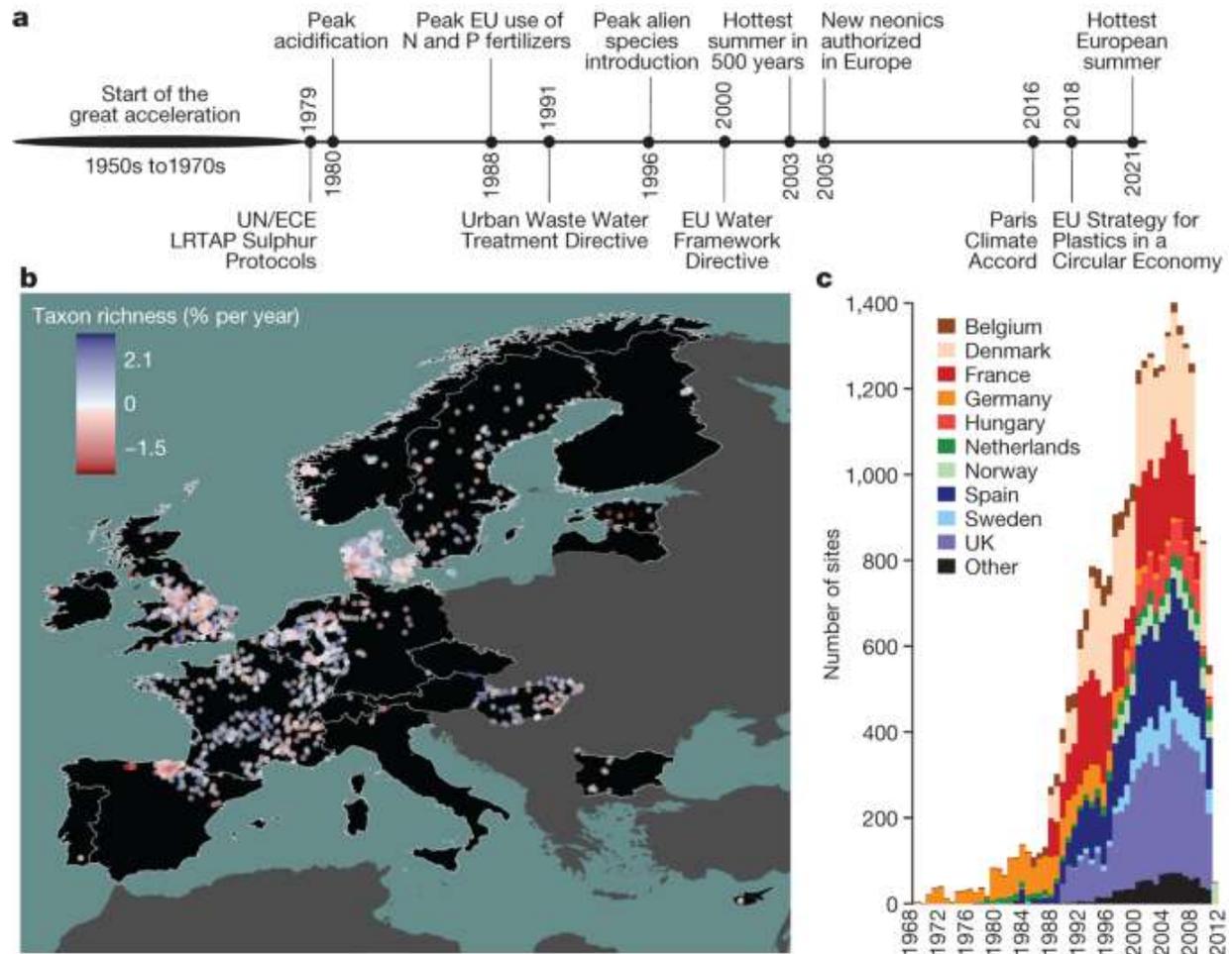
Citizen science - some areas:



Has the diversity an influence on the stability of an ecosystem?

- Charles Elton who first proposed (in the 1950s) that a **more complex and rich ecosystem** should also be **more stable**, meaning that it was **less prone to violent fluctuations** such as those caused by epidemic disease or pest outbreaks
- a **species** in a diverse ecosystem is **no less subject to fluctuations** caused by unfortunate events, such as drought or disease, than is a species in a simple ecosystem.
- On the conservation side, the loss of global biodiversity that we are currently experiencing may well be affecting the functioning of the entire biosphere: i.e. In the field of agriculture, the use of multi-cropping systems rather than single-species stands can provide advantages in terms of both productivity and stability of the system, which is a particular concern in marginal areas, such as arid regions.

a, A timeline of major stressors (above the line) and environmental legislation (below the line) affecting Europe's freshwater ecosystems (citations are provided in Supplementary Table 1). UN/ECE LTRAP, United Nations Economic Commission for Europe Long-Range Transboundary Air Pollution. **b**, The sampling sites (points) and the rate of **temporal change in taxon richness of freshwater invertebrate communities** (colour of points) across 22 European countries (black). **c**, The distribution of sampling sites over time and countries. 'Other' includes countries with fewer than 50 sampling sites.



<https://www.nature.com/articles/s41586-023-06400-1>

- Some confusion can arise because of the different ways in which the term *diversity* is used.
- often, it is simply used as an alternative to the number of species present within an ecosystem: **species richness**

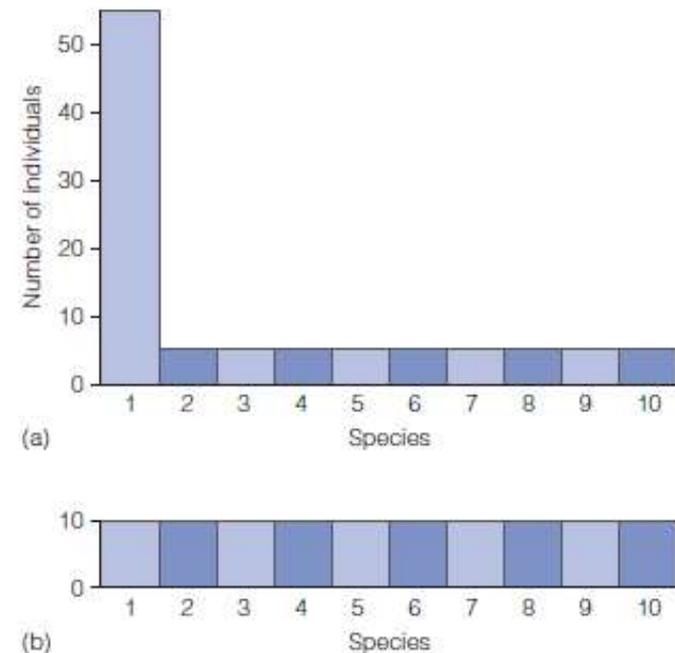


Figure 3.5 Hypothetical community of 10 species and 100 individuals. In (a), one species dominates; and in (b), all species have equal representation. It can be argued that (b) represents the more diverse of the two communities despite their having identical species richness.

what precisely do we mean by **stability**?

- Is a stable ecosystem one which is difficult to deflect from its current composition or function?
- Stability can be explained in terms of **inertia**, or **resistance** to change
- Alternatively, a stable ecosystem could be defined as one which rapidly returns to its original state following disturbance → this uses the concept of **resilience** as a basis for defining stability.
- A **stable ecosystem** should behave in a **predictable manner** no matter what fate may cast in its path, and biodiversity does appear to render an ecosystem predictable by providing a kind of '**biological insurance**' against the failure of certain sensitive species when exposed to particular stresses.

Responses of an ecosystem to disturbance

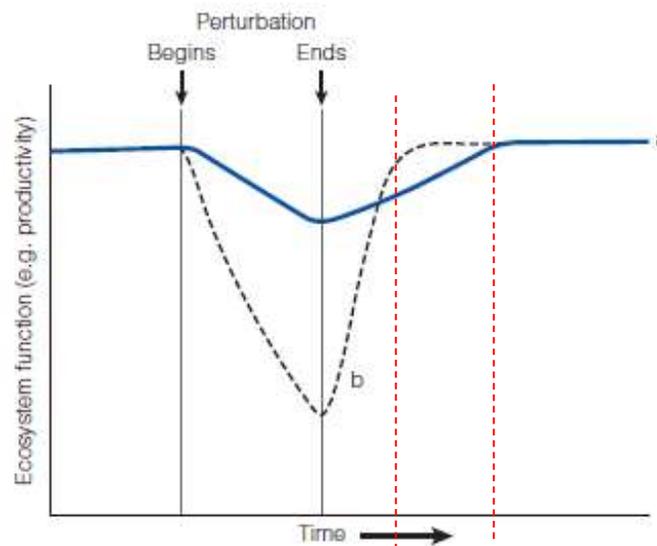


Figure 3.6 Two possible responses of an ecosystem to disturbance. Line a (solid) represents an ecosystem that is resistant to perturbation. Its response to disturbance is slower and less severe, but its return to its original state is slow. Line b (dashed) shows a resilient ecosystem that is more severely affected by the disturbance, but rapidly returns to its original state. Either could be regarded as an illustration of ecosystem stability. Adapted from Leps [16].

1 The idea of 'communities' of organisms that occur in discrete units, which are predictable in terms of species composition, is attractive and useful to biogeographers, but nature often exhibits a gradual and continuous change in species assemblages depending on the individual requirements of species.

2 In a landscape consisting of a fragmented mosaic of different habitats, communities are more likely to have distinct boundaries and therefore to be recognizable in nature.

3 The ecosystem is a useful way of considering biotic (animal, plant, and microbial) assemblages in relation to the non-living world. It is a concept based on the ideas of energy flow through a series of feeding (trophic) levels and the circulation of elements between living organisms and the non-living world.

4 The use of the ecosystem concept and the notion of functional types of organisms (producers, decomposers, nitrogen-fixers etc.) within the community

provides a way of investigating the implications of biodiversity for natural systems. It allows us to ask the question: are all species really necessary for the maintenance of the stability of an ecosystem, or are some redundant? Current research suggests that some species can be lost without necessarily destabilizing an ecosystem. More critical is the maintenance of a balance of functional types.

5 Global ecosystems, often called biomes, are best defined in terms of vegetation physiognomy or of functional types, either morphological or physiological. Models relating biome distribution to climate can then be developed.

6 Climate-biome models provide a means of predicting the outcome of climate change on the Earth's biogeography and will have implications in both conservation and agriculture. But predictions of biome shifts are only as good as the climatic predictions that underlie them.



Summary