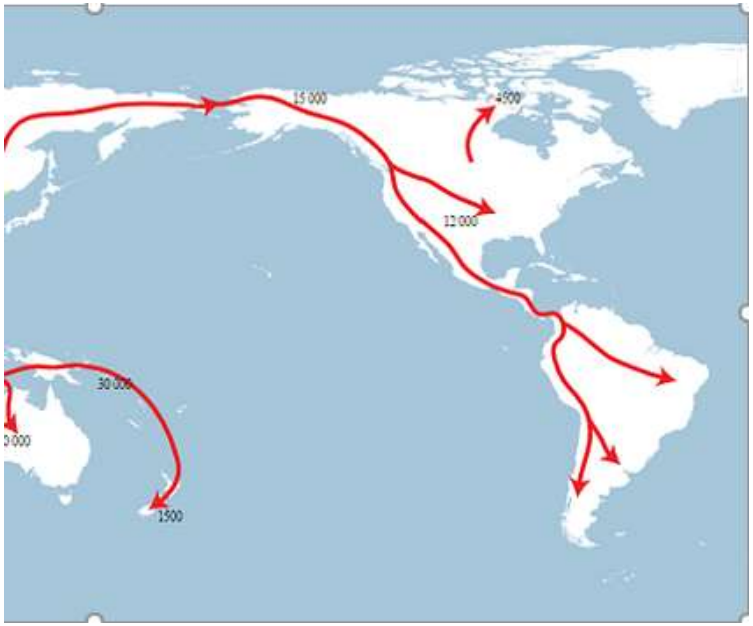
ZOOGEOGRAPHY

LESSON 20

1) When the first people migrated through the colder lands of northern Asia and across the Bering Straits into the New World, they left behind their domesticated animals and, with them, their associated diseases. Perhaps the only parasite that is found naturally in both the Old World and the New World is the hookworm Ancylostoma.

2) Another factor that reduced the prevalence of disease in the pre-Columbian peoples of North America was that they did not succeed in domesticating the large mammals of that continent.



SITUATION IN THE NEW WORLD

- Old World:

- Huge domestication activity with numerous mammal species → high amount of pathogens and thus diseases.

- New World:

- Humans left in Eurasia their animals, failde to domesticate local mammals → less amount of diseases

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they had no immunological defences when they were confronted by the spread of the peoples of the Old World.
So the diseases that Eurasians had caught from their domesticated animals (smallpox, measles, influenza and typhus) ravaged the pre-Columbian Native Americans of the New World, killing 95% of those of North America and 50% of the Aztecs of Mexico and of the Incas of Peru.

PATHOGENS EVOLUTION

- However, in South America a New World version of leishmaniasis evolved independently of that of the Old World.
- It is caused by a different species of the parasite and carried by a different sandfly.
- South America is also the home of Chagas disease, caused by a species of Trypanosoma related to that which causes sleeping sickness in Africa; it is present in South American mummies dating from 2000 BC.

- So geography, climate and mammalian evolution have all played important roles in controlling the variety and incidence of the diseases that plague our species.

  the incidence of some of these diseases has been affected by the increasing environmental impact of humanity and its activities.

For example, human operations such as mining, deforestation and road building have led to increases in the predominance of *P. falciparum* (the more virulent species of malaria, which causes cerebral malaria), at the expense of *Plasmodium vivax*, which causes a less serious variant of the disease.

This has also been aided by the evolution of drug-resistant strains of *P. falciparum* and by the construction of dams and large-scale irrigation projects.

→increase the area of water in which the mosquitoes can breed,
→Placing the water close to areas in which people live

DIFFERENT SCENARIOS

- Human activities, have also increased the size and widespread distribution of human populations available as hosts to *Leishmania* and *Trypanosoma* (pathogens).

- Increasing aridity in parts of southern Africa has caused the movement of tsetse flies and Simulium blackflies into new areas, leading to increases in sleeping sickness and river blindness.

- On the other hand, the loss of forest in some parts of Africa has led to the loss of these vectors and a consequent reduction in these illnesses.

Environmental degradation, as well as human population pressures, resource exhaustion and disease, can thus combine to cause the collapse of human societies

- When societies do collapse, the environment often recovers remarkably rapidly.

- Black Death pandemic in Europe (1347–1352).
- When this plague spread into Europe from Asia, it resulted in 30–60% mortality among the human population.

Analysis of contemporaneous pollen profiles from lakes has shown that:

-when arable farming was abandoned, and
-pastoral activity was greatly reduced → regrowth of many forest areas that had previously been cleared for agriculture

ENVIRONMENTAL IMPACT OF EARLY HUMAN CULTURES

- Environmental modification was an essential consequence of domestication and subsequent human spread.
- The incentive to modify the environment to make it more suitable for enhanced productivity of domestic animals and plants became a major driving force for the expanding human populations.

→ Temperate forests are unsuitable for the growth of domesticated plants, because most of them have a southern origin and need a high light intensity

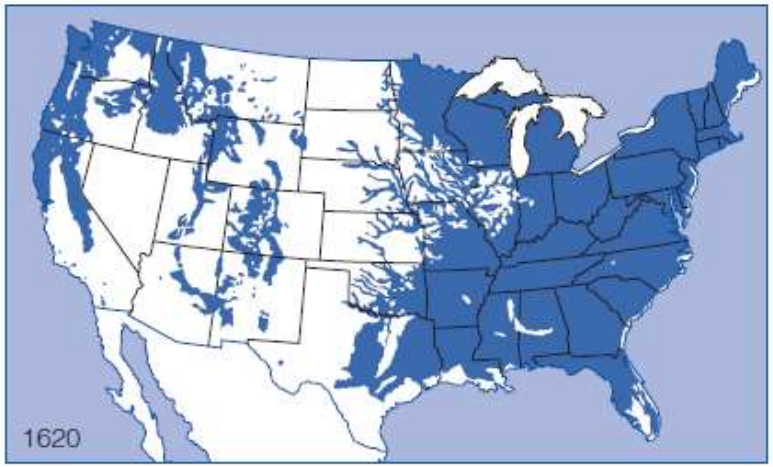
→ Domestic animals (sheep and goats) are not at their most efficient in a woodland habitat, preferring open grassland conditions

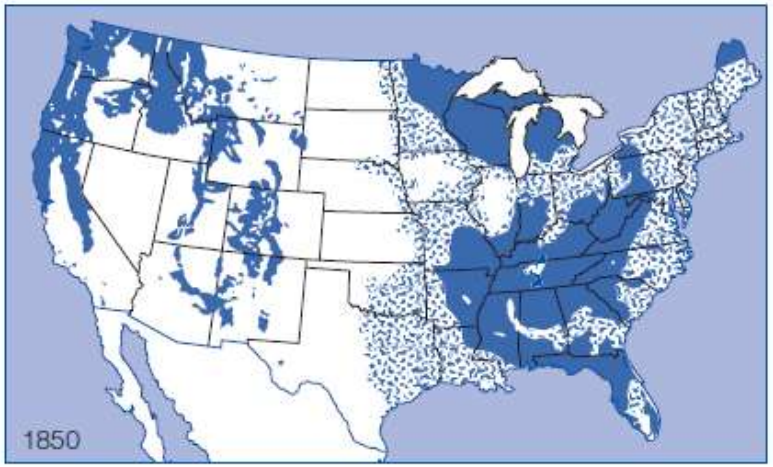
→ Cattle and pigs, on the other hand, can be herded within forests, but even they can be managed more efficiently in a habitat that is more open

In pre-agricultural times, the Mesolithic people of northern Europe discovered that the opening of forest and burning to retain open glades provided a higher productivity of red deer (*Cervus elaphus*).

The intensification of forest clearance with the coming of agriculture in northern Europe is very apparent from pollen diagrams, where the pollen of open habitat species (e.g. grasses, plantains and heathers) rises and the proportion of tree pollen falls.

Some of the most severe deforestation, judging from the pollen record, took place in the northwest of Europe, including the British Isles.
Perhaps it was in this region that the forest was least able to recover from human impact, and the maintenance of heavy grazing kept the area relatively open.





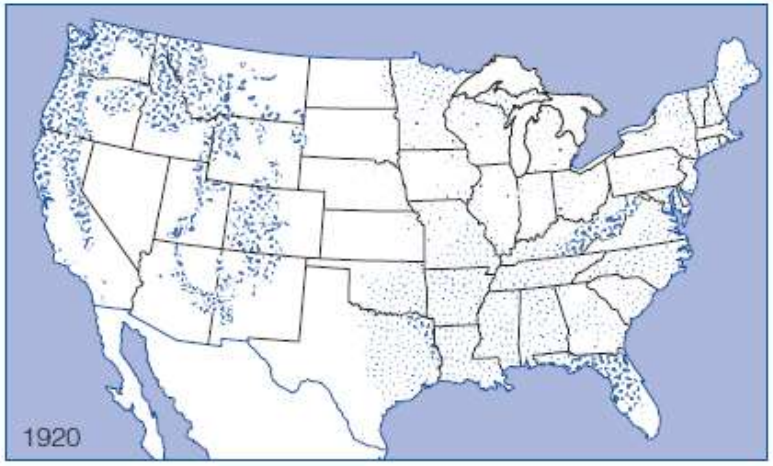
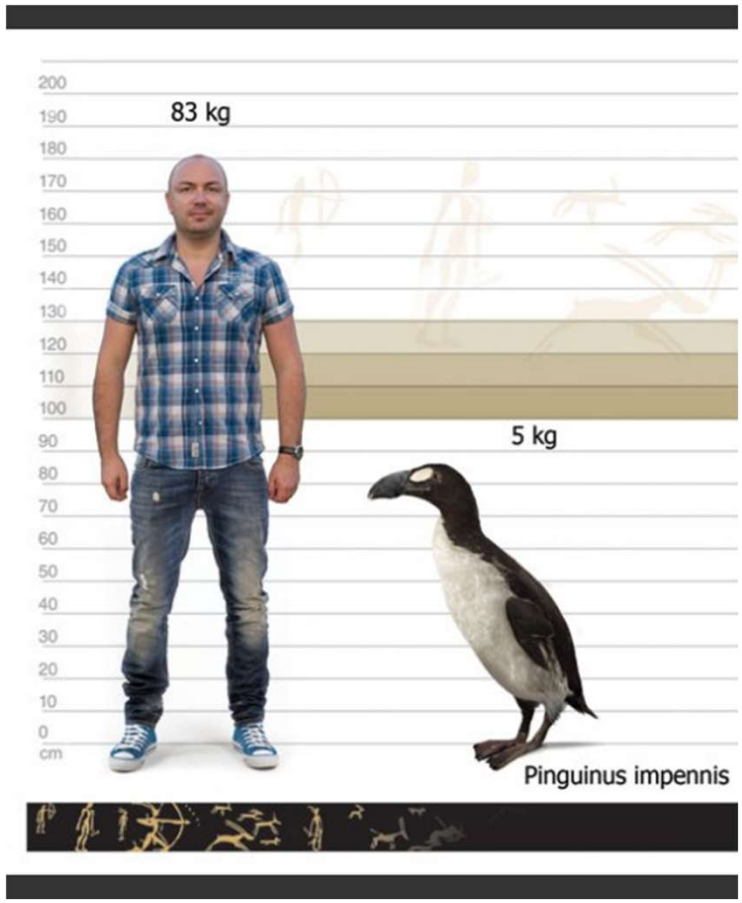


Figure 13.11 The extent of virgin forest in what is now the United States of America in 1620, 1850 and 1920, showing the progressive destruction of American old-growth forests. From Linz *et al.* [65].

the great auk (*Pinguinus impennis*), an impressive seabird that was hunted into extinction by European fishermen. Nineteenth-century accounts indicate that the last documented specimens were collected in 1844 and that the species was extinct by 1852.



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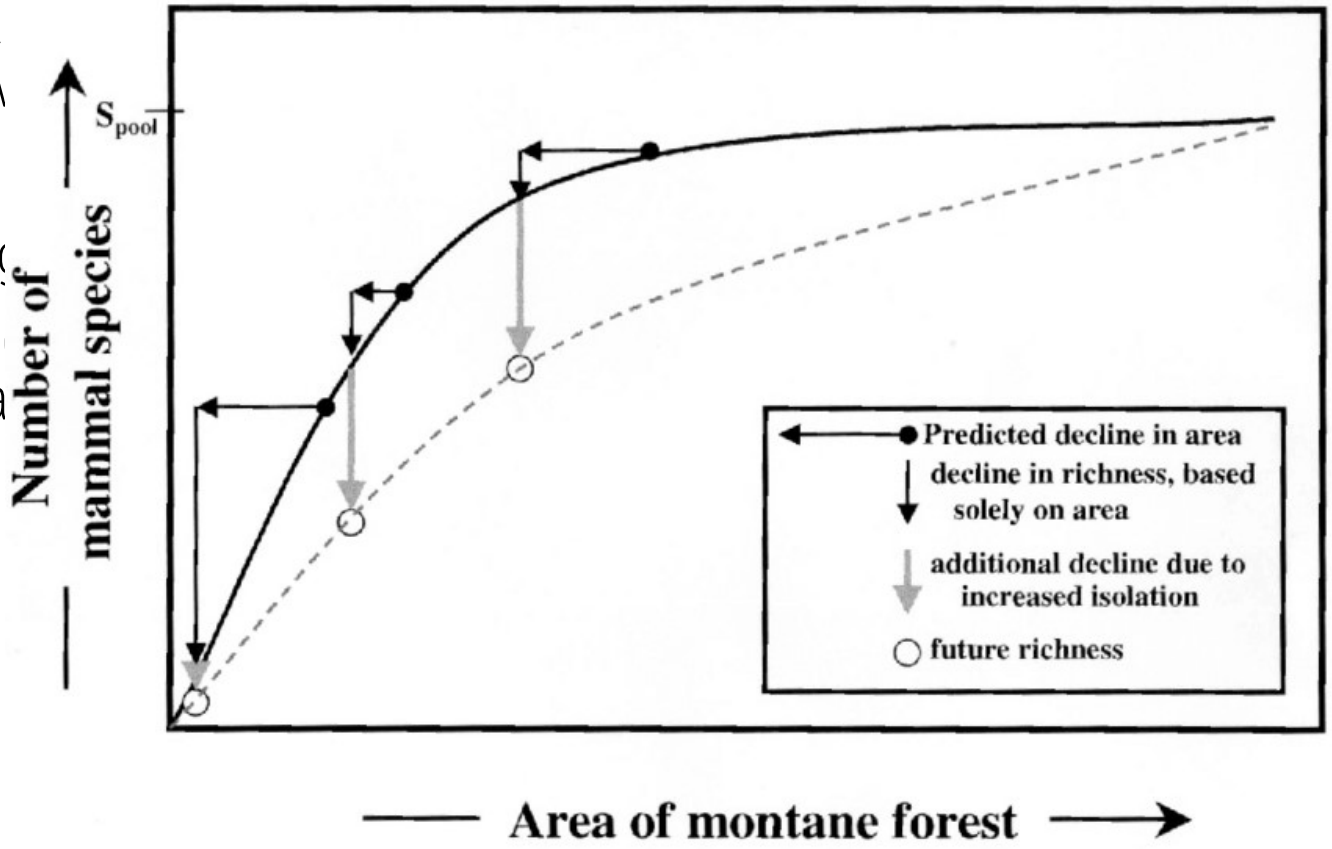
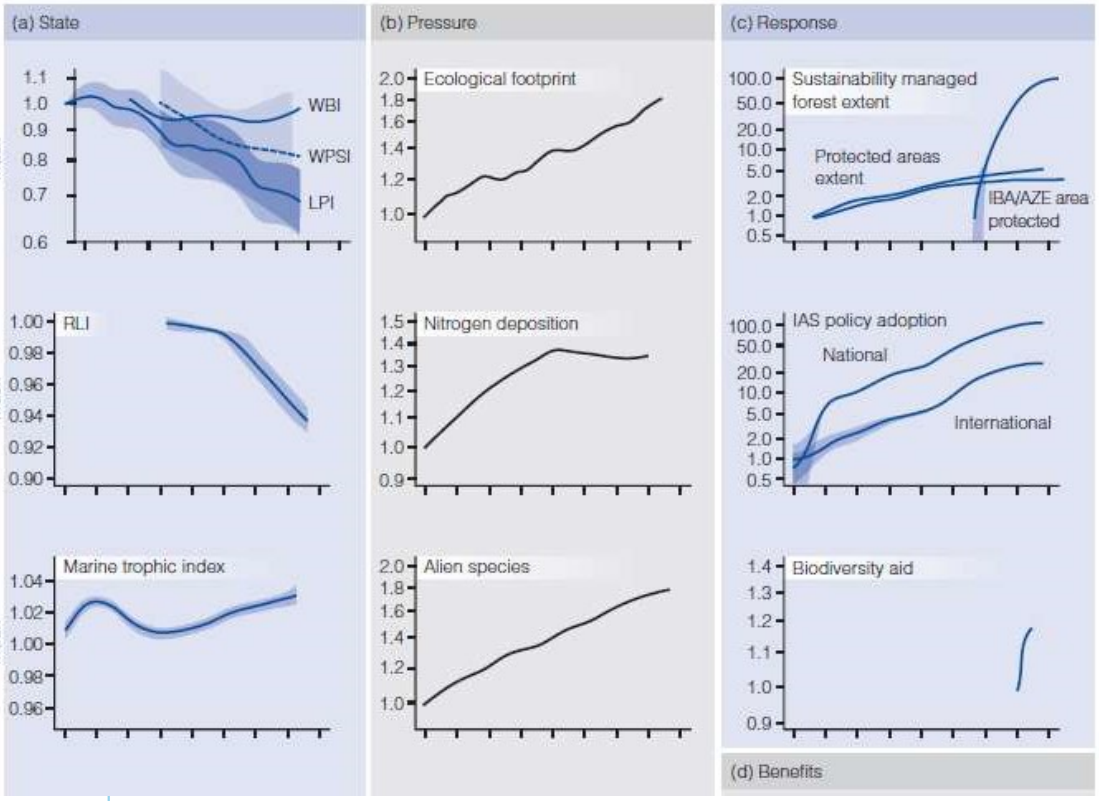


- Wilson's 'conservative' prediction from 1992 that approximately **27 000 species** are going extinct every year, based on the rate of tropical forest loss.

- Throughout the history of life on Earth, extinction is normally more or less balanced by speciation.

- But this is not the first time that extinctions have decimated life on Earth: there are at least five occasions in the last 600 million years where the world lost more than three-quarters of its species over a geologically short time period.

- Mass extinctions in the past were characterized by a conjunction of unusual conditions, such as abnormal climate dynamics, atmospheric composition and very high-intensity levels of ecological stress.



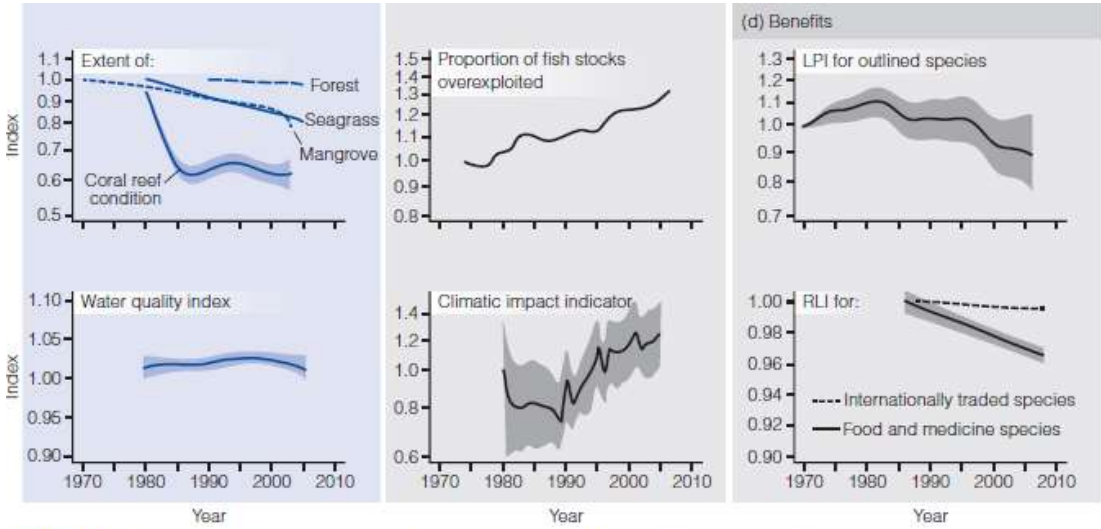


Figure 14.1 Indicator trends for (a) the state of biodiversity, (b) the pressures upon it, (c) the responses to address its loss, and (d) the benefits humans derive from it. Data are scaled to 1 in 1970 (or for the first year of data if before 1970), modelled (if >13 data points) and plotted on a logarithmic ordinate axis. Shading shows 95% confidence intervals except where unavailable (i.e. mangrove, seagrass and forest extent, nitrogen deposition, and biodiversity

Less, and less interesting

- in addition to extinctions, biological communities are also changing their composition as new species arrive.
- However, these species are only a narrow subset of the world's biota, leading to an increasing homogenization of life on the planet.

Table 14.1 A comparison of prehistoric versus human-assisted biological invasions. Adapted from Ricciardi [17].

Characteristics	Prehistoric invasions	Human-assisted invasions
Long-distance dispersal events	Very rare	Common
Species transported per event	Few	Few to many
Propagule size	Typically small	Small to large
Mechanisms of dispersal	Few	Many
Temporal and spatial dynamics	Few, episodic short-distance events	Many, continuous long-distance events
Biotic homogenization	Weak and local	Strong and global
Potential for interacting with other stressors	Low	Very high

Another example: the transportation of aquatic organisms in the ballast water of ocean-going ships. Vessel stability without a cargo is reached by pumping water into ballast tanks. The quantities are enormous: a typical commercial vessel might carry over 30 000 metric tonnes of water.

The problem for conservation is that the ballast water taken from the port of departure is discharged into the arrival port, along with any animals that unintentionally came along for the ride.

Current estimates suggest that the global fleet (about 35 000 commercial vessels) is transporting 7000–10 000 species at any given time.

BE IS

i.e. British forests began to appear with the advent of post-glacial climate conditions about 12 000 years ago and,

within 5000 years, mature forests covered most of the island.

At about the same time, Neolithic farmers began to chop down forest for small-scale agriculture and,

by time the Romans arrived about 2000 years ago, Britain's once vast forests had been largely reduced to small fragments.

The loss of Britain's forests must have been catastrophic for populations of woodland species such as bears, wolves and beavers, which all eventually succumbed to the pressures of small population size and overexploitation in the Middle Ages

HABITAT FRAGMENTATION

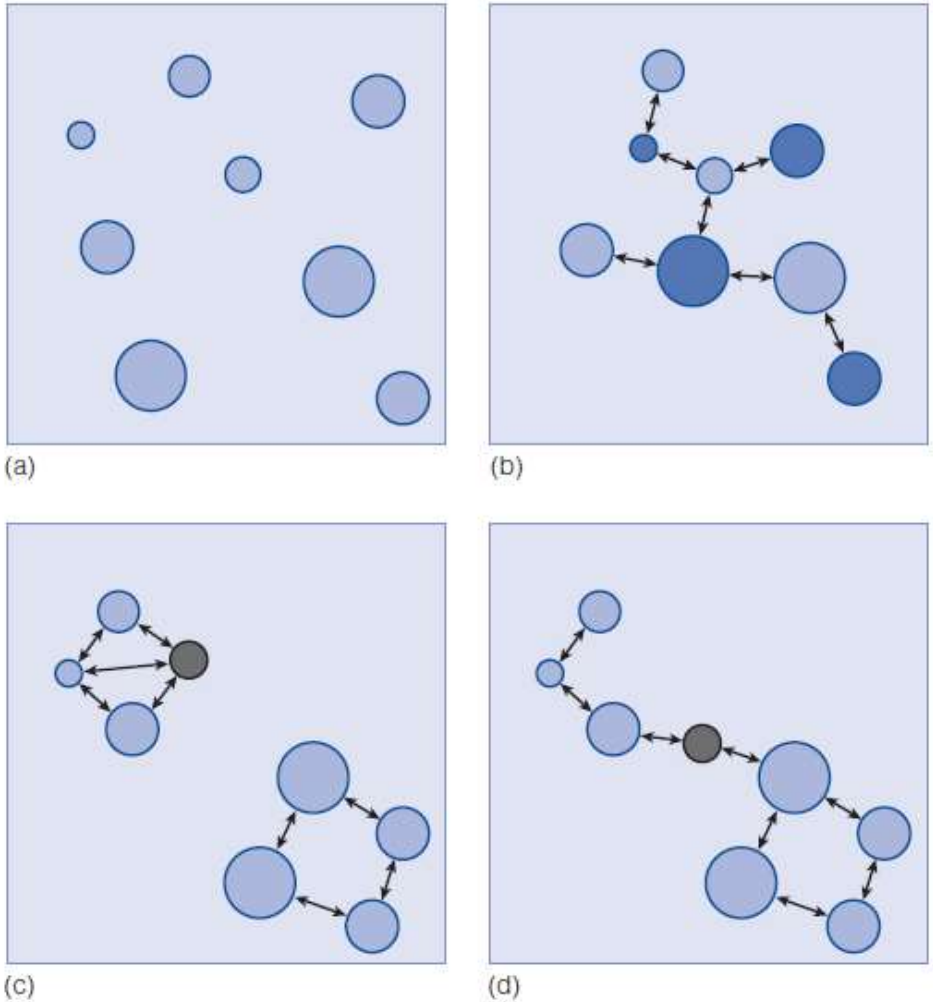


Figure 14.3 The spatial arrangement of habitat patches matters. Landscapes with the same amount of habitat and also with the same number of patches of the same size, but in different spatial locations, may result in situations where functional connectivity and habitat reachability are completely different for a hypothetical species. In scenario (a), the patches are too isolated and there are no biological fluxes among them (similar to a 'metapopulation in non-equilibrium'), while in scenario (b), the displacement of four patches allows free movement among all the patches (like in a 'patchy metapopulation'). In scenarios (c) and (d), the insertion (or restoration) of a small patch (in grey) in different locations may have very different effects on functional connectivity and the corresponding habitat network. From Villard and Metzger [27]. (Reproduced with permission of John Wiley & Sons.)

- A recent review of bushmeat studies in central and west Africa found that 177 wild species from 25 orders are hunted for meat, with 31 species classified as threatened by the International Union for Conservation of Nature (IUCN).

- but it is in the marine environment that the effects of overexploitation are most visible.

Archaeological literature shows that ancient human fishing frequently caused gradual shifts in the size of the fish caught and the serial depletion of species – unmistakable characteristics of overfishing. However, the depletion of the world's oceans really started to get going when the fishing process became industrialized in the early 19th century.

diesel engines in the 1920s, and, after World War II, fishing boats began to use the accoutrements of modern industrialized fishing, such as freezer trawlers, radar and acoustic fish finders

- Since the late 1980s, the main focus of conservation has been the protection of the world's biological diversity, typically shortened to the term **biodiversity**

- **Convention on Biological Diversity (CBD)**, formulated at the 1992 Earth Summit in Rio de Janeiro.

There are currently more than 100 000 protected areas that cover 14.6% of terrestrial land area and 2.8% of the marine environment

Table 14.2 Main technical responses to threats to biodiversity. Adapted from Ladle and Malhado [21].

Main threats	*Responses*
Habitat loss	Protected areas
	Ecological restoration projects
	Systems of quotas and fines
Habitat fragmentation	Protected areas
	Protected area networks
Habitat degradation	Protected areas
	Remediation and restoration measures
	Stricter emission controls on contaminants
	System of quotas and fines
Invasive species	Eradication
	Biocontrol
	Containment
	Invasion prevention measures
Over-exploitation	Anti-poaching measures
	Systems of quotas and fines
Climate change	Protected area networks
	Improved forecasting
	Translocations and reintroductions

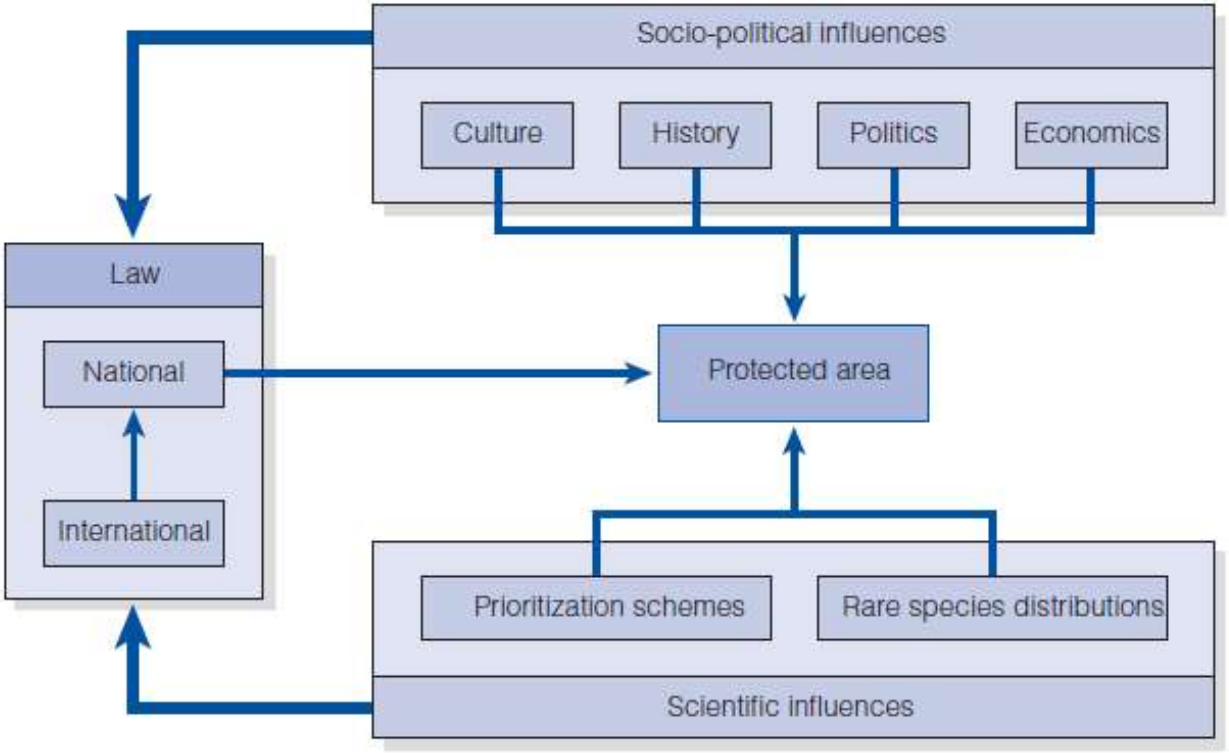


Figure 14.5 Main factors influencing the creation of new protected areas. The creation of a major new protected area is primarily achieved through national legislation but is heavily influenced by socio-political factors and is informed by science. From Ladle and Malhado [21].

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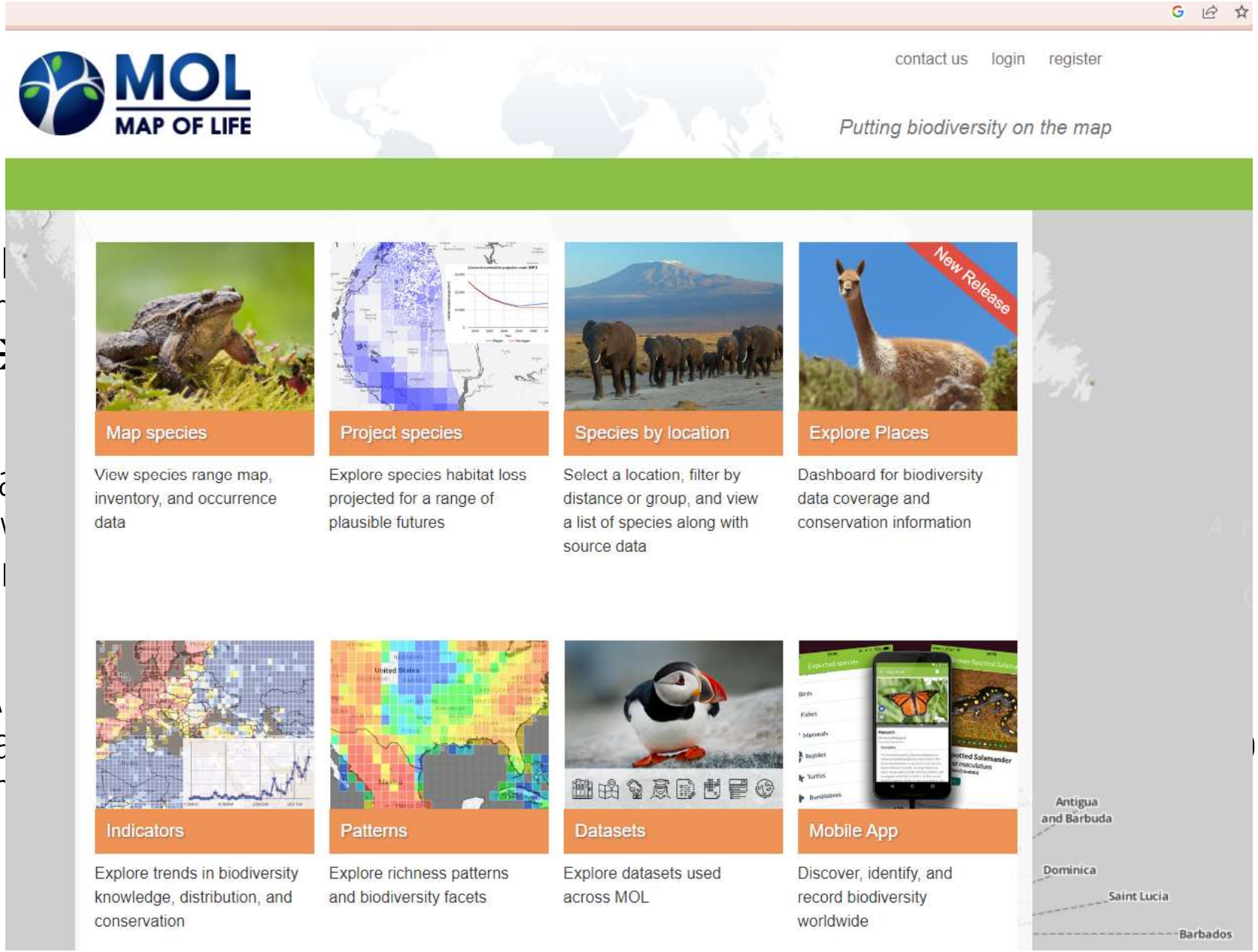

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