Environmentální rizika biodiverzity

Z5151

GEOGRAFICKÝ ÚSTAV
PŘÍRODOVĚDECKÁ FAKULTA MU

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https://www.tiverton.bham.sch.uk/rainforest-mania/

SYLABUS

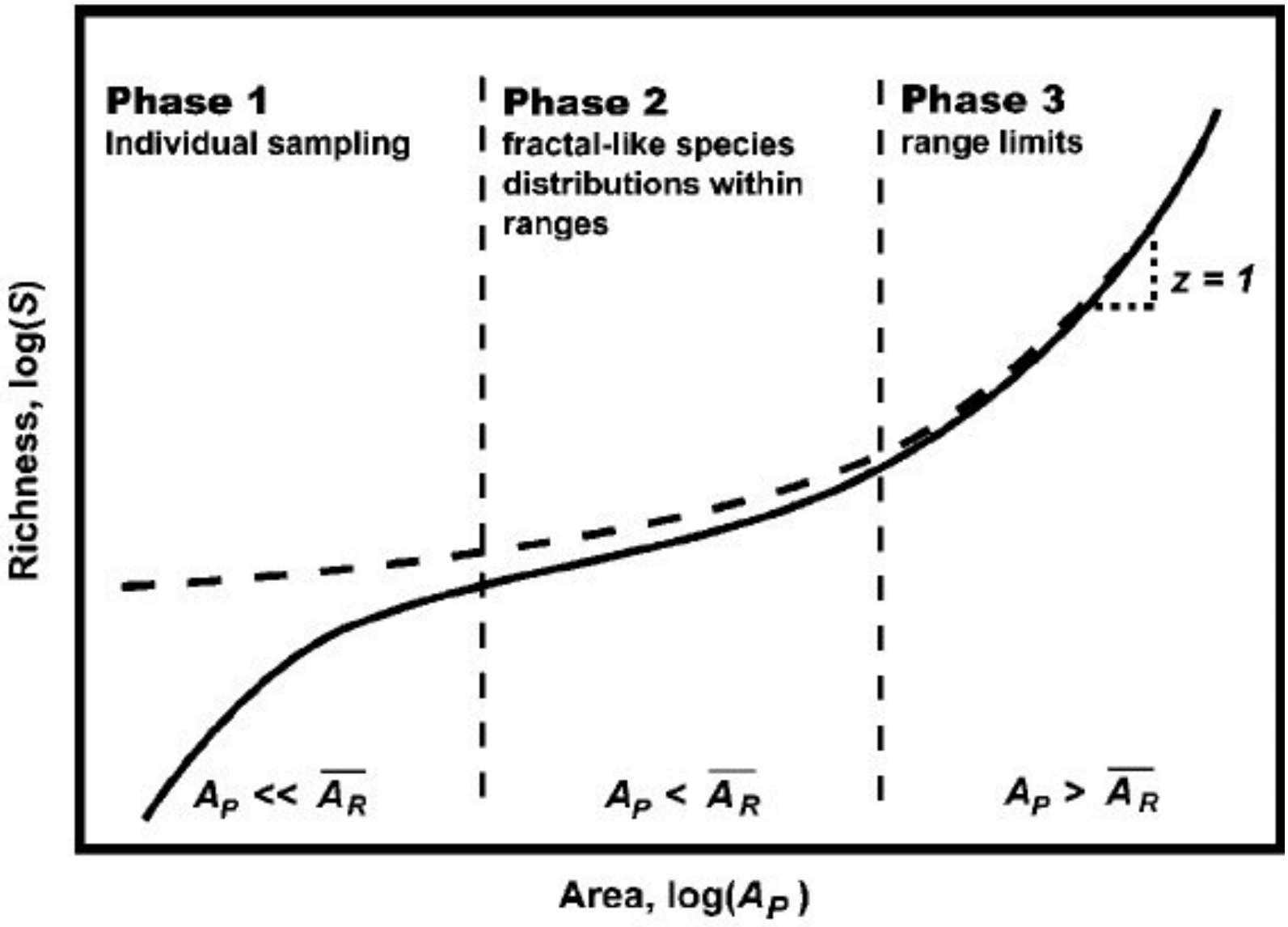
1) Úvod (struktura ekosystémů, biologická diverzita, ekologické procesy)
2) Biodiverzita – teorie, charakteristiky, řídící faktory
3) Environmentální rizika (typologie); schéma DPSIR (Řídící faktory, Tlaky, Stavy, Dopady, Odezvy)
4) **Biodiverzita – časo-prostorové aspekty**
5) Ekologie působení stresoru
6) Biodiverzita a ekosystémové procesy
7) Vztahy biodiverzity ke klimatu
8) Scénáře změn využití krajiny
9) Změny biotopů (Natura 2000, Ochrana stanovišť)
10) Vliv chemického znečištění na biodiverzitu
11) Biologické invaze
12) Ekosystémové služby
13) Analýza rizik pro biodiverzitu

OTÁZKY

- 6. masové vymírání (rychlost srovnatelná s dřívějšími vymíráními, bude záležet na délce trvání této dynamické změny – dříve perioda 60-100 mil. let – poslední před 65 mil. let
- ničení pralesa od prostředka a od krajů – rozdíly? vysvětlení?
- vymírání – vliv časové škály
- velikost zrna krajiny
- alfa, beta, gama diverzita vs. invaze
- 25-30 % produktivity spotřebovává lidská populace
- temperátní graslandy ☺
- funkční diverzita – zástupnost taxonů
- vody jsou ephemernější (vysychání/zazemění – méně ostrovního fenoménu
- původní bezlesé oblasti krajiny udržovány dříve požáry a býložravci (později extenzivní hospodaření) – to dnes ubývá

- přibývá bobrů, krkavců, vlků
- kaskádový efekt ubývání druhů
- snaha, aby změny nebyly tak rychlé

VZTAH POČTU DRUHŮ A PLOCHY



ALTERNATIVNÍ VYJÁDŘENÍ BIODIVERZITY

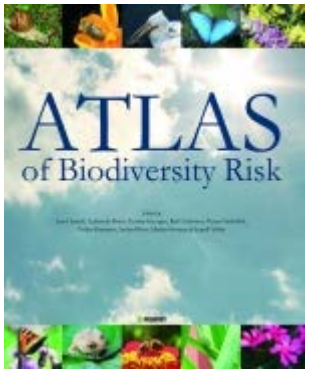
taxonomická
systematická/fylogenetická
obměna druhů (turnover)

PROCESY A SYNTÉZY

- distribuční vzorce (patterns) biodiverzity souvisejí se složitými dynamickými časo-prostorovými procesy
- například prediktabilita druhové bohatosti roste nejen se zvetšující se prostorovou škálou, ale také s délkou pozorování (temporal window of observation)
- negativní vztah mezi species-area a species-time (druhová bohatost roste s časem pomaleji v rámci vetších prostorových jednotek)

DIVERZITA V PROSTORU

Diverzita cévnatých rostlin



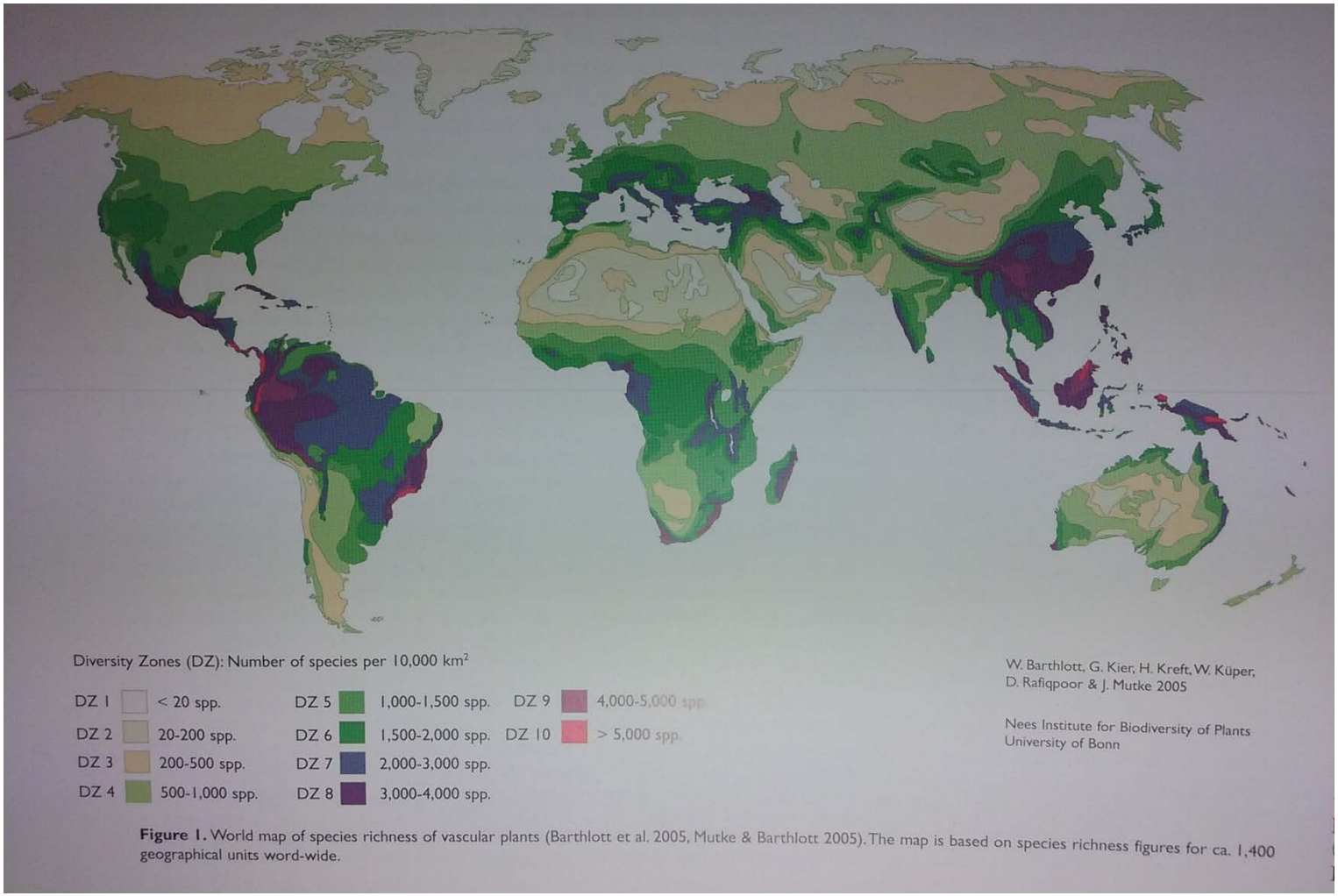
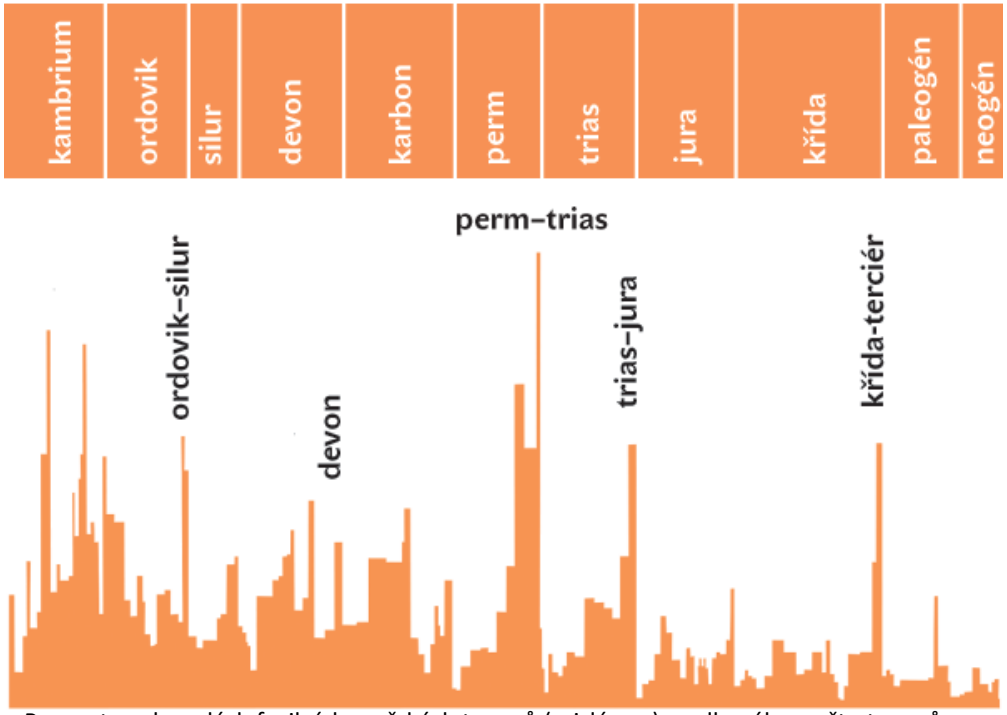


Figure 1. World map of species richness of vascular plants (Barthlott et al. 2005, Mutke & Barthlott 2005). The map is based on species richness figures for ca. 1,400 geographical units word-wide.

DIVERZITA V ČASE

- kambrická exploze
- vymírání na konci permu
- vymírání na konci křídy

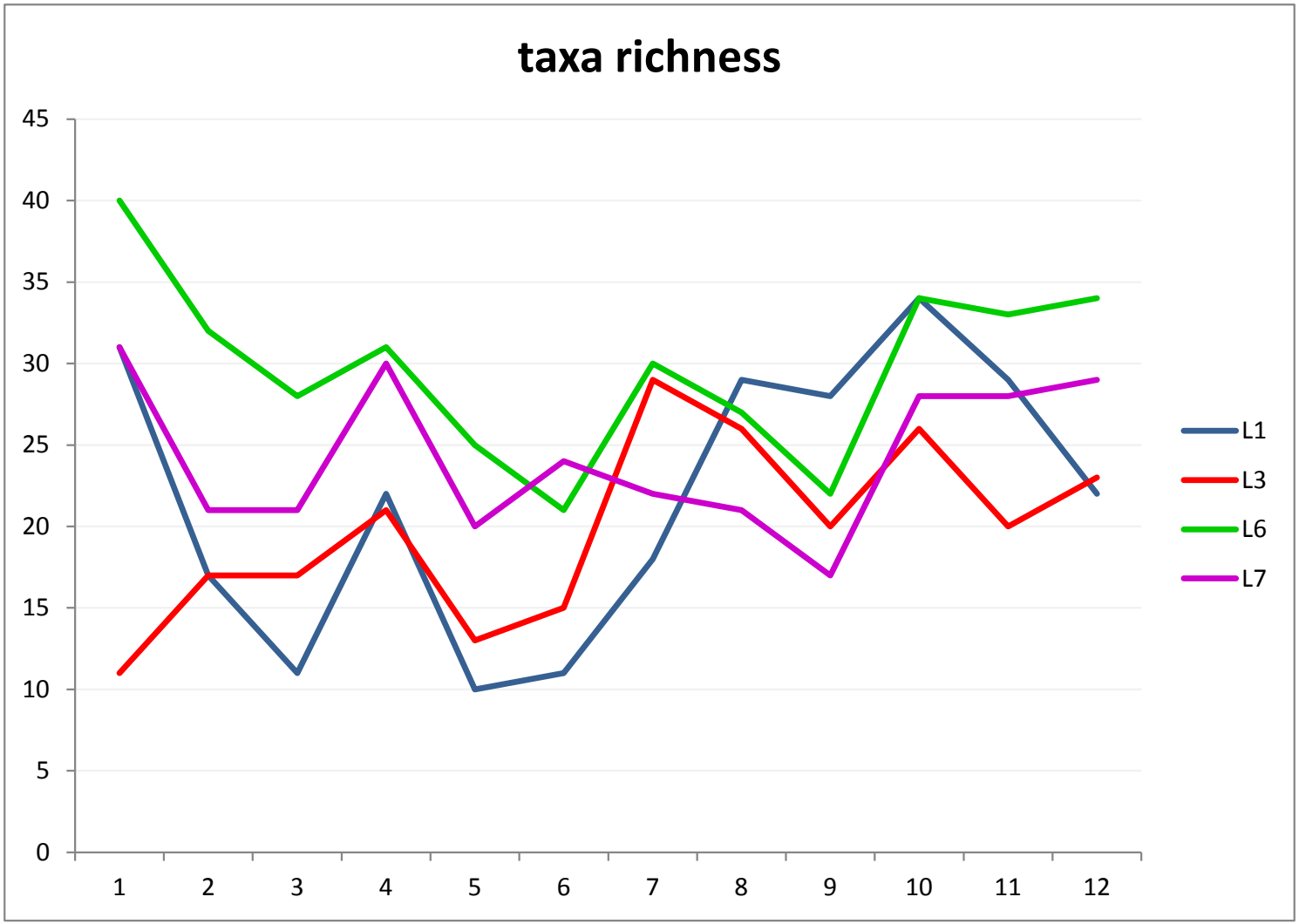


Procento vyhynulých fosilních mořských taxonů (svislá osa) z celkového počtu taxonů za libovolný časový úsek (podélná osa).

Geologický čas			
Eon	Éra	Perioda	Miliony let
fanerozoikum	kenozoikum	kvartér (čtvrtohory)	0 – 3
		neogén	3 – 23
		paleogén	23 – 66
	mezozoikum (druhohory)	křída	66 – 145
		jura	145 – 201
		trias	201 – 252
	paleozoikum (prvohory)	perm	252 – 299
		karbon	299 – 359
		devon	359 – 419
		silur	419 – 443
		ordovik	443 – 485
		kambrium	485 – 541
proterozoikum (starohory)			541 – 2500
archaikum (prahory)			2500 – 4000
hadaikum			4000 – 4600

Voldřichová M., Mi hulka S., 2011. Masová vymírání v historii Země. Vesmír 90: 564-568.

DIVERZITA V ČASE



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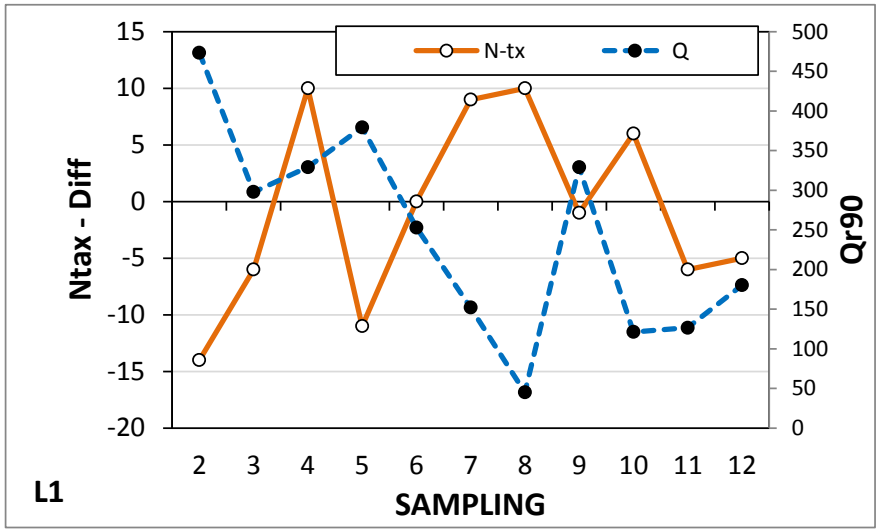
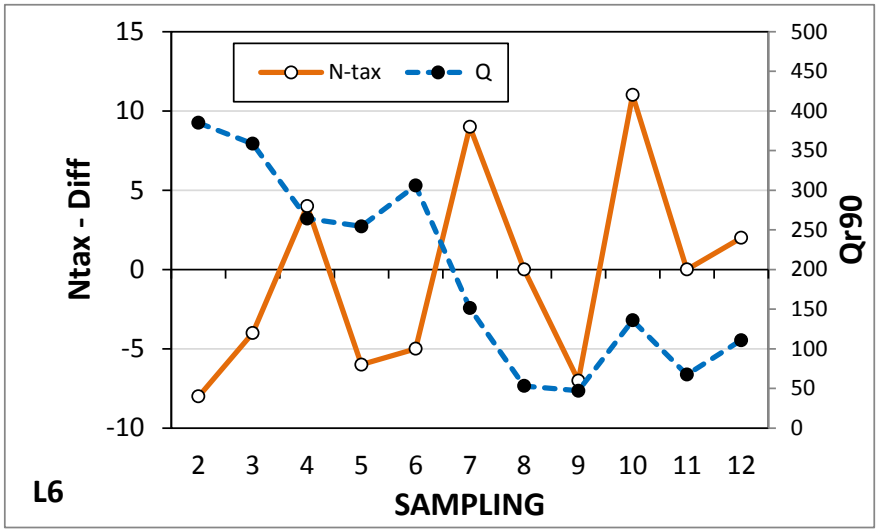
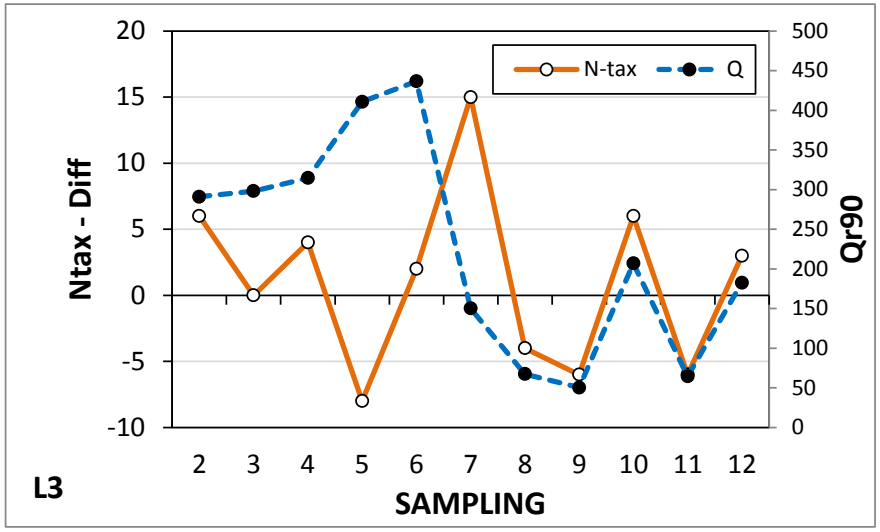
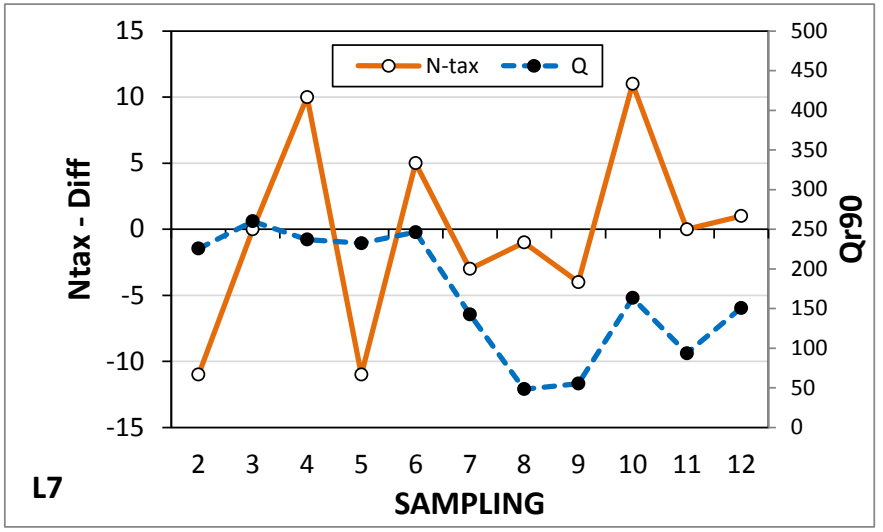
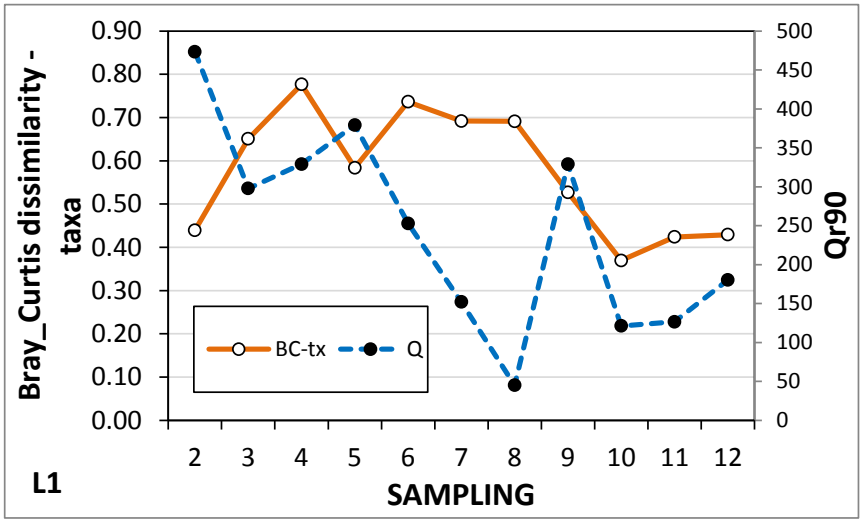


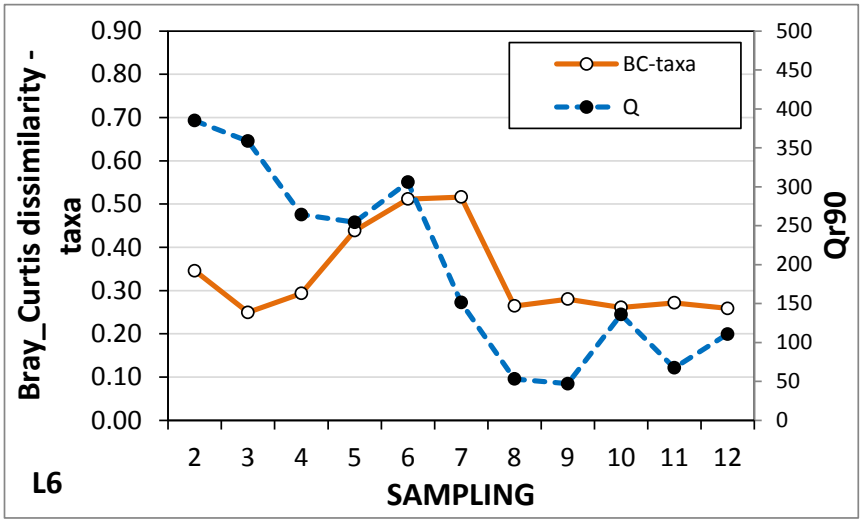


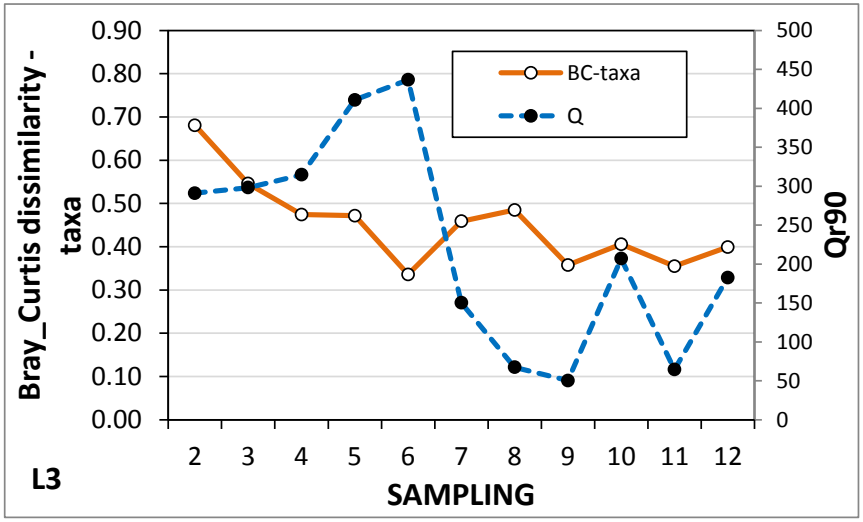


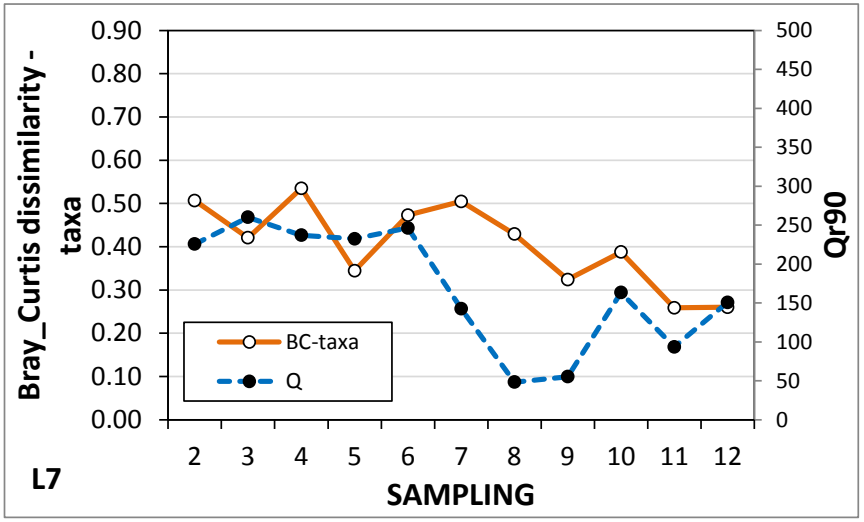


DIVERZITA V ČASE



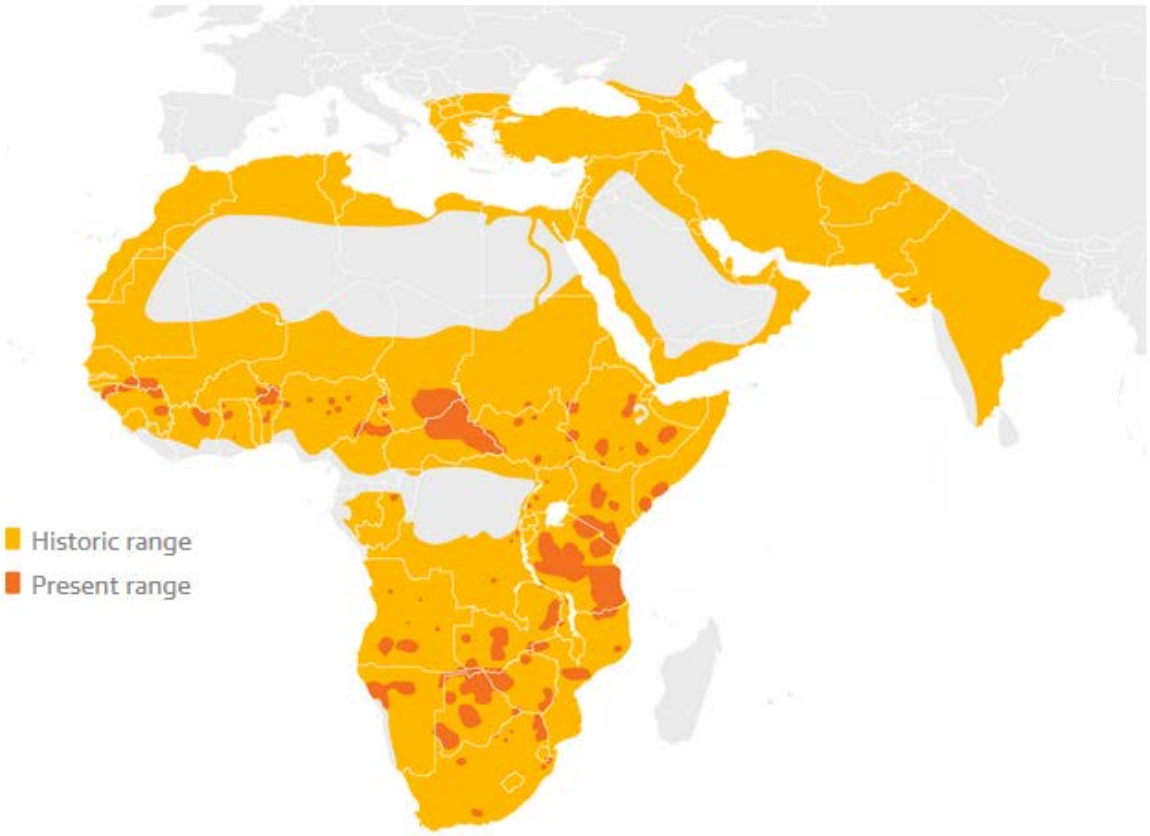






DIVERZITA V ČASE

Current and historic distribution of lions



Guardian graphic | Source: PNAS

Historically lions lived across Africa, southern Europe, the Middle East, all the way up to Northwestern India. Today their habitat has been reduced to a few tiny pockets of the original area.

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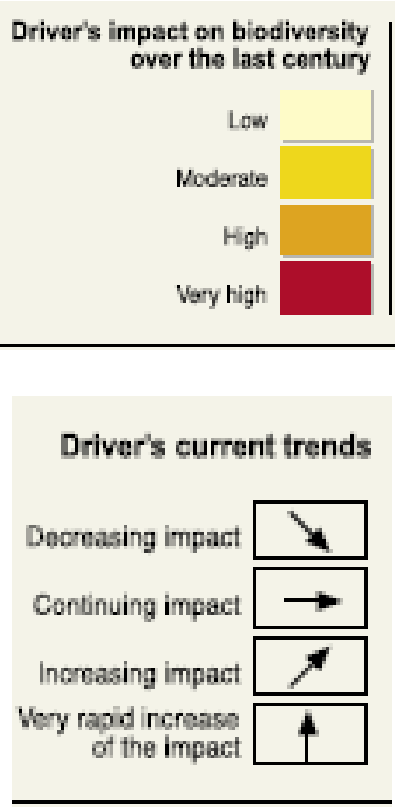
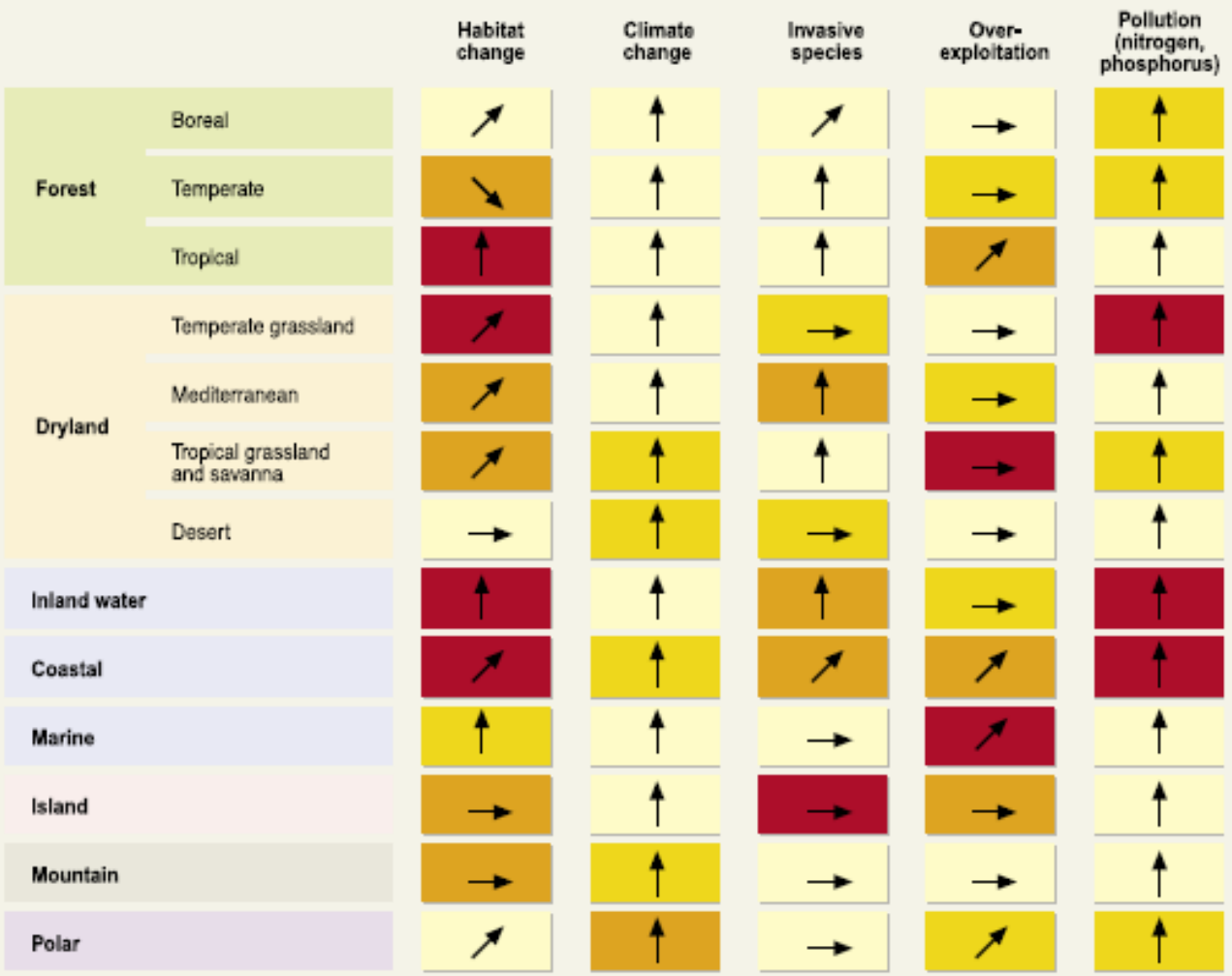
Ekosystémové hodnocení milénia

Figure 3. Main Direct Drivers

The cell color indicates the impact to date of each driver on biodiversity in each biome over the past 50–100 years. The arrows indicate the trend in the impact of the driver on biodiversity. Horizontal arrows indicate a continuation of the current level of impact; diagonal and vertical arrows indicate progressively increasing trends in impact. This Figure is based on expert opinion consistent with and based on the analysis of drivers of change in various chapters of the assessment report of the Condition and Trends Working Group. This Figure presents global impacts and trends that may be different from those in specific regions.





barva – historický vliv

šipka - současný trend

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Box 1.2. Measuring and Estimating Biodiversity: More than Species Richness

Measurements of biodiversity seldom capture all its dimensions, and the most common measure—species richness—is no exception. While this can serve as a valuable surrogate measure for other dimensions that are difficult to quantify, there are several limitations associated with an emphasis on species. First, what constitutes a species is not often well defined. Second, although native species richness and ecosystem functioning correlate well, there is considerable variability surrounding this relationship. Third, species may be taxonomically similar (in the same genus) but ecologically quite distinct. Fourth, species vary extraordinarily in abundance; for most biological communities, only a few are dominant, while many are rare.

Simply counting the number of species in an ecosystem does not take into consideration how variable each species might be or its contribution to ecosystem properties. For every species, several properties other than its taxonomy are more valuable for assessment and monitoring. These properties include measures of genetic and ecological variability, distribution and its role in ecosystem processes, dynamics, trophic position, and functional traits.

In practice, however, variability, dynamics, trophic position, and functional attributes of many species are poorly known. Thus it is both necessary and useful to use surrogate, proxy, or indicator measures based on the taxonomy or genetic information.

Important attributes missed by species or taxon-based measures of diversity include:

- abundance—how much there is of any one type. For many provisioning services (such as food, fresh water, fiber), abundance matters more than the presence of a range of genetic varieties, species, or ecosystem types.
- variation—the number of different types over space and time. For understanding population persistence, the number of different varieties or races in a species or variation in genetic composition among individuals in a population provide more insight than species richness.
- distribution—where quantity or variation in biodiversity occurs. For many purposes, distribution and quantity are closely related and are therefore generally treated together under the heading of quantity. However, quantity may not always be sufficient for services: the location, and in particular its availability to the people that need it, will frequently be more critical than the absolute volume or biomass of a component of biodiversity.

Finally, the importance of variability and quantity varies, depending on the level of biodiversity measured. (See Table.)

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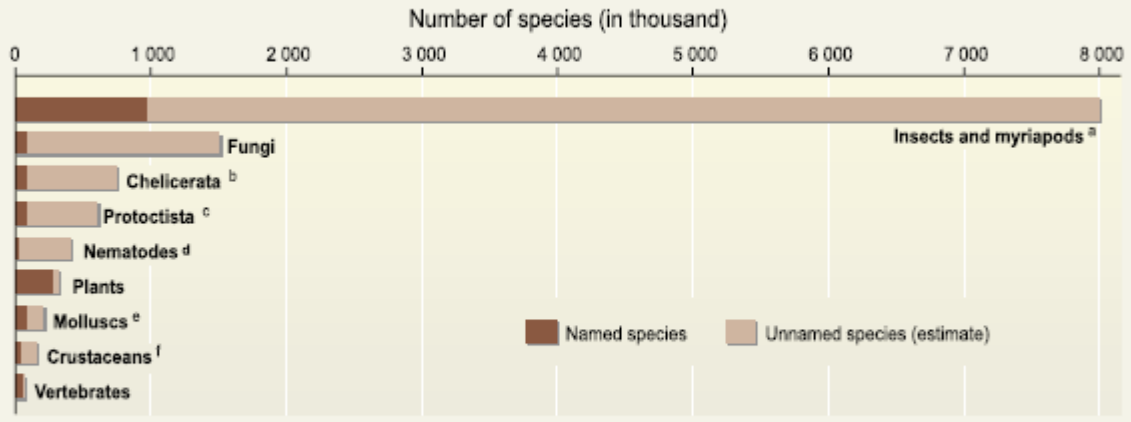
Level	Importance of Variability	Importance of Quantity and Distribution
Genes	adaptive variability for production and resilience to environmental change, pathogens, and so on	local resistance and resilience
Populations	different populations retain local adaptation	local provisioning and regulating services, food, fresh water
Species	the ultimate reservoir of adaptive variability, representing option values	community and ecosystem interactions are enabled through the co-occurrence of species
Ecosystems	different ecosystems deliver a diversity of roles	the quantity and quality of service delivery depend on distribution and location

[1] Biomes represent broad habitat and vegetation types, span across biogeographic realms, and are useful units for assessing global biodiversity and ecosystem services because they stratify the globe into ecologically meaningful and contrasting classes. Throughout this report, and elsewhere in the MA, the 14 biomes of the WWF terrestrial biome classification are used, based on WWF terrestrial ecoregions (C4.2.2).

Figure 1.1. Estimates of Proportions and Numbers of Named Species in Groups of Eukaryote Species and Estimates of Proportions of the Total Number of Species in Groups of Eukaryotes (C4.2.3)



[a] Myriapods: centipedes and millipedes
[b] Arachnids
[c] Algae, slime mold, amoeboids, and other single-celled organisms (excluding bacteria)
[d] Roundworms
[e] Snails, clams, squids, octopuses, and kin
[f] Barnacles, copepods, crabs, lobsters, shrimps, krill, and kin

Source: Millennium Ecosystem Assessment

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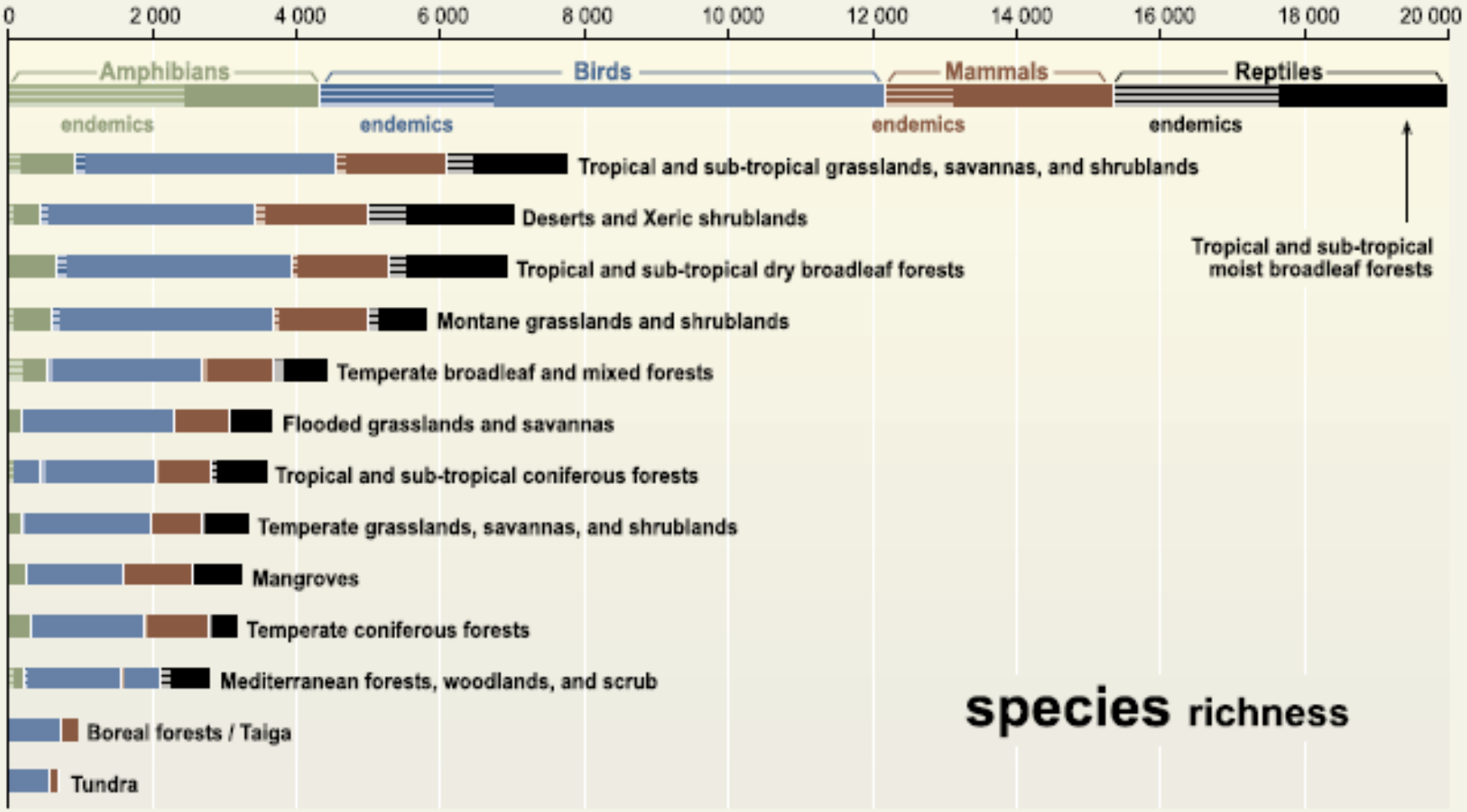
Figure 1.2. Comparisons for the 14 Terrestrial Biomes of the World in Terms of Species Richness, Family Richness, and Endemic Species (C4 Fig 4.7)



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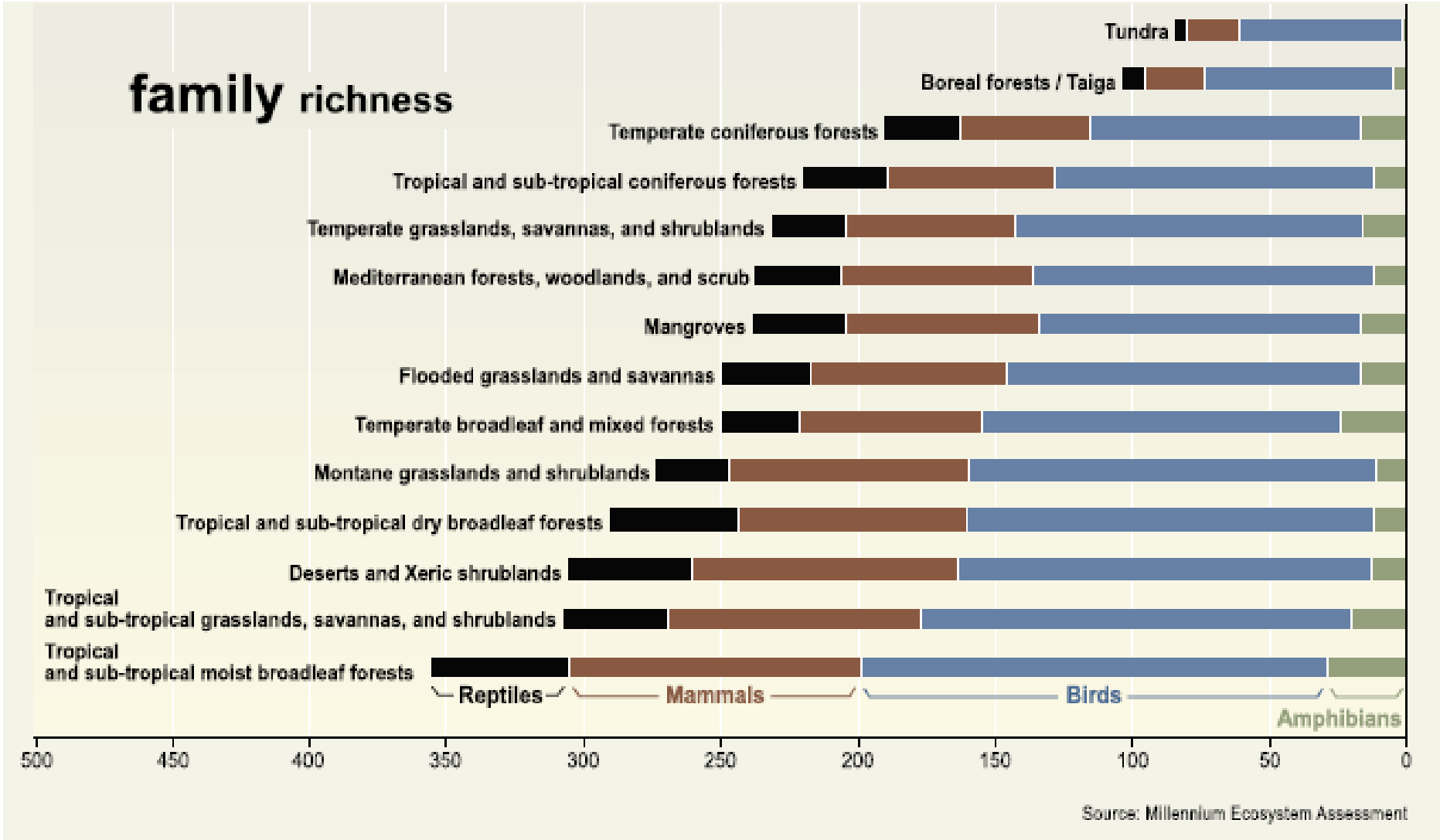

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Figure 1.3. The 8 Biogeographical Realms and 14 Biomes Used in the MA (C4 Figure C4.3)

Biogeographic realms are large spatial regions within which ecosystems share a broadly similar biological evolutionary history. Eight terrestrial biogeographic realms are typically recognized, corresponding roughly to continents. Although similar ecosystems (such as tropical moist forests) share similar processes and major vegetation types wherever they are found, their species composition varies markedly depending on the biogeographic realm in which they are found. Assessing biodiversity at the level of biogeographic realms is important because the realms display substantial variation in the extent of change, they face different drivers of change, and there may be differences in the options for mitigating or managing the drivers. Terrestrial biogeographic realms reflect freshwater biodiversity patterns reasonably well, but marine biogeographic realms are poorly known and largely undefined (C4.2.1).

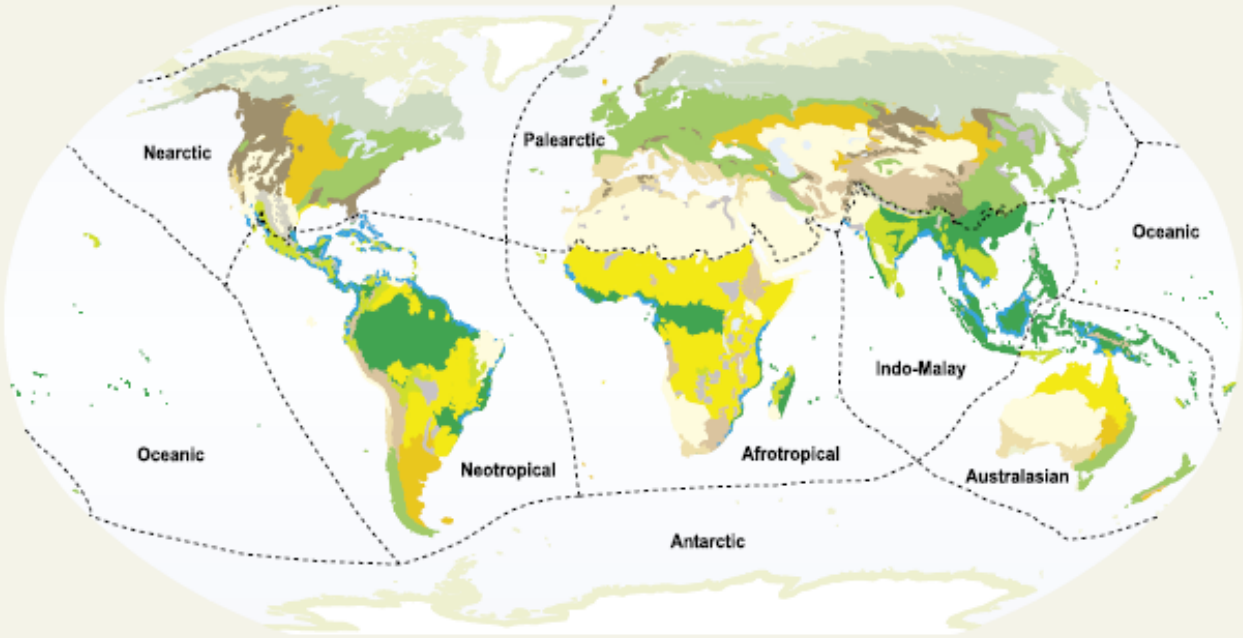

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Table 1.1. Ecological Surprises Caused by Complex Interactions

Voluntary or involuntary introductions or deletions of species often trigger unexpected alterations in the normal provision of ecosystem services by terrestrial, freshwater, and marine ecosystems. In all cases, the community and ecosystem alterations have been the consequence of indirect interactions among three or more species (C11, Table 11.2).

Study Case	Nature of the Interaction Involved	Ecosystem Service Consequences
Introductions		
Top predators		
Introduction of brown trout (*Salmo trutta*) in New Zealand for angling	trophic cascade, predator increased primary producers by decreasing herbivores	**negative**—increased eutrophication
Introduction of bass (*Cichla ocellaris*) in Gatun Lake, Panama	trophic cascade, top predator decreased control by predators of mosquito larvae	**negative**—decreased control of malaria vector
Introduction of pine marten (*Martes martes*) in the Balearic Islands, Spain	predator of frugivorous lizards (main seed dipersers)	**negative**—decreased diversity of frugivorous lizards due to extinction of native lizards on some islands; changes in dominant shrub (*Cneorum tricoccon*) distribution because marten replaced the frugivorous-dispersing role
Intraguild predators		
Egg parasitoid (*Anastatus kashmirensis*) to control gypsy moth (*Lymantria dispar*)	hyperparasitism (parasitoids that use parasitoids as hosts)	**negative**—disruption of biological control of pests; introduced parasitoid poses risk of hyperparasitism to other pest-regulating native parasitoids
Gambusia and *Lepomis* fish in rice fields to combat mosquitoes	intraguild predator (adult fish feed on juveniles as well as on mosquito larvae)	**opposed to goal**—decreased control of disease vector (mosquito)
Intraguild preys		
Opossum shrimp (*Mysis relicta*) in Canadian lakes to increase fish production	intraguild prey depletes shared zooplankton prey	**opposed to goal**—decreased salmonid fish production
Apparent competitors		
Rats (*Rattus* spp) and cats (*Felis catus*) in Steward Island, New Zealand	rats induced high cat densities and increased predation on endangered flightless parrot (*Strigops habroptilus*)	**negative**—reduced diversity
Herbivores		
Zebra mussel (*Dreissena polymorpha*) in Great Lakes, United States	zebra mussel reduced phytoplankton and outcompeted native bivalves	**negative**—reduced diversity **positive**—increased water quality
Mutualists		
Myna bird (*Acridotheres tristis*) for worm pest control in Hawaiian sugarcane plantations	myna engaged in the dispersal of the exotic woody weed *Lantana camara*	**negative**—increased invasion by *Lantana* produced impenetrable thorny thickets; reduced agricultural crops and pasture carrying capacity and sometimes increased fire risk; displaced habitat of native birds

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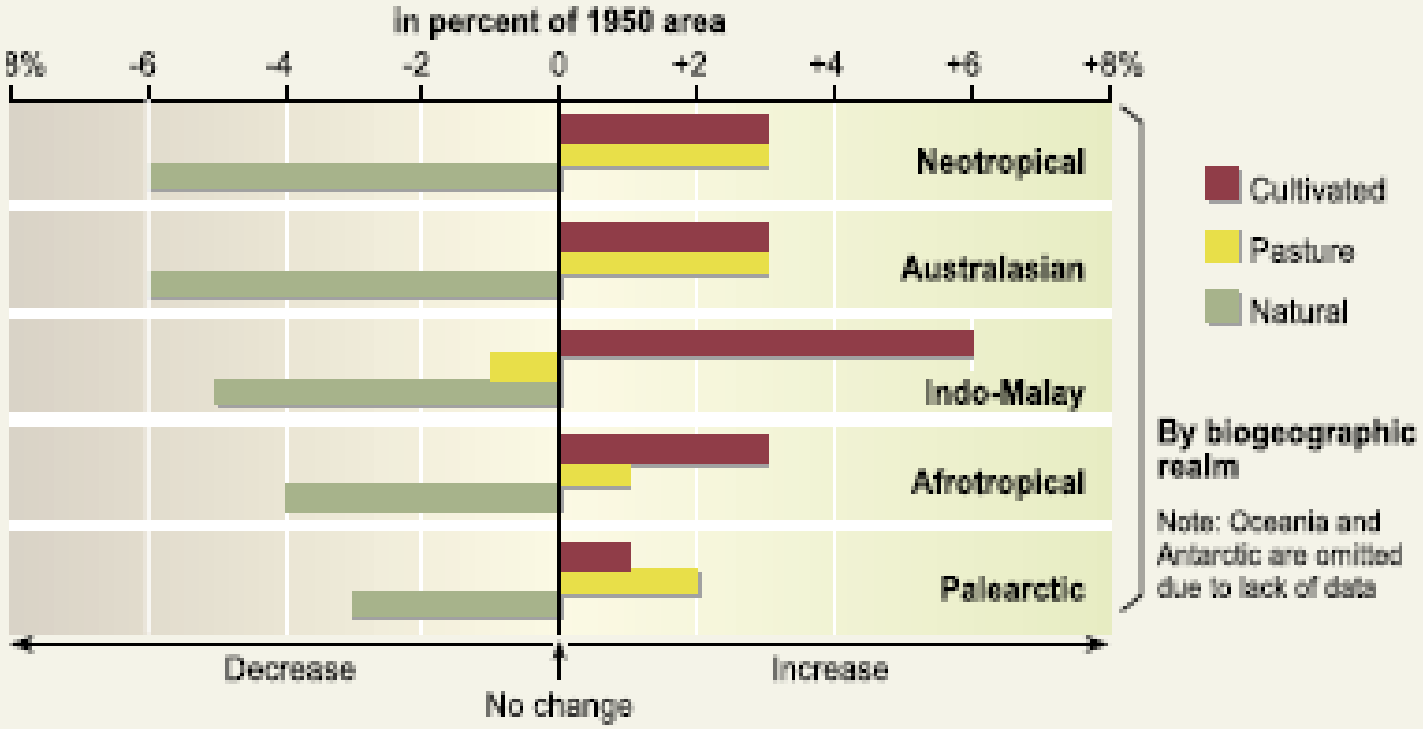
Figure 3.1. Percentage Change 1950–90 in Land Area of Biogeographic Realms Remaining in Natural Condition or under Cultivation and Pasture

Two biogeographic realms are omitted due to lack of data: Oceania and Antarctic. In the Nearctic, the amount of land under cultivation and pasture has stabilized, with no net change in cover since 1950.



Source: Millennium Ecosystem Assessment

MILLENNIUM ASSESSMENT REPORTS

Key Messages

- The most important direct drivers of biodiversity loss and ecosystem service changes are **habitat change** (such as land use changes, physical modification of rivers or water withdrawal from rivers, loss of coral reefs, and damage to sea floors due to trawling), **climate change, invasive alien species, overexploitation, and pollution**.

MILLENNIUM ASSESSMENT REPORTS

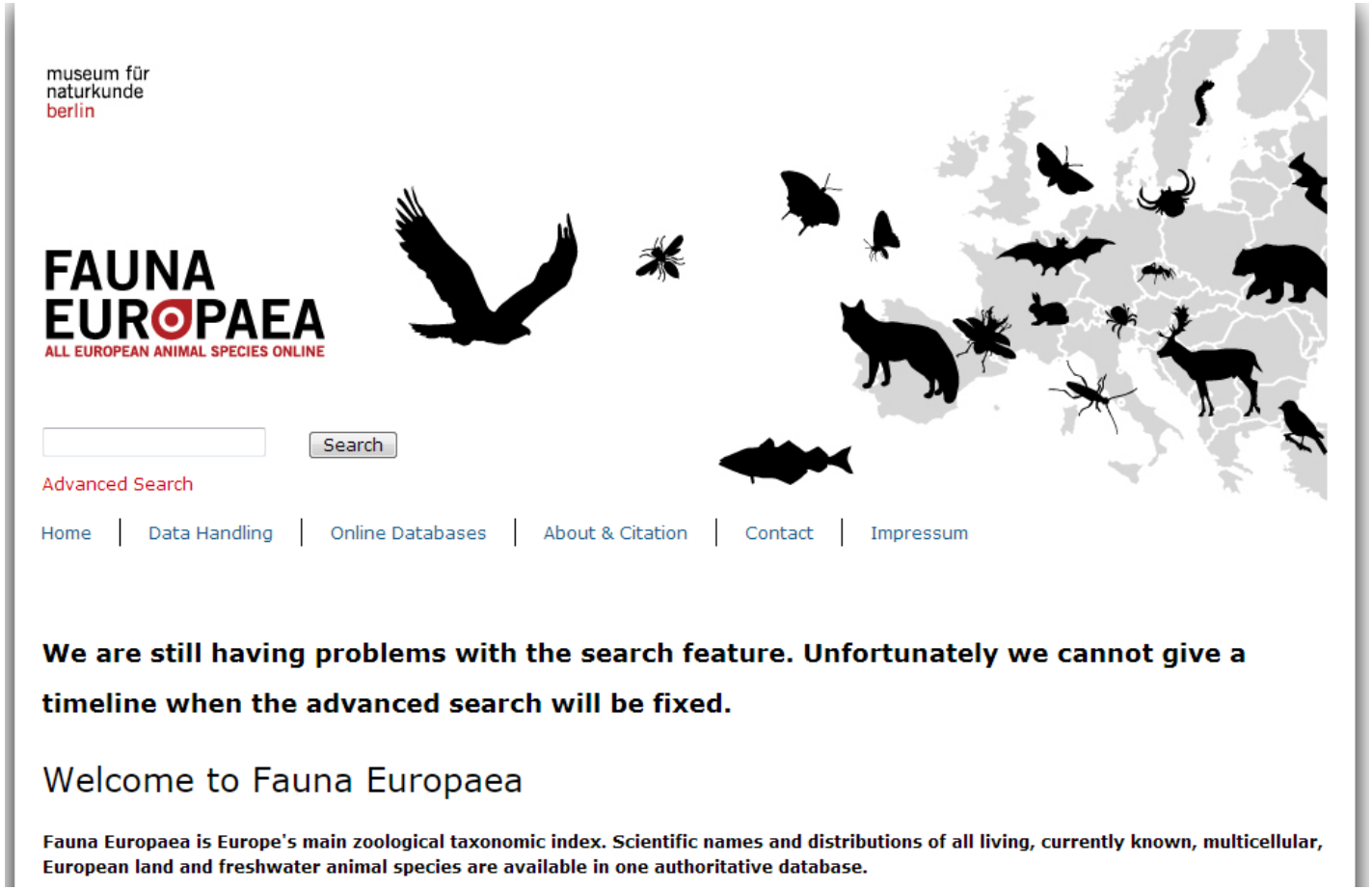
Key Messages

■ Short-term goals and targets are not sufficient for the conservation and sustainable use of biodiversity and ecosystems. Given the characteristic response times for political, socioeconomic, and ecological systems, longer-term goals and targets (such as for 2050) are needed to guide policy and actions.
■ Science can help ensure that decisions are made with the best available information, but ultimately the future of biodiversity will be determined by society.

INFORMAČNÍ ZDROJE

Fauna Europea

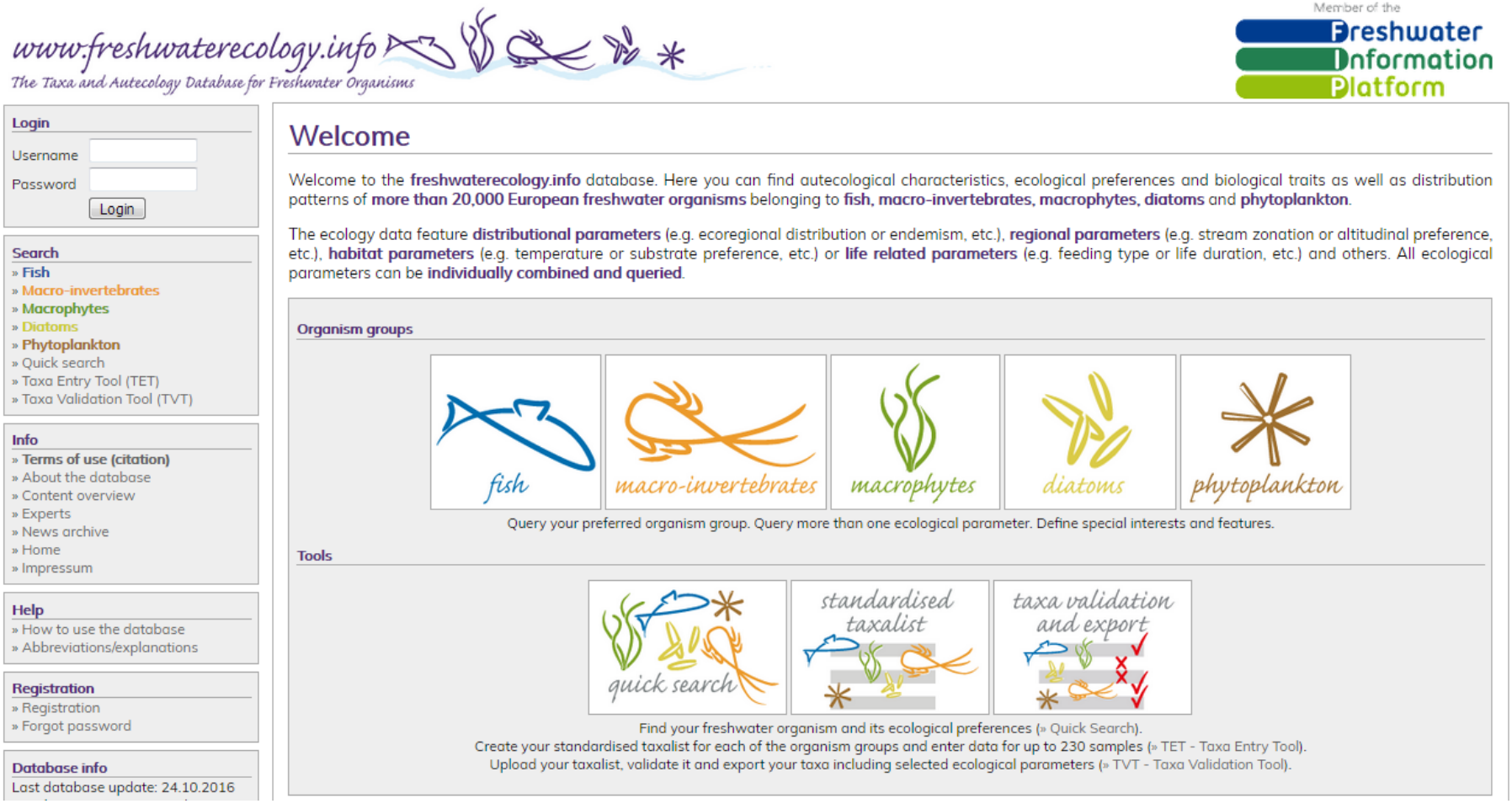
https://fauna-eu.org/



INFORMAČNÍ ZDROJE

Freshwater Ecology

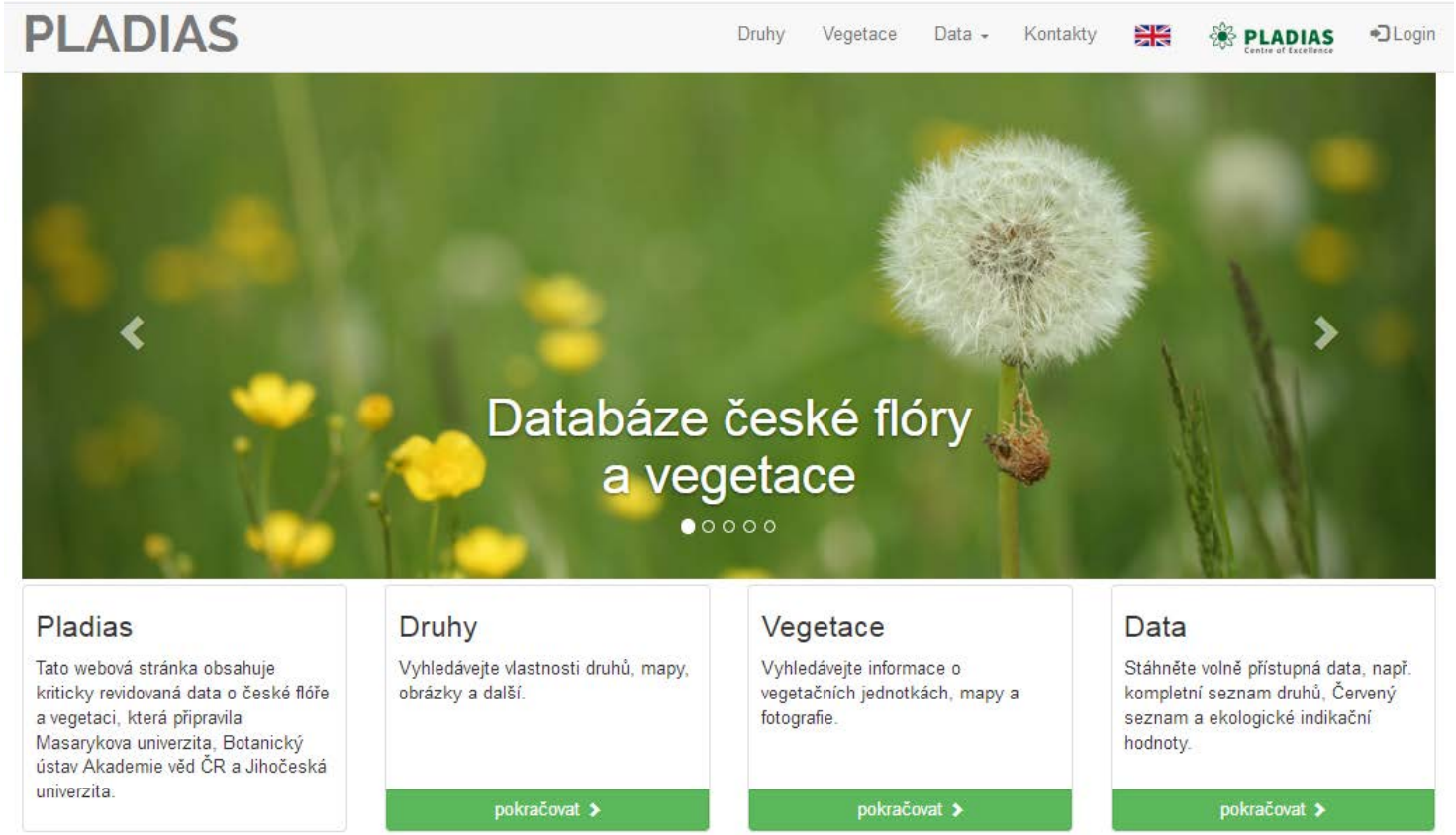
www.freshwaterecology.info



INFORMAČNÍ ZDROJE

Pladias (Plant Diversity Analysis and Synthesis Centre)

www.pladias.cz



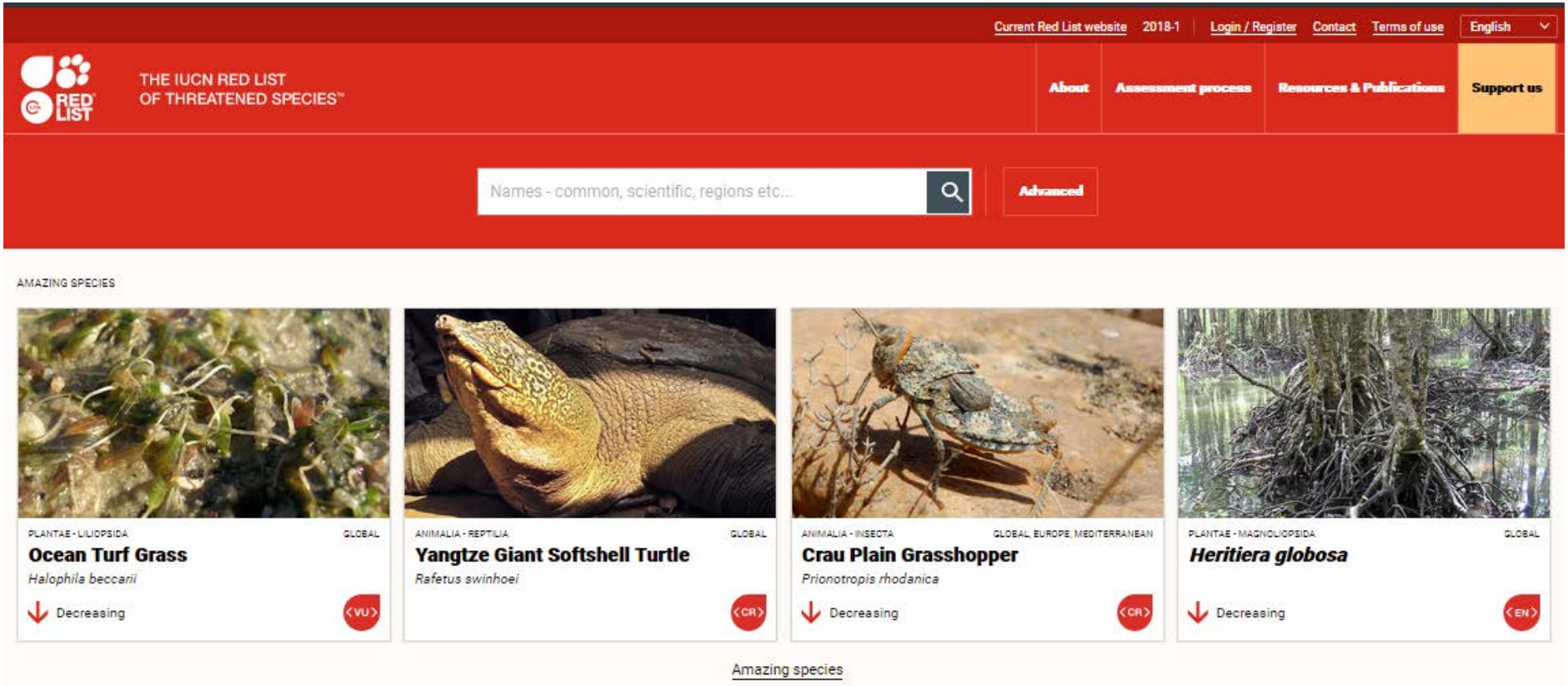
OCHRANA DIVERZITY

Informační systém Úmluvy o biologické rozmanitosti
http://chm.nature.cz/

OCHRANA DIVERZITY

Červený seznam IUCN (Mezinárodní svaz ochrany přírody)

https://newredlist.iucnredlist.org/



OCHRANA BIOTOPŮ

Natura 2000

https://newredlist.iucnredlist.org/

OCHRANA BIOTOPŮ

Natura 2000 je soustava chráněných území, které vytvářejí na svém území podle jednotných principů všechny státy Evropské unie. Cílem této soustavy je zabezpečit ochranu těch druhů živočichů, rostlin a typů přírodních stanovišť, které jsou z evropského pohledu nejcennější, nejvíce ohrožené, vzácné či omezené svým výskytem jen na určitou oblast (endemické).

1) směrnice 2009/147/ES (nahradila směrnici 79/409/EHS), o ochraně volně žijících ptáků („směrnice o ptácích“)

2) směrnice 92/43/EHS, o ochraně přírodních stanovišť, volně žijících živočichů a planě rostoucích rostlin („směrnice o stanovištích“)

OCHRANA DIVERZITY

Červený seznam IUCN

Červený seznam IUCN eviduje celosvětově téměř 17 tisíc druhů ohrožených vyhynutím. V rámci živočichů je to 21% savců, 12 % ptáků, 31 % plazů, 30 % obojživelníků a 37 % ryb.

Jen v Evropě je to dle evropského červeného seznamu ohroženo 23 % obojživelníků, 19 % plazů, 15 % savců a 13 % ptáků.

www.veronica.cz

VYMÍRÁNÍ DRUHŮ

https://video.aktualne.cz/dvtv/storch-planeta-je-v-krizi-je-ohrozena-podstata-civilizace-vy/r~8a08272a78fb11e7bc2d0025900fea04/

https://www.youtube.com/watch?v=ELNMF-kPhoo

http://forumochranyprirody.cz/zijeme-v-dobe-sesteho-masoveho-vymirani-aneb-krize-biodiverzity-ve-svete-u-nas

https://www.youtube.com/watch?time_continue=18&v=ELNMF-kPhoo

Hallmann CA, Sorg M, Jongejans E, Siepel H, Hofland N, Schwan H, et al. (2017) More than 75 percent decline over 27 years in total flying insect biomass in protected areas. PLoS ONE 12(10): e0185809. https://doi.org/10.1371/journal.pone.0185809