



Biodiversity Change in Europe

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Scope of talk

- Biodiversity change: huge topic
- Short presentation: outline
- Everything I'll say already familiar
 - but not terribly cheerful

late Pleistocene

- 45 000 to 20 000 years ago
 - before humans were present
 - climate-caused extinction
 - warm-adapted megafauna withdraw or die out
 - giant Irish deer, elephants, rhinos, giant deer, hyena
 - cold-stage faunas survive
 - woolly rhinoceros, woolly mammoth, lions, reindeer, red deer, horses, bison all sorts of smaller creatures (lemmings, arctic fox)

Holocene

- 12 000 years ago climate warming
 - reorganization of vegetation, smaller fauna
 - forest replaces steppe tundra by 9 000 years ago
 - rise of *Homo sapiens sapiens*
 - tools, weapons
 - diverse diet
- cold-adapted megafauna died out
 - should have expanded northward
 - instead, suffer extinction
 - 30% of animal species > 40kg in Europe
 - 100% > 1000 kg (6 species)

Humans and climate

- no immediate coincidence between extinctions and either
 - the arrival of humans or
 - climatic change
- combination of climatic change and advanced Paleolithic humans drove extinction between 50 000 and 10 000 years ago

Climate and humans

- Climate change killed small animals
- Humans removed big animals
 - Blitzkrieg
 - rapid
 - unsustainable hunting
 - Sitzkrieg
 - slower
 - habitat change

Europe in late stone age

- almost completely forest, woodland, marsh, scrub land, mountains
- humans start to clear forest on hilltops

Iron age

- 2000 years ago
 - Europe forests largely gone
 - Radical shift in relative species population sizes
 - Large carnivores on way out
 - Anthropogenic redirection of evolution
 - wheat, barley, oats, beans, vetch, peas, rye, flax, sheep, goats, cattle, pigs, poultry

Middle Ages

- 536AD comet impacts Earth
 - *Astronomy + Geophysics* 45 (Feb 2004) 23-26
 - Nuclear winter
 - famine, migration, war, massive political change
- 900s – 1300s: Medieval Warm Period
 - temperatures higher than today
 - summer 1 - 1.4°C
 - winter 1 - 2°C
 - good harvests ⇒ population increase
 - fields expand into hills and woodland
- 1340s-1350s
 - decline in global temperature, Black Death
 - 25-40% drop of European population
 - Reduced production of methane and carbonates
 - forest re-established, absorbing CO₂

medieval attitudes

- God gives Man dominion over nature
- nature
 - the enemy
 - to be controlled
 - to be subjugated to humans
 - appreciated
 - not for beauty
 - only for what it could provide humans – “ecosystem services”
- civilization = conquest of nature
- God Will Provide

Species data

- Existence
 - Great majority of known species based on 1 museum specimen
- Distribution
 - Data frequently old
 - Few systematic studies
- Conservation status
 - Requires knowledge of autecology, demography, meta-populations
- Conservation trend
 - ?
 - !

Europe: from forest to cities

- Europe's ecosystems
 - more human-induced fragmentation than those of any other continent
 - >95% of Western Europe's forests disturbed
 - >50% wetlands lost since the 1950
 - >50% of high-nature-value farmland lost since 1950
 - >50% marine ecosystems degraded
 - most major marine fish stocks are below safe biological limits
 - Extinction threatens
 - >50% freshwater fish
 - >40% mammal species
 - >40% birds
 - >40% reptiles
 - >40% butterflies
 - >30% amphibians
 - 800 plant species
- Most species of large vertebrates now geologically extinct

Difficult to be optimistic

- collapsing fish stocks
- acidification of seas
- soil fertility maintained only by huge inputs of chemicals
- crashes in pollinator populations
- emergent disease

Capacity of living world
to provide for human needs
is remarkable

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- Status of knowledge today
 - Remarkably poor inventories even in Europe
 - Very little long-term data
 - Some groups well known; many (e.g. fungi) very largely unknown
 - Most biodiversity is not in protected areas

Choices, choices

- Future is a construct of society
 - not just scientific decision
 - implementation is vital
- Failing to choose is also a decision
 - time is not on our side
 - denial and ignorance are not solutions
 - no miraculous intervention
- Need knowledge to inform decision
 - Need Catalogue of Life, GBIF, EoL...
 - LifeWatch