



Biodiversity

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EU legislation and biodiversity

- Political commitment to halt biodiversity loss in the EU by 2010
 - Birds and Habitats Directives – Natura 2000 network
 - Common Agricultural Policy – agri-environment schemes
 - Water Framework Directive
 - Environmental Liability Directive
 - Marine Strategy Framework Directive
 - Framework for achieving sustainable use of pesticides (13 Jan 2009)
 - Regulation on the placing of plant protection products on the market (repealing of Directive 91/414/EEC)

Outline

- What is biodiversity?
- Why is biodiversity important to agriculture?
- Is there cause for concern?
- What are the drivers of biodiversity change?
- What does the revision of 91/414 say about biodiversity?
- What will change?

What is biodiversity ?

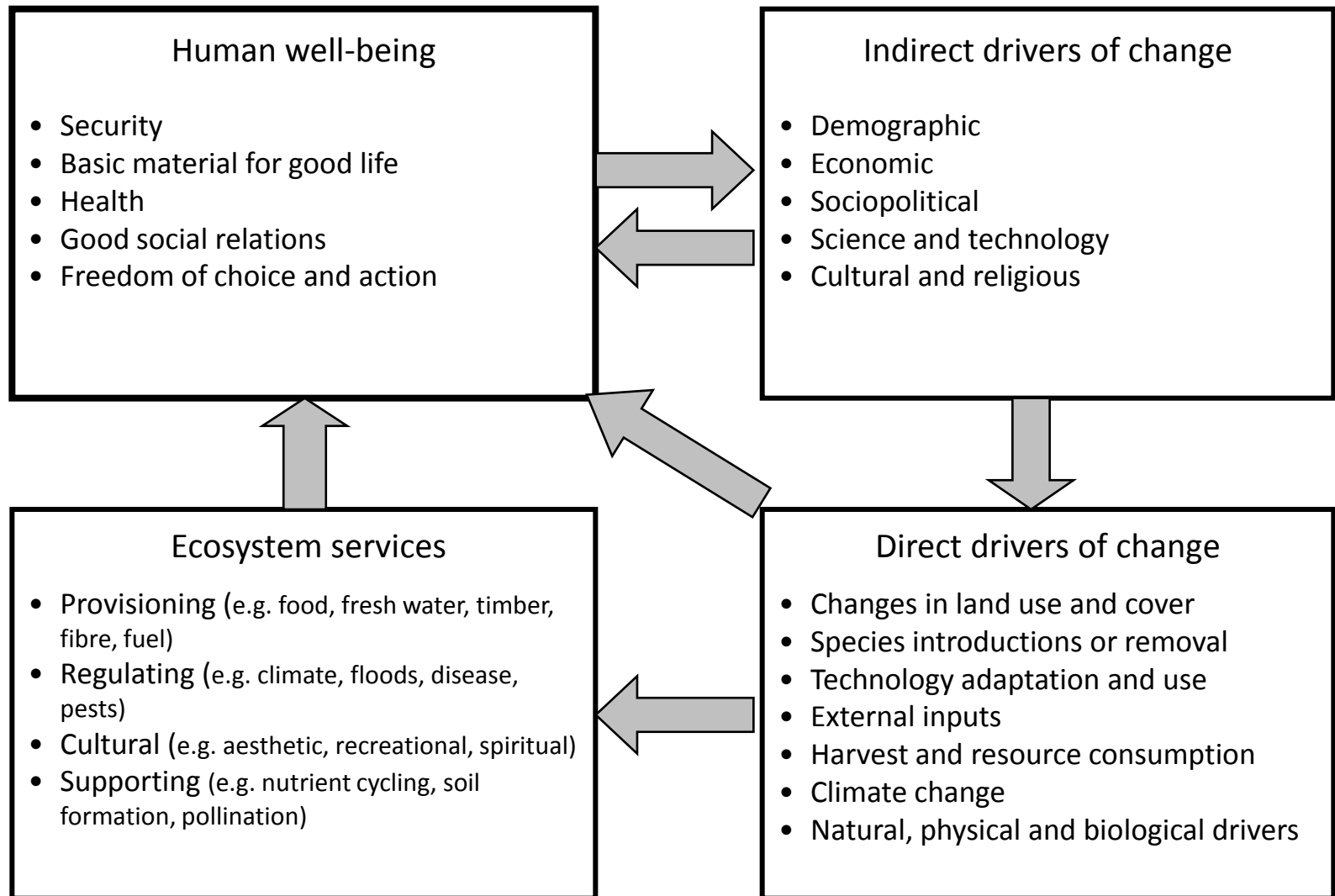
- "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems“.

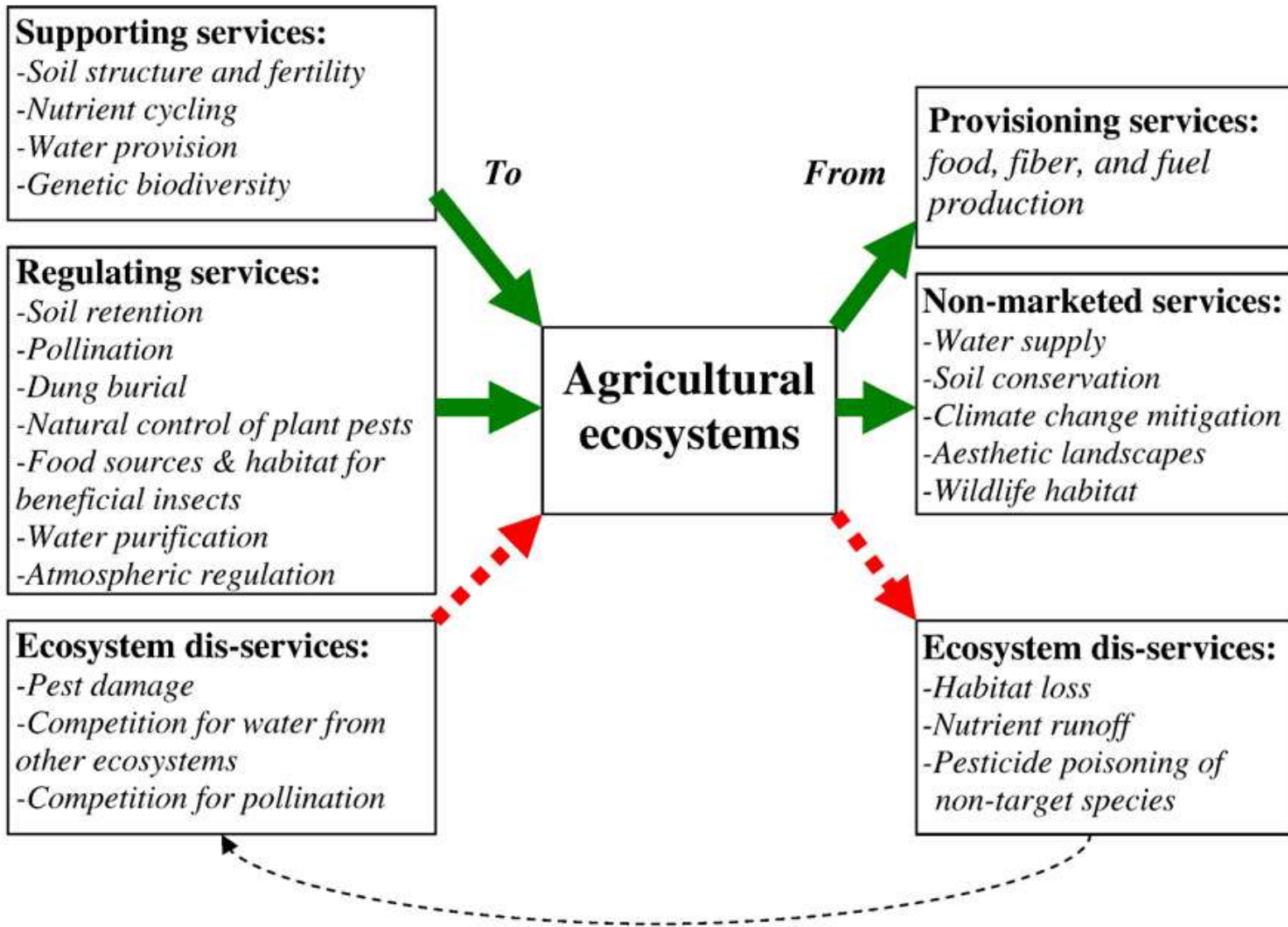
(The Convention on Biological Diversity)

- Totality of genes, species and ecosystems in a particular region.

Biodiversity and Ecosystem services:

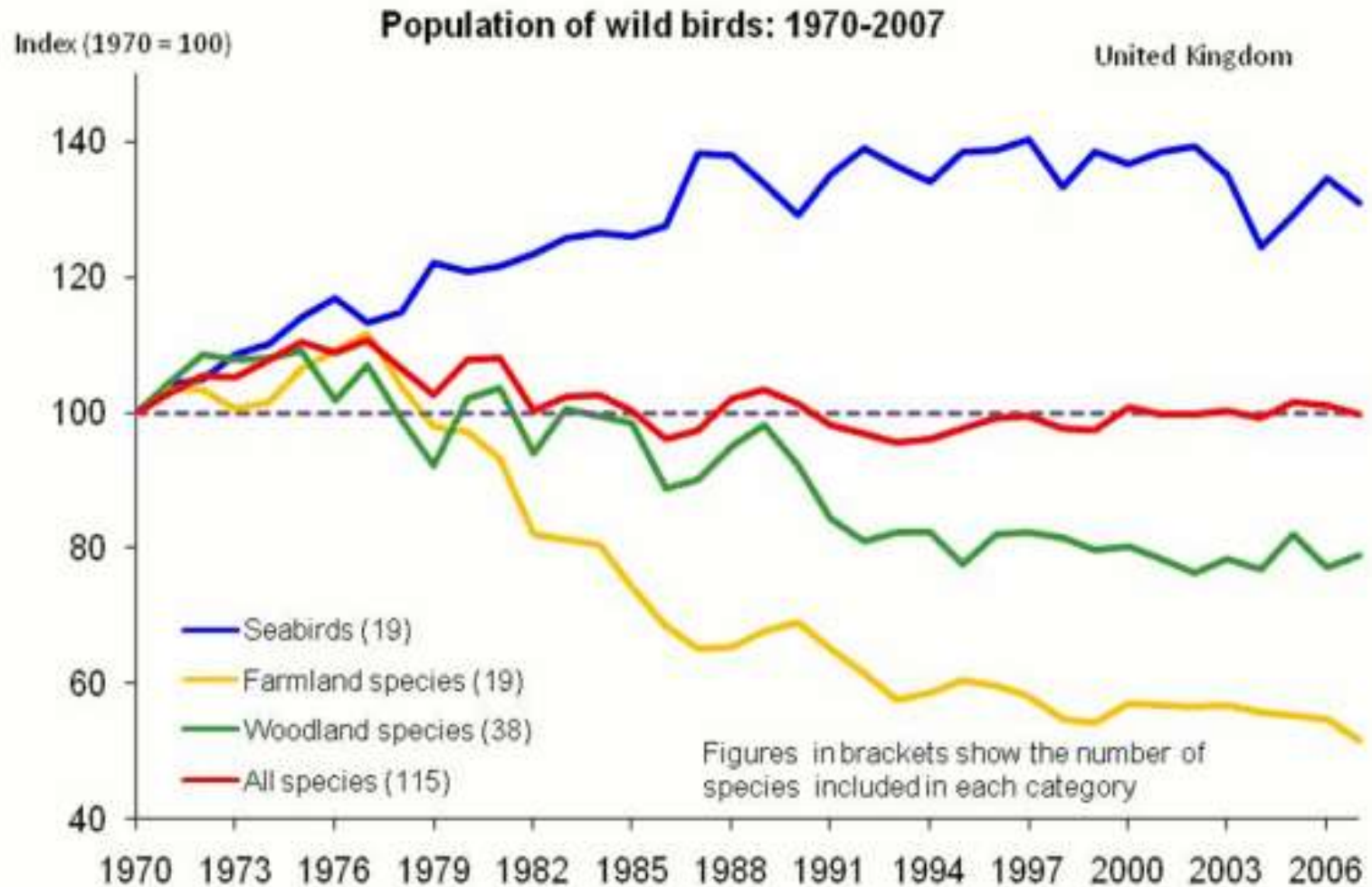
benefits people obtain from ecosystems (Millennium Ecosystem Assessment 2003)





Feedback effect of dis-services from agriculture to agricultural input (e.g., removal of natural enemy habitat can encourage pest outbreaks)

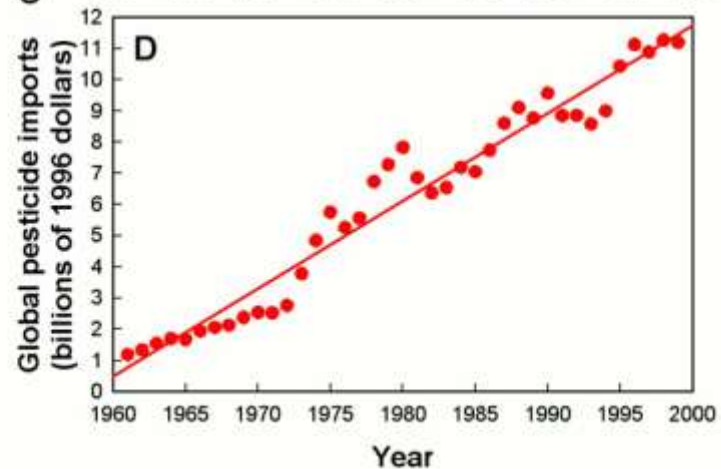
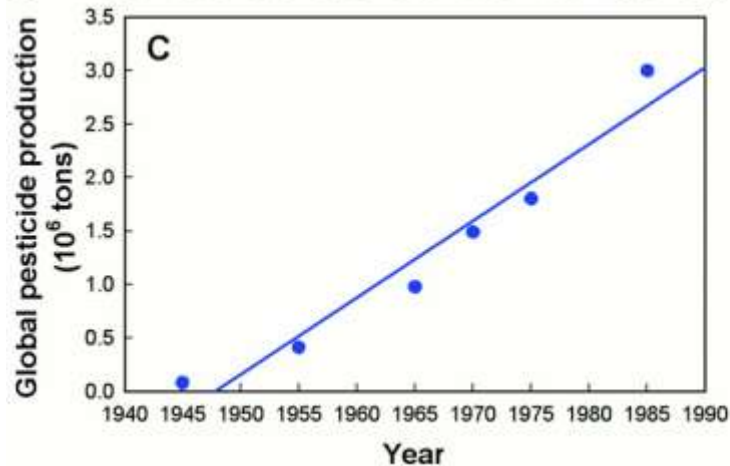
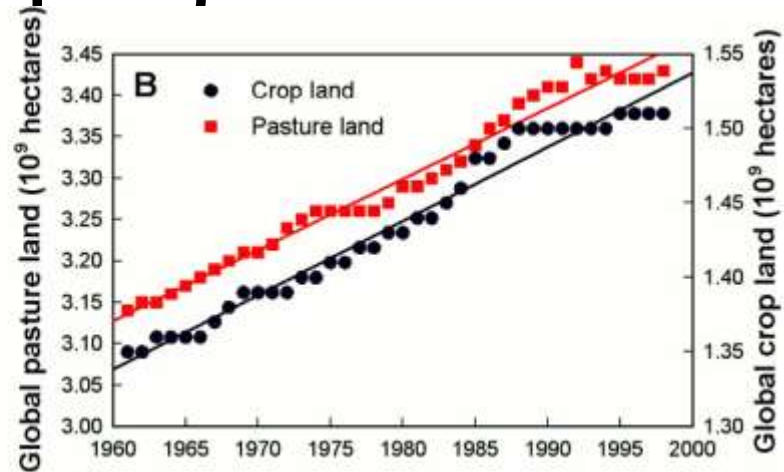
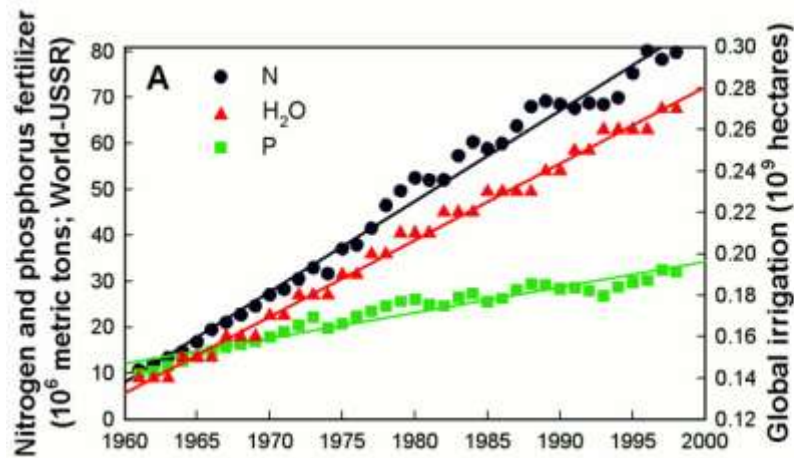
Causes for concern?



What are the drivers of biodiversity change?

- Habitat fragmentation, degradation and destruction (land use change).
- Over-exploitation
- Alien species
- Pollution

Trends and projections



By 2050 – Human population = 9 billion, global food demand will double
 – 2.7 fold increase in pesticide production and N fertilizer

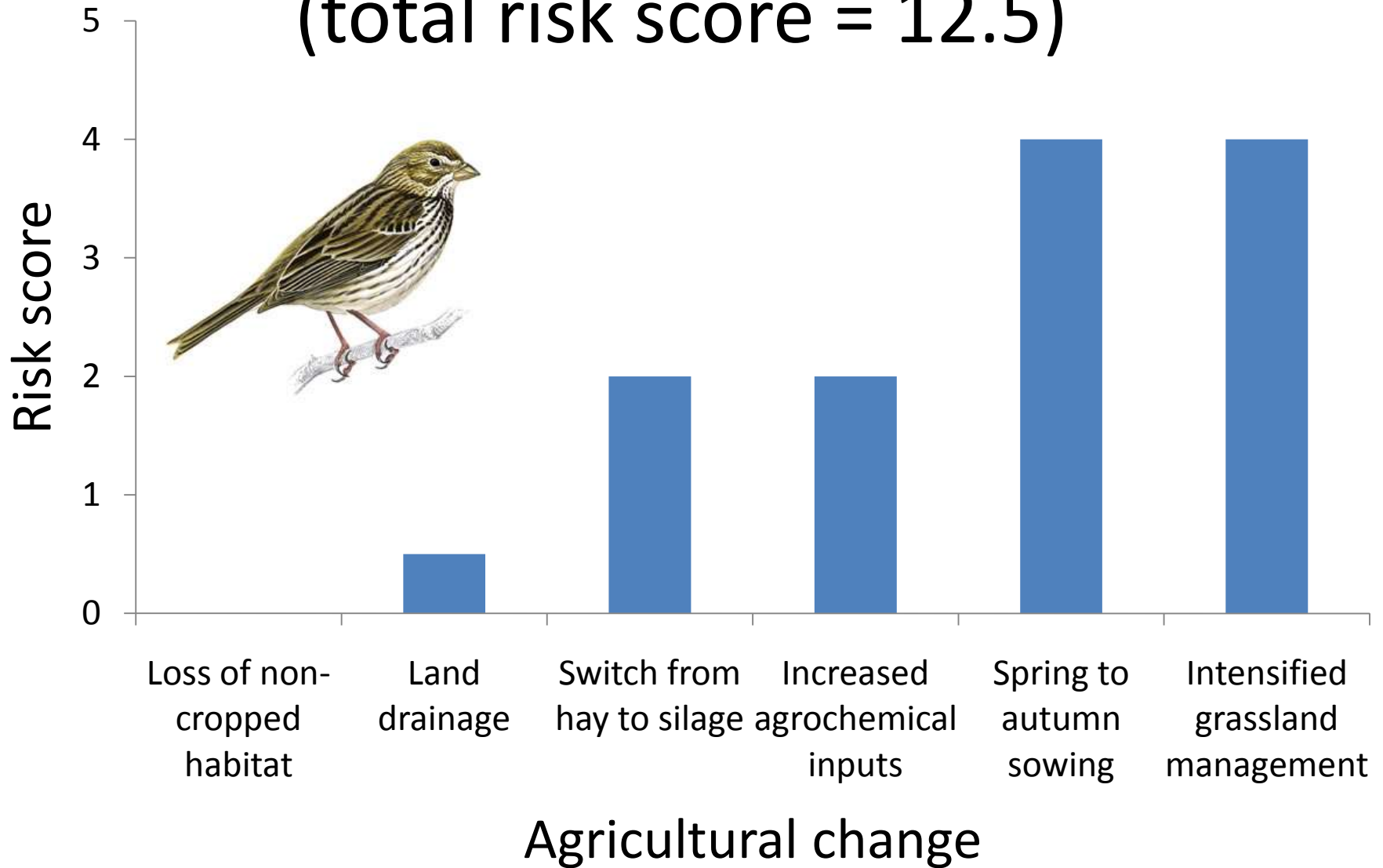
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- Habitat fragmentation, degradation and destruction (land use change).
- Over-exploitation
- Alien species
- Pollution
- Underlying drivers: population growth and increased per capita consumption

Agriculture intensification and farmland bird decline

- Risk assessment framework using 6 components of intensification:
 - Loss of non-cropped habitats
 - Increased land drainage
 - Intensity of grassland management
 - Switch sowing from spring to autumn
 - Switch from hay to silage
 - Increased agrochemical inputs
- Calculated risk score for 62 species based on effects on:
 - Food abundance: abundance or availability of diet, foraging habitat
 - Nesting success: nesting habitat

Corn bunting (total risk score = 12.5)



New Framework Directive for achieving sustainable use of pesticides

- Applies to plant protection products and could be extended to include biocidal products.
- *Article 4: Approval criteria for active substances*
[PPP] shall have no unacceptable effects on the environment, having particular regard to the following considerations **where the scientific methods accepted by the Authority to assess such effects are available:**
 - i) its fate and distribution in the environment, particularly contamination of surface waters, including estuarine and coastal waters, groundwater, air and soil taking into account locations distant from its use following long-range environmental transportation;
 - ii) its impact on non-target species, including on the ongoing behaviour of those species;
 - iii) **its impact on biodiversity and the ecosystem;**

How many species are there?

- Global species diversity – around 10 million of which only 1.4 million have been named.
- Major groups – estimated diversity
 - Insects - 4 million
 - Fungi - 1.5 million
 - Plants - 320,000
 - Chordates - 50,000
- Fresh waters – 126,000 known animal species and 2,600 macrophytes (IUCN)

Available test methods

91/414 tests

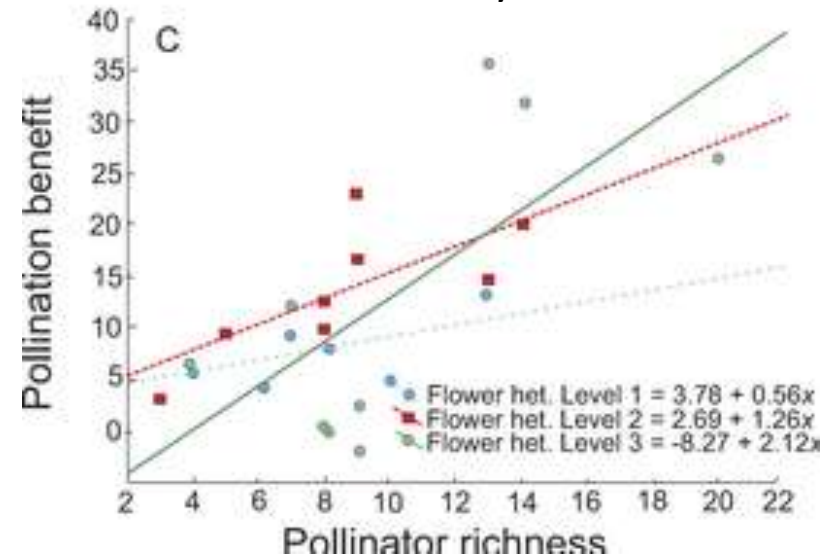
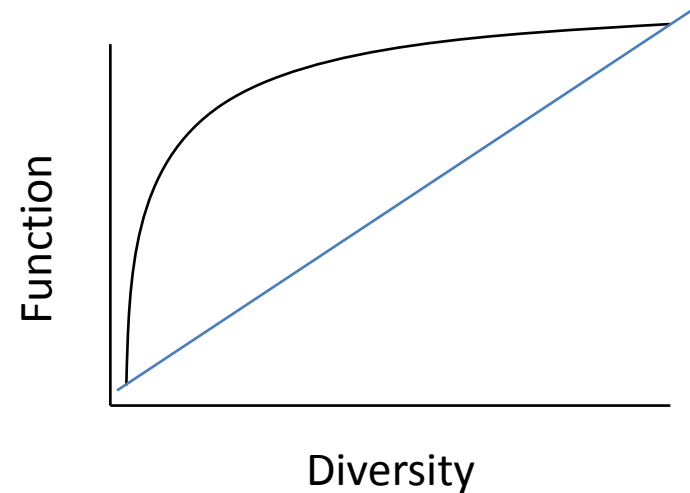
- Vertebrates
 - Mammals
 - Birds
 - Fish
- Invertebrates
 - Arthropoda (insects, crustaceans, arachnids)
 - Annelida
 - Mollusc (gastropod)
- Plants
 - Angiosperms
 - Algae
- Microbes
 - soil microbial function (C, N)
 - sewage treatment

Other standard methods

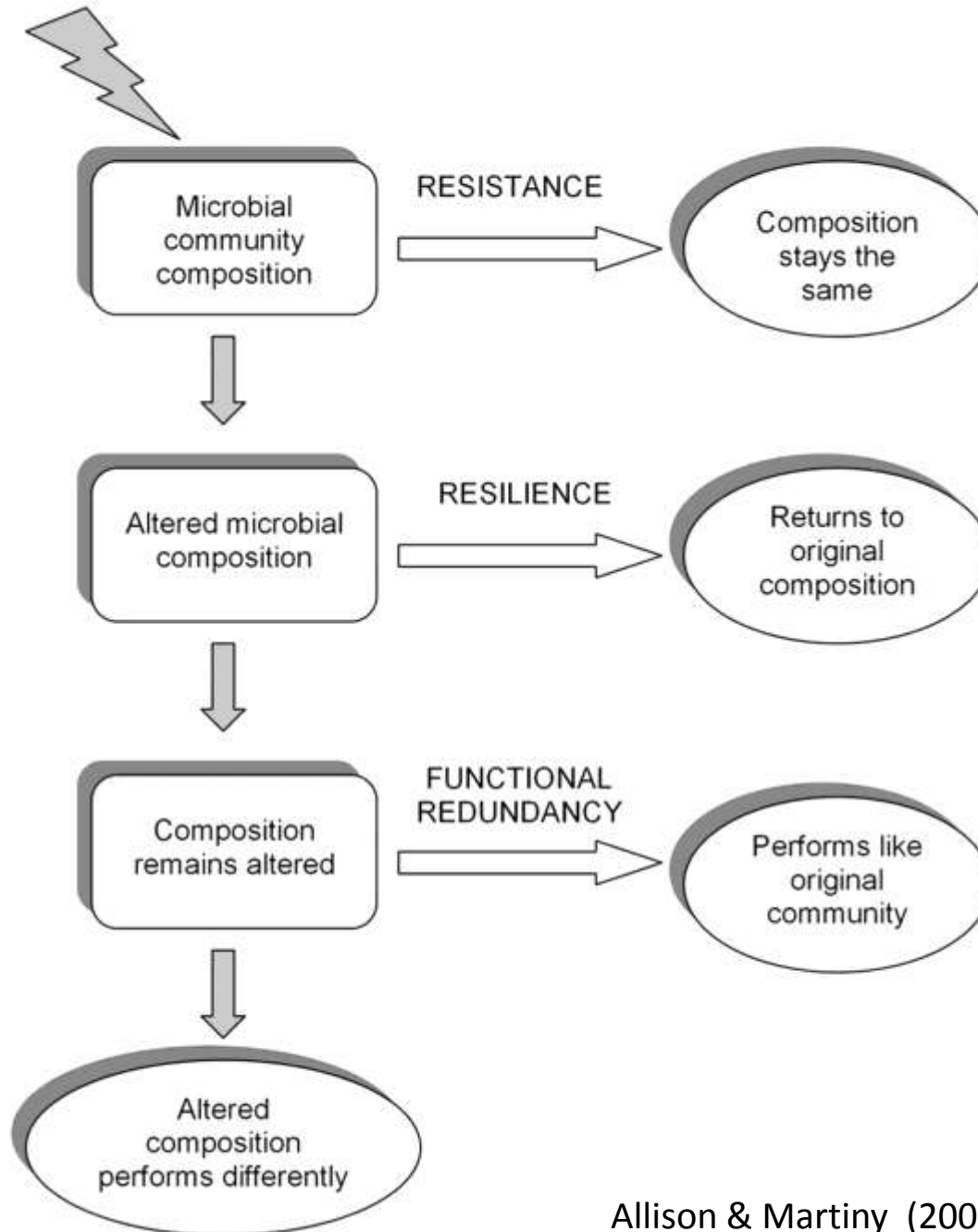
- Vertebrates
 - Amphibians (OECD, Draft)
 - Reptiles
- Invertebrates
 - Rotifers (ASTM)
 - Bivalve molluscs (ASTM)
 - Collembola (OECD, Draft)
 - Polychaetes (Environment Canada)
 - Echinoids (Environment Canada)
- Mesocosm studies.

Species diversity v function

- Diversity-function relationships
- Functional diversity/ redundancy
- Different responses to stress (insurance)



DISTURBANCE



Cannot test all species, so ...

- Pollution Prevention Principle
 - Precautionary approach
- Ecological Threshold Principle
 - Sensitive endpoints protected
- Community Recovery Principle
 - Reversible impacts on sensitive populations
- Functional Redundancy principle
 - Protect functional diversity

Patchy landscapes, variable protection levels?

- Conservative protection level for highly valued systems
 - Pollution prevention or ecological threshold principles
- A more liberal approach for multifunctional systems in the agricultural landscape
 - Community recovery or functional redundancy principles

Future landscapes: multifunctional agriculture



Jordan et al. 2007,
Science, 316 1570-1571

- Joint production of standard commodities and ecological services (including biodiversity protection).
- Increased landscape heterogeneity, refuges, metapopulation dynamics.

Summary

- Political commitment to halt biodiversity loss by 2010.
 - Framework for achieving sustainable use of pesticides
- Global biodiversity estimated at 10 million species
 - accepted testing methods for <100 species (i.e. < 0.001%)
- Ecosystem service protection is necessary for sustainable agriculture.
 - Increase focus on ecosystem processes and keystone species?
- Multifunctional landscapes, variable protection goals
 - Manage landscapes for suites of services, spatially-explicit risk assessment and protection goals?