Functional Diversity, Ecosystem Services and Global Change

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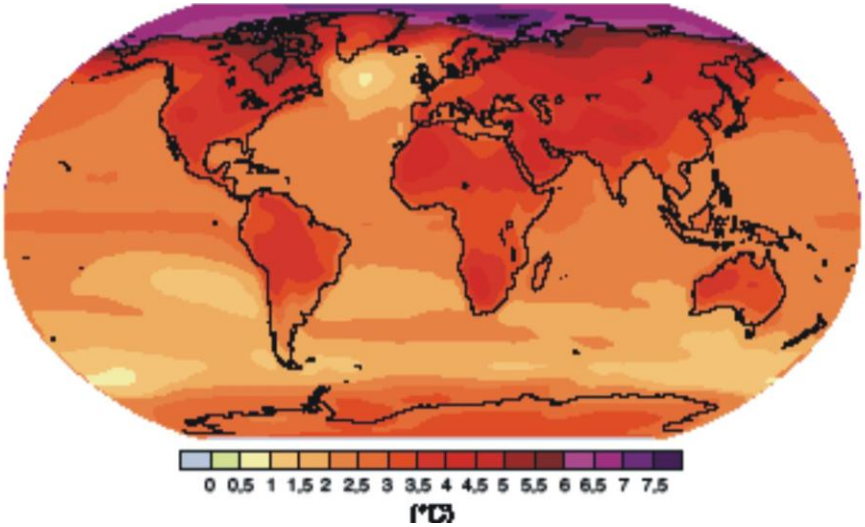
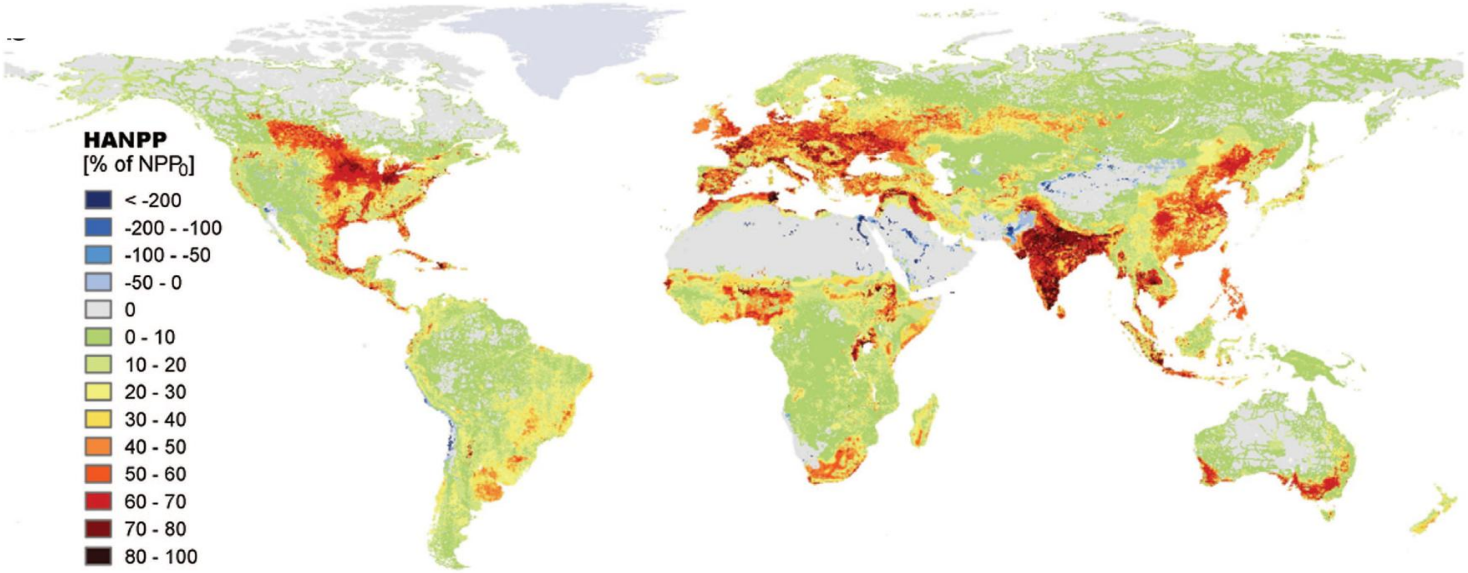


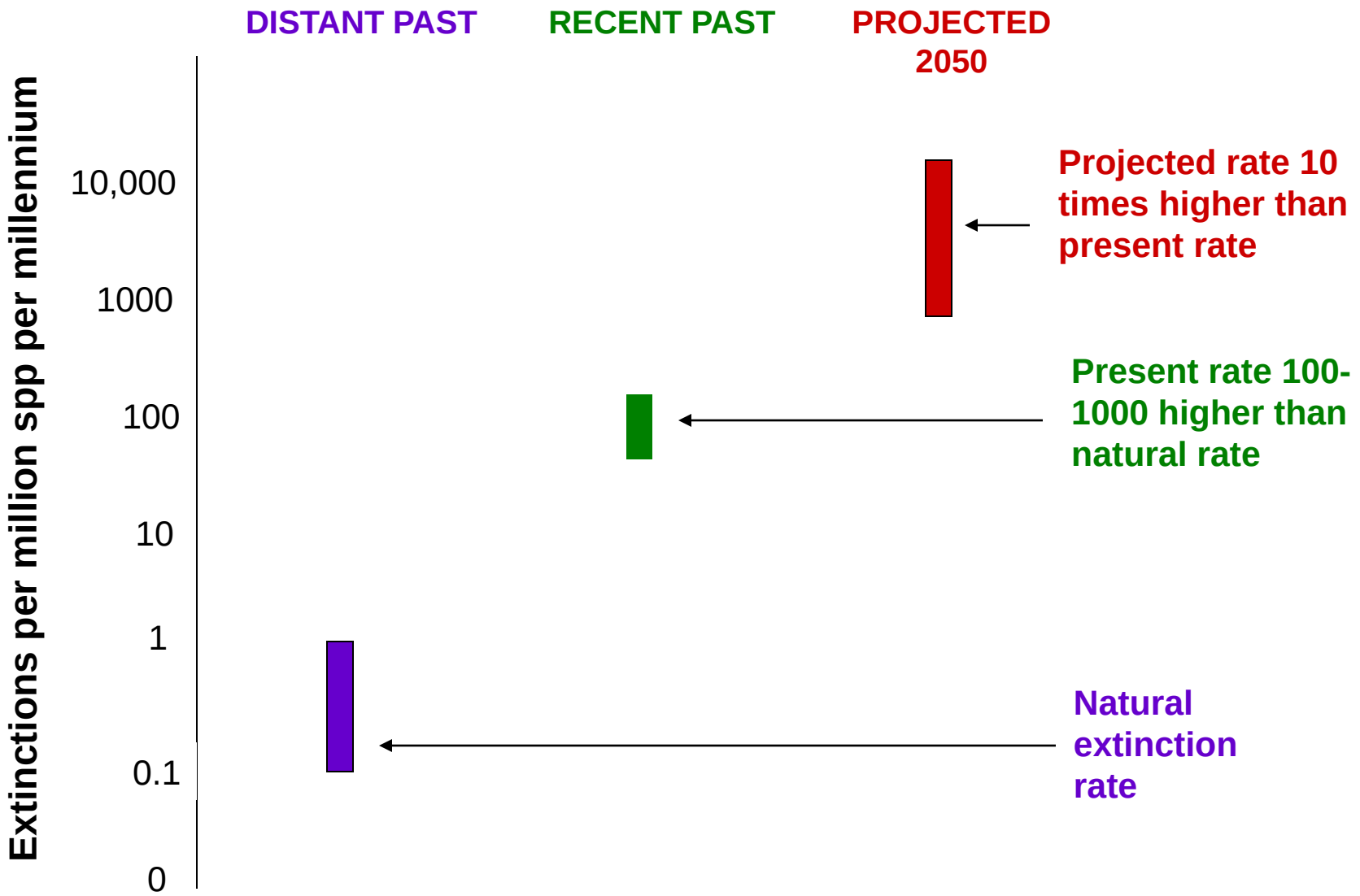
Projected surface warming 2090-99 (A1B SRES scenario, IPCC SYR, 2007)

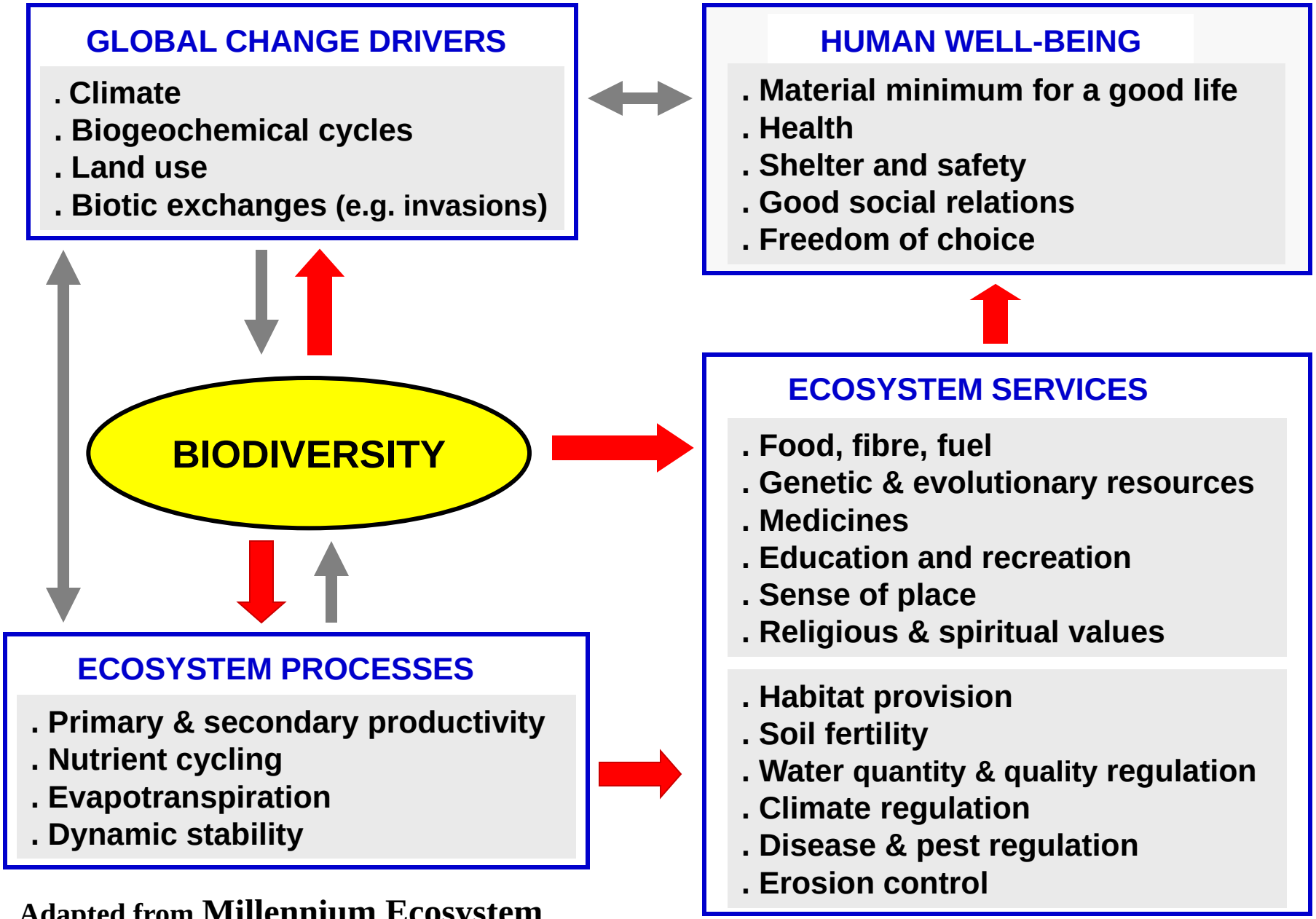


Human appropriation of net primary productivity c. yr 2000 (Haberl et al. 2007, PNAS)

REDUCTION IN THE TOTAL NUMBER OF SPECIES ON THE PLANET

Mace et al. (MA 2005)



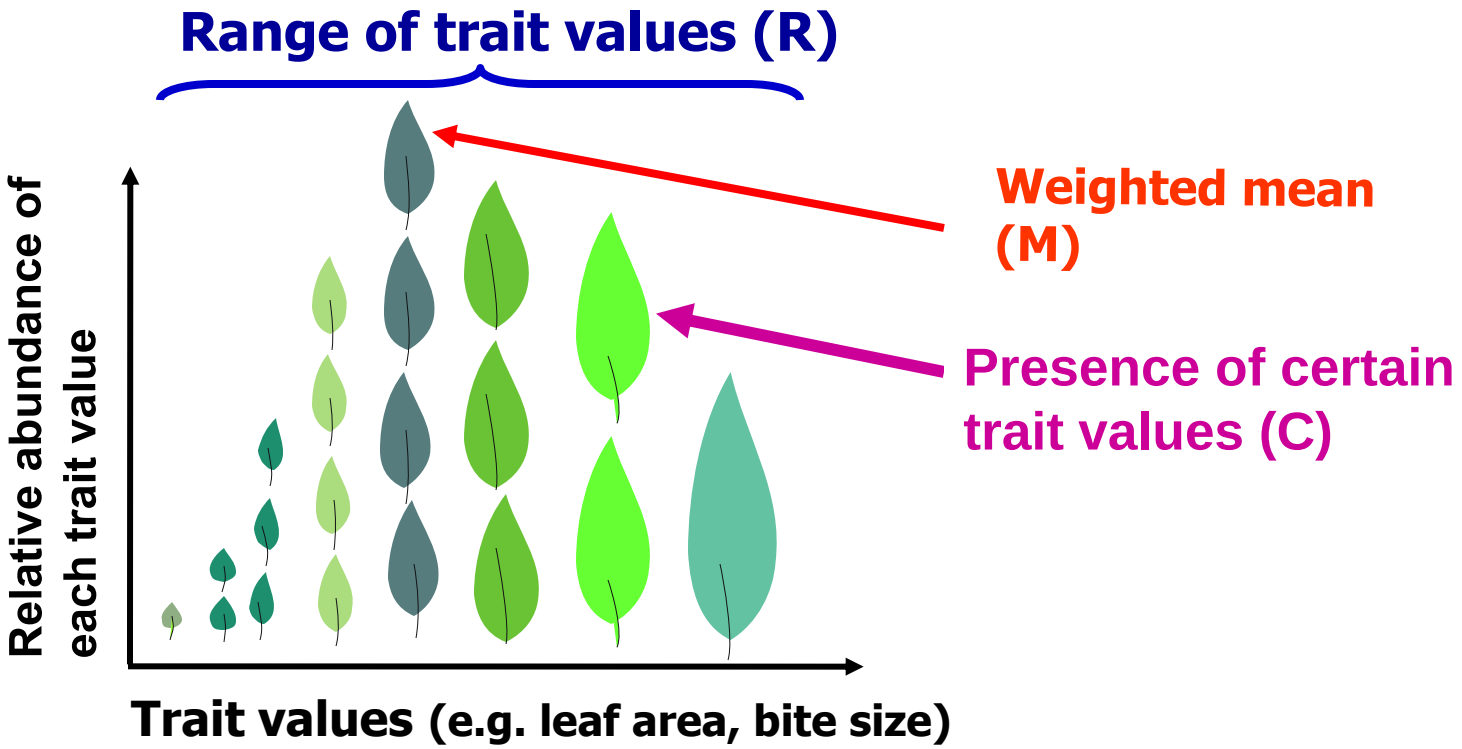


Adapted from Millennium Ecosystem Assessment (2005)

FUNCTIONAL DIVERSITY

The value, range and relative abundance of the functional traits of the organisms present in a given ecosystem.

(Tilman 1999 Ecology; Díaz & Cabido 2001 *TREE*; Díaz et al. 2007 *PNAS)*



Ecosystem processes *ƒ* (EF, R, M, C)

Ecosystem services that depend mainly on the traits of the locally most abundant species

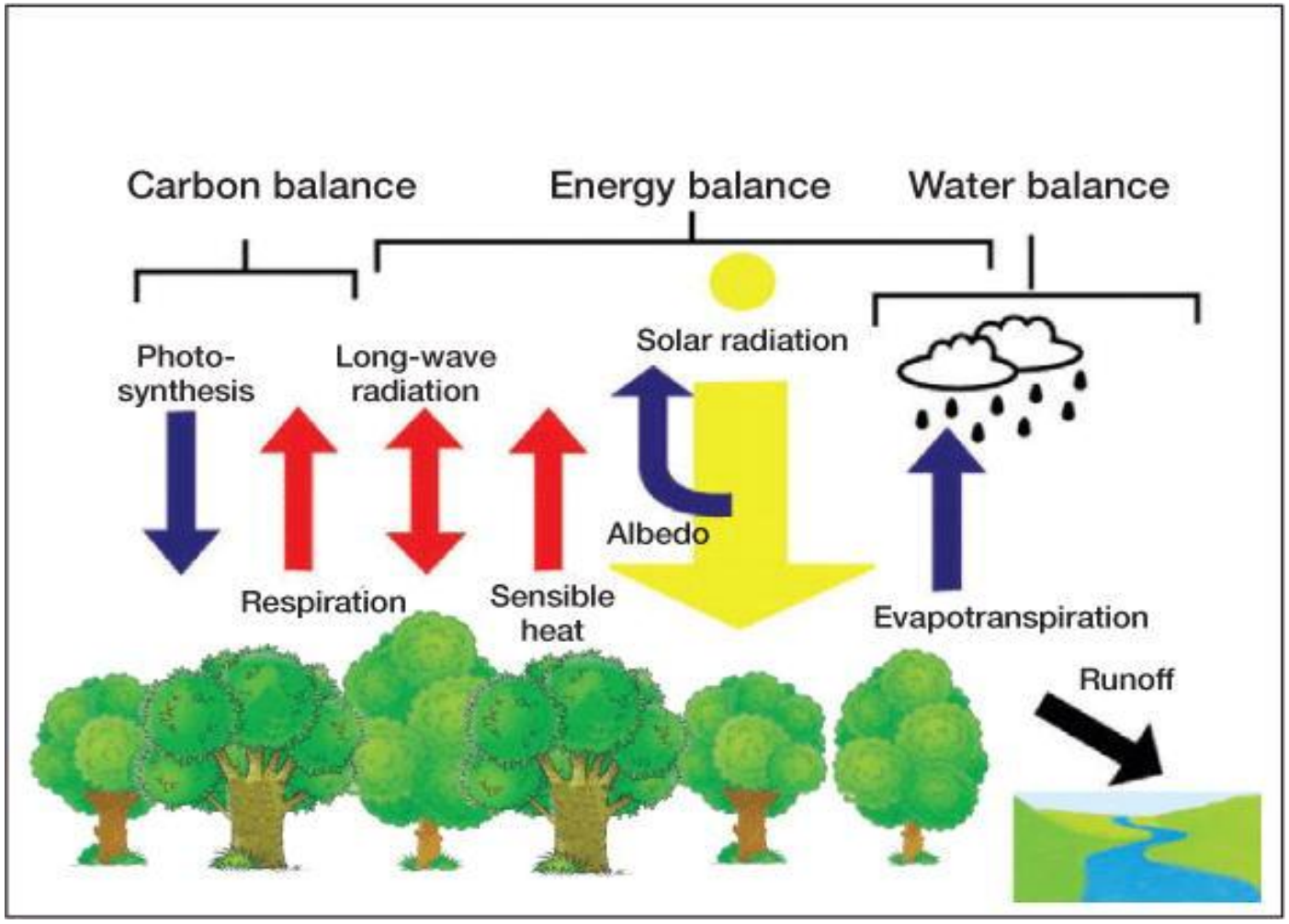
Carbon sequestration
Soil protection

Climate regulation
Protection against natural hazards

Regulation of water quality and quantity

Forage provision

Feedbacks between vegetation and climate



Chapin et al. 2008 ***FREE***

	Leaf physiology & morphology	Canopy size & architecture	Wood mechanical & chemical properties	Root depth & architecture
C storage	✓	✓	✓	✓
Albedo & sensible heat	✓	✓		
Balance between evapotranspiration, infiltration & runoff	✓	✓		✓
Vulnerability (pest outbreaks, fire, storms…)	✓ (P,F)	✓ (F,S)	✓ (F,S)	✓ (S)

Chapin et al. 2008 *FREE*
Gough et al. 2008 *Biosci.*
Luyssaert et al. 2008 *Nature*

De Deyn et al. 2008 *Ecol. Lett.*
Díaz et al. 2009

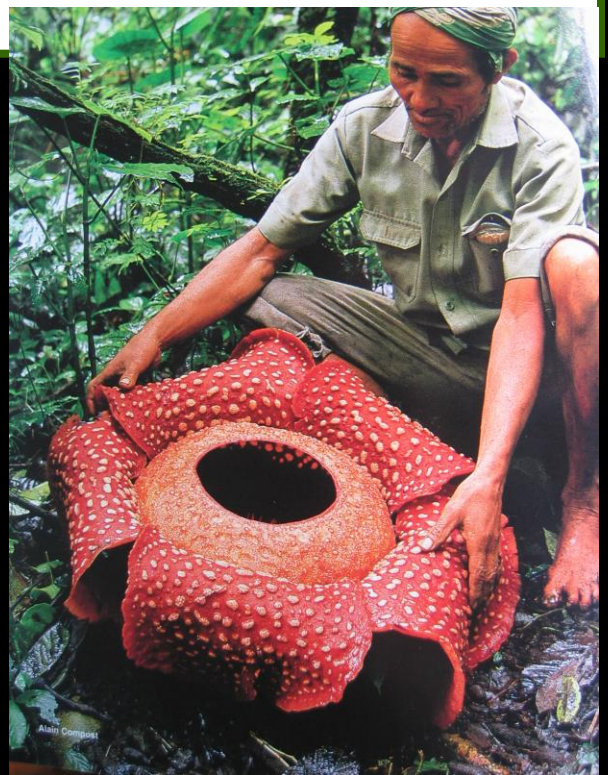
Ecosystem services that depend mainly on the presence of organisms with a a wide RANGE (variety) of functional traits.

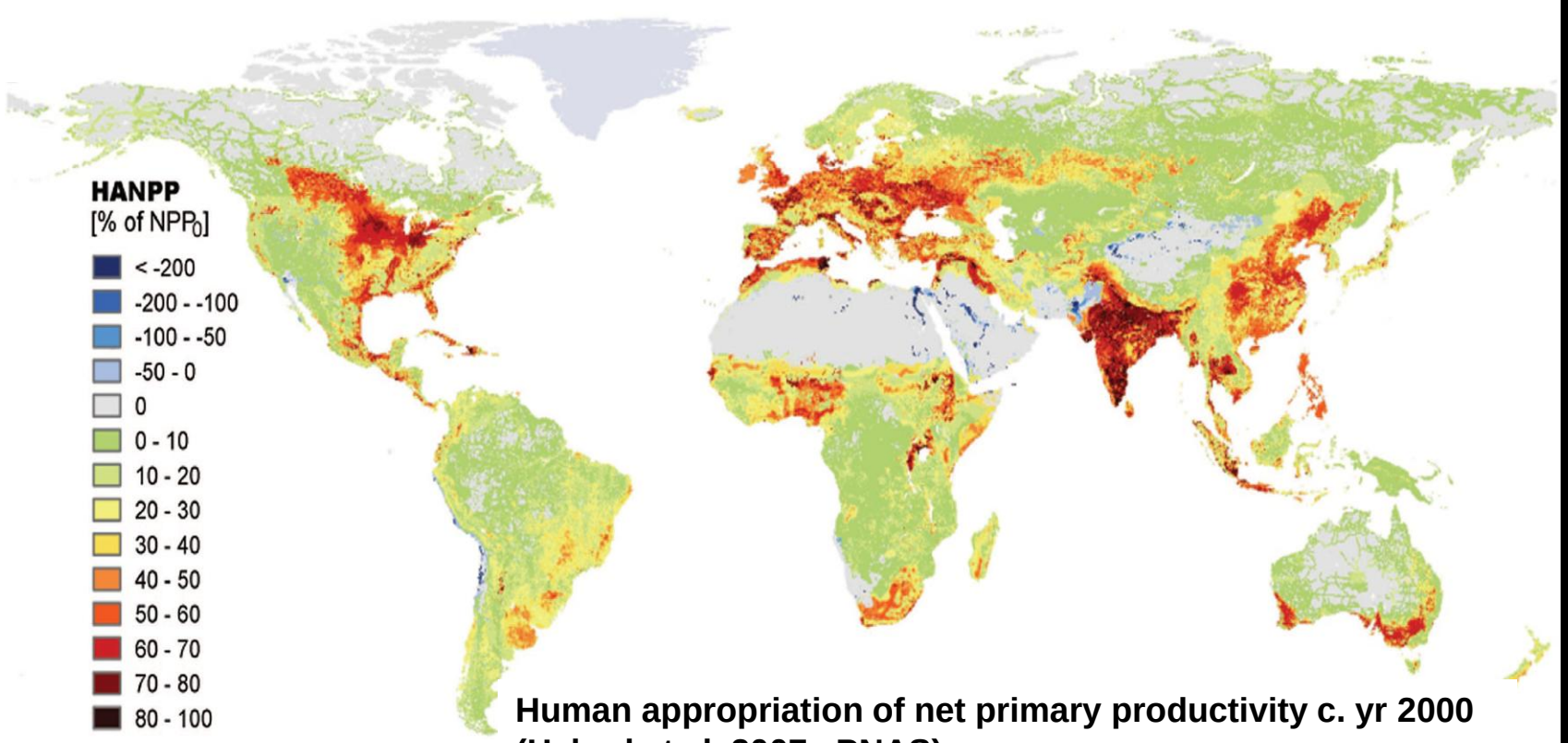
Food security in subsistence agriculture

Aesthetic enjoyment

Ecosystem services depend on the presence of certain species

Cultural ecosystem services:
Sense of place and identity
Aesthetic enjoyment
Religious and spiritual
Ecotourism

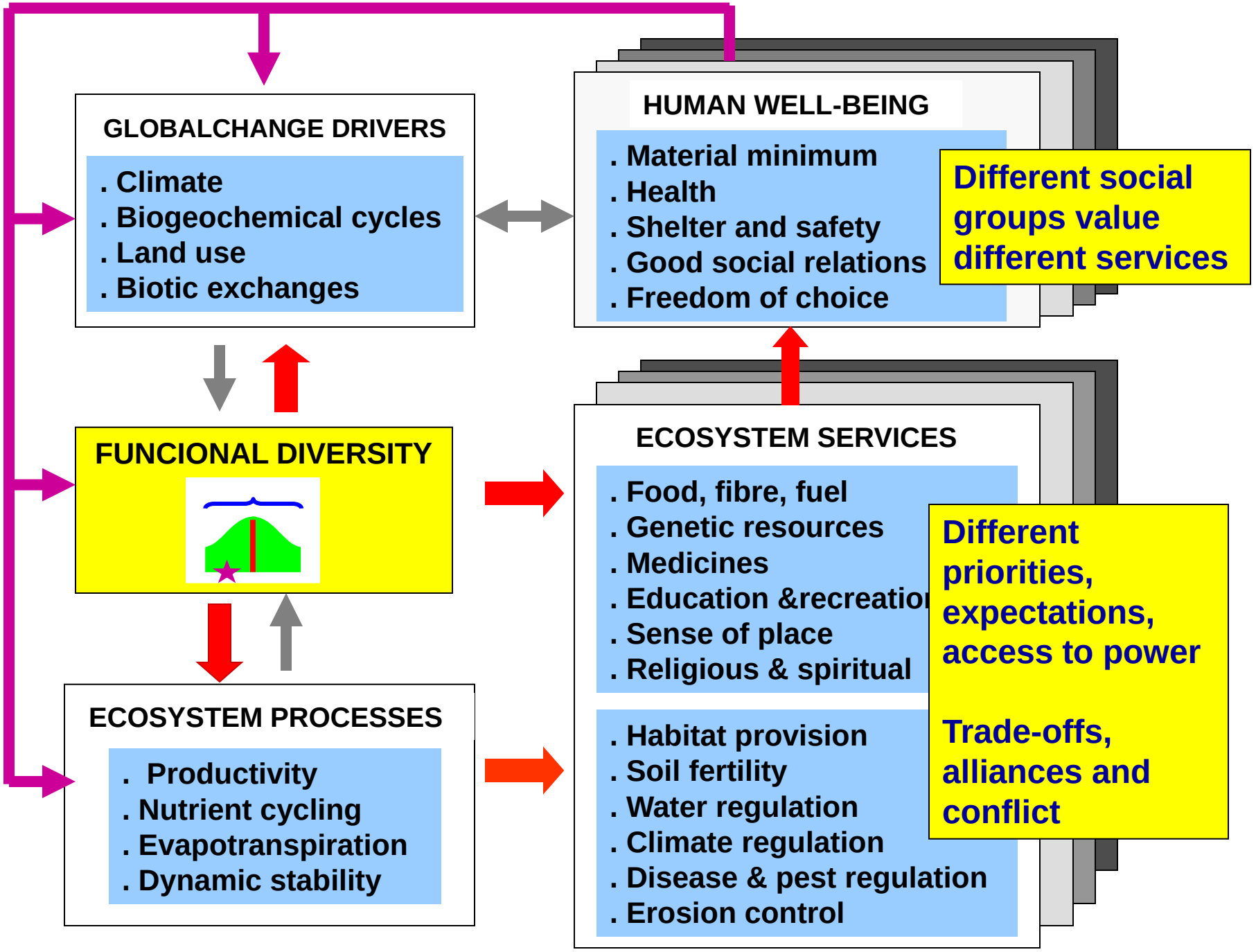




Human appropriation of net primary productivity c. yr 2000 (Haberl et al. 2007, PNAS)

The provision of many ecosystem services is scale-dependent.

The minimum ecosystem size required for sustained provision varies widely among different services.


GLOBALCHANGE DRIVERS
. Climate
. Biogeochemical cycles
. Land use
. Biotic exchanges
HUMAN WELL-BEING
. Material minimum
. Health
. Shelter and safety
. Good social relations
. Freedom of choice
Different social groups value different services
FUNCIONAL DIVERSITY
ECOSYSTEM SERVICES
. Food, fibre, fuel
. Genetic resources
. Medicines
. Education &recreatio
. Sense of place
. Religious & spiritual
. Habitat provision
. Soil fertility
. Water regulation
. Climate regulation
. Disease & pest regulation
. Erosion control
Different priorities, expectations, access to power
Trade-offs, alliances and conflict
ECOSYSTEM PROCESSES
. Productivity
. Nutrient cycling
. Evapotranspiration
. Dynamic stability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SEMENTE DE BARBASCO
SEMENTE DE ANDIROBA
SEMENTE DE TENTO
SEMENTE DE PAXIÚBA
SEMENTE DE CUMARUANA
NÃO PICE
Kentinha

CONCLUSIONS

- Biodiversity change not just colateral damage.
- Biodiversity change is an integral part of global change, affecting ecosystem services and human well-being.
- Social heterogeneity actively shapes diversity.

RECOMMENDATIONS

- **Biodiversity is ecologically and socially multidimensional and thus deserves a multidimensional approach:**

  Interdisciplinary, multiscale, multisectorial

  - **PRIMARY RESEARCH**
  - **ASSESSMENT**
  - **MONITORING and PROTECTION**