Outline

1 Biodiversity and Ecosystem Services

2 Rio+20: 20 years of biodiversity research

3 Toward a BioDiverse Future Earth: research priorities

Biodiversity and Ecosystem Services

"Biodiversity is the degree of variation of life forms within a given species, ecosystem, biome, or an entire planet" (wikipedia)

"Ecosystem services are the benefits people obtain from ecosystems (MEA 2005)"

Consequences of Ecosystem

Deuxième niveau

• Troisième niveau
– Quatrième niveau
» Cinquième niveau

CONSTITUENTS OF WELL-BEING

ECOSYSTEM SERVICES

Provisioning
- FOOD
- FRESH WATER
- WOOD AND FIBER
- FUEL

Supporting
- NUTRIENT CYCLING
- SOIL FORMATION
- PRIMARY PRODUCTION
- ...

Regulating
- CLIMATE REGULATION
- FLOOD REGULATION
- DISEASE REGULATION
- WATER PURIFICATION
- ...

Cultural
- AESTHETIC
- SPIRITUAL
- EDUCATIONAL
- RECREATIONAL
- ...

LIFE ON EARTH - BIODIVERSITY

Security
- PERSONAL SAFETY
- SECURE RESOURCE ACCESS
- SECURITY FROM DISASTERS

Basic material for good life
- ADEQUATE LIVELIHOODS
- SUFFICIENT NUTRITIOUS FOOD
- SHELTER
- ACCESS TO GOODS

Health
- STRENGTH
- FEELING WELL
- ACCESS TO CLEAN AIR AND WATER

Good social relations
- SOCIAL COHESION
- MUTUAL RESPECT
- ABILITY TO HELP OTHERS

Freedom of choice and action
OPPORTUNITY TO BE ABLE TO ACHIEVE WHAT AN INDIVIDUAL VALUES DOING AND BEING

Source: Millennium Ecosystem Assessment

ARROW'S COLOR
Potential for mediation by socioeconomic factors
- Low
- Medium
- High

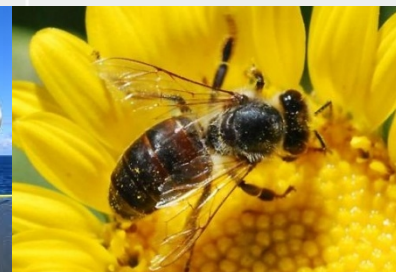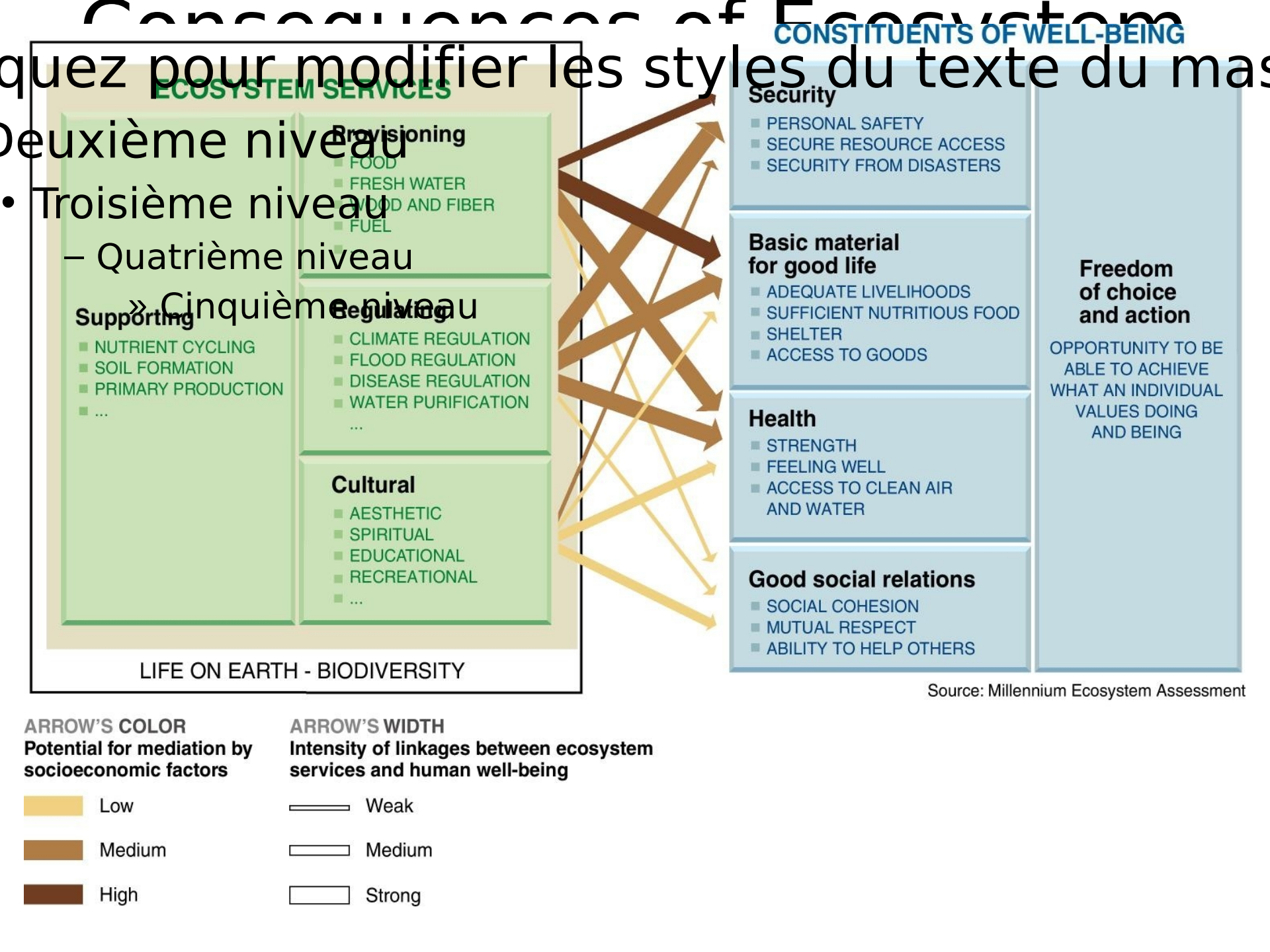**ARROW'S WIDTH**
Intensity of linkages between ecosystem services and human well-being
- Weak
- Medium
- Strong
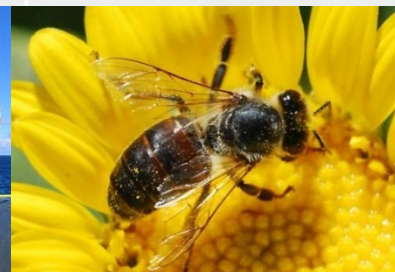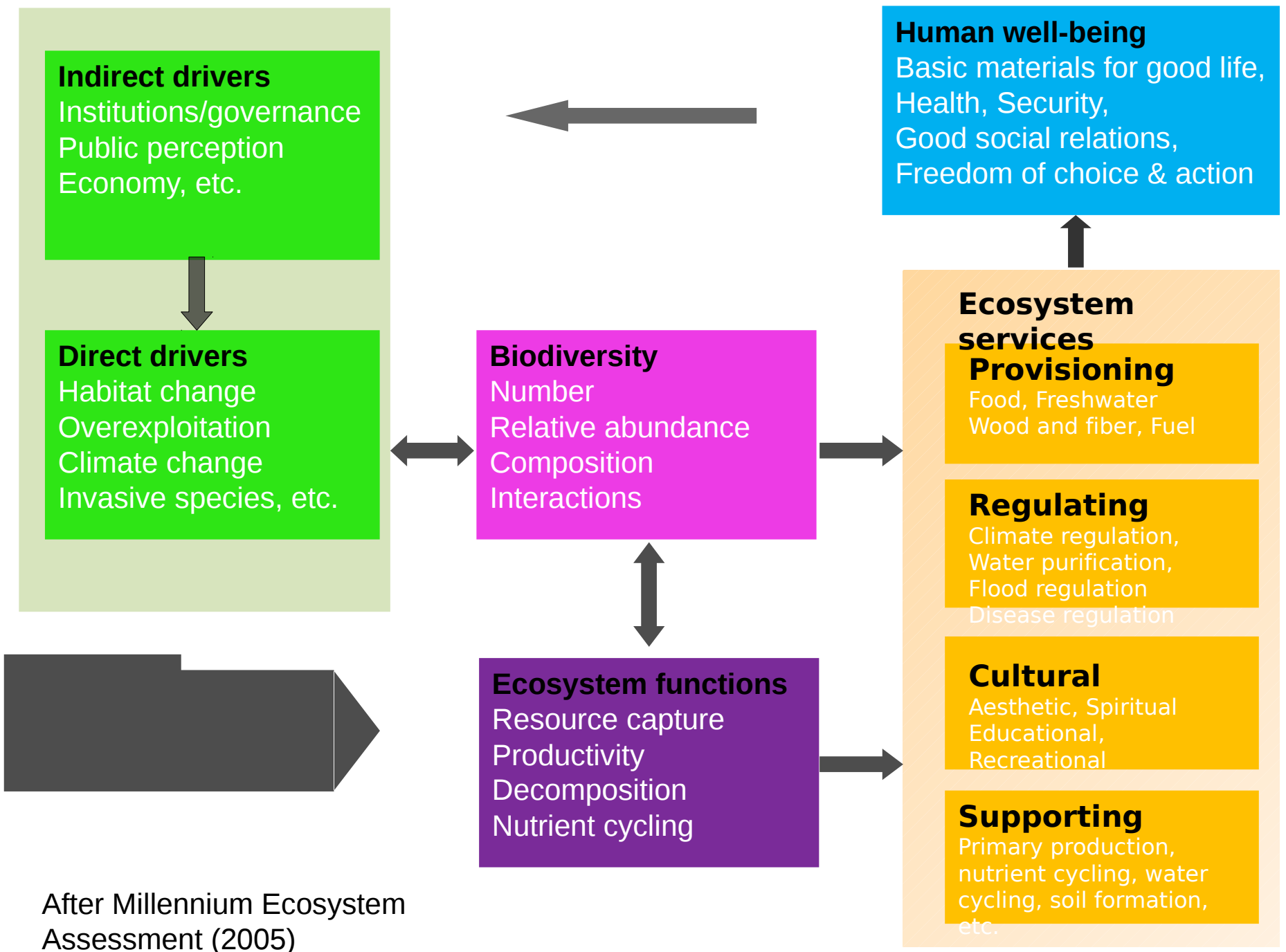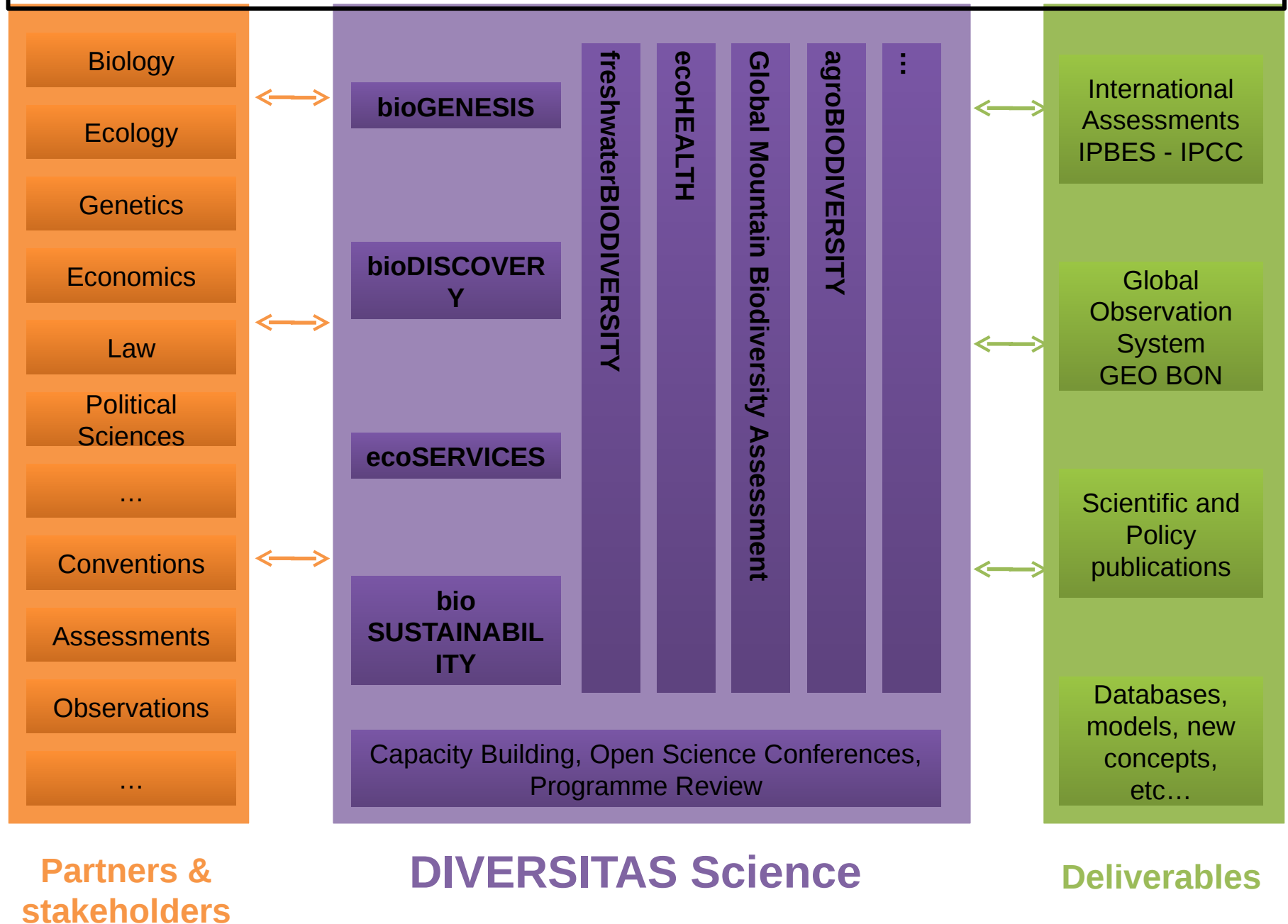
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Indirect drivers
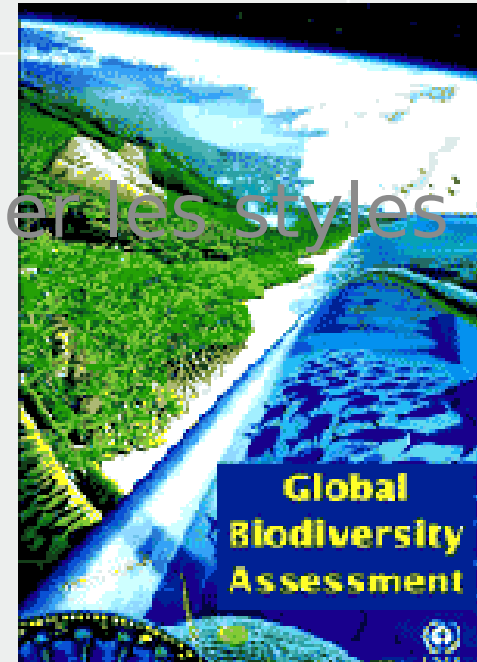Institutions/governance
Public perception
Economy, etc.

Human well-being
Basic materials for good life,
Health, Security,
Good social relations,
Freedom of choice & action

Direct drivers
Habitat change
Overexploitation
Climate change
Invasive species, etc.

Biodiversity
Number
Relative abundance
Composition
Interactions

Ecosystem services

Provisioning
Food, Freshwater
Wood and fiber, Fuel

Regulating
Climate regulation,
Water purification,
Flood regulation
Disease regulation

Ecosystem functions
Resource capture
Productivity
Decomposition
Nutrient cycling

Cultural
Aesthetic, Spiritual
Educational,
Recreational

Supporting
Primary production,
nutrient cycling, water
cycling, soil formation,
etc.

After Millennium Ecosystem
Assessment (2005)

DIVERSITAS vision for biodiversity and ecosystem services (2002-11)

Partners & stakeholders		DIVERSITAS Science		Deliverables

Partners & stakeholders column:
- Biology
- Ecology
- Genetics
- Economics
- Law
- Political Sciences
- …
- Conventions
- Assessments
- Observations
- …

DIVERSITAS Science column:
- bioGENESIS
- bioDISCOVERY
- ecoSERVICES
- bio SUSTAINABILITY
- freshwaterBIODIVERSITY
- ecoHEALTH
- Global Mountain Biodiversity Assessment
- agroBIODIVERSITY
- ∶
- Capacity Building, Open Science Conferences, Programme Review

Deliverables column:
- International Assessments IPBES - IPCC
- Global Observation System GEO BON
- Scientific and Policy publications
- Databases, models, new concepts, etc…

Partners & stakeholders

DIVERSITAS Science

Deliverables

1995: The Global Biodiversity Assessment (First assessment)

- Major focus on:
  - Taxonomy, distribution
  - Monitoring, trends
- Only 0.3 page on global climate change impact!
- 2 chapters (out of 13) on functional aspects
- 1 chapter related to policy

DIVERSITAS
an international programme
of biodiversity science

Global Biodiversity Assessment

Heywood, 1995

Indirect drivers
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After Millennium Ecosystem Assessment (2005)

1995-2005: Biodiversity and ecosystem functioning:
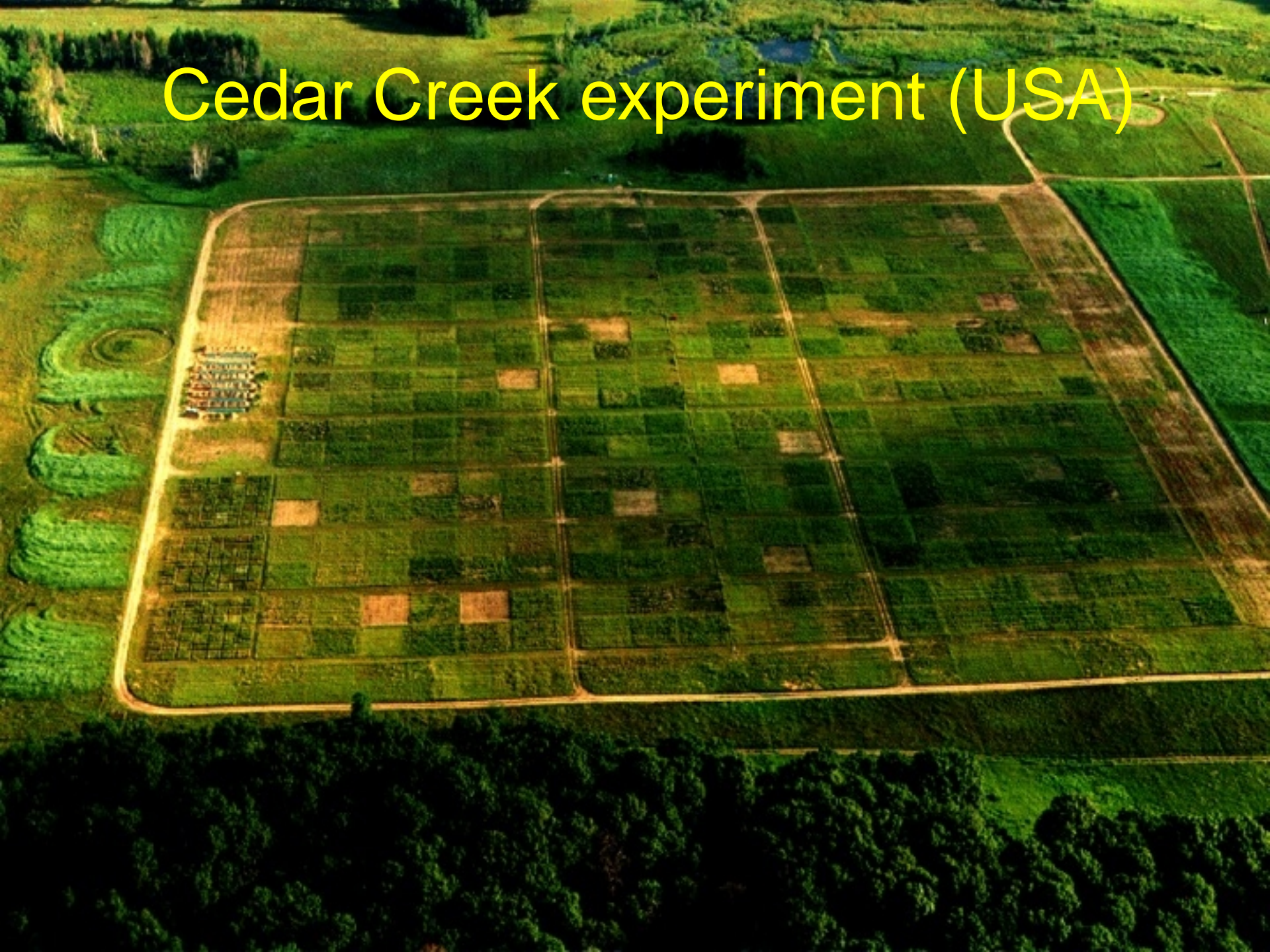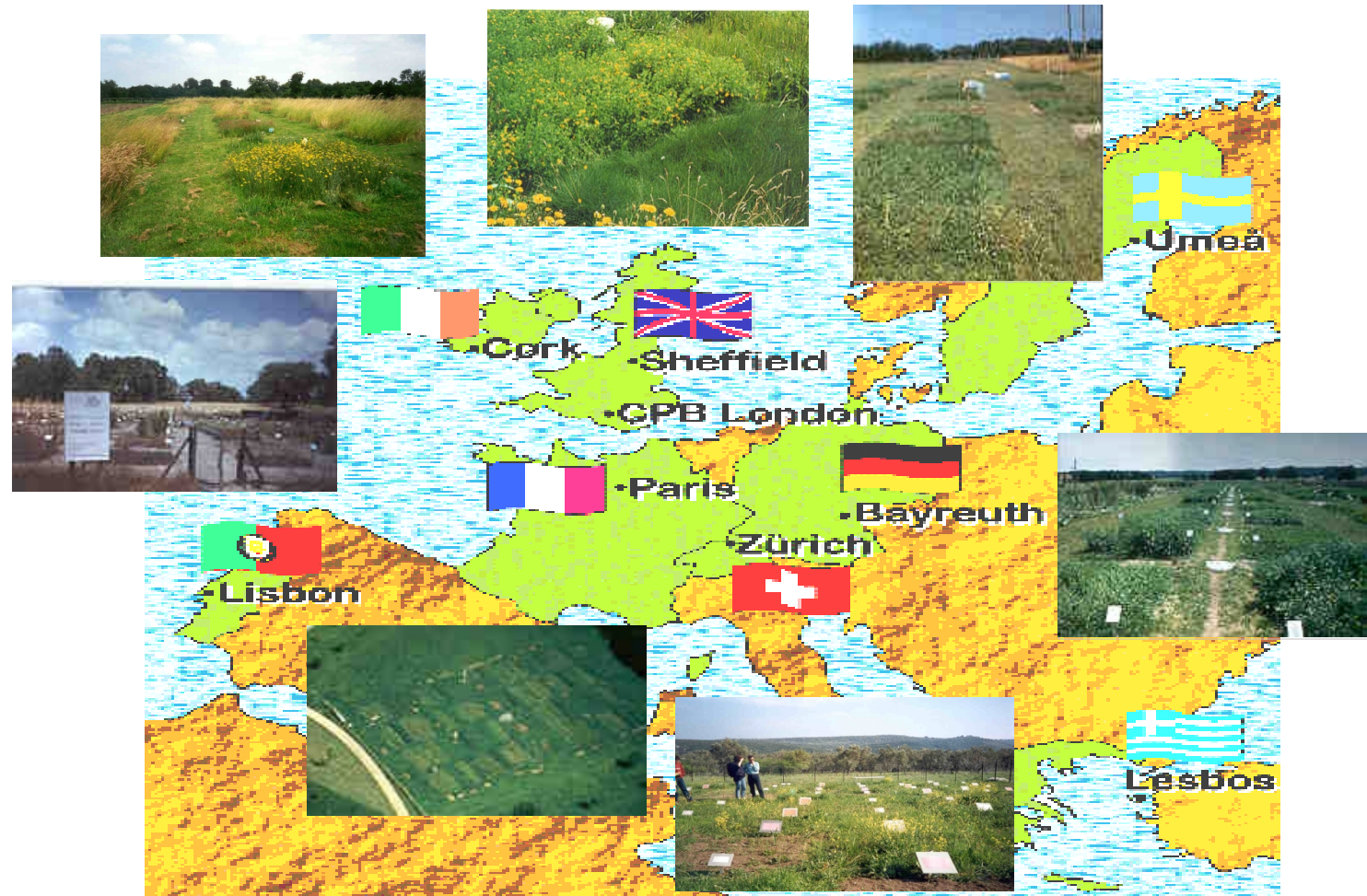## Emergence of a new research field
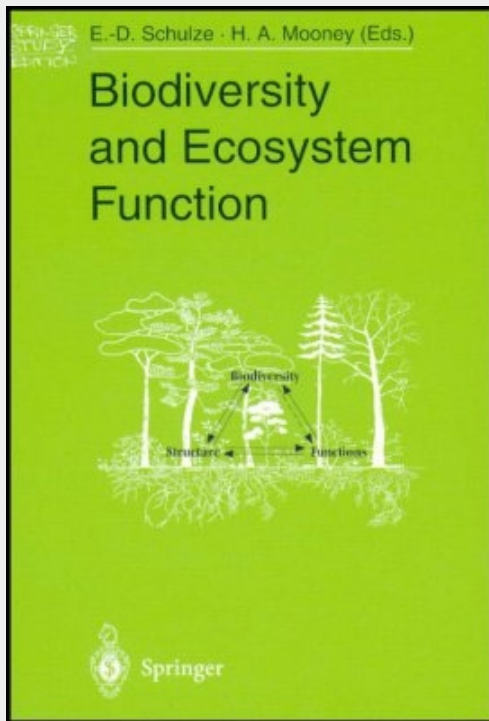
1993
SCOPE
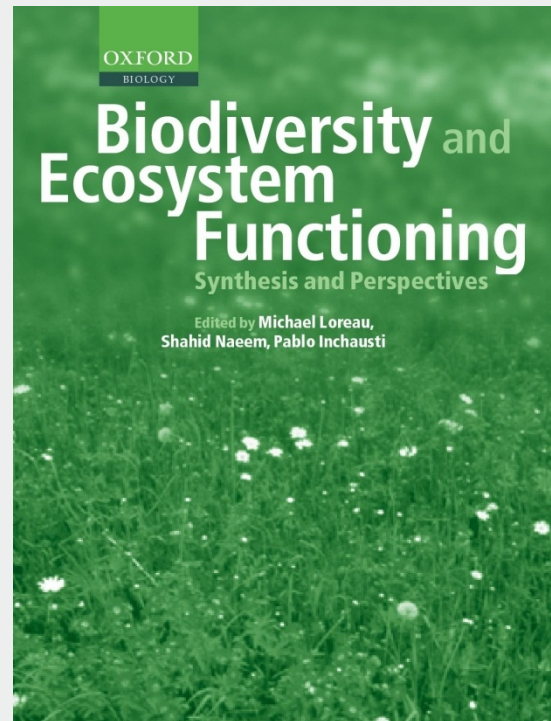
2002
DIVERSITAS
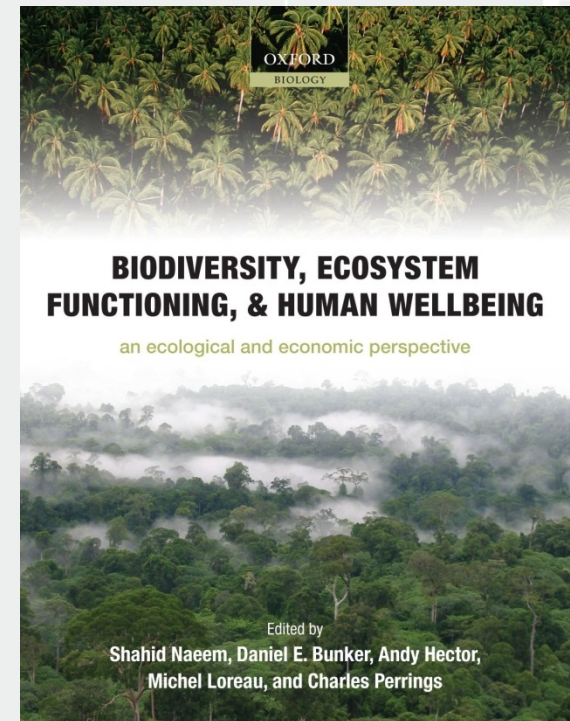
2009
DIVERSITAS

Cedar Creek experiment (USA)

BIODEPTH experiment (Europe)

Biodiversity loss reduces efficiency of ecosystems to capture resources

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an international programme
of biodiversity science

Ecosystem function
(resource capture, biomass production, decomposition, nutrient recycling)

Biological diversity
(variation in genes, species, functional traits)

Cardinale et al.,
Nature 7 June 2012

Typical diversity-function relationship
(based on several 100's experiments)

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After Millennium Ecosystem
Assessment (2005)

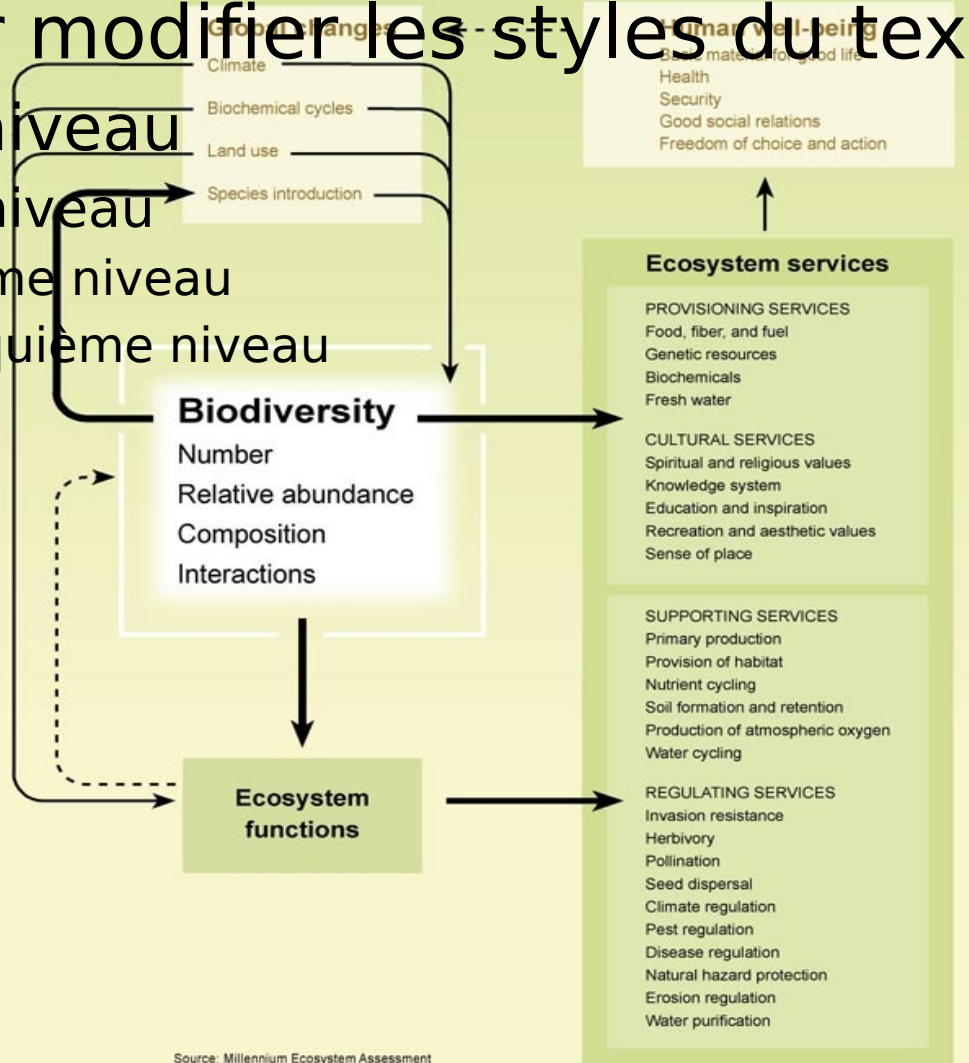# The Millennium Ecosystem Assessment (2005) 2nd assessment

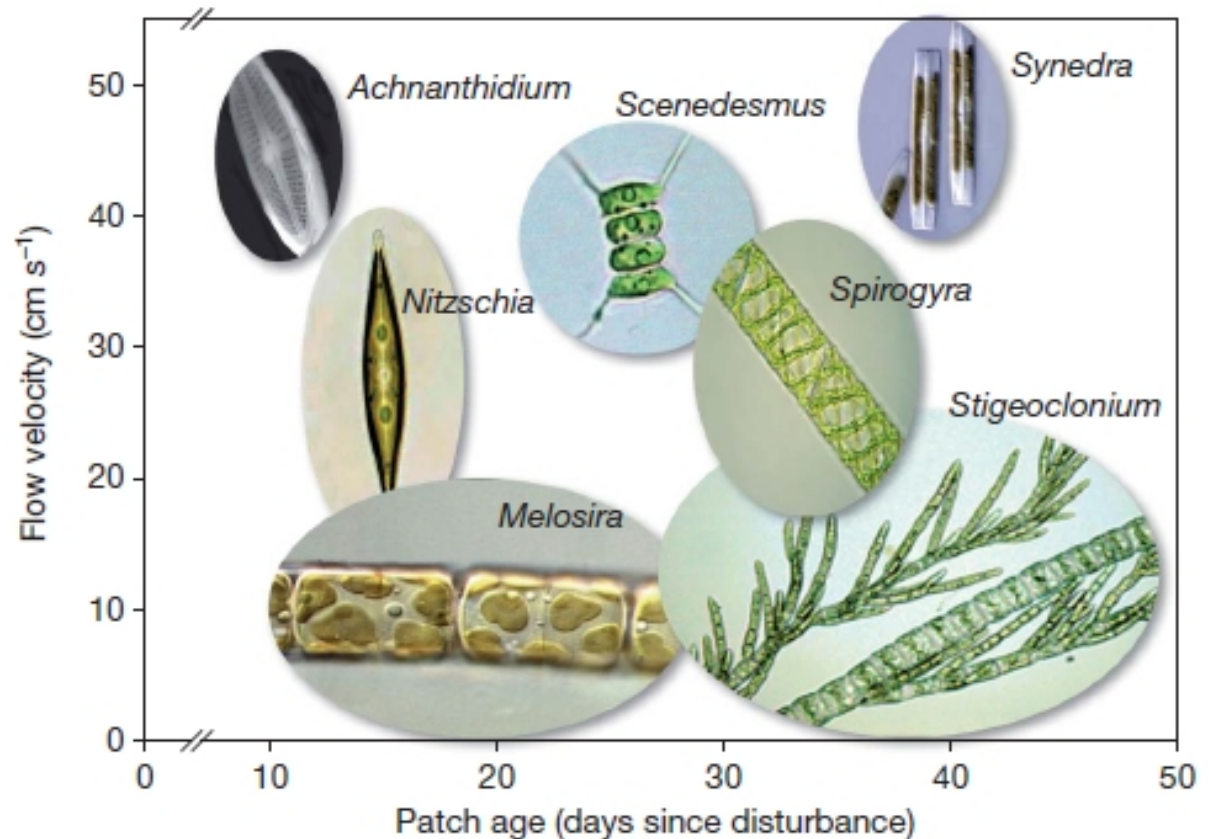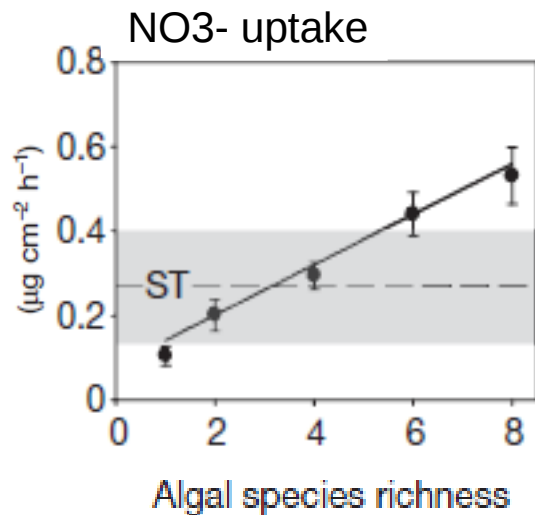ur modifier les styles du texte du masque

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inquième niveau

Source: Millennium Ecosystem Assessment

Ecosystem services
Focus on human well-being
Biodiversity underpins ecosystem services
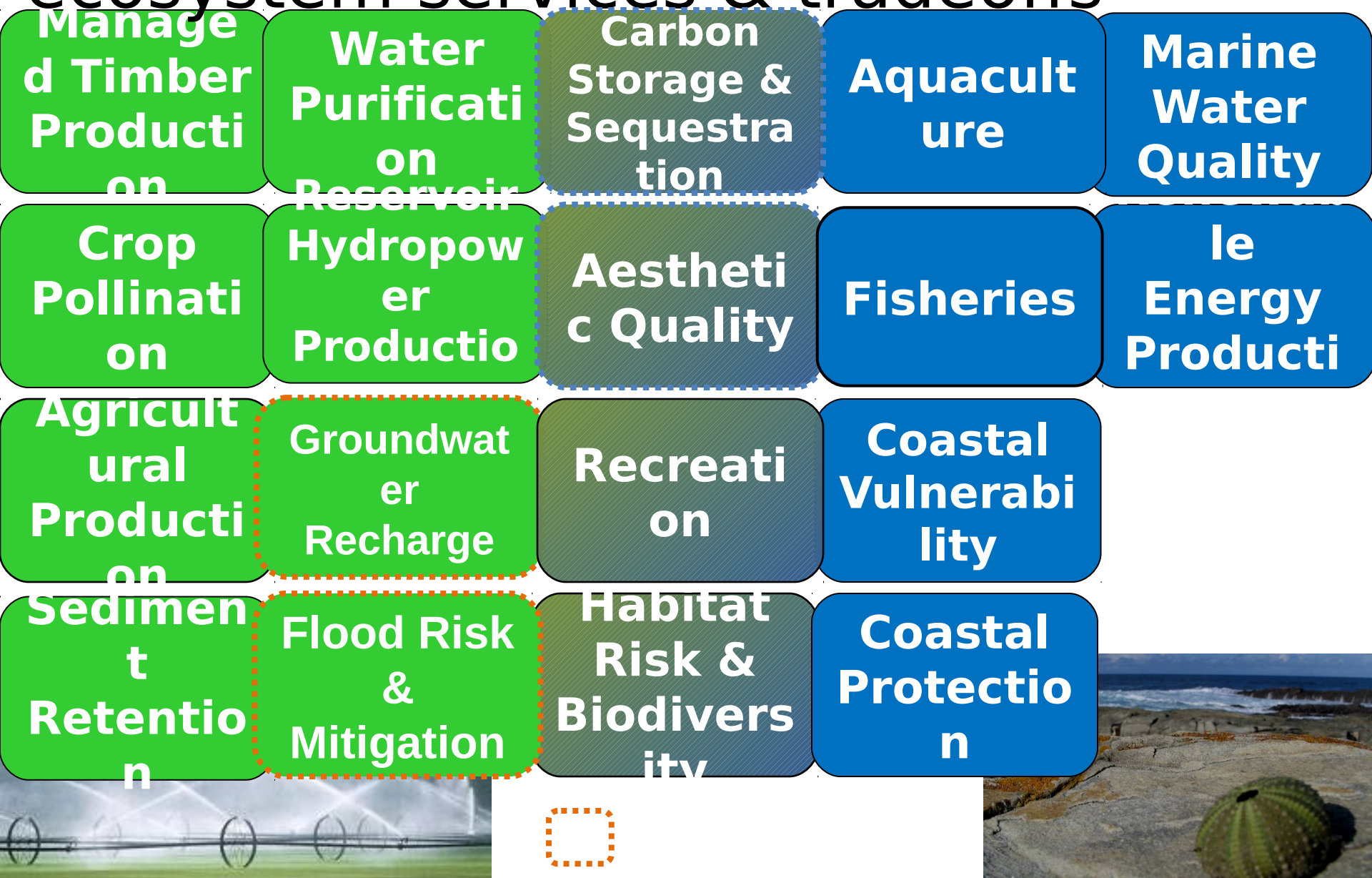
DIVERSITAS

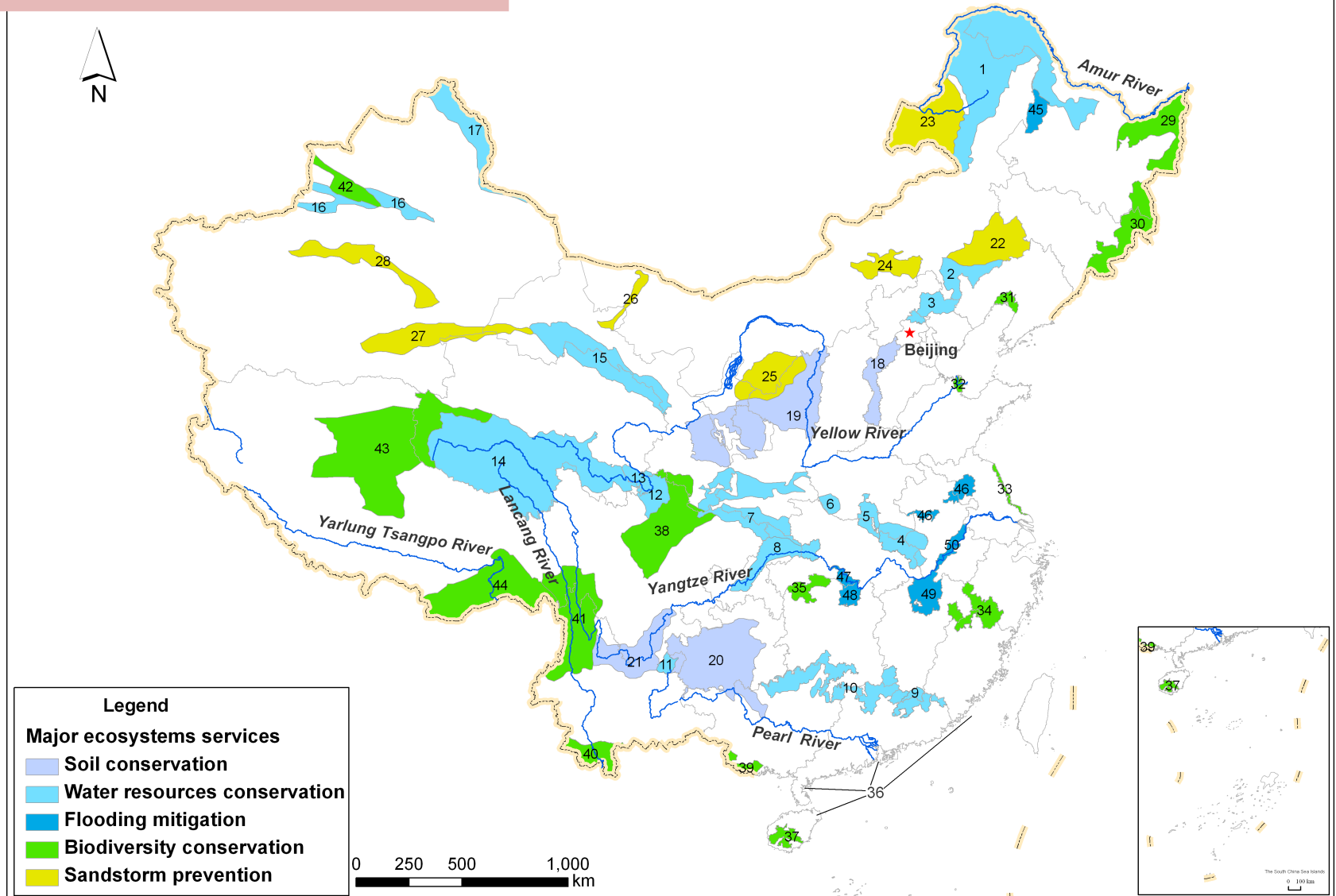# Species diversity improves water quality by removing nutrient pollutants

NO3- uptake
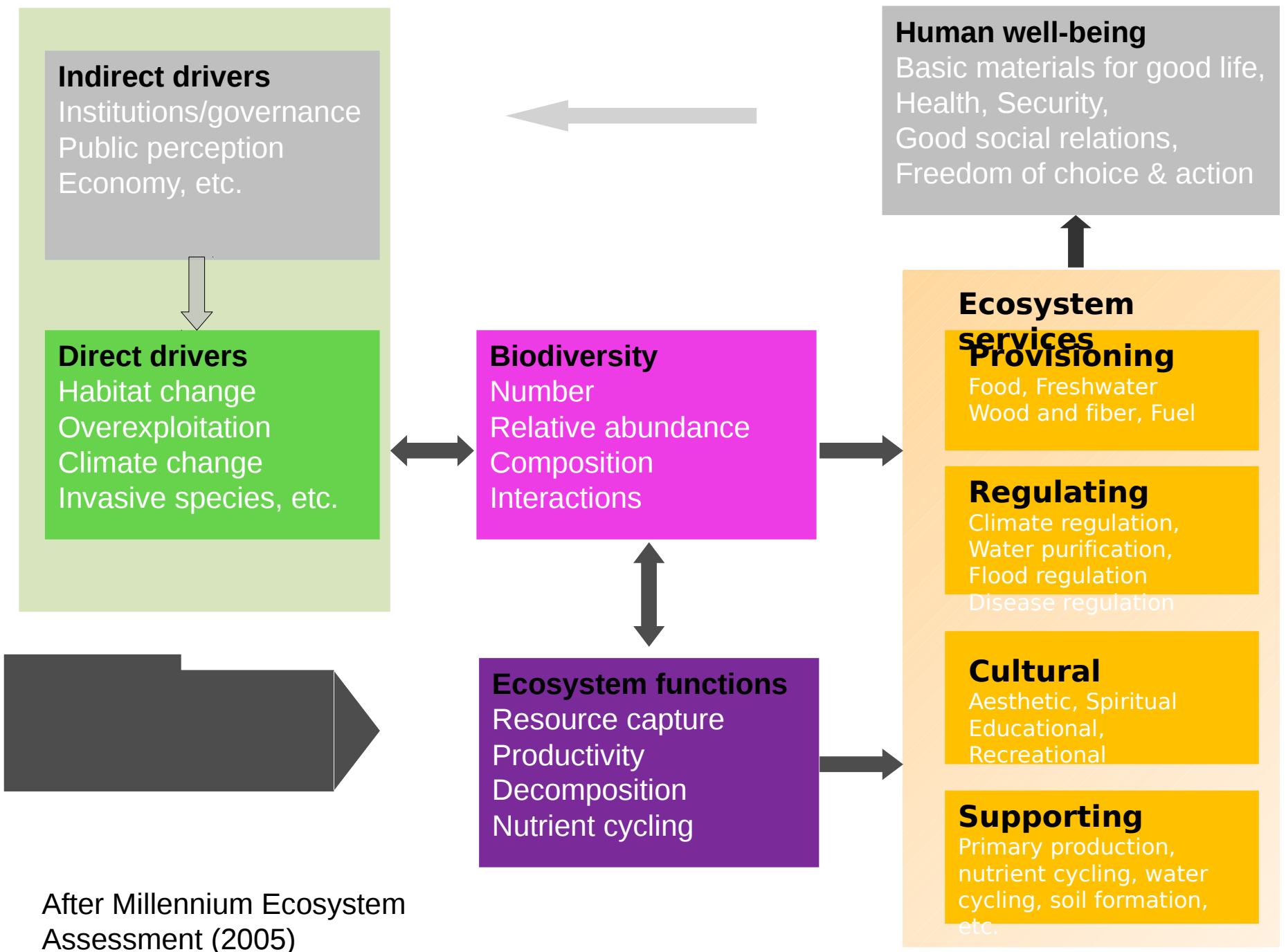
Mechanism: ecological niche partitioning

Cardinale, Nature 2011

InVEST: Integrated valuation of ecosystem services & tradeoffs

Managed Timber Production	**Water Purification Reservoir**	**Carbon Storage & Sequestration**	**Aquaculture**	**Marine Water Quality**
Crop Pollination	**Hydropower Production**	**Aesthetic Quality**	**Fisheries**	**le Energy Producti**
Agricultural Production	**Groundwater Recharge**	**Recreation**	**Coastal Vulnerability**	
Sediment Retention	**Flood Risk & Mitigation**	**Habitat Risk & Biodiversity**	**Coastal Protection**	

China's new system of Ecosystem Function Conservation Areas

Legend

Major ecosystems services

- Soil conservation
- Water resources conservation
- Flooding mitigation
- Biodiversity conservation
- Sandstorm prevention

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After Millennium Ecosystem
Assessment (2005)

Latest assessment: The Global Biodiversity Outlook 3 (2010)
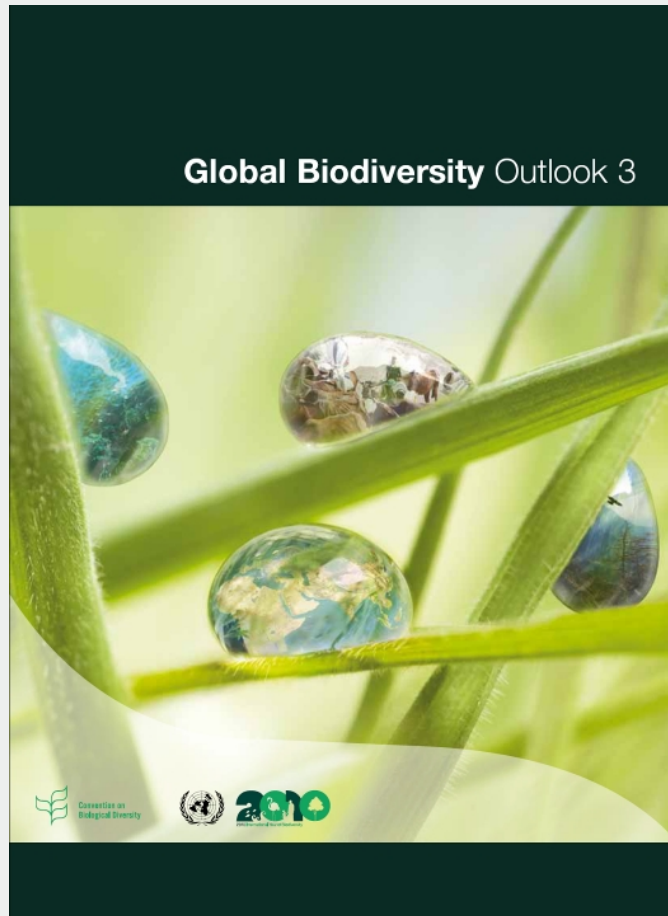
Some features of GBO-3:

- Sense of urgency (biodiversity crisis)

- Focus on indirect drivers

- Tipping points

The information behind GBO-3:

- 110 National Reports

- 500 scientific papers
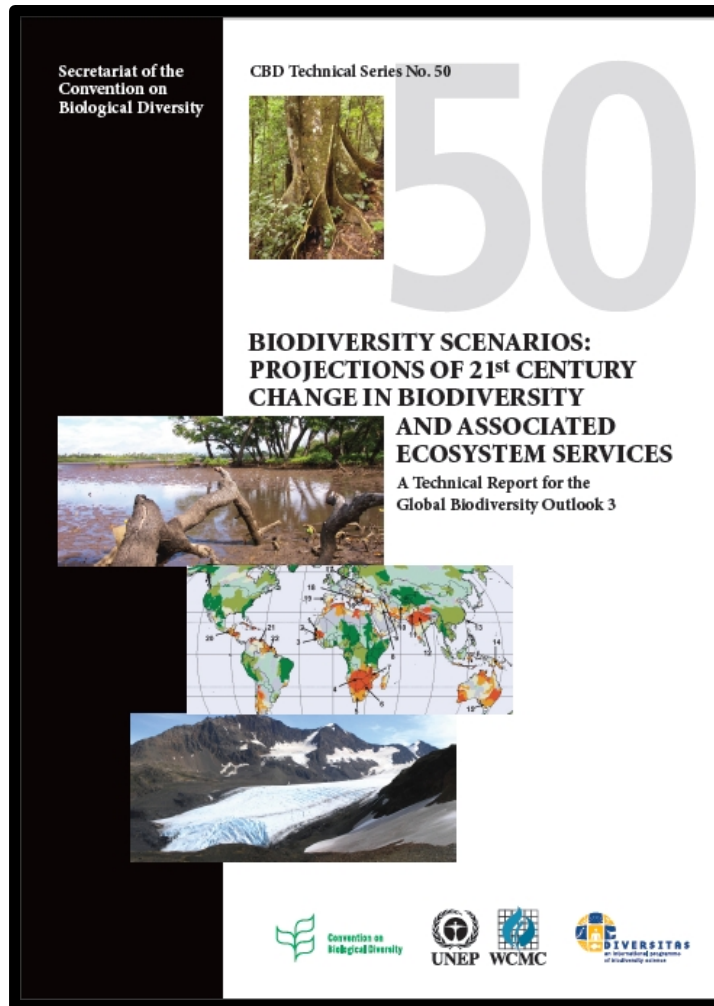
- Open review process

Living Planet Index
(abundance)

Globally, abundance of vertebrates declined by one third compared to 1970

Size of 7 100 populations of 2 300 species of mammals, fish, birds, reptiles & amphibians measured through time.
WWF, ZSL

Living Planet Index

Temperate

Global

Tropical

GBO-3, 2010
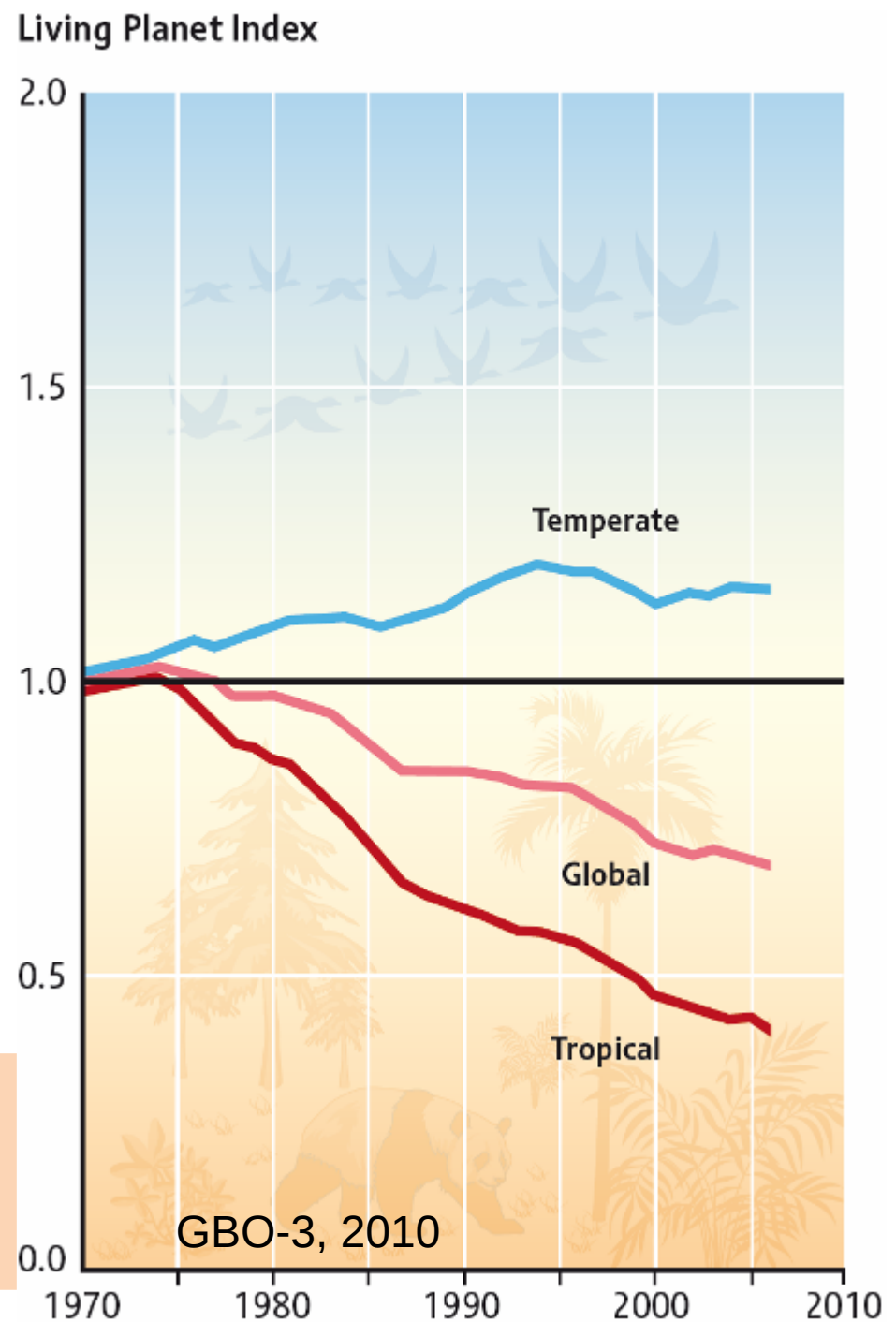
Biodiversity Scenarios

A synthesis and assessment of projections of 21st century changes in biodiversity and associated ecosystem services based on an analysis of a broad range of existing models, experiments and observations

Pereira H, Leadley P et al.
Scenarios of global biodiversity in the 21st century.
Science, 26 Oct 2010

What is a tipping point?

Pressures

Tipping point

Threshold

Existing biodiversity

Time lag

CHANGED STATE

Self-perpetuating

Actions to increase resilience

Long lasting/hard to reverse

SAFE

OPERATING

SPACE

Less diverse
Fewer ecosystem services
Degradation of human well being

Changed biodiversity
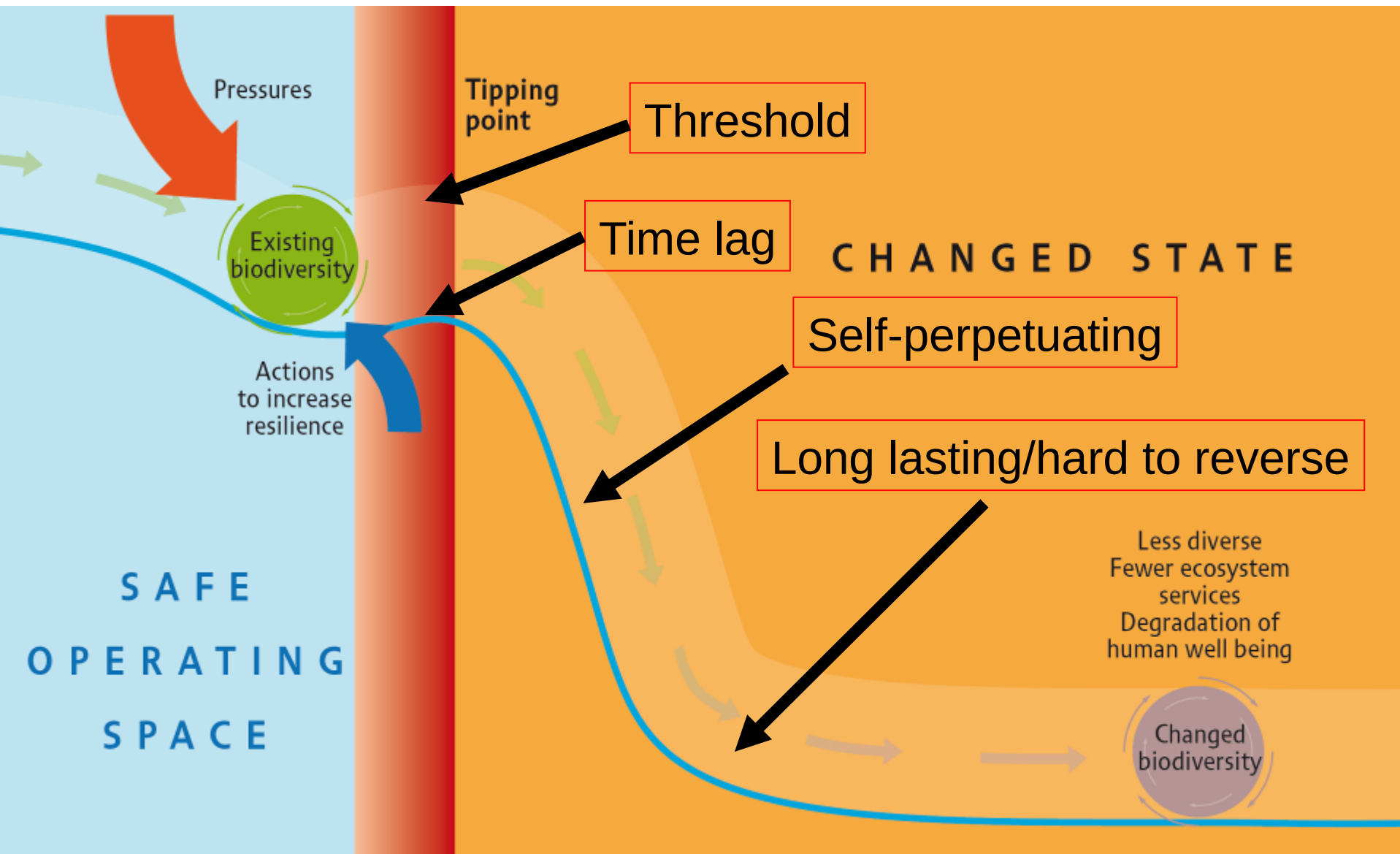
DISTRIBUTION of TIPPING POINTS
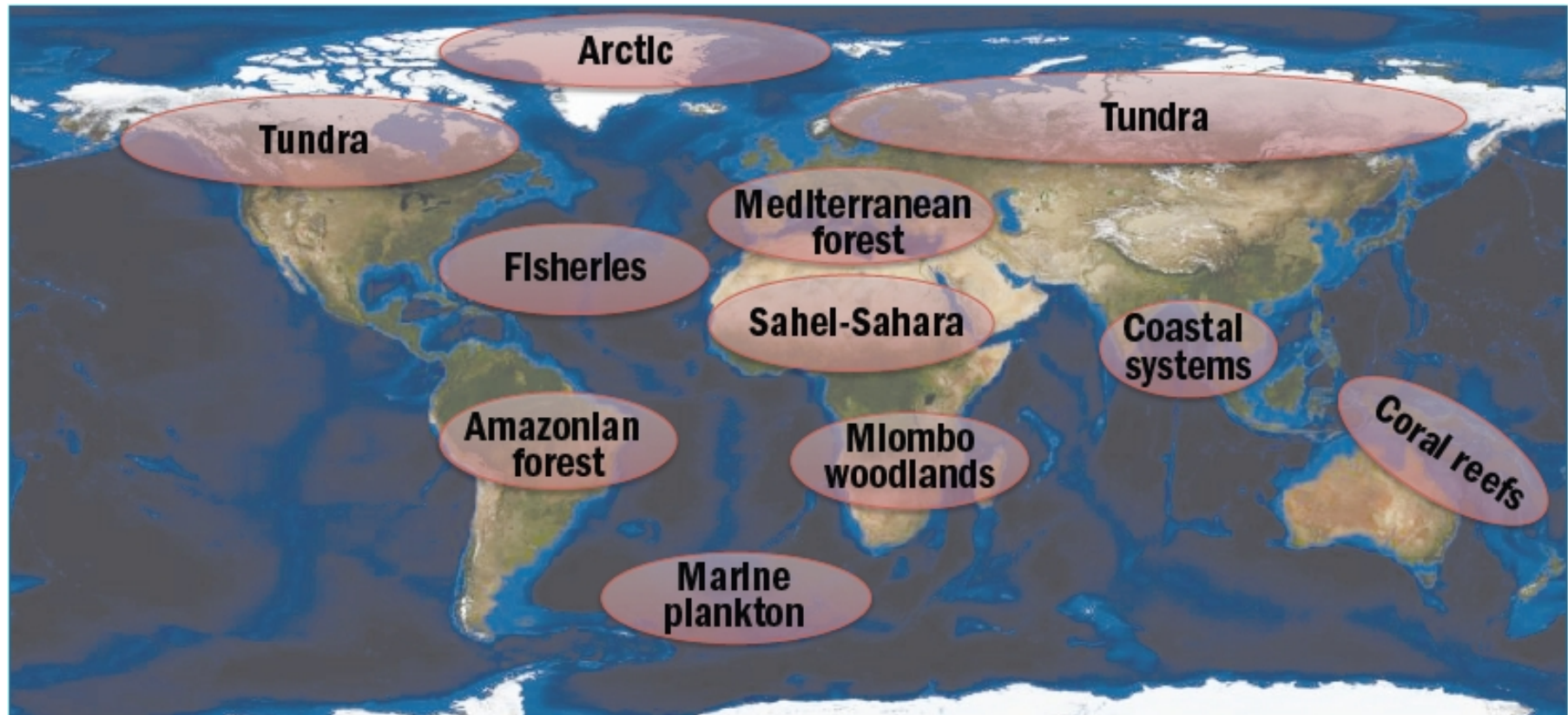
FIGURE 1 | MAP OF THE DISTRIBUTION OF TIPPING POINTS OF GLOBAL IMPORTANCE.

Base map is the NASA Blue Marble Next Generation, a MODIS-derived 500m true color earth dataset. Source: onearth.jpl.nasa.gov/.
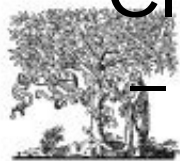
- Cliquez pour modifier les styles du texte du masque
  - Deuxième niveau
    - Troisième niveau
      - Quatrième niveau
        - Cinquième niveau

Program on ecosystem change and society: an international research strategy for integrated social-ecological systems

Stephen R Carpenter[1], Carl Folke[2,3], Albert Norström[2], Olof Olsson[2], Lisen Schultz[2], Bina Agarwal[4], Patricia Balvanera[5], Bruce Campbell[6], Juan Carlos Castilla[7], Wolfgang Cramer[8,9], Ruth DeFries[10], Pablo Eyzaguirre[11], Terry P Hughes[12], Stephen Polasky[13], Zainal Sanusi[14], Robert Scholes[15] and Marja Spierenburg[16]

The Program on Ecosystem Change and Society (PECS), a new initiative within the ICSU global change programs, aims to integrate research on the stewardship of social-ecological systems, the services they generate, and the relationships among natural capital, human wellbeing, livelihoods, inequality and poverty. The vision of PECS is a world where human actions have transformed to achieve sustainable stewardship of social-ecological systems. The goal of PECS is to generate the scientific and policy-relevant knowledge of social-ecological dynamics needed to enable such a shift, including mitigation of poverty. PECS is a coordinating body for diverse independently funded research projects, not a funder of

Corresponding author: Carpenter, Stephen R (srcarpen@wisc.edu)

The Programme on Ecosystem Change and Society (PECS) aims to integrate research on the stewardship of social—ecological systems, the services they generate and the relationships among natural capital, human wellbeing, livelihoods, inequality and poverty.

Biodiversity science-policy interface

Outline

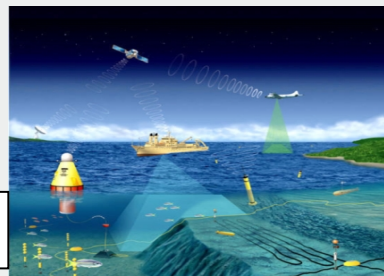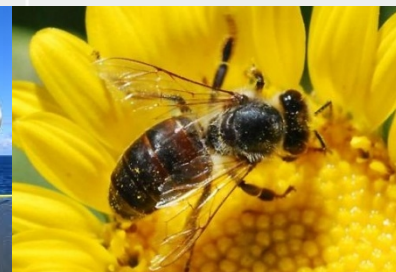

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Closing the loop

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After Millennium Ecosystem Assessment (2005)

What drives individual & collective behavioural change?
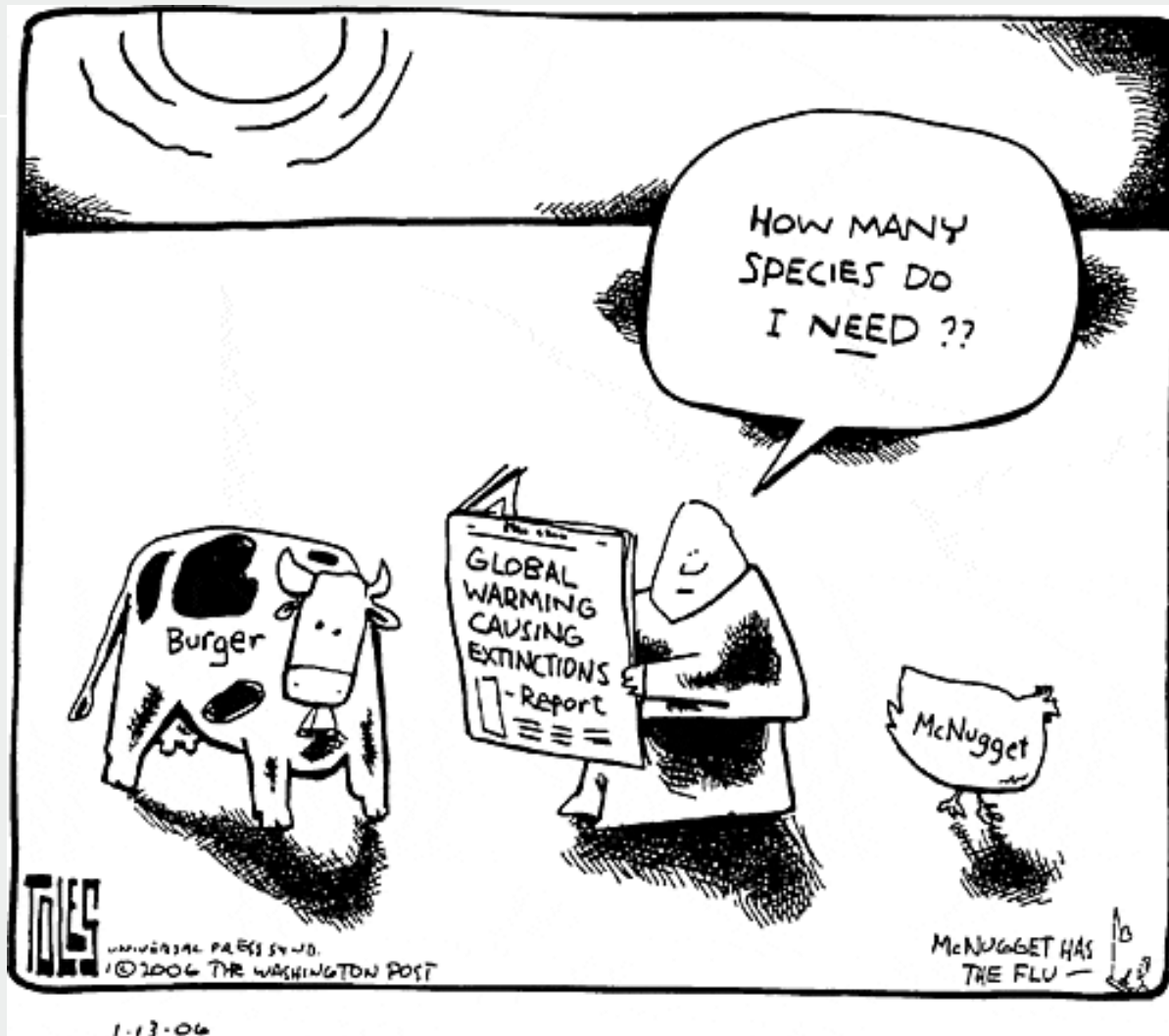
New goals:

- Develop a strong social science component to biodiversity & ecosystem services science
- Become more solution oriented:
  - Focus on proposing management tools
- Become more user driven:
  - Forge new partnerships with various stakeholders groups (NGOs, business, etc.)
- Become more policy relevant:
  - Forge ties with key policy mechanisms (IPBES)

- Challenge 1: Identify urgent detrimental changes in biodiversity & ecosystem services and provide the knowledge to avoid, limit or mitigate such changes

- Challenge 2: Enhance the capacity of socio-ecological systems to support biodiversity & ecosystem services under global change

- Challenge 3: Develop the knowledge base on the use and conservation of biodiversity to sustain ecosystem services and human well-being

- Challenge 4: Build a global network of biodiversity science

Challenge: Implement this agenda as part of Future Earth

We need to improve our capacity to:

- Observe:
  - Build a global observing system for biodiversity & ecosystem services (GEO BON)
- Predict:
  - Threshold/tipping points
  - Build models and scenarios (IPBES)
- Respond (confine/innovate):
  - Build more resilient systems
  - Develop tools for decision making (include values of ecosystem services into tools & management)

DIVERSITA

Thank you for your attention!
anne@diversitas-international.org
wolfgang.cramer@imbe.fr