



The Science of OT-Med: Integrated Modelling of Ecosystem Services

Wolfgang Cramer,





Why ecosystem services?

“Ecosystems and the services provided by them have been the very foundation of human socio-cultural development in the Mediterranean basin for many millennia – both from the land and from the sea.”



The value of the world's ecosystem services and natural capital

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The services of ecological systems and the natural capital stocks that produce them are critical to the functioning of the Earth's life-support system. They contribute to human welfare, both directly and indirectly, and therefore represent part of the total economic value of the planet. We have estimated the current economic value of 17 ecosystem services for 16 biomes, based on published studies and a few original calculations. For the entire biosphere, the value (most of which is outside the market) is estimated to be in the range of US\$16–54 trillion (10^{12}) per year, with an average of US\$33 trillion per year. Because of the nature of the uncertainties, this must be considered a minimum estimate. Global gross national product total is around US\$18 trillion per year.

Because ecosystem services are not fully 'captured' in commercial estimate represents a minimum value, which would probably

Ecosystem Service Supply and Vulnerability to Global Change in Europe

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Global change will alter the supply of ecosystem services that are vital for human well-being. To investigate ecosystem service supply during the 21st century, we used a range of ecosystem models and scenarios of climate and land-use change to conduct a Europe-wide assessment. Large changes in land use typically resulted in large changes in ecosystem service supply. Some of these trends may be positive (for example, increases in forest area and productivity) or offer opportunities (for example, "surplus land" for agricultural intensification and bioenergy production). However, many changes increase vulnerability as a result of a decreasing supply of ecosystem services (for example, declining soil fertility, declining water availability, increasing risk of forest fires), especially in the Mediterranean and mountain regions.

To sustain a future in which the Earth's life-support systems are maintained and human needs are met, human activities must first be recognized as an integral component of ecosystems (1, 2). Scenarios of global change raise

models. A dialogue with stakeholders from relevant sectors was conducted throughout the study (4).

Our assessment was based on multiple scenarios for major global change drivers

2080, relative to baseline conditions in 1990 (5). Socioeconomic trends were developed from the global Intergovernmental Panel on Climate Change Special Report on Emission Scenarios (IPCC SRES) storylines B1, B2, A1FI, and A2 for EU15+ (4, 6, 7) (table S1). With this common starting point, socioeconomic changes relate directly to climatic changes through greenhouse gas concentrations and to land-use changes through climatic and socioeconomic drivers, such as demand for food. Four general circulation models (GCMs)—the Hadley Centre Coupled Model Version 3 (HadCM3), the National Center for Atmospheric Research-Parallel Climate Model (NCAR-PCM), the Second Generation

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Mainstream 2004

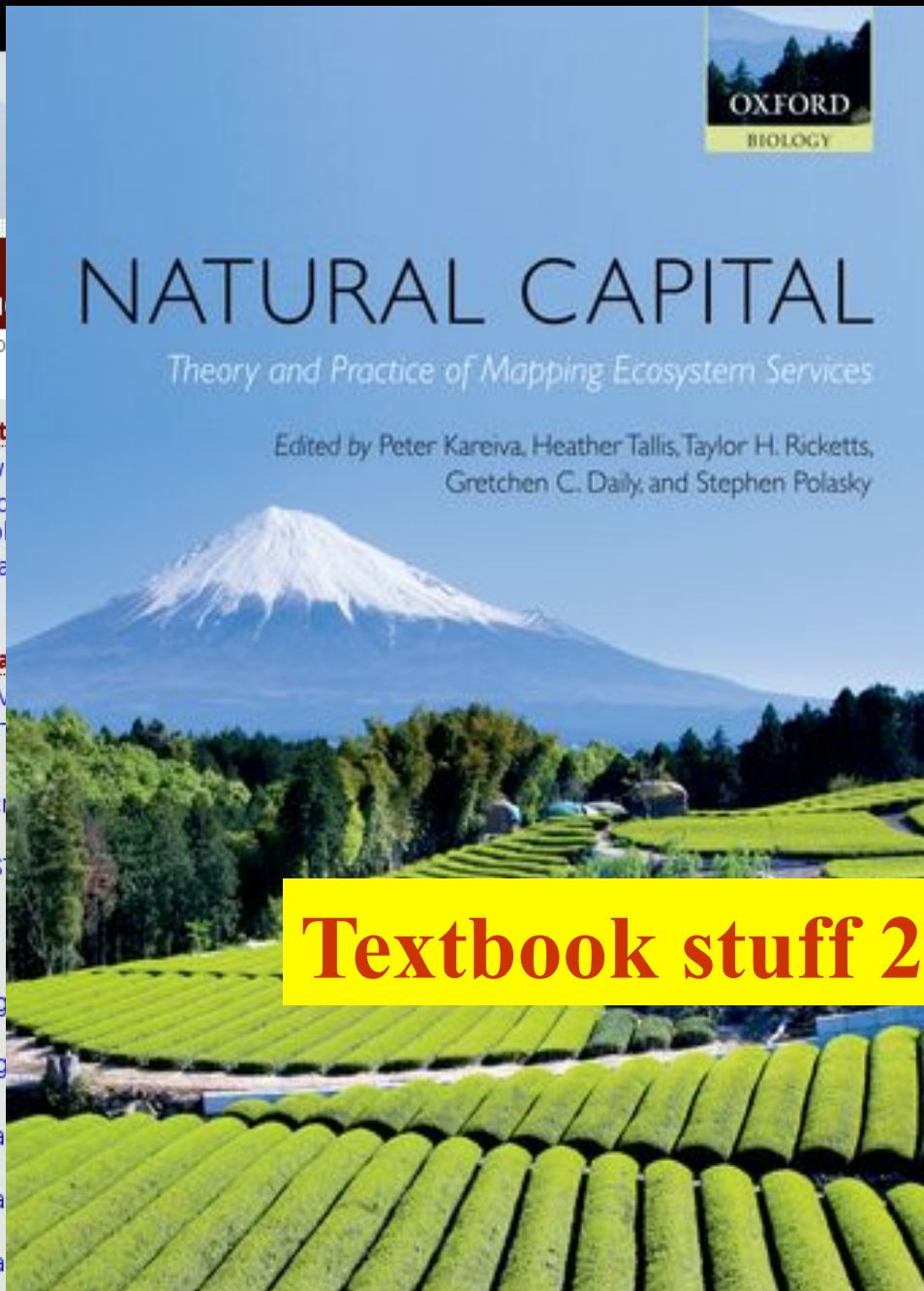
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Textbook stuff 2011

Ecosystem goods and services

(as defined by the Millennium Ecosystem Assessment)

**Agricultural
Lands**

**Coastal
Zones**

**Forest
Lands**

**Freshwater
Systems**

**Arid Lands &
Grasslands**



Food and Fiber Production
Provision of Pure and Sufficient Water
Maintenance of Human Health
Maintenance of Biodiversity
Storage of Carbon, Nitrogen, Phosphorus

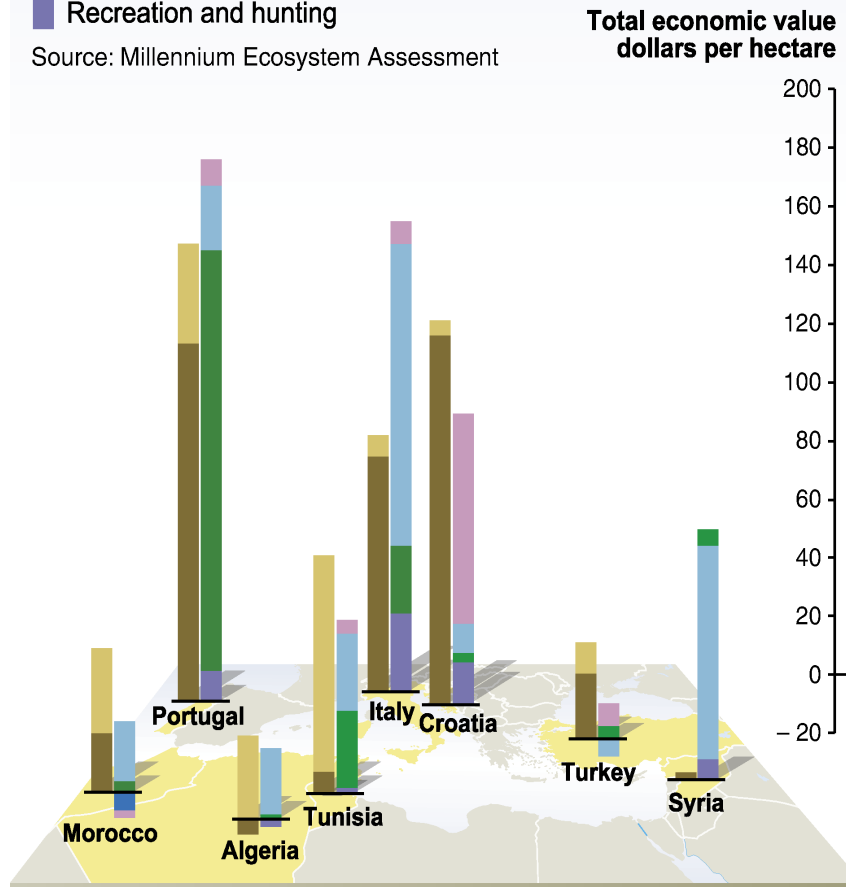
Left column: Commonly measured economic values

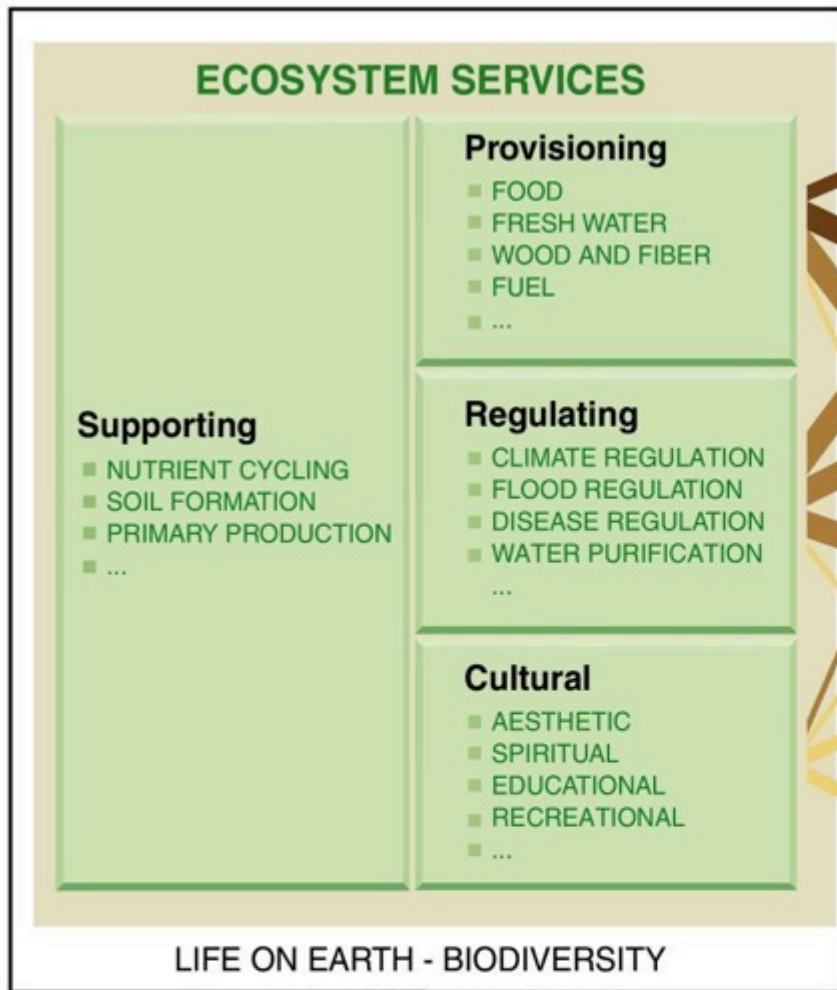
- Grazing
- Timber and fuelwood

Right column: Nonmarketed and other economic values

- Carbon sequestration
- Watershed protection
- Non-timber forest products
- Recreation and hunting

Source: Millennium Ecosystem Assessment





CONSTITUENTS OF WELL-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

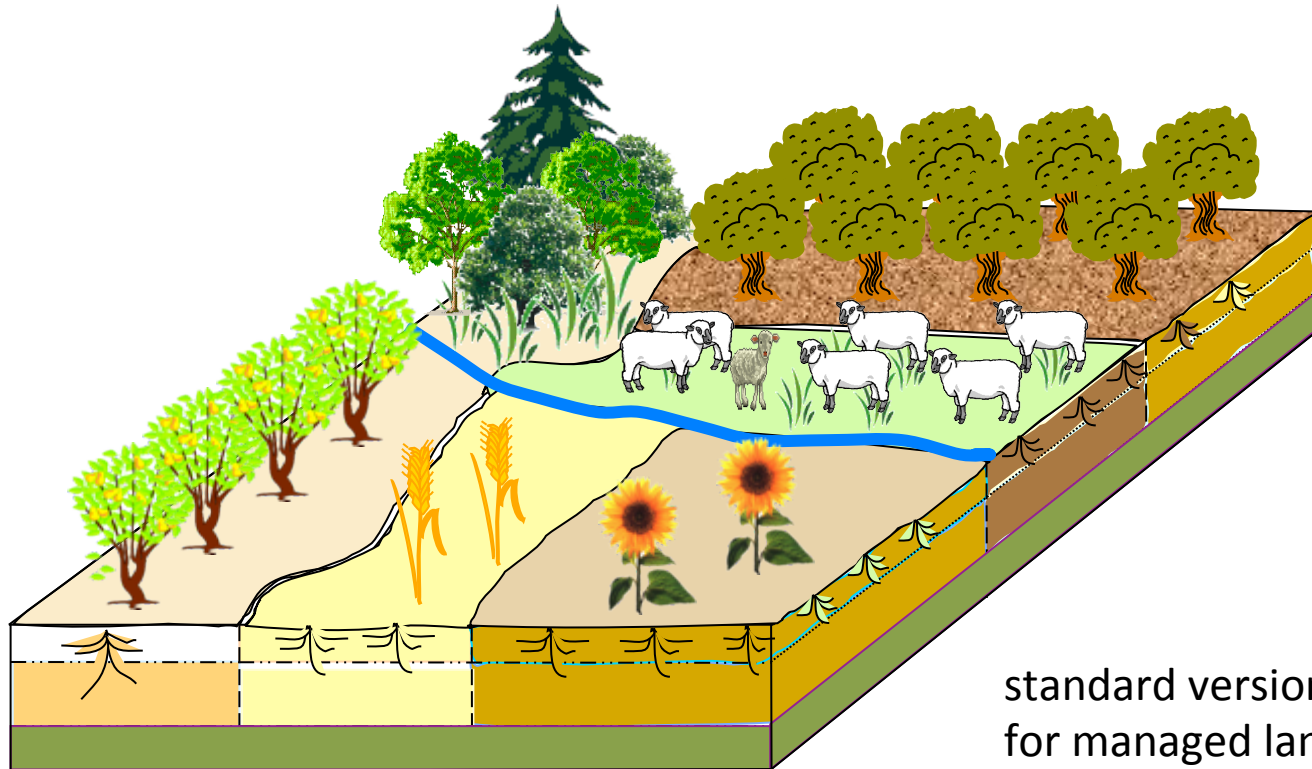
- Weak
- Medium
- Strong



Ecosystem services for sustainability

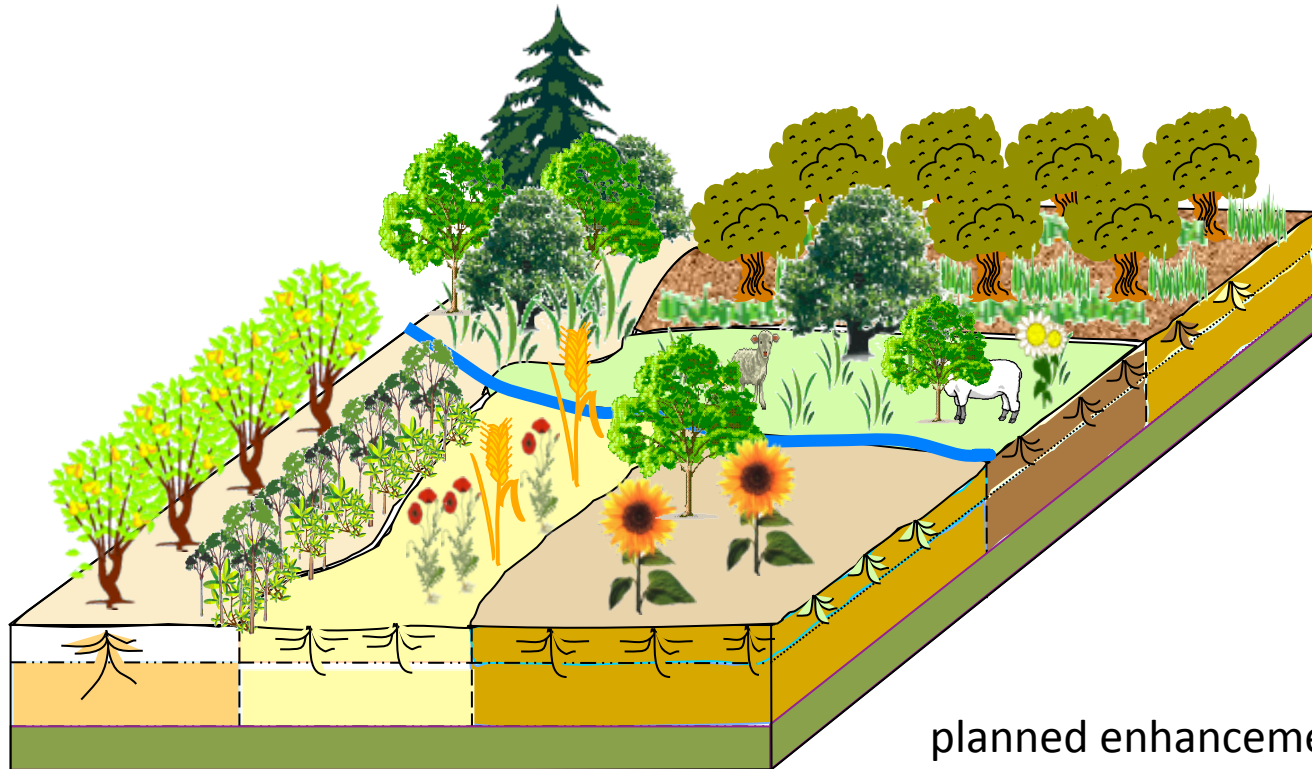
- Goods and services for near-term economic benefits:
 - agricultural yields, fish, timber
 - water purification, etc.
- Goods and services for near-term social benefits
 - environmental quality
 - biodiversity conservation
- Goods and services for long-term sustainability
 - maintenance of soils and the marine environment

The Lund-Potsdam-Jena Dynamic Global Ecosystem Model LPJmL

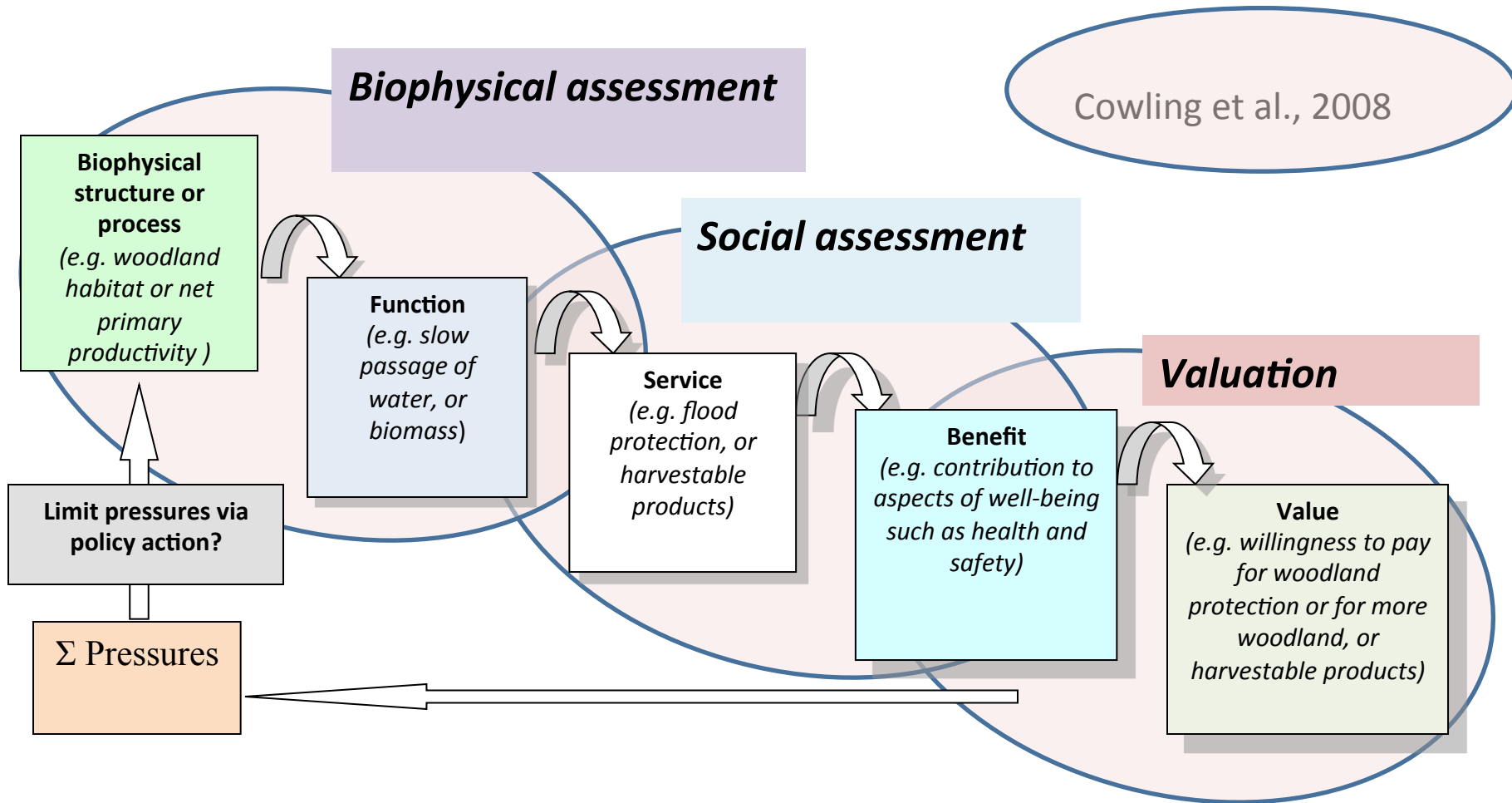


standard version
for managed land

The Lund-Potsdam-Jena Dynamic Global Ecosystem Model LPJmL



Assessment approaches



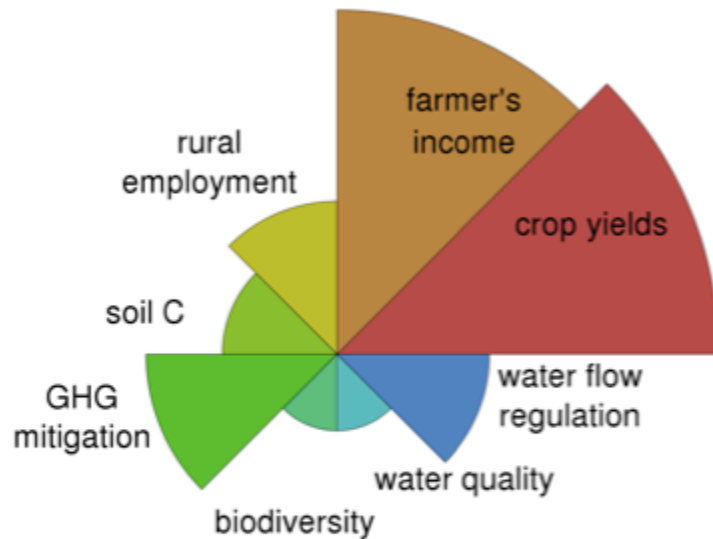
Assessment methods are complementary and co-dependent processes...

[modified according to Potschin & Haines-Young, 2011, PiPG]

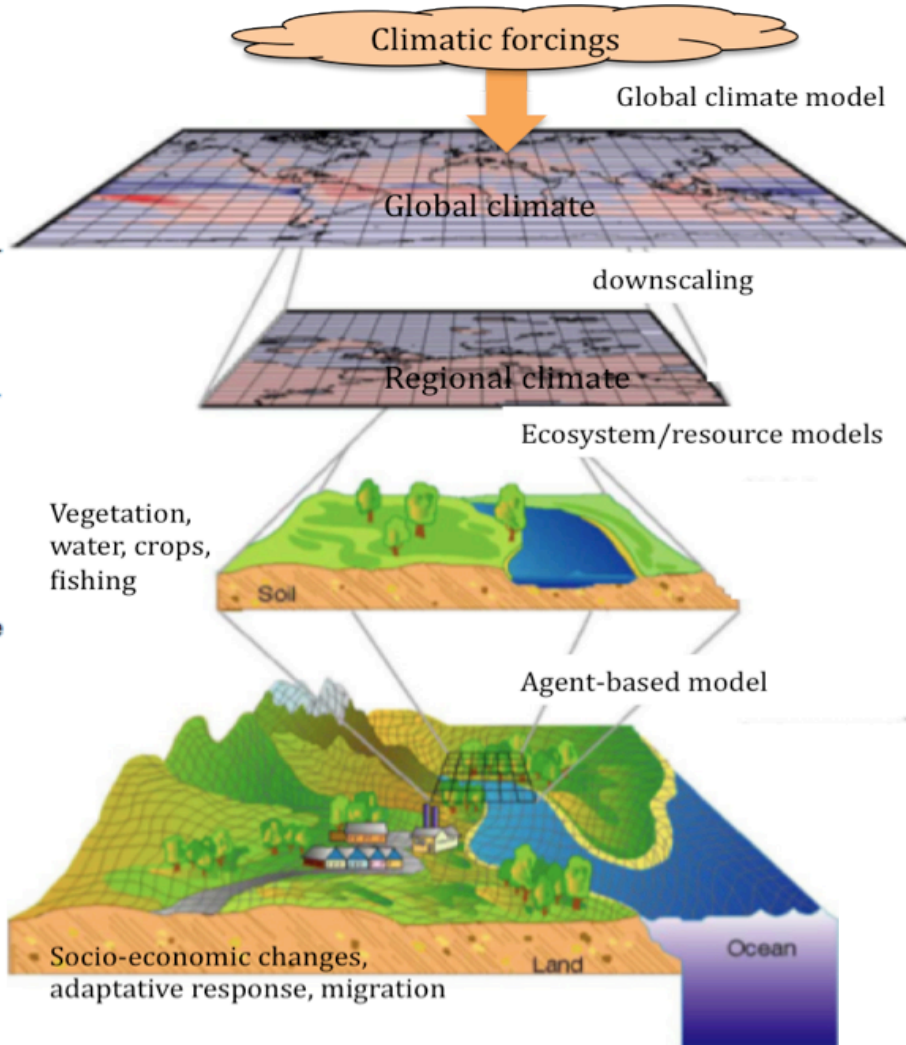
Ecosystem services provided by different land use systems (hypothetical)



“conventional”



Integrated modelling of the Mediterranean systems



- Simulations with coupled climate models (IPSL, CNRM, LOVECLIM)
- Terrestrial ecosystem models: natural vegetation, hydrology, agrosystems (LPJ-Guess, LPJmL), soils
- Ocean model: circulation, biogeochemical cycles, ecology (Eco3M)
- Behaviour of human societies in response to climate stresses
- Model coupling and data assimilation
- Simulations for the past, present and future



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Report of IPBES Panama meeting now available

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The meeting report from the second session to determine the modalities and institutional arrangements for IPBES is now available, including in annex I the resolution to which 94 Governments consented, establishing IPBES. Annex II to the meeting report contains the