KNEU–WP3 workshop: demonstration case ‘floodplain management’

November 7th – 9th 2012

Hainburg an der Donau

On the value of nature - the concept of „Ecosystem Services“

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University of Vienna
Content

1. Background

2. History of ESSs

3. What are ESSs?

4. Integrative evaluation concepts
   - Quantification and visualisation of ESSs
   - Evaluation methods
   - Application

5. The Economics of Ecosystems and Biodiversity (TEEB)

6. ESSs as policy issues
24 % of terrestrial surface are cultural systems

- until 2050 further 10-15 % grasslands and forests will be converted
- Water extraction from rivers doubled since 1960 (70 % für agriculture)
- 20 % of corall reefs und 35 % of mangroves are destroyed
Endangered ecosystems and ecosystem services

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The value of nature

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Lacking visibility of services and value of biodiversity in our economic system often caused an inefficient use or the destruction of natural capital!
Concept of ecosystem services

Ecosystem services
(Costanza et al. 1997, MA 2005; TEEB 2010)

• ‘are defined as the contributions that ecosystems make to human well-being, and arise from the interaction of biotic and abiotic processes.’ (CICES, 2010)

Management/Restauration

Institutions & human judgments determining services

Feedback between value perception and use of ESS

Biophysical structure or process
(e.g. vegetation cover, or Net Primary Productivity)

Function
(e.g. slow passage of water, or biomass)

Service
(e.g. flood protection, or harvestable products)

Benefit
(contribution to health, safety, etc.)

Value
(e.g. willingness to pay for protection or harvestable products)

Ecosystems & Biodiversity

after Haines-Young and Potschin, 2010 and Maltby (ed.), 2009
Ecosystem services - a meteoric career

„Ecosystem services“ in scopus

- Origin: Environmental Science, USA

- Previous and parallel discussions in Europe in landscape planning, forestry and agriculture
Ecosystem services of the time

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EU Biodiversity strategy 2020

„the loss of biodiversity and degradation of ecosystem services in the EU by 2020!“

Research funding

Media news, public
‘the value of nature?’ (der Spiegel)
‘we must put a price on nature if we are going to save it’
What is so special about the concept of ESS?

• **Quantitative measurability** of nature’s capital

• **Raising awareness** and visualisation

• Integrating **non marketable services** (ecological and cultural) into decision making processes

• Pointing out the **added value** of restored ecosystems
MA, 2005 – a major step forward

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ECOSYSTEM SERVICES

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

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

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

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

LIFE ON EARTH - BIODIVERSITY

CONSTITUENTS OF WELL-BEING

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
Supporting services

- Nutrient cycling
- Soil formation
- Primary production
- ....
- biodiversity as basis of many ESSs
Provisioning services

- **Food**
  - Cereals, fruits, vegetables
  - Livestock raising
  - Fisheries
  - Hunting

- **Raw materials**
  - Wood
  - Fibers
  - Fuels
  - Chemical raw materials

- **Freshwater**

- **Genetic resources**
  etc.
Regulation services

- Air pollution prevention
- Climate regulation
  - global (CO₂-retention)
  - regional und local
- Erosion control, flood protection
- Water purification
- Mitigation of epidemics, calamities und extreme natural events
- Pollination
  (Gallai et al. 2009; €153 billion)
Cultural services

- Spiritual and religious values
- Cultural importance
- Education
- Aesthetic values, inspiration
- Identity
- Recreation and tourism
## Classifications - overview

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</thead>
<tbody>
<tr>
<td>supporting</td>
<td>supporting</td>
<td>supporting</td>
<td>provisioning</td>
<td>provisioning</td>
</tr>
<tr>
<td>production of goods</td>
<td>provisioning</td>
<td>provisioning</td>
<td></td>
<td>provisioning</td>
</tr>
<tr>
<td>regulation</td>
<td>regulation</td>
<td>regulating</td>
<td></td>
<td>regulation and maintenance</td>
</tr>
<tr>
<td>cultural</td>
<td>cultural</td>
<td>cultural and amenity</td>
<td>cultural</td>
<td></td>
</tr>
<tr>
<td>habitat</td>
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</tbody>
</table>

**common classification in mapping, assessment and accounting** would provide an integrated and holistic perspective.
MAES working group aims at providing

- an analytical framework for ecosystem assessments under Action 5 of the EU Biodiversity Strategy to 2020
CICES classification, MAES 2012

- as **generic** as possible
- **flexible and hierarchical** classification that can be adapted to the specific situation and needs of Member States
- a **five** level hierarchical structure (section – division – group – class – class type)

- more **user-friendly** and provides greater clarification on what ecosystem services are included within each class
- Member states use the hierarchical structure to show where the focus of their work lies, or aggregate measurement into the broader groupings for reporting or for making comparisons
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Assessment and mapping of ESS

GLOBAL

REGIONAL

LOCAL

Human well-being and poverty reduction
- Basic material for a good life
- Health
- Good social relations
- Security
- Freedom of choice and action

Indirect drivers of change
- Demographic
- Economic (e.g., globalization, trade, market, and policy framework)
- Socio-political (e.g., governance, institutional and legal framework)
- Science and technology
- Cultural and religious (e.g., beliefs, consumption choices)

Ecosystem services
- Provisioning (e.g., food, water, fiber, and fuel)
- Regulating (e.g., climate regulation, water, and disease)
- Cultural (e.g., spiritual, aesthetic, recreation, and education)
- Supporting (e.g., primary production, and soil formation)

Direct drivers of change
- Changes in local land use and cover
- Species introduction or removal
- Technology adaptation and use
- External inputs (e.g., fertilizer use, pest control, and irrigation)
- Harvest and resource consumption
- Climate change
- Natural, physical, and biological drivers (e.g., evolution, volcanism)

LIFE ON EARTH - BIODIVERSITY

Strategies and interventions

Source: Millennium Ecosystem Assessment
### List of indicators: examples for AUT

<table>
<thead>
<tr>
<th>Service Typ (MA)</th>
<th>Service</th>
<th>Benefit</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provision and regulation service</td>
<td>Natural freshwater</td>
<td>Federal Ministry for Health. Freshwater report</td>
<td>Freshwater from untreated springs and groundwater resources (Mio. m³ Water/year)</td>
</tr>
<tr>
<td>Regulation service</td>
<td>Pollination</td>
<td>Contribution to agriculture/forestry and food industry</td>
<td>Number and quality of pollen and nectar producing plant species; average density of honey bees</td>
</tr>
<tr>
<td>Provision service</td>
<td>Genetic resources</td>
<td>contribution to agriculture and food industry</td>
<td>Harvest/income from rare races of livestock (e.g. milk), rare agricultural crops (t, ha)</td>
</tr>
<tr>
<td>Cultural service</td>
<td>Recreation</td>
<td>Well-being, recreation</td>
<td>Number of hunters, number of fishermen; km hiking trails, number of nature park, etc.</td>
</tr>
</tbody>
</table>

1. **Background**
2. **History of ESSs**
3. **What are ESSs?**
4. **Integrative evaluation concepts**
5. **The Economics of Ecosystems and Biodiversity (TEEB)**
6. **ESSs as policy issues**
Linkage of ESS data with spatial data

Global:
- ESS data (often from literature) linked with land cover categories (Costanza et al. 1997)

Regional and local:
- empirical data (surveys, literature) linked with spatial data (e.g.: grid units, municipalities, districts, biotop networks, landscape elements) (Hermann et al. in press, regional TEEB studies)
Examples of maps

Global map of value (Costanza et al. 1997, Nature)

(Troy and Wilson 2006)
Assessment of ESS - Problems

- Lack of suitable indicators! (no existing data, too expensive, too complex…)

- Different ESSs affect at different scales (spatial and temporal)
  - Are exact deliniations in a map possible / meaningful??

- Problem at aggregating data at spatial units
  - Loss of information

- Ecosystems can be synchronously „service provider“ and „service suppressor“ for the same service (z.B.: greenhouse effect)
Multifunctionality and trade offs among ESSs

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Case study „Neusiedlersee – Fertö“ (AT/HU), Hermann et al. in press
Valuation

• Gives „weights“ for goods in decision-making processes
• Underline that ESSs are a limited ressource
• Use/Consumation of ESSs is not free of cost (as we consume someth that has a value)
Methods for valuation

- Monetary methods
  - tradable goods:
    - directe market values (cost-based)
  - non-tradeable resources:
    - Revealed preferences: e.g.: travelling costs, hedonic costs
    - Stated preferences: Contingent Valuation Method (e.g.: costs for mitigation, costs for replacement/restoration), choice modelling

- Integrative methods
- Participative methods
- Hybride methods
Problems with (monetary) valuation

- Uncertainties, caused by **lack of knowledge on ecosystem dynamics and preferences** as well as due to practical problems
- Troubles to deal with events that are disastrous but occur with low probability
- Praxis of benefit transfers (cf. Costanza et al. 1997)
- Discounting benefits
Monetary evaluation: Case study

Ecosystem benefits to a city in the developed world
The case of greater London, UK

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Flooding
London has 1.2 million people living in a floodplain, at increasing risk from rising sea level. London contributes to climate change by emitting 53 million tonnes of CO₂ each year. The tropical forests of Masoala National Park in Madagascar store 44 million tonnes of CO₂.

Existence values
The Royal Society for the Protection of Birds, with 120,000 members in London, is working to conserve 101,000 ha of rainforest in Indonesia and 75,000 ha in Sierra Leone, in addition to 200 reserves within the UK.

Physical and mental health
There are at least 22,500 children in London under the age of ten with Attention Deficit Hyperactivity Disorder, which puts them at greater risk of dropping out of school and becoming involved in crime. Children given the opportunity to interact with nature (for example at the London Wetlands Centre, which has 180,000 visitors each year) show a 30% improvement in symptoms.
Global study

- Initiated by the G8+5-countries in Potsdam (Germany) in 2007

- Deals with the "global economic benefits of biological diversity" and the costs of biodiversity loss caused by non-action in terms of conservation management in relation to cost-benefits of effective and proactive nature conservation

- Several reports (basic principles/methods, specific reports for several stakeholder groups)

- TEEB offers an approach that support decision makers, in recognizing the values of ecosystems, and to consider them in their decisions
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The Goals

• To review the current state of the science and economics of ecosystems and biodiversity, and recommend a valuation framework and methodologies

• To address the needs of the “end-users” of these economics: policy-makers, local administrators, corporations and citizens

• To mainstream the economics of ecosystems and biodiversity
TEEB rationale - challenges

• Clearly communicate the chances but also the trade-offs and problems of valuation and economic approaches
• Explicitly address the ethical dimension of the approach
• Discuss the approach in (very) different contexts
• Make clear that the approach is an add-on argument to other arguments to safeguard biodiversity
The Economics of Ecosystems & Biodiversity

TEEB’s main reports

- Science & Economics Foundations
- Policy Evaluation for National Policy-Makers
- Evaluation & Decision Support for Local and Regional Policy
- Business Risks & Opportunities
- Synthesis
TEEB for Citizens - a social network approach

www.teeb4me.com // www.bankofnaturalcapital.com
TEEB - MOFILM contest

- MOFILM “crowd sources” videos for global brands (Unilever, Walmart, Coke, Pepsi, etc. etc.) and a few social causes, helping aspiring filmmakers showcase their talent.

- MOFILM chose TEEB as their 2010 social cause thanks to a pitch by TEEB’s Indian partner.

- 55 Film entries

- Top 25 TEEB films will be made available for “social media” outreach, school education, CBD, ....
TEEB Videos – Pavan SUKHDEV

www.bankofnaturalcapital.com


http://fora.tv/2010/08/03/Pavan_Sukhdev_What_Is_the_World_Worth
Adding value through protected areas
Investing in ecological infrastructure
Addressing losses through regulation and pricing
Reforming environmentally harmful subsidies
Rewarding benefits through payments and markets
Investing in ecological infrastructure
The approach for the local & regional level

Six steps for effectively appraising ecosystem services

This approach is not a fixed recipe. It is intended to guide policy makers in designing their own processes:

1. Specify and agree the policy issue with stakeholders.
2. Identify which ecosystem services are most relevant.
3. Define the information needs and select appropriate methods.
4. Assess ecosystem services.
5. Identify and appraise policy options.
6. Assess distributional impacts of policy options.
Recommendations:
Make Nature’s values visible…

The destruction of nature has now reached levels where serious social and economic costs are being felt – and will be felt at accelerating pace under “business as usual“

- Assess and Communicate the role of biodiversity and ecosystem services in the economy
- Ensure public disclosure of, and accountability for, impacts on nature
Recommendations:
Measuring better to manage better

Natural resources are economic assets, whether or not they enter the marketplace.

Conventional measures of national economic performance (eg: GDP Growth) fail to reflect these stocks and their benefits flows.

- Rapidly upgrade the System of National Accounts (SNA) to include changes in natural capital stocks and ecosystem service flows.
- URGENT: physical accounts for forest stocks / carbon storage need to be in place (e.g. for orderly development of REDD+).
Recommendations: Natural capital and poverty reduction

Ecosystem services dependency

<table>
<thead>
<tr>
<th>Country</th>
<th>Population</th>
<th>Ecosystem Services Dependency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>99 million</td>
<td>21%</td>
</tr>
<tr>
<td>India</td>
<td>352 million</td>
<td>16%</td>
</tr>
<tr>
<td>Brazil</td>
<td>20 million</td>
<td>10%</td>
</tr>
</tbody>
</table>

Ecosystem services as a % of classical GDP

<table>
<thead>
<tr>
<th>Country</th>
<th>Population</th>
<th>Ecosystem Services % of Classical GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>99 million</td>
<td>75%</td>
</tr>
<tr>
<td>India</td>
<td>352 million</td>
<td>53%</td>
</tr>
<tr>
<td>Brazil</td>
<td>20 million</td>
<td>90%</td>
</tr>
</tbody>
</table>

Ecosystem services as a % of “GDP of the Poor”

<table>
<thead>
<tr>
<th>Country</th>
<th>Population</th>
<th>Ecosystem Services % of GDP of the Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>99 million</td>
<td>47%</td>
</tr>
<tr>
<td>India</td>
<td>352 million</td>
<td>11%</td>
</tr>
<tr>
<td>Brazil</td>
<td>20 million</td>
<td>89%</td>
</tr>
</tbody>
</table>

Source: Gundimeda and Sukhdev, D1 TEEB
Recommendations:
Natural capital and poverty reduction

In many developing countries, poor households rely heavily on natural capital for their survival and livelihoods, and are highly vulnerable to losses of ecosystem services.

- Fully integrate into policy our dependence on ecosystem services, especially their role as a lifeline for poor households.

- Target development interventions & evaluate the social impacts of policies that affect the environment.
The Economics of Ecosystems & Biodiversity

Recommendations:
Ecological infrastructure and climate change

Example: Nature-based climate change mitigation, Germany

- Drainage of 930,000 ha peatlands for agriculture caused emissions of 20 Mio. t of CO$_2$-eq. per year, @ social cost 1.4 billion €
- **Peatland restoration**: low cost, biodiversity friendly mitigation

Mecklenburg-Vorpommern:
- Pilot project 2000-2008
- Restoration of 30,000 ha
- Reduced emissions up to 300,000 t CO$_2$
- Cost of 8 to 12 € / t CO$_2$ (& if extensive grazing / reed production/ alder forest then costs down to 0 to 4 €)

Source: Federal Environmental Agency 2007; MLUV MV 2009; Schäfer 2009
Recommendations:
Ecological infrastructure and climate change

Investing in ecological infrastructure makes economic sense when the full range of benefits is taken into account.

It is usually cheaper to avoid degradation than to pay for restoration, but both are relevant in the context of climate change.

- Ecosystem conservation and restoration should be evaluated & pursued in support of climate change mitigation and adaptation.

- Within the UNFCCC process, REDD+ should be accelerated for implementation: pilot projects & capacity building in developing countries.
Uptake of TEEB (1): Media

The Economics of Ecosystems & Biodiversity

**DER SPIEGEL**

Ecosystem destruction costing hundreds of billions a year

**REUTERS**

U.N. experts warn of economic cost of species loss

**Independent.co.uk**

Loss of biodiversity threatens livelihoods of world's poorest

**TIMES ONLINE**

This stock collapse is petty when compared to the nature crunch. The financial crisis at least affords us an opportunity to now rethink our catastrophic ecological trajectory.

**The Guardian, Tuesday October 14 2008** George Monbiot

**Raubbau kostet Menschheit Billionen**

UN-Artenschützer: Waldverlust verschlingt jährlich sechs Prozent des Bruttosozialprodukts

**Nature loss 'dwarfs bank crisis'**

By Richard Black
Environment correspondent, BBC News website, Barcelona

**The Economic Times India, 30.05.2008**

Nature loss could halve living standards for the world's poor.

30 May, 2008, 1303 hrs IST, ANI

LONDON: An environmental review, headed by an Indian, has concluded that damage to forests, rivers, marine life and other aspects of nature could halve living standards for the world's poor.
Economic report into biodiversity crisis reveals price of consuming the planet
Species losses around the world could really cost us the Earth with food shortages, floods and expensive clean up costs

• UN biodiversity report calls for global action to prevent destruction of nature

Juliette Jowit
guardian.co.uk, Friday 21 May 2010 20.00 BST
Article history
Uptake of TEEB (2): Public discussion

Reactions to the article in The Guardian, 22nd of May, 2010

• Over a thousand tweets, facebook links, & comments on the article

Most frequently discussed topics

1) Why can't preventing global warming and preserving biodiversity go hand in hand?

2) Can we preserve biodiversity and still see development?

3) Can we preserve biodiversity with current levels of population and predicted increased levels of population in the future?

4) Is the free-market/Capitalistic system to blame?

5) There is no future in reducing the whole planet to goods and services and then putting a price on it.

6) If only everyone would be vegetarian...
Uptake in Policy

New CBD strategic plan and some major decisions at COP10

Source: Global Biodiversity Outlook 3 (2010)
Main demands for the future

- TEEB Capacity Building for Developing Countries
- “Country” and “Regional” TEEB Analysis
- Green National Accounts (Project w/ WB, UNEP & Others)
- Estimating Business Sector Externalities
- Identifying & closing knowledge gaps
- Communicating the Issue to Society at Large
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**Application**

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- Awareness raising
- Decision tool at local to international scale
  - Landscape planning
  - Conservation management
  - Compensation payments
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**ESS as policy issue**

- CBD-COP 10
  “Aichi goals and targets” (2010)
• **What is IPBES?**

  • “Intergovernmental science-policy platform on biodiversity and ecosystem services”.

  • IPBES will be an interface between the scientific community and policymakers that aims at building capacity for and strengthen the use of science in policymaking.
Do we need an IPBES?

- Many organizations and initiatives contribute to the science-policy interface on biodiversity and ecosystem services.
- Currently there is no global mechanism recognized by both the scientific and policy communities that brings information together and synthesizes and analyses it for decision-making.
- Following a gap analysis and 3 intergovernmental and multi-stakeholders meetings convened between 2008 and 2010, it was determined that there was a need for a new platform to fill in the gaps in the science-policy interface on biodiversity and ecosystem services.

→ Established in Panama City, April 2012.
• What will IPBES do?

IPBES will respond to requests for scientific information related to BD and ESS from Governments, relevant multilateral environmental agreements and UN bodies, as well as other relevant stakeholders. 4 main functions:

• To identify and prioritize key scientific information needed for policymakers and to catalyse efforts to generate new knowledge;
• To perform regular and timely assessments of knowledge on biodiversity and ecosystem services and their interlinkages;
• To support policy formulation and implementation by identifying policy-relevant tools and methodologies;
• To prioritize key capacity-building needs
ESS as policy issue – IPBES/Biodiversity Knowledge

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Thanks for your attention!!


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