The multiple functions of mountain areas and regulatory services
Global decline of ecosystems and decrease in biodiversity, caused by direct and indirect factors of change

Nine planetary boundaries
- Climate changes
- Modification of the integrity of the biosphere (loss of biodiversity and extinction of species)
- Land system modification (e.g. deforestation)
- Use of fresh water

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) - Global Assessment on Biodiversity and Ecosystem Services, 2019
Sustainable Development Goals: peer and hierarchically ordered vision

- Take urgent action to combat climate change and its consequences
- Ensure the availability and sustainable management of water and sanitation for all
- Protect, restore and promote the sustainable use of terrestrial ecosystems, manage forests sustainably, combat desertification, halt and reverse soil degradation and stop biodiversity loss
- Conservation and sustainably use the oceans, seas and marine resources

Folke et al. 2016
In the mountains, the demand for ecosystem services exceeded the potential demand by more than 3 (THREE) times.
AGRICULTURE

Typical products
150 products including Dop, Igp, Doc and Docg
180 agro-food products surveyed by Slow Food
263 traditional products (Ministerial Decree 8/9/1999)
In the municipalities of the National Parks and regional, in 2000, were surveyed 232,000 farms for a UAA of 1,232,500 ha

FORESTRY

Wood supply chain
Sustainability of uses

ENERGY

Biomass
Wind power
Hydroelectric etc.

ENTERPRISE

Tourism

• summer, winter, seasonal or weekend
• mountain, lake and sea
• cultural and artistic
• religious
• mass tourism
• «hit and run»
• food & wine
• ecological

How many of these activities depend in whole or in part on the natural environment? From Natural Capital?
OPPORTUNITIES AND BUSINESS RESPONSIBILITY

**Organization Models for Sustainability**

- Program 1.1: Environmental Management Systems
  - ISO 14001 Reg. EMAS

- Program 1.2: Management of Social Responsibility
  - SA 8000
  - ISO 26000

- Program 1.3: Management Systems of Health and Safety
  - OHSAS 18001

- Program 1.4: Organizational Models
  - D.Lgs. 231/01
  - D.Lgs. 81/08

**Energy Management and CO2 reduction**

- Program 3.1: Energy Efficiency and Energy Management
  - UNI CEI EN 16001

- Program 3.2: Energy Production from Renewable Sources

- Program 3.3: Energy Diagnoses and Energy Saving Actions

- Program 3.4: Towards a Carbon Free Society
  - ISO 14064 and ISO 14067

**Guide to Corporate Ecosystem Valuation**

A framework for improving corporate decision-making

**GO - GREEN**
KNOWLEDGE CANNOT BE REGARDLESS TO MANAGE THE LARGEST COMPANY WE OWN: NATURAL CAPITAL
You can't manage what you don't know well: knowing the natural capital you have and its effective value, therefore, is the basis of our ability to maximize collective well-being. In economics, then, what is devoid of any monetary value ends up being excessively exploited or ignored.

**Biodiversity Strategy:**
Create protected areas for at least 30% of the European surface
Restore degraded terrestrial and marine ecosystems
- Biological agriculture
- Reduce the harmfulness of pesticides (50% 2030)
- Stop the decline of pollinators
- Restoration of 25,000 km of free-flowing rivers
- Planting 3 billion trees

**Forest Strategies**
Single forest law
Focus on the SE mainly of regulation, provided by the forests

**Regional policies.**
Improvement of work and green growth by investing in green / blue infrastructures

**Energy and Climate Policies** to support adaptation actions

**Agricultural policies** support for sustainable agriculture through an increase in compatible practices: Definition of HNV, Biological, Ecodynamic ...

**Policies on the Sea.** Marine protected areas and improvement of fishing and fight against plastic pollution

- Water" Directive 2000/60 / EC (WFD)
- Floods Directive 2007/60 / EC (FD)
- Nitrates Directive 91/676 / EEC

**LN 221/2015**
Environmental provisions to promote green economy measures and to limit the excessive use of natural resources

**Art. 70**
Delegation to the Government for the introduction of remuneration systems for environmental ecosystem services
... without prejudice to the safeguarding over time of the collective function of the asset
... assignment under concession of a naturalistic asset of common interest, which must keep intact or increase its functions;

**Art. 72**
National strategy of green communities
... sustainable development plan not only from an energy, environmental and economic point of view

**Art. 67**
https://www.minambiente.it/pagina/quarto-rapporto-sullo-stato-del-capitale-naturale-italia-2021
Integrate the accounting of Natural Capital and the objectives of prevention, restoration, management and enhancement of Natural Capital in the territorial planning tools at all levels - DEF (Economic and Financial Document)
the ecological transition is aimed at achieving a green and ecological transition of society and the economy to make the system sustainable and ensure competitiveness. It includes interventions for sustainable agriculture and to improve waste management capacity, investment and research programs for renewable energy sources, investments for the development of the main industrial chains of ecological transition and sustainable mobility. It also provides for actions for the efficiency of public and private real estate assets and initiatives to combat hydrogeological instability to safeguard and promote the biodiversity of the territory and to guarantee the security of supply and the sustainable and efficient management of water resources.
Assets such as food resources, water, air, soil, raw materials, genetic resources, etc., their functional relationships (CO2 fixation, atmospheric gas regulation, purification, soil conservation, etc.) that, combined with human capital artifacts and services, allow humans to achieve and maintain a condition of well-being (Costanza et al., 1997).

### Nature’s Contributions to People (NCP)

<table>
<thead>
<tr>
<th>Material NCP</th>
<th>Non-material NCP</th>
<th>Regulating NCP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Habitat creation and maintenance</td>
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<tr>
<td>2. Pollination and dispersal of seeds and other propagules</td>
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<td></td>
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<tr>
<td>3. Regulation of air quality</td>
<td></td>
<td></td>
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<tr>
<td>4. Regulation of climate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Regulation of ocean acidification</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Regulation of freshwater quantity, location and timing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Regulation of freshwater and coastal water quality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Formation, protection and decontamination of soils and sediments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Regulation of hazards and extreme events</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Regulation of detrimental organisms and biological processes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Energy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Food and feed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Materials, companionship and labor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Medicinal, biochemical and genetic resources</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Learning and inspiration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Physical and psychological experiences</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Supporting identities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. Maintenance of options</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

IPBES website 2019  Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services,
**MBI MULTIDIMENSIONAL BIODIVERSITY INDEX** coupled that explicitly considers biodiversity and people as part of a healthy system (supported by two sub-indexes; a biodiversity index (BI) and a biodiversity for people index (BCPI)) can help integrate biodiversity into all assessments, policy decisions, and actions that affect human development and well-being.

---

**The NC is part of the aggregate stock of resources but a large part is not interchangeable**

**ESs are not interchangeable objects, nor are they easily mitigated**

**Ecosystems must have room to function**
A. Directing an ecosystem towards an increase in supply SEs produces a rapid loss of regulation services

B. **Regulatory services** decrease linearly with the increase in supply services

C. Supply services can rise to quite high levels before declining on a regular basis

Source: Elmqvist et al. (2010)
WHAT KIND OF VALUE?

Total Economic Value

Use Value

Existence Value

Direct

Indirect

Option

Existence

Others

Direct Consumption of Primary Goods

Secondary Goods and Services, Including Ecological

Future Consumption of Goods and Services

No Consumption of Goods and Services

Bequest values

- Timber
- Fruits, nut, herbs, latex, gum arabic, litter, etc.
- Fuelwood
- Forage and fodder
- Developed recreation and hunting

- Scenery
- Recreation
- Community integrity
- Wildlife
- Climate mitigation
- Air quality
- Soil quality
- Water cycle
- Biodiversity

- Biodiversity
- Scenery
- Community integrity
- Wildlife
- Recreation
- Air, soil and water quality

what is it

what does he do

what does it represent
WOOD OF ECOLOGICAL FUNCTIONS

SE Regolazione
ECOLOGICA

Interesse collettivo

SE Culturali
SOCIALE

SE Fornitura
PRODUUTIVA

Santoloni, 2007
A forest ecosystem services evaluation at the river basin scale: Supply and demand between coastal areas and upstream lands (Italy)

Elisa Morri\textsuperscript{1,4}, Fabio Prusci\textsuperscript{1,4}, Rocco Scozzii\textsuperscript{1,4}, Riccardo Santolini\textsuperscript{4,5}

\textsuperscript{1}Department of Earth, Life and Environment (DEI), University of Bologna, campus scientificoarea Bologna, 40126 Bologna, Italy
\textsuperscript{4}Center of Molecular and Environmental Biology (CMAB), University of Coimbra, Campus de Coimbra, 4714-001 Coimbra, Portugal

Table 7
The economic values of the forest ecosystem services of the Marecchia and Foglia river basins.

<table>
<thead>
<tr>
<th>Type</th>
<th>Ecosystem services</th>
<th>Marecchia river basin</th>
<th>Foglia river basin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Value ($\times 10^6$ €/yr)</td>
<td>Value (€/ha yr)</td>
<td>Value ($\times 10^6$ €/yr)</td>
</tr>
<tr>
<td>Direct value</td>
<td>Firewood</td>
<td>27.3</td>
<td>2085</td>
</tr>
<tr>
<td>Indirect value</td>
<td>Water retention</td>
<td>72.2</td>
<td>3866</td>
</tr>
<tr>
<td></td>
<td>Drinking water supply</td>
<td>2.9</td>
<td>157</td>
</tr>
<tr>
<td></td>
<td>Soil protection</td>
<td>1.8</td>
<td>96</td>
</tr>
<tr>
<td></td>
<td>CO$_2$ sequestration</td>
<td>7.3</td>
<td>358</td>
</tr>
<tr>
<td>Total indirect</td>
<td>value</td>
<td>84.2</td>
<td>4477</td>
</tr>
</tbody>
</table>
Direct and indirect ECOSYSTEM SERVICES (Supply and Regulation)

THE FUNCTIONS OF FORESTS IN ITALY

SE in millions of € (data reprocessed from Third Report on Natural Capital, 2019 and ISPRA 2018)

Supply
- Forest biomass production
  - 648
- Water supply
  - 551

Regulation
- CO2 absorption
  - 832
- Flood risk
  - 417
- Hydrological efficiency vegetation
  - 17.050
- Pollination
  - 701

Cultural
- Recreational activities
  - 3.463

Ratings for four regions (Tuscany, Emilia Romagna, Marche, and Umbria). The value is normalized (0-1) in the coverage classes for the year 2017 (III Natural Capital Report, 2019).
Direct and indirect ECOSYSTEM SERVICES (Supply and Regulation)
Ecosystem Services

Regulation
- Water cycle (quality and quantity)
- Instability
- Air quality

Ecosystem Services

Supply
- Forest production
- Forage

Potential trade-offs between supply and regulatory SEs.
A) Steering an ecosystem toward an increase in supply SEs produces a rapid loss of regulatory services
B) Regulation services decline linearly as supply services increase
C) Supply services can increase to fairly high levels before decreasing on a regular basis.

Source: Elmqvist et al. (2010)

COMPETENCES

- Capacity for collaboration
- New roles (municipalities, municipal union, etc.)
- New models of Governance
- Models of useful and circular economy
- New taxation
Natural based solution and IN for maintaining the functions of Natural Capital

**ERC – ASSESSMENT OF ENVIRONMENTAL COSTS**

«Water» Directive 2000/60/EC (WFD)

DM 24 February 2015, n. 39

**Budget economies SYSTEMIC AND NON-EMERGENCY ACTION PLANS**

€ 1.105.663.552 equal to 0.07% of the regional GDP
The challenge and the main advantage of an integrated and territorial environmental management procedure is to have a tool available that allows you to coordinate all environmental initiatives in a business, within a global and cross-functional approach.
PARTICIPATION IS AWARENESS

Reconfigure the relationship between man and nature over time

<table>
<thead>
<tr>
<th>Framing of conservation</th>
<th>Nature for itself</th>
<th>Nature despite people</th>
<th>Nature for people</th>
<th>People and nature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species Wilderness Protected areas</td>
<td>Extinction, threats and threatened species Habitat loss Pollution Overexploitation</td>
<td>Ecosystems Ecosystem approach Ecosystem services Economic values</td>
<td>Environmental change Resilience Adaptability Social-ecological systems</td>
<td>Ecosystem functions, environmental economics Interdisciplinary, social and ecological sciences</td>
</tr>
<tr>
<td>Key ideas</td>
<td>Species, habitats and wildlife ecology Population biology, natural resource management</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Socio-ecological system

CLEAR OBJECTIVES

INTEGRATION

MULTIFUNCTIONALITY

Reclamation consortium

Regional Basin Technical Service

Management Body for Parks and Biodiversity

District authority

Mayors

Coordination

University and Research

Region

Union of municipalities
Identify FUNCTIONAL ECOLOGICAL / ECONOMIC UNITS (management areas, hydrogeographic basins, ecoregions, ...) in which to develop the resource assessment and management process through restoration ecology actions (Nbs and IN);

Trigger processes of territorial equalization of the area on an ecosystem basis through an environmental balance;

Integration of actions between government sectors (e.g. Departments, etc.) with the aim of maintaining ecological functions and resources;

Understand the potential effects on ecological functions and related dependencies and consider interactions at different scales to avoid the impacts of out-of-scale;

The enhancement of the activities that deal with the care of the territory (agriculture and sustainable forestry) that offer at least the maintenance of the ES.

Identity and Understanding how local populations can influence and / or depend on ecological functions and widen the benefits for the local populations in which companies operate by decreasing their conflicts; Corporate responsibility and non-financial reporting;

Corporate responsibility and non-financial reporting;

New taxation

Useful and circular economy models that economically recognize who provides SEs in relation to the demand in a territorial equalization perspective, implementing the decrees already partially prepared.
Thank you for your attention

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