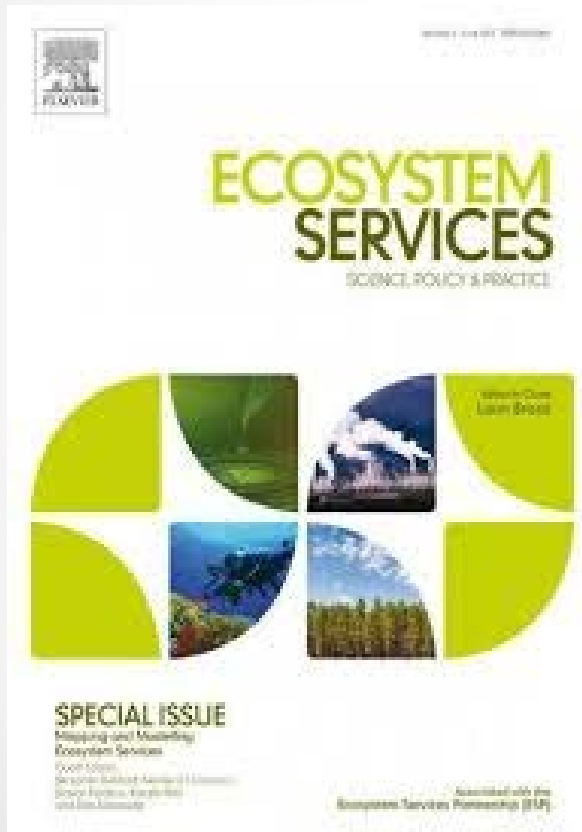


Ecosystem Goods and Services: Where are We?

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- Published by Elsevier; First issue July 2012
- Journal aims
 - to improve our understanding of the dynamics, benefits and social and economic values of ecosystem services;
 - to provide insight in the consequences of policies and management for ecosystem services with special attention to sustainability issues;
 - to create a scientific interface to policymakers in the field of ecosystem services assessment and practice, and
 - to integrate the fragmented knowledge about ecosystem services, synergies and trade-offs, currently found in a wide field of specialist disciplines and journals.

Ecosystem Services

- *“Ecosystem services are the conditions and processes through which natural ecosystems , and the species which make them up, sustain and fulfill human life” (Daily, 1997).*
- This definition focuses on the processes that improve conditions through complex natural cycles including large scale biogeochemical cycles to very small scale life cycles of organisms (Brown et al., 2007).

Ecosystem Goods

- Ecosystem services, while generally unnoticed by humans, produce a range of 'goods' that are tangible, material products that are the natural resources that we consume (Daily, 1997) – ecosystem goods
- The distinction between ecosystem services and goods has been largely obscured in much of the work in this area:
 - The benefits human populations derive, directly or indirectly, from ecosystem functions (Costanza et al. 1997)
 - The benefits people obtain from ecosystems (Millennium Ecosystem Assessment, 2005)

Ecosystem Goods and Services

- Ecosystem Goods and Services have been characterized in 4 broad areas:
 1. **Provisioning services** – providing the endpoints which are often valued goods including food, fibre, wood, fuel and fresh water.
 2. **Regulating services** – maintain balance of ecosystems to enable human survival: climate regulation, flood regulation, water quality, disease regulation.

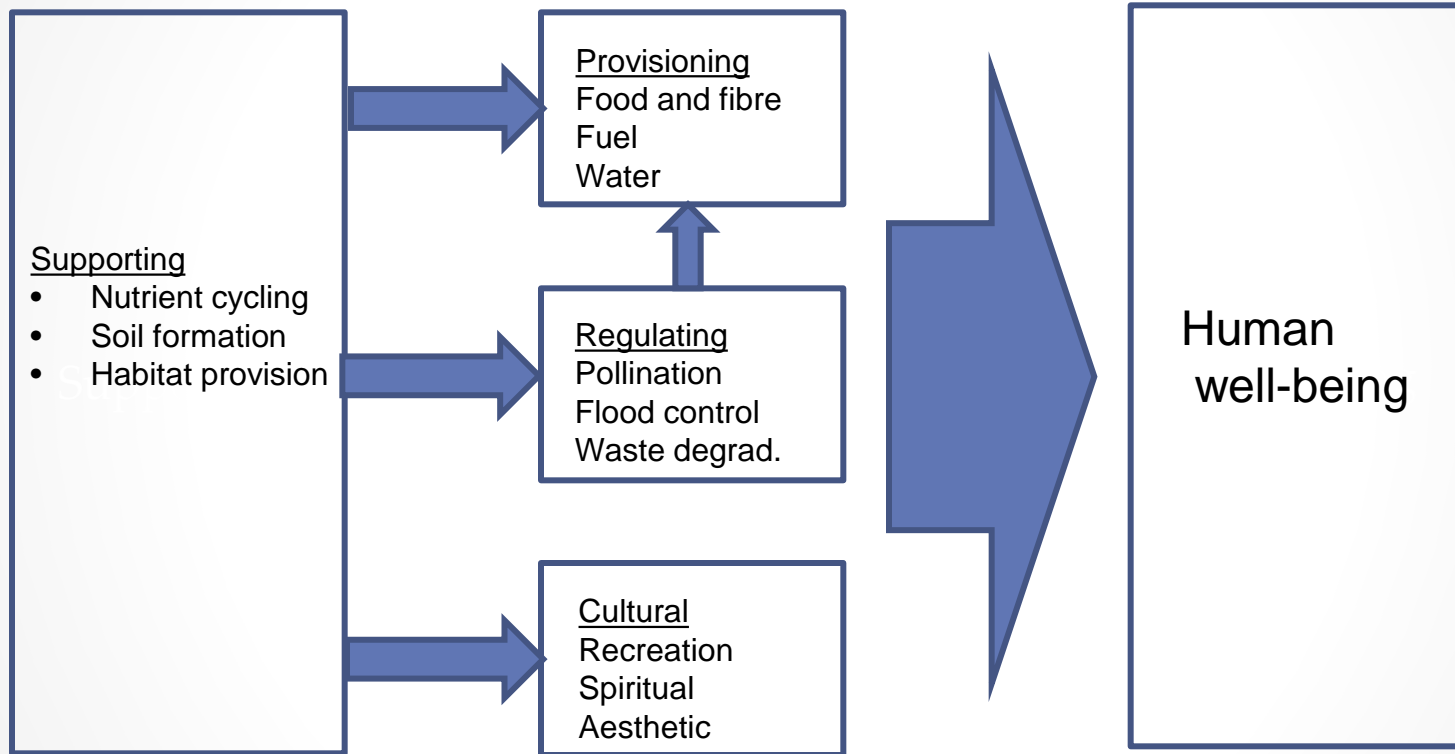
Ecosystem Goods and Services

3. **Cultural services** – spiritual, inspirational, aesthetic, heritage, recreational and tourism benefits.
4. **Supporting services** – range of natural systems that enable the previous three – organic matter cycling contributing to soil creation, photosynthesis transforming solar energy to plant matter, carbon cycling.



Ecosystem Goods and Services

- Ecosystem goods also include non-renewable resources (minerals, fossil fuels) which accumulated through geologic processes.
- As commonly defined ecosystem goods and services (EG&S) are characterized in terms of the direct, or indirect, value provided to humans-beneficial to society.



(Source: Zhang et al. 2007)

Agriculture EG&S

- Policy context – much of the work on EG&S has focused on applications to agricultural and agri-environmental policy.
- Earth Summit (1992) acknowledged the relationship between agriculture and EG&S.

Multifunctionality of Agriculture

- A multifunctional agriculture is defined as a system that jointly produces food and fibre commodities and non-commodity benefits and/or costs - a firm produces multiple outputs that are interlinked.
- Management of agricultural land usually provides co-benefits.

Multifunctionality



- The production of livestock can jointly provide wildlife habitat. The production of livestock can also jointly produce nutrient and sediment pollution in surface water.



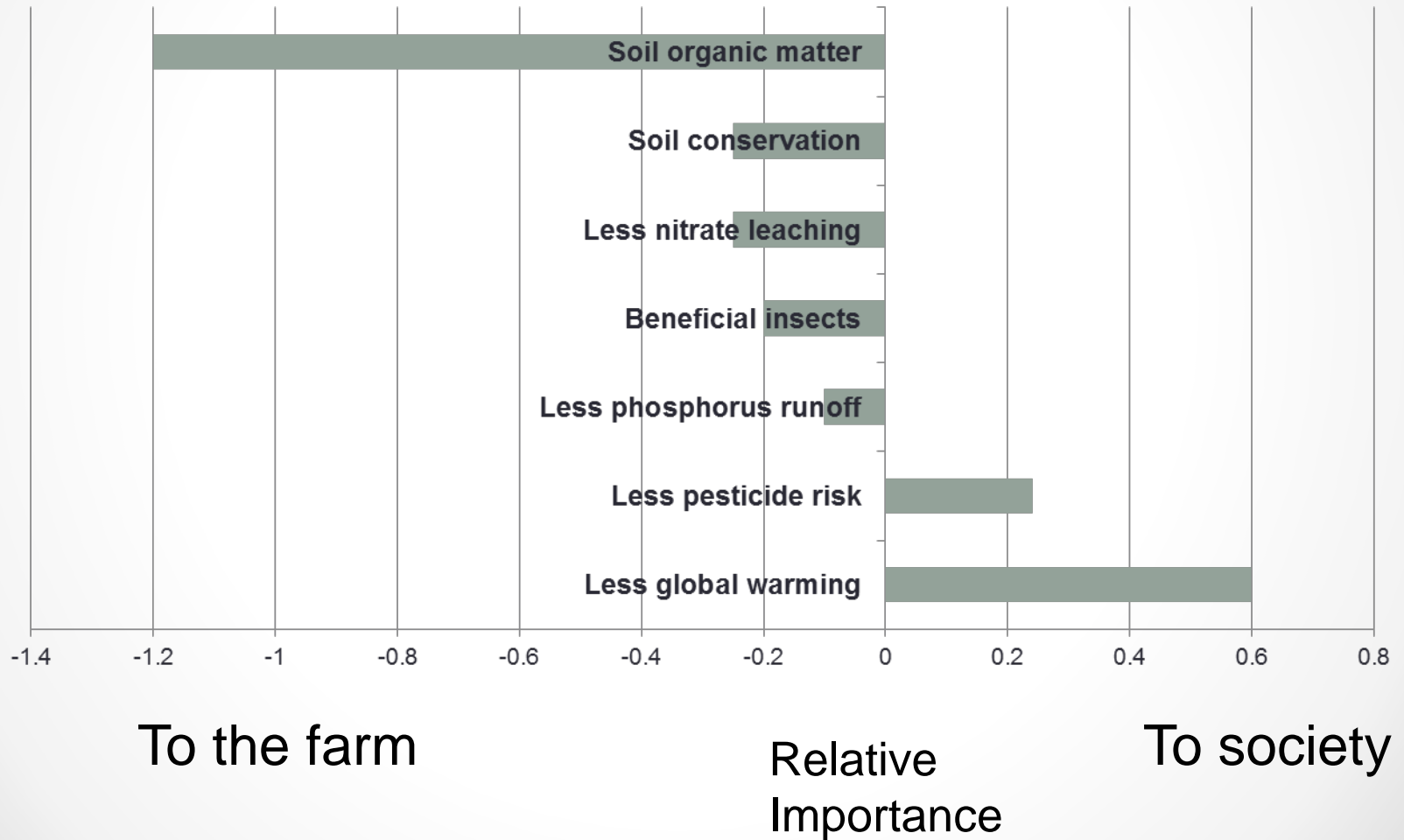
Provision of EG&S

- Agricultural management involves the redirection of energy and nutrient flows to the production of desired commodities.
- Agricultural production is dependent on certain EG&S – soil formation, nutrient cycling, pollination etc. – providing direct benefits to farmers and land managers.
- Many EG&S provide benefits that, from the perspective of the farm, have no value, or only indirect value, but have a value to society.



- “Tragedy of ecosystem services” – in the absence of regulation or incentives to steer them toward production of regulating services, farms naturally manage their resource base toward provisioning services associated with the production of agricultural commodities (Ruhl et al. 2007).

Farmer ratings of relative importance of environmental benefits
(Michigan farmers – Likert scale (Source: Swinton 2008))



Provision of EG&S

- Research focus – quantifying the monetary value of ecosystem services to be included in economic decision making.
- Developing approaches to encourage EG&S provision depends on an understanding of:
 - Social value of EG&S components – trade-offs acceptable to society in return for EG&S provision.
 - What are the costs of providing EG&S – what are the costs of adopting appropriate management (BMPs)

Provision of EG&S

- For policy development there is a focus on EG&S that can be measured and can be interpreted as valuable to society.
- Those EG&S that produce a measurable change or product are more amenable to policy acceptability (Roy et al., 2011):
 - Water quality
 - Biodiversity in wetlands and aquatic environments
 - Carbon storage
 - Habitat creation and landscape protection

- Four 'generations' of programs have been developed to address EG&S provision in agricultural systems (Roy et al., 2011):
 1. Policies for the benefit of a single environmental good or service.
 2. Scaling up of programs and recognition of their multiple benefits.
 3. Increased cost efficiency and testing of innovative funding mechanisms and EG&S markets.
 4. Improved targeting and increasing the flow of benefits to society.

Provision of EG&S

- Policy measures for the management and conservation of environmental resources has shifted in emphasis from regulatory approaches to become based, most often, on market and non-market based instruments – tax incentives, direct payments, offset trading, offset banking, credits etc. (Roy et al., 2011).

EG&S Policy

- The EG&S that are linked to direct benefits to the farm (e.g. soil nutrient cycling, soil erosion) will tend to be supplied with no, or limited, policy intervention.
- In certain cases the role of policy could be:
 - i. Provide information to support adoption of appropriate management (e.g. Environmental Farm Plans)
 - ii. Provide technical assistance to support adoption of appropriate management.
 - iii. Cost share approaches to offset costs of adoption/transition

EG&S Policy

- Cost share approaches are intended to offset the costs of adopting Beneficial Management Practices (BMPs) that decrease the environmental cost of agricultural production and/or increase the environmental benefits.
- These BMPs often contribute EG&S co-benefits.

- Canada-Saskatchewan Farm Stewardship Program – cost-share beneficial management practices (BMPs) (Saskatchewan Ministry of Agriculture, 2013)
 1. Protecting High Risk Erodible and Saline Soils – minimize erosion and soil salinity by converting at risk soils to permanent cover (50% cost share - \$5,000).
 2. Protecting Riparian Areas – reduce erosion and improve water quality by re-vegetation to decrease erosion potential (75% cost share - \$50,000).
 3. Native Plant Re-establishment – planting native vegetation where invasive plants have reduced native plant populations, increase rangeland productivity (50% cost share - \$5,000).
 4. Manure Application Equipment and Technologies – equipment purchase or modification improve manure application, reduce run-off (30% cost share - \$30,000).

Providing EG&S

- Range of EG&S provide significant benefits to society but provide little to no direct benefits to farmers and land managers – farmers will perceive limited incentive to invest in the provision of these EG&S.



Providing EG&S

- Where there are clearly identified benefits to society from EG&S there is a justification for policy measures that provide compensation for the EG&S provision.
 - Agriculture Environmental Stewardship Program (UK)
 - Conservation Reserve Program, Wetland Reserve Program (US)

Providing EG&S

- **Conservation Easements:**
- A legally binding agreement between a landowner and a conservation organization (DU, NCC) and tied to a land parcel.
- The landowner voluntarily limits defined development rights to land in exchange for, primarily, financial incentives - land management meets some conservation objectives (wetlands, wildlife habitat, watershed protection).



Market Based Instruments

Bush Tender and Eco Tender – Australia (Eigenraam et al., 2006)

- A reverse auction process where farmers submit a dollar value bid to undertake a set of actions that would provide environmental outcomes.
- Target outcomes – terrestrial biodiversity, aquatic function and saline land.
- Sum of all outcomes was total score for each farmer – determine the supply cost per unit of total environmental outcomes (price discovery) – used to determine successful bids based on cost.

Market Based Instruments

Eco Tender - Australia

- The process focused on multiple environmental outcomes (co-benefits) – those bids that provided the greatest collection of EG&S at the lowest cost are successful.
- Majority of bids provided 2 or more of the targeted outcomes.

Market-based

- Recreational leases/ fee hunting – policy approach focused on establishing institutions to allow landowners to sell access to their land - co-benefits wildlife habitat, biodiversity, water quality.

Program Targeting

- Program Targeting – mechanisms to increase the EG&S productivity of policy investments – cost effectiveness.
- Australia has developed the Investment Framework for Environmental Resources (INFFER) – prioritize project to address reduced water quality, biodiversity, environmental pests and land degradation.

Program Targeting

- INFFER - Decision support tool that assesses and ranks environmental and natural resource projects comparing value for money, degrees of confidence and the likelihood of achieving stated goals.
- Policy should be targeted based on EG&S productivity, cost of implementation and socio-economic fit.

Conclusion

- EG&S are essential to Agriculture as well as providing many important, and non-substitutable, benefits to society thereby influencing social welfare.
- EG&S policy measures are necessary to meet human needs and have developed at different rates in different countries. There is a suite of policy mechanisms that can be adopted to EG&S provision.





“Your proposal is innovative. Unfortunately, we won’t be able to use it because we’ve never tried something like this before.”

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