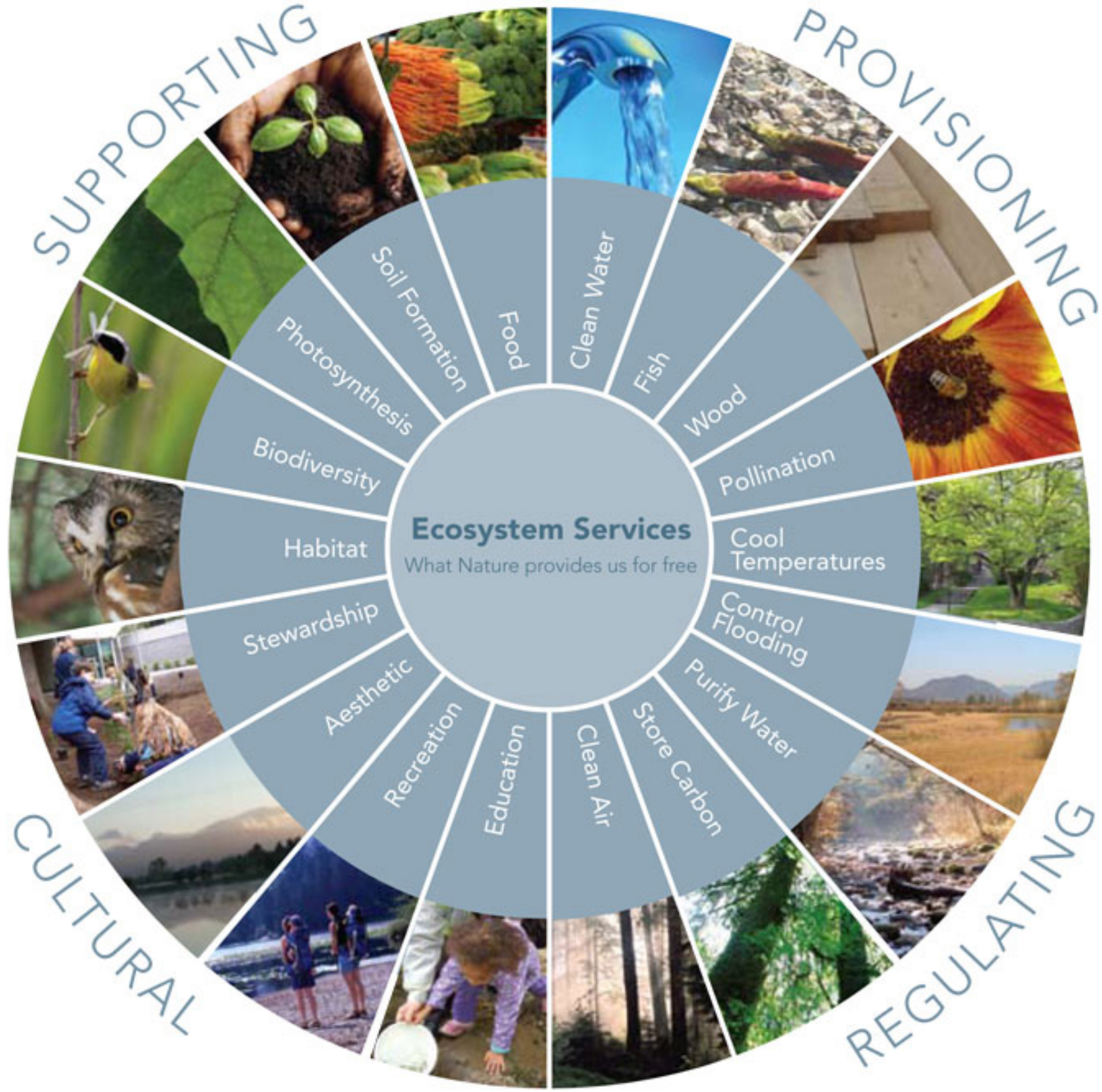
Using an ecosystem services framework with systematic conservation planning

Introduction: concepts and questions
(Tools and software session)
11th Dec 2012

Anna Renwick and Liz Law

A FEW DEFINITIONS…

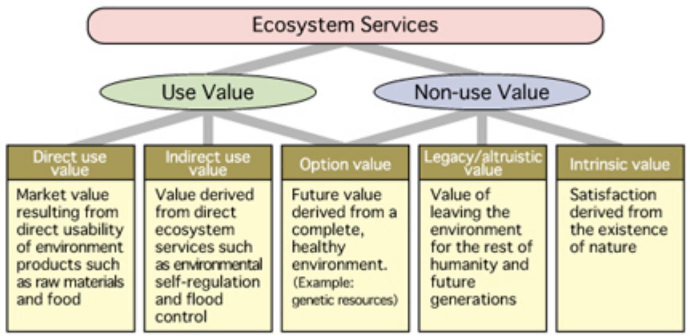
Ecosystem services (ES)



http://www.metrovancouver.org

“benefits people obtain from ecosystems”

[MEA 2005]



Not “free” – we must manage it for purpose...

Systematic conservation planning (SCP)

tools

- Choose surrogates for feature targets, map
- Choose surrogates for cost, map
- Define explicit goals – quantitative, operational targets
- Use simple, explicit methods for locating actions
- (Implement, manage, monitor)

"The effectiveness of systematic conservation planning comes from its efficiency in using limited resources to achieve conservation goals, its defensibility and flexibility in the face of competing uses"

insight review articles

Systematic conservation planning

C. R. Margules* & R. L. Pressey†

HOW IS ECOSYSTEM SERVICE PLANNING SIMILAR/DIFFERENT TO BIODIVERSITY PRIORITISATION?

ES vs Biodiversity planning

- Multiple services also require concept of (spatial) complementarity
- “Thresholds” required (targets) difficult to define
  - Benefits not necessarily additive
- Different levels of site specificity/dependency
- Interactions between species and between ES generally not defined or lack data
  - unless via land use scenario
  - Or include complex “connectivity” relationships

- BUT probably require different “actions”
  - (though this being increasingly recognised for species conservation too)

ES vs Biodiversity planning

- Differences in ES valuation (cf. biodiversity)
  - Can be substitutable internally and externally (transferable across time and space) but specifically...
  - More dependant on flow to specific beneficiaries
  - Possibility of technological substitution
- Fundamental conceptual challenges
  - Consideration of off-site effects (e.g. leakage)
  - Ecosystem service flows (non-static services)
  - Valuation issues...
    - Monetorisation
    - Benefit transfer
    - etc...

ES vs Biodiversity planning

- Other things we might want to do:
  - Planning vs prioritisation: Are all our goals achievable?
    - (possibly less goals but more differentiated)
  - Tradeoffs between targets
    - Among ES
    - Between ES and Biodiversity
  - Incorporate threats
    - Different land uses
    - Policy options/scenarios

THE TOOLS

ES tools

Aims: to evaluate ES (spatially)(under different scenarios)

Tool	Description
InVEST (Integrated Valuation of Environmental Services & Tradeoffs) http://www.naturalcapitalproject.org/InVEST.html	Family of tools to map and value the goods and services. User defines scenarios, and biophysical (and economic) models are used to evaluate potential ES.
Artificial Intelligence for Ecosystem Services (ARIES) http://www.ariesonline.org/	Modelling platform using either user supplied process (deterministic) models OR probabilistic Bayesian ad hoc models. Agent based models used to simulate ES flows. Online and "behind the scenes", or can contact to develop local models.
Multi-scale Integrated Models of Ecosystem Services (MIMES) http://www.afordablefutures.com/services/mimes	Multi-scale suite of models for land and sea use change spatial planning decision making. Incorporates stakeholder input and biophysical data sets for valuation of ES and decision making.
Our Ecosystem http://ecometrica.com/products/our-ecosystem/	Commercial service using global datasets on e.g. Water security threat, crops, species, hotspots of CC and food insecurity, wilderness
Corporate Ecosystem Services Review (ESR) http://www.wri.org/project/ecosystem-services-review	Manual for conducting (corporate) analysis, highlighting resources that could be used.
Natural Value Initiative (NVI) http://www.naturalvalueinitiative.org/	"Ecosystem Services Benchmark Tool" specific for food, beverage and tobacco industries. Based mainly on public data. Like CESR, is corporate driven.

SCP tools

Aims: repeatable, transparent, rule based decision making / optimisation

Tool	Description
Marxan family http://www.uq.edu.au/marxan/	Identify areas that efficiently meet targets for a range of biodiversity features for minimal cost – simulated annealing algorithm for a "packing problem"
Zonation http://www.helsinki.fi/bioscience/consplan/software/Zonation/index.html	"hierarchical prioritization of the landscape" based on "maximal retention of weighted, range size normalized (rarity corrected) richness" (connectivity)
ConsNet uts.cc.utexas.edu/~consbio/Cons/consnet_home.html	Modular Abstract Self-Learning Tabu Search (MASTS) framework for "packing problem"
MultCSync and others on	http://uts.cc.utexas.edu/~consbio/Cons/ResNet.html
Numerous "front-ends" + for Marxan Via http://www.uq.edu.au/marxan/	C-Plan, Zonae Cogito, TNC Protected Area Software, P.A.N.D.A., CLUZ, NatureServe Vista

Coming up...

- Matt – Marxan family + C-Plan
- Liz – Zonation
- Jessie – ARIES
- Audric - InVEST

NOTES

ICES Journal of Marine Science

ICES Journal of Marine Science (2012), 69(1), 75–83. doi:10.1093/icesjms/fsr180

Systematic conservation planning in the eastern English Channel: comparing the Marxan and Zonation decision-support tools

Juliette Delavenne[1*], Kristian Metcalfe[2], Robert J. Smith[2], Sandrine Vaz[1], Corinne S. Martin[3], Ludovic Dupuis[4], Franck Coppin[1], and Andre Carpentier[1]

http://icesjms.oxfordjournals.org/content/69/1/75.full.pdf+html

The systematic conservation approach is now commonly used for the design of efficient marine protected area (MPA) networks, and identifying these priority areas often involves using specific conservation-planning software. Several such software programmes have been developed in recent years, each differing in the underlying algorithms used. Here, an investigation is made into whether the choice of software influences the location of priority areas by comparing outputs from Marxan and Zonation, two widely used conservation-planning, decision-support tools. Using biological and socio-economic data from the eastern English Channel, outputs are compared and it is shown that the two software packages identified similar sets of priority areas, although the relatively wide distribution of habitat types and species considered offered much flexibility. Moreover, the similarity increased with increasing spatial constraint, especially when using real-world cost data, suggesting that the choice of cost metric has a greater influence on conservation-planning analyses than the choice of software. However, Marxan generally produced more efficient results and Zonation produced results with greater connectivity, so the most appropriate software package will depend on the overall goals of the MPA planning process.

Identifying spatial priorities for protecting ecosystem services [v1; ref status: Indexed, http://f1000r.es/T0yHOY]

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Indexed in: **Scopus, Embase, Google Scholar**

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Abstract Priorities for protecting ecosystem services must be identified to ensure future human well-being. Approaches to broad-scale spatial prioritization of ecosystem services are becoming increasingly popular and are a vital precursor to identifying locations where further detailed analyses of the management of ecosystem services is required (e.g., examining trade-offs among management actions). Prioritization approaches often examine the spatial congruence between priorities for protecting ecosystem services and priorities for protecting biodiversity; therefore, the spatial prioritization method used is crucial because it will influence the alignment of service protection and conservation goals. While spatial prioritization of ecosystem services and prioritization for conservation share similarities, such as the need to document threats and costs, the former differs substantially from the latter owing to the requirement to measure the following components: supply of services; availability of human-derived alternatives to service provision; capacity to meet beneficiary demand; and site dependency in and scale of service delivery. We review studies that identify broad-scale spatial priorities for managing ecosystem services and demonstrate that researchers have used different approaches and included various measures for identifying priorities, and most studies do not consider all of the components listed above. We describe a conceptual framework for integrating each of these components into spatial prioritization of ecosystem services and illustrate our approach using a worked example for water provision. A fuller characterization of the biophysical and social context for ecosystem services that we call for should improve future prioritization and the identification of locations where ecosystem-service management is especially important or cost effective.

Many ways to value

- The six major methods for valuing ecosystem services in monetary terms are:[31]
  - Avoided cost
    - Services allow society to avoid costs that would have been incurred in the absence of those services (e.g. waste treatment by wetland habitats avoids health costs)
  - Replacement cost
    - Services could be replaced with man-made systems (e.g. restoration of the Catskill Watershed cost less than the construction of a water purification plant)
  - Factor income
    - Services provide for the enhancement of incomes (e.g. improved water quality increases the commercial take of a fishery and improves the income of fishers)
  - Travel cost
    - Service demand may require travel, whose costs can reflect the implied value of the service (e.g. value of ecotourism experience is at least what a visitor is willing to pay to get there)
  - Hedonic pricing
    - Service demand may be reflected in the prices people will pay for associated goods (e.g. coastal housing prices exceed that of inland homes)
  - Contingent valuation
    - Service demand may be elicited by posing hypothetical scenarios that involve some valuation of alternatives (e.g. visitors willing to pay for increased access to national parks)

- BUT increasing emphasis to view as non-monetary, and value in biophysical potential or similar

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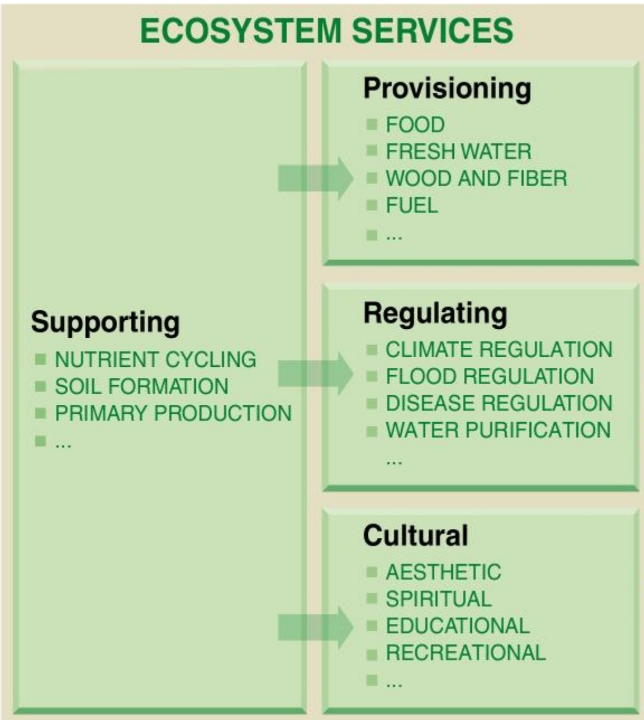
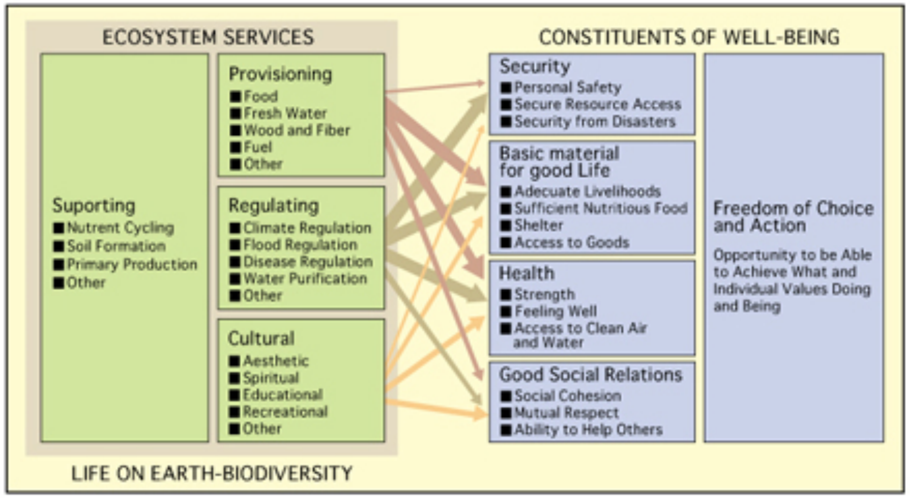
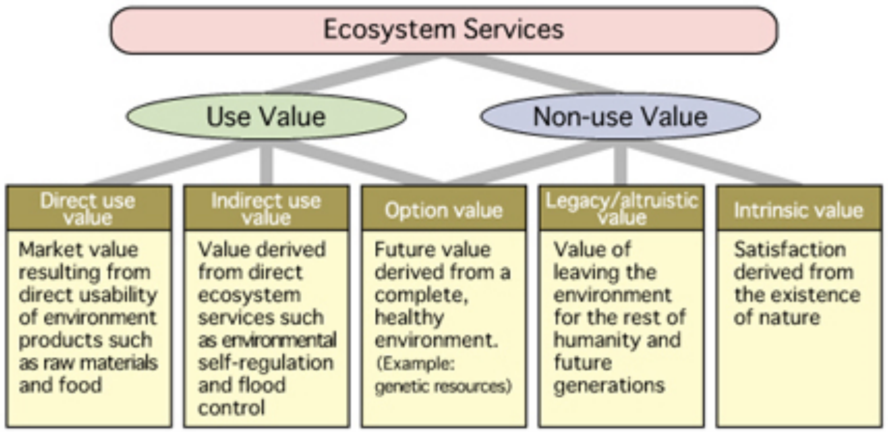
"First, it requires clear choices about the features to be used as surrogates for overall biodiversity in the planning process. Second, it is based on explicit goals, preferably translated into quantitative, operational targets. Third, it recognizes the extent to which conservation goals have been met in existing reserves. Fourth, it uses simple, explicit methods for locating and designing new reserves to complement existing ones in achieving goals. Fifth, it applies explicit criteria for implementing conservation action on the ground, especially with respect to the scheduling of protective management when not all candidate areas can be secured at once (usually). Sixth and finally, it adopts explicit objectives and mechanisms for maintaining the conditions within reserves that are required to foster the persistence of key natural features, together with monitoring of those features and adaptive management[12] as required. The effectiveness of systematic conservation planning comes from its efficiency in using limited resources to achieve conservation goals, its defensibility and flexibility in the face of competing"

Ecosystem services, human well-being and values







A whole bunch of tools and procedures

http://ebmtoolsdatabase.org/guidedsearch/results/planning%20field_tool_type%3A%22Software/Web%20Tool%22