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Integrated land-sea planning: an operational framework

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The need for an integrated land-sea operational framework

» Marine ecosystems face increasing threats from both land-based and sea-based anthropogenic activities (Leslie 2005).


Photo: Gordon Peterson


Photo: www.airtecsprayers.com


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Photo www.airtecsprayers.com

» Globally, around 60% of MPAs are experiencing a high risk of degradation due to coastal development (Tallis et al. 2008).

» Explicit consideration of interactions between sites (land-sea); may alter the design of conservation area networks.

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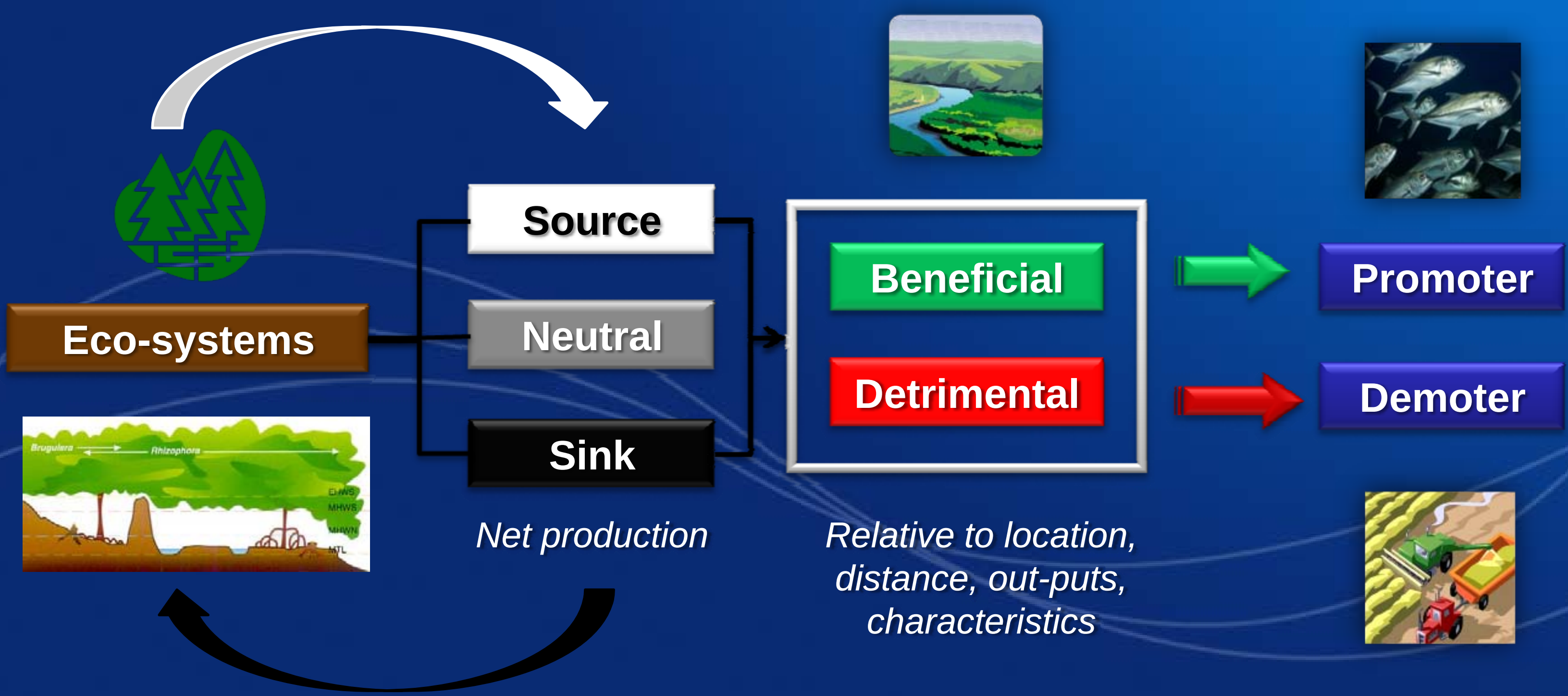
The need for an integrated land-sea operational framework

Composition and function of reserves are dependent upon the strength of interactions and inputs from other ecosystems: spatial position in an ecological network (Stoms et al. 2005).



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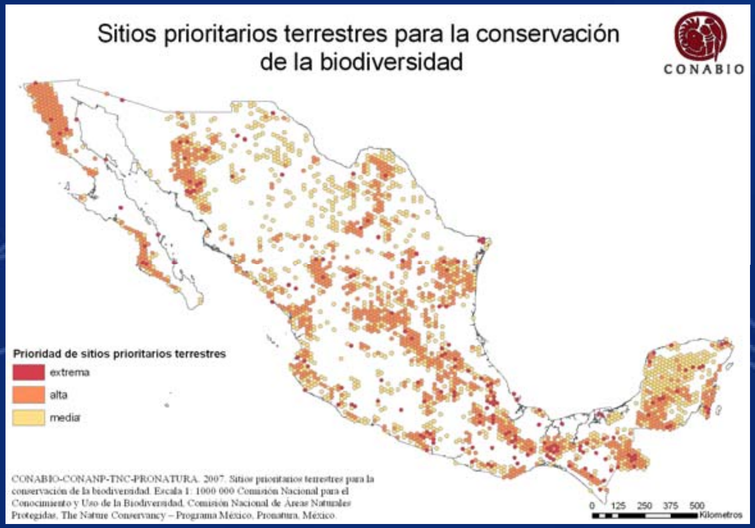
The need for an integrated land-sea operational framework

- Focus on reserve networks in terrestrial or marine ecosystems without considering interactions; no integrated perspective (Beck 2003, Stoms et al. 2005, Beger et al. in review).



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Conceptual models and methods

- Processes that connect two or more realms involve flows of material, energy and/or organisms: fixed or diffuse (Beger et al).
- Positive or negative impacts on species and environments derive from these flows (Stoms et al. 2005).
- MPAs are vulnerable to natural resource development and exploitation occurring outside them (Cicin-Sain and Belfiore 2005).
- Upstream detrimental factors (e.g. sedimentation/deforestation, pollution/industry, eutrophication/agriculture) within the watershed of any given MPA can be harder to mitigate (Beger et al. 2004).
- Decision-making for integrated coastal management involves multiple decision-makers and multiple stakeholders often with conflicting needs and interests (Westmacott 2001).

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Conceptual models and methods

- Few exercises explicitly analyze or incorporate cross-system threats or target biodiversity features-processes occurring across different realms (Stoms et al. 2005, TNC 2006, Tallis et al. 2008, Beger et al. in review).

- Integration levels in systematic planning (Tallis et al. 2008):

  - **Concurrent** : Separate site prioritization with *post hoc* integration.

  - **Simultaneous**: Multiple systems conservation goals (system specific threats).

  - **Integrated**: Multiple systems and cross-system threats and processes (spatial explicit connectivity).

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Tallis et al. 2008

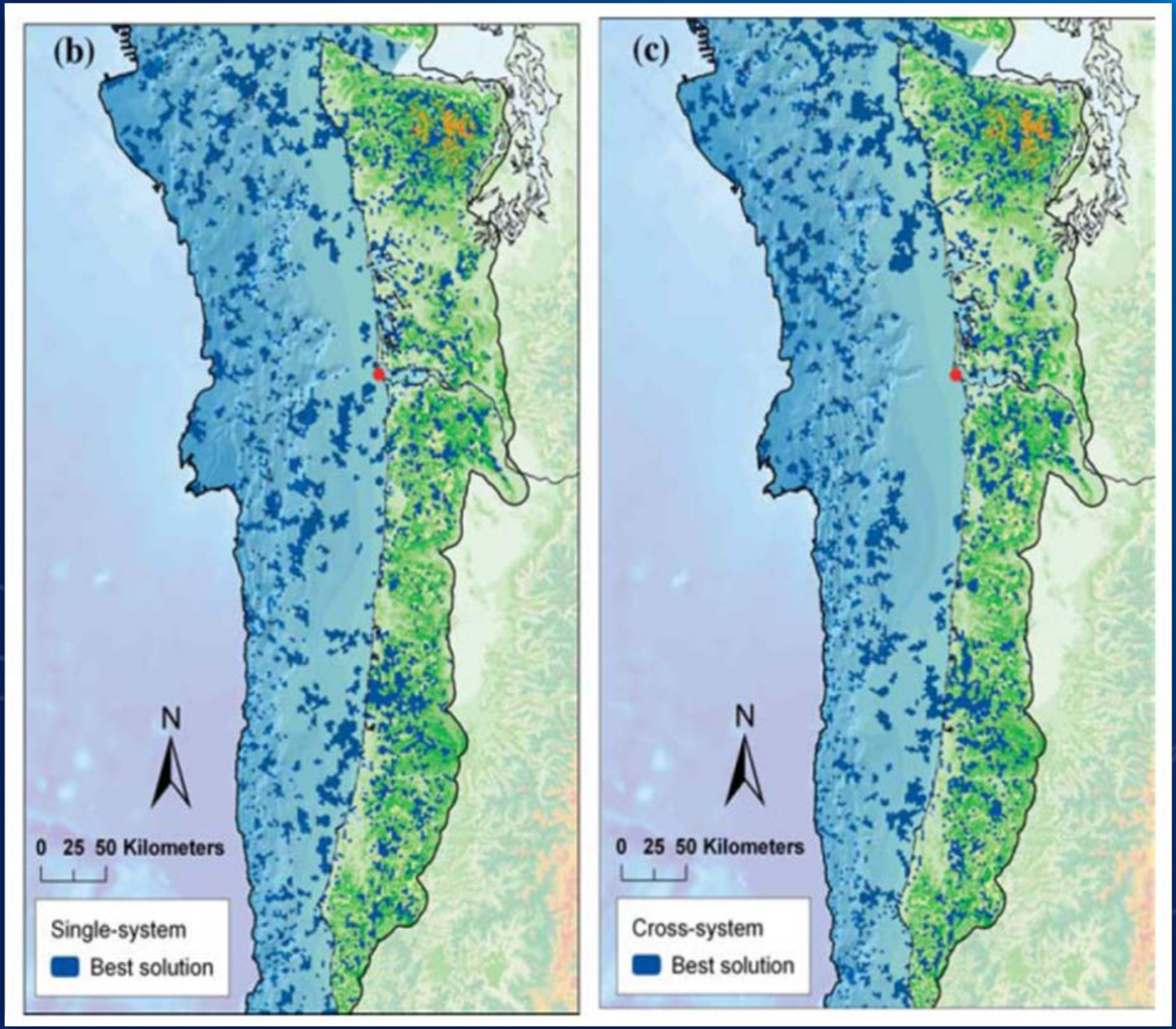
Influence zone

Trade offs

Higher costs

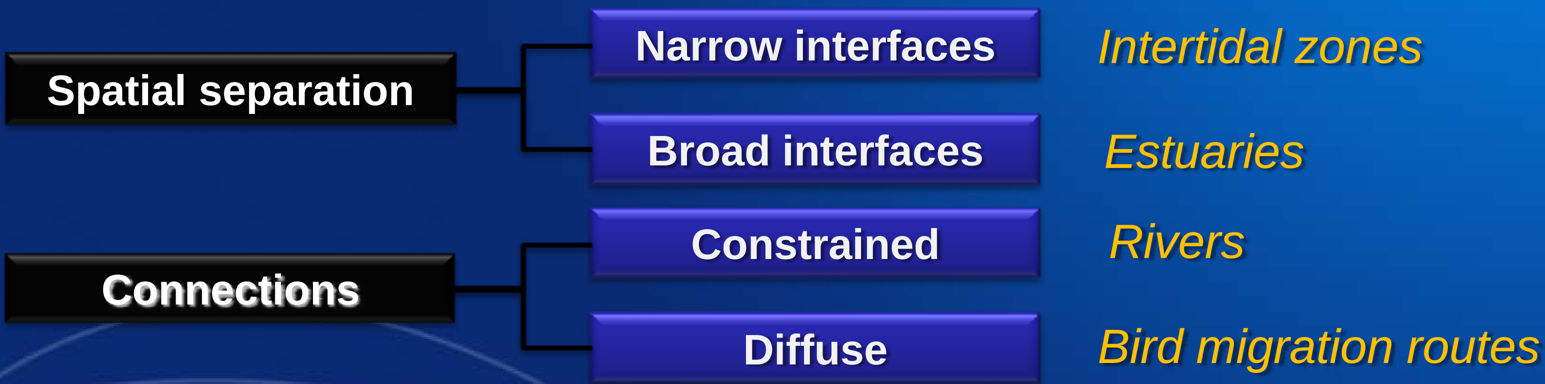
Less efficiency

?



Beger et al. in review

» Biophysical processes operating on/across realm boundaries differ in their "function" scales and planning must ensure the representation of features and supporting processes.



» Cross boundary or linked processes can provide important ecosystem services or opportunities for resource use.

» Processes occurring across realms often require protection of different sites to those representing features in single realms.

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Land-sea planning: EBM approach

- Tools and models should take into account ecological linkages (terrestrial-freshwater-marine functional relationships) to plan for the persistence of biophysical processes.
- An integrated land-sea planning exercise should then address the main issues of concern under the EBM Approach:
  - Account for biological, socio-political and economic **interests**.
  - Plan for persistence of **patterns** and **processes**.
  - Consider **monitoring** and **adaptive management**.
  - Incorporate **stakeholders** in the planning-decision making process.
  - Take into account **uncertainty** and **vulnerability**.

An operational framework

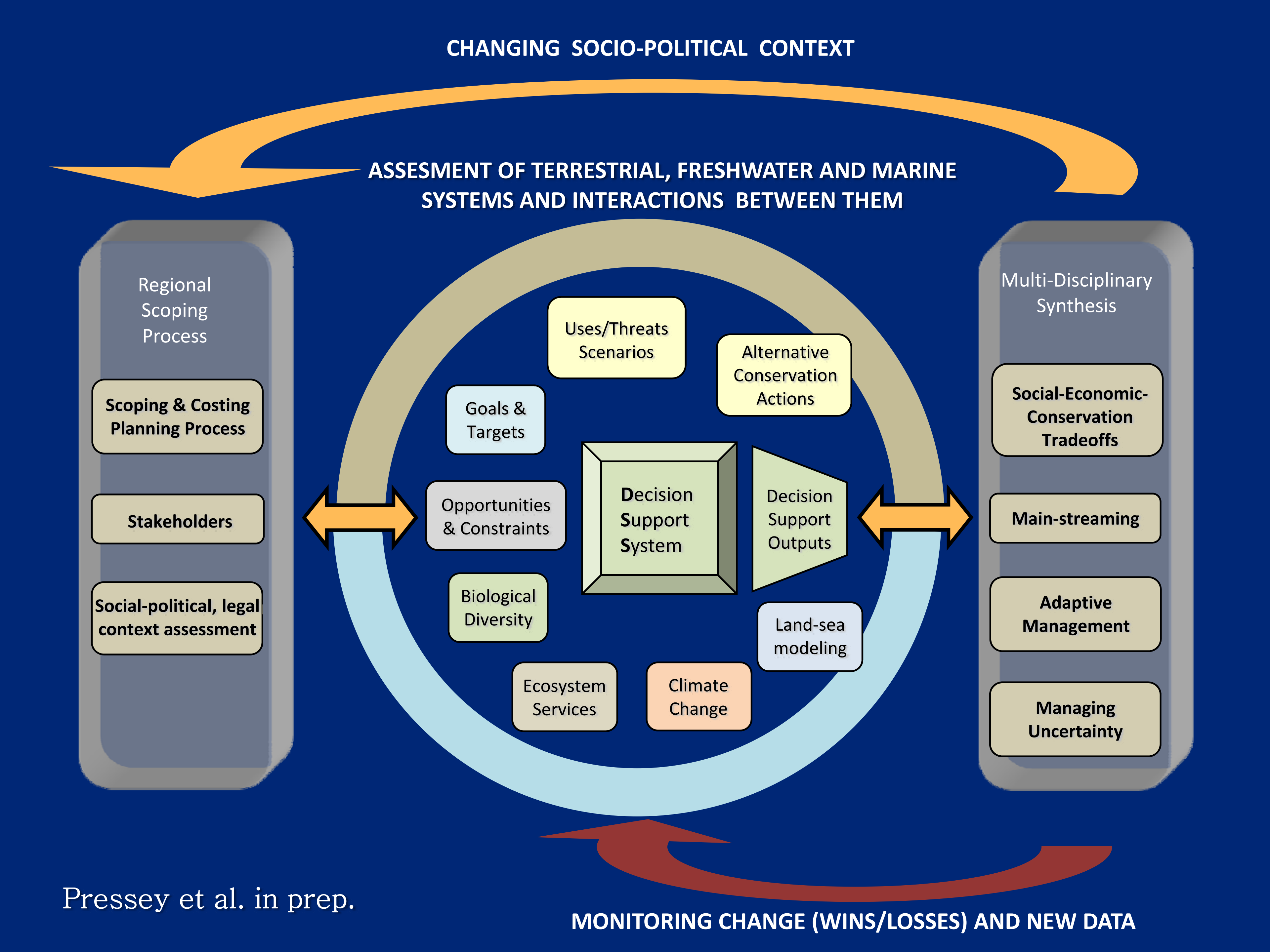
» A prioritization exercise consisting in a series of stages.

» Dynamic and iterative process: delineate and refine policies and alternatives for conservation actions in the view of:

- New and improved data
- Change in preferences
- Socio-political context
- Loss or degradation of selected areas

» Continuum of policy options: from reservation to restoration.

» Aided by tools (software), some of which can be interfaced or linked to work together to integrate different stages.


CHANGING SOCIO-POLITICAL CONTEXT
ASSESMENT OF TERRESTRIAL, FRESHWATER AND MARINE SYSTEMS AND INTERACTIONS BETWEEN THEM
Regional Scoping Process
Scoping & Costing Planning Process
Stakeholders
Social-political, legal context assessment
Uses/Threats Scenarios
Alternative Conservation Actions
Goals & Targets
Opportunities & Constraints
Decision Support System
Decision Support Outputs
Biological Diversity
Land-sea modeling
Ecosystem Services
Climate Change
Multi-Disciplinary Synthesis
Social-Economic-Conservation Tradeoffs
Main-streaming
Adaptive Management
Managing Uncertainty
Pressey et al. in prep.
MONITORING CHANGE (WINS/LOSSES) AND NEW DATA

Regional scoping process

Scoping and costing the planning process	- Boundaries - Team - Budget
Stakeholders identification, characterization and involvement	- Who is influenced or affected - How they should be involved - Social network mapping
Socio-political-legal context assessment	- Regional assessment - Institutional arrangements - Threats and alternative of mitigation actions - Strengths and weaknesses

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Data and models integration

Opportunities and constraints	- Ownership, costs, conservation-management initiatives and programs, threats (single and cross-system), community groups influence.
Goals and targets	- Qualitative and quantitative (biodiversity, ecosystem services, livelihoods) - Biodiversity requirements, include processes.
Uses-Threats Scenarios	- Uses and infrastructure projections - Model proximate (urbanization) or ultimate threats (markets).
Biodiversity	- Spatially explicit data (biodiversity patterns and processes) - Marine, freshwater and terrestrial
Ecosystem services	- Relative values of areas (water quality and supply, soil conservation, carbon sequestration, sediments, pollutants capture, harvest).
Land, freshwater & marine interactions	- Catchment land uses and conservation actions: downstream effects. -Marine effects on coastal habitats (potential rise in sea level, storms) - Upstream-downstream processes (migration).
Climate change	- Shifts in geophysical features associated to biodiversity. - Adaptability or adjustment to changes. - Effects on threatening processes (land uses, rainfall-runoff).

Data and models integration

Decision support system	- Develop/adapt decision-support software (DSS) to integrate project components. - Graphical interface to maps, highly interactive - Display spatial options for achieving targets - Multi-criteria analysis of multiple conservation values and tradeoffs
Alternative conservation actions	- Toolbox of actions (terrestrial, freshwater and marine). - Assessment consider cost, effectiveness, feasibility and spatial and functional interactions between actions.
Decision-support outputs	- Spatially explicit scenarios of conservation actions - Contribution to maintaining and enhancing values of terrestrial, freshwater and marine environments. - Evaluate benefits and costs of alternatives.

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Tools products synthesis: multidisciplinary

Social , economic and conservation tradeoffs	- Alternative planning scenarios (conservation actions) - Portfolios: commitments, exclusions, preferences.
Mainstreaming	- Interpret technical outputs for users. - Different outputs for catchment managers, government. - Designed with their involvement.
Apply conservation actions	- Apply effective conservation actions to areas identified in the conservation plan.
Adaptive management	- Changes to plans: loss of areas, new information, socio-ecological monitoring and identification of barriers. - Asses achievement of targets.

Tradeoffs between competing objectives

- Managers need to make choices and face difficult trade-offs:

Limited budget →	Incremental investment →	*Schedule implementation*
Diverse values →	Up-Down stream balance →	*Include trade-offs in DSS*
Sites losses →	Prioritize sites / actions →	*Vulnerability analyses*

- Catchments values can be diverse and un-correlated: biodiversity, endangered-rare species, connectivity, soil conservation, etc.
- Terrestrial sites important for marine conservation can be also important for terrestrial-freshwater conservation or uncorrelated.
- Choices can lead to spatial variation in priority areas and DSS may help in guiding those choices (complex issues).

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