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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).

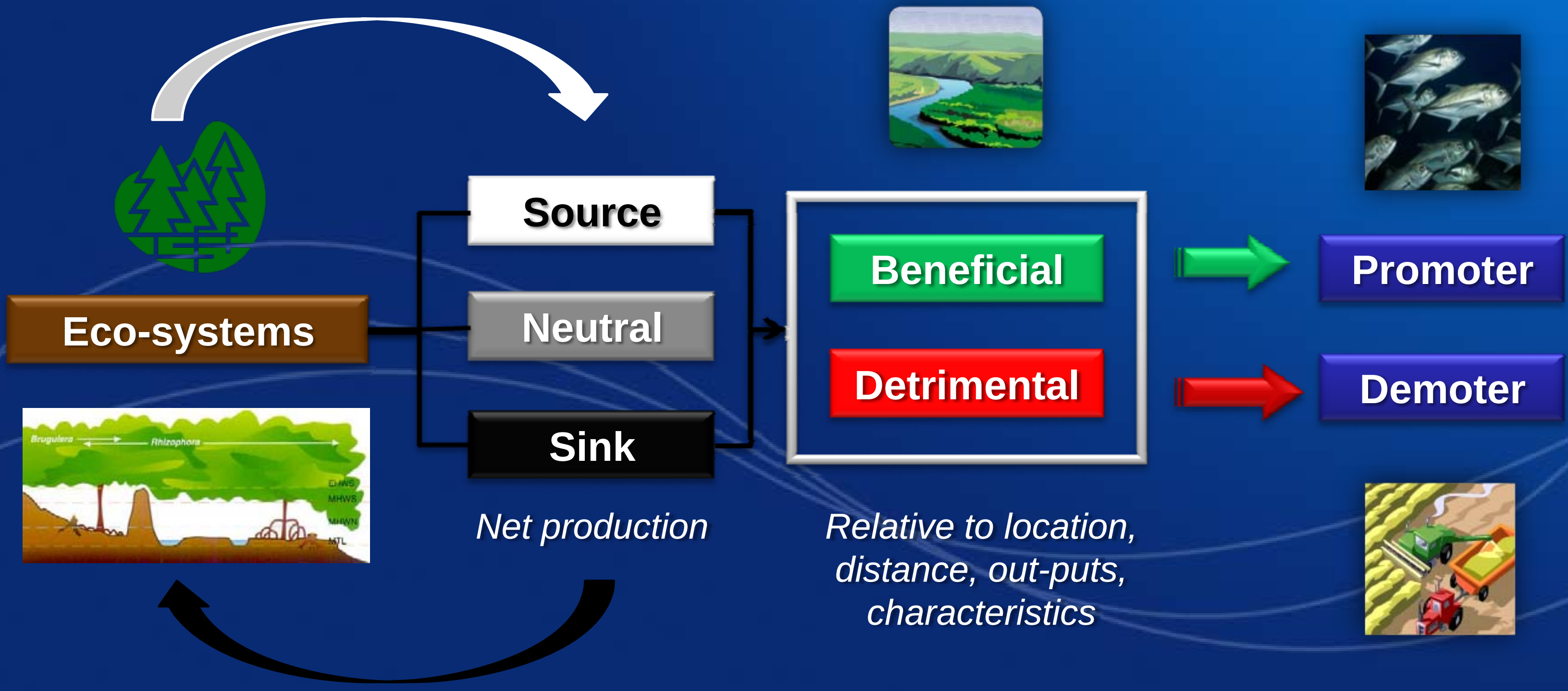




- Globally, around 60% of MPAs are experiencing a high risk of degradation due to coastal development (Tallis et al. 2008).
- Explicit consideration of interactions between sites (land-sea); may alter the design of conservation area networks.

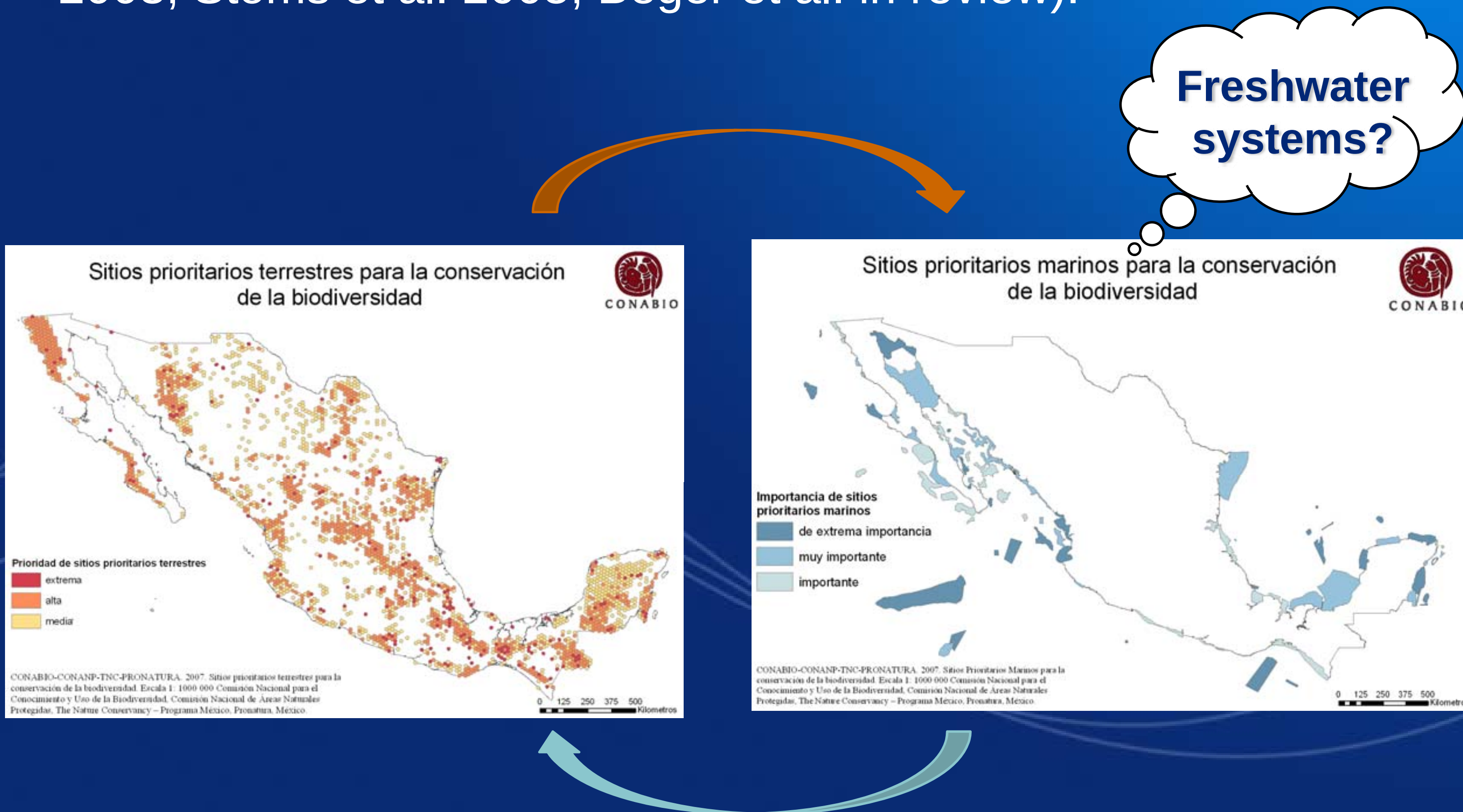
# The need for an integrated land-sea operational framework

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).



# 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).



# 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).

# 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).

Tallis et al. 2008

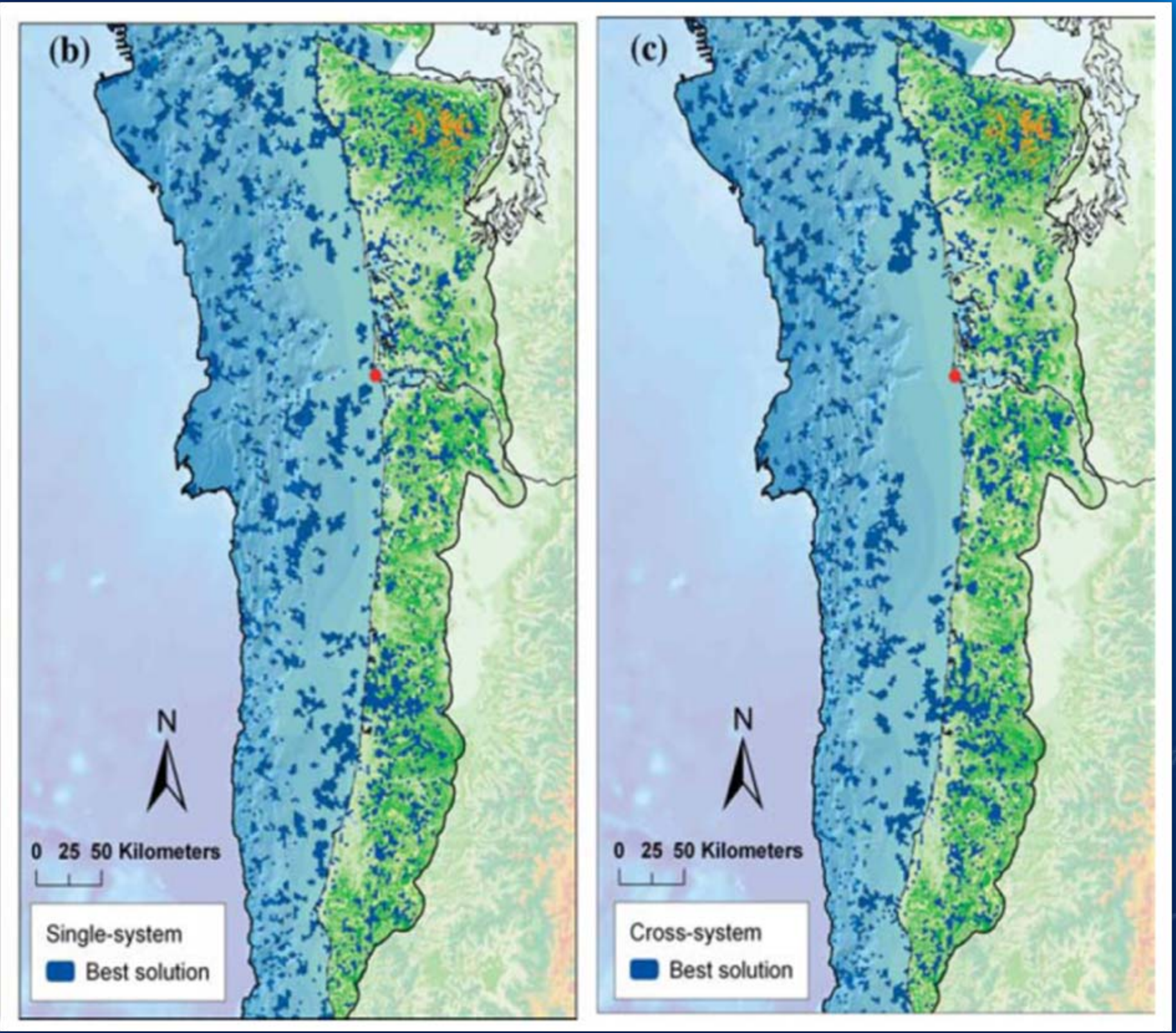
*Influence zone*

*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.

**Spatial separation**
- **Narrow interfaces** — *Intertidal zones*
- **Broad interfaces** — *Estuaries*

**Connections**
- **Constrained** — *Rivers*
- **Diffuse** — *Bird migration routes*

- 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

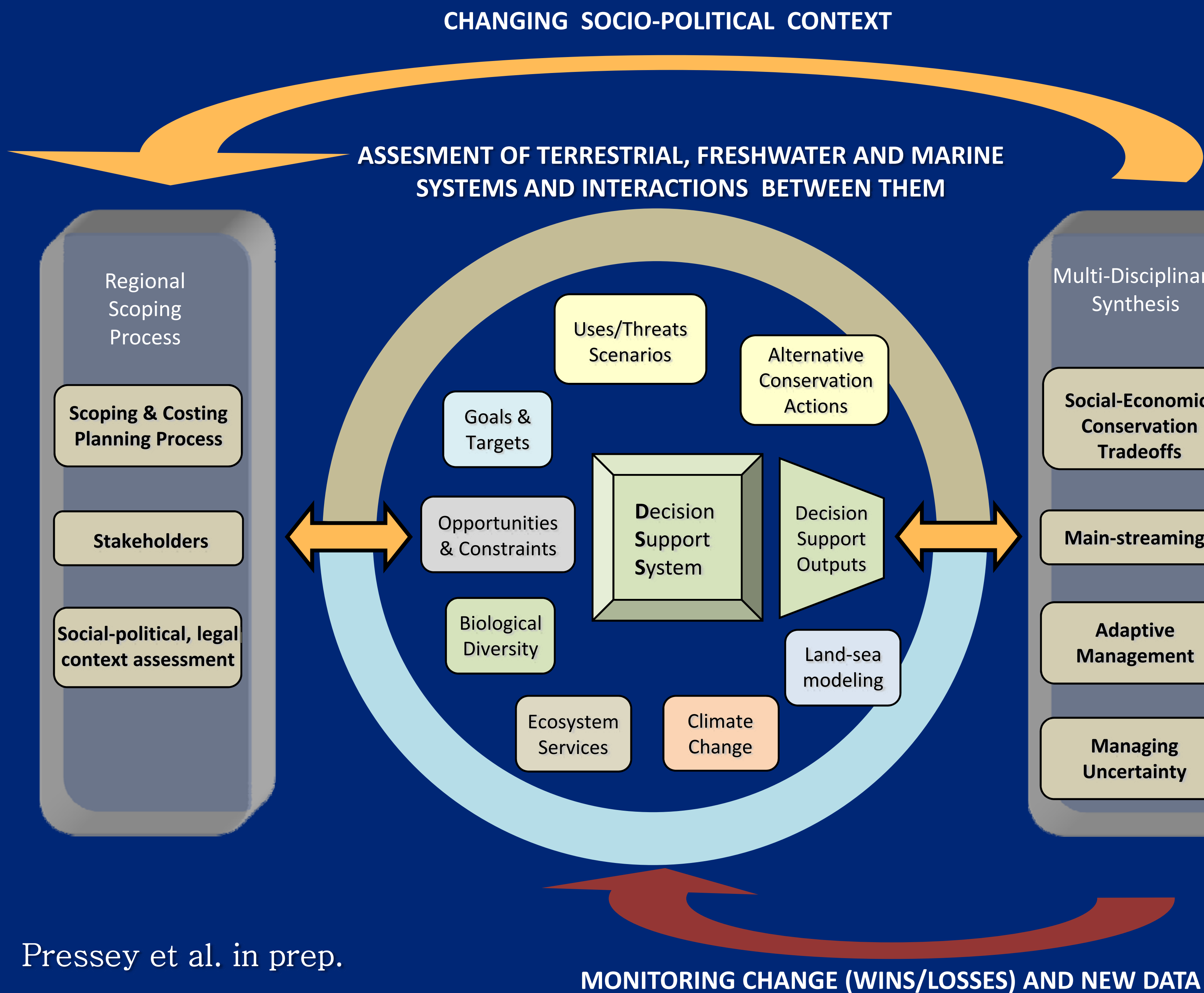
» A prioritization exercise consisting in a series of stages.

» 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.




Pressey et al. in prep.

# Regional scoping process

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

# 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)<br>- Biodiversity requirements, include processes. |
| *Uses-Threats Scenarios* | - Uses and infrastructure projections<br>- Model proximate (urbanization) or ultimate threats (markets). |
| *Biodiversity* | - Spatially explicit data (biodiversity patterns and processes)<br>- 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.<br>-Marine effects on coastal habitats (potential rise in sea level, storms)<br>- Upstream-downstream processes (migration). |
| *Climate change* | - Shifts in geophysical features associated to biodiversity.<br>- Adaptability or adjustment to changes.<br>- Effects on threatening processes (land uses, rainfall-runoff). |

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# *Data and models integration*

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

# *Tools products synthesis: multidisciplinary*

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| *Social , economic and conservation tradeoffs* | - Alternative planning scenarios (conservation actions)<br>- Portfolios: commitments, exclusions, preferences. |
| *Mainstreaming* | - Interpret technical outputs for users.<br>- Different outputs for catchment managers, government.<br>- 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.<br>- Asses achievement of targets. |

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# Tradeoffs between competing objectives

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

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|---|---|---|
| *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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