Integrated land-sea planning: an operational framework

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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.
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).
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).
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).
Influence zone

Trade offs

Higher costs

Less efficiency
Biophysical processes operating on/across realm boundaries differ in their “function” scales and planning must ensure the representation of features and supporting processes.

- Narrow interfaces: Intertidal zones
- Broad interfaces: Estuaries
- 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.
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.
Multi-Disciplinary Synthesis

Social-Economic-Conservation Tradeoffs

Main-streaming

Adaptive Management

Managing Uncertainty

MONITORING CHANGE (WINS/LOSSES) AND NEW DATA

Pressey et al. in prep.
An operational framework

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
### Data and models integration

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

**Data and models integration**
**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.
 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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