September 26, 2008

Meta-analysis notes

Overall objectives
To systematically review empirical evidence for and against impacts of regime shifts in coastal interface habitats on the delivery of ecosystem functions and/or services using meta-analytic techniques.

To identify potential drivers of observed differences in the effect of regime shifts on coastal interface habitats and the ecosystem functions and services they provide.

The database
We are collecting empirical (observational or field-based experimental) studies from kelp forest, coral reef, salt marsh, mudflat, mangrove, seagrass, and dune habitats which have been observed to undergo a regime shift or shift to an alternate stable state. Individual regime shifts may have resulted from natural or anthropogenic causes or both. We are particularly interested in anthropogenically driven regime shifts, but are collecting both kinds of cases for comparison.

We are particularly interested in studies that have quantified changes in these habitats that ultimately have implications for ecosystem services (e.g. regime shifts in dune habitats impact plover populations, which *may* negatively impact birdwatching opportunities). We recognize that ecosystem services *per se* will seldom have been quantified in these studies. We are including papers that have data on ***at least one*** of the following: (1) changes in the foundation species/habitat, (2) changes in other ecosystem functions, (which may be measured, e.g. in changes in associated species, communities or biophysical conditions) and (3) in the few cases where available, changes in ecosystem services.

Defining regime shift (modified from Lees et al. 2006)

- Sudden – change occurs over short time period
- High amplitude of change in foundation species, with impacts on the rest of the community, as evidenced by change in community structure (measured by spp. diversity, rel. abundance/spp. evenness, community composition/assemblages)
- Infrequent and relatively persistent – change does not occur often and lasts a long time
- Impacts multiple trophic levels (though multiple trophic levels may not be addressed in the paper)
- Large scale (oceanic) OR small scale ('local')
- Associated with or evident in 'biophysical changes' (at least one of the following: over-exploitation, oceanic, climatic, biological)

Questions to be addressed

- Is there an effect on the delivery of ecosystem functions (and/or services) after regime shift in coastal interface habitats relative to control conditions?
- What is the magnitude of the change in delivery of ecosystem functions (and/or services) after regime shift in coastal interface habitats relative to control conditions?

  Related sub-questions
  - Is there a threshold magnitude beyond which an observed change constitutes a regime shift?
  - Does this threshold differ across habitats?
- What drivers (moderators) are associated with observed differences in the effect of regime shift in coastal ecosystems? (e.g. habitat type, location, methods, scale of study/analysis, anthropogenic or natural source of regime shift, etc.)
  - How are these drivers (moderators) related to the probability of exceeding observed regime shift thresholds (if we can identify a threshold(s) above)?

Questions we decided to set aside for a separate analysis (though we are still collecting papers on recovery as they come up)

- How does delivery of ecosystem services or functions change with recovery after a regime shift and what driving factors that moderate this response across different ecosystems/latitudes/countries, etc.?

Status of the database

- Initial searches completed for all habitats
- Lists narrowed down to appropriate papers for
  - Kelp forests
  - Coral reefs

ACTION ITEMS

To be completed by October 15

- Sand dunes – **Sally** – refine list to relevant papers with appropriate data
- Seagrasses – **Eva** – refine list to relevant papers with appropriate data and add missing relevant papers
- Mangroves (area-fisheries productivity list) – **Jurgenne -** refine list to relevant papers with appropriate data for papers she knows or has hard copies of

To be completed by November 1

- Rocky intertidal – **Ben** – refine list to relevant papers with appropriate data
- Saltmarshes and mudflats – **Brian** – refine list to relevant papers with appropriate data and add any missing relevant papers
- Reviews – **Carrie (with assistance from Chris)** – search for relevant review papers and identify papers for inclusion from their lit cited

To be completed by November 31

- Mangroves (to finish list after Jurgenne goes through it first) – **Elise**