

Adapting Coral Reef Management in the Face of Climate Change

Part I

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Introduction

This workshop was the first of two to explore how coral reef management is being adapted in response to climate change. Case studies demonstrated how some managers are engaging user and scientific communities to identify ecological & socio-economic vulnerabilities and to plan for climate change impacts to tropical ecosystems. Special attention was given to the proposal that tropical ecosystems should be “managed for resilience” as a strategy for responding to climate change. Analysis and discussion considered what it means to manage for socio-ecological resilience, what “resilient governance” might look like, and what scientific agenda is needed to underpin resilient management.

This workshop focused on presenting aspects of social resilience in coral reef management from the perspective of social learning and the development of mitigating actions, and how social resilience enables dealing with synergistic stressors to climate change and in particular those originating from human activities such as eutrophication and overfishing.

Case Studies

- The Reduction of Synergistic Interactions in Building Resilience to Climate Change
- Using the Marine Learning Partnership to better understand social resilience in MPAs and MPA networks
- Assessing Resilience in American Samoa

Key Discussion Questions:

- What are the key ecological and social vulnerabilities to climate change?
- Is “managing for resilience” a good response to climate change and what does that mean?
- What is social resilience and how can it be incorporated into management?

Case Studies

1. The Reduction of Synergistic Interactions in Building Resilience to Climate Change

Lara J. Hansen³

There are generally believed to be four main tenets to how resilience is increased in the management of natural systems. First, there must be adequate and appropriate

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space preserved for the system to respond to climate change. Second, it is necessary to reduce all of the non-climate stresses on the system so that the system has a greater tolerance for the new variance associated with climate change. Third, these approaches need to be implemented as rapidly as possible, but as part of an adaptive management approach where adequate monitoring is built in to really determine if the approach is working. Finally, if these approaches are going to work there must be larger actions in place, beyond the site of concern, to reduce the rate and extent of climate change. This talk will focus on the second tenet, examining several projects underway to assess the role of synergistic non-climate stresses on increasing or decreasing the resilience of coral reef ecosystems.

There will be four projects highlighted to explore different synergistic stresses, as well as to demonstrate how adaptive management may be designed to assess or respond to each one:

- *American Samoa*: This case study will be examined in greater detail by a second presenter, however here the highlight will be the approach to examining the role of nutrient run off from terrestrial sources onto nearshore reefs.
- *Mesoamerican Reef*: This case study considers the role of terrestrial run-off of both nutrients and agricultural chemical from a large watershed.
- *Indonesia*: This case study, also examined in a previous session, considers the use of a co-management approach to reduce damaging fishing practices in order to increase resilience.
- *Florida Keys*: In this case a meta-analysis is used to examine historic data, rather than field monitoring, to consider the spatial variability in water quality through the greater Florida Keys. This will consider not only local water quality alterations due to nutrients but also agricultural and industrial contaminants.

While reduction of synergistic stresses alone will not build enough resilience to protect reefs from climate change, it is an important part of the conservation approach, as protected areas alone will be insufficient responses to this new threat to coral reefs.

Summary

Sobering facts are being introduced to the global community regarding climate change. For example, the 4th Intergovernmental Panel on Climate Change report predicts 9_C increase by 2100!

Multiple, synergistic stresses of climate change include increased SSTs, increasing acidity, changing storm systems, and increasing sea level, all of which are exacerbated when interacting with local threats such as pollution, disease, coastal development, damaging fishing practices, tourism, and invasive species.

The threat is happening now - coral reef species *Acropora* is listed as threatened because of sea surface temperatures (SSTs), hurricanes, and disease.

Barriers to this problem include the following: the fact that it is overlooked, the fact that climate change impacts are not yet realized by people at large, people feel it is too big to manage, and there is low funding or capacity to deal with climate change.

The new conservation paradigm expressed here requires that we protect an adequate

and appropriate space (e.g. resilient species, new areas for species, replication), limit non-climate stresses, manage adaptively and reduce greenhouse gases.

The way forward in building resilience to climate change requires reducing local threats. However, these actions require an assessment of interactions of stresses with climate change.

Recommendations

1. 'Buying time' is a good phrase because many people think they can't deal with this issue, so they don't. It's very important to deal with stresses on the ground.
2. Create a very strong public message through collaboration - get concepts voiced in an effective way and plan strategically about how to distribute this message - e.g. on government, organizational and local levels.
3. Take this idea further. Example: Advertising is a powerful tool. We need a change in behavior on huge scales. E.g. cigarettes make loads of money yet they are bad for you... but coral reefs are great and not many people know about them. Get companies who sell tobacco to put up billboards to save coral reefs. Work with big industry on a pro bono basis. Make coral reef conservation 'sexy'.
4. Use a business-level approach in terms of profit (as in conservation of coral reefs) to get more buy-in.
5. Use a marketing campaign to build momentum for public awareness. Suggestion that 2008 is the year of the reef...

2. Using the Marine Learning Partnership to better understand social resilience in MPAs and MPA networks

Stuart Campbell⁴, Colleen Corrigan⁵ and Mark Drew⁶

Social resilience has been identified as one of three key priority learning areas for NGO field staff faced with scaling up marine conservation practice to the MPA network level. During 2005 and 2006, members of the Marine Learning Partnership, a global group of marine conservation professionals with a diversity of expertise and experience, have collaborated on ideas and exploration of the concepts and variables of social resilience as it applies to our regions and immediate work. We will share the most recent findings from our joint efforts, including what is social resilience and why it is a critical area for consideration as a response to climate change and other factors, such as political and economic conditions and MPA management regimes. Finally, we will describe how we are working on ways to use insights from academia and field-based case studies to help us devise a framework for measuring and building social resilience within large-scale marine protected and managed areas.

Summary

Social resilience is the ability of institutions and communities to cope with external stress as a result of social, political, and environmental changes. It differs

⁴ Wildlife Conservation Society, Marine Program Coordinator

⁵ The Nature Conservancy, Marine Protected Area Learning Partnership Facilitator

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fundamentally from ecological resilience because of the human capacity to anticipate and plan for or react to change. In a resilient community, these changes, including those brought about by managed areas, should not have a significant negatively altering impact on the community.

There are four critical factors regarding the social resilience concept: (1) learning to live with change (social structure), (2) nurturing diversity for reorganization and renewal (livelihoods), (3) combining different types of knowledge for learning (social organization), and (4) creating opportunity for self-organization (governance).

As a group, the Marine Learning Partnership plans to identify indicators and measure qualitative metrics at 25 MPA networks from the Caribbean, IndoPacific and Africa. The next steps in this group-learning process will involve observation of social drivers, testing of assumptions in the field, dissemination of findings, and establishment of long-term site-level projects to test hypotheses more robustly.

Recommendations

1. While there are studies being conducted with ecological aspects of resilience, there should be a greater balance on the social aspect of this work. Much of the groundwork laid in the terrestrial realm should be extended to better understanding social aspects of marine protected areas.
2. Some emphasis should be placed on publishing material so that we have a broader understanding of what is being learned in the field, especially with respect to social resilience in marine environments. Dissemination of information is important for getting the word out.
3. There is a good selection of academic material that can help bolster these field-based efforts. Suggestion to look into these.
4. Theories about social resilience should be balanced with simple concepts that the field already incorporates in marine conservation, such as building trust and engaging with the local community.
5. Operationalizing this idea of social resilience is difficult. The Marine Learning Partnership gives an opportunity for exploration of interactions between biophysical, ecological & social resilience. Programs like this should be financially supported to maintain communication and efforts to share and build knowledge on social resilience so it can be operational.
6. The idea of resilience in a social context can be positive or negative in relation to the success of marine conservation. For example, a resilient community might thrive briefly under certain conditions but unrestrained development will negatively impact marine resources. However, resilience to necessary or unavoidable changes can be detrimental to a community and its environment.
7. Expert analysis is a complementary alternative to using metrics and indicators. Quick assessments by experts can often replace complicated monitoring programs. Also, the knowledge of local communities and "experts," especially conservation practitioners in the field, should not be underestimated.
8. Management actions related to social resilience could potentially be more effective than measuring different metrics. However, where abundant and quality information is available, metrics can certainly help move this field forward and should not be ignored. In poorer parts of the world, studies like this are very necessary to push the envelope.

9. Resilience provides an idea for adapting to change. Resilience is a very important way to communicate to people who don't think more than three years in advance.

3. Climate Change and Interacting Stressors: Implications for Coral Reef Management in American Samoa

Jordan M. West⁷ and Eric Mielbrecht⁸

Coral reef ecosystems are especially sensitive to changes in climate. Climate variability and change can either directly or indirectly affect sea surface temperatures, ocean carbonate concentrations, sea level, storm surges, precipitation patterns, stream flows to the coast, salinity, and pollution loads - all of which must be considered in the design of effective strategies for management of coral reefs and their ecosystem services. Because geographic patterns of climate variability differ among and within regions, as do the combinations of localized stressors that are unique to any given reef area, there can be no single management plan that will be optimal for all reef systems. Rather, the effectiveness of any reef management strategy will hinge on skillful application of general principles that are used to guide place-based analyses of specific vulnerabilities and to identify priority management responses that are likely to be most effective in the context of that particular location.

In this project, a case study of the coral reefs of American Samoa was used to develop: 1) a simple conceptual model for identifying climate and non-climate stressors, assessing reef vulnerabilities, and using the information to identify priority management actions; 2) an assessment of the particular vulnerabilities of American Samoa's reefs to climate stressors in combination with other, localized stressors; and 3) a set of priority management actions identified by the process, including discussion of how these could be incorporated into local management strategies to maximize long term reef resilience in the face of a changing climate.

Summary

Apply simple conceptual model for vulnerability analysis and identification of adaptive strategies. Assess vulnerability of reefs to interacting stresses. Identify priority management actions in response.

Actions include improving sewage system (EPA Clean Water Act), using monitoring programs (climate-related criteria and resilience testing), and developing MPA networks for resilience (20% goal of no-take areas by 2010).

Existing barriers include lack of authority, lack of local capacity, conflicting jurisdictions and mandates, and disconnected organizational units

Successes include multi-agency coordination, creative integration with existing and related activities, and increased attention to information hand-off in program planning.

⁷ U.S. Environmental Protection Agency

⁸ Emerald Coast Environmental Consulting

The US Climate Change Science Program contributes by assessing products to support policy-making and adaptation decisions, reviewing adaptation options for climate-sensitive ecosystems, and promoting successful implementation.

The coral reef community is way ahead in thinking about these issues compared to other ecosystems. We are now looking at barriers in creating such a program and getting our products disseminated to a broad audience.

Recommendations

1. First barrier is part of process; giving people answers instead of solutions. It's difficult to get politicians to buy in so pressure from key senators is important. Politics at high level is done through a very transparent process. All drafts are publicly available.
2. This is a great product to include in the ITMEMS statement. There are so many people with ecological backgrounds. Maybe we need more people involved in governance?
3. Because this is such a big process, there is a danger of lack of information flow. There are key people involved who deal with governance and there will be stakeholder workshops for each chapter. Make sure there are representatives at workshops of a cross-section of social scientists, managers, scientists, and other stakeholders.
4. Informal and external peer-review processes are important. People in formal government review cannot be involved in writing the document. There is reliance on NGO partners, such as TNC, for some of expertise. Need to look at barriers and how to address the problems.
5. Grey literature can be very important in forming processes.
6. Barriers to implementation of resilience approaches are not managers but institutions themselves. Forums to discuss these barriers should be more readily available. NAPA is one possible forum. The UK has a Ministry for Climate Change - they are dealing with barriers all the time. It would be interesting to ask them if they have done a strategic analysis of barriers like this program is doing. Also, what can we contribute internationally to ecosystems beyond coral reefs? There should be a global 'cross-fertilization' between different systems, including more integration between various levels to move past those barriers.

Small Group Discussion Outputs

Based on three case study presentations and small group discussion process, we identified the following recommendations (which were selected while identifying common barriers, solutions/opportunities, recommendations and actions for three main stakeholder groups):

- Stakeholders/General Audience
 1. Partnerships aimed at including locally appropriate groups to achieve local empowerment.
 2. Studies to understand local context to get good messages out by using local people and building capacity.
 3. Enable local communities to develop the "messengers" from within; encourage sustainable relationships.

