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# Understanding the interactions between biodiversity, threats and climate change

## Vulnerability analysis and strategies for climate change adaptation at conservation sites- the MARISCO methodology

### Connecting biodiversity and climate change adaptation and mitigation

Biodiversity, basically through the ecosystem services it supports, has a role to play in both climate change adaptation and mitigation. Conserving terrestrial, freshwater and marine ecosystems and restoring degraded ecosystems can reduce the amount of carbon dioxide released into the atmosphere and thus contribute significantly to mitigation objectives. At the same time, biodiversity can help people adapt to climate change effects (so-called *ecosystem-based adaptation*). Wetlands, mangroves and beach ridges provide protection against storms and floods and high levels of agro-biodiversity offer additional adaption options. For example, more drought-resistant crop plant varieties can counter the risk of food production failure in areas where rainfall is decreasing, thus contributing to food security.

Nonetheless, biodiversity conservation and management require a strategic adaptation for its own sake – and the conservation sector is only recently beginning to develop adaptation measures.

“Nature conservation management faces an increasing complexity of threats which impact biodiversity. Unforeseen, unpredictable risks are major challenges which, in order to mitigate, require a high degree of uncertainty conservation planning. Nature conservation is thought to be more effective if strategy design already integrates these potential, sometimes unknown threats. Nature conservation also has to factor in complexity-induced uncertainty and be ready for decision-making in the absence of evidence” (Geiger et al. 2012).

### Assessing vulnerability in the context of biodiversity management

One essential element of any adaptation process is to analyze the system’s vulnerability to expected changes, as these can affect the integrity, functionality and viability of this system. According to IPCC, vulnerability is “The degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes.” Vulnerability is also determined by the functionality or health of the system affected. A healthy ecosystem for example can withstand a change in exposure to a certain factor, such as drought. Methodological approaches for vulnerability assessments range from indicator-based and simulation-model-based to bottom-up approaches, as well as mixed-types. Challenges are inter alia related to the harmonization of concepts and methodological approaches, the availability of quality data and information and the required technical capacities in partner countries.

### The MARISCO methodology

MARISCO (acronym of the Spanish name for the approach: Manejo Adaptativo de RIesgo y vulnerabilidad en Sitios de COnservación – adaptive risk and vulnerability management at conservation sites) was developed by the Centre for Econics and Ecosystem Management at Eberswalde University for Sustainable Development as a result of projects and workshops carried out in

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several countries, including China, Costa Rica, Germany, Guatemala Peru and Ukraine. A number of these projects are implemented by GIZ on behalf of the Ministry of Economic Development and Cooperation /BMZ and the Ministry of Environment/BMU. While other scientific approaches to vulnerability assessments focus on prediction models based on biophysical data, MARISCO, which is derived from the Conservation Measures Partnership *Open Standards for the Practice of Conservation*, integrates both scientific data and information of other stakeholders, such as indigenous groups.

> "MARISCO is a participatory approach with the objective of facilitating the integration of risk and vulnerability perspective into the management of conservation sites to adapt management in the face of climate change, which is achieved in the form recommendations given at the end of the process".
>
> P. Ibisch, Centre for Economics and Ecosystem Management, Eberswalde (2011)

Key to this method is the input of multi-stakeholder groups which get together and discuss ecosystem services, likely impacts of climate change, as well as other direct and underlying threats. This discussion is supported by further knowledge, such as scientific data that is collected beforehand and presented in an easy to understand way during the stakeholder get-together. Vulnerability is then assessed within the group in 4 steps:

1. Definition of the conservation targets, with regard to biodiversity and human well-being.
2. Identification and assessment of current and future threats and stresses affecting the targets, underlying processes (e.g., criticality, dynamics, manageability, knowledge).
3. Illustration of the systemic effects in a conceptual model that also identifies major groups of relevant factors.
4. Identification and prioritization of vulnerability-decreasing and low-risk strategies and incorporation of these into existing management plans.

## Results & Successes

The great potential of MARISCO lays in its holistic and systemic approach. At the same time, its participatory character gives stakeholders the opportunity to state their experiences and concerns and enables them to be involved in decision-making, thus increasing acceptance for agreements and resulting policies. MARISCO is adaptable to different workshop and project settings, and does not rely on specific types or amounts of data, but utilizes different forms of available data. Furthermore, it not only refers to ecological vulnerability but also includes other factors influencing the management plans, such as socio-economic factors (e.g. population growth) in an integrated approach. A specialty of MARISCO is a dynamic analysis of threats and contributing factors also comprising plausible future trends and risks.

Despite the fact that stakeholders have different backgrounds and are on different knowledge levels, the assessments nevertheless succeed at making a reasonably comprehensive and complex systemic analysis, displaying these results and presenting a vision on future changes to existing management plans.

In Peru, the most stressed and threatened conservation targets were identified, as well as ineffective management strategies. In China, the management plan was revised and updated and additional new strategies were proposed for the local and regional level. These measures include assisting the agricultural sector, spatial planning around roads, as well as the establishment of bio-corridors to maintain connectivity. In Costa Rica, in two marine and coastal protected areas, the planning teams identified gaps in the existing strategic approach and came up with new proactive strategies, whose scope goes beyond the boundaries of the parks.

> "We value the results of the exercise, particularly in view of the fact that they contribute to developing the capacities of the actors involved in the management of our protected areas, so that they can address the challenges they face and future risks in a more strategic way. In this context, it is important for management strategies to incorporate the principles of precaution and prevention, so that we can be more proactive rather than simply responding to acute crises."
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> Mr Rudy Valvidia, head of strategic planning, SERNANP (National Service of Natural Protected Areas), Peru

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