INTERNATIONAL PROJECT

Integrating ecology and economics

By Rudolf de Groot, Jennifer Allen, Jenny DuVander, Ida Kubiszewski, Elinor Ostrom, Robert Costanza, Dieter van den Broeck

RUDOLF DE GROOT

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Interest in both the science and practice of ecosystem services is on the rise. Many studies have confirmed the economic value of investing in the conservation, restoration, and sustainable use of ecosystem services (TEEB, 2010). It is time to put all of this knowledge into practice. Local communities are increasingly using the concept of ecosystem services to manage shared or 'common pool' resources sustainably, challenging the long-held belief in the 'tragedy of the commons.'

This chapter and this book show that tragedy of the commons is avoidable, provided that people communicate when a shared resource is at stake, such as clean water provided by an intact watershed, the pollination provided by a community of bees, or the carbon sequestration provided by a healthy forest. In many places – from Swiss pastures to Japanese forests – communities have come together for the sake of the environment and their own long-term well-being.

PRESENCE (PARTICIPATORY RESTORATION OF ECOSYSTEM SERVICES & NATURAL CAPITAL)

By Dieter Van den Broeck, Marijn Zwinkels and Silvia Weel

BAS VERSCHUUREN

Contractors with the South African Public works program 'Working for Woodlands' plant native trees (Spekboom) in the Baviaanskloof Nature Reserve to help restore the land and sequester carbon.

The Baviaanskloof Mega Reserve in South Africa includes a nature reserve, which is a World Heritage site and private and community land. Over several decades, areas across the Mega Reserve have been subjected to severe ecological degradation, largely a result of overgrazing by domestic livestock, large-scale crop irrigation, loss of wetlands and invasive species. The impacts include riverbank erosion, a lowering of the groundwater table, and a decline of water supply to Port Elizabeth. This loss of natural capital and decline of derived ecosystem services is causing great socioeconomic strain on the area and its people.

Since 2008, PRESENCE learning network, facilitated by Living Lands (NGO), has been working with the local people to restore the area (http://www.livinglandscapes.co.za/). The group combines ecosystem services approach, transdisciplinary research and awareness-based technologies (social learning) to create collective awareness and understanding of challenges and opportunities for living landscapes. This mobilizes civil society to undertake collective action to restore natural capital for the recovery of sustainable water flow, to enhance carbon-sequestration potential, and to provide tourism and other livelihood opportunities through restoration of degraded ecosystems.

UNDERSTANDING PEOPLE AND PLACE One of the most important lessons to be learned from common-pool resource management is that no one solution is appropriate in all circumstances. While certain ecological and social principles can guide us in understanding how watersheds work and how humans interact with them, these principles will never tell us all we need to know about every basin. Instead, this understanding must come from a place-based assessment of the specific physical, ecological, climatic, societal, and economic factors shaping that particular place and people. We need to move toward a deeper understanding of these complex systems and their interactions.

EXPERIMENTATION AND STORYTELLING A key to successful management of ecosystem services is to share knowledge. An effective way to involve local communities is through storytelling (Poteete at al., 2010). Case studies provide an ideal opportunity to 'tell the story' and acknowledge both the qualities that make particular places and efforts unique as well as the elements that may be generalizable across contexts.

COMMUNITY BASED MANAGEMENT Using multiple ways to communicate about the services being managed has proven an essential element in successful co-management of shared resources. In many communities, voting is seen as the primary mechanism for participation in democratic systems. But the use of participatory geographic information system (GIS) technology, mediated modeling (see box 2), town meetings, or other approaches can also help participants develop shared learning about a resource and shape a unique place-based approach.

CHANGING ECONOMICS For many years much research has been devoted to developing ways to put a value on ecosystem services to help ensure that they are given adequate weight in decision making and resource management efforts (Costanza et al., 1997, TEEB, 2010). While some aspects of these services are easier to assign a monetary value to than others, a variety of approaches have been developed to better capture the value of ecosystem services to society. (see also www.teebweb.org)
While incorporating such values into cost-benefit analyses will help make these services more visible to policymakers, such analyses do not determine how such resources will be managed. A cost-benefit analysis cannot serve as a neutral arbiter of value, because even the best, most comprehensive cost-benefit analysis, even when it includes non-market values, will come down to a social decision about a community's shared ideals. Similarly, while a mediated modeling exercise can help people to come to some agreement about managing their resource systems (see box 2), there may still be conflicting beliefs and values regarding the use of these resources.
By making more explicit all of the values and ethical considerations that influence decision making, we can better design institutions to mediate when values are in conflict and assist in creating compensation mechanisms. This will help communities to make more balance trade-offs between managing for the delivery of ecosystem services and other types of outcomes that may be of value to society at large (see Box 4).

A GLOBAL PARTNERSHIP FOR ECOSYSTEM SERVICES To provide a forum for knowledge sharing on the science and practice of ecosystem services, the Ecosystem Services Partnership was launched in 2008 to coordinate efforts to assess and manage ecosystem services at all scales, global to local. It supports projects on the ground that aim to educate resource managers about best practices in different contexts while avoiding unnecessary duplication of efforts.
Through the ESP website (www.es-partnership.org), participants that include university groups, NGOs, practitioners and many others have easy access to the latest information and discussions on ecosystem services assessment tools, data, and policy-support instruments.
The ESP also stimulates and coordinates the development of a worldwide network of best-practices case studies ('show cases') on ecosystem services assessment and applications in actual management, such as at the Mega Reserve in South Africa (see Box 1), and works closely together with the IUCN Commission on Ecosystem Management.
Through these activities ESP provides a forum for communication between scientists and policymakers, government officials and business leaders to put ecosystem services into practice for more sustainable ecosystem management

www.esa.wur.nl

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MODELING MANAGEMENT OPTIONS OF THE SOUTH AFRICAN FYNBOS

by Robert Costanza

One example of how mediated modeling has been used effectively comes from the South African 'fynbos' shrubland ecoregion, one of the world's 'hot spots' for biodiversity.
In order to adequately manage the species-rich fynbos ecosystems, information about what services they provide and what their value is to society was needed. In 1995, a two-week workshop was held at the University of Cape Town with a group of faculty and students from different disciplines, along with parks managers, business people, and environmentalists.
One product of the workshop was the creation of a general dynamic model that integrated ecological and economic processes in fynbos ecosystems (Higgins et al., 1997). Benefits and costs of different management scenarios were addressed by estimating values for harvested products, tourism, water yield, and biodiversity. Costs included direct management costs, such as clearing invasive trees, and indirect costs, such as personnel and infrastructure. The model showed that the ecosystem services derived from the Western Cape mountains were far more valuable when the mountains were vegetated by fynbos plant communities than by alien trees. The difference in water production alone was sufficient to favor spending significant amounts of money to clear invasive pine trees and maintain fynbos in mountain catchments.
The model was designed to be user-friendly and interactive, allowing the user to adjust for different areas of alien-plant clearing, fire-management strategies, levels of wildflower harvesting, and park visitation rates. The model has been valuable in demonstrating to decision makers the benefits of investing now to stop the spread of alien plant species, since delays have serious social costs. Park managers have implemented many of the recommendations from the Cape Town workshop and have invested in alien-plant and fire management to enhance ecosystem services.

Flowering fynbos in western South Africa. A model created in a mediated modeling exercise showed that fynbos plant communities, which are threatened by invasive species, contribute substantially to the ecosystem services derived from the Western Cape mountains.

WARREN ROHNER

SUCCESSFUL CO-MANAGEMENT IN THE AMAZON

by Carol Franco and Leandro Castello

NATALUZO BALBINO

The Amazonian pirarucu is one of the region's most important and overexploited fish resources. Now, local fishers are working to sustainably co-manage pirarucu stocks.

In two reserves in the Brazilian Amazon, a local conservation organization, the Mamirauá Institute, has worked with fishers to develop a co-management model for the pirarucu (Arapaima sp.) (Castello et al., 2009). The pirarucu is one of the Amazon's most historically important and overexploited fish resources, growing up to three meters in length and 200 kg in weight. The Mamirauá Institute provides fishers with a broad range of institutional support services, and it facilitates negotiations between the fishers and governmental agencies. For example, the institute works with the fishers to facilitate vigilance of lakes to prevent violators from illegally harvesting the fish. Fishers also earn exclusive rights of use over the pirarucu with the condition that they obey fish size, season, and quota regulations. Fishers use their traditional knowledge to assess pirarucu stocks by counting the fish at the moment when the individuals surface to breath air. Fishers then use the data to set fishing quotas in collaboration with partner institutions.

Since the implementation of this co-management model within the reserves, overexploited pirarucu populations have rapidly recovered and fishers' economic returns have increased. Involving fishers in the co-management scheme also has improved compliance with management policies. Due to demand from fishers from other regions, NGOs, and governments, this co-management model has now been incorporated in legislation covering a fourth of the Amazon Basin area.

MANGROVE ECOSYSTEMS AND THE TRAGEDY OF THE NON-COMMONS

by Joshua Farley, David Batker, and Isabel de la Torre

Mangrove ecosystems provide many goods and services that are of critical importance to humans and other species, including protection against storms and tsunamis, retention of coastal freshwater lenses, filtration of sediments and pollutants that could harm coral reefs and other marine ecosystems, critical habitat for commercially and ecologically important species, and carbon sequestration. In collaboration with academics, NGOs, local government, and local communities in Puerto Princesa, Palawan, Philippines, we conducted a scientific atelier (a transdisciplinary workshop/field course) on the conversion of mangrove ecosystems to shrimp aquaculture in the region—currently the leading cause of mangrove deforestation.

We focused on a site that was actively being deforested as we worked. Facts were uncertain, decisions were urgent, stakes were high, and people's values mattered, so detailed, time-consuming scientific research was not an option. We instead conducted a transdisciplinary synthesis across the natural and social sciences, relying heavily on local knowledge, anecdotal evidence, the values of affected communities, and scientific studies conducted elsewhere. Decision-makers participated in the atelier.

We found that aquaculture yields high returns on investment for shrimp farmers for an average of three to five years before succumbing to disease and waste buildup, leaving behind a degraded ecosystem and grossly diminished ecosystem services. The economic, social, and ecological benefits of intact mangroves significantly outweighed the returns to aquaculture on both a short-term annual scale and multi-year scale. In fact, because intact mangroves serve as a nursery for commercial fisheries, they provide more seafood with a higher monetary value than shrimp aquaculture. The benefits of conservation are shared by many in neighboring communities, while the benefits of conversion accrue to the few private owners of the aquaculture ponds. Private property rights to mangrove ecosystems favor inefficient, unjust, and unsustainable allocation of the resource—a tragedy of the non-commons.

We presented the workshop results to the press and local government, the latter of which shut down the aquaculture ponds to conserve the threatened ecosystem, effectively restoring common property rights. In addition, the local government embarked on a mangrove replanting schedule in which the city's school children plant mangroves for two days, every school year.

Employees of Lexmark Research and Development Corp planted almost ten thousand mangroves along the shoreline on Olango Island, Philippines, as part of a corporate social responsibility initiative. Mangroves provide many important ecosystem services, including serving as nurseries for commercial fisheries.

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