

# Linking rewards and governance to effects of land use on environmental services at the scale of the lake

## The Context

Lake Singkarak is a beautiful, dramatic water body in the heartland of the former Minangkabau kingdom, well-known for its culture of blending a matrilineal society, Islam, entrepreneurship and a strong tradition of village government systems. The lake takes in water from five streams and rivers with the Lembang/Sumani River draining the intensively used rice fields around Solok town as major source. For centuries, the lake has bountifully supplied the people living on its shores and slopes with resources needed for a good life. The lake harbours an endemic fish species (*Mystacoleucus padangensis* or 'ikan bilih') that is an acclaimed delicacy.



Now, more than 400,000 people live on its slopes and shores. Their use of the lake and surrounding landscape risks destroying it. The forests of the area were depleted during the colonial era to provide wood for coal mines and never recovered. Government reforestation programs within delineated protection forests had little success. People throughout Indonesia benefit due to the lake's hydropower contribution to Indonesia's stretched-thin electrical power supply, but erratic water supplies lead to shortfalls especially in years with long dry spells. Fishers catch and eat or sell the ikan bilih, but experience declining stocks. The fallow cultivation systems used on the slopes under community and clan controlled land management have degraded towards a grassland/fire climax dominated by alang-alang (*Imperata cylindrica*). The productivity increase in paddy rice fields could not be copied in the upland cropping systems, although a mixed tree garden (agroforestry) system developed along part of the lake shore. A Satellite images of the lake's current condition show many denuded grass-covered hills around the lake, as well as healthy forest cover on the west-facing slopes of the Bukit Barisan range.

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effectiveness of local community systems in resolving and avoiding conflicts. In Singkarak, thirteen Nagaris line the lakeshore. While Nagari boundaries tend to coincide with hydrological subcatchments, the lake itself belongs to two different districts within the province of West Sumatra.

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lake who suffered the impacts of electricity production on their livelihoods. Also, allocations were not structured to work as incentives for enhancing environmental conditions, nor were allocation methods transparent to local communities. Finally, no process existed for forming consensus over what could be done to improve local livelihoods as well as environmental services, and there was no 'lake-centric' view on the management of local resources.

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### Understanding the technical design of the hydropower scheme

The Singkarak hydroelectricity scheme captures the energy of a 300 m difference in elevation between intake and outflow, of approximately 700 liter per m<sup>2</sup> per year (annual rainfall about 2000 mm, used by plants about 1300 mm) over an area of more than 1000 km<sup>2</sup>. Creating a new westward exit from the lake, the engineers could capture a much bigger difference in elevation than was possible in the valley of the Ombilin River, the natural eastward outflow. Although the lake has a large surface area (approximately 10% of the catchment area), its buffer capacity is limited because bank overflow leads to undesirable flooding and low levels of the lake lead to bank collapse and disrupts livelihoods. In the lake's natural condition, high incoming water flows from the streams were rapidly passed on to the outflow. Now, engineers have constrained such outflow, so the floods last longer. Water use for hydroelectricity production in periods without inflow causes nearly 1 m drop of water level per month. A drop of more than 2 m is considered unacceptable, so hydroelectricity production has to stop in dry periods, when the streams and rivers dry up and the water in the 'active storage capacity' of the upper 2 meters of the lake has been used.

### What Succeeded

#### Making the money flow to the upland communities

RUPES worked with both the hydropower producer and local communities to establish the importance of allocating the required royalties in a way that encouraged improved conditions for electricity production and other activities in the lake.

As a result, in 2005 Nagari Paninggahan received close to US \$40,000 as its first allocation of hydropower royalties about \$1 per person per year. This allocation system offers an example for applications elsewhere. The system uses criteria that include compensation for damage to livelihoods (Nagaris bordering the lake) and also favors relatively poor Nagaris. The funds are intended to provide incentives for maintaining

## Site profile: RUPES Singkarak

healthy environmental conditions. Because the amount of royalties available depends on the amount of electricity produced, all players have a strong interest in the good performance of the hydropower company.

### Multiple perspectives on forest, water and land degradation

At the start of the project, many stakeholders identified erosion as the key problem and reforestation of the grasslands as the priority for enhancing environmental services, particularly increasing water supply. However, exploring water-balance models and local ecological knowledge of the landscape in conjunction with the perceptions and preferences in the local policy discourse suggested that reforestation would not be the universal solution sought. RUPES hydrological research suggested likely mixed effects of reforestation on the lake and electricity generation. At the same time, according to surveys, all stakeholders had valid concerns about the quality of the lake water and its inflows pollution reduces fish stocks and other direct use values of the lake. Thus the project shifted focus from the quantity to quality of water flows as the primary focus for environmental services at Singkarak. This shift led to a need for better data and more detailed understanding of the effects of land use change.

Analysis of the data suggests that a reality check is in order for the public attribution of responsibility for inadequate water supplies for hydropower. Low forest cover and erosion probably have only a small role, with the primary 'blame' for the black-outs and underperformance of the hydroelectricity scheme going to years with long dry periods. Climate variability and global climate change not upland farmers may be the main culprit.

RUPES work also resulted in the evolution of national reforestation from a top-down planning mode towards more flexible mechanisms that invite community proposals for support, including those for 'protective gardens' or mixed agroforestry systems. As an example of community desires for protective gardens, Nagari Paninggahan placed high importance on re-intensifying the use of their traditional coffee gardens in a village-controlled enclave in the state forest zone that had been the primary location of the village in the past. Discussions with RUPES staff raised community awareness about the possibilities for using an eco-friendly form of coffee intensification in this area which had no history of fertilizer or pesticide use, and of the risks to the village's own water resources if it pursued more radical intensification.

RUPES Singkarak also yielded more experience on the voluntary carbon market with forms of reforestation that are aligned with local interests and decision making. However, the project led to the realization that the automatic bundle of environmental services first envisioned



*Farmers harvesting coffee in old gardens that they want to intensify organically to keep their water sources clean*



*The Paninggahan stream is clean and provides breeding ground for the 'ikan bilih' fish*

when more trees were supposed to assist in all environmental functions of interest is too simplistic.

### Creating a mediator at an appropriate scale

The new focus on lake quality and the interlinkage of land-use decisions in the two districts that control the lake, led to an effort to institute a new forum of all the lakeshore Nagaris. All local stakeholders have now come to the table to participate in developing the future for Singkarak.

Two of the lakeshore Nagaris have set up their own organization to be the intermediary with the other stakeholders. Also, after initial resistance, the hydropower company has become an enthusiastic participant since discovering RUPES did not seek study funding from it. The company wants a better framework for provision of environmental services. If it can position itself as simply a buyer of these services, then it can concentrate on the business of producing power rather than on being a pseudo-government. Finally, local government officials have come to the table showing a willingness to cooperate outside their normal sphere of regulatory authority as long as guidelines for the new regulators exist including budgeting and reporting mechanisms.

## Next Steps

**Institutionalizing Lake-Centricity:** Through RUPES facilitation, local stakeholders in Singkarak's environmental services have already succeeded in the first steps toward restoring environmental functions of the lake catchment area forming a "lake-centric" forum and implementing criteria that enhance environmental services for allocation of royalties.

For long-term success, stakeholders must develop a land use plan for the area. This is already in process with steps moving forward for a participatory process at the Nagari level with the involvement of traditional leaders. One example of the challenges the plan must resolve is that to minimize the potential of conflict between the community and the hydropower company during droughts, water regulation processes may need to be set up and climate forecast information used to improve the regulation. Different water regulation or compensation systems should be created for normal and extreme drought years to equitably, transparently and sustainably allocate the water among users.

**Scaling Out:** Making sustainable impacts on the environmental functions of the lake requires extending involvement outward by engaging more stakeholders. RUPES Singkarak needs to:

- Secure the participation of more Nagaris from around the lake in the governance structure.
- Extend the trust and social capital created among Singkarak Nagaris. Right now, some Nagaris have more trust in formal institutions, other in traditional institutions.
- Spread more knowledge about environmental functioning and payments conditional on environmental performance. Many community members still are confused on the effects of land use on landslides and water flows, and years of 'propaganda' have left their mark.
- Organize for optimum effect on policy makers. More government and parliament members need to become familiar with the project so they can learn of needs for policy changes in the water tax distribution systems and in other areas affecting environmental services.

### The RUPES Project:

Throughout the world, upland people, many of them poor, earn their livelihoods from lands and landscapes that, when properly managed, provide valuable environmental services to others. However, management practices that maintain or increase environmental services often have a cost to the upland people in time or income. Regulations and prescriptions of land use aimed at securing the services are often ill-designed and enhance rural poverty. RUPES aims to work with both potential users and producers of environmental services to find conditions for positive incentives that are voluntary (within the existing regulatory framework), realistic (aligned with real opportunity costs and real benefits) and conditional (linked to actual effects on environmental services), while reducing important dimensions of poverty in upland areas.

At each of the 6 RUPES action sites, local institutions partner with the World Agroforestry Centre (ICRAF) to implement action research aimed at developing effective reward mechanisms in the local context. The sites are Kulekhani in Nepal; Sumberjaya, Muara Bungo, and Singkarak in Indonesia; and Kalahan and Bakun in the Philippines. National policy dialogues are aimed at making policy frameworks more conducive to positive incentives.

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