

Singkarak: Combining Environmental Service Markets for Carbon and Watershed Functions?

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Introduction

The hills surrounding Lake Singkarak at the equator in Sumatra are a mosaic of natural forest, strongly degraded forest, grassland, failed reforestation projects, home gardens and agroforestry systems, separated from the lake by a zone of intensive paddy rice cultivation. There are clear opportunities for an increase in carbon stock through trees that farmers want and expect to gain the benefits from. A substantial part of the grasslands belongs to the community, and negotiations over resource sharing for reforestation on the state forest land are ongoing.

In 2002, the National Strategy Studies on CDM conducted by the Indonesian Ministry of Environment identified the Singkarak watershed as one of the potential sites in Indonesia for implementing a reforestation-carbon project. Despite its preparedness, the project has not obtained confirmed buyers in engaging in the carbon market. One of the reasons for the difficulties in finding investors is that the project was initiated when most of the rules regarding implementation of the Kyoto Protocol and the carbon market in Indonesia were still in an embryonic stage¹.

¹ Indonesia ratified the Kyoto Protocol in 2004 under Indonesian Law 17/2004 after more than four years of legislative and heated public debates.

An Indonesia-wide study to determine eligible districts for afforestation/reforestation (AR) under CDM categorized the two districts of Singkarak - Solok and Tanah Datar - as a Cluster 1 District (Murdiyarso *et al.* 2005). A Cluster 1 District has low to medium fire risk and still has, given its population density, substantial forest left. The site can well serve as a representative case for this 'cluster 1', as there is a substantial area that was deforested before 1990, while the track record of forest protection is good.

In 2004 the site joined the Rewarding Upland Poor for Environmental Services (RUPES) they provide program as one of six main learning sites for a program focused on mechanisms and modalities for poverty reduction through rewards for verifiable environmental services to the global and national communities. Under RUPES, the Singkarak project is seeking to build the capacity of local communities by developing institutions at relevant scales. As part of Indonesia's decentralization of government, West Sumatra province has restored the traditional form of local government in the form of *nagari* to replace the 'village' as lowest unit. Based on traditions, the *nagari* has broader responsibilities for local natural resource management in addition to the administrative role of 'village'.

Within the RUPES framework, Singkarak is an action research site that combines efforts to more directly link to watershed protection the existing monetary flows from the hydroelectricity plant to provincial and district governments (**Figure 9.1**) with efforts to participate in the global carbon market. By bundling the carbon sequestration and watershed protection as environmental services provided, the Singkarak project is prepared to take part in both local and international tender for its environmental service provision. The concept of bundling services, however, forms a challenge for the CDM concept of additionality and the apparent preference of investors for 'new' sites, where they can be in a more controlling role rather than being part of a 'bundle'. We will first describe the setting and efforts so far.

A Watershed in the Heartland of the Old Minangkabau Kingdom

The Singkarak watershed forms the heartland of the old Minangkabau kingdom. The southern part of the watershed forms Solok district, and the northern part, Tanah Datar. Lake Singkarak is a deep depression in the rift valley of the Bukit Barisan mountain range and covers nearly 10% of the watershed. Its natural outflow via the Ombilin river feeds into the Indragiri river, which flows to Riau province. The total area of the Singkarak watershed is about 129,000 ha. About one third of this area, or 43,000 ha, is considered to be 'critical land' mostly covered by *Imperata* grassland but also including land used for dryland agriculture, paddy fields and housing. Most of these critical lands with high slopes belong to the clan (*Ulayat Kaum*) and local community (*Ulayat Nagari*), while only a small part belongs to the state.

In 2002, about 400,000 people lived in the Singkarak watershed, at a density of around 205 people per square kilometre. According to official statistics, about 10% live below the poverty line. Dryland agriculture and fishery are the main income sources for the majority of people around Singkarak lake, while 10% of the people

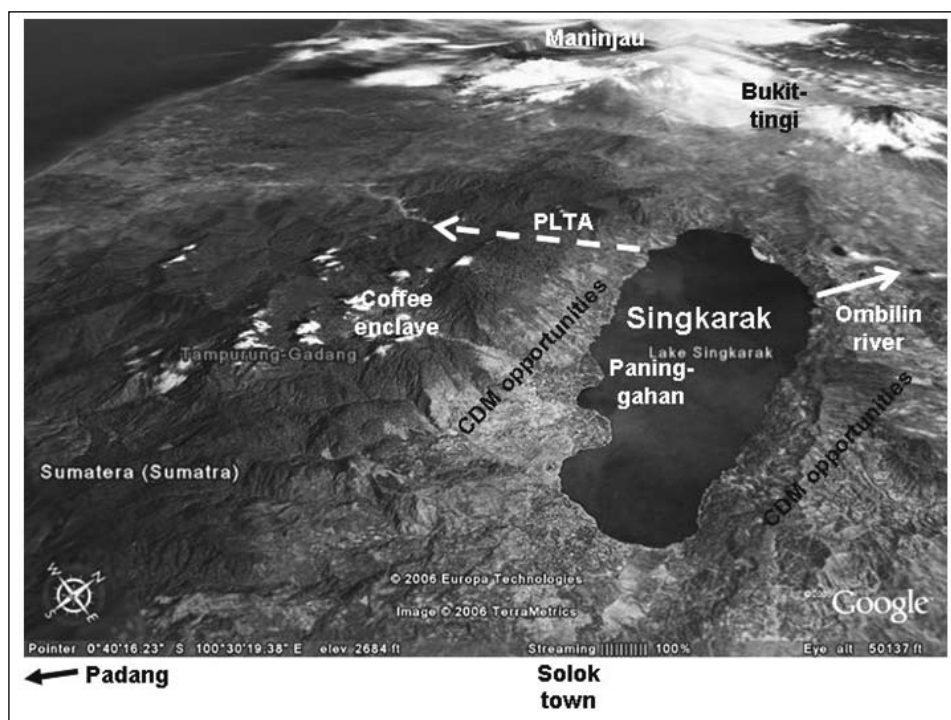


Figure 9.1. Bird's-eye view of Lake Singkarak in the rift valley amidst the Bukit Barisan mountain chain, which runs the length of the island, the forested escarpment that separates the lake from the Indian Ocean on the left (west), the grass covered hills to the east and west of the lake and the rice paddies at lake level; while the natural outflow of the lake to the Ombilin river has been reduced to an 'overflow' channel, most of the water now passes through a tunnel to a hydroelectric scheme (PLTA) to the west; the village of Paninggahan owns a coffee enclave in the natural forest zone

still practice swidden agriculture or shifting cultivation. The watershed is famous for native agriculture products such as good-quality rice, called *Bareh Solok*, and local fish, *Ikan Bilih*. Fish production is declining. The roles of overfishing on the one hand and land degradation and unsustainable land-use practices on the other hand are still under discussion.

***Nagari*, a Distinguished Local Government System**

The 'reformation' era in Indonesia in the beginning of this millennium has benefited the Singkarak communities. New decentralization policies launched in this era have revived the significant roles played by informal leaders in the governance system in West Sumatra, including in Singkarak (Arifin 2005). Unique to other districts in Indonesia, they apply the *nagari* government system, which is an autonomous, locally based institution led by a *wali nagari*, who is directly elected at village level. Each *nagari* government governs and enforces its traditional norms and conventions.

Each *nagari* has representatives or a parliamentary body called *Badan Perwakilan Anak Nagari* (BPAN). It consists of *adat* elders (*ninik mamak*), religious leaders (*alim ulama*) and intellectuals (*cerdik pandai*). The BPAN usually also involves the *adat* women organisation (*bundo kanduang*) and the young generation (*pemuda*). Besides the BPAN, there exist a supreme body of consultative *adat* agency called the village council, or *Kerapatan Adat Nagari*, and consultative institutions, *Badan Musyawarah Adat dan Syarak*. Benda-Beckman (2001) and Arifin (2005) provide more complete reviews of the *nagari* system.

In the beginning of 2000, local authority in managing natural resources had triggered environmental awareness within the communities. In *nagaris* surrounding the lake, they gradually started small-scale land rehabilitation and reforestation efforts, mostly using forms of agroforestry. A rehabilitation effort called Million Trees Planting Program started in February 2003 at Junung Sirih subdistrict, Kanagarian Paninggahan. The target of this rehabilitation program is to restore about 540 ha per year, or about 2,700 ha in five years. Progress is slow, however. Using the community fund, the program is able to rehabilitate only 30–40 ha in six months. Despite the slow rate of progress, the communities have a sense of belonging of their self-initiated efforts in protecting the environment. Current efforts are in stark contrast to previous government initiatives in which community members were seen and treated only as labourers for planting trees under reforestation mega-projects of the government. Therefore, these projects often spent a great deal of money with minimal success.

An institutional study of Singkarak showed that the *nagari* system acknowledges self-ownership both by societal rules and formal state rules (Arifin 2005). These imply that informal rules are well-defined and enforced. On the other hand, the society in Singkarak is generally aware of formal rules enforced by the state. Local people generally understand and comply with no-trespass rules for state-owned forest land, which also apply to land ownership. Land ownership—or more precisely the ‘right to use’ the land—is governed through locally defined conventions with *kerapatan nagari*, a decision-making institution. The communities generally trust their *nagari* leaders that they will govern and enforce norms and conventions for the sake of overall prosperity. The *nagari* system does enhance social bonding capital and reduces conflicts among community members.

Bundling Environmental Services: Potential Benefit Transfers Exist

In the emerging environmental service markets four environmental services are usually recognized: biodiversity conservation, carbon sequestration, landscape beauty preservation and watershed protection. From the buyers’ side the markets for these different environmental services are distinct, as the beneficiaries of services differ by location. From the sellers’ side, however, joint production of services is possible and efficient. In other words, investment in the production of one service results in the simultaneous production of other services (Landell-Mills and Porras 2002). In Singkarak, two environmental service reward schemes have high potential: carbon sequestration transfer benefits and watershed protection. The local government,

however, has seen that landscape beauty and biodiversity conservation also have potential to be further developed. The tourism office of West Sumatra is now setting up plans to revive commodities that had virtually disappeared, such as Kacang orange (*limau kacang*) and *ulu* coffee (*kopi ulu*); it also supports efforts to domesticate the bilih fish to sustain its production in a lake that is protected from pollution. Through the Ministry of Industry the central government will support revitalization of *Kopi Ulu Panningahan*.

Participation in Carbon Markets

In 2004, the Indonesian government ratified the Kyoto Protocol and established Designated National Authorities for CDM. These efforts are to allow Indonesia to participate in CDM projects. Carbon benefits generated by CDM projects, such as carbon sequestration projects through AR, can be sold or purchased by developed countries. The Singkarak project is being prepared to take part in an international tender under RUPES.

As previously mentioned, Singkarak lake is located in two districts, *i.e.* Solok and Tanah Datar. The total area of CDM eligible lands in these two districts is about 40,000 ha in Solok and about 30,000 ha in Tanah Datar (Murdiyarso *et al.* 2005). The total area proposed for AR CDM so far is only 15,000 ha, all in Solok district, surrounding Lake Singkarak. These lands have been cultivated as dryland agriculture



Figure 9.2. Condition of land proposed for AR CDM project at Singkarak

since the early 1950s. Erratic rainfall and inherently infertile soil have become the constraints in this cultivation. Most of the land has been abandoned and has turned into grassland and shrubs (**Figure 9.2**). These natural factors combined with financial and technical barriers are the main difficulties communities face in rehabilitating the lands. Therefore, their engagement in the carbon market may afford additional support from external beneficiaries in both land rehabilitation and reforestation.

CDM Project Design

According to interviews, about 45% of farmers preferred to establish an agroforestry system, while 55% preferred monoculture tree systems. To establish the system, about 80% of farmers required financial support, while the remaining required technical support. Furthermore it was found that farmers prefer to have fruit trees rather than timber as the price of timber is relatively low. Therefore, species and varieties used as well as planting arrangements in the project will follow farmers' preferences. **Table 9.1** presents the list of species to be used and the areas tentatively allocated to them.

Table 9.1. Species to be used for CDM project at Singkarak, based on farmers' preferences

English name	Local name	Scientific name	No. Household involved	Area allocated (ha)	Rate of planting (ha/yr)
Teak	Jati	<i>Tectona grandis</i>	1,500	1,500	300
Mahogany	Mahoni	<i>Swietenia mahogani</i>	1,500	1,500	300
Surio	Surian	<i>Toona sureni</i>	1,500	3,000	600
Cacao	Coklat	<i>Theobroma cacao</i>	1,500	1,500	300
Manggo	Mangga	<i>Mangifera indica</i>	1,500	1,500	300
Durian	Durian	<i>Durio zibethinus</i>	1,500	1,500	300
Candle nut	Kemiri	<i>Aleurites moluccana</i>	1,500	1,500	300
Avocado	Alpokas	<i>Persea americana</i>	1,500	1,500	300
Clove	Cengkeh	<i>Eugenia aromatica</i>	1,500	1,500	300
			Total	15,000	

The project will monitor the following carbon pools: aboveground biomass, belowground biomass and soil organic carbon. Deadwood is not considered, as new plantations will not acquire significant deadwood volumes during the project cycle. Similarly, the litter layer will contribute only a small amount of carbon to the total. Some studies (Zaini and Suhartatik 1997; Tiepolo *et al.* 2002) showed that fine litter contributed only 0.6% and 5.0%, respectively, to the total carbon stock in secondary forest and degraded land, while deadwood contributes only 0.3% of total carbon stocks in secondary forest; in primary forest litter contributed 1.7% and deadwood 3.2%. In general it can thus be said that the latter two pools account for less than 5% of the total carbon stock. The crediting period being selected for the project

is the renewable crediting period, *i.e.* 20 years with two possible extension of 20 years each. The type of credit being produced is that of temporary certified emission reduction, or t-CER. Baseline and monitoring methodology will follow Approved Methodology 'reforestation of degraded land' (AM0001) with deviation. The methodology is downloadable from the United Nations Framework Convention on Climate Change website (http://cdm.unfccc.int/methodologies/ARmethodologies/approved_ar.html).

The estimated cumulative net greenhouse gas removal by sinks will be about 4 million ton CO₂e. Using the t-CER system, the project will produce about 0.54 million tCO₂e in year 10, 1.7 million tCO₂e in year 15, and 4 million tCO₂e in year 20 (Figure 9.3). A study at one of the other proposed CDM sites in Indonesia indicated that even without considering the income from sale of CER, this type of project is financially attractive. Boer *et al.* (2006) found that using a discount rate of 12.7% (interest rate for agriculture project long term loan), without including the sale of CER, the net present value of the project is about US\$441/ha and the internal rate of return (IRR) is 32.8%. With the inclusion of CER, the IRR will increase slightly, depending on the price of the CER. The IRR increased by 1.7% at a CER price of US\$4/tCO₂e, by 3.3% at a CER price of US\$8/tCO₂e and by 4.6% at a CER price of US\$12/tCO₂e.

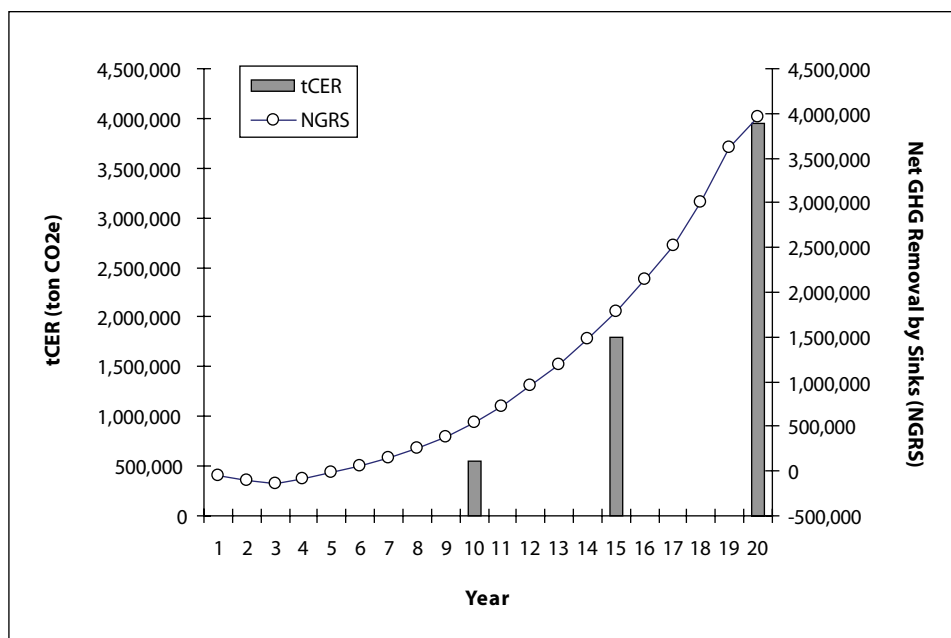


Figure 9.3. Net greenhouse gas removal by sink and t-CER produced by the projects

The main barrier to implementation of this type of project at Singkarak is the investment barrier and the absence of suitable credit facilities. If the AR CDM project is to be implemented, farmers expect the government to provide them with planting

materials as well as other agriculture inputs, particularly herbicide for killing grassland. Considering the decision made at CoP11 regarding further guidance relating to the CDM, paragraphs 20 and 21 of which state,

. . . a local/regional/national policy or standard cannot be considered as a clean development mechanism project activity but . . . project activities under a programme of activities can be registered as a single clean development mechanism project activity . . . [provided that CDM methodological requirements are met. And] . . . large scale project activities under the clean development mechanism can be bundled,

the government may consider Singkarak part of the programmatic CDM. With this scheme the government may provide financial support. Additional funding for investments is also sought from the PLTA Singkarak.

Tapping Transfer Benefits from Watershed Function

The lake contributes to the livelihoods of both people surrounding it and those living downstream. A state-owned hydroelectric power (HEP) company built a water tunnel starting in the western part of the lake and produces about 986 GWH per year. This electricity supply covers two provinces, West Sumatra and its neighbour, Riau. The lake still is the source of the Ombilin river, which irrigates rice paddy fields in four downstream districts.

The HEP cannot escape from the environmental problems caused by degradation of the watershed condition, which potentially aggravate the fluctuations in annual rainfall that are part of the local climate. In a period without rainfall, the water level of the lake can drop nearly 1 m per month if the HEP operates at full capacity. A drop of more than 2 m in level causes the HEP to stop operation and hence causes blackouts in the areas depending on its electricity. Local rice farmers also have to stop operation in dry periods and/or may lose crops in which they have invested.

As part of RUPES, a rapid assessment of hydrological functions of the Singkarak watershed was made, comparing the perspectives of local people, government officials and scientists (Farida *et al.* 2005; see **Box 9.1**). The study concluded that the watershed needs to balance three objectives: to maintain a clean lake, to produce electricity for the two provinces and, most importantly, to meet expectations of the large population residing upland and downstream for productive landscapes on hills and irrigated plains.

Based on national regulations, the local government in West Sumatra has issued its own regulation on the utilization of tax money derived from the use of surface and subsurface water. Such income, as derived from the HEP, is shared among provincial government (30%), the district that produces the tax (35%) and other districts of West Sumatra (35%). Further regulation on how this tax should be used or distributed to the community is unavailable, however. For this year, water tax collected from the Singkarak HEP was about Rp 2.2 billion (US\$250,000), and about Rp 777 million (US\$88,300) has been distributed to Solok and Tanah Datar districts. The *wali nagaris* expect that most of this tax will be given directly to the local community through the *nagari*, and therefore they also requested the district governments to issue a regulation on tax distribution. The funds gained from such

Box 9.1. Rapid Hydrological Appraisal of Lake Singkarak Watershed Functions

The rapid hydrological appraisal of Farida *et al.* (2005) analyzed perspectives of a range of stakeholders—local communities, researchers and policy makers. A topic that appeared to be controversial is the effect of planting *Pinus merkusii* or other fast-growing evergreen tree species on the quantity of water supplied to the lake. Although these species were favoured by foresters for past ‘re-greening’ efforts, water use by canopy interception and transpiration of such trees reduces total water yield to the lake, and the expected increase in regularity of flow through better soil structure will not fully compensate this effect.

The hydrological model pointed to a strong dependence of HEP performance on variations in annual rainfall and possible increase of El Niño years with long dry seasons under the influence of global climate change. This effect exceeds that of local land cover change. The study pointed to the importance of maintaining water quality in the lake for all stakeholders, with concerns over sediment inflow, as well as nutrients and urban waste.

Reforestation efforts using appropriate tree species and focused on relevant ‘erosion hot-spot’ locations can lower sediment influx to the lake and improve regularity of water flow. As part of these findings were surprising to some of the stakeholders, good communication is needed to avoid over-responses on perceptions that reforestation is either sacred or evil. It requires ‘the right tree in the right place’.

tax distribution may be a source of investment in watershed protection. Use of these funds to maintain sustainable management of the Singkarak watershed will increase both internal and external benefits for the communities. A transparent mechanism for the allocation of such funds is needed.

Institutionalizing Environmental Service Rewards in Singkarak

The process for institutionalizing RUPES at the Singkarak site has followed a number of steps. The first step was the identification of the range of environmental services that can be provided by the landscape managed by the communities, as well as of barriers for the implementation of effective reward schemes. The second step was the establishment of appropriate institutional arrangements for transfer payment, agreements, monitoring system and enforcement mechanisms. An important lesson from the first step involved scale. With the shift towards management of water quality in the lake it became important to have cooperation between all lakeside *nagaris*, and a relevant forum has now started. The third step, currently, is piloting the RUPES program and disseminating best practices and lessons learned from these projects to raise awareness at all levels on how the transfer of payments in delivering environmental services can benefit upland communities.

In its first and second year, the RUPES Singkarak has successfully clarified its environmental services and potential schemes in getting rewards from the external

beneficiaries based on scientific data. Main activities in the second step were to identify types of rewards and to set up institutional setting at *nagari* and district level as well as regulations needed to support the implementation of the RUPES program. Activities being conducted in the third step include the piloting of institutional processes for the provision of environmental services and the enabling of the local institutional system to implement an environmental services program.

The regional institutions are the Joint Committee as a means for negotiation between sellers and buyers, the Joint Audit as monitoring and enforcing institution and the Management Body for Singkarak Lake as representatives of sellers at higher level, coordinating all activities and development on the scale of Singkarak lake basin. At the more localized level, an environmental management body has been established for each *nagari* surrounding the lake.

From the stakeholders process it was suggested that the principle of giving reward or compensation for environmental services should follow four principles, namely, (i) an individual or community receiving benefits from the environmental services should pay, (ii) any individual or community being affected by the development activities that damage the environment should get compensation, (iii) any individual or community that contributes to the environmental enhancement should get rewards, and (iv) any individual or community that contributes to environmental damage should pay compensation.

Following these principles, any individual or community giving the rewards will be considered a 'buyer' of the environmental services, while the ones who receive the rewards will be considered 'sellers' of the environmental services. The main difference between rewarding and compensating is that in a rewarding process, sellers have (voluntary) roles in either maintaining or rehabilitating the environment, while in a compensating process, the individual or communities are (involuntarily) affected by environmental damage.

Through a consultation process with related entities and agencies, it was considered that governments (central and local), the private sector (hydropower and electricity companies) and international communities may be buyers, while the community that contributes to the improvement of environmental quality (local and global) in the form of environmental services will be sellers.

In this institutional system, the central institution in Singkarak is the Joint Committee, a forum where buyers and sellers can negotiate and discuss environmental services projects and agree on price and financing system. The community or farmers' group that has a program could prepare a proposal and submit it to the Joint Committee, which could then assist or facilitate the further process such as by finding buyers. When buyers and seller reach an agreement and the project is implemented, there would be a Joint Audit that will evaluate and monitor the achievement of the seller in conducting the project activities. In conducting the activities, the seller or the provider of the environmental services will get supervision from local government or any entity at the local level that has the capacity to do such services. In this case, governments could act as regulators, intermediaries and also as buyers.

At the regional level, the communities surrounding Singkarak Lake represented by the *wali nagaris*, heads of Kabupaten Solok and Tanah Datar districts and

representatives from the local House of Representatives discussed the institutional system for coordinating all the development processes at Singkarak Lake. It was agreed that such an institution should be formed and it would be named Management Body for Singkarak Lake (*Badan Pengelola Danau Singkarak*). A series of meetings to discuss the formation of this entity as well as its role and function are being held. It is expected that the management body will play an important role in representing the environmental service sellers at higher levels in engaging the reward schemes.

Institutional Model at Nagari Level

In less than two years, the RUPES Singkarak team has succeeded in strengthening the local institutions. Pioneered by Nagari Paninggahan as the core *nagari* for the RUPES Singkarak project, 13 local environmental organisations at *nagari* level have been established. The mission of these local organisations is to become a means for environmental service providers in enhancing the local role in environmental management and directly involving them in any potential environmental services reward schemes. These local institutions have *nagari*-specific structures, which means that local conditions and needs will be the main consideration when making any decisions.

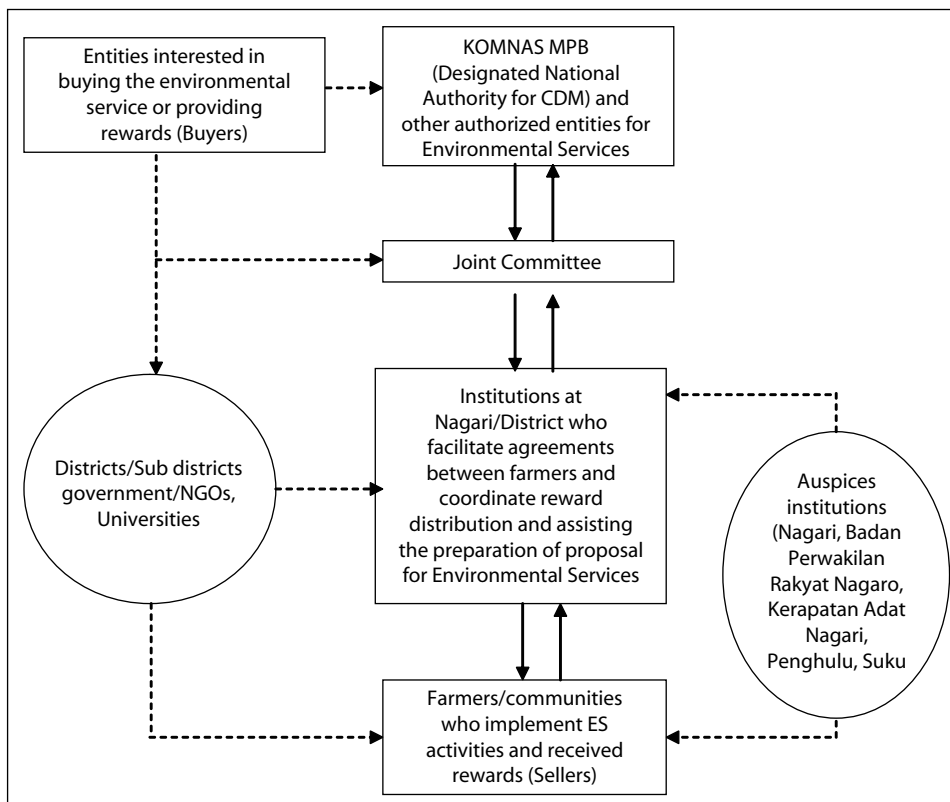


Figure 9.4. Relationships among local and national institutions on environmental services rewards.

The relationship between institutions at *nagari* level and other institutions (Figure 9.4) shows that at the national level institutions are being formed by the government of Indonesia that will give approval to any proposal related to carbon services. These institutions are National Commission for CDM, or KOMNAS MPB in Indonesian, which is formed through Environmental Minister Decree Number 206/2005, and CDM Working Group which is mentioned in the Forestry Minister Regulation Number 14/2004.

In order to make the above institutional system operational and sustainable, further activities are still needed. Consultation with government and parliament members should be continued (new local regulations may be needed, e.g. rewards distribution system, funding allocation system to communities or villages should be based on achievement).

Conclusions

The Singkarak case shows that to engage in the environmental service markets a site should address not only environmental responsibility but also social responsibility. By prioritizing social responsibility, the success of the project will be ensured. The Singkarak case fits the pro-poor approach and scientific evidence in the management of a watershed. Planting tree-based and agroforestry system with carefully selected species that benefit and comply with the preferences of local communities as well as are able to provide environmental services can become an example.

After clarifying problems at different scales of watershed, its potential environmental services and reward schemes, the Singkarak team under the RUPES program decided that the most critical step was to strengthen institutions at both local, regional and provincial levels. Strong institutions based on specific local conditions and customary systems have proved their effectiveness in governing environmental management and enforcing goodwill for communities' overall welfare, including enhanced participation from communities.

At the local level, the Singkarak case shows the potential to build on the *nagari* system as the core system for establishing more just and sustainable environmental service reward mechanisms, especially for local communities as sellers. This customary based local governmental system is rich in well-defined and enforced informal rules—including ones for environmental protection, society-based collective actions and respect for land ownership. All of this conditionality could reduce conflicts and support credible commitments to supply environmental services, which assumedly can further reduce transaction costs—costs incurred in the creation, alteration, protection or enforcement of property rights for engaging in environmental service markets.

A challenge, however, in current CDM guidelines is that 'additionality' is more difficult to assert if in fact there are multiple reasons for and benefits to be derived from the interventions that will enhance local carbon stocks. While 'synergy' is lauded, we still need a credible answer to the question why such landscape rehabilitation has not happened spontaneously, if its economic rates of return plus local environmental benefits make it attractive. Part of the answer is that a degree of collective action is

needed that requires a ‘trigger’. Another part is valid especially for the state forest land, where use of conditional tenure instruments has only recently become legally possible.

In getting broader opportunities, the Singkarak project is undertaking the bundling of two environmental services: carbon sequestration and watershed protection. Difficulty in finding proper buyers is one of the challenges faced by the project. Therefore, the maintenance of positive, or at least neutral, environmental service supplies for both watershed protection and carbon sequestration is expected to tap local and international transfer benefits for environmental services.

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