

WATER AND A PAYMENT SYSTEM FOR ENVIRONMENTAL SERVICES

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Abstract

This paper discusses the nature, uses and value of water and explores models successfully established in some countries for delivering watershed services and water resources. In light of the conditions that have resulted in the institutionalization of market-like arrangements outside the Philippines for the use of water, the paper also assesses the prospects for establishing a system of payment for watershed and water-related services in the country.

1. The Supply and Uses of Water and Watershed Services

Water is produced through the hydrological cycle and has been accessed historically as a public good in local watershed sites. Through the continuous process of evaporation-transpiration, cloud formation, and precipitation, water, as a natural product, is generated without economic costs. It rains down on the land, streaming from forest headwaters through rivers, draining into lakes and bays, and infiltrating the aquifers. The surface and groundwater sources are then available for diversion or human use. Given the natural processes in water production, the availability and quality of the resource is dependent on the watershed, which does not only provide raw water but environmental services as well. Its quality is a function of the state of the forest ecosystem particularly the area covered by intact forests, the allocation of land and water resources for agriculture, settlement, recreation, nature protection, and other uses, and the impact of such uses on the watershed.

The state of the forest ecosystem and the resource-use pattern within the watershed may either

disrupt or sustain the flow and quality of water and the performance of the watershed's regulation functions (de Groot 1994)¹. A stable forest ecosystem, for instance, regulates the flow of both surface and groundwater. Specifically, it slows down the rate of runoff during the rainy season, increases dry season base flows, and determines the recharge of the water table. It also maintains both water quantity and quality by protecting the soil and reducing the incidence of soil erosion and landslides, thereby preventing the sedimentation of waterways while filtering contaminants and controlling the nutrient and chemical load of water and its salinity. Apart from contributing to topsoil formation and maintaining soil fertility, a healthy forest ecosystem also determines local climate conditions, which enhance the productivity of natural resources. In particular, forests alongside waterways and mangroves provide both nutrients to life forms in water bodies and adequate shade to keep temperatures at optimum levels for maintaining quality aquatic reserves and fishery stocks.

The forest ecosystem, the watershed and the quality water resources produced in it provide

¹ The regulation functions of watersheds include the following: topsoil formation and soil fertility maintenance, prevention of runoffs and floods, control of soil erosion and sedimentation, water catchment and regulation of the water table or groundwater recharge, control of sediment and nutrient load, maintenance of aquatic habitats, and the determination of local climate conditions.

benefits to human consumers and generate quantifiable producers' surpluses. For as long as they are abundant, the taken-for-granted value of these resources is not as apparent. However, it is when environmental conditions deteriorate and the supply of water resources and environmental services is short of demand that their scarcity value becomes apparent. The threat of water scarcity has led economists to make its value problematic.

From the perspective of economics as a discipline, water, while a natural product, is considered a good with complementary outputs or a resource with multiple and alternative uses (Young and Haveman 1985). A water reservoir, for instance, has both off-stream and in-stream uses apart from providing flood control and other complementary services. Withdrawn or diverted from surface and ground sources, the off-stream uses of water include crop irrigation, industrial and service sector production, municipal and domestic consumption, recreation, and waste removal.

In-stream waters or those that are neither diverted nor consumed have direct use values including the production of hydroelectric power or the provision of inland waterways navigation. They also provide indirect benefits to the community and particular groups in the form of free environmental functions, e.g. assimilation of wastewater, dilution of saline water bodies, recharge of the aquifer, maintenance of fish and wildlife habitats, and provision of aesthetic values.

Given the use value of water and the context of its production, both off-stream and in-stream water uses must be managed competently within a watershed context. Because off-stream withdrawals are made within a given spatial or geographic space, their direct use values are distributed sequentially among users — from those in the upper watershed areas or reservoir to those in the lower drainage areas. Similarly, the impacts of changes in stream flows and water quality are transmitted in the same sequence.

Being a collective or public good, in-stream waterflows must also be managed and integrated to off-stream uses within a watershed context. This approach is imperative because in-stream flows absorb the impact of negative externalities, such as wastewater from off-stream uses, and pollutants derived from agriculture, logging, mining, industrial production, or municipal solid wastes. Moreover, the quality of in-stream waterflows is adversely affected by forestland losses and changes in watershed resource uses. A logical consequence of a watershed approach to in-stream water management is the inclusion of watershed conservation and restoration efforts and comprehensive pollution regulation to policies that aim to maintain the environmental services and benefits (e.g. livelihood opportunities) from water bodies that are not diverted off their streams.

The conservation and management of the watershed is essential because its degradation results in a less congenial local climate, droughts, floods, excess sediments, reduced groundwater recharge, soil nutrient and other resource losses. The deterioration of watershed resources and environmental services also translates into economic welfare and productivity losses that can be measured by the decline in consumer and producer surpluses. Specifically, farm yields and rural incomes are adversely affected by deforestation, soil erosion, and the consequent loss in productivity of existing irrigation systems and hydroelectric power facilities. Similarly in the more urban areas, if surface water sources become polluted, the resulting dependence on groundwater resources would bring depletion threats, raise energy or production costs, and lower living standards.

2. What is the Value of Raw Water?

The *in situ* value of raw water or its value at the ground or surface source is distinct from its “supply” cost, namely the cost of its diversion, extraction or withdrawal, storage, and conveyance.

In more precise terms, raw water value net of this “supply” cost is the benefit that a user obtains, whether as a resource input demander or as a direct consumer. As an input in the production of a marketable good like agricultural crops, bottled mineral water, beverage (soft drinks, beer, liquor), or any water-dependent product, a unit of raw water generates a value equal to the marginal revenue product (MRP). In economic parlance, MRP is the contribution to sales revenue of using an additional unit of water in the production of a final good. If raw water is freely obtained, i.e. at zero price, then its direct use provides producer-water users an economic rent that becomes part of their surplus. In other words, MRP or economic rent is the value of raw water. Similarly, each direct consumer of free raw water receives benefits in the form of consumer’s surplus that can be quantified by their willingness-to-pay (WTP) to have it. While MRP is the value of raw water as a factor resource, WTP is its value as a final good.

Whether as a factor or a good, raw water that possesses value is necessarily of a quality that renders it usable. If raw water loses this quality or becomes polluted, it ceases to have positive use value. The value of degraded water could only be restored by an investment outlay in the treatment, damage reparation, restoration, pollution abatement or prevention of further degradation of the resource.

In light of the competing or alternative uses of raw water, opportunity cost is another source of value. To illustrate, given two alternative uses for raw water, say domestic consumption and farm irrigation, its reallocation from irrigation use to domestic consumption entails an opportunity cost or foregone income for farmers. The reallocation of raw water in this example is socially beneficial when the estimated economic value of water to domestic consumers is greater than the opportunity cost of irrigation water.

Apart from the competing uses of raw water and the resulting opportunity cost of shifting from

one resource use to another, the positive value of raw water, particularly ground water, could also be derived from the foregone future consumption of present consumption. In a situation where groundwater use is increasingly unsustainable because withdrawals exceed aquifer recharge, the depletion premium becomes the basis for raw water value.

Given the various considerations for assessing raw water values and the need for water resource and watershed management, government may implicitly or explicitly establish any of these values as it deems fit through a water user fee system. There is an underlying raw water value in a fee system that seeks to capture a portion of the producers’ economic rents or the consumer’s willingness to pay. Similarly, the actions of state or non-state agents to address watershed deterioration, stabilize waterflows, abate water pollution or improve water quality by establishing a water payment system are efforts to restore the positive raw value of water.

3. Existing Country Payment Systems for Watershed Services

Individual enterprises and local or national states in several countries have successfully established market-like watershed arrangements or payment systems that have restored and improved the availability of sufficient quality water and watershed environment services. With or without government support, downstream farmers’ irrigation associations, water utility or hydroelectric companies, bottled mineral water producers, other industrial water users, and tourist resorts in these countries have either identified and contracted potential upstream providers of watershed service, or have contributed funds to local governments, state agencies, non-governmental organizations (NGOs), multisector associations, or intermediaries to enable them to manage the watershed and bring into the arrangement both the demanders and suppliers of environmental services.

3.1 Direct Payments to Environmental Service (ES) Providers

Table 1 shows the various forms and terms of environmental service payments and their uses in particular case countries². The hydroelectric plant in Costa Rica, for instance, makes direct payments to upstream forestland owners to undertake forest protection measures that would stabilize waterflow and reduce sedimentation. Similarly, Perrier-Vittel of France, the world's largest bottler of natural mineral water, has directly negotiated with other users of the Rhine-Meuse watershed, spending millions of dollars in long-term contracts with landholders surrounding the springs, the purchase of hydrologic-sensitive lands, the restoration of the natural forest of northeastern France especially the sensitive infiltration zones, the extensive promotion of organic farming practices to prevent nitrate and pesticide pollution of ground and spring water sources, and the overall rehabilitation of the natural water purification capacity of the forest³.

3.2 Indirect ES Payments to Intermediaries

Water users have also made payments indirectly to providers of watershed services through intermediaries that manage the funds and oversee the implementation of watershed rehabilitation and conservation projects. As cases in point, water utilities in Sao Paulo and hydroelectric companies in Costa Rica, respectively, pay a percentage of their revenues to a municipal environmental council or a fixed fee sum per hectare of upstream forestlands managed by an NGO. In Cauca Valley, Colombia, on the other hand, farmers' irrigation associations pay additional water fees to the Regional Environmental Authority to finance its upland community and environment projects for reforestation, erosion control on steep slopes, protection of springs and stream buffers, land purchases, and livelihood. Their

WTP is based on the expectation that the efforts of intermediaries would improve base waterflows and reduce sedimentation in their irrigation canals. Interestingly, intermediaries in these countries have established a trust fund for sustainable watershed management from various sources. The Water Conservation Fund in Quito, Ecuador, for instance, has been built up from various user-fee payments, water district revenue contributions, and national and foreign grants. The Fund is used to promote agriculture best practices, alternative upland livelihoods, purchase of hydrologic sensitive lands, on the one hand, and implement other watershed protection projects that improve water stream flow and quality, on the other.

3.3 State-established Funds for Watershed Services

Local, regional or national governments have not only provided support to local private initiatives in the establishment of watershed arrangements through technical assistance and counterpart funds. Some have also directly raised funds for watershed environment services restoration and improvement by either reallocating existing state revenues or levying new ecological taxes. The state of Parana, Brazil, for instance, has legislated the allocation of a significant portion of indirect sales tax revenues on goods and services for protected area and watershed management at the municipal level⁴. The Colombian government, on the other hand, has mandated the so-called environmental services tax (eco tax), a new tax measure specifically directed for watershed management. Pooling together a portion of municipal and departmental budgets into an Ecosystem Fund with a percentage of both the revenues of hydroelectric companies and the investment expenditures of industrial water-users, regional autonomous corporations are managing the fund for their respective watersheds.

² Some of these cases were drawn from Landell-Mills et al. (2002) and Pagiola et al. (2002).

³ These ecosystem-based measures were deemed to be cheaper than conventional investments in filtration plants.

⁴ A portion of sales taxes is redistributed to municipalities that take action either on their own or in cooperation with private landowners to protect watersheds. Allocated on a competitive basis, a larger portion of tax funds is being given to municipalities that protect more watershed areas.

At the local level, city governments have also directly raised and harnessed funds for watershed protection and development. The city government of New York, for instance, has raised water bill rates and issued city government bonds to finance such activities as distribution of land development rights, promotion of non-timber production, and establishment of awards for best farm and forestland practices that would help increase and improve domestic water supply. Similarly, the local authority in the Murray-Darling Basin of Australia pioneered the marketing of water transpiration or salinity credits to induce irrigation farmers who contribute to the salinity problem with their high water consumption levels to buy transpiration credits from landowners and State forests. Funds from these sales have then been used for reforestation and protection of the existing forest cover, thereby keeping water table levels under control and preventing dissolved mineral salts from rising to the surface and degrading freshwater supplies. All these human interventions at the enterprise, local and national state levels have thus been undertaken to restore and improve the delivery of watershed environment services.

3.4 Lessons from PES experiences: Conditions for Success

The successful establishment of watershed arrangements and eventual restoration and provision of environmental services in particular countries may be attributed to the following conditions. These conditions specify to some extent the requirements for replicating the arrangements discussed above in the Philippines.

- Local water users are particularly aware that their problems on reduced water availability, severe shortages, deteriorating water quality, and the threats of uncertain future water supplies are related to the state of

local forest vegetation, watershed conditions, soil stability, upstream land uses or farm and forest practices. The awareness of this relationship is the basis of their demand for environmental services or their desire for changes in forest, watershed conditions and land uses.

- Knowledge or direct experience of the adverse effect of forest and watershed degradation and the consequent unavailability of adequate quality water on current economic rents and future net income streams have pushed local water-dependent enterprises to take action and mitigate the adverse environmental impacts on their economic activities and recover past productivity or income flows.

- The willingness or resolve to take action is also partly supported by the awareness that there are particular activities, land-use practices, technologies, or “proxy commodities”⁵ that can help restore, improve watershed conditions and produce the needed environment services. These required activities or proxy commodities, however, become available only with the establishment of an agreement or contract with potential suppliers. Apart from specifying the desirable required activities that must be undertaken, an agreement between demanders and suppliers of environment services should also define the terms, rights and responsibilities of the parties involved, and the mode of compensation. The measurable activity inputs in the agreement serve as the basis for monitoring supply and determining payments.

- The established agreement or arrangement is an expression of the demanders’ willingness and capacity to invest in the restoration of natural capital. The payments for proxy

⁵In the above cases, the proxy commodities for regulating water runoffs and maintaining the water table or water quality may include the establishment and management of a protected area, agreements for springs and riverbanks protection, nursery establishment, reforestation of riverbanks, and provision of upstream livelihood projects. The proxy commodities for improving water quality, on the other hand, consist of watershed protection, soil stabilization, best management practices contracts, construction of conservation easements, development of alternative products or non-timber markets.

commodities are essentially purchases of capital or investment goods or expenditure outlays for the maintenance, improvement or restoration of watershed assets that would ensure future income streams⁶.

- The particular conditions that constrain the decision to invest, such as the free-rider problem or the uncertainty in the delivery of the services or proxy commodities, must be addressed. The free-rider problem is partly reduced when investment decisions do not depend on many unorganized individual producers but are made instead by an institution, group, corporate enterprise, or producers' association. The uncertainty over the expected results of an arrangement, moreover, may be addressed through the terms of the contract, monitoring activities, and contract negotiations.

- In the context where neither the willingness to pay of some water users nor their capacity to initiate contract agreements with potential providers of environment service can guarantee the establishment of such arrangements, the role of intermediaries or state intervention is essential. Under conditions where many unorganized demanders of environment services experience uncertainties and are prone to free riding, the intermediary can cover the transactions costs of building consensus, resolving conflicts, forming agreements, pooling demands and payments for risk sharing, and negotiating contracts with potential suppliers⁷. Once agreements are formed, the intermediary may also handle the costs of fund management, monitoring and enforcement, or the oversight and implementation of watershed rehabilitation and conservation projects. It may also take on

the pedagogical function of instilling positive appreciation of raw water value and the perspective that water is not a free good. This function, in turn, supports the state's function to collect or enforce water-user fees.

- Because the funds that individual water-dependent enterprises can invest may not be sufficient for the restoration and improvement of the watershed for the benefit of the public, state revenues must be raised and allocated for this purpose. There is, therefore, a need for a legal policy and regulatory framework that recognizes the public goods nature of hydrological services and the public desire for watershed protection. This framework would then justify the reallocation of budgetary resources or the imposition of new ecological taxes or higher water-user fee rates for priority watershed rehabilitation and protection projects⁸, while recognizing the differential capacities of various water users to pay for environmental services.

Given some of the conditions for the successful establishment of payment arrangements for watershed services, what is the prospect for adopting similar arrangements in the Philippines? The answer to this question requires a review of particular features of Philippine watershed use and management.

4. Prospects for PES in the Philippines

Small farmers, rural households, water-dependent enterprises, local governments, and state agencies in the country are generally aware of the problems on reduced water availability, severe shortages, or deteriorating water quality, if not the threat of uncertain future water supplies. Some can also

⁶These expenditures as the replacement cost of lost watershed services are an indirect measure of such environment services.

⁷Involving stakeholders, particularly in the design of the payment mechanism and service delivery arrangement, is one important role of the intermediary. Stakeholder participation is crucial to win the support of beneficiaries and ensure against free riding. Similarly, consultations with potential suppliers would enable the payment system to respond and meet their needs and thereby provide watershed protection. Broad participation is thus essential in order to avoid "free-riding" in consumption and convince beneficiaries to pay.

⁸While budgetary transfers from existing or higher revenue collections have financed state-initiated watershed projects, it is not apparent whether the increase in water fees by some national governments was explicitly based on the direct valuation/pricing of raw water.

relate these problems to the state of local forest vegetation, watershed conditions, soil stability, upstream land uses or farm and forest practices. However, the actions taken by individual parties have not positively addressed the larger supply-constraining watershed conditions. While some farmers and individual households have adopted coping measures, such as reduced consumption schemes, farm erosion control techniques, installation of water storage facilities, etc., water-dependent enterprises have tried either to divert existing surface-water sources from other users for their own needs, pump deeper into the aquifer, or simply move out to other areas with more ample supply. There are no known cases of enterprises or local downstream communities or local governments contracting upland communities to restore and improve water delivery and quality. This is partly due to the fact that a watershed management programme is beyond their respective financial, technical, and organizational capabilities.

4.1 The need for a comprehensive watershed policy framework

On the part of the local governments or state agencies, their initiative to address watershed conditions by themselves or in collaboration with NGOs depends on the direction and opportunities set by existing laws and policies. However, existing policies and laws for water resource and watershed management are either limited or loosely related, if not contradictory. Historically, there has been no explicit comprehensive policy framework for all watersheds. Existing laws, such as the Forestry Reform Code, Water Code Act, Provincial Water Utilities Act and National Integrated Protected Areas System, merely focus on particular areas or resources and do not link them together within the ecosystem of a watershed.

The principle of beneficial use in the 1975 Forestry Code wherein forestland resources would be evaluated and ranked according to their provision of “optimum benefits to the development and progress of the country and the public welfare, without impairment or with the least injury to other resources,” seems to be an implicit approach to forestland use allocation. It is not clear, however, whether this principle was the actual basis for officially allocating public forestlands. Most of these lands have been classified as timberland areas or mineral reservations, and only a small fraction have been delineated for conservation purposes⁹. The apparent bias in the allocation of public forestlands towards commodity production suggests that economic growth has been the primary consideration while biodiversity or ecotourism seems to have been viewed as having little or no significant economic contribution.

Moreover, the beneficial environmental function of the watershed did not seem to have figured in initial considerations of forest protection¹⁰. At the onset, there seemed to have been no imperative or need to protect watersheds for their role in providing water, soil conservation, and groundwater recharge. Although the Forestry Code discusses the evaluation and ranking of forestland resources, it did not expound on the valuation and determination of optimum watershed resource use. Neither did subsequently promulgated policies recognize the contribution of non-marketable watershed environment services to local or national progress.

Only particular use values of watershed services were recognized as important when critical watersheds were identified. For instance, watersheds consisting of medium-sized and large river basins, which cover about 5.49 million ha or 20 per cent of total watershed areas, have been

⁹From 1953 to 1990, as much as 10.2 million ha (about 68%) of classified forestlands were covered by timber license agreements while the area of national parks, game refuge and bird sanctuaries (GRBS), and wilderness amounted to only 1.34 million ha. Biodiversity or recreational value was initially the basis for the classification of protected forests.

¹⁰An earlier policy in the 1960s to protect and rehabilitate particular headwater forests was neither expanded nor continued.

classified as critical because of their economic use in irrigation, power development, and domestic water production¹¹. In each of the major river basins, there is at least one national irrigation system (NIS) and a hydroelectric plant in the larger basins.

While large proportions of watershed lands have been classified as “not critical” and are thus not protected from logging, mining, and other development claims, the classification and protection of critical watersheds did not redound to the recognition of the value of their environmental services. In fact, valuation of its various uses has not been incorporated into watershed management. Also, the value of raw surface or groundwater or that of particular watershed services, such as assurance of constant stream flows, wastewater assimilation, and aquifer recharge has not been assessed or used to establish water-user fees systems for watershed management. Up to this writing, the value of raw surface and groundwater is assumed to be zero while the water permit fee of the National Water Resource Board (NWRB) for surface water or groundwater use is merely an administrative cost¹². The Department of Environment and Natural Resources (DENR), moreover, has yet to formulate and implement a water pollution charge nationwide in accordance with the Clean Water Act.

4.2 Potential agents and actions for the promotion of payments for ES

The limitations of the existing watershed policy framework, together with other factors, have not only contributed to forest loss and watershed

degradation; they have also constrained the actions of various state and local agencies that manage and benefit from watershed services, such as the National Irrigation Authority (NIA), the Department of Energy (DOE) the National Power Corporation (NPC), Water Districts, and the Protected Area Management Board (PAMB).

While the deforestation and degradation of the country's watersheds since the 1970s can be attributed to government incentives to the commercial wood industry, the large concession grants, the weak enforcement capacity of the state, the failure of logging concessionaires to undertake replanting, and other factors that encouraged extensive unsustainable commercial and illegal logging have significantly contributed to the loss of forestlands in both critical and non-critical watersheds¹³. The resulting decline in water yields, erratic waterflows, increase in soil erosion and sedimentation of waterways, in turn, strained the limited capacity of the NIA¹⁴. Given such challenging conditions, which further exacerbate demand for watershed services, the management and protection of critical watersheds should not depend solely on the NIA and the local DENR forest guards. A more comprehensive watershed framework policy must be formulated, with the roles and responsibilities of various stewards and beneficiaries clearly defined and efficiently organized.

Because of its limited budget and inability to fully collect and raise irrigation service fees (ISF)¹⁵, the NIA has not had the resources to maintain and invest in the rehabilitation and improvement of the water-generation and delivery functions of watersheds. As a revenue measure and concept,

¹¹ Together with the national parks and GRBS, the critical watersheds account for about 39 per cent of watershed lands. Medium-sized river basins have a drainage area ranging from 124,000 to 483,999ha while the large basins range from 484,000 to as much as 2.6 million ha.

¹² The Water Code implicitly does not consider groundwater depletion as a problem in the short, medium or long term. If the groundwater reservoir can be maintained for at least 50 years, it does not consider groundwater abstraction problematic. No limits to groundwater withdrawals have been specified. Hence, the Code does not see an imperative need to ensure or protect the recharge of aquifers.

¹³ A significant portion of forestlands in non-critical watersheds was historically allocated to forest product licenses or granted to other forestland lessees. These lands have become non-forested, unproductive grassland areas, logging roads, and swidden plots. A greater proportion of degraded forestlands or grasslands are found in these non-critical watersheds than in the critical watersheds.

¹⁴ As a result of watershed degradation, the number of NIS facilities began to decline onwards from the 1970s. By 1995, 83 of the 171 NIS were already severely eroded and could only service about 17 per cent of the total critical watershed area.

¹⁵ NIA's total expenses started escalating much faster than its income in the 1970s. By the 1980s, it was already incurring deficits, and these deficits grew in the latter half of the 1980s because ISF collections stagnated.

the ISF has restricted NIA's role in watershed management. Covering a portion of personnel, operations and maintenance cost, the ISF merely constitutes payment for NIA's service function of bringing down water from its dam or collection point to lowland farms. It is not a fee that would ensure the constant flow of raw water from the headwaters and upstream areas to the tributaries and downstream users.

Unlike the NIA, the NPC receives an annual fund for watershed protection and management that it could use within its river basin coverage. Through the Energy Act of 1992 and the Electric Power Industry Reform Act of 2001 (EPIRA), a Reforestation, Watershed Management, Health and/or Environmental Enhancement Fund (RWMHEEF) was established in the DOE. The 1992 Energy Act stipulates that "one centavo per kilowatt-hour of the total electricity sales" of a generation company shall be used for the "financial benefit of the host communities of such generation facility ...," and that in non-highly urbanized cities, 25 per cent of this one-centavo-per-kilowatt-hour allocation should be allotted to watershed management. The EPIRA, on the other hand, levied a universal charge of PHP0.0025 per kilowatt-hour sales on all end-users of electricity and added it to the fund for watershed rehabilitation and maintenance. Against the backdrop of the Energy Act and EPIRA, it is important to assess and learn lessons from these watershed management fund experience. For instance, there is a need to ascertain the compliance of companies that provide electricity, the growth of the universal fund revenues, the adequacy of the fee for watershed management, protection and rehabilitation, and the extent fund disbursements have gone into watershed rehabilitation and maintenance. Specifically, it would be instructive to know if the funds were used mainly for public relations and livelihood projects in the on-site plant communities rather than the rehabilitation

and reforestation of upstream areas and alternative community livelihoods. The insufficiency of funds, on the other hand, might suggest higher universal charges or fees on generation company sales or the mobilization of voluntary fund contributions.

The present water access or permit system also needs to be improved, if not completely transformed even as the capacity of the water regulatory agency requires strengthening¹⁶. The low tax levy on NPC or generation companies could possibly reflect NPC's control over water access rights in river basins. Similarly, NIA's control of water permits in rivers partly accounts for its low ISF charge. Having assured control or access to water, the NPC or NIA would expectedly register low WTP for watershed services. In other words, a more even and competitive distribution of water rights would raise water-user fees to the scarcity value of the resource. Moreover, because water users who can freely access water, i.e. illegally or without permit would naturally have a low WTP, the NWRB as the regulatory agency must have a stronger monitoring and enforcement capacity to realize the value of watershed services.

The local Water Districts have also been tasked through the Provincial Water Utilities Act of 1973 with the rehabilitation and management of the proximate watershed area in their domain¹⁷. Apart from supplying water to various sectors, the district must also "take over the management, administration, operation and maintenance of all watersheds within its territorial boundaries." The Act, however, does not provide a fund source for this function. It must have implicitly assumed that the water district could either draw from its net revenues or raise the funds voluntarily through community contributions. While some, if not most, water districts are able to generate profits, most have not paid attention to securing surface water supply through watershed management and protection. Instead, they have focused narrowly on

¹⁶No person, business enterprise, government agency, or government-operated or controlled corporation can appropriate surface water or groundwater without a water permit. The NWRB issues a water permit to a particular sector (irrigation, power, commercial, domestic, fisheries, industrial, livestock and recreation) after assessing registered data on available water sources.

¹⁷In the Maasin, Iloilo case, the local water district was responsible for the management of the forest reserve (Salas 2005).

their water delivery function through extraction of the exhaustible groundwater supply.

Like most water districts dependent on groundwater sources, the Davao Water District is an exceptional case in that it attempted to raise revenues for watershed management by levying production assessment fees on free-riding commercial well owners, especially the beverage industry. However, the District's course of action was strongly resisted by the industry, and has not prospered up to the present. Had the district undertaken a campaign for tree planting, watershed conservation, and voluntary contribution, it might have generated some needed funds. Of course, a volumetric groundwater charge policy would have raised even more substantial revenues. These alternative approaches, however, would have entailed the District having a separate unit for public environmental education, community information and relations, as well as an intelligence and enforcement unit for groundwater metering and monitoring.

Apart from the lack of an overall national policy framework for watershed protection, the need for financial resources, effective enforcement, and local participation in watershed rehabilitation and protection must all be addressed at the local level. If the existing state agencies cannot play the lead role in mobilizing resources and mediating between users and potential suppliers of watershed services even in critical areas, then linking state agencies with local governments and communities becomes more imperative.

Intermediation is presently taking place in some protected areas through the formal function of the PAMB. With the National Integrated Protected Areas (NIPAS) Act of 1992, the PAMB has served as a forum, bringing together all major stakeholders — local governments, (quasi) public and private corporate companies, and NGOs in protected area (PA) management. Because the geographical coverage of the PA encompasses subwatershed areas, PA management has subsumed watershed management concerns.

With the Implementing Rules and Regulations (IRR) of the NIPAS Act, the PAMB has been able to mobilize “at least 75 per cent of the revenues generated by a protected area to be retained for the development and maintenance of the area ...” With this legal power to collect fees for the use of protected area services, some PAMBs have also been able to extend their resource-generation capacity and generate funds from local municipal governments, commercial farm plantations, and other locally based enterprises. In the March 2004 Water Forum in Malaybalay, Bukidnon, organized by the provincial government and the PAMB of the Mt. Kitanglad Natural Range protected area, as much as PhP48.55 million were generated in the form of pledges from banana and pineapple plantation companies, the hydroelectric plant at the midstream level, the water district of a downstream city, and other local stakeholders for the reforestation, watershed and riverbank rehabilitation, and forest protection of the PA.

While the prospects for establishing a payments arrangement for watershed services may be realized under particular conditions in critical watershed and protected areas, there seems to be more obstacles in the so-called “non-critical” watersheds. Apart from being more degraded and requiring greater rehabilitation work, such watersheds do not have state agencies with available funds for their management. This is quite unfortunate since environmental conditions in non-critical watersheds, where smaller river basins with creeks and tributaries representing the lifeblood of the local communities predominate, make the establishment of a watershed arrangement essential for survival. Under these conditions, intervention can only potentially emanate from the local government, and the possibilities for the establishment of a local watershed arrangement would depend on the quality of its leadership, its understanding of the institution-building requirements for restoring watershed services, and its ability to solicit seed money, mobilize external resources and NGO support, and mediate among conflicting groups and between demanders

and service providers of watershed services. The mediation role of the local government leadership and its external allies are thus the key elements to local-institution building.

5. Concluding Remarks: Way Forward for PES

In conclusion, market-like payment schemes reflecting the proper valuation of raw water and the watersheds that ensure its quality and supply have been successfully implemented in other developed and developing countries. Although similar schemes are slowly evolving in Philippine watersheds, they are still in their infancy. In order for more watershed arrangements to emerge, various policy and institutional developments must be in place. These include the following recommendations that reiterate points made earlier in the paper:

- a comprehensive watershed policy framework that properly gives value to both watershed resources with direct uses and the positive contribution of non-marketed environmental services;
- greater awareness among local leaders and willingness among users to invest or mobilize funds for the required activities, land use practices, technologies, or projects that can help restore, improve watershed conditions and produce the needed environment services ;
- the application of environmental service valuation in watershed management, specifically through the implementation of user fees or raw water values, and the establishment of a watershed fund from these user-fee payments and donations; and
- the identification of intermediaries (state agencies, local government, NGO) who would cover the transaction costs of building consensus, resolving conflicts, forming agreements, pooling demands and payments for risk sharing,

negotiating contracts with potential suppliers, and handling the costs of fund management, monitoring and enforcement, or the oversight and implementation of watershed rehabilitation and conservation projects, and pedagogically instilling the positive appreciation of raw water value and the perspective that water is not a free good.

Specifically, two concrete actions can be undertaken to promote PES based on existing conditions:

- assess the watershed rehabilitation and maintenance fund created by the Energy Act and EPIRA as a means to promote PES arrangements in the critical watersheds and conduct discussions and education campaigns with the Department of Energy and the National Power Corporation; and
- identify potential partners in the establishment of PES arrangements among the PAMBs, LGUs, and water districts, and implement orientation and capacity-building programmes for the establishment and management of such arrangements.

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Table 1
Description of Selected PES Schemes on Water and Watershed Services

Enterprise Payments Direct to Environmental Service Providers

Country	Terms and Sources of Payments	To Whom	Purpose
Costa Rica	Payment by hydropower company, plus other voluntary supplemental funds	Upstream forestland owners NGO	Forest cover protection for stabilizing waterflow and reducing sedimentation
China	Domestic water suppliers gives 0.01 yuan per ton of water; while hydroelectric companies contribute 0.005 yuan/kilowatt of electricity generated	Farmers	Tree planting
France	US\$24.5M from mineral water company while the French National Agronomic Institute finances 20 per cent of research, and the water agencies pay 30 per cent of the building cost of barns	Farmers, dairy producers Forest landowners	Reforestation and land purchase to restore natural springs; farm contracts and organic farming to reduce pollution and improve water quality; construction of farm facilities

Enterprise Payments to Intermediary

Country	Terms and Sources of Payments	To Whom	Purpose
Brazil	One per cent of the revenues of the water utility company is paid to the council	Municipal Environmental Council	Nursery establishment and reforestation of riverbanks
Costa Rica	Hydroelectric company pays US\$16/ha to upstream forest land-owners while government provides a counter-part of US\$30/ha	National Forest Office National Fund for Forest Financing	Reforestation and forest conservation to improve waterflow and reduce sedimentation
Columbia	Farmer-members of irrigation association voluntarily agree to pay US\$1.50-2.00/l/sec in addition to the existing water fee of US\$0.50 every trimester to the Regional Environmental Authority (REA)	REA collects payments; supports water user associations, and contracts upland communities.	Watershed protection and management, reforestation, land purchase, land enclosure and management
Ecuador	Various user fees (e.g. monthly water bill), plus 1 per cent of water district sales, and funds from national and foreign grant sources, like Nature Conservancy, USAID	Water Conservation Fund, Nature Conservancy, Fundacion Artisana	Watershed protection projects, land purchase, alternative livelihood projects, agriculture best management practices, & training

State-established Funds for Environmental Services

Country	Terms and Sources of Payments	To Whom	Purpose
Brazil	The state allocates 2.5 per cent of ICMS (indirect tax on consumption of good and services) for protected area management, plus another 2.5 per cent of	Municipalities with protected areas and Municipalities with watersheds supplying water to neighboring towns	Watershed rehabilitation and conservation of biodiversity
Columbia	Ecotax comes from 1 per cent of the municipal and department budgets; 3 per cent of the revenues of hydroelectric companies; and 1 per cent of the investments of industrial-water users Hydroelectric companies also provide another 3 per cent to municipalities with hydrological basins and reservoirs	These funds are placed in the Ecosystem Fund and managed by the Regional Autonomous Corporations.	Land purchase, reforestation, and watershed management to stabilize the soil and improve waterflow and quality.
New York	The city government increases water bill rates by 9 per cent over a 5-year period, and sells NY bonds The federal and state governments, together with USDA, also provide financial and technical assistance	The city government provides subsidies to farmers and forestland holders, and implements various programs.	Best farm and forest management practices, land development rights distribution, land purchase and non-timber production
Australia	Irrigation associations purchase salinity credits from state forests, AU\$17.0/million litres transpired of AU\$85/ha/yr compensation	Public sector mediates between irrigation association and state forests	Tree planting and reforestation to prevent or reduce water salinity.

The regulation functions of watersheds include the following: topsoil formation and soil fertility maintenance, prevention of runoffs and floods, control of soil erosion and sedimentation, water catchment and regulation of the water table or groundwater recharge, control of sediment and nutrient load, maintenance of aquatic habitats, and the determination of local climate conditions.

Some of these cases were drawn from Landell-Mills et al. (2002) and Pagiola et al. (2002). These ecosystem-based measures were deemed to be cheaper than conventional investments in filtration plants.

A portion of sales taxes is redistributed to municipalities that take action either on their own or in cooperation with private landowners to protect watersheds. Allocated on a competitive basis, a larger portion of tax funds is being given to municipalities that protect more watershed areas.

In the above cases, the proxy commodities for regulating water runoffs and maintaining the water table or water quality may include the establishment and management of a protected area, agreements for springs and riverbanks protection, nursery establishment, reforestation of riverbanks, and provision of upstream livelihood projects. The

proxy commodities for improving water quality, on the other hand, consist of watershed protection, soil stabilization, best management practices contracts, construction of conservation easements, development of alternative products or non-timber markets.

These expenditures as the replacement cost of lost watershed services are an indirect measure of such environment services.

Involving stakeholders, particularly in the design of the payment mechanism and service delivery arrangement, is one important role of the intermediary. Stakeholder participation is crucial to win the support of beneficiaries and ensure against free riding. Similarly, consultations with potential suppliers would enable the payment system to respond and meet their needs and thereby provide watershed protection. Broad participation is thus essential in order to avoid “free-riding” in consumption and convince beneficiaries to pay.

While budgetary transfers from existing or higher revenue collections have financed state-initiated watershed projects, it is not apparent whether the increase in water fees by some national governments was explicitly based on the direct valuation/pricing of raw water.

From 1953 to 1990, as much as 10.2 million ha (about 68%) of classified forestlands were covered by timber license agreements while the area of national parks, game refuge and bird sanctuaries (GRBS), and wilderness amounted to only 1.34 million ha. Biodiversity or recreational value was initially the basis for the classification of protected forests.

An earlier policy in the 1960s to protect and rehabilitate particular headwater forests was neither expanded nor continued.

Together with the national parks and GRBS, the critical watersheds account for about 39 per cent of watershed lands. Medium-sized river basins have a

drainage area ranging from 124,000 to 483,999ha while the large basins range from 484,000 to as much as 2.6 million ha.

The Water Code implicitly does not consider groundwater depletion as a problem in the short, medium or long term. If the groundwater reservoir can be maintained for at least 50 years, it does not consider groundwater abstraction problematic. No limits to groundwater withdrawals have been specified. Hence, the Code does not see an imperative need to ensure or protect the recharge of aquifers.

A significant portion of forestlands in non-critical watersheds was historically allocated to forest product licenses or granted to other forestland lessees. These lands have become non-forested, unproductive grassland areas, logging roads, and swidden plots. A greater proportion of degraded forestlands or grasslands are found in these non-critical watersheds than in the critical watersheds. As a result of watershed degradation, the number of NIS facilities began to decline onwards from the 1970s. By 1995, 83 of the 171 NIS were already severely eroded and could only service about 17 per cent of the total critical watershed area. NIA's total expenses started escalating much faster than its income in the 1970s. By the 1980s, it was already incurring deficits, and these deficits grew in the latter half of the 1980s because ISF collections stagnated.

No person, business enterprise, government agency, or government-operated or controlled corporation can appropriate surface water or groundwater without a water permit. The NWRB issues a water permit to a particular sector (irrigation, power, commercial, domestic, fisheries, industrial, livestock and recreation) after assessing registered data on available water sources.

In the Maasin, Iloilo case, the local water district was responsible for the management of the forest reserve (Salas 2005).

■ ■ ■ OPPORTUNITIES AND CHALLENGES IN ENVIRONMENTAL SERVICE PAYMENTS: CARBON SEQUESTRATION

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Abstract

Tropical forests have an important role to play in climate regulation as sources and sinks of carbon. They can help mitigate climate change by conserving existing carbon stocks, expanding carbon in terrestrial systems, and by substituting fossil fuels. The Kyoto Protocol sets greenhouse gas emission limits for Annex 1 (developed) nations. The Clean Development Mechanism (Article 12) is one of the three flexibility mechanisms established to meet the goals of the Kyoto Protocol. In COP-6, the parties agreed to include land use, land-use change and forestry projects under the Clean Development Mechanism but limited projects to afforestation and reforestation. The potential of Philippines forest lands to sequester carbon is presented. Millions of hectares of denuded lands are potentially suitable for reforestation and agroforestry type of activities. Finally, the paper discusses the potential global market size of the Clean Development Mechanism.

1. Introduction: A Changing Climate

Climate change or more popularly known as global warming is one of the primary concerns of humanity today. The Earth's climate has been stable for about 10,000 years (mean temperature fluctuation not > 1°C per century). However, since the advent of the industrial revolution, Intergovernmental Panel on Climate Change (IPCC) Third Assessment Report (TAR) concludes that there is strong evidence that human activities have affected the world's climate (IPCC 2001). The rise in global temperatures has been attributed to emission of greenhouse gasses (GHG), notably CO₂ (Schimell et al. 1995).

The concentration of CO₂ in the atmosphere has increased by more than 30 percent since pre-industrial times and is still increasing at an unprecedented rate of an average 0.4 per cent per year, mainly due to the combustion of fossil fuels and deforestation. This is true for other GHG as well. The increased concentration of GHG in the atmosphere enhances the absorption and emission of infrared radiation. This is called the "enhanced greenhouse effect" that leads to warming of air

temperature. In the next 100 years, it is projected that the concentration of GHG will further increase as a result mainly of fossil fuel emissions (Figure 1).

The IPCC-TAR (2001) provides compelling evidence that Earth's climate is indeed changing as a result of human influence. Its major conclusions are:

- The global average surface temperature has increased over the 20th century by about 0.6°C. Globally, it is very likely that the 1990s was the warmest decade and 1998 the warmest year in the instrumental record, since 1861.
- Temperatures have risen during the past four decades in the lowest 8km of the atmosphere.
- Snow cover and ice extent have decreased. Satellite data show that there are very likely to have been decreases of about 10 per cent in the extent of snow cover since the late 1960s. There has been a widespread retreat of

mountain glaciers in non-polar regions during the 20th century.

In the future, the IPCC TAR (2001) projects the following changes in the world's climate:

- Global average sea level has risen and ocean heat content has increased. Tide gauge data show that global average sea level rose between 0.1 and 0.2m during the 20th century.
- The globally averaged surface temperature is projected to increase by 1.4 to 5.8°C over 1990-2100 (**Figure 2**).

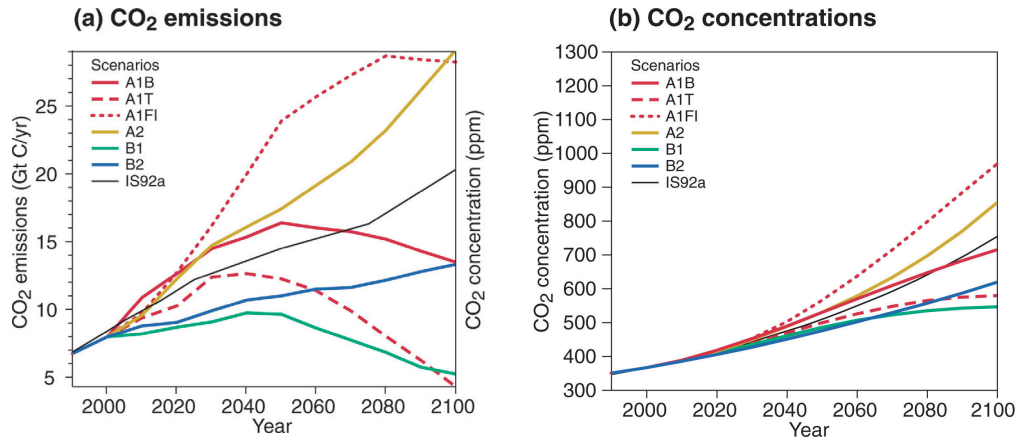


Figure 1. Projected increase in CO₂ emissions and atmospheric concentration in the next 100 years (Source: IPCC WG1 2001)

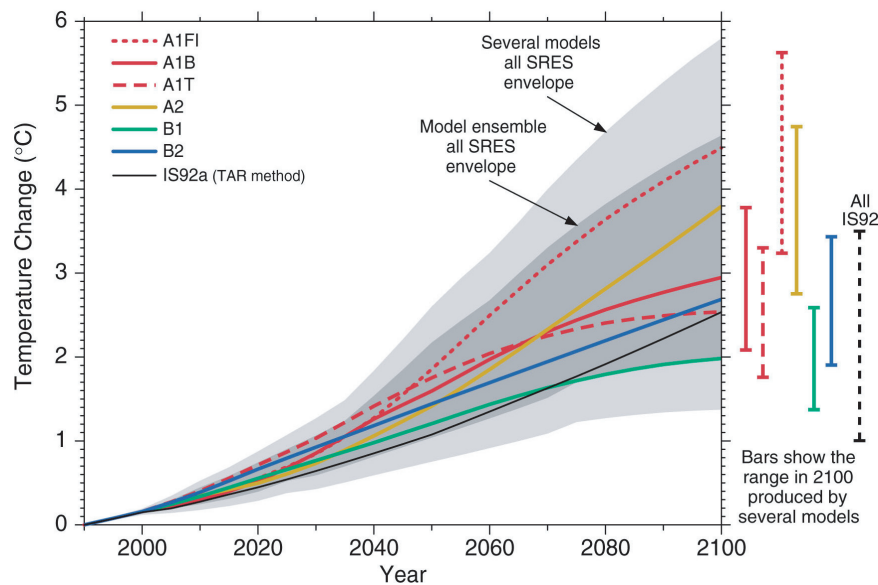


Figure 2. Projected rise in temperature from the present to 2100 (Source: IPCC WG1 2001)

- Global average water vapour concentration and precipitation are projected to increase during the 21st century.
- It is likely that warming associated with increasing GHG concentrations will cause an increase of Asian summer monsoon precipitation variability.
- Global mean sea level is projected to rise by 0.09 to 0.88m between 1990 and 2100. This is due primarily to thermal expansion and loss of mass from glaciers and ice caps.

2. Tropical Forests and Climate Change

There is considerable interest on the role of terrestrial ecosystems in the global carbon cycle. The world's tropical forests covering 17.6M km² contain 428Gt C* in vegetation and soils. It is estimated that about 60Gt C is exchanged between terrestrial ecosystems and the atmosphere every year, with a net terrestrial uptake of 0.7 ± 1.0 Gt C (Figure 3). However, land use, land-use change

and forestry (LULUCF) activities, mainly tropical deforestation, are also significant net sources of CO₂, accounting for 1.6Gt C/yr of anthropogenic emissions (Houghton et al. 1996; Watson et al. 2000).

In the last few decades there have been massive deforestation and land-use/cover change in the tropics. Annual deforestation rates in tropical Asia were estimated to be 2.0M ha in 1980 and 3.9M ha in 1981-1990 (Brown 1993). In Southeast Asia, the 1990 annual deforestation rate was about 2.6M ha/yr (Trexler and Haugen 1994). A recent review showed that natural forests in Southeast Asia typically contain a high carbon density, more than 200MgC/ha (Lasco 2002). However, logging activities could reduce carbon stocks by at least 50 per cent while deforestation could result in C density of less than 40MgC/ha.

On the other hand, tropical forests have the largest potential to mitigate climate change amongst the world's forests through conservation of existing carbon pools (e.g. reduced impact logging),

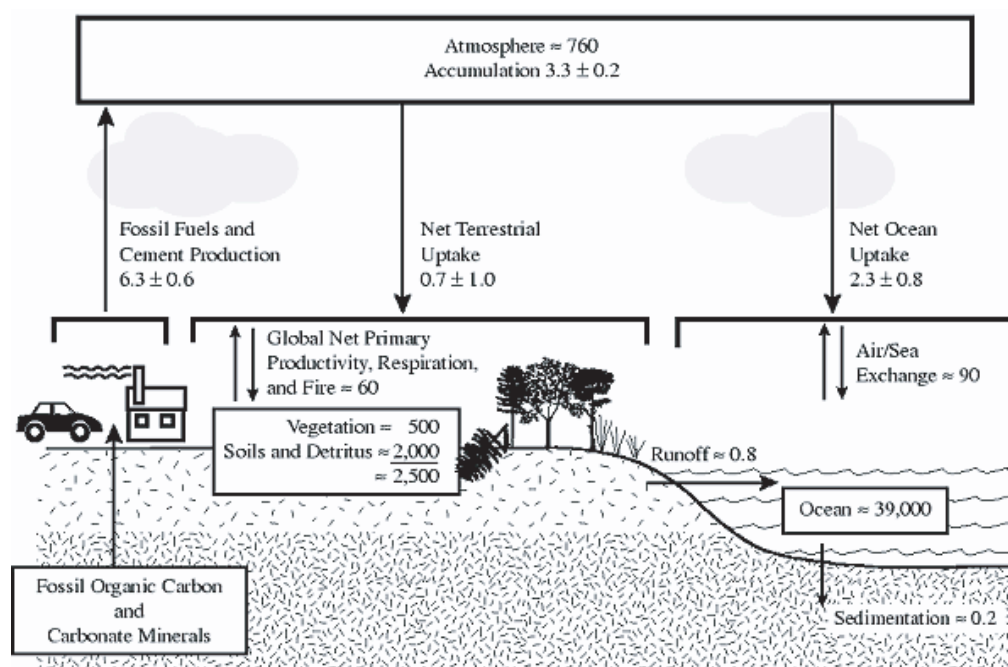


Figure 3. The global carbon cycle (from Bolin and Sukumar 2000)

* Some units of measure commonly used in climate change literature: 1Gt (gigaton)= 1 billion metric tonnes or 10^9 tons; 1 Mg= 1 metric tonne or 10^6 g.

expansion of carbon sinks (e.g. reforestation, agroforestry), and substitution of wood products for fossil fuels. In tropical Asia, it is estimated that forestation, agroforestry, regeneration and avoided deforestation activities have the potential to sequester 7.50, 2.03, 3.8-7.7, and 3.3-5.8 billion tons C between 1995 and 2050 (Brown et al. 1996).

3. Mitigating Climate Change Through LULUCF Projects

Mitigating carbon emission through forestry in tropical countries like the Philippines provides a promising way of reducing CO₂ in the atmosphere. Tropical forestry for mitigation is receiving much attention because of its cost effectiveness, high potential rates of carbon uptake, and associated environmental and social benefits (Brown et al. 2000; Brown et al. 1996; Moura-Costa 1996).

(a) Conservation of existing carbon stocks

The goal of this strategy is to maintain or improve existing carbon pools in forests by protecting forest reserves, by the use of appropriate silvicultural practices and by controlling deforestation. Tropical forest ecosystems contain substantial amount of carbon. Activities that destroy forests, such as slash-and-burn farming, logging and conversion to other land uses (deforestation), could significantly reduce the stored carbon in the forest. For example, logging of tropical forests in Mindanao could reduce carbon stocks by about 50 per cent. Similarly, land-use change, such as converting forests to agricultural plantations, could likewise decrease total carbon stocks.

Activities that promote the conservation of the remaining forest cover, or that reduce deforestation, could help mitigate carbon emissions by preventing the release of stored carbon to the atmosphere. Certain silvicultural practices, such as enrichment planting of sparse forests, could also lead to increased carbon sequestration in existing forests.

As a general rule, the more biomass produced the greater the amount of carbon sequestered.

Another way of minimizing carbon emission from forest lands is by preventing fire which is common in grassland areas of the country. The exact area affected by burning is not known but is likely to have been substantial especially in drier zones. Aside from CO₂, other GHGs such as methane are also released to the atmosphere during fires. Programmes aimed at fire prevention would result in conservation of carbon in plant biomass.

(b) Expansion of carbon stocks

The goal of this strategy is to expand the amount of carbon stored in forest ecosystems by increasing the area and/or carbon density of natural and plantation forests and increasing storage in durable wood products.

Since carbon sequestration is a function of biomass accumulation, the simplest way to expand carbon stocks is to plant trees. For example, in Mindanao the rate of carbon sequestration of two plantation species was estimated to be 1.4 to 7.8 tons C/ha/yr.

The choice of species to be planted will affect the potential to sequester C (Muora-Costa 1996). Fast-growing species such as *Paraserianthes falcataria* and *Casuarina equisetifolia* are commonly used. They accumulate more biomass and carbon than slow-growing species for the same period of time. However, fast-growing species typically have lower wood density and thus contain less carbon per unit volume than wood of slow-growing species.

(c) Substitution of wood products for fossil fuels-based products

Substitution aims at increasing the transfer of forest biomass carbon into products (e.g. construction materials and biofuels) that can replace fossil-fuel-based energy and products, cement-based

products and other building materials (Brown et al. 1996). This approach is considered to have the greatest mitigation potential in the long term (> 50 years). For instance, the substitution of wood grown in plantations for coal in power generation can avoid carbon emissions by up to four times that of carbon sequestered in the plantation (Brown et al. 1996).

4. Opportunities under the Clean Development Mechanism

The Kyoto Protocol sets emission limits for six GHGs for the developed nations, mostly industrialized countries and economies in transition, known as “Annex 1” or “Annex B” countries. These countries committed to collectively reduce GHG emissions by at least 5 per cent relative to their 1990 emissions. To enter into force, 55 countries must ratify the Protocol and must include 55 per cent of emissions of Annex 1 Parties for 1990.

On the 90th day after the ratification by Russia, the Kyoto Protocol entered into force on 16 February 2005. The Philippines has ratified the protocol in November 2003.

The Clean Development Mechanism (CDM) is one of the three flexibility mechanisms established to meet the goals of the Kyoto Protocol. The dual goal of the CDM shall be to assist Parties not included in Annex I to achieve sustainable development, and to assist Parties included in Annex I to achieve compliance with their quantified emission limitation and reduction commitments through projects in developing countries.

The CDM essentially offers many opportunities for financing sustainable development projects in developing countries that could generate Certificates of Emission Reduction (CERs). It specifically presents opportunities for a developing country to host projects that rehabilitate degraded lands, among others. [See Ramos, A. *Introduction to CDM*, this volume, for further details.]

Figure 4 shows the project cycle under the CDM. The first step is the preparation of a project design document (PDD), which needs approval at the national and international levels. The national approving body is called the Designated National Authority (DNA). The Philippines is currently working on the identification and development of its DNA.

Eligible participants (buyers and sellers) of the CDM are individuals, groups of individuals, private companies, and NGOs that belong to a country that is a Party (signed and ratified) to the Kyoto Protocol.

At the Conference of the Parties-6 (COP-6), the parties agreed to include LULUCF projects under the CDM but limited projects to afforestation and reforestation (A/R). A key output of COP-9 in December 2003 was the modalities and procedures for A/R CDM projects (Decision 19/CP.9) that could serve as a workable basis for project development. The key conclusions of COP-9 relevant to LULUCF projects are as follows:

- *Only afforestation and reforestation are eligible; agricultural sink projects are excluded* (e.g. soil organic matter enhancement projects). Thus, certain types of agroforestry systems that do not meet the definition of forests are not included (e.g. hedgerow cropping with less than 10 per cent tree cover).
- *Definitions of “forest”, “afforestation”, “reforestation” for domestic activities apply under the CDM*, i.e. those used for reporting under Articles 3.3 and 3.4 of the Kyoto Protocol in the UNFCCC decision 11/CP.7 for the first commitment period. This implies that non-Annex I countries that wish to host A/R projects need to choose ranges of potential project area sizes, tree densities and tree heights, derived from their reporting standards to FAO (see section 1.3.4 above).

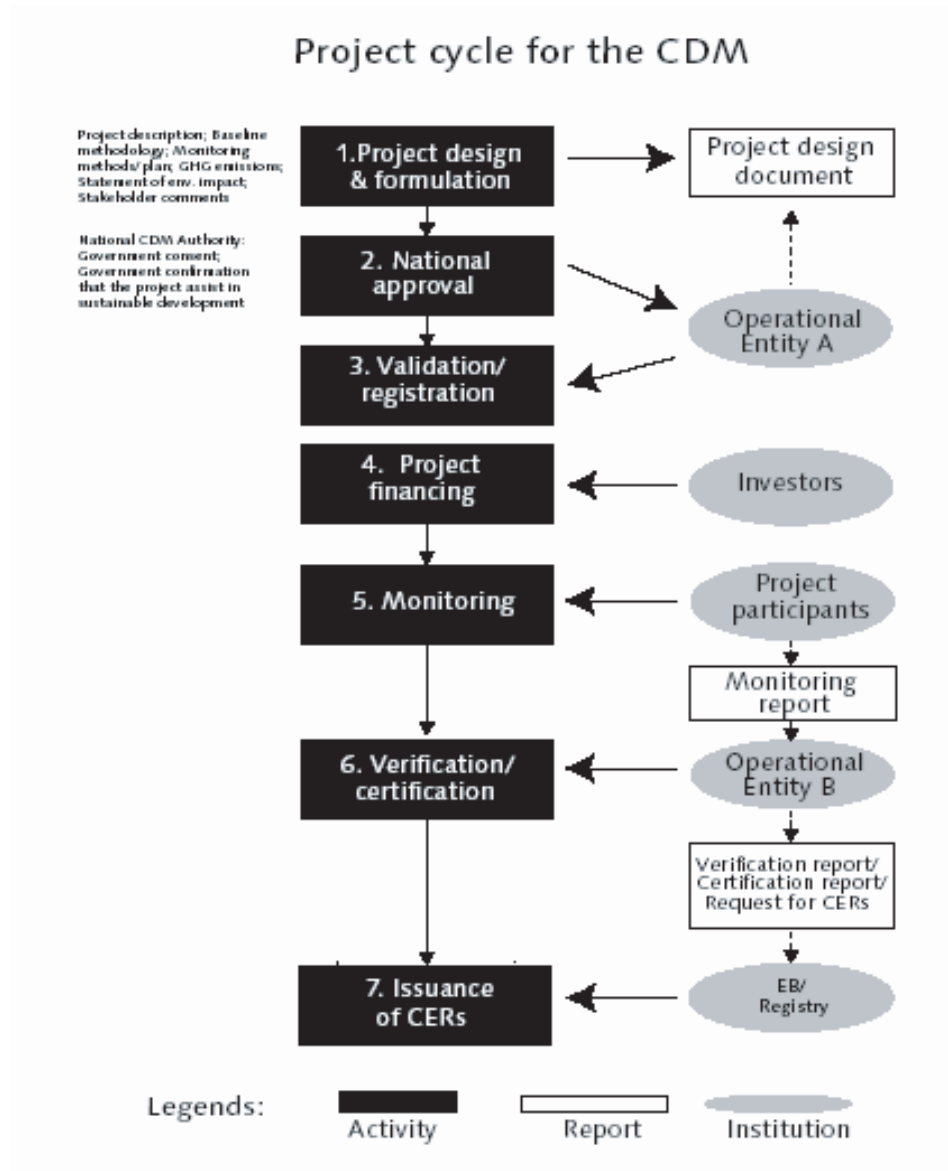


Figure 4. The CDM project cycle

- “Reforestation” can only be done on lands that were not forests prior to 1990. The main implication of this decision to many countries, such as Indonesia, is that it reduced the area of land potentially available to CDM because significant deforestation occurred since 1990.
- Permanence of carbon sequestration ensured via two options:
 - tCER’s: temporary carbon emission reduction units, which expire after at most 10 years
 - lCER’s: long-term carbon credits, which are valid for the crediting period of the project or the project lifetime

Both CER's need to be replaced after their expiration date; in addition CER's need to be replaced if reversal of sequestration has occurred during crediting period.

- *Small-scale forestry projects are now eligible, i.e. those with maximum annual sequestration of 8000t CO₂ or 2180t C;* such projects would enjoy simplified and special facilitating conditions to be decided by COP-10, based on: submissions by countries and observers until the end of February 2004. The participation of low-income individuals or communities was set as a precondition. Depending on the agro-ecological conditions and the species selected, the maximum project area is estimated at 500-1,000ha.

Reforestation and afforestation are officially defined by the UNFCCC as follows (Decision 11/CP.7, 2001):

- "Afforestation" is the direct human-induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding and/or the human-induced promotion of natural seed sources.
- "Reforestation" is the direct human-induced conversion of non-forested land to forested land through planting, seeding and/or the human-induced promotion of natural seed sources, on land that was forested but was converted to non-forested land. For the first commitment period, reforestation activities would be limited to reforestation occurring on those lands that did not contain forest on 31 December 1989.

It should be noted that how a country defines a forest is very important in determining which activities qualify. Under the CDM, a "forest" is

a minimum area of land of 0.05-1.0ha with tree crown cover (or equivalent stocking level) of more than 10-30 per cent with trees with the potential to reach a minimum height of 2-5m at maturity in situ. A forest may consist either of closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground or open forest. Young natural stands and all plantations that have yet to reach a crown density of 10-30 per cent or tree height of 2-5m are included under forest, as are areas normally forming part of the forest area that are temporarily unstocked as a result of such human intervention as harvesting or natural causes but which are expected to revert to forest. Depending on how a party chooses its definition, certain type of agroforestry systems may not be eligible for CDM. For example, if a low cover is selected (e.g. 10%), then many agroforestry systems, such as tree farms, will be classified as forest already and are thus not eligible for "reforestation or afforestation".

For the first commitment period, credits from CDM LULUCF projects cannot exceed 1 per cent of total commitments of Annex 1 parties.

Our initial estimates showed that the life-cycle cost of potential forestry projects (not necessarily Kyoto Protocol compliant) in the Philippines ranged from about US\$0.12 per tC to US\$7.60 per tC (Lasco and Pulhin 2001). On the other hand, the cost of protecting a Philippine National Power Corporation - Exploration Corporation (PNOC-EC) geothermal forest reservation in the island of Leyte was US\$2.94 per tC (Lasco et al. 2002). In contrast, a systematic comparison of sequestration supply estimates from national studies in the USA produced a range of US\$25 to US\$75 per tonne for a programme size of 300 million tons of annual carbon sequestration (Stavins and Kenneth Richards 2005).

Areas suitable for CDM in the Philippines, which include those that need to be permanently forested for legal, ecological or social reasons, are the

most likely candidate areas for climate mitigation projects. These include the following areas:

- critical watersheds
- forest reserves (including those under the management of other government agencies and government-controlled corporations, such as the Philippine National Oil Company and National Power Corporation, academic institutions and the military)
- forest lands under the National Integrated Protected Area System (NIPAS), including those with 50 per cent slope and 1,000m asl altitude.

The total area of the above forest lands is about 5 million ha (FMB 2001), a large portion of which needs to be either protected or rehabilitated.

Another way of estimating potential areas for climate projects is to look at the extent of degraded areas needing rehabilitation. Grasslands and brushlands in the uplands cover 3.5 million ha (Lasco and Pulhin 1998). In addition, many of the supposed agroforestry lands (5.7 million ha) are actually shifting cultivation areas or simply degraded farmlands that need stabilization most likely through some form of agroforestry and soil conservation practices.

Once new financing schemes are available, property rights issue may become important (Lasco and Pulhin 2003). Competition on who will control forest lands may intensify. In the Philippines, many upland areas are being claimed by indigenous peoples. Such claims may be ignored in favour of establishing climate-change forests. Thus, the guidelines should have adequate provisions respecting the rights of local users. This is easily said than done in many developing countries. These issues could be adequately addressed, however, through public consultation and participation in project planning and implementation. The Environmental Impact Assessment (EIA) system is the main mechanism for facilitating this in the Philippines. Existing policies and procedures embodied in the Indigenous People's Rights Act (IPRA) should also be able to ensure that the rights of the IPs are fully safeguarded.

5. Potential Size of the CDM Market

A recent World Bank-commissioned study showed that the estimated market potential of the CDM is a demand for CERs in 2010 of 250MCO₂e (range 50-500MCO₂e) at a price of US\$11.00/tCO₂e (range + 50%) (Haites 2004). This potential is based on the assumptions of continued preference for CERs and Emission Reduction Units (ERUs)

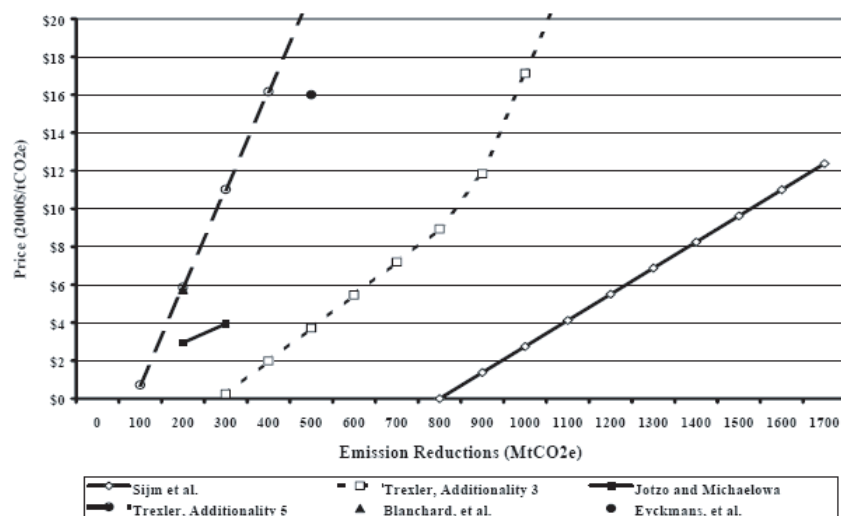


Figure 5. Potential supply of CDM in 2010 (Haites 2004)

by buyers, a sustained flow of new CDM projects, and a realization of a substantial share of the potential emission reductions in Asia.

The total potential supply of CDM has been variously estimated, depending on certain assumptions (**Figure 5**). The CDM could potentially supply up to 32 per cent of the Annex B commitments based on one study (**Table 1**). This

will translate to over US\$1 billion in revenues during the first commitment period (**Table 2**). Of this amount, about US\$300 million could come from the sale of 67Mt CO₂ of CERs from forestry carbon sequestration projects. China and Indonesia are expected to get the lion's share of sinks projects (**Table 3**).

Table 1. Share of mechanisms in meeting Annex B Kyoto Protocol commitments (Jotzo and Michelova 2001)

Mechanism	Mt CO ₂ /year	Share in market
CDM	297	32%
Domestic abatement in net buying countries (Annex B OECD countries except United States)	149	16%
Joint implementation in EIT countries	78	8%
Sales of AAUs by EIT countries ('hot air') – modelling assumption	400	43%
Total	923	100%

Source: PET modelling, standard scenario.

Note: See text for assumption on hot air volume.

Table 2. CDM volume, prices and revenue (Jotzo and Michelova 2001)

	PET standard scenario
Total CER sales (Mt CO ₂ /year)	297
Of which:	
CERs from non-sink projects	230
CERs from sink projects ^a	67
International quota price (\$US/t CO ₂)	0.90
Total CDM revenue over first commitment period (\$US million) ^b	1,332
Total adaptation tax over first commitment period (\$US million) ^b	27

Source: see table 3.1.

^a Sink CERs limited to 1 per cent of assigned amounts of participating OECD Annex B countries. EIT countries (net sellers of quota) are assumed not to use the quota of sink CERs they are allowed to purchase.

^b Revenue calculation assuming same price for sink and non-sink CERs. In practice, prices for sink CERs may be lower, leading to lower overall CDM revenue.

Table 3. Distribution and magnitude of sink CERs - examples (Jotzo and Michelova 2001)

	Allocation based on potential for plantations a				Memo: Non-sinks projects
	Trexler and Haugen 1995 a		Niles et al. 2001 c		PET modelling
	Share	Mt CO ₂ /year given global cap	Share	Mt CO ₂ /year given global cap	Mt CO ₂ /year
China	(37%) b	24.7	7%	4.5	120
India	5.6%	3.8	1.3%	0.9	29
Indonesia	25%	17.0	0.7%	0.4	5.6
Other Asian countries	12%	8.3	22%	14.6	24
Middle East	0%	0.0	0%	0.2	18
Africa	2.4%	1.6	13%	8.8	25
Brazil	15%	9.9	33%	21.8	1.3
Other Latin American countries	2.5%	1.7	24%	15.8	7.3
Total	100%	67	100%	67	230

a Shares in non-Annex B potential carbon storage in new plantations using Trexler and Haugen (1995). Author's calculations based on data for plantation potential in hectares and average carbon density.

b China estimate substituted from shares provided in Polidano et al. 2001 (data based on projections for new plantings).

c Shares in non-Annex B potential carbon storage through reforestation using Niles et al. 2001.

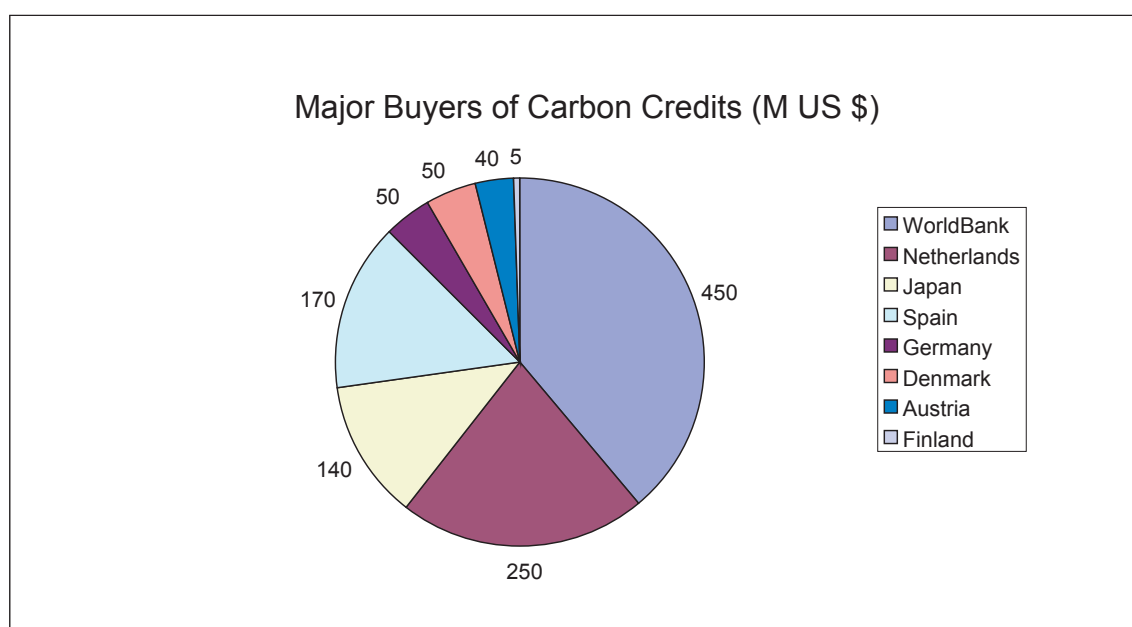


Figure 6. Major buyers of carbon credits (total = US\$1.2 billion) (Cosbey et al. 2005)

To date, over US\$1 billion of carbon credits have been purchased with World Bank as the leading buyer (**Figure 6**). Other leading buyers include the Netherlands, Japan and Spain.

6. Conclusions

There is a high level of interest for carbon sequestration projects as a strategy to mitigate climate change. The Philippines can take advantage of the emerging market for carbon credits arising from sinks projects. However, there are pitfalls that must be addressed if the country would truly benefit from the carbon market.

At present, there are still a couple of barriers to investments in CDM sinks project in the Philippines. First, there is the uncertainty of allowing sinks projects. Earlier, there were some sectors that had reservations on forestry projects. Recently, however, there has been more openness in allowing forestry projects. Second, there are yet no rules and guidelines for forestry projects.

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