Policy Briefing

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Summary

A pilot ecosystem account was developed for the Laguna de Bay, to provide science-based information for flood control, water, and fishery resource management; to identify priority areas for protection, regulation of pollution and sediment loading; and to inform on possibilities for water pricing and greening of development planning.

Background

The Laguna Lake Development Authority (LLDA) is responsible for water and land management in the basin and took the lead in developing the ecosystem account. Staff from several of its technical units undertook the analyses, supported by international and national experts.

Ecosystem Accounts for Laguna de Bay, Philippines

Laguna de Bay is confronted with increasing flood risks and sedimentation; intensification of land, water, and resource use; increasing demand for licenses for fisheries and shoreland reclamation; conversion of forestlands; urban areas expansion; encroachment of informal settlers on shorelands; rapid clearing of forests; and conversion of prime agricultural lands to residential areas. Many land use plans of local government are not harmonized with the lake master plan.

- *Land and Land Cover (Condition) Accounting:* Built-up areas more than doubled in the period between 2003 and 2010 (representing an annual growth of more than 11 percent) while open forest areas decreased by 3 percent and closed forests by 35% in this same period. This reflects the rapid development and change of land use in the region; lands have been converted, mostly by private owners, for industrial/commercial and residential purposes.
- *Aquatic Ecosystem Accounting:* The flood-retention capacity of the lake has been assessed to be 11.5 to 12.5 meters, with 11.5 meters the average water level at the beginning of the rainy season and 12.5 meters the level where the first houses become flooded. Analysis of the lake bathymetry in 1997 and 2014 shows that this water storage volume has decreased, thereby increasing flood risks.
- *Aquatic Ecosystem Condition Accounting:* Water condition and water emissions accounts show that the lake water condition is closely tied to emissions from businesses. The water account also shows that treating even a small proportion of household sewerage yields benefits for lake water quality, and that increasing the rate of treatment of household sewerage has a lot of potential for increasing the water quality of Lake Laguna.
- *Ecosystem Services Accounts:* The ecosystem service "erosion control," defined as the amount of sedimentation avoided because of the vegetation cover, in the Laguna de Bay basin amounted to between 7,000 and 8,000 kilotons/year of sediments avoided. Sedimentation analysis shows that between 2,500 and 2,800 kilotons/year of suspended sediment are discharged to the lake.

Why Ecosystem Accounts Are Important for the Laguna Lake Region

The Laguna Lake, the largest inland body of water in the Philippines and the third largest freshwater lake in Southeast Asia, is a source of livelihood for 17,000 fishermen, producing 80,000 to 90,000 metric tons of fish per year. The entire Laguna de Bay region occupies 1.3 percent of the total land area of the Philippines, covering 3,880 square kilometers and extending over 24 watersheds. Its boundaries include 61 municipalities and cities within 6 provinces (including Metro Manila)—29 towns are lakeshore, covering 188 barangays (smallest political unit in the Philippines), and 32 are non-lakeshore towns—with an estimated total population of 13.6 million, or about 14 percent of the country's total population (World Bank 2011). It hosts a range of industries, including manufacturing. The lake itself supports a significant fishery sector and serves several other purposes: irrigation, transportation, energy generation, and other industrial uses (LLDA 1996).

Over the past decades, conflicts of interest, competing uses, and unsustainable land and water uses have caused the rapid deterioration and degradation of the lake and its sub-basins. Population expansion, urbanization, industrialization, deforestation, and land conversion have led to massive changes in the Laguna de Bay basin, threatening its water quality and ecology and increasing flood risks in the basin, including the southern part of Metro Manila. The root causes of this deterioration may be attributed to intensified economic activities, open access to natural resources use, lack of economic resource pricing policies, and lack of common policy for management and development of the lake and its watershed.

Land Account: Declining Vegetation Cover and Expanding Built-Up Areas

The land account very clearly illustrates the major land cover change in the basin for the period 2003–10. Table 1 shows land cover change between 2003 and 2010. All mangrove forest (except a 1-hectare patch) disappeared, and closed forest decreased by 33 percent. Remaining forests are found, in particular, in the Mt. Makiling Forest Reserve and Sierra Madre mountain ranges, but even in these areas illegal settlements have been established. There is rapid urbanization and industrialization in the lake region, in particular in the Greater Metro Manila area in the northwest and in the western and southern portions of the lake. The spread and location of residential subdivisions are characterized by unplanned urban sprawl. This involves, among other things, the conversion of agricultural lands to residential uses, and the construction of new settlements close to the lakeshore, in the zone that is vulnerable to flooding.

Further development of land accounts should continue to provide basic information on the availability and usability of land resources to provide planners and users with an adequate basis for facilitating its orderly development and wise usage. We therefore recommend that land accounts should be regularly updated, and be incorporated in the watershed-based or regional planning process. This requires an ongoing collaboration with National Mapping and Resource Information Authority (NAMRIA) to provide data sets for land cover and land use comparison on a regional up to micro-watershed level.

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Land cover	Area in hectares 2003	Area in hectares 2010	Change in percent
Annual crop	96,578	57,366	-40.6
Built-up	48,390	88,940	83.8
Closed forest	7,844	5,264	-32.9
Fallow	26	—	-100
Fishpond	—	76	—
Grassland	9,563	19,868	107.8
Inland water	89,946	96,168	6.9
Mangrove forest	94	1	-98.9
Marshland	—	4	—
Open forest	41,770	40,704	-2.6
Open/ barren	1,152	703	-39
Perennial crop	84,674	67,058	-20.8
Shrubs	89,621	77,892	-13.1
Wooded grassland	21,734	37,348	71.8

Note: Derived from NAMRIA Land Cover Map, 2003 and 2010.

Table 1. Land Cover Change in the Laguna de Bay, 2003 and 2010

Aquatic Ecosystem Accounts: Declining Flood- (or Water-) Retention Capacity

For the aquatic ecosystem accounts, the LLDA TWG analyzed the bathymetry data of 1997 and 2014 to determine changes in the flood-retention capacity of the lake. Contrary to expectations, the lake depth increased between 1997 and 2014. At the same time, sedimentation is decreasing the areal surface of the lake, with most of the sediments deposited close to the points where the rivers that feed Laguna Lake enter the lake. These changes—in combination with an ever increasing population density on the lakeshores—are effecting the water-retention capacity of the lake. The final analyses still have to be concluded, but first indications are that the lake's water-retention capacity has decreased in the last two decades, increasing the impacts of potential future flood events.

Ecosystem Services Account: Increasing Sedimentation of the Lake

The ecosystem service "erosion control" was defined as the amount of sedimentation avoided because of the vegetation cover. It was calculated by comparing the erosion and sedimentation rates in the lake that would have taken place without vegetation cover with the actual erosion and sedimentation rates. Results of sedimentation analysis using SedNet, a sedimentation modeling software developed by CSIRO of Australia (Wilkinson et al., 2004), show that between 2,500 and 2,800 kilotons/year of total suspended sediment are discharged to the lake. The service amounted to between 7,000 and 8,000 kilotons/year of sediments avoided. Despite the current state of the ecosystem, the seminatural and natural ecosystems are still capable

of preventing 7,000 to 8,000 kilotons of sediment per year from being deposited to the Laguna Lake Basin. With this information, efforts should be made to improve these ecosystems and prevent further degradation to alleviate the basin's siltation. Furthermore, the modeling enabled identifying zones that are particularly important as a source for sediments. An example is shown in Figures 1 and 2. This information allows the LLDA to identify the most important areas for protection and restoration of vegetation cover in order to avoid sedimentation and a subsequent decline in the flood retention service of the lake.

Aquatic Ecosystem Condition Account: Deteriorating Water Quality Potentially Affecting Fisheries Production

Data from the water condition account can be compared with data from the water emissions account to give a picture of how closely tied emissions from businesses are with the water condition of the lake. Figure 3 shows a large increase in the biochemical oxygen demand (BOD) of water discharged by businesses, compared to the water quality of Lake Laguna (5 being the lowest possible quality score, 25 the highest). The total BOD load from businesses is increasing, as is the lake's water quality in the lake, which at first look may seem counterintuitive. In 2007, the rate of domestic sewerage that was being treated increased dramatically; it now sits at approximately 13 percent of households. Figure 3 also shows that the sewerage treatment share of total BOD load from businesses in the area increased dramatically in 2007, and it has since varied between 39 and 55

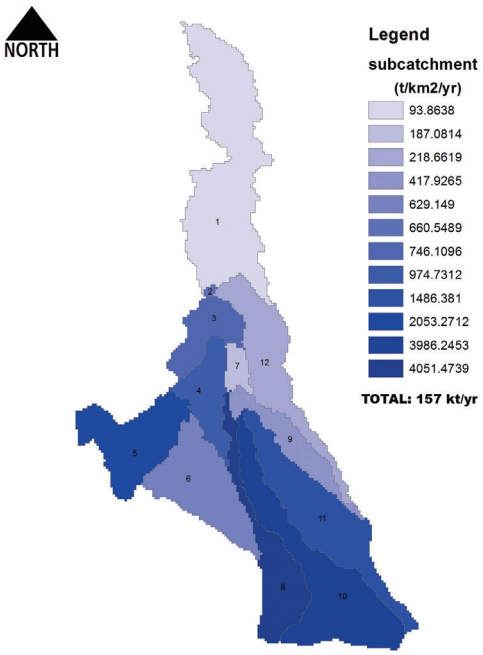


Figure 1. Total Sediments Generated (t/km²/year) in Marikina Sub-basin

percent of the total. From 2003, when the sewerage treatment proportion was virtually zero, water quality in 2012 has increased from a score of 17 to 19.5 (out of a possible 25).

This indicates that treating household sewerage would yield major benefits for lake water quality, and that increasing the rate of treatment of household sewerage, approximately

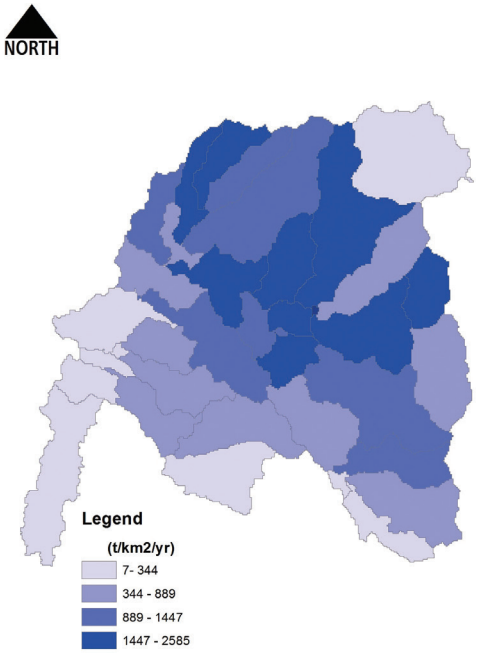
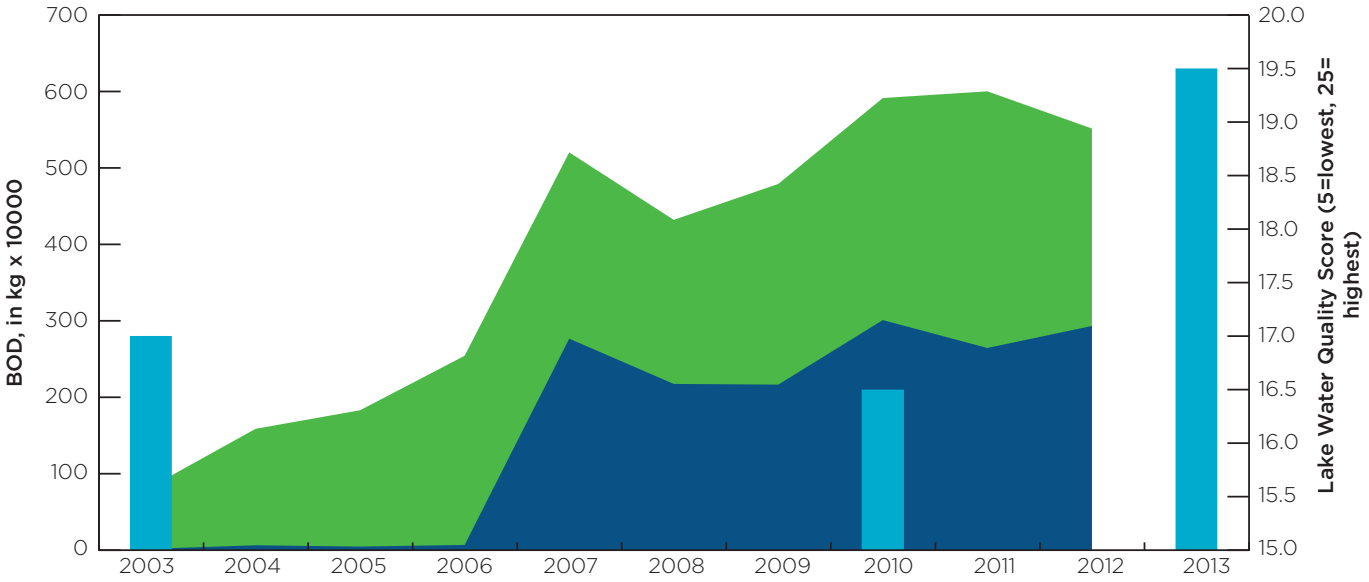


Figure 2. Total Sediments Generated (t/km²/year) in Santa Cruz Sub-basin

Figure 3. Biochemical Oxygen Demand (BOD) Load from Water Discharged by Businesses to Laguna Lake Catchment, 2003 to 2012, and Water Quality Scores for 2003, 2010, and 2013



87 percent of which remains untreated, has a lot of potential for increasing the water quality of Lake Laguna.

Using inputs to, and data generated by the Hymos model, as well as data on industry returns of water to the Laguna de Bay region (monitored by the LLDA Environmental User Fee program, which covers many industries, but not households, operating in the area), SEEA water asset accounts were prepared for the study area.

What Ecosystem Accounts for the Laguna Lake Region Mean for Policy

The initial findings from the ecosystem accounts for the Laguna lake region have important policy implications:

- Land conversions are, at present, not aligned with development plans or planning laws, and better enforcement of such regulations is exigent.
- There is a need to further strengthen water resources management and development through an integrated and holistic approach to regulate water use and allocation. The following are needed: (1) craft a policy for water allocation for different types of water user; and (2) prioritize preferential use of water.
- Treating household sewerage yields major benefits for lake water quality, and increasing the rate of treatment of household sewerage has a lot of potential to increase the water quality of Lake Laguna.
- Efforts should be made to improve soil erosion control services and prevent further degradation of land cover to alleviate the siltation in the lake basin. The accounts show priority areas for rehabilitation.
- Improve water-retention capacity of the lake to reduce vulnerability of shoreland populations to future flood events. A key issue is that more and more new houses are being built close to the 12.5-meter water level. These houses are all extremely vulnerable in high rainfall events and in particular during cyclones. Initial calculations of the accounts show that there has been a major increase in vulnerability to

floods since the last strong typhoon (Typhoon Ketsana, or Ondoy, the local name) in 2009.

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