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Using Community-Generated Data for Water Management Policy

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As population and their demands for water continue to rise, water resources in turn become more scarce. In the Philippines, where surface water constitutes about three quarters of the country's fresh water supply and comes largely from rivers and lakes sourced from the forest ecosystem or the watersheds, its growing scarcity is thus largely associated with the degradation of watersheds. And because of the spatial nature of such concerns, their solutions require locally-based action that is consistent with decisions and support at the watershed and national levels.[1] Certainly, communities located within watershed areas and headwaters are the most affected by problems in the watersheds. As such, it is only appropriate that they should take on a more active role in addressing such concerns and in influencing decisions and policies that relate to them.

It is in this context that this *Policy Notes* presents the case of such a community—Lantapan in Bukidnon—and examines how the initiatives that it has taken to address some of its water resource problems may serve as a starting point to influence a more concerted water management policy.

Significance of the place

Why Lantapan? Why is it important to present its case?

The municipality of Lantapan is contained wholly within a watershed area. It is located at the Upper Manupali River watershed, running west from about 15 km. south of Malaybalay City in Bukidnon, along the south-

PIDS Policy Notes are observations/analyses written by PIDS researchers on certain policy issues. The treatise is holistic in approach and aims to provide useful inputs for decisionmaking.

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[1]*See* PIDS Policy Notes No. 2002-09 *entitled "Why Watershed-Based Water Management Makes Sense" by Herminia Francisco for a clearer understanding of the linkage and rationale.*

ern boundary of the Mount Kitanglad Range Nature Park. It consists of four subwatersheds, namely, from west to east: Tugasan, Maagnao, Alanib and Kulasihan, that drain from the Mt. Kitanglad range to the Manupali River. At its lower part, the river runs into a dam which diverts flow into the Manupali River Irrigation System, a 4,000-hectare system constructed by the National Irrigation Authority in 1987, which in turn ultimately drains into the Pulangi River, one of the major waterways of Mindanao Island.

Like many other upland communities in Mindanao, Philippines, the rich natural resources at the Lantapan area have attracted many migrants from all over the country. In particular, the abundant supply of water from the numerous rivers and springs in the area became natural attractions for people to settle in and pursue profitable economic activities like agriculture. Propelled by certain trade policies and price support measures at the national level, agriculture became so extensive that it eventually led to the conversion of forest lands into corn and other annual cropped land. Land conversion also eventually spread to the higher-altitude areas and more steeply sloping lands. This history of agricultural expansion in Lantapan is no different from the pattern followed in many other Philippine watersheds.

As such, the site may be considered as a representative example of many upland Philippine areas. However, more than this, the case of Lantapan takes on greater significance because for almost a decade now, it has been the focus, as a pilot site, of intensive data-gathering, analysis and action at the farm, community, project and local government levels by a research project[2] adopting a landscape-lifescape development approach to food production and natural resource management.

[2]*The Sustainable Agriculture and Natural Resource Management Collaborative Research Support Program for Southeast Asia (SANREM-CRSP/SEA) is a USAID-funded project being locally coordinated by the Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD).*

In particular, Lantapan has extensive time series data on water quality and quantity sampling in its four subwatersheds located at the Upper Manupali River. The data, which date back to 1994, represent one of the very few time series sets capable of linking water trends to agricultural development and deforestation. *The importance of these data cannot be overemphasized because they provide concrete evidence of the effect and negative consequences of certain economic activities on the natural resources, in particular, water resources, if not accompanied by appropriate environmentally-friendly policies. The data also provide the basis on which local governments and other authorities concerned can decide accordingly on the course(s) of action to undertake*.

Community "Water Watch" group: monitoring water quality and quantity at Upper Manupali

Nearly a decade ago, a group of citizen volunteers, encouraged and assisted by the previously-mentioned SANREM-CRSP/SEA project, formed themselves into a citizens' "Water Watch" group that would regularly collect water samples from the various water bodies in the area and test and monitor their quality and quantity in order to establish trends that could help assess and improve environmental conditions.

The "Water Watch" group used a combination of methods, some of which were modeled after those employed by the Alabama Water Watch, a citizen volunteer and water quality monitoring program in the United States, and some techniques customized by Filipino researchers and scientists for the local situation. The methods and equipment used were practical and relatively inexpensive. They also made use of locally available materials.

Initially testing the water for a set of 8-10 parameters or indicators, the group eventually focused on the parameters related to *soil erosion*, *disrupted stream flows* and *bacterial contamination* to monitor the quality and quantity of the water in the area. They likewise applied the tests with the use of both qualitative methods like community perception, memory and experience, and science laboratory-based methods.

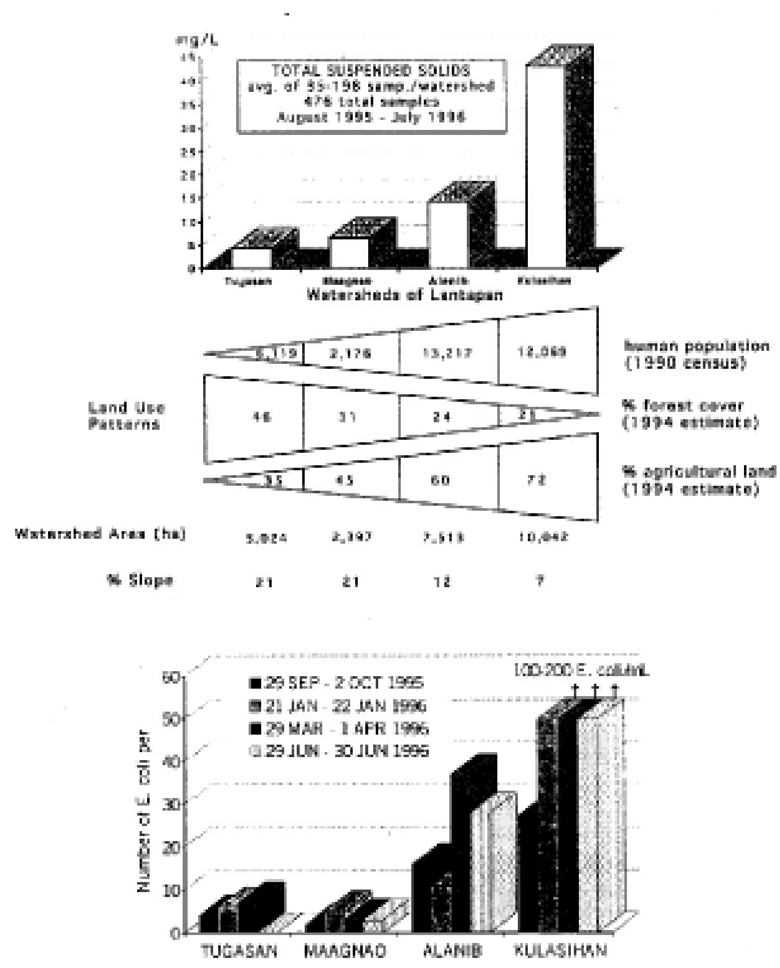
What the results show: clear and disturbing trends

The three parameters/indicators monitored over a certain period of time all reveal patterns of water quality and quantity degradation directly or indirectly linked with agricultural development.

Data for *soil erosion*, for instance, manifested in the level of total suspended solids (TSS) in the water bodies, show differences in erosion rates at the four subwatershed levels, with the TSS concentrations sharply increasing as one moves from the heavily forested and lightly cultivated western area of Maagnao to the intensively farmed eastern subwatershed at Kulasihan.

For the measurement of *stream discharge* which shows the hydrologic cycle, the data gathered by the community water watch group indicate that the surface flow in the eastern Kulasihan River is much more dependent upon seasonal rainfall patterns than the western-located Maagnao River. What this implies is that the Kulasihan River has become more unstable in its flow and more prone to "flashiness" or abrupt flooding and drought cycles, thereby posing a serious problem to its municipality.

Figure 1. Total suspended solids, land use patterns and concentration of E. coli bacteria in four subwatersheds of the Manupali River, August 1995-July 1996



The four bacteriological surveys, meanwhile, conducted in different seasons throughout 1995-96 show the *concentration of E. coli bacteria* in the waters of the four subwatersheds of Lantapan. The results of the surveys reveal exactly the same pattern and location as that of the TSS concentrations, reinforcing the impression drawn from the erosion and stream discharge data that degradation is occurring in a west-to-east gradient across the landscape.

When compared with demographic and land cover patterns in Lantapan, all of the above results indicate a clear but very disturbing trend as shown in Figure 1—that the progressive decrease in forest cover and corresponding increase in cleared land for agricultural purposes and settlements from west to east across the subwatersheds of Lantapan are *closely correlated* with the patterns of water quality degradation. In short, this implies that the *watershed degradation problem* has been brought about by changes in land use resulting from agricultural activities that were made in response to certain favorable economic policies.

As gleaned in the Figure, TSS is higher in subwatersheds where the forest cover falls below 30 percent and agricultural land makes up more than 50 percent of the area. To make matters worse, the subwatersheds in the western side which have steeper slopes—Tugasan and Maagnao—are more vulnerable to severe erosion due to deforestation; thus, any further deforestation in that side will lead to a higher cascade of TSS in the lower eastern subwatershed areas. Furthermore, due to the larger populations and more lands in the eastern side, Alanib and Kulasihan experience higher E. coli concentrations and other water-related problems.

What do these pieces of information imply? Can revealing information help Lantapan "turn the tide" in its watershed situation?

To get a better appreciation of the meaning of this question, it is best to describe the local policy and administrative scenario in Lantapan, Bukidnon.

Policy and administrative environment in Lantapan

In 1991, the Philippines' Local Government Code (LGC), a landmark legislation in local administration, was passed. Among others, the Code provides powers to local governments to serve as local enforcers and implementers of national environmental laws, with the Department of Environment and Natural Resources (DENR) issuing an administrative order in 1992 that spells out the devolved functions.

It was, however, only in July 1998 that a manual operationalizing such functions was adopted by both the DENR and the Department of Interior and Local Governments (DILG). Unfortunately, even to this date, this manual is not familiar to most local officials.

But in Lantapan's case, its local government invoked its mandate from the Code which enjoins local governments to prepare their own local environmental programs as early as in 1996. It developed its Natural Resources Management Plan (NRMP) focusing on the improvement of water quality, quantity and distribution; conservation of soil for sustained productivity; and protection of the remaining forests. In 1998, the Lantapan local government also passed a municipal ordinance setting up the Natural Resources Management Council (NRMC) to implement the Plan and in August 2001, created the Lantapan Watershed Management Council (LWMC), a multisectoral group in the area, in response to an urgent call to save the rivers from certain demise.

Surely, all these were made possible by an active and concerned local government and leadership. But more important, the decisions and actions came about because the local government, leadership and citizenry were kept informed by the data and regular monitoring results of the Water Watch group as well as by the studies related to the watershed situation in Lantapan.

The pressure coming from the multisectoral LWMC who reacted positively and quickly to the disturbing trends of the data presented to them by the water group and other related studies strengthened the local leadership's resolve to implement the conservation and environmental protection program prepared for Lantapan.

And while several proposals for water sector policy reforms are already contained in a number of pending legislative bills, policy papers and water forum discussions, the data collected from the grassroots at Lantapan indicate the *urgency* of having those proposed reforms implemented for areas like Lantapan and its watershed.

Prospects for sustainability: need for supporting and consistent policies at both national and local levels

Yet, the implementation of the watershed protection and management plan cannot be sustained at the local level if there are no supporting and complementary policies and programs made at the national level.

The forces of globalization and decentralization have accelerated economic activities in the rural areas. However, without proper institutional safeguards, these activities may negatively affect the fragile environments, especially of the upland communities.

The community-based monitoring of water quality and quantity energized local policy action. But in order to sustain it in view of future production intensification, there has to be an *optimal water resource management strategy* that combines both national and local policies affecting the use, access and control of environment services, specifically water resources.

Recommendations

What are some of these decisions/actions that therefore have to be made?

A set of recommendations is hereby being put forward, to wit:

- Consider economy-environment wide models, taking into account the environmental impacts of various economic policies like those in agriculture.

- Streamline the national level institutions to create an effective approach to policymaking for water resource use.

- Strengthen national-local government collaboration in water resource management.

- Strengthen the Local Government Code provisions on environmental management. In this regard, real devolution can take place if the DENR effectively abrogates its powers to the LGUs. Moreover, the manual of procedures for the DENR-DILG-LGU partnership defining the step-by-step procedure for the devolution of environmental services should be properly disseminated to the LGUs and funds for such activities should be allocated.

- Facilitate the proposed amendment in the LGC about host watershed communities, especially in the uplands, being given a share in the management of and revenues earned from watershed facilities.

- Carefully consider the formation of multijurisdiction entities for a most efficient management of watersheds.

Hopefully, these measures can create a more effective and efficient water management policy and help "turn the tide" for a more sustained prosperity in the fragile upland environments.

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Annex

Community-Based Water Quality Monitoring: Rationale and Methodology

The quality and urgency of policy reforms, especially for certain sectors, depend a lot on the availability of timely and credible data. For the water sector in the Philippines, a number of proposals for policy reform have been put forward in terms of conservation measures, market-based mechanisms, pricing policy, institutional reforms, ecosystems management approach and many others. Unfortunately, many of them—which are written as House bills, policy papers and highlights of water fora—have remained unimplemented. Water resources being site-related, what would normally signal the urgency of the situation and the need to push for the implementation of such reforms are site-specific data. Site-specific data that accurately record and monitor the quality and quantity of the water resources and indicate the state of degradation or nondegradation of the resources.

The data collected by a community-based or grassroots-level group for the water resources in Lantapan, Bukidnon at the Upper Manupali watershed demonstrate how information may help in alerting communities and local governments on the critical state of their resources and thus help in averting a possible water crisis.

The water monitoring project

In 1994, an environment and natural resource management project named the Sustainable Agriculture and Natural Resource Management Collaborative Research Support Program for Southeast Asia (SANREM-CRSP/SEA) chose Lantapan as its pilot site in espousing a landscape-lifescape development approach to food production and natural resources management. It designed a number of interdisciplinary research projects, one of which was on local water quality assessment and management whose goal was to develop community-based water monitoring groups and to collect credible water quality and quantity data that could lead to environmental and policy improvements.

The approach of the project was to develop and test water quality indicators that would be appropriate for natural resource management by community volunteers and local government units. The choice of indicators was based on the following criteria:

- scientifically valid methods, for credible qualitative and quantitative information,
- relevant to the community, for their endorsement and participation in data collection, and
- practical and relatively inexpensive, for sustainable use and applications using locally available materials.

Many of the methods used were modeled after those developed in the Alabama Water Watch, a citizen volunteer, water quality monitoring program in the US. Filipino partners in the activity helped customize techniques to the local situation. Community volunteer water monitors selected 16 sampling sites in four main tributaries of the Manupali River, including subwatersheds of varying degrees of forest cover, agricultural land and population.

After several months of testing water for a set of 8-10 parameters presented in the project's training workshops, the data began to suggest that the relatively few parameters related to soil erosion, disrupted stream flows and bacterial contamination were the most productive to pursue as indicators. Both the citizen monitors and researchers concurred. There then followed more indepth studies and application of these indicators.

The following is a summary of the rationale and methodology behind each of the key indicators, starting with the qualitative indicator of community perception, memory and experience before the science-based project began.

Indicator #1: community perceptions, memories and experience

The first dialogues set up between community members in Lantapan and the project researchers regarding potential environmental indicators revealed that residents were concerned with water contaminants such as pesticides and pathogens, in addition to soil erosion and sedimentation of streams and irrigation canals. Some farmers did not bathe their livestock in streams during rainfall events, citing cases of death or illness of their animals due to the pesticide runoff. Public health records, although scanty, indicated a higher than average infant mortality and morbidity rates in the community. Many of the common ailments were caused by waterborne pathogens.

Besides water quality concerns, residents also lamented that some streams were no longer maintaining regular flows but were just cycling through seasonal floods and drought. Memories of stable stream flow and clean water were within the last few decades. Flash floods were increasingly common in the eastern part of the Manupali watershed, resulting in severe soil erosion, crop loss and occasional loss of livestock or human life. Overall, the pattern of watershed degradation experienced by the community was typical of that in upland landscapes of the Philippines and in many other parts of the world.

Indicator #2: eroded soils in streams

Since the community of Lantapan is primarily agrarian, measurements of soil loss and sedimentation were particularly relevant to volunteer monitors. Farmers generally understood that soil loss usually meant a reduction in the fertility of their fields, with accompanying reduction of crop production. Most of the total sedimentation solids (TSS) monitoring by the community was done once or twice monthly at four main sites (bridge crossings of the four major tributaries of the Manupali River) in daytime, base flow conditions. By using the TSS indicator in this way, monitors tried to determine important trends and patterns occurring in the river valley. Their overall measurements, however, were an underestimate of the greatly increased erosion rates during strong storms. Recognizing this fact, the monitors began to measure TSS more frequently, just before and during selected rainfall events in each subwatershed. Results were sometimes dramatic, and the TSS indicator became an increasingly important way for the Lantapan residents to quantify environmental change and lay the foundation for local action and policy changes.

Indicator #3: altered stream flows and soil export

TSS is only a relative indicator of erosion and watershed degradation (a concentration value) and does not provide important estimates of soil loss in water past a given point. Because the streams of the four subwatersheds in Lantapan are similar in size, TSS trends were generally comparable. However, in monitoring stream discharge measurements, the use of TSS in its full potential was required to calculate soil export. Said patterns of stream discharge provide important clues to the watershed stability and the effects of land use change.

Typically, stream discharge measurements are made by researchers using expensive and fixed structures and instruments. Such methods are usually impractical for rural communities using their own resources. Thus, low-tech methods were developed and adapted for use by the volunteer water monitors in Lantapan. Stream velocity and discharge measurements were made with locally available materials, including rope, measuring sticks and a float. A cross-sectional map of each of the four streams was made at the main bridges, using the regular, concrete sides of the revetment wall under the bridge as boundaries when possible. A rope was stretched perpendicularly across the stream between two fixed points and stream depth was determined at one-meter intervals along the rope. Measurements of stream width and depth were used to draft cross-sectional maps and calculate areas.

Another rope of known length was stretched parallel with the stream bank to mark the distance that a floating orange (or other tropical fruit) would travel while being timed. Multiple measurements of the time required to float a known distance in different parts of the stream were used to determine average current velocity. Together, the cross-sectional area of the stream (square meters) and its current velocity (meters per second) were used to estimate stream discharge (cubic meters per second).

Indicator #4: bacterial contamination of water

Levels of potentially harmful bacteria in streams, wells and piped drinking water were of primary concern to many citizens of Lantapan because of obvious public health risks and personal experiences of illness. Like the related memories of community members regarding stream degradation

Annex (cont'd.)

from pesticides and silt, older adults recounted how they freely drank from streams in the past. Today, though, drinking from streams in these same places would cause them to become ill.

Evaluation of water for bacteria in the community had been infrequent before this water watch monitoring project. The occasional tests done by the Department of Health or the barangay health workers only detected the presence or absence of fecal coliforms without determining a concentration value.

For the project, a relatively new technique of measuring concentration of E. coli and other coliform bacteria was used for the monitoring. Said technique was based on simplicity, accuracy and low cost. With this method, a one milliliter sample of water is collected using a sterile, plastic pipette and squirted into a 10 ml bottle of sterile, liquid medium. The medium (with color indicators for coliforms) containing the water sample is poured onto a sterile, plastic dish which is designed to induce the liquid to solidify. Incubation of sample plates at ambient tropical temperature was sufficient to grow the bacterial colonies for enumeration in about 30-36 hours. No incubators, sterilizers or glassware were needed for this technique and the necessary supplies (which cost about US$1 per sample) could easily be transported to remote areas for sampling scores of sites per day. After the incubation period, the bacterial colonies of E. coli and other coliforms were enumerated and reported for feedback to the community. The same procedures used to monitor coliform bacteria in Lantapan were approved by the U.S. Environmental Protection Agency for the Alabama Water Watch Program in January 2000 (Deutsch and Busby 1999).

While the initial participants in the water quality training workshops and monitoring were predominantly young men, bacteriological monitoring generated much interest among women and girls. It is believed that this parameter was of particular interest to women because of its direct effect on the family health, especially on infants and children. It may also have been more relevant than other parameters because the measurement was made from community faucets and public springs that had a close connection to household affairs and daily chores. The strong involvement of the Federation of Lantapan Women's Organizations and other women of the community added a new dimension to the community-based water quality indicators and their applications. On the whole, the concentration of coliform bacteria has become an important indicator of water quality and is used by diverse sectors of the community.

Below is a summary of the indicators and the situation or specific problem that each of them monitors. Given the usefulness and impact that they had in informing the local residents and officials in Lantapan on the state of their water resources and pulling them into action to save such resources, it may be worthwhile to consider the possibility of setting up similar community water monitors in other areas of comparable landscape and resources in the Philippines.

Summary of community-based water quality indicators

Issue/problem	Indicator	Unit of measure
General environmental degradation	Community perceptions, memories, experiences	Anecdotal or questionnaires/surveys
Soil erosion	Suspended soils in water	Mg/l TSS
	Soil loss in water	Kg/h soil export
Disrupted stream flow	Stream discharge	Cu meters/second flow (monthly measurement)
	Flow variability	Coefficient of variation
Bacterial contamination	Coliform concentration	No. colonies/ml of water (E. coli and other coliforms)