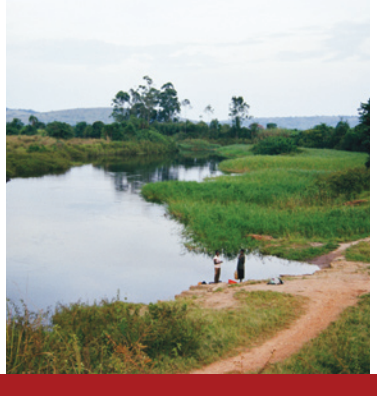
WATER
P-NOTES
ISSUE 28
FEBRUARY 2009



Rural Watershed Management
The Power of Integration

A watershed is an area that supplies water by surface or subsurface flow to a drainage system or body of water (Figure 1). Watersheds vary from a few hectares to thousands of square kilometers. Watershed management (WSM) is the integrated use of land, vegetation, and water in a specific drainage area with the objective of conserving hydrologic services and reducing or avoiding damage downstream or underground.

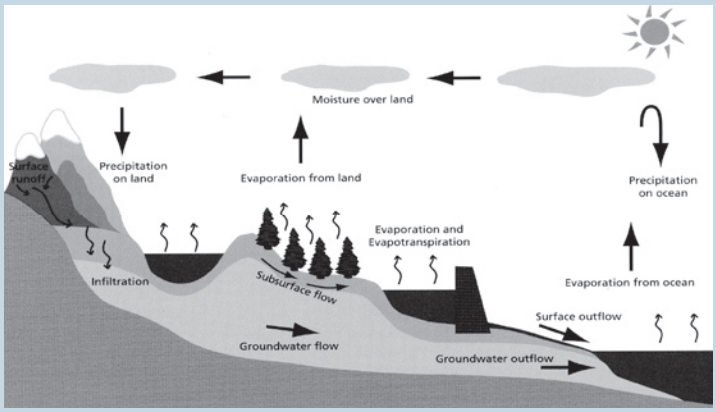
The first generation of WSM projects emphasized engineering and civil works. By the end of the 1980s, the comparative failure of this top–down approach was clear. Since the 1990s, WSM programs have integrated livelihood improvements and poverty reduction objectives with soil and water conservation.

Integrated WSM—the new way

In practice, there are now two basic approaches to WSM—targeted and mainstreamed. In the first, management interventions address very specific objectives and indicators related to water resources and hydrologic outcomes, whereas in the second, the principal focus is on wider goals and objectives, such as improved management of land or other natural resources, poverty alleviation, or rural development. Unless land and water interactions and upstream–downstream impacts are critical issues, the mainstreamed approach usually makes sense, because it achieves natural resource goals and rural poverty objectives.

Most WSM projects funded by the World Bank adopt the micro-watershed as the basic unit for integration of land, water, and infrastructure development. It has proved to be a flexible, practical, and economical unit for project implementation. Within the micro-watershed, all stakeholders are included in participatory processes that stand or fall on the development of a common purpose, the availability of funds to build capacity, and the establishment of income and livelihood incentives.

Figure 1. The hydrological cycle in a watershed



Source: http:/www.waterencyclopedia.com/Hy-La/Hydrologic-Cycle.html.

This note by Jim Smyle, Grant Milne, and Halla Qaddumi summarizes lessons from *Watershed Management Approaches, Policies and Operations: Lessons for Scaling-up,* by Salah Darghouth, Christopher Ward, Gretel Gambarelli, Erika Styger, and Julienne Roux (Water Sector Board Discussion Paper Series 11, World Bank, Washington, D.C., 2008). Readers may download the full report from http://www.worldbank.org/water.

Table 1. Watersheds scale and management focus

Watershed Management Unit	Typical Size (km^2)	Influence of Land Use on Hydrology	Primary Planning Authority	Typical Management Focus
Micro-watershed	0.1–1.5	Very strong	Property owners (local)	Participatory planning: BMPs; site design
Sub-watershed	2.5–25	Very strong to strong	Local government w/principal local stakeholders	Stream classification; land use planning/zoning; land, water resources and stakeholder management
Watershed	25–250	Strong to Moderate	Local or multiple-local government w/principal local and regional stakeholders	Watershed-based zoning; land use and water resources planning; stake-holder management; policy, norms, regulations and incentives
Sub-basin	250–2,500	Moderate to weak	Local, regional or state w/principal regional stakeholders	Basin planning; stakeholder management; policy, legal framework and incentives
Basin	2,500–25,000	Weak to very weak	State, multi-state or federal w/principal regional and state stakeholders	Basin planning; stakeholder management; policy, legal framework and incentives

Stakeholders will engage in conservation if it makes economic sense, yet technically sound WSM interventions have often neglected financial profitability and incentives. Financial and economic analysis can help design investment packages that achieve conservation objectives while also offering incentives where necessary to ensure viability.

To be sure of capturing upstream and downstream interactions, interventions must be planned within the larger watershed context and with understanding of the spatial and hydrological links between perceived externalities and their causal factors. Best practice in this regard includes mechanisms for: (i) planning processes in which stakeholders have a voice and are able to agree on measures that can achieve both local and larger-scale objectives; and (ii) interagency collaboration and coordination between local and regional authorities and organizations. The China Loess II Project is an example of an effective process (Box 1).

Properly done, WSM can achieve soil and water conservation while simultaneously intensifying natural resource use and agriculture to improve rural livelihoods. Success is greatest where communities select from a menu of interventions that yield both short- and long-term benefits. The identification of synergies requires careful analysis of social, institutional, economic, and environmental dynamics.

Institutional arrangements for collaboration, capacity building, and supportive policy

Although integrated WSM can help relieve rural poverty, landless segments of the rural poor have been left out of some projects or have benefited only tangentially (for example, from construction jobs). Projects often target landed farmers for soil and water conservation, while landless people dependent on commonly held natural resources (forests and grazing lands) suffer from rangeland closure, restrictions on collecting minor forest products, or other conservation interventions. In best-practice projects, however, poverty concerns are addressed through the participatory process. To facilitate participation and maximize poverty reduction, investment programs may aim to establish self-help groups and income-generating activities. Non-farm activities can be an effective alternative to reduce out-migration.

Participatory approaches require political commitment and equitable rules, time for the process

Box 1. Watershed scales in the China Loess II Project

The Loess Plateau covers 640,000 km^2 of the drainage basin of the Yellow River. The project is increasing agricultural production and incomes, and improving ecological conditions in tributary watersheds of the Yellow River, in particular by reducing sediment overload in the river. The project area contains about 1,100 micro-watersheds ranging from 1,000 ha to 3,000 ha. Counties and micro-watersheds were selected through combined top-down and bottom-up processes, beginning with areas facing the greatest difficulties. Then, sustainable local development plans were designed with the communities. Extensive use was made of maps, both to monitor progress in micro-watersheds and to get an overview of basin-level impacts.

to mature, careful sequencing, inclusion of all stakeholders, openness of public agencies to the rationale and process of participation, and sustained capacity building at implementing agencies, to provide better service, and at the village level, to enable farmers to collaborate on management and conservation of resources. The interface between local government, technical agencies, and community organizations needs to be carefully defined and managed. Natural resource management practices, in particular, should reflect local legislation and land-tenure patterns. Common property resources are a particular challenge for WSM, and a clear policy and legal framework is needed to support effective management and benefit sharing.

Like participation, decentralization is a hallmark of integrated WSM. Several countries, such as Brazil, China, India, Tunisia, and Turkey (see Box 2), have shown that success in testing participatory approaches in one project can lead to adoption of broader policies for nationally funded WSM programs. As agencies that provide services across sectors—forestry, animal husbandry, veterinary care, irrigation, water management, agriculture—increase their collaboration, even technical functions may be decentralized.

Monitoring and managing the downstream impact of WSM projects

The planning process for any WSM project must balance the community's interests in the micro-watershed with larger resource-conservation objectives.

A principal attribute of the best integrated WSM is to manage the downstream impacts—or "externalities"—resulting from upstream land use and water resources interactions. Market-based approaches, often termed "payment for environmental services," have been used with success in some projects to address externalities. At local levels, deals can be organized between upstream and downstream residents, but as scale and complexity increase, contracts require increased scientific knowledge and more institutional capacity.

Paradoxically, basic hydrology has received insufficient attention in some WSM projects. It need not be so. New advances in modeling, remote sensing, and GIS can help increase understanding of the relationships between water, land, and proposed WSM interventions. Using these tools, analysis at the basin and sub-basin levels should be conducted to support watershed planning. But the new tools have not settled all pertinent questions. In some areas, additional scientific research will be needed to establish the hydrological impacts of WSM practices and technologies, particularly larger-scale forestation under varying climatic, soil, and geologic conditions.

Climate change is expected to bring increased variability and unpredictability to the water cycle, with effects on biodiversity and agricultural productivity. Greater frequency of high-intensity rainfall of short duration is likely to increase the vulnerability of communities in many watersheds to soil erosion, floods, and damage from debris. Although climate change will have economic and social costs, an integrated set of management responses, within an integrated basin planning and WSM framework, can help identify and mitigate those costs.

Just as the measurement of externalities has been fragmentary in WSM projects, monitoring and evaluation (M&E) have generally been weak. But the most successful WSM programs track performance against objectives to guide implementation and allow for adjustments in inputs, outputs, impacts, outcomes, processes, and institutional arrangements. Useful and affordable tools, such as remote sensing,

Box 2. Institutional collaboration at the local level in Turkey

The Eastern Anatolia Project helped departments and bureaus, such as soil and water conservation, agriculture, livestock and animal husbandry, environment, and forestry, make joint efforts in planning and implementing integrated watershed development works. Capacities were improved to coordinate activities, deliver more effective service, and gain experience in collaborating with farmers. The capacity of farmers to collaborate with each other was also strengthened by working together on project-financed investments for management and conservation of community land resources.

GIS, and community-based monitoring are increasingly common for these purposes (see Box 3).

A recipe for success

World Bank WSM programs have been fairly successful with:

- Starting from the building block of the micro-watershed;
- Using integrated projects to address watershed and natural resource conservation and livelihood objectives;
- Adopting participatory and decentralized implementation;
- Supporting demand-driven research and dissemination; and
- Mainstreaming WSM into public institutions and national policies.

But, lessons gained over 15 years suggest that new programs:

- First determine if local site conditions require an integrated WSM approach or a rural livelihoods model with minor soil and water conservation inputs;
- Use readily available models for basin or sub-basin level planning and analyses—then connect to micro-watershed delivery;
- Consider starting with pilot projects to learn lessons and build experience before scaling up;
- Recognize that WSM and participatory processes need careful design and balancing of objectives to be pro-poor and equitable;
- Strengthen the focus on upstream and downstream interrelations, to address potential externalities;
- Improve M&E, including monitoring how micro-level activities and institutions upstream contribute to improved conditions in the wider watershed;
- Include "water" in WSM and take into account how interventions will impact on hydrology; and
- Contribute to broader environmental objectives and help communities (especially farmers) adapt to climate change.

Box 3. Monitoring and evaluation in Karnataka Watershed, India

The Karnataka Watershed Development Project offers a best practice example of Monitoring, Learning and Evaluation (MEL) systems with community driven, integrated watershed development in India. The MEL system engages communities, NGOs, government, and a third party technical agency to achieve a robust system of checks and balances. The planning and monitoring process uses remote sensing, GIS, special analyses, thematic mapping, and a computerized Management Information System to track performance, measure impacts, and guide project implementation.

The Water Sector Board Practitioner Notes (P-Notes) series is published by the Water Sector Board of the Sustainable Development Network of the World Bank Group. P-Notes are available online at *www.worldbank.org/water*. P-Notes are a synopsis of larger World Bank documents in the water sector.

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