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Reducing Resource Degradation: Designing Policy for Effective Watershed Management

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Abstract

Throughout the world, massive spontaneous migration and planned resettlement to upland areas have resulted in over-exploitation and degradation of land and water resources. This threatens both the present and the future sustainability of the livelihood, and the health and well-being of millions of residents of both uplands and areas downstream.

Policymakers face a number of challenges in dealing with these issues. Social and political institutions rarely coincide with watershed boundaries, the scale that governs most biophysical processes that affect the productivity and sustainability of land use. Usually there is a diverse set of stakeholders concerned with the resolution of upland land use issues. And commonly a number of other sectors and issues that affect upland resource use carry more political clout than considerations of upland conservation.

Using a watershed management perspective, this paper provides a framework for the assessment and design of policy and programs intended to help achieve productive and sustainable upland resource use. There are a number of key factors that policymakers should consider. They need to identify all stakeholders, and understand their perceptions and attitudes. Jurisdiction over lands and activities among different government agencies must be clarified, and coordination among them improved. Watershed residents often have the greatest potential for managing local resources. Policy should be designed to encourage this. A major barrier to effective watershed management is the inequitable distribution of benefits to those who employ sound land use practices and the failure of those responsible for resource degradation to bear the costs. Policy can be used to help correct this. Last, policymakers need better assessment of the impacts of current policy in order to design more effective policy for the future.

Foreword

This Working Paper is a product of the Environmental and Natural Resources Policy and Training Project funded by the United States Agency for International Development (USAID). EPAT is part of USAID's effort to provide environmental policy information to policymakers and practitioners in developing countries. The objective is to encourage the adoption of economic policies for promoting sustainable use of natural resources and enhancing environmental quality.

EPAT Working Papers are written for development professionals and policymakers in developing countries who are responsible for establishing and implementing policies on the sustainable use of natural resources and for civil servants, project officers, and researchers who are directly involved in the implementation of development activities.

This Working Paper provides a state of the art review of the major challenges in dealing with the issues of soil and water resource degradation. It then presents watershed management approaches to dealing with these problems plus key ways in which policy initiatives can help achieve the goals of watershed management. Policymakers in developing countries may find this analytical framework applicable to their own situations as they try to develop effective policies for managing water resources and dealing with related natural resource questions.

The contribution of USAID toward writing, printing, and distribution of this document is estimated to be $10,000. The document is being distributed to more than 2,000 policymakers and professionals in developing countries. We will assess its effectiveness by soliciting the views of recipients. An evaluation sheet is enclosed with each mailing of EPAT publications for that purpose.

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Introduction

Watersheds exist as coherent biophysical systems. Processes occurring in one part of the watershed have impacts in other parts downstream. Thus, disturbance of soil and vegetation in the upper areas of a watershed can affect land and the quality and quantity of water further downslope. Watershed management provides a useful framework for considering biophysical linkages in managing natural resources for sustainable development. It does this by dealing with both upland and downstream communities, particularly with their linkages.

The ultimate goal of watershed management, like rural development, is to provide goods and services desired by society. However, the focus is on sustainable development that maintains the long-term productive capability of the soil and the quality of water resources. In this sense, one can look at watershed management as a tool for sustainable development. Society desires a variety of goods and services from the land, including forest products; agricultural crops; meat and dairy products; water for consumption, recreation, and tourism; hydropower; flood control; and biodiversity maintenance. Depending on the local situation, specific objectives of watershed management may include:

- increasing water supplies in an area,
- enhancing water quality,
- preventing soil erosion to protect the land's productive potential and reduce downstream sedimentation, and
- rehabilitating land already degraded.

Many of these goals coincide with soil and water conservation practices aimed at local farmers, herders, foresters, engineers, or other natural resource users. Indeed, soil and water conservation is an integral part of watershed management. What distinguishes the watershed management approach is its holistic consideration of all watershed activities, how they affect each other, and how to sustain the resource base on which they depend (see box 1).

Achieving watershed management goals requires using multiple resources, coordinating activities among several stakeholders, dealing with many land uses, and possibly operating within several different political jurisdictions. It also often requires working within a policy environment involving several agencies, many formal and informal policies, and many different sectors.

Some policies shaping the nature and direction of watershed management may be appropriate and effective while others may be inappropriate, ineffective, or unenforceable. Some policies may even be contradictory when looked at in the broader context of the overall policy environment. Sometimes there may be no policies at all dealing directly with watershed management or the linkages between land and water use.

Because of their rapid and accelerating degradation, uplands have become a point of particular concern in most developing countries. Dealing with them, in the context of watershed management, forces policymakers to consider the inequities in the distribution of costs and benefits arising from either the proper or improper use of upland areas.

Box 1. Concepts and Definitions

(Working Group on Watershed Management and Development 1988; Brooks, Ffolliott, Gregersen, and Thames 1991; Brooks, Gregersen, Ffolliott, and Tejwani 1992)

A watershed is the total land area above some point on a stream or river that drains to that point. Depending on the topography and the point chosen, a watershed may be small (several hectares) to very large (hundreds of thousands of hectares). Although a physical unit of land, the watershed is also useful when considering socioeconomic and political issues related to managing natural resources. A river basin is similarly defined but much larger, for example, the Amazon River Basin.

Watershed management is the process of organizing and guiding all resource uses on a watershed. This process provides desired goods and services without adversely affecting soil and water. This concept recognizes interrelationships among land use, soil, and water, and the linkages between upland and downstream areas.

Watershed management practices are land use practices using vegetative cover and other nonstructural and structural measures to:

- **rehabilitate** degraded lands,
- **protect** soil and water systems, the resource base on which the production of food, fiber, forage, and other products depends, and
- **enhance** water quantity and quality.

A watershed management approach incorporates "soil and water conservation" and "land use planning" into a broader framework by focusing on the following concepts:

The interaction of water with other resources affects people both positively and negatively. In turn, people affect the nature and severity of such interactions by the ways in which they use resources and the quantities they use.

The physical effects of these interactions follow watershed boundaries, not political boundaries. For example, water flows downhill regardless of how people define their social and political institutions. Thus, what one political unit does in the highlands can significantly affect another political unit downslope.

Since such interactions cut across political boundaries, what may be sound resource use for one political unit, may not be sound resource use for another because of undesirable downstream effects. The watershed management approach brings such externalities into the analysis by considering watershed boundaries.

Externalities, negative consequences for which those guilty are not held responsible, and positive results for those who are responsible do not receive benefits or compensation, are common. Therefore, ecologically-sound management becomes good economics only if political units, communities, and individuals involved receive benefits and bear costs equitably.

Policymakers need to design programs that promote upland conservation and watershed management. This will lead to wise use of natural resources without adversely affecting the soil and water in both upland and downstream areas.

This paper provides a state-of-the-art review of:

- major challenges of soil and water resource degradation issues, especially in the uplands,
- watershed management approaches to these problems, and
- key ways that policy initiatives can help achieve those goals.

Land and Water Degradation: A Global Concern

Land and water degradation directly affects millions of rural upland residents. It also adversely affects millions more living downslope and downstream. In many parts of the world fast-growing populations are seeking opportunities to earn livelihoods on whatever land is available no matter how steep and marginal. This causes land degradation to increase at an alarming pace.

People notice upland degradation because they can see it occurring. Surface soil erosion, gully formation, landslides and mudflows, polluted water, sediment-filled channels and reservoirs, and shortages of potable water are apparent to all rural people. Problems resulting from such obvious, as well as more subtle, processes are:

- declining productivity of uplands,
- reduction in consumer water supplies,
- declining quality of water supply and its negative effect on aquatic life, and
- increasing loss from landslides and floods, caused by improper land use and water management.

Causes and Sources of Degradation

Some land degradation does occur from natural phenomena, such as geologic instability, high intensity rainfall, steep slopes, shallow and highly erodible soils, and frequent fires (Brooks, Gregersen, Lundgren, Quinn, and Rose 1990). But human activity worsens these sources of degradation and makes them major issues (see box 2).

Erosion, for example, is a natural process caused by wind and water that occurs in most natural systems. These natural causes can be significant in some younger mountain systems such as the Himalayas. They are of concern, but they are not the subject of this paper. Rather, we are interested in the ways in which land use practices cause accelerated erosion leading to environmental degradation and loss of productive potential other than natural loss.

Box 2. Mudslides in Thailand Caused by Torrential Rainfall in Deforested Areas

In November 1988, southern Thailand experienced three days of torrential rains totaling nearly 1,000 millimeters. It caused massive flooding and mudslides resulting in death, devastation, and loss of property (Rao 1988). In Nakhon Sri Thammarat, there were 236 fatalities; 305 missing persons; 688 injured; and 4,952 homes, 221 roads, and 69 bridges destroyed. Some people attributed these mudslides to "illegal and unwise logging." In response to the November catastrophe, the Royal Thai Government declared a total ban on logging. Clearing natural forest cover on steep slopes, whether for cultivation or logging, had made them more susceptible to landslides and mudflows. But logging itself is no worse than the widespread conversion of forests to cultivated fields. In fact, if loggers use practices that avoid severe erosion and if forest cover regenerates quickly, forest harvesting and logging will cause less long-term damage than cultivating uplands.

The key point is that excessive torrential rainfall occurring over such short periods will wreak havoc no matter what the condition of the ecosystem. This is a risk of living in steep upland areas. People living in uplands and those immediately downstream are in peril when such events occur. Preventing or reducing the permanent conversion from forest to cultivated crops on steep uplands can help reduce the effects of such storms. But it cannot prevent them from happening. Policies that take a zoning approach identifying hazardous areas would be more effective in saving lives and property than blanket bans on logging.

Human causes or sources of degradation include the following:

Unwise Deforestation[1] (see box 3)

- Shifting cultivation with shortened and now inadequate fallow periods results in poor forest regeneration and loss of soil nutrients. Increases in population, migration, resettlement programs, refugee movements, and other demographic changes alter the way people use upland resources and may cause such changes in traditional practices.
- Cutting fuelwood well above sustainable yield is a response to the growing needs of expanding rural and urban populations.
- Converting forests to grazing lands or cultivated croplands in areas not able to sustain those activities may be the result of either illegal encroachment or legal land settlement.
- Fires set by local inhabitants and not adequately controlled can damage forests.

Poor Forest Management Practices

- Logging practices, such as skidding up and down steep slopes without adequate protection measures, damage soil and water systems.
- Some forest harvesting practices may inhibit or fail to encourage adequate regeneration.

Inappropriate Cultivation Practices

- Farmers, who have encroached upon or been resettled to steep upland areas, may use practices appropriate only for lowlands with gentle slopes.
- Increasing population pressures may force upland inhabitants to change their traditional practices, such as shortening fallow periods or moving to lands they would usually consider unfit for cultivation.
- Economic forces, such as price and market changes or price subsidies can also cause inappropriate farming practices. Such forces may encourage farmers to plant crops, such as cassava and opium poppies, that yield a high return. However, farmers cannot cultivate them on a sustained basis on steeply sloping lands.

Improper Road Construction

- Poor construction practices lead to severe erosion and landslides.
- Increased accessibility of upland areas leads to more rapid and often ill-considered settlement and the over-exploitation and degradation of upland areas.

Poor Range Management Practices

- Overstocking leads to a loss of forage species, increased erosion, and land degradation.
- Poor choices of watering areas for livestock and poor management of adjacent areas cause further damage.

Water Contamination in Upland Areas

- Problems include inadequate treatment and disposal of potential water pollutants including human excreta, livestock feces, and pesticides.
- Mining activity that does not prevent sedimentation and pollution of downstream waters causes other damage.

A Watershed Management Framework

To deal effectively with issues resulting from land use in upland areas, policymakers must approach them from a watershed management framework. They should use such a framework as the basis for addressing these issues or at least as the basis for analyzing them.

Box 3. Common misconceptions about the impacts of forest harvesting and deforestation on water and watersheds.

Several commonly held misconceptions about forests, water, and watershed management complicate the development of appropriate policies for watershed management. These include:

- Some think forests and trees increase the abundance and frequency of precipitation. They suggest that cutting forests reduces precipitation. This is not true for most upland watersheds, although it can occur under "cloud forest" conditions (as explained below). Usually, trees and forests have little or no effect on the amount of precipitation.

- Some think forests influence global weather and precipitation patterns. Forests have a profound influence on microclimate. But there is no evidence that the presence or absence of forest cover affects general weather circulation patterns.

- Many believe that cutting forests reduces the flow of streams, rivers, and springs. They equate forests with sponges that hold and then gradually release water. In fact, except for the "cloud forest" situation, the opposite is true. Cutting forests reduces the loss of water to evapotranspiration and will therefore increase water yield. Cloud forests, which occur along coastal areas or in high elevations in the humid tropics, are the lone exceptions to this rule. They intercept fog allowing it to condense. This increases water yield, sometimes significantly. Cutting such forests reduces fog interception and water yield.

- Many say deforestation is the cause of large, regional floods, such as those that occur frequently in low-lying countries like Bangladesh. Forests cannot prevent the major floods that occur from exceptionally high amounts of precipitation. Forest cover can, however, affect the size and frequency of smaller, more localized floods.

- Some blame forest harvesting and logging for much of the erosion, landslides, mudflows, and other related problems that begin in upland areas. Policymakers must realize that, if undertaken in proper areas and managed correctly, timber harvesting can cause minimal erosion and land degradation. Unfortunately, forest harvesting is all too frequently done inappropriately. Roads, important for logging and other activities, are frequently the major cause of erosion and sedimentation in upland watersheds.

Such misconceptions often attract political attention. Some use them to attract support for a variety of causes. But to be successful over time, policymakers must base their decisions on reality, not misconceptions. The problem here is to develop rational policies that promote sustainable land use practices and achieve watershed management goals.

Objectives and Principles of Watershed Management

The concepts of watershed management provide an integrated framework for achieving upland conservation and for planning and implementing natural resource development (see box 1 on page 2).

Watershed management practices dealing with land use and soil and water conservation are tools to achieve watershed management goals (see table 1). These practices include a variety of structural and nonstructural (land use and vegetative) measures undertaken to:

- maintain or increase land productivity,
- assure adequate quantities of usable water,
- assure adequate water quality,
- reduce flooding and flood damage, and
- reduce the occurrence of landslides and other forms of mass soil movement.

Various institutional mechanisms, such as regulations, market and nonmarket incentives, public investments, and local residents' groups, help encourage these practices. To succeed, these mechanisms need a policy environment that:

- recognizes the existence of watersheds and the processes that operate on a watershed scale,
- allows for detailed accounting of the environmental benefits and costs associated with forestry, water resource, and other development programs, and
- encourages formation of institutions that help achieve watershed management goals.

Policymakers need to understand the link between environmental improvement and long-term increases in productivity. They also need to reconcile the diverse interests of upland residents and the divergent interests of lowland residents downstream.

Potential Benefits of Watershed Management

Properly implemented watershed management practices can benefit both upland and downstream areas. Benefits include immediate increased production and conservation of the soil and water base for current and future production. Another benefit is the protection and enhancement of the overall environment, including biodiversity.

Besides immediate production increases, we can quantify resource preservation in economic analyses that provide strong justification for applying watershed management practices. Watershed management projects are easy to justify on lands upslope of, and near, a reservoir (see box 4). Increasing the lifespan of the reservoir by reducing sedimentation rates can yield an extremely high rate of return on investment. In other cases, policymakers may justify watershed management efforts based on increased upland productivity alone (see box 5). Except in areas already highly degraded, policymakers can justify using watershed management practices if they consider all benefits, both on-site and downstream.

Table 1. Watershed Management and Upland Conservation Goals and Practices

Goals	Measures	
	Vegetative/Land Use Management	Structural
Maintain or increase land productivity	• agroforestry practices, such as, windbreaks, alley-cropping • reforestation or afforestation to meet fuel, fodder, and fiber needs • soil conservation practices, such as strip cropping, no-till or minimum tillage cropping • mulching or cover crop vegetation to stabilize structural conservation measures • limiting grazing to sustainable levels	• terraces (bench, broad-based) • contour ditches and furrows • gully control structures and grassed waterways • water harvesting, spreading, and irrigation measures
Assure adequate quantities of usable water	• encouraging low water-consuming species • using appropriate land use measures to protect reservoirs and channels	• water harvesting systems • reservoir and water diversion structures • irrigation facilities • wells • encouraging water-saving technologies
Assure adequate water quality	• maintaining or establishing vegetative cover in key areas such as streambanks • controlling waste (human, livestock, mining, *etc.*) • using natural forests and wetlands as secondary treatment systems of wastewater • controlling grazing and developing guidelines for agricultural systems	• water treatment facilities • developing alternative supplies, such as wells, water catchments
Reduce flooding and flood damage	• revegetating or maintaining vegetative cover to enhance infiltration and water consumption by plants • zoning/regulating flood plain use • protecting and maintaining wetlands	• reservoir flood control storage • water diversion structures • levees • gully control structures • improving channels
Reduce the incidence of landslides	• reforestation or afforestation for soil stabilization • maintaining good vegetative cover to promote infiltration of rainfall • restricting residence and productive activities on steep unstable slopes	• bench terraces • grassed waterways, drop structures, *etc.* to control overland flow

Box 4. Watershed Management Justified by Its Downstream Impacts: A Case Study From the Philippines (Briones 1986)

Briones' analysis found that reducing sedimentation of a reservoir could economically justify watershed management practices above the San Roque Multipurpose Project (SRMPP), on the Lower Agno River in central Luzon in the Philippines. Briones used erosion and sedimentation data from two other watersheds and reservoirs located upstream from the SRMPP to estimate future sedimenation. Based on those estimates, Briones found the predicted 50-year lifespan of the reservoir to be too optimistic. That projection assumed that current erosion and sedimentation rates would remain constant. Briones estimated the losses in irrigation, flood control, and hydropower capacity that would be avoided by implementing structural and vegetative measures to control surface and gully erosion. Such a watershed management program would have a benefit-cost ratio between 2.73 and 4.14. This clearly justifies it from the perspective of downstream impacts alone. However, the benefits may be even greater if policymakers consider on-site benefits, such as maintenance of or increases in upland productivity too.

Box 5. Watershed Management Justified by Its On-site Impacts: A Case Study From Haiti (White and Quinn 1992)

Save the Children implemented an Integrated Watershed Management Project in Maissade, Haiti, during the five-year period from 1986 to 1991. The project invested heavily in the development of peasant organizations to gain voluntary and sustained adoption of soil conservation, forestry, and community development innovations. Project components included:

- tree planting, particularly along property boundaries,
- hillside soil conservation treatments, such as contour hedgerows, trash barriers, and rock walls, and
- gully control structures, such as trash barriers using living stakes, hedgerows, and rock checkdams.

An economic analysis considered only benefits of increased on-site productivity and avoided losses in productivity that would occur if no treatment took place. The analysis found the project highly justified. From the perspective of the donor agency, the benefit-cost ratio was 1.5. From the perspective of the project participants, Haitian peasants, the project had a benefit-cost ratio of 29.7. Of the various project components, hillside treatments had the greatest degree of economic efficiency with a benefit-cost ratio at 3.46 for donors and 52.0 for the peasants. These figures suggest that increased upland productivity alone may justify watershed management practices although there are also significant benefits downslope and downstream.

Policy Implications: Overcoming the Barriers to Watershed Management

If watershed management and conservation of uplands are to succeed, there should be a policy framework that supports them. Often, where land degradation occurs, such a framework is absent.

Failure of Policy to Deal with the Problems

It has been difficult to achieve successful watershed management through policy intervention. The reasons include:

- Watershed and political boundaries rarely coincide. Biological and physical processes, and social, political, and economic institutions and activities do not normally occur on the same scale nor within the same boundaries.

- Commonly, policies that affect watershed management and land use in uplands are ill defined, inadequate, or nonexistent (see box 6). When they do exist, many organizations often share watershed management responsibilities. Organizations include those with jurisdiction over forestry activities, agricultural extension, land management, water management and irrigation, rural development, transportation, and others. Yet no single agency has complete coordination responsibility or authority.

- Often, decisionmakers unintentionally enact policies that hinder watershed management. They do not understand, do not consider, or they give low priority to watershed management goals and benefits. For example, policymakers who set resettlement policies often operate a great distance from upland areas. Those decisionmakers have more influence than those concerned with upland conservation and watershed management. Typically, resettlement occurs with inadequate regard to whether the uplands can sustainably support the immigrants.

- Governments construct roads for a variety of reasons. These include national security and increasing the accessibility of mineral, petroleum, or forest resources. Easier access makes their exploitation economically viable. Frequently policymakers do not adequately consider the full consequences of opening fragile lands. In many countries, unplanned settlement and land degradation rapidly follow road construction.

- Decisionmakers often set policies to encourage land-use activity in upland areas because they want increased export production and foreign exchange. They do not consider whether that land use activity is sustainable over time or what negative side effects may result from it. For example, price subsidies on such crops as cassava may encourage farmers to plant it on fragile marginal lands prone to soil erosion and eventual degradation. Initial crop production does not compensate for the loss of productive potential. And, policymakers did not consider the siltation of downstream waterways when they formulated the policy.

- In many upland areas there are diverse stakeholders who may be from different ethnic groups and speak different languages. This makes communication difficult and misunderstandings common. Land use practices of different stakeholder groups may be so different that conflicts result. It becomes very hard to establish policies that will work in isolated upland communities and regions.

- Even when local communities have both the social cohesion and mechanisms necessary to manage their own resources responsibly, policies often do not help or even make possible such communal efforts and local control.

Box 6. Watershed Management Policy of Inadequate Scope: A Case Study From Indonesia (Schweithelm 1988)

The Citanduy II Project occurred in Java, Indonesia, between 1981 and 1986. It set as one of its major goals control of erosion in upland parts of the basin and decrease of sediment delivered to downstream waters. The project set specific policies about erosion control on privately-owned lands. But it did not address the problems of erosion on government teak and pine plantations and erosion coming from roads and settlement areas. Both of these problems were often severe. The total area covered by policy, and hence by the project, was only about one-third of the Citanduy Basin. Failure of policy to address forest plantation management and road construction activities and methods reduced the possibility that the project would significantly lessen adverse downstream impacts.

Overcoming Barriers to Watershed Management

Developing an appropriate policy framework to encourage effective watershed management will require governments to become directly involved in:

- making government officials at all levels, other agents of development, and the public aware of the importance of sustainable land use and the linkages on which watershed management attempts to build,

- identifying stakeholders in watershed use issues and their perceptions and attitudes with respect to those issues,

- clarifying agency jurisdiction over watershed management activities and improving coordination among various agencies,

- incorporating watershed management principles in development projects and other productive activities,

- facilitating the local management of upland resources by residents, where this is the most efficient and effective option,

- fairly distributing costs and benefits associated with upland resource use and the application of watershed management practices between upland and downstream land users, and

- assessing the impacts of watershed management policies and activities as they evolve.

The following sections deal with each of these topics.

Increasing Awareness and Concern

In recent years, awareness of the importance of watershed management has increased substantially among policymakers, government officials, nongovernmental organizations, farmers living in upland watersheds, and the general public. Many now acknowledge the importance of proper upland management to the sustained productivity and health of the entire ecosystem. Further education is desirable for the public, government officials, and development agents from nongovernmental and private voluntary organizations. This education must include both the biophysical realities and the social, cultural, and economic factors that affect land use in upland areas.

Identifying Stakeholders and Their Perceptions of the Issues

To design policies that will help achieve watershed management goals, it is essential to: (1) identify the stakeholders in a particular issue and (2) understand their perceptions and motivations about that issue.

Policymakers need to identify stakeholder groups based on shared goals and common types of resource use, perceptions, and views. Resource users in upland watersheds may include a diverse group of:

- upland farmers,
- loggers,
- small-scale forest users,
- pastoralists,
- cattle ranchers,
- hydropower agencies or companies,
- downstream farmers who depend on the uplands for their source of irrigation water, and
- downstream residents who depend on the uplands as their source of water for household consumption.

Although we often classify stakeholders into these groups, any one group may represent a wide diversity of views and interests. For example, upland farmers may include traditional shifting cultivators, land poor or landless lowlanders who are recent immigrants to the uplands, and wealthy absentee landlords. Each group is likely to have different perceptions about upland land use and

different motives influence their behavior. Each likely wants different outcomes when resolving issues. Policymakers need to treat each as a separate stakeholder group. Accurately identifying these groups is critical to understanding issues and designing policies to address them.

Rugged topography means that upland watersheds usually have greater diversity than lowlands. This includes greater variety of land uses, resources, and ethnic groups. To add to the complexity, land use in upland watersheds affects most if not all downstream residents in many ways. Therefore, proper identification of stakeholder groups and their perceptions and interests are even more critical to successful resolution of upland land use issues (see box 7).

Box 7. The Importance of Identifying All Relevant Stakeholders: A Case Study From Thailand (Quinn 1985).

A USAID-sponsored project, from 1981 through 1984, to improve the living conditions of squatter families, included the Lamtakhong Land Settlement in Khorat, in northeast Thailand. Because soil erosion and declining productivity was a severe problem, a pilot project constructed broad-based terraces on moderately sloping land. The Department of Land Development, the Royal Thai Government (RTG) agency charged with promoting soil conservation, heavily promoted this erosion control measure.

Farmers easily saw that the terraces reduced erosion. However, problems arose in cultivating their land. With the terraces in place, they could not use their typical cultivation methods. They usually made long passes the length of the field, most often parallel to the vertical slope. They now had to plow along the contour which, though better from the perspective of soil conservation, was more time consuming. Since moneylenders provided cultivation as part of their input packages, farmers could not make the decision of how to plow. Some moneylenders requested a higher rate for plowing along the contour. Others complained and implied that they might raise prices in the future. The participating farmers could not afford higher fees because of the exorbitant interest rates. They also could not afford to anger the moneylenders on whom they depended. As a result, several farmers plowed up their contour terraces by the second cropping season and returned to previous practices. Later they said they regretted their decision and professed to be fully aware of the negative effects of plowing and planting up and down slopes.

This case raises doubts about the appropriateness of an essential aspect of the Thai soil conservation policy. Decisionmakers presumably acted without either identifying an important stakeholder group, moneylenders, or recognizing their power to affect the success of the policy. Had they recognized the role of moneylenders, they might have considered the moneylenders' interests and designed policy not to conflict with those interests. Or, they could have developed alternative sources of credit.

The following points are important to consider in identifying stakeholders and their concerns.

- Often, upland and lowland residents do not understand each other's perspectives. They are not fully aware of the impacts their activities have on each other and their obligations to each other. Upland residents are often unaware of negative effects their land use activities may have downstream. Or if aware, they may view them as unavoidable results of necessary activities and not really their responsibility. On the other hand, downstream residents, including representatives of government agencies, know about those negative impacts. But they do not always correctly identify their root causes. Furthermore, downstream residents find it hard to understand that upland residents may be justifiably entitled to payment for using practices that reduce negative downstream effects but are costly to upland residents. Such costs include increased labor and use of resources and possibly a short-term decrease in production. In fact, there may be a different understanding of land tenure between the two. Lowland residents may believe that upland residents have no right to use those lands at all. We refer, particularly, to people living on land classified as forest or watershed reserve.

- Uplands, with their rugged topography and relative isolation, may be home to groups who are culturally and linguistically distinct from the dominant groups of society. Upland residents are often geographically, socially, and politically on the fringes of society. Therefore, central governments may look upon upland residents with indifference, uncertainty, or even suspicion. A common tendency is for central governments to blame indigenous upland residents for negative downstream impacts. Governments rarely single out recent migrants from the lowlands who often use the most environmentally damaging practices. In turn, upland residents may also distrust government representatives or lowlanders in general.

- Agencies concerned with land use in upland areas, whether government or nongovernment, typically have different missions and can even find themselves opposing each other. So, each may act more as a stakeholder than as an impartial arbiter, and should be considered as such.

Clarifying Agency Jurisdiction and Promoting Effective Interagency Cooperation

Few countries have a single agency charged with the holistic management of natural resources on a watershed scale. In most countries, several different agencies have jurisdiction over uplands and particular activities in upland areas (see box 8). Coordination among these various agencies is often inadequate. Sometimes they may even enact conflicting or contradictory policy. Also, some areas or land types commonly have no agency that is responsible for enacting or implementing land use policy.

Effective interagency coordination and cooperation result from:

- agencies having similar, or at least compatible, missions,
- institutional mechanisms that help cooperation and coordination, and
- incentives for agency personnel that encourage loyalty to management goals rather than to their home agency.

Box 8. Responsibility for Upland Conservation and Watershed Management: A Case Study From Northeast Thailand (Srivardhana 1983)

The main component of the Nam Pong water resources development project was the Ubolratana Dam, constructed in northeast Thailand in 1966. The creation of the reservoir displaced approximately 4,000 families. By 1980, population in the shoreline area alone had increased to nearly 80,000. The cropping and livestock-rearing activities of these settlers increased erosion and sedimentation of the reservoir, threatening to reduce its effective lifespan. Resultant pollutants have reduced water quality, adversely affecting fisheries and water used for consumption.

Obviously, Thailand needed a shoreline management program. But it was unclear which, if any, of the various government agencies involved in the project had responsibility for the reservoir shoreline area. The Electricity Generating Authority of Thailand was responsible for operating the reservoir. But it did not have authority for the land immediately above the reservoir. The Royal Forest Department might have had responsibility for the land. But it was not active in the immediate area and had little incentive to become involved. The Department of Public Welfare was responsible for resettling those displaced by the dam and reservoir construction. However, it had authority only over certain resettlement areas. Those did not include the shoreline area. So, no agency addressed the problems of overpopulation and improper land use in the shoreline area. The government needed a policy that clearly set authority over, and responsibility for, the shoreline area.

Bureaucratic institutions are naturally conservative and resistant to change in structure or authority. However, policymakers can make practical changes to help achieve watershed management goals by addressing the way in which agencies act and interact at the local level. Institutional mechanisms to encourage cooperation among local agencies will probably be more effective than those at higher levels. If they have the authority, local interagency coordinating bodies can help achieve such cooperation.

However, to achieve interagency coordination, particularly through formal mechanisms (such as interagency coordinating bodies), agencies will probably have to give up some authority and/or accept new responsibilities. Agencies must have missions compatible with each other and the interagency coordinating body. If compatibility is a problem, it may be necessary to change the mission of some or all of the agencies. This is difficult but possible by retraining current agency personnel, hiring personnel with different backgrounds, and by adjusting incentives for agency personnel. In addition, all agency personnel must feel secure and see that working with other agencies is cooperation, not competition.

Incentives for agency personnel are critical to the success of interagency efforts, yet are often taken for granted. Officials working on interagency efforts may receive fewer effective rewards and less recognition for their efforts than those working within the normal agency framework. Their superiors

on interagency programs may not be those who decide about their future security and advancement. Supervisors may view the time spent on interagency efforts as not benefitting their own careers. This means that their loyalty remains more with their agency than with the interagency effort. For interagency coordination to succeed, supervisors need extra incentives to make up for what they are losing by not working within the normal institutional framework.

Facilitating Local Management of Upland Resources

Government or other agencies are not responsible or permitted to manage privately-owned land, water, and other resources. Rather, their goal is to aid, encourage, and promote wise use of those resources. Throughout the world, many watersheds of concern, are partially or entirely privately owned. Even many public lands, particularly in developing countries, actually are under private control and management. The issue is not so much how government agencies can effectively manage these resources but how the local watershed residents can do so. For policymakers the question is: How can policy, program, and project intervention help local watershed residents manage soil and water resources efficiently and sustainably?

Individual action alone can rarely achieve the goals of watershed management and upland conservation. On the highly-fragmented land holdings common in developing countries, isolated individual conservation efforts are ineffective. All or most landholders must practice conservation to affect the entire watershed or even to prevent erosion on their own lands. Therefore, a key role for government or other agencies is to strengthen local institutions that can manage resources (see box 9). They can do this by:

- identifying existing cooperative institutions for resource management and seeking to support them. Institutions can range from structured groups to informal agreements among residents. If no institutions exist, other local cooperative institutions, such as labor exchange groups, may serve as starting points.

- defining land tenure and resource use rights compatible with local tenure systems or acceptable to local residents,

- providing credit as needed to carry out watershed management practices, and

- providing training and advice in technical matters such as soil conservation, upland production systems, and marketing.

Local institutions give local residents a sense of ownership and a greater interest in and sense of responsibility for resource management. Such institutions can respond to specific conditions found in the local area. This is more difficult for top-down management institutions. And, if allowed adequate authority, the local institutions can respond more quickly and positively to changes in local conditions.

Box 9. Cooperative Watershed Management Among Local Residents: A Case Study From Haiti (White and Runge 1994)

Individual upland conservation measures were not enough to control overland flow and resulting soil erosion in the Maissade Integrated Watershed Management Project (see box 6). Therefore, the project promoted new collective effort by watershed residents. These were social organizations of people who owned or worked land within small degraded watersheds. These groups shared interest in controlling surface runoff and erosion and increasing agricultural yields. Therefore, project officers expected that they would cooperate in constructing and maintaining checkdams and surface erosion control measures such as contour hedgerows and trash barriers.

Meetings, which were mostly self-organized and directed, included all peasants who held or worked lands within a given watershed. Without external incentives, they volunteered their labor to group efforts to construct checkdams. Fifty-four percent of all landholders participated. Within two years they treated all major gullies within 10 watersheds, including some gullies within an additional seven watersheds. In later years, active groups continued to maintain the checkdams they had constructed. Checkdams, besides preventing further expansion of the gullies, collected an average of 3.2 cubic meters of sediment with far higher soil moisture levels than the surrounding slopes. This allowed peasants to produce more valuable crops with higher yields (White and Jickling 1992).

Particularly noteworthy in this project are the degree of participation, the construction of soil conservation measures without external incentives, and the willingness of watershed residents to maintain the structures in later years. It seems unlikely that they could have achieved this sort of success without a local institution to coordinate activity and to establish strong incentive.

Equitably Distributing Costs and Benefits

Even far downstream, residents can feel the impacts of land use activities in upland areas. These negative impacts occur from the failure to account for and fairly distribute costs and benefits from land use activities. Negative impacts from poor land use include increased siltation of waterways and reservoirs, decline in water quality, and more small scale floods. Small-scale land users, commercial interests, and even government agencies are all responsible for such negative impacts.

Their own poor land-use practices may negatively affect upland residents. One such effect is the decline in crop yields. However, the initial investment for conservation practices may be too large or the benefits of carrying them out may be too late or too small to justify them. Although downstream residents often benefit from upstream watershed management practices, they do not usually help establish or maintain these conservation measures.

Cooperative watershed management efforts among local residents can do much to hold individuals accountable for any negative impact on other local watershed residents. Cooperative efforts can apply social pressures or legal sanctions to bring about more results than possible through individual action. However, such local cooperative institutions cannot account for impacts further downstream. Downstream communities who benefit from their watershed management do not pay upstream families for their efforts. But downstream communities also cannot hold upland residents accountable for the negative results of improper land-use practices.

However, developing agreements or social institutions by which downstream residents compensate upland residents for implementing conservation practices can improve this situation. Downstream residents benefit directly from these actions. By bearing a fair portion of the costs, they make it economically possible for upland residents to maintain upland areas in an environmentally-sound condition. It is, in effect, payment for environmental services. Japan has used several innovative means to accomplish this (see box 10).

Large commercial interests active in upland areas, such as large cattle ranches, timber operations, and mining activities, pose a different sort of problem. Although they may have the resources to carry out watershed management practices, they may not have the social or economic incentives.

Length and terms of tenure, as well as market and economic factors, may give commercial interests little incentive to carry out their activities in ways consistent with watershed management goals. Nor will they want to use watershed management practices as part of their activities or employ best management practices. Tenure and economic factors may give businesses strong incentives to act in ways opposed to watershed management goals, using detrimental practices both upland and downstream. For example, short-term logging concessions give the concessionaire little incentive to assure sustainable future yields from the site or to maintain the area's ecological health. Flat charges for logging rights, rather than charges based on the amount extracted, may encourage the concessionaire to over cut rather than use good forest management.

Policy can encourage commercial interests to employ appropriate practices and avoid harmful ones. First, the policy should establish the terms of concessions or other forms of tenure that will give commercial interests incentive to employ sustainable practices. Policy can also offer direct financial incentives, such as tax credits, to encourage businesses to use good practices. Alternatively, by using the polluter pays principle, the government can hold those causing negative impacts responsible for their actions (see box 11).

In their management of government lands located in upland areas and the activities conducted on them, government agencies, too, may cause negative effects for which they are not held responsible. This is especially likely when several agencies, each with a narrow mission, have only a portion of the fragmented authority over land and land-use activities. Usually there is little coordination among them. Even without effective interagency coordination, agencies can reduce negative impacts by developing and using best management practice guidelines. Such guidelines must consider more than an agency's mission and take a more holistic view of resource management and society's needs. Each agency must have sufficient incentive to employ best management practices.

Box 10. Equitably Distributing the Costs of Employing Environmentally-sound Practices: Downstream Residents Pay Upland Farmers to Implement Conservation Practices in Japan (Kumazaki 1982)

Several regions in Japan have developed innovative schemes to share the cost of upland management. Downstream water users have a long history of improving forest land in headwater areas. They have used the following approaches:

- Profit-sharing watershed plantations promoted by district governments. Following disastrous floods in the 1930s, the government established a forest plantation on watershed headlands in Niigata Prefecture (District). Fourteen towns and villages located downstream paid for about a third of the costs. The government distributed the profits from the plantation: landowners - 40%, donor towns and villages - 30%, Niigata Prefecture - 27%; and local forest protection associations - 3%.

- Profit-sharing watershed plantations promoted by public corporations. In 1966, Shiga Prefecture and other downstream municipalities established the Shiga Reforestation Corporation. The group included Osaka because much of its water came from surface flow originating in Shiga Prefecture. The goal was to convert low quality second growth hardwoods to conifer plantations. A loan from the federal government covered most of the expenses. Shiga Prefecture was responsible for 40% of the remaining costs and downstream water users 60%. Of the timber harvesting revenues, the corporation received 60%, and the landowners 40%. They repaid the loan from this income.

- Incentive programs for improving forested watersheds. Such programs have become necessary to make up for declines in domestic timber prices and increases in forestry wage rates. These costs have made it difficult for upland landowners to maintain good timber stands based on timber production alone.

In Hyogo Prefecture, starting in 1975, about 30 manufacturing companies, located downstream and dependent on water from the Prefecture, pay an amount toward the cost of forestry operations upstream. Payment depends on the quantity of water they use.

In Fukuoka Prefecture, starting in 1979, major cities, other smaller municipalities, and private companies located downstream, established a fund to support forestry operations in critical watersheds. Forest owners pledged to care for their woodlots according to minimum standards set by the funders.

Box 11. The Polluter Pays Principle

The basis of the polluter pays principle is that those who cause environmental damage, whether intentionally or accidently, have to pay for their actions. The difficulty in implementing such policy lies in actually determining the economic value of that damage. Many valuable products derived from a given environment, such as aesthetic or recreational value and the value of cleaner drinking water, are not tradeable commodities. The open market does not set their value and therefore it is difficult to quantify.

Presently, in the United States, in most cases of environmental damage, if the polluter is held responsible at all, it is done through litigation in the courts, an expensive and time-consuming process. Lawsuits determine responsibility, an expensive and time-consuming task. The U.S. Department of the Interior is developing a computer model, the National Resources Damage Assessment model, to assess the extent of damage caused by environmental accidents. It will assess damage based on a model of the biophysical processes by which the damage occurs and the value of lost or damaged environmental goods and services. The model is based on large-scale polls of ordinary citizens (Meyers 1995). Whether the department will actually use the model will depend on political factors. But a well-developed model of this type would allow all parties to know in advance the value and cost of environmental damage. The government will be able to collect payment for environmental damages that are too small to be processed economically through the courts. It would, in effect, hold the polluter responsible for the true cost of activities that damage the environment.

Assessing Policy Impacts to Encourage More Effective Watershed Management

To make policy to encourage effective watershed management, and to make it responsive to changing conditions, requires a feedback mechanism. This must do two things.

- It must determine whether productive activities, and the soil and water resource base on which such activities depend, can be sustained under current policy.
- It must also use the lessons from that assessment.

Too often policymakers develop monitoring and evaluation programs without a clear sense of what questions they want answered. They also need to plan how they will use the information to design future policy.

The overall goal of a monitoring and evaluation program is to design and use policy that more effectively helps achieve watershed management goals. Policymakers need to address questions that

will bring them closer to achieving that aim. They need to consider both the biophysical and the socioeconomic dimensions. They may ask:

- How effective are given technologies?
- How effective are particular means of promoting or implementing them?
- What effects will result from particular activities?
- What is the economic viability or desirability of a given strategy?

The data collected should answer those questions. It may seem simpler to decide what data to collect without considering such questions. However, that will not yield useful information.

We need to remember that collecting and processing data is not free. Human and other resources may be quite costly. We should not undertake such a project unless we clearly identify the desired product, and it will be useful. We need to consider the ease of collection. Integrative or proxy variables, which combine the information of several more pertinent variables, can be cheaper and simpler to use. For example, the population of a given fish species or aquatic invertebrate may serve as a good indicator of overall water quality.

The second thing to consider is how to use the information collected, and lessons learned from it, to improve future efforts. Most importantly, the data must be in a usable form. Vast amounts of unprocessed or partly-processed data sit in filing cabinets, on shelves, or on computer disks. Much of this data fails to appear in a form that decisionmakers find useful. We need communication between those assessing current efforts and those charged with planning future monitoring and evaluation programs.

Such information must be available when needed though that can be difficult. There are often inadequate funds to conduct monitoring and evaluation. Also, the impacts of a given activity may only become apparent long after project or program intervention has ended, and monitoring has ceased. Designers of a monitoring and evaluation program need to consider the time frame of biophysical and socioeconomic processes as well as that of policy and program planning. Ideally, though probably not realistically, they should reconcile the time frame of the latter with the former.

Designers also need to consider the effective shortness of institutional memory. Personnel changes, as well as other factors, contribute to this. Even well-done, useful evaluations may sit on shelves unread and unused, while administrators design and use related policies and programs.

Conclusions and Recommendations

Awareness of the importance of watershed management has increased in recent years. Yet, we are far from achieving the goals of watershed management. Many policy interventions have failed, partially, or completely, because:

- Various policies affecting watershed management have been contradictory.
- Responsibility for policy accomplishment has been ill-defined.
- The issues themselves are complex, and decisionmakers have developed policy without adequately understanding the depth and complexity of factors involved.
- Attempts to enable and encourage local people to assume responsibility for managing their own resources have been inadequate.
- Decisionmakers have not developed practical mechanisms to resolve the unequal distribution of costs and benefits connected with upland land use.
- Inadequate monitoring and evaluation have limited policymakers' ability to learn from both successes and failures.

Recommendations for policy intervention, of course, depend on the specific conditions of each situation. However, we can make the following generalizations.

- Policymakers must do a better job of identifying the stakeholders in each watershed management issue. They must understand their perspectives and attitudes and use that knowledge to formulate policies and programs.
- They must better define and coordinate the roles of various government and nongovernment agencies involved in setting up watershed management policy.
- To have broad impact, they must incorporate watershed management principles into policy for other activities, from forestry to flood plain residence zoning. These principles are not only for specific watershed management projects.
- Government and nongovernment agencies should search for ways to enable and encourage local watershed residents to manage their own resources responsibly and sustainably. Local cooperative institutions may be a good place to start.
- Innovative mechanisms to distribute correctly the costs and benefits resulting from upland resource use are essential. Governments need a means of holding those causing negative downstream effects responsible. It is also important to develop mechanisms that can adequately compensate

those implementing watershed management practices based on the benefits they give to downstream residents.

- Monitoring and evaluation are essential to properly test watershed management policy and to be aware of changing conditions. To develop better watershed management policy, monitoring and evaluation must supply useful information. Policymakers must use that information in formulating and implementing future policy.

Notes

1. Not all deforestation leads to land degradation. In some instances, removing forest cover to permit agricultural crops, cattle grazing, or other productive activities can be an acceptable form of land use (Gregersen, Belcher, and Spears 1994).

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