

Global Perspective of Watershed Management

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Abstract.—This paper discusses the role of watershed management in moving towards sustainable natural resource and agricultural development. Examples from 30 field projects and six training projects involving over 25 countries are presented to illustrate watershed management initiatives that have been implemented over the last half of the 20th century. The level of success has varied from project to project. Means of achieving greater success are discussed, including the need for institutionalizing watershed management, that take into account the workings of people, governmental agencies and organizations, and their use of resources at local and national levels.

Introduction

Watersheds have been viewed as useful systems for planning and implementing natural resource and agricultural development for many centuries. Recognition of the importance of watersheds can be traced back to some of the earliest civilizations; ancient Chinese proverbs state that “Whoever rules the mountain also rules the river,” and “Green mountains yield clean and steady water.” The Polynesians who settled Hawaii organized their economic and political systems on the basis of watersheds, realizing that their livelihood depended on the sound management of land and water together, from the ridge tops to the lowlands and the productive coral reefs that received runoff from the land (Morgan 1986).

Expanding human populations and their increasing demands for natural resources have led to exploitation and degradation of land and water resources. Revenga et al. (1998), in an assessment of 145 watersheds globally, emphasized that expanding human demands for resources have intensified watershed degradation, with the result that some of the watersheds with the greatest biological production are becoming the most seriously degraded. Development projects and programs by all types of organizations (national governments, multinational and bilateral agencies, nongovernmental organizations (NGOs),

etc.) have proliferated in response to these problems. Previous reviews of watershed projects throughout the world, indicate that inadequate diffusion of technology and an absence of continuity of project benefits have hindered many countries from achieving sustainable development (Brooks et al. 1992). If watershed management is deemed an essential underpinning of sustainable natural resource and agricultural development, then what needs to be accomplished so that we can move from short-term projects to sustainable programs? To address this question, we will highlight selected countries and projects, examining the successes and failures, and look ahead at the key issues in the coming century.

The Issues

Current and expanding scarcities of land and water resources, and the human response to these scarcities, threaten sustainable development and represent paramount environmental issues for the 21st century (Rosegrant 1997; Scherr and Yadav 1996; Rosegrant and Meinzen-Dick 1996). An added concern is developing means of coping with the extremes and uncertainty of weather patterns, such as the 1997-1998 El Nino effect that resulted in severe droughts in some parts of the world and record flooding elsewhere. We suggest that watershed management provides both a framework and a pragmatic approach for applying technologies to cope with these issues, which are discussed below.

Water scarcity has been widely called the *top global issue* of concern in the coming century in developed and developing countries alike (Kundzewicz 1997; Meinzen-Dick and Rosegrant 1997; Rosegrant 1997; Rosegrant and Meinzen-Dick 1996). By 2025, it is estimated that between 46 and 52 countries, with an aggregate population of about 3 billion people, will suffer from water scarcity. Coping with water scarcity is compounded by soil degradation, groundwater depletion, water pollution, and the high costs of developing new water supplies or transferring water from water rich to water poor areas (Rosegrant 1997). Through watershed management we can recognize

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both the opportunities and limitations of water yield enhancement through vegetative and structural measures.

Floods, landslides and torrents result in billions of dollars being spent each year globally for flood prevention, flood forecasting, and hillslope stabilization. Yet the cost of lives and property damage due to floods, landslides and debris flows are staggering. The impacts of these naturally occurring phenomena are exacerbated by human encroachment on flood plains and other hazardous areas, which is often the result of land scarcity discussed below. In many parts of the world there has been an over reliance on structural solutions (dams, levees, channel structures, etc.) in river basins, along flood plains, and in areas susceptible to debris torrents, all of which impart a false sense of security to those living in hazardous areas. In addition, the replacement of natural wetlands, riparian systems, and flood plains with urban and agricultural systems can cumulatively add to downstream problems, a point emphasized in post flood assessments of the 1993 Mississippi River flood by Leopold (1994). A watershed perspective brings these cumulative effects and linkages into focus, but the ability to develop solutions requires that we have the appropriate policy and institutional support.

Point and nonpoint water pollution continue to plague many parts of the world, threatening the health of humans, compounding water scarcity issues noted above, and adversely impacting aquatic ecosystems, with subsequent implications for fish and wildlife. Best Management Practices (BMPs) and related technologies of watershed management have the advantage of stopping non point pollution at its source.

Scarcity of land and natural resources results from a shrinking arable land base due to expanding populations of humans and livestock. Land degradation resulting from cultivation, grazing, and deforestation of marginally productive lands compounds the effects of land scarcity. These are often steep areas with shallow soils that experience accelerated surface and gully erosion, soil mass movement, and increased sediment and storm flow damage to downstream communities. In the tropics, it is estimated that about 0.5 ha of farmland is needed to feed one person (Pimental et al. 1995). Lal (1997) indicates that by the year 2025, 45 countries in the tropics will have less than 0.1 ha of arable land per capita. Globally, of the 8.7 billion ha of agricultural land, forest, woodland and rangelands, over 22% has been degraded since mid-century, with 3.5% being severely degraded (Scherr and Yadav 1996). Deforestation continues to gain worldwide attention with most of the concern expressed in terms of lost biodiversity; of equal importance are the implications of deforestation on watershed functions.

Watershed management efforts have been directed towards one or more of these issues in countries around the world, as illustrated with the following examples.

Watershed Management Projects: Some Examples

Projects aimed at soil and water conservation and watershed rehabilitation date back to the colonial period, particularly in the former British colonies. After independence, large-scale afforestation, hydropower, and other water resource projects were enthusiastically promoted by government leaders in an effort to demonstrate rapid progress toward development. In the 1960s — 1980s, watershed management in many developing countries focused on restoring land and water systems that had become degraded and protecting earlier water resource development investments. Much work was accomplished under the umbrella of soil and water conservation without the spatial and temporal view of watershed management. Unfortunately, such projects tended to be narrowly focused and sometimes were considered to be quick fix solutions, but in fact, they often dealt with the symptoms (e.g., soil erosion) and not the causes (human demands for food, fuel wood, etc.) of the problem. In recent years, interdisciplinary and participatory methods have been promoted in watershed management as a more sustainable approach to overcome these problems.

After a half century of implementation, what can we learn from past experience? Has there been any transition from technically oriented, operational projects (e.g., erosion control) to sustainable watershed management? To what degree are communities involved in identifying problems and proposing solutions? What can be learned from our past successes and failures?

Projects on Watersheds

Thirty operational watershed management projects in 20 countries were reviewed, spanning the period from 1967 to 1999 (table 1). Although some of these involved training, six international training projects were reviewed separately (table 2). In selecting projects, we included those described in terms such as *integrated rural development*, *soil and water conservation*, and *upland conservation*, because they often have a major focus on watershed management. Any such review must be aware of the changing terminology that is prevalent in the interna-

Table 1. List of projects reviewed.

Number	Project Title	Countries Involved	Reference
1	Interregional Project for Participatory Upland Conservation and Development	Bolivia, Nepal, Tunisia	Urquizo 1999; fe D'Ostiani 1999
2	Watershed program in Andhra Pradesh	India	Turton et al 1998
3	Watershed program in Orissa	India	Turton et al 1998
4	Watershed program in Madhya Pradesh	India	Turton et al 1998
5	Integrated Rural Environmental Program	Java Indonesia	McCauley in Easter et al 1991
6	Peum Perhutani Project	Java Indonesia	McCauley in Easter et al 1991
7	Watershed Management Through People's Participation and Income Generation	Java Indonesia	McCauley in Easter et al 1991
8	Yallah's Valley Land Authority Programme	Jamaica	Edwards 1995
9	Farm Development Scheme	Jamaica	Edwards 1995
10	Integrated Rural Development Project	Jamaica	Edwards 1995
11	Hillside Agricultural Programme	Jamaica	Edwards 1995
12	Agroforestry Development in NE Jamaica	Jamaica	Eckman 1997
13	Agricultural Production and Support Systems for Achieving Food Security	Grenada	Eckman 1998
14	Maissade Integrated Watershed Management Project	Haiti	White and Quinn 1992; White July 1992; White October 1992; White November 1994
15	Pilot Project in Watershed Management on the Nahal Shikma	Israel	UNDP/FAO 1967
16	Mae Se Integrated Watershed and Forest Use Project	Thailand	FAO/UNDP 1982
17	Salto Grande Hydroelectric Project	Argentina and Uruguay	IADB ¹ (unpublished)
18	Abary Water Control Project	Guyana	IADB (unpublished)
19	Cauca River Regulation Project	Colombia	IADB (unpublished)
20	La Fortuna Hydroelectric Project	Panama	IADB (unpublished)
21	Pueblo-Viejo-Quixal Hydroelectric Project	Guatemala	IADB (unpublished)
22	Tavera-Bao-Lopez Multipurpose Hydro Project	Dominican Republic	IADB (unpublished)
23	Kandi Watershed and Area Development Project	Punjab India	Gupta 1988
24	Integrated Watershed Development Project	Himachal Pradesh India	Development Alternatives 1989
25	Loess Plateau Watershed Rehabilitation Project	China	World Bank 1994
26	Integrated Rural Development Through Communes	Rwanda	Eckman 1987
27	Women's Development in Sustainable Watershed Management	Myanmar	van Leeuwen 1995
28	Sustainable Agriculture Development and Environmental Rehabilitation in the Dry Zone	Myanmar	Eckman 1995
29	Watershed Management for Three Critical Areas	Myanmar	UNDP 1994
30	Konto River Watershed Project Phase III	Indonesia	de Graaff 1987; DVH Consultants 1990

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tional development arena. The projects range from those that are relatively small, with low budgets implemented by nongovernmental organizations (NGOs), to those with a large regional focus implemented by international agencies with budgets in excess of US \$250 million.

A comprehensive and detailed case study analysis of all of these projects is beyond the scope of this study. Our approach was more of a synthesis of various projects and project components to help understand key factors that contribute to success and those that present barriers in the transition towards sustainable use of land, water and other natural resources. In reviewing project documents, we attempted to identify factors that contribute to positive and sustainable impacts. We also looked for elements that seem to foster undesirable and unsustainable project outcomes. Published literature, unpublished official agency reports, reports from evaluation missions and consultant visits, baseline survey reports, feasibility studies, and

other fugitive materials were reviewed. We should note that for some of these projects we had access to limited, unpublished reports from various agencies; complete documentation of many such projects reside in agency files and were not available for scrutiny.

Training in Watershed Management

Six international watershed management training projects (table 2) that have been undertaken in the past few decades were examined, representing a small sample of projects that were specifically targeted for training and education. Some of the projects listed in table 1 also contained training components, but their focus was more field implementation.

To paraphrase an old saying, “give a man a fish and he eats for a day, teach him to fish and he eats forever,”

Table 2. Examples of international training and educational programs in watershed management.

Project title and sponsor	Country	Training components and outcomes	Duration and reference
ASEAN Watershed Project / US Agency for International Development	Regional: Indonesia, Malaysia, Philippines, Singapore, Thailand, Brunei	Symposia, seminars, workshops, short courses, study tours, manuals, networking (465 participants)	1983-1990 (Cortes and Saplaco, 1984)
FAO/Finland Training Course in Forestry and Watershed Management	Regional: Asia-Pacific Region (Nepal), and Southern Africa Region (Lesotho)	Training courses with field trips:43 participants from 18 countries	1985-1986 (Food and Agricultural Organization 1985, 1986)
Eastern Anatolia Watershed Rehabilitation Project (World Bank)	Turkey	Extension training; short term study tours and long term (3 month) training	1993-1998 (Ministry of Forestry, 1997)
Water and Soil Conservation and Environmental Protection; Upper and Middle Reaches of the Changjiang River Basin (Asian Development Bank)	People's Republic of China	Seminars for 67 provincial and county leaders; training course for 32 middle managers/technicians Training manuals in English and Chinese	1995-1996 (Brooks et al. 1995)
Resource Development of Watershed Lands; (OICD - USDA and University of Arizona)	Global (participants from 27 countries)	Six-week training courses with field trips; over 350 mid-level managers trained	1978-1991 (personal commun., P.F. Ffolliott, 1999)
Watershed Resources Management and Environmental Monitoring in Humid Tropical Ecosystems (UNESCO - MAB)	Regional Training held in Honduras, Panama, the Philippines, and Thailand	Five 2-week training courses; 115 mid-level managers trained	1979-1982 (personal commun., P.F. Ffolliott, 1999)

underlies the importance of training and educational programs. Although it is sometimes difficult to evaluate the success of training, or any educational program, making people aware of the importance of watershed management and its role in meeting production and environmental goals, cannot be minimized. In many instances, regional training programs have brought people together with common problems and have facilitated networks that last long after the formal training ends. As many of the participants of workshops, seminars and training courses move into positions of upper management, policy makers and political leaders, their ability to implement watershed management becomes enhanced. Such outcomes of training programs may far outweigh the benefits of learning a particular technology at some point in time.

Lessons Learned

The outcomes of projects ranged from those with significant benefits, to failures that had unwanted environmental and socioeconomic consequences. Examination of the 30 watershed projects suggests that while there have been some notable successes, there is considerable need for changes in planning and implementation strategies to foster more sustainable outcomes. Because few of the projects had documented ex post evaluations, we could not provide a comprehensive analysis of individual projects, and therefore, have summarized our observations in an overview context.

Planning Aspects

The reviewed watershed projects were largely planned in a top-down manner with specific, technically oriented objectives, such as erosion control, reforestation, and so forth. Most projects are planned by outside experts on short-term contracts who have limited responsibility for implementation, or accountability for long-term outcomes and consequences.

The importance of participatory planning methods was emphasized by many, but D'Ostiani (1999) notes that participatory methods are not ends in themselves, and, if used alone, are insufficient. The importance of local involvement and input in the planning process is stressed to help ensure that the most basic cultural and socioeconomic dimensions, such as land use, are fully considered. Projects that are more technically oriented tend to focus more on outputs, whereas projects planned with participatory methods tend to focus on outcomes. A case can be made that *neither* technical nor participatory approaches are sufficient in watershed management. Close collabora-

tion with local resource users tends to promote more sustainable outcomes, both environmentally and socio-economically.

Only five of the projects reviewed (table 1) attempted to study socioeconomic factors, such as land use, farming systems or land tenure, prior to project implementation. In most other cases, socioeconomic studies were conducted after project planning was already completed, often years after the project was operational, and then only when problems surfaced. Three projects were planned in consultation with local communities in which the project was sited. Several larger-scale projects called upon non-governmental organizations (NGOs) once project implementation was well underway, either to diagnose socioeconomic problems associated with the project or to assist with project management.

Management and Administrative Aspects

Project management and planning are interrelated with other factors that affect project success. For example, the smaller projects in our modest survey seemed to experience better coordination, integration, communication, and local participation than the larger, more complex projects. Smaller, more focused projects seemed to be more successful in achieving project objectives. Projects with less complex institutional and administrative structures had more flexibility and seemed to have greater success in monitoring benefits attributed to project measures. Several larger projects lacked a mechanism for equitable sharing of project benefits, and some did not monitor such benefits.

Subsidies, cash-for-work, and other payments were components of many of the projects. As incentives, such measures are intended to facilitate direct project benefits. In reality, however, whether they contribute to voluntary, long-term local participation is questionable. For example, maintenance of soil conservation structures, or planting of trees in degraded areas often cease when subsidies or cash payments end. Clearly projects should carefully consider using appropriate incentives that will motivate local people to carry out and sustain those practices needed to achieve watershed management objectives.

As mentioned earlier, few of the projects reported ex post evaluations. One explanation, we hypothesize, is an absence of comprehensive monitoring of costs and benefits throughout and beyond the project life. Monitoring is an essential management tool that allows managers to track projects and make needed adjustments to achieve objectives, and furthermore, allows donor agencies to determine project success. Too often, monitoring is underutilized and underappreciated (Eckman 1994). One-third of the projects routinely monitored for technical environmental data; four projects also monitored socio-

economic aspects, and one project successfully employed participatory monitoring techniques. As a result, formal and informal evaluations of projects were not complete, nor as comprehensive as they should be to determine success or failure of project components. Participatory monitoring and evaluation techniques, with direct involvement of local resource users and other watershed residents, would have facilitated more effective project management.

Scale and Topography

Scale and topography appear to be interrelated in influencing project success. As discussed earlier, less ambitious projects in smaller watersheds seem to be more successful in achieving project objectives than larger more complex projects. Positive impacts of such projects are often reported in terms of improved farm incomes, improved fisheries, etc. rather than an emphasis on such components as number of gully plugs constructed, miles of roads improved, etc. While this is a tentative finding, we noted that the very large and administratively complex projects, encompassing numerous watersheds, were also reporting more complex outputs that were more difficult to translate into impacts at the local level. We also observed that projects that focused on mountainous uplands and island systems had some unique characteristics.

The hydrologic response of montane watersheds to land use can be direct and severe to both upland and downstream inhabitants. On one hand, such areas are prone to extreme events associated with excessive rainfall resulting in landslides and debris flows, but on the other hand, land and water scarcity are also prevalent as well (Brooks 1998). The capacity of these often fragile lands to support growing populations is limited. Yet, upland areas are commonly seen as the last remaining living areas for rural poor, resulting in the upland migration of growing populations of humans and livestock. The resulting differences in socioeconomic well being between upland and lowland inhabitants becomes an issue that must be dealt with in watershed management projects.

Projects in the mountainous areas of Nepal, India and Myanmar suggest that watershed management projects require special considerations and planning must incorporate practical interdisciplinary approaches. In many tropical areas that are both island and montane, extreme meteorological events associated with monsoons exacerbates watershed problems. Under these conditions, the potential cumulative effects are severe, with local communities experiencing more direct and immediate consequences.

Montane and small island ecosystems with densely inhabited watersheds pose acute challenges to watershed

management. The close proximity of uplands to productive lowlands and estuaries highlight upstream-downstream linkages. Island case studies from Grenada, Jamaica and Java suggest that natural conditions make hillsides particularly vulnerable to serious erosion and runoff problems (Edwards 1995). Given the inherent scarcity of land and natural resources with dense populations, small island watersheds seem more prone to conflicts over land use and resource rights in coping with upstream-downstream impacts (Eckman 1997; Eckman 1998). Financial constraints to natural resources programs on small islands are also a problem (Lugo and Brown 1985). Attempts in Jamaica since the 1950s to introduce effective engineering structures for soil and water conservation have not been successful, and none were sustained by farmers after termination of four major watershed projects. It is now widely accepted that such structures are not feasible for general use in Jamaica, as they are not compatible with farmers' patterns of resource use and labor allocation (Edwards 1995).

Tenure Issues

Land and resource tenure and rights of access issues were noted in about one-fourth of the project documents reviewed. In most projects, the right of access to land was of concern in carrying out projects, although in four cases water tenure was an important issue. Too often land and natural resource tenure are neglected in project planning. To achieve sustainable programs in watershed management, and ultimately sustainable development, projects need to fully recognize the tenure arrangements in any country. To understand these arrangements, appropriate socioeconomic studies need to be conducted early in project planning. Specifically, projects should examine pre-existing land use and tenure, thereby avoiding problems of the past. For example, in some countries trees and forests are owned by national governments; projects promoting reforestation on watershed, therefore need to understand how such activities would affect local people and how such people may respond. Who has rights to water and what are the methods of resolving conflicts? In some instances tenure arrangements may be seen as barriers to achieving project objectives, and may require institutional and policy changes.

Role of Training

The types of training activities in table 2 are far ranging and represent innovative ways of delivering information to international audiences. Some of these training projects had a regional focus, such as the UNESCO-MAB and the

ASEAN Watershed Project, which utilized a variety of seminars, workshops, and training courses that were held in the respective ASEAN countries but also included study tours to other countries. Similarly, the FAO/Finland training courses held in Nepal (Asia-Pacific focus) and Lesotho (Southern Africa focus) brought together mid-level managers and professionals who were facing common land and water management issues and problems. In the Lesotho training, there was direct support for the Southern African Development Community (SADC), with goals of promoting regional development cooperation between South Africa, Lesotho, Angola, Botswana, Malawi, Mozambique, Swaziland, Tanzania, Zambia and Zimbabwe. SADC has formed a regional watershed network, called the SADC Environment and Land Management Sector (SADC-ELMS), and publishes a watershed management newsletter called *Splash*. SADC-ELMS has developed a joint policy and strategy, as well as a sustainable development program based upon watershed management principles. These types of projects built networks of professionals who continue to collaborate on research, training and development activities today.

The Eastern Anatolia and the Water and Soil Conservation and Environmental Protection projects of Turkey and China, respectively, represent efforts to build national expertise to deal with a particular region with serious watershed problems. The Chinese project developed specific training activities for different groups, including county and local government officials, and middle and upper level resource managers. In all cases, training objectives were to improve watershed capabilities and ultimately watershed conditions above the major Three Gorges Dam project on the Changjiang (Yangtze) River.

The Resource Development of Watershed Lands was a series of courses held at the University of Arizona as part of the U.S. Department of Agriculture's support of U.S. Agency for International Development (USAID) programs in the field. The six week courses provided intensive training in technical subjects and included field applications. Participants had the option of receiving formal university graduate credit. Participants were selected from countries in which USAID had missions. The outcome of such training is difficult to track, given the dispersion of people who are trained. Even so, the experience of instructors in these courses suggests that many of the participants have emerged as country, regional and international leaders in watershed management.

Institutional and Policy Implications

Policy and institutional support is essential for watershed management projects to become integrated into long-

term programs that have lasting impacts on people and their use of land and water resources. Institutional issues are many and involve all aspects of land and resource use. In the context of projects reviewed, policies and institutional considerations need to include not only those of national governments, but also those of donor agencies. In the initial development of projects, better coordination and communication between national governments and external donors and agencies would facilitate success. In smaller countries, such as Jamaica, Lesotho, Nepal, and Rwanda, the myriad of large projects with many donors and implementing agencies can overwhelm the institutional capacity of the government. Projects initiated by outside donors should consider national development goals of the host country and the assimilation capacity of the respective governmental agencies and institutions.

An observation with respect to both donor and national agencies is a lack of institutional memory concerning the lessons of past watershed management projects, and an over reliance to repeat the same techniques and approaches without adapting to changing circumstances. This problem prevails at several levels, including the policy level, and is particularly troublesome within agencies that are funding projects and training programs. Policy makers must become aware of what has happened in the past and with changing leadership, there is need to frequently update and increase the understanding of policy makers about watershed management. The issue is one of developing mechanisms for maintaining continuity of projects and programs so that knowledge from past projects are passed on for future reference.

Effective institutional support is necessary for project outcomes to become implemented into sustainable watershed management programs. This support can be at various levels, local, regional or national. Two observations can be made in this regard. First, institutional arrangements are needed so that natural resources are managed in a way that recognizes watershed boundaries, even though those organizations responsible for management are often organized around politically determined boundaries. Second, interdisciplinary approaches are needed to manage soil and water resources in a watershed framework. These two points are interrelated. Governmental organizations usually have specific mandates for a particular natural resource component, for example, forests, irrigation water, or hydropower, and are staffed with professionals in a particular discipline, i.e., foresters and engineers. They usually lack the ability and authority to cope with the myriad of watershed-level issues and they are not organized around watersheds, leading to both duplication of efforts and/or voids in responsibilities from a watershed perspective. Interestingly, this problem has been recognized by community based groups who

have organized around watersheds; these groups have proliferated in the United States (Lant 1999) and in other countries as well, such as Australia (Ewing 1999) and Brazil (Porto et al. 1999). It is clear that institutional arrangements are needed that facilitate the management of land and water in concert with one another.

Strategies For Sustainable Watershed Management: Some Conclusions

Given the experience over the past few decades there is little evidence that watershed management is becoming woven into the fabric of natural resource and agricultural development. In the past, water resource, forestry, and agricultural projects were often developed with little regard to watershed management and upstream-downstream linkages. Furthermore, the role of local people and the importance of changing land use practices by those people are critical factors in achieving successful programs. Common sense tells us that to develop sustainable programs, land and water must be managed together and that an interdisciplinary approach is needed. Are we moving in that direction? There are some indicators that this may be happening. People who are trained and educated in watershed management are assuming leadership positions in many countries. Furthermore, the emergence of citizen-based watershed organizations in the United States and other countries recognizes on one hand, that a watershed management approach is relevant, but on the other hand, existing governmental institutions are not fulfilling the role of watershed management. Such movements indicate that policies and institutions that support integrated watershed management are emerging. Based on our observations and experience, the following are also noted:

- Interdisciplinary approaches to project design are needed that integrate the technical and human dimensions of watershed management. This requires an understanding of cultures and traditional land use practices. Watershed planning has historically relied upon engineering and technical expertise, but has been deficient in socioeconomic aspects, resulting in less than optimal outcomes and a diminished flow of benefits beyond the termination of projects.

- Socioeconomic research and participatory techniques need to be incorporated early in the conceptual design and planning stages of projects. Without coincident local participation, top-down approaches alone often have inconsistent and unpredicted results, even though they may be technologically sound. Bringing in local participation, and socioeconomic specialists later on when problems arise may be too late, and places undue responsibility on those not responsible for original project design. Participatory monitoring and evaluation methods should be used throughout the project cycle.
- Before utilizing subsidies or cash-for-work incentives, other means of providing incentives should be considered. Negative externalities can result when projects rely on subsidies; such economic strategies that may not fit because of cultural and economic differences between donor agencies and receptor countries.
- *Both* environmental and socioeconomic monitoring are needed throughout implementation and following project completion to assist in informed decision making.
- Project design and planning should consider scale and topography aspects in coping with upstream-downstream interactions and cumulative watershed effects (Reid 1993). Small scale projects with clearly defined watershed management objectives have a greater chance of demonstrating positive outcomes that can lead to long-term programs in contrast to large, ambitious, and complex projects that are difficult to manage and administer.
- Administrative and institutional structures should be developed that recognize watershed boundaries, without becoming overly complex. Flexibility in planning and management is essential.
- Regional training and networking programs at all levels should be promoted, building upon existing networks. Long-term funding support for technical professionals, managers, and policy makers should receive the same attention as operational field projects. Through expanded training programs, including training of trainers, diffusion of technology occurs and the continuity of positive project outcomes can be enhanced.

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