

Important and Controversial Watershed Management Issues in Developing Countries

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ABSTRACT

The concept of watershed management originated from "Torrent Control" in European Countries. The work is mainly for flood and debris control of mountain streams and their drainage basins. Since North America adopted the concept and work at the turn of this century, the emphasis has gradually been on managing the upstream areas or watersheds for water benefits: water yields, water quality and flood prevention.

When watershed management later extended to developing countries, the concept and the nature of the work focused on land management, erosion control, as well as sedimentation and flood control. In recent decades, greater attention has been given to the watershed inhabitants and their environment. Thus, a new term of "Integrated Watershed Management" has emerged.

While the concept of watershed management has evolved over time and by countries, policy makers and planners in developing countries often feel confused about potential conflicting objectives of watershed management, soil conservation and rural development. Misconceptions and ill-designed and implemented programs have caused tremendous waste.

In the international meetings of the last decades, many controversial but important issues in watershed management have been raised. Often, these issues have not been adequately resolved or discussed.

IMPORTANT AND CONTROVERSIAL ISSUES IN WATERSHED MANAGEMENT

This paper is intended to discuss briefly six important and controversial watershed management issues. Pros and cons of many arguments are presented, and an objective analysis is given. The author tries to present a complete picture and wishes to stimulate further discussions in order to obtain workable and agreeable conclusions for the benefit of watershed work in developing countries.

Who Should Receive the Most Benefits from a Watershed Program?

In designing a watershed program or project, the first consideration confronting the planners or policy makers is who will receive most benefit from the work: upstream inhabitants or downstream people? The upstream inhabitants in developing countries are mostly small farmers, whereas the downstream people are middle class and town or city dwellers. Government investments in watershed work usually aim at protecting downstream interests such as reservoirs, irrigation installations, water supply schemes, electricity generating stations and roads and bridges from sedimentation or flood damages. To protect public investments or downstream-developed areas is a priority for

many governments. The problem is that the upstream inhabitants may have not shared in these benefits; they simply have no electricity, irrigated water and treated water in their watersheds.

To protect downstream interests is a classic approach. The crucial question is how does the government convince the upstream farmers to participate in a watershed program where they are not benefited much from the work?

On the other hand, some governments have stressed production functions of the watershed work especially for increasing crop and animal production on individual farms in a watershed. Such an approach becomes merely a soil conservation, crop or animal development program situated in a watershed, lacking interest in downstream protection and water benefits.

Since the 1970s, many governments have advocated integrated watershed approach, which involves rural development work in the program. The main purpose is to improve the livelihood and environment of the upstream areas. Roads, housing, marketing, etc. are included. Often, because of resource constraints, the main purpose of watershed protection and rehabilitation is sacrificed or compromised.

Whether a watershed program should emphasize on protection, production, or rural development depends upon the actual needs and the priorities of the people. Watershed management should be site specific and community oriented. For such work to be successful, however, both upstream and downstream benefits should be considered and an optimum balance among protection, production, and development should be maintained. Thus, the program will receive support from both the downstream and upstream communities and it likely to be sustainable.

Should Incentives Be Given to People Who Participate in a Watershed Program?

Should incentives be given to the farmers or people who participate in a watershed program? This issue generates many controversial and strong opinions. In many international soil conservation meetings, this issue has been raised many times. Even as recent as in an international symposium held in Xi'an China in 1997, the subject has been actively debated.

One school of thought holds the view that small farmers simply have no resources to implement watershed work that can be costly. Yet, the benefits may take several years or even generations to realize, or they occur at elsewhere in the downstream area. For farmers to either provide land or labor for conservation work, or for time lost for production, compensation is needed from the government. Incentives can also be viewed as an equitable distribution of income, considering that the town or city people receive so much from the government in terms of infrastructure. These urban

inhabitants need to share a part of the cost of watershed work upstream.

Another school of thought has a different opinion. From past experience, they have learned that incentives, particularly cash subsidies, have been misused and the farmers in many countries have developed a kind of "Subsidy-Dependent Mentality". Another reason is that governments in developing countries have resource constraints and they cannot afford to give incentives. Hence, they adhere to education and extension, and particularly teaching farmers to understand that watershed and conservation work practiced on the farms will eventually benefit them.

Actually, the different views of the two schools is due to different "scales" of thinking. The first school looks at a larger, social scale focusing on benefits of watershed work extending beyond the boundaries of the individual farm and watershed, and into the whole society. The consideration of the second school concentrates on individual farms.

If the justification of giving incentives is there, a careful selection of the right type of incentives and proper management of them should follow to minimize their misuses. A Chinese proverb says rightly, "Do not quit eating simply because of choking once". Cash subsidies are only one type of incentives that is unfortunately, easily misused. In fact, there are many different types of incentives, both direct and indirect. Botero (1986) has listed 29 types of incentives for watershed work; some are quite inexpensive and affordable.

In order to lessen the government's burden, incentives should be only given at the initial stage of a watershed program or used for introducing a new type of work. When the farmers know the benefits of such work that is the time for the farmers to do and maintain the work by themselves. On the other hand, innovative ways to secure more resources for incentives should be sought. Collecting cess from exporting crops for protecting their growing slopes, and including small fees in the utility bills of the downstream beneficial areas, among others, should be seriously considered. (Sheng, 2000).

Which Type of Work Should Be More Emphasized: Structural or Vegetative?

In developing countries, steep watershed slopes are under intensive cultivation. Erosion control on these kinds of cultivated slopes is usually one of the major watershed tasks. To minimize erosion and achieve sustainable use, structural measures such as bench terraces have been extensively and effectively used in many parts of the world. Terraces, especially bench terraces, are costly though they can last for long time. In addition to cost problem, many of the dryland bench terraces are designed and built without considering modern farming needs such as transportation, irrigation, drainage, and mechanization, thus resulting in their limited use. Therefore, a demand for vegetative or low cost control measures has often been raised.

Some of the vegetative measures commonly employed include grass barriers, cover cropping, mulching, as well as agroforestry. Each has its merit when applied properly on the right sites and under the right climatic environment. The

crucial questions are: 1) can these vegetative measures handle excess runoff under humid climate zones and on steep terrain? And 2) do these measures consider and facilitate in any way to the modern farming practices used today? The honest answers are "No" to both questions. When the answer is "No" to the first question, erosion will not be controlled since most developing countries are situated in the humid tropics where torrential rains are frequent and runoff is unavoidable. When it is "No" to the second question, then, these measures will only be considered as temporary and transitional.

Structural measures can be employed to protect steep slopes up to about 30 degrees and they are very effective in erosion control (FAO, 1977; Hudson, 1981; Wu, 1986). There are many types of structural measures ranging from intermittent types of narrow benches to full bench terraces. They act as drains, roads, and level strips and their major functions are for safe drainage of excess runoff, facilitation of modern farming practices, and convenience of cultivation. Structures are not necessarily more expensive than vegetative measures. An economic study in the USA found that terraces are more economical in the long run than cover cropping (Barbarika, Jr., 1987). Simple structures like hillside ditches cost only one fifth of bench terracing yet they can reduce erosion by 80 percent. (Sheng & Michaelson, 1973; Liao, 1976; Sheng 1990).

There is a general tendency for engineers to prefer more structural measures while agronomists and foresters tend to employ vegetative measures. The right approach is not to stereotype or predetermine the land treatments. Rather, watershed managers should devise a variety of effective treatments including vegetation and structures for farmers to choose according to their cropping systems, interest, resources, and land conditions. Stressing only on low cost without looking into its effectiveness and sustainability is not a wise policy.

Should Watershed Program Emphasize Rehabilitation or Prevention?

Just like our health, it is a common belief that prevention is more desirable and economical than rehabilitation afterwards. This is true when a watershed is in a good condition and natural or human disturbance has been kept to minimum.

As stated previously, watersheds in developing countries are often densely populated. Through decades of cultivation and misuse, the lands are experiencing severe deterioration and destruction. Many watersheds in the humid tropics are already dominated with sheet erosion, rills, gullies, and landslides. Farmers are cultivating mostly sub-soils for making a living. Rehabilitation for the purpose of stopping further erosion and bringing back productivity, though expensive, is in many instances necessary and feasible.

Natural disasters are also common in many watersheds of humid region. Hurricanes and torrential rains cause severe damage to roads, streams, slopes, and valleys. Expensive rehabilitation work is usually required. Although prevention work could minimize damages, such works like levees, dykes, or dams are also expensive.

In reality, watersheds in developing countries need both

erosion prevention measures and varying degrees of rehabilitation. A generalized statement that prevention is always better and economical than rehabilitation is vague and not convincing. A better strategy is to classify a country's watersheds according to their rehabilitation needs. Deteriorated watersheds need rehabilitation while watersheds with little disturbance need prevention or routine care.

In an individual watershed, land capability classification is needed. After land is classified, farmers should be encouraged to use their better parcels for intensive cultivation with proper conservation measures and soil-improving practices, leaving severely eroded lands and steep slopes for other uses or for protection. In a similar manner, whole watershed slopes should also be set treatment priorities.

To use the land according to its capability is probably the best prevention measure. Unfortunately, such land capability classification work is seldom done in watersheds of developing countries. Some countries employ impractical criteria resulting in more confusion in land use. In the 1970s, the author introduced a land capability classification system for hilly watersheds (Sheng, 1972; Morgan, 1980; Hudson 1983). However, it still needs wider applications (Sheng & Barrett, 2000).

Should Planning Be Carried Out at the Farm Level or Watershed Level?

For managing a watershed, an overall survey and planning of the watershed in whole is an ordinary approach and a required task. There have however been objections to these approach, and a call for "Planning should be on a farm-field rather than a watershed" (Douglas, 1992). The major reasons for the objections are: 1) the watershed is a less natural unit of perception and action for farmers than their own holdings, and 2) a conservation package that requires the farmers all to work together, for the conservation of resources not solely their individual responsibility, is difficult to implement and rarely successful.

While there is some truth in these statements, the necessity and advantage of planning a watershed in whole cannot be denied. Watershed is a geographic and hydrologic unit though it may not coincide with farm and administrative boundaries. Also, watershed is a functional unit that links upstream and downstream in an integrated system. In order to protect it fully, each piece of land should be considered and involved in an overall plan, whether it is farmland, forestland, rangeland, or others. In addition, streams, roads, residential areas are all need to be included in survey and planning to see their conditions as well as their protection or rehabilitation needs. The responsibility of carrying out soil conservation work on the farms rests solely with individual farmers whereas on national or public land, the government or public bodies should do their work. In the latter, farmers are employed to do the work and earn wages, such as hiring them for planting trees on forest reserves and protecting public roads and streams. These are by no means farmers' responsibilities.

For watershed planning, we should distinguish two

stages of work. The first stage is overall planning including resource inventory, problem identification, management strategy formulation, budgeting and others. This is usually done in a reasonable and short time. After the overall plan is approved and resources are available, a more detailed implementation plan is required for each category of land including forest reserve, public land, and private land i.e. conservation farm planning with individual farmers over time. Because hundreds and thousands of small farms are usually situated in a watershed in developing countries, it is extremely time consuming for planning individual farms at the first stage. Therefore, to protect and manage watersheds in their entirety, planning both at watershed level and farm level are necessary. One without the other is incomplete.

How Far Should Integrated Watershed Go?

Integrated watershed management is a recent concept developed in the 1970s. The main objective is to develop and sustain natural resources in a watershed along with emphasizing human resources and their environment (FAO, 1976; Eren, 1977). In many such programs or projects, rural development elements are included such as building and improving roads, markets, houses, and even schools and health centers. In the watersheds of many developing countries, such work is greatly need and therefore welcomed by the local communities.

Many problems, however, have also been created due to integration. The first one has been institutional. Even if a watershed agency has the funds and the interest to manage rural development work, they usually lack staff and expertise to do the work. Even if they do have experienced personnel, the next question is what will the other agencies do in the same watershed? Integration going too far will overlap local government responsibilities. Even coordinating too many agencies to work harmoniously in a watershed is a tedious and difficulty task.

The second and usual problem has been funding and maintenance. Funds are often limited. In most watershed projects, funds are not even sufficient for comprehensive protection or rehabilitation of a watershed. If a part of the funds are to be used for rural development, the major task of watershed management will be either delayed or sacrificed, defeating its main purpose. In the past, it was not uncommon for many roads, buildings and installations built in the rural areas are left in ruins because of no maintenance due to termination of projects, lack of available funds, or unclear responsibility.

The third problem encountered with integrated watershed management is the conflict of interests between downstream and upstream people when both are involved in the planning process. The downstream community, being located at the receiving end, prefers more protection and conservation work while the upstream inhabitants demand more rural development. How to strike a balance between conservation and development with limited funds is a serious challenge to watershed planners.

Probably, watershed planners need to limit the integration to a certain degree. For instance, it is acceptable to give priorities to agricultural development facilities such as water harvesting, small-scale irrigation, marketing excess,

storage, fuel wood plantation, and cottage and agro-industry. These activities could be used to promote income and wealth to the community and to induce farmers to participate in watershed program. Depending on availability of funds, the development part of the project or program should be kept economic yet attractive enough for stimulation and incentive purposes, leaving an ample portion of funds for watershed conservation, protection or rehabilitation.

CONCLUSIONS

The management of watersheds in developing countries is quite different from those in developed countries due to their differences in socio-economic conditions and physical settings. In developing countries, watershed programs are relatively new and concepts still need to be developed. Because the nature of watershed management work relates to many disciplines and multi-sectors, it raises many controversial issues for planning and implementation.

This paper selects six important and controversial issues and tries to give some explanations and clarifications. The main purpose is to stimulate further discussion and studies for the benefit of watershed work in developing countries.

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