MANAGING WATERSHEDS IN DEVELOPING COUNTRIES: WHAT MANAGEMENT SKILLS AND EDUCATION ARE NEEDED?*

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ABSTRACT

This short paper emphasizes the management skills and education needed for protecting and rehabilitating watersheds in developing countries where watershed slopes are often heavily populated with subsistence type of farmers. Brief explanations of the knowledge required for better management are given such as watershed problem identification, proper land use, rehabilitation technology, resources management, rural development, as well as management specifics including extension, incentives, and monitoring and evaluation.

After explaining ‘Watershed Management’ is as important as ‘Watershed Science’ and a review of the management courses offered at Colorado State University and others, the paper finally makes a suggestion on how management courses could be emphasized. Though the paper was originally intended for the occasion of 50th anniversary of the Watershed Science Program in Colorado State University, the contents may be applicable for other universities with similar programs. The main objective is to stimulate further discussions among educators, students and professionals in the field of watershed conservation.

FOREWORD

Watersheds in developing countries are generally populated with numerous subsistence farmers on steep slopes. Erosion is rampant yet to move people out is difficult and impractical. Facing this kind of dilemma, anyone without proper training in management skills will often be overwhelmed.

The solution may depend upon taking both human factors and land conditions into consideration. A practical and useful approach would minimize erosion, improve land production, and benefit the farmers at the same time. To do this, certain skills, experiences, or training are required.

This short paper intends to bring up the subject of management skills and education needed for watershed work in developing countries for the purpose of stimulating further discussions. Watershed programs of universities may consider strengthen these education needs for preparing their students, national and international, for the future job markets.

SOME BASIC SKILLS AND EDUCATION NEEDS

The following sections are some basic skills and education needed for the management of watersheds in developing countries. These are by no means syllabus of the courses but some reasoning and illustrations for the subject matters.

Watershed Problem Identification

Watershed problems need to be first identified including physical, socio-economic, institutional, and cultural ones in order to diagnose a proper plan for management. Today, most students are familiar with physical survey techniques such as using GIS, remote sensing, and modeling. What most of them are lacking are the skills of identifying socio-economic, cultural problems and institutional deficiencies which may greatly influence the implementation of the management plan. Therefore, students in watershed management should have ample time to learn and to discuss subjects like policy, legislation, land tenure, poverty, illiteracy, farmers attitude, farming systems, and the like.

Proper Land Use

The principles of land use especially the knowledge of proper use of land are essential for whoever is working in watersheds. Proper land use may vary from country to country. Farmer’s land use objectives may differ greatly from government and the public. However, students need to understand well the basics of proper land use i.e. using the land without impairing it.

There is no universal land use criterion in the world. Some criteria devised from the developed world have been used unsuccessfully in many developing countries (Sheng,
A useful criterion for developing countries in general, should put emphasis on how to use hill-slopes since these kind of slopes usually populated with subsistence farmers in the developing world. A proper criterion should not result in harming the land at one hand, and should promote better use to benefit the farmers on the other. Therefore, land use principles, the existing criteria and their applications, the design basics, as well as the tools to be used for land use planning, etc. need to be fully discussed and taught in the classes. The main objective is to prepare students to have abilities to use, modify, or, if necessary, to devise certain practical criteria in accordance with a country’s socio-economic needs and physical conditions of the land.

**Erosion Control Principles and Rehabilitation Techniques**

Since erosion is the major concern of the watersheds in many of the developing world, the processes of erosion and its control principles need to be well explained to the students. The subject may include the control of gully erosion, road erosion, stream bank erosion in addition to control surface erosion of cultivated land. Students might also be exposed to special techniques such as landslide stabilizations, mining waste control, and torrent control.

The techniques of erosion control on cultivated slopes are utmost important because the watersheds in developing countries usually suffers severe erosion hazards from there. The control methods used in developed countries where cultivated land are on flat and gentle slopes are not applicable. Thus, the knowledge of terracing, vegetative barriers, safe drainage, agro-forestry and particularly, conservation farming are much needed. The object of conservation farming is not only for erosion control but also for maintaining or improving land productivity.

**Multiple Resources Management**

Any watershed in the world contains many resources. Therefore, for managing any watershed effectively one needs to be equipped with basic knowledge and understandings of the inter-relationships among resources such as their use conflicts, constraints, and trade-off effects. For instance, removal of forest cover may affect recreation and water resources, yet timber harvesting may be an important source of government revenue. People should weigh the pros and the cons among resources management to make a satisfied decision. Students, therefore, need to understand resources management principles of forest, rangeland, water, recreation, mining, and others to cope with the conflicts or the use problems.

In many developing countries, the administration of these resources are often lacking, overlapping or contradicting. Students also need to be familiar with resources management conflicts, sound examples, or cases studies from developing countries for benefiting their future careers.
Students equipped with only hydrology, water resource knowledge and without this kind of broader management understandings will find them difficult to do an effective work in developing countries.

Management Specific: Extension, Incentives, Monitoring and Evaluation

To engage subsistence farmers to protect a watershed, some specific management skills are required. Extension skills such as setting demonstrations, interviewing farmers, conducting farmers’ training, promoting local participation, and undertaking farm planning, all are important to the success of such task.

An often controversial and important issue is whether incentives should be given to farmers for participating in watershed or soil conservation programs (Napier, 1999). Government resources are often limited yet farmers are too poor to take up any extra work. It is not fair to ask poor farmers to heavily invest in watershed work, yet the benefits such as irrigation and electric power are provided to the people in the downstream areas (Sheng, 1999). On the other hand, incentive programs should be economically viable, socially acceptable and equitable to everybody who participated in the watershed conservation work. If incentives are determined to be given, then, what kind of incentives, the criteria and how to manage it is still a topic of discussion. Students need to be exposed to this crucial subject thoroughly along with other socio-economic problems.

Development is a continuing process that requires constant adaptation and checking, thus the subject of monitoring and evaluation (M&E) can not be overlooked. It is a necessary skill to be learned by student today although the subject is a difficult one. Between doing nothing and doing an ideal job, there should be a practical way to do it (Sheng, 2007). Students should have ample opportunities to discuss and to learn this subject thoroughly.

Rural Development and Watershed Management

In many developing countries, the emphasis of watershed work is on the welfare of the people. The main reason has been that any watershed work could not be successful without giving priority to consideration of human factors in the area (Eren 1977). Hence, adding rural development elements to watershed work becomes a new trend since 1980s and it is called: “Integrated Watershed”. Consequently, watershed manager’s responsibilities are greatly increased and also the work becomes more a complex. How far the integration should go and what will be the best combination are the topics mirate much discussion. Involving too many rural development elements will make the watershed administration like a local government which is not at all desirable (Sheng, 1998). Students without this kind of exposures will be caught unprepared when they take up such a watershed job in developing countries.
WATERSHED MANAGEMENT AND WATERSHED SCIENCE

Watershed Science has two major but closely related components: Science and Management. “Science” is to advance the knowledge and understanding of the watershed resources especially in hydrology, erosion, and conservation. “Management” is to apply such learned knowledge to watershed areas to the betterment of the people, resources and land. Both are important.

Experience has shown that students only equipped with watershed hydrology could not easily manage a complex watershed populated heavily with farmers. To setup only a network of climate and hydrological stations is far from sufficient to benefit the land and people in a watershed. Therefore, management skills should be greatly emphasized in college education along with other science and physical courses.

The Watershed Science Program in Colorado State University (CSU) is probably the oldest one established among the universities of the world. A review of its course work offered in the 60s and 70s together with a special paper dealing with watershed management education (Dils, 1972) has found that there were several management-oriented courses already in that period, such as Applied Watershed Management, Watershed Analysis, and topics on Erosion Control, Forest Management, and Policy, etc. The management-oriented courses in CSU, however, have not been developed much since then. Not until the 80s was a course of Watershed Management in Developing Countries created. This is only a two-credit graduate course emphasizing managing watersheds in developing countries. The course has been attended by enthusiastic students from other departments and disciplines as well. More specific courses in management skills should be added to prepare students for their future careers. Other universities with watershed programs may also require more practical management courses for their national and international students.

FINAL REMARKS AND SUGGESTIONS

In comparison with other disciplines, watershed science and management education is still new in USA as well as in the world. There are not too many universities worldwide providing such specialized education and training. Now the demand seems growing because more people, than ever, are aware of and concern about resource conservation and environment protection. At the present trend of globalization and distant education, such Program or Department should prepare itself well to train more international and national students in the management of watersheds in the world.

Probably, the Program in CSU as well as in other universities could be developed into two options for the students to choose, one in “Watershed Science” and the other in “Watershed Management”. In addition to basic courses, each option could concentrate on its special requirements. Or, management skills should be emphasized on undergraduate level and M.S level, while science and research be concentrated for Ph. D level. The subjects or courses mentioned previously could be either created or shared with other departments.
REFERENCES CITED


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