

Microcatchment Water Harvesting For Agricultural Production: Part II: Socio-Economic Considerations

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Water harvesting can be defined as a range of techniques for collecting and concentrating precipitation. Microcatchments are a form of water harvesting employed for agricultural and reforestation practices suitable for widespread implementation. The basic microcatchment water harvesting system consists of two parts, the catchment area and infiltration basin. The catchment collects rainfall from a small area cleared of or lacking vegetation. The concentrated runoff is stored in the soil profile of the infiltration basin irrigating trees and crops.

Microcatchment water harvesting is a viable means of providing food, fiber, and drinking water if the systems are designed to fit the local physical, economic, and social environment. To design a successful microcatchment system certain physical, technical, and socio-economic elements must be investigated. There is limited information on the physical and technical design elements of microcatchment water harvesting. However, few scientists have investigated the sociological or economic aspects of water harvesting. This paper will focus on presenting some of the socio-economic design elements of microcatchment water harvesting.

Socio-Economic Advantages of Microcatchments

When properly designed, microcatchment water harvesting systems possess several socio-economic advantages for the small farmer. Several of the economic and social benefits are as follows. Because microcatchments are a simple technology to understand, they are easily transferable to the local population. Since microcatchments are small scale structures, they have lower economic and labor costs for construction and to maintenance than large scale irrigation systems and with their small scale, microcatchments do not apportion water among many users. Conflicts over water rights are minimized. These systems are usually independently used and small-scale, eliminating the need for communal regulating groups.

Economic Design Characteristics

In addition to being technically sound, water harvesting systems must be economically feasible for the local population. For a water harvesting system to be economically fea-

sible, crop or tree production must have greater benefits than costs (capital, and labor). In other situations, water harvesting is economically beneficial for local farmers because it is the only feasible method of farming for degraded land lacking irrigation water. Frequently, the local population views water harvesting differently if the water is a means of survival as opposed to a method of profit.

A. Labor

Water harvesting systems are usually labor intensive to construct and to maintain. Depending on the type of water harvesting systems, the amount of needed capital costs and the labor requirements vary greatly. Some water harvesting systems have high material construction costs with low labor needs and visa-a-versa (Frasier 1988). In some instances, the amount of labor required to maintain water harvesting systems can be higher than the construction labor. The maintenance labor can be high since these systems may need to be inspected and repaired as necessary and especially after major rainfall events.

B. Costs versus Benefits

Proposed water harvesting systems should be closely analyzed to evaluate if the potential costs versus benefits are economically feasible for the local population. Communities who are beneficiaries of water harvesting may see advantages to systems that are different than those listed by outside technical advisors. To make a water harvesting project successful, the system must provide both economic and non-economic benefits. The economic benefits may be monetary profits from the sale of production items such as crops or trees. Local people may not immediately see the non-economic benefits of the reduced silting of local rivers, soil conservation and aquifer recharge which may result from water harvesting. Some other less noticeable advantages of rain water collection for communities may be sustainable agriculture, heighten self-reliance and reduction of future famine relief. For new water harvesting systems, designers need to acknowledge that increases in gross income may be negated by additional construction or maintenance costs (Oron et al. 1983).

Besides being evident to water harvesting system designers, the economic and non-economic benefits of a project should also be apparent to the local community. Designers and project managers should realize that the economic benefits of a particular system may not be used as anticipated for reinvestment into tree or crop production. For

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agricultural water harvesting, the costs must include construction, maintenance, seed, tillage, and fertilizer for the system. But other costs can be imposed not on the individual farmer but on the society as a whole. Such costs might arise from land use conflicts which eliminate animals from communal lands and generate overgrazing in other areas (Pacey and Cullis 1986).

Microcatchment systems are considered by some to be the most economical of runoff farming systems because they are less expensive to construct and maintain. The costs are lower because microcatchments do not require terraces, conduits, water conveyance channels, or water storage structures. They can also be constructed without high technological inputs. Only a small capital investment is required. Microcatchments are less likely to be destroyed during large storms so reconstruction costs are generally lower. In the Negev desert of Israel, microcatchment construction costs ranged from five to twenty U.S. dollars per hectare. The costs of the construction were easily repaid within a few years in crop production revenues.

Social Design Characteristics

If water harvesting is to be successful, then the socio-economic direct and peripheral effects on the local population should be monitored. In planning and designing a water harvesting project, impoverished groups and individuals should be identified to reduce the possibility of increased economic inequality within the society (Critchley et al. 1992). Improperly designed water harvesting systems

can lead to heightened inequalities in a society. For example, impoverished village herders may be excluded from certain farming land which was previously left to pasture, resulting in animal deaths and loss of weight. This may cause great economic hardship to the herders during important animal market periods.

Water harvesting systems should be compatible with and supported by the existing social structure (Bruins et al. 1986). To do this, water harvesting structures must be designed to incorporate the socio-economic characteristics and monitor the resulting impacts on the local population. To properly design a water harvesting system for local socio-economic characteristics, the needs of the local population must be identified. The local population should feel that the proposed rain water collection program is the best alternative for their intended uses and situation. Local participation, the involvement of women, incentives versus need, and appropriate technology are important social attributes to identify in designing a water harvesting system.

A. Local Participation

A project's success depends on the attention paid to social issues from its beginning. The social aspects of a community must be understood in order to enlist local participation. In some villages, it may be difficult to get community members to give their input during planning and development phases. If good local participation exists, the design of water harvesting systems can be changed and



Village meeting in Haiti, to discuss water development project

improved to better meet the needs of the local population.

Participation throughout the phases of a water harvesting project depends on many socio-economic factors. It is also affected by the scale of the water harvesting project. If the water harvesting system is very large, a communal organization may need to be formed to organize and run the project. As a result, individual participation may be minimal. Greater farmer participation may occur after the communal organization becomes decentralized. Microcatchments can have higher individual participation because of the small scale and need for minimal communal organization.

The most successful water harvesting systems are those where communities work in small collective groups. One benefit of these small collective systems is that farmers can be trained during work sessions by a community extension service. By encouraging communal action, groups of poor farmers also have the same benefits as rich farmers in relation to access to credit and marketing (Pacey and Cullis 1986). Although some farmers may prefer to work alone, participation in an undemanding village association managed by a community extension agent can raise revenues for developmental progress while allowing the farmers to work independently. These revenues can initiate social and technical development such as starting a small bank or pharmacy. This approach is well suited for microcatchments. The technology could be disseminated in communal organizations but farmers could also continue to work individually.

B. Involvement of Women

In designing water harvesting projects, the role of women is often overlooked. In semi-arid regions of Africa, women are the majority of the work force and, because of the seasonal labor migration of men, are often the head of the household. This is also the case for women in developing nations in South America and Asia as men journey to urban areas to work on a seasonal basis.

Agricultural extension services are oriented toward working with men rather than women. Very few women work as extension agents for agricultural services outside of the area of home economics. This is unfortunate since so many women in developing nations own farms or gardens and could greatly benefit from water harvesting. In many areas of the developing world, the women farm a small degraded portion of their family's holdings.

C. Incentives versus Need

If a water harvesting project is installed in an area which lacks water for agricultural production or reforestation, the system may be accepted by the local population. Without a locally perceived need for increased water, the project will end in disaster. Unless the local community believes that the project is best for their needs and means, the project will fail. In general, reliance on food aid or other incentives to motivate the local participation is not productive (Reig et al. 1988). Many incentives for participation offered to a local community are meaningless either for social or economic reasons.



Women traveling to market in Haiti.

Incentives are inappropriate when food for work is used to overcome labor problems in constructing and maintaining the systems. In Kenya, where villagers received food for constructing water harvesting structures, the systems failed because of poor maintenance. The local people did not maintain the structures because food for work rather than increased food production had been improperly used to motivate them (Pacey and Cullis 1986).

D. Appropriate Technology

Water harvesting techniques may be unsuccessful because the systems are inappropriate for the social environment in the area. Several reasons exist for why certain water harvesting systems may be termed as "inappropriate technology." The technical design may be too difficult for farmers to comprehend making it difficult for them to maintain the structures. The water harvesting system could also be incompatible with patterns of local food production, have high labor requirements, or rely on machinery. Machinery usually requires some degree of technical knowledge to maintain and without regular maintenance will fail. Where a water harvesting project relies on machinery, the system will fail because the local population or government usually can not afford the necessary maintenance.

Although water harvesting techniques may be appropriate for certain communities, these systems may be inappropriate for certain indigenous cultures. Pastoral people can be hurt by water harvesting systems because increased farming of degraded lands may limit nomadic herding patterns. In marginal areas, governments should be aware of the social and environmental implication of introducing water harvesting projects.

Indigenous water harvesting techniques may often be more appropriate than introduced systems. For instance, in Burkina Faso, development project directors decided to abandon an introduced water harvesting technique and adopt an indigenous technology of constructing stone bunds in fields. They improved the microcatchments by building the bunds on the contour which allowed water to be collected, spread evenly over the fields and percolate slowly through the earth bund. By modifying the indigenous microcatchment system, they were able to satisfy local environmental characteristics while increasing crop production. Because of the small scale of microcatchments, when these traditional systems are modified, this often augments crop production and makes the technique even more adaptable by the local population.


Conclusion and Recommendations

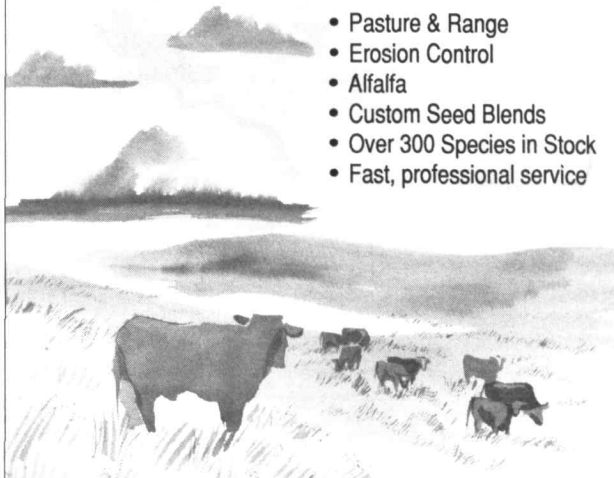
Microcatchment water harvesting will be an important technique for sustainable agriculture in developing countries if the important socio-economic design elements are incorporated into these systems. Professionals implementing water harvesting systems should analyze the economic benefit and social acceptability of their project. Most scientific research on water harvesting has been primarily technical and has ignored ways of extending these systems to farmers and communities. Increased research on the socio-

economic aspects of water harvesting should be performed and widely published. All water harvesting projects should evaluate and monitor their activities to learn how new technologies influence socio-economic factors. If professionals in this field increase their awareness of the socio-economic elements of implementing a water harvesting project, greater success in the field will occur and this viable technology will help increase agricultural production while reducing consumption of water resources.

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