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RURAL DEVELOPMENT BY WATER CONSERVATION

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Abstract - The water conservation measure has been suggested on the Piyali River basin area in Kultali Block of South 24th Parganas, West Bengal, India for rainwater harvesting based on field survey. In this study, the Basin of Piyali River, an estuarine river with regular tidal influx, with special emphasis on Kultali Block has been chosen for utilizing the water of the Piyali River during dry months and augmenting water supply through rainwater harvesting in the Kultali Block mouza-wise. Especially during flash floods the entire catchments used to be flooded. To eradicate the problem, in early post-independence time a master plan was prepared and implemented by the Irrigation Department to restrict the entry of tidal ingress by means of a major sluice gate and construction of similar sluices in each tributaries debouching to the Piyali River, to check the flood problem in the area as also to conserve rainwater for use in the lean periods. Unfortunately after thirty years of installation of the closure, the Piyali River remains saline during dry months thereby defeating the very important purpose of utilizing huge quantum of water for irrigation during dry months of the year. Consequently the present study suggests some measure to eradicate the salinity problem in the river. An extensive plan has been made on the basis of study for augmenting water supply through rain water harvesting with the help of ponds network. The measure needs to be implemented for irrigation facilities for multi cropping in the area of Kultali Block to make the water of Piyali River fresh. Thus the main objective is to provide a plan for augmenting irrigation water for the development of command area by considering either of individual land or community land block wise through rainwater harvesting structure ponds and also to suggest crop pattern and crop rotation according to water availability, quality and soil condition. The study attempts to delineate not only for enhancement of their economic return through pisciculture and improved cropping intensity during dry season for sustaining their livelihood but also reducing the salinity level of the Piyali River by selecting the location of the dyke in Piyali River for utilizing huge quantity of water for multi-cropping during lean period..

INTRODUCTION

Rainwater harvesting is the process to capture and store rainfall for its efficient utilization and conservation to control its runoff, evaporation and seepage. It improves not only the quality of groundwater through dilution but also increases water availability. Surface depressions, natural or manual collecting and storing rainwater, runoff and seepage from the surrounding areas are known as pond structures.

The structure will act to lessen the intensity of drought, help in recharging groundwater, provide crucial irrigation for multi-crop production, function as a source of multiple uses for the village community like fishing, washing, bathing and stock of water for livestock and plays a role in the maintenance of a good natural environment. Because of these benefits, the rainwater harvesting pond should be built in a community based land. Ponds structure mean not only for multi-cropping agriculture and fish production in the adjacent mouza of Kultali block but also serve as a resource-base for many other activities such as the collection of fodder, the making of bricks, baskets etc, with women offering their assistance in these processes. Ponds structures on community land should become a very important part of the socio-economic system in the Kultali block affecting significant income opportunities. The location of pond and its physical conditions are a matter of much significance to the people, particularly women, in carrying out their economic activities.

The maintenance of natural resources through a continuous process of use and conservation means not merely the assurance of livelihoods to the people of the different mouzas of Kultali block, but also the preservation of the ecological balance. Based upon the information and field studies carried out by the School of Water Resources Engineering, Jadavpur University, it is conjectured that formerly Piyali River was an estuarine river with regular tidal influx. Especially during flash floods the entire catchments used to be flooded. To eradicate the problem, in early postindependence time a master plan was prepared and implemented by the Irrigation Department to restrict the entry of tidal ingress by means of a major sluice gate and construction of similar sluices in each tributaries debouching to the Piyali river, to check the flood problem in the area and also to conserve rainwater for use in the lean periods. Unfortunately after thirty years of installation of the closure, the Piyali River remains saline during dry months thereby defeating the very purpose of utilizing huge quantum of water for irrigation during dry months of the year. The study identifies the extent of salinity of the Piyali River and proposes the location of the dyke structure to eradicate the salinity problem. The main objective is to provide a plan for augmenting irrigation water for the development of command area by considering either of individual land or community land block wise through rainwater harvesting structure ponds and also to suggest crop pattern and crop rotation according to water availability, quality and soil condition.

1.1 PROBLEM STATEMENT

Water is a critical input into agriculture in nearly all its aspects having a determining effect on the eventual yield. Good seeds and fertilizers fail to achieve their full potential if plants are not optimally watered. Adequate availability of water is important for animal husbandry as well. Fisheries are, of course, directly dependent on water resources. India accounts for about 17% of the world's population but only 4% of the world fresh water resources. Distribution of these water resources across the vast expanse of the country is also uneven. The increasing demands on water resources by India's burgeoning population and diminishing quality of existing water resources because of pollution and the additional requirements of serving India's spiraling industrial and agricultural growth have led to a situation where the consumption of water is rapidly increasing while the supply of fresh water remains more or less constant.

1.2 Problem Motivation

Water is prime life sustaining natural resource which cannot be created like other commodities. It is a nature's gift to all living beings on the earth. Water is the elixir of life. Unfortunately for our planet, supplies are now running dry – at an alarming rate. The world's population continues to soar but that rise in numbers has not been matched by an accompanying increase in supplies of fresh water. In India, the increasing stress on the availability of water is due to population explosion and improved standard of living. The scarcity is compounded further because of massive agricultural and industrial development coupled with improper and indiscriminate exploitation of groundwater resources.

II. LITERATURE SURVEY

2.1 Water Conservation Measures for Sustainable Livelihood of Rural Communities

2.1.1 Introduction

With increasing water scarcity, it is essential to view water allocation and distribution in rural areas from the basin perspective. Traditionally, in the water sector, much of the focus on rural development has been aimed at individual systems or communities. This focus has to change to cope with wider issues of competition for water, particularly for water of good quality. Looking at water from a basin perspective means that we have to look not only at water supply and demand for all users but also at institutional issues involved in the provision of services. The issue may best be exemplified by the issue of "scaling-up," whereby each separate water use, by itself, may not have a noticeable impact, but as the number of such water uses intensifies, the overall impact on water resources and other water users becomes significant. In light of these issues, safeguarding and developing water resources for rural development require a combination of inputs or interventions in three major dimensions:

2.2 Rainwater Harvesting

Rainwater Harvesting is an effective method and a simple method of collecting water for future usage. Rainwater harvesting is the process of collecting, filtering, storing and using rainwater for irrigation and for various other purposes. Rainwater is collected when it falls on the earth, stored and utilized for various purposes. It can be purified to make it into a drinking water facility in some islands and dry land regions. Rainwater harvesting (RWH) is a simple method by which rainfall is collected for future usage. The collected rainwater may be stored, utilised in different ways or directly used for recharge purposes.

Benefits of Rainwater

Harvesting Rainwater harvesting has many benefits. The major benefit is that it is a sustainable water management practice. It can be implemented by every citizen at various levels. It is a socially acceptable practice and promotes environmentally responsible future. The rainwater that falls on any roof and property is essentially free. All it needs is to adopt a method to harvest it and store it in a tank or cistern for future use. Rainwater harvesting helps to reduce the peak demand of water expected during summer period, by saving treated water for more important water uses. While rainwater can be a perfect primary water source for many uses and situations, it is would be a good backup water supply for emergency situations.

The Environmental Benefits

Rainwater harvesting can reduce storm-water runoff and wastage from any land. The reduction in runoff volume can reduce the level of contamination of surface water resources with pesticides, solid wastes, municipal effluents, sediments, metals, and fertilizers. By reducing the storm-water runoff, rainwater harvesting can reduce the flow volume and velocity in local streams, and rivers. This also help to avoid the potential for erosion along river beds. Rainwater harvesting systems can be an excellent source of water for growing plants and carry out landscape irrigation

The Economic Benefits

Collecting and using rainwater, in place of municipal water supply, reduces the water bill to some extent. This also reduces the water service cost to a municipality, for their people. Rainwater harvesting can reduce water demand from municipalities. It helps to provide potable water at a lower cost. Designing and installing rainwater collection systems can provide sustainable jobs for people and help to earn more. The rainwater harvesting industry can become a leading employer in the green infrastructure movement. Rainwater stored onsite in a rainwater harvesting system can avoid increasing forest fires. Insurance companies can offer better discounts for those who implement better water management practices.

Miscellaneous Benefits

Rainwater doesn't have the any chemicals in it. Rainwater can be used for irrigation. It is a suitable potable water source. Rainwater harvesting can provide an independent water source in areas where other water sources are not available. In some places where the water quality is poor, we may use rainwater, safely. Good rainwater provides many advantages. Rainwater harvesting is the key to the future water conservation gains.

Rainwater harvesting is a vital resource for the future of sustainable water resources. Reduce demand on Ground Water. Rainwater harvesting is part of a sustainable water supply strategy for local communities.

2. 3 Techniques of Rainwater Harvesting

Rooftop rainwater harvesting (RTRWH) is the most common technique of rainwater harvesting (RWH) for domestic consumption. In urban and rural areas, this is most often practiced method at a small-scale. It is a simple, low-cost technique that requires minimum specific expertise or knowledge. Rainwater is collected from the roof top and transported with gutters in to a storage reservoir, where it provides water at the point of consumption or can be used for recharging a well or the aquifer. Collected rainwater can be the best supplement to other water sources when they become scarce or are of low quality like brackish water, saline groundwater or polluted surface water, in the rainy season. The technology is flexible and adaptable to a very wide variety of geographic and geomorphic conditions. It is used in the developed and the developing societies.

2.4 Different Situations, Different Needs

Through water-scarcity studies, such as those presented in this document, we see that there are different needs for different areas. Three useful categorizations help in understanding these differences:

- water-scarce areas
- high potential areas
- high need areas

Water-Scarce Areas

Areas of physical water scarcity cover much of the globe, including MENA (Middle East and North African) countries, and large parts of SA (South Asia), China, and ECA (Europe and Central Asia), i.e., those areas shown in red on IWMI's water scarcity map. These countries do not have additional water that can be tapped for more development. Water-related problems include groundwater overdraft and pollution that threaten long-term productivity of water. Challenges are reallocating water from lower-value, typically agriculture uses, to higher-value uses in industries, cities and high-value agriculture. This must be done in a manner where poor people can take advantage of the increase in the value of water, and where they do not lose out because water is taken away from them. Managing and designing for water savings in agriculture to free up water for cities, industries and environment are key challenges for many water-stressed areas.

High Potential Areas

Fortunately, water is not a limiting resource in many areas where there is much remaining scope to use water development to help poor people. The Ganges basin, home to

500 million people, many of whom are amongst the poorest in the world, is an example of a high potential area. Much of the Mekong river basin can also be classified as a high potential area. Those areas on IWMI's water scarcity map in SA, East Asia and Pacific (EAP) and Latin America and the Caribbean (LAC), classified as economically water scarce, are typically high potential areas.

In the Ganges basin, there is huge scope remaining to increase production. The problem, of course, is that during a few days of the year, there is too much water, while during most of the year, water supplies are insufficient. Many argue for more large dams, while others look to groundwater and alternative means of storage to help in this area. There is scope for investment in these areas, but these should be made with an understanding of basin-wide impacts of various development alternatives.

High Need Areas

For many people in sub-Saharan Africa, water scarcity is a daily reality. But in many areas there are utilizable water resources that could be tapped. IWMI has termed these regions economically water scarce because these countries do not have the economic, financial and skilled human resources to tap this water supply. In these areas, there is a great need for water resources development but the difficulty in doing so is also quite great. The fact that much of the water serves important ecological functions is not only a major difficulty but also a major point of conflict. Legitimate concerns over water development must deal with equally legitimate concerns over the environment. Oftentimes, those in favor of water for the environment are at loggerheads with those in favor of water for agriculture. Meanwhile, we are far from an optimal solution, and people suffer. A major question in this area is how to use water for agricultural and rural development in a way that meets ecological needs. Much more information is required, and much more dialogue between these two groups is required to meet needs in these areas.

2.5 Key Areas for Interventions in Water Resources Management for Rural Development

To address these issues, IWMI has organized its research program around five key themes. We feel that these are the most critical areas in water resources management for rural development:

- Integrated Water Management for Agriculture
- Smallholder Water and Land Management Systems
- Groundwater
- Environment and Health
- Water Resource Institutions and Policies

The following discussion is based on the experience gained from IWMI's work and involvement with other key players in developing countries including farmers, managers, researchers and policy makers. It touches on these five thematic areas, which we feel are very important for the World Bank's strategy

Integrated Water Resources Management for Agriculture

Reinventing irrigation.

There are considerable concerns about the performance of irrigated agriculture. In many cases, we know that promised goods have not been delivered—productivity remains low, the environment suffers, and issues of poverty have not been adequately addressed. We also know that food security is essential for a growing population in spite of increasing water scarcity and land degradation. And we know we have to preserve nature, and make sure our environment sustains future generations. It is time to put the pieces together to carefully assess the benefits and costs of irrigation. IWMI, with key partners, proposes to perform a comprehensive assessment of the benefits and costs of water management for agriculture. The result will provide key insights into the most pressing question about water: How much irrigation do we really need?

How much irrigation and how we do irrigated agriculture will have profound impacts on people and nature, and are some of the most pressing natural resources questions of the early twenty-first century. The face of irrigated agriculture is changing rapidly, but the public perception of irrigation remains as one of dams and canals. Many new innovations are being realized in the areas of institutions, practices for improving the productivity of water, water-management systems for smallholders such as water-harvesting structures and low-cost drip lines, and in the ways water is managed at the basin scale. There is a need to change the public perception about this new irrigation. Yet there remain serious issues of poverty, groundwater depletion and environmental security that we will address more in this document. If these are successfully addressed, we will have reinvented both irrigation and the way we use water for agriculture. Increasing the productivity of water. It is useful to shift thinking from increasing the productivity of land to increasing the productivity of water where water-scarce areas are concerned. For each drop of water, we should aim at increasing the value added and welfare derived from its use. In agriculture, this means promoting practices that achieve more output per unit of water consumed by agriculture. In the context of a river basin, this means ensuring clean water for drinking and industry. It means wise allocation between sectors and uses of water. It means ensuring enough water for the environment. One of the best ways to free up water for other uses is to improve the productivity of water in agriculture. With more crop from each drop, there is a need for fewer drops. In agriculture there is considerable scope remaining to increase the productivity of water. Productivity gains can be achieved from improved agricultural practices and improved water delivery services (see box). Irrigated agriculture has received a decreasing amount of attention by the international assistance community because of disappointing performance of irrigation systems, increasing interests in the environment and the doubts about the linkage between irrigation development and poverty alleviation. But putting productivity of water in the basin perspective, we see that it has everything to do with helping the environment and helping poor people get the most out of a limited resource. Increasing agricultural productivity of water will free up more water for nature, it will reduce scarcity by giving more opportunities to poor, and with a poverty focus, it can improve their incomes and livelihoods.

Smallholder Water and Land Management Systems

Where other conditions are favorable, smallholders have shown themselves to be willing to adopt new technologies that can help them increase production even when water is scarce. In recent years, there has been an upsurge in adoption of technologies such as treadle pumps, low-cost bucket and drop lines, small portable pump sets, supplemental irrigation, sustainable land management practices in rain-fed areas, recharge and use of groundwater and water-harvesting systems. This wide range of technologies, collectively referred to as smallholder water and land management systems, enable producers to access hitherto unusable water supplies and to compensate for poor levels of service in large-scale irrigation systems. Clearly, this is an area where targeted support can be invaluable in the fight against poverty. These systems give the chance for poor people to gain access to water to gain more income. There are many indications that, by gaining access to water through these approaches, women have greatly benefited. There are possibilities to benefit the poor by designing interventions that recognize the interwoven nature of water and land rights in smallholder irrigation systems. Typically, landownership is a prerequisite for water rights. There may be opportunities to help those with limited access by swapping land and water rights: landowners with limited water rights, and landless with water rights. But it has always been difficult for large agencies to provide effective support for these fragmented and diverse production systems. In many cases, initiatives for developing and 10 introducing these systems come from the producers themselves, often with support from NGOs, rather than through formal government channels: their success is often the direct result of their diversity and flexibility of approach. Care has to be taken in finding appropriate ways in which to foster the continued development and adoption of these locally oriented innovations and avoid the risk of too much top-down control.

III. Advantages

1. **It's easy to maintain.** Maintenance for a rainwater harvesting system requires very little time and energy.
2. **It reduces water bills.** Water harvested can be put to many functions including drinking and non-drinking such as irrigation. Harvesting water can lead to large reduction in utility bills such as the water and energy bill for houses, small businesses, and even at the industrial and commercial level.
3. **It can be used for irrigation.** Because rainwater is free of any chemicals that can be found in groundwater, it is the perfect choice to use for irrigation and landscaping.
4. **It can be used to control fires.** Having large storage tanks that contain harvested water are great in areas known for forest fires as the tank is a readily available water source
5. **It can reduce floods and soil erosion.** It can reduce pesticides from fertilizers that lead to run off water which results in cleaner lakes.

IV. Limitations

1. **The rainfall is unpredictable.** Precipitation is extremely difficult to predict and sometimes no rainfall is supplied meaning the system can't harvest water.
2. **Initial Costs.** The costs of such system can sometimes take anywhere from 10 to 15 years to see any profit.
3. **Maintenance.** While the time and energy might be small these systems can be prone to algae growth and mosquitoes. Thus, this requires regular maintenance of the systems.
4. **Roofs.** The roofs of buildings are the catchment area for most harvesting system. Depending on the roof type, they could allow for unwanted chemicals and animal droppings to enter the system
5. **Storage.** The storage is the highest cost of harvesting systems. There is also the fact the sometimes harvesting systems may not be able to hold all the water that the roofs catch leading to some of the water to enter drains and rivers.

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V. CONCLUSION

In many cases, groundwater or surface water may be unavailable for drinking water. The groundwater level may be too deep, groundwater may be contaminated with minerals and chemicals such as arsenic or salt, surface water may be contaminated with faeces or chemicals. In these cases, rainwater harvesting can be an effective and low-cost solution.

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