IMPACT EVALUATION OF COMMUNITY BASED SOURCE PROTECTION WORKS AND WATER QUALITY MONITORING OF RIVER – A Case Study from India.

Dr Anwar Ali Khan
Water Supply & Environment Officer (ADB)
Department of Urban Development
Govt. of Uttarakhand,India
Email:envanwar@gmail.com

Abstract: Population dwelling in upstream catchments of Big Rivers like Ganga and Yamuna face pressing challenges in water sector in the form of declining per capita availability of water, less water yield from drying sources, deterioration in water quality, over exploitation of water resources due to population growth, industrialization, and infrastructure development. Lack of Sanitation and waste management facilities, discharge of untreated wastewater has contributed to severe deterioration of water quality in terms of bacteriological and chemical pollution. World Bank Assisted Sector Program (Swajal Project) was started in 2006 with the millennium development goal to improve the availability, quality and sustainability of water in appx 8000 villages in the state. The project is 100% based on community participation in planning, implementation and operation and maintenance of catchment area treatment schemes for source protection and its sustainability. Various Engineering and Bio- Engineering works have been completed in 80 villages in the state by the village community. The impact evaluation study was carried out in randomly selected 20 villages. The objective of the study was to analyze the impact of current and further activities and the degree to which objective have been met. The study was aimed to identify the "Social" or "Quality of Life" impacts which appear to be related to such outcomes, and determining the overall extent to which quality of environment in the selected villages has improved and impact on the water sources and downstream water bodies. Paper discusses the various Social, Institutional, Management and Technology related issues related to the Catchment Area Treatment/Source protection and its linkage with restoration of wholesomeness of water bodies serving the huge population in downstream plain. **Key Words: Community Participation, Catchment Area Treatment, Water Quality. Impact Evaluation**

1.0 Introduction: The Uttarakhand state, well known for its rich, natural and cultural heritage, is also marked with characteristics such as inaccessibility, fragile and young ecosystems, inadequate infrastructural facilities, poverty and politically and economically marginalized peoples living in remote rural areas in the state. Communities, that are totally dependent on natural resources for livelihood, are facing a serious threat to their survival due to increased rate of depletion of natural wealth and degraded environment. These areas we are talking are the catchments of origin of major rivers of India viz, Ganga and Yamuna which are lifeline to the down-steam 7 states comprising of more than 20 million people who in turn depend on these rivers for potable water, irrigation, tourism and pilgrimage. To reverse the trend of environmental degradation and ensure sustainable livelihood to the people, the participatory integrated watershed management approach has been very effective to reverse the trend. The key thrust of this approach is to seek active and effective participation of community as a major stakeholder in conservation, regeneration and the judicious use of all the natural resources - land, water, plants and animals within a particular watershed. Community based Catchment area treatment and measuring water quality of the sources and their storage tanks and stand post has been the major intervention which has laid the success in restoration of water quality.

The participatory approaches are being recognized as a powerful and helpful tool for achieving the goals and objectives of any program, especially in developing a sense of ownership, accountability and responsibility among the community to save their water body.

1.1 Background of the study

The Uttarakhand Rural Water Supply & Environmental Sanitation (Swajal) Project was initiated as an innovative experiment in the Rural Drinking Water and Environmental Sanitation (RWSS) Sector in 2006 in the state of Uttarakhand with the objective to achieve the millennium development goal of providing water and sanitation to all people in the state by 2012 and to address the issue of sustainability of water resources. This project is being funded by World Bank. Demand responsive approach, 100% community participation and decision making, capital cost sharing, community ownership of water supply and source protection schemes were the main principles of the project. The main focus of the project was to adopt a participatory approach for management of drinking water, livestock and horticulture development, crop production, realizing gainful employment, ensuring environmental security and strengthening capacities of local people. Special emphasis has been given on mobilizing and involving local people right from the stage of planning and identifying the priorities up to the implementation and monitoring of the programme through participatory approach. Community based Catchment Area Treatment and Water quality monitoring and surveillance is the integrated part of this project.

1.2. Study Objectives

In this background, a study on "Impact Evaluation of Catchment Area Treatment works and Water Quality Monitoring – A case study of in Uttarakhand state" was conducted in the Swajal project with the World Bank support. The main objectives of the study were to learn from the experiences of the project and capture the successes of the programme for replication in other watersheds of India. The study covers the impacts of 'Community based Catchment Area Treatment Works Management Project' on social, economic and ecological aspects mainly agriculture and horticulture development, forest conservation, ecological security and income and employment opportunities. Impact of community based water quality surveillance and monitoring has also been evaluated in terms of the water quality of their potable drinking water and consequently their health. Under this project the Catchment Area Conservation and Management Activities were carried out in 80 villages in the state which are characterized as an inaccessible, resource poor, and fragile but ecologically important region. The present paper gives an account of Impact Evaluation study conducted for Catchment Area Treatment works carried out in randomly selected 20 villages under the project. The objective of the study was to make an assessment of Long Term Catchment Area Conservation and Management Works carried out under the project and the degree to which objective have been met. The study was aimed to identify the "Social" or "Quality of Life" impacts which appear to be related to such outcomes, and determining the overall extent to which quality of life in the selected villages has improved and impact on water quality of the sources and downstream water bodies.

1.3 Methodology:

In the present study both qualitative and quantitative research methods have been used. An efficient and effective plan has been formulated for collection of primary and secondary information, analysis of data and report preparation**.**

2.0 Economic profile of the households: It was revealed that relatively higher proportion of households in rural areas is land owners (92.2percent). But most of them (94 percent) have less than 5 acres of land; while about 4 percent of landowners have5-10 acres.Details were sought from respondent households on their occupation status and accordingly categorized to understand the main source of their household income. About 93 percent of the households are engaged in farming activity. Only about 4 percent are agriculture laborers. As such, there hasn't been any change in the occupational status before and after project. About three-fifth of the households have average monthly income of Rs. 1000.

3.0 Catchment Area Treatment Works.

As per Sector program Guidelines, the CACMP was implemented in four distinct phases;

Phase I: Preliminary Survey for identification of sources

A survey was done and those sources have been identified where there is a need of CACMP activities for restoring water availability or maintaining quality. Only those sources were taken where some problem of water quality or availability exists due to water contamination or depletion.

Phase II: Baseline data generation

The next phase was baseline data generation through extensive field work and use of Participatory Rural Appraisal technique. In this phase, the village resource map has been generated and preliminary mapping of Catchment Area has been done. During this phase, User Water Sanitation Group was formed.

Phase III: Delineation of treatment zone

As per the guideline, in-depth bio-geographical survey of the area for delineation of treatment zones was done by the Engineers.

Phase IV: Development of CACMP

After all these phases, actual CACMP development plan was chalked out and attached in the DPR. The plan included technical interventions to be done, implementation schedules, maintenance plan and assessment plan. The Engineering and Bio-Engineering Catchment Area Treatment works have been taken up as part of activities for improvement of Catchment area. The major activities include**:**

Plantation- Plantation has been carried out in some of the schemes for improvement of catchment like scheme Daunk in Tehri, Korva Sagaria in Dehradun, Kasnu Saryali in Dehradun etc.

Check Dams & Coolie Walling- Check dams and coolie walling have been constructed under the programme to check the runoff of water in some of the schemes, for instance in Agar scheme in Almora.

Recharge Pit-Recharge pits have been constructed in catchment areas of most of the schemes**.**

Chalkhal- Chalkhals were found to be constructed under Uttarakhand Rural Water Supply And Sanitation Program. Some natural chalkhals that were rejuvenated under Uttarakhand Jal Sansthan schemes are found to be in working condition.

Grass patch- Grass patches are an important biological method ofCatchment Area Treatment. Though it was planned for about 10 catchment areas but none of them have been implemented**.**

Contour trench- Contour trenches have been constructed under the programme in some catchment areas being visited by us during our study.

3.1. Adequacy and efficacy of the Engineering and Bio-Engineering Catchment area.

Sector Programme has achieved success in providing water to the community. However, Catchment area management programme has attained the tempo during the later stage. It was found from interactions with the stakeholders that the activities for CACMP were undertaken slightly late somewhere after exhausting the funds which were meant for it.

Nearly 77 percent of the activities that had been planned have been implemented, it is important to note that sampling was based on number of activities being taken up in each catchment. This means that the catchment area where more number of activities have been taken up have fair chance of selection. From the villager's perspective, they see this programme to provide them water at their door step. The money that has been provided to the Gram Panchayat/ Water User Sanitation Group for development of the scheme has been provided in three instalments i.e. 40:40:20, and the fund for catchment area treatment was included in each installment. During the interactions with the community, our study team found that more than 80% of the funds have been spent in developing the water supply scheme and CACMP activity was done with the last installment.

Apart from that, plantation in hills requires high level of commitment of the user community to maintain so that the plants survive but it seems that the user community are only concerned about the water. Thus, the CACMP activities have limited outcome despite the ambitious goals as they cannot be managed by the community within the limited implementation phase period.. The study has identified the critical concerns hampering the proper implementation of the catchment area treatment interventions viz; lack of integrated water resource management approach as most of the water sources lie in reserve forests; where public entry is prohibited. This land ownership pattern in the state makes source centered catchment activities complex and multi-Institutional. The socio-political factor includes conflicts over the water source in upstream and downstream communities. Benefit sharing has been affecting the water schemes and sources in many ways. Water shortage has always been instrumental in increasing such conflicts, which in turn creates more problems like damage to pipe lines, intentional degradation of catchments areas, open defecation, garbage dumping etc. Absence of Geo-hydrological considerations in selection of the engineering and bioengineering interventions, lack of source discharge data, lack of adequate funds for recharge works, Insufficient Information, Education, Communication (IEC) campaign and lack of capacity building among NGO's and officers to motivate the community are few limitations for effective implementation of the catchment area treatment work.

3.2. Impact of CACMP:

The impact of the Catchment area treatment interventions is positive in terms of increase in water yield over short time, reduction in soil erosion, regeneration of plants, improved water quality of water bodies, environmental awareness in upstream community, improved livelihood, and improved agricultural yield. It implies that interventions applied in the project could be replicated in next phase of the project subject to the hydro- geological conditions, topography of the catchment area. The study has come up with some well defined indicators for selecting the type of components of works for specific catchment and other indicators for impact assessment of various activities during implementation and post implementation of the schemes. A comparison is also made with other watershed development projects running in the region and critical limitations of these projects with regards to water source recharge are also discussed

3.2.1 Impact on Quality of Life: The scheme (CACMP) of Batch 1A has many issues as mentioned in earlier sections. However, it has helped a lot in providing water to the households who were earlier forced to travel long distances in search of water. Thus, these schemes have helped a lot in enhancing the quality of life of habitations. Also, various capacity building activities have been implemented as part of scheme development which has helped in governing and empowering the community, now they are ready to work together for betterment of their own village and they feel that issue of water can be sorted out if they will remain united. It was also reported that some of the habitations have done some plantation with their own money for improving the status of their Catchment. They feel proud that their schemes have been successful in decreasing the waiting time spent per household for drinking water collection.

3.2.2. Impact on Household Income

Table1 provides information about the impact of catchment area conservation and management program on the source of income of household and to average monthly income. It was observed that there is some impact on economic condition due to CACMP

Table 1: Impact of CACMP on Household Income

Main source of income of household	Before Project		After Project	
	Number of Households	Percent	Number of Households	Percent
Farming/Cultivation	555	92.5	562	93.7
Agricultural labour	19	3.2	21	3.5
Livestock/forestry/fishing/orchards/allied activities	1	0.2	2	0.3
Business	1	0.2	1	0.2
Service(government/private)	17	2.8	5	0.8
Others (specify)	7	1.2	9	1.5

Average monthly income of household	Before Project		After Project	
	Number of Households	Percent	Number of Households	Percent
Rs. 1000	373	62.2	374	62.3
Rs. 1001-5000	205	34.2	171	28.5
Rs.5001-10000	17	2.8	41	6.8
Rs 10001-15000	2	0.3	10	1.7
5001<	3	0.3	4	0.7
Source: MM Sample survey				

3.2.3. Impact on Empowering the Community:

The scheme has united the community for a general cause of water and sanitation, community is now empowered and aware about their basic right of water.

Several capacity building programmes have been organized in the villages and the villagers have been motivated to come and talk in a same platform for a common cause i.e. water. In most of the villages community has been maintaining the schemes by collecting user charges on monthly basis but is limited up to operation and maintenance of the scheme not beyond that. It was observed that community has been empowered and awareness programmes have been launched not only regarding environmental issues but also on governance issues like handling and managing the operation of schemes and the community forest. As high as 90 percent of the villagers agreed that they have been provided information about this environment and how they can save it for betterment. As high as 94 percent of the villagers were found to be aware about environment issues like impact of deforestation and cause of depletion of their perennial springs.

3.2.4. Impact on Forest Cover & Plantation Activities: The removal of vegetation largely for fuel wood, which has been accelerating over the past 50 years and still continues, has worsened ecological conditions. While analyzing the impact of project on forest cover we could see that the forest matrix was showing a positive sign, as the net change was only 2 percent raise in forest cover during 2007.

3.2.5. Impact on overall CACMP Activities: The overall impact of CACMP of Batch 1 A has been felt and it was found that both the implementers and the community did have complete understanding of the project. In most of the places the scheme was launched through gram panchayat wherein the gram panchayat was more interested in water than the catchment area works. However, the project has generated the awareness among the community. A short time frame of intervention of CACMP is not a good idea- this should have been undertaken simultaneously with the water supply system being put in place with subsequent phase of regular monitoring of catchment area works wherein the community is driven so that they feel proud to conserve their own environment and hygienic environment sanitation becomes their habit.

4.0. Community Based River Quality Monitoring of Water:

Monitoring water supply and its health was concern to many rural communities. Citizen groups in the Rudraprayag (Uttarakhnad) are actively gathering water data and monitoring the health of local rivers and streams. These watershed groups are forging a new governance model for citizens to better understand their watersheds and use this knowledge to take a more active role in the decision-making process to ensure water sustainability in their communities. Community-based water monitoring (CBWM) is one activity that can be used to bridge citizens' involvement with decision-makers in a partnership of shared responsibility for planning and managing a sustainable water system.

4.1. Sustainable Development Characteristics

Water governance in the rural areas of Uttarakhand cannot be shaped by government agencies alone, but needs to include the cultural norms and values of the people who live and work in the region. Governments and community members are increasingly recognizing that non-government actors like citizens, non-government organizations, and business are essential to effective water management. Thus, connection and collaboration between community-based organizations, like the ones found in the Ganga Basin, which are monitoring water quality, involved with water education and outreach, and restoration efforts, along with the decision-makers making and enforcing policy around water, is fundamental to sustainable community development.

4.2. Critical Success Factors

For a system to make the kind of transformation required to implement sustainable development, power and authority must be linked and distributed among the various stakeholders. By bridging the existing bonding social capital, a community can facilitate effective information generation-sharing, decision-making and accountability, and the distribution of resources and wealth (Doppelt, 2003). In the Ganga Basin, there is some evidence that this is being achieved and that effective bridging social capital between community water monitoring groups and decision-makers is being generated. User water groups of gram panchayats initiatives are examples of when groups are connected and the inclusion of multiple values, knowledge and interests of different stakeholders come together to create a co-management framework. With this framework, there is a space created that allows for sharing of knowledge, agreement on parameters for monitoring, and the publication and dissemination of knowledge to the wider community.

What Worked?

The User Water and Sanitation Group emulated a positive working relationship with the District Water Authorities. Working together, River Water Quality data was incorporated into the Project Community Plan and guidance document for district water sanitation mission. This group was also able to update the PMU at State level. These meetings enabled all of the individuals involved in water stewardship to

understand that they all share the common goal of protecting water resources while building a foundation of trust and respect for each other. It involved women and school children.

What Didn't Work?

This case study revealed four key areas where community-based action groups need to be more strategic. Managing and analysing the collected water data is difficult for both community groups and decision-makers. With each group working independently to collect their own data sets, there are few resources available to compile and analyse the data, keep the data current and disseminate the information to other decision-makers and communities. This reinforces the argument that community groups and decision-makers need to work in a partnership with shared responsibility for planning and managing a sustainable water system.

Local water management knowledge is also in jeopardy since few of the groups have viable succession plans to replace the current leadership. They are challenged to find volunteers, especially since the population is seasonal, and in some cases, many of the full-time residents have had to relocate due to increasing property values and taxation rates. Decision-makers have similar problems due to the nature of government, with a subsequent loss of continuity between citizen-based groups and the decision-makers. With some rapid changes in civil servants, citizen-based groups have had to continuously re-establish their credibility and legitimacy to new staff.

There are various levels of trust and respect between community-based water groups and decision-makers. A lack of trust in the region can be traced back to past perceptions of one another, poor communication, and weak networks between the two groups. By allowing these perceptions to persist, relationships between these two working groups will languish limiting the available social capital needed to protect the region's water systems. There are also various monitoring and reporting protocols used by both community groups and decision makers involved. This complicates the communication issues and networking capabilities between the different water monitoring groups, further eroding the much needed social capital to facilitate a new governance model.

The data revealed that there are often conflicting priorities between citizen-based monitoring groups and traditional decision-makers. Citizens are concerned with water quality, quantity and the relationship between healthy water and healthy communities. Decision-makers are concerned with the lack of integrated management, lack of historical data to guide future decisions and the decline in available government human and financial resources. These differing priorities have ultimately led to differing visions and indicators. Community groups want to use a holistic approach to protect water quality and quantity since healthy aquatic ecosystems are a large of part of water sustainability. Decision-makers, on the other hand, are mandated to see water users comply with laws, regulations, permits and licenses, and balance competing interests with societal objectives while making sure drinking water is safe, clean and reliable. Clearly, integration of these perspectives would lead to a more sustainable water management system in the long-term.

Shrinking financial resources have seriously eroded the ability of governments to act alone, thus, arguing for this new model of governance based on citizen-based science working in intimate partnership with government scientists.

The citizens in this case study were willing and able to participate actively to shape a water sustainable future with a high degree of volunteer capacity; in fact, they are vital to achieving this desired future state.

5.0 Conclusion: Water will continue to be a scarce resource in the region as long as steps leading to retention of rainwater and water recharge do not find place in all drinking water schemes. As aquifer yield is a function of many ecosystem processes, water yield can be increased only when "Source Centred Catchment Area Management" measures are adopted as per site condition. This needs multidirectional approach and action, scaling from engineering and vegetative measures in the recharge zones to social measures in beneficiary villages for management, rational use and aftercare of the water sources. Multiple land tenure system in the catchment area and recharge zones has also to be resolved with stakeholder participation. Indeed, no Government can deal with this complex ecosystem function alone without cooperation and participation of the target population. Traditional water management often has many

merits and it has been stated that the State Government should play the role of a facilitator, enabling inhabitants to reassume greater responsibility for local water management, which may aid the planning of future interventions. CAMP Project was successful to a great extent in improving the productivity of crops and enhancing the livelihood opportunities of local people mainly by the change in livestock composition pattern and new farming technologies. The encouraging results of this innovative project lie in the fact that the people themselves are practicing water quality monitoring and a positive mindset has been developed for river water quality restoration and source protection. The encouraging results of this project shows the way forward for adopting a similar approach with proper follow-ups in other watersheds covering a larger area for a longer period of time to achieve a long-term impact and bigger extrapolation.

Reference:

1. Backstrand, K. (2003). Civic science for sustainability: reframing the role of experts, policy-makers and citizens in environmental governance. *Global Environmental Politics, 3*(4), 24-41.

2. Bradshaw, G. & M. Bekoff. (2001). Ecology and social responsibility: the re-embodiment of science. *TRENDS in Ecology & Evolution 16*(8), 460-465.

3. Doppelt, B. (2003),Overcoming the seven sustainability blunders. *The Systems Thinker 14*(5), 1-7.

4 .Uttarakhand Rural Water Supply and Environmental Sanitation Project Reports.

5. Environment Management Framework of World Bank assisted Swajal Project.