

PARTICIPATORY RS AND GIS FOR MICRO LEVEL WATERSHED PLANNING AND MANAGEMENT

Dr. U.N. Roy

National Institute of Technical Teachers' Training and Research, Chandigarh - 160 019, India (unroy2000@yahoo.com)

Abstract

Remote sensing and GIS has emerged as an effective tool for the macro and micro level mapping of natural resources. With the increased resolution in RS data the accuracy in mapping has increased multifold and further these data may be uniformly overlaid on the geographical maps of the region or locality with various GIS packages. In order to have people's viewpoint in the validation of ground level truths and actualization of planning and management of natural resources the PRA/RRA (Participatory Rural Appraisal/ Rapid Rural Appraisal) Exercises are very useful. These exercises are helpful in identification of the sites for the construction of water harvesting structures, mapping the potentiality of the natural resources and most important thing is that it ensures people's participation in the management of natural resources. Thus, the participatory RS and GIS is the need for hour for micro level planning and management.

Keywords: Participatory Micro-planning for watershed management, PRA/RRA, remote sensing, GIS etc.

1. INTRODUCTION

Watershed Management Programme has emerged as a sustainable strategy to conserve the natural resources i.e. water, forest and soil in an integrated manner particularly in the rain fed and drought areas. As per an estimate of Government of India out of the total geographical area (329 million hectare), two third (260 million hectare) of its area is drought prone and 144.30 million hectare is subjected to degradation due to soil erosion (Wasteland Development Board, 1992). The integrated and holistic approach of watershed development has been focused for sustainable development of the society. The planners, academicians, development professionals, NGO activists, and national and international funding agencies like Government of India and World Bank have led a major emphasis on development through watershed management approach. The people's participation has been termed as a key to success of watershed development. Sukhomajri Project in Ambala district, Haryana (India) was a turning point for the Gujjars (a nomadic tribe) of Sukhomajri who were living in their traditional way before the watershed project intervention in 1979. They were the poor graziers/ shepherds. Their land was not irrigated and they were dependent on rainfed farming. The forest areas near to village Sukhomajri was highly degraded. Later on successful implementation of watershed projects and creation of water harvesting structures provided sustainable livelihood to the Gujjar families. People of the village

organized themselves gave up grazing as occupation to protect the near by forest which was highly degraded. This concept was popularly known as 'social fencing' (Mishra and Sarin, 1987).

In mid eighties the watershed projects were launched in a massive way in Haryana and Punjab as a replication of Sukhomajri model. In Punjab Soil Conservation Department, Irrigation Department initiated the works in mid eighties. Later on World Bank assisted first phase of integrated watershed development projects were initiated in 1990 for five years but extended up to 1997. The major works were undertaken initially by Soil conservation Department, which constructed 66 earthen dams, and 33 Makkowal type Water harvesting structures (Soil Conservation Department, Punjab 2000). The Irrigation Department has constructed 9 dams till 2000 (Irrigation Department, Lal, 2000). The IWDP has constructed about 20 Makkowal type water-harvesting structures (IWDP, 1999). Thus total water harvesting structures created in the Kandi villages of the four districts of Punjab i.e. Patiala, Ropar, Nawanshahar, Hoshiarpur and Gurdaspur is about 130.

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(a) Ecological Sustainability

Whether the WSMP (Watershed Management Programme) has resulted in 'Ecological Sustainability' with respect to increase in (a) irrigation potential and ground water recharge, (b) forest cover, (c) fodder and *Bhabbar* grasses (d) reduction in run-off and soil loss and (e) decrease in number of incidence of grazing and number of grazing animals.

(b) Economic Sustainability

Whether the WSMP has generated 'Economic Sustainability' in terms of increase in (a) Cropping intensity (b) food grain production (c) quality of livestock and milk production (d) employment generation and (e) augmentation of assets.

(c) Social Sustainability

Whether the WSMP has contributed to 'Social Sustainability' with respect to 'equity' dimension i.e. in terms of class, caste and gender in

- (i) distribution of generated resources through the WSMP like irrigation potential, fodder, *Bhabbar* grass etc., and
- (ii) generation of assets structure, employment and other forms of tangible / intangible benefits.
- (iii) Whether the WSMP has ensured active involvement of the beneficiary and non-beneficiary groups (with respect to caste, class and gender) in decision making and empowerment process;
- (iv) Whether the WSMP has led to the emergence of effective leadership, creation and functioning of viable social institutions like VDC (Village Development Committee), WUS (Water Users' Society), FPC (Forest Protection Committee) and other social institutions on sustainable basis

2. Research Methodology and Data Collection Techniques

The Shivalik of Himalayas are made of sedimentary rocks have a long range from Jammu (north-west) to Darjeeling (east) in India. The Shivalik region of Punjab is popularly known as *Kandi* area which is the universe for the present study. The *Kandi* area of Punjab mainly falls in Ropar, Nawanshahar and Hoshiapur districts. In order to study sustainability of the watershed projects 6 watershed villages were selected out these 130 water-harvesting villages excluding the Patiala and Gurdaspur district, because major works were undertaken in the Ropar, Nawanshahar and Hoshiapur District. The criterion for the selection of watershed villages was the sociological criterion to select equal number of homogeneous and heterogeneous caste composition villages. Thus total six (06) villages; 3 homogeneous and 3 heterogeneous villages were selected after conducting a pilot study of about 20 villages in these three districts selecting randomly from all

the three districts. Total sample size was 240 men and 240 women were selected from 240 households. Apart from 06 (six) watershed villages; 02 forest dependent namely Ballawal-saunkhari from Nawanshahar and Dada from Hoshiapur districts were selected especially to examine JFM activities in Punjab. The data was collected through interview schedule methods from all the households. However the case studies and PRA/RRA techniques constituted major of qualitative data. The PRA/RRA exercises were conducted mainly to understand the various problems of villagers, the solutions or alternatives suggested by them and micro-planning of one small village was done in detail. A total 240 men and 240 women from 240 households were interviewed in watershed villages and 60 men and 60 women were selected from 60 households from the forest dependent villages. Thus total sample size was 600 respondents.

3. Results and Discussion (Major Findings of Watershed Villages)

The WSMP (Watershed Management Programme) run by various agencies have been proved successful in providing sustainable livelihood to the direct beneficiaries who constitute the 27% of the population in terms of families. The agricultural production, milk production, income and employment status for the direct beneficiaries have improved significantly. Crop production has increased more than two times and milk production more than one and half times after the project's intervention. The net annual average income has gone up to Rs. 56, 000 which is just double of the NBLOFs (Non-beneficiary Landowning Families). It has also proved successful in terms of ecological sustainability to create water harvesting structure and taking other measures in the field of soil and water conservation and forestry programme. The achievements made in the indicators like increase in surface and ground water potential, decline in the soil erosion and increase in forests cover etc., have helped in the rehabilitation of the ecologically degraded *Kandi* region. The *Makkowal* type surface and sub-surface water harvesting structure had a better performance in comparison of the earthen dams. The major problems in the earthen dams were the high rate of siltation (sedimentation).

A large number of the non-beneficiary farmers (they constitute 41% of the total population in terms of family) were not provided with any alternative mechanism for the irrigation, which was the major demand among the left out farmers of the village. Their status has hardly improved. The net average annual income of the NBLOFs was Rs. 27,000 just half of the DBFs. About 70% of the NBLOFs are still dependent on seasonal migration to work as *Paledars* (Loading unloading work) in the nearby grain markets. Thus the disparity in income between two landowning groups has increased due to the intervention of WSMP.

WSMP has failed to provide social equity in terms class, caste and gender. A major section about 73% of the population was not benefited from the programme. The status of landless schedule castes (*dalits*) has hardly improved. Their net average annual income of *dalit* forest dwellers is Rs. 22, 000 placing the majority

of them below poverty line. There is no access to the forest resources for the landless dalits and artisans in the privately owned forest (*Mustarka Malkan Land*). The rope making used to provide sustainable livelihood to the forest dweller, but now many of the traditional rope makers are bound to leave this occupation due to increase in price of Bhabbar grass, less production of Bhabbar and low marketability of the finished product i.e. rope. The major demand of *Dalit* forest dwellers was the ¼th share in forest produces mainly Bhabbar as their livelihood is dependent on this in a major way.

The people's participation was not ensured in 4 out of 6 watershed project villages before the implementation of the project. The functionality of the created social institutions has many mixed stories. The group conflicts have dampened the dynamism of the societies like Makkowal and Nara, which were working successfully 2-3 years back. The women folks were hardly involved in the WSMP at any stage. There was no special programme for the women folk. The integrated approach could not be proved beneficial for all sections of the society. The capacity building component of the functionaries of the village level society needs special attention because in most of the cases the village institutions were not found working successfully. The major ingredients of Social Sustainability emerging out of the study are 1. Equity with respect to caste, class and gender is necessary condition and social homogeneity with respect to caste composition is sufficient condition. 2. Project Staffs Initiatives followed by active People's Participation or Initiatives emerge as an essential ingredient of Social Sustainability. From sociological angle the social inequity, non-functionality of the village level institutions (conflicts and court cases), non-participation of the common members and women folk were the major weaknesses of the WSMP in studied watershed villages.

The JFM programme could not be initiated in the forest dependent villages. The status of landless *dalits* was found miserable. In the *Panchayat* forestland they had the share in the forest resources through the *Panchayati Raj* department, but in government forestland they had hardly any right to collect the *Bhabbar* grass on which their livelihood is dependent. The major demand of the *dalits* forest dwellers (rope makers) was the ¼th share in the *Bhabbar* grass production which otherwise auctioned by the forest department to the local contractors who exploit the rope makers. Thus the attitudes and vision of the Forest Department officials need to be changed.

4. Participatory Mapping with the Villagers (Non-beneficiary Families)

As about 73% of the population was non-beneficiary of IWDP, thus some alternative solution to their problems were asked from the non-beneficiary groups of the farmers and landless. The details of some of the PRA/RRA exercises are presented as follows:

(a) Village Makkowal

Makkowal is a Chang caste dominated village in Dasuya Block of Hoshiarpur district. The watershed management project was initiated in the year 1986-87 by the Soil and Water Conservation Department, Punjab. It was the first watershed management project based on Sukhomajri Experiment. The total investment was about Rs. 4.0 lakhs. The total number of beneficiary was about 80. The number of non-beneficiary land owning farmers constitutes a major group of 100.

The major problem at village Makkowal is the unequal distribution of water among the farmers. The conflict between beneficiary and non-beneficiary families was so acute during 1999 that it resulted into severe conflicts and court cases. During the discussion with the non-beneficiary farmers suggested some alternatives for providing irrigation facilities to the left out farmers. The participatory map was prepared and later on discussed with them in a group meeting. The map shows how the present water harvesting structure leaves apart a major section of the community who demand for alternative irrigation facilities.

(b) Village Nara

Nara is a *dalits* dominated village in Hoshiarpur – II block of Hoshiarpur district. The watershed experiment was launched by the Soil and Water Conservation Department, Punjab in the year 1995-96. The total investment in the project was Rs. 21.60 Lakhs. The project staffs did not follow the participatory approach for the installation of the watershed project. The result of this the majority of the villagers remained non-benefited from the project. Only 43 *dalit* farmers were benefited. The number of non-beneficiary land owning families in the village was 70. Many of the non-beneficiary farmers suggested during the mapping exercise that about 30 additional small farmers could also be included in the project if an extension pipelines are provided to them.

(c) Village Takarla

Takarla is Gujjar dominated village. The watershed management project was launched by the Soil and Water Conservation Department, Punjab in 1995-96. The total investment was Rs. 17.46 lakhs. The benefits of the project went to 84 Gujjar families leaving other 216 families non-benefited from the project. About 150 non-beneficiary farmers do not have better irrigation facilities. In last few years few medium-rich farmers have installed tube-wells as an alternative for the irrigation facilities. But these are costly and not affordable by all the farmers. During fieldwork a participatory mapping was done for the existing water resources facilities and possibilities of other alternatives like tube-wells, earthen dams suggested by the non-beneficiary farmers which can supplement their irrigation demand. The map clearly indicates their alternative solutions. Thus, the PRA/RRA exercises help us to correct our mistakes and find out solutions from equity point of view.

5. Conclusions

The WSMP (Watershed Management Programme) run by various agencies in Punjab Shivalik in India have been proved successful in providing sustainable livelihood to the direct beneficiaries who constitute only 27% of the population in terms of families. The agricultural production, milk production, income and employment status for the direct beneficiaries have improved significantly. It has also proved successful in terms of ecological sustainability to create water harvesting structure and taking other measures in the field of soil and water conservation and forestry programme. The food grain production and milk production has increased more than 1.5 times due to project interventions.

WSMP has failed to provide social equity in terms class, caste and gender. A major section about 73% of the population was not benefited from the programme. The status of landless dalits has hardly improved. The people's participation was not ensured in 4 out of 6 watershed project villages before the implementation of the project. The functionality of the created social institutions has many mixed stories. The group conflicts have dampened the dynamism of the societies like Makkowal and Nara, which were working successfully 2-3 years back. The women folks were hardly involved in the WSMP at any stage. There was no special programme for the women folk. The integrated approach could not be proved beneficial for all sections of the society.

The major reason of uneven development was that the government officials did not follow participatory approach of development. PRA/RRA exercises were hardly conducted to ensure people's participation. The maps were prepared with the help of RS and GIS by the development agencies, but so far no participatory exercises were conducted. Although the project officials talk about people's participation in micro-planning, implementation and monitoring of the project. But they still follow the stereotype bureaucratic approach and project works were implemented by contractors. The RS and GIS has proved an effective tools to map and monitor the natural resources including watershed development projects, but in order to implement the watershed management projects at the grass roots the PRA/RRA exercises emerge as the effective tools to map the natural resources and its equal distribution to ensure people's participation. Further it would also be helpful in monitoring the impact of the programme. The suggestions made during participatory impact study by some affected farmers to provide them alternative source of irrigation were very important for follow up and long term sustainability of the project ensuring equity.

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