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Livelihood and socio-economic development through watershed management - An impact assessment of Lachhaputraghati tribal catchment

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ABSTRACT

Livelihood and socio-economic development are the most important indices of development of tribal agrarian community particularly those of rainfed areas. A model watershed in the tribal dominated areas of southern Odisha was developed using diverse treatments implemented by ICAR-IISWC, Research Centre, Koraput. A comprehensive assessment of watershed was taken up to gauge socio-economic impacts of various technological interventions. The overall watershed productivity increased from 4962 kg ha^{-1} (pre-project) to 6126 kg ha^{-1} (19%) post-project period. The average human population carrying capacity of crops increased from 4.0 to 4.4 with an increase of 9.3%. The overall People Participation Index was found to be 56% indicating that the stakeholders' overall participation was above the medium level. Income and expenditure analysis revealed that due to project implementation, large farmers showed interest in initiating large scale enterprises *i.e.,* poultry and livestock. Among medium and small farmers, agricultural activities registered an increase of 15% which shows their diversification from labour work and their engagement in their own activities. A significant decrease of 5% in fuelwood sales shows the changing attitude as well as dependency on forests. Among economic parameters, BC ratio at 10% discount rate was found to be 1.16 with an internal Rate of Return of 19.5%.

1. INTRODUCTION

Livelihood designates a set of activities involving securing water, food, fodder, medicine, shelter, clothing and the capacity to acquire above necessities working either individually or as a group by using endowments (both human and material) for meeting the requirements of the self and his/her household on a sustainable basis with dignity. The sustainable livelihoods idea was advocated by Chambers and Conway (1992), they proposed that "A livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living; a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, provide sustainable livelihood opportunities for the next generation and which contributes net benefits to other livelihoods at the local and global levels in the short and long term".

Livelihood security with a strong commitment for natural resource conservation would be the foremost challenge of the 21st Century. Globally, 80% of agriculture is rainfed and contributes 60% to world's food basket. Current productivity of rainfed agriculture is low (<1 t ha^{-1}) and needs to be increased for sustainable agricultural productivity to achieve second green revolution. Holistic development of the rainfed areas is one of the prime concerns of the Government of India. About 60% of total arable land (142 m ha) in the country are rainfed which are characterized by low productivity, low income, low employment with high incidence of poverty. Catchment development is one of the most trusted and eco-friendly approaches to manage rainwater and other natural resources, which has paid rich dividends in the rainfed areas and is capable of addressing many natural, social and environmental issues (Rockstorm *et al*., 2007). Management of natural resources at the watershed scale produce multiple benefits in terms of increasing food production, improving livelihood, protecting environment, addressing gender and equity issues along with biodiversity concerns (Ahluwalia, 2005) and is also recommended as the best option to upgrade rainfed agriculture to meet the

growing food demand globally. The challenge before the Indian agriculture therefore, is to transform rainfed farming into more sustainable and productive systems through efficient use of natural resources through the integrated resource management following the concept of participatory integrated watershed management.

Eastern Region of India has a predominance of tribal population (54 tribal communities) constituting about 30% of the total population of 37.9 million (Chauhan, 1998). It is also observed that around 62.5% of the total geographical area of Eastern region is degraded exclusively by water induced soil erosion which in conjunction with salt-affected and acid soils works out to be 74%. A model watershed in the tribal dominated areas of southern Odisha was implemented by ICAR-IISWC, Research Centre, Sunabeda, Koraput under the Macro Management of Agriculture (MMA); National Watershed Development Programme for Rainfed Areas (NWDPRA), sponsored by the MoA, Govt. of India, New Delhi. Koraput district is one among the top one-third districts (167 nos.) based on high Rainfed Areas Prioritization Index (RAPI) developed by the NRAA (2012). A comprehensive assessment of watershed was taken up to assess socio-economic impacts of various interventions.

2. MATERIALS AND METHODS

Study Area

Lachhaputraghati watershed is located in Pottangi Tehsil of Koraput District in Odisha state. The geographical location is 82°56' to 82°58' E longitude and 19°45' to 19°47' N latitude with an elevation range of 900 m to 1258 m above msl with an area of about 601.24 ha having undulating to steep sloping (up to 50%) topography. The order of the watershed is 4th with a drainage density of 7.14 km km^{-2}. The climate of the watershed is warm and humid with an annual mean maximum and minimum temperature of 35.8°C and 7.6°C, respectively. The normal annual rainfall is 1452.2 mm which is received in 77 rainy days. About 81% of the total rainfall is received from June to September (South-West monsoon). Out of the total geographical area of catchment (601.24 ha) maximum area is under degraded forest (61%) followed by cultivated area (20.15%), current fallow (11.5%), area under non-agricultural use (6.0%) and pasture land (1.4%). The watershed has population of 992 living in 315 households. Lachhaputraghati watershed possesses 66% tribal population. Major occupation is agriculture and landless labours. The average land holding is 0.52 ha with an average family income is ₹ 2500 month^{-1}.

Project Implementation Strategies

The programme was implemented following a participatory approach with active community participation at all the stages of the project following "Common guidelines for watershed development projects" (NRAA, 2008). Various interventions were undertaken in the watershed based on the Participatory Rural Appraisal (PRA) based detailed project report (DPR) made on the problems, needs, priorities of the watershed community, their technical suitability and economic viability. The watershed development activities taken were soil and water conservation measures in arable lands, water resource development, productivity enhancement activities, entry point, income generation activities and community organization including capacity building.

Monitoring and Impact Assessment Methodology

The present study on impact analysis is based on the baseline data collected during 2008 (Jakhar *et al.,* 2010), data monitored and collected during the project implementation period till June 2013. Data was collected through field visits, detailed resource survey, household survey, PRA techniques, meeting, interviews and fragmented group discussions during pre-project and post-project implementation of the watershed project. Periodic monitoring and measurement of social-economic parameters were collected in terms of contribution, change in income, income from SHGs, participation of the community in different activities *etc*. through pre-tested questionnaires and interviews. Data on expenditure incurred on various activities of watershed development were compiled from the expenditure statements (audited bills). The post-project impact assessment of investment in watershed activities in the village was carried out to examine the efficiency of economic returns and other parameters. Technical man days were calculated on per ha basis for the entire watershed and the treatable watershed area at three phases watershed (preparatory, work and consolidation) and expressed in mandays ha^{-1}.

3. RESULTS AND DISCUSSION

Watershed Productivity

Watershed productivity (WP) indicates the overall productivity level of watershed. It was calculated by taking the yield of crops, cropped area and output price of different crops grown in the watershed and expressed in equivalent yield of dominating crop (ragi) of the area (Sikka *et al.,* 2004; Sharda *et al.,* 2005). The overall WP increased from 4962 kg ha^{-1} (pre-project) to 6126 kg ha^{-1} (19%) during post-project period. This can be attributed to increased area under irrigation, slightly increased productivity of crops, increased vegetable cultivation; which is highly remunerative than any grain crops raised in the watershed. Dhyani *et al.* (2001) and Joshi *et al.* (2004) have reviewed different dimensions of watershed management and emphasized that these interventions have positive impact of watershed management on cropping, agricultural productivity, employment generation and increase in income.

Human Population Carrying Capacity

The human population (adult) carrying capacity (HPCC) is the ratio of energy output from the land use (production system) to the annual energy requirement of an

adult. The energy output from each land use or crops was calculated based on the energy coefficient value of each crop (Alipour *et al*., 2012; Tuti *et al*., 2012). The annual energy requirement for an adult was calculated based on the daily energy requirement recommended by the National Institute of Nutrition, Hyderabad (NIN, 2009) presented in Fig. 1 and spatial demarcation in the watershed area is presented in Fig. 2.

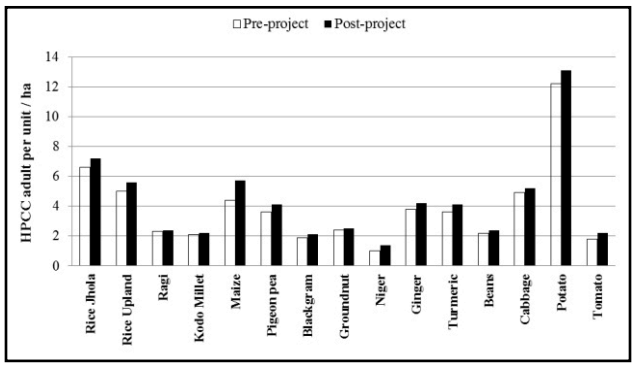

Fig. 1. Human population carrying capacity of different crops in the watershed

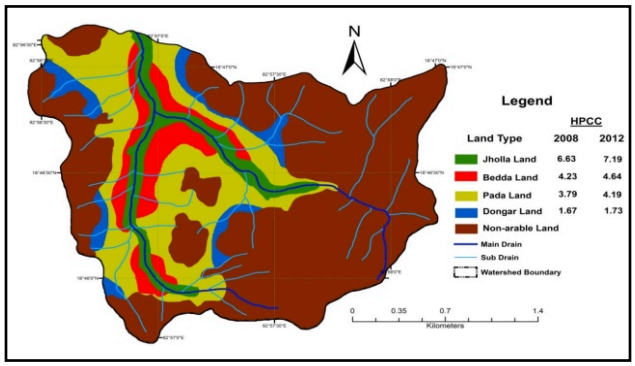

Fig. 2. Human population carrying capacity of different land uses in the watershed development

Pre-project analysis of HPCC showed that among different crops, Niger recorded lowest (1.0) whereas potato crop registered maximum value (12.2). Among the cereals, paddy in *jhola* land, upland paddy and maize have the HPCC of 4.9 to 6.6 during pre-project period and 5.5 to 7.2 during the post project period. The HPCC of vegetables varied between 2.2 (Beans) to 12.2 (Potato) during pre-project period and it increased to 2.4 and 13.1, respectively during the post-project period due to increase in productivity of crops. The average HPCC of crops increased from 4.0 to 4.4 with an increase of 9.3% attributed to enhanced productivity of crops through watershed activities.

People's Participation Index

People's participation is the soul of integrated watershed management in any region. It is measured through People's Participation Index (PPI; Singh, 1992**)** indicating its sustainability. The overall PPI was found to be 56% indicating that the stakeholder's overall participation was just above the medium level. Among the three stages of the project (Fig. 3), the level of people's participation was highest (64%) at preparatory phase followed by 58% at work phase and 46% at consolidation phase indicating high to medium level of participation. This high level of people's participation could be attributed to the sincere, committed and devoted efforts of the Watershed Development Team and watershed functionaries. Active people's participation is, therefore, highly critical in the success of the watershed program (Kerr *et al*., 2000). People's participation in planning, developing and executing the watershed activities is indispensable (Joshi *et al*., 2005). Active and voluntary participation of all stakeholders guarantees the successful implementation of watershed program.

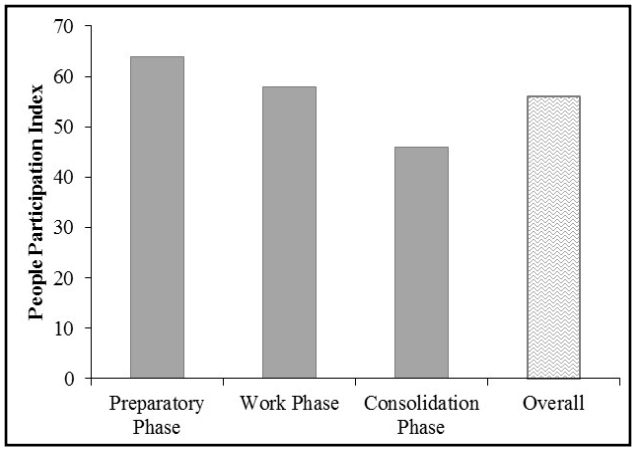

Fig. 3. PPI at different stages of watershed development

Income and Expenditure Pattern

Income expenditure analysis is an important activity which insights into the material development of the watershed inhabitants. The analysis was carried out before (2008) and after (2012) the implementation of watershed project for large, medium and small farmers. The analysis reveals that after implementation of the project, there is a shift of income from non-institutional finance to agricultural activities to the tune of 5% (Fig. 4). Large farmers showed interest in initiating large scale enterprises *i.e.,* poultry and livestock *etc.* In expenditure analysis, large farmer increased expenditure on inputs procurement and labour work by 5%. However expenditure on food and education remains unchanged. As per the initial income analysis (2008), a medium farmer income was depended on agriculture activities (60%) and labour work (20%). In 2012, medium farmer income source is shifted to the tune of 5% on agricultural activities, which grossly contribute to 65%. There was an increase in income for agricultural as well as in labour use by 5% which signifies the consolidation of agriculture activities for earning livelihood. In expenditure, there is slight increase in expenses on credit facility and education by 15 and 2%, respectively for adoption of new activity; medium farmers are approaching banks for credit. It shows the changing attitude of farmers for adopting new enterprises for livelihood development as well as providing quality education to his children.

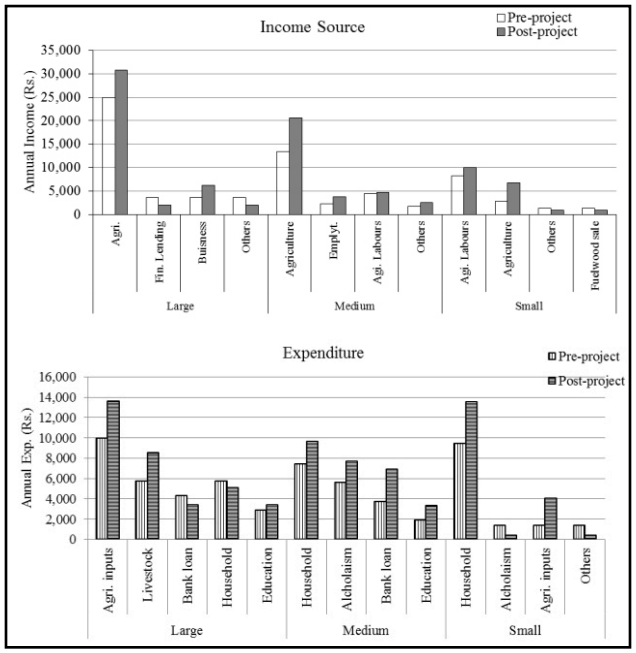

Fig. 4. Income and Expenditure pattern of different categories of farmers in the watershed

Small farmers are most important to address the change for development and success. In Lachhaputraghati watershed, the income analysis reveals that this change was more pronounced in their source of income. The agricultural activities showed increase of 15% which shows the independence of farmers from labour work and their engagement in their own activity. A significant decrease of 5% in fuelwood sales shows the changing attitude and dependency on forests. On the expenditure side, a small farmer is accessing good food with increasing in expenditure on quality food by 4%. A drastic decrease in the expenditure of alcoholism by 8% and an increase in purchase inputs (12%) show a sea-change in the attitude of small farmer for improving his living conditions and leading a respectful life.

Employment and Income Generation

A total of 14,052 mandays employment was generated wherein maximum employment generation was through water harvesting structures, DLTs and plantation works. Maximum employment generation was during the watershed work phase (84%) followed by a consolidation phase (15.3%) of the watershed development. Landless farmers and families hold considerable population (84 families' *i.e.,* 27% of total families) of the watershed. To provide seasonal as well as year around income to landless farmers, women and unemployed youths were supported through various income generating activities (IGAs) in the watershed areas. A total of 221 beneficiaries benefited from these activities. The annual income per SHGs varied between ₹ 14,000 and ₹ 40,000 (Table 1). On an average, the annual income per beneficiary is ₹ 2543.

Community Contribution

Contribution of the community towards watershed activities is considered a measure of participation. Moreover, contribution in terms of cash and kind enhances the responsibility and commitment to maintain the works and activities created under the project. People came forward enthusiastically to contribute for private as well as Panchayat land in terms of cash and kind, showing indication of sustainability of works carried out under the project. A total amount of ₹ 1,21,252 has been received as a contribution under various works in the watershed will be utilized in the post project maintenance of the assets created in the watershed.

Economic Viability and Convergence

Economic analysis of the project was carried out for the entire watershed (arable and non-arable) by considering the cost and direct benefits from different activities. The productive life of the watershed project was assumed up to 20 years. The economic analysis of arable lands at 10% discount rate revealed BCR to be 1.16 and IRR as 19.5% indicating the economic viability of the project. Watershed management cannot be realized in isolation as it involves different administrative wings of the government. To have effective watershed management schemes like Rashtriya Krishi Vikas Yojana, MGNREGA, Swarnajayanti Gram Swarozgar Yojna (SGSY), Odisha Forestry Sector Development Project (OFSDP) and such other schemes or private players must converge to yield desired results. For convergence substantial public investments are being made

Table: 1
Details of income generation activities and annual gross returns in the watershed

Income Generating Activities			SHG	Beneficiaries (no.)	Annual Income (₹ Group^{-1})
A.	Small entrepreneur system	Tailoring	1. Gramdevi, 2. Swetapadma 3. Mahadevi	33	18,000
B.	Household production system	Pickle and sauce making	4. Swagatika, 5. Budirani 6. Janani	30	30,000
C.	Biomass based rural industry	Mushroom production	7. Gramdevi, 8. Swagtika, 9. Neelabadi	39	35,000
		Honey production	10. Prayas, 11. Brahminbuda, 12. Budirani	32	14,000
D.	Dairy activity	Cow rearing	13. Aakanshya, 14. Shanti	20	35,000
E.	Livestock management	Goats rearing	15. Kalamgam, 16. Pritam, 17. Neelabadi	36	27,000
		Backyard Poultry	18. Maamangla, 19. Janani, 20. Sagarika	31	40,000

for the strengthening of the rural economy and the livelihood base of the poor, especially the marginalized groups like SC/STs and women.

Technical Mandays

The watershed development is an essential technical skill required starting from planning to completion stage of the watershed. Actual scientific and technical staff involved at three different phases of the watershed development was calculated based on the contributions of each staff associated in the project period. The technical man days (> 8 hrs) at watershed work phase is worked out to be 2.3 and 3.0 mandays ha^{-1} (71% of the total man days) for the total and the treatable area in the watershed, respectively. The technical man days accounts for only 12 and 17% of the total mandays ha^{-1} during the preparatory and the consolidation phase of the watershed, respectively.

Gaps and Policy Interventions

During the implementation of the scheme in this tribal catchment, certain gaps were also observed. Socio-cultural-economics of tribal community needs to be fully understood and respected in the successful implementation of any project and to get community participation and support. Basic amenities are still lacking in most of the tribal villages which needs to be addressed properly through filling gap in infrastructure development and convergence approach.

In the formation and functioning of SHGs' financial operations difficulties were also observed. The government should support the SHG at village level with ease in registration process and other banking operation technicalities. The minimum cap of 5% of construction activities should be omitted from tribal watersheds. The poor populace comes to terms with difficulty of huge cost. Watershed committee linkage with development departments are the key factor in holistic and sustainable development of the tribal dominated watersheds.

4. CONCLUSIONS

Sustainable Livelihood and socio-economic development of tribal population through Watershed management is an important intervention. Socio-cultural-economics of tribal community should be understood and respected in the successful implementation of any project for getting community participation and support. Most of the tribal villages are to be addressed properly through gap filling infrastructure development and convergence approach. Community/watershed committee linkage with the development departments are the key factor in holistic and sustainable development of the tribal dominated watersheds.

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