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Review

Role of participatory research on natural resource management: A case of Karnali Watershed Area, Nepal

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This paper discusses the development trends of participatory research in Nepal with reference to natural resource management, taking example from Karnali watershed area. The issues discussed in this paper clearly indicate that there is urgent need to promote the participatory action research on environment and development for the proper links between population, development, technological implication and institutional strengths, using a micro level conservation and development model that suits local environments. The author opines that both government organizations and academic institutions have to join hands with an effort to promote the participatory research culture in Karnali watershed area for sustainable natural resource management.

Key words: Scientific research, relaxed rapport, extractive survey, eco-development, integrated conservation and development planning, village level model.

INTRODUCTION

Over the decades, there have been drastic changes in modes of research and learning. Shifts from logical-positivism paradigms (quantitative) to phenomenological paradigms (qualitative) have been witnessed in research and development practices since 1980s. These shifts move now from top-down to bottom-up and from extractive survey questionnaires to participatory appraisal, in which more and more activities for innovation, management and development of available resources are done by local people rather than outsiders. It is seen that various methods and approaches of participatory research evolved from here, with local people learning these methods themselves in order to map out their conditions in planning and action. An important method of participatory research is rapid rural appraisal (RRA), which had a widespread in the 1980s. Its further evolution, which was met in the 1990s, into participatory rural appraisal (PRA) has grew fast and promoted participatory action research (PAR), participatory learning action, focus group discussion and perception study for development dialogue with a view to enable local people share, enhance and analyze their knowledge of life and conditions to plan and to act. Thus, the participatory research in natural resource management and development appeared since 1990s with several sources, reasons and traditions; however, the term activist participatory research was introduced in the 1970s by the work and inspiration of Paulo Freire in his book Pedagogy of the Oppressed (Rhoades, 1990; Chambers, 1995). Historically, it evolves continuously quicker and closer communication, transfers and sharing of activist participatory research, agro-ecosystem analysis, applied anthropology, field research and rapid rural appraisal. Particularly, field research on farming systems and conservation of natural and environmental resources by geographers, agricultural economics or biological scientists have contributed in shaping the present form of the participatory research in a complex structure.

LOCATION OF THE KARNALI WATERSHED AREA

The Karnali- Watershed Basin (KWB) lies in the western part of the Mid Western Development Region of Nepal, which is about 500 km west from the capital city, Katmandu, of the country. It is located between 27°42' N

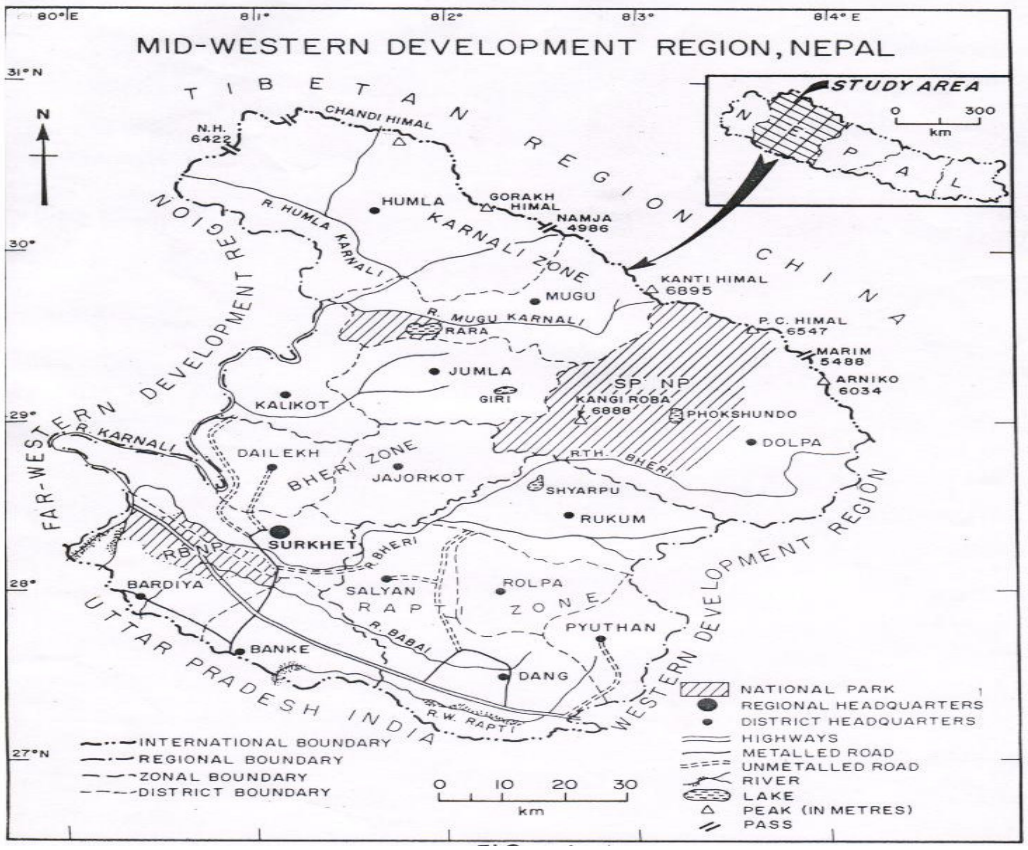

Figure 1. Map of Karnali watershed area.

to 30°27' North latitude and 81°E to 83°45' East longitude, extending from Dhaulagiri Himal in the east to Bayas-Rishi Himal in the west. The total spatial cover of the area is 42,559 sq km, which is about 29.02% of the country. Its average length is 176.59 km from the east to west with non-uniform width of 240 km from the north to south (MOFSC, 2010). Hence, the north-south extension of the basin makes great variations between ecological regions namely: mountain, hill and *tarai* in regard to relief features, climatic characteristics, and distribution pattern of resources. However, about 80% of the land is covered by rugged terrain. The elevation ranges from 129 m in the southern plain area to 7,000 m height in the northern mountain (CBS, 2007). It borders the Western Development Region in the east, Far-Western Development Region in the west, Uttar Pradesh of India in the south, and the Tibetan Region of China in the north (Figure 1).

REVIEW OF PARTICIPATORY RESEARCH ACTIVITIES

Researchers and scientists believe that participatory research is a legitimate and useful method of scientific research in natural and social sciences by rapid assessment procedures like conversation, observation, informal interviews and focus group discussion of realities. Chamber (1989) pointed out many reasons to the origin of the rapid rural appraisal that further evolved into participatory rural appraisal and participatory action research. Among them, the first reason was dissatisfaction with anti-poverty biases of rural development by urban-based professionals. These biases were spatial (visit to nearby cities, on roadsides, and to the villages' centers with neglected peripheries), a project that gave special attention to the donor desires rather than people's demands, a person meeting men more than women, and elites more than the poor and disadvantaged groups, seasonal visits to sites in favorable weather, and diplomacy, that is, where the outsiders do not wish to cause offence by asking to meet poor people in bad conditions. The next one is disillusionment with the normal processes of the questionnaire survey and their results. This is as a result of the fact that the conventional approach to research tended to be long drawn-out, tedious, difficult to administer, a nightmare to process and write up, inaccurate and unreliable data obtained, and difficult to use in wider perspectives. Another important preseason was more positive and was in favor of this study to make it a more cost-effective method of learning. It was

developed by the growing recognition of the development professional to discern the fact that rural people are knowledgeable on many issues which touched their lives and which are recognized as the indigenous technical knowledge (ITK) to tap it more effectively, as a source of information for analysis and use by outsiders.

In the mid of the 1990s, it became a more popular model of research and development in Asia, Africa and South America in both the GOs and NGOs sectors. It also became the main theme of field research for academic institutions and it spread internationally. Many international NGOs contributed to shape its present form, which is important for need based development activities. Among them, International Institute for Environment and Development (IIED) London, Institute of Development Studies (IDS) UK, World Bank, Action Aid and Win rock International have played significant role to promote the participatory research. Therefore, it is a simple method, with set of approaches for scientific inquiry that enable local people conduct their own analysis and often plan and take action.

Principles of participatory research

To carry out a good and practicable participatory research, some important performances are required by the practitioners, and they are briefly discussed here.

A reversal of learning: To learn from rural people directly, on site and face-to-face, thereby gaining from local physical, technical and social knowledge.

Learning rapidly and progressively: With conscious exploration, the flexible use of the methods of opportunism, improvisation, iteration and cross checking do not follow a blueprint program, but the ability to adapt in any learning process.

Offsetting biases: Rural development is all about relaxing and not rushing, listening and not lecturing, probing instead of passing on to the next issues, being unimposing instead of important, and seeking out the deprived people and learning their concerns and priorities.

Optimizing trade-off: Relating the cost of learning to the useful truth of information, with trade-off between quantity, relevance, accuracy and timeliness. This includes the principles of optimal ignorance - knowing what is not worth knowing, and of appropriate imprecision - not measuring more than needed. As Keynes is reputed to have said; it is better to be approximately right than to be precisely wrong.

Triangulating: Using a range of methods, types of information, investigators and disciplines to cross-check.

Seeking diversity: This has been expressed in terms of seeking variability rather than average and has been described as the principle of maximum diversity or maximizing the diversity and richness of information. This can involve sampling in a non-statistical sense. It goes beyond the cross checking of triangulation. Defined broadly, it deliberately looks for notices and investigates contradictions, anomalies and differences.

Facilitating: Rural people are allowed to facilitate investigation, analysis, presentation and learning by themselves, so that they present and own the outcomes, and as well learn from it. This has been expressed as 'handing over the stick'. This often entails an outsider starting a process and then sitting back or walking away, and not interviewing or interrupting.

Self-critical awareness and responsibility: Facilitators continuously examine their behavior, and try to do better. This includes embracing error-welcoming error as an opportunity to learn to do better and using one's own best judgment at all times, that is, accepting personal responsibility rather than vesting it in a manual or a rigid set of rules.

All these principles are behavioral, since they are applied in practice by people doing things. Thus, the quality and accuracy of participatory research in environment and development area depend on the moral responsibility and technical efficiency of researchers.

In the new millennium, it is more applicable in integrated conservation and development planning with respect to climate change adaptation and humanitarian issues. Thus, it requires picking up an appropriate theme and area of research that has in the priority of the country issues that suite the interdisciplinary research. However, funding institutions do not provide grants to such research in general due to the tradition of providing grant based on donor desires rather than local needs and demands. It further demands that the old concept of research and fund granting traditions should be modified to make it more applicable for use in research outputs into socio-economic development with due consideration of natural resources conservation and development policies of the country, which could be carried out with in-depth investigation, critical inquiry and exact assessment in seeking facts through collective efforts. Conducting such research in an environment with natural resource appraisal and development, self searching methods of inquiry that promote the culture of self-research with participatory mapping and modeling of what is on ground are used. It also requires that trend analysis, livelihood analysis, analysis of difference and participatory planning and budgeting should be done.

Innovation of participatory research

Participatory research has broken new ground of research

and methods of rediscoveries that encourage people to improvise the spirit of play. Various discoveries and innovations of participatory research have existed since the last three decades, and are briefly reviewed.

Villagers' knowledge and capabilities: The first discovery is that villagers have a greater capacity to map, model, estimate, rank and score their surrounding resources than outsiders. Findings of the participatory research show that rural people have more extensive and detailed mental maps than urban people and that when given the right conditions and materials, they can express this visibly on ground or on paper as three dimensional models (that is, watersheds). Rural people have now noticed social details using local materials such as seeds, manure, vegetables; land resource, water resource, market and other information. It evinces that having the right methods and materials, villagers can show themselves capable of generating and analyzing information far beyond normal professional expectations. It is evident that rural people are able to use largely independent culture of literacy to reflect and rank the problems and opportunities as they perceive them, and express their preferences for improving their farming system, managing and using common property resources for better livelihoods and for development actions in their communities.

Relaxed rapport: The second discovery (the relaxed rapport between outsiders and rural people) can be established early in the process, which is the key to facilitating participation. To measure trust and minimize predisposing conditions for inquiry, it promotes the culture of honest and accurate sharing of detailed knowledge and values between outsiders and villagers.

Diagramming and visual sharing: The discovery is the power of diagramming and visual sharing information. It helps to transfer the world of the person interviewed into paper and to change the information into public goods from personal to unverified. With visual sharing of map, the model, diagram or unit can be used for ranking, scoring, counting, or quantification, and all who are present can see, point, discuss, manipulate and alter physical objects or representation. Triangulation takes place with people crosschecking and correcting each other. Learning becomes more progressive and information is visible by the public, checked, verified, amended, added to and owned by the participants. Through participatory mapping and modeling, villagers can draw and model their resources with location, deciding what to include, debate, add and modify in the details. In shared diagramming information, seasonal changes dimensions, such as rainfall, agricultural production, labor, income, indebtedness, food security and migration trends can be shown in paper or other local materials. In the media, villagers commend and alter the fact of whether they are literate or not with confidence.

Sequences: The next popular discovery is the sequences of participatory methods like participatory mapping, social mapping and matrix scoring or ranking, which have more striking combinations and sequences that present new and complementary information on socio-cultural, natural resources and livelihood improvement aspects. In many areas, participatory resource map leads to transect planning, in which villagers made the map act as guides for outsiders. It further leads to the identification and discussion of problems and opportunities and then leads to listing and ranking options. A village social map provides up-to-date household information which leads to discussion, negotiation and reconciliation of priorities. Thus, the power of such sequences is four fold. First, the commitment of participation increases, before it further makes the action more likely, spontaneous and sustainable. Secondly, sequences triangulate and reveal errors of omissions in earlier presentations. Thirdly, the different activities interact cumulatively, and each activity add a dimension to the quality of details and enrich others, so that when taken together the whole become more than the sum of the parts. Fourthly, all concerned learn through the process, through people sharing what they know, through observation and through analysis. Therefore, participatory methods fit well with flexible learning process approach which is even more open-ended and adaptable to the villagers. Thus, it enables them use their own categories and criteria to generate their own agenda, and to assess and indicate their own priorities.

Training and reorientation for outsiders: The fifth innovation of participatory mapping, which is the initial training and orientation given to outsiders, can be conducted in practice in a short span of time. Face-to-face field experience is the main thrust of participatory research. Hence, the principles of optimal unpreparedness are applied. Usually, it is best to start sooner; as such, it seems safe or sensible for newcomers not to wait, but to start, stumble, self-correct and then share. Through participatory methods, villagers are encouraged to map, participate and plan for the training of outsiders to facilitate changes in perceptions and action, listening and not lecturing, learning progressively, embracing error and being critically self-aware of participation. Thus, the reversing role is taught to villagers in order for them to perform village tasks. For some outsiders, especially those who have had a strictly formal professional training, this can threaten trauma. They deserve sympathetic understanding, and no significant change may take place. For some though, a new range of possibilities and sense of freedom to experiment and innovation opens up. Thus, there is no need for the villagers to be trained in all methods. The methods can be tried, improvised and adopted subsequently, and new ones can be invented.

Sharing and spread: The last and most important discovery is sharing the culture and spread of technologies through participatory research. Participatory research is recognized now to have three foundations: methods, behavior and attitudes, and sharing. Previously, methods appeared to be the most important than behavior and attitudes of the outsiders, but now sharing is the most important for spreading of experience and mutual learning. To share and exchange methods and experience, interchanges of staff are efficient; as such, staff of one organization spending time with staff of other organizations can enhance the creativity and inventiveness of villagers to come into play. In such ways, innovations can be continuously stimulated. Thus, all forms of sharing-trainings, trainers, ideas, experiences, methods and innovations take place.

Practical application of participatory research

Participatory research methods, approaches and techniques have been widely used for appraisal, analysis and research in many subject areas such as agro ecosystems, natural resources, environment, technology and innovation, health and nutrition, family system research and extension, pastoralism marketing, disaster risk reduction, organizational assessment, socio-cultural and economic conditions. Participatory appraisal and planning, participatory implementation, monitoring and evaluation, and training and orientation for outsiders and villagers are the major processes that have been used in development and resource management areas. However, most of the application of the participatory research can be listed out in four categories.

Natural resources management: Participatory research is more popular and it uses widely acceptable techniques for watershed planning and management including: rapid catchment assessment, soil and water conservation, degraded forest assessment, nurseries and planting, identification of trees' uses, rural energy assessment, green enterprise development, wildlife reservation, and village resource management plans.

Agriculture: The next application is farmer participatory farming system research done by farmers in addressing crop farming, livestock farming, irrigation system, and market network for their products.

Equity and inclusive development: Another application focuses on a research on policy level to sustain the growth momentum in order to ensure inclusive development, where benefits of economic development are to percolate to the poor and under privileged with an objective to boot economic growth along with augmenting employment opportunities, alleviating poverty and ensuring regional equity and prosperity.

Health and nutrition: Health and nutrition monitoring is the fourth important application of participatory research which focuses on reproductive health, disease problem ranking, healthcare providers and costs, planning health projects, food security, nutrition assessment and monitoring, and water and sanitation assessment, planning and location.

All these applications are positive evidences that are scaled and used by various organizations and individuals, who have been engaged in training and appraisal, to respond to demand and their own sense of priorities and experiences. The use of monitoring and evaluation was found to be limited and academic researchers have been slow to recognize what was happening in practical application of participatory research. These methods have usually proved more reliable in information flow arguments and discussions taking place among the villagers, outsiders and between both villagers and outsiders. However, the success and failure much depend on the behaviors and attitudes of the outsiders whether or not they have the time, patience and will to get closer to reality. Any way, reversals of modes like from closed to open, from verbal to visual, from counting to comparing, and reversals of dominance as from extracting to empowering, reserve to rapport and from tedium to fun are some important changes in the research that was brought out by participatory research. In Nepal and other developing countries, like India and the middle east countries, it proved more useful to carry out the research and development activities for conservation of environmental and natural resources and livelihood improvement of rural communities. Besides these, policy research and change, personal behavior, attitudes and learning, farming system research, quality assurance, inclusive growth and empowerment, and substituting for survey are potential fields to participatory research in Nepal for achieving flexibility by empowering people, learning to love change, becoming obsessed with listening, deferring to the front line, and building system for a world turned upside down. Therefore, we have challenged the locals to further develop and disseminate approaches and methods to promote their own analysis and make their own needs and priorities known to scientists.

Usage of participatory methods in Karnali watershed area

Since 1990s, participatory approaches and methods of research and development have been widely used in many parts of the country. Particularly, this has been done in rural resources development and management practices through community based organizations and users' groups at community level, and it has become more popular in the world as the model of participatory development, such as community forestry and water

Table 1. Perceived challenges for ensuring people's participation.

Challenges	Key informants	
	No.	%
Lack of ownership feeling	12	19.57
Low level of public awareness	9	14.28
Unclear policy	7	11.11
Growing unemployment	9	14.28
Lack of technical assistance	7	11.11
Lack of social mobilization	7	11.11
Lack of need basis plan	11	17.46
Total	63	100

Source: Field Survey (2010).

resource management through users' groups. Many gainful evidences indicate that rural communities have benefited from using participatory methods to development for improving their farming system, conserving their available resources and preparing their own plan based on their own choices. However, it has little effects in Karnali watershed area. There are many reasons behind this which are discussed here with resolutions in brief.

Low level of people's participation

The Onward Fifth Five Year Plan (1975 to 1980) was initiated with the central objective of institutionalization of people's initiative in all development plans. The Decentralization Act of 1982 was enacted in the mid 1980s. However, in practice, particularly, in the Karnali watershed area, it is often seen that both the government and non-governmental organizations, involved in the local resource development, did not promote people's participation, rather the local people were kept away from taking active part in development. In the most cases, local people had not been given the choice to take decision for their development. Even though the financial authority was kept by the Central Government, the role of government was still found as the body in-charge of development and welfare of the local people. Further, there is growing number of middlemen who have bred corruption and mismanagement of available resources. Thus, only a small number of elite people are the beneficiaries of the development activities. The local people (real beneficiaries) are always kept far from the mainstream of development. It is evinced that the drawbacks of top-down development approach have largely been attributed to promote the people's participation in local level development. Sundaram (1997) has nicely noted that the government mechanism in Asian countries, like Nepal and India, hardly want to enhance the people's participation in the real term. It may be seen from Table 1 that the unclear government policy towards the participatory development, owing to the lack of strong sense of ownership feeling of local people on the ongoing development programs, was observed as the main challenges for increasing people's participation in the area. The skewed distribution of resources has also been hampering people's participation and the major bulk of resources are to be occupied by a small number of elites. About 11% of key informants have noticed the lack of appropriate social mobilization policies where people are educated, organized, motivated and enabled to undertake social enquiry and analysis for understanding their life situation and taking decisions and actions to change it for their well-being. As a result, 14% of the key informants further noted the dominant role of resource rich family on community-based organizations, which is further responsible for mass unemployment, and low level of local participation. Moreover, people's involvement has been considered to volunteer a form in the implementation stage of local development in the region. Thus, it is the Central government authority that takes almost all development decisions. Consequently, the local needs have not been taken seriously at the time of programming. All these make the people to be less willing to participate in development activities in Karnali watershed area. Among the various issues, the most remarkable was observed to be technological drawbacks. The present use of technology for local resource mobilization is not appropriate and adequate. The level of participation has also been observed to vary among the ethnic groups based on resource base and priorities. Therefore, an appropriate need-based and time specific strategic intervention in various stages is of utmost importance for the mobilization of local resources. On the whole, the imposition development from the top level without due consultancy from the village level failed to activate people's participation in local resource mobilization. So, there is a need to look at the opinion and idea of the local people in utilizing the local resources effectively at the local level. It shows that people's participation is found as the most effective social measure for empowerment of local communities and the only way by which backwardness of the area can be eradicated (Pokhrel, 2004). It further permits to note that genuine public participation of people at the centre of development is the hallmark of eco-development. This is so, because it is an endogenous development process in which local people themselves assume the responsibility to manage their resources, define their needs, goals and aspiration, and to make decision affecting their well being and sustainable development. People's participation is the process by which the rural poor would be able to identify their needs, share in design, implementation and evaluation of the participatory action for resource development (FAO, 1990). Some important activities that have been conducted by local communities for the conservation and management of natural and livelihood resources in Karnali watershed area are presented in the following photographs (Figures 1, 2a, 2b, 2c and 2d).

Figure 2a. Briefing of project activities with authors at the field office of the Local NGO.

Figure 2b. Meeting with beneficiary farmers of Jumla.

Figure 2c. Discussion with INRM user groups in Surkhet valley.

Figure 2d. Discussion with beneficiary women of organic farming.

Under such circumstances, the collective efforts of locals become self-organizing and self-sustaining in unleashing the potential of the local community and in meeting their inner urges and preferences with regard to development through self-reliance. The gravity of such development is to be self-generated, self-organized and self-sustained at the local level (Gultung, 1980; Charles, 1987; Bajpai, 1998). Thus, the insight development of the locals is most important. In doing so, there is an immediate need of resource knowledge to the local people which is further possible through people's resource right (Joshi, 2002). Of course, to ensure people's involvement in eco-development activities of the concerned communities, they must have a sense of belonging to the local and natural resources that is the main process of gaining power by real actors. Therefore, efforts are needed to promote the capabilities of local and indigenous institutions for making their functions more productive. This is possible only by strengthening such community institutions through providing sufficient autonomy as part of the organization involved in resource development. So, if local communities are to become principal actors in promoting their social well-being, they must be able to give vision and focus to their endeavors. It is indicative that devolution of power from the top to bottom (that is, grassroots) for capacity building with generation, application and diffusion of knowledge through a unified approach social change at the grassroots level could be achieved, and the resource poor could participate directly in efforts to improve their own well being. Furthermore, their participation must be substantive and creative in order to enhance the development of material resources and technologies with regard to serving and matching its real needs. It is clear that eco-development can only change the potential beneficiaries into functional groups. Thus, government authority should be given a priority for ushering in people's involvement. Moreover, it needs to be a strong support of finance, policy and technical inputs from the government to local institutions for enabling their capacity with regard to resource mobilization. Most importantly, government authorities need to establish broad eco-technological strategies in partnership with key stakeholders. Evidences suggest that in the national

Table 2. Need of people's participation for eco-development.

Perceived needs	Key informants	
	No.	%
Need basis/Bottom up planning	19	30.15
Ownership feeling	10	15.87
Coordination between outsider and insiders	6	9.52
Verification of implementing program	5	7.93
Development of indigenous knowledge	6	9.52
Organized/Collective Efforts	8	12.60
Institutionalization	9	14.28
Total	63	100

Source: Field Survey (2010).

level, local resources user groups and self-managed enterprises are emerging and functioning successfully. It proves that such grassroots organizations have great potential in those regions like the Karnali watershed area where environmental, as well as development challenges are immense. For this purpose, local people (that is, primary beneficiaries) need to form their own organization different from that of the primary local unit for mobilizing resources to acquire ownership of resource utilization and management overtime and assume full responsibility on decision making and implementation of community based resource development activities (Bavuskar, 1999; Sethi, 2003; World Bank, 2003). To achieve this, first, efforts need to be made to access the attitudes, behaviors and priorities of the locals with deep understanding of the group dynamics and heterogeneous characters of the society. Secondly, steps should be taken to identify and support formal and informal groups and institution. So, special attention must be given to explore the resource and resource rights. It is necessary thus to ensure eco-education of people to make them able to understand their needs and problems. Thirdly, investment has to be made in institutional capacity development which will further enhance the internal capabilities of local units. Such institutions should be considered as the form of public services. Therefore, local authorities must be strengthened to secure common benefits through accepting mutual obligation on resource mobilization. It shows that people's involvement in resource development is necessarily desirable for a need base bottom-up planning, strong feeling of ownership on local resources, development of indigenous technology and promotion of collective action of the grass-roots people in the region. It can further be noted that coordination among and between the line agencies who are involved in community based resource development, correction and verification of their implementation procedures, and institutionalization of such community based organization are also possible at the micro level by adopting eco-development strategy (Table 2).

Thus, people's participation is essential to replace a relationship based on dominance and competition with that based on reciprocity and collaboration, and to promote solidarity and unity of purpose among all members of the community. However, several challenges are ahead in ensuring people's participation in the study region. In most cases, the mechanisms involved for this purpose have failed to reach the grassroots level. The possible reasons might be over dependence on foreign aid and central controlled programs. Therefore, need base and resource base planning with right advocacy skill development and technical dissemination should be emphasized on government policy. At the moment, local efforts should be institutionalized to empower themselves with regard to income generation, social change, environment management and ecological balance of community life in the region. Emphasis should also be given to human resource development in order to promote the indigenous resource management system. Such indigenous systems have significant role on conservation of forest and other natural resources. For example, community forest user groups have proved themselves to be more responsible and reliable than the government officials. So, the participation of user groups and others who have rights in decision-making process about utilization and conservation of local and natural resources is what is needed now with respect to the region's sustainable development. Therefore, cultural, social and ecological dimensions should be prioritized in the implication process of integrated eco-development strategies in Karnali watershed area, because the gravity of cultural values, social norms and people's perception is much more on the control mechanism that acts for resource utilization and management. In short, the current emphasis should be on policies for strengthening indigenous resource management systems and institutionalizing such systems in order to succeed in the integrated eco-development model at the village level.

ECO-DEVELOPMENT PRACTICES

It is true that in Karnali region, the traditional farming system might have some little effect on ecological stability, so long as the population of man and his animals do not exceed the carrying capacity of the environment, but when they do, there has been consequent pressure on land, less suitable for farming, depletion of forest resources, erosion, and environmental destruction particularly of the marginal and sensitive areas. Lack of ecological consideration in development activities has also been intensified by environmental assaults and the life support systems have undergone diminishment. Thus, there is need to modify current land use policies that can make the region available for ecologically sound and sustainable agro-farming with man-environment kinship needs to be restored in order to link the socio-economic interests of the local people with the sustainable management of natural resources for environmental stability and ecological security. Therefore, shift in priorities, change in implementation methods, modification in the planning process, and examination in resource allocation patterns are needed for maximizing the economic returns of development without ecological destruction. Due to the wide range of topography, climatic elements, soil characteristics, and socio-economic condition, the Karnali watershed area presents very special ecological features having more than 75% of terrain rugged and steep, and the unit cost of infrastructure development is high, while returns are relatively low. The ever growing human demands, faulty method of cultivation, and development patterns have brought considerable damage to fragile eco-systems in the area. In this regard, an integrated approach of development and conservation by involving local people in all processes and steppes could be effective to promote the quality of life of the people in the area, because eco-development refers to sustainable development in which all development activities are performed in such a way that regional ecological balance can be maintained. Practically, environmental planning is done for regional (Meso) and rural (Micro) level development with a rational use of the resources and application of technological styles (Bhati, 1985; Guleria, 1987; Peet, 1989). Through the principal objectives of the development strategies, protection of the available resources, regeneration of resources and development of human knowledge could enhance the quality of environment and the economy of the area. Furthermore, through social development with respect to maximizing the productivity of both the natural and human resources, and through preventive planning and development policy, many adverse ecological consequences could be avoided and the interest of the local people to environment management could be enhanced. Finally, people will feel comfortable with their environment and process of development. Therefore, such development approach would make people adopt the integrated conservation and development in which people can decide their real goals and objectives for the proper utilization of local and natural resources. At present, it is shaping into people's movement, and the active people's participation is envisaged from the grassroots rather than from the remote control exercised by the corporate executives. Consequently, a fair hope that people can decide what their priorities of work are for conservation and development is expected. Thus, it is necessary to give top priority to the livelihood of the locals for designing such development strategies. This can be achieved through social planning norms that promote an organized collective effort of local people at the community level. All these are possible on a resource-base planning unit which may be a watershed unit, be it macro or micro, but more than the political boundary. It also enables the integration of environment management and socio-economic development by adopting watershed management approach at the village level. It shows that the holistic vision of the proposed development strategy is essential for the integration of the environment into development practice with regards to rational utilization of local resources and minimization of the environmental hazards.

WATERSHED MANAGEMENT

It is clear that the plans of the administrative units and central government failed to address the real needs of the area and the utilization of regional resources in Karnali watershed area. This is mainly due to top-down planning for local development and less interest of local people towards the government launched program. Further selection of the planning unit which is based on political boundary is also the factor responsible for ignoring the ecological bases of development. Thus, a socially desirable, economically viable and ecologically sound development approach is required to promote harmonious relationship between development and ecology. It is possible, to adopt only the watershed management strategy that prove to be an appropriate development path for the area. Pokhrel (2009) has noted that watershed management strategy should be the core for development activities, and there is need to popularize it in Himalayan region. Some other case studies have also shown that the integrated watershed development approach is more practicable and it evolves a compact technical, economical, ecological and geographical unit of planning for resource utilization and conservation (GOI, 1988; Grewel et al., 2001; Narayan, 1993). Thus, in Karnali watershed area, watershed management approach could play a significant role in increasing the productivity of the total resources. Watershed is a very appropriate spatial unit for examining the physical aspects of Karnali and its tributary rivers with

Table 3. Number and area of watersheds.

Basins	Catchment area (km^2)	Watersheds		Sub watersheds		Micro watersheds	
		No.	Area (km^2) per watershed	No.	Area (km^2)	No.	Area (km^2)
Karnali	42,890	7	6,127	15	2,859	90	476.55
Babai	3,270	2	1,635	6	545	27	121.11
Rapti	6,500	5	1,300	10	1,083	42	240.71
Total	43,260	14	3,090	31	1,395	159	272

Source: Sharma (1977); Field Survey (2010).

their size, which may vary from small to some large catchment areas. So, watershed is a logical planning unit for evaluating the biophysical linkages of upstream and downstream activities of the basin. It is only the sixth five-year plan introduced as an integrated development approach in Nepal as the synonymous of soil and water conservation, but the failure of large scale development programs and the realization of the importance of interlink ages between resource productivity and sustained increase in rural income have led to the shift in watershed management approach with the prime focus of integrating environment and development in regional level. In operational level, it made efforts to bring all concerned institutions into single window system through interdisciplinary approach. Recently, it is more anthropo-eco-centric and community based rather than technology based, thereby leading empowerment and self-reliance of the primary stakeholders as an entry point for outsiders to understand local environment, and for making development plan in a comprehensive way. However, evidences show that macro watershed management programs in Nepal have some remarkable failures, in that many watersheds are still being degraded. Particularly, in the Karnali watershed area, large scale programs have rarely been successful in conservation and utilization of local and natural resources with people's participation. The degraded watersheds are further worsening due to over intervention of outside technical teams (Shah, 2000). Thus, social mobilization is needed to enhance the success of watershed development approach for the strong feeling of belongingness of local people towards the ongoing development and conservation programs. This is possible only by adopting micro-watershed development approach that can provide an appropriate path way for eco-development. Further, it would also be helpful in devising location specific solutions that may emerge by resolving activities that are conflicting (Head reach-tail end beneficiaries), and build-on complementary activities (forestation and soil conservation in hill and mountain regions enables better productivity in the *Tarai* region). Thus, emphasis should be shifted from large to small watershed areas in which both management of environment and socio-economic development can be integrated (Agarwal, 2003). Therefore, an effort is made here to delineate estimated watersheds, sub watersheds, and micro watersheds in the region. Based on the drainage pattern, transport network, population statistics and relief features, the whole Karnali-West Rapti basin (43,260 km^2) was divided into four hierarchical orders: resource regions, macro watersheds, sub watersheds and micro watershed. So, 14 macro watersheds, 31 sub watersheds and 159 micro watersheds were identified as the unit of eco-development planning in the area (Table 3). These micro watershed units can further be sub-divided into small and mini watershed units varying in size (50 km^2) for different land use purposes. Therefore, it is the micro watershed development strategy that could solve the problem of the five 'es': employment, economy, ecology, expert and equity, and would then be ushered in eco-development with a sharp focus on resource conservation and poverty alleviation in the region. Furthermore, the institutional and technical co-ordination amongst the involved agencies would also be strengthened in the region (Figure 3).

As the concept of integrated eco-development refers to sustainable resource development, it requires local initiations for integrating the environmental issues into socio-economic development. This development approach can make a substantial contribution to resource management at the micro level incorporating biophysical, technological, social, political and other variables which account for resource utilization and conservation. Further, such type of development approach maps the complex connection, direct-indirect effects, feedback loops, and reciprocal relations and effects of environmental and human resources to each other. Experiences have shown that local institutions in essence, community resource user groups are so effective in conservation and development of natural resources at regional and national levels in the country. Even in many parts of the Karnali watershed area, especially in the hills, such user groups have also exhibited extra-talents in forest resource protection, utilization and management. Thus, it is strongly felt that a micro level resource utilization and conservation model is necessary in the precise and synthetic form that would increase the productivity of environmental resources in a sustainable manner. Such grassroots model can as an aspect of bottom-up strategy call for mass action at the micro level (that is, village level). So, the kingpin of the natural resource

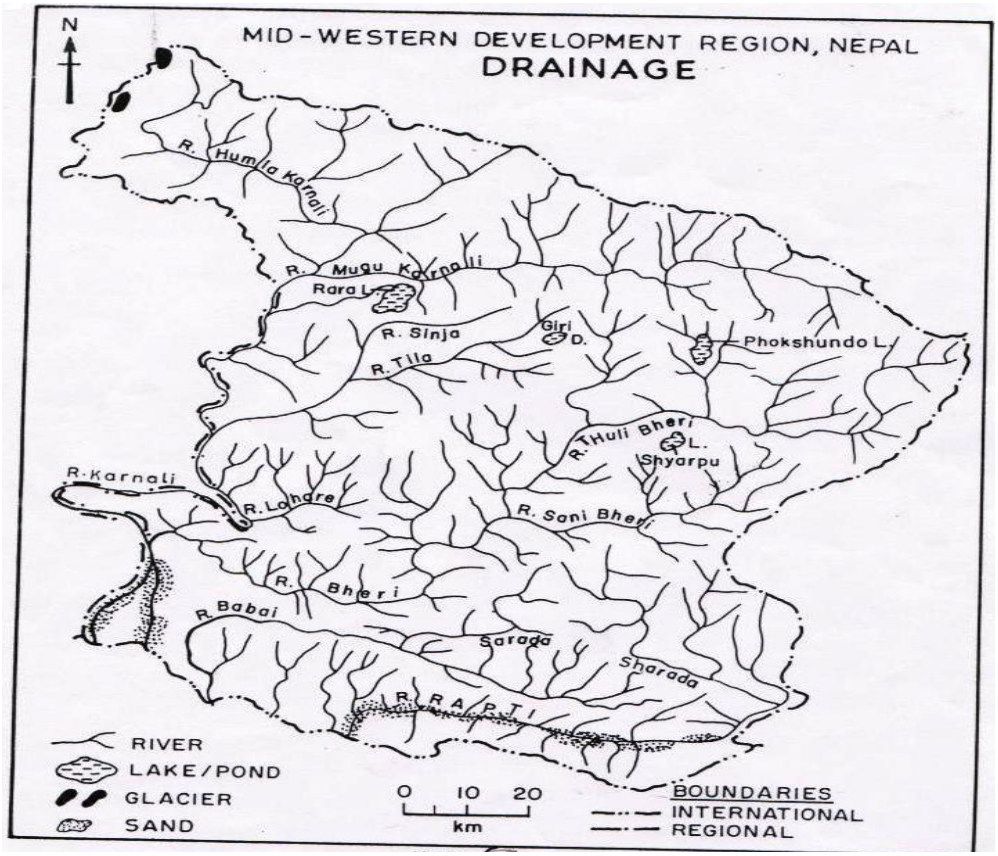

Figure 3. Watershed Management in Karnali watershed Area.

development strategy of Karnali watershed area is self-reliance on resource mobilization by using indigenous knowledge and experiences. Thus, the right mix of traditional knowledge would be a winning combination of resource development. The central thrust of participatory development has to integrate development and conservation, government authorities and local beneficiaries, and coordination of the involved institutions between the decision making and implementation level and that of the micro watershed level. Further, such adaptive model of resource management focuses on environmental feedback to shape policy. Thus, the model explicitly considers social learning and institutional development. Under such provision, large numbers of community based organizations would have evolved out of the region, and would be able to develop locally suitable technology, appropriate policy feedback and strategic clarity for resource development and conservation. Better information system, participatory monitoring and systematic implementation of resource mobilization will also evolve through local initiations. Finally, a specific technique would be modeled against the top-down tendencies for resource based regional development planning in Karnali watershed area and in Nepal in general. For this purpose, it is necessary to build-up local capacity for the total reforms of institutions in order to change the environmental policies in different orders. The principal concepts and components of this grassroots development model are:

(i) Formulating policy, strategy and programming the project based on the resource knowledge of the local people and an application of a suitable technology. Thus, it has to have a local base including people, traditions and indigenous institutions.
(ii) Implementation of resource development activities through people's involvement to strengthen local organizations and to bring about positive change in the local environment.
(iii) Participatory monitoring system with a view to avoid previous drawbacks of resource development planning at the micro level.

Thus, such innovative model can eventually lead to a district, as well as village level conservation and development plans. Further, such model could successively imply that the local organizations have to control the local and natural resources, adopt a sustainable pattern of development and avail appropriate technologies in subsequently distributing local resources

amongst beneficiaries on an equitable basis. Therefore, government authorities need to develop suitable methodology and guideline in order to ensure people's participation and facilitate local organizations for the process of institutionalization in the proper way. Similarly, to provide some financial support in the form of seed money is also needed. To build up local capabilities by imparting training and techniques at the local level is also essential from the government side. Hence, it should be emphasized that the catalytic role of government is to galvanize the people to initiate resource development actions according to their priorities at self reliance. In this regard, district development committee (DDC) and village development committee (VDC) as the authority of government need to make a framework, in which this model may function and evolve. To achieve this, there is need to modify outside intervention for the dynamics of local institutions. Actors, like non-government organizations, should collaborate with resource owned communities to develop the integrated micro level model, and explore and exhibit relevant alternatives that would stimulate the development of new resource management institutions (Saravanan, 2001).

CONCLUSION

It is evident that such participatory resource-based research and development model enables both the local people and collaborating authorities to learn about each other (their goals, knowledge and techniques) and finally make development efforts that are socially desirable and ecologically suitable. All these imply far-reaching changes and cooperation among and between the beneficiaries with respect to up-grading of skills and adaptation of new technologies for community based resource utilization and management in Karnali watershed area.

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