academicJournals

Vol. 6(5), pp. 172-183, July, 2013
DOI: 10.5897/JGRP12.088
ISSN 2070-1845 © 2013 Academic Journals
http://www.academicjournals.org/JGRP

Journal of Geography and Regional Planning

Full Length Research Paper

Chure forestry conservation and management plan: A case study of Arghakhanchi district, Nepal

Kabi Prasad Pokhrel

Department of Geography, Research Division, Tribhuvan University, Kathmandu 44618, Nepal.

Accepted 12 April, 2013

Chure Region has a distinct geographical and bio-physical specificities lying on the foothill of Himalaya. It is the youngest mountain of the world, and suffers from mass erosion, landslides and other environmental externalities which make the region vulnerable. Resource depletion, for example deforestation, due to natural as well as human induced factors in the Chure Region has accelerated; and livelihood opportunities have been retreating. Degradation of watershed, lowering the underground water and disturbing the ecological niche in and around the region makes the region more sensitive and fragile. Ecological balance and conservation of natural resources of the Chure Region, therefore, is very urgent. For the betterment of the people and resources of the Chure, Bhabar and Terai regions, there is need to design the work plan for conservation and development. The Government of Nepal, at present, has also given greater emphasis to the protection of Chure through initiation of 'Rastrapati Chure Conservation Program since 2009 in the field of conservation and management of the resources in the Chure Region. The present paper is an attempt to identify the problems and issues of Chure forest conservation and to prepare conservation and management plan using qualitative as well as quantitative methods of analysis. The paper has pointed out that the ecological, geographical and bio-physical conditions of the Chure Region have rapidly degraded since the last 32 years. Increasing landslides and flooding; and human intervention makes Chure more fragile and weakest zone where lack of/inadequate livelihood assets and food insecurity are noted. However, Chure Region has many opportunities of employment and income generation through establishment of environmental friendly green enterprises. Thus, the paper concludes an urgent need to formulate short-term to long-term strategies with policy priorities actions and result-oriented efforts. The policies and strategies should be related to establish Chure as a rich bio-diversity zone, with hazardless and improved livelihoods.

Key words: Chure, forestry, forestry conservation, forest management, Nepal, land use.

INTRODUCTION

Chure area forest resources are considered instrumental factors for economic development, social upliftment, for reducing the negative impacts of climate change, biodiversity conservation and adaptation of human ecosystem in changing environment. The Chure forest consists of important ecological and livelihood resources such as water source, forage, fodder, herbs, wildlife, flora and fauna, sand, stone, biodiversity and ecosystem services. By realizing the need and importance of Chure forest conservation, Government of Nepal has made many policy changes and shift in the paradigm of forest management. However, not all the changes saved the green gold of the area or created environment for fuller participation of the local resides with an authority to

E-mail:drkabipokhrel@gmail.com.

protect, manage, and utilize the forests. Thus, wrongly designed policy acted as the factor of Chure forest degradation since the 1950s. The promulgation of nationalization Act 1957 appeared to have been unfavorable to protection of forest resources. The act implemented on the assumption that it could consolidate the protection and management of forest, but conversely it rather led to the massive degradation of Chure forest. Further the Land Tax Act, 1977 defined land with forest as the government land encouraged local inhabitants to cut down trees around their farms. Inconsistency in the distribution policy and mechanism of forest products through different agencies has also acted as the factor of forest resource degradation. Forest office and community management committees directly manage the auction of forest products to the private parties. It is felt that there is heavy transaction of money in quantification of the forest products and in the fixing of the prices, which the common people cannot afford; and so they use illegal way to get their basic needs forest products, which further accelerate the forest destruction in the Chure area. Another policy weakness is to fail to control the Indo-Nepal boarder trans-boundary smuggling of logs into India. The activity intensifies when the price of product is higher in India than in the border area of Nepal.

Further, there are vague policies and weak institutional arrangement regarding protecting, managing and utilizing the NTFPs. Regulatory rules concerning the commercial collection of valuable medicinal plants are not being followed properly. The supervision and evaluation role of forest officials to the community forest groups is mostly superficial and incomplete. All this policy issues indicate that the problems and challenges related with Chure forest resource management are multidimensional, complex and inter-connected with social, economic, political, physical environment and policy issues. These problems and challenges are arisen due to growing population pressure, poverty, highland to lowland migration, lack of resource conservation literacy, political instability, unclarity in policy and poor implementation. In addition to these, efforts to get preference for forest conservation from all sectors, balancing between development and conservation, provisions of necessary resources utilization for effective management, inclusive and equitable forest resource management and getting constructive support from all stakeholders of Chure forest are more challenging. Looking at the complexity of the forestry problems in the Chure, of Nepal in general and Arghakhanchi in particular, there is need to address the issues of livelihood improvement through integrated development efforts for the scientific management of Chure forest. Thus, the main focus of the paper is to identify the basic policy issues for forest promotion programs or protection, management and livelihood improvement integrated efforts as well as collaborative involvements of all stakeholders to solve the practical problems of Chure forest conservation.

MATERIALS AND METHODS

This paper is based on field study so that the description of the paper is made on the basis of primary data that were collected during the field study. All of the community forestry groups of the Chure Region (235) were taken as the key respondents and focus group discussion. District level government officials were chosen as the key informants of the study. Available documents and policies were reviewed at the national and district level. However, the paper is more qualitative in nature in order to point out the practical policy and programs to conserve and manage the Chure forest in a sustainable way.

Description of the study area

Geophysical conditions

Chure area is unique in terms of physiographical, biological, hydrological and ecological characteristics. It rises gradually from the Southern plain of the terai made up of debris, which eroded over the last 40 million years as the Himalayas were formed. The erodible nature of these conglomerates and sandstone, coupled with the steep terrain and porous soil, contributes to the fragile nature of the Chure which is also known as the Siwalik Hills. The range covers a total area of 55,754.91 ha (557.5491 km^2) (equivalent to 46.74% of the district area) and consists of hills, steep land slopes, gorges, large spans of temporary streams. The altitude ranges from 205 to 1493 msl. A meeting of District Forest Coordination Committee (DFCC) under the chairmanship of Local Development Officer (LDO) held on Chaitra 2, 2067 BS demarcated the area (boundary) of the Chure Region in Arghakhanchi District. Based on DFCC decision, the total spatial coverage of the Chure Region accounts for 47,719 ha, which is about 40% of the district area. Whereas, land capability and land system 1978 classified the land under different uses; and demarcated the Chure area to about 55,754.91 ha of land, which is about 46.74% of the total district area. Besides the above VDCs (village development committee) and wards, some parts of the other VDCs, for example, Jukena, Subarnakhal, Patauti and Pokharathok fall under the Chure Region (Figure 1).

Location of Chure Region, Arghakhanchi

Geologically, Chure range associates with the Lesser Himalaya, or outer ranges, bounded against the Ganges plain (Tarai) by the Main Frontal Thrust (MFT), a major thrust translocation. Highest summit of the range approaches 1493 m and in lower parts of the range tectonic depressions occur which support some of the fertile agricultural patches ranging from Banganga River in East to West Rapti River in West. Lower parts of the range are locally referred to as river basin. The Chure is composed of the youngest, tertiary strata and contains some of the most easily erodible lithologies including unconsolidated sands and gravels. The range has been extensively deforested and the higher north-facing slopes tend to be semi-arid to extremely arid because of high altitude, steep slope and rain-shadow that affect, for example, the big landslide *Maharai* of Siddara VDC. Gundruk, Banganga, Bhalang, Sit Khola, Khayar-Bhatti, Ransing and West Rapti are the major river/streams, which originate in the Chure area itself. The main factor causing floods, flash floods, landslides and riverside cutting is the area's

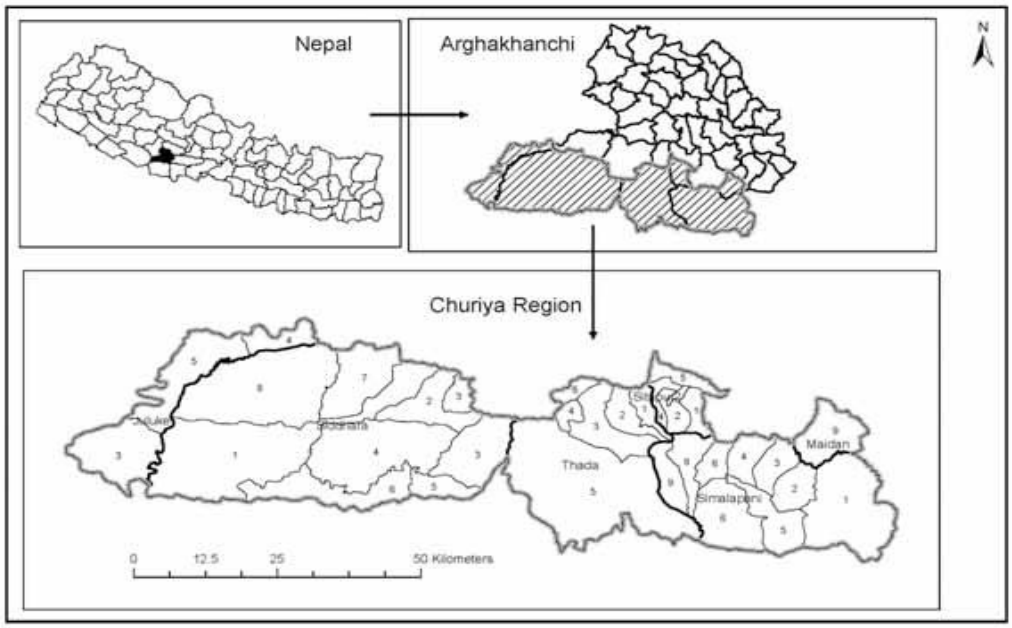

Figure 1. Chure Region, Arghakhanchi.

permeable structure, weak geology and high risk of natural disaster. Most of the water supply comes from springs and waterholes. Lack of required water for drinking and irrigation is the man problem of the range, especially, areas located at higher elevations. More than 75% of agriculture depends on monsoon rain for water. Poor irrigation and unsafe drinking water sources were observed as the major problems of the Chure range.

There is an extremely complex landscape, heavily sculptured by fluvial erosion and there has been a catastrophic production of sediments and development of bad land topography. The relative relief slope of the range has been increasing throughout the past hundred years or so because stream down cutting has exceeded lowering of the local interfluves. Riverside slopes therefore, have progressively lengthened and their parallel retreat has been affected by stream down cutting and land sliding. Debris mobilized on the steep slopes flows directly into river/stream, giving a very high sediment-delivery ratio, and subsequently moved out onto the Tarai plain by flooding (Gautam et al., 2007). As a result, Bhabar zone or porous place was found to be composed of massive coarse-grained alluvial fans and torrent fans, whereas the low Tarai is underlined by fine sediments of floods. Thus, lithologies of the range extremely varied, including sedimentary and metamorphic. Chure landscape has degraded by the rate of mountain building and regional denudation within the geologic time frame because it lies on an extremely dynamic section of the earth's crust (Ives and Musseril, 1989). The Chure range of the district has deteriorated extensively by deforestation, heavy amount of soil erosion due to road construction and cultivation on steep slopes. It is found from the field study that deforestation automatically and most certainly produces devastating soil erosion, overland flow of water, rill and gully development; rainy –season flooding and dry-season water shortage are so widespread in the range. Where deforestation occurred on Chure slopes, the environmental degradation is greater than the deforestation in tarai. Linked to this with hydrological cycle, forest acts as hydrological regulators that cause floods during summer season and also results in lower water levels or rivers totally drying up during the dry season. Forest cutting for fuel wood, commercial logging, shifting cultivation, forest clearing for continuous annual cropping, for grazing, for food, beverage are observed in many parts of the area. In most cases, tree cutting increases the incidence of flood and droughts to the live system of the Chure range. Moreover, the cutting of trees does not per se cause large increases in on-site erosion, but the method of cutting and of transporting the products out of the area and the subsequent form of use of the cutover land. Local people perceived that government agencies, development and aid organizations, conservationists, and western-trained elites regard the forest as a renewable resource. Their efforts are directed toward preserving the resource by ensuring that a balance is achieved between use and biomass reproduction so that the use becomes sustainable. However, the indigenous subsistence farming communities perceived it as convertible resource, that is, as a source for new agricultural land. Such contrasting perception of the value of the forests has remained a major issue to the possible solutions (restoration) that have been conceived and imposed from the top down tradition.

Geological structure, topographical features and climate of the area determine the quality and quantity of soil. Residual and sandy as well as boulder type of soils are found in the upper and high elevation area, and old or *bagar* type of alluvial soil is in the lower part of the Chure range. The alluvial soil found in the lower part consists of loam, silt and sand. However, the amount of sand is much more than silt and loam. It is fertile and suitable for agriculture. The sandy/gravel soil, which is found in upper part of the area is mainly gravel type and highly coarse and porous. It was formed out the mixing of sand, pebbles and stones. The amount of organic matter is relatively low. It is suitable for forest not for agriculture. Residual soil is widely found in the top of the Chure hills and it is rocky in nature. The climate of the Arghakhanchi Chure is subtropical to deciduous. The average mean monthly temperature over a year is 10.6°C in January and 30.5° in June-July. Most of the rain occurs in the four monsoon months from June to

Table 1. Annual forest products in Chure forest (ha).

S/N	Products	Sal	Asana	Khair	Pine	Others	Total
1	Tree	47	14	2	78	26	167
2	Pole	98	27	2	190	141	458
3	Lathra	393	151	1	357	674	1576
4	Plants	5207	921	56	1088	5149	12421

Source: District Forest Office Five Years Plan, 2009-2012; Field Survey, 2011.

Table 2. Annual growth rate by tree species (m^3/ha).

S/N	Types	Sal	Asana	Khair	Pine	Others	Total
1	Tree	0.784	0.305	0.025	0.921	0.369	2.404
2	Pole	0.162	0.056	0.004	0.331	0.138	0.691
3	Total	0.946	0.361	0.029	1.252	0.507	3.095

Source: DFO, 2009-2012; Field Survey, 2011.

September. The rainfall is moderate with mean annual rainfall ranging from 1800 mm in the Northeast to 1200 mm in the Southwest.

Forest conditions

The forest area covers 39994.28 ha, which accounts for 71.73% of the total land area of Chure Region. As per data available at district forest office, the forest of the Arghakhanchi Chure area is mostly deciduous, semi-deciduous, subtropical tropical sal forest mixed with broad leaves and lower mountain hardwood mixed forest. *Sal* is the predominate species with *Asana, Karma, Harro, Barro, Banji* and J*amun* which covers about 17% forest area of the district. An average annual forest products of *Sal* predominated forest has been presented in Table 1.

Table 1 reveals that the annual forest products of Chure forest is at satisfactory level with the 167 trees, 458 poles, 1576 Lathra and 12421 plants. Based on tree and pole production, annual growth rate of Chure forest was measured and the forest growth rate was estimated to be 3.095 m^3/ ha in a year with 2.404 m^3/ha tree and 0.691 m^3/ha pole growth rate. The annual growth rate of both pole and tree is relatively in Sal species than others (Table 2).

In terms of maturity of tree, average 35% trees in the Chure Region are matured. Simalpani and Sitapur VDC have recorded large number of mature tree as compared with other VDCs.

Socio-economic conditions

The main economic activities continue to be agriculture, animal husbandry and harvesting forest resources. The average land holding ranges from 0.20 to 2.5 ha. The literacy rate is reported to be 60% among males and less than 45% among females. The per capita fuel wood consumption is 1425 kg- more than double the national average 750 kg per capita per year (NPC, 2010). Modern infrastructures and social amenities are not existing in most parts of the Arghakhanchi Chure range.

The opening of the Gorusinge-Sandhikharka road as created a new dimension in land use change in the Chure range area. Although it is suitable only for limited agricultural crops, illegal encroachment and population pressures and the need to sustain livelihoods have compelled settlers to clear forest areas. Since 1971, there has been a tremendous increase in agricultural land. Subsistence agriculture is widely practiced in most part of the Chure range. Farmers grow food grain crops like maize, paddy and wheat in their cultivated land. Cropping system gradually becomes intense by taking three crops in a year at the foot of the hills and on the lower areas where irrigation facility is available. However, most of the farmers of hilly areas of the range depend on monsoon for cultivation and grow hardly two crops in a year. There is great potentiality for cash crop production in the range but nobody practices it due to lack of market facility. Cash crops such as ginger, green vegetation, turmeric, and broom grass have high potential to be cultivated in low cost. Mixed livestock and cropping system of the range is common where livestock is an integral part of local economy. Average number of cattle that has been lesser and lesser since the last decades is about five. Free grazing in common pastureland is becoming scarce after the government handed over forest management rights to the community people and the livestock farming of the range is threatened. Food insecurity and livelihood challenges are rising. Some family members engage in additional sources of income. Except agriculture and livestock, these people are partially engaged in small trade/business, services and foreign employment. It is found that foreign employment brought significant changes in the rural life and lifestyle of people and or family members. Remittance from the foreign employment increases the mobility, social and financial network and financial ability of the rural people. Land use of the Chure reveals that there has been drastic change in land use pattern and has brought many changes in the local environment, different dimensions of natural resource use and socio-economic transformation over the decades. A glance at land utilization shows 19.48% for cultivated land, 55.44% for forests, 16.30% for shrub land and 8.96% for badland (Table 3).

Table 3 exhibits that the land use of the Chure experienced considerable changes during the period of 1978 to 2010. It is observed from the table that cultivated land has increased by 19.48%, forest decreased by 31.19%, the shrub land has increased by 1824.67% and badland (cliff cutting, landslides, and deserted area) increased by 5781.88% over the last 32 years. It is evident that the change has largely brought land degradation by landslides, soil erosion and bad extension by extraction of sand, stone and

Table 3. Land use and land cover change in Chure Region, Arghakhanchi.

Land use categories	1978		1995		2010		Change 1978-2010	
	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	(%)
Cultivated land	9008.99	16.2	8878.79	15.92	10763.97	19.31	+ 1754.98	+ 19.48
Forest	44921.97	80.6	44825.80	80.40	30908.67	55.44	- 14013.30	- 31.19
Grazing land	954.51	1.71	37.52	0.07	-	-	-	-
Shrub land	472.06	0.84	995.68	1.79	9085.61	16.30	+ 8613.55	+ 1824.67
Sand and Gravels	312.41	0.56	829.71	1.48	-	-	-	-
Badland/Degraded land	84.95	0.15	187.40	0.34	4996.66	8.96	+ 4911.71	+ 5781.88
Total	55754.91	100.00	55754.91	100.00	55754.91	100.00	-	-

Sources: LRMP, 1978; Toposheet, 1995; Landsat Satellite Imagery, April 2010.

gravels. Population dynamics, method of cultivation, construction of roads and encroachment of forest for farmland, settlement and illegal trade of forest products were reported by local people for rapid change of land use in the Chure Region.

Policies and programs

Government of Nepal has adopted various acts, regulations, and guidelines to ensure the integration of development and conservation of environment. Present study is a guide to the requirements and provisions of the applicable acts, rules and guidelines. Land use Policy 2002 stated that all land use plans be prepared mainly based on the land capability classification and accordingly implemented in all areas. The policy has suggested forests of Chure hills, considering their fragility in nature, to be allocated as 'protection forests' as their over-exploitation and degradation would lead to loss of bio-diversity and soil erosion. However, the policy is suitable for the protection of Chure region; it does not address the increasing trends of human encroachment, that is, settlements and cultivation in Chure hills and slopes. The Forest Act (1993) (amendment, 1998) contains several provisions to ensure the development, conservation, management, and sustainable use of forest resources, based on an approved Operational Plan. It also recognizes the importance of forests in maintaining a healthy environment. Sections 68 of the Forest Act, 1993 enable the government, in case of no alternatives, to provide parts of any types of forests for the implementation of a national priority plan with assurance that it does not adversely affect the environment significantly. Section 49 of the Act prohibits reclaiming lands, setting fires, grazing, removing or damaging forest products, felling trees or plants, wildlife hunting and extracting boulders, sand and soil from the national forest without prior approval from District Forest Office. The Master Plan of Forestry Sector (1989) was formulated as long-term forestry sector development plan and prioritized as soil conservation and watershed management programs to protect the land against degradation and to conserve the forest resources through mobilization of national and local resources. The program proposed forestry development programs to meet the growing needs of forest products through better management and plantation forest in different ecological zones. But the master plan does not have a specific program for the management and conservation of the Chure hill region. Revised Forestry Sector Policy (2000) recommended delineating contiguous large blocks of forest in the Chure area and managing them. It also recommends barren land and small patches of forests in Terai to be handed over to the local users as community forestry. The policy is designed and implemented in collaborative management of the forest in Terai.

Another stipulation of this policy is that the Chure hills be managed as protected area because they are geologically very fragile and recharged underground water in Terai will also face similar threat if the concerns of the people in and around them are not addressed first. The forest policy is silent on such essential provisions needed for the conservation and management of the Chure area. Forest Rules (1995) further elaborate legal measures for the conservation of forests and wildlife. Rule 65 of the Forest Regulation stipulates that in case the execution of any proposal having national priority in any forest area causes any loss or harm to any local individual or community, the proponent of the proposal itself shall bear the amount of compensation to be paid. Similarly, the entire expenses required for the cutting and transporting the forest products in a forest area to be used by the approved proposal shall be borne by the proponent of the proposal. National Agriculture Policy (2004), although this policy has not any specific programs related to Chure, it has the provision of leasing marginal, pasture, degraded forest and unused common lands to the poor and marginalized target population for the cultivation of cash crops and horticulture-grass, forage, fodder, agro-forestry, medicinal plants, sericulture and other perennial tree crops, which would contribute to land improvement and poverty alleviation. It also calls for the improvement of degraded forests and natural water bodies for the bio-diversity conservation, as well as utilization and development of the agro-forestry system.

Besides, this policy stresses the importance of conservation farming through local people participation, in the watershed management and control of unwanted mass movement. Agriculture Perspective Plan (1995) has proposed the areas of the Chure hill region under forest, not occupied by settlements and agriculture, should be managed as protected forests and put under effective conservation following the recommendation of the Nepal Environmental Policy and Action Plan 1993 suggests to encourage high value product that is fruits, vegetable, medicinal herbs in the hills and mountain region. In the case of Chure region, being fragile and sensitive, the plan recommends it to be designed as protected forest. National Conservation Strategies (1988) emphasized the importance of forests in Chure hills and Bhabar. The strategies recommended that the forests be strictly protected against human encroachment, heavy removal of biomass and over gazing. The strategies include the need of conservation forests of Chure region for maintaining ecological balance. It also revolved that a separate body, the National Council for the Conservation of Natural and Cultural Resources be responsible for implementing the National Conservation Strategies and formulating guidelines concerning resource conservation matters. It also stipulates that Chure region, being a very fragile and sensitive, should be managed as a

Table 4. Demand and supply of the forest products in Chure region, Arghakhanchi.

VDCs	Demand			Supply					
	Timber (Cu.ft)	Firewood *(Bhari)*	Fodder/*Sottar*/ Grass *(Bhari)*	Timber (Cu.ft)		Firewood *(Bhari)*		Fodder/*Sottar*/Grass *(Bhari)*	
				CFs	Others	CFs	Others	CFs	Others
Jaluke	500	2900	-	500	-	2400	500	-	-
Siddhara	617	11500	17083	517	100	1863	9637	7180	9903
Thada	296	2495	3807	296	-	2495	-	3807	-
Simalpani	419	10277	6087	419	-	1333	8943	2554	3533
Sitapur	1055	15250	14770	1055	-	3000	12250	3000	11770
Maidan	280	9790	16530	-	280	200	9590	3000	13530
Average/	528	8702	9713	465	63	1882	6820	3257	6456
Total	-	-	-	(88%)	(12%)	(22%)	(78%)	(34%)	(66%)

Source: Community Forestry Operation Plans, 2010; DFO, 2009.

protected forest and there should virtually be no disturbances there. Nepal Environmental Policy and Action Plan (1993) was prepared and adopted in 1993 by Environmental Protection Council. It has recommended policies and actions in a wide array of sectors including sustainable management of natural resource and biodiversity conservation. Among others, the policy and action plan emphasized involving local people in the management and preservation of endemic and endangered species and their habitats. The National Biodiversity Strategy (2002) lays down Nepal's strategy for biodiversity conservation and has clearly identified the need for conservation and sustainable use of natural resources. It also recognized the need of a comprehensive approach aimed at conserving forest, soil, water, and biological diversity while at the same time meeting the basic needs of people. National Environmental Impact Assessment Guideline (1993) provides guidance to proposal proponent on integrating environmental mitigation measures, particularly on the management of quarries, borrow pits, stockpiling of materials and spoil disposal, operation of the work camps, earthworks and slope stabilization, location of stone crushing plants, etc. Environmental Management Guidelines (Department of Roads, 1997) has also issued the Environmental Management Guidelines (DOR, 1997), which provides guidance to the proponent on the integration of environmental mitigation measures into the proposal. This specifically deals with the management of quarries; borrow pits, material stockpiling and spoil disposal, camp operation. Soil and Watershed Conservation Act (SWCA) (1982) empowers the government to declare any area as a protected watershed to limit degradation of land by floods, water-logging, salinity in irrigated areas and acceleration of siltation in storage reservoirs, and to properly manage the watersheds of Nepal. The Act of 1982 and its regulations of 1985 together provide the legal basis for managing watersheds. The Act also outlines the essential parameters necessary for proper watershed management (including both rivers and lakes). Local Self Governance Act (1999) and Rules (2000) has been enacted to provide greater political, administrative and financial autonomy to local bodies and facilitate community participation at the local level. The Local Self Governance Act, 1999 empowers the local bodies for the conservation of soil, forest and other natural resources and implements environmental conservation activities. Sections 28 and 43 of the Act provide the Village Development Committee (VDC) a legal mandate to formulate and implement programs related to the protection of the environment during the formulation and implementation of the district level plan. Section 55 empowers VDC to levy taxes on utilization of natural resources. Section 189 elaborates the power and functions of DDC, which include formulation and implementation of plans for conservation of forest, vegetation, biological diversity and soil. According to the section 189 and 202, DDC would have power to stop some of the development proposals considered environmentally unsafe.

Demand and supply of the forest products

Many forest areas of the Chure region in Arghakhanchi are controlled under the community management regime. A very few patches of the government (national) forest are recorded in the Chure region but most of them are under the process to handover to the community. Almost all households of the community are involved in the collection of firewood, grasses, timber or forage from the nearby national forests.

Firewood is main source of energy for cooking and heating. A very few households, particularly in the market center, that is, Thada and Badachaur have been using LPG and kerosene for cooking purposes. However, there is not an evidence of installation biogas in the Chure Region. Similarly, livestock is an integral part of the people living in the region, and a major source of income and energy. Therefore, they need fodder and grass and/or open grazing lands. Increasing population pressure in the Chure region has increased the demand of timber for construction housing units and other infrastructures.

Key informants noted that the quantity of the forest products collected from the nearby community forests and national forests decreases as the distance increases from the settlements in the Chure region. Most of the forests near the community or settlements have already been handed over to the local community or some forests are under the processes of being handed over to the local communities. Rural people depend on it for various forest products like timber forest products (TFPs) and non-timber forest products (NTFPs) or miner forest products for their livelihoods. Many rural families of the area fulfill their basic needs such as fuel wood, pole, fodder, leaf-litter, fruits, and herbs and receive other services that are essential for their farming system. Demand and supply of timber and non-timber forest products of the Chure area is presented in Table 4.

Average demand of the timber in the Chure region is about 528 cu.f, of which 88% is from the community forests and the rest 12% from the private and national forests. Similarly, average 8702 *Bhari* firewood demand in the Chure region is calculated and only 22% firewood is available from the community forests. Much firewood is

extracted from national forest and farmland. In addition, there has been 9713 *Bhari* fodder, grass, or *Sottar* demand in the Chure region of which about one-third is extracted from the community forests and remaining two-third extracted from either private or national forests or farmland.

RESULT AND DISCUSSION

Farmers of the Chure range have considered the forest as an integrated part of the farming system for long. The economic sources of the rural poor of the Chure indicate that more than one-fifth income of the poor, crucial for subsistence living, comes from the common resources such as forest and other available natural resources. It is also found that large number of people get seasonal employment by selling firewood, timber and NTFPs. For example, about 300 households of Thada VDC are virtually dependent on the Chure forests for their livelihood (MOF, 2008). Faced with immediate survival needs, with few options and without choices, the rural poor have over harvested natural resources and aggravated the undesirable ecological conditions in the Chure range. Similarly, rural rich of the range own more land and have larger family with larger herds of animals. The rich use natural resources in larger quantities, hence forest resource has been depleting continuously since the last five decades. This has created a dynamically unstable vicious circle amongst population, poverty and environmental resource degradation. Recently, deforestation, soil erosion, landslides, desertification, resource scarcity and the adverse effects of climate change appear as the challenging issues of the Chure range.

The Department of Forest focuses its activities on conservation and management of different types of forest. The Community and Private Forestry Division carries out forest development, management and utilization of work on community and private forests, introduces agro-forestry activities, identifies seed sources and uses them to improve the quality of trees. Among the various departments, Department of Soil Conservation and Department of Forest are very close to the Chure area conservation and management; however, none of these departments has a separate division to look after the issue of Chure conservation. It seems that co-ordination and cooperation among the concerning government agencies, community based organizations and/or non-governmental organizations, local youth clubs, local political parties, community forest user and police is very important.

Photographically and floristically, the Chure range vegetation is related to the Indian and Southeast Asia Malaysian region. Altogether 500 plant species are recorded in the Chure. Out of them one-third species lie in the upper part of the Chure where sub-tropical and temperate types of climate and sloppy land area exist.

The rest lie in the lower part (below 500metres) of the range. *Shorea robusta* (sal) is the predominant species of the lower part of the range. Local people reported that about 50 flowering plant species have become locally extinct. There are some rare species namely- some of them are vulnerable species, and around 10 to 20 commercially threatened plant species. More than ten are endangered plant species. About 30 plant species with medicinal properties have been identified in the range as well as some valued for their perfume (aromatic plants). Similarly, around 18 leguminous plant species are beneficial to agriculture. The Chure area of Arghakhanchi district is also rich in wildlife species: Kathe Bhalu (Wood Beer), Leopard, Assamise monkey, Languor, tiger, fox, Jackal, rabbit, forest pig, clouded leopard, toddy cat, small Indian mongoose, sambhar, hog deer, and numbers of bird species, reptiles and mammals species. Although the Chure range enjoys a rich faunal diversity, there has been a gradual decline of species in the last decades. National record shows that there are 23 common species and 10 rare species such as Assamise monkey, leopard, clouded leopard, the toddy cat, the small Indian mongoose, the fox, sambhar, and hog deer. Many faunal species are now extinct. More than eighty species of birds have been reported in the Chure of the district. Loss of habitat due to human encroachment, rampant tree cutting and loss of understory cover due to an increase in livestock grazing and illegal timber trading are largely responsible for rapid decline of wildlife in the area. The Constitution of Nepal (2047) commitment to environmental conservation is ensured in the Constitution of the Kingdom of Nepal-2007 under Chapter 4, which states that, " The kingdom of Nepal will give priority to raising public awareness on environmental issues, to mitigate the adverse effects development works have on the environment, and to the conservation of rare fauna and flora". Interim Constitution of Nepal (2006) identifies the exclusion of indigenous and marginalized communities in the development processes.

Forty Five-year plan (1970-1975) was a milestone; since then the issues of Chure conservation has emerged in Nepal. Until the end of the Seventh Plan (1985-1990) the policies focused on afforestation and construction of physical infrastructure in watershed conservation (Kanel, 2010). In 1989, Master Plan for Forestry Sector was prepared. Subsequently, Eighth Plan (1992-1997), Ninth Plan (1997-2002) and Tenth Plan (2002-2007) were formulated based on the Master Plan of Forestry Sector (1989). Eight Plan (1992-1997) emphasized that the 'Chure will be declared a specially protected area and the programme will be launched to conserve the soil flora and fauna'. Chure Forestry Development Project was also designed in order to conserve Chure through participatory approach. Ninth Plan (1997-2002) stressed that 'conservation of Siwalik area which is very fragile will be carried-out; in order to maintain the renewal capacity of ground water resources by giving priority to the soil

and water conservation programme' (Kanel, 2010). The focus is on the participation of the local community/user groups in the forest and watershed management. Tenth Plan (2002-2007) proposed that priority should be given to participatory integrated watershed management for the conservation of groundwater and soil along the Chure, Bhabar and Terai regions in coordination with agriculture and water resources sector. Tenth plan also recommended the implementation of massive forest and soil conservation programme in Chure watershed in order to minimize the natural calamities of flooding, bank erosion and decline in the fertility of soil in Terai and inner Terai. The Interim Plan (2007-2010) highlighted the roles of forests in climate change and the implementation of Payment for Environmental Services (PES) as a mechanism for the provision of ecological and economic goods and services in watershed and landscape management. It also identifies NGOS as an institutional opportunity in conservation and development (Kanel, 2010). Three Year Plan (2010-2013) emphasizes promoting livelihood in Chure and implementing programme based on ecosystem service provision. It also recommends upland resource management so as to reduce negative downstream impact in the Bhawar and Terai (Kanel, 2010).

Ministry of Forests and Soil Conservation (MFSC) of Government of Nepal is implementing Biodiversity Sector Program for Siwalik and Terai (BISEP-ST) through sector wide approach in eight districts of the central development region of the country in 2001. It aims to produce and does equitable distribution of forest products and revenues, while maintaining ecological balance and conserving biodiversity through forestry and biodiversity conservation programs. Collaborative Forest Management scheme is being piloted to include such excluded majority people in benefiting from management of these state forests. One of the focus areas of BISEP-ST is promotion and trade of NTFPs for better life of rural communities. The program has realized that poverty in local forest communities is both a cause and result of deforestation and environmental degradation. CAPS was formulated by the Ministry of Forest and Soil Conservation in collaboration with CARE-Nepal, IUCN-Nepal and WWF-Nepal in 2008. The main objective of this CAPS is 'to create an enabling environment for all stakeholders so that they can contribute to the conservation of the Chure as well as to the livelihood of the resource-dependent people in an equitable manner' (MOFSC, 2008). It buffers the Chure region in Nepal, states the present status of the region, and identifies root causes of Chure degradation and its consequences/ impacts on the bio-physical and socio-economic environment in the region. Conservation and development are interrelated and a multidimensional issues. Many conservation policies, rules and regulation were enacted in the past; in fact, they poorly touched the Chure landscape degradation and conservation issues. Similarly, there are various arms of government involving in the resource (bio-diversity) conservation. Central level institutions are preparing legislative acts, policies, strategies and regulations for conservation and management; but they do not have clear policies to improve the living environment of the people living in the Chure region. Their role seems to be an evaluator and an advisor for the conservation and management issues. Inconsistency and weak coordination among the different arms of government agencies have also been recognized, which is the main cause of poor implementation of the policies. A decade long political instability in the country led to poor performance of the government in the field of implementation. It also seems that legislations have been designed in a very top-down approach, and hence the policies and programmes are not properly implemented in the field. It also seems that the policies and programmes designed for the conservation and management of the natural resources seem good, but the mechanism and procedures of implementation of these policies and programmes are not cleared. Market-led farming technology and appropriate farming techniques and policies, related to the integrated management and conservation of Chure region are still lacking. A large number of farmers in the region depend on livestock agriculture. Therefore, it is really a challenging task promoting livestock and agriculture activities in association with resource conservation and development in the Chure region. None of the policies and programs is designed in this context.

'Payment for Environmental Service' and 'Carbon Trade', as mentioned in the interim plan, generally does not specify the mechanism of its use in the conservation of Chure watershed. It is estimated that more than 70% of the Chure hills is occupied by forest and degradation and deforestation of forest resources in the region is fast growing. Increasing population pressures and persistence of poverty in the region could be difficult to prepare and implement conservation policies and working mechanism properly. There has been lack of settlement plan or settlement inventory of the Chure hills, narrow river valley and Bhabar. None of the policies and programs dealt with this issue. There has been conflict between DDC and DFO regarding resource ownership, utilization and infrastructure development in the Chure region. This is true in the case of extraction of river deposits (sand, gravel, stone etc) and construction of roads. Forest Act gives full authority to DFO while Local Self-Governance Act gives the power to the DDC. In general before extraction of the sand, stone gravel or mixture, an IEE or EIA must be conducted, but in many cases recommendations (mitigation measures) of the study will not be implemented and are not taken seriously or/and are largely ignored or not carried-out at all. It also found that the IEE/EIA study conducted by DDC (2010) for the extraction of river deposits would not be acknowledged

or recognized by DFO or vice versa.

Conservation and management plan

Based on the availability of Chure forest products for employment and income generation through establishment of environmental friendly green enterprises, development of integrated resources conservations models, strengthening the institutional capacity of forest organizations, activating stakeholders, production of multi-propose goods and services according to local perspectives, carbon trade and payments for environmental services are some of the opportunities that prevail in Chure forest. Therefore, considering these potentialities, there is an urgent need to formulate common and longer-term vision with policy priorities actions and result-oriented efforts. Long term forest management strategies and implementation policies as well as procedures of integrated forestry conservation plan of Chure area have been designed with a view to contributing to Chure forest resource promotion in order to improve their livelihood through promotion of ecosystem services, mitigation of natural hazards and adaptation measures of negative impacts of climates change by sustainable, participatory and decentralized as well as collaborative management and development system (ICIMOD, 2010).

Strategies

1. To meet the peoples' basic needs for fuel wood, timber, fodder, and other forest products in a sustainable way, and to contribute to food production through an effective interaction between forestry and farming practices in the Chure area.
2. To protect the land resource against degradation by soil erosion, landslides, riverside cutting, desertification and other effects of ecological imbalance.
3. To conserve the biodiversity of the Chure in order to continue the ecosystem services.
4. To contribute to the growth of local and national economies by increasing forest products and by developing forest based green enterprises.
5. To maintain ecological stability through enhancing the biomass production and reducing adverse effects of climate change.
6. To enhance natural resource productivity by increasing the regeneration rate of bio-resources and promoting environmental services through scientific and participatory management.
7. To support sustainable livelihood improvement of the inhabitants of Chure area by poverty reduction, generating employment opportunities through promotion of forest activities and forest products enterprises development**.**
8. To promote local peoples' participation in forest resource development, management and conservation.
9. To develop the legal framework needed to enhance the contribution of individuals, communities and institutions to natural resources management and utilization.
10. To strengthen the organizational capacity and institutional network for Chure forest to recover the ecological restoration in the ecologically sensitive zone Chure.
11. Maintain ecological stability through conservation existing forest cover and plantation on degraded land area of the Chure as to its geographic and environment sensitivity.
12. Conduct research and development to way out the cluster and scientific settlement plan in order to shift small and squatter hamlets from the inner parts of the Chure forest.
13. Promote sustainable management of forest resources, water source, watersheds, bio-diversity and other natural resources by participatory approach.
14. Apply landscape management approach for conservation and management of forest resources.
15. Operate an appropriate and location specific livelihood improvement activities and framework for natural resource management and distribution of potential income that accrued from reducing negative impacts of environmental degradation and climate change and contributing in adaption by carbon deposits through forest conservation and economic services derived from forest resources;
16. Lunch advocacy and awareness development activities at community and district level to educate people on natural resource conservation of Chure area.
17. Implement such activities that create green employment opportunities for empowering local community through public-community-private investment in environmental friendly enterprises based on forest products.
18. Democratize governance system of government, non-government, community and private institutions working in forest management and making it inclusive, transparent and accountable.

Working plan

1. All the forests of the Chure have to be managed under community forest by applying Joint forest management principles for their sustainability.
2. Forest areas have to be recovered for it to be stable by planting trees in degraded or deserted lands; as well as forest area damaged due to road construction sites.
3. Policy assessment has to focus on building collaborative working mechanism at district level to frame a scientific settlement plan that provides all social services rural infrastructural facilities in low cost. In

addition, for controlling forest encroachment, illegal felling of trees, smuggling of forest products and poaching by developing a coordinated framework.
4. Fire line demarcation is essential in all areas for the protection of forest from fire and other irresponsible activities through participatory approach by applying prohibitive and controlling.
5. Remapping of all forest area and resources assessment need to be carried out with the application of geographic information system (GIS) and use these information in local forest promotion.
6. Biodiversity conservation, community livelihood improvement and Chure Forest saving strategy need to be formulated with long-term perspective by involving the concerned stakeholders at district level.
7. Income generation for the poor, indigenous and ethnic people needs to increase by providing crop plan for cultivation and domestication of medicinal and aromatic plants, which could ensure economic empowerment and environmental balance.
8. Forest resources of high elevation area have to be managed in balanced and integrated approach by including grasslands where lifestyle is based on forest resources, herbs, crop farming and livestock bio-diversity.
9. Balance needs to be maintained between livelihood and natural resource conservation by ensuring the support and participation of the public to government managed forest**.**
10. Scientific and participatory action research in collaboration with district development committee, district forest office, and district soil conservation office needs to be carried out in order to plan and lunch integrated conservation and development activities that enhance the ecological stability of the Chure.
11. Ethno-botanical nurseries need to be established in different parts of the Chure area to encourage local people to plant, cultivate and domesticate the herbal plants species especially in Thada, Siddara and Jaluke VDCs.
12. Certified organic production of non -timber forest products has to be initiated in national standards for forest certification of sustainable forest management.
13. Forest resources utilization by the means of silvi-cultural management, which promotes regeneration and ground cover system.
14. Tree plantation in private areas, schools, and public places outside forest areas need to increase by distribution of seedlings free of cost, providing conservation support through regular supervision and monitoring system.
15. Leasehold forestry practice in all road sides needs to be developed by motivating local people for the conservation of bio-diversity, fresh water source and livelihood improvement livelihood, with the perspective of landscape management approach in the terai-Chure interactive system.
16. District level development arrangement allows for the judicious distribution of district resources and manages basket fund for Chure area integrated conservation and development programs as its revenue sharing proportion.
17. Model plot needs to be developed to motivate the people towards regeneration by space system in which every stakeholder easily compares between regeneration and non-regeneration rates in the forest.
18. Vulnerability assessment needs to be conducted for the assessing potential risks due to landslides, soil erosion, riverside cutting, forest encroachment, illegal trade of forest products, and climate change. Necessary and appropriate adaptation measures are to be applied for risk management.
19. Conservation works in the whole Chure-Bhabar area launched with upstream and downstream environmental linkage and sustainable management of Chure ecological system in integrated approach in accordance with conservation strategy to support livelihood of the local people of Chure region.
20. Opportunities for green employment generated with the provision of special facilities in order to encourage interested communities for the availability of resource, indigenous technology, and processing and market facility for environmental friendly enterprise based on forest resources for its commercialization.
21. Public services have to be provided by the government machineries through policy support for the partnership with the communities and private sector based on necessity, priority and feasibility.
22. Policy of ‘One User Group: One Forest Enterprise’ has to be implemented in every VCDs to support economic development through forest conservation.
23. Action for searching aromatic and medicinal plants needs to be executed with public-community-private partnership and policy of development of special zone for the production and management of aromatic and medicinal plant species to be made.
24. Special program of green employment needs to be introduced for the youths.
25. At least 35% of revenue, accrued from all of forest management approach based on community, has to be investigated for the enhancement of livelihood of ultra poor, backward community and indigenous ethnic group of the same region.
26. Gender and social inclusive activities need to be effectively implemented as a model by ensuring the participation of at least 50% women in the community forest user group.
27. Duplication in program implementation needs to be avoided by coordinating at district level stakeholders of Chure conservation.
28. Institutional capacity building of district forest office and its branches need to be enhanced by providing sufficient resources modern technology in accordance with new national strategic plan of forest sector.

29. Mutual cooperation among district authority, civil society, community and overall forest sector has to be made more effective extending it up to village level in accordance with the spirit of decentralized and democratic governance system.
30. Chure forest program fund has to be developed with the formulation of multi-stakeholder coordinating mechanism in the leadership of DFO in order to mobilize resources in Chure forest conservation in local interest.
31. Policy of conducting public auditing of on-going programs has to be applied to ensure good governance in forest conservation and management.
32. Institutional strengthening needs to go along with strengthening of monitoring and evaluation system by making necessary revisions in existing practices for effective conservation, promotion, and management of Chure forest resources.

Conclusion

Based on the above mentioned facts and figure the study suggested the result oriented work plan for the forestry conservation and management of Chure landscape in Arghakhanchi District. There is no clear policy for the resource conservation of Chure landscape. Therefore, there is urgent need of the policy assessment, formulation or amendment, which minimizes the gaps in existing policies and strategies for the conservation and management of the Chure landscape. This can be possible only through the coordination or collaboration among the line agencies and other related government agencies. Research and development needs to be conducted to way-out the cluster and scientific settlement plan in order to shift small and squatter hamlets from the inner parts of the Chure forest. Policy assessment has to focus on building collaborative working mechanism at district level for searching best way to frame a scientific settlement plan that provides all social services rural infrastructural facilities in low cost. In addition, for controlling forest encroachment, illegal felling of trees, smuggling of forest products and poaching, a coordinated framework has to be developed. All the forests of the Chure have to be managed under community forest by applying Joint Forest Management (JFM) principles for their sustainability. Scientific and participatory action research in collaboration with district development committee, district forest office, and district soil conservation office needs to be carried out in order to plan and lunch integrated conservation and development activities that enhance the ecological stability of the Chure. Conservation works in the whole Chure-Bhabar area launched with upstream and downstream environmental linkage and sustainable management of Chure ecological system in integrated approach in accordance with conservation strategy to support livelihood of the local people of Chure region. Leasehold forestry practice in all road sides needs to be developed by motivating local people to conserve the resources. Vulnerability assessment needs to be conducted for assessing potential risks due to landslides, soil erosion, riverside cutting, forest encroachment, illegal trade of forest products, and climate change. Necessary and appropriate adaptation measures are to be applied for risk management. Opportunities for green employment need to be generated with the provision of special facilities in order to encourage interested communities for the availability of resource, indigenous technology, and processing and market facility for environmental friendly enterprise based on forest resources for its commercialization. Model plot needs to be developed to motivate the people towards regeneration by space system in which every stakeholder easily compares between regeneration and non-regeneration rates in the forest. Chure forest program fund has to be developed with the formulation of multi-stakeholder coordinating mechanism in the leadership of DFO in order to mobilize resources in Chure forest conservation in local interest. At least 35% of revenue, accrued from all of forest management approach based on community, has to be investigated for the enhancement of livelihood of ultra poor, backward community and indigenous ethnic group of the same region. For the implementation of the programs, as mentioned in the logical framework of this report, public interest and their participation need to be developed. Conservation and management planning is an interactive process and it produces or re-produces knowledge through communication and participation. Therefore, there is also a need of collaboration and communicating mechanism among the DDC, DFO, DADO, DLSO and DSCO in the planning as well as implementation phase for the conservation of resources in the Chure region.

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