Promoting Institutional Development for Sustainable Rangeland Management in Mountainous Areas of Northern Nepal

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Introduction

Rangeland ecosystems are one of Nepal's most important resources, especially those in northern mountainous regions of the country. About 11 percent of Nepal's territory is rangelands and most of it lies above the tree line (Shrestha, 2001). Rangeland ecosystems and their biological resources play a critical role in the region's overall economic development and in its people's well being (Miller, 1997a). Firstly, the livelihoods of pastoralists depend greatly on plants, water, animals and other natural resources found in the rangelands. Other people, residing either in rangeland environments or adjacent areas, also are directly or indirectly dependent on rangeland resources. Secondly, rangelands provide habitats for a variety of wildlife, especially ungulates and large grazing animals, which share rangelands with a host of birds and other mammals (including some endangered species like snow leopards). Thirdly, the rich genetic diversity of wild and domesticated plants and animals found in these areas is a valuable resource for improving livestock, developing new crop varieties, curing disease and providing numerous other benefits as yet discovered. Finally, the tourist industry in Nepal is based, in part, on the attractiveness of its rangelands' wildlife and surrounding magnificent mountain landscapes.

Sustainable development of rangeland resources and ecosystems in Nepal like other countries in the Hindu Kush Himalayan (HKH) region in Asia is presently confronted with a number of problems (Watanabe, 1994; Miller, 1997b; Nepal, 2003). Declining wildlife populations associated with the loss and degradation of habitats is becoming a serious problem as rangelands simply can no longer support certain wildlife species. Overgrazing by livestock is a serious issue in some areas where most of the original vegetation has disappeared as a result of heavy disturbance by pastoralists and livestock. Overexploitation of medicinal plants, especially in alpine regions, is eroding biological diversity and becoming a disaster for sustainable rangeland development. Excessive tourism associated with a lack of planning has resulted in decreased biodiversity and environmental degradation in some areas, posing serious problems and handicapping sustainable development. Promoting the sustainability of rangelands in Nepal under these current pressures has challenged scientists and officials to improve management strategies to insure a viable future of this important resource.

Biological dynamics, such as vegetation structure and biomass, ecological and economic values and biodiversity loss have been studied in rangelands in Nepal's national parks and protected areas (Lehmkuhl et al., 1988; Carpenter and Klein, 1995; Katrina, 1997). However,

sociological studies are scarce, and this lack of understanding of the social dimensions of rangeland resource use has limited the proper management and sustainable development of rangeland ecosystems (Miller, 1997b; Gurung, 1998). Several researchers have noted that promoting sustainable management of rangeland resources without supporting related social dimensions represents a major challenge for Nepal's future (Richard et al., 2000; Chetri and Gurung, 2004). Worldwide, research has revealed that the sustainable management of natural resources requires not only technical supports, but also social dimensions (Altman and Cochrane, 2005; Antinori, 2005; Vella et al., 2005; Plummer and FitzGibbon, 2006). Hence, sustainable rangeland management will not be possible without the involvement of all stakeholders including local governments (Banks et al., 2003) and changes in policies and schemes related to natural resource management that affect rangeland management systems (Li, 2002). Clearly, social aspects must be emphasized for promoting sustainable development of important rangeland resources and ecosystems in Nepal.

Among social factors, institutional development is appealing and may ultimately lead to the improved management of natural resources, because whether formal or informal, institutions gain their social significance by constraining social action and shaping expectations about social interactions (Poteete and Welch, 2004). The role of institutions in natural resource management and rural development has received increased attention in recent times and has been widely discussed (Gustafsson, 1984; Mearns 1995; Appendini et al., 1999; Boesen et al., 1999; Hinchcliffe et al., 1999; Shah and Shah, 1999; Koku and Gustafsson, 2001). Experiences gathered from research and development work show that in most rural areas the governing (regulatory) mechanisms of institutions have often influenced sustainable natural resource use (Koku and Gustafsson, 2003). The role of institutions in rangeland resource management is of particular interest to discussions concerning mountainous areas in northern Nepal where local livelihoods are mostly dependent on the use of rangeland resources.

There are three sets of institutions -- state, market and civil -- with varying scopes and operations that have evolved in response to human ideas and aspirations while reflecting at the same time the apprehensions and limited imagination of society (Uphoff, 1993). Sustainable development will depend in large part on creating positive synergy among these three sets of institutions. It is necessary to understand how these alternative channels for raising economic, social and political productivity can be made to function better, respectively and collectively (Uphoff, 1993). From this context, this study uses an institutional analysis and development (IAD) framework to examine the problems facing institutional development for sustainable rangeland management at the local and national levels and proposes possible approaches to resolving these problems in mountainous areas in northern Nepal. In addition, the study will provide insights into the social dimensions of sustainable rangeland resource and ecosystem management that may be useful elsewhere in Nepal and neighboring areas across the HKH region.

Methods

Case study

Guided by the institutional analysis and development (IAD) framework developed by Ostrom (1986, 1990) and Uphoff (1993), we conducted a case study in the Rasuwa district, a high Himalayan district of Nepal, whose name means "grazing land for sheep and cattle." It can be considered a representative pastoral area in Nepal in light of its indigenous production system, historical tradition, and social-economic importance to local people. The Rasuwa district is situated in the northwest part of the Central Development Region (latitude 27°57′30″ to 28°23′30″N, longitude 85°7′00″ to 85°48′15″), about 120 km north from Kathmandu, the capital city of Nepal (Figure 1). It is surrounded by the Langtang and Salang Sungo mountain ranges along its northern border with the Tibet Autonomous Region of China; and the Sindhupalchowk, Nuwakot and Dhading districts of Nepal in the southeast, south and west, respectively. The district has a total area of about 1515 km^2, with almost 120 km^2 of cultivated land, 380 km^2 of forest land, and 260 km^2 of grass- and shrub-land. Most of the district is dominated by the Tamang ethnic group of Tibetan origin. There are 18 village development communities (VDCs) and 8689 households within the district. The average household size is 5.05. In 2001, the district had a census population of 43,900, which is about 0.2% of Nepal's population, and 64.7% of the population is Tamang people (TRPAP, 2005). Pastoralism plays an important role in the livestock farming system, the dominant farming system in the district. Three VDCs, Dhunche, Gatlang and Langtang were selected in this district as investigation sites for the field survey based on a consideration of their different geographic locations, climatic zones, and farming systems (Table 1).

Data collection

This case study was developed using a variety of data sources including research publications, reports, newsletters, and a field survey. Different stakeholders (farmers and professionals) involved directly or indirectly in rangeland management were surveyed. A combination of open-ended and pre-tested questionnaires, key person interviews, and a participatory rural appraisal (PRA) were used in the investigation. Farmers were interviewed face-to-face as this is the most accurate method for surveying people who cannot read and write (Salant and Dillman, 1994). The PRA developed by McCracken et al. (1988) and modified by Cornwall and Pratt (2004) and Netherlands Development Organization (SNV)/Nepal (2004) is a good tool to encourage farmers to freely give their knowledge, ideas, and opinions. Information missed in questionnaire surveys and key person interviews often can be supplemented using this tool. Observations and guided transect/mapping walks were also used. The sample farmer households were randomly selected from a VDC based on the household numbers in the village. In sum, 10, 14, and 11 households were surveyed with a questionnaire; 6, 6, and 8 key persons (older and experienced people who have lived in the VDC for a long time) were interviewed;

and 21, 14, and 12 participants were involved in the PRA in Dhunche, Gatlang and Langtang, respectively. The sampled households accounted for approximately 16, 14, and 50% of the total households in the individual villages.

Open-ended and pre-tested questionnaires, face-to-face interviews and group discussions were also used to survey resource specialists. Twenty-nine resource persons were randomly selected from different fields (livestock, natural resource, wildlife, land management, etc.) and organizations (local and International non-governmental organizations [NGOs], government service offices, research institutions and universities at both the state [13 persons] and district levels [16 persons]). The pre-tested, mailed questionnaire survey for professionals was designed and administered following the Total Design method (Dillman, 1978) to collect information about public service, policy-making, land tenure and ownership, and institution and governance issues related to rangeland management. At the same time, we conducted face-to-face interviews with most of these resources persons to get their experiences, opinions, and suggestions about sustainable rangeland resources and ecosystem management.

Data analysis

Original data from the surveys were grouped separately for the interviewees representing farmer households from different VDCs and professionals from district and central organizations. The information collected from individual interviews and group discussions were summarized. The data was then analyzed using systematic qualitative techniques (Patton, 1990; Miles and Huberman, 1994).

Results

State institution arrangement in rangeland management

There are no institutions specifically focused on rangelands and all policies related to their management are covered by community forest agencies. The Ministry of Forests and Soil Conservation (MOFSC) is the lead agency working jointly with the Ministry of Agriculture and Cooperatives (MOAC) in rangeland management at the national level. Four MOFSC departments -- the Department of National Parks and Wildlife (DNPW), the Department of Soil Conservation and Watershed Management (DSCWM), the Department of Forest Research and Survey (DFRS) and the Department of Forest Services (DFS) -- are responsible for managing land and resources within national parks, and for land reclamation and erosion control, land and resource survey, research and management of land and resources outside national parks. Two units in MOAC, the Department of Livestock Service (DLS) and National Agriculture Research Council (NARC), are responsible for development and research on livestock and pasture,

respectively. Although there are five administrative regions in Nepal, resource management institutions do not seem to exist at the regional level. Instead, there are corresponding district rangeland institutions responsible for rangeland resource and livestock management (Fig. 1.).

The interviews with professionals found that while four departments of MOFSC primarily work together on rangeland management planning and decision-making, they rarely cooperate with the two MOAC departments. There are often conflicts between the two ministries over land management and resource development. Some pasture development programs initiated by NARC or DLS may fail because their applications for land use rights are denied by DNPW or DFS. In turn, if DSCWM or other units in MOFSC attempt to restore a degraded watershed by reducing livestock numbers, they may face difficulties gaining cooperation from departments in MOAC. Some national level professionals claim that some current rangeland management problems stem from poor institutional cooperation in the past. Although linkages between national and district units in the same institution are quite strong, poor coordination between different district institutions has limited the improvement of rangeland management practices. Poor linkages among government organizations, NGOs, and some universities and research institutes at both the national and district levels appear to further constrain improving rangeland management practices.

According to the professionals interviewed, state institutions have provided some public services such as technology transfer, consultation, training, and subsidies at both national and district levels, but the sustainability of these services is rarely guaranteed due to several limitations, including lack of funding, poor infrastructure, and farmer illiteracy (Table 2). Development and research projects are not successful over the long term as they either fail to meet farmer expectations or are unsustainable and unstable. Poor communication with farmers is another barrier to smooth implementation of research and development projects. According to state professionals, lack of funding, poor infrastructure, and illiteracy are major limits in research, extension, and management interventions. Furthermore, a shortage of human resources also seems to be a problem based on responses from district professionals (e.g., there is only one college-trained animal and forage scientist out of five officers and 12 technicians at the National Agriculture/Pasture Research Station of NARC in the Rasuwa district). The development of more practical projects and enhanced human and funding resources were suggested by both state and district professionals as means for improving the implementation of rangeland projects. In addition, capacity-building is stressed by district professionals and literacy improvement is emphasized by state professionals. The survey results indicate that low salary, a lack of incentives, and poor group cooperation constrain improving professionals' work efficiencies in rangeland management. Improved motivation strategies for rangeland or related professionals should be considered in institutional improvement.

Market institution arrangement in rangeland management

In addition to pastoral products, cash crops and vegetables, cash crops, and tourism account for 60%, 10% and 70% of household family incomes in Dhunche, Gatlang and Langtang VDCs, respectively (Table 3). As pastoral productivity at the household level is very low, the agro-pastoral trading economy in this area is minor and fragile. Historically, bartering and micro-trading have dominated pastoral marketing in mountainous areas of northern Nepal. In the past, local farmers bartered their commodities such as grain, potatoes, and dairy products for Tibetan salt, wool, and ritual goods. Presently, border trading for daily necessities, clothes, and electric utilities from the Tibetan Autonomous Region of China and selling pastoral products, cash crops, and other products to local markets and contracted companies or middlemen (retailers) dominates the pastoral marketing system. Both government organizations and NGOs are not involved in pastoral marketing, and producers, consumers, and sometimes investors/tradesmen maintain all the systems.

Although the current trading system is more flexible and diverse than that of the past, local herders report many problems with the pastoral economy and marketing systems (Table 4). The pastoral economy cannot be improved due to low pastoral production rates related to poor pasture management, poor animal feeding, and malnutrition, and poor animal health care. Even though some herders can consult professionals for solutions to overcome these problems, public services are not practically available for most. Small economic margins result from a pastoral production system characterized by low input and low output. Both poor public supports and low inputs limit the improvement of pastoral production and the development of a stronger pastoral economy. Poor access to markets, lack of marketing information, and unstable or absent markets are major problems facing the pastoral marketing system. Herders in Gatlang VDCs have to sell their pastoral products to middlemen at low prices because they do not have other options in their remote and isolated villages. People in Langtang VDCs cannot sell their pastoral products to tourists or hotels during the off-season (monsoon season) or when tourism declines because of political disruptions. Farmers in Dhunche VDCs sometime miss reaping large profits due to poor marketing information dissemination even though they can trade their pastoral products at local markets. A Dairy Development Centre (DDC) has been developed recently as the contract company for some chauri and yak herders in Langtang and Dhunche VDCs but the effectiveness of this system is still under investigation.

The survey indicated that market institutions supporting rangeland management in northern Nepal are often poorly developed. Local farmers claim that the pastoral economy and marketing system can be improved if more public support and investment are provided and if there is more involvement by NGOs. Professionals stress that institutional development and cooperation, infrastructure development, and illiteracy alleviation are needed to improve the pastoral economy and marketing system.

Civil institutional arrangements in rangeland management

There are basically two sets of local organizations involved in rangeland management, community committees at the community level and civil associations at the group level (Table 5). A community committee is normally made-up of about 12 people elected by all community members and acts as the leader, decision-maker, and representative for the whole community. Civil associations are self-identified groups of households with common interests or the same resource pools, for example livestock, vegetable, crops, and forests. These two sets of grassroots (local) organizations have more social content and function compared to administrative and political institutions. Usually, community committees are responsible for major decision-making for all community members' concerns, while associations make decisions about the specific affairs of self-organized groups. The community committee can decentralize the decision-making process to the associations and the associations can ask for help from the community committee to solve the conflicts and problems between or within associations. When the question "Who decides the grazing time, livestock number, and campsite-building on rangelands?" was asked, the farmers interviewed replied "both livestock association and community committee." When the question "How do you mitigate conflicts over the sharing of pastures for grazing?" was asked, interviewees replied "first get arbitration from the livestock association, if this fails, we ask for help from the community committee." It seems that grassroots organizations work well supporting the community-based management of important public resources, like rangelands, whose use rights are controlled by local communities.

The structures and relations of grassroots organizations are summarized in Fig. 2. The community committee plays a very important role in spreading governmental policies (both state and district) related to rangeland management to community members through user groups (associations). Research institutions, universities, NGOs and other professional organizations at the national level can transfer technical support, professional consultations, or other public services to the community members either through local NGOs or directly to specific associations. Farmer associations contribute greatly to helping guide local people to access, understand, and apply the policies and techniques designed by policy-makers and professional resource managers. Although the effects of such "top-down" policies and techniques on sustainable rangeland management and livelihood improvement have not been investigated, these civil institutions do play important roles bridge-building between government organizations and civil society in promoting sustainable rangeland management. Aside from providing good organizational structures, community committees and farmer associations understand there are well-designed civil regulations and rules evolved from tradition or developed from reality. These civil regulations and rules bring local organizations into being and maintain their sustainable development.

Interrelation of State institution and civil society

In general, the linkage between state institutions and civil society (local institutions and NGOs) is very poor. Few farmer households in this study have been involved in the decision-making process related to rangeland management. When involved, it seems that few of their suggestions have been accepted by the authorities. In other words, farmers' voices have not been heard or considered by policy-makers in the process of initiating and implementing natural resource policies, especially those related to rangeland management. Similarly, the involvement of local communities in research and development projects promoted by district or central governments is very limited. Even farmers involved in some projects are generally not satisfied with their passive roles and resulting inability to contribute their ideas and suggestions about better rangeland management. Although community involvement in technical training is more common, the targets and contents of most training activities are often far afield from those required and anticipated by local community members. It seems indigenous knowledge of rangeland management is normally ignored by policy-makers and professional practitioners. Involvement by NGOs in developing rangeland programs and in policy-making is scare due to poor institutional cooperation between the government and NGOs (Table 6).

Although state and district professionals think that the involvement of local communities and NGOs in policy-making, project design, and implementation are very important, they rarely invite farmers to give suggestions or to provide evaluations before and after they make decisions or implement projects. Unfortunately, policy-makers and professionals often overlook the roles of civil society in improving interventions and practices related to rangeland management. Most professionals think indigenous knowledge is very important for sustainable rangeland management but it is not efficiently considered an "up-down" system. They also think that the community is more efficient than the government in terms of land tenure of rangelands and that the linkage and cooperation between state institutions and civil society should be strengthened and improved (Table 7).

Institutional development for sustainable rangeland management

Efforts to develop sustainable rangeland management practices in Nepal require recognizing the importance of institutional development. Institutions are human constructs and can be altered if there is willingness and co-operation among beneficiaries and stakeholders in an existing system (Koku and Gustafsson, 2003). Institutional cooperation must be stressed not only among different institutional sectors (state, market, and civil institutions) but also among different organizations in the same sector, for example, different departments (e.g., livestock and forest departments) in the state institution (Uphoff, 1993). All levels of government must work in partnership with each other together and with community bodies and user groups. This will require ongoing and effective communication, particularly during policy and program development. Government, in consultation with civil society, should introduce programs to

increase the understanding of indigenous peoples' special association with the land and the implications this has for the management and use of rangelands. Government should integrate plans and strategies of local representative bodies, where appropriate, within broader regional strategies. Governments should seek the full participation of relevant NGOs and user groups in undertaking regional planning, using culturally appropriate consultation processes. Governments should actively encourage relevant research institutions and universities to direct a significant portion of their research efforts to issues facing rangeland management and to consulting with rangeland users, local communities and NGOs in setting research priorities. Research organizations should work with local communities and rangeland user groups to implement the practical outcomes of their research efforts. They should ensure that information is accessible and easy to understand. Scientists working in relevant fields should collaborate with local people to utilize their knowledge and practical experience to find optimal solutions and vice versa.

Another institutional issue vital to sustainable rangeland management in mountainous areas of northern Nepal is the development of a viable market institution. Governmental agencies and NGOs should create diverse channels for local communities to develop viable pastoral economies and marketing systems and should encourage financial institutions and other service providers to cooperate with local communities in such efforts. The government and NGOs should ensure that the commercial services they provide are sufficiently flexible to meet the needs of rangeland users. Financial institutions, in consultation with rangeland users and local communities, should develop codes of practice that are compatible with sustainable rangeland management. Banking products and other financial services, while being commercially based, should be sufficiently flexible and tailored to meet the specific circumstances of rangeland production and marketing. Financial institutions should consider the overall management and planning capabilities of rangeland users and ensure that they are aware of the challenges and objectives of their client groups.

Rangeland policy and program development are important issues for sustainable rangeland management in Nepal. National legislation should separate rangeland management activities from those associated with forests and other natural resources. Government and NGOs should initiate the development of rangeland laws, regulations, and norms. State legislation should clarify the roles and responsibilities of rangeland owners and users as security of land tenure and access to resources is required to enable appropriate resource management (Koku and Gustafsson, 2003). Government should ensure that land tenure legislation takes into account the rights of indigenous people with respect to rangeland management and promote relatively equitable access to resources for all members of the community, including the poor and socio-politically weak. Consultative mechanisms between decision-makers and local communities should be established and utilized to ensure full coordination among all spheres of stakeholders with respect to policy development. The government should consult and report regularly on policy and program initiatives, which would result in the development and communication of consistent and complementary policies and legislative actions related to rangeland management.

Government should ensure that all programs, policies, and services related to rangeland management are subject to regular public evaluation to ensure they remain relevant and appropriate. Rangeland planning, research and development activities should be flexible and responsive to the ongoing and changing needs of rangeland communities and the environment. Such activities should also include transparent evaluations by users and third parties (e.g., NGOs) to ensure that they remain relevant.

The development of institutional governance should also be taken into account by governmental authorities. A case study in Ghana showed that the activities of District Assemblies throughout the country were brought closer to rural people since the management of natural resources was decentralized in 1988 (Koku and Gustafsson, 2003). Following this shift in governance, the status of District Assemblies changed from being mere conveyers of centralized (i.e., pre-formulated) decisions and plans to one where they served to support local level bottom-up decision makers. As a consequence, rural people throughout Ghana began seeing district assemblies as agents of change for matters related to their development. Similarly, in Nepal, it is necessary to change the centralized decision-making and planning process for rangeland management to a more “bottom-up” process so that the voices of local people can be clearly heard by policy makers and to ensure that sound indigenous knowledge (especially rules and regulations) can be integrated into sustainable rangeland management practices. The government and NGOs should also support communities by funding locally employed facilitators to develop and promote local strategies and planning processes for enhancing sustainable rangeland management. Through such actions at all institutional levels, Nepal will be able to develop and maintain an integrated set of policies and actions that will ensure the sustainability of valuable rangeland resources in its northern mountainous region.

Tables and Figures:

Fig1. Institutional arrangements in rangeland management at state level

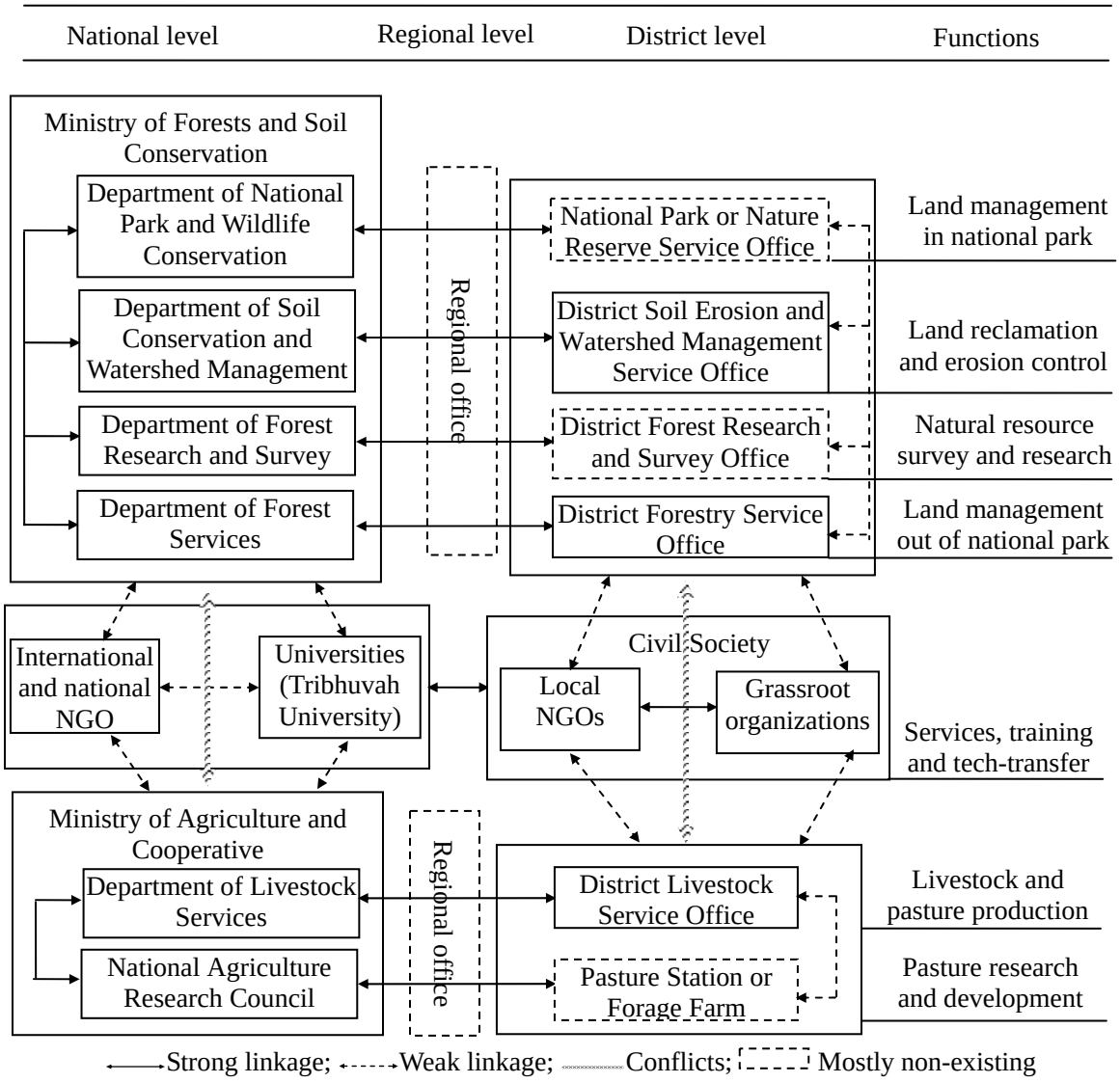

Fig 2. Institutional arrangements in rangeland management at grassroot level

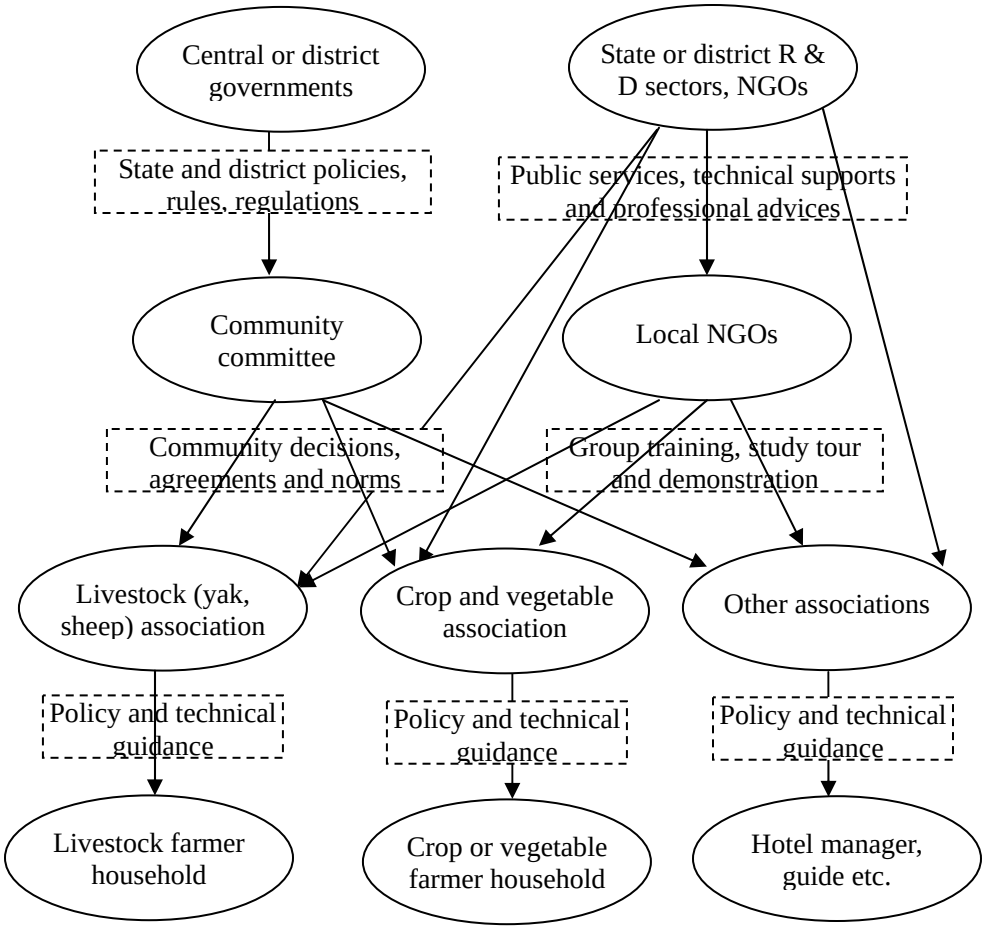

Table 1 General information about village development community (VDC) case study sites and farmer interviewees

Information about case study sites	Dhunche VDC	Gatlang VDC	Langtang VDC
Location (elevation)	Lowland (1900 m)	Midland (2200 m)	High Mountain (3300 m)
Climatic zone	Subtropical-temperature transition zone	Temperature zone	Subalpine zone
Farming systems	Multiple farming of livestock, crop, fodder and vegetable	Crop-livestock mixture farming	Livestock farming (tourism)
Total households	164	223	61
Livestock composition in individual household	1-2 cattle, 2-3 buffalo, 4-5 sheep and goats, 10-15 yak and chauri	1-2 cattle, 10-20 sheep and goats, 10-15 yak and	20-30 sheep, 2-3 horses, 10-15 yak and chauri (80% of

	(only 10% of households keep yak farming)	chauri (half of households keep yak farming)

Table 2. Problems and solutions in institutional development at state level

Items	Professionals' response at different importance order	
	District	State
Public services provided for farmers		
1st priority response	technology transfer	training and education
2nd priority response	consultation and demonstration	subside and income-generation
3rd priority response	policy and planning	technology transfer
Limits in improving public services		
1st priority response	poor infrastructure	lack of funding
2nd priority response	lack of funding	poor infrastructure
3rd priority response	illiteracy	illiteracy
Mitigation of limits in public services		
1st priority response	creating financial resources	increasing financial incentives
2nd priority response	capacity-building	capacity-building
3rd priority response	involving multi-stakeholder	mitigating illiteracy
Causes of failure in project and policy implementations		
1st priority response	gap between professionals' efforts and farmers' needs	instability and discontinue of the project and policy
2nd priority response	poor communication with farmers	gap between professionals' efforts and farmers' needs
3rd priority response	instability and discontinue of the project	poor communication with farmers
Problems in extension and supervision		
1st priority response	poor infrastructure	lack of funding
2nd priority response	lack of funding	poor infrastructure
3rd priority response	shortage of human resource	illiteracy
Solutions to overcome problems in research, extension and management		
1st priority response	more practical projects	more practical projects
2nd priority response	more financial and human resource	more resources persons and incentive
3rd priority response	strengthening capacity-building	illiteracy mitigation
Factors limiting professionals' work efficiency		
1st priority response	low salary	no incentives
2nd priority response	no incentives	poor group cooperation
3rd priority response	poor group cooperation	low salary

Table 3. Pastoral economy and market systems in mountain areas of northern Nepal

Queries	Farmer interviewees' responses		
	Dhunche	Gatlang	Langtang

Major pastoral products	Dairy, wool, culling livestock	Wool, culling livestock	Dairy, wool, culling livestock
Uses of pastoral production	Family income, home-consumption	Home-consumption, family income	Home-consumption, family income
Proportion of pastoral product to total family income	40%	90%	30%
Non-pastoral products	Crops and vegetables	Crops	-
Uses of non-pastoral products	Home-consumption, family income	Home-consumption	-
Other source of family income	Business	Labor	Tourism
Non-pastoral product and others' contributions to total family income	60%	10%	70%
Major market	Local market, contracted company	Middlemen, retailers	Tourists, hotel, contracted company
Major decision makers in pastoral market	Producer, consumers, investor	Producer, middleman	Producer, consumers, investor
NGOs' involvement in pastoral market	Rare	Rare	Never
Public invest in pastoral economy	No	No	No
Public control on pastoral market	No	No	No

Table 4. Existing problems and possible solutions in pastoral economy and marketing systems

Queries	Interviewee's responses
Major limits for pastoral economy	Poor pasture management, poor animal feeding and malnutrition, poor animal health care etc.
Farmers' measures to overcome the limits in pastoral productions	Sometimes consulting professionals (local livestock or pasture service officers, researchers and extensionists etc.)
Professional's suggestions to improve pastoral economy	Increasing public supports/services (rangeland improvement, fodder production, livestock feeding, animal health care etc.)
Problems in pastoral market	Poor access to market, no market, unstable and single market system, lack of marketing information
Farmers' suggestions to overcome problems in pastoral market	Public support/investment in pastoral economy, multi-market development, NGOs' involvement in pastoral market
Professional's suggestions to improve pastoral production	Institution development and cooperation, infrastructure development, illiteracy alleviation

Table 5. Local institutions in rangeland management

Items	Components	Attributes
Grassroots organizations		
Community level	Community Committee	Elected body
Group level	Livestock (e.g., yak) Association (all VDCs)	Self-identified group
	Vegetable Association (Dhunche)	Self-identified group
	Crop Association (Dhunche and Gatlang)	Self-identified group
	Forest Association (Gatlang)	Self-identified group
	Hotel and Guide Association (Langtang)	Self-identified group
Non-government	Women Association (Dhunche)	Voluntary organization

organizations	Paldor Peak Youth Club (Gatlang)	Voluntary organization
Decision makers	Government officials or committee members	Community meeting
	Household representatives (mostly male)	Dialogue or negotiation
Guides for behaviors	Traditions or rules	Oral or documented
	Agreements	Mostly oral
Criteria for decisions	Policy and best implementation means	Formal
	Interests of members	informal
Land tenure	Public/government (over 95%)	Native rangeland
	Private (less than 5%)	Fodder filed
Sanctions	Authority coercion	External
	Social pressure	Internal

Table 6. Public services and institutional governance in rangeland management

Queries	Farmer interviewees' responses		
	Dhunche	Gatlang	Langtang
Herders' involvement in policy-making	Never	Sometimes	Never
Herders' suggestions to policy makers	Ignored	Mostly Ignored	Ignored
Herders' involvement in research & development programs	Sometimes	Sometimes	Never
Herders' involvement in training programs	Sometimes	Seldom	Seldom
Availability of public service to herder community	Mostly no	Mostly no	Mostly yes
Quality of public service	good	good	fair
Integration of public service and indigenous practices	Mostly no	Mostly no	Mostly no
NGOs' involvement in policy-making and public services	Sometimes	never	never

Table 7. Public services and institutional governance in rangeland management

Items	District	State
Investigation on farmers before project design	Sometime	Sometime
Importance of farmers' involvement in decision-making	Very important	Very important
Farmers' involve in decision making	Sometimes	Sometimes
Importance of NGOs' involvement in decision making	Very important	Very important
Government cooperation with NGOs	Sometime	Sometime
Importance of cooperation with NGOs	Very important	Very important
Importance of indigenous knowledge in rangeland management	Very important	Very important
Which land tenure would be more efficient in pastoral production	Community	Community
Which land tenure would be more efficient in economic-socia development	Community	Community

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