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An approach to effective assessments in low data environment: Evidence from Sikkim, India

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ABSTRACT

Program evaluations for conservation interventions have to take into account the complex interrelationships of various components in an ecosystem. Measuring direct impact can be difficult, given that changes are often the result of complex systemic interactions and can take a long time to evolve. Therefore, the focus of the paper is to bring forth the importance of designing an effective program evaluation in low data environments by adopting a multi-disciplinary approach. The paper illustrates this by identifying a framework to evaluate specific measurable ecological and societal outcomes that also assist in reviewing relevance and importance of implemented policy. For this, the paper uses learning's from an ongoing research project on evaluation of grazing exclusion policy in West district of Sikkim. The findings of study would serve as an input to further impact assessment studies on grazing ban. The paper reveals how program impacts can be established by using a mix method approach. It identifies precise measurable environmental outcomes that also assist in reviewing relevance and importance of implemented

Key words**:** low data environment, conservation policy evaluation, impact assessment, grazing ban, effective assessment

1 Introduction

Pastoralism is an age-old practice and a livelihood strategy adopted by many communities across the globe. In India itself there are many indigenous pastoral tribes still practicing traditional pastoral forms supported by community norms: Gujjars and Dhangars in North India, Gaddis in Himachal Pradesh, Bakarwals in Kashmir, Toda and Kuruba in southern India and Gurungs and Monpas in North East to state a few. However of late, there is a rise in cases of conflicts between the pastoral communities and the governing regimes over the resource use issue. This can be largely attributed to lack of transparency in explicit property rights regime and absence of robust institutional arrangements and rapid increase in resource exploitation rate. The problem is compounded by the fact that livestock numbers have been increasing exponentially, but technology and management practices have not kept up with the increased pressure on resources. Similarly, there is a shift from sustenance to commercial scales of livestock domestication which has an adverse effect on the ecological stability of forest ecosystems. As a consequence of all these factors, the forest lands and grazing lands have come under enormous pressure leading to their rapid degradation. This crunch is particularly evident in India: there is not enough feed and fodder available to support the growing livestock populations in India. This not only has ecosystem consequences, but also livelihood consequences as almost 60% of the cattle population is owned by small and marginal farmers.

With environmental degradation concerns rising, the outlook of central government has shifted to adoption of conservation-centric policies. Under the conservation-based approach, long term policies balancing economic development and conservation are being formulated. In the forestry sector, the paradigm shift towards environmental conservation and social focus was brought in with the revision of National Forest Policy, 1988. The emergence of

participatory approach to forest management with commissioning of Joint Forest Management committees was believed to be progressing towards inclusive approach to conservation. Also, a host of conservation related policies and programs such as afforestation activities, delineation of critical wildlife habitat amongst others have been introduced in the last two decades. This has brought restrictions on activities such as grazing and collection of forest products in protected area networks. The basic objective behind these restrictions is to promote efforts for conserving biodiversity, protecting habitats for the dwindling wildlife population and providing an opportunity for the degraded forest ecosystems to recover from degradation. Considering the high dependency of the rural population on forest resources, policy implementation is a difficult task.

There are contrasting perspectives on the suitability and appropriateness of such policy majors. Conservationists on one hand feel the need of such conservation centric policies while social scientists on the other hand are skeptic of them. The bigger question is "Is there a practical solution to this raging debate of social cause versus environmental cause?" The surge of such initiatives has also raised the need to investigate their role in attaining the desired set of objectives. Thus, evaluations of conservation interventions or policies assume significance in this context. However, there are few examples of such program evaluations of conservation policies or interventions especially in a developing country like India. There is a lot of literature available on the topic of program evaluation of developmental or environmental intervention. But most of it employs quantitative approaches requiring detailed data sets, securing which is a challenging task in most of the developing countries. Also program evaluations of conservation interventions are much more complex to execute in the field due to the composite and dynamic nature of ecosystems and the multitude of the factors acting upon them. Another significant issue pertains to the object of focus for such

evaluations. Typically program evaluations focus on one aspect of the intervention or policy. For instance, some studies about forest degradation focus solely on the impact of disturbance on vegetation or soil aspects. On the other hand others focus solely on the implications of policy prescription on socio-economic pertaining to local communities. But there are very few studies that integrate the ecological and socio-economic aspects to present a holistic picture.

Program evaluation for conservation intervention has to take into account the complex interrelationships of various components in an ecosystem, including humans as a component of the ecosystem. Measuring direct impact can be difficult, given that changes are often the result of complex systemic interactions and can take a long time to evolve. Therefore, the focus of the paper is to bring forth the importance of designing an effective program evaluation in low data environments by adopting a multi-disciplinary approach. The paper illustrates this by identifying framework to evaluate specific measurable ecological and societal outcomes that also assist in reviewing relevance and importance of implemented policy. For this, the paper uses findings from an ongoing research project on evaluation of grazing exclusion policy in West district of Sikkim.

2 Evaluation in low data environments

This section briefly describes the design alternatives for impact assessment type of exercise for conservation intervention and the challenges associated in applying them to low data environments. Subsequently, we discuss an effective framework that can be used to measure the impacts of conservation interventions. The area of conservation policy evaluation is still evolving and the rationale behind discussing the framework provided

2.1 Available impact assessment frameworks

Based upon when the program evaluation is conducted, the two broad types of evaluation approaches for impact assessment type of studies are:

- *Before and after assessment*

  Comprises of comparing a scenario before the intervention to the one after the completion of the intervention. Such an assessment can be resource intensive, particularly when new data sets need to be collected. These are difficult to carry out in the absence of baseline data. The exercise is most applicable for programs that are regularly monitored and where baseline information is available.

- *Ex-post impact assessment*

  Comprises of comparing an area or a group that has received the intervention to a similar area or group from whom the intervention was withheld. Such an assessment is characterized as summative evaluation and cross sectional data sets suffice the data need. The challenge in this case lies in establishing the "similarity" of the treatment and control groups – our ability to attribute current differences between the "treatment" and "control" group to the intervention being studied depends on how sure we can be that the two areas were similar before the intervention.

Adopting any of the above type of evaluation approach requires / necessitates a rich repository of available data sets which is usually difficult in real life projects. Establishing clear control sites or control groups is the crucial step in the ex-post assessments. For conservation intervention in the forestry sector that would mean identifying a site that has similar environmental, social, and economic characteristics as the proposed study site, but where the implementation of the conservation intervention differs from the study site. Quantitative strategies using either of experimental, quasi experimental or non experimental

designs can then be applied to attribute the causal relationship. Experimental designs require complete random assignment of subjects to the control group and hence are tricky to apply in field situations for conservation interventions. Quasi experimental designs are relatively easier than experimental designs but they too require establishing a comparison group and their effectiveness depends a lot on the way the comparison group is established. In real life situations, the resource and time constraints are overriding factors that affect conducting such in-depth evaluations. Also, such evaluation shows the impact on a single entity i.e. dependent variable which could be variable on deforestation rate or species specific. Such evaluations rarely capture or provide an explanation for the change in the ecosystems due to the intervention.

2.2 Challenges of evaluation in low data settings

As described in the earlier section conducting impact assessments for conservation interventions in low data environments presents many challenges. The section below discusses some of the key challenges that are typically encountered in a rural or natural setting in data deficient regions.

Lack of available data

Impact assessment designs are usually data intensive. For a successful impact study either, before and after data or cross sectional data for control and treatment groups or sites is essential. Evaluations for conservation interventions require data on environmental attributes such as forest cover, forest types, wildlife populations, water and soil quality, classified imagery etc. Usually secondary information on such relevant parameters is unavailable. Conducting a primary survey to capture data on relevant parameters is extremely expensive in terms of time and budget.

Unplanned nature of program evaluation

A program or policy evaluation for environmental policies is rarely done in developing countries like India. There are usually no budget allocations separately made for research components in such interventions. They are usually not planned and are mostly commenced after the intervention. In such cases, it becomes difficult to conduct an impact assessment as there is neither baseline data nor any regular monitoring information.

Ensuring similarity between control and treatment sites

The selection of a control site in an impact assessment study would be based on key attributes that would substantiate the similarity between the treatment and control sites. The attributes are selected in a way so that they should remain relatively constant over time and that they should be easily assessable. For conservation interventions in forestry, this means finding a control site that is similar in nature to the treatment site in terms of vegetation composition, topographical features (altitude, slope), long-run edaphic factors (soil type) and socio-economic conditions of people living in an around the area (ethnicity of people, livelihood strategy). Thus in real life conservation projects it is extremely challenging to establish a control site.

Terrain challenges

Collecting primary data is challenging and time consuming task especially in difficult natural settings. Also, seasonal element is a crucial criterion in vegetation characteristics. For example, there could be numerous considerations such as; a variety of annual herbs or grasses or medicinal plants have different growing seasons, shedding of leaves makes tree identification difficult etc. In order to capture the vegetation characteristics of the area

sometimes seasonal surveys become important which requires more resources in terms of time and finance. Also, access to undisturbed locations could become an issue due to the dense growth or wildlife concerns or difficult terrain considerations.

Prolonged interval between intervention and the impacts

Conservation interventions take substantial time for the ultimate impacts to show. Usually the policy interventions are designed for short to medium time frames. While the time taken by ecosystem to reflect the impacts of the intervention could be considerably more than that. In such cases, the evaluations conducted immediately after the intervention would not be able to capture the ultimate impacts. In such cases selecting appropriate associative parameters to measure the intermediate outcomes and to gauge the direction of the impact becomes a crucial step.

Expert knowledge

Conservation interventions require a multidisciplinary approach. For a robust design inputs are needed from a variety of fields such as ecology, pedology, hydrology, imagery & social sciences. Besides these, local experts having in-depth knowledge and understanding of the area are also essential. Getting a multi-disciplinary team for small scale projects is an enormous challenge.

Resource constraints

This is an overriding in most of the impact assessments constraint. Impact assessment studies are time and cost intensive. The scope of the study and design that can be employed depends to a great extent on the type of budget and time available for the study. Typically limited

budgets and time are available for such studies as policy makers or governmental bodies who mostly commission such studies require rapid and informative assessments.

Mismatch of scales

The boundary of protected area network does not match with the administrative boundaries of districts and states. For example in Indian Forestry, the records might be available at a forest circle or forest division level which would not correspond with administrative boundary of a district. So it becomes to inter-link the socio-economic and ecological variables in such cases. Also sometimes the study is conducted at the micro level and secondary information is available only at district level. It becomes difficult in either case to utilize the data as micro level site could differ significantly from the larger landscape such as district in many ways.

Blanket policy prescriptions

Forming control groups is an essential approach in most of impact evaluation designs. For conservation projects, to ascertain the causal relationship this translates to finding a control site and a control group similar to the study site (treatment) but which differs in implementation of the conservation policy. Usually policy prescriptions in conservation are brought in for a larger landscape (national or state level) and they usually cover all the protected forest areas and reserved forest areas. Thus, establishing control site or a control group becomes in these contexts.

2.3 Evaluation design components for effective assessment

The various elements in an ecosystem are inter-linked with each other. A change in the status of one is bound to cause an alteration in some of the other elements. Accordingly, successful implementation of the ban is supposed to improve the condition of the degraded forest

landscape, but it is necessary to fully understand what aspects of the forest it helps more than others as well as where its impact could be strengthened. Evaluations can also help understand other, potentially confounding, influences on forest health. Restricting the analysis to ecological characteristics in such a study can provide highly misleading policy inputs as it would overlook the opportunity costs of livelihood foregone by local communities. Thus, indicators referring to impact on welfare of people and ecology, both should be used as the basis of designing a holistic & effective program evaluation of the conservation intervention. Figure 1 provides a schematic representation of the distribution of impacts of a conservation policy across various thematic areas.

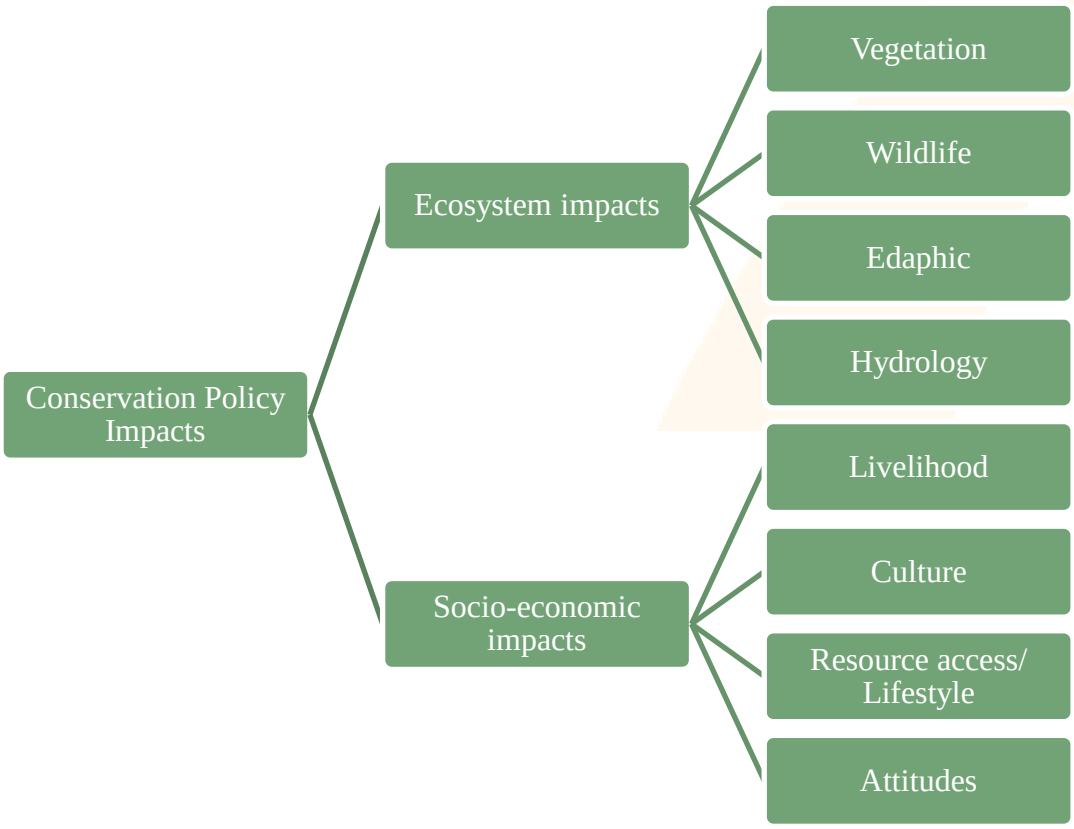

Figure 1 : Schematic representation of identified components for evaluation of conservation intervention

Accordingly, presented below is the framework designed for evaluating a grazing exclusion study in the West district of Sikkim in India. The framework can be adopted for other studies related to grazing in forest areas. The evaluation framework is divided into three main components: Vegetative, Physical and Social. A detailed criteria-indicator (C&I) framework can also be developed from this for a qualitative assessment. The section below describes in details the important parameters under each of these components and also provides an overview of the likely indicators to be considered by the study.

2.3.1 Vegetative component

One of the prominent and observable changes induced due to grazing is on vegetation in an area. When the density of domestic livestock increases, it leads to overgrazing of an area. Continued grazing pressure on forests could lead to change in species composition in the long run due to selective lopping and cutting of preferred fodder and firewood species. Also, this may cause increased abundance of unpalatable species and introduction of non native invasive species. Other than grazing by livestock the vegetation is also impacted by the activities of the herders. Also, increase in livestock densities leads to competition between wild herbivores and domestic livestock. Some of the issues could be site specific and it is important to understand and include those vegetative parameters in the evaluation. Table1. presents a list of important parameters that should be considered for a grazing related evaluation study.

Table 1: Identified Vegetative parameters for evaluation of grazing related studies

Parameter	Description	Recommended Indicators
Forest structure	Forests are characterized by vertical layers typically consisting of ground floor, understory, and middle storey and over storey. Lopping and cutting of trees introduce alterations in the forest structure by making forests more open. And sometimes the pressures are felt more by a particular age-class distribution of trees.	Percentage of canopy density, Presence and status of forest layers, DBH distribution, tree height distribution
Species composition and distribution	Grazing and associated activities possibly could alter the vegetative composition of an area via activities like selective grazing, lopping etc. It is important to examine the extent of change brought about mainly in key species & medicinal plants from ecosystem and community needs point of view.	Three most common species as percentage of total growing stock, Ten most common species as percentage of total growing stock, Diversity indices, Species at risk, Fodder species as percentage of total growing stock, Fuelwood species as a percentage of total growing stock, Existence and distribution of medicinal plants, litter distribution, presence and distribution of medicinal plants
Wildlife sightings	Wild animals are extremely sensitive to changes and disturbances in their habitat. It is a measure to predict the impact on wildlife in the area	Area of plantations for habitat improvement works Number of sightings of wildlife / calls
Regeneration	Regeneration is one of the most important functions that are hampered by grazing. It is a measure to observe the status of recovery via regeneration	Species wise number of saplings, Coppice Regeneration,
Forest disturbances	It is important to examine the extent of change brought about by disturbance such as grazing, fire, cutting, lopping and introduction of non native and invasive species. This measure captures the vegetative health of the ecosystem	Presence of domestic livestock Percentage of vegetation affected by grazing, Area affected by forest fire, Percentage of area affected by lopping, cutting etc Species affected by the disturbance, Percentage of area under non native or invasive species

2.3.2 Physical component

Overgrazing is a common phenomenon in pasturelands and forest areas and consequently it leads to deterioration in land quality and creation of wasteland. Typically an area subjected to overgrazing becomes more susceptible to threats like soil erosion, soil compaction and loss in moisture holding capacities besides other. While overgrazing could be a problem, available literature also shows instances where controlled grazing is beneficial to the site and has helped in improving the fertility of the area. Study of edaphic factors and hydrology constitutes a challenging task. Table 2 presents some main parameters to capture the soil stability and hydrologic functions for grazing affected forest lands.

Table 2 : Identified physical parameters for evaluation of grazing related studies

Parameter	Description	Recommended Indicators
Soil composition, texture and structure	Soil constitutes a basic element of forest ecosystems. Health of the vegetation in an area is directly dependent on the health of the soil at a place. This measure attempts to capture the soil properties in the area	Percentage of Moisture Water holding capacity Bulk Density Particle Density Porosity Soil texture
Soil chemical composition	Nutrient rich soil aids vegetative growth and in turn assists in improving habitat quality. Fertility of soils is a significant factor especially in hilly areas. Controlled grazing is considered beneficial for improving the soil quality at a place. This parameters gauges the effect of grazing on the nutrient levels	Level of acidity (or alkalinity) Soil Nutrients (N,P,K) Soil Organic Carbon content Cation exchange capacity
Soil stability	Vegetative cover or presence of organic matter in the top layer of the soil binds the soil particles together, in turn decreasing the erosion potential. The other factor is the structure of the top layer of soil itself. Loosely bind soils are more prone for erosion. In hilly terrains having steep slopes, water flow increases gullies and rills formation, which in turn accelerates soil degradation.	Soil stability test results Soil erosion status Soil compaction Gullies and Rills formation

Parameter	Description	Recommended Indicators
	Livestock tracks tend to result in gully formation especially in mountainous regions. This parameter classifies the erosive properties and degradation at site.	
Water quality	Quality of water in a catchment is a function of many factors. Undisturbed catchments will tend to have better water quality than the ones with disturbance. This parameter evaluates the water attributes.	Status of Water streams (seasonal/perennial), water quality tests
Recharge of aquifers	Overgrazing and other anthropogenic pressures hamper the hydrological regime by impacting infiltration rates and percolation rates and increasing surface run off. This parameter attempts to capture any change in hydrological properties after the ban on grazing	average ground water level in water bodies in the vicinity of forests during past 3-5 years

2.3.3 Social component

In order to do a holistic impact evaluation, the study of the impact of conservation policy (in this case grazing exclusion) on the local economy and the lives of dependent local communities is essential. The significance of this aspect is for several reasons: first, the social component is important for assessing successful proliferation of the intended outcomes of the conservational policy i.e. grazing exclusion. Second, peoples' perceptions of the impact of a ban can be as important, if not more important, than its actual impact. The sustainability of any changes depends on the policy being either enforced or incentive compatible with the local community. Third, the social component may help to develop a more robust strategy if credible historical data based on peoples' recollections can be gathered. Such data must be handled with care, but it could help us do some limited before-and-after comparisons, which would in turn strengthen confidence in our results.

Table 3: Identified elements of interest for evaluation of impact on socio-economic aspects

Study Elements	Description	
Livelihood strategies	Livestock rearing is a significant livelihood across communities in India. Livestock are the main source of milk and related products and many livelihood strategies are dependent or partially dependent upon it. Through this element, the impact of policy on livelihood strategies would be studied.	Livelihood strategies and income before and after the conservation policy implementation, asset ownership, debt , alternative means of livelihood
Cultural impacts	Due to conservational policy, access to earlier free forest resources is curtailed. This can bring about change in resource extraction pattern and also in lifestyle. Access to education and health could also be affected	Access to resource, Resource extraction pattern, making of local milk products,
Forest Fires	Relationship of forest fires and grazing is tricky considering that controlled grazing is regarded as beneficial for controlling forest fires, while heavy grazing along with fires is known to degrade forests. In addition the aspect of human induced forest fires is associated with grazing. This measure investigates the role of ban on the forest fire frequency	Frequency and distribution of forest fires
Wildlife conflicts	An increase in wild animal numbers is usually associated within conservational policies. This may lead to substantial increase in man-animal conflicts within the fringe areas An effort is made to document this and get people's perception on this issue	Damage caused by Wild animals, Frequency,
Perception towards the conservation policy	From a policy strengthening perspective it is important to understand how people perceive the conservational program.	Perception of local community on performance of conservational policy on environmental, health, education, livelihood aspects and participatory approach

3 Case study on applying an effective evaluation approach

This section is based on an ongoing research project in Sikkim undertaken by the authors in collaboration with Sikkim Forest Department. The objective of the project is twofold: Firstly it is to examine the effect of grazing exclusion on ecological characteristics and the socio-economic characteristics of the dependent local communities in the selected study sites. Secondly, to create a holistic framework for assessing grazing exclusion that can be further used for a larger study on grazing exclusion evaluation in the State. The study sites are Barsey Rhododendron Sanctuary (BRS) and a part of buffer zone of Kanchenjunga Biosphere Reserve (KBR) in the West District of Sikkim. The project has adopted the evaluation framework discussed in the earlier section. Here, a brief overview of the project in presented citing details of study methodology to capture the data on indicators given in the framework. Also, this section discusses how policy relevant information is captured through this exercise.

3.1 Evolution of pastoral practices

Sikkim is a small peaceful State in the Himalayan Ranges with total geographical area of about 7096 sq. km. About 80% percent of its geographic area is notified as recorded forest area (FSI, 2009). The State plays a vital role in biodiversity conservation at the global level as it is located in Eastern Himalayan Region, one of the 34 global biodiversity hotspots (DFEWM, Sikkim, 2011). In the study area, local communities such as Gurungs, Bhutias, Limboo, Chettri and Sherpas have been traditionally practicing agro-pastoral form of livelihood. The livestock composition of the area included *cow, yak, dee, dzo & urang (yak and cow cross breeds*), and sheep. In the area, the pattern of domestic livestock composition has changed a lot over the last 7 decades. Until mid-1970's, the livestock ownership was more for subsistence purpose and was mainly composed of a few cows or buffaloes or sheep.

With Sikkim becoming part of Republic of India in 1973, and the markets opening, the subsistence model started changed to commercial scales. Around this time yak herding was introduced in the landscape and this led to the advent of heavier animals such as *yak, dee, urang & dzo* (yak-cow hybrids) grazing in the landscape. Over the next two decades, the livestock population (of *yak, dee, urang, dzo*) increased exponentially while that of sheep and buffalo reduced drastically. The increased livestock density started affecting the health of forest ecosystems and subsequently the State government of Sikkim laid a ban on open grazing of domestic livestock in reserved forests in 1998. The ban was implemented phase-wise and now covers all the protected forest areas in the State.

3.2 Impacts of pastoral life style: need for conservation centric approach

Prior to the ban, pattas (permits) were given to herders for grazing their livestock in forest areas. As part of the livestock management system, a goath (cattle-shed) would be established in the forest area where the herder would reside sometimes accompanied by family or caretaker. Average herd size in the region was 20-25 cattle. Vegetation in and around the cattle-shed would be cleared to create *kharka* (open space for grazing). Also in adjacent areas of the cattle-shed trees would be heavily lopped off for fodder and cut for firewood and timber. Herders would stay in one location till there was sufficient grass in the area to support the livestock. After grass depletion in an area, they would move to the next location. The movement of the herders depended upon availability of fodder, water, livestock type and hence was seasonal in nature. During summer, particularly from April to September, cows were left to graze freely in forests in the temperate zones while movement of yaks, *urang* and *dzo* was restricted to sub alpine zone. During winter, cows would be brought back to the agricultural fields while other livestock types would proceed to lower altitudinal mixed coniferous forest and temperate forests. Each herder would lop on an average two head loads

of firewood (1 head load is approximately 40 kgs) and minimum 2 equal quantity of fodder from the forests every day. It was this with increasing anthropogenic pressure that led to rapid degradation of the forest areas. Consequently a ban was implemented in order to stop the degradation further.

3.3 Evaluation of ecology – our approach

The key aspects studied under ecology include vegetation parameters (forest structure and composition, regeneration, disturbance etc), soil parameters (soil chemical properties and soil erosion related information) of the place, hydrology (water sources flow & quality) and wildlife (trends in sighting). The data on vegetation and soil parameters were collected in the field using extensive field surveys while qualitative data was collected on hydrological and wildlife aspects.

The altitude of the study area varied between 2000 m to 4000m. The forest types were stratified into 4 broad categories:

1. Upper Hill-Himalayan Wet Temperate Forest (Oak and dwarf bamboo dominated)
2. Moist temperate forest (Mixed coniferous)
3. Sub-alpine forest (Birch/Fir & Rhododendron forests)
4. Sub-Alpine scrub (Rhododendron & scrub thickets)

In each of the forest type zone, cow-shed spots were identified in high and low grazing intensity (disturbance) areas. The high and low disturbed areas were identified by consultations with local herders and forest officials. 10 plots were laid in each of the forest type zones within 1 ha radius of the cow-shed locations, except for the sub-alpine scrub forest where quadrants were laid. In all 60 plots of 0.1 ha each and 40 1 m^2 quadrants were laid.

Also, 70 soil samples were collected. The methodology prescribed by the Forest Survey of India was followed for collecting vegetation data from the plots. In each of the plot, four 3 m X 3m sub-plots were laid to capture regeneration and shrubs data and four 1m X 1m quadrants were laid to capture data on herbs. (FSI, 2002). A detailed inventory on important vegetation attributes such as canopy cover, regeneration, girth at breast height, tree height etc was prepared. Also details on forest disturbance such as lopping, cutting, fire, signs of domestic livestock grazing were also recorded. Any wild life signs during the survey were also recorded. Thus, we prepared a rich repository of ecological data on key attributes.

3.4 Evaluation of socio-economic aspects– our approach

The key aspects studied under socio-economic aspects include livelihood strategies, resource use, asset ownership with details from this section a total of 100 households were surveyed with 50 ex-herders and 50 non–herders. A combination of techniques was used to capture the data. Focused group discussions (FGD) and key informant interviews were conducted at each of the sites. Members from Eco development committees and Joint Forest Management Committees were present for the FGDs. Most of the members were ex-herders. Evolution of pastoral practices in the area, livestock composition and population change dynamics over the years, fodder and firewood preferences, distribution of key species before the imposition of grazing ban across forest types and their perceptions on the policy were the key points that were covered during these discussions. Also, resource maps were prepared for the forest types depicting important grazing areas and water sources. Thus, a rich repository of information was generated through these participatory methods.

3.5 Discussion on some of the main findings from the study

The study has adopted the framework discussed in the earlier section to carry out a rapid and robust assessment of the grazing exclusion issue at the study sites. While designing the evaluation framework for impact assessment, we encountered huge data gaps. There was no baseline data for the given study areas. Alternatively selecting a control site was a most challenging task. As the policy implementation was done simultaneously across the district, it was difficult to establish robust control site and control group. The study has been carried out in a low data environment and the framework was designed to provide inputs to policy makers on critical parameters. The extensive field work and data collected at both the study sites i.e. KBR and BRS provided the status of recovery of forest vegetation after the implementation of the grazing exclusion policy. The livestock grazing pressure in the region before the grazing ban was moderate to high with about 61 livestock/ sq km in BRS (Tambe et.al. 2005). It was observed that the area of about 1ha adjoining the cow-shed was the high impact zone. The regeneration status of these areas shows intense growth of dwarf bamboo especially in the temperate forests but the *kharaka* openings have remained mostly barren with grasses growing and sometimes covered with Rumex. Spp. Areas such as *Nayapatal* in the KBR and *Thulodhap* and *Deoningale dhap* that had large openings supported high grazing intensities and were the high impact areas. On the other hand there were areas such as *Taal* in BRS and *Sailey chowk* in KBR that were relatively less disturbed. The data collected provide insights into disturbances introduced in each of the forest zone and the recovery process associated in each zone. This rich data set can be used for habitat manipulation exercise, marking ex-situ conservation zones and plantation of species having socio-economic importance.

The details from the household survey will provide insights into the magnitude of the livelihood impact associated with the policy implementation. It was observed that not only herders were impacted but also the non herder group was impacted though to a less extent. Amongst the herder group, caretakers and people with less land ownership were the most impacted. Earlier mostly people used to practice subsistence agriculture and now they focus on doing agriculture for livelihood. Other livelihood options such as NREGA and eco-tourism have been introduced of late. Thus, the perceptions and information captured from the socio-economic survey can be used as an input for further policy refinement. Using a mix method approach, we have generated comprehensive baseline information for the area including environmental, edaphic, and social and livelihood factors. Thus, the framework assisted us in designing a comprehensive evaluation providing insights into the actual impacts of the grazing ban intervention in terms of it providing sustainable benefits to the society overall.

4 Conclusion

The purpose of carrying out evaluation of conservation policies is to provide the policy makers with meaningful and reliable information on the outcomes and impacts achieved by the policy on ecosystems as well as on the local communities. The quantitative designs of impact assessments are statistically more robust and establish casualty but in real life conservation projects, it is difficult to implement such designs. Also in certain cases it is difficult to create treatment and control groups. In low data environment, using alternative design options and frameworks using mix method approach as presented in the paper offer useful insights on policy relevant parameters. The presented framework integrates qualitative and quantitative techniques, and it serves as an effectual approach to program evaluation for conservation interventions. The quantitative techniques provide the necessary logical base

and ascertain the relationships statistically while the qualitative techniques help in substantiating the findings of the study. Thus it presents a feasible methodology for assessing impacts in the absence of detailed longitudinal ecological or socio-economic data.

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