

Lura – Indigenous approach to Biodiversity Conservation by Temporary Community Confinement of *Mithuns (Bos frontalis)* During Growing Season

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Keywords: Overgrazing, *Lura*, *Mithun*, Indigenous knowledge, Biodiversity, Agriculture

ABSTRACT. The extraordinary knowledge of indigenous people about their immediate environment and natural resource base can be a great asset for conservation of biodiversity. The current study aims to investigate an indigenous method of grazing management through temporary confinement of *Mithun (Bos frontalis)* of whole village community in a well selected area in the forest during the cropping and growing season. The whole system is called *Lura* and practiced by *Galo* tribes of Eastern Himalayan region of India. Every year *Lura* management committee is formed that selects a new site based on number of *Mithuns*, forage availability, time period and several other key criteria without affecting flora-fauna diversity and rare medicinal plants. The practice checks continuous, free, random and selective grazing by *Mithuns*. It prevent continuous disturbance of soil surface due to treading, during growing and rainy seasons that avoid soil erosion and compaction, and facilitate seedling germination and the invasion by plants. Change of site, provide resting period to the forages in the previous *Lura* site especially during growth stage that allow them to renew and regenerate appreciably within 1-2 months. It also saves resources and time for construction of fencing in each *Jhum* and other agricultural site of each farmer. The confinement offers easy monitoring, protection and regular health assessment of the livestock. Thus, it is a multifaceted indigenous practice that ensures grazing management, biodiversity conservation, protection of standing agricultural crops and animal health management

1. INTRODUCTION

Eastern Himalayas (Indo-Myanmar) is a biodiversity hotspot. For effective and sustainable conservation of these natural stock of diversity, integrated, holistic and site specific approaches are needed. Majority of the area of this region coincide with the areas occupied by indigenous people. Indigenous people and biodiversity conservation are strongly and positively correlated [1]. Indigenous people are carriers of ancestral knowledge and wisdom about natural diversity and its sustainable management. Their effective participation in biodiversity conservation programs would result in more comprehensive and cost-effective conservation and management of biodiversity [1]. Out of various factor affecting ecology, animal overgrazing is a serious threat [2] leading to loss of biodiversity, irreversible loss of topsoil, increase of turbidity in surface water and increase in flooding frequency/intensity. For current study overgrazing is defined “as an excess of herbivory that leads to degradation of plant and soil resources” [3]. Also, here grazing is overgrazing when it conflict with the biodiversity conservation efforts [4]. Impacts of overgrazing to biodiversity and topsoil loss are of immense concern, since they are effectively irreversible. Species loss removes a resource that has a regeneration time of millions of years (it is primary output of four-and-a-half billion year evolutionary processes) [5], while significant topsoil loss has a regeneration time scale of tens of millennia [6]. The impact of overgrazing and related behavior on vegetation composition and species diversity were well documented [7, 8, 9, 10, 11]. Overgrazing can cause change or modification to plant morphology and physiology directly through defoliation and trampling, and indirectly through alteration in growth conditions [12]. In due course, overgrazing may cause directional change in the structure and composition of the plant communities due to alteration of the

dynamics of plant population through impact of grazing intensity on species natality, density and mortality [13]. Herbivores have habit of selective grazing or browsing, usually preferring forages having high nutrient contents and low structural or chemical defenses [14]. Overgrazing decrease plant density of a particular species, which in turn favor growth of other plants that are less preferred by animals decreasing their food supply [15] and productivity.

Overgrazing is considered to be one of the major causes of soil degradation worldwide [16]. Prolong grazing on the same site changes soil physical, chemical and microbiological properties [17]. Inappropriate grazing practices leads to destruction of soil structure approved by high bulk density, high dry mechanical resistance and low structural stability [18]. Soil fertility largely depends on the presence of soil microorganisms, and their existence and activities in turn depends on soil water content and storage capacity, texture, size and rate of pores. The decrease in pore space and increase in bulk density, due to treading of animal, negatively affect soil microbes [19]. These especially become serious problem in hilly regions with high rainfall where the microorganism in soil is inherently low because of acidic nature of soil. Moreover, lack of ground cover due to overgrazing make the top soil susceptible to erosion [20]. Some studies indicate loss of soil carbon due to overgrazing [21].

Overgrazing does not depend on the number of animals, but it is the function of time that how long the animals are allowed to graze on a particular site. Overgrazing occur when the animals were kept in the same site for a considerable long period or are allowed to turn back to the same site before plants have recovered [22]. Degradation of the landscape may be a short term phenomenon and recovery is possible after grazing pressures have been greatly reduced. During peak growing period, periods for 1-2 months may be adequate for appreciable recovery. Overgrazing is a serious issue during the growing season as it has thrice more effect on the key forage species as compared to grazing during seasons when plants were senescent [23]. Thus grazing pressure depends on the season effect and overgrazing is result of grazing at inappropriate times relative to flora productivity cycle [24]. The defoliation of the forages during their growth period can reduce their vigor and their capacity to maintain growth. Seedling stage was identified to be the most critical stage [12]. Intensive grazing during growth period lowers the re-growth and renewing capacity of the plants [25], which is attributed of the fact that the level of non-structural carbohydrates reserve lowers due to defoliation [26]. Impact of grazing on biodiversity is a complicated and diverse issue that vary spatially and temporally [27] and management effort must be location and time specific.

The *Galo* tribes of West Siang District of Arunachal Pradesh (situated in north-eastern Himalayan region of India), have unique traditional methods for temporary confinement of *Mithun* (*Bos frontalis*) during cropping season called *Lura*. The region, owing to its diverse physical and climatic situations, harbor and sustain immense biodiversity (Indo-Myanmar zone). The livelihood of tribe is based on a natural resource that relies directly on biodiversity and ecosystem services, and they know that their livelihoods would be affected first and foremost by biodiversity loss. Conservation of biological diversity is in the forefront of their social agenda from antiquity through indigenous traditional methods specific to the location and its environment. These approaches provide resilience to their ecosystem, thus enabling them to adapt to changing condition. *Mithun* (*Bos frontalis*) is heavily built semi-domesticated bovine species originated in North Eastern Himalayan Region of India [28]. It is also found in Myanmar, Bhutan, Bangladesh as well as Tuman province of China. Out of the total *Mithun* population (0.29 million) in India, 83.5 percent animals are found in Arunachal Pradesh [29]. This animal is well adopted in steep forest at an elevation of 600 – 3000 meter above mean sea level (msl). *Mithun* have economic, social, cultural and religious significance to the *Galo* tribes. It is mainly a free-ranging forest dweller. The *Galo* tribes mainly practice *Jhum* cultivation (shifting cultivation) because of the geography and climate of the region. In *Jhum* cultivation each farmer of a community usually have large plot of land for cultivation. Management of *Mithun* is vital during cropping season to protect their crops, forest resources and also for their proper monitoring. The *Mithuns* of each village community were confined to a temporary selected enclosure in forest during growing season. The site of *Lura* is selected based on certain key criteria. The site for confinement is changed every year. The objective

of the current study was to investigate the various stages of *Lura* and to find its significance especially towards ecological sustainability.

2. METHODS

The study was conducted in *Lipu Namchi* village under Basar circle of West Siang district of Arunachal Pradesh. Arunachal Pradesh is situated in Eastern Himalayas as priority ecoregion and biologically rich 'hotspot' [30]. The state is custodian of 23.52 % of total flowering plants of India [31] and is also regarded as nature's repository of medicinal plants [32] where around 500 medicinal plants were identified during preliminary survey. The village is located N 28° 00.165' and E 094°40.832' at about 787-1150 meters (msl). The study site comes under alpine and temperate sub alpine climate zone. The normal annual rainfall is around 2550 mm with mean rainy days of 144. The villages have 25 household with a population of around 158 consisting of *Galo* tribe. The village as a whole had 109 *Mithuns*. The study was carried from October 2012 to October 2014. The Extensive field survey was conducted along with the members of the *Lura* community. Detailed information was collected through focused group discussion with village elders and youths. The practices and associated rituals were closely studied in the *Lura* site.

3. RESULTS

Management Committee

Every year, before cropping season, the villagers constitute a *Lura* management committee comprising of village elders and youths, with a president, a vice-president and members. After sowing of paddy in the month of April, the committee conduct meeting at *Dera* (community hall) to make major decision regarding selection of site and other related activities associated with *Lura*. Each villager has to make necessary contribution for making confinement and activities related to monitoring and health care. Also they take active part in organization of rituals and ceremonies related to the practice.

Selection of Site

Site selection is a vital task of the *Lura*. Here in the region there is a unique land tenure system, the land belongs to community and not to the government, so selection of forest land is decision of the *Lura* committee. Since *Mithun* is free ranging, based on the number of animals the selected site must provide free room for the animal to gaze freely and to keep them physically fit. The selected site must contain adequate supply of forages and water for the period of 3-4 months. So the size of the site depends on number of *Mithuns*, available forages and period of confinement. Preference is given to site that required minimum fencing. *Mithuns* generally prefers deep and dense forest to avoid bright sunshine. The site must be easily reachable from the village and can be monitored properly. Beside these basic needs for the site, there are few very important aspects that are kept in priority while site selection. The selected site must not contain some rare and important species of plants or animals. Also it must not contain some plants of religious and medicinal importance. The marshy and shadowy areas are considered to be dwells of sprits, so are not suitable for the purpose. Several rituals and ceremonies are conducted in the area to take permission of the deity of forest and for well being of the animals. The selected forest area is either owned by certain family or families in the village or a community land. The selected area should be away from human dwelling to prevent inter-transmission of any infectious diseases during any epidemic as *Mithuns* are susceptible to Tuberculosis, Para-tuberculosis, Brucellosis, Foot and Mouth disease (FMD), Infectious Bovine Rhinotracheitis (IBR), and Bovine Viral Diarrhea [33]. Fig. 1, depict a typical *Lura* in the selected village identified in Google earth. Depending on the population of *Mithun*, the area of the present site is around 25 square kilometers. After the captivity period is over the reuse of the same site for next period is strictly avoided.

Construction of fencing

The construction usually starts from the month of May, at the start growing season of crops as well as forest. The area is fenced by the village community using locally available materials like bamboos, wooden post (10-15 cm diameter) and rope made of cane or bamboo. The height of the fence ranges from 1-1.5 m and provision of gates are made at eight or more different locations for entry and exit having a width 1-1.2 m. Temporary houses are constructed at various sites for monitoring and night watch. The entire process generally takes around 20-30 days for completion depending on the area of selected site. The bamboos and wooden posts used for the fencing are generally acquired during new moon day (or days near to it) to avoid or minimize insect attack. Various religious ceremonies and community feasts are organized during the process to seek blessing from their deity to protect their animal. Fig. 2, depict the construction of fencing for confinement that needs special expertise and experience. In the present study *Lura* was selected between two hills *Mohen* (upper side) and *Odi*, and two rivers namely *Yalom* and *Bui* which runs between stretching an area from 10-12 km. After completion, the village priest called *Nyibu* chants prayers and grand feast is given for the entire village. *Mithun* owners are directed to bring their animals to the *Lura* as early as possible. Each *Mithun* kept inside the *Lura* have a unique identification ear mark which is distinct for a particular clan and family.

Monitoring

Beside protection of the agricultural crop, monitoring of *Mithuns* is one of the very important goals of the *Lura*. At least one person from each household, compulsorily, has to take part in the monitoring activity turn-wise and in rotation to form a group of 2-3 persons every day. The group periodically checks and monitors the condition of fences, health of *Mithun*, intrusion of any predators etc. They provide salt and medicines at certain interval to all the animals. During the period of captivity human movements except the selected members are restricted in *Lura*. In case of injury or disease outbreak they inform the committee to take necessary suggestion of village elders or Veterinary Department. In case of calving the owners is informed who provide salt to the calves and brings it along with the mother to their houses for proper health care and making identification marks by doing ear notching with a sharp knife and sterilization by applying wooden ash till wound is healed [34]. The committee regularly repairs the fences at an interval 20-30 days.

Natural feed resources in LURA

The *Mithuns* browse on wide varieties of natural fodders viz. tree leaves, herbs, shrubs, grasses and creepers available. The common feed resources identified by farmers were: 1) Tree fodders (*Ficus hirta*, *Ficus* spp., *Oreocnide integrifolia*, *Sarcochlarvys pulcherrima* and *Bischofia javanica*), 2) Shrubs and Herbs (*Musa* spp., *Saccharum spontaneum*, *Boehmeria* spp. and *Dendrocalamus hamiltonii*), 3) Creepers (*Conocephalus sauvelence*, *Puereria* spp., *Entada poseatha* and *Micrenga micranta*) and 4) Grasses (*Setaria palmifolia* and *Carex cruciata*). They selectively browsed on delicate leaves and accessible twigs of the branches. Bamboo leaves and their shoots were selectively preferred. The *Mithuns* feed more for the *Musa* spp. during hot part of the day and delicate leaves were preferred over to mature or dry leaves.

The gates are opened after the harvesting of paddy field in the month of September-October.

4. DISCUSSIONS

Lura may be regarded as farmers' innovation for conservation of bio-diversity, social governance system and agricultural & veterinary management system. The confinement checks *Mithuns* from continuous, free and random grazing of forest vegetation during the growing season. The seedling germination and plant growth is inhabited when the soil surface is continuously disturbed by animals during growing season [35]. Though in the area, *Mithun* density is adequate for forage yield of the forest adjacent to the villages, they are not allowed to graze freely especially during growing season. This might be due to the fact that domestic livestock are usually driven by

habit like preference for particular vegetation and preference for previously grazed area. Various literatures have indicated that livestock normally select and continuously graze on most preferred and palatable plant species first, leading to the death of the plant due to complete defoliation [36]. As when animals are allowed to graze freely, overgrazing generally occurs in same pasture and on same forage species [37]. Moreover, observation on Hungarian Grey Cattle reveal that though pasture yield was sufficient for animal density, difference in utilization leads to overgrazing in some part [38]. The *Lura* site is changed every year to allow the diverse high-quality and *mithun* preferred grasses and other forages to re-grow and renew in the previous site during growing season and to thrive sustainably, particularly the taller growing forages (trees, shrubs and herbs) that usually die under continuous grazing. It is in accordance to suggestion of Pratt (2002) [22] to move livestock out of a pasture before re-growth begins to prevent overgrazing. The farmers prefer to maintain diverse plant communities rather than going for some specific forage type. This might be due to the fact that diverse plant communities are more resilient and resistant to disturbances, which is in accordance to findings of Mara  n (1997) [39].



Figure 1: A typical *Lura* site in *Lipu Namchi* village identified through google earth. The area within the red boundary denotes the *Lura* site.



Figure 2: Fencing construction for confinement with gate at certain places. It is a community event and at least person from all household of the village have to represent and take part.

The confinement of Mithuns during growing season in *Lura* might avoid disturbance of soil surface, especially in the left out *Jhum* slopes and previous *Lura* site, thus check soil erosion and compaction and allow free regeneration of grazed vegetations as well as seedling germination throughout the forest. Similar conclusion was drawn from the study on deer grazing in New Zealand indicating that continuous grazing can cause compact of topsoil and destruction of soil structure

[40]. The confinement of the livestock during growing season that coincide with period of heavy rainfall also checks indiscriminate treading. It was found that scars left by sheep disturbed disproportionately more during growing season hindering regeneration of the bare soil [41]. Also, livestock grazing intensity and lack of vegetation cover affect the soil porosity [42] leading to high bulk density. The annual shifting of *Lura* site might allow recovery of the compaction of soil caused by treading in the previous *Lura*. Change of site, also might allow soil to renew and regenerate appreciably within 3-4 months. Lack of continuous grazing pressure allows soil to improve and compensate quickly [43]. During *Lura*, grazing systems cause livestock to graze more uniformly and completely. This enhance metabolism of nutrients to growing points per root biomass [44], thus facilitate fast recovery of pasture during rest period.

Beside bio-diversity conservation, the system also provides an effective method to save the standing agricultural crops. It also saves resources and time for construction of fencing in each *Jhum* and other agricultural site of each farmer. It also preserves the rare and important medicinal plants species during growing season. Monitoring of the animal against seasonal and infectious diseases is another important aspect of *Lura*, along with protection from predators. The farmers can also divert their attention towards farming without bothering whereabouts and safety of their *Mithuns*. The customs and ceremonies associated with *Lura*, besides strengthening the unity of community, make the system rigid and mandatory. Overall *Lura* is an all inclusive traditional practice that has multifaceted benefits that maintain a harmony and ecological balance between human, animals and nature. Biodiversity conservation with the participation of indigenous people presents great opportunities as they have extraordinary knowledge of their immediate environment.

Limitation in the system includes the initial cost and labor involved in fencing of such vast area, and labor for constant monitoring.

Acknowledgement

We are very thankful to villagers of *Lipu Namchi* village for their eager to provide all necessary help and information during the endeavor. We are grateful to National Initiative on Climate Resilient Agriculture (NICRA Research) Project for all necessary aid during the survey.

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