

## Grassland Management Impacts on Small Mammals

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### Abstract

Grasslands cover more than 13% of the total area of Nepal. They have declined very rapidly in area, however, and are now mostly confined to protected areas. Nepal has established 15 protected areas, however, excessive grass cutting, fire, and grazing continues. Villagers are allowed into the protected areas to harvest thatch grasses and reeds for 10 days annually. In Royal Bardia National Park, 21,000, 45,000, and 57,000 people entered the park in 1983, 1993, and 1999, respectively, to harvest grass. Grazing is rampant in the protected areas. Both park staff and local people set fire to the *Terai* grasslands in winter burning 70-90% of the total area. This form of management, however, has been shown to have deleterious effects on disturbance intolerant and cover dependent small mammals.

### Introduction

Grassland covers more than 13% of the total area of Nepal (HMG 1992). A wide variety of grasslands are distributed across the country from the *Terai* (lowlands) to the highlands. Their distribution depends on the topography, soil type, and soil moisture (Tsuchida 1983, Peet *et al.* 1997). Nepal has established 15 Protected Areas, covering an area of 21,050 sq.km. However, several threats have been identified in these protected areas. They include excessive cutting of grass, forest fires, and grazing. Grazing is a year-round threat in the lowland protected areas, and generally a seasonal threat in the high pastures of the Himalayas. Cutting of grass and fire are seasonal (Yonzon and Heinen 1997). The *Terai* grasslands have declined very rapidly in area as a result of conversion to agricultural lands, grazing pressure from livestock, and natural succession. The *Terai* grasslands once extended across the northern Gangetic plain from Uttar Pradesh, through the Nepalese *Terai*, to Bengal in the valley of the Ganges and Brahmaputra rivers and their tributaries. They are now restricted to protected areas in Uttar Pradesh, Assam, and lowland Nepal (Bell and Oliver 1992).

Traditionally, local people have collected thatch grass and reeds in the areas that are now protected. In Nepal, villagers are allowed into the protected areas to collect thatch grasses and reeds for 7-10 days annually. This practice is allowed because suitable grasslands for harvesting are available within the protected areas, and the alternative materials for roofing and building are expensive (Lehmkuhl *et al.* 1988; Brown 1997). However, the grass cutting is massive and the number of grass cutters has been increasing. For example, in Royal Bardia National Park, 21,000, 45,500, and 57,000 people entered the park to harvest grasses and reeds in 1983, 1993, and 1999, respectively.

In addition to cutting of grass, burning is also common in the protected areas. Villagers set fire in almost all the parks and reserves of the *Terai* during the grass

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harvesting period. The main aim is to remove leaves and dead materials from the clumps of reeds so that they can be harvested more easily.

Park staff also set fire to the grasslands in the protected areas immediately after cutting of grass. They burn the stubble and uncut grass, supposedly to reduce the incidence of 'spontaneous' and 'more-damaging' large scale burning later in the dry season by removing any accumulated combustible material. Fire arrests succession, promotes the growth of new shoots, and provides ungulates with important forage resources from the regenerating grasslands (Mishra 1982; Moe and Wegge 1997). More than 70% of the area of grasslands in Royal Bardia National Park is burned annually (Peet *et al.* 1997). Lehmkuhl (1989) said that approximately 80% of the area of grasslands of the Royal Chitwan National Park was burned annually.

### **Small Mammals**

Small mammals are an integral component of grassland communities, contributing to energy flow and nutrient cycling, and playing an extremely important role as seed predators, and dispersal and pollination agents (Fleming 1975). They eat varieties of vegetative materials (grazers, browsers, seed-eaters, nectivores), and a number of species are predators, preying upon insects, amphibia, fish, and others. Small mammals also form an important prey base for medium sized carnivores, birds of prey, and snakes (Emmons 1987; Golley *et al.* 1975; Hayward and Phillipson 1979). Some species can readily adapt to the micro-climates which are to be found in most environments. Most small mammals can cope with drastic changes in their environment, and can recover quickly from 'ecological disasters' because of their high rates of conception and fertility, short gestation periods, and large litter size.

The present paper reviews the impacts of grassland management on small mammals with reference to the *Terai* grassland of Nepal, and provides recommendations for their conservation.

### **Management Effects**

Both cutting and burning can reduce litter inputs and lead to an increased floristic diversity (Peet *et al.* 1997) that appears to benefit a number of small mammal species. In Nepal, early burning, cutting of grass, and uprooting and felling of trees have been practised for some years in order to arrest succession and provide new shoots for ungulates. Cutting of grass and burning influence the stratification of grasses, plant species composition, and the height of standing crops in the grassland ecosystem. However, there is ample evidence that fire can also affect the species composition and species abundance of small mammals (Chesman and Delany 1979; Oliver 1985; Bell *et al.* 1990; Fa and Sanchez-Cordero 1993; Friend 1993). Kerney and Stubbs (1980) argued that mouse populations are severely affected by fire. Based on such findings, most conservation organisations oppose the use of fire in management (Ditlhogo *et al.* 1992).

### **Fire and Small Mammals**

Only a very few studies have been carried out on small mammals in the Indian sub-continent. Data on fire effects are available for only two species, the hispid

hare (*Caprolagus hispidus*) and the pygmy hog (*Sus salvanius*). Both species occur in the tall grasslands of India and Nepal (Bell 1986; Bell and Oliver 1992).

Bell (1987) studied the biology and conservation problems of the hispid hare in the Sukla Phanta Wildlife Reserve in western Nepal. The results indicated that the hispid hares were confined to patches of unburnt tall grassland along streams, where they were vulnerable to predation. Similarly, Oliver (1980), in Barnardi reserve forest, Assam, found that the hispid hare and the pygmy hog were confined to small areas of unburnt tall grasslands in post-burn areas, where they were vulnerable to disturbances and poaching.

The populations of hispid hare have been declining over the previous range, as a result of widespread clearance of their tall grassland habitat for agricultural land and human settlements, together with cutting of grass, burning, and overgrazing. Oliver (1985) concluded that the long-term survival of the hispid hare population remained at risk as a result of the current management policies where tall grassland is burned or harvested for thatch and canes during the dry season.

#### ***Livestock Grazing and Small Mammals***

Livestock can affect small mammals directly by trampling burrows, compacting soil, and competing for food; and indirectly by altering the structure or species composition of vegetation in a manner that influences habitat selection. The effect of grazing does, however, vary with the environmental conditions and type of plant communities. The vegetation cover influences the distribution and abundance of small mammals. Some species prefer tall grassland cover, whereas other species use short grassland or open areas more intensively.

It is very difficult to generalise the effects of grazing on small mammals. Hayward *et al.* (1997) reported that 50% more white-footed mice were found in ungrazed areas than in grazed areas. Grand *et al.* (1982) noted that the variety and abundance of small mammal communities depends on how grazers have utilised the grassland.

#### **Conclusions and Recommendations**

Widespread cutting and burning and grazing can have significant effects on disturbance intolerant or cover-dependent small mammals. Thus patch burning is recommended as a conservation measure (Fyfe 1980; Braithwaite 1987; Fa and Sanchez-Cordero 1993; Johnson 1997). Fire can reduce the input of litter and lead to increased floristic diversity (Peet *et al.* 1997).

Cutting of grass should be allowed under a patch management system in the protected areas. An alternative resource should be explored for thatch (Brown 1997; Peet *et al.* 1997). The patch management system could be effective if the buffer zone people are only allowed into the protected areas to harvest thatch and reeds. Such a system would provide opportunities to the local communities to generate income by selling surplus thatch and reeds, and provide them with an economic reason to protect the grasslands.

At the beginning of this century, burning would probably have produced a mosaic of burned and unburned grassland with different ages of post-burn regeneration. Today, with increasing human pressure on grasslands, virtually the entire area of grassland is cut and burned annually so that only a very limited area is left as a refuge for small mammals. This means that hispid hares and pygmy hogs are seriously threatened. Unfortunately, the ecological consequences on many of the small mammal species in the Indian sub-continent are unknown and inventories of these species in the grasslands are poor.

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