ECOLOGICAL OBSERVATIONS ON THE GRASSLANDS OF CORBETT TIGER RESERVE, INDIA

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Introduction

The grasslands of Terai and Bhabar regions in North Indian plains are among the most productive ecosystems of South Asia as reflected by the high diversity and biomass of herbivores (Eisenberg and Seidensticker, 1976; Rodgers, 1988). These grasslands from early seral stage in the forest succession, and are governed by various factors such as flood, fire and past cultivation (Yadav and Singh, 1977). In Bhabar tracts of Uttar Praedsh, these grasslands are locally known as "Chaurs" and have been heavily used by man for permanent settlement, agriculture and grazing by domestic livestock. As a result, very few sizable grasslands without human interference remain in this tract today.

Although tropical grasslands have been studied by several authors (Yadav and Singh, 1977; Kotwal and Pandey, 1981; Lehmkuhl, 1989; Rodgers, 1990), very little ecological information exists on the grasslands of Bhabar region. Such information is crucial for the conservation of wildlife in the protected areas (Panwar, 1986; Rahmani, 1992; Rodgers and Sawarkar, 1988). The Chaurs of Corbett Tiger Reserve (CTR) are know for high concentration of wild herbivores and thus the Tiger (*Panthera tigris* Linn.). Wildlife tourism in this park is also dependent on the animal sightings in these grasslands. Therefore, the Wildlife Managers need to (1) assess habitat quality for large herbivores, and (2) quantify the proportions of grasses, forbs and weeds in areas of different regimes of fire and flood in order to manage the grassland habitat effectively. This article is based on a short survey conducted in the grasslands of CTR keeping above objectives in view. The results are discussed along with the management recommendations and long term conservation strategies.

Materials and Methods

The study was conducted in the core area of CTR i.e. within Corbett National Park, U.P. (29° 13' to 29° 35' N. Lat. and 78°46' to 76° 33' E. Long.). The grasslands comprise about 20% area of the core area (Dabadghao and Spillett, 1966) and are crucial for the grazing herbivores viz. Elephant (*Elephas maximus* Linn.), Chital (*Axis axis* Erxleben), and Hog Deer (*Axis procinus* Zimmermann). Black Partridge (*Francolinus francolinus*) is the most common bird in the grassland besides several other smaller birds. We selected two large grasslands viz. Dhikala and Phulai Chaurs for the present study. Dhikala Chaur, located at slightly higher elevation, is drier and frequently burnt unlike Phulai Chaur which is inundated and remains wet

most of time of the year and hence less intensively burnt. These variations in terrain, moisture and fire regimes have led to two different types of grasslands within the CTR.

Based on the history of burning (personal communication, Deputy Director, CTR) and physiognomy Dhikala Chaur was stratified into four categories viz (i) intensively burnt grassland (IBG), (ii) scattered scrub mixed grassland (SSG), (iii) forest grassland edge (FGE) and (iv) degraded, weed-infested area (DWA). Only two strata were identified for the Phulai Chaur, viz., (a) low lying wet grassland (LWG), and (b) elevated moist alluvial grassland (EMA). The brief description of the sites and characteristic herbaceous species are given in Table 1. For the quantification of grass cover, species composition of herbaceous plants, and weed abundance quadrats of 0.25 m^2 (50 cm x 50 cm) were laid randomly in each area. In all 150 quadrats were laid in Dhikala Chaur i.e. 50, 25, 50 and 25 in IBG, SSG, FGE and DWA respectively. In Phulai Chaur 30 quadrats each were laid in LWG and EMA. Relative frequency of grasses (all species pooled) and herbs was estimated. Sorenson's Similarity Index (Mueller-Dombois and Ellenberg, 1974) was calculated for different sites. The evidences of animal use in these sites and palatability of different species were noted through extensive search in the quadrats and direct observations on the animals. Plants were identified with help of local flora (Pant, 1981).

Results and Discussion

The relative frequency of grasses was highest in intensively burnt Dhikala Chaur (IBG) and lowest in low lying wet alluvium (LWG) (Table 2). Mean frequency of grasses in Dhikala (x = 55.4%) was significantly higher than Phulai Chaur (x = 44.6%) (unpaired t test, t = 2.899; $p < 0.025$ - one

Table 1

Site description and major plant communities of the study locations in Corbett Tiger Reserve

Study Site	Site Description	Characteristics Species
Burnt Grassland (IBG)	Intensive burnt Old alluvium, dry and compact soil.	*Imperata, Themeda, Desmostachya*
Scrub mixed Grassland (SSG)	Less burnt, Old alluvium, dry and compact soil.	*Imperata, Cymbopogon, Artemisia*
Forest Grassland Edge (FGE)	Unburnt, cleared, Old alluvium, Moist, loose soil.	*Artemisia, Ageratum,Imperata, Oplisemnus*
Degraded Weedy Area (DWA)	Unburnt, past cattle camp, mixed alluvium, moist loose soil.	*Ageratum, Solanum, Cannabis, Pseudosorghum fasciculare.*
Low-lying Wet Grassland (LWG)	Unburnt, seasonal inundation, frest loose alluvium.	*Ampelopteris, Cyperus,Phragmites, Arundo, Cannabis.*
Elevated Moist Alluvium (EMA)	Occasional burning moist, loose alluvial soil.	*Saccharum, Vetriveria, Trigonella, Cannabis.*

Table 2

Relative frequency of grasses, herbs, and weeds in Dhikala (IBG, SSG, FGE, DWA) and Phulai (LWG, EMA) Chaurs of CTR (weeds indicated as W, Scientific names follow Pant, 1981).

Species	IBG	SWL	FGE	DWA	LWA	EMA
Grasses	92.00	85.20	67.17	55.07	42.56	47.20
Desmodium microphyllum	0.92	0.88	-	-	-	-
Lotus corniculatus	0.60	-	-	0.78	-	-
Premna herbacea	0.58	1.19	-	-	-	-
Vicoa indica	0.51	-	-	-	-	-
Peucedanum dhana	0.42	-	-	-	-	-
Borreria pusilla	0.41	-	2.17	-	-	-
Desmodium pulchellum	0.36	-	-	-	-	-
Oxalis corniculata	0.30	1.79	6.05	4.0	-	-
Artemisia nilagirica	-	1.03	3.23	1.70	-	-
A. parviflora	-	1.03	1.64	0.80	-	-
Grewia sapida	-	1.51	1.37	-	-	-
Cirsium arvense (W)	-	1.55	0.80	3.46	1.28	-
Erigeron sp. (W)	-	1.19	-	-	-	-
Peristrophe bicalyculata	-	0.92	-	-	-	-
Zizyphus mauritiana	-	0.68	-	-	-	-
Ageratum conyzoides (W)	-	-	8.50	11.18	4.27	-
Perilla frutescens (W)	-	-	2.39	-	-	-
Pogostemon benghalense (W)	-	-	1.15	-	-	-
Dicliptera roxburghiana	-	-	-	13.70	-	-
Solanum surattense	-	-	-	1.40	-	-
Cotula anthemoides	-	-	-	-	10.14	10.00
Polygonum barbatum	-	-	-	-	0.84	0.94
Cannabis sativa (W)	-	-	-	-	2.63	0.89
Ampelopteris proliferana	-	-	-	-	28.45	0.69
Orthosiphon rubicundus	-	-	-	-	1.93	-
Rumex dentatus (W)	-	-	-	-	1.04	-
Trigonella sp.	-	-	-	-	-	31.09
Veronica sp.	-	-	-	-	-	2.96
Polygonum plebejum	-	-	-	-	-	2.68
Solanum nigrum	-	-	-	-	-	0.97

tailed test). In all the strata, grasses emerged as most dominant component of the vegetation with a great deal of variation within and between the Chaurs (Table 2). Weed and herb species were more abundant in LWG followed by EMA. Some of the unpalatable and weedy species e.g. *Ageratum conyzoides* Linn., *Cirsium arvense* Scop., *Cannabis sativa* Linn. and *Solanum indicum* Linn., featured among the first ten dominant herbs in both the grasslands.

The forest grassland edge in Dhikala showed highest number of species (36) followed by degraded, weedy site (31) and low lying wet alluvial grassland had minimum species (18) per unit area whereas, the highest percentage of palatable species occurred in frequently burnt site (Table 3). Sorenson's Similarity Index (SSI) was lowest (17.24) between two major grasslands i.e. dry and wet types. SSI for EMA and LWG, IBG and SSG, IBG and DWA, IBG and FGE were 48.88, 56.71, 42.85, 35.00 respectively. Common woody species in SSG were *Ochna pumila*, Ham., *Combretum nanum* Ham., *Lagerstroemia parviflora* Roxb., *Zizyphus xylopyrus* Willd., *Butea monosperma* (Lamk.) Taub., and *Lantana camara* Linn. FGE was characterised by *Lantana camara, Butea monosperma, Cassia fistula* Linn., *Shorea robusta* Gaertn., and *Lagerstroemia parviflora*.

Table 3

Number of species and per cent palatable species in different study locations of Corbett TR (based on 25 random quadrats of 0.25 m^2 area each).

Location	Total no. of species	Palatable species (%)
Burnt Grassland	23	68
Scattered Scrub mixed	28	46
Forest Grassland Edge	36	50
Degraded Weedy Site	31	40
Low Lying Wet Grassland	18	33
Elevated Moist Alluv.	19	36

The low lying grassland in Phulai Chaur is dominated by *Sacharum spontaneum* Linn., *Phragmites karka* Trin., and various herbs such as *Ampelopteria prolifera* (Retz.) Copel, *Cotula anthemoides* Linn., *Trigonella emodi* Behth., *Polygonum hydropiper* Linn., *Cyperus* spp. etc., which are indicative of seasonal inundation. This means the fire resistant species of Dhikala such as *Imperata cylindrica* Beauv., *Desmostachya bipinata* (Linn.) Stapf. and *Themeda arundinacea* (Roxb) Ridley may not be able to establish in the low lying wet area. Although various authors (Bell and Oliver, 1982; Debroy, 1986; Dhungel and O'Gara, 1991; Rodgers, 1986) have recommended intensive burning of wet grasslands, experience in low lying grasslands of Corbett has shown that burning followed by seasonal inundation promotes the growth of several annual weeds including *Cannabis sativa*. In such areas planting certain species of local grasses e.g. *Phragmites karka, Arundo donax* Linn. and *Pseudosorghum fasciculare* (Roxb.) A. Camus may prove to be useful as they are typical species of low lying moist areas and preferred by Elephants (personal observations).

Conclusions

It can be concluded that (a) Dhikala and Phulai Chaurs represent two different grasslands of Bhabar tract representing various stages of succession influenced by different regimes of fire and flood, (b) moist areas in Dhikala which are partly or less frequently burnt show the indications of woodland invasion and weed proliferation,

(c) in addition to manual eradication, fire can be used as effective tool to control weeds and woody species encroaching the typically mesic grasslands of Dhikala Chaur, but weeds in Phulai Chaur, which is largely hygrophilous, can be controlled by planting tall perennial grasses in controlled areas. Conservation of these grasslands and native fauna require intensive management and long term monitoring.

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SUMMARY

Two grasslands (Chaurs) in the core area of Corbett Tiger Reserve were studied to compare the species composition, frequency and distribution of grasses, herbs and weeds. The study revealed that less frequently burnt Chaurs of first site i.e. Dhikala had high frequency of weeds and tree saplings. On the other hand, the low lying wet grasslands showed a different species composition. The frequency of grasses was significantly lower in the areas of seasonal inundation compared to elevated grasslands of Dhikala Chaur ($t = 2.899$, $p = <0.025$). Since elevated and low lying grasslands represent different ecological conditions, these would require different management practices. Weeds in low lying wet areas can be eradicated by planting native tall grasses and weeds rather than attempts of burning.

कार्बेट टाइगर रिजर्व के घासीय स्थलों का पारिस्थितिक आकलन

जी०एस० रावत, एस०पी० गोयल व ए०जे०टी० जॉनसिंह

सारांश

कार्बोट टाइगर रिजर्व में स्थित दो बृहद् घासीय स्थलों (चौरों) का यह जानने हेतु अध्ययन किया गया कि इनमें घासों, शाकीय पौधों व खरपतवारों का विस्तार व प्रचुरता किस प्रकार है। अध्ययन से यह मालूम हुआ कि ऊंचे, स्थानों में स्थित कम दहन किये जाने वाले घासीय स्थलों में पेडों व खरपतवारों की प्रचुरता अधिक थी। तलाऊ घाटी में बिल्कुल भिन्न प्रकार की वनस्पति थी। पहले स्थान के मुकाबले दूसरे घासीय स्थल में घास की प्रचुरता निश्चित रूप से कम थी। ये दोनों स्थान अलग-अलग परिस्थितियों में विकसित हुए हैं अतः दोनों के प्रबन्धन के लिए अलग-अलग कार्य योजनाओं की आवश्यकता होगी। तलाऊ घाटी से खरपतवार हटाने हेतु दहन की अपेक्षा लम्बे स्थानीय घासों का रोपण उपयुक्त रहेगा।

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