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Grassland management in wildlife protected areas (PA's) in India

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Introduction

Ecological status of Indian grasslands had been a subject of conflicting opinion in the past. Existing grasslands are anthropogenic in origin except, Himalayan meadows in high altitudes. Extensive clearing of the forests for human settlements, agricultural cultivation and domestication of animals in the past have been resulted into opening of pockets/grasslands amidst the forest areas. Such tame grasslands are categorized as succession or rotational grasslands. There are four categories of PAs viz., National parks, wildlife sanctuaries, conservation reserves and community reserves. Thus, 683 PAs (102 national parks, 551 wildlife sanctuaries, 47 conservation reserves and 04 community reserves) spread over an area of 164985 sq km (about 5% of total geographic area) have been constituted in different bio-geographic zones of the country, most of PAs are situated in the forest ecosystems. According to the report of the Forestry Commission (2006), nearly 40% of these PAs are suffering from livestock grazing and fodder extraction by the inhabitants of well-established villages. At the beginning, 'Project Tiger' was launched in the year 1972-73 for conservation of tiger and their habitats, consisting of entire food web in the natural ecosystem, including prey species. A step ahead, till 2005, 28 Tiger Reserves spread over 37,700 sq km in 17 States, have been established and representing to different bio regions of the country.

Materials and Methods

The present paper highlights the structural and functional attributes of the grassland of PA's, which was previously studied in the year 1978-82 and subsequently reassessed after 20 years in the year 2003-004 in Kanha Tiger Reserve (KTR) of central India. The extensive meadows in the lower valleys support excellent grasses. Some of the main species are *Apluda mutica*, *Bothriochloa intermedia*, *Capillipedium parviflorum*, *Chionachne koenigii*, *Coix lacryma-jobi*, *Cymbopogon martinii*, *Dichanthium annulatum*, *Eragrostiella brachyphylla*, *Eragrostis tenella*, *Eragrostis uniolooides*, *Heteropogon contortus*, *Imperata cylindrica*, *Iseilema antheptoides*, *Ophiuros megaphyllus*, *Pennisetum hohenackeri*, *Sorghum nitidum*, *Themeda laxa*, *T. triandra* *Saccharum spontaeum*, *Desmostachya bipinnata* etc. In stream beds grasses grow very tall and the chief among them are *Thysanolaena maxima*, *Phargmatis karka*, *Themeda arundinacea*, *T. laxa*, *T. quadrivalvis*, *Saccharum spontaneum*, *Vetiveria zizanioides* etc. The major wild herbivores are chital (*Axis axis*), Sambhar (*Cervus unicolor*), Barasingha (*Cervus duvaucelii brandri*), Neelgay (*Boselaehus tragocamelus*), Barking deer (*Muntiacus muntjak*) etc.

Grasslands management in PA's: Observation on changes in the 16 plant communities in the previous study (1978-82), found to have changed community structure and leading to middle succession stage after a period of 20 year during reassessment in the year 2003-04 (Pandey, 1982; Pandey and Hardaha, 2006). The grasslands having comparatively more grazing pressures and/or fire incidences were prone to support less palatable and fire resistance grass species. Moreover, invasion of weed species has also led to deteriorate the ideal grass communities of previous study, along with reduction of utility per cent of the grasslands. Consequently, changing structure of grassland has also influenced the movement, daily activity pattern and ultimately to a distribution of wild ungulate population in the PA's.

Early successional communities of the evacuated lands viz., *Dichanthium annulatum-Dimeria ornithopoda*, *Dichanthium annulatum-Themeda triandra* and *Dichanthium annulatum-Heteropogon contortus* communities have been changed into *Dimeria ornithopoda-Panicum montanum*, *Heteropogon contortus-Dimeria ornithopoda* and *Themeda triandra-Bothriochloa odorata* community types have shown the influence of grazing and fire on community structure and tend to develop middle successional stages. These grasslands were subjected to low grazing pressure and repeated annual fire which developed into fire resistant community types consisting of less palatable and fire resistant grass species. Similarly, the communities, grouped into middle successional stages in pervious study i.e. *Themeda triandra-Eragrostis tenella*, *Themeda triandra-Themeda quadrivalvis*, *Heteropogon contortus-Saccharum spontaneum*, *Ischaemum laxum-Imperata*

cylindrica, *Imperata cylindrica*- *Heteropogon contortus* etc. were influenced by moderate grazing and frequent annual fire and changed into communities consisting of course, fire resistant grasses and weed species having comparatively less palatability. Further, over grazing and induced fire in middle succession stage communities, of the grasslands tend to change into regressive stage as experienced in the highly deteriorated grassland of Kanha meadow. This regressive stage was dominated by *Saccharum spontaneum*-*Eragrostis unioides* community type in previous study and further change into highly regressive stage by forming *Saccharum spontaneum* and *Desmostachya bipinnata* community type. Consequently, highly unpalatable and fire resistant grass communities have overcome in the grassland and occupied by the less palatable grasses/forage with minimum utility percent in Kanha meadow of KTR. However, experimental closure for five years with protection from grazing and fire in the part area of this grassland have shown the improvement in the structure and grass composition by providing congenial conditions for the palatable and fire sensitive species to come up. This closure sites were found to be associated with more palatable species and dominated by *Dimeria ornithopoda*-*Ischaemum indicum* community type in comparison to over grazed grassland. It would be worth to record that the closer for four to five years from grazing and fire in deteriorated grassland could improve the quality of grassland with comparatively higher utility percent with little management intervention.

Results and Discussion

Successional changes in the grasslands over a period of 20 years has envisaged that well developed communities, changed into communities having relatively less palatable grass species due to impact of grazing and fire in the absence of adequate management intervention. Further, increased intensity of grazing and/or fire in these intermediate communities have led to regression through increased composition unpalatable forage in the prevailing grassland communities. It is obvious that the successional change of grassland structure is a dynamic process which governs by fire and grazing intensity.

Interaction between Grassland habitat and wild ungulates. Utilization of wildlife habitat is greatly depends upon seasonal availability of food, phenology of plants, seasonal movements of the ungulates and consequently their distribution. Interaction of a number of environmental variables greatly affects the grazing and other activities of the animal making seasonal pattern of utilization. Wild ungulates spent more time for grazing / browsing in open areas in the day hours. However, large herbivores viz., gaur (*Bos gaurus*), sambhar, neelgay generally remained in the forest cover for browsing in the day hours and remain in the grasslands in night hours.

Weed management: Prevention of weed is a difficult task in the wildlife protected areas, where grasslands are managed in natural condition without physical/mechanical management interventions. Even unregulated grazing and fire are the unpredictable phenomenon, which regulate the structure and function of the grassland communities in wildlife managed protected areas. Application of herbicides / pesticides to control weed in the grasslands are not a suggestive measures in wildlife management area. In the protected areas like Kanha Tiger Reserve grazing and / or fire are the major factors responsible to provide congenial habitat conditions for invasion of weed species in the grassland habitats.

Fire management: There is no natural fire. The grasslands are burnt to avoid the consequences of fire in summer season in the PAs. However, burning is one of the convenient methods of removing unutilized herbage residues of previous year and to control the growth of undesirable shrubs and weeds. Such practices are most suitable in the managed grasslands where grazing and fire are controlled. However, fire has caused substantial adverse impact on the structure and function through succession changes and altered the tropic dynamics of the grasslands of KTR.

Management implications: Grasses /plants of later succession stages are perennials, relatively having vigorous rhizomes and root system are prone to dominate the site over a long period as Kush (*Desmostachya bipinnata*,) has covered most of well-drained area by replacing *Saccharum spontaneum* and *Imperata cylindrica* in highly regressive grassland of Kanha meadows. This stage of succession established, more stable, environment and dominated in relatively more adverse conditions (biotic stress) by drawing the energy from underground rhizomes and root system and do not support wide variety of wild animals because of poor quality of forage (Martin, 1978; Pandey, 1982). Fire resistant species tend to overcome in the area by suppressing the several annual and palatable grass species. In addition to fire, soil, moisture also plays an important role in the phenology of grasses and in controlling the abundance of new growth in grasslands during winter and summer seasons.

Conclusion

Conclusion envisaged that the structural and functional attributes of grasslands of KTR are undergoing in different intermediate stage of succession with lower utility percent, It is suggested that the rotational grazing practices along with weed eradication should be adopted to provide the congenial conditions for growth of graminoid species. Induce fire should be avoided from grassland habitats.

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