IMPERATA CYLINDRICA (LINN.) RAEUSCH IN THE GRASSLANDS OF PABITORA WILDLIFE SANCTUARY, ASSAM, INDIA

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ABSTRACT

A randomized -block experiment was carried out in Pabitora Wildlife Sanctuary to study the ecology and the growth of Imperata cylindrica *in both managed and non-managed areas.* I. cylindrica *increased in abundance in disturbed/managed plots and declined in abundance in unmanaged plots.* I. cylindrica *is a shade-intolerant grass species and therefore a build up of litter and increased shading on the unmanaged plots may result in a decline in its abundance and an increase in the abundance of shade-tolerant grasses. After cutting, burning or grazing,* I. cylindrica *is the first species to resprout and grow dominantly over other species.*

KEYWORDS

Erianthus ravanae, *grassland,* Imperata cylindrica*, Pabitora Wildlife Sanctuary,* Saccharum spontaneum, *wildlife*

Pabitora Wildlife Sanctuary in Assam is one of the remaining examples of a tropical grassland in India. The Sanctuary (26º12'-26^{0}15'N & 90^{0}2'-90^{0}5'E) occupies a total area of 38.81km^2 in the Valley of Kallong, a small southern tributary of river Brahmaputra. The Sanctuary is nourishing a considerably large area of healthy tropical alluvial grassland which can also be referred as *Imperata* grassland. A total of 72.25% area of the Sanctuary is covered by this type of grassland having *Imperata cylindrica* as the major and, dominant species with *Phragmites karka* and *Saccharum spontaneum* as the associated species. The trees cover almost 13.09% of the total area out of which *Albizzia procera* covers 90% of the tree forest as a result of secondary succession.

This important grassland supports a wide range of biodiversity and is a subsistence resource for the local community in the form of cane and thatch for house building. It appears from the grassland utilization that *Imperata cylindrica* is an economically important species which has a good market demand and therefore value. This Sanctuary is famous for the Indian One-horned Rhinoceros bearing Asia's highest density. Other animals like Leopard, Wild Buffalo, Wild Boar, Civet Cat, Fishing Cat, Python and Cobra are also present.

The climate of the study is monsoonal with average annual rainfall of about 3000mm. A cool dry season lasts from October to February, followed by a hot dry season until April-May with an average maximum temperature of 38ºC and minimum of 9ºC.

Practically, there is very little or no management of the grassland in this region. The only management policy practiced in the Pabitora Sanctuary is burning which is also not directly aimed to managed the grassland and its animals. The main reason of annual burning of the grassland in this region is to improve the visibility inside the Sanctuary. Burning is generally not controlled, and planned. The effects of the burning is neither recorded nor studied. Moreover, the whole area is surrounded by 22 revenue villages and these villages utilize the grassland of the Sanctuary as the major source of thatch for house building.

Imperata cylindrica is one of the primary food sources of rhinos. The present studies was made to emphasise this fact and understand important limiting factor constraints for the species.
1. To study the present status of *I. cylindrica* dominated grassland in the Sanctuary.
2. To identify other different dominant grass species and their distribution pattern in the Sanctuary.
3. To study associations between animal species and grass type assemblages.
4. To study the present practice of grassland management.

METHODS

Randomized blocks: During the survey, Pabitora Wildlife Sanctuary was divided into 25 blocks and designated under some camps. These camps were Noltoli, Kachuoni, Khulabhuyan, Pokari Dipirang, Hahsora, Tuplung, Kamalpur, Buramayang, Bordia and Nekera. The blocks were of 35 x 35m size inside which, small quadrats of 5 x 5m were taken randomly. This method is also called randomized block design method.

Data were collected from each quadrat and the dominant grass species were identified in the Department of Botany, Gauhati University. Shrubs, trees or tall grass species occurring in a plot, but not falling within sampling quadrats, were also recorded. Visual estimates of the percentage of the dominant grass species were also made in the study plots.

In each plot, indirect and direct monitoring methods were used to measure animal utilization. Signs of mainly pellets and footprints were studied. Unidentified pellets were collected and identified in the Department of Zoology, Gauhati University. Plots were surveyed during cool, dry season (October-January) before the grasslands dried and were burned. The period of study was October 1999 to March 2001.

Species preference for different grassland assemblages were calculated using Jacobs Index (Jacobs, 1974):

$$D = \frac{r - p}{r + p - 2rp}$$

where, r is the proportion of 5 x 5m quadrats in which a species was present in a given plant assemblage and p is the proportion of total number of 5 x 5m quadrats consisting of a given plant

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Table 1. Grass species in all study blocks

Sp. code	Scientific name	Max. height	GD	GW	% of cover	Assemblage	% Assemblage
A.	*Imperata cylindrica*	3-6 ft	Present	Present	40%	AD	40%
B.	*Saccharum spontaneum*	4-6 ft	Present	Present	20%	BD	20%
C.	*Phragmites karka*	5-6 ft	Present	Present	10-20%	CB	20%
D.	*Erianthus ravanae.*	6-7 ft	Present	Present	20-40%	DA	40%

GD - grazing by domesticated animals; GW - grazing by wild animals

assemblage. D varies between +1 for complete selection of a plant assemblage and -1 for complete avoidance of a plant assemblage.

r (Mean relative abundance) =
No. of quadrats in which a species present in a plant assemblage
Total no. of quadrates in a plant assemblage
(Muller-Dombois & Ellenberg, 1974; Lehmkuhl 1994; Peet *et al.,* 1997).

Results and Discussion

Four major grass species occur predominantly in the study site which cover almost 90% of the total grassland area. They are *Imperata cylindrica, Saccharum spontaneum, Erianthus ravanae* and *Phragmites karka*. Other grass species are *Arundo donax, Pollinia ciliata* and *Cynodon dactylon*.

Table 1 shows the high percentage of *I. cylindrica* in the study blocks. Except in the wet areas, *I. cylindrica* which is the shortest of all tall grass species is present in all study blocks. Grazing is more or less common in all the study areas. Of the seven tall grass species recorded, four contributed over 90% of the total cover of grasses. Out of the four dominant species, *I. cylindrica* was found to be structurally important in all experimental blocks.

In the study area, it was observed that *I. cylindrica* shoots resprout generally in three to seven days after burning. The mean shoot height of *I. cylindrica* is .9-1.7m during the full growth period. The shoots are visible usually after three to four days of burning.

In Pabitora, the management pattern is not always strategic. It appears that management does not involve the cutting practice except for utilization by local people which is usually patchy. Management only involves controlled burning irrespective of cut or non-cut areas and hence all the areas are not burned after cutting. Therefore, the mean shoot heights vary in different study blocks (Bell, 1997).

Table 2. Name of the dominant grass species identified in the study

Name	Location	Grazing	%
Imperata cylindrica	Disturbed area	Maximum	40%
Saccharum spontaneum	Wet area	Maximum	20%
Saccharum fuscum	Wet area	Medium	5%
Phragmites karka	Watershed area	Medium	10%
Erianthus ravanae	Marshy area	Maximum	25%
Cynodon dactylon	Almost all areas	Maximum	-
Dactyloctenium aegyptium	Grassland	Minimum	-
Cyperus brivifolius	Marshy area	Minimum	-

The growth of *I. cylindrica* is significantly dominant in disturbed and managed areas. On the contrary, in unmanaged and undisturbed areas, growth pattern of this species was observed to be slower and the assemblage pattern was dominated by other grass species along with the forbs (Figs. 1, 2 & 3). *Imperata cylindrica* rapidly colonizes only disturbed sites (Brook, 1989). It has a high root ratio of rhizome and shoot which provides a source of dry matter for regeneration after cutting or burning (Saxena & Ramakrishnan, 1983; Peet *et al.,* 1999). It was also reported that *I. cylindrica* is shade-intolerant (Brook, 1989), shading reduces both shoot and rhizome biomass (Soer-jani 1970). It is therefore possible that a build up of litter and increased shading on the unmanaged plots might result in a decline in the abundance of *I. cylindrica* and an increase in the abundance of shade-tolerant grasses (Tilman & Wedin, 1991; Peet & Bell 1999). *I. cylindrica* dominated grasslands are often described as a fire climax community (Seth, 1970; Falvey, 1981; Skerman & Reveros, 1989; Peet & Bell, 1999) and in northern India they are considered to dominate following fire, cutting and grazing, being the first stage of degradation of *Phragmites – Saccharum - Erianthus* community, which is also true in the Pabitora Sanctuary.

Percentage of assemblages with *I. cylindrica*

It was observed that *I. cylindrica* has the following average degrees of assemblage with the other three dominant grass species in all study blocks - *I .cylindrica* 30 %; *I. cylindrica* + *E. ravanae* 35%; *I. cylindrica* + *S. spontaneum* 20%; *I. cylindrica* + *P. karka* 15%.

Although during the study period the percentage of assemblage

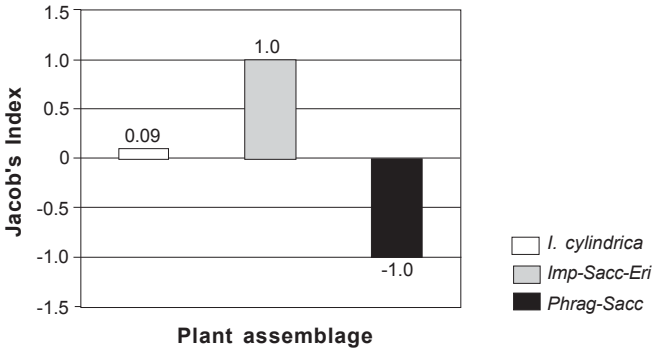

Figure 1. Species preference for different grassland assemblages - Rhino

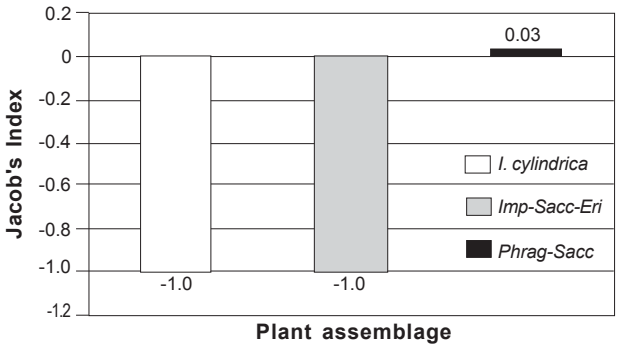

Figure 2. Species preference for different grassland assemblages - Buffalo

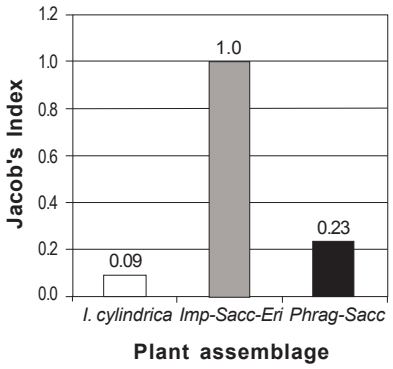

Figure 3. Species preference for different grassland assemblages - Cattle

was found to remain the same, *I. cylindrica* showed a tendency to over dominate the other three species in the managed areas.

The following preferences were observed for the dwelling grassland animal species:

Species	Assemblages
Rhinoceros	*I . cylindrica - S. spontaneum*
Sus scrofa	All assemblages
Bubalus bubalis	*P. karka - S. spontaneum*
Domestic cattle	All assemblages

It has been shown that *Imperata* is preferred by Rhino and also *Phragmites karka, Saccharum spontaneum, Cynodon dactylon* and *Erianthus ravanae* (Bhattacharyya, 1991). *Imperata cylindrica* dominated grasslands of the Pabitora Wildlife Sanctuary is common in many features with savanna systems in terms of climate, seasonality and structure (Medina & Huber, 1998). Savannas are typically dominated by grasses Poaceae, of which a few species is highly dominant.

Other grassland associated plant species

1. *Cardiospermum helicacabum*
2. *Leucas aspera*
3. *Solanum ferox*
4. *Polygonum plebajum*
5. *Polypodium* sp.
6. *Mikania scandens*
7. *Naphrodium cuculantum*
8. *Ipomoea aquatica*
9. *Polygonum barbatum*
10. *Rungia parviflora*
11. *Xanthium strumarium*
12. *Pouzolzia indica*
13. *Eupatorium odoratum*
14. *Enhydra fluctuans*
15. *Polygonum* sp.
16. *Desmodium trifoliatum*
17. *Cyclosorus extensum*
18. *Spelanthes paniculata*
19. *Rosa* sp.
20. *Teraxacum* sp.
21. *Mimosa pudica*

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