Our Nature (2007)5:14-20

Rhino-Fodders in Jaldapara Wildlife Sanctuary in Duars of West Bengal, India

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Received: 1.12.2007, Accepted: 12.12.2007

Abstract
Jaldapara Wildlife Sanctuary is the second largest *in situ* conservatory in India for *Rhinoceros unicornis* L. As much as 57 species of Rhino-fodders have been recorded from the sanctuary and the list is dominated with the record of 34 species (i.e. 59.65 %) from Poaceae itself. It is followed by five species of Cyperaceae and three species of Euphorbiaceae. Another 13 families are represented with two or one species only. These plants have been categorised into three groups (1) Most Preferred, 15 spp., (2) Preferred, 38 spp. and (3) Stress-time fodders, 4 spp. Local names, habit and edible parts of these plants have been provided in this article.

Keywords: *Rhino fodder*, Jaldapara Wildlife Sanctuary.

Introduction

Jaldapara Wildlife Sanctuary (JWLS) is the second largest natural home after Kajiranga National Park in Assam for great Indian one-horned Rhinoceros (*Rhinoceros unicornis* L.) and is one of the prestigious sanctuaries of West Bengal. This unique trouser shaped sanctuary (Figure 1) is situated in the Duars at the foot of the Darjeeling part of the Eastern Himalaya and falls in the district of Jalpaiguri (West Bengal, India), located in between 25º58′ N and 27º 45′ N latitudes and 89º 08′ E and 89º 55′ E longitudes, falls under the jurisdiction of Coochbehar Wildlife Forest Division.

This Sanctuary is situated at the foothill region which is popularly referred as Duars. In 1941 it was first declared as a 'Game Sanctuary' with an area of 99.5 sq km. But, later on it was extended twice in 1976 and in 1990 to achieve its present area of 216.5 sq km (Pandit 1996; Anonymous, 1997; Das *et al.*, 2003). For administrative purposes, Sanctuary has been divided into 07 forest ranges, 25 forest Beats and 68 compartments.

Most Rhino concentrated areas of the Sanctuary are East, West and North Ranges. They visit occasionally in some areas of Chilapata and Kodalbasti Ranges. But Rhinos never visit any part of South and Nilpara Ranges.

Its topographical situation and environmental factors made itself a beautiful natural habitat not only for Rhinos but also for an amazing variety of wild flora and fauna. As it is situated in the Duars at the foot of the Darjeeling hills, it becomes a part of the IUCN recognised Himalayan Hotspot. Darjeeling region is situated nearly at the central part of the Eastern Himalaya and is famous for its fabulous biodiversity.

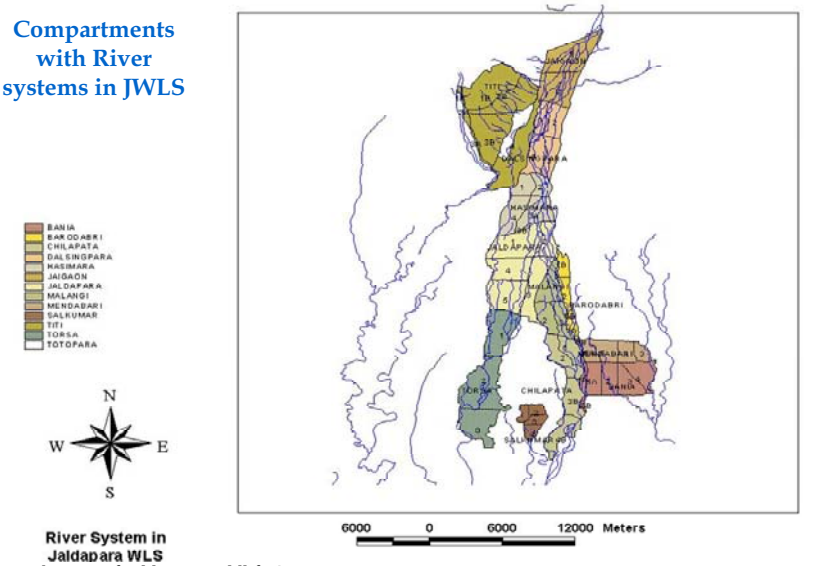

Figure 1. The map of Jaldapara Wildlife Sancuary.

Like hills, Duars and Terai are also equally rich in their biodiversity.

The basic vegetation structure of this region is mixed deciduous forest (Champion and Seth, 1968). Recent workers (Banerjee, 1993; Pandit, 1996; Anonymous, 1997; WII 1997; Das *et al.*, 2003) recognised the formation of following types of vegetation in JWLS: Riverine Forests, Sal Forests, Wet Mixed Forests, Semi-evergreen Forests, Evergreen Forests, Riverine Grasslands, Savannah Grasslands, Open low lying Herbland, Hydrophytic vegetation, etc. A good number of threatened and endemic species as well as wide range of timber yielding, fodder, food, medicinal and other types of NTFP producing plants (Pandit, 1996; Das *et al.*, 2003; Pandit *et al.*, 2004) grow in the sanctuary. All strata in vegetation are floristically rich and have created the situation very much congenial for evolution.

Materials and methods

Random survey was made for rhino-fodders during 2002 and 2007 in different rhino concentrated regions of JWLS.

Collected specimens were processed and identified through conventional techniques (Jain and Rao, 1977) in the taxonomy laboratory of the Department of Botany, North Bengal University and matched at CAL and stored in the NBU-Herbarium.

Results and discussion

Rhinos are voracious consumers. Their food habit is very selective and they forage only on the young twigs of their edible plants. The list of edible plants for Rhinos is quite short and that too is dominated with grasses.

Even they consume very little of the sedges, other monocotyledonous plants and few dicotyledonous plants.

Banerjee (1993), Pandit (1996) and Anonymous (1997) provided lists of 49 fodder plants as Rhino-fodder. Of them, later two workers have not made any modification in the list. Whereas Das *et al.* in 2003 reported 58 species of Rhino-fodders.

Type of Fodders: Considering the likeliness or the preference different identified Rhino-fodders can be categorised into three distinct groups:

I. Most Preferred Fodders

Among the recorded Rhino fodders, 15 species can be regarded as most preferred ones. These are mostly grasses and are available mainly in open and grassland vegetations. These are growing in enormous quality and are supplying major bulk of the food for Rhinos and also to other herbivores of the sanctuary. Table 1 presents the list of most preferred Rhino-fodders:

It is interesting to note that both the plant Ikra and Kasia or Kash (Table 1; Sl. No. 12 and 13) have been identified as *Saccharum spontaneum* though there are some morphological differences. It is expected that on further study differences at varietals level could be established.

II. Preferred Fodders

As much as 38 species are categorised as preferred Rhino-fodder. The degree of preference varies greatly during browsing. When a Most Preferred fodder is available in good quality, these plants are generally avoided by this giant herbivore. Table 2 presented the list of preferred Rhino-fodders.

III. Stress-time Fodders

Only 4 species (Table 3) are categorised as stress-time Rhino fodders. These plants are available in varying quantity but are generally not browsed by Rhinos when most of the preferred fodders are in good supply. But during dry season, when supply of major fodders are nil or nominal, these plants are then browsed by Rhinos.

An analysis (Table 5) of the recorded Rhino-fodders reveals that this giant herbivore prefers grasses in general as out of 57 plants 34 species (i.e., 59.65%) are from Poaceae. And, out of 15 most preferred species only one is from Zingiberaceae (*Alpinia nigra*) and all others are grasses. Nearly a similar situation is for 'Preferred' group of fodders where out of 38 species 20 (i.e. 52.63%) are grasses. Poaceae is followed by Cyperaceae (five species; all 'Preferred') and Euphorbiaceae (three species; all 'Preferred') (Table 4). Rhinos eat flowers of *Bombax ceiba* much eagerly. Flowers of this species are available for a very short period but at a time when there is much scarcity of fodder in the sanctuary. Flowers of *Oroxylum indicum* are also equally liked by Rhinos but, on the contrary, the species flowers for a much longer period and at a time when there is no dearth of fodder in the sanctuary.

The overall picture is that the recorded 57 species of Rhino-fodder from JWLS are represented by 16 angiospermic families (Table 5). There is no doubt that the giant animal prefers the grasses most and out of 57 recorded fodders 34 or 59.65% species belongs to Poaceae (Figure 2).

Conclusion

Rhinoceros unicornis L. is the keystone species of JWLS and their population is increasing quickly. So, for the conservation of this species, it is necessary to increase

Table 1. Most Preferred Rhino-fodders in JWLS.

Sl. No.	Plant Name	Family	Local Name	Habit	Edible Parts
1.	*Alpinia nigra* (Gaertner) B.L. Burtt	Zingiberaceae	Purundi	Medium, shoots few	New leaves & pseudostem
2.	*Arundinella bengalensis* (Sprengel) Druce	Poaceae	Chhoto Jharu	Medium grass	Tips with new leaves
3.	*Arundo donax* L.	Poaceae	Nol	Medium grass	Tips with new leaves
4.	*Axonopus compressus* (Sw.) P. Beauvois	Poaceae	Chhoto Chepti	Small prostrate grass	Whole plant
5.	*Cymbopogon jwarancusa* (Jones) Schultes	Poaceae	Chhoto Gandali	Medium bushy	Tips with new leaves
6.	*Imperata cylindrica* (L.) Räusch.	Poaceae	Thatch, Kush	Small grass	New leaves
7.	*Saccharum arundinaceum* Retzius	Poaceae	Madhua	Tall grass	Tips with new leaves
8.	*Saccharum bengalense* Retzius	Poaceae	---	Tall grass	Tips with new leaves
9.	*Saccharum longisetosum var. hookeri* (Hackel) Bor	Poaceae	Ekra	Tall grass	Tips with new leaves
10.	*Saccharum longisetosum* (Anderson) V. Naray. *var. longisetosum*	Poaceae	Ekra	Tall grass	Tips with new leaves
11.	*Saccharum narenga* (Nees ex Steudel) Hackel	Poaceae	Dhadda	Tall grass	Tips with new leaves
12.	*Saccharum spontaneum* L.	Poaceae	Ikra	Medium grass	New leaves
13.	*Saccharum spontaneum* L.	Poaceae	Kasia, Kash	Medium grass	New leaves
14.	*Themeda arundinacea* (Roxburgh) Ridley	Poaceae	Baro chepti	Tall grass	Tips with new leaves
15.	*Thysanolena latifolia* (Roxburgh ex Horrem) Honda	Poaceae	Jharu, Ambrosa	Medium bushy	Tips with new leaves

Table 2. Preferred Rhino-fodders in JWLS.

Sl. No.	Plant Name	Family	Local Name	Habit	Edible Parts
01.	*Acacia catechu* (L.f.) Willdenow	Mimosaceae	Khair	Tree	Young shoot
02.	*Alpinia calcarata* Roscoe	Zingiberaceae	---	Rhizomatous herb	Leaf, pseudostem, inflorescence
03.	*Arundinella decempedalis* (Kuntze) Janowski	Poaceae	**---**	Suffrutescent tall herb	Young leaf, inflorescence
04.	*Arundinella nepalensis* Trnius	Poaceae	---	Suffrutescent tall herb	Young leaf, inflorescence
05.	*Brachiaria ramosa* (L.) Stapf	Poaceae	---	Annual herb	Shoot, inflorescence
06.	*Bridelia retusa* (L.) Sprengel	Euphorbiaceae	Datan	Tree	Young shoot
07.	*Chrysopogon aciculatus* (Retzius) Trinius	Poaceae	Chorkanta	Annual herb	Young Shoot
08.	*Coix aquatica* Roxburgh	Poaceae		Annual herb	Shoot
09.	*Coix lachryma-jobi* L.	Poaceae	Malagadi	Annual herb	Young leaf

10.	*Curculigo capitulata* (Loureiro) Herbert	Hypoxidaceae	Bansh pata	Perennial herb	Young leaf, inflorescence
11.	*Cymbopogon flexuosus* var. *sikkimensis* Bor	Poaceae	Baro Gandali	Suffrutescent tall herb	Young leaf, inflorescence
12.	*Cymbopogon khasianus* (Muro ex Hackel) Stapf ex Bor	Poaceae	Baro Gandali	Suffrutescent tall herb	Young leaf, Inflorescence
13.	*Cynodon dactylon* (L.) Persoon	Poaceae	Durba	Perennial runner	Young shoot
14.	*Cyperus pangorei* Rottboel	Cyperaceae	---	Annual herb	Young shoot
15.	*Cyperus pilosus* Vahl	Cyperaceae	---	Annual herb	Young shoot
16.	*Dalbergia sissoo* DC.	Papilionaceae	Sissoo	Tree	Young leaf
17.	*Eleusine indica* (L.) Gaertner	Poaceae	Marua	Annual herb	Young shoot
18.	*Ficus hispida* L.f.	Moraceae	Khoksa	Tree	Young leaf
19.	*Fimbristylis rigidula* Nees	Cyperaceae	---	Annual herb	Young shoot
20.	*Helicteres hirsuta* Loureiro	Sterculiaceae	---	Tree	Young leaf
21.	*Helicteres isora* L.	Sterculiaceae	Fersa	Shrub	Young leaf
22.	*Litsea monopetala* (Roxburgh) Persoon	Lauraceae	Kutmero	Tree	Young leaf
23.	*Macaranga denticulata* (Blume) Mueller	Euphorbiaceae	Malata	Tree	Young leaf
24.	*Mallotus philippensis* (Lamarck) Mueller	Euphorbiaceae	Sindure	Tree	Young leaf
25.	*Nasturtium officinale* Brown	Cruciferae	Alua Ghash	Annual herb	Leaf, Inflorescence
26.	*Oplismenus burmannii* (Retzius) P. Beauvois	Poaceae	---	Annual herb	Young shoot
27.	*Oplismenus compositus* (L.) P. Beauvois	Poaceae	---	Annual herb	Young shoot
28.	*Oroxylum indicum* (L.) Ventenat	Bignoniaceae	Totola	Tree	Flower
29.	*Oryza meyeriana* (Zoll. & Moritzi) Baillon	Poaceae	---	Annual herb	Young shoot
30.	*Panicum auritum* Presl ex Nees	Poaceae	---	Annual herb	Young leaf, Inflorescence
31.	*Paspalum scrobiculatum* L.	Poaceae	Marua Ghash	Annual herb	Young Shoot
32.	*Schizachyrium brevifolium* (Sw.) Nees ex Büse	Poaceae	---	Annual herb	Young Shoot
33.	*Scleria terrestris* (L.) Fassett	Cyperaceae	Kella Ghash	Annual herb	Young Leaf, Inflorescence
34.	*Scleria levis* Retzius	Cyperaceae	Kella Ghash	Annual herb	Young Leaf, Inflorescence
35.	*Setaria palmifolia* (J. König) Stapf	Poaceae	Banshpata	Annual herb	Young Leaf, Inflorescence
36.	*Sporobolus fertilis* (Steudel) Clayton	Poaceae	---	Annual herb	Young Leaf, Inflorescence
37.	*Tripsacum laxum* Nash	Poaceae	Bhutta ghash	Perennial herb	Young Leaf
38.	*Vetiveria zizanoides* (L.) Nash	Poaceae	Bena	Suffrutescent tall herb	Young Leaf, Inflorescence

Table 3. Stress-time Rhino-fodders in JWLS.

Sl. No.	Plant Name	Family	Local Name	Habit	Edible Parts
1.	*Bombax ceiba* L.	Bombacaceae	Simul	Tree	Flower
2.	*Mikania micrantha* Kunth	Asteraceae	Assamlata, Mikenia	Climber	Leaves
3.	*Typha angustifolia* L.	Typhaceae	Hogla	Rhizomatous herb	Young shoot
4.	*Vallisneria spiralis* L.	Hydrocharitaceae	Jalua gachh	Submerged annual	Leaves

Table 4. Representation of different families among the different groups of Rhino-fodders in JWLS.

Most Preferred Fodder	No. of Plants	Preferred Fodder	No. of Plants	Stress-time Fodder	No. of Plants
Poaceae	14	Bignoniaceae	1	Asteraceae	1
Zingiberaceae	1	Brassicaceae	1	Bombacaceae	1
		Cyperaceae	5	Hydrocharitaceae	1
		Euphorbiaceae	3	Typhaceae	1
		Fabaceae	1		
		Hypoxidaceae	1		
		Lauraceae	1		
		Mimosaceae	1		
		Moraceae	1		
		Poaceae	20		
		Sterculiaceae	2		
		Zingiberaceae	1		
TOTAL:	**15**	**TOTAL:**	**38**	**TOTAL:**	**4**

Table 5. Families of Rhino-fodders in JWLS and their numerical representation at the species and variety level.

Sl. No.	Families	No. of Plants
1	Poaceae	34
2	Cyperaceae	5
3	Euphorbiaceae	3
4	Sterculiaceae	2
5	Zingiberaceae	2
6	Bombacaceae	1
7	Asteraceae	1
8	Bignoniaceae	1
9	Brassicaceae	1
10	Hydrocharitaceae	1
11	Hypoxidaceae	1
12	Lauraceae	1
13	Mimosaceae	1
14	Moraceae	1
15	Papilionaceae	1
16	Typhaceae	1
	TOTAL:	**57**

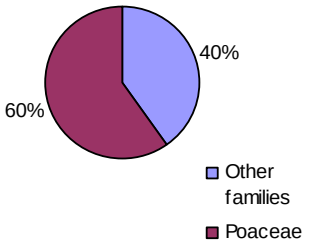

Figure 2. Grasses are dominating the fodder-flora for Rhinos.

grassland area in the sanctuary for the production of more fodder not only for Rhino but also for many other herbivore inhabitants. But whenever such plantation program is taken up certainly it is replacing other types of vegetation inside the sanctuary area. As it appears, sanctuary managers are not much concerned about the conservation of its rich biodiversity. Due to the use of mostly one particular species i.e., *Saccharum narenga* (Dhadda) the balance in the diversity of Rhino fodders is also much disturbed. Dhadda grows vigorously and, naturally, suppress the growth of other species in the vegetation. It is suggested that conservation policy or strategy for JWLS should also cover the idea of conserving all of species of plants and animals living there. They planted only single species of grass and due to its vigorous growth other species suppress.

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