

Table3.1: Distribution of animal in the forest patches of Corridor I and II of North Kheri

Corridor	Spent time (hrs: min)	Area of forest patches (ha)	Location of forest patches	Animal evidence found
I	10.10	136.78	Bela Parsua	Jackal, Chital, Nilgai, Elephant and Hare, Wild boar
I	12.30	244.46	Ragunagar	Chital, Jackal, Nilgai, Hog deer, Elephant, Tiger, Wild boar
I	4.45	208.66	Kishunnagar	Elephant, Jackal, Chital and Nilgai
I	6.00	187.63	Deepnagar	Elephant, chital, Nilgai
I	2.25	27.75	Ganganagar	Jackal, Chital
I	2.20	456.71	Kharatiya	Tiger
II	5.45	233.78	lcchanagar	Chital and hare, Wild boar, Monkeys
II	4.50	39.59	Sissaya	Wild boar and Hog deer, Chital, Hare
II	17.40	1641.96	Nunia	Wild boar Chital, Nilgai, Hare, Jackal
II	6.45	89	Dharmapur	Hare, Wild boar, Nilgai
II	4.40	*1	Badura	Hare
II	8.44	231.14	Ladhori, Chakra	Chital, Hare
II	4.00	45.92	Singahi	Hare, Nilgai
II	3.45	349.26	Banglaha	Hare
II	4.25	*2	Takiya	Hare
II	2.30	178.05	Mohammadpur	Hare, Nilgai, Chital
II	5.10	223.98	Naurangabad	Jackal and Hare, Chital, Wild boar
II	9.10	542	Bathua	Nilgai, Hare
II	4.40	166.14	Murtiha	Chital and Hare, Wild boar
II	10.13	453.98	Baria	Hare, Jackal, Chital
II	6.40	251.56	Lathua	Sloth bear, Hare, Chital
II	9.04	775.38	Majhra East	Tiger, Chital and Hare, Nilgai
Total time spent	146.11			.

*1 Not define

*2 Area merged with Takiya

Table3.2: Evidence of wild animal in autumn

Animal and type of evidence	Density/ha	Standard deviation (SD)
Scat	*	*
Jackal	0.83	5.10
Wild boar	0.42	3.63
Pugmark	*	*
Elephant	5.20	41.73
Chital	1.04	5.68
Nilgai	0.21	2.57
Tiger	0.42	3.63
Jackal	0.05	0.21
Wild boar	0.62	4.43
Pellet	*	*
Hare	5.20	11.81
Chital	4.37	11.00
Nilgai	1.25	6.20
Hog Deer	0.21	2.57

Table3.3: Evidence of wild animal in summer

Animal and type of evidence	Density/ha	Standard deviation (SD)
Scat	*	*
Jackal	0.62	4.43
Wild boar	0.21	2.57
Tiger scat	0.21	2.57
Sloth bear	0.21	2.57
Pugmark	*	*
Elephant	0.83	5.10
Chital	2.29	8.25
Wild boar	3.12	11.42
Chital	3.54	10.04
Pellets		
Nilgai	3.12	9.50
Hog Deer	2.08	7.90
Hare	9.37	14.56
Wild boar digging	0.21	2.57

Table 3.4: Evidence of wild animal in winter season

Animal and type of evidences	Density/ha	Standard deviation (SD)
Scat	°	°
Jackal	0.21	2.57
Wild boar	0.21	2.57
Pugmark	°	°
Nilgai	0.83	5.10
Tiger	0.62	4.43
Pellet	°	°
Swamp deer	0.42	3.63
Nilgai	2.08	7.90
Chital	2.50	8.59
Hare	1.87	8.36
Wild boar digging	2.91	9.21

Table 3.5: Difference between the sites where evidence of wild animal were present and absent

	No. Of cut trees	No. Of lopped trees	Road distance (m)	Habitation distance (m)	Water distance	Dung	Canopy cover	Height
Chi-Square	4.149	.676	1.494	2.521	.345	7.683	2.799	.290
df	1	1	1	1	1	1	1	1
Asymp. Sig.	.042	.411	.222	.112	.557	.006	.094	.590

a Kruskal Wallis Test

b Grouping Variable: Total evidence

Table 3.6: Evidence of animal in autumn

Location of forest patches	Scat density/ha		Pugmark density/ha							Pellets density/ha			
		Jackal	Wild boar	Elephant	Chital	Nilgai	Tiger	Jackal	Wild boar	Hare	Chital	Nilgai	H Deer
Bela Parsua	Mean	3.98	0.00	15.92	3.98	0.00	0.00	7.96	0.00	7.96	7.96	3.98	0.00
	SD	10.53	0.00	15.92	10.53	0.00	0.00	13.79	0.00	13.79	13.79	10.53	0.00
Bhaganagar	Mean	0.00	0.00	60.51	9.55	3.18	0.00	0.00	0.00	0.00	3.18	0.00	0.00
	SD	0.00	0.00	166.10	10.70	10.54	0.00	0.00	0.00	0.00	1.06	0.00	0.00
Bishannagar	Mean	0.00	0.00	5.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	SD	0.00	0.00	6.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bheepnagar	Mean	5.31	0.00	5.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	SD	13.00	0.00	13.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bhanga-nagar	Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bharatiya	Mean	0.00	0.00	0.00	0.00	0.00	31.85	31.85	0.00	0.00	31.85	0.00	0.00
	SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bhanganagar	Mean	0.00	6.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.11	0.00	0.00
	SD	0.00	14.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.44	0.00	0.00
Bhissaya	Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.98	3.98	7.96	0.00	0.00
	SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.26	11.26	14.74	0.00	0.00
Bhunia	Mean	1.59	1.59	0.00	0.00	0.00	0.00	1.59	1.59	7.96	7.96	1.59	0.00
	SD	7.12	7.12	0.00	0.00	0.00	0.00	7.12	7.12	14.15	14.15	7.12	0.00
Bharmapur	Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.62	0.00	0.00	0.00
	SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.45	0.00	0.00	0.00
Bhiora	Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bhadhuri, Bhakra	Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.58	11.58	0.00	0.00

Location of rest patches	Scat density/ha			Pugmark density/ha						Pellets density/ha			
		Jackal	Wild boar	Elephant	Chital	Nilgai	Tiger	Jacka l	Wild boar	Hare	Chital	Nilgai	H Deer
	SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.07	16.07	0.00	0.00
inghai	Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.96	0.00	7.96	0.00
	SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.92	0.00	15.92	0.00
anglaha	Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.37	0.00	6.37	0.00
	SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.24	0.00	14.24	0.00
akiya	Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.37	0.00
	SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.24	0.00
ohamadpur	Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.96	0.00	0.00	0.00
	SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.92	0.00	0.00	0.00
orangabad	Mean	4.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.65	0.00	0.00	0.00
	SD	12.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.02	0.00	0.00	0.00
athua	Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.98	31.85
	SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.19	0.00
urthiha	Mean	0.00	0.00	0.00	0.00	0.00	0.00	6.37	6.37	6.37	6.37	0.00	0.00
	SD	0.00	0.00	0.00	0.00	0.00	0.00	14.24	14.24	14.24	14.24	0.00	0.00
aria	Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.08	0.00	0.00	0.00
	SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.04	0.00	0.00	0.00
athua	Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.31	0.00	0.00	0.00
	SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.00	0.00	0.00	0.00
azhra East	Mean	0.00	0.00	0.00	4.55	0.00	4.55	0.00	0.00	4.55	9.10	0.00	0.00
	SD	0.00	0.00	0.00	12.04	0.00	12.04	0.00	0.00	12.04	15.54	0.00	0.00

Location of rest patches	Scat density/ha		Pugmark density/ha		Pellet density/ha			H Deer	Hare
	Jackal	Wild boar	Elephant	Chital	Wild boar	Chital	Nilgai		
anglaha	SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.92
	Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.37
akiya	SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.24
	Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	31.85
ohamadpur	SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Mean	0.00	0.00	0.00	0.00	0.00	7.96	0.00	31.85
orangabad	SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Mean	0.00	0.00	0.00	0.00	0.00	0.00	15.92	0.00
athua	SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.10
	Mean	0.00	0.00	0.00	0.00	0.00	4.55	4.55	0.00
urthiha	SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.04
aria	SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Mean	7.08	0.00	0.00	0.00	0.00	0.00	0.00	4.55
athua	SD	14.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.04
azhra East	SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.54

Table 3.8: Evidence of animal in winter

Location of forest patches	Scat density/ha			Pugmark density			Pellet density/ha			
		Jackal	Wild boar	Nillgai	Tiger	Chital	Nillgai	Chital	Hare	Wild Boar Digging
Bela Parsua	Mean	0.00	0.00	3.98	0.00	3.98	0.00	3.98	3.98	7.96
	SD	0.00	0.00	11.26	0.00	11.26	0.00	11.26	11.26	14.74
Gugunagar	Mean	0.00	0.00	6.37	3.18	0.00	9.55	6.37	3.18	3.18
	SD	0.00	0.00	13.43	10.07	0.00	15.38	13.43	10.07	10.07
Kishannagar	Mean	0.00	0.00	5.31	0.00	0.00	0.00	0.00	5.31	0.00
	SD	0.00	0.00	13.00	0.00	0.00	0.00	0.00	13.00	0.00
Keepnagar	Mean	0.00	0.00	0.00	0.00	0.00	5.31	0.00	0.00	0.00
	SD	0.00	0.00	0.00	0.00	0.00	13.00	0.00	0.00	0.00
Kanga-nagar	Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.62
	SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.39
Kharatiya	Mean	0.00	0.00	0.00	31.85	31.85	0.00	0.00	0.00	0.00
	SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Kunia	Mean	0.00	0.00	0.00	0.00	2.50	0.00	0.00	12.74	1.74
	SD	0.00	0.00	0.00	0.00	8.59	0.00	0.00	16.01	3.99
Khanagar	Mean	0.00	0.00	0.00	0.00	0.00	0.00	19.11	12.74	6.37
	SD	0.00	0.00	0.00	0.00	0.00	0.00	17.44	17.44	14.24
Kisaya	Mean	0.00	0.00	0.00	0.00	0.00	0.00	11.94	7.96	7.96
	SD	0.00	0.00	0.00	0.00	0.00	0.00	16.48	14.74	14.74
Kharmapur	Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.92	5.31
	SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.44	13.00
Kilora	Mean	0.00	0.00	0.00	0.00	0.00	6.37	0.00	0.00	0.00
	SD	0.00	0.00	0.00	0.00	0.00	14.24	0.00	0.00	0.00
Kadhouri,	Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.37	0.00

Location of rest patches	Scat density/ha			Pugmark density			Pellet density/ha			
		Jackal	Wild boar	Nilgai	Tiger	Chital	Nilgai	Chital	Hare	Wild Boar Digging
hakra	SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.63	0.00
inghai	Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	31.85	0.00
	SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
anglaha	Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.74	0.00
	SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.44	0.00
akiya	Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.11	0.00
	SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.44	0.00
ohamadpur	Mean	0.00	7.96	0.00	0.00	0.00	23.89	0.00	7.96	0.00
	SD	0.00	15.92	0.00	0.00	0.00	15.92	0.00	15.92	0.00
orangabad	Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.20	4.55
	SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.02	12.04
athua	Mean	2.65	0.00	0.00	0.00	0.00	0.00	0.00	2.65	0.00
	SD	9.19	0.00	0.00	0.00	0.00	0.00	0.00	9.19	0.00
urthiha	Mean	0.00	0.00	0.00	0.00	0.00	0.00	6.37	6.37	12.74
	SD	0.00	0.00	0.00	0.00	0.00	0.00	14.24	14.24	17.44
aria	Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.54	0.00
	SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.62	0.00
athua	Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
azhra	Mean	0.00	0.00	0.00	4.55	0.00	9.10	0.00	0.00	0.00
	SD	0.00	0.00	0.00	12.04	0.00	15.54	0.00	0.00	0.00

3.5 Study of Avi-Fauna Diversity in the Corridor Areas

Point count exercise was done to estimate the bird abundance as method described by Burnham *et al.*, (1990). Data on bird abundance was taken in terms of spending hours in forest patches and nearby areas of both corridors (Rodgers, 1988). Bird data were mainly collected during the months of May (summer) and December (winter), 2002 only while carrying out work for recording data on animal distribution. Measurement of various diversity indices was done using Biodiversity Pro (2000) window based software package developed by Neil McAleece for the Natural History Museum, London. Birds were counted for 10 minutes at each point and only correctly identified birds were recorded. Scientific and common name of birds used as given by Bombay Natural History Society in its newsletter *Buceros* (2001).

3.6 Results

Altogether 1130 minutes (18 hrs 50 min) were spent covering 113 sample points during the month of May (summer) and 121 species were recorded whereas 750 minutes (12 hrs 30 min) were spent covering 75 points during the month of December (winter) and 111 species were recorded. About 175 species were identified during the short period of fieldwork.

Most common birds observed during summer were Small green Bee-eater (1.12/hrs), followed by Sand martin (1.05/hrs), N H martin (.9/hrs), RR parakeet (.87) and Jungle myna (.83/ hrs) **Table 3.9**. Maximum 38 % birds were identified at the time of flying over the sampling point, followed by Perching (23.9%), Calling (19.7%), Feeding (14.5%) and Moving (2.9%) **Table 3.10**. Similarly, most abundant bird species in winter was LW duck (2.40/hrs), followed by Common teal (1.33/hrs), Large cormorant (1.27%), Red whiskered bulbul (1.12/hrs) and Little cormorant (1.07/hrs) **Table 3.11**. Similarly in summer, 31.3% birds were identified in flying, followed by Perching (25.4), Calling (18.9%), Feeding (18.6%) and Moving (5.1%) **Table 3.12**. Bird s abundance of all species was 14.78/hrs during summer whereas it was 22.18/hrs in winter. Diversity indices estimated for winter were higher than summer **Table 3.13**

3.7 Discussion

Although lots of work have been done on bird community of Dudhwa NP and Katerniaghat WLS. More than 450 species have been identified and listed in the Booklet published by Forest department. Since corridor area falls between Himalayan and sub-tropical belt, which shows a wide range of birds of both the zone. Along with fieldwork to collect data on other aspects as assigned, 175 species of bird were identified in the corridor area.

During winter, corridor area also receives lots of migratory species, which take small stop over in the scattered wetland of the area while proceeding towards various Tal of Dudhwa NP and Katerniaghat WLS. Because of migratory birds, estimated density and diversity was highest in winter. Dudhwa and Katerniaghat is famous for its bird fauna and many of them such as Bengal Florican, Swamp partridge, Black neck stork have been put in the category of endangered and threatened birds. However, these birds often used corridor area for feeding and moving purpose.



Table 3.9: Bird Abundance during the summer in corridor area between Dudhwa and Katerniaghat

	SPECIES	Frequency of occurrence	No. of Birds	Mean abundance/hrs	No. Of birds/ hrs	Minimum birds/hr	Maximum birds/hrs	Std. Error of Mean	% of Total Sum
	<i>Accipiter badius</i>	2	2.00	0.02	0.03	0.02	0.02	0.00	0.23
	<i>Accipiter nisus</i>	1	2.00	0.03	0.03	0.03	0.03	.	0.23
	<i>Acridotheres fuscus</i>	1	50.00	0.83	0.83	0.83	0.83	.	5.64
	<i>Acridotheres ginginianus</i>	1	1.00	0.02	0.02	0.02	0.02	.	0.11
	<i>Acridotheres tristis</i>	10	22.00	0.04	0.37	0.02	0.13	0.01	2.48
	<i>Actitis hypoleucas</i>	1	1.00	0.02	0.02	0.02	0.02	.	0.11
	<i>Aegithina tiphia</i>	1	1.00	0.02	0.02	0.02	0.02	.	0.11
	<i>Anastomus oscitans</i>	4	28.00	0.12	0.47	0.07	0.20	0.03	3.16
	<i>Anhinga melonogaster</i>	1	1.00	0.02	0.02	0.02	0.02	.	0.11
0	<i>Anser indicus</i>	1	8.00	0.13	0.13	0.13	0.13	.	0.90
1	<i>Anthus campestris</i>	4	5.00	0.02	0.08	0.02	0.03	0.00	0.56
2	<i>Anthus trivialis</i>	2	3.00	0.03	0.05	0.02	0.03	0.01	0.34
3	<i>Ardeola grayii</i>	7	7.00	0.02	0.12	0.02	0.02	0.00	0.79
4	<i>Bubulcus ibis</i>	2	2.00	0.02	0.03	0.02	0.02	0.00	0.23
5	<i>Calidris minuta</i>	1	3.00	0.05	0.05	0.05	0.05	.	0.34
5	<i>Casmerodius albus</i>	1	1.00	0.02	0.02	0.02	0.02	.	0.11
7	<i>Centropus sinensis</i>	4	6.00	0.03	0.10	0.02	0.03	0.00	0.68
8	<i>Ceryle rudis</i>	1	1.00	0.02	0.02	0.02	0.02	.	0.11
9	<i>Chalcophaps indica</i>	1	1.00	0.02	0.02	0.02	0.02	.	0.11
0	<i>Charadrius alexandrinus</i>	1	3.00	0.05	0.05	0.05	0.05	.	0.34
1	<i>Charadrius dubius</i>	1	1.00	0.02	0.02	0.02	0.02	.	0.11
2	<i>Ciconia ciconia</i>	1	1.00	0.02	0.02	0.02	0.02	.	0.11
3	<i>Copsychus malabaricus</i>	2	3.00	0.03	0.05	0.02	0.03	0.01	0.34
4	<i>Copsychus saularis</i>	2	2.00	0.02	0.03	0.02	0.02	0.00	0.23
5	<i>Coracias benghalensis</i>	6	6.00	0.02	0.10	0.02	0.02	0.00	0.68
5	<i>Coracina macei</i>	1	1.00	0.02	0.02	0.02	0.02	.	0.11
7	<i>Corvus macrorhynchos</i>	10	15.00	0.03	0.25	0.02	0.05	0.00	1.69
8	<i>Cuculus canorus</i>	6	6.00	0.02	0.10	0.02	0.02	0.00	0.68

	SPECIES	Frequency of occurrence	No. of Birds	Mean abundance/hrs	No. Of birds/ hrs	Minimum birds/hr	Maximum birds/hrs	Std. Error of Mean	% of Total Sum
9	<i>Cuculus varius</i>	7	7.00	0.02	0.12	0.02	0.02	0.00	0.79
0	<i>Delichon nipalensis</i>	24	54.00	0.04	0.90	0.02	0.17	0.01	6.09
1	<i>Dendrocitta formosae</i>	6	8.00	0.02	0.13	0.02	0.05	0.01	0.90
2	<i>Dendrocitta vagabunda</i>	3	3.00	0.02	0.05	0.02	0.02	0.00	0.34
3	<i>Dendrocopos canicapillus</i>	1	1.00	0.02	0.02	0.02	0.02	.	0.11
4	<i>Dendrocopos mahrattensis</i>	3	5.00	0.03	0.08	0.02	0.03	0.01	0.56
5	<i>Dicaeum ignipectus</i>	2	2.00	0.02	0.03	0.02	0.02	0.00	0.23
6	<i>Dicrurus macrocercus</i>	7	7.00	0.02	0.12	0.02	0.02	0.00	0.79
7	<i>Dicrurus paradiseus</i>	8	11.00	0.02	0.18	0.02	0.05	0.00	1.24
8	<i>Elanus caeruleus</i>	1	1.00	0.02	0.02	0.02	0.02	.	0.11
9	<i>Eudynamis scolopacea</i>	8	9.00	0.02	0.15	0.02	0.03	0.00	1.01
0	<i>Eumyias thalassina</i>	8	27.00	0.06	0.45	0.02	0.17	0.02	3.04
1	<i>Francolinus francolinus</i>	3	3.00	0.02	0.05	0.02	0.02	0.00	0.34
2	<i>Francolinus pondicerianus</i>	1	1.00	0.02	0.02	0.02	0.02	.	0.11
3	<i>Galerida cristata</i>	1	1.00	0.02	0.02	0.02	0.02	.	0.11
4	<i>Gallus gallus</i>	5	5.00	0.02	0.08	0.02	0.02	0.00	0.56
5	<i>Grus antigone</i>	1	2.00	0.03	0.03	0.03	0.03	.	0.23
6	<i>Gyps bengalensis</i>	4	10.00	0.04	0.17	0.02	0.08	0.02	1.13
7	<i>Halcyon capensis</i>	3	4.00	0.02	0.07	0.02	0.03	0.01	0.45
8	<i>Halcyon smyrnensis</i>	2	4.00	0.03	0.07	0.02	0.05	0.02	0.45
9	<i>Hydrophasianus chirurgus</i>	2	4.00	0.03	0.07	0.02	0.05	0.02	0.45
0	<i>Megalaima haemacephala</i>	2	2.00	0.02	0.03	0.02	0.02	0.00	0.23
1	<i>Megalaima virens</i>	7	7.00	0.02	0.12	0.02	0.02	0.00	0.79
2	<i>Megalurus palustris</i>	1	1.00	0.02	0.02	0.02	0.02	.	0.11
3	<i>Merops leschenaulti</i>	5	5.00	0.02	0.08	0.02	0.02	0.00	0.56
4	<i>Merops orientalis</i>	47	67.00	0.02	1.12	0.02	0.05	0.00	7.55
5	<i>Merops philippinus</i>	5	7.00	0.02	0.12	0.02	0.05	0.01	0.79
6	<i>Mesophoyx intermedia</i>	1	1.00	0.02	0.02	0.02	0.02	.	0.11
7	<i>Metopidus indicus</i>	1	1.00	0.02	0.02	0.02	0.02	.	0.11
8	<i>Milvus migrans</i>	1	1.00	0.02	0.02	0.02	0.02	.	0.11
9	<i>Motacilla alba</i>	1	1.00	0.02	0.02	0.02	0.02	.	0.11

	SPECIES	Frequency of occurrence	No. of Birds	Mean abundance/hrs	No. Of birds/ hrs	Minimum birds/hr	Maximum birds/hrs	Std. Error of Mean	% of Total Sum
0	<i>Motacilla flava</i>	2	2.00	0.02	0.03	0.02	0.02	0.00	0.23
1	<i>Nectarinia asiatica</i>	18	28.00	0.03	0.47	0.02	0.05	0.00	3.16
2	<i>Neophron percnopterus</i>	2	2.00	0.02	0.03	0.02	0.02	0.00	0.23
3	<i>Ocyrceros birostris</i>	4	4.00	0.02	0.07	0.02	0.02	0.00	0.45
4	<i>Oriolus chinensis</i>	1	1.00	0.02	0.02	0.02	0.02	.	0.11
5	<i>Oriolus oriolus</i>	1	1.00	0.02	0.02	0.02	0.02	.	0.11
3	<i>Oriolus xanthornus</i>	13	17.00	0.02	0.28	0.02	0.07	0.00	1.92
7	<i>Orthotomus sutorius</i>	2	3.00	0.03	0.05	0.02	0.03	0.01	0.34
3	<i>Parus major</i>	5	8.00	0.03	0.13	0.02	0.03	0.00	0.90
3	<i>Pavo cristatus</i>	2	2.00	0.02	0.03	0.02	0.02	0.00	0.23
0	<i>Pericrocotus cinnamomeus</i>	3	8.00	0.04	0.13	0.03	0.05	0.01	0.90
1	<i>Pernis ptilorhynchus</i>	1	1.00	0.02	0.02	0.02	0.02	.	0.11
2	<i>Phaenicophaeus leschenaultii</i>	1	1.00	0.02	0.02	0.02	0.02	.	0.11
3	<i>Phalacrocorax niger</i>	4	11.00	0.05	0.18	0.02	0.12	0.02	1.24
4	<i>Phalacrocorax carbo</i>	1	1.00	0.02	0.02	0.02	0.02	.	0.11
5	<i>Phylloscopus fuscatus</i>	1	1.00	0.02	0.02	0.02	0.02	.	0.11
3	<i>Phylloscopus magnirostris</i>	3	4.00	0.02	0.07	0.02	0.03	0.01	0.45
7	<i>Picus squamatus</i>	3	3.00	0.02	0.05	0.02	0.02	0.00	0.34
3	<i>Picus xanthopygaeus</i>	1	1.00	0.02	0.02	0.02	0.02	.	0.11
3	<i>Pitta brachyura</i>	1	2.00	0.03	0.03	0.03	0.03	.	0.23
0	<i>Ploceus philippinus</i>	2	8.00	0.07	0.13	0.07	0.07	0.00	0.90
1	<i>Prinia criniger</i>	1	1.00	0.02	0.02	0.02	0.02	.	0.11
2	<i>Prinia socialis</i>	3	3.00	0.02	0.05	0.02	0.02	0.00	0.34
3	<i>Prinia sylvatica</i>	5	10.00	0.03	0.17	0.02	0.07	0.01	1.13
4	<i>Prinia gracilis</i>	2	2.00	0.02	0.03	0.02	0.02	0.00	0.23
5	<i>Pseudibis roseata</i>	2	6.00	0.05	0.10	0.03	0.07	0.02	0.68
3	<i>Psittacula eupatica</i>	3	7.00	0.04	0.12	0.02	0.08	0.02	0.79
7	<i>Psittacula krameri</i>	24	52.00	0.04	0.87	0.02	0.08	0.00	5.86
3	<i>Psittacula roseata</i>	2	4.00	0.03	0.07	0.02	0.05	0.02	0.45
3	<i>Pycnonotus cafer</i>	2	3.00	0.03	0.05	0.02	0.03	0.01	0.34

	SPECIES	Frequency of occurrence	No. of Birds	Mean abundance/hrs	No. Of birds/ hrs	Minimum birds/hr	Maximum birds/hrs	Std. Error of Mean	% of Total Sum
0	<i>Pycnonotus jocosus</i>	28	46.00	0.03	0.77	0.02	0.10	0.00	5.19
1	<i>Riparia riparia</i>	13	63.00	0.08	1.05	0.02	0.22	0.02	7.10
2	<i>Saxicola caprata</i>	8	10.00	0.02	0.17	0.02	0.03	0.00	1.13
3	<i>Saxicoloides fulicata</i>	1	1.00	0.02	0.02	0.02	0.02	.	0.11
4	<i>Sitta castanea</i>	3	7.00	0.04	0.12	0.02	0.07	0.01	0.79
5	<i>Sterptopelia orientalis</i>	6	9.00	0.03	0.15	0.02	0.05	0.01	1.01
3	<i>Streptopelia chinensis</i>	15	16.00	0.02	0.27	0.02	0.03	0.00	1.80
7	<i>Streptopelia decaocto</i>	2	3.00	0.03	0.05	0.02	0.03	0.01	0.34
8	<i>Sturnus contra</i>	1	1.00	0.02	0.02	0.02	0.02	.	0.11
9	<i>Sturnus sturninus</i>	3	4.00	0.02	0.07	0.02	0.03	0.01	0.45
00	<i>Sylvia curruca</i>	7	19.00	0.05	0.32	0.02	0.08	0.01	2.14
01	<i>Tachybaptus ruficollis</i>	1	4.00	0.07	0.07	0.07	0.07	.	0.45
02	<i>Podiceps cristatus</i>	1	3.00	0.05	0.05	0.05	0.05	.	0.34
03	<i>Tephorodornis gularis</i>	1	1.00	0.02	0.02	0.02	0.02	.	0.11
04	<i>Terpsiphone paradisi</i>	2	2.00	0.02	0.03	0.02	0.02	0.00	0.23
05	<i>Tringa nebularia</i>	1	4.00	0.07	0.07	0.07	0.07	.	0.45
06	<i>Tringa nebularia</i>	1	1.00	0.02	0.02	0.02	0.02	.	0.11
07	<i>Turdoides caudatus</i>	4	12.00	0.05	0.20	0.02	0.08	0.01	1.35
08	<i>Turdoides striatus</i>	6	26.00	0.07	0.43	0.02	0.13	0.02	2.93
09	<i>Upupa epops</i>	1	2.00	0.03	0.03	0.03	0.03	.	0.23
10	<i>Vanellus indicus</i>	9	10.00	0.02	0.17	0.02	0.03	0.00	1.13
11	<i>Zosterops palpebrosus</i>	1	1.00	0.02	0.02	0.02	0.02	.	0.11
	Total	477	887.00	0.03	14.78	0.02	0.83	0.00	100.00

Table 3.10: Bird activities during count in summer season

Activity	Frequency Percent	Cumulative Percent
Call	19.7	19.7
Feeding	14.5	34.2
Flying	38.8	73.0
Moving	2.9	75.9
Nesting	.2	76.1
Perchin	23.9	100.0
Total	100.0	

Table 3.11: Bird Abundance during the winter in corridor area between Dudhwa and Katerniaghat

	Species	Frequency of occurrence	No. of birds seen	Mean abundance/hr	Abundance/hrs	Minimum/hr	Maximum/hrs	Std. Error of Mean	% of Total Sum
	<i>Accipiter badius</i>	1	1	0.02	0.02	0.02	0.02	.	0.08
2	<i>Acridotheres tristis</i>	2	6	0.05	0.10	0.03	0.07	0.02	0.45
3	<i>Acrocephalus stertoreus</i>	1	3	0.05	0.05	0.05	0.05	.	0.23
4	<i>Actitis hypoleucas</i>	2	3	0.03	0.05	0.02	0.03	0.01	0.23
5	<i>Amaurornis phoenicurus</i>	2	2	0.02	0.03	0.02	0.02	0.00	0.15
6	<i>Anas acuta</i>	1	2	0.03	0.03	0.03	0.03	.	0.15
7	<i>Anas crecca</i>	3	80	0.44	1.33	0.25	0.83	0.19	6.01
8	<i>Anas poecilorhyncha</i>	2	3	0.03	0.05	0.02	0.03	0.01	0.23
9	<i>Anastomus oscitans</i>	3	4	0.02	0.07	0.02	0.03	0.01	0.30
10	<i>Anhinga melonogaster</i>	1	1	0.02	0.02	0.02	0.02	.	0.08
11	<i>Anser anser</i>	2	5	0.04	0.08	0.03	0.05	0.01	0.38
12	<i>Anthus campestris</i>	1	2	0.03	0.03	0.03	0.03	.	0.15
13	<i>Anthus trivialis</i>	2	4	0.03	0.07	0.03	0.03	0.00	0.30
14	<i>Apus apus</i>	1	15	0.25	0.25	0.25	0.25	.	1.13

	Species	Frequency of occurrence	No. of birds seen	Mean abundance/hr	Abundance/hrs	Minimum/hr	Maximum/hrs	Std. Error of Mean	% of Total Sum
5	<i>Ardea cinerea</i>	1	1	0.02	0.02	0.02	0.02	.	0.08
6	<i>Ardeola grayii</i>	2	2	0.02	0.03	0.02	0.02	0.00	0.15
7	<i>Aythya ferina</i>	2	14	0.12	0.23	0.07	0.17	0.05	1.05
8	<i>Aythya nyroca</i>	1	140	2.33	2.33	2.33	2.33	.	10.52
9	<i>Bubulcus ibis</i>	3	23	0.13	0.38	0.02	0.20	0.06	1.73
10	<i>Casmerodius albus</i>	1	1	0.02	0.02	0.02	0.02	.	0.08
11	<i>Ceryle rudis</i>	1	1	0.02	0.02	0.02	0.02	.	0.08
12	<i>Charadrius hiaticula</i>	1	2	0.03	0.03	0.03	0.03	.	0.15
13	<i>Ciconia ciconia</i>	3	4	0.02	0.07	0.02	0.03	0.01	0.30
14	<i>Circus melanoleucas</i>	1	1	0.02	0.02	0.02	0.02	.	0.08
15	<i>Copsychus saularis</i>	3	3	0.02	0.05	0.02	0.02	0.00	0.23
16	<i>Coracias benghalensis</i>	3	5	0.03	0.08	0.02	0.03	0.01	0.38
17	<i>Corvus macrorhynchos</i>	16	24	0.03	0.40	0.02	0.07	0.00	1.80
18	<i>Corvus splendens</i>	2	2	0.02	0.03	0.02	0.02	0.00	0.15
19	<i>Cuculus micropterus</i>	1	1	0.02	0.02	0.02	0.02	.	0.08
20	<i>Culicicapa ceylonensis</i>	2	16	0.13	0.27	0.13	0.13	0.00	1.20
21	<i>Delichon nipalensis</i>	4	10	0.04	0.17	0.02	0.08	0.02	0.75
22	<i>Dendrocitta formosae</i>	1	1	0.02	0.02	0.02	0.02	.	0.08
23	<i>Dendrocitta vagabunda</i>	9	12	0.02	0.20	0.02	0.03	0.00	0.90
24	<i>Dendrocopos canicapillus</i>	2	4	0.03	0.07	0.03	0.03	0.00	0.30
25	<i>Dendrocopos mahrattensis</i>	1	1	0.02	0.02	0.02	0.02	.	0.08
26	<i>Dendrocygna javanica</i>	2	144	1.20	2.40	0.07	2.33	1.13	10.82
27	<i>Dicrurus leucophaeus</i>	7	9	0.02	0.15	0.02	0.03	0.00	0.68
28	<i>Dicrurus macrocercus</i>	15	22	0.02	0.37	0.02	0.08	0.00	1.65
29	<i>Dicrurus paradiscus</i>	6	6	0.02	0.10	0.02	0.02	0.00	0.45
30	<i>Egretta garzetta</i>	2	5	0.04	0.08	0.02	0.07	0.03	0.38
31	<i>Elanus caeruleus</i>	2	2	0.02	0.03	0.02	0.02	0.00	0.15
32	<i>Ephippiorhynchus</i>	2	2	0.02	0.03	0.02	0.02	0.00	0.15

	Species	Frequency of occurrence	No. of birds seen	Mean abundance/hr	Abundance/hrs	Minimum/hr	Maximum/hrs	Std. Error of Mean	% of Total Sum
	<i>asiaticus</i>								
i3	<i>Erithacus brunneus</i>	2	2	0.02	0.03	0.02	0.02	0.00	0.15
i4	<i>Falco jugger</i>	1	1	0.02	0.02	0.02	0.02	.	0.08
i5	<i>Francolinus gularis</i>	2	12	0.10	0.20	0.03	0.17	0.07	0.90
i6	<i>Fulica atra</i>	2	36	0.30	0.60	0.03	0.57	0.27	2.70
i7	<i>Gallinula chloropus</i>	1	24	0.40	0.40	0.40	0.40	.	1.80
i8	<i>Gallus gallus</i>	1	1	0.02	0.02	0.02	0.02	.	0.08
i9	<i>Glaucidium cuculoides</i>	1	1	0.02	0.02	0.02	0.02	.	0.08
i0	<i>Graminicola bengalensis</i>	1	2	0.03	0.03	0.03	0.03	.	0.15
i1	<i>Grus antigone</i>	1	3	0.05	0.05	0.05	0.05	.	0.23
i2	<i>Halcyon campestris</i>	3	3	0.02	0.05	0.02	0.02	0.00	0.23
i3	<i>Halcyon smyrnensis</i>	3	3	0.02	0.05	0.02	0.02	0.00	0.23
i4	<i>Hirundo rustica</i>	10	29	0.05	0.48	0.02	0.17	0.01	2.18
i5	<i>Ichthyophaga ichthyaetus</i>	1	1	0.02	0.02	0.02	0.02	.	0.08
i6	<i>Leptoptilos javanicus</i>	1	2	0.03	0.03	0.03	0.03	.	0.15
i7	<i>Lonchura malacca</i>	1	5	0.08	0.08	0.08	0.08	.	0.38
i8	<i>Lonchura punctula</i>	3	6	0.03	0.10	0.02	0.07	0.02	0.45
i9	<i>Lonchura striata</i>	1	5	0.08	0.08	0.08	0.08	.	0.38
i0	<i>Megalaima virens</i>	6	6	0.02	0.10	0.02	0.02	0.00	0.45
i1	<i>Melophus lathami</i>	1	4	0.07	0.07	0.07	0.07	.	0.30
i2	<i>Mesophoyx intermedia</i>	6	9	0.03	0.15	0.02	0.05	0.01	0.68
i3	<i>Metopidius indicus</i>	1	5	0.08	0.08	0.08	0.08	.	0.38
i4	<i>Milvus migrans</i>	3	3	0.02	0.05	0.02	0.02	0.00	0.23
i5	<i>Motacilla alba</i>	6	9	0.03	0.15	0.02	0.07	0.01	0.68
i6	<i>Motacilla cinerea</i>	1	1	0.02	0.02	0.02	0.02	.	0.08
i7	<i>Motacilla flava</i>	3	7	0.04	0.12	0.02	0.05	0.01	0.53
i8	<i>Motacilla maderaspatensis</i>	1	1	0.02	0.02	0.02	0.02	.	0.08
i9	<i>Nectarinia asiatica</i>	1	1	0.02	0.02	0.02	0.02	.	0.08

	Species	Frequency of occurrence	No. of birds seen	Mean abundance/hr	Abundance/hrs	Minimum/hr	Maximum/hrs	Std. Error of Mean	% of Total Sum
'0	Neophron percnopterus	2	2	0.02	0.03	0.02	0.02	0.00	0.15
'1	Ocyrceros birostris	5	11	0.04	0.18	0.02	0.07	0.01	0.83
'2	Oriolus xanthornus	16	17	0.02	0.28	0.02	0.03	0.00	1.28
'3	Pandion haliaetus	1	1	0.02	0.02	0.02	0.02	.	0.08
'4	Parus major	9	17	0.03	0.28	0.02	0.08	0.01	1.28
'5	Pavo cristatus	1	1	0.02	0.02	0.02	0.02	.	0.08
'6	Pericrocotus cinnamomeus	2	6	0.05	0.10	0.03	0.07	0.02	0.45
'7	Pericrocotus ethologus	1	1	0.02	0.02	0.02	0.02	.	0.08
'8	Pericrocotus flammeus	1	1	0.02	0.02	0.02	0.02	.	0.08
'9	Phaenicophaeus leschenaultii	2	3	0.03	0.05	0.02	0.03	0.01	0.23
'0	Phalacrocorax carbo	7	76	0.18	1.27	0.02	1.17	0.16	5.71
'1	Phalacrocorax fuscicollis	1	5	0.08	0.08	0.08	0.08	.	0.38
'2	Phalacrocorax niger	4	64	0.27	1.07	0.02	1.00	0.24	4.81
'3	Phylloscopus affinis	4	5	0.02	0.08	0.02	0.03	0.00	0.38
'4	Phylloscopus magnirostris	1	1	0.02	0.02	0.02	0.02	.	0.08
'5	Phylloscopus neglectus	5	13	0.04	0.22	0.02	0.07	0.01	0.98
'6	Picus xanthopygaeus	5	6	0.02	0.10	0.02	0.03	0.00	0.45
'7	Ploceus benghalensis	2	4	0.03	0.07	0.03	0.03	0.00	0.30
'8	Ploceus philippinus	1	1	0.02	0.02	0.02	0.02	.	0.08
'9	Porphyrio porphyrio	2	4	0.03	0.07	0.03	0.03	0.00	0.30
'0	Prinia buchanani	2	2	0.02	0.03	0.02	0.02	0.00	0.15
'1	Prinia cinereocapilla	1	1	0.02	0.02	0.02	0.02	.	0.08
'2	Prinia socialis	1	2	0.03	0.03	0.03	0.03	.	0.15
'3	Prinia sylvatica	4	5	0.02	0.08	0.02	0.03	0.00	0.38
'4	Pseudibis papillosa	1	1	0.02	0.02	0.02	0.02	.	0.08
'5	Psittacula krameri	10	40	0.07	0.67	0.02	0.17	0.01	3.01
'6	Psittacula roseata	2	6	0.05	0.10	0.03	0.07	0.02	0.45

	Species	Frequency of occurrence	No. of birds seen	Mean abundance/hr	Abundance/hrs	Minimum/hr	Maximum/hrs	Std. Error of Mean	% of Total Sum
07	<i>Pycnonotus cafer</i>	4	8	0.03	0.13	0.02	0.07	0.01	0.60
08	<i>Pycnonotus jocosus</i>	15	67	0.07	1.12	0.02	0.17	0.02	5.03
09	<i>Rhodonessa rufina</i>	1	4	0.07	0.07	0.07	0.07	.	0.30
00	<i>Riparia paludicola</i>	5	59	0.20	0.98	0.07	0.50	0.08	4.43
01	<i>Saxicola caprata</i>	4	4	0.02	0.07	0.02	0.02	0.00	0.30
02	<i>Saxicola insignis</i>	1	1	0.02	0.02	0.02	0.02	.	0.08
03	<i>Saxicola leucura</i>	2	3	0.03	0.05	0.02	0.03	0.01	0.23
04	<i>Saxicola torquata</i>	4	4	0.02	0.07	0.02	0.02	0.00	0.30
05	<i>Spilornis cheela</i>	3	3	0.02	0.05	0.02	0.02	0.00	0.23
06	<i>Spizaetus cirrhatus</i>	3	3	0.02	0.05	0.02	0.02	0.00	0.23
07	<i>Streptopelia chinensis</i>	6	9	0.03	0.15	0.02	0.03	0.00	0.68
08	<i>Streptopelia decaocto</i>	1	1	0.02	0.02	0.02	0.02	.	0.08
09	<i>Streptopelia orientalis</i>	2	2	0.02	0.03	0.02	0.02	0.00	0.15
10	<i>Sturnus contra</i>	1	3	0.05	0.05	0.05	0.05	.	0.23
11	<i>Tadorna ferruginea</i>	1	2	0.03	0.03	0.03	0.03	.	0.15
12	<i>Tephrodornis gularis</i>	1	1	0.02	0.02	0.02	0.02	.	0.08
13	<i>Treron phoenicoptera</i>	1	10	0.17	0.17	0.17	0.17	.	0.75
14	<i>Tringa nebularia</i>	3	5	0.03	0.08	0.02	0.05	0.01	0.38
15	<i>Tringa stagnatilis</i>	1	2	0.03	0.03	0.03	0.03	.	0.15
16	<i>Turdoides caudatus</i>	3	22	0.12	0.37	0.08	0.17	0.02	1.65
17	<i>Turdoides striatus</i>	3	11	0.06	0.18	0.02	0.12	0.03	0.83
18	<i>Upupa epops</i>	2	3	0.03	0.05	0.02	0.03	0.01	0.23
19	<i>Vanellus indicus</i>	5	21	0.07	0.35	0.02	0.13	0.02	1.58
20	<i>Vanellus vanellus</i>	3	12	0.07	0.20	0.02	0.13	0.03	0.90
21	<i>Zosterops palpebrosus</i>	1	4	0.07	0.07	0.07	0.07	.	0.30
	Total	353	1331	0.06	22.18	0.02	2.33	0.01	100.00

Table 3.12: Birds activity pattern during count in December

Activities	Frequency Percent	Cumulative Percent
	.6	.6
Calling	18.9	19.4
Feeding	18.6	38.0
Flying	31.3	69.3
Moving	5.1	74.4
Nesting	.3	74.6
Perching	25.4	100.0
Total	100.0	

Table 3.13: Diversity indices for birds in the corridors area

Indices	Summer	Winter
Shanon H log base 10	1.7	1.8
Shanon Hmax log base 10	2.1	2.0
Shanon J	0.79	0.87
Simpson Diversity (1/D)	24.01	36.99
Hill s Number H0	121	111
Hill s Number H1	349.40	517.21

Appendix 1. List of Birds observed during study period in corridor areas

No.	Scientific name	Common name
GALLIFORMES		
Phasianidae		
1.	<i>Francolinus francolinus</i>	Black Francolin
2.	<i>Francolinus pondicerianus</i>	Grey Francolin
3.	<i>Francolinus gularis</i>	Swamp Francolin
4.	<i>Gallus gallus</i>	Red Junglefowl
5.	<i>Pavo cristatus</i>	Indian Peafowl
ANSERIFORMES		
Anatidae		
6.	<i>Dendrocygna javanica</i>	Lesser Whistling-duck
7.	<i>Anser indicus</i>	Bar-headed Goose
8.	<i>Tadorna ferruginea</i>	Ruddy Shelduck
9.	<i>Anas poecilorhyncha</i>	Spot-billed Duck
10.	<i>Anas crecca</i>	Common Teal
11.	<i>Rhodonessa rufina</i>	Red-crested Pochard
12.	<i>Aythya ferina</i>	Common Pochard
13.	<i>Anas acuta</i>	Northern Pintail
14.	<i>Aythya nyroca</i>	Ferruginous Pochard
15.	<i>Sarkidiornis melanotos</i>	Combduck
16.	<i>Anser anser</i>	Greylag Goose
PICIFORMES		
Picidae		
17.	<i>Dendrocopos canicapillus</i>	Grey-capped Pygmy Woodpecker
18.	<i>Dendrocopos mahrattensis</i>	Yellow-crowned Woodpecker
19.	<i>Dinopium benghalense</i>	Lesser Golden-backed Woodpecker
20.	<i>Picus xanthopygaeus</i>	little scaly-bellied Green woodpecker
21.	<i>Picus squamatus</i>	Large scaly-bellied Green Woodpecker
Capitonidae		
22.	<i>Megalaima virens</i>	Great Barbet
23.	<i>Megalaima haemacephala</i>	Coppersmith Barbet
BUCEROTIFORMES		
Bucerotidae		
24.	<i>Ocyrceros birostris</i>	Indian Grey Hornbill
UPUPIFORMES		
Upupidae		
25.	<i>Upupa epops</i>	Common Hoopoe
CORACIIFORMES		
Coraciidae		
26.	<i>Coracias benghalensis</i>	Indian Roller

	Alcedinidae	
27.	<i>Alcedo atthis</i>	Common Kingfisher
28.	<i>Ceryle rudis</i>	Lesser Pied Kingfisher
29.	<i>Halcyon capensis</i>	Stork-billed Kingfisher
30.	<i>Halcyon smyrnensis</i>	White-breasted Kingfisher
	Meropidae	
31.	<i>Merops orientalis</i>	Small Bee-eater
32.	<i>Merops philippinus</i>	Blue-tailed Bee-eater
33.	<i>Merops leschenaulti</i>	Chestnut-headed Bee-eater
	CUCULIFORMES	
	Cuculidae	
34.	<i>Hierococcyx varius</i>	Brainfever Bird
35.	<i>Cuculus micropterus</i>	Indian Cuckoo
36.	<i>Cuculus canorus</i>	Common cuckoo
37.	<i>Eudynamys scolopacea</i>	Asian Koel
38.	<i>Phaenicophaeus leschenaultii</i>	Sirkeer Malkoha
39.	<i>Centropus sinensis</i>	Greater Coucal
40.	<i>Centropus bengalensis</i>	Lesser Coucal
	PSITTACIFORMES	
	Psittacidae	
41.	<i>Psittacula eupatria</i>	Alexandrine Parakeet
42.	<i>Psittacula krameri</i>	Rose-ringed Parakeet
43.	<i>Psittacula cyanocephala</i>	Plum-headed Parakeet
44.	<i>Psittacula roseata</i>	Blossom-headed Parakeet
	APODIFORMES	
	Apodidae	
45.	<i>Apus apus</i>	Common Swift
	TROCHILIFORMES	
	Strigidae	
46.	<i>Glaucidium cuculoides</i>	Asian Barred Owlet
	COLUMBIFORMES	
	Columbidae	
47.	<i>Columba livia</i>	Rock Pigeon
48.	<i>Streptopelia chinensis</i>	Spotted Dove
49.	<i>Streptopelia decaocto</i>	Ring Dove
50.	<i>Chalcophaps indica</i>	Emerald Dove
51.	<i>Streptopelia orientalis</i>	Turtle Dove
52.	<i>Treron phoenicoptera</i>	Yellow-footed Green Pigeon
	GRUIFORMES	
	Gruidae	
53.	<i>Grus antigone</i>	Sarus Crane

- Rallidae**
- | | | |
|-----|-------------------------------|-------------------------|
| 54. | <i>Fulica atra</i> | Common Coot |
| 55. | <i>Amaurornis phoenicurus</i> | White-breasted Waterhen |
| 56. | <i>Porphyrio porphyrio</i> | Purple Moorhen |
| 57. | <i>Gallinula chloropus</i> | Common chloropus |

CICONIIFORMES

Scolopacidae

- | | | |
|-----|---------------------------|-------------------|
| 58. | <i>Tringa totanus</i> | Common Redshank |
| 59. | <i>Tringa stagnatilis</i> | Marsh Sandpiper |
| 60. | <i>Tringa nebularia</i> | Common Greenshank |
| 61. | <i>Actitis hypoleucos</i> | Common Sandpiper |
| 62. | <i>Calidris minuta</i> | little Stint |

Jacanidae

- | | | |
|-----|---------------------------------|------------------------|
| 63. | <i>Hydrophasianus chirurgus</i> | Pheasant-tailed Jacana |
| 64. | <i>Metopidius indicus</i> | Bronze-winged Jacana |

Burhinidae

- | | | |
|-----|------------------------------|--------------------|
| 65. | <i>Himantopus himantopus</i> | Black-winged Stilt |
|-----|------------------------------|--------------------|

Charadriinae

- | | | |
|-----|--------------------------------|----------------------|
| 66. | <i>Charadrius hiaticula</i> | Common Ringed Plover |
| 67. | <i>Charadrius dubius</i> | Little Ringed Plover |
| 68. | <i>Charadrius alexandrinus</i> | Kentish Plover |
| 69. | <i>Vanellus vanellus</i> | Northern Lapwing |
| 70. | <i>Vanellus indicus</i> | Red-wattled Lapwing |

Accipitridae

- | | | |
|---------------------|---------------------------------|------------------------|
| Pandioninae | | |
| 71. | <i>Pandion haliaetus</i> | Osprey |
| Accipitrinae | | |
| 72. | <i>Pernis ptilorhyncus</i> | Oriental Honey-buzzard |
| 73. | <i>Elanus caeruleus</i> | Black-shouldered Kite |
| 74. | <i>Milvus migrans</i> | Black Kite |
| 75. | <i>Ichthyophaga ichthyaetus</i> | Grey-headed Fish Eagle |
| 76. | <i>Neophron percnopterus</i> | Egyptian Vulture |
| 77. | <i>Gyps bengalensis</i> | White-rumped Vulture |
| 78. | <i>Pilornis cheela</i> | Crested Serpent Eagle |
| 79. | <i>Circus melanoleucos</i> | Pied Harrier |
| 80. | <i>Accipiter badius</i> | Shikra |
| 81. | <i>Accipiter nanus</i> | Small Sparrowhawk |
| 82. | <i>Spizaetus cirrhatous</i> | Changeable Hawk Eagle |

Falconidae

- | | | |
|-----|---------------------|---------------|
| 83. | <i>Falco jugger</i> | Laggar Falcon |
|-----|---------------------|---------------|

Podicipedidae

- | | | |
|-----|-------------------------------|--------------|
| 84. | <i>Tachybaptus ruficollis</i> | Little Grebe |
|-----|-------------------------------|--------------|

85. Podiceps cristatus Great Crested Grebe

Anhingidae

86. Anhinga melanogaster Darter

Phalacrocoracidae

87. Phalacrocorax niger Little Cormorant
88. Phalacrocorax fuscicollis Indian Cormorant
89. Phalacrocorax carbo Great Cormorant

Ardeidae

90. Egretta garzetta Little Egret
91. Ardea cinerea Grey Heron
92. Casmerodius albus Large Egret
93. Mesophoyx intermedia Median Egret
94. Bubulcus ibis Cattle Egret
95. Ardeola grayii Indian Pond Heron

Threskiornithidae

96. Pseudibis papillosa Black Ibis

Ciconiidae

97. Anastomus oscitans Black Stork
98. Ciconia ciconia White Stork
99. Ehippiorhynchus asiaticus Black-necked Stork
100. Leptoptilos javanicus Lesser Adjutant

PASSERIFORMES

Pittidae

101. Pitta brachyura Indian Pitta

Corvidae

Corvinae

Corvini

102. Corvus splendens House Crow
103. Oriolus oriolus Golden Oriole
104. Oriolus chinensis Black-naped Oriole
104. Oriolus xanthornus Black-headed Oriole
105. Dendrocitta vagabunda Indian Treepie
106. Corvus macrorhynchos Jungle Crow
107. Pericrocotus cinnamomeus Small Minivet
108. Pericrocotus flammeus Scarlet Minivet
109. Pericrocotus ethologus Long-tailed Minivet

110. Tephrodornis gularis
111. Coracina macei Large Cuckoo Shrike

Dicrurinae

Rhipidurini

Dicrurini

112. Dicrurus macrocercus Black Drongo

- | | | |
|------|---|------------------------------|
| 113. | <i>Dicrurus leucophaeus</i> | Ashy Drongo |
| 114. | <i>Dicrurus caerulescens</i> | White-bellied Drongo |
| 115. | <i>Dicrurus paradiseus</i>
Monarchini | Greater Racket-tailed Drongo |
| 116. | <i>Terpsiphone paradisi</i>
Aegithinae | Asian Paradise-flycatcher |
| 117. | <i>Aegithina tiphia</i>
Malaconotinae | Common Iora |
| 118. | <i>Tephrodornis gularis</i> | Large Woodshrike |

Muscicapidae

Muscicapinae

Muscicapini

- | | | |
|------|---|------------------------|
| 119. | <i>Muscicapa sibirica</i> | Dark-sided Flycatcher |
| 120. | <i>Muscicapa ceylonensis</i> | Grey-headed Flycatcher |
| 121. | <i>Erithacus brunneus</i> | |
| 122. | <i>Eumyias thalassina</i>
Saxicolini | Verditer Flycatcher |
| 123. | <i>Copsychus saularis</i> | Oriental Magpie Robin |
| 124. | <i>Copsychus malabaricus</i> | White-rumped Shama |
| 125. | <i>Saxicoloides fulicata</i> | Indian Robin |
| 126. | <i>Saxicola insignis</i> | Hodgson's Bushchat |
| 127. | <i>Saxicola torquata</i> | Common Stonechat |
| 128. | <i>Saxicola leucura</i> | White-tailed Stonechat |
| 129. | <i>Saxicola caprata</i> | Pied Bushchat |

Sturnidae

- | | | |
|------|---------------------------------|--------------------------|
| 130. | <i>Acridotheres tristis</i> | Common Myna |
| 131. | <i>Acridotheres ginginianus</i> | Bank Myna |
| 132. | <i>Acridotheres fuscus</i> | Jungle Myna |
| 133. | <i>Sturnus contra</i> | Pied Myna |
| 134. | Brahminy Myna | <i>Sturnus sturninus</i> |

Sittidae

Sittinae

- | | | |
|------|-----------------------|---------------------------|
| 135. | <i>Sitta castanea</i> | Chestnut-bellied Nuthatch |
|------|-----------------------|---------------------------|

Paridae

Parinae

- | | | |
|------|--------------------|-----------|
| 136. | <i>Parus major</i> | Great Tit |
|------|--------------------|-----------|

Hirundinidae

Hirundininae

- | | | |
|------|----------------------------|--------------------|
| 137. | <i>Riparia paludicola</i> | Plain Martin |
| 138. | <i>Hirundo rustica</i> | Common Swallow |
| 139. | <i>Delichon nipalensis</i> | Nepal House Martin |

	Regulidae	
	Pycnonotidae	
140.	<i>Pycnonotus jocosus</i>	Red-whiskered Bulbul
141.	<i>Pycnonotus cafer</i>	Red-vented Bulbul
	Cisticolidae	
142.	<i>Prinia buchanani</i>	Rufous-fronted Prinia
143.	<i>Prinia gracilis</i>	Graceful Prinia
144.	<i>Prinia sylvatica</i>	Jungle Prinia
145.	<i>Prinia socialis</i>	Ashy Prinia
146.	<i>Prinia cinereocapilla</i>	Hodgson s Prinia
147.	<i>Prinia criniger</i>	Striated Prinia
148.	<i>Sylvia curruca</i>	Lesser Whitethroat
149.	<i>Megalurus palustris</i>	Striated Grassbird
150.	<i>Graminicola benghalensis</i>	large grass Warbler
151.	<i>Acrocephalus stentoreus</i>	Indian great reed Warbler
	Zosteropidae	
152.	<i>Zosterops palpebrosus</i>	Oriental White-eye
	Sylviidae	
	Acrocephalinae	
153.	<i>Orthotomus ruficeps</i>	Ashy Tailorbird
154.	<i>Phylloscopus neglectus</i>	Plain Leaf Warbler
155.	<i>Phylloscopus fuscatus</i>	Dusky Warbler
156.	<i>Phylloscopus affinis</i>	Tickell's Leaf Warbler
157.	<i>Phylloscopus magnirostris</i>	Large-billed Leaf Warbler
	Sylviinae	
	Timaliini	
158.	<i>Turdoides caudatus</i>	Common Babbler
159.	<i>Turdoides striatus</i>	Jungle Babbler
	Alaudidae	
160.	<i>Galerida cristata</i>	Crested Lark
	Nectariniidae	
	Nectariniinae	
	Dicaeini	
161.	<i>Dicaeum ignipectus</i>	Fire-breasted Flowerpecker
	Nectariniini	
162.	<i>Nectarinia asiatica</i>	Purple Sunbird
	Passeridae	
	Motacillinae	
163.	<i>Motacilla alba</i>	White Wagtail
164.	<i>Motacilla flava</i>	Yellow Wagtail
165.	<i>Anthus trivialis</i>	Tree Pipit
166.	<i>Motacilla cinerea</i>	Grey Wagtail
167.	<i>Motacilla maderaspatensis</i>	large Pied Wagtail

168. *Anthus campestris* Twany Pipit
Ploceinae
169. *Ploceus benghalensis* Black-breasted Weaver
170. *Ploceus philippinus* Baya Weaver
- Estrildinae**
171. *Lonchura striata* White-rumped Munia
172. *Lonchura punctulata* Scaly-breasted Munia
173. *Lonchura malacca* Black-headed Munia
174. *Amandava amandava* Red Munia
- Fringillidae**
175. *Melophus lathami* Crested Bunting

Socio-Economic Status and Dependency of People

4.1 Introduction

Studies on socio-economics of local people have contributed in the understanding of people's needs and aspirations and also in the identification of their ideas, opinions and suggestions regarding conservation issues. Socio-economic status of local people not only provide guidance for the policy and management decisions involved in the design, implementation and evaluation of the conservation with development of projects (Hill 1991; Parry and Campbell, 1992; IIED, 1994) but also offer guidance for management decisions, as well as provide baseline data to assess the efficiency of new policies (Fiallo and Jacobson, 1995).

Population explosion, Industrial revolution and thereby changes in land use pattern have been major reasons behind the degradation of natural resources (Tidsell, 1994). All man made activities have been responsible for the loss of species, their habitat and biodiversity (Enrich, 1988). Apparently the loss of biodiversity is predominantly because of anthropogenic pressure. The objectives of conservation cannot be achieved without a clear understanding of social and economic forces and their interaction with the environmental factors (Gadgil, 1992), especially in a country like India where about 4% of geographical area comes under the wildlife reserves and 80% protected areas have human presence and some level of natural resource use (Kothari *et al.*, 1989). There are about 100 million forest dwellers in the country living in and around forest lands for whom Forests have continued to be an important source of their livelihoods and means of survival (Lynch, 1992).

However, there has been a dramatic change in the landuse at the PA-Reserve Forest- Settlements interface, as a result of which there is significant change in wildlife habitat continuum into the agricultural area all along the Indo-Nepal border areas. This has given rise to a host of problems such as crop damage by migratory elephants and other herbivores, poaching of wild animals including fishing, timber lifting, grazing by domestic cattle, encroachment into forest land and sugar cane cultivation alternating with grasslands. The Park management is already aware of

these and has been addressing them. However, the impact of their efforts have so far been limited and possibly partly due to rigid adhering to the traditional approach of forest management. Whereas, these issues and problems need to be mitigated by proper and more sensitive planning and management. Since the Park side communities can in no way be wished away, they need to be seen as co-partners working for a long-term conservation of this area. As such, any planning must be preceded by an effort to understand the dependency needs of the local people on the forest based resources, their varied land use practices, socio-economic conditions and linkages in the overall conservation strategies.

Current study envisaged identification of potential corridors frequently used by large animal and its restoration with special reference to rhino habitat viability assessment in between Dudhwa NP and Katerniaghat WLS, keeping the ideas of peoples dependency on forest and impact of forest on the life of dwelling people and vice versa.

4.2 Methodology

First few days were devoted in reconnaissance of the study area and identification of villages lying in the vicinity of the corridors. Nine village panchayat namely Belapursua, Kariya, Gularia Pathar Sah, Ganganagar, Banbirpur, Suratnagar, Barsolakalan, Jusnagar, Kharatiya were identified in first (Northern) corridor whereas 15 village panchayat namely Majhara, Bairia, Bathua, Naurangabad, Sidhauna, Takiya, Bharora, Khairigarh, Banglaha, Chakhra, Singaha kalan, Sitalapur, Khairahna, Ghazipur, Laduri were identified in the vicinity of second (Southern corridor). Ten families of different status were taken from each village to assess the socio-economics status, resource use, attitudes and availability of basic amenities were recorded in predesigned formats. Survey was conducted between February 2002 and May 2002. Questions were put up to local people for conservation issues, their dependency on forest, demographic information. The questionnaire was divided into (gender, age, education, community), economic activities such as land and occupation, family income and awareness and attitudes of local people towards conservation and developmental issues. Respondents answered each question according to their knowledge regarding related issues and

secondary information was collected from the Block offices, District collector office, Forest department and other Revenue offices of Kheri district.

Data were analyzed using the Statistical Package for Social Sciences (SPSS) Version 8.0. (Norussis, 1994). Descriptive statistics (frequency, percentages) were used to summarize the data.

4.3 Results

4.3.1 Available land for agriculture and land holding pattern in Nighasan

In Nighasan, available land was 1,73,096 hectare and out of that 20,057 hectare is covered by forest whereas 2,561 ha land was suitable for agriculture purpose. **Table 4.1** This is the area where small and large holding of land is quite common. People who hold land between the categories of < 0.5, 5-1, 1-2, 2-4 hectare were 47808, 28076, 20515, and 11172 respectively. However, people who have land holding between 4-10 and > 10 hectare were 4090 and 219 respectively. Altogether there were 111880 holding comprising of 121726-hectare land **Table 4.2**

4.3.2 Population and number of villages

There are altogether 280 villages, which comes under the administration of Nighasan. Out of them 11 are non habituated **Table 4.3**. As per 1991 census total population of Nighasan was 153618 and rate of increase was 27.47 **Table 4.4**. Whereas according to 2001, population of Nighasan has reached 195645 with 103567 men and 92078 women. Most of the Nighasan population comprised into 30708 families and live in 30580 houses. Based on mother tongue, Hindi (91.75%) was most speaking language followed by Urdu (6.23%), Punjabi (1.88%) **Table 4.5**. As far religion is concerned 78.54% population belong to Hindu religion followed by 18.0% Muslim, 2.05% Budhist, 0.36 Jain, 0.18% Christian and 0.01% were others **Table 4.6**

4.3.3 Livestock population

Total population of Kheri district as per 1993 census was 4,11,091 **Table 4.7** Almost similar population was recorded during 1982 and 1988. There was no increase in cattle population since 1982.

The number of cows (94237) was higher than the buffalo population (91652). There were 12,069, 6,169, and 33,599 sheep, pig, and others animals counted respectively **Table 4.8.**

4.3.4 Literacy

In Kheri district as per 1991 census, only 29.7 people were literate. There was a trend of increase literacy, which has gone up to 14.6 of 1971 to 29.7 of 1991 **Table 4.9 and 4.10**

In Kheri district, there are 1795 junior basic school, 325 senior school, 63 higher secondary school and 3 graduate/postgraduate colleges to educate the people and to provide technical education as well for possible employment. As compared to Kheri, there were 297 junior schools, 53 senior basic schools, 9 higher secondary and 1 Graduate/postgraduate College at Nighasan **Table 4.11 and 4.12.** Number of higher secondary school, per every one lakh human population was 11.80 and 1.87 respectively. As such there was increase in these schools during period of 1990-91 to 1995-96 **Table 4.13**

4.3.5 Nativity

People were asked where they came from. 69.3% and 11.3% people were found native and local migrant (came from nearby villages and towns) respectively whereas 5.5%, 5.2%, 3.4%, 2.8%, 0.6%, 0.6% and 0.6% respondent told they came from UP (other district), Punjab, Nepal, Pakistan, Haryana, Rajasthan, and Uttaranchal. 0.6% respondents were unable to tell from where they came from **Table 4.14.**

4.3.6 Collection of Non-timber forests produce

People are allowed to collect forest produce through out year. They get permission only in winters to harvest grasses for 5-10 days annually from the Dudhwa National Park in exchange of labour **Table 4.15.** But the people situated adjacent to the forest venture into the forest illegally and collect grasses and fuel wood. Status of the forest in the North Kheri is reserved and scattered in the form of small patches. People settle in and around both corridors have easy access to collect these grasses. Since

according to availability. Since all the forest patches are interspersed with human settlement and agriculture land so they are facing immense biotic pressure in terms of grazing, fuel wood and grass collection. Most of the northern corridor is unforested and pass through agriculture land. So people of this area either go to forest of Dudhwa for grasses or buy from market. The villagers for grass collection similarly use southern corridor.

4.3.7 Crop damage by wild animals in the vicinity of the corridors

Wild animals reach the end of northern and southern corridor. In the northern corridor Bela parsua, Kariya, Gulria Pathar Sha, Ganganagar, Banbirpur, Suratnagar, Barsola Kalan, Jasnagar and Khairatya was found highly affected from Elephants, Wild boar, Chital, Nilgai and Chital. These animals mainly feed on sugarcane, wheat, rice, maize, mustard and pulses **Table 4.16**. Southern corridor is comparatively less affected from crop damage from wild animal. Nilgai and wild boar are important problematic species in these areas. Vicinity of Dudhwa national park especially in the southern corridor is also affected by chital and hog deer.

4.3.8 Cropping pattern in the vicinity of Dudhwa NP and Katerniaghat WLS

Cropping activities go on all the year-round in North Kheri, provided water is available for crops. In northern India, there are two distinct seasons, *kharif* (July to October), and *rabi* (October to March). Crops grown between March and June are known as *zaid*. These crops are grown sole or mixed (mixed-cropping), or in a definite sequence (rotational cropping). The land may be occupied by one crop during one season (mono-cropping), or by two crops (double-cropping), which may be grown in a year in sequence. Of late, the trend is even more than two crops (multiple-cropping) in a year. Table 17 shows the important crop and their harvesting period of North Kheri. Sugarcane, wheat, rice, maize, groundnut, lahi chana, Arhar, and masur were the important crops of that area.

4.3.9 General Information

There were 227 Biogas plant found at every 100 villages in Kheri district which were quite higher than that of 1990-91 i.e. 168.77. Number of Allopathic dispensaries and primary health center at every one lak population were 76.90 and there was no

which is comparatively less of 84.33 observed in 1990-91. Number of human population at every Bank was 37220.33, which is almost double recorded during 1990-91 and 1994-95 **Table 4.18**.

4.3.10 Transport and communications facilities

There were 372 post office, 13 Telegram office, 178 Public call office, 8061 telephone, 26 railway station and 163 Bus stop in Kheri district which make important part of transport and communication **Table 4.19**. Except in the increase of telephone connections, which have gone upto 4450 to 8067, there is no major change occurred over the period in the status of PO, TO, PCO, Railway station and Bus stop since 1994.

As far a Nighasan is concerned, there were 91 Post office, 4 telegram office, 41 PCO, 757 Telephone, 6 Railway station and 36 Bus stop **Table 4.20**

4.3.11 Availability of water facilities in Kheri district

As per the 1996-97 census there were 1696 Tube well and hand pump in Kheri district. Whereas in Nighasan there were only 269 Tube well and hand pump which were mainly for providing drinking water **Table 4.21**

4.3.12 Use of fertilizer and insecticides in Nighasan

Nitrogen, phosphorus and Potash were important fertilizer, which is being used frequently. 5490, 4415 and 2776 Metric ton of Nitrogen, Phosphorous and Sulphur were distributed respectively in the Nighasan areas **Table 4.22 and 4.23**

There are many insecticides available in the markets of Palia and Nighasan and Lakhimpur e.g. for Sugarcane; Lindane, Phorate, Malthion, 2,4-D Ehtyl Ester, 2,4-D amine salt, for Rice; cartap hydrochloride, carbofuran, Butachlor, Copper hydroxide. For wheat: Isoproturon, phorate, Endosulfan, 2,4-D Ehtyl Ester, 2,4-D amine salt and Dinocap, for Mustard; Phorate, Malation, Carbofuran, Endosulfan and Chlorphyriphos, for Groundnut; Hexaconazole, Phorate and Fenitrothion. For Maize; Lindane, Phorate, Mancozeb, Endosulfan, Carbofuran, for Mango; Hexoconazole, Ethephon, Malathion, Sulphur, and Alpha naphthyl acetic acid, for Pulses; Phorate,

Fenitrothion, Zinc phosphide, 2,4-D Ethyl Ester & 2,4-D amine salt, Butachlor, Beta cyfluthrin & Barium carbonate, Carbofuron, Lindane, Isoproturon, Formothion, malathion, Aluminium phosphide, Methyl ethyl mercury chloride (MEMC), Endosulphan and Chlorpyrifos were found to be used by 6.1%, 31.1%, 42.0%, 29.7%, 18.6%, 0.6%, 1.8%, 1.2%, 1.2%, 0.9%, 0.3%, 1.2%, and 0.3% respondent respectively.

4.3.13 Source of income

How do people earn their living? a agriculture b service c labour and d from other sources. 60.4%, 15.3%, 13.2%, 6.1%, 1.5%, 1.2%, 0.9%, 0.3%, 0.3%, 0.3%, respondent preferred option a, ac, c, ad, d, ab, cd, acd, b, and bc respectively. Only 0.3% respondent could not explain the way of their income **Table 4.24**.

4.3.14 Status of forest among the people of the area

What do people think about the forest? a for conservation b let it be natural c for exploitation. Maximum people preferred b option (50.0%) followed by a (47.5%), c (1.5%) and ac (0.3%). 0.6% respondent could not give any answer **Table 4.25**

4.3.15 Use of forest

People were asked for what purpose they used the forest i.e. grazing, fuel wood and collection of non-timber forest produce. 57.4%, 12.0%, 4.0%, and 1.5% respondent told that they used forest for fuel wood, grazing, other purpose and collection of non-timber forest produce respectively **Table 4.26** Whereas 21.2%, and 4.0% respondent said they used forest for grazing, fuel wood & collection of non-timber forest and grazing and fuel wood respectively.

4.3.16 Fulfillment of fuel requirement

If the wood from the forest will not be available to the villagers in future how will they meet their fuel requirement? **a** by buying fuel from market **b** from other forest **c** from plantation in crop land and **d** from other sources. 45.4%, 22.1%, 11.0%, and 1.5% respondents opted for d, b, a and c respectively. Whereas 2.5% and 0.3% respondent opted abc and abd option respectively **Table 4.27** Similarly, 9.5%, 1.5%, 2.8%, 0.9%, and 0.6% respondent preferred ab, ac, ad, bc, and bd respectively.

4.3.17 Awareness about fuel resources

When people were asked that how many fuel resources you know with six option namely **a** fuel wood **b** Biogas **c** fuel efficient chullah **d** Dung Cakes **e** LPG and **f** other source. Many people opted more than one options. 91.4%, 2.5%, 1.5%, 1.2%, 0.6%, 0.6%, 0.6%, 0.6%, 0.3%, 0.3%, and 0.3% respondent opted ad, ade, a, e, abd, adf, d,de, abde acd and be options respectively **Table 4.28**

4.3.18 Why do people not use these resources?

When people were asked why did they not use these item? **(a)** unavailability of fuel resources in sufficient quantity **(b)** insufficient to meet all requirement **(c)** unable to afford it financially **(d)** not knowing and **(e)** other reasons. 99.7 % did not respond openly due to fear or hesitation but admitted that resources getting is free of cost **Table 4.29** Only 0.3 % opted all the options together.

4.3.19 Reason of keeping livestock

Why do people keep livestock? **(a)** for milk **(b)** for agriculture and dung **(c)** for business and **(d)** for other use. 53.7%, 25.5%, 3.1%, 0.6% and 0.3% responded

option ab, a, b, abc, and bc respectively. However, 16.9% respondent could not opt any given option **Table 4.30**

4.3.20 Use of agriculture waste as fodder

Do you use agriculture waste as fodder? 74.5% respondent said yes whereas remaining said no **Table 4.31**

4.3.21 Agriculture waste as fuel

Do you use agriculture waste as fuel? 69.0% and 30.4% respondent said yes and no respectively. Whereas, 6 respondent were unable to express their choice **Table 4.32**

4.3.22 Use of Agriculture waste as fuel

People living in the vicinity of corridors were asked whether they used waste (remaining) of agricultural crop such as wheat (straw), sugarcane, rice para (straw), maize, sugarcane leaf, paddy husk and Arhar stem as fuel? About 0.9%, 54.6%, 55.8%, 0.6%, 46.9%, 0.3%, and 1.2% respondent revealed that they use wheat, sugarcane, para, maize, leaf, paddy husk and Arhar stem respectively as agriculture waste for fuel purpose.

4.4 Discussion

When people were asked what they think about forest and their conservation. About 50% respondents were in favour to let the forest be in natural condition and nature will take its own course. But about 47.5% respondent gave their verdict in the favour of forest conservation.

Northern corridor is almost lying along the international border. When questioned of their nativity 69.3% and 11.3% were found native and local migrant respectively. However lots of people from Punjab, Nepal, Pakistan, Haryana, Rajasthan and Uttaranchal have settled here. Most of them have come from Pakistan after partition and independence of the country. Now they have become the backbone of the economy of this area. Large numbers of them are engaged in agriculture practice although many of their relative have settled abroad (UK, Canada, and US) and contribute to the economy of this area.

As far as use of forest is concerned, lots of people were found to use forest for grazing and collection of fuel wood. During the month of November and December they also collect non-timber forest produce (mainly grasses to make the roof of their houses). When people were asked if they were not allowed collection of fuel wood from the forest what will they do? Most of them expressed their views that they would buy from the market but few of them also said they would venture in the other nearby forest for the collection. In case of non-availability of fuel a large proportion of respondents were ready to buy the alternatives available in market. These findings are contrary to that of Badola (1998), where only people opted for this alternative. When awareness of the people was assessed it was found that most of the people are familiar to fuel wood and dung cakes. Under eco-development projects, forest department had distributed LPG cylinder at subsidized price in selected villages. Since there is no LPG godown in these villages so most of the cylinders have become useless for them. One Biogas plant was found in Kishunnagar but it was not functioning. In India, between 80 and 90 per cent of the total domestic fuel consumed in rural areas is made up of fuel wood, agricultural wastes and animal dung (Saxena, 1995). The national average of per capita firewood consumption has been reported to be 0.6 tons per year (Bartwal, 1987). Most of the respondent did not respond when they were asked how many fuel sources they know.

Important reason behind keeping livestock was agriculture use and getting dung for manure. About 25.5% people said they keep livestock for getting milk. However, few people were exclusively dependent upon the sale of milk for their livelihood. Use of agriculture waste as fodder of livestock is very common in the villages. Sugarcane green leaf, Paddy straw, Wheat straw, and maize stem are important item which is use as fodder frequently. Similarly people do use Sugarcane (dry root and leaf), Paddy straw and husk, maize stem and Arhar stem.

Economy of the people is mainly dependent upon the agriculture practice. About 64.4% people were found engaged in agriculture whereas 15.3% and 13.2% people were engaged in Service and Labour respectively. Since people are mainly dependent upon the agriculture so they are very much familiar to available insecticides and pesticides in the market. People were largely found to use Butachlor (Macheti), 2,4-D Ethyl Ester & 2,4-D amine salt and Lindane.

People living in the North Kheri venture in the forest to collect grasses and non-timber forest produce. Besides grass people do collect Mushroom, Rangoi, Gondi (Typha) species. Forests grasses people use for making roof and kachha house. Because of grass thatched roof incidence of fire are very common in these areas.

Northern corridor is severely impacted from the raiding of wild animal especially elephant, which keep on moving between Nepal and India. Nilgai and wild boar is the foremost nuisance creator and these animals easily get shelter in sugar cane fields. Southern corridor is not as much affected by crop raiding. Here nilgai and wild boar damage larger part of the crop. North Kheri is agricultural dominant area and people largely sow wheat, sugarcane, and rice. Besides this, they also grow fruit trees like mango and Guava.

Socio economic studies are becoming useful in environmental management decisions because they can provide information about public support and about the current and future behaviour of relevant parties. Findings from this study is in sharp contrast with the findings by Infield (1988), from which he inferred that third world populations are almost entirely antagonistic to conservation and ignorant of conservation issues. Attitude and awareness are supposed to be related with respondent s education, wealth and other demographic variables. Most residents living in the villages around the study area were aware of the fact that the forest adjoining to their village has been given protected status legally. The education is one of the major variables, which can affect conservation attitudes and awareness (e.g. Infield, 1988; Mordi 1987; Fiallo and Jacobson 1995). However, Infield and Namara (2001) found that people who owned land had more positive attitude than those who did not have land. Larger landholdings, in the present study, were found to be associated with large families, which have an implication that larger families have more fuel wood consumption and hence they feel that their rights have been violated. A relatively large proportion of people were reported to be dependent on forest resources, this could be due to relatively large number of livestock holding.

Table 4.1: Land suitable to agriculture (ha) in Nighasan Taluka

Total area	Forest	Suitable land
173096	20057	2561

Table 4.2: Pattern and Size of cultivated land in Nighasan (in hectare)

<0.5		0.5-1		1-2		2-4		4-10		>10		Total	
Number	Area	Number	Area	Number	Area	Number	Area	Number	Area	Number	Area	Number	Area
47808	14704	28076	21915	20515	27309	11172	31316	4090	22762	219	3720	111880	121726

Table 4.3: Status of villages in Nighasan Taluka

No. Habituated village	No. Abandoned village	Total
120	1	121
90	8	98
59	2	61
		280

Table 4.4: Population of Nighasan Taluka

Man	Woman	Rate	Total population
83053.00	70565.33	27.47	153618.33

* Based on 1991 census

Table 4.5: Population of Nighasan based mother tongue

Mother tongue	Percent of population
Hindi	91.75
Urdu	6.23
Punjabi	1.88
Bengali	0.07
Others	0

Table 4.6: Population of Nighasan based religion

Religion	Population in percent
Hindu	78.54
Muslim	18
Christen	0.18
Budh	2.05
Jain	0.36
Others	0.01

Table 4.7: Cattle population of Kheri district

Year	No. of livestock
1982	402136
1988	425408
1993	411091

Table 4.8: Cattle population of Nighasan Taluka during 1993

Animal	No. of livestock
Cow	90029
Cow crss	4208
Buffalo	91652
Sheep	11324
Sheep	745
Pig	6169
Other animal	33599

Table 4.9: Rate of literacy in Kheri district

Year	Man	Woman	Total
1971	21.4	6.4	14.6
1981	26.2	7.6	17.7
1991	40.6	16.3	29.7

Table 4.10: Rate of literacy in Nighasan Taluka

Man	Woman	Total
28.10	9.67	19.83

Table 4.11: Recognized school and villages in Kheri district

Year	Junior Basic School	Senior basic School		Higher secondary		Degree college	
		Total	Girl	Total	Girl	Total	°
1994-95	1696	314	50	61	9	3	0
1995-96	1795	325	50	62	9	3	0
1996-97	1795	325	55	63	9	3	0

Table 4.12: Recognized school and villages in Nighasan Taluka

Year	Junior Basic School	Senior basic Scholl		Higher secondary		Degree college	
		Total	Girl	Total	Girl	Total	°
1994-95	297	53	4	9	1	0	0

Table 4.13: Changing pattern of some socio educational aspect of Nighasan Taluka

	1990-91	1994-95	1995-96
No. of Junior school per every one lack	62.80	65.30	65.47
No. of Senior Basic school per every one lack	13.17	11.80	11.80
No. of Higher secondary school per every one lack	2.70	1.60	1.87

Table 4.14: Nativity of the resident living in the Villages of Corridor Area

Queries	Frequency	Percent
Native	226	69.3
Local migrant (Different parts of Kheri district)	37	11.3
UP (Other district of UP)	18	5.5
Punjab	17	5.2
Nepal	11	3.4
Pakistan	9	2.8
Haryana	2	.6
Rajasthan	2	.6
Uttaranchal	2	.6
No Answer	2	.6
Total	326	100.0

Table 4.15: NTFP collection by the People in & Around Corridor Villages

Panchayat	Frequency of visit in the Forest	No. Of NTFP Items
Bela Pursua	10	6
Kariya	10	5
Gulria Patharsha	1	4
Banbirpur	1	5
Suratnagar	1	3
Barsolakalan	1	5
Jushnagar	1	4
Khairatia	2	3
Majhara	2	5
Bairia	2	6
Bathua	2	5
Naurangabad	2	3
Sidhauna	1	3
Takiya	2	4
Bharora	Uncertain	3
Khairigarh	Uncertain	5
Banglaha	Uncertain	4
Chakra	Uncertain	5
Dharmapur	Uncertain	4

Singaha kala	Uncertain	0
Shitalapur	Uncertain	6
Khairahna	Uncertain	5
Ghazipur	Uncertain	4
Ladhori	Uncertain	6

NTFP: Narkul, Munja, Miyari, Kush, Khus, Khagar, Chitawar, Mashroom, Rangoi, Kasi, Ratwa, Gondi (Typha)
Month of collection: Winter (November-December)

Table 4.16: Crop damage by wild animals in the vicinity of corridors

Panchayat	Animal	Activity				Crop name
		F	T	R	D	
Bela Pursua	Chital	F	*	*	*	Rice, Wheat, Musoor
	Hog deer	F	*	*	*	Rice, Matar, Wheat
	Wild boar	F	T	R	D	Rice, Sugarcane
	Nilgai	F	T	R	*	All Crops
	Sambar	F	*	*	*	Lahi, Matar, Musoor, Wheat
	Elephant	F	T	R	*	Rice, Sugar cane, Banana
Kariya	Elephant	F	T	*	*	Rice, Sugar cane
	Wild boar	F	*	*	D	Rice, Wheat, Maize, Sugarcane
	Monkey	F	*	*	*	Rice, Wheat, Sugarcane, Vegetables
	Nilgai	F	T	*	*	Rice, Wheat, Sugarcane
Gulria Patharsha	Wild boar	F	T	*	D	Rice, Wheat, Maize, Sugarcane
	Chital	F	*	*	*	Rice, Wheat, Musoor
	Tiger	*	*	*	*	
	Elephant	F	T	*	*	Rice, Sugarcane, Banana
	Nilgai	F	T	*	*	All Crops
	Hog deer	F	T	*	*	Rice, Wheat
Ganganagar						
Banbirpur	Elephant	F	T	*	*	Rice, Sugarcane
	Nilgai	F	*	R	*	All Crops
	Chital	F	*	*	*	Rice, Wheat, Maize
Suratnagar	Elephant	F	T	*	*	Sugarcane, Rice, Wheat
Barsola Kalan	Rhino	F	T	*	*	Sugarcane, Rice, Wheat
	Elephant	F	T	*	*	Sugarcane, Rice, Wheat
	Tiger	*	*	*	*	
	Nilgai	F	T	R	*	All Crops
	Wild boar	F	T	R	D	Rice, Wheat, Maize, Sugarcane
Jushnagar	*	*	*	*	*	
Khairatia	Wild boar	F	*	R	D	Sugarcane, Lahi
Majhara	Wild boar	F	*	R	D	Rice, Wheat, Sugarcane
	Nilgai	F	T	*	*	Rice, Wheat, Sugarcane, Lahi, Mussore
	Chital	F	T	*	*	Rice, Wheat, Lahi, Mussore
	Jackel	F	T	*	*	Maize, Sugarcane

	Monkey	F	T	*	*	Rice, Wheat, Sugarcane, Lahi, Mussore
	Tiger	*	*	*	*	*
Bairia	Monkey	F	T	*	*	Sugarcane, Wheat, Rice, Mussore, Arhar
	Nilgai	F	T	*	*	Maize, Rice, Wheat
Bathua	Nilgai	F	T	*	*	Sugarcane, Rice, Wheat, Lahi, Mussore
	Chital	F	T	*	*	Sugarcane, Rice, Wheat, Lahi, Mussore
	Wild boar	F	*	R	D	Sugarcane
	Jackel	F	*	*	*	Sugarcane, Maize
Naurangabad	Tiger	*	*	*	*	*
	Wild boar	F	*	R	D	Sugarcane
	Nilgai	F	T	*	*	Sugarcane, Wheat, Rice
	Chital	F	*	*	*	Sugarcane, Wheat, Rice
Sidhauna	Nilgai	F	T	*	*	Rice, Wheat
	Wild boar	F	*	R	D	Sugarcane
	Monkey	F	T	*	*	Sugarcane
Takiya	Tiger	*	*	*	*	*
	Nilgai	F	T	*	*	Rice, Wheat
Bharora	Nilgai	F	T	*	*	Wheat, Rice, Mussore
	Tiger	*	*	*	*	*
Khairigarh	Nilgai	F	T	*	*	Rice, Wheat, Lahi
	Wild boar	F	*	*	D	Sugarcane
	Elephant	F	T	*	*	Sugarcane
	Chital	F	*	*	*	Wheat, Rice
	Tiger	*	*	*	*	*
Banglaha kuti/Takiya	Nilgai	F	T	*	*	Rice, Wheat, Mussore, Lahi
Chakra	Nilgai	F	T	*	*	Rice, Wheat, Mussore, Lahi
	Jackel	F	*	*	*	Sugarcane
	Tiger	*	*	*	*	*
Dharmapur	*	*	*	*	*	*
Singaha kala	*	*	*	*	*	*
Shitalapur	Elephant	F	T	*	*	Rice, Wheat, Sugarcane
	Wild boar	F	*	*	D	Sugarcane, Rice
	Chital	F	*	*	*	Rice, Wheat, Mussore
	Hog deer	F	*	*	*	Rice, Wheat, Mussore
	Nilgai	F	*	*	*	Rice, Wheat, Maize
Khairahna	*	*	*	*	*	*
Ghazipur	Nilgai	F	*	*	*	Lahi, Mussore, Wheat, Rice
Ladhori	Nilgai	F	*	*	*	Wheat, Rice, Lahi, Mussore

F= Feeding, T=Trampling, R= Resting and D=Digging

Table 4.17: Cropping Pattern

Village	Crop	Sowing month	Harvesting month
Babapurba, Sisaiya, Dharmapur, Singaha Kurd, Ganga-purba	Arhar	May	July
Bharmpur, Rahimpurba, Kauria, Bairia, Bharora, Khairigarh, Banglaha kuti/Takiya, Dharmapur, Singaha kalan, Shitalapur, Khairahna,	Aurad	May	Oct-November
Majhara	Bajara	Oct	May
Bela Pursua, Banbirpur, Khairatia, Majhara	Barseem	July	Feb-March
Kariya, Gulria Patharsah, Banbirpur, Shitalapur	Chana	Oct	April
Bela Pursua	Dhaniya	Winter	Winter
Bela Pursua	Garlic	Nov	Mar-April
Bairia	Ground nut	July	Nov
Banbirpur, Suratnagar, Khairatia, Manjhara, Bharora	Jawhar	March	August
Bela Pursua, Kariya, Gulria Patharsah, Banbirpur Suratnagar, Barsolakala, Jushnagar, Khairatia, Bairia, Bathua, Naurangabad, Takiya, Bharora, Khairigarh, Banglaha kuti/Takiya, Chakra, Dharmapur, Singaha kalan, Shitalapur, Khairahna, Ghazipur, Ladhori	Lahi	Oct	Feb- March
Bela Pursua, Kariya, Banbirpur, Suratnagar, Jushnagar Bairia, Bathua, Naurangabad, Bharora, Khairigarh, Banglaha kuti/Takiya, Chakra, Dharmapur, Singaha kala, Shitalapur, Khairahna, Ladhori	Maize	July	September
Bela Pursua	Matar	Nov	Mar-April
Khairigarh, Banglaha kuti/Takiya, Chakra, Ladhori	Mungfali	May	Oct-Nov
Kariya, Gulria Patharsah, Ganganagar, Banbirpur, Suratnagar, Jushnagar, Khairatia Manjhara, Bairia, Bathua, Naurangabad, Sidhauna, Takiya, Bharora, Khairigarh, Banglaha kuti/Takiya, Chakra, Dharmapur, Singaha kalan, Shitalapur, Khairahna, Ghazipur, Ladhori	Mussore	Oct	March-April
Bela Pursua, Manjhara, Ladhori	Potato	Nov	Mar-April
Bela Pursua, Kariya, Gulria Patharsah, Ganganagar, Banbirpur, Suratnagar, Barsolakala, Jushnagar, Khairatia, Manjhara, Bairia, Bathua, Naurangabad, Sidhauna, Takiya, Bharora, Khairigarh, Banglaha kuti/Takiya, Chakra, Dharmapur, Singaha	Rice	July	Oct-Nov

Ladhori			
Bela Pursua Kariya, Gulria Patharsah, Ganganagar, Banbirpur, Suratnagar, Barsolakala, Jushnagar, Khairatia, Manjhara Bairia, Bathua, Naurangabad, Sidhauna, Takiya, Bharora Khairigarh, Banglaha kuti/Takiya, Chakra, Dharmapur Singaha kala, Shitalapur, Khairahna, Ghazipur, Ladhori	Sugarcane	March	Nov-April

Table 4.18: Changing pattern of some socio economic aspect of Nighasan

	1990-91	1994-95	1995-96
No of Bio gas plan per 100 villages	168.77	214.80	227.90
No. Of Allopathic /dispensaries and primary health center per every one lack population	3.30	3.13	3.53
No. Of primary health center per every one lack population	2.53	2.67	3.07
Human population per Bank	17679.67	18306.00	37220.33

Table 4.19: Transport and communication facilities in Kheri district

Year	Post Office	Telegram Office	PCO	Telephone	Railway Station	Bus Stop
1994-95	383	13	135	4413	26	163
1995-96	372	13	209	4450	26	163
1996-97	372	13	178	8067	26	163

Table 4.20: Transport and communication in Nighasan

Post Office	Telegram Office	PCO	Telephone	Railway Station	Bus Stop
91	4	41	757	6	36

Table 4.21: Availability of irrigation facilities in Kheri district

Year	Tube well	Well	Hand pump	Hand pump of India mark
1994-95	1694	207	107	1376
1995-96	1696	0		1696
1996-97	1696	0		1696

Table 4.22: Changing pattern in use of fertilizer of Nighasan Taluka

	1990-91	1994-95	1995-96
Use of fertilizer per hectare in kg	84.33	72.43	76.93

Table 4.23: Use of fertilizer in Metric ton in Nighasan Taluka

Name of fertilizer	Quantity in Metric ton
Nitrogen	5490
Phosphorus	4415
Potash	2776

Table 4.24: Source of income

Queries	Code for queries	Opted queries	Frequency	Percent
Agriculture	A	a	197	60.4
Service	B	ac	50	15.3
Labour	C	c	43	13.2
Others sources	D	ad	20	6.1
		d	5	1.5
		ab	4	1.2
		cd	3	.9
		acd	1	.3
		b	1	.3
		bc	1	.3
No Answer			1	.3
		Total	326	100.0

Table 4.25: Status of forest among the people

Queries	Code of query	Opted query	Frequency	Percent
Conservationist approach	A	a	155	47.5
Let be natural	B	b	163	50.0
Exploitive approach	C	c	5	1.5
		ac	1	.3
No answer			2	.6
	Total		326	100.0

Table 4.26: Use of forest by the people in the Corridor Area

Queries	Code of query	Opted query	Frequency	Percent
Grazing	a	b	187	57.4
Fuel wood collection	b	a b	69	21.2
Collection of non-timber forest produce	c	a	39	12.0
Other purpose	d	abc	13	4.0
		d	13	4.0
		c	5	1.5
	Total		326	100.0

Table 4.27: Fulfillment of Fuel Requirement

Queries	Code of query	Opted query	Frequency	Percent
Buying fuel form market	a	d	148	45.4
From other forest	b	b	72	22.1
Planted in crop land	c	a	36	11.0
Other sources	d	ab	31	9.5
		ad	9	2.8
		abc	8	2.5
		ac	5	1.5
		c	5	1.5
		cd	4	1.2
		bc	3	.9
		bd	2	.6
		abd	1	.3
No Answer			2	.6
		Total	326	100.0

Table 4.28: Awareness for Fuel Resources

Queries	Code for query	Opted query	Frequency	Percent
Fuel wood	a	ad	298	91.4
Biogas	b	ade	8	2.5
Fuel efficient chullah	c	a	5	1.5
Dung (Upley)	d	e	4	1.2
LPG	e	abd	2	.6
Others	f	adf	2	.6
		d	2	.6
		de	2	.6
		abde	1	.3
		acd	1	.3
		be	1	.3
		Total	326	100.0

Table 4.29: Reason behind the non-using of fuel resources

Queries	Code for query	Opted query	Frequency	Percent
Unavailability of fuel resources in sufficient quantity	A	abcde	1	.3
Insufficient to meet all requirement	B			
Unable to afford it financially	C			
Not knowing	D			
Any other reason	E			
No Answer			325	99.7
Total			326	100.0

Table 4.30: Reason of keeping livestock

Queries	Code for query	Opted query	Frequency	Percent
Milk	A	Ab	175	53.7
Agriculture and dung	B	A	83	25.5
Business	C	B	10	3.1
Other	D	Abc	2	.6
		Bc	1	.3
No Answer		55	16.9	
		Total	326	100.0

Table 4.31: Use agriculture waste as a fodder

Queries	Code for query	Opted query	Frequency	Percent
No	N	N	83	25.5
Yes	Y	y	243	74.5
		Total	326	100.0

Table 4.32: Agriculture waste as a fuel

Queries	Code for query	Opted query	Frequency	Percent
No	N	N	99	30.4
Yes	Y	y	225	69.0
No Answer			2	.6
		Total	326	100.0

4.5 Biotic pressure and dependency on the resources

4.5.1 Methodology

Grazing, collections of fuel wood and non-timber forest produce are the important variables, which can be, used to determine extent of biotic pressure in a habitat. All forest patches of Northern and Southern corridor were covered laying random circular plot of 10m and 20m for dung and cut & lop tree respectively. Density of cut and lop trees were estimated per hectare in both corridor whereas grazing in terms of dung density per hectare. Besides this, information on location of habitation and road from the patches of forest, to know closeness of habitation and road from each sampling plot was also recorded. Information on livestock census was collected from the Kheri revenue department.

4.5.2 Results

4.5.2.1 Status of encroachment

There are three forest ranges namely Mazgai, North Nighasan and South Nighasan whose area comes under both the proposed corridors. Total area of three ranges covers 24946.25 ha land and 4384.74 of this is, found encroached by the villagers mainly for agriculture purpose. This shows 17.58 percent of total area currently encroached by the local farmers **Table 4.33**.

Area covered for study in Mazgai, North Nighasan, South Nighasan, was 1950.91, 4958.5, and 840.42 hectare respectively. Altogether 7749.83-hectare land was covered for the study and 20.90% of this found encroached **Table 4.34**. There was no encroachment in the Mazgai area **Table 4.35**. In North Nighasan encroachments are evident in the areas of Anupnagar, Indranagar, Kishunagar, Khairatya, Deepnagar, Raghunagar, Rannagar and Suratnagar. **Table 4.35**.

4.5.2.2 Grazing

Livestock population recorded in 1993 in the Kheri district was 4,11,091, which is almost similar to the census of 1982 and 1988. There was as such no increase recorded in the livestock population **Table 4.36**. In 1993 census, number of Buffalo in Nighasan was greatest 91652 followed by cow and sheep 90029 and 11324 respectively **Table 4.37**.

In the Northern corridor, maximum dung was recorded in Belaparsua 203.02 followed by 11.47, 58.39 and 10.62 in Ragnagar, Kishunnagar and Deepnagar respectively. Absence of dung in Ganganagar and Khairatya does not mean, that this area is not affected from grazing but the signs were not visible may be due to rain. In general whole Northern corridor is highly affected from grazing. People of adjacent areas do also come here with their livestock for grazing. Many time Nepali villagers bring their cattle in the forest of Indian Territory.

In Southern Corridor, maximum-recorded density of dung in Badura, Banglaha, Nunia, Bathua, Singahi, Sissaya, Bairia, and Majhra east was 375.79, 254.78, 208.6, 180.47, 175.16, 167.20, 159.24 and 127.39 per hectare respectively Table 4.38. Dung density in Dharampur, Ladhuri, Naurangabad, Murthiha, and Lathua was comparatively less than other forest patches.

4.5.2.3 Cutting of Trees

In Northern corridor, Raghunagar had greatest cut density of 86.73 per hectare followed by Kishunnagar, Deepnagar, and Ganganagar 77.47, 67.37, and 25.59 per hectare respectively Table 4.39. Whereas in Southern corridor, Singhai was found maximum affected from cutting of trees of 102.89/ha followed by Dharmapur, Icchanagar, Bairia and Majhra east 56.02, 41.22 40.16, and 36.03 respectively. Lathua, Badura, Murthiha, Takiya, and Mohammadpur were comparatively less affected from the cutting of the trees by the villagers. In Raghunagar and Kishunnagar, 328.03 and 276.01 lop trees per hectare respectively were estimated. Ganganagar and Belaparsua had comparatively less cut trees. Most of the Khairatya forestland found encroached or submerged in the water hence there was hardly any tree to be cut Table 4.40. Mean cut tree density in both corridors was estimated 33.98 – 3.93 per hectare.

4.5.2.4 Lopped Trees

In Northern corridor, Ganganagar and Kishunagar found highly affected from lopping of trees 132.7 and 91.56 per hectare respectively. Whereas Raghunagar and Deepnagar had comparatively less 74.04 and 59.71 lop trees per hectare respectively.

Southern corridor was also highly affected from lopping of trees, maximum density of lopped trees in Banglaha was 95.54 per hectare followed by in Murthiha, Singhai, Bairia and Naurangabad was 76.43, 69.67, 67.23 and 61.42 respectively. Takiya, Sissaya, Dharmapur and Majhra east patches were comparatively less affected from lopping **Table 4.41**. Mean density of lopped trees in both the corridor was 52.87–3.55

4.5.2.5 Road location from the forest patches

It seems that more closeness to forest from the road is an indicator of the biotic disturbance. Ganganagar forest patches were most close from the road i.e. 76.67 m. Whereas other forest patches which had the close proximity to forest were Rangunagar, Icchanagar, Badura, Singhai, Banglaha, Takiya, Murthiha, Deepnagar, Belapursua, and Sissaya at the mean distance of 340, 360, 580, 167.5, 580, 568, 680, 641.67, 417.5 and 193.75 m respectively.

Bairia, Naurangabad, Laduri, Kishunnagar patches were located comparatively far from the road and hence receive less amount of disturbance in the form of people movement **Table 4.42**.

4.5.2.6 Availability of water resources

Availability of water also determines extent of biotic pressure in most of the habitat. To fulfill the need of water animal search nearest sources, if water is available in and around animal may face less disturbance as most of the forest patches are interspersed with agriculture field and human settlement. Hence least distance obviously will give more security to animal from the people presence. Interestingly, most of the forest patches have close proximity to water sources. Only Khairatya, Murthiha, Lathua, and Laduri had the water source at comparatively long distance of 1000, 880, 758.33 and 663.64 m respectively **Table 4.43**. Rest of forest patches were very close to nullas, river and its tributaries. Bairia, Lathua, Bathua, Naurangabad and Murthiha forest patches were very close to Suheli and Joraha River whereas whole Northern corridor was lying along the Mohana River. Majhra east and Khairatya patches were very close to Kuryala River.

4.5.2.7 Location of human settlement in the forest patches

Most adjacent forest patches from the human habitations in the Northern corridor were Ganganagar, Deepnagar, and Belaparsua at the distance of 250, 358, and 587 m respectively. Khairatya Kishunagar and Raghunagar were comparatively far from the human settlement.

Human settlements close to patches of the Southern corridor were Lathua, Bairia, Bathua, Banglaha and Mohammadpur at 542, 600, 687.5, 820, 850 m respectively. Sissaya, Singahi, Dharmapur, Majhra east, Takiya and Naurangabad were located at comparatively more distance from human settlement **Table 4.44**.

4.5.3 Discussion

Biotic pressure on the forest patches becomes crucial especially when wild animals are using the patches. In Northern corridor forest patches up to Deepnagar are being frequently used by animals even though presence of high intensity of biotic pressure in form of grazing, cutting/lopping, road and habitation. This area is being used due to proximity of this area to Belrayan range of Dudhwa NP and presence of these forest patches in the form of belt on the other side of Nepal. Animal especially elephants do keep on crossing over Mohana river frequently. 50% of the northern corridor i.e. Ganganagr, Suratnagar, Barsola, Khairatya do not have forest cover and shelter for free movement. However wild boar, elephant, tiger and nilgai frequently use these areas. According to local residents, they have seen elephant herd crossing river Kuriyala. Old dung and track marks were seen on the bank of the river during the visit of review team in October 2002. Later on a Tigress with two cubs became active in this area of Surutnagar and Barsola. In the same area a herd of 12 elephants raided the agriculture crop and were active for one month.

In southern corridor, forest patches adjoining to Katarniaghat and Dudhwa are in use despite presence of biotic pressure. Nunia and Sissyaya southern corridor forest patches form the side of Dudhwa NP and are also being used by wild animal despite presence of biotic pressure of grazing, cutting/loping and NTFP collection. But as the distance from the Nunia increases towards the Dharampur, Badura, Charka, Singahi, this area gets lots of biotic pressure. Due to anthropogenic pressure it is difficult for

Nunia to Majhra via Naurangabad, Bairia, and Mohammadpur due to fragmented forest cover and poaching. Poaching and continuous human and livestock movement exist in Naurangabad, Bairia, Bathua and Mohammadpur. But it is comparatively less than Singahi, Banglaha and Chakra. Although Majhra east also have similar problems but due to proximity of this area to Katreniaghat WLS, this area is being used by tigers frequently. During the study period another male killed one Sub Adult tiger during the fight, probably defending and establishing their territory. Recently one of the male rhino escaped from RRA reached Naurangabad area and living in the cultivation. This rhino has killed a labourer in the sugar cane field. This area falls in the proposed corridor area.

In brief, it seems that the middle part of the Southern corridor is highly affected from grazing, cutting and lopping of trees, non-timber forest produce collection. Poaching is a limiting factor, which restricts the free movement of animals including large mammals including tiger and elephant. Surprisingly elephants could reach only upto Majhra east so far. Elephants have never been in the middle part of the southern corridor or in the areas of corridor adjacent to Dudhwa NP. It has been also observed that if animal moves away unnoticed during night hours then the animal can reach the other side. Otherwise, if local villagers sight wild animals they chase away and harass the animals and on many occasion animal like tiger in retaliation charge and attack the people in its defense and on number occasion get killed or attack the people.

Table 4.33: Status of encroachment in three forest ranges of North Kheri

	Total available area (ha)	Encroached (ha)	Percent
Mazgai	10042.68	1381.52	13.76
N. Nighasan	6060.31	1671.96	27.59
S. Nighasan	8843.26	1331.26	15.05
Total	24946.25	4384.74	17.58

Table 4.34: Status of encroachment in sample area of three forest ranges of North Kheri

	Area sampled (ha)	Encroached (ha)	Percent (ha)
Mazgai	1950.91	24.47	1.25
North Nighasan	4958.5	1585.94	31.98
South Nighasan	840.42	9.44	1.12
Total	7749.83	1619.85	20.90

Table 4.35: Status of encroachment in Mazgai forest ranges of North Kheri

	Area (ha)	Encroached area (ha)
Udhonagar	86.03	23.26
Kaudia	137.79	-
Khairigarh	4.04	1.21
Chakra	77.09	-
Dharmapur	173.71	-
Nunia	1472.25	-
Total	1950.91	24.47

Table 4.36: Status of encroachment in North Nighasan forest ranges of North Kheri

	Area (ha)	Encroached area (ha)
Anupnagar	96.15	96.15
Ichhanagar	233.78	-
Indranagar	341.71	168.7
Kadiya	10.83	-
Kishunagar	208.66	54.5
Khairatya	440.4	392.82
Ganganagar	27.75	19.34
Gulria Pathar Sha	24.5	-
Jasnagar	1.48	1.48
Deepnagar	182.58	41.86
Naurangabad	168.42	8
Pachpedi Richya	25.75	3.78
Belaparsua	136.77	51.95
Bathua	542	4
Bairia	453.98	15.5
Majhra east	775.38	-
Moortiha	166.14	-
Mohammadpur	178.05	-
Raghunagar	244.46	105.8

Suratnagar	301.02	240.66
Total	4958.5	1585.94

Table 4.37: Cattle population of Kheri district

Year	No. of livestock
1982	402136
1988	425408
1993	411091

Table 4.38: Cattle population of Nighasan during 1993

Animal	No. of livestock
Cow	90029
Cow cross	4208
Buffalo	91652
Sheep	11324
Sheep	745
Pig	6169
Other animal	33599
Total	411091

Table 4.39: Biotic pressure in terms of grazing (dung density/ha)

Corridor	Location of forest patches	Dung/ha – SE
I	Belapursua	203.1 – 176
I	Ragunagar	111.5 – 55
I	Kishunnagar	58.4 – 20.8
I	Deepnagar	10.6 – 10.6
I	Ganganagar	0
I	Kahiratya	0
II	lcchanagar	31.6 – 31.7
II	Sissaya	167.2 – 53.8
II	Nunia	208.6 – 53.2
II	Dharampur	95.5 – 42.7
II	Badura	375.8 – 166.5
II	Ladhouri, Chakra	31.8 – 14.9
II	Singhai	175.2 – 67
II	Banglaha	254.8 – 72.7
II	Takiya	165.6 – 79
II	Mohammadpur	103.5– 62.9
II	Naurangabad	54.6 – 31.7
II	Bathua	180.5 – 37.7
II	Murtiha	12.7 – 12.7
II	Bairia	159.2 – 80.7
II	Lathua	58.4 – 15.2
II	Majhra east	127.4 – 43.4

Table 4.40: Biotic pressure in terms of cut trees density/ha

Corridor	Location of forest patches	Cut (ha) – SE
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I	Belapursua	17.5 – 4.6
I	Ragunagar	86.7 – 36.7
I	Kishunangra	77.5 – 20.8
I	Deepnagar	67.4 – 42.7
I	Ganganagar	25.6 – 11.3
I	Kahiratya	0
II	Icchanagar	41.2 – 27.3
II	Sissaya	36.4 – 9.8
II	Nunia	37.4 – 8.7
II	Dharampur	56.1 – 18.3
II	Ladhouri, Chakra	27.9 – 5.9
II	Singhai	33.4 – 11.3
II	Banglaha	102.9 – 17.6
II	Takiya	14.2 – 2.4
II	Mohammadpur	4 – 0.9
II	Naurangabad	12.9 – 4.3
II	Batua	13.6 – 5.7
II	Murtiha	16.9 – 19.9
II	Bairia	40.16 – 13.73
II	Badura	10.7 – 4.8
II	Lathua	11 – 6
II	Majhra east	36 – 13.7

Table 4.41: Biotic pressure in terms of lop trees density/ha

Corridor	Location of forest patches	Lop (ha) – SE
I	Belapursua	15.9 – 5.7
I	Ragunagar	74– 18
I	Kishunangra	91.6 – 29.5
I	Deepnagar	59.7 – 10
I	Ganganagar	132.7 – 2.7
I	Khairatya	0
II	Icchanagar	63.7 – 13.6
II	Sissaya	30.85 – 15.7
II	Nunia	41 – 10
II	Dharampur	26.5 – 5.5
II	Badura	46.2 – 46.2
II	Ladhouri, Chakra	42.7 – 10.6
II	Singhai	69.7 – 27.5
II	Banglaha	95.5 – 17.7
II	Takiya	19.1 – 16.2
II	Mohammadpur	39.8 – 2.9
II	Naurangabad	61.4 – 12
II	Bathua	58.4 – 15.6
II	Murtiha	76.4 – 8.7
II	Bairia	67.2 – 10.3
II	Lathua	50.4 – 23.6
II	Majhra	34.1–13.9

Table 4.42: Location of road from the forest patches

Corridor	Location of forest patches	Road distance (m) – SE
I	Belapursua	417.5 – 110
I	Ragunagar	340 – 98.8
I	Kishunangra	783.3 – 242.8
I	Deepnagar	641.7 – 209.9
I	Ganganagar	76.7 – 22.7
I	Kahiratya	1000 – 0
II	Icchanagar	360 – 60
II	Sissaya	193.6 – 48.6
II	Nunia	917.5 – 121.8
II	Dharampur	1300 – 159.2
II	Badura	580 – 73.5
II	Ladhouri,Chakra	945.5 – 163.7
II	Singhai	167.5 – 65
II	Banglaha	580 – 139.9
II	takiya	568 – 186.1
II	Mohammadpur	2350 – 132.3
II	Naurangabad	1142.9 – 209.2
II	Bathua	591.7 – 112.5
II	Murtiha	680 – 198.5
II	Bairia	1222.2 – 141.2
II	Lathua	1300 – 264.6
II	Majhra east	628.6 – 96.9

Table 4.43: Location of water source form the forest patches

Corridor	Location of forest patches	Water distance (m) – SE
I	Belapursua	255 – 48.8
I	Ragunagar	395 – 109.9
I	Kishunangra	200 – 64.5
I	Deepnagar	208.3 – 63.8
I	Ganganagar	183.3 – 10.2
I	Kahiratya	1000 – 0
II	Icchanagar	98 – 28.4
II	Sissaya	195.6 – 43.6
II	Nunia	350 – 49.6
II	Dharampur	258.33 – 55.4
II	Badura	430 – 70
II	Ladhouri,Chakra	663.6 – 43.2
II	Singhai	387.5 – 132.8
II	Banglaha	184 – 63.7
II	takiya	400 – 44.7
II	Mohammadpur	325 – 85.4
II	Naurangabad	307.2 – 64.1
II	Batua	395.8 – 113.2
II	Murtiha	880 – 251.8
II	Bairia	431.1 – 112.5
II	Lathua	758.3 – 205.9

Table 4.44: Location of forest patches from human settlement

Corridor	Location of Forest Patches	Habitation distance (m) – SE
I	Belapursua	587.5 – 104.3
I	Ragunagar	900 – 118.3
I	Kishunangra	1058.3 – 324.2
I	Deepnagar	358.3 – 73.5
I	Ganganagar	250 – 30.6
I	Kahiratya	3000
II	Icchanagar	590 – 145.3
II	Sissaya	2175 – 336.4
II	Nunia	890 – 83.6
II	Dharampur	1383.3 – 276.2
II	Badura	1110 – 245.2
II	Ladhour, Chakra	895.5 – 124.8
II	Singhai	2175 – 118.2
II	Banglaha	820 – 200.4
II	Takiya	1100 – 114.02
II	Mohammadpur	850 – 50
II	Naurangabad	1014.3 – 188.3
II	Batua	687.5 – 112.8
II	Murtiha	860 – 220.5
II	Bairia	600 – 110.55
II	Lathua	541.7 – 86
II	Majhra	1300 – 129.1

Habitat Restoration and Management inputs

5.1 Background

The first Forest Act was enacted in 1878 to control the massive ongoing clearing of forests for agriculture and to establish State control over the land, timber and other forest products, after a due settlement process by government officials to consider and take care of local needs for forest products. Thereafter, forests were classified as Reserve Forests, Protected forests and village forests with different levels of state control with reserved forests having the highest level of protection. It must be noted that, in most wooded districts, approximately twice as much area under reserved forest was left outside the government reserve forest, solely for the use of local communities, during the Forest Reservation Process. However, with increased human population, social failure to effectively implement land distribution schemes within the already cultivated area and to meet the needs of economic development, the forested lands both inside and outside the reserved forests area steadily being released by the State Governments for various other purposes under the powers vested in them. It is estimated that between 1951 and 1980, more than 45 lakh hectares of forestland has been diverted for various non-forestry activities, a vast majority of it being for agriculture. From 361 million people in 1951, the country's population has today crossed the one billion mark with more than 30% of the people still being landless. As against this, good forest cover has shrunk to less than 12% of the total land area as against 33% generally considered necessary to support ecological balance in an agriculture society. This huge loss of forest due to human encroachment has led to serious ecological damage .

5.2 Existing Problem

In response to the above crisis, the Hon'ble Supreme Court of India, in 1996, passed an interim order in WP 202/95- Godavarman Thriumalpad v/s Union of India & others, prohibiting all non-forestry activity on any forest land including thickly wooded areas irrespective of the legal status/ownership. Since then more than 1000 interlocutory applications have been filed in this landmark case on several related issues including the issue of encroachments. Directions have been issued to the

central government not to entertain any proposals from State government for regularization of encroachments. Further, all State governments have been directed to identify and evict encroacher in a time bound manner. The court has also directed the setting up of a statutory committee - Central Empowered Committee (CEC), which has now been done, to monitor and oversee the implementation of the orders and examine violations and report to the court.

While the efforts of the Hon ble Superime Court and CEC have been substantial and clearly necessary, the actual progress achieved on the ground in halting forest loss has been rather slow considering the enormity of the problem and due to a combination of poor enforcement of anti-encrochment laws based on local political and social considerations.

In addition to the above fundamental problems the following are some of the key on-ground issues:

- Extent of large scale encroachments and fragmentation (honeycombing)
- Poor demarcaton of forests on the ground and technologically outdated suvey methods
- Lack of proper computerized and geo-referenced modern land records that is accepted by all government department
- Complicated, site specific laws of land tenure and related issues
- Growing protest by poltically powerful forest encroachers, often projecting themselves as underprivileged landless people
- There is no coordination between forest department, police department and revenue department to solve these issues and make independent decisions..

All these make forest encroachment a complicated issue that requires solutions, which need to be carefully crafted to comprehensively solve the problem with a pragmatic approach without compromising on the objectives.

5.3 Approaches to Evolve Solutions

The first step at evolving a durable and pragmatic solution to this problem is to identify the most serious threats both in terms of the ecological and associated socio-political aspects. All PA s must be fully protected and there can be no regularization of encroachments in any PA. The second important parameter should be to reduce fragmentation and honeycombing in ecologically important tracts of forests, which are also crucial watersheds, and forests, which are contiguous with PAs forming large blocks of forested areas. This would entail use of GIS mapping techniques to prepare correct maps on which priority could be set. Thirdly, a careful analysis of the land tenure patterns wherever thickly wooded areas are classified as revenue lands in Government records and cultivation rights certificates have also been issued.

At another level, it would be absolutely necessary to make clear distinction on the kind of people who have encroached based on their social class and economic backwardness. As a first step here, it would be broadly accepted if eviction of economic and socially backward communities are not undertaken with precautions. The effort to evict socially backward encrochers then would lead to intervention from the minority commission, as has happened in some of the area around Dudhwa National Park.

The Karnataka Government order FEE 5 FGL 90, Bangalore, dated 05/05/1997 while dealing with pre 1978 encroachment has set some clear guidelines to categorize such people.

Some of the parameters are:

- Persons belonging to SC/ST Class
- Landless marginal farmer (a person who does not hold any land and whose income does not exceed Rs 8000/- per annum)
- Insufficient land holding (a person whose land holding of the encroached land does not exceed 3 acres). Additional parameters such as ownership of mechanized farm equipments, vehicles, telephones etc could also be added to filter out non-eligible encroachers and clearly identify only under privileged encroachers.

Further, the Karnataka State order does not permit any regularization of encroachments deep in the forest, steep slopes or in NP s / WLS. It states that such under privileged encrochers shall be relocated on the fringe of the forest and that lands so regularized shall not be sold during the persons life time. It is estimated that this category of truly underprivileged people would consititue less than 15% of the total encroachments. The need is to be provide a proper resettlement package and compensation funded by the Central Government, which would minimize a great deal of political resentment of the State Governments.

While dealing with the latter, politically powerful encroachers, should be levied fines which can be deposited as a fund to rehabilitate the socially under privileged encroacher and to consolidate boundries and development of forests.

Table 5.1: Status of encroachment and restoration in different years

	Area (ha)	Encroached area (ha)	Year of Restoration	Area of restoration (ha)
Anupnagar	96.15	96.15		
Icchanagar	233.78	-		
Indranagar	341.71	168.7	1997-98	168.70
Kadiya	10.83	-		
Kishunagar	208.66	54.5	2000-2001 2002-2003	10.00 10.00
Khairatya	440.4	392.82	1996-97	96.00
Ganganagar	27.75	19.34		
Gulria Pathar Sha	24.5	-		
Jasnagar	1.48	1.48		
Deepnagar	182.58	41.86	2001-2002	10.00
Naurangabad	168.42	8		
Pachpedi Richya	25.75	3.78		
Belaparsua	136.77	51.95		
Bathua	542	4		
Bairia	453.98	15.5		
Majhra east	775.38	-		
Moortiha	166.14	-		
Mohammadpur	178.05	-		
Raghnagar	244.46	105.8	1997-98	
Rannagar	398.69	381.4	1997-98	381.40
Suratnagar	301.02	240.66	2000-2001 2001-2002 2002-2003	20.00 5.00 20.00
Total	4958.5	1585.94	In 5 Years	721.10 (45.46%)

Source: Office of the Divisional Forest Officer, North Kheri (UP)

5.4 Restoration and management inputs in the encroached forestland

Considering the present scenario of forestland encroachment in the corridor areas 21 villages are situated near the forest patches and a total of 1585.94 ha forestland is encroached mostly by the farmers. Most of the farmers are well established with political backup. More than 100 cases are pending in different courts right from High Court to Supreme Court. In last 8 years (1996-2003) only 721.10 ha (45.46%) of encroached forestland have been restored back by using force. Unfortunately, in the villages like Indernagar (168.70 ha) and Rannagar (381.40 ha), a total of 550.10ha encroached forest land which was restored in 1997-98 is again encroached back by the farmers because revenue department intervened and showed different location of forest patches. This shows that in last 8 years only 171.00 hac of encroached forestland have been brought back for restoration, which is only 23.71 percent of the total of 1585.94 hac of encroached forestland. Once the encroached area is evacuated, standing crop if ripen then it is sold or villagers are allowed to harvest.

Next steps are to prepare land for sowing of plant species of local variety such as *Delbergia sisso* and *Accacia catcheu*. In some area only monoculture was adopted. In these areas either Dalbergia (Sissam) or Accacia (Khair) plant were sown. In restoring an area of 171.00 ha of encroached forestland cost wise a total of Rupees 34,20,00 (Rupees Thirty four lakh and twenty thousand or US \$ 69,795.91) was spent which includes soil work, 11 thousands sapling of plants per hectare and labour cost during the period of sowing.

The plant species, which are usually preferred by the forest department are not fast growing species and takes years to grow. During study visit to plantations showed that local villagers and farmers have either tried their best to remove the saplings or cut down and use it as fuelwood. Such areas are regularly used by the livestock as a grazing land. Main problem is to provide regular protection, which is lacking due to limited funds and manpower. In due course of time it is difficult to identify such evacuated land as they would turn into cropland. Taking into account that for the restoration work of an encroached area of 721.10 ha it will cost approximately Rupees 1,44,22,000 (Rupees one crore forty four lakh and twenty two thousands Rupees) which is equivalent to US\$ 2,94,326.53. This amount does not include the protection by the permanent forest staff and time-to-time laborer used for irrigation and replantation purposes. This amount is not available with the forest division for this purpose because of lack of allocation of funds from State and Central Government.

5.5 Proposed Action Plan

5.5.1 Corridors linking

Western Terai is currently having three isolated reintroduced rhino populations namely, Dudhwa NP, India, The Royal Bardia NP and Sukhlaphanta WLS, Nepal. Their survival depends on various co-related aspects. It is essential to have accessibility to more area and a free movement across the forested tract. This is only possible when corridors will be viable and will provide fearless, smooth passage to wild animals. Linking these populations will play an important role in future rhino conservation.

Today corridors between these parks are in highly degraded state and even abandoned by the wild animals. The corridors between Dudhwa National Park and Katarniaghat Wildlife Sanctuary are facing encroachment and various biotic pressures. Most of the area has been encroached for agriculture and settlements. The recovery of encroached forestland and rehabilitation within a time frame is essential to make these corridors viable. It has to be handled very carefully and with the involvement of revenue department, Police department and the local people. Ecodevelopment activity will help in reducing the various biotic pressures. At the same time protection of forest and habitat improvement through community involvement will be a great help.

Though Corridor No.1 between DNP and KWLS is highly degraded and have large area under encroachment, it will be easier to make it viable than the Corridor No.2. Corridor No.2 has complete gap at one place, an area of 6-7 km filled with agriculture land and settlements. Another problem in this corridor is of water logging in an area of 7 km width, due to backwater of dam and river Ghaghara, which separate it from Katarnighat WLS.

Corridor between Katarniaghat and Royal Bardia WLS is almost in the same condition. The only viable link, along the river Girwa is also under various human induced threats. Encroachments, habitat degradation, cattle grazing are common problems like everywhere, but poaching is the grave problem in this area. Another link through river Kauriala has large number of difficulties and is not being used. So attention should be given on the corridor along river Girwa for habitat improvement, protection and safer passage for wild animals.

Another important corridor link between Dudhwa National Park and Nepal forest is through Basanta Forest patch, which seems to be viable near Bela Persua forest area. In this particular area there is gap of approximately 500 - 1000 m, which has to be restored back on the Nepal side to make a contiguous Forest between Dudhwa Forest and Nepal Forest. This will help wild animals to move in both the areas but pressure of poaching in the Nepal side has to be checked.

Considering the present condition of encroachment its revival and restoration is difficult because of various reasons given in the earlier chapter. We have to accept that with the time man made corridor in term of patchy forested and grassland areas are replaced by sugar cane cultivation and Paddy cultivation which will provide cover and forage to the large mammals like tiger, elephant and rhino and also facilitate their migration from one PAs to another as per the evidences gathered. Migration of animals from one PA to another is a natural phenomenon and animals follow it traditional routes no matter human made obstruction comes across e.g. there is no corridor between Kishanpur Wildlife Sanctuary and Dudhwa NP, which also a satellite core of Dudhwa NP. Every year elephant herd pass through Kishanpur WLS by crossing Sharda River and crossing cultivated field to reach Dudhwa NP. Need is for proper patrolling by the forest staff and awareness among local people as to how to tackle the situation when wild animals passing through the neighboring area and precaution to be taken which at present is lacking. Unless until local inhabitant feel that wild animals area a part of this area and people started residing in this area came later than the wild animals living time immortal. It is also a responsibility to protect wild animals rather harass them. On this point till now no serious efforts has been made by the forest department as well as by the Non-Government Organizations working in these areas.

5.5.2 Habitat improvement and development of New Rhino Area

Habitat improvement work is very important to make the Programme successful. Search for new suitable habitat within the park and its proper management is essential. Bhadital area in Dudhwa National Park have better habitat for translocation of animals straying out the RRA and possibly from outside. On this line work is in progress and partial fencing around proposed area has been constructed. The present population in Dudhwa is increasing, which will require more area in future; hence the new suitable habitat is needed.

The 3800 ha. Area under Central State Farm in Katerniaghat WLS could be a viable habitat for large herbivore and for the migratory rhinos from Nepal. Rhinos from Nepal are currently living in the isolated island and a large number of local livestock graze in the same area. After the declaration of Katrniaghat WLS it needs protection and proper training of staff in the field of wildlife management. From both the areas

there is urgent need to remove teak and eucalyptus plantation from the grasslands and from prime wildlife habitat areas in systematic manner to improve the habitat and forage availability.

5.5.3 Anti poaching

Poaching is a serious threat everywhere in park area and in corridors. But in corridor, particularly between Katarniaghat and Royal Bardia the chances of animal being poached are very high. To curb the poaching Royal Bardia has already established an anti-poaching squad, which has shown fruitful result in recent years. On the same line Katarniaghat WLS and DNP authority should also develop strategies to curb the poaching in and around the park. To reduce the poaching pressure on international border and in corridor, the Katarniaghat and the Royal Bardia National Park authority should work in co-ordination with Nepalese authorities and other paramilitary forces working in this area.

5.5.4 Small population and inbreeding depression

The inbreeding problem in case of rhino in Dudhwa National Park is a serious threat from genetic point of view. In Dudhwa, there is only one adult male, mating with the females and all in new generation are his progeny. The new generation share gene, adopted from a single male. If they will interbreed, generation after generation there will be a chance of homogenization and threat of genetic viability and imbalance in sex ratio or number of abortion case will increase. So there is urgent need to introduce few males from different stock to save the future population from genetic disorders. In Katarniaghat the three animals are totally isolated from the mainstreams. As they came in the year 1989, and till today they are not in contact with other rhinos and are isolated sexually (sex of the two rhinos living in the same area are not confirmed). If this situation persists they will die without transferring their genes to the progeny.

5.5.5 Monitoring

5.5.5.1. Monitoring of animal is very important task for future. Animals should be monitored for their movement pattern, habitat utilization, breeding status and general health. A proper census should be conducted every year to know the demography.

Information should also be gathered on adult and calf mortality and the reason behind it.

5.5.5.2. Based on the estimation of population and sex ratio of the large mammals and the carrying capacity of a PA, decision has to be taken whether some of the individuals can be shifted in the neighboring PAs to increase the genetical variability. Other wise animals will disperse in the surrounding areas mainly cultivation and become problematic. There is also need of well-trained staff, which can immobilize wild animal and translocate animals from one area to another in a short period of time.

5.6 Revenue Generation

Any development activity in the PAs need adequate fund, which at present is lacking. In future all the PAs will have to generate its own revenue to cover the expenses. There is also need to modify the current policy that is revenue generated by the PA should be recycled back to the respected areas for different developmental activities.

5.6.1 Currently by ecotourism small amount is generated by the Parks but it is not adequate considering the actual need. On many occasions park personal have to face hardship. On this line all the policy makers have to consider and develop a common consensus and evolve a strategy to solve this problem.

Earlier under the silviculture working plan and the plantation work most of the grassland are as and prime habitat were planted with Teak, Eucalyptus and in some place poplars. Most of them have now reached full maturity and is also encroaching other prime habitat of wildlife. As per the order of Hon Supreme Court there should be no felling of trees and removal of any type of natural resources from National Park areas. In plantation areas there is no chance of forage availability for the wild animals and it is growing further in the neighboring areas. There is urgent need under habitat improvement to clear such areas by removing teak and eucalyptus in proper manner. Since teak provides best timber and is costly, it should be auctioned and revenue gained should be pooled and recycled back to the park for its developmental activities. From the interest alone generated enough funds can be generated for the developmental work of the park including the staff salaries.

5.6.2. Formation of Dudhwa welfare foundation is needed to look after the welfare of the forest staff which will provide assistance during emergency like immediate medical care, compensation if any for mortality taking place during antipoaching operation and fellowship for the deserving students. This foundation will also help in different developmental activities. The foundation should be allowed to accept funds and donations from India as well as from abroad for this the foundation will have to procure a certificate of Foreign Currency Regulation Act (FCRA) from Home Ministry and have to be a registered body under Societies Act. In Gir Wildlife Sanctuary & National Park, Gujarat State has already constituted such foundation and allowed them to accept donations in kind and funds from different funding agencies. Similar provision is also there in Madhya Pradesh.

5.7 Conservation issue and current threats

In the WWF-Asian Rhino action-planning workshop held in Ho Chi Minh City, Vietnam, Dec. 1-6, 1998, following immediate threats were identified for western Terai:

1. Habitat degradation- prime issue
2. Small population,
3. Poaching
4. Habitat conversion and
5. Conflicts.

In case of western terai, threats which were categorized, are not specifically applicable to all the Rhino conservation area eg. Corridor links between DNP and Katarniaghat and link between Katarnighat and Bardia. Problems, threats and its intensity vary in different places and are area specific. In case of Dudhwa National Park immediate threat or prime issue is the small population and inbreeding. Since only one adult male mated with all the female and now population has increased to 16. Before the implementation of Rhino Reintroduction in DNP experts decided to translocate at least 30 rhinos in five-year interval, but due to number of fact nothing has been done. Unless a male of fresh gene pool is translocated in future, genetical disorders, abortion cases can rise, which are not easy to trace out in tall grassland area of DNP and usually goes undetected. Still in DNP, 90 sq. km area of good

grassland, a prime rhino area exists with good forest cover. But on the other hand currently rhino population is enclosed in an area of 27 sq. km. of electric fence. Close to the southern boundary, approximately 3 km. touches the cultivated lands. As Rhino population will increase, electric fence will be a major issue whether the area has to be increased or how far rhino will be kept in electric fence. In case of removal of electric fence crop raiding by rhino will be a major conflict, as already crop raiding incidences by straying rhinos and elephants exists. Local people have already started complaining regarding the loss and large amount of compensation are given. There is also possibility of rhino getting poached once outside the fence.

In case of buffer zone and corridor link between Dudhwa NP and Katarniaghat WLS in past no effort was made to restore, more over it has degraded and encroached by migrated farmers from Punjab and also by local inhabitants and political buck up. So corridor has an unique problem and restoration of such link has to be done through the rehabilitation and evacuation of the encroach area systematically with the local understanding and is of multi dimensional and multi facultative efforts.

While in case of Katarniaghat WLS, in the past the area was under the territorial division and no effort was made for the improvement of habitat. In 1991, 35 swamp deers were seen in this area but now only few are reported (Sinha, S.P., per comm.). Poaching problem, grazing and excessive use of natural resources, encroachment, settlements around farmland are the major problems in the area. These threats have to be tackled individually. Poaching of Tiger, deer and trapping of migratory ducks were the major threat in the past. Newly formed Katarniaghat WLS has slowly recovered through its past but immediate attention has to be paid to train staff, proper infrastructure, fund facilities and the changes in staff mentality by deputing trained officers with wildlife background and priority to protect both habitat and wild animals.

In case of Bardia and the corridor link situation it is similar around Katarniaghat and the buffer. Main problem is human population and livestock population and limited forest in Nepal side. It is clear from the satellite imagery that forest cover towards the Bardia -Katarniaghat is limited except the catchments area of river Girwa. There is immediate need from Nepal side to restore the corridor and improve the habitat

and give enough protection. In these corridor tiger were sighted number of times but unfortunately one of the tigress and one male Rhino (collared) was poached in the corridor area across Katarniaghat WLS on the Nepal side

5.8 ASRSG meeting comments

IUCN/SSc-Asian Rhino Specialist Group (ASRSG) Regional meeting for India and Nepal was held in Kaziranga National Park, Assam from 21-27 February 1999. Delegates and members of ASRSG from India, Nepal, USA, Malaysia, Netherlands and UK took part in this meeting. In this meeting members agreed that priority should be primarily on the funding of Rhino Conservation for in-situ activities, reinforce anti-poaching, habitat management, its improvement and buffer zone management with proper planning to encourage ecodevelopment activities. To get more support at state level Government, ASRSG should have more interfaces. To strengthen the current inelegance system adequate funding should be arranged and provided to the rhino areas. Group reaffirms that rhino population should be a viable of minimally 2500 in at least 10 population of minimally 100 each and a meta-population of 5000 individual. Formations of a Technical management Advisory Group comprising representative from all major Rhino areas in India and Nepal. To get more recognition and support for Rhino conservation, ASRSG recommended that at Government level should establish a *Project Rhino* similar to other species like *Project Elephant* and *Tiger* . To make it further success in the rhino conservation in in-situ condition in the Nepal and India, member felt that at Government level in both the country with the help of international funding could make more efforts in this direction.

Behind the success story of rhino conservation in India and Nepal, goes to the effort made by the dedicated staff of rhino areas and their hard work. Individually members expressed great concern to provide proper facilities, their safety and by proper funding. Since staff can efficiently work in the adverse condition to save the rhinos for future generation.

Corridor Survey between The Katarniaghat Wildlife Sanctuary, India and The Royal Bardia National Park, Nepal

Katarniaghat Wildlife Sanctuary

The Katarniaghat Wildlife Sanctuary is situated in the Nanpara Tehsil of district Bahraich on the Indo-Nepal border and is a part of the Katarniaghat Wildlife Division. It lies between 28 06 N and 28 24 N latitudes and 81 02 E and 81 19 E longitudes. After the enactment of Wildlife (Protection) Act 1972. An area of 400.9 sq km area of the division was declared as Wildlife Sanctuary in 1976. However, the control of the forests of the sanctuary continued to remain with the territorial forest division (West Bahraich Forest Division). Finally in April 1997, the West Bahraich Forest Division was converted in to Wildlife Division and named as Katarniaghat Wildlife Division. The total area of the division is 551.64 sq km of which 400.9 sq km is sanctuary and rest are reserved forests.

There are six ranges in Katarniaghat Wildlife Division, of which four, Katarniaghat, Nishangarh, Dharmapur and Murthia are the part of sanctuary and remaining two, Motipur and Kakaraha are outside the sanctuary. The Katarniaghat wildlife sanctuary represents the Terai- Bhabhar biogeographic subdivision of the upper Gangetic Plains.

Vegetation

The vegetation of the Katarniaghat Sanctuary varies from dense moist terai Sal forests to large open grassland. The vegetation close to Girwa River and its tributaries is characterised by the presence of very dense canebrakes. According to the Champion and Seth's classification the forest of this area belong to the following forest types

- Northern Moist Deciduous Sal Forests
- Northern Dry Plains Sal Forests
- Northern Dry Deciduous Mixed Forests
- Tropical Seasonal Swamp Forest

- Low Alluvial Savannah
- Moist Sal Savannah Forests

There are 95 species of trees, 57 shrubs and small trees, 28 species of grasses in Katarniaghat WLS. The main tree species are *Shorea robusta*, *Terminalia tomentosa*, *Dalbergia sissoo*, *Acacia catachu*, *Syzygium cumini*, *Scioichera oleosa*, *Bombex cieba*, *Adina cardifolia*, *Aegle marmelos* etc. The main grass species are *Saccharum spontaneum*, *Saccharum munja*, *Bahrichola intermedia* etc.

Fauna

The faunal diversity of sanctuary is very high. The Girwa river, being a large snow fed river adds greatly to the faunal diversity of the area. About 40 species of mammals are found in this sanctuary. Tiger and Leopard are the important carnivores of the area. The other carnivores are Jungle Cat, Fishing Cat, Leopard Cat, Ratel, Jackal, Indian Fox, and Palm Civet. Area has five species of Deer namely Chital, Hog Deer, Sambar, Barking deer and the highly endangered, Swamp Deer. There may be strong possibility of existence of endangered *Caprolagus hispidus* and *Huberopsis bengalensis*. The area has a small population of black buck and Nilgai also.

According to the wildlife census held in May 1997 there are 37 Tiger, 6 Leopard, 5341 chital, 77 Swamp Deer, 185 Sambar, 212 Hog deer, 281 Barking Deer, 12 Black Buck.

Due to reservoir and joining places of several rivers many areas remains water logged throughout the year and attracts large number of migratory waterfowl and other water birds. There are approximately 300 birds species in this area. There are at least 100 species of fishes found in river Girwa. Gangatic Dolphins, Ghariyal, Muggar and smooth Indian Otter are the other aquatic members in Katarniaghat.

Hydrology

Kauriyala and Girwa are two major rivers, which flow through the sanctuary area. The river Kauriyala flow on the northern boundary of Katarniaghat range. River Girwa flows through the Katarniaghat range from east to west and split it in to two

equal parts. The two rivers join at a point outside the park about 2 kms upstream of Girjapur Barrage. Thereafter the river is known as the Ghaghara. The Barrage has a great impact on the surrounding vegetation in KWLS. Mailanala and Gandhela nala are two tributaries of river Girwa. There are few other nalas, which finally joins to either one of the two major rivers of the area.

Landuse

There are two major landuse in and around Katarniaghat WLS, Forestry and agriculture. Agriculture is the main occupation but people are also dependent on forest for their various needs. The average land holding is very small (0.66 ha.). Many people are landless, either cultivate the land of other farmers or work as agricultural labourers.

The agricultural pattern in the area close to Kheri district is very similar to the agricultural pattern around DNP and Corridors forests. But agricultural pattern inside the park and towards the Nepal border is slightly different. Here area under paddy (27.8%) cultivation is higher than the others (Table 2.6). The other major crops are Rai (22.24%), wheat (14.83%), Maize (13.9%) and Turmeric (11.59%) (Table 2.6). Area under sugarcane cultivation is very less and only restricted to few area southwestern side of the park.

The time for sowing and harvesting of different crop is similar to the area around corridors between DNP and KWLS.

Rhino in Katarniaghat

Katarniaghat WLS has three rhinos, dispersed from the Royal Bardia National Park, Nepal in 1989. These rhino inhabit the island on the river Girwa and also the swampy areas close to it. Their movement is only restricted to Katarniaghat range of Katarniaghat WLS. Out of these three rhinos two moves in the northern half of the Katarniaghat range, areas north to the river Girwa. They moves in Bharthapur beli and adjoining area under compartment No. 1C and 1A of beat No. 1, Badi beli and chotti beli under compartment 4A of Sadar beat and compartment No 1 B of beat No 1. From compartment No 1A they goes to compartment No 2A and to compartment No 2B. They some times even go to Bharthapur village and do crop raiding during

rainy season. The movement records collected from forest department, of the period between Sep 97 to Feb 99, reveals that the movement of these two rhino is more in Compartment No 1C, 1A and 4A (53 % of locations) of beat No 1 and sadar beat than the compartment No 2A and 2B (44.7% of locations) of beat No 2 (Table 2.7).

Table: Movement of Rhino in Katarniaghat range of Katarniaghat WLS.

Location of 2 Rhinos staying north to river Girwa			Location of 1 Rhino south staying south to river Girwa	
Compartment	Locations	%	Compartment	Locations
1C+1A+4C	117	53.92	6B+6A	72
2A+2B	97	44.20		
5B	3	1.38		
Total	217	100		

The major portion of 1A, 1B, 1C and 4A compartments are covered by grasslands and swampy with woodlands very few. 2A and 2B compartments of beat No2 have dense mixed forests with dense cane breaks.

Another one rhino stay in Sissam beli (compartment 6B), an island in the river Girwa in the eastern portion of Katarniaghat range close to Indo-Nepal border. His movement is confined to the southern side of the river Girwa. Sissam beli is situated in block 6B of Bichia beat of Katarniaghat range. This rhino moves in the area of compartment 6B and 6A of katarniaghat and the adjoining area of Nepal near Dhanora Tal. During paddy and wheat crop season he also do crop raiding in Amba bardia and other nearby villages of Katarniaghat range close to sissam beli. Sissam beli has mixed forest dominated by *Dalbergia sissoo*.

The area near 6B and 6A is on the corridor route of rhino from Nepal. River Girwa enters the parks near Compartment No 6B. Rhinos, elephants and some times use river Girwa and forest patches along it from royal Bardia to katarniaghat by tigers as corridor while movement from one park to other. During rainy season both elephants and rhinos from Bardia use to come to Katarniaghat or nearby areas and do crop

raiding in Amba Bardia or other villages. Some stray movements of rhino from Bardia to Dharmapur range through Nishangarha range has been recorded.

Potential habitat for Rhino

Approximately 3814.2 ha area in the heart of sanctuary is under Central State Farm, which was given on lease during 1975-77. Out of this total, 3300 ha, areas are of compartment No 1B and 2B of Dharmapur block under Nishangarha range and rest other are part of compartment No 5A and 4A of Bichia and Sadar beat under Katarniaghat range. The area close to state farm in Katarniaghat range is grassland and swampy.

The area of central state farm, falling under Dharmapur block of Nishangarha range could be a unique habitat for the rhino. The southwestern portions of the farm are marshy and have water logged throughout the year. The other area is grassland with large number of palatable species. The portion where the agricultural activity is going on, grasses come out very fastly even after exposure of more than 25 years of continuous cultivation. The whole area is basically a grassland and very fertile and a good habitat for rhino.

The area under Central State Farm was given for 25 years of lease, going to end in the year 2000-2004. Forest department should now take back the whole area for further habitat development.

Immediate threat

There are many human induced threats for Rhino and other wildlife including flora and fauna. These are as follows

Poaching

Approximately 30 km of eastern and northern boundary of park share boundary with Nepal, across which free movement is permitted. Several people across the border are involved in gang poaching of various wild animals. They even penetrate the area and come inside the park for poaching. On the other side of the border there is no forest and due to involvement of the Nepal's army in to forest management, now

people has concentrated themselves for illegal activity on Indian side. As there is no restriction on movement they are taking advantage of it.

Except these lots of people residing inside or on the fringe of park in the Indian side are also involved in poaching activity. Few records of poaching by farm staffs have been also recorded. Though, poaching cases is now going down due to effort taken by park staffs, it is essential to curb it completely.

Timber felling

Large number of people from Nepal is involved in felling of trees from park. These people take advantage of the International border and free mobility across it and extract timber from sanctuary area. As these people are totally dependent on Indian forest for their requirements this become a grave problem for the park. Large-scale unemployment and poverty are major drawbacks, which is fuelling these activities.

People inside the park are also involved in large scale of timber extraction. It has been observed during our study period in Katarniaghat area, the Range Officer of Katarniaghat captured two truck full of illegal timber from the Nishangarha Range Forest.

Cattle grazing

There are 9 villages inside the park and many more on the fringe from both Indian and Nepal side. The cattle from these villages graze inside the park area and are fully dependent on it. The most important thing is that the cattle density in the area is very high and most of them are either dry or non-working. Grazing was officially permitted inside park up to 1991 on nominal payment basis. Even though grazing was banned subsequently; it has continued, as the staff of the P.A. has made no particular effort to stop it.

Crop depredation

Crop damage in and around the park area is general problem for people. The animals involved in crop depredation are Elephants, Rhinos, Chital, Wild Boar and Nilgai (Table 2.6). Crop depredation cases by elephants, Chital and Wild Boar is *very high* as compares to others. Elephants are responsible for paddy crop damage

during rainy season. Elephants enter from Royal Bardia during rainy season. At present there are three elephants in the park area. Rhino from park and from Royal Bardia are also involved in crop depredation but in very small scale.

Pressure due to Central State Farm

Large amount of pesticide and fertilizer use in farm is a great threat to the park. These are also going to the water system through runoff and can badly affect the aquatic animals and water birds for which park is famous. Except these the use of large amount of crackers to deter the wild herbivores from crop raiding is also dangerous practice.

There are lots of other problems in the park. Fuel wood collections, grass cutting from park area are the other biotic problems and a threat to the park. The Dam on river Ghaghara has also severely damaged the park and still a big threat for it. During monsoon large area of forests come under water, which affect the vegetation. It is also a big hurdle in corridor route from KWLS to DNP.

Royal Bardia National Park

The Royal Bardia National Park is located in the southwestern terai of Nepal between 28 15 to 28 40 N and 80 10 to 80 50 E. The Park contains almost half of the Bardia District (968 sq km). It has a core area of 968 sq km and buffer area of 327 sq km. It was established in 1969 as a Royal Hunting Reserve. Later in 1976, it declared as Royal Karnali Reserve with an area of 348 sq km. It was renamed as Royal Bardia Wildlife Reserve in the year 1982 and was extended to include the Babai River Valley in 1984. It was declared as National Park in 1989.

The river Girwa, a branch of river Karnali (in India called it as Kauriala) forms the western boundary of the Park and the crest of the Churia Range (Siwalik Hills) demarcates the northern limits. Physiographically the park has following distinct regions—Siwalik, Bhabar area. The alluvial flat land and the riverine floodplains.

Vegetation

According to Champion and Seth's (1968) classification forest of Bardia belong to "Moist Semi-deciduous Forests" in the Bhabar. Dinerstein (1979a) classified the

vegetation in to six major vegetation type, which latter modified to seven by Jnawali and Wegge (1993). These include four main forest types along with three type of grassland.

- Sal Forests
- Khair-sissoo Forests
- Moist Riverine Forests
- Mixed hardwood Forests
- Wooded Grassland
- Phanta, and
- Floodplain Grassland

Area under sal forest has higher percentage than the others (Ghimire, 1997) (Table 2.8). The Khaire-sissoo forest is composed of *Dalbergia sissoo* with *Acacia catechu* as associate. A moist riverine forest has species like *Syzigium cumini*, *Ficus racemosa*, *Mallotus philippinensis*. In mixed hardwood *Garuga pinnata*, *Bombax ceiba*, *Adina cordifolia* and *Mitragyna parviflora* are the main species. Open grassland is called Phanta. *Imperata cylindrica*, *Saccharum spontaneum* and *Vetiveria zizanioides* are common species in these grasslands.

Fauna

The park shelters some of the world's most endangered species. There are at least 39 mammalian species and approximately 400 bird species. Tiger, Leopard, Sloth bear, Elephant, Rhino, Swamp Deer, Spotted Deer, Hog Deer, Barking Deer, Sambar, Wild boar and Nilgai are the main large mammalian species.

Among aquatic fauna Mugger (*Crocodylus palustris*), River Dolphin, Gharial crocodile (*Gavialis gangeticus*), Otter (*Lutra perspicillata*), turtles etc. are important species.

Climate and Hydrology

The climate is sub-tropical. The area has three distinct seasons, Dry (from Feb to mid June), Monsoon (mid June to late September) and Winter (from late September to January). The mean annual precipitation is 1200mm to 1800 (Ghimire, 1997).

The dry season is hot and temperature reaches up to 40°C and during winter season the temperature drops down to 4-5°C.

There are two major river namely, Karnali and Babai which form the water system of the area. The river Girwa, an eastern branch of river Karnali forms the western boundary of the park. It is the habitat of the last possible viable population of Gangetic dolphin (*Platanista gangetica*) in Nepal.

People

There are 17 villages in the buffer zone of park. The total human populations of these villages are more than 90 thousand. The population density of buffer zone is 249.86 person/sq. Km., higher than the population density in the terai region of mid far Western region (only 118 person/sq. Km.) (Ghimire, 1997) and also higher than the whole terai region of Nepal (almost 221 persons/sq. Km.).

Tharu is the main tribe of the area. Economy of the area is totally agriculture based and 90 percent people are dependent on it. Rest 10 percent people work as labourer in sector other than agriculture or are involved in trade.

Landuse Pattern

A recent study of Central Department of Geology, Tribhuvan University, Kirtipur, Kathmandu (Ghimire, 1997), on the landuse pattern of the Royal Bardia National park through remote sensing shows that, the area under forest in core zone is more than 92 %, though it is only 49.42 % in the buffer zone (Table 2.8). There is no agricultural land in the core zone but in buffer zone 41.48 % area are under cultivation.

Forest and agriculture is the main landuse. Most of the farmers have small land holding. Large numbers of people are land less, work as labourers.

Paddy is the major crop of the area. Wheat, maize, mussoore, mustered and sugar cane are the other important crop of the area.

Rhino reintroduction in Royal Bardia National Park

To safe guard the species against natural calamities and to establish a new viable breeding population, a small sub-population based on individuals translocated from Chitwan was established in the Royal Bardia National Park (Jnawali and Wegge, 1993). The first batch of 13 rhinos was introduced in the year 1986 (Mishra and Dinerstein, 1987). After a gap of few years again in 1991, 25 rhinos were reintroduced in the same area. The rhino were introduced in the flood plains of river Karnali and in Babai river valley. So total 38 rhino were introduced in park among them 10 were male and 28 adult female. Today the total population of rhino in Bardia is 50 animals. The mean annual rate of increment is 2.43 %.

Till today 29 calves born in Royal Bardia, out of which only 21 could survived rest 8 died (Table 2.9), hence survival rate of calf is 72.41 %. Since 1986, 13 adult deaths have been recorded, out of which 9 or 69.23 % (5 male and 4 female) occurred due to poaching and rest 4 or 30.77 (3 male and 1 female) due to natural death (Table 2.9).

Between 1986 to March 2001, a total of 63 rhinos were translocated from Chitwan NP to Bardia WLS and 6 rhinos to Sukhla Phanta WLS.

This year again 4 adult males are introduced in the park. In 1989 three rhinos from Royal Bardia dispersed to the Katarniaghat Wildlife sanctuary, India and became permanent member of this park. They never return to Bardia.

The rhino in Bardia moves in flood plain of River Karnali and in Babai River Valley area. But during rainy season they some time comes near Katarniaghat WLS along River Girwa and also enter the park area or cultivation land close to it. Such crop raiding cases in Ambia Bardia village of Katarniaghat has been recorded several times.

Major threat to park and Rhino

Poaching

Poaching is a big problem for Rhino and for park's other animal also. Since 1986, from the date of introduction of 63 rhinos, poachers have killed 9 rhino. Organised

way of poaching cases has been recorded from the park. The moment when rhino goes outside of park in open area or in cropland they are in the high risk of being poached, particularly when they go towards the Indo-Nepal border.

Now the park authority has established two anti-poaching groups with the help of WWF. The anti-poaching group is headed by a Park Ranger and comprises of one senior game Scot along with four games Scot and three field level informer. Nepal army is also helping the park authority in cubing poaching. Since the establishment of anti-poaching group the poaching cases has been came down.

Biotic pressures

The buffer zone of park and other area around park has large number of human population. Particularly in the buffer zone there are more than 90 thousand people are residing. The people are fully dependent on park for their fuel wood requirement, cattle grazing and for other purposes. The total livestock population in the buffer zone is 142825 and its population density is 265.60 cattle/sq. Km. Cattle s are dependent on grazing inside the park, which is exerting large amount of pressure.

Except this many people are also involved in illegal felling of timber. There are many more other management problems related to the human dimension around park.

Corridor between Katarniaghat WLS and Royal Bardia NP

Important Corridors

The main corridor (Corridor-G) between Bardia and Katarniaghat are along the Girwa River (Fig 2 & Fig 4). The rhino entry takes place through this route only. They generally enter in Katarniaghat WLS from this route either near Dhanora Tal area, slightly southeast of river Girwa or near Ambia Bardia village. Some times rhino also enter near Maila nala area, on the north to river Girwa travelling through this route only. Elephants and tiger also use the same route while coming from Royal Bardia. From this route entry takes place in block 2B, 6B and 6A area of Katarniaghat range on the eastern boundary.

The second corridor (Corridor-K) link is through Kauriala River on the norther tip of the sanctuary. But this corridor is not in use by Rhino. Even elephant does not use

it frequently. This corridor is completely open at several places and is under encroachment.

The corridor along the Girwa River is still a viable corridor and it needs attention for habitat improvement.

Status of Corridor

The forest along this corridor (corridor-G) is very narrow sometimes only 1.5 to 2 km wide. The vegetation in this corridor is of Sal, mixed forest and riverine forest. As this corridor forest is linked with Bardia and KWLS, it is a seltor of various types of ungulates. There are various types of human pressure along the corridor. The forest towards the Nepal side has been cleared by the people and converted in to the cultivation land. The settlers in the transborder are mainly retired army personals of Nepal, who has completely destroyed the forest at almost all places along the border. Large number of human habitations is there in corridor areas. Livestock grazing, encroachments are the major threat to the corridor. Among the other threats, illegal timber cutting, firewood collection, fodder extraction are important.

The second corridor (Corridor-K) along the Kauriala river is in more degraded condition. The other problem with this corridor is that to follow this route the rhino has to cross the Girwa River in the Royal Bardia and they have to also cross the open croplands. That's why they do not take risk and they do not come easily.

The agriculture is the main landuse in the corridor area. Paddy is the major crop of the area. The other crops are wheat, maize, mustered etc.

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