BIODIVERSITY STATUS OF PROPOSED RIICO INDUSTRIAL AREA, NEAR GOGALAO CONSERVATION RESERVE, NAGAUR

PROJECT LOCATION

RIICO INDUSTRIAL AREA, GOGALAO CONSERVATION RESERVE AT NAGAUR

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1. ABOUT NAGAUR DISTRICT

Glorified by the bards, the history of Nagaur finds mention even in the Mahabharata. The kingdom of Ahichhatrapur which Arjun is said to have conquered and subsequently offered to his Guru Dronacharya, was perhaps some of the area of the Nagaur district. The birth place of Meera and Abdul Fazal, Nagaur district has a charbhuja and Parsawanath Temple at Merta and the Dargah of Sufi Saint Tarkin at Nagaur City. Nagaur also witnessed the valour of Great Rao Amar Singh Rathor who challenged the mighty Mughal empire. The large old fort has many glorious tales of bravery of the erstwhile rulers of the states.

Nagaur District is situated between 26^0. 25" & 27^0.40" North latitude & 73^0.10" & 75.15" East Longitude. It is situated amidst seven districts namely Bikaner, Churu, Sikar, Jaipur, Ajmer, Pali, Jodhpur. Nagaur is the fifth largest district in Rajasthan with a vast terrain spreading over 17,718 sq. K.M. its geographical spread is a good combine of plain, hills, sand mounds & as much it is a part of the great Indian Thar Desert.

The present district of Nagaur finds a place in the heart of the Rajasthan state. If we draw a cross over the map of Rajasthan the centre of this cross is bound to fall in the district of Nagaur. Before the merger of the states, Nagaur was a part of the erstwhile Jodhpur State.

After independence, Nagaur had the honour of being selected as the place in the country from where the Democratic Decentralisation process was launched by the late Shri Jawaharlal Nehru, the first Prime Minister of India on the 2nd October 1959.

The town of Ladnu in the district has gained its place on the map of the country being the headquarters of the famous 'Jain Vishwa Bharti' which has become a centre of spiritual learnings & knowledge under the leadership of

Acharya Tulsi, a great Jain saint, who has propagated the philosophy of " ANUVRAT" in order to enlighten people in this area of the country.

2. FOREST DIVISION, NAGAUR

There are Seven Ranges in forest division Nagaur, whose jurisdiction is as given below:

1. Nagaur
2. Ladnun
3. Didwana
4. Jayal
5. Kuchaman
6. Parbatsar
7. Merta

BIODIVERSITY STUDY

Biodiversity Study is a non – renewable resource. We cannot recreate a species if it is extinct. So biological/ ecological impact assessment is an integral and important component of environmental impact assessment (EIA). Baseline information/ data on the flora and fauna of the particular area is important form for inferring the impact of a proposed project. The ultimate aim of an ecological assessment is to avoid or minimize the impacts of a proposed development. They are therefore related to the aim of Nature conservation which, in broad terms, is to maintain and where possible increase, biodiversity.

Environment impact assessments have become an integral part of development projects in India ever since 1994, to formulate policies and guidelines for environmentally sound economic development. Proper assessment of biological environment and compilation of its taxonomical data is essential for the impact predication. The present work describes a present status of floral and faunal components occur within the study area (10 km radius from the boundary of the proposed project) and also identification of threatened/ rate species if any. The present work also envisaged to assess the likely impacts of project activities and streamline the recommendations to assist minimizing the impact on biodiversity.

PERIOD OF THE STUDY AND STUDY AREA

Baseline study, for the assessment of the floral and faunal biodiversity of the terrestrial environment of the study area, with in 10 km radius from the boundary of the porposed retail outlet has been conducted during April 2016.

The road project of rehabilitation of RIICO Industrial Area, Gogalao Conservation Reserve At Nagaur

Total reas 14.14 ha. Revenue land 12.56 ha. Forest land 1.53 forest area has a varied habitat having diversified fauna and flora and the important faunal species include Hyena, Jackal, Civet, Wild boar, Cheetal, and Crocodile and the sanctuary has tropical dry deciduous forest and the important tree species include Anogeissus pendula, Mitragyna parviflora Boswellia serrate, Acacia catechu, A. leucophioea etc.

METHODOLOGY ADOPTED FOR BIODIVERSITY STUDY

The main objective of survey woa to describe the floral inventory were selected of the project study area. The sampling plots for floral inventory were selected randomly in the covering various habitats within the 10 km radius of the proposed retail outlet. Desktop literature review was also conducted to identify the representative spectrum of threatened species, population and ecological communities listed by IUCN, WCME, ZSI, BSI and Indian wild life protection act, 1972.

The objectives of the present study were as follows :-

1. To identify the floral and faunal diversity.
2. To identify the endangered species of flora and fauna, if any
3. To prepare conservation plan for Schedule I, if any
4. To mark eco- sensitive areas in the study area, if any

FLORAL STATUS

Floral status was assessed in different habitat types of the study area. Quantitative data was collected using standard methods of Circular plot method followed by Mueller- Dombois and Ellenberg 1967, Kershaw ,1973. Status of tree, shrub, was quantified using circular plots of sizes of 10m radius. Annuals like herbs and grass were quantified within 1 x 1 plots (grass, herbs and others) plotted randomly within the every circular sample plots.

FAUNAL STATUS

Herpetofauna : Sttus of herpetofauna was assessed using intensive time constrained search method covering different micro habitats (Welsh, 1987) within the sample plots.

Birds : Avifaunal status was assessed both in terrestrial and aquatic habitats. Total count or folck count method was adopted to assess the status of aquatic birds (Sridharan, 1989 and Bhupathy, 1991). Point count method was used to

Assess the status of terrestrial birds (Bibby et al., 1992 and Hutto et. Al 1986) at every sample points, covering 30 m radius plots.

Mammals: status and distribution of different mammal species was quantified using, direct count along the line transect (Burnham et. Al. 1980) and indirect evidences within the circular plots of 15 m radius (Rodgers 1991, sale and Berkmuller 1988). Indirect evidences like, pellet, Dung, tracks and other signs were enumerated within the 15 m. radius plots for nocturnal species (Daniels, 1992)

Presence of different faunal species was also confirmed by interviewing the local people with pectoral colored field guide.

DATA ANASYSIS

Calculations for various parameters have been performed to understand phytosociology of in and around of the proposed retail outlet project. Following formulas were used to perform various statistical calculations,

The data collected in the field was analyzed for secondary parameters such as density, frequency and abundance following standard phyto- sociological methods, Shannon, Wiener diversity index (Shannon and Wiener, 1963) was calculated for all life forms as follows :-

Estimation of phyto- sociological parameters

1. Frequency (%) = (No. of quafrats of occurrence of the species x 100)/ Total No. of quadrats sampled
2. Density = Total No. of individuals of the species/ Total No. of quadrats sampled
3. Abundance = Total No. of individuals of the species / No. of quadrats of occurrence
4. Relative Frequency = (Frequency of the given species X 100) / Sum of all frequencies
5. Relative density = (Density of the given species X100) / Sum of all densities
6. Relative abundance = (Abundance of Species X 100 / Sum of all abundances
7. Basal Area = (GBH)2 / 4
8. Dominance = Total basal Area / Total area sampled
9. Relative Dominance = Dominance of given species X 100) / Dominance of all species
10. Important value Index (I.V.I.) = Relative Density + Relative Frequency + Relative Dominance

Note: Density refers to the number of individuals per unit area of a site.

STATISTICAL ANALYSIS

Shannon- Wiener diversity index (Shannon and Wiener, 1963) was calculated for all life forms following :-

Shannon- Wiener Information function : $D = \sum pi \ In \ pi$

Where : I = an index for the number of species sampled, $p_i = n_i / N$= percentage of species I in the entire sample (N) of individuals, and In- natural log. Multiply

the percentage (or proportion) of each species in the sample times the natural log of that same value, sum the products across all species, and then multiply by minus 1.

HABITATS OF STUDY AREA

Project area includes various habitats like Forest and Agriculture. Landscape of the region is mainly dominated by agricultural fields, except for part of Wildlife Sanctuary.

Biodiversity of the Study Area

Road widening part (Core Zone – CZ)

The diversion part encompasses mix vegetation, mainly dominated by the porsopis juliflora and other common herb, shrub and grass species. 5 species shrub, 12 species of herb and 3 species of grass were recorded in the core zone during the field survey. The dominant species among the shrubs was Vilayati Babool (Prosopis juliflora) and Kantkeri (Solanum xanthocarpum) was the dominant herb. Details are given in the following table.

Flora reported from the Core Zone (RIICO Industrial Area , Nagaur)			
S.No.	Common Name	Species name	Family

No trees species observed at the core zone (Area of proposed BPCL outlet)

SHRUBS

1.	Aak	Calotropis gigantean	Asclepiadaceae
2.	Vilayati Babool	Prosopis juliflora	Fabaceae
3.	Dhatura	Datura stramonium	Solanaceae
4.	Raimunia	Lantana camara	Verbenaceae

5.	Tarwar	Cassia auriculata	Fabaceae Sub. Caesalpinioideae
6.	Began Belia	Bougainvillea spectavilis	Nyctagineceae
7.	Dhamasa	Tephrosia purpurea	Papilionaceae
8.	Bair	Zizyphus Nummularia	Rhammaceae

HERBS

1.	Latjeera	Achyranthes aspera	Amaranthaceae
2.	Jangli Chaulai	Amaranthus Spinosus	Amaranthaceae
3.	Satyanasi	Argemone Mexicana	Papaveraceae
4.	Aak	Calotropis prosera	Asclepiadaceae
5.	Doob Ghas	Cynodon dactylon	Poaceae
6.	Oontkata	Echinops echinatus	Asteraceae
7.	Badi Dudhi	Euphorbia hirta	Euphorbiaceae
8.	Van gobi, Jangali gobi	Launaea procumbens	Asteraceae
9.	Gajar Ghas	Parthenium hysterophorus	Asteraceae (Composite)
10.	Kantkeri	Solanum Xanthocarpum	Solanaceae`
11.	Sarphonka	Tephrosia purpurea	Fabaceae
12.	Gokhru	Tribulus terrestris	Zygophyllaceae

GRASS

1.	Doob ghas	Cynodon dactylon	Poaceae
2.	Sheda Grass	Dichanthium annulatum	Poaceae
3.	Makra	Dactyloctenium aegyptium	Poaceae

Total of 12 herb species belonging to 10 families were recorded in the porposed study area during the survey, Asteraceae, having 03 species was the largest family. Herb species commonly seen in the study area were solanum xanthocarpum, Tephrosia purpurea, (38.15) parthenium hysterophorus, Euphorbia hirta, and Cynodon dactylon. The highest IVI for herb at study area was recorded for cynodon dactylon (48.25), Tephrosia purpurea, (38.15), parthenium hysterophorus (30.65) Solanum xanthocarpum (29.72) and Amaranthus spinosus (27.41), Shannon – Wiener diversity index (H) for herb and grass was 2.39.

Phyto- Sociology of Core Zone - RIICO Industrial Area , Nagaur (Herbs)										
Vernacular name	Scientific Name	#	@	F	D	A	RF	RD	RA	IVI
Latjeera	Achyranthes aspera	4	2	50	1.5	3.00	6.67	6.12	7.71	20.50
Jungli Chaulai	Amaranthus Spinosus	4	2	50	2.25	4.50	6.67	9.18	11.56	27.41
Satyanasi	Argemone Mexicana	4	3	75	1.75	2.33	10.0	7.14	6.00	23.14
Aak	Calotropis prosera	4	4	100	1	1.00	13.33	4.08	2.57	19.98
Doob Ghas	Cynodon dactylon	4	4	100	5.25	5.25	13.33	21.43	13.49	48.25
Oontkata	Echinops echinatus	4	1	25	0.75	3.00	3.33	3.06	7.71	14.10
Badi Dudhi	Euphorbia hirta	4	2	50	1.25	2.50	6.67	5.10	6.42	18.19
Jangli	Launaea	4	1	25	0.5	2.00	3.33	2.04	5.14	10.51

gobi	procumbens									
Gajar Ghas	Partheniu m hysteropho rus	4	3	75	2.75	3.67	10.0	11.22	9.42	30.65
Kantkeri	Solanum xanthocarpum	4	2	50	2.5	5.00	6.67	10.2	12.85	29.72
Sarphonka	Tephrosia purpurea	4	3	75	3.75	5.00	10.0	15.3	12.85	38.15
Gokhru	Tribulus terrestris	4	3	75	1.25	1.67	10.00	5.10	4.28	19.38
		48	0	750	24.5	38.92	100.00	100.00	100.00	300.00

Total No of quadrate studied, (@ : Total no of quadrate in which species occurred, F: Frequency (%), D: Density , A: Abundance, RF: Relative Frequency, RD: Relative Density, RA: Relative Abundance, IVI: Important value Index

Phyto- sociology of core Zone - (**RIICO Industrial Area, Near Gogalao Conservation Reserve At Nagaur**											
Vernacular Name	Scientific Name	#	@	Total No of individual	F	D	A	RF	RD	RA	IVI
Aak	Calotropis procera	4	3	7	75	1.75	2.33	25.00	18.42	14.51	57.93
Vilayati Babool	Prosopis juliflora	4	4	11	100		2.75	33.33	28.95	17.10	79.38
Dhatura	Datura Stramonium	4	2	7	50	1.75	3.50	16.67	18.42	21.77	56.85
Raimunia	Lantana camara	4	2	11	50	2.75	5.50	16.67	28.95	34.20	79.82
Tarwar	Cassia auriculata	4	1	2	25	0.5	2.00	8.33	5.26	12.44	26.03
					300	9.50	16.08	100.00	100.00	100.00	300.00
#: Total No of quadrate studied, @:total no of quadrate in which species occurred, F: Frequency (%),D: Density , A: Abundance, RF: Relative Frequency, RD: Relative Density, RA: Relative Abundance, IVI: Important value Index											

Total of 05 shrub species belonging to 05 families were recorded in the core zone RIICO Industrial Area , Nagaur during the survey. Shrub species commonly seen in the study area were Lantana camara, prosopis juliflora, Calotropis procera and Cassia auriculata. The highest IVI for shrub at study area was recorded for lantana Camara (79.82), followed by prosopis juliflora (79.38), calotropis procera (57.93) and Datura stramonium (56.85), Shannon- Wiener diversity index (H) for shrub was 1.54.

BUFFER ZONE

HERB & GRASSES

Total of 39 herb and grass species were recorded in the proposed study area during the survey. Herb species commonly seen in the study area (10 km radius from the boundary of the proposed Rehabilitation of **RIICO Industrial Area, Gogalao Conservation Reserve At Nagaur** were Euphorbia hirta, Amaranthus spinosus, Tephrosia purpurea and Achyranthes aspera. The highest IVI for herb at study area was recorded for Euphorbia hirta (12.65), Amaranthus spinosus (11.05), followed by Tridax procumbens (10.89) and Achranthes aspera (10.88), Shannon- Wiener diversity index (H) for herb and grass was 2.96

Important value Index (IVI) for herb and grass species in the buffer zone									
Scientific name	#	@	F	D	A	RF	RD	RA	IVI
Acalypha indica	51	73	72.86	1.04	1.43	5.00	3.48	1.72	10.20
Achyranthes aspera	25	88	35.71	1.26	3.52	2.45	4.20	4.24	10.88
Adiantum raddianum	12	26	17.14	0.37	2.17	1.18	1.24	2.61	5.02
Aerva persica	9	23	12.86	0.33	2.56	0.88	1.10	3.08	5.05
Amaranthus	39	92	55.71	1.31	2.36	3.82	4.39	2.84	11.05

spinosus									
Amaranthus viridis	26	77	37.14	1.10	2.96	2.55	3.67	3.56	9.78
Apluda mutica	7	19	10.00	0.27	2.71	0.69	0.91	3.27	4.86
Argemone Mexicana	33	63	47.14	0.90	1.91	3.23	3.01	2.30	8.54
Blumea lacera	21	45	30.00	0.64	2.14	2.06	2.15	2.58	6.78
Cassia occidentalis	28	52	40.00	0.74	1.86	2.74	2.48	2.24	7.46
Cassia tora	36	49	51.43	0.70	1.36	3.53	2.34	1.64	7.50
Cenchrus ciliarias	15	35	21.43	0.50	2.33	1.47	1.67	2.81	5.95
Cleome Viscosa	18	47	25.71	0.67	2.61	1.76	2.24	3.14	7.15
Corchorus tridens	34	82	48.57	1.17	2.41	3.33	3.91	2.90	10.15
Croton bonplandianum	22	37	31.43	0.53	1.68	2.15	1.77	2.02	5.94
Echinops echinatus	23	54	32.86	0.77	2.35	2.25	2.58	2.83	7.65
Eragrostis ciliaris	22	33	31.43	0.47	1.50	2.15	1.57	1.81	5.53
Euphorbia hirta	41	112	58.57	1.60	2.73	4.02	5.34	3.29	12.65
Euphorbia milli	7	16	10.00	0.23	2.29	0.69	0.76	2.75	4.20
Euphorbia neriifolia	33	71	47.14	1.01	2.15	3.23	3.39	2.59	9.21

Indigofera cordifolia	36	81	51.43	1.16	2.25	3.53	3.86	2.71	10.10
Launaea procumbens	41	53	58.57	0.76	1.29	4.02	2.53	1.56	8.10
Ocimum americanum	29	47	41.43	0.67	1.62	2.84	2.24	1.95	7.03
Parthenium hysterophorus	35	77	50.00	1.10	2.20	3.43	3.67	2.65	9.75
Peristrophe bicalyculata	17	41	24.29	0.59	2.41	1.67	1.96	2.90	6.52
Phyla nodiflora	21	34	30.00	0.49	1.62	2.06	1.62	1.95	5.63
Phyllanthus fraternus	41	79	58.57	1.13	1.93	1.02	3.77	2.32	10.10
Physalis minima	12	19	17.14	0.27	1.58	1.18	0.91	1.91	3.99
Pteridium aquilinum	9	21	12.86	0.30	2.33	0.88	1.00	2.81	4.69
Sida acuta	24	33	34.29	0.47	1.38	2.35	1.57	1.65	5.58
Sida cordifolia	28	53	40.00	0.76	1.89	2.74	2.53	2.28	7.55
Solanum surattense	23	49	32.86	0.70	2.13	2.25	2.34	2.56	7.15
Solanum xanthocarpum	31	52	44.29	0.74	1.68	3.04	2.48	2.02	7.54
Sorghum halepense	13	57	18.57	0.81	4.38	1.27	2.72	5.28	9.27
Tephrosia purpurea	44	93	62.86	1.33	2.11	4.31	4.44	2.54	11.29
Tephrosia	27	59	38.57	0.84	2.19	2.64	2.81	2.63	8.09

villosa									
Tribulus terrestris	24	37	34.29	0.53	1.54	2.35	1.77	1.86	5.97
Tridax procumbens	45	87	64.29	1.24	1.93	4.41	4.15	2.33	10.89
Xanthium strumarium	19	30	27.14	0.43	1.58	1.86	1.43	1.90	5.19
			1458.5	29.9	83.0	100.0	100.0	100.0	300.0
			7	4	8	0	0	0	0
#: Total No of quadrate studied, @:total no of quadrate in which species occurred, F: Frequency (%),D: Density , A: Abundance, RF: Relative Frequency, RD: Relative Density, RA: Relative Abundance, IVI: Important value Index									

SHRUBS

Total of 26 shrub species were recorded in the buffer zone of the study during the survey. Shrub species commonly seen in buffer zone of the study area (10 km radius from the boundary of the proposed RIICO Industrial Area , Nagaur were Lantana camara, prosopis juliflora, cassia auriculata, Ipomoea carnea and Ricinus communis. The highest IVI for shrub at study area was recorded for lantana camara (28.07), followed by parthenium hysterophorus (24.30), Calotropis prosera (22.71) and prosopis juliflora (19.61), Shannon Wiener diversity index (H) for shrub was 2.78.

Important value Index /9ivi0 for shrub species in the buffer zone									
Scientific name	#	@	F	D	A	RF	RD	RA	IVI
Adhatoda	17	36	24.29	0.51	2.12	3.51	3.69	5.30	12.51

visica									
Calotropis prosera	41	87	58.57	1.24	2.12	8.47	8.92	5.31	22.71
Capparis deciduas	7	12	10.00	0.17	1.71	1.45	1.23	4.29	6.97
Carissa congesta	7	9	10.00	0.13	1.29	1.45	0.92	3.22	5.59
Cassia auriculata	36	81	51.43	1.16	2.25	7.44	8.31	5.63	21.38
Datura Stramonium	23	35	32.86	0.50	1.52	4.75	3.59	3.81	12.15
Dhatura metal	29	46	41.43	0.66	1.59	5.99	4.72	3.97	14.68
Grewia tenax	16	21	22.86	0.30	1.31	3.31	2.15	3.29	8.75
Prosopis juliflora	28	72	10.00	1.03	2.57	5.79	7.38	6.44	19.61
Lantana camara	52	115	74.29	1.64	2.21	10.74	11.79	5.54	28.07
Mimosa hamata	27	39	38.57	0.56	1.44	5.58	4.00	3.62	13.19
Nerium oleander	19	42	27.14	0.60	2.21	3.93	4.31	5.53	13.77
Nyctanthes arbour- tristis	12	25	17.14	0.36	2.08	2.48	2.56	5.22	10.26
Opuntia dillenii	3	10	4.29	0.14	3.33	0.62	1.03	8.35	9.99
Parthenium hysterophorus	36	98	51.43	1.40	2.72	7.44	10.05	6.82	24.30

Sesbania sesban	28	38	40.00	0.54	1.36	5.79	3.90	3.40	13.08
Thevetia peruviana	24	41	34.29	0.59	1.71	4.96	4.20	4.28	13.44
Vitex negundo	19	40	27.14	0.57	2.11	3.93	4.10	5.27	13.30
Zizyphus nummularia	31	57	44.29	0.81	1.84	6.40	5.85	4.60	16.85
Ricinus Communis	29	71	41.43	1.01	2.45	5.99	7.28	6.13	19.40
			691.43	13.90	39.94	100.0	100.0	100.0	300.0

#: Total No of quadrate studied, @:total no of quadrate in which species occurred, F: Frequency (%),D: Density , A: Abundance, RF: Relative Frequency, RD: Relative Density, RA: Relative Abundance, IVI: Important value Index

Important value Index (IVI) for tree species in the buffer zone									
Scientific name	#	@	F	D	A	RF	RD	RA	IVI
Acacia catechu	31	42	44.29	0.60	1.35	3.98	3.36	1.91	9.25
Acacia leucopholea	14	27	20.00	0.39	1.93	1.80	2.16	2.71	6.67
Acacia nilotica	29	33	41.43	0.47	1.14	3.72	2.64	1.60	7.97
Acacia Senegal	15	22	21.43	0.31	1.47	1.93	1.76	2.06	5.75

Aegle marmelos	9	13	12.86	0.19	1.44	1.16	1.04	2.03	4.23
Ailanthus excela	12	33	17.14	0.47	2.75	1.54	2.64	3.87	8.05
Albizia lebbeck	12	23	17.14	0.33	1.92	1.54	1.84	2.70	6.08
Annona squamosa	14	27	20.00	0.39	1.93	1.80	2.16	2.71	6.67
Anogeissus pendula	22	31	31.43	0.44	1.41	2.82	2.48	1.98	7.29
Anogiessis latifolia	26	33	37.14	0.47	1.27	3.34	2.64	1.79	7.76
Azadirachta indica	11	19	15.71	0.27	1.73	1.41	1.52	2.43	5.36
Boswellia serrata	9	9	12.86	0.13	1.00	1.16	0.72	1.41	3.28
Butea monosperma	42	69	60.00	0.99	1.64	5.39	5.52	2.31	13.23
Carissa congesta	12	22	17.14	0.31	1.83	1.54	1.76	2.58	5.88
Cassia fistula	39	67	55.71	0.96	1.72	5.01	5.36	5.42	12.79
Cassia siamea	29	58	41.43	0.83	2.00	3.72	4.64	2.81	11.18
Dalbergia sissoo	13	22	18.57	0.31	1.69	1.67	1.76	2.38	5.81
Delonix regia	5	7	7.14	0.10	1.40	0.64	0.56	1.97	3.17

Dichrostachys cinerea	7	11	10.00	0.16	1.57	0.90	0.88	2.21	3.99
Diospyros melanoxylon	39	58	55.71	0.83	1.49	5.01	4.64	2.09	11.74
Erythrina indica	4	4	5.71	0.06	1.00	0.51	0.32	1.41	2.24
Feronia limonia	4	6	5.71	0.09	1.50	0.51	0.48	2.11	3.10
Ficus benghalensis	11	14	15.71	0.20	1.27	1.41	1.12	1.79	4.32
Ficus glomerata	9	10	12.86	0.14	1.11	1.16	0.80	1.56	3.52
Ficus religiosa	9	11	12.86	0.16	1.22	1.16	0.88	1.72	3.76
Flacourtia indica	2	3	2.86	0.04	1.50	0.26	0.24	2.11	2.61
Holoptelea integrifolia	14	19	20.00	0.27	1.36	1.80	1.52	1.91	5.23
Lannea coromandelica	36	52	51.43	0.74	1.44	4.62	4.16	2.03	10.82
Maytenus emarginata	11	28	15.71	0.40	2.55	1.41	2.24	3.58	7.23
Moringa oleifera	12	21	17.14	0.30	1.75	1.54	1.68	2.46	5.68
Morus alba	17	24	24.29	0.34	1.41	2.18	1.92	1.99	6.09
Phoenox	1	23	20.00	0.33	1.64	1.80	1.84	2.31	5.95

sylvestris	4								
Pithecellobium dulce	24	36	34.29	0.51	1.50	3.08	2.88	2.11	8.07
Pongamia pinnata	33	56	47.14	0.80	1.70	4.24	4.48	2.39	11.11
Prosopis cineraria	7	18	10.00	0.26	2.57	0.90	1.44	3.62	5.96
Prosopis juliflora	37	79	52.86	1.13	2.14	4.75	6.33	3.00	14.08
Salvadora persica	7	19	10.00	0.27	2.71	0.90	1.52	3.82	6.24
Sterculia urens	12	19	17.14	0.27	1.58	1.54	1.52	2.23	5.29
Syzygium cumini	31	42	44.29	0.60	1.35	3.98	3.36	1.91	9.25
Tamarindus indica	7	10	10.00	0.14	1.43	0.90	0.80	2.01	3.71
Tecomella undulate	5	7	7.14	0.10	1.40	0.64	0.56	1.97	3.17
Terminalia arjuna	21	26	30.00	0.37	1.24	2.70	2.08	1.74	6.52
Wrightia tinctoria	34	61	48.57	0.87	1.79	4.36	4.88	2.52	11.77
Ziziphus mauritiana	28	35	40.00	0.50	1.25	3.59	2.80	1.76	8.15
		1249	1112.86	17.843	71.10	100.00	100.00	100.00	300.00

TREES

Total of 44 tree species were recorded in the buffer zone of the study during the survey. Tree species commonly seen in buffer zone (10 km radius from the boundary of the proposed RIICO Industrial Area , Nagaur of the study area were Butea monosperma, prosopis juliflora, cassia fistula, Diospyros melanoxylon, Pongamia pinnata, Lannea coromandelica. The highest IVI for shrub at study area was recorded for Prosopis juliflora (14.08), and Butea monosperma (13.23), followed by cassia fistula (12.79), Diospyros melanoxylon (11.74), and lannea coromandelica (10.82). Shannon- Wiener diversity index (H) for tree was 2.9

Tree Species reported from the study area

Belpatra *(Aegle marmelos)*

Tendu Patta *(Diospyros montana)*

Siris *(Albizia lebbeck)*

Ardu *(Ailanthus excelsa)*

Kaitha *(Feronia Lemonia)*

White Gulmohar *(Delonix elata)*

Karaya, Kadaya *(Sterculia urens)*

Khajoor *(Phoenix sylvestris)*

Subabool *(Leucaena leucocephala)*

Indarjao *(Wrightia tinctoria)*

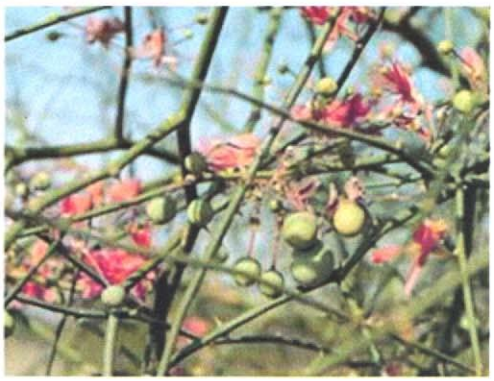
Bargad *(Ficus benghalensis)*

Karanj *(Pongamia pinnata)*

Ber *(Ziziphus mauritiana)*

Shrub and herb species reported from the study area

Tarwar *(Cassia auriculata)*



Kair *(Capparis decidua)*

Dandathor *(Euphorbia caducifolia)*

Adusa *(Adhatoda vasica)*

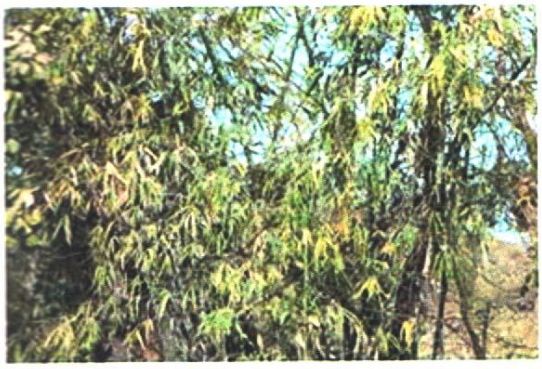
Kaunch, Atmagupta *(Mucuna pruriens)*

Arandi *(Ricinus communis)*

Aak *(Calotropis procera)*

Gajar ghas *(Parthenium hysterophorus)*

Thor ki bel *(Rivea hypocrateriformis)*



Baans *(Bambusa bambos)*

Satyanashi *(Argemone maxicana)*

Shankhpushpi *(Evolvulus alsinoides)*

Unthkanta *(Echinops echinatus)*

FAUNAL DIVERSITY OF THE STUDY AREA

Herpetofauna

Overall 25 species from 13 families were inventoried on the basis of direct and secondary sources. Schedule – I species, a common Indian Monitor i.e. – Varanus bengalensis were reported from forest areas of Sanctuary. All species of turtles, one species of lizard and all snake species (except Spectacled Cobra) are included in the list based on the secondary sources (interviews of the local people). Skin of the Spectacled Cobra was reported from the rocky forest areas, details of the species reported from the study area are give below:

HERPETOFAUNA REPORTED FROM THE BUFFER ZONE AREA

(10 km radius from the boundary of the proposed (RIICO Industrial Area , Nagaur)

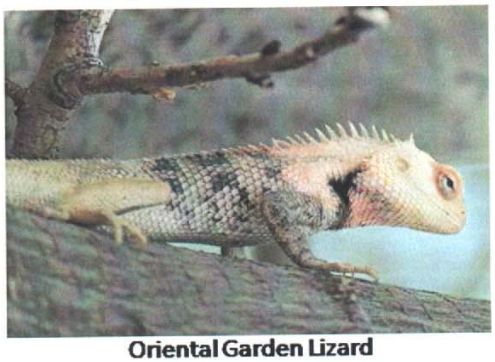
S.No. & Family	Species Name	Common English Name	Conserversation		
			IUCN	CITES	IWPA
TOADS/ FROGS					
1	Bufo melanostictus	Common Indian Toad	VU	…..	…..
2.	Bufo stomaticus	Marbled Toad	LRnt	…… .	…….
2.	Microhylidae				
3.	Microhyla ornate	Ornate Microhylid	LRlc	……	……
Ranidae					
4.	Euphlyctis Cyanophlyctis	Skittering Frog	LRnt	…… .	Schedule IV
5.	Tomopterna breviceps	Indian Burrowing Frog	……	……	…..
6.	Hoplobatrachus	Indian Bull Frog	VU	App. II	Schedule IV
Tortoise / Turtle					
4	.Testudinidae				
	Geochelone elegans	Indian Star Trotoise	VU	App.	….

				II	
LIZARDS					
5. Gekkonidae					
	Hemidactylus brookii	Spotted Indian House Gecko	LRlc		
	Hemidactylus flaviviridis	Yellow Bellied House Gecko	LRlc		
	Hemidactylus leschenaultia	Bark Gecko	….	….	….
Agamidae					
11.	Calotes Versicolor	Indian Garden Lizard	LRlc		
12.	Sitana Ponticeriana	Fan- Throa	LRlc		
6. Chamaeleonidae					
13.	Chamaeleo zeylanicus	Indian Chamaeleon	VU	App. II	Schedule -II
Scindidae					
14	Lygosoma punctata	Spotted supple Skink	LRlc	…	…
15.	Mabuya Carinata	Common Keeled Grass Skink	LRnt	…	…
16.	Mabuya	Eastern	LRlc	….	….

	macularia	Bronze Skink			
Lacertidae					
17.	Ophisops jerdoni	Snake – Eyed lacerta	DD	….	….
18	Ophisops microlepis	Small – Scaled lacerta	LRlc	….	….
Varanidae					
19.	Varanus bengalensis	Common Indian Monitor	VU	App. I	Schedule -1
Snakes					
Tyhlopidae					
20	Ramphotyphlops braminus	Common Blind Snake	LRnt	…	Schedule IV
12. **Colubridae**					
21	Lycodon aulicus	Common Indian Wolf Snake	LRlc	….	Schedule – IV
22	Oligodon taeniolata	Russell's or Variegated Kukri Snake	LRnt	…	Schedule – IV
23	Ptyas mucosa	Indian Rat	LRlc	….	Schedule

		Snake			–II
24	Xenochrophis piscator	Checkered keelback water snake	LRlc	…	Schedule –II
Elapidae					
25	Naja naja	Spectacled Cobra	LRnt	App. II	Schedule -II

Mammal & Reptile Species reported from study area



Oriental Garden Lizard
(Calotes versicolor)

Five stripped palm squirrel
(Funambulus pennantii)

Nilgai *(Boselaphus tragocamelus)*

Fan-Throated Lizard (Sitana ponticeriana)

AVIFAUNA

Totally 63 species of the birds belonging to 36 families were recorded from the buffer zone of the study area. A schedule I species, pavo cristatus (Indian peafowl) was reported from the hills of forest area and other habitats located close vicinity of the human habitation / villages. For the same. Conservation plan is given in the report. All the bird species reported from the study area enlisted in the following table :

AVIFAUNA REPORTED FROM THE STUDY AREA					
Familys No.	Species No.	Family & Species	Common English Name	MGS	IWPA Schedule
1Phasianidae					
	1.	Francolinus Pondicerisnus	Grey Francolin	R	IV
	2.	Pavo Cristatus	Indian Peafowl	R	I
2.Picidae					
	3.	Dinopium Benghalense	Common Flamebacked Woodpecker	R	IV
3.Upupidae					
	4.	Upupa Epops	Common Hoopoe	WV	IV
4.Coraciidae					
	5.	Coracias benghalensis	Indian Roller	R	IV
5.Alcedinidae					
	6.	Alcedo Hercules	Common	R	IV

			Kingfisher		
6.Dacelonidae					
	7.	Halcyon smyrnensis	White – throated kingfisher	R	IV
7.Meropidae					
	8.	Merops orientalis	Green Bee-eater	R	IV
8.Cuculidae					
	9.	Cuculus micropterus	Indian Cuckoo	SV	IV
	10.	Surniculus lugubris	Drongo Cuckoo	SV	IV
	11.	Eudynamys scolopacea	Asian Koel	R	IV
9.Centropodidae					
	12.	Centropus sinensis	Greater Coucal	R	IV
10.Psittacidae					
	13.s	Psittacula Cyanocephala	Plum-headed Parakeet	R	IV
	14.	Psittacula krameri	Rose- ringed parakeet	R	IV
11.Caprimulgidae					
	15.	Caprimulgus asiaticus	Indian Nightjar	R	IV
12.Columbidae					
	16.	Columba livia	Rock Pigeon	R	IV

	17.	Streptopelia Senegalensis	Laughing Dove	R	IV
	18.	Streptopelia decaocto	Eurasian Collared Dove	R	IV
13.Rallidae					
	19.	Gallinula chloropus	Common Moorhen	R	IV
	20.	Fulica atra	Common Coot	R	IV
14.Scolopacidae					
	21.	Actitis hypoleucos	Common Sandpiper	R	IV
15.Burhinidae					
	22.	Burhinus oedicnemus	Eurasian Thick- knee	R	IV
16.Charadriidae					
	23.	Himantopus Himantopus	Blackwinged stilt	R	IV
	24.	Vanellus malabaricus	Yellow-wattled Lapwing	R	IV
	25.	Vanellus indicus	Red- wattled Lapwing	R	IV
17.Laridae					
	26.	Sterna aurantia	River tern	R	IV
18.Accpitridae					
	27.	Elanus caeruleus	Black-	R	IV

			shouldered kite		
	28.	Haliastur indus	Brahminy Kite	R	IV
19.Podicipedidae					
	29.	Tachybaptus ruficollis	Little Grebe	R	IV
20.Phalacrocoracidae					
	30.	Phalacrocorax niger	Little Cromorant	R	IV
21.Ardeidae					
	31.	Egretta garzetta	Little Egret	R	IV
	32.	Bubulcus ibis	Cattle Egret	R	IV
	33.	Ardeola grayii	Indian pond heron	R	IV
22.Ciconidae					
	34.	Ciconia episcopus	Wooly-necked stork	R	IV
	35.	Anastomus oscitans	Asian Open-billed Stork	R	IV
23 Laniidae					
	36.	Lanius meridionalis	Southern Grey Shrike	R	IV
	37.	Lanius schach	Long- tailed Shrike	R	IV
24.Corvidae					
	38.	Dendrocitta vagabunda	Rufous Treepie	R	IV

	39.	Corvus splendens	House Crow	R	IV
	40.	Dicrurus macrocercus	Black Drongo	R	IV
	41.	Tephrodornis pondicerianus	Common Woodshrike	R	IV
25.Muscicapidae					
	42.	Copsychus saularis	Oriental Magpie Robin	R	IV
	43.	Saxicoloides fulicata	Indian Robin	R	
26.Sturnidae					
	44.	Sturnus pagodarum	Brahminy Starling		
	45.	Acridotheres tristis	Common Myna		
27.Certhiidae					
	46.	Salpornis spilonotus	Spotted Creeper		
28.Hirundinidae					
	47.	Hirundo smithii	Wire- teiled swallow		
29.Pycnonotidae					
	48.	Pycnonotus leucotis	White- eared Bulbul		
	49.	Pycnonotus cafer	Red-vented Bulbul		
30.Cisticolidae					
	50.	Prinia sylvatica	Jungle Prinia		

	51.	Prinia Socialis	Ashy Prinia		
	52.	Prinia inornata	Plain Prinia		
31.Zosteropidae					
	53.	Zosterops palpebrosus	Oriental White- eye		
32. Sylviidae					
	54.	Turdoides Striatus	Jungle Babbler		
	55.	Trudoides Caudatus	Common Babbler		
33.Alaudidae					
	56.	Galerida Cristata	Crested Lark		
34.Nectariniidae					
	57.	Nectarinia asiatica	Purple Sunbird		
35.Passeridae					
	58.	Anthus rufulus	Paddyfield Pipit		
	59.	Lonchura malabarica	Indian Sliverbill		
	60.	Passer domesticus	House Sparrow		
	61.	Ploceus philippinus	Baya Weaver		
36.Fringillidae					
	62.	Emberiza striolata	House Bunting		
	63.	Melophjus lathami	Crested		

			Bunting		

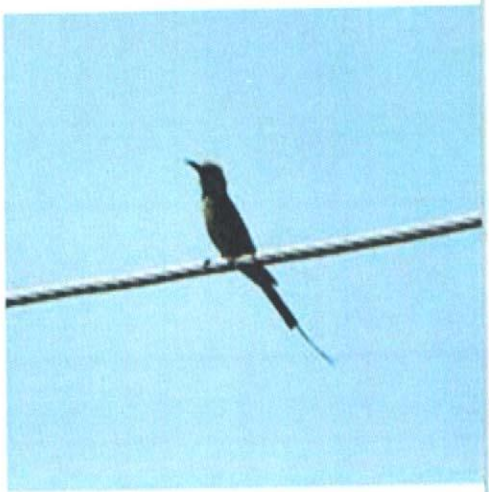
R- Resident, WV- Winter Visitor, MGS- Migratory Status, CS: Conservation Status : NT- Near Threatened

Common Birds Reported from the Buffer Zone

Red Vented Bulbul

Purple Sunbird

Crested bunting



Green bee eater

MAMMELS

Overall 16 species of the mammals belonging to 13 different families were recorded from the buffer zone of the study area. Some species like, sloth Bear (outside 10 km radius,) striped Hyena, Nilgai, Small Indian Civet, Ruddy Mongoose and Indian Porcupine are included in the list based on the secondary sources (interview of local people). All the mammals reported from the study area given in the following table:

LIST OF MAMMALS RECORDED FROM THE STUDY AREA

Family S.No.	**Family/ Genus/ Species**	**Common Name**	**Conservation Status**		
			IUCN	**CITES**	**IWPA, 1972**
1. **Cercopithecidae**					
1.	Semnopithecus entellus	Common Langur	LRlc	App.I	Schedule-II
2.	Bovidae				
2.	Boselaphus tragocamelus	Nilgai	LRlc	…..	Schedule-III
3.	Gazella bennettii	Chankara	LRlc	…..	Schedule-I
3.	Suidae				
4.	Sus scrofa	Wild Pig	LRlc	…..	Schedule-III
4.	Ursidae				
5.	Melursus ursinus	Sloth Bear	VU	App.I	Schedule-I
5.	Canidae				

6	Canis aureus	Jackal	LRlc		Schedule-II
6.	Hyaenidae				
7	Hyaena Hyaena	Striped Hyena	LRnt	…..	Schedule-III
7.	Felidae				
8	Felis chaus	Jungle Cat	LRnt	App.II	Schedule-II
8.	Viverridae				
9	Viverricula indica	Small Indian Civet	LRnt		Schedule-II
9.	Herpestidae				
10	Herpestes edwardsil	Grey Mongoose	LRlc	App.III	Schedule-IV
11	Herpestes smithii	Ruddy Mongoose	LRlc	App.III	Schedule-IV
10.	Leporidae				
12	Lepus nigricollis	Indian Hare	LRnt	…….	Schedule-IV
11.	Hystricidae				
13	Hystrix indica	Indian Porcupine	LRlc	…….	Schedule-IV
12.	Sciuridae				
14	Funambulus pennantii	Five-Striped palm squirrel	LRlc	…….	Schedule-IV
13.	Muridae				
15	Tatera indica	Indian	LRlc	…….	Schedule-V

		Gerbil			
16	Meriones hurrianae	Indian Desert Jird	LRlc	…….	Schedule-V
17	Rattus rattus	Black Rat	LRlc	…….	Schedule-V
14.	Rhinopomatidae				
18	Rhinopoma microphyllum	Greter Mouse-teiled	LRlc	…….	…..
Note: included in the list based on the secondary sources, LRlc- Lower Risk lest concern, LRnt- Lower Risk near threatened, VU- Vulnerable, App.- Appendix					

ENDEMIC FAUNA OF THE STUDY AREA

None of the sighted animal species can be assigned endemic species category of the study area.

MIGRATORY BIRDS & WINTER VISITORS IN THE STUDY AREA

Maximum birds reported were resident. However, some common birds like common Hoopoe is a winter visitor while Indian Cuckoo, Drongo Cuckoo and plaintive Cuckoo are summer visitor. However, all these birds are locally migrant.

STATUS OF THE FOREST, THEIR CATEGORY IN THE STUDY AREA

Proposed RIICO Industrial Area falls near Gogalau conservation reserve, Nagaur in the study area and adjacent and part of the Gogalau, Nagaur.