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Editor
Prakash Gole



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Ecological Society

1 B Abhimanshree Society

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Foreword

My colleagues of the Ecological Society have briefly indicated the two or three programmes undertaken by the Society during the first decade of its existence. Critics may perhaps be inclined to call it an uneventful decade, but that may perhaps be due more to the paucity of funds and/or of staff than to any lack of interest on our part. For example, the socio-biological survey of Pune's river-front was intended to be connected eventually with the larger scheme of setting up a metropolitan development authority for the Poona Metropolitan Region, a scheme which did not receive adequate political support and continues to be mentioned sporadically by political leaders. The second project of regenerating the catchment area of Panshet dam could also have been known better if it was nearer the Metropolis and been more publicised. The third, Wetlands Project at Bhigwan has had to face heavy weather because of a misplaced agitation by a group of people.

Our Society wants to get into the good books of a lot of agencies and functionaries and to establish that bio-diversity need not be inconsistent with development and that a lot of non-humans can coexist on the fringes of our towns and villages, so as to render our environment much more attractive.

L. G. Rajwade
Chairman, Ecological Society

On the Trail of Wintering Blacknecked Cranes in India

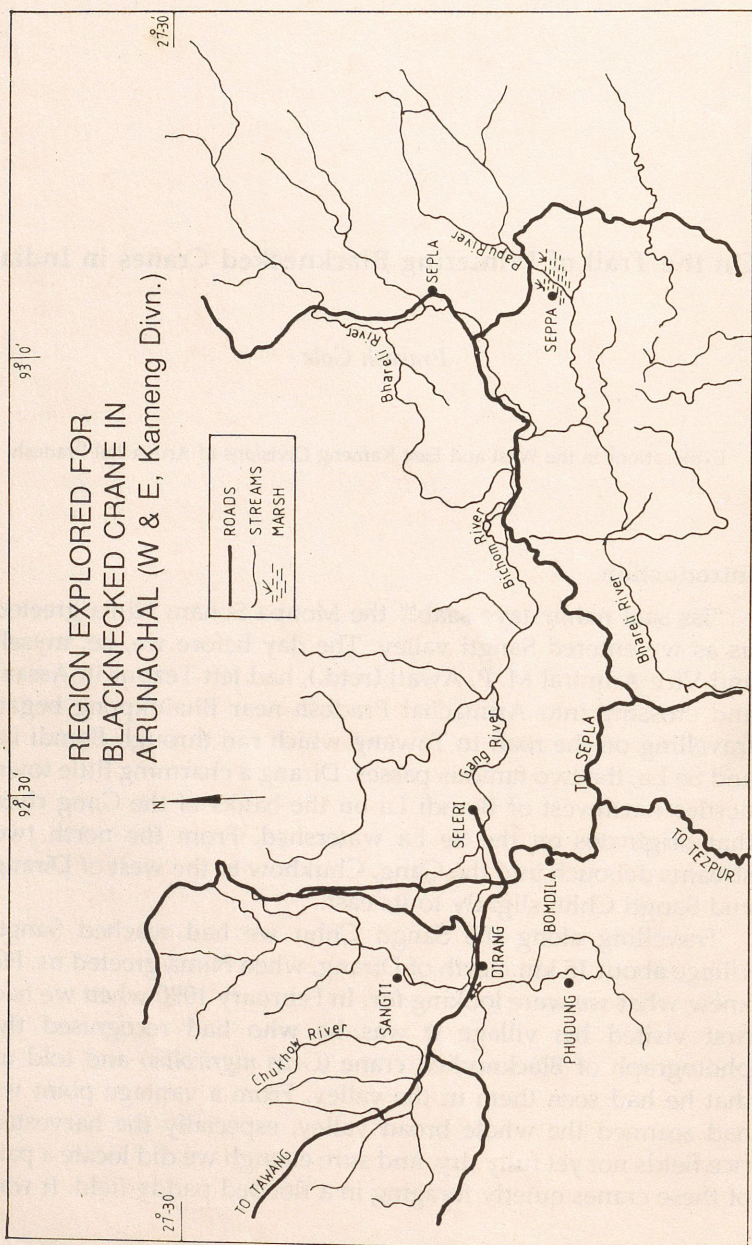
Prakash Gole

Explorations in the West and East Kameng Divisions of Arunachal Pradesh

Introduction

"Iss saal nahin aaye saab!" the Monpa Sonam Nima greeted us as we entered Sangti valley. The day before we, i.e. myself and Vice Admiral M. P. Awati (retd.), had left Tezpur in Assam and crossing into Arunachal Pradesh near Bhalukpong began travelling on the road to Tawang which ran through Bomdi La and Se La, the two famous passes. Dirang a charming little town nestles northwest of Bomdi La on the banks of the Gang river that originates on the Se La watershed. From the north two streams debouch into the Gang, Chukhow to the west of Dirang and Sangti Chhu slightly to its east.

Travelling along the Sangti Chhu we had reached Sangti village about 15 km. north of Dirang, when Nima greeted us. He knew what we were looking for. In February 1990 when we had first visited his village it was he who had recognised the photograph of Blacknecked crane (*Grus nigricollis*) and told us that he had seen them in the valley. From a vantage point we had scanned the whole broad valley, especially the harvested rice fields not yet fully dry; and sure enough we did locate a pair of these cranes quietly foraging in a flooded paddy field. It was



Thursday, 15th February, a day of mild, clear weather with temperature around 15°C at 14.30 hrs with easterly winds blowing at speeds of 5 to 8 knots.

It was in a way a historic occasion for the crane was sighted on Indian territory after a lapse of almost 35 years. They were last seen around 1954 by a British officer in the Apa Tani valley of the Upper Subansiri Division of the then NEFA (Betts 1955).

The Mission

We entered Sangti valley again exactly 2 years and 2 days after the first visit i.e. on 17th February 1992. Our mission was to find out if Blacknecked Cranes could still be found in the Sangti and to explore other valleys suitable for the cranes : habitat-wise and culture-wise. Observations of wintering Blacknecks in Bhutan have indicated that cranes used flat, broad valleys with cultivation and marshes intermingling and situated between 1500 and 2800 metres above mean sea level. Buddhism with its benign attitude towards animals and birds, especially cranes, was also reckoned to be a factor of considerable importance in locating these cranes.

We therefore, wanted to look for and explore flat, broad cultivated valleys inhabited by people of Buddhist culture.

A Perspective of the Region

The accompanying map shows the region where we searched for cranes in Arunachal Pradesh. The part inhabited by Buddhist people the Monpa, begins from Bomdi La the pass 2650 metre high. From Bomdi La the road descends into the valley of the Gang river which originates from glacial lakes west of Se La at a height of about 4575 metres. The region between Bomdi La and Se La is drained by this river and its tributaries flowing into it from north and south. The Gang in turn joins the Bichom that drains the ranges east of Bomdi La. Further east the Bichom joins the Bhareli draining the mountains north of Sepla, the headquarters of the East Kameng Division of Arunachal. The Bhareli flows into the Brahmaputra east of Tezpur in Assam.

The region between Se La (in west Kameng) and Sepla (in east Kameng) lies east of and adjacent to our border with Bhutan. Rivers in the eastern part of Bhutan also drain into the Brahmaputra river system. Some of these rivers have also

carved broad valleys where in 1980 and 1988 I had located large flocks of Blacknecked crane. For example, in west-central Bhutan's Phobjikha valley I had studied 101 Blacknecked cranes while in Tashi Yangtshi region of east Bhutan I had located 146 Blacknecks. I reasoned that the valleys on the Indian side adjacent to Tashi Yangtshi area might harbour a certain number of Blacknecked cranes if the factors that were seen to be associated with Blacknecks wintering in Bhutan were also available to them on the Indian side.

The cultural factor viz. the presence of a benign religion that tended to protect cranes has already been noted. Availability of adequate forage was an equally important factor together with proper roosting sites. At an altitude above 2000 metres cranes were seen to subsist on marsh plants and insects as also on wheat and barley from harvested fields. At altitudes below 2000 metres they subsisted on grains gleaned in paddy fields. The valleys between Se La and Sepla on the Indian side lay not only in the same latitudinal zone but also presented more or less the same conditions that prevailed in the valleys of Bhutan.

Investigation in the Sangti Valley

Weather did not exactly favour us during our second visit to the Sangti (Lat. 27°-26" N and Long. 92°E). In 1990 the weather was sunny, even warm in the afternoon with temperature around 15°C and light, easterly breezes. On 17th February 1992 the weather was cold, heavy mist lay on the hills and the breeze blowing from the snow-bound Se La brought shivers. The temperature was around 5°C. At night it dropped to zero and thick frost lay on the lawns of the sheep breeding farm in the valley where we stayed.

We did not notice any major change in the landscape of the valley. The road was still not pucca, there was no major settlement before Sangti village though logs of wood recently cut down were stacked along the route. We learnt later of large-scale illegal felling having been discovered and stopped by Forest Dept. Hence the logs lying in situ. The hills on both sides of the stream (Sangti chhu) were mainly covered by aspen and a shrub identified as *Thimus*. I thought pines were less in evidence than before.

We soon came upon a group of Monpa, one of them, a school

teacher in Sapper further west, knew that Blacknecked cranes had come to Sangti in 1990. He felt that they could be seen on the Gang river near Sapper. As we proceeded in the direction of Sangti village, we met other Monpas who had no recent knowledge of the crane. Sonam Nima only confirmed what everybody knew : Blacknecks were not to be seen in the valley this winter!

When we reached the village and began scanning the paddy fields, I became aware of the increase in the settlement of the valley. The number of houses had gone up from about 45 to 68. A school buildings complex had come up near the north-eastern end of paddy field area and a track was being widened to link the village with the school. Next day we also heard dynamites being used in road construction.

In 1990 we had not noticed cattle grazing in paddy fields, though a few sheep and goats were there. Now some cattle were seen also, probably a result of increase in human settlement.

Deciding to explore the valley beyond Sangti village, we proceeded along the stream in the direction of Lachang situated NE of Sangti village. Crossing the Khasho stream we entered Kachow village to be met by the village school teacher Dorjee Thangkar. He reported that 6 Blacknecked cranes had visited Sangti in early 1991 but none had come this year. We also met the village elder Langa Dorjee who narrated in Assamese that 30-40 years ago 10-12 Blacknecks used to visit the valley. Some outsiders had shot one of them. Monpas had protested telling the outsiders that their crops would fail if these birds were harmed. Hunting stopped thereafter but the number of cranes went on declining till only 2-3 came in 1991. The range forest officer Kalung Bida translated Dorjee's statement for us and we recorded the whole interview.

Towards Lachang the valley narrowed, flat fields along the stream gave way to terraced cultivation on slopes which began closing in on the stream from both sides. Paddy cultivation was replaced by maize on hillsides which became steeper as we proceeded. As the habitat which cranes used near Sangti village was no longer in evidence, we decided to stop short of Lachang. Not far from Lachang the map showed glaciers indicating sudden increase in height and steepness.

We also explored the stream that flowed into Sangti chhu

from the northwest. There again the valley bottom was narrow, steeper slopes converging to terminate the crane habitat beyond Sangti village.

The only habitat suitable for cranes was around the paddy fields of Sangti village and cranes were reported to be using it till 1991. As the human culture was friendly, the increase in settlement and grazing cattle was not such as to deprive cranes of food, freedom of movement and shelter. The only factor of disturbance to which cranes were not used appeared to be road construction and the use of dynamite. The unusual human activity accompanied by frightening booms must have scared them away, we surmised. Once road construction was over there was nothing to prevent cranes from entering the Sangti, we thought.

Because of the disturbance in the Sangti could they have taken shelter in some adjacent valley which offered them a suitable habitat? This question could be answered only at the end of our exploration of the region north and west of Bomdi La.

Investigation in the Chukhow Valley

About 11 kms northwest of Dirang, the Chukhow river, originating in the mountains to the north, flows into the Gang river. Chukhow valley is broad near the junction of the two streams but narrows markedly 3 kms north as one moves away from the junction.

When we reached the junction and showed Blacknecked crane pictures to local people, they averred that 3-4 cranes had visited that area in 1991. Crossing the streams by the suspension bridge, we examined paddy fields stretching on the west of the Chukhow stream. Its eastern bank however, was steep and terraced with maize and fruit gardens being cultivated in patches. Even on the west side the flat stretch along the stream was only about 100 meters wide. Terracing began after it with increasingly narrow terraces on upper slopes. There was however, plenty of fallen grain in harvested fields.

We continued our walk towards north to the point where the valley became so narrow that cultivation almost ceased. At a small settlement we enquired again but were told that cranes had never visited that part of the valley. Then we returned.

Looking at the favourable but narrow habitat available for cranes and lack of shelter anywhere in the valley, we surmised that cranes might be visiting Chukhow valley either on passage or for short bouts of feeding from their base at Sangti.

Investigation East of Dirang

As no more broad valleys could be seen on the map west of Dirang, we decided to explore the downstream reaches of the Gang river i.e. the region east of Dirang. The river Gang has carved a rather broad valley before it meets the Bichom further east. Though the valley floor is not broad enough to accommodate cultivation, wide spur tops overlooking the stream accommodate both cultivation and settlement. At some point the valley was so deep and the spur tops were at such a height as to replace sub-tropical vegetation with tropical. At Saleri while the slopes were covered with pine, the settlement itself was amidst banana and bamboo growing at a height of about 1000 metres. Paddy cultivation was however, not in evidence and the fields were not as extensive as to provide at least a 1 kilometer radius view on all sides for cranes.

We reached all the bigger settlements like Chander, Rahung and Saleri occupying spur tops but local people were unanimous in telling us that they had never seen a crane around their villages. The people were followers of Do-Ni-Po-Lo (earth-nether world-sun-moon) and not Buddhists.

It appeared therefore, that human culture, no less than the presence of a suitable habitat, determined the occurrence of Blacknecked crane in a particular area.

Investigation in the East Kameng Division

Blacknecked cranes were not unknown further east. In the fifties they used to winter in the Apa Tani valley around Jiro, i.e. in the Upper Subansiri Division east of the Kameng divisions of Arunachal Pradesh. But Lavkumar Khacher in 1978 (Khacher 1981) and I in 1990 (Gole 1990) had confirmed that these cranes had stopped migrating to the Apa Tani area. Where did they go? Did they shift to some other valley nearby where suitable habitat existed?

I knew Buddhism was not a prevailing religion in the Apa

Tani area or in other nearby areas such as the East Kameng Division. Though the Apa Tanis, Nishings and other tribes inhabiting these districts are hunter-gatherers, the cranes were not totally unprotected. Their occurrence in the midst of hunter-gatherers was itself a proof of a measure of protection that they enjoyed. This was confirmed by Apa Tanis when they told me in 1990 that they never killed the crane lest some evil befell their families. It was the entry of increasing number of outsiders in the valley that drove away the crane.

We therefore, wanted to look for a valley where suitable habitat existed and where outside culture had not yet penetrated to any extent.

The map showed an extensive marsh near Seppa (or Sebba) along a tributary of the Bhareli in the East Kameng Division of AP. Even Lavkumar Khacher had thought that the marsh needed to be explored (Khacher 1981).

Sepla and Seppa

The road to Bomdi La from Tezpur branches off at a point called Nachifu and heads east in the direction of Sepla, the district headquarters of the East Kameng Division. The dense rain-forest at Nachifu gradually gave place to moist deciduous by the time Paliji was reached and deep down in the valley the river Bichom was glimpsed. It was in fact the flow of the Gang and the Bichom, the former merging with the latter further west.

The Bichom was crossed near Bana where the great river had uprooted the mighty supports of a huge suspension bridge. A few kilometers ahead the Bichom met the Bhareli coming from Sepla to the northeast. Their joint flow turned south and running through a deep, narrow gorge entered the plains near the Assam-AP border and ultimately joined the Brahmaputra east of Tezpur.

From Bana we went to Sepla to meet forest department and other officials. The DFO turned out to be an Apa Tani himself and had seen cranes in his childhood in the Apa Tani valley. According to him the number of cranes that used to visit the valley was not more than 2-3 and he had seen them from far away and could not note any details. He however, told us that

Apa Tanis were familiar with Kendah (the Apa Tani name for Blacknecks) and knew of their arrival and departure.

Our destination being the great marsh shown in the map, we headed southeast towards a place called Lumdung, 24 kms from Sepla. The dirt road climbed through a tropical forest of giant tree ferns. But the people had cut down the forest to cultivate *Eleusine coracana*. Wild banana and Bamboo grew wherever the slopes lay fallow for some years. As we crossed a pass at a height of 2000 metres a broad valley opened out below through which a river meandered. Stretches of marsh bordered the stream, the rest of the almost 3 km wide valley having gone under paddy cultivation. Lumdung turned out to be a small settlement on the northern slope overlooking the valley and the marsh through which the Papu river flowed.

From a vantage point we scanned the whole valley which was about 6 km long and 3 km wide stretching northeast to southwest. No birds could be seen though the habitat looked extremely promising. The wet and dry paddy fields now lay fallow and deserted. There was no human movement or cattle grazing in the valley. We appeared to have reached a uniquely undisturbed habitat.

We accosted the first human we came across and showed him the Blackneck pictures. He was a Nishing, the hunter-gatherer tribe that inhabited the valley. He said that a few of these birds came to the valley and they called the birds Pani-hans. But he indicated that the birds he was referring to were smaller in height than cranes. The paddy fields according to him, having been harvested, people had gone to the jungles to hunt. They also did not keep any cattle. We started on the road that led down into the valley. On the way we kept on meeting more Nishings who however, denied any knowledge of cranes. We soon reached Sedé near the valley floor where a group of Nishing gathered around us. There were many young men among them. They told us that they had seen 3-4 of these birds. One of the village elders also supported them. In their dialect they called the blacknecked crane ONWA. They further informed that they never hunted these birds as it was feared that the family of the man who hunted them would be visited by death. We recorded the interview on tape. The Nishing who

lived on the upper slopes however, seemed to have no knowledge of cranes.

With such conflicting evidence, it was difficult to reach any conclusion. While the people who lived nearer the valley bottom would know better the birds that visited the valley, their occurrence must be quite irregular and sporadic to have gone unnoticed by others who lived on upper slopes. The habitat however, looked quite promising with all the factors that could attract cranes being present, viz. availability of winter forage, undisturbed view on all sides, little competition from grazing cattle and lack of disturbance from human movement. The place was however, situated at a lower height than Apa Tani and Sangti valleys or the valleys in Bhutan where Blacknecks wintered. While the height of Seppa valley was around 1200 metres, none of the other valleys was lower than 1500 metres above MSL.

About Seppa, the marsh of the Papu river, we kept our fingers crossed. It looked probable that sporadically cranes did visit the valley as Nishings living near valley bottom told us. Nishings even had a name for them in their dialect. The habitat being extremely good, the valley deserves monitoring every winter. We have alerted the DFO at Sepla who would be the best person to keep a watch on the valley even though any kind of forest operations are not being undertaken in the valley at present.

Habitat Suitability for Blacknecked Cranes in Arunachal Pradesh

Let us now see if we can in any way quantify the habitat suitability of the valleys we investigated in AP. Cranes use a valley like the Sangti mainly for feeding and roosting during winter.

Actual observations in Sangti valley showed that cranes used the flat valley bottom on both banks of the Sangti chhu, an area with a zigzag length of almost 2.5 kms and width varying between 0.5 and 1.0 kms. The period of use was tentatively placed at from December to March. How can we define habitat suitability for cranes? One can identify 3 requisites that can be considered critical in supplying winter staging habitat for Blacknecked cranes. These requisites are grain food, invertebrate

food and roosting requirements. It may be added that if feeding and roosting requirements are met, loafing requirements, another essential requisite, of cranes will be met also. These need not be identified as a separate critical sub-component of winter crane habitat.

Cover Type Origins of Habitat Requirements

Blacknecked cranes were observed to obtain their food (grains) from stubble grainfields. The grain food consisted mainly of rice with lesser amounts of wheat, maize and barley taken wherever available (e.g. in Bhutan). Cropland thus becomes a major cover type supplying food. Invertebrate food consisted of earthworms, beetles, worms and snails. Time budget analysis of foraging behaviour in Bhutan indicate that cranes spent about one-third of the total diurnal foraging time in wet areas where such food was available. Though no data are available on the percentage of total food formed by invertebrates, the time spent in wet areas (wet meadows and marshes) to obtain this food, makes invertebrate food a distinct habitat requirement.

Roosting requirements, as observed in winter in Bhutan, are supplied by marshes and river channels. Habitat conditions observed in valleys of Arunachal Pradesh do not necessitate any sub-division of this habitat into one or more sub-components.

Cover types that may modify the value of habitat requirements supplied by types (cropland, wet meadows, marshes and river channel) are identified as presence of woody vegetation less than or greater than 1 metre in height.

In Arunachal Pradesh availability of grain food for cranes was not seen to be a problem as most areas considered here, supported paddy fields and other grain crops. Of course technological improvements and land-use changes may alter this situation in future. The area of cropland thus becomes a significant variable. But some part of it may be rendered unsuitable for cranes due to presence of disturbance factors. There will be zones of varying widths around disturbance factors which cannot be used by cranes, as they would supply no grain food to them. The disturbance factors and widths of zones identified as supplying no grain food are presented in Table 1.

Table 1

Types of disturbances resulting in avoidance of cover types by Blacknecked crane and the size of affected area.

Type of disturbance	Width in metres of affected area	
	Cropland	Wet areas
Gravel road	100	50
Single dwelling	50	30
Group of dwellings	150	75
Bridge	100	100
Powerline	50	50

Again as invertebrate food was gathered by cranes from mesic habitats, the area of wet meadows and marshes becomes a variable of interest here. The disturbance factors are the same as those used to adjust total area of cropland. But it was observed that the degree of disturbance tolerated by cranes in using wet habitats is greater than that found when dry habitat was used.

Variables associated with roosting requirements could be identified as the area available, i.e. the radius of unobstructed view around the roosting site; a minimum depth of water of 10 to 30 cms in and around the roost site was also considered to be essential for roosting cranes. Otherwise optimum roost sites will not be used if they are within disturbance zones. Disturbance factors affecting roost sites and the corresponding disturbance zones in metres are shown in Table 2.

Table 2

Types of disturbances influencing use of potential riverine roost sites by Blacknecked cranes and the size of affected areas.

Types of disturbances	Width in metres of affected area
Gravel road	100
Single dwelling	150
Group of dwellings	250
Bridge	250
Powerline	100

What is the focal point or the key sub-component of winter staging habitat of cranes? From observational data in Bhutan it appears that roosting requirements and not the cover type supplying food provide the focal unit. Proximity of cover types

supplying food to cranes was seen to vary between 1 and 8 kms. Food resources located beyond 8 kms are assumed to decrease in importance linearly. In the Arunachal such data are lacking but the occurrence of cranes in particular valleys only, indicates that food sources located beyond these valleys are only of marginal importance to Blacknecked cranes.

Observational data on the composition of habitat requirements that go to make the optimum winter habitat for cranes are also lacking. Rough estimates of the composition of habitat requirements in wintering sites of Blacknecked crane in Bhutan and Arunachal Pradesh are given below :

Table 3

Wintering Site	Cropland %	Wetland %	Riverine %
In Bhutan			
Bumthang	70	Nil	5
Bumdiling	60	10	20
Chortenkholo	80	5	Nil
Phobjikha	55	20	5
In Arunachal			
Sangti	50	15	10

(The remaining area in each of these valleys is under human settlement).

The suitability of a given roost site is a function of 3 variables : the area of unobstructed view, the mean depth of water and the presence or absence of disturbance factors within defined distances from the site. Optimum roosting conditions for Blacknecked cranes may be defined as :

- a) unobstructed view of greater than 100 metres;
- b) mean depth of water between 10 and 30 cms and
- c) freedom from disturbance factors within defined distance.

There may be situations where values other than optimum can be compensatory between the 3 variables. But if any of the values is 0.0 then the overall suitability of the site should be 0.0. Therefore, the suggested function for overall suitability of a site will be a geometric mean of the 3 variables :

$$RS = (UA \times WD \times DF)^{1/3}$$

where RS = roosting suitability, UA = unobstructed area,

WD = water depth and DF = presence or absence of disturbance factors.

UA and WD can be expressed as indices with values ranging from 0.0 to 1.0 with optimum value equal to 1.0. Only 2 values viz. 1.0 or 0.0 are possible for disturbance factors: 1.0 if no disturbance exists within the respective distance and 0.0 if one or a combination of disturbance factors exists within the defined distance.

Let us now see the RS for different valleys in AP investigated during the current expedition. The index values for the 3 variables and the resulting RS in different locations are presented below.

Table 4

Roosting suitability for Blacknecked cranes in different valleys of Arunachal Pradesh

Name of the Valley	UA	WD	DF	RS
Sangti	1.0	0.7	1.0	0.88
Chukhow	0.8	0.6	1.0	0.78
Sareli	0.4	0.5	0.0	0.00
Seppa	1.0	0.6	1.0	0.84

The total food availability for cranes at a particular site can only be estimated if we take into account the fact that food availability decreases with the increase in distance from roosting site of a particular cropland or wetland. For Sangti valley if the total area available is 200 ha. of which about 100 ha. is cropland, 30 ha. wetland, 20 ha. riverine habitat and 50 ha. of human settlement, the food availability in different sectors of cropland can be estimated as follows :

50 ha. within 1 km of roosting : index value 1.0

25 ha. within 2 km of roosting : index value 0.66

15 ha. within 3 km of roosting : index value 0.33

10 ha. within 4 km of roosting : index value 0.11

Evaluation of distances for cover types serving as potential food sources will yield adjusted grain food suitability values. For Sangti valley these values will be :

$50 \times 1.0 = 50$; $25 \times 0.66 = 16.5$; $15 \times 0.33 = 4.95$; $10 \times 0.11 = 1.1$.

Total grain food suitability value is : 72.55.

Likewise invertebrate food suitability in different sectors of

wet areas (wet meadows and marshes) may be presented as follows :

- 10 ha. within 0.5 km of roosting : index value 1.0
- 10 ha. within 1.0 km of roosting : index value 0.66
- 5 ha. within 1.5 km of roosting : index value 0.33
- 5 ha. within 2.0 km of roosting : index value 0.11

The adjusted values of invertebrate food suitability will be :
 $10 \times 1.0 = 10$; $10 \times 0.66 = 6.6$; $5 \times 0.33 = 1.65$; $5 \times 0.11 = 0.55$.
 Total invertebrate food suitability value is 18.80.

If these totals are divided by the total study area (i.e. 200 ha.) they will give percent of a defined study area that provides grain and invertebrate food.

$72.55 / 200 = 0.3627$ and $18.80 / 200 = 0.0940$ and $0.88 / 200 = 0.0044$. These figures are estimates of the usable habitat resources per unit area.

The 3 variables viz. cropland, wetland and riverine habitat constitute respectively 50%, 15% and 10% of the total area of the valley. Therefore resources per unit cover type area will be :

$0.3627 / 0.5 = 0.7254$; $0.0940 / 0.15 = 0.0062$; $0.0044 / 0.10 = 0.00044$.

For a pair of Blacknecked crane sighted in Sangti valley in Feb. 1990, it appears that the above figures indicate resource availability per unit cover type area. The lowest of these adjusted values viz. 0.00044 represents the overall Blacknecked crane habitat suitability of the area under study.

Similarly habitat suitability for other valleys can also be calculated (provided their total area and areas under different cover types are known). In the Chukhow valley local people had seen cranes. If the suitability values for the 3 variables in Chukhow are less than the values given above, the cranes may not find it expedient to use the valley as their winter staging area but may choose to visit it sporadically. The conditions in Seppa valley will probably approach the values obtained for the Sangti. If the cranes are not wintering there regularly, the reasons may not be inadequacy of food or shelter but something else such as low altitude of the valley, unsuitable climate etc. This aspect of course will need further investigation.

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Birds of the Pichavaram Mangroves and the Adjoining Coastal Environs

K. Sampath & K. Krishnamurthy

Abstract

Pichavaram mangrove is a highly productive ecosystem. It attracts an appreciable number of many species of both true migrants and local migrants. Also it harbours many species of resident birds in good numbers. At the mangroves during the observation made for five years from the early 1984 to late 1988, 177 species of birds belonging to 15 orders and 41 families have been recorded. The season for the birds is from September to April every year, the peak population of birds could be seen between November and January. With the availability of different habitat types, the mangroves become an ideal ground for the survival of many varieties of birds. The most common birds at the mangroves are the members of the family Ardeidae, Recurvirostridae, Charadriidae and Laridae. Besides, many species of terrestrial birds are also found.

Introduction

Knowledge of the occurrence of plants and animals of a particular habitat is essential for the management and conservation of its resources. This will also indicate how important it is for taking suitable protection and conservation measures. Envisaging its significance, a check list of birds of the Pichavaram

mangroves has been prepared. The bird species sighted till December 1988 are listed here based on continuous observations since early 1984.

Despite mangroves being highly important for the survival of many species of birds, research on birds associated with mangroves in India is scant (Mukherjee 1969; Samant 1985; Rashid and Scott 1988; Perennou 1989; Sampath 1989; Krishnan and Sampath 1989; Sampath and Krishnamurthy 1990).

Location of the Study Area

The Pichavaram mangroves (11°29'N; 79°49'E) are located near Chidambaram in South Arcot district of Tamil Nadu on the south east coast of India (Bay of Bengal). The mangroves are spread over an area of about 11,000 ha. There are numerous channels, creeks and gullies traversing the mangroves, discharging freshwater into the system. It is a very healthy mangrove forest formation. But it is getting more endangered by Man's activities.

In the mangroves there are 51 islets spread all over the area. They are separated by intricate waterways. This forest possesses a variegated assemblage of 61 species of halophytes mangrove vegetation. The common species among them are *Rhizophora* spp., *Avicennia marina*, *Bruguiera cylindrica*, *Salicornia brachiata*, *Suaeda maritima*, *Sesuvium portulacastrum*, *Anthrocnemum indicum* and *Excoecaria agallocha*. Some of the islets are vegetated and others are unvegetated. Most parts of the mangroves remain wet throughout the year. They are subject to tidal influence. In this mangroves the area of waterways comprises about 40% and forests about 50% of the total area and the rest 10% being filled with saltflats, sandflats and mudflats. These areas would get exposed during neap tide and submerged during spring tide. Altogether with the availability of different habitats, these mangroves form an ideal ground for feeding and roosting for many species of birds which hail from different areas or centres of origin.

Many aspects of the ecology of mangrove ecosystem have been studied in the past 25 years (Jeyaseelan and Krishnamurthy 1980; Krishnamurthy and Jeyaseelan 1981; Krishnamurthy *et al* 1981; Sultan Ali *et al* 1983; Krishnamurthy 1984a, b; Subramanian *at al* 1984 and Muniyandi and Natarajan 1985). But little attempt

has been made hitherto on the avain presence of these mangroves. The mangroves are a highly productive ecosystem. Concomitantly it accommodates a great number of birds belonging to many species. The importance of conservation of the mangroves as an ideal habitat was unequivocally stated among others by Krishnamurthy (1983) and Parish (1987).

Climatological Features

In the mangroves the atmospheric temperature did not fluctuate widely. It ranged between 20°C and 37°C. The lowest temperature prevailed during monsoon (October to December) and the highest during summer (April to June). The Pichavaram mangroves receive scant rainfall during the southwest monsoon (July to September) and copious rainfall during the northeast monsoon (October to December). The total annual rainfall is about 1,300 mm.

Avifauna

The bird species sighted during the study period are given in Table 1. The present list of birds is bound to expand with more studies for which attempt is being made. The following literature were of use for identifying the birds; Ali and Ripley (1983a, b) and King and Dickinson (1983).

General Account on the Status of some of the Notable Species of Birds

1. *Ardeidae*

Although the members of this family were seen throughout the year, no bird species was found nesting. Generally their population swelled during the monsoon. Of the different members only the population of the Night heron *Nycticorax nycticorax* was high, and fluctuated around 2,000. The White stork *Ciconia ciconia* visits the area during late pre-monsoon (September), stays here for a few days and disappears.

2. *Phoenicopteridae*

A small flock of around 50 Flamingos *Phoenicopus roseus* visited these mangroves during the mansoon. Their stay on these mangroves was only for a short period.

3. Anatidae

Of the different members in this family, the Gadwall *Anas strepera* was the most common and the population was about 2,500. The population of other species of this family was around 1,000 birds. The size of the population varied annually.

4. Recurvirostridae

Among the different species of shorebirds, the Blackwinged stilt *Himantopus himantopus* was the most common. Their population was nearly 3,000.

5. Charadriidae

They arrived in the late pre-monsoon season and remained till the end of post-monsoon (March). They foraged on the mudflats and over the unvegetated swampy area. Among the various species, the Little stint *Calidris minuta* was common and their population was around 7,000. Though, most of them were true migrants a small population of a few species 'loitered' in the mangroves even during summer.

6. Laridae

They were very common and inhabit close to the sea. Of the gull species, the Brownheaded gull *Larus brunnicephalus* was common and the population was over 2,000. Of the tern species the Whiskered tern *Chlidonias hybrida* was common. Their population was nearly 1,500.

Discussion

The mangroves ecosystem is unique in that it comprises of land, water and forests. Such a combination results in a high biomass production. The forest canopy, the water channels and the terrain of the land suit the bird populations. Added to it is the nearby seashore, coastal and tidal pools and estuaries.

This mangrove attracts a large number of birds during monsoon (October to December). This is due to high productive nature (in terms of prey organisms) of the ecosystem and coincidence of the time of arrival of the true migrants as well as local migrants from the breeding ground. Similar reports have also been made from the present study area and from other

wintering grounds in India (Ali 1986; Ali and Vijayan 1986; Hussain *et al* 1984; Vijayan 1986, 1988; Sampath 1989; Sampath and Krishnamurthy 1989a, b and Sampath and Krishnamurthy 1990). The common birds at this mangrove are the members of the family Ardeidae, Charadriidae and Laridae. The abundance of the members of Charadriiformes could be attributed to the nature of the habitat, which is a shallow-water area with high density of macrobenthos. The macrobenthos forms the staple diet of shorebirds (Sampath 1989 and Sampath and Krishnamurthy 1989a, b). The common occurrence of piscivorous birds (members of Ardeidae and Laridae) was due to the occurrence of many species of fish in plenty which form their diet. Also availability of many mangrove plants shelter many species of insects in great density. These in turn invite many insectivorous birds. As a whole the population of birds declines towards summer (April). This was because of the departure of the migrants, back to the breeding ground. Similar observations have also been made from the other wintering grounds in India. Besides residents, some migrants in a thin population were found loitering even during the offseason (summer). The availability of food would be tempting them. The first year birds were also among those which prolonged their stay. Some of the "Stay back" birds were noticed with deformities.

In the mangrove ecosystem, the functioning of the food web is quite interesting. The mangrove forests with mixed freshwater and brackish-water aspect is suited for the litter production and its degradation. This aspect enhances the productive potential of the mangroves. For the degradation and consumption of the fallen leaves (litter) mangrove hosts many varieties of organisms of different trophic levels.

In the food web, as a first step bacteria and fungi play a key role for degradation. This activity is vital for the system. It enriches the nutrients in the water, the nutrient-rich water becomes ideal for the colonization of autotrophs - primary producers (phytoplankton). Also the very next dependent are the zooplankton. To the next tier belong the deposit-feeders namely the benthic animals such as polychaetes, apseudes, amphipods and other crustaceans, etc. which feed on the degrading matter available in the mangroves. In the same category are the dependents of the said groups, namely crabs, shellfish,

fish and some species of gastropods. Altogether all these organisms are food for the bigger fish.

The different species of birds form a terminal end in the mangroves, different levels occupied by different groups of birds. The shorebirds (Charadriiformes) which are one of the commonest of birds, feed on benthic organisms, the detritus feeders. It is evident that they (shorebirds) compete with the crustaceans and fish, which also feed on benthic organisms. The various duck species also share the same food with shorebirds by feeding on the benthic organisms. In the food web, egrets, herons, storks, gulls, terns and raptors hold the top position owing to their habit of feeding on fishes.

Conclusion

This mangrove with its unique edaphic, climatic and biotic characters fulfills its promise as a custodian of its inhabitants. Such a sensitive ecosystem faces threats from many a sphere. A long-term study of these mangroves is necessary to reveal its true potential.

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K. Sampath* and K. Krishnamurthy
Centre of Advanced Study in Marine Biology
Annamalai University, Parangipettai 608 502

* Present Address : Post Graduate Teacher in Zoology,
Government Higher Secondary School, Sathanur 606 706
Chengam Taluk, Tiruvannamalai District, Tamil Nadu

List of bird species recorded from the Pichavaram mangroves

		STATUS
	FAMILY	PODICIPEDIDAE
1.	Little grebe	Podiceps ruficollis LM, O
	FAMILY	PHALACROCORACIDAE
2.	Large cormorant	Phalacrocorax carbo LM, O
3.	Indian shag	phalacrocorax fuscicollis LM, O
4.	Little cormorant	Phalacrocorax niger LM, O
5.	Darter	Anhinga rufa LM, O
	FAMILY	ARDEIDAE
6.	Grey heron	Ardea cinerea R, C
7.	Purple heron	Ardea purpurea R, C
8.	Large egret	Ardea alba R, C
9.	Little green heron	Ardeola striatus R, C
10.	Pond heron	Ardeola grayii R, C
11.	Cattle egret	Bubulcus ibis R, C
12.	Median egret	Egretta intermedia R, C
13.	Little egret	Egretta garzetta R, C
14.	Indian reef heron	Egretta gularis R, U
15.	Night heron	Nycticorax nycticorax LM, C
16.	Chestnut bittern	Ixobrychus cinnamomeus R, U
17.	Black bittern	Ixobrychus flavicollis R, U
18.	Painted stork	Mycteria leucocephala LM, O
19.	Openbill stork	Anastomus oscitans LM, O
20.	White strok	Ciconia ciconia M, O
	FAMILY	THRESKIORNITHIDE
21.	White ibis	Threskiornis aethiopica LM, O
22.	Glossy ibis	Plegadis falcinellus LM, O
23.	Spoonbill	Platalea leucorodia LM, O
	FAMILY	PHOENICOPTERIDAE
24.	Flamingo	Phoenicopterus roseus LM, O

	FAMILY	ANATIDAE	
25.	Pintail	<i>Anas acuta</i>	M, O
26.	Common teal	<i>Anas crecca</i>	M, O
27.	Spotbilled duck	<i>Anas poecilorhyncha</i>	LM, O
28.	Mallard	<i>Anas platyrhynchos</i>	M, O
29.	Gadwall	<i>Anas strepera</i>	M, O
30.	Wigeon	<i>Anas penelope</i>	M, O
31.	Garganey	<i>Anas querquedula</i>	M, O
32.	Shoveller	<i>Anas clypeata</i>	M, O
33.	Cotton teal	<i>Nettapus</i> <i>coromandelianus</i>	LM, O
	FAMILY	ACCIPITRIDAE	
34.	Blackwinged kite	<i>Elanus caeruleus</i>	R, C
35.	Pariah Kite	<i>Milvus migrans</i>	R, C
36.	Brahminy Kite	<i>Haliastur indus</i>	R, C
37.	Shikra	<i>Accipiter badius</i>	LM, O
38.	Sparrow-hawk	<i>Accipiter nisus</i>	M, U
39.	Basra sparrow-hawk	<i>Accipiter virgatus</i>	M, U
40.	Whitebellied sea-eagle	<i>Haliaeetus leucogaster</i>	LM, O
41.	Egyptian vulture	<i>Neophron percnopterus</i>	LM, O
42.	Pale harrier	<i>Circus macrourus</i>	M, O
43.	Montagu's harrier	<i>Circus pygargus</i>	M, O
44.	Pied harrier	<i>Circus melanoleucos</i>	M, O
45.	Marsh harrier	<i>Circus aeruginosus</i>	M, C
46.	Osprey	<i>Pandion haliaetus</i>	M, O
	FAMILY	FALCONIDAE	
47.	Peregrine falcon	<i>Falco peregrinus</i>	M, O
48.	Redheaded merlin	<i>Falco chicquera</i>	LM, O
49.	Kestrel	<i>Falco tinnunculus</i>	LM, U
	FAMILY	PHASIANIDAE	
50.	Grey partridge	<i>Francolinus</i> <i>pondicerianus</i>	R, C
51.	Jungle bush quail	<i>Perdica asiatica</i>	R, C
52.	Common bustard-quail	<i>Turnix suscitator</i>	R, U
53.	Blue-breasted banded rail	<i>Rallus striatus</i>	R, C
54.	Banded crane	<i>Rallina eurizonoides</i>	R, C

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|---------------------------------|---------------------------------|------------------|
| 55. Whitebreasted waterhen | <i>Amaurornis phoenicurus</i> | R, C |
| 56. Water cock | <i>Gallicrex cinerea</i> | R, C |
| FAMILY | | HAEMATOPODIDAE |
| 57. Oystercatcher | <i>Haematopus ostralegus</i> | M, U |
| FAMILY | | RECURVIROSTRIDAE |
| 58. Blackwinged stilt | <i>Himantopus himantopus</i> | LM, C |
| 59. Avocet | <i>Recurvirostra avosetta</i> | M, O |
| FAMILY | | BURHINIDAE |
| 60. Stone curlew | <i>Burhinus oedicephalus</i> | R, U |
| 61. Great stone plover | <i>Esacus magnirostris</i> | R, U |
| FAMILY | | GLAREOLIDAE |
| 62. Small Indian Pratincole | <i>Glareola lactea</i> | LM, O |
| FAMILY | | CHARADRIIDAE |
| 63. Redwattled lapwing | <i>Vanellus indicus</i> | R, C |
| 64. Yellow-wattled lapwing | <i>Vanellus malabaricus</i> | R, C |
| 65. Grey or Blackbellied plover | <i>Pluvialis squatarola</i> | M, C |
| 66. Eastern golden plover | <i>Pluvialis dominica</i> | M, C |
| 67. Large sand plover | <i>Charadrius leschenaultii</i> | M, U |
| 68. Little ringed plover | <i>Charadrius dubius</i> | R, C |
| 69. Ringed plover | <i>Charadrius hiaticula</i> | M, U |
| 70. Kentish plover | <i>Charadrius alexandrinus</i> | R, C |
| 71. Lesser sand plover | <i>Charadrius mongolus</i> | M, C |
| 72. Whimbrel | <i>Numenius phaeopus</i> | M, C |
| 73. Curlew | <i>Numenius arquata</i> | M, C |
| 74. Blacktailed godwit | <i>Limosa limosa</i> | M, C |
| 75. Bartailed godwit | <i>Limosa lapponica</i> | M, Ra |
| 76. Spotted redshank | <i>Tringa erythropus</i> | M, L |
| 77. Common redshank | <i>Tringa totanus</i> | M, C |
| 78. Marsh sandpiper | <i>Tringa stagnatilis</i> | M, C |
| 79. Greenshank | <i>Tringa nebularia</i> | M, C |
| 80. Green sandpiper | <i>Tringa ochropus</i> | M, C |

81. Wood sandpiper	<i>Tringa glareola</i>	M, C
82. Terek sandpiper	<i>Tringa terek</i>	M, U
83. Common sandpiper	<i>Tringa hypoleucos</i>	M, C
84. Turnstone	<i>Arenaria interpres</i>	M, C
85. Asiatic dowitcher	<i>Limnodromus</i> <i>semipalmatus</i>	M, Ra
86. Fantail snipe	<i>Gallinago gallinago</i>	M, C
87. Little stint	<i>Calidris minuta</i>	M, C
88. Temminck's stint	<i>Calidris temminckii</i>	M, O
89. Dunlin	<i>Calidris alpina</i>	M, O
90. Curlew sandpiper	<i>Calidris testacea</i>	M, C
91. Broadbilled sandpiper	<i>Limicola falcinellus</i>	M, U
92. Ruff and reeve	<i>Philomachus pugnax</i>	M, O
FAMILY		LARIDAE
93. Herring gull	<i>Larus argentatus</i>	M, C
94. Great blackheaded gull	<i>Larus ichthyaetus</i>	M, C
95. Brownheaded gull	<i>Larus brunnicephalus</i>	M, C
96. Blackheaded gull	<i>Larus ridibundus</i>	M, C
97. Whiskered tern	<i>Chlidonias hybrida</i>	M, C
98. Gullbilled tern	<i>Gelochelidon nilotica</i>	M, C
99. Caspian tern	<i>Hydroprogne caspia</i>	M, C
100. Common tern	<i>Sterna hirundo</i>	M, C
101. Little tern	<i>Sterna albifrons</i>	R, C
102. Indian lesser crested tern	<i>Sterna bengalensis</i>	M, C
103. Large crested tern	<i>Sterna bergii</i>	M, U
104. Indian river tern	<i>Sterna aurantia</i>	LM, O
FAMILY		COLUMBIDAE
105. Blue rock pigeon	<i>Columba livia</i>	R, C
106. Indian ring dove	<i>Streptopelia decaocto</i>	R, C
107. Spotted dove	<i>Streptopelia chinensis</i>	R, C
108. Little brown dove	<i>Streptopelia</i> <i>senegalensis</i>	R, O
FAMILY		PSITTACIDAE
109. Roseringed parakeet	<i>Psittacula krameri</i>	R, C
FAMILY		CUCULIDAE
110. Pied crested cuckoo	<i>Clamator jacobinus</i>	LM, O

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| 111. | Common hawk-cuckoo
or Brainfever bird | <i>Cuculus varius</i> | LM, O |
| 112. | Koel | <i>Eudynamys scolopacea</i> | R, C |
| 113. | Crow-pheasant | <i>Centropus sinensis</i> | R, O |
| | FAMILY | STRIGIDAE | |
| 114. | Barn owl | <i>Tyto alba</i> | R, U |
| 115. | Spotted owl | <i>Athene brama</i> | R, C |
| | FAMILY | APODIDAE | |
| 116. | House swift | <i>Apus affinis</i> | R, C |
| 117. | Palm swift | <i>Cypsiurus parvus</i> | R, C |
| | FAMILY | ALCEDINIDAE | |
| 118. | Lesser pied kingfisher | <i>Ceryle rudis</i> | R, C |
| 119. | Common kingfisher | <i>Alcedo atthis</i> | R, C |
| 120. | Whitebreasted
kingfisher | <i>Halcyon smyrnensis</i> | R, C |
| 121. | Blackcapped kingfisher | <i>Halcyon pileata</i> | R, C |
| | FAMILY | MEROPIIDAE | |
| 122. | Chestnutheaded
bee-eater | <i>Merops leschenaulti</i> | LM, U |
| 123. | Bluetailed bee-eater | <i>Merops philippinus</i> | R, C |
| 124. | Green bee-eater | <i>Merops orientalis</i> | R, C |
| | FAMILY | CORACIDAE | |
| 125. | Indian roller | <i>Coracias benghalensis</i> | R, C |
| | FAMILY | UPUPIDAE | |
| 126. | Hoopoe | <i>Upupa epops</i> | R, C |
| | FAMILY | CAPITONIDAE | |
| 127. | Crimsonbreasted
barbet | <i>Megalaima
haemacephala</i> | R, U |
| | FAMILY | PICIDAE | |
| 128. | Lesser goldenbacked
woodpecker | <i>Dinopium
benghalense</i> | R, C |

	FAMILY	PITTIDAE	
129.	Indian pitta	<i>Pitta brachyura</i>	LM, O
	FAMILY	ALAUDIDAE	
130.	Bush lark	<i>Mirafra assamica</i>	LM, U
131.	Redwinged bush lark	<i>Mirafra erythroptera</i>	LM, O
132.	Ashycrowned finch lark	<i>Eremopterix grisea</i>	LM, U
133.	Crested lark	<i>Galerida cristata</i>	LM, U
134.	Eastern skylark	<i>Alauda gulgula</i>	R, C
	FAMILY	HIRUNDINIDAE	
135.	Eastern swallow	<i>Hirundo rustica</i>	M, C
136.	Redrumped swallow	<i>Hirundo daurica</i>	LM, C
137.	Indian cliff swallow	<i>Hirundo fluvicola</i>	M, U
	FAMILY	LANIDAE	
138.	Baybacked shrike	<i>Lanius vittatus</i>	LM, U
139.	Rufousbacked shrike	<i>Lanius schach</i>	LM, O
140.	Brown shrike	<i>Lanius cristatus</i>	R, U
	FAMILY	ARTAMIDAE	
141.	Ashy swallow shrike	<i>Artamus fuscus</i>	R, C
	FAMILY	ORIOOLIDAE	
142.	Golden oriole	<i>Oriolus oriolus</i>	R, O
	FAMILY	DICRURIDAE	
143.	Black drongo	<i>Dicrurus adsimilis</i>	R, C
	FAMILY	STURNIDAE	
144.	Brahminy myna	<i>Sturnus pagodarum</i>	R, C
145.	Rosy pastor	<i>Sturnus roseus</i>	M, C
146.	Common myna	<i>Acridotheres tristis</i>	R, C
	FAMILY	CORVIDAE	
147.	Tree-pie	<i>Dendrocitta vagabunda</i>	R, O
148.	House crow	<i>Corvus splendens</i>	R, C
149.	Jungle crow	<i>Corvus macrorhynchos</i>	R, C

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|------|-----------------------------|-------------------------------|-------|
| | FAMILY | CAMPEPHAGIDAE | |
| 150. | Common wood-shrike | Tephrodornis
pondicerianus | R, O |
| | FAMILY | IRENIDAE | |
| 151. | Common iora | Aegithina tiphia | R, C |
| | FAMILY | PYCNONOTIDAE | |
| 152. | Redvented bulbul | Pycnonotus cafer | R, C |
| 153. | Whitebrowed bulbul | Pycnonotus luteolus | R, C |
| | FAMILY | MUSCICAPIDAE | |
| 154. | Common babbler | Turdoides caudatus | R, C |
| 155. | Brown flycatcher | Muscicapa latirostris | M, U |
| 156. | Brownbreasted
flycatcher | Muscicapa muttui | M, O |
| 157. | Paradise flycatcher | Terpsiphone paradisi | LM, O |
| 158. | Plain wren-warbler | Prinia subflava | LM, U |
| 159. | Tailor bird | Orthotomus sutorius | R, C |
| 160. | Thickbilled warbler | Acrocephalus aedon | M, O |
| 161. | Blyth's reed warbler | Acrocephalus
dumetorum | M, C |
| 162. | Lesser whitethroat | Sylvia curruca | M, U |
| 163. | Largebilled leaf
warbler | Phylloscopus
magnirostris | M, U |
| 164. | Magpie robin | Copsychus saularis | R, C |
| 165. | Indian robin | Saxicoloides fulicata | R, C |
| | FAMILY | MOTACILLIDAE | |
| 166. | Paddyfield pipit | Anthus
novaeseelandiae | LM, U |
| 167. | Forest wagtail | Motacilla indica | M, Ra |
| 168. | Yellow wagtail | Motacilla flava | M, C |
| 169. | Grey wagtail | Motacilla cinerea | M, C |
| 170. | Pied or white wagtail | Motacilla alba | M, C |
| 171. | Large pied wagtail | Motacilla
maderaspatensis | LM, C |
| | FAMILY | DICAEIDAE | |
| 172. | Tickell's flowerpecker | Dicaeum
erythrorhynchos | R, C |

FAMILY		NECTARINIIDAE	
173.	Purplerumped sunbird	<i>Nectarinia zeylonica</i>	R, C
174.	Purple sunbird	<i>Nectarinia asiatica</i>	R, C

FAMILY		PLOCEIDAE	
175.	House sparrow	<i>Passer domesticus</i>	R, C
176.	Yellowthroated sparrow	<i>Petronia xanthocollis</i>	LM, O
177.	Spotted munia	<i>Lonchura punctulata</i>	R, O

LM = Local Migrant, M = Migrant, R = Resident, C = Common,
O = Occasional, U = Uncommon, Ra = Rare

Birding in Orang Wildlife Sanctuary (OWLS)

Manideep Raj

Introduction

The state of Assam with its typical geologic, physiographic and climatic diversity holds a pivotal place in the process of progressive evolution of the present day flora and fauna of India, serving as an effective gateway to the floristic faunistic influx (Kurup 1986). Around thirtynine percent of the state is under forest cover, with one national park and eleven sanctuaries occupying more than 2000 sq. km. area. Yet except for the Kaziranga National Park and Manas Tiger Project, not much effort has been put in to the survey of the avifauna of the rest of the protected areas. The present paper is an attempt to the listing of avifauna of Orang Wildlife Sanctuary, a hitherto unsurveyed area.

Study Area And Methods

The Orang Wildlife Sanctuary is located within the geographical limits of 92°15'E to 92°30'E longitudes and 26°30'N to 26°40'N latitudes. The sanctuary straddles two civil districts of Assam, Darrang and Sonitpur. It is situated on the North bank of, and abuts on the river Brahmaputra. Two main rivers, the Dhansiri and the Panchnoi along with a number of smaller streams and nullahs drain the sanctuary and ultimately fall into the Brahmaputra.

The reserve enjoys a typical subtropical monsoon climate which can be divided into four periods: Premonsoon (March, April), Monsoon (May-September), Retreating Monsoon (Late September-November) and Winter (December-February). The temperature varies between 7°C to 35°C. The relative humidity is high, which never falls below 66% and may go upto 90% or more.

The vegetation cover of the sanctuary is mainly grassland which occupies more than 60% of the total area. Near the Brahmaputra river, *Saccharum spontaneum* is the dominant grass with *Tamarix diocea* as coloniser. The higher alluvial terrace is occupied mostly by the coarser grasses viz. *Narenga porphyrocoma*. Along the edges of water bodies there are seasonally inundated regions containing very short grass like *Cynodon dactylon*, *Haemarthia sp.*, *Grysopogon sp.*, *Pennisetium sp.*, with these areas serving as a favourite foraging ground for the herbivores. In the aquatic bodies water hyacinth predominates. Woodlands are confined to the higher terrace only. There are natural pockets of wet miscellaneous formations containing *Sterospermum*, *Dillenia*, *Lannea*, *Bischoffia*, *Listea*, *Albizzia*, *Terminalia* etc. but these are very limited in extent and occur only in the North Eastern and North Western corners of the sanctuary. Plantations attempted in the past for afforestation of the grassland contain *Salmalia*, *Gmelina*, *Acacia*, *Dalbergia*, *Albizzia*, *Terminalia*, *Laegerstroemia* etc. In the plantation areas the ground cover is an admixture of *Eupatorium odoratum* and coarse grass with heavy infestation of *Milkania macarantha* and occasional patches of *Curcuma sp.* There are a few patches of naturally growing *Acacia sp.* and *Salmalia sp.* also scattered in the sanctuary.

The sanctuary was surveyed intensively during 1988 and 1989. Birds were observed while walking, by taking jeep rides on predetermined routes through various habitats, at specific wetlands and from watch towers. Observations were taken with 8 x 30 Photophone binoculars. At least two visits were paid to the sanctuary in each of the four seasons.

Results and Discussion

The total of 107 species sighted in Orang are representative of 36 families. 82 species were found to be resident, 16 migratory, 5

locally migratory and 4 species of uncertain status. Of the resident species, 17 species were abundant, 33 common and 32 rare. The rarest species is perhaps the king vulture. Partridges occur quite abundantly inside the reserve. Of the migratory species only the ruddy shelduck and common teal were found to be abundant while 6 species could be recorded as common and 8 rare.

Major important areas in the sanctuary from the avifaunal viewpoint are the Bhellajhar, Heron village and Ramdas chapori. The Bhellajhar with its tall trees serves as a favourite ground for the nesting of Adjutant storks and the pelicans. The Heron village on the other hand becomes ablaze with the calls of thousands of nesting herons during the monsoons. During the current Midwinter Waterfowl Census in the sanctuary, 17 black storks were sighted at the Ramdas chapori. Another regular sighting the area provides is that of ruddy shelduck. While in most areas of Assam the species is generally found in two and fours, at the chapori however a rare sight of 150-200 ruddy shelducks sitting together await the bird watcher anytime during the winter season.

Table 1

Showing the birds spotted in Orang Wildlife Sactuary during the study period. (R = Resident, M = Migratory, LM = Local Migratory, U = Uncertain status, a = abundant, c = common, r = rare)

The bird species recorded are given as follows :

S. No.	Scientific Name	Common English Name	Status
	FAMILY	PELECANIDAE	
1.	<i>Pelecanus philippensis</i>	Spotted-billed pelican	Ra
	FAMILY	PHALACROCORACIDAE	
2.	<i>Phalacrocorax carbo</i>	Cormorant	Rs
3.	<i>Anhinga rufa</i>	Darter	Rc

	FAMILY	ARDEIDAE	
4.	<i>Ardeola grayii</i>	Pond heron	Ra
5.	<i>Ardea cineria</i>	Grey heron	Rc
6.	<i>Nyctirocax nycticorax</i>	Night heron	Rr
7.	<i>Ixobrychus cinnamomeus</i>	Chestnut bittern	Rr
8.	<i>Bubulcus ibis</i>	Cattle Egret	Ra
9.	<i>Ardea alba</i>	Large egret	Rr
10.	<i>Egretta intermedia</i>	Median egret	Rr
11.	<i>Egretta garzetta</i>	Little egret	Rc
	FAMILY	CICONIIDAE	
12.	<i>Ciconia episcopus</i>	White-necked stork	Rr
13.	<i>Ciconia nigra</i>	Black stork	Rr
14.	<i>Ephippiorhynchus asiaticus</i>	Black-necked stork	Rr
15.	<i>Leptoptilos dubius</i>	Adjutant stork	Rc
16.	<i>Leptoptilos javanicus</i>	Lesser adjutant stork	Ra
	FAMILY	ANATIDAE	
17.	<i>Dendrocygna javanica</i>	Lesser whistling teal	Rc
18.	<i>Tadorna ferruginea</i>	Ruddy shelduck	Ma
19.	<i>Aythya ferina</i>	Common pochard	Mr
20.	<i>Aythya baeri</i>	Baer's pochard	Mr
21.	<i>Aythya nyroca</i>	White-eyed pochard	Mr
22.	<i>Anas platyrhynchos</i>	Mallard	Mc
23.	<i>Anas crecca</i>	Common teal	Ma
24.	<i>Anas querquedula</i>	Garganey	Mr
25.	<i>Anas poecilorhyncha</i>	Spotbilled duck	Mc
	FAMILY	ACCIPITRIDAE	
26.	<i>Haliaeetus leucorhynchus</i>	Pallas fishing eagle	Rc
27.	<i>Milvus migrans</i>	Pariah kite	Rr
28.	<i>Haliastur indus</i>	Brahminy kite	Rc
29.	<i>Circus melanoleucos</i>	Pied harrier	Rr

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|-----|-------------------------------------|-------------------------|-----|
| 30. | <i>Circus cyaneus</i> | Hen harrier | Ur |
| 31. | <i>Circus aeruginosus</i> | Marsh harrier | Rr |
| 32. | <i>Spilornis cheela</i> | Crested serpent eagle | Rr |
| 33. | <i>Pernis ptylorhyncus</i> | Honey buzzard | Ur |
| 34. | <i>Sphizaetus cirrhatus</i> | Changeable hawk eagle | LMr |
| 35. | <i>Accipiter badius</i> | Shikra | Ur |
| 36. | <i>Accipiter nisus</i> | Sparrow hawk | Rr |
| 37. | <i>Sarcogyps calvus</i> | King vulture | Rr |
| 38. | <i>Gyps bengalensis</i> | White-backed vulture | Rc |
| 39. | <i>Gyps indicus</i> | Long-billed vulture | Rc |
| | FAMILY | PHASIANIDAE | |
| 40. | <i>Francolinus
fracolinus</i> | Black partridge | Ra |
| 41. | <i>Francolinus gularis</i> | Swamp partridge | Ra |
| | FAMILY | RALLIDAE | |
| 42. | <i>Amaurornis
phoenicurus</i> | White-breasted waterhen | Rc |
| 43. | <i>Gallinula chloropus</i> | Moorhen | Rc |
| 44. | <i>Gallixrex cineria</i> | Watercock | Rr |
| | FAMILY | JACANIDAE | |
| 45. | <i>Metopedius indicus</i> | Bronze-winged jacana | Ra |
| 46. | <i>Hydrophasianus
chirurgus</i> | Pheasant-tailed jacana | Rr |
| | FAMILY | OTIDIDAE | |
| 47. | <i>Eupodotis
bengalensis</i> | Bengal florican | Rc |
| | FAMILY | CHARADRIIDAE | |
| 48. | <i>Vanellus indicus</i> | Redwattled lapwing | Rc |
| 49. | <i>Vanellus cinereus</i> | Greyheaded lapwing | Mr |
| 50. | <i>Vanellus spinosus</i> | Spurwinged lapwing | LMr |
| 51. | <i>Charadrius dubius</i> | Little ringed plover | Mc |
| 52. | <i>Tringa totanus</i> | Redshank | Mc |
| 53. | <i>Tringa stagnatilis</i> | Marsh sandpiper | Mr |
| 54. | <i>Tringa nebularia</i> | Green shank | Mr |
| 55. | <i>Tringa hypoleucos</i> | Common sandpiper | Mc |

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|-----|-----------------------------------|-----------------------------------|-----|
| 56. | <i>Charadrius alexandrinus</i> | Kentish plover | Mr |
| 57. | <i>Gallinago solitaria</i> | Solitary spine | LMc |
| | FAMILY | LARIDAE | |
| 58. | <i>Sterna aurantia</i> | Indian river tern | Rc |
| | FAMILY | COLUMBIDAE | |
| 59. | <i>Streptopelia chinensis</i> | Spotted dove | Rc |
| 60. | <i>Streptopelia decaocto</i> | Indian ring dove | Rc |
| 61. | <i>Streptopelia tranquebarica</i> | Red turtle dove | Rr |
| 62. | <i>Treron sp.</i> | Green pigeon | Rr |
| | FAMILY | PSITTACIDAE | |
| 63. | <i>Psittacula krameri</i> | Rose-ringed parakeet | Ra |
| | FAMILY | CUCULIDAE | |
| 64. | <i>Cacomantis merulinus</i> | Rufousbellied plaintive
cuckoo | Rc |
| 65. | <i>Eudynamys scolopacea</i> | Koel | LMc |
| 66. | <i>Centropus sinensis</i> | Coucal | Rr |
| 67. | <i>Centropus toulou</i> | Lesser coucal | Ra |
| 68. | <i>Cuculus varius</i> | Brainfever bird | Rc |
| | FAMILY | STRIGIDAE | |
| 69. | <i>Bubo zeylonensis</i> | Brown fish owl | Rr |
| 70. | <i>Glaucidium cuculoides</i> | Barred owlet | Rr |
| 71. | <i>Athene brama</i> | Spotted owlet | Ra |
| | FAMILY | CAPRIMULGIDAE | |
| 72. | <i>Caprimulgus sp.</i> | Nightjar | Ra |
| | FAMILY | APODIDAE | |
| 73. | <i>Apus affinis</i> | House swift | Ra |
| | FAMILY | MEROPIDAE | |
| 74. | <i>Merops orientalis</i> | Green bee-eater | Rc |

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|-----|-------------------------------|--------------------------------|-----|
| | FAMILY | CORACIIDAE | |
| 75. | <i>Coracias benghalensis</i> | Indian roller | Rc |
| | FAMILY | UPUPIDAE | |
| 76. | <i>Upupa epops</i> | Hoopoe | Rr |
| | FAMILY | ALCEDINIDAE | |
| 77. | <i>Halcyon smyrnensis</i> | White breasted kingfisher | Rc |
| 78. | <i>Alcedo atthis</i> | Small blue kingfisher | Rr |
| 79. | <i>Ceryle rudis</i> | Lesser pied kingfisher | Rc |
| 80. | <i>Ceryle lugubris</i> | Large pied kingfisher | Rr |
| | FAMILY | CAPITONIDAE | |
| 81. | <i>Megalaima australis</i> | Blue-eared barbet | Rr |
| 82. | <i>Megalaima zeylanica</i> | Large green barbet | Rc |
| 83. | <i>Megalaima lineata</i> | Lineated barbet | Rc |
| 84. | <i>Megalaima haemacephala</i> | Coppersmith | Ra |
| | FAMILY | PICIDAE | |
| 85. | <i>Dinopium benghalense</i> | Lesser goldenbacked woodpecker | Rr |
| | FAMILY | ORIOOLIDAE | |
| 86. | <i>Oriolus xanthornus</i> | Blackheaded oriole | Rc |
| | FAMILY | ALAUDIDAE | |
| 87. | <i>Mirafra assamica</i> | Bushlark | Rc |
| 88. | <i>Alauda gulgula</i> | Eastern skylark | Rc |
| | FAMILY | HIRUNDINIDAE | |
| 89. | <i>Hirundo rustica</i> | Swallow | LMc |
| | FAMILY | PYCNONOTIDAE | |
| 90. | <i>Pycnonotus cafer</i> | Redvented bulbul | Ra |
| 91. | <i>Pycnonotus jocosus</i> | Redwhiskered bulbul | Rr |
| | FAMILY | DICRURIDAE | |
| 92. | <i>Dicrurus adsimilis</i> | Black drongo | Ra |
| 93. | <i>Dicrurus annectans</i> | Crowbilled drongo | Rr |

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|------|------------------------------|----------------------|----|
| | FAMILY | CORVIDAE | |
| 94. | <i>Dendrocitta vagabunda</i> | Tree pie | Rc |
| 95. | <i>Corvus macrorhynchos</i> | Jungle crow | Rc |
| | FAMILY | PARIDAE | |
| 96. | <i>Parus major</i> | Grey tit | Rr |
| | FAMILY | MUSCICAPIDAE | |
| 97. | <i>Copsychus saularis</i> | Magpie robin | Ra |
| 98. | <i>Saxicola torquata</i> | Stone chat | Rc |
| 99. | <i>Prinia socialis</i> | Ashy wren warbler | Ur |
| 100. | <i>Orthotomus sutorius</i> | Tailor bird | Rr |
| | FAMILY | LANIIDAE | |
| 101. | <i>Lanius schach</i> | Rufous backed shrike | Rr |
| 102. | <i>Lanius cristatus</i> | Brown shrike | Rc |
| | FAMILY | MOTACILLIDAE | |
| 103. | <i>Motacilla alba</i> | Pied wagtail | Mc |
| | FAMILY | STURNIDAE | |
| 104. | <i>Sturnus contra</i> | Pied myna | Rc |
| 105. | <i>Acridotheres tristis</i> | Common myna | Rr |
| 106. | <i>Acridotheres fuscus</i> | Jungle myna | Rc |
| | FAMILY | PLOECIDAE | |
| 107. | <i>Lonchura malacca</i> | Blackheaded munia | Rr |

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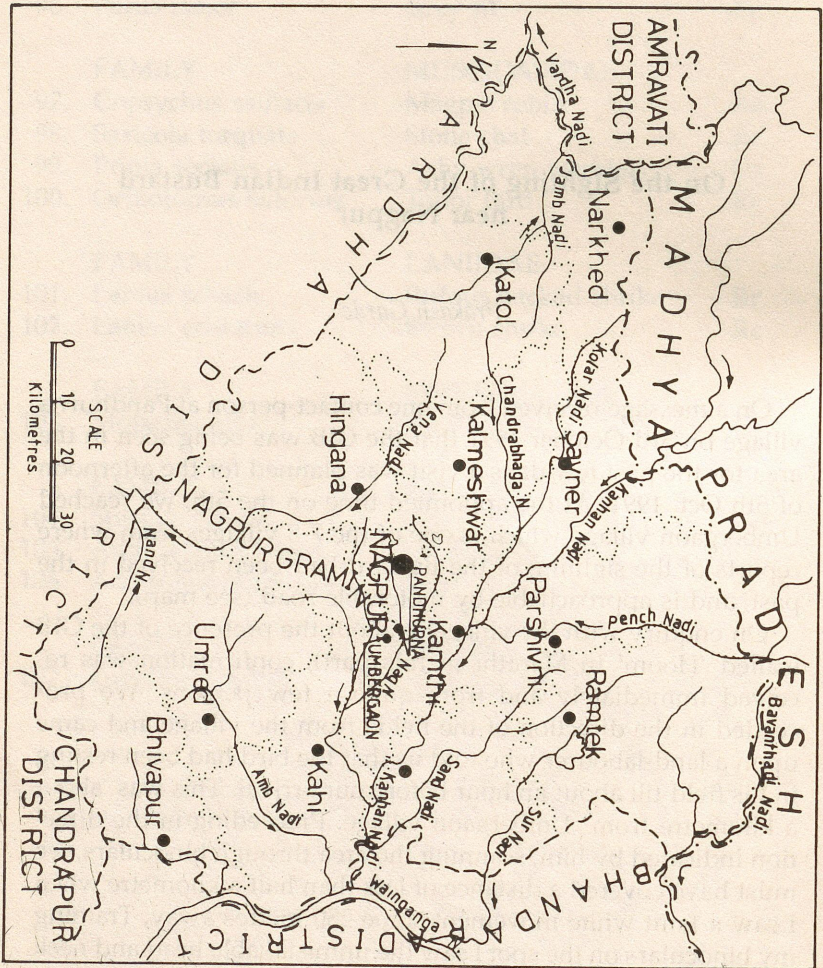
Manideep Raj
Lecturer, Department of Zoology
Darrang College
Tezpur 784001
Assam, India

On the Sighting of the Great Indian Bustard near Nagpur

Prakash Garde

On a message received from one contact-person at Pandhurna village on 3rd October 1991 that the GIB was being seen in the area for the past few days a visit was planned for the afternoon of 5th Oct. 1991. At the appointed time on the 5th, we reached Umbergaon village which is one of the 7-8 villages from where reports of the sighting of the Bustard had been received in the past, and is approachable by motorable road (see map).

On enquiry with the villagers about the presence of the GIB (called 'Hoom' in Marathi in this part), confirmation was received immediately and from quite a few persons. We proceeded in the direction of the fields from the village and came upon a land-labourer who told us that the bird had been resting in his field till about an hour before our arrival. This was about a kilometre from Umbergaon village. Proceeding in the direction indicated by him, scanning the area through binoculars, we must have covered a distance of less than half a kilometre when I saw a faint white movement some 250 metres away. Training my binoculars on the spot I saw the unmistakable head and neck of the Great Indian Bustard being raised above the grass behind which it was grazing. The bird was partially hidden behind the grass but soon took a few paces and emerged clear of the grass. I took advantage of a patch of Babul trees lying to my right to approach closer to the bird. By now it had become aware of our



presence and tried to hide in a thorny bush by retracting its neck under the bush. This presented another opportunity for us to go still closer until we were about 20 metres from it. It then broke cover and walked away into an open field which was freshly ploughed with not a blade of grass to hinder our view. With the evening sun shining on the bird from behind our backs we got a clear view of the Bustard from its tip to toe and I was also able to take a few photographs.

It was a male bird, about one metre in height, approx. 9 to 10 kg. in weight. Shri Lad CCF, Madhya Pradesh, who was with us, opined that the bird was old, well past its prime.

Description of the Habitat

The habitat where the GIB was sighted could be described as open cultivated land interspersed with thorny bushes and Babul trees. There are large patches of uncultivable fallow land with this type of scrub jungle within the habitat. About 30% of the fields have motor pumps for irrigation. A rivulet runs across the habitat on the north side, a small river on the south. On the east the area is bordered by the Nagpur-Umred Rly. line and on the West, by the Nagpur-Umred road.

Other Wild Life Present

Black-bucks used to frequent the area in the past and I have myself seen a herd of about 22 Black-bucks in the area in 1982 when we were searching for the GIB. The antelope seems to have disappeared though villagers report seeing a few, but rarely. A lone fox was seen in the same field on a subsequent visit.

Human Interference

The area is bordered by 7-8 villages, the residents of which own cultivable land comprising the habitat. Human and cattle interference is, therefore much in evidence.

The Great Indian Bustard seems to have developed good tolerance for these elements as villagers report that it allows approach or itself approaches to within 5 metres of the land labourers.

The Great Indian Bustard was sighted in a village about 15 km. from Nagpur on the 5th October 1991 at 5.00 p.m. in the

presence of the following :

1. Shri Prakash Garde, Director of the Vidarbha Natural History Study Centre Nisarga Seva Sangh, Nagpur.
2. Shri Ravi Deshpande, Member of the Vidarbha Natural History Study Centre Nisarga Seva Sangh, Nagpur.
3. Shri R. N. Indurkar, CCF (WL), Maharashtra.
4. Shri P. M. Lad, CCF, Madhya Pradesh.
5. Shri S. S. Mishra, DCF (WL), Nagpur.
6. Shri Nitin Kakodkar, ACF (WL), Nagpur.
7. Shri Santoshrao Meshkar, Resident of Umbergaon village.
8. Shri Prabhakar Rao Raut, Resident of Umbergaon village.

About VNHS Centre of the USS

The Nisarga Seva Sangha is a voluntary organisation with the Vidarbha Natural History Study Centre as its wing. The VNHS Centre has taken up the project to determine the 'Status of the Great Indian Bustard in Vidarbha' since November 1990. Persistent information about the bird's occurrence was being received by us from many parts of Vidarbha. It was therefore, decided to take up the project to conduct a systematic survey and study of the GIB in this area. We have tried to set up a network for receiving information about the bird. It was a sequel to our grand work that the bustard's presence in this part could be confirmed by actual sighting and photographing the Bird.

Prakash Garde
Nisarga Seva Sangh
Behind Nagpur Times Office
Ramdeo Peth
Nagpur 440010

Sustainable Agriculture and Nature Conservation in the Amur River Basin

Dr. Sergei Smirenski

Background

The Amur River is one of the 10 largest rivers in the world. Within its basin lies the greatest concentration of species diversity in all of Russia (including 12 mammal, 31 breeding birds, one amphibian, three fish, eight mollusc, and 17 insect species that are listed in the Red Data Book of Russia).

Until a few decades ago, the Amur River basin constituted a vast wilderness. Siberian Tigers roamed its forests. Cranes and storks returned each year to its marshlands to breed and rear their young. Great Siberian Sturgeons, one of the largest freshwater fish in the world spawned in the river's tributaries, joined by the Calico Salmon completing its 1,500 km journey from the Pacific Ocean.

Today, the region is undergoing a transformation. Its woodlands and wetlands are being rapidly converted into farmlands. (The basin includes more than 90 percent of all the agricultural land in the Russian Far East.) Improved Soviet-Chinese relations have contributed greatly to settlement of the region and, as the population has increased, to a growing demand for agricultural land. As previous Soviet restrictions on domestic travel and land ownership are lifted, settlement within the basin will likely increase.

The accelerated process of settlement and land conversion already has had an environmental impact. Wetland reclamation and deforestation have contributed to soil erosion, a decline in water quality, and the loss of important wildlife habitat. Extensive reliance on commercial fertilizers, pesticides, and herbicides - a problem throughout the former Soviet Union - is linked to contaminated drinking water and decreased soil productivity in the river basin.

As land and water is further degraded, the pressure for additional land conversion increases, placing the region's wildlands and the wildlife that inhabit them at greater risk of destruction. According to Russian conservationists, much of the land that is now being converted is of marginal value as farmland, and may provide greater economic benefits as protected conservation areas that attract tourism and recreation.

Increased settlement of the region also has led the Russian and Chinese governments to propose construction of at least 12 dams on the Amur River and its tributaries. These dams are expected to generate cheap electricity, improve flood control, and add to the agricultural landbase. However, Russian conservationists point out that the dams also will prevent seasonal floods from distributing nutrients that enhance soil fertility, block the migration of fish, and destroy wildlife habitat on a scale not previously experienced in the region.

Ongoing Conservation Efforts

Until recently, most Soviet conservation efforts in the Amur River basin focused on protecting endangered storks and cranes and their habitat. Under the direction of the "Crane Working Group of the USSR," conservationists worked to establish and expand nature preserves, monitor and recover bird populations, educate citizens on the benefits of land conservation, and foster cooperative projects with their Chinese and Mongolian counterparts. From the start, their efforts were supported by the US-based International Crane Foundation.

The collapse of the Soviet centralized agricultural system and the prospect of additional settlement in the river basin make this a priority project. Wetlands that serve as an important refuge for many animals and plants are threatened with development because of their close proximity to farmlands. While some of

these lands may be directly purchased by the Crane Working Group for conservation purposes (land acquisition initiatives are ongoing), there are not sufficient public or private funds available to acquire all endangered wildlife habitat.

The Crane Working Group realizes that land acquisition alone is not sufficient to preserve the region's wildlands. These efforts must be complemented with a systematic program that involves local citizens in a wide range of conservation and economic development initiatives. Because agricultural activities in the river basin have the greatest impact on the region's land and water resources, the participation of farmers is critical to the development of such a systematic program.

Dr. Sergai Smirenski
Biology Dept.
Laboratory of Ornithology
Moscow State University
Lenin Hills, Moscow 119899
Russia

The Black-Necked Crane Winter Count 1991-1992

Dr. Mary Anne Bishop

Introduction

A growing concern for the Black-necked Crane (*Grus nigricollis*) has underscored the need for more complete information on its population status. Historic descriptions of the Black-necked Crane's wintering range included Bhutan, India, China, Vietnam and Burma. Beginning in November 1988, researchers and government agencies were contacted to census known wintering areas between 1 January and 15 February 1989. The first, 1989 winter count yielded 705 cranes in China and Bhutan (Bishop 1989a, b) but none in Vietnam. The discovery of new wintering areas in Yunnan (Huang 1990, Wang et al. 1990) and Tibet (Bishop 1991b) have increased the world's known population to 4,024 during the third, 1991 winter count (Bishop 1991a).

This past 1991-92 winter, the Fourth Annual Black-necked Crane Winter Count was again organized by Dr. Mary Anne Bishop of the International Crane Foundation in Baraboo, Wisconsin U.S.A. Participating countries included the People's Republic of China, the Kingdom of Bhutan and India. Compared to the previous years, additional areas in Tibet, Arunachal Pradesh and central Bhutan were surveyed. No surveys were conducted in Vietnam for the 1991-92 winter count.

The 1991-92 Black-necked Crane Winter Count is intended to be the fourth of an ongoing series of yearly winter Black-necked

Crane counts as part of the IUCN Five-Year World Crane Action Plan. The goals of the annual Black-necked Crane Winter Count are :

1. Determine the relative abundance and distribution of the Black-necked Crane population by censusing their numbers on wintering areas between 1 January and 15 February.
2. Determine the annual juvenile recruitment by censusing the number of juvenile-plumaged cranes.
3. Identify important wintering areas for Black-necked Cranes and encourage their protection.

The following is a summary of the Fourth Annual Winter Count, conducted between December 1991 and February 1992.

Methods

Potential participants, including national and provincial Forestry Departments, conservation organizations and biological institutes were contacted in China, Bhutan, Vietnam and India during December 1991. Participants were asked to conduct one or two complete counts of Black-necked Cranes at each wintering area between 1 January and 15 February 1992. In some cases, peak numbers are from surveys as early as 20 December 1991.

Collaborators were provided with a data form. Information requested included: date, location, total number of Black-necked Cranes including the number of juvenile-plumaged cranes (cranes hatched in 1991). Additional information requested included number per flock, habitat, method of counting and number of observers. Final count results were compiled from returned data forms, reports, interviews and letters reporting results. For areas surveyed more than once, the high count is reported for the final count.

On areas where juvenile-plumaged cranes were surveyed, a juvenile recruitment rate (%) was calculated as the number of juvenile-plumaged cranes/total cranes \times 100. For some areas in Tibet, distances prevented total identification of juveniles. Numbers are reported only for those flocks where presence or absence of juveniles could be determined.

Results and Discussion

Between 20 December, 1991 and 11 February 1992 peak

counts were determined during surveys for Black-necked Cranes in the Kingdom of Bhutan and the People's Republic of China. Searches in Arunachal Pradesh State, India, were conducted on February 17-20th. A total of 5,554 Black-necked Cranes were located including 315 in Bhutan, 5,239 in China and 0 in Arunachal Pradesh, India. A brief summary by areas is included below.

Kingdom of Bhutan

In Bhutan, Col. R. T. Chacko conducted extensive surveys in cooperation with the Royal Bhutan Forestry between 26 October 1991 and 23 March 1992. The following results are taken from his report (Chacko 1992).

Throughout the winter, Chacko surveyed all known and suspected wintering areas several times. His surveys revealed that Black-necked Cranes in Bhutan decreased from 332 in 1991 to 315 in 1992 (Chacko 1992), (Table 1). Compared to the 1991 count, the Phobjika/Khatokha wintering area recorded a small increase (from 135 to 142). At Phobjika, peak numbers of 133 were observed by 12 November 1991, and again during January and February surveys. While a peak count of 10 cranes was recorded at nearby Khatokha in November 1991, a 13 January count at both Phobjika and Khatokha revealed 133 and 9 cranes respectively.

At Bumdiling, numbers of cranes decreased from 171 to 160. The high count of 160 was recorded as early as 19 December and again in early January. Bumthang District recorded the largest decrease, 26 to 13 Black-necked Cranes.

Chacko surveyed the Kuri Chu River again for Black-necked Cranes. He determined that the Black-necked Cranes migrate along the Kuri Chu River en route to their Bhutan wintering areas. In fall, families will sometimes stopover at Dungkhar and Thangmachu. However, they apparently do not stop over during spring migration. Cranes first began to arrive to Phobjika and bumdiling on 23 and 28 October respectively. Cranes migrated from Phobjika between 13-23 March. Cranes migrated from Bumdiling earlier. By 6 March, only 42 cranes remained at Bumdiling with the last cranes leaving by 18 March (Chacko 1992).

India

Prakash Gole of the Ecological Society in Pune, India surveyed valleys in Arunachal Pradesh in early 1992. He located no Black-necked Cranes. In the Sangti Valley (Lat 27° 26'N, Long. 93° 18'E.), no cranes were observed in 1992, although 6 Black-necked Cranes were reported in 1990-91. Gole reported an increase in human settlements, and a new road in this valley. Gole also explored other valleys north and south of the Sangti. Local people in these valleys recognized photos of Black-necked Cranes and reported that in the past they used to visit their valleys. They also reported that in recent years, only Sangti Valley had wintering cranes. Gole believes that there are many suitable valleys in west Arunachal Pradesh where habitat exists for a few pairs, although most of them are now settled (Gole, pers. commun. to G. Archibald 17 March 1992).

Guizhou Province, PR China

For the fourth year, scientists from the Guizhou Institute of Biology conducted surveys at Caohai Nature Reserve. Professor Wu Zhikang, Li Zhumei and Tang Guojun counted/observed 215 Black-necked Cranes during a 29-30 January count. This is the same number observed during the 1991 winter count.

Yunnan Province, PR China

Reports from the Yunnan Environmental Protection Commission (1991) and Yunnan Forestry Bureau indicate that as many as 1,114 Black-necked Cranes are wintering in Yunnan, with >90% counted in northeast Yunnan. At Napahai, 84 Black-necked Cranes were reported (Li Gui, Yunnan Forestry Department, pers. comm. to J. Harris, January 1992), up from 72 the previous year. Counts were not made at Bitahai Nature Reserve (Zhongdian County), Luguhu Lake (Ninglang County) nor Lo Sho Hai Swamp (Lijiang County) where small populations (<50) were observed in 1989, 1983 and 1985 respectively (Bishop 1989b, Yang 1991).

From 20-26 December 1991, the Yunnan Environmental Protection Commission (YEPC) organized extensive surveys in northeast Yunnan. Biologists from the Guangxi Academic, the Biological Department of Yunnan University, China Academic

and Environmental Institute of Yunnan Province and YEPC researchers from Qiaojia and Zhaotong counties participated. They photographed, videoed and counted cranes. Counts were made simultaneously at several different locations.

A total of 1030 cranes were located at 3 major sites: 1. Changhaizi and Daquiao reservoirs, 2. Dashanbao area, and 3. Maolin and Wuzhai (180) (YEPC 1991). At Changhaizi and Daquiao Reservoirs in Huize Country, 350 cranes were located, up from 240 the previous year. Cranes from these 2 reservoirs are believed to also frequent the Mashu reservoir in Qiaojia Country (YEPC interview with J. Harris, January 1992).

At Dashanbao, 500 Black-necked Cranes were located at the Tiaodunhe and Chelu reservoirs and Dayindi and Zhuanshanbao marshes. This represents almost 200 more Black-necked Cranes than were counted the previous year. In Yongshan County, YEPC researchers located 180 Black-necked Cranes at Maolin and Wuzhai villages (YEPC 1991).

Tibet Autonomous Region, PR China

For the second year, extensive surveys were conducted in south central Tibet by a joint team of International Crane Foundation (ICF) and Tibet Plateau Institute of Biology (TPIB) researchers. The team was led by Mary Anne Bishop (ICF) and included Canjue Zhouma and Zhang Yao Zhong of TPIB and Song Yangling (ICF and Academia Sinica-Beijing).

Between 21 December 1991 and 22 January 1992, some 3,910 Black-necked Cranes were observed, an increase of almost 1,000 cranes over the 1991 winter count. The increase in numbers was due to familiarity with survey areas, and more thorough searches than in the previous year. For example, a more thorough search of the Penbo River valley and its side valleys on 21 December 1991 revealed that the wintering population was 449 cranes, some 160 cranes more than were detected in 1991. In addition, higher numbers were detected in the western arm of the Yarlung River between Lhaze and Pindzoling (641 versus 360 in 1991), and in the Jiding Valley (314 versus 126 in 1991).

This year surveys of the adjoining north-south Xaintongmoin and Tashikang Valleys determined that 398 cranes wintered in this area, and that approximately 1/2 wintered on each side of the valley. The 1991 calculations underestimated the total num-

ber of cranes in these valleys by only counting 159 cranes in the Tashikang Valley and not counting the 154 cranes at Xaintongmoin (see page 4, Bishop 1991a). The 1991 numbers for this area and total count have been revised in Table 1 to reflect these higher crane numbers.

Three new areas were surveyed in south-central Tibet: Tingri (southwest of Lhaze), Yon Valley (north of Nedong), and the upper Lhasa River (from Old Linzhou to Maizhokuknggar). No significant crane numbers were detected in the newly surveyed areas: Tingri 0 cranes, upper Lhasa River 16 cranes and Yon Valley 54 cranes. Although historic reports by Liu (1986) indicate a small wintering population at Bayi in Linzhi County, northeast of Nedong, researchers were not able to conduct surveys in this area during the 1991-92 winter.

Juvenile Recruitment

Information on juvenile-recruitment was reported from all survey areas. On major wintering areas in southcentral Tibet with local populations >40 cranes, recruitment ranged from a low of 9.7% (Lhasa River Valley from Dagze-Maizhokunggar-Old Linzhou, 74 chicks and 764 total) to a high of 23.2% (Lhasa River Valley, Doilungdeqen-Quxu, 34 chicks, 164 total). Overall for Tibet, the recruitment rate was 12.6%.

At Bhutan's two largest wintering areas, Bumdiling and Phobjikha, recruitment was similar, with 16.1% and 16.5% per respective site. At Caohai Nature Reserve, in Guizhou Province China, recruitment rate was 14%, down from 22% in 1991 (Bishop 1991a). No information was received on juvenile recruitment for Yunnan.

Long-term studies on the greater Sandhill Crane (*Grus canadensis tabida*) suggest that an 8% juvenile recruitment rate maintains a stable breeding crane population when cranes are not hunted (R. Drewien, pers. commun. April 1989). Currently, hunting is not a major factor on any of the wintering areas. With all major wintering areas reporting >9.5% recruitment, Black-necked Cranes appear to be increasing throughout their range.

Conclusion

The December 1991-February 1992 surveys resulted in almost a 25% increase of the previous known world population of

Black-necked Cranes from 4,183 to 5,554. This increase is due primarily to more complete surveys in southcentral Tibet and northeast Yunnan. Southcentral Tibet, especially along the western Yarlung Tsangpo, Lhasa and Penbo Rivers are key concentration areas. In Yunnan, Dashnbaos and Changzhizi and Daquiao Protected areas support the main wintering populations for this province.

Black-necked Cranes continue to be vulnerable to habitat changes and human pressures because of their tendency to winter in traditional areas. Therefore, winter count participants should make specific recommendations to their local and national governments for the appropriate management and protection of the Black-necked Cranes on their wintering areas.

Table 1

Results of the Third and Fourth Annual Black-necked Crane Winter Count in the Kingdom of Bhutan, People's Republic of China, and India. Surveys for 1991 count conducted between 22 December 1990 and 3 March 1991. Surveys for 1992 count conducted between 20 December 1991 and 11 February 1992.

Location	Altitude (M)	1992 Survey Dates	1991 Totals	1992 Totals
India				
<i>Arunachal Pradesh</i>				
Sangti Valley	--	1 Feb	--	0
Kingdom of Bhutan				
Wangdiphodrang Dist				
Phobjika & Khatokha	2,900	6-14 Jan	135	142
Tashigang Dist/ Bumdiling	1,950	20 Dec	171	160
Bumthang Dist Gyetsa	3,000	1 Jan	22	9

Kurjey, Thangby, and Kharsa	2,630	30-31 Dec	4	4
People's Republic of China				
<i>Guizhou Province</i>				
Weining Co/Caohai Lake	2,170	11 Feb	214	215
<i>Yunnan Province</i>				
Zhongdian Co/Napahai	3,300	Dec	72	84
Huize Co/Changhaizi & Daquiao Lakes	2,500	20-21 Dec	240	350
Zhaotong City/ Dashanbao	3,200	25 Dec	309	500
Yongshan Co/ Maolin & Wuzhai	3,100	Dec	50	180
<i>Tibet Autonomous Region</i>				
Shigatse Municipality :				
Airport-Dashuka Ferry	3,800	26 Dec	102	156
Namling/S. Shang & Yarlung Rivers	3,840	27 Dec	72	94
Shigatse-Namling	3,818	9 Jan	135	185
W. Shigatse/ Tangma-Shalu	3,850	7-8 Jan	245	282
Bainang Co/Nyang River	3,882	7 Jan	109	78
Gyantse Co/Nyang River	3,950	9-10 Jan	0	0
Sakya Co/Jiding Valley	3,910	28 Dec	126	314
Xaitongmoin & Lhaze Cos Xaitongmoin & Tashikang	3,910	29Dec, 5 Jan	329 ^a	398

Lhaze Co./Lhaze-Pindzoling	3,922	5-6 Jan	360	641
Tingri Co	4,350	31 Dec	--	0
Maizhokunggar & Dagze Cos	3,750	18-22 Jan	768	872
Lhunzub Co/Penbo River	3,750	21 Dec	280	449
Doilungdeqen & Quxu Cos.	3,650	16-17 Jan	216	167
Yamdruk Tso	4,480	10 Jan	0	0
Gonggar-Zhanang-Nedong Cos.	3,570	12-14 Jan	224	274
Grand Totals			4,183^a	5,554

a. Revised count for 1991 at Xaitongmoin and Tashikang from 169 to 329 after 1992 surveys determined double counting had not occurred.

Table 2

Juvenile recruitment for major wintering areas in the Kingdom of Bhutan, and Guizhou and Tibet Autonomous Region, PR China, December 1991-February 1992.

Location	Total Cranes	Total Juveniles	% Recruitment
Bhutan			
Phobjika & Khatokha	142	24	16.9
Bumdiling	160	26	16.3
Bumthang	13	5	38.5
China/Guizhou			
Caohai	215	30	14.0
China/Tibet			
Gonggar & Zhanang Cos	206	34	16.5

Shigatse Airport-Dagshuka	121	20	16.5
Namling	78	16	20.5
Shigatse-Namling	40	4	10.0
W. Shigatse:Tangma-Shalu	272	44	16.2
Bainang Co.	78	12	15.4
Jiding Valley	274	33	12.0
Xaitongmoin & Tashikang	377	45	11.9
Lhaze-Pindzoling	561	64	11.4
Maizhokunggar & Dagze Cos.	764	74	9.7
Lhunzub Co.:Penbo River	449	45	10.0
Doilungdeqen & Quxu Cos.	164	34	23.2

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Dr. Mary Anne Bishop, Coordinator
 Black-necked Crane Winter Count
 C/o International Crane Foundation
 E-11376 Shady Lane Road
 Baraboo, WI 53913, USA

The Rio Conference : Some Bare Truths

For environmentalists all over the world 1992 proved memorable as it saw their largest gathering ever for the global conference on environment held at Rio De Janero in Brazil. India had sent a strong official delegation and a number of our eminent environmentalists attended it as representatives NGOs. Anil Agarwal and Sunita Narayan of Centre for Science and Environment, New Delhi, had circulated a draft statement on Global Environmental Democracy for comments which they presented to the conference.

Everybody now knows what the global conference achieved or failed to achieve. The issues raised, discussed, shelved or thrown overboard by the conference concern everyone living on this planet : human as well as non-human beings alike. It is in this context our comments on Global Environmental Democracy appear to be relevant. They are reproduced below. (Editor)

Dear Anil Agarwal, Sunita Narayan and others

Once again I must congratulate you for bringing out a concise, logically argued draft statement on Global Environmental Democracy. I commend your optimism and am in agreement with the basic position taken on the need to formulate a global social contract, the benefits accruing from a global programme to provide jobs to generate ecological regeneration and restoration and the need to compensate South adequately for their store of

germplasm and biodiversity that their traditional practices have helped to preserve.

In some respects however, I find the position taken by you to be too optimistic or too simplified.

With the cessation of cold war and the nations of eastern Europe, the erstwhile USSR and even China now joining the North (USA, W. Europe and the Antipodes), the North is more likely to impose its viewpoint on the South than agree to any sharing of the burden. The annihilation of Iraq should serve as a warning that whenever necessary brute force will be used. Any talk of the South demanding compensatory payment from the North for its errant behaviour appears to me a bit unrealistic. I do not believe that the North will consider it its moral responsibility to provide a lead that gives confidence to the South. Instead a new colonialism is likely to emerge.

The only way to bring the North to the negotiating table on an equal footing is to deny them the vast markets that the S provides for their products. The nations of the S must unite to tell them that they do not want the destructive technology : machines, chemicals and weapons produced by the N nor are they interested in selling their raw materials to the N. Their own technology and production system by using their own skills, brain power and materials, are fully capable of satisfying their wants. I have no doubt this alternative technology is possible and is realistic.

Achieving this unanimity among the S is obviously a tall order. As long as this unity and confidence cannot be achieved by the S its bargaining position will continue to be extremely weak.

In your Elements of Global Environmental Democracy a great stress has been laid on participatory community institutions. I find that our environmentalists are greatly swayed by a few successful experiments carried out in our country in that direction. That they are not copied generally is because they demand complex social and legal changes as you have stated. Apart from this I may draw your attention to the north-south divide that exists in each developing country. I am referring to the city and countryside divide (India and Bharat).

Our whole development in the last 40 years has been city-oriented. The average city-dweller enjoys a far higher standard

or living than even a rural rich. City-life is heavily subsidized at the expense of the countryside. Now if village institutions are strengthened, it will result in the diversion of resources away from the cities. Any fall in the living standards of city-dwellers will be resisted by our elite which includes all our social leaders, politicians and bureaucrats.

I believe that if village institutions are strengthened, become fully democratic and are headed by well-trained, skilled rural leaders, they will definitely lower the disparity between cities and rural areas given the existing technology. It will not however, be tolerated by our elite.

The bargaining position of the S is weak because the elite in the S take pride in slavishly aping the N.

You have insisted upon a global right to survival for all human beings. Why not extend this right to non-human beings also? I find that all environmentalists dither on this particular point.

You feel that the vast numbers of unemployed and underemployed in the S can gain employment through a massive global initiative for ecological regeneration. It is however, not enough to provide a survival wage; it is also necessary to ensure better prospects for the future. This can only be possible if almost each manual labourer acquires a definite skill and take pride in his work. This aspect is utterly neglected in our educational system. Environmentalists should not take the elitist position that only a survival wage is enough to ensure satisfaction and dignity to a manual labourer.

I also do not agree that this massive employment programme should be financed through a Planet Protection Fund. The N will never agree to tax themselves to the extent suggested. Indeed it is in their interests to keep unemployment and social divisions high in the S, as it is in the interests of our elite too. Such a programme should be financed through taxing the rich agriculturists, denying subsidies to industries and levying an environment tax on city-dwellers. I do not want here to go into the details of the eco-regeneration programme.

I do not know how you can incorporate my comments in your draft. If you succeed in bargaining on the position taken in the draft, nothing like it. All good luck to you!

Ecological Society

The First Decade 1982-92

In March 1992 Ecological Society completed 10 years of fruitful work.

Concern for environment is often projected as anti-development. The agitational approach adopted by certain environmental groups appears to lend credence to such allegations. Our Society has kept itself away from the agitational approach and has consistently tried to chart a novel course in finding solutions to various urban and rural problems. Take for example, the problem of river pollution in Pune. The Society began its work, back in 1982, by carrying out a socio-biological survey of Pune's river-front and then drew up a development plan based on ecological considerations. Some of its elements are incorporated in the measures that Pune Municipal Corp. is carrying out to give a face-lift to Pune's rivers.

The Society was next assigned the work by Govt. of India of preparing a development plan for one of the ecologically most fragile areas of Western Ghats. From 1983 to 1985 the Society developed this plan after making a thorough survey of the ecology of this area : the catchment area of Panshet dam that supplies water to Pune. Not only the plan was hailed as a model one, but the Society was then given the task of developing a model to restore the ecology of the catchment. The forest restoration model developed by the Society during 1986-89 lowered the cost of greening of our hills from the prevailing

Rs. 16000 per hectare to Rs. 6000 improving in addition the quality of the soil, the vegetation and the life forms associated with it.

Since 1990 the Society has concentrated its research on problems of catchment and command areas of our irrigation projects. Not only has the Society developed and regularly conducts orientation courses for Class I officers of Maharashtra's Irrigation Department, it has suggested constructive and viable steps that aim to improve the water supply and quality of life of human beings as well as non-human creatures inhabiting the catchment and command areas. On one of the large reservoirs in Maharashtra the Society is running a project to improve the bio-diversity on the reservoir periphery adopting model techniques in land and water management. Indeed restoration of bio-diversity is the field which Ecological Society has set itself to devote to improve the quality of life of our countrymen. Since 1987 the Society publishes its Journal every year, which has now become one of the important research works in the field of ecological research in India.

You too can participate in this noble task either through your contribution in cash or kind or by assigning the Society the work of restoring soil, tree-overs, ponds and lakes, river-fronts, in fact restoration of bio-diversity of any degraded eco-system.

Trustees of Ecological Society

Ecological Society

The Society was founded in 1982 to promote research and education in ecology. Through research, the Society endeavours to study the impact of developmental activities on ecology; through education, the Society tries to make people aware of the implication of the adverse effects on ecology; and through field projects the Society proposes to set up model units where developmental planning and ecological conservation complement each other to better the lot of the people.

Members of the public are cordially invited to participate in the work of the Society by becoming a Wellwisher (life contribution Rs. 100), a Benefactor (life contribution Rs. 1000), or a Patron (life contribution Rs. 10000). Contributions in cash or kind are accepted. All donations are exempt from income tax. All the three categories of participants receive Society's Journal and are invited to programmes organised by the Society such as talks, film and slide-shows, seminars and symposia, field trips and excursions etc.

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