

BUSTARD SANCTUARIES OF INDIA



STRATEGIES FOR THEIR CONSERVATION AND MANAGEMENT

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BOMBAY NATURAL HISTORY SOCIETY

TECHNICAL REPORT NO. 13

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By

ASAD R. RAHMANI & RANJIT MANAKADAN

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BOMBAY NATURAL HISTORY SOCIETY

and

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Introduction

The Great Indian Bustard *Ardeotis nigriceps* (Vigors) owing to its increasing rarity has been a cause for concern among conservationists (e.g. Ripley 1952, Ali 1970, Gupta 1970, Dharmakumarsinhji 1978, Vardhan & Goriup 1980). Till about the early 1900's, the bustard was widely distributed in almost all the plains, grasslands from Uttar Pradesh-Punjab in the north to Tamil Nadu in the south, and from Sind (Pakistan) in the west to Orissa in the east (Hume and Marshal 1887, Baker 1921, Ali & Ripley 1969; see Map 1). Hunting and destruction of its grassland habitat has greatly reduced its numbers. The Great Indian Bustard was legally protected under the Bombay Wild Animals and Wild Birds Protection Act of 1951 but its number continued to decrease as enforcement of the law was inadequate. At the IUCN Eleventh Technical Meeting in New Delhi in 1969, Dr. Salim Ali, basing his estimate on the figures of Dharmakumarsinhji, stated that there were only about twelve hundred bustards left in the country (Ali 1970). In the early 70s, Dharmakumarsinhji did some surveys and recommended certain areas in Maharashtra, Madhya Pradesh and Gujarat to be established as bustard sanctuaries, but his recommendations were not effectively implemented. In the late '70s the bustard attracted attention of the media, thanks to the activities of Arab falconers (Vardhan & Goriup 1980), and quickly a few bustard sanctuaries were established by different state Governments.

At present the Great Indian Bustard survives in a few isolated pockets in six states of India, namely Gujarat, Rajasthan, Madhya Pradesh, Maharashtra, Karnataka, and Andhra Pradesh (Rahmani & Manakadan 1983, Rahmani 1987a). During the last few years, various surveys have been done under the Endangered Species Project of the Bombay Natural History Society and the population estimate is between 1500 to 2000 bustards for the whole country, with Rajasthan holding more than half of the population (Rahmani 1986, 1987a).

ENDANGERED SPECIES PROJECT

The Endangered Species Project of the Bombay Natural History Society was started in 1981 and two species—the Great Indian Bustard and the Asian Elephant were taken up for a study. In 1984, this project was expanded to include other endangered species of birds like the Lesser Florican *Sypheotides indica*, Bengal Florican *Houbaropsis bengalensis*, Jerdon's Courser *Cursorius bitorquatus*, etc. The Endangered Species Project is funded by the U.S. Fish & Wildlife Service and is sponsored by the Government of India.

Work on the bustard was started with the following objectives:

1. To obtain precise data on the present distribution of the bustard.
2. To examine habitats presently holding bustards.
3. To determine whether in such habitats the bustards are transient or resident.
4. To determine exact breeding areas, to study the constraints on such areas and to prepare management plans for such areas for their complete protection.
5. To study the ecology of the bustard with special reference to breeding success of the species in different areas of its distribution and to investigate the parameters required for breeding success.
6. To study the dispersal and seasonal movements of the bustards.
7. To prepare, on the basis of the data obtained, a management plan for the conservation of the bustard.

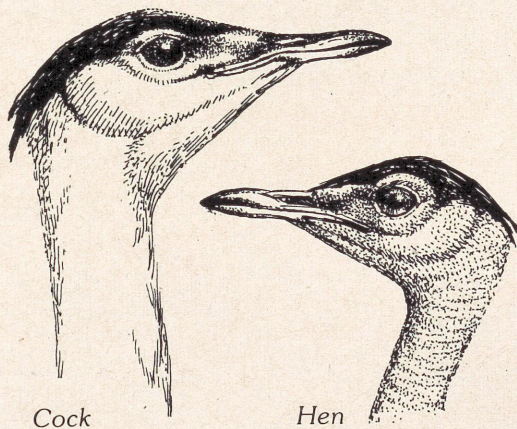
A RESUME OF THE PROJECT WORK

The results of the work done on the bustard under the Endangered Species Project, have been presented in various annual reports, technical reports and papers. A resume of the work is given below.

The study was started in April 1981 with preliminary surveys in Rajasthan and Maharashtra. A field station was started in August 1981 in Nanaj near Solapur in Maharashtra state where 8 bustards were seen. As the birds at Nanaj are seen mainly during the monsoon (Rahmani and Manakadan 1986), another field station was started at the Karera Bustard Sanctuary in Shivpuri district of Madhya Pradesh. Bustards at Karera are resident and seen throughout the year. Intensive studies were done at Nanaj from 1981 to 1984 and at Karera from 1982 to 1986. In 1985, the field biologist working at Nanaj was shifted to Rollapadu Bustard Sanctuary of Andhra Pradesh. Studies at Rollapadu were conducted from August 1985 to December 1987. In addition to these, extensive surveys were done in all the known bustard areas. Results of these surveys were given in the annual reports as well as in technical reports. This report on bustard sanctuaries is based on six years of intensive research at the three field stations, i.e. Nanaj, Karera and Rollapadu and, on the various surveys.

Bustard Biology

The Great Indian Bustard belongs to an ancient family of birds called Otididae, with 22 species out of which six are reported from the Indian subcontinent. Among these, three are resident and three non-resident. The non-resident species are (i) the Great Bustard *Otis tarda*, with a few records from Baluchistan, (ii) the Little Bustard *Tetrax tetrax*, with records from Kashmir, Punjab and Uttar Pradesh, and (iii) the Houbara Bustard, *Chlamydotis undulata*, which is a regular winter migrant to Gujarat and Western Rajasthan. The resident bustard species are (i) the Great Indian Bustard, (ii) the Lesser Florican, and (iii) the Bengal Florican. All the three Indian bustards are endangered and protected under the Wildlife (Protection) Act 1972. The BNHS is currently studying the three resident bustard species.



Cock

Hen

Sexual Dimorphism

The bustard is a terrestrial bird, the adult males standing upto 110 cm, while the females are smaller (90-92 cm). Among birds, the bustards, especially members of *Ardeotis* genus show the greatest sexual size dimorphism. The male bustard is almost double the weight of the hen. There is not much difference in the plumage but the male has a much whiter and thicker neck than the female.

Flock Composition

Male and female bustards are seen in separate flocks. Mixed flocks are rare and temporary (Rahmani & Manakadan 1986). In the non-breeding season, all the males of an area flock together. Similarly, hens also forage, roost and rest together. Mixed flocks of both sexes are seen mainly in the crop fields where the birds congregate for feeding. The juvenile bustard moves with its mother for about a year, till the next breeding season. Mother-juvenile family groups frequently join the female flocks but they are rarely seen with the male group. The male chick grows very fast and even when taller than the mother, moves with her, thus giving an erroneous impression of a pair of bustards. True pairing as seen in Sarus Crane, geese, certain ducks, etc. does not occur in the Great Indian Bustard. Sometimes, if a cock and a hen bustard happen to be in the same area, they may join together for a short time during their foraging activities but permanent pair bond is not seen in this species.

In the non-breeding season, male bustards of an area are generally seen together



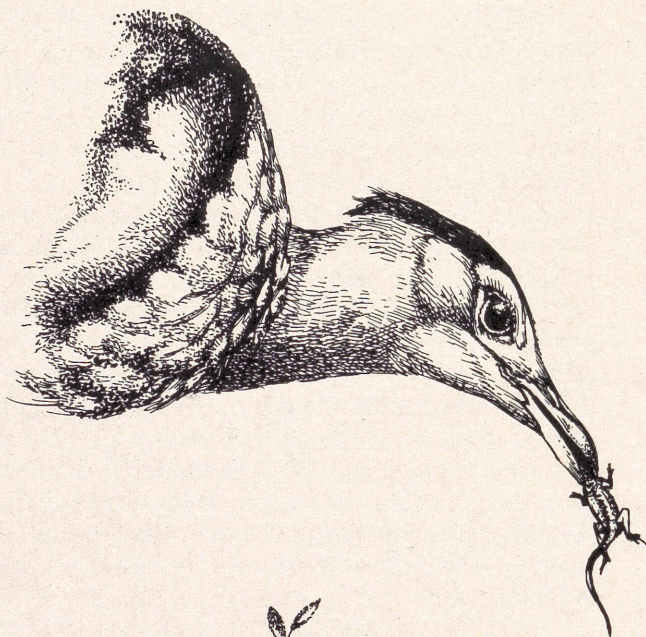
Food and feeding habits

The bustard is an omnivorous and an opportunistic feeder. Its diet varies from insects, snakes, scorpions, lizards to Bengal gram (*Cicer arietinum*), Soeha or Taramira (*Eruca sativa*), Groundnut (*Arachis hypogea*), Wheat (*Triticum vulgare*), ripe fruits of Ber (*Zizyphus* spp.) and *Morinda tinctoria*.

Like most of the animals of the desert environment, the bustard is also perfectly adapted to long dry spells when surface water is scarce. It is a facultative drinker, i.e. it drinks regularly when water is available but otherwise it can go without water for days together.



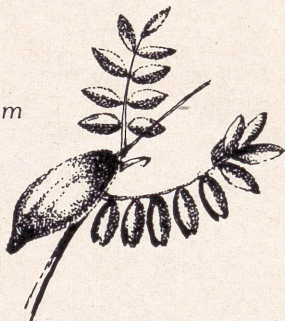
Insects



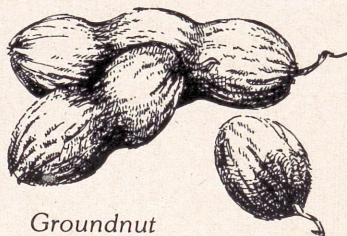
Some food items of the bustard

Reptiles

Bengal Gram



Morinda



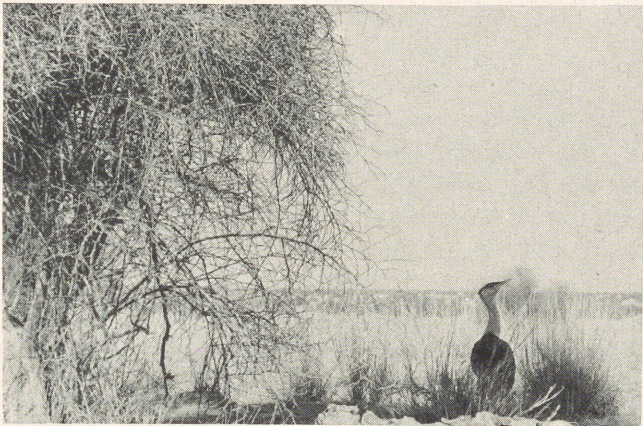
Groundnut

Roosting and Resting Behaviour

The bustard is largely a terrestrial bird and all its life's activities occur on the ground. Though it is a strong flier, it prefers to walk and flies only when it is disturbed.

Roosting is done on the ground in comparatively bare area. Roosting sites are not fixed, the bustards roost in any open area near their foraging ground. If suitable roosting site is not present near the foraging site, the bustard may walk upto a kilometre in search of bare ground. Night roosting is never done in thickly vegetated areas. They roost in open areas in order to detect ground predators at night.

Day resting on the other hand, is generally done in thick grass or under the shade of bush. All the birds of a flock rest together and a constant watch is kept by some birds to detect danger. The bustard may rest either standing or sitting. Preening is frequently seen during the resting period.



During mid-day, bustards (above and top) seek shade from the hot sun



To avoid detection, bustards sometimes squat on the ground near bushes

Activity Rhythm

Like most birds, the bustard also show a bimodal pattern of activity rhythm, i.e. the bird is most active during morning and evening and takes rest during noon. This biomodal pattern is more marked in hot weather. During cool, cloudy days they could be seen foraging at any time of the day.

The same activity rhythm is shown by the incubating hen, i.e. the incubation recess or foraging is mainly done during morning and evening. However, if it starts raining or drizzling while she is foraging, she returns to the nest at once.

Courtship display of the male bustard also occurs in the morning and evening but much depends on the weather. If it is cloudy, an adult male may display at any time of the day, especially if hens are around.



A fine male with his gular pouch extended in full display

Breeding Season

The breeding season of the bustard varies from area to area but everywhere it coincides with the increase in the natural food, especially insects and reptiles. In the arid and semi-arid areas like the Thar Desert and the Deccan tableland (e.g. Maharashtra, Andhra and Karnataka), the main breeding season is during the Monsoon when the seemingly barren land turns green with the rains. In Madhya Pradesh (e.g. Karera, Ghatigaon, and Pohri), the bustard starts breeding from mid-March and the peak is reached in April and May. Sometimes eggs are seen upto August. At Rollapadu in Andhra Pradesh, some breeding activity is seen during summer (i.e. April-May) but the main breeding period is between August and December. A few eggs are seen even in January (Manakadan & Rahmani 1986).



Courtship Display

The male bustard has an elaborate and remarkable display. The cock selects a prominent place in its territory and displays every morning and evening. During display a special gular pouch is inflated with air, which hangs in front of the legs like a balloon. The tail is cocked over the back, and wings are partially drooped. This display is enhanced by a loud booming calls, which can be heard upto a kilometre depending on the wind direction. The main function of the courtship display is to attract the female, and to repel rival males.

Territoriality

In the breeding season the adult cock Great Indian Bustard is highly territorial. With the approach of the breeding season, adults separate from the flocks and move to their traditional display grounds to establish territories of more than one square kilometre depending upon the terrain. Only the hens and subadult males are tolerated in the territory. Territorial fights between adult males are frequent and generally the territory owner wins the skirmish.

Hen bustards move from territory to territory and mates with the male of their choice. All matings which we saw were with the territorial cock.

A cock bustard displaying near a hen

Nesting

The bustard is a promiscuous species, and pair formation is not seen. Generally one, rarely two eggs are laid on the bare ground and practically no attempt is made at nest building. Incubation and chick rearing is done solely by the hen. Incubation period is about a month, and the chick is able to fly in about 2½ months time. It remains with the mother for a year or more till the next egg is laid.



An alert hen bustard, incubating



Bustards generally lay only one egg ↑



↓ Hatching success is highly dependent on habitat protection

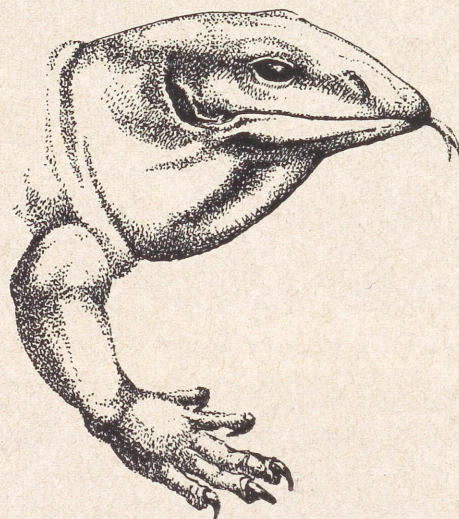
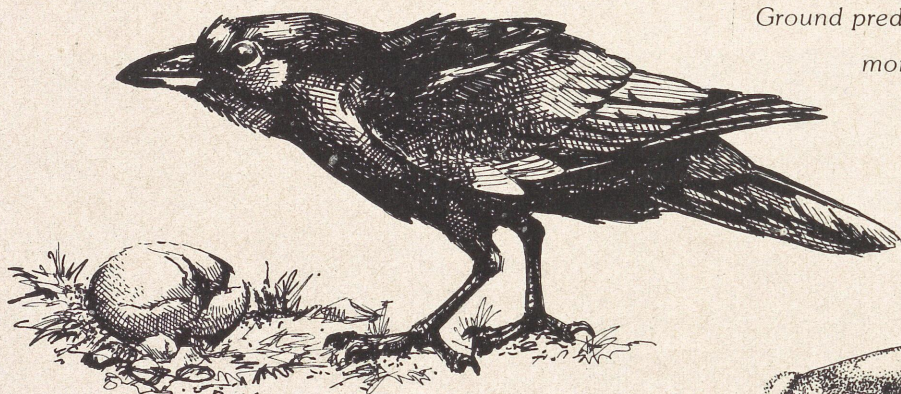


Natural Predators

An adult Great Indian Bustard has few natural predators. One of its potential predators—the cheetah—is extinct in India and another, the wolf has become quite rare. However, we have seen wolf in all our field stations. At Nanaj, circumstantial evidence indicates that one incubating hen bustard was picked up by wolves at night. Apart from this, we do not have any record of natural predation of the bustard during our study period.



Ground predators like foxes (above), crows (left), monitor lizards (below) and mongooses are destructive to bustard eggs



The egg and chick of the bustard have many predators like crow, fox, jackal, monitor lizard and mongoose. The one month incubation period and 2½ months of pre-fledging time are the most crucial period in the life of a bustard. Once the chick is able to fly, it can escape most of its natural enemies. The adult bustard is quite capable of confronting a fox, a jackal or a monitor lizard (Rahmani & Manakadan 1987).

Apart from the natural predators, the most insidious enemy of the egg of the bustard is livestock. With our stupendously huge livestock population no area is safe from overgrazing. Even if the egg is not trampled upon by livestock, frequent disturbance to the incubating bird would decrease the chance of successful incubation. Though the hen bustard sits tightly on the egg when the livestock comes near her, the presence of herdsmen disturbs her and she generally moves off, leaving the egg unattended. That is the time when the egg is likely to be accidentally trampled upon by livestock. Also if the egg is left unattended for long periods during the harsh summer, there are chances that the embryo will die due to exposure to the sun's rays. These factors make it necessary for every bustard sanctuary to have some undisturbed core areas where bustards can breed successfully.

A hen feigning wing injury to distract would-be predators away from the nest



Incubation Behaviour

In order to survive the long ordeal of incubation, the hen forages every morning and evening for one to two hours. This foraging is generally done within sight of the nest. At Karera, where the bustards breed during the hot summer months, the incubating bird drinks every day. Thus, water availability, appears to be important in nest site selection (atleast in those places where the bustard breeds during summer).

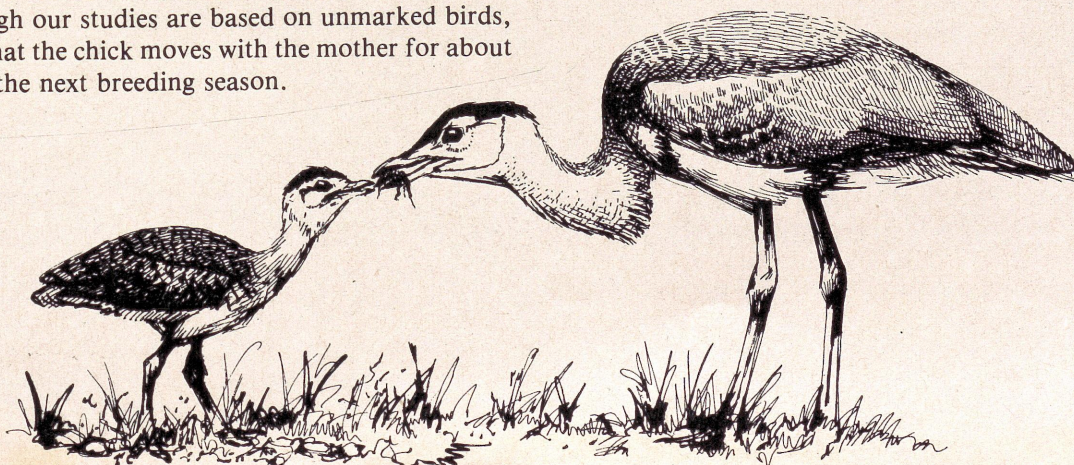
An alert hen with a few-weeks-old chick



Rearing of chick

The precocial bustard chick leaves the nest within 24 hours of hatching. Adequate vegetal cover is necessary for about 2½ months till the chick is able to fly. Therefore, as soon as the chick hatches, the mother takes the chick to better vegetated parts of the habitat to protect it from natural predators. The chick is fed mainly insects and other proteinous food. Growth of the chick is fast and in six months the chick is the size of the hen. Though our studies are based on unmarked birds, we think that the chick moves with the mother for about a year till the next breeding season.

Chicks are generally fed animal matter



Habitat Preference

The bustard prefers wide open areas where the vegetation is below its eye-level. The preferred habitat is grassland, with widely scattered bushes and trees. Tall dense grass, forests and marshy areas are avoided. It may be found in marginally cultivated areas with scattered crop fields but rarely in intensively cultivated areas, possibly due to the high degree of human interference. It freely enters crop fields like Groundnut, Bengal Gram, Taramira and Til—all these crop plants are between 30 to 70 cm tall. If the plants are not dense, the bustard may be seen even in Sorghum fields, but most of our bustard sightings were at the edges of Sorghum fields, and rarely inside, clearly indicating that the bird avoids tall vegetation. Though the height of wheat plant is mostly below the eye-level of the bustard, we have never seen them inside the standing wheat fields. This is mainly because wheat is densely planted and the bird finds it difficult to move in there. Only the fallen grains are picked up after the wheat is harvested.

Knowledge of the habitat preference of the bustard has a direct bearing on the development and management of bustard sanctuaries (see Chapter III for more details).

Associate Animals

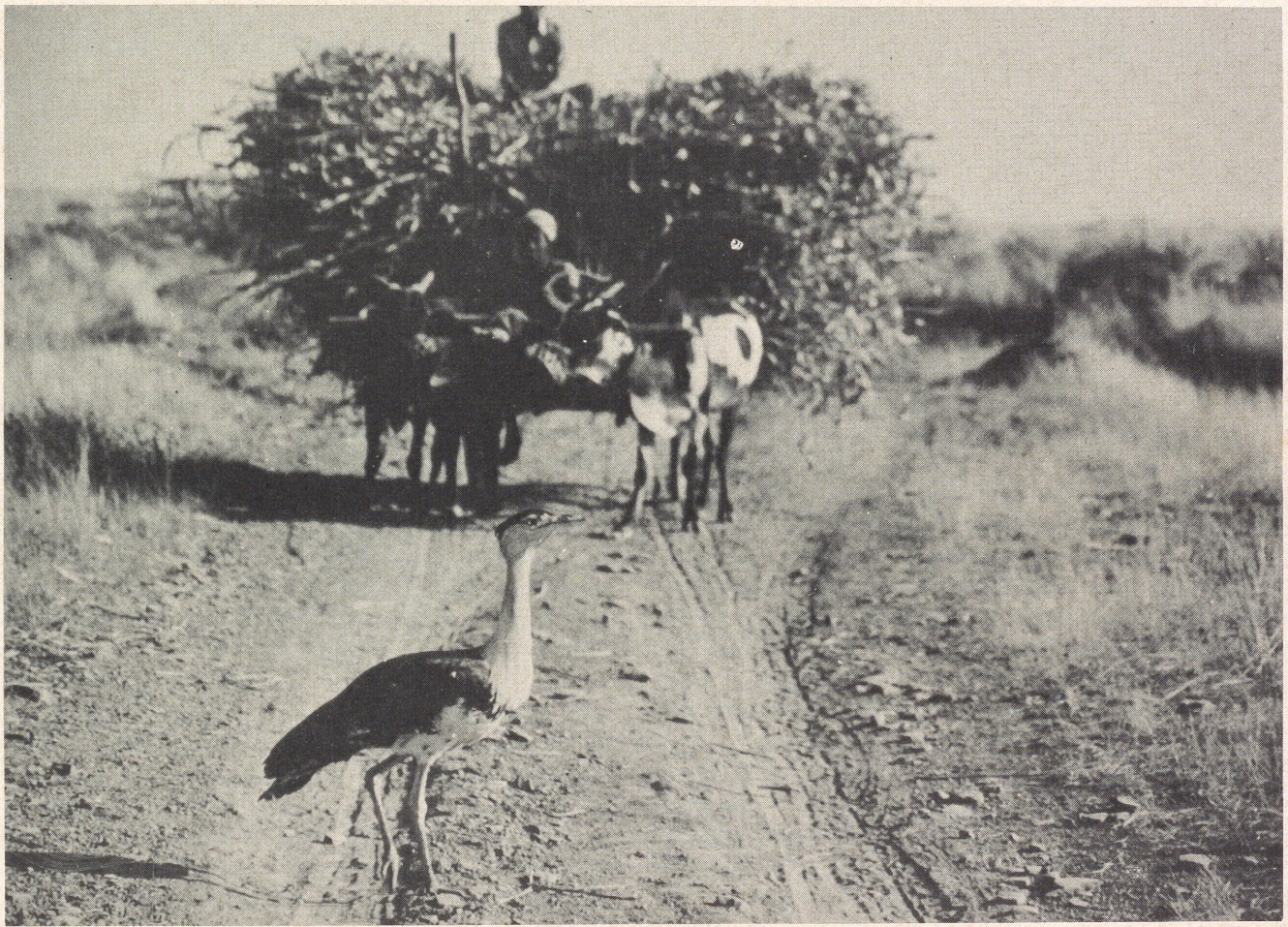
A large number of animals are present in the bustard areas, of which a few species may be considered as indicator species of a perfect bustard habitat. Among herbivores, Blackbuck *Antelope cervicapra* and/or Chinkara *Gazella gazella* are present or were once present in all the bustard areas. Except for western Rajasthan and certain parts of Kutch, Blackbuck is even now seen in all the important bustard sanctuaries (Table II).

Indian Fox *Vulpes bengalensis*, Jackal *Canis aureus* and Wolf *Canis lupus* represent the carnivores of a bustard habitat. Wolf, which is an endangered species is seen at Karera, Ghatigaon, Pohri, Kundanpur, Nanaj, Rollapadu and Rannibennur (Table II). In the Desert National Park and other parts of the Thar Desert, Red or Desert Fox *Vulpes vulpes pusilla* is seen in the same area where the bustards live. In Sonkhaliya, Nilgai or Bluebull *Boselapus tragocamelus* is sometimes seen but as these antelopes are not a true denizens of grasslands, they are not found in most bustard areas.

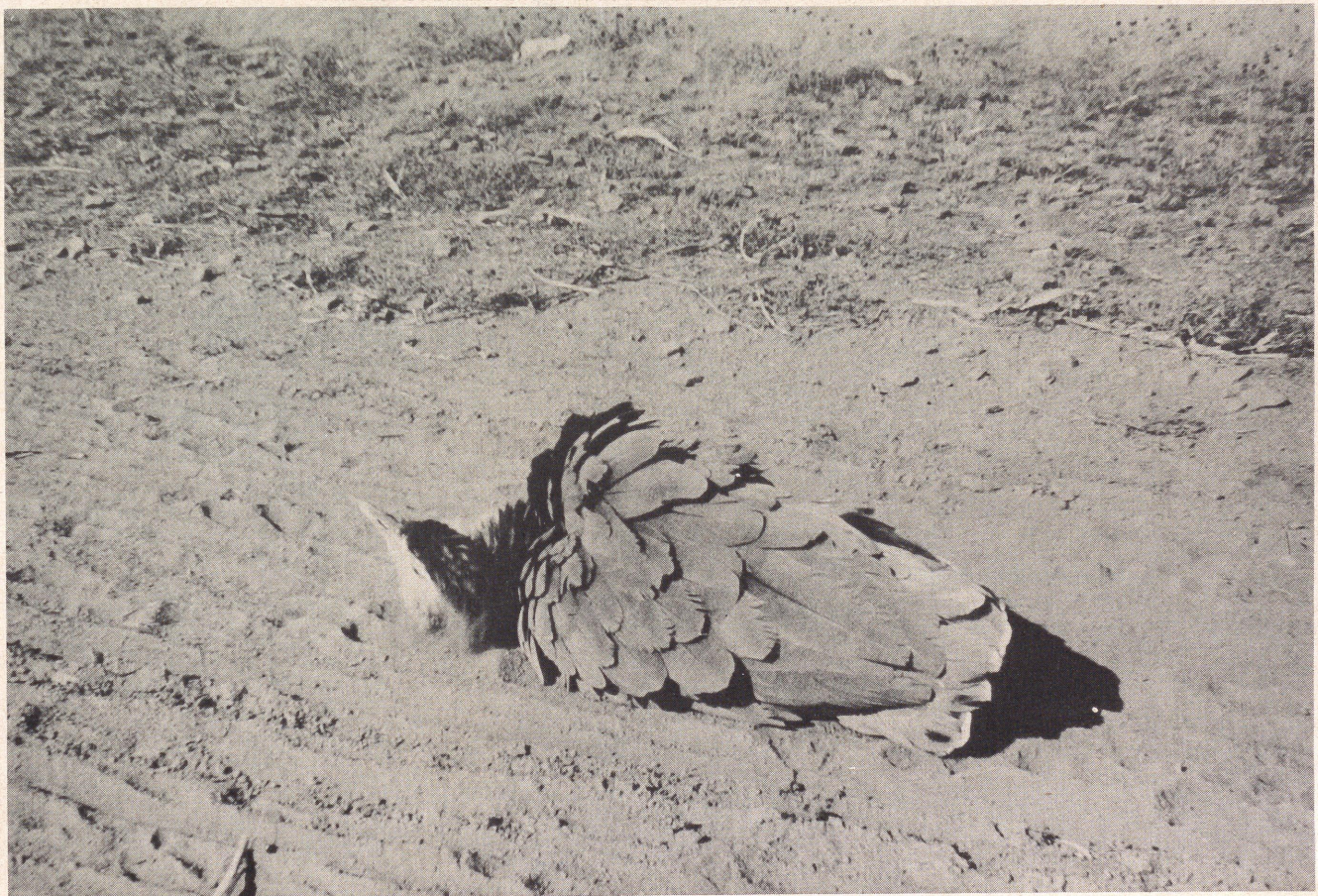
Striped Hyena *Hyaena hyaena*, Common Mongoose *Herpestes edwardsi*, Small Indian Mongoose *Herpestes auropunctatus*, Common Indian Monitor Lizard *Varanus bengalensis* and Desert Monitor *Varanus griseus* are some other animals encountered in bustard habitats.

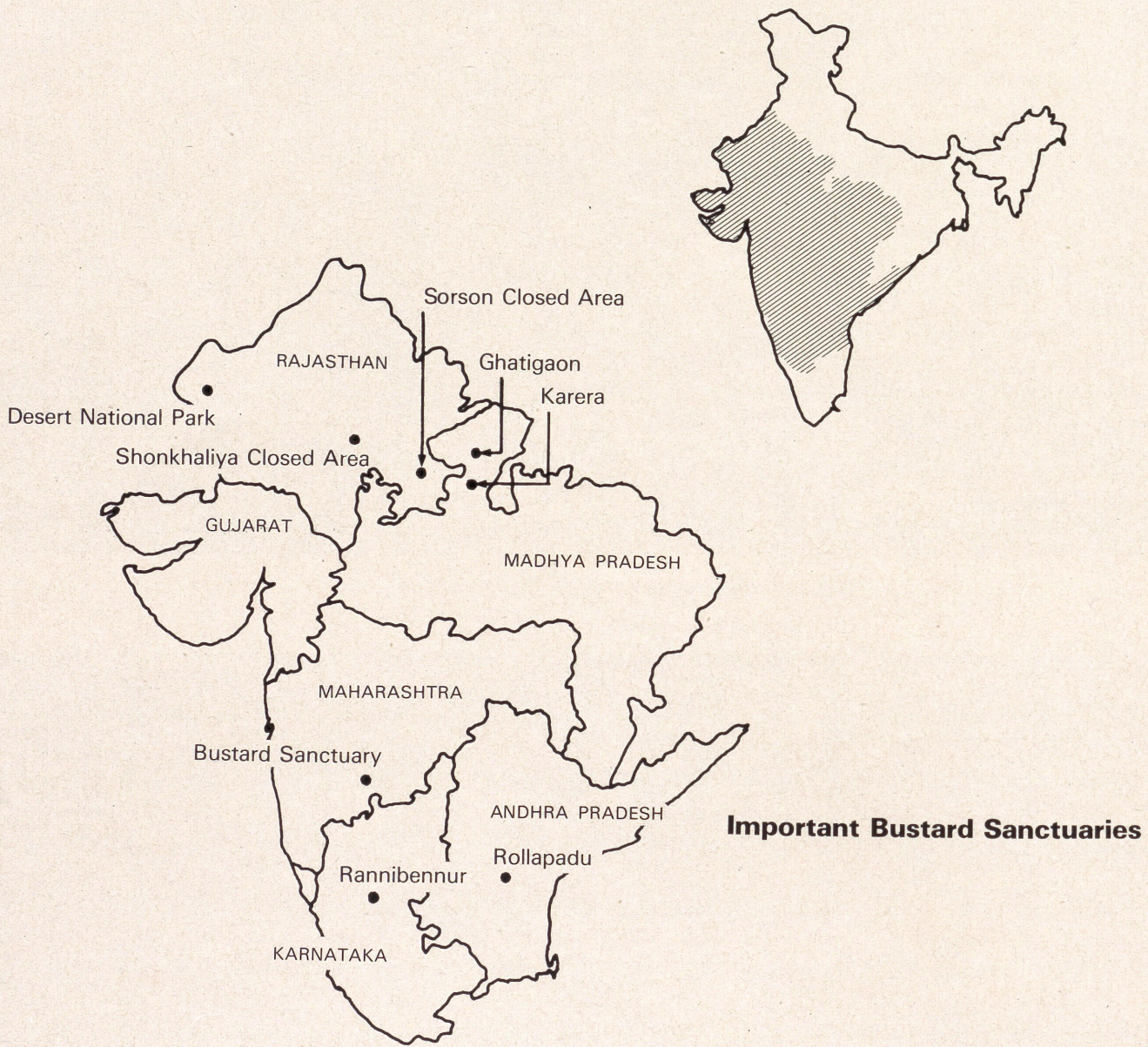


Open grasslands are preferred by bustards



Bustards are generally not disturbed by bullock carts
Dust bathing is an important maintenance activity





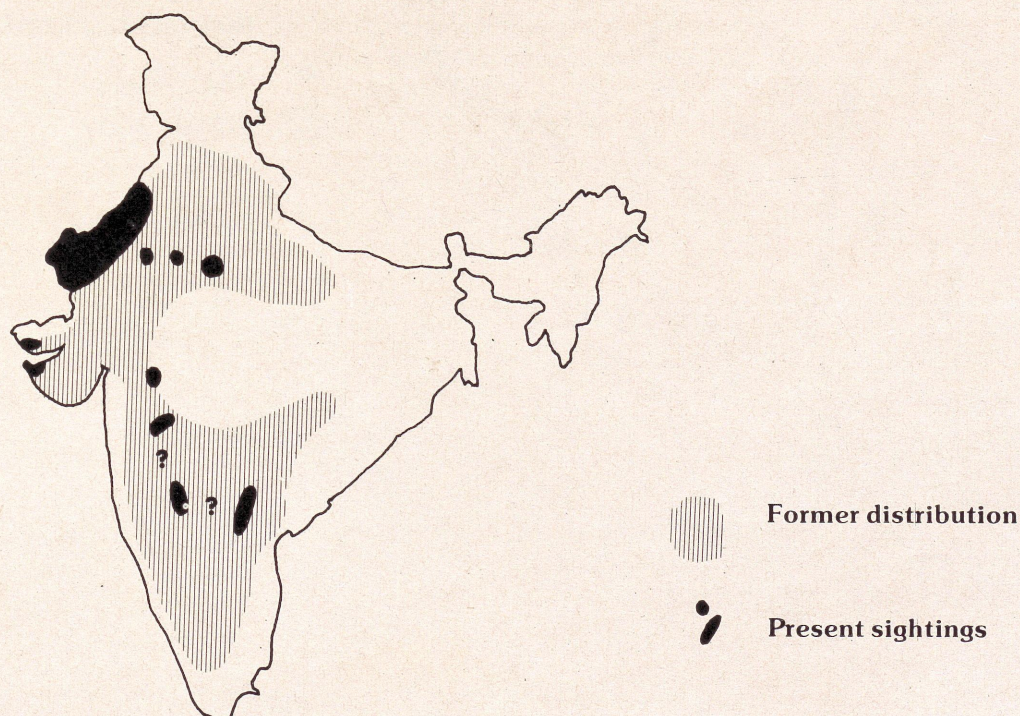
Bustard Sanctuary in Maharashtra (Rego 1980) was perhaps the first sanctuary declared to protect the Great Indian Bustard. Later the main impetus for establishment of bustard sanctuaries was given by the International Symposium on Bustards, organized in 1980 by the Tourism and Wildlife Society of India. Sonkhaliya in Ajmer district was declared in 1980 as a closed area for shooting. Though Desert National Park in Jaisalmer and Barmer districts of Rajasthan was protected since late '70s, it was officially declared as a Park only in 1981. In Madhya Pradesh, Karera and Ghatigaon were made as sanctuaries in 1981 on the recommendations of Dr Salim Ali. Kundanpur in Kota district of Rajasthan and Rollapadu in Kurnool district of Andhra Pradesh were made as sanctuaries in 1984 and 1985 respectively, on BNHS recommendations.

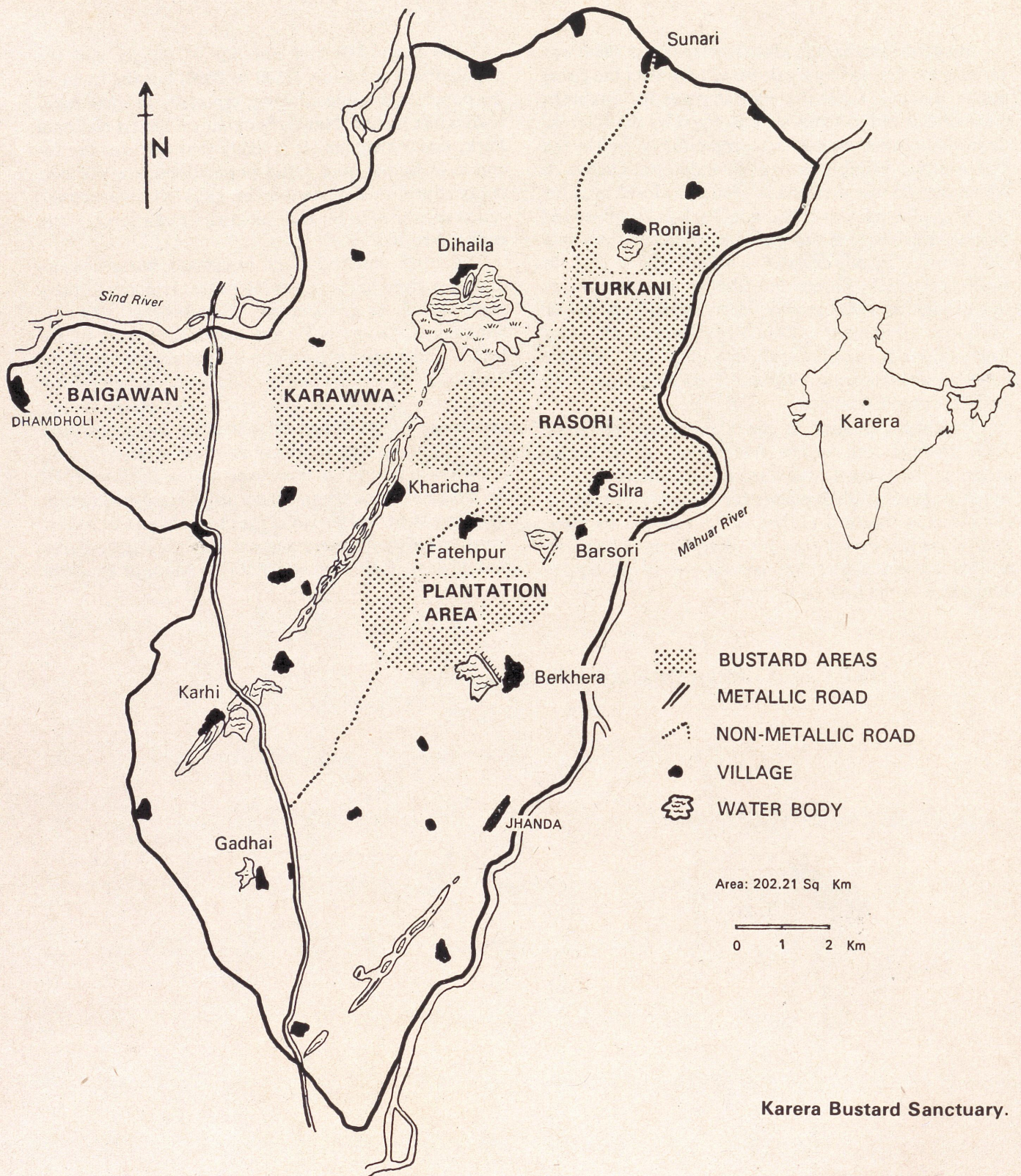
Except for Gujarat, all the other states which have some bustard populations have taken conservation measures. At present, there are 13 sanctuaries or protected areas established mainly for the protection of the Great Indian Bustard (Table 1). In addition to these three areas in Gujarat were proposed by us to be made as bustard sanctuaries but remain yet to be legally designated at the time of writing.

The bustard is still not out of danger and the population is quite low (1500 to 2000) but the trend of the population is encouraging, especially in some sanctuaries like Karera, Nanaj, Sonkhaliya, Desert National Park, and Rollapadu. It is likely that with further increase in human and cattle populations, we will lose many unprotected bustard areas. Only effective conservation measures in bustard sanctuaries will protect this endangered bird.

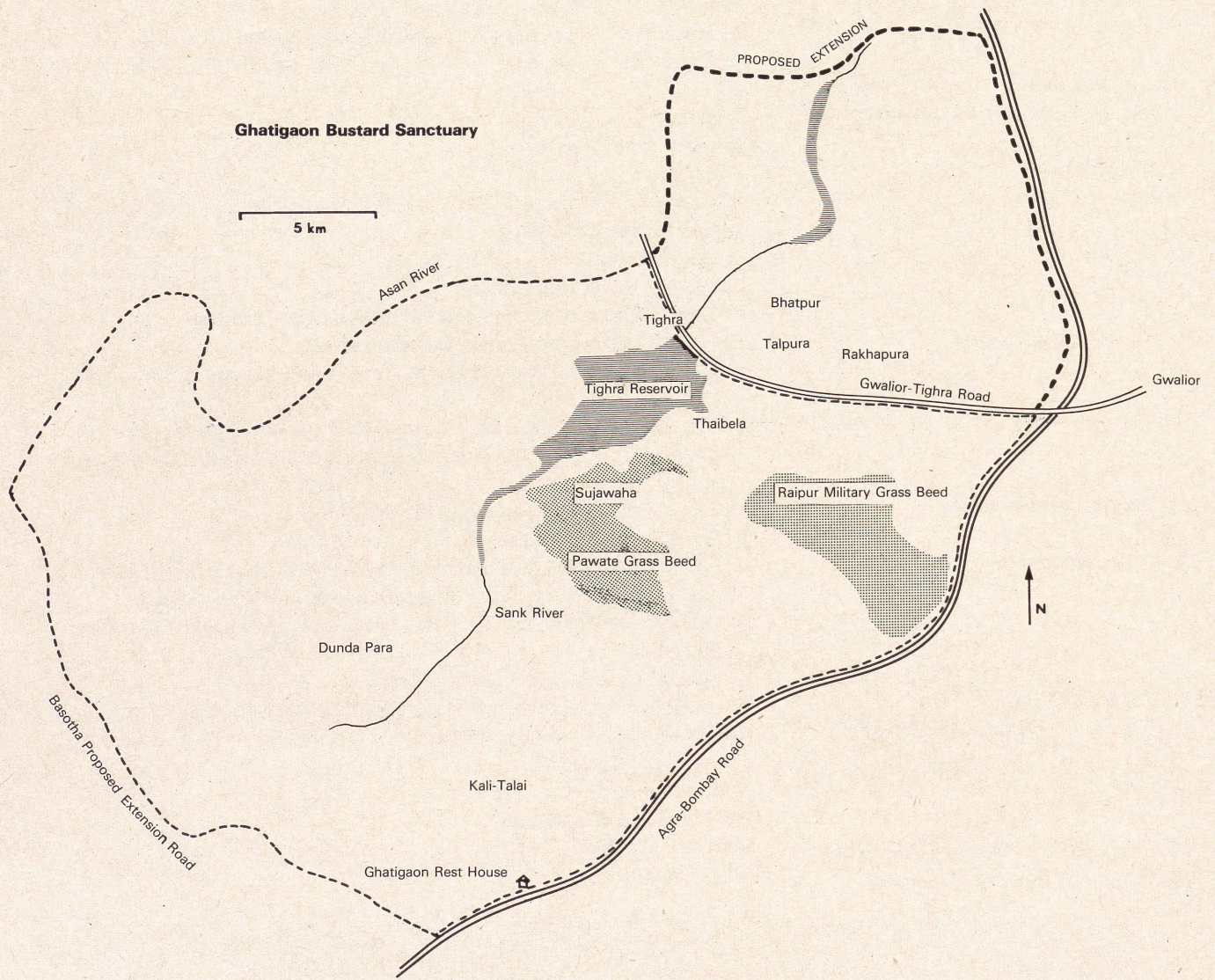
A brief description of important bustard sanctuaries is given in the following pages. In many of these sanctuaries (e.g. Karera, Kundanpur, Nanaj, Sonkhaliya, Desert N.P. and Rollapadu) most of the land is under private hands so habitat management for the benefit of the bustard was difficult, therefore, not much could be done in these sanctuaries except for appointment of staff and establishment of a few core areas. To make them more suitable for the bustard, a lot more has to be done in these sanctuaries. In Chapter III we have described management of bustard sanctuaries which we hope will be useful for the managers of the existing and also proposed bustard sanctuaries like Banni and Abdasa in Gujarat and Pohri in Madhya Pradesh.

The Great Indian Bustard – Then and Now





Karera Bustard Sanctuary.



<i>Name of the Sanctuary</i>	: GHATIGAON GREAT INDIAN BUSTARD SANCTUARY
<i>State and district</i>	: Gwalior district, Madhya Pradesh
<i>Coordinates</i>	: 25°28' to 26°50' N and 77°40' to 79°9' E
<i>Date of Establishment</i>	: 21 May 1981
<i>Size</i>	: 512 sq km
<i>Climate</i>	: Cold Winter (Min. 4°C), Hot summer (Maxi. 46°C) Rainfall 625 - 750 mm
<i>Topography</i>	: Undulating and hilly terrain, with few flat areas
<i>Habitat</i>	: Mixed dry deciduous forest
<i>Local Name</i>	: "Son-Chirya"
<i>Crops</i>	: Wheat, Bengal Gram, Maize, Groundnut, Mustard, Taramira
<i>Population</i>	: 1. Human 24,000 Per sq km 46.8 2. Livestock 21,000 Per sq km 41
<i>No. of Bustards</i>	: 15-18
<i>Trend of the Bustard Population</i>	: Possibly increasing
<i>Breeding Status</i>	: Limited breeding observed
<i>Nesting Season</i>	: March to June
<i>Important Fauna</i>	: Blue-bull, Blackbuck, Chinkara, Wolf, Jackal, Panther, Hyena, Hare, Peacock, Jungle fowl etc.
<i>Disturbances</i>	: 1. Overgrazing
<i>Conservation Measures</i>	: 1. Adequate protection to the Bustards 2. Some control on grazing in Kalitalai area
<i>Any major alteration in the Habitat</i>	: None
<i>Future Development Plans</i>	: Not yet finalized
<i>Visitor's Facilities</i>	: Rest house in Ghatigaon village. Private transport necessary
<i>Specific Recommendations</i>	: 1. Vast open areas near Tighra Dam should be included in the Sanctuary 2. Core areas should be developed near Kalitalai and Hanuman Dauda
<i>Staff Structure of the Sanctuary</i>	: Asstt. Conservator of Forests (1) - Ranger (1) - Dy. Rangers (2) -Forester (1) - Forest guards (12) - Game Guards (5)
<i>Contact Address</i>	: Superintendent (ACF) Ghatigaon Bustard Sanctuary Near Roop Singh Stadium Central Nursery, Gwalior 474 002 Madhya Pradesh

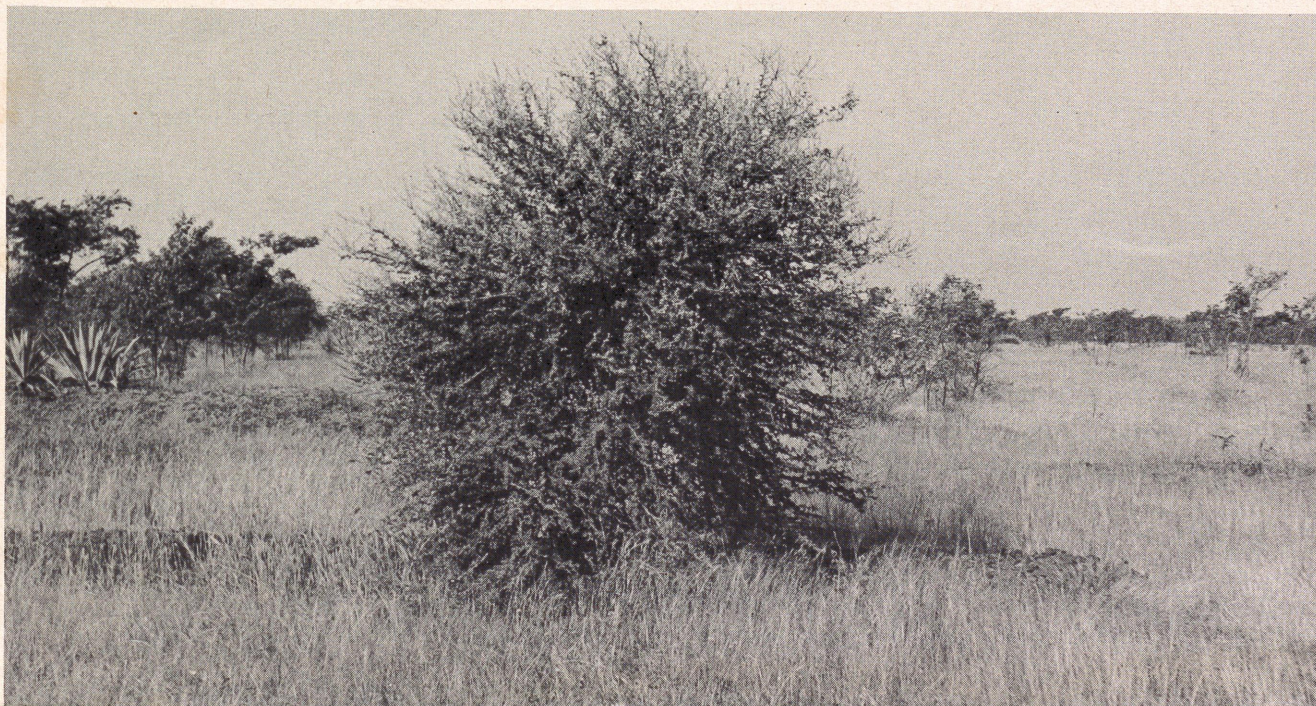
A group of hen bustards in Kalitalai (Ghatigaon)





<i>Name of the Sanctuary</i>	: BUSTARD SANCTUARY (NANAJ)
<i>State and District</i>	: Ahmednagar and Solapur districts, Maharashtra
<i>Coordinates</i>	: 17°10 to 19°32' N and 74°22 to 76° E
<i>Year of Establishment</i>	: 1979
<i>Size</i>	: 7,818.47 sq km
<i>Climate</i>	: Dry, mild winter. Hot summer (40-43°C)
<i>Topography</i>	: Gentle undulations, with isolated hillocks of 450-500 msl.
<i>Habitat</i>	: 6A/01 Southern Tropical Thorn Forest (Champion & Seth 1968)
<i>Local Name</i>	: "Maldhok"
<i>Crops</i>	: Wheat, Maize, Sorghum, Sunflower, Groundnut, Bengal Gram etc.
<i>Population</i>	: 1. Human 7,91,1972 Per sq km 101.29 2. Livestock (only cattle) 7,82,820 Per sq km 100.12
<i>No. of bustards</i>	: 50-60
<i>Trend of the bustard population</i>	: Increasing
<i>Breeding status</i>	: Breeds in Nanaj, Karmala, and some other DPAP plots
<i>Nesting Season</i>	: Monsoon (July-October)
<i>Important Fauna</i>	: Blackbuck, Fox, Jackal, Wolf, Chinkara (Rare)
<i>Disturbances</i>	: 1. Overgrazing 2. Expansion of agriculture
<i>Conservation measures</i>	: Not much was done to protect the habitat, except for including Nanaj area in the Sanctuary complex. DPAP plots are well protected.
<i>Any Major Alteration in the Habitat</i>	: Minor irrigation projects
<i>Future Development Plans</i>	: None
<i>Visitor's Facilities</i>	: Excellent rest house near Nanaj village. Bus available from Solapur
<i>Specific Recommendations</i>	: 1. More grassland plots should be developed in the sanctuary complex 2. The Sanctuary should be under the charge of a separate ACF or CF
<i>Staff structure of the Sanctuary</i>	: Presently the DPAP plots of Solapur district (Nanaj and Karmala) are looked after a Ranger. Similarly, in Ahmednagar district, a Ranger is in-charge of the DPAP bustard plots.
<i>Contact Address</i>	: Solapur: Range Forest Officer (Bustard Sanctuary) C/o. Forest Department, Solapur Ahmednagar: Divisional Forest Officer Ahmednagar

Protection of habitat under the Drought-Prone-Areas-Programme has benefitted bustards in Maharashtra

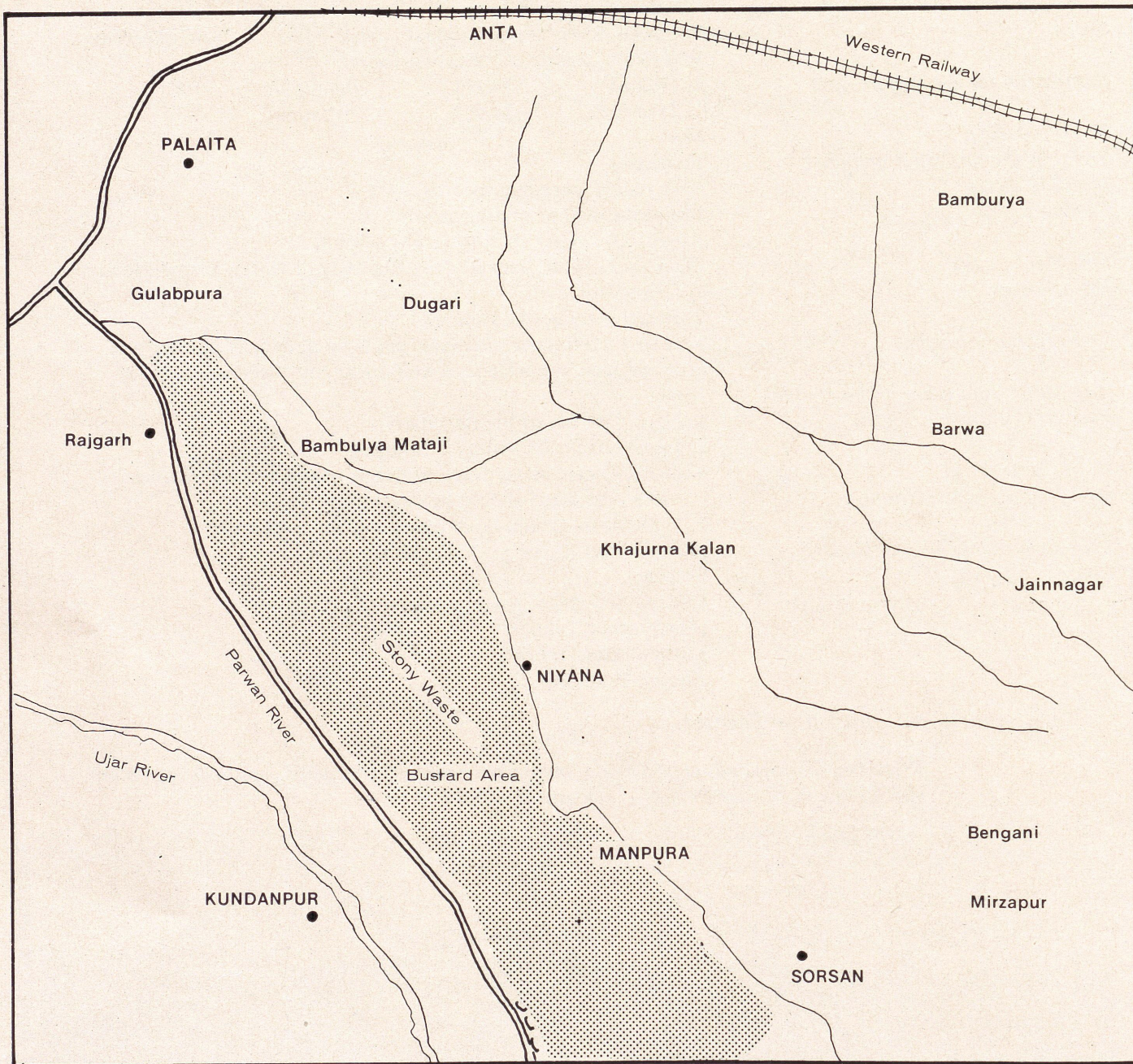


<i>Name of the Sanctuary</i>	: ROLLAPADU BUSTARD SANCTUARY
<i>State & district</i>	: Kurnool district, Andhra Pradesh
<i>Coordinates</i>	: 15°52'N and 78°18'E
<i>Year of Establishment</i>	: 1985
<i>Size</i>	: 1,240 acres (core areas only)*
<i>Climate</i>	: Mild winter, hot summer (42°C). Rainfall 670 mm
<i>Topography</i>	: Gently undulating
<i>Habitat</i>	: Grassland
<i>Local Name</i>	: "Battameka Pakshi"
<i>Crops</i>	: Sorghum, Tobacco, Groundnut, Italian Millet, Cotton, Sunflower, Red Gram, Paddy, Chillies, Safflower
Population (in the buffer zone)	: 1. Human 30,373 Per sq km 100
	: 2. Livestock 34,957 Per sq km 116
<i>No. of bustards</i>	: 60+
<i>Trend of the bustard population</i>	: Increasing
<i>Breeding Status</i>	: Very regular breeding records
<i>Nesting season</i>	: May-June (Minor nesting season) August-December (Major nesting season)
<i>Important Fauna</i>	: Blackbuck, Wolf, Jackal, Fox, Blacknaped Hare , Lesser Florican
<i>Disturbances</i>	: 1. Grass fires 2. Illegal grazing (occasionally)
<i>Conservation Measures</i>	: 1. Nearly 1200 ha of grassland has been developed as core area 2. Watchmen are present in Rollapadu and Vipingandla areas.
<i>Any Major Alteration in the Habitat</i>	: None
<i>Future Development Plans</i>	: 1. Consolidation of the Sanctuary 2. Development of Visitor's Centre
<i>Visitor's Facilities</i>	: Visitor's Centre being developed. Bus available from Kurnool
<i>Specific Recommendations</i>	: 1. More core areas should be developed 2. Waterholes should be developed in the core areas.
<i>Staff structure of the Sanctuary</i>	: Forester (1) - Guard (1) - Watchmen (4)
<i>Contact Address</i>	: Forester Rollapadu Village Nandikotkur Taluka Kurnool Dist. 518 508 Andhra Pradesh

*Area of the buffer zone not yet finalized.

Protection of grasslands at Rollapadu, apart from helping the bustards, has benefitted other species like the Lesser Florican, wolf and blackbuck





Kundanpur bustard area (dotted) in Kota, Rajasthan.

Name of the Sanctuary : **SORSON CLOSED AREA (KUNDANPUR)**
State and district : Kota district, Rajasthan
Coordinates : Approx. 26°18'N and 74°46'E
Date of Establishment : 9 January 1984
Size : c. 10 sq km
Climate : Cool winter, very hot summer (46°C). Rainfall 600-650 mm
Topography : Undulating, Gravel
Habitat : Vast open *Zizyphus rotundifolia* scrubland, with occasional *Acacia leucophloea*

Local Name : "Godawan", "Nahar Goonjni"
Crops : Sorghum, Millet, Wheat, Groundnut, Mustard
Population : 1. Human No data Per sq km No data
 2. Livestock No data Per sq km No data

No. of bustards : 10-15
Trend of the bustard population : Stable
Breeding Status : Resident and breeds regularly
Nesting Season : May to August
Important Fauna : Blackbuck, Chinkara, Wolf, Fox, Jackal, Hare
Disturbances : 1. Overgrazing
Conservation Measures : 1. One enclosure of 100 ha developed in 1985-86
 2. Two guards posted in 1985-86

Any Major Alteration in the Habitat : Stone quarrying but now stopped
Future Development plans : 1. Development of two more enclosures
 2. Posting of more guards and watchmen

Visitor's Facilities : None. Private transport necessary
Specific Recommendations : 1. Upgrading the area into a sanctuary
 2. Posting of at least one Forester
 3. More publicity in the local areas

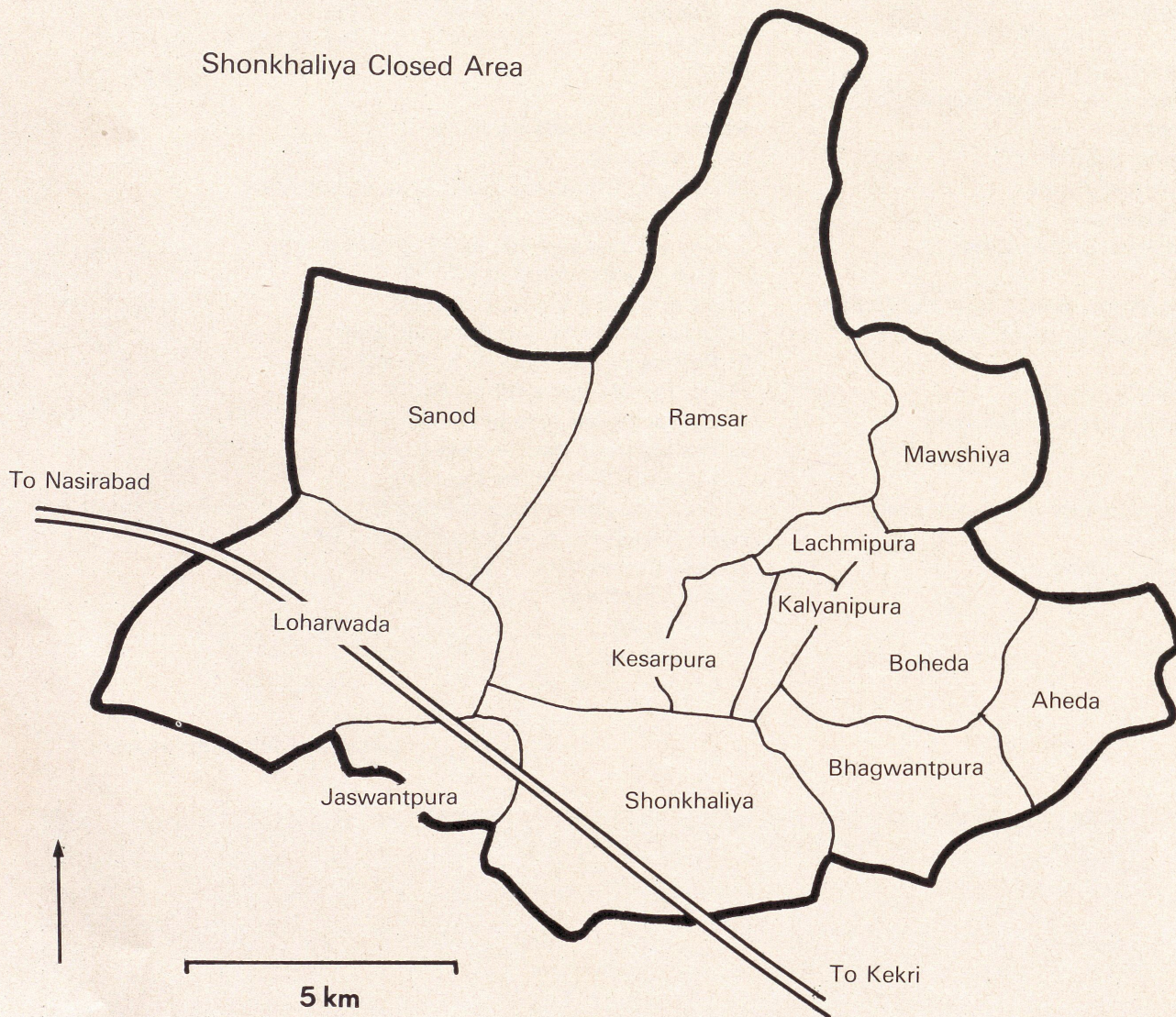
Staff Structure of the Sanctuary : The Sorson Closed Area is being looked after by the Deputy Conservator of Forests, with two forest guards.

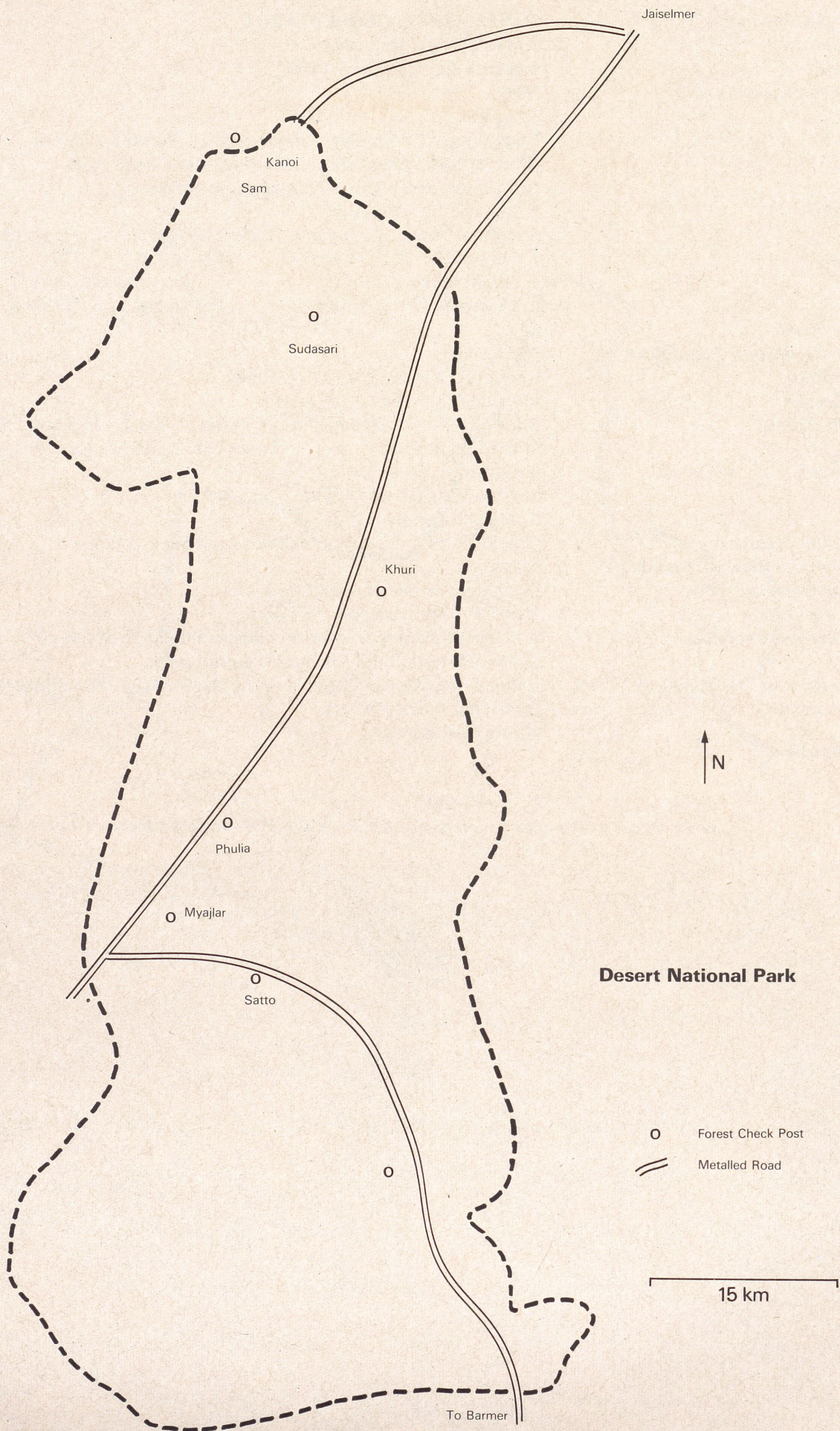
Contact Address : Deputy Conservator of Forests (WL)
 Kishorpura Bajar
 Kota 324 009
 Rajasthan

Bustard plot (right) in Sorson



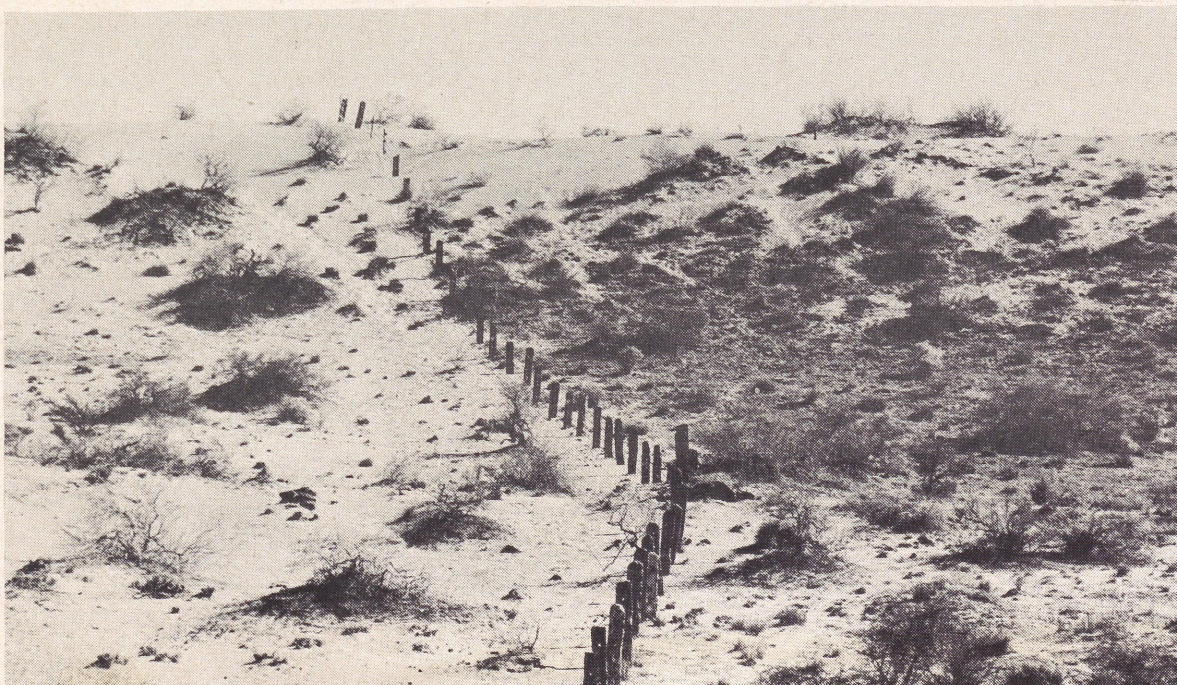
Shonkhaliya Closed Area

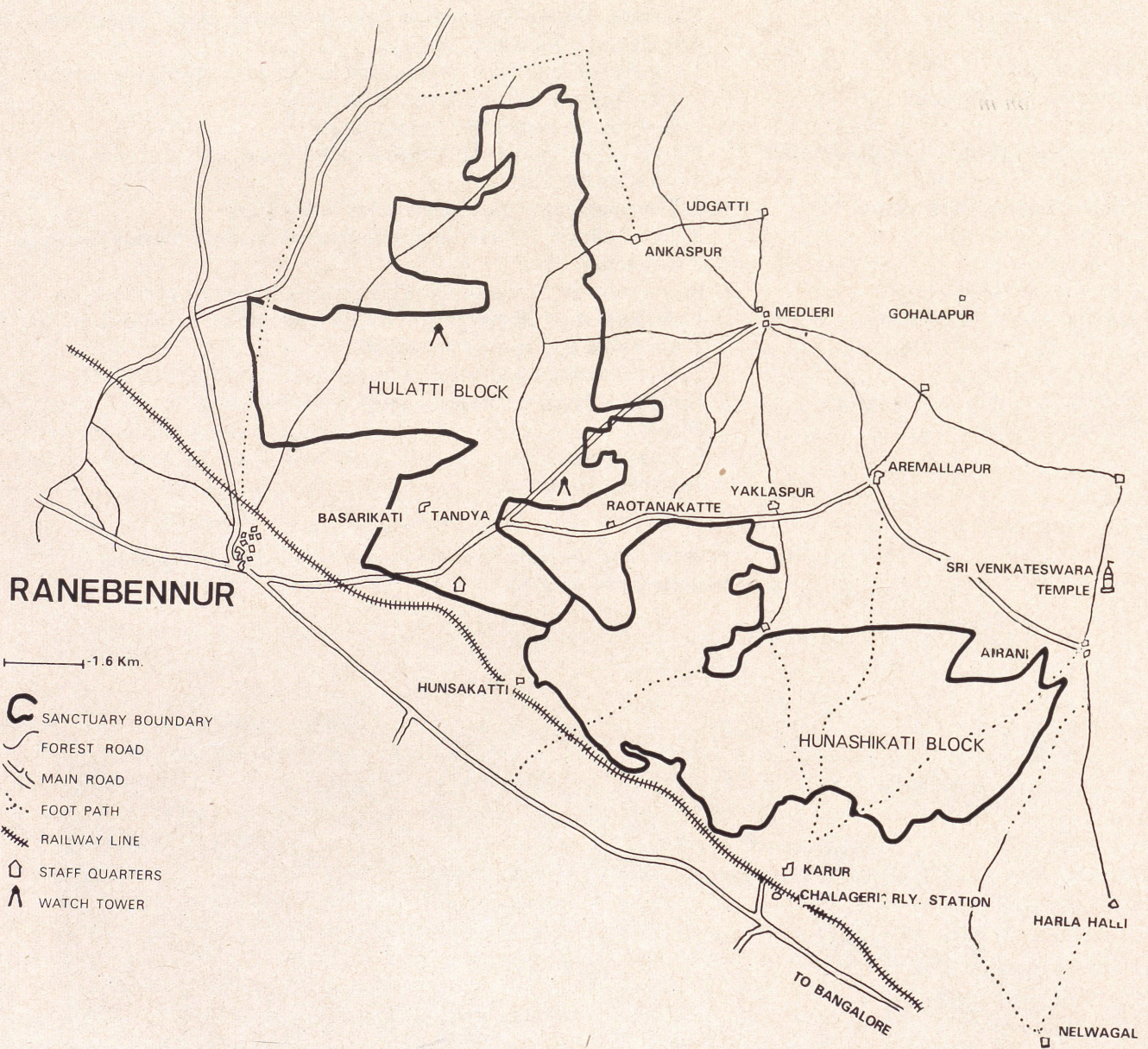
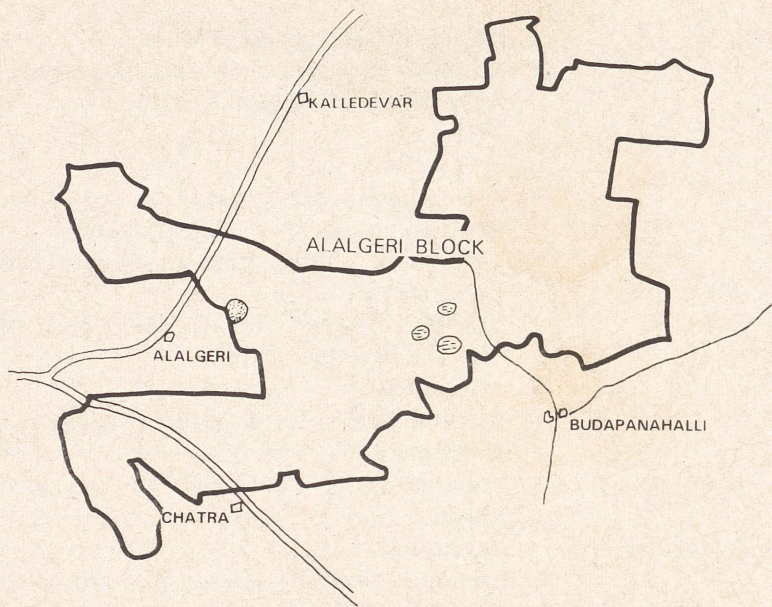




<i>Name of the Sanctuary</i>	: DESERT NATIONAL PARK
<i>State and district</i>	: Jaisalmer and Barmer districts, Rajasthan
<i>Coordinates</i>	: Approx. 26°25' N and 70°55' E
<i>Year of establishment</i>	: 1981
<i>Size</i>	: 3162 sq km
<i>Climate</i>	: Typical desert climate, extremely dry. Very cold winter (Min. 2°C), Hot summer (48°C), Rainfall 150 mm
<i>Topography</i>	: Very varied: shifting sand dunes, interdunal valleys, vast flat and gravel areas
<i>Habitat</i>	: Variable: <i>Lasiurus indicus</i> grassland, <i>Acacia</i> , <i>Euphorbia</i> scrub land and dry water courses
<i>Local Name</i>	: "Godawan"
<i>Crop Pattern</i>	: Sorghum and Millet in good rainfall years
<i>Population</i>	: 1. Human — Per sq km 6 (District figure) 2. Livestock — Per sq km c. 20 (mainly sheep and goats)
<i>No. of bustards</i>	: 200-400
<i>Trend of the Bustard Population</i>	: Increasing
<i>Breeding status</i>	: Breeding commonly seen in good rainfall years
<i>Nesting Season</i>	: June-August/September
<i>Important Fauna</i>	: Chinkara, Desert Fox, Indian Fox, Wolf (very rare), Sandgrouse, and Houbara (in winter only)
<i>Disturbances</i>	: No disturbance in the core areas but buffer zone severely overgrazed
<i>Conservation measures</i>	: 1. Development of core areas of 300-800 ha 2. Reasonable protection to all wildlife
<i>Any Major Alteration in the Habitat</i>	: Future expansion of the Indira Gandhi canal will destroy a large portion of the Park
<i>Future Development plans</i>	: 1. Development of more enclosures in the Park 2. Development of nine satellite conservation areas outside the Park boundary
<i>Visitor's Facilities</i>	: Rest houses in all major chowkis. Private transport necessary
<i>Specific Recommendations</i>	: 1. At least 15 to 20 percent of the Park should be developed as the core area and strictly protected 2. More facilities and vehicles to Park staff
<i>Staff structure of the Sanctuary</i>	: Director - Rangers - Forest guards - Watchmen
<i>Contact Address</i>	: Director Desert National Park Jaisalmer, Rajasthan

At least 15 to 20 percent of the Desert National Park should be totally protected from grazing





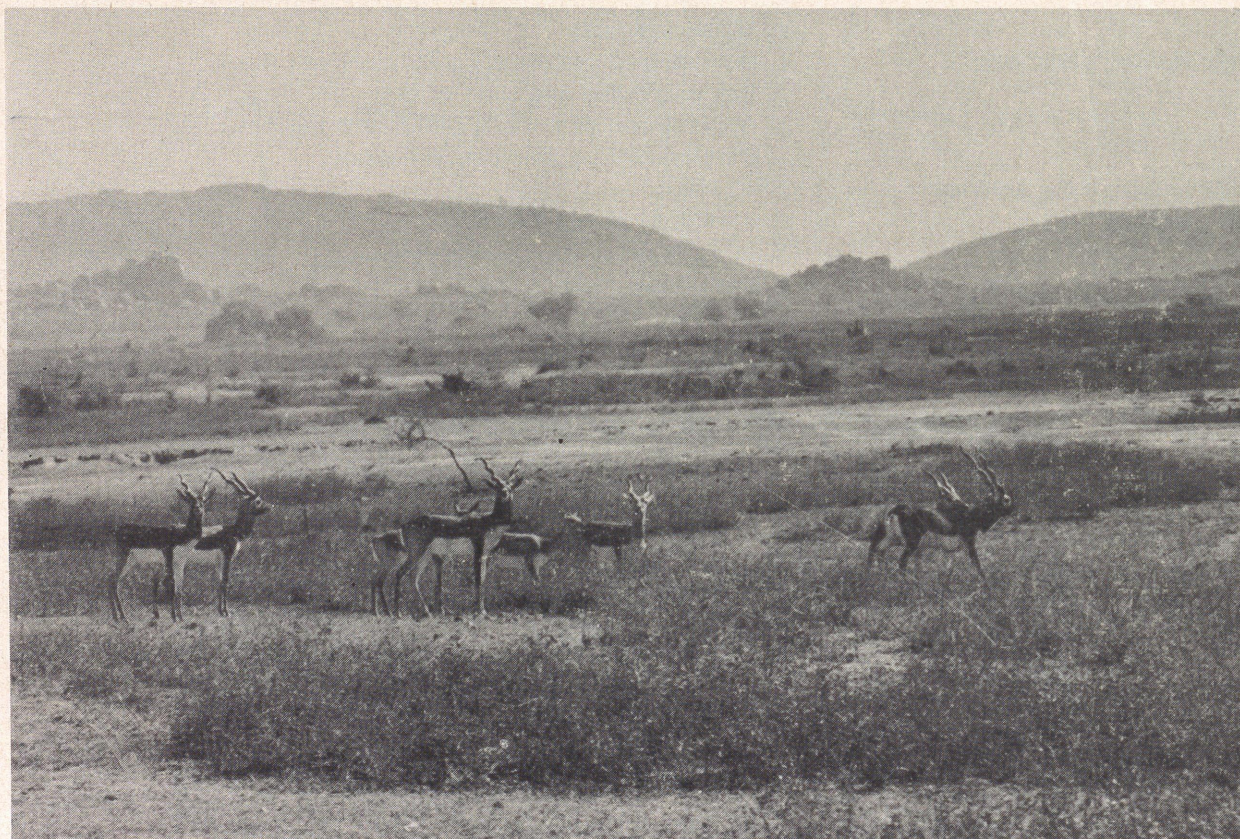
<i>Name of the Sanctuary</i>	: RANNEBENNUR BLACKBUCK SANCTUARY
<i>State and district</i>	: Dharwad district, Karnataka
<i>Coordinates</i>	: 14°33 to 14°47' N and 75°31 to 75°32' E
<i>Year of Establishment</i>	: 1971
<i>Size</i>	: 123 sq km
<i>Climate</i>	: Rainfall 619 mm 35°C-38°C in summer
<i>Topography</i>	: Gently undulating with localized hillocks
<i>Habitat</i>	: Southern Thorn Forest GA/C1 (Champion & Seth 1968) (original forest) now extensively planted with Eucalyptus
<i>Local Names</i>	: "Yerraladdu" in north, "Doravayana hakki" in south Karnataka
<i>Crops</i>	: Millet, Sorghum, Cotton, Ground nut
<i>Population</i>	: 1. Human No data Per sq km No data 2. Livestock No data Per sq km No data
<i>No. of bustards</i>	: 10-15
<i>Trend of the Bustard Population</i>	: Not clear
<i>Breeding status</i>	: Infrequent breeding records
<i>Nesting Season</i>	: Not clear
<i>Important Fauna</i>	: Blackbuck, Wolf, Fox, Jackal
<i>Disturbances</i>	: 1. Aforestation in the sanctuary 2. Overgrazing adjoining the sanctuary where most of the bustards are found
<i>Conservation Measures</i>	: 1. Strict protection to animals but no control on grazing and tree poaching
<i>Any Major Alteration in the Habitat</i>	: 1. Severe overgrazing outside the sanctuary 2. Habitat alteration by Eucalyptus plantation
<i>Future Development Plans</i>	: Development of core areas for bustard breeding
<i>Visitor's Facilities</i>	: Rest house near Rannebennur village. Private transport necessary to go in the sanctuary
<i>Specific Recommendations</i>	: 1. Development of core areas in the Hulati Block 2. Ban on grazing and entry of dogs 3. Appointment of bustard guards and watchmen 4. Development of core area in Guttal
<i>Staff Structure of the Sanctuary</i>	: Not known
<i>Contact Address</i>	: Asstt. Conservator of Forests Wildlife Preservation Division Dharwad, Karnataka

Eucalyptus has destroyed potentially good bustard areas in the sanctuary



TABLE I
EXISTING AND PROPOSED GREAT INDIAN BUSTARD SANCTUARIES

State	Name of the Sanctuary	Size	Approximate No. of bustards
Andhra Pradesh	1. Rollapadu	1,240 acres (core areas)	60+
	2. Banganpalli Closed Area (Proposed)	—	10-15
Gujarat	3. Bhatiya-Kalyanpur Area (Proposed)	—	5-10
	4. Banni grasslands (Proposed)	840 sq km	Not known
	5. Abdasa Taluka (Proposed)	—	Not known
Karnataka	6. Rannebennur Blackbuck Sanctuary	123 sq. km.	10-15
	7. Guttal Plantation	1200 acres	8-10
	8. Bagalkot Plantation	—	3-5
Madhya Pradesh	9. Karera Bustard Sanctuary	202.21 sq. km.	30+
	10. Ghatigaon Bustard Sanctuary	512 sq. km.	15-18
	11. Pohri Bustard Area (Proposed)	—	10-15
Maharashtra	12. Bustard Sanctuary (Nanaj)	7818 sq. km.	50-60
Rajasthan	13. Sorson Closed Area (Kundanpur)	c 10 sq. km.	10-15
	14. Shokhaliya Closed Area	17 sq. km.	80
	15. Desert National Park	3162 sq. km.	200-400
	16. Bathnoke Range, Bikaner (Proposed)	100 acres	10-15



Blackbuck (above) and chinkara are the common inhabitants of many bustard areas

Though heavily persecuted, the wolf is still holding on in many areas



TABLE II
SOME INDICATOR SPECIES OF BUSTARD AREAS

+ Present
- Absent
? Not known

Species	Name of the Bustard Sanctuary							
	Karera	Ghatigaon	Nanaj	Rollapadu	Kundanpur	Sonkhaliya	Desert N.P.	Rannebennur
<i>Mammals</i>								
Blackbuck	+	+	+	+	+	-	-	+
Chinkara	+	+	+	-	+	+	+	-
Nilgai (Bluebull)	-	+	-	-	-	+	-	-
Wolf	+	+	+	+	+	+	+	+
Jackal	+	+	+	+	+	+	+	+
Fox	+	+	+	+	+	+	+	+
<i>Birds</i>								
Blackwinged Kite	+	+	+	+	+	+	+	+
White-eyed Buzzard	+	+	+	+	+	+	+	+
Harriers	+	+	+	+	+	+	+	+
Short-toed Eagle	+	+	+	?	+	+	+	?
Kestrel	+	+	+	+	+	+	+	+
Lesser Florican	+	?	?	+	+	+	-	?
Stone Curlew	+	+	+	+	+	+	+	+
Indian Courser	+	+	+	+	+	+	+	+
Yellow-wattled Lapwing	+	+	+	+	+	+	?	+
Sandgrouse	+	+	+	+	+	+	+	+
<i>Reptiles</i>								
Monitor Lizard	+	+	+	+	+	+	+	+

All the bustard sanctuaries described in Chapter II have some common problems like (i) expansion of agriculture and change in the land-use practices (ii) overgrazing by livestock and (iii) general disturbance to the bustard and its habitat by human activity. These problems are too well known to need any elaboration.

The following are some of the reasons why it is difficult to establish a large inviolable bustard sanctuary where human activity is not allowed.

- a) Owing to the tremendous land hunger of our growing population, it is impossible to develop a large bustard sanctuary of a few hundred sq km exclusively for the bird. We simply do not have that much land to 'block' it from rational/traditional human use. Most of the bustard area is already occupied by man and it will be impossible to evict the local people. Moreover, even if we are able to develop a large bustard sanctuary in some remote corner of Kutch or Jaisalmer district where agriculture and grazing are totally eliminated, only a very small percentage of the total bustard population of the country can live in that sanctuary.
- b) Secondly, the semi-nomadic nature of the bustard makes it difficult to confine the bird to a sanctuary. Even in the 202 sq km Karera Bustard Sanctuary the bustards are frequently seen outside the sanctuary limits. Bustards of Nanaj (Rahmani & Manakadan 1986) and Rollapadu (Manakadan & Rahmani 1986) are mainly seen in the grassland plots during the breeding season and during rest of the year they roam around in a large area. Owing to lack of ringing and biotelemetry data their post-breeding movement is not known.
- c) Habitat preference of the bustard indicates that with proper protection during the breeding season, the bustard can survive in marginally cultivated areas, and, moreover, limited or traditional cultivation is even beneficial to the bird by providing it food during certain months. Traditional agricultural practices widely prevalent in India, create a mosaic of habitats which are used by the bustard.

Taking into consideration the above factors, a typical bustard sanctuary should have two major components: (1) A very large buffer zone of a few hundred sq km where traditional agriculture and grazing should be allowed, and (2) small core areas of 100-500 hectares, zealously protected from all interferences during the breeding season.

1) BUFFER ZONE

The buffer zone or size of the bustard sanctuary will depend on the suitability of the habitat.

As all areas having bustards cannot be declared as sanctuaries, optimum areas, with the following features should be selected:

- a) Low human and livestock populations
- b) Less chances of future developments and urbanization
- c) Continuity of traditional cultivation in future
- d) Reasonably good bustard population
- e) Continuity of the area with other bustard areas
- f) Local support
- g) Effective administrative and political support

Declaration of an area into a bustard sanctuary, even if the land does not belong to the Forest Department has many advantages, as described below:

1. More legal power to prosecute a poacher as it is a greater offence to kill a protected species inside a sanctuary
2. Better administrative support from other departments like Revenue, Police, Judiciary etc.
3. Better chances to get funds for staff (i.e. posting of guards) and for infrastructure (e.g. building of forest chowkis).
4. More sense of involvement and responsibility by the Forest Department in the protection of the area.
5. More power to prevent any major habitat alteration by development of new roads, irrigation canals, dams, factories etc. (e.g. realignment of the irrigation canal in the Karera Bustard Sanctuary, control of stone quarrying in Kundanpur).
6. More chances of collaboration with other eco-development activities like afforestation, wasteland development, social forestry and Drought Prone Areas Programme.
7. Better protection to all wildlife of the area (e.g. increase in Blackbuck, Chinkara, Fox, Jackal populations in Karera, Nanaj, Ghatigaon, DNP and other bustard sanctuaries; protection of waterbodies and waterfowl in Karera (see Rahmani 1987b)).
8. Creation of job facilities to local people, as watchmen and guards.
9. Prestige value of having a sanctuary in an area.
10. Development of interest in the local people for wildlife protection.

2. CORE AREA

The core areas should be the backbone of any bustard sanctuary. Success of Nanaj, Rollapadu, Karera and DNP have shown that development of core areas is extremely important for successful breeding of the bustard. As we have mentioned earlier, the main danger to the bustard is from habitat alteration resulting in breeding failure. Thus the primary aim of the core area should be to provide optimum breeding requirements to the bustard.

The core area should have the following characteristics and functions:

- i) **Size:** It should not be less than 100 hectares—the bigger the better.
- ii) **Shape:** It should be as circular as possible, in order to minimize disturbances at the boundary. The greater the boundary, the greater would be the chance of human/livestock disturbance to the bustard.
- iii) **Site Selection:** The bustard shows some site-fidelity with regards to its breeding and display grounds, so the first objective should be to obtain information of the areas where nests are generally found, and also the traditional display areas. Such areas should be given preference to be developed as the core areas.
- iv) **Number and distribution:** The number of core areas will depend on (i) the total area of the sanctuary, (ii) availability of land, (iii) the number of bustards, (iv) sizes of different core areas, and (v) budget of the sanctuary.

Instead of having one large core area it will be better to have a number of smaller core areas dotted all over the sanctuary. For example if 1000 ha is to be developed as a core area, then it will be better to develop five plots of 200 ha each. The core areas should not be clumped together but they should be widely distributed in the sanctuary and should have some sort of corridors. This will have the following advantages:

- a) Create and protect more habitat types
- b) Provide territories to more adult males
- c) Create more nesting sites
- d) In case of unavoidable habitat change/development near some core areas, atleast a few will remain unaffected.
- v) **Fencing:** If the core area is between 100 and 200 hectares, it should be enclosed by Trench-cum-Mound (TCM). The TCM should be as inconspicuous as possible and some bushes and grass should be planted on the mound. The trench should be about one metre deep and 1.5 m. wide to prevent entry of cattle. If the core area is more than 500 ha, as in the DNP, permanent chain-link fencing may be used. The fence should be 1 to 1.5 m. tall.
- vi) **Transition zone:** If the core area is small (c. 200 ha)

then there should be a transition zone between core and buffer zone. In the transition zone, only marginal cultivation should be allowed.

FUNCTION OF THE CORE AREA

The main functions of the core areas are to provide undisturbed nesting, displaying, chick rearing and foraging facilities to bustard. The following points will have to be considered in selection of the core area.

1. **Nesting requirements:** Well drained, slightly stony ground is ideal for nesting.
2. **Chick rearing:** Though the bustard nests are generally found in comparatively open areas, once the chick hatches, it is taken to more vegetated parts of the habitat. Therefore, the core area should be maintained in such a way that one quarter or half is under tall grass (50-70 cm) and the remaining under low grass (20 cm).
3. **Display:** As reported earlier, preference should be given to develop core areas around traditional display spots. However, if it is not possible, then while demarcating a new core area, slightly undulating terrain should be selected which can provide a few elevated spots for the cock to display. If the terrain is uniformly flat then one or two artificial mounds, with very gentle gradient, should be created in the open patch of the core area. To avoid disturbances to the displaying bird, the mound should be atleast 200 metres inside the boundary of the core area. The mound should be developed away from thickly vegetated areas because the bustard displays in areas from which it can have a commanding view of its territory.
4. **Resting requirements:** Though the bustard prefers wide open areas, for display, foraging and roosting, —for resting it needs some shade. The core area should have some natural bushes (e.g. *Acacia*, *Carissa*, *Euphorbia*, *Zizyphus* etc.) or tall grass (e.g. *Sehima nervosum*, *Cymbopogon*) for the birds to rest during noon.
5. **Roosting requirements:** A typical bustard habitat generally has many open, bare patches which are used by the birds for night roosting. These are generally overgrazed areas. If such a micro-habitat is not present in the core area then artificial roosting spots should be provided by clearing away some vegetation. The roosting spots should be away from thickly vegetated parts so there are less chances of ambush by a nocturnal predator. Atleast two or three roosting spots should be developed in every core area. One roosting spot should be developed near the display area.
6. **Foraging requirements:** If the core area is properly selected, developed and maintained, then the whole plot will be used for foraging. Quantity and quality of food in the core area will depend on the type of

vegetation, degree of protection to the core area and the crop pattern of the region.

7. **Dust bathing requirements:** The bustard is very fond of dust bathing, especially during the breeding season. One or two spots can be maintained with loose soil. One dust bathing spot should be near the main breeding area.

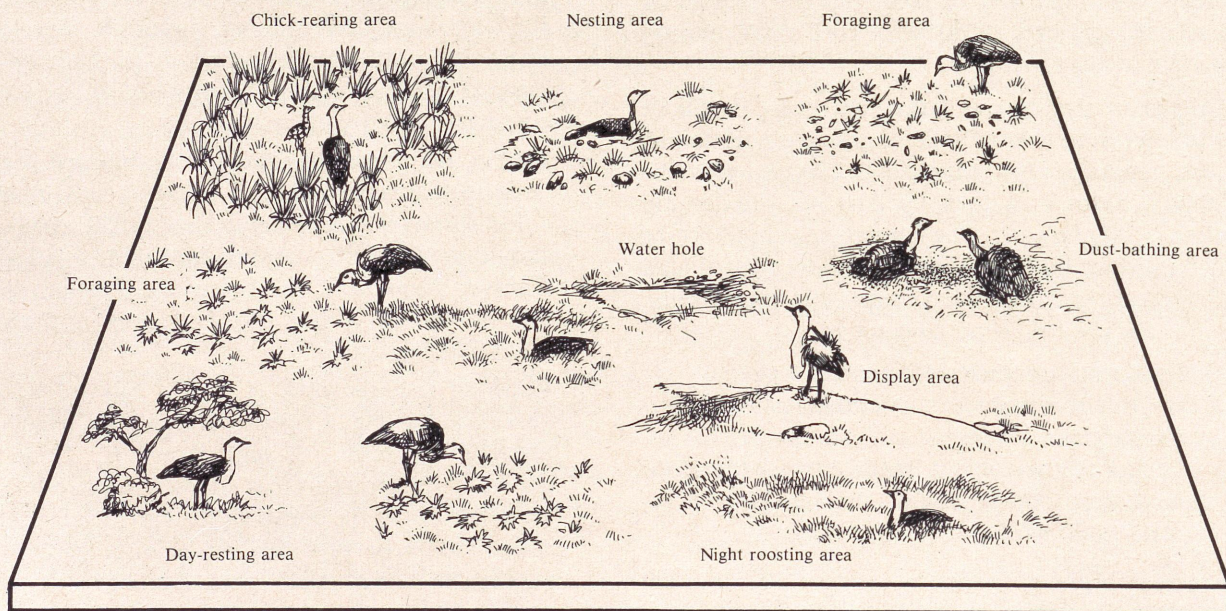
PROTECTION AND MAINTENANCE OF CORE AREA

The success of any bustard sanctuary will depend on the protection and maintenance of the buffer zone and core areas. This will involve (i) good administration and (ii) scientific habitat management.

ADMINISTRATION

1. Every sanctuary should have a superintendent of the rank of Assistant Conservator of Forest.
2. The Superintendent should have a few rangers, assistant rangers, forest guards and watchmen. Forest guards and watchmen should be from the local area.

3. Proper vehicle and accommodation should be provided to all the staff members.
4. Forest guards and watchmen should not live in a colony but their houses should be located in all the strategic corners of the sanctuary. This will be easy if they are recruited from different villages.
5. Forest check post should be present in all the important entry points of the sanctuary and regular checking, especially of four-wheel drive vehicles should be done.
6. Licences for the so-called crop protection guns should be cancelled in and around the sanctuary.
7. From time to time, local leaders, village elders, religious heads and other important people of the area should be involved in protection of bustards. A few interested local people should be made as honorary wardens of the sanctuary. Special importance should be given to maintaining good public relations with the local people and administration.
8. A small percentage of the budget of the sanctuary should be utilized for the welfare of villagers, e.g. constructing a Panchayat Bhawan (community



Necessary micro-habitats of a bustard enclosure

hall), starting a small dispensary, free distribution of saplings of fruiting trees, making a bus shelter, etc.

9. If the necessity arises to cut grass from the core area (see below), then this grass should be given free or at a nominal charge to the local people.
10. Proper compensation should be given to the affected parties if crops are damaged by wild herbivores. Population of wild herbivores should be kept under control either by shooting (in case of non-protected species like wild boar) or by trapping (in case of protected species like blackbuck).
11. In a suitable place in the sanctuary, an education centre should be established dealing with the ecology of the local fauna. There should also be some visitor management to the sanctuary including simple hides for viewing. However, movement of visitors should be strictly controlled.

SCIENTIFIC MANAGEMENT OF THE CORE AREA

Once the core areas are selected, protected and proper staff appointed, maintenance and management of the core area should be given top priority. Habitat management and monitoring the bustard population should be regularly done.

HABITAT MANAGEMENT

As has been repeatedly emphasised earlier in this report, the bustard prefers treeless, open areas with short grass and a few scattered bushes. Therefore, the core areas should be maintained as a grassland. As the grasslands in India are at the pre-climax stage (Champion & Seth 1968), grazing, fire or cutting is necessary to maintain them. With complete protection, the grassland soon turns into dense scrubland and finally into forests. Therefore to maintain the grassland, the following steps should be taken in the core areas.

1. *No tree planting*: No trees should be planted in the core area. Only natural growth of local trees should be allowed but if the growth becomes dense or some trees become tall (above 3 m) they should be trimmed.

However, owing to earlier over-use if there is no bush or shrub left in the core area, then some species like *Acacia leucophloea*, *Zizyphus rotundifolia* and *Carissa* sp. may be planted in the low-lying areas of the core area. These species should not be planted on ridges or near the display and roost sites. Before deciding to introduce any species in the core area, a time lapse of 2-3 years should be given to see whether bushes or trees come up naturally. Only when the natural regeneration is slow some bushes or trees can be introduced. Care should be taken that no exotic or commercial species like *Eucalyptus*, *Casaurina*, *Prosopis* or *Subabul* (*Leucoena leucocephala*) is introduced in the core area.

It should be remembered that it is better to have less trees or bushes in the core area than to have too many of them.

2. *Maintenance of grassland*: As the precipitation in most of the bustard areas is low, the grass generally does not grow very tall. However, at places like Karera and Ghatigaon, where the precipitation is more, sometimes the grasses grow dense and tall (about one metre) which is not preferred by the bustard. Similarly in Maharashtra and Andhra Pradesh areas, with the complete stoppage of grazing, tall grasses like *Sehima nervosum* come up. Though *Sehima nervosum* is useful in the protection of the chick, it hinders foraging and displaying activities. In the DNP enclosures, Sewan grass (*Lasiurus sindicus*) has covered many core areas (enclosures). In such cases, cutting or limited grazing would be useful to maintain the grassland at the optimum suitability for the bustard.

a) *Grass cutting*: Limited grass cutting by local inhabitants at nominal charge should be allowed only if the grass has become tall (above 1 m) and dense. Grass cutting should be carried out strictly under supervision and between 10 am to 4 pm to create least disturbance to the bustard. In those places where the bustard is not resident, grass cutting (or grazing) should be allowed only when the birds have left the area. Cutting (or grazing) should start atleast one month after the breeding season is over.

b) *Limited grazing*: Grazing should be strictly on a limited basis and only local people should be allowed to graze their livestock. Preference should be given to those people who have land or fields adjacent to the core area. Once they are benefited, they will develop interest in protecting the core area. Non-resident graziers should never be allowed in the core area.

Like grass cutting, limited grazing should also be allowed only after the breeding season. As a policy, only cattle should be allowed inside the plot and not the herdsmen as the bustard is not very much disturbed by unmanned livestock. Sheep and goats should never be allowed inside the core area.

The time of grazing should be between ten to four and not during mornings and evenings when the bustard is most active. Only a limited area (c. 25%) of the plot should be opened for grazing at a time to leave some undisturbed areas for the birds.

In order to enrich the soil, dung picking should not be allowed from the core area.

Both grass cutting and grazing should not be allowed at the same time. Local people should be consulted before starting grazing or grass cutting.

It should be kept in mind that the main purposes of allowing limited grazing or grass cutting is to make the habitat suitable for the bustard and to help the local people. It should not become a commercial activity of the Forest Department.

There should be strict adherence to the dura-



TCM walls provide adequate protection to the plot without hampering the movement of bustards

Increase of motor vehicles in rural areas adds to the disturbances to the bustard



tion of grass cutting/grazing. In the present Indian condition, it is very difficult to control the number of livestock as it involves daily checking and a very high degree of integrity of watchmen. Therefore, it is easier to limit the duration of grazing/grass cutting time to two or three months. This will depend upon the grass growth, grass type, size of the core area, livestock pressure, cooperation of the local people, and most importantly on the managerial skill of the custodians of the sanctuary.

Population Monitoring

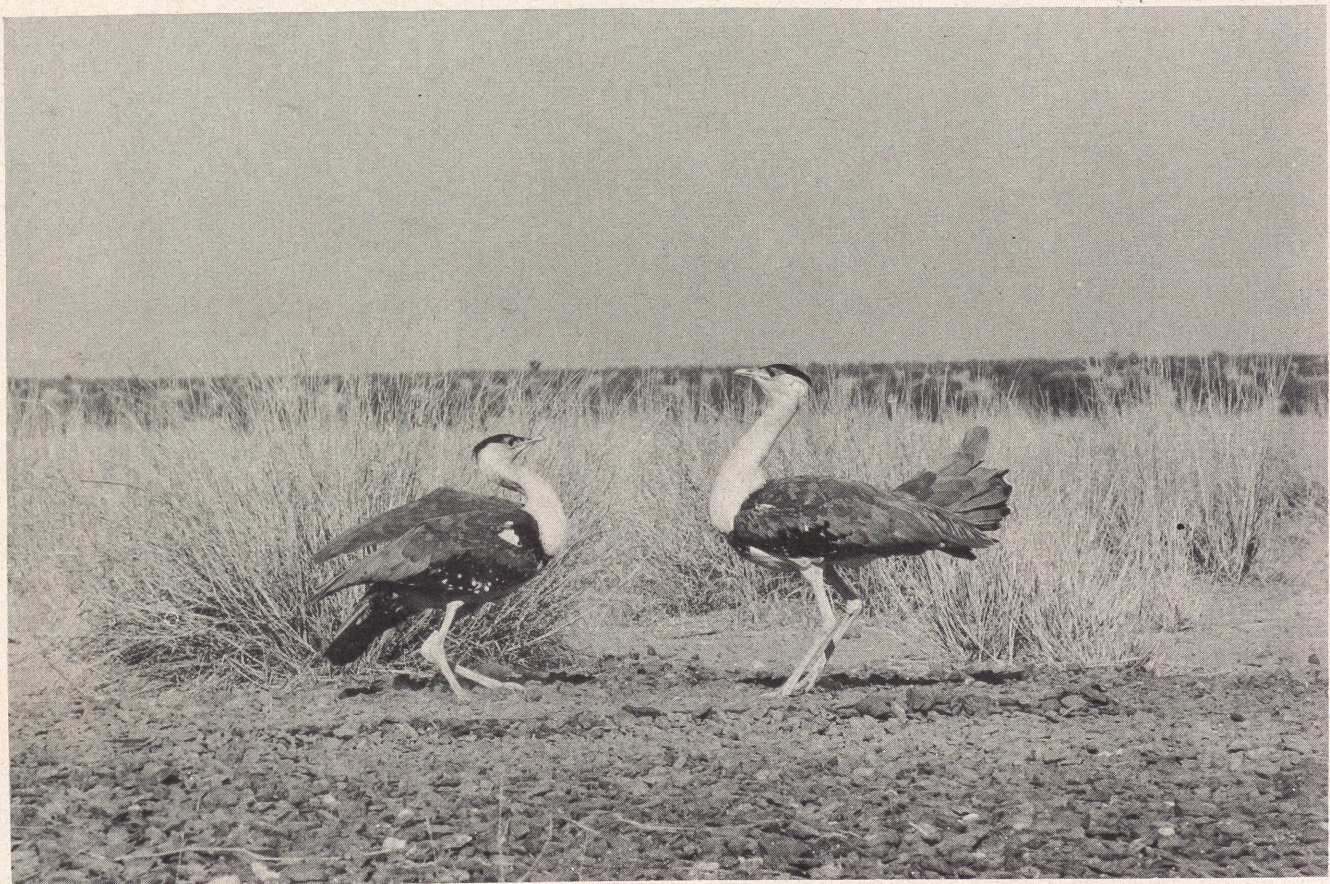
A yearly census of the bustard in all the core areas and the buffer zones of the sanctuary should be done. As bustard has a tendency to flock during heavy rains (Rahmani and Manakadan 1986), the census should be done during the peak rainy season. Days with over-cast sky or with a slight drizzle will be best for census. Early mornings or evenings would be the best time for census, and all the plots should be surveyed simultaneously.

The maximum number of bustards sighted in any given area should be noted every year. This will give the rate of natural increase (or decrease), as well as the rate of colonization of a particular core area. Preferably the same date or week should be selected every year for census. (This will depend on the rainfall pattern from year to year).

The number of cocks, hens, and if possible juveniles should be noted separately. The number of displaying (territorial) males should also be noted. Basic data like nest sites, number of eggs located per year, number of chicks hatched etc. should also be noted.

Precautions

- (1) The duties of a forest guard or watchman should be to protect the core area. Not much emphasis should be given to searching a nest and protecting individual nests. If the habitat is perfect, the bustard will successfully breed and raise the chick. They existed for millions of years without our 'help' and they can do so for many more years if we do not disturb them and their habitat. However, if a nest is found in a private field or in an unprotected area, the watchman should see that the egg is not trampled by livestock, or picked up by villagers.
- (2) If an egg is found presumably unattended, it should never be taken for artificial breeding or for showing it to superior officers in the department. The bustard rarely abandons the nest and if the hen is not seen it does not mean that she has deserted the nest. She will come back as soon as the person leaves.
- (3) The location of the nest should not be disclosed to visitors. There is nothing special about a bustard egg except that if allowed to be incubated, it adds one more individual to the population of this rare species.



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