

Guidelines for the Great Indian Bustard Recovery Programme
Ministry of Environment and Forests, Government of India

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Introduction

Identification of the species for initiating action

The Great Indian Bustard (*Ardeotis nigricaps*) has been up listed to critically endangered category in 2011 by BirdLife International and IUCN based on the research conducted by the Wildlife Institute of India (WII). Population of the Great Indian Bustard (Great Indian Bustard) has been dwindling very fast and the bustard has disappeared from about 90 % of its range. About 75% decline was observed within three generation time scale. Predicted extinction probability is very high within next three generation time. Human induced threats have increased and likely to increase manifold. Currently not more than 300 birds left in the world with no known breeding population outside India.

The Great Indian Bustard is listed in Schedule I of the Indian Wildlife Protection Act. It has been declared as State Bird of Rajasthan. It was also listed in National Wildlife Action Plan 2002-2016. As per the National Forestry Commission recommendation No. 172, 'Project Bustards' should be initiated to protect highly endangered Great Indian Bustard, Lesser Florican, Bengal Florican and other grassland fauna and flora. in recent years. During World Conservation Congress at its 3rd Session in Thailand, the IUCN in 2004 had passed a resolutions to urging Government of India to protect all the bustard species and start 'Project Bustards' It is the largest grassland-specific bird.

Looking at its precarious status and high probability of extinction, the Ministry of Environment and Forests have identified the Great Indian Bustard for taking initiatives for the recovery of this species. Therefore these Guidelines were developed after detailed consultative meetings with the state Forest Department, experts from WII, Bombay Natural History Society, WWF-India and field scientists.

Section I: Details about taxonomical classification, ecology, behavior, habitat requirement, past and current distribution, current status in terms of therat (as per WPA 1972/IUCN red list) threats to the species, current management practices etc. under following headings.

1. Taxonomy

The systematic classification is as follows:

Kingdom: Animalia

Phylum: Chordata

Class: Aves

Order: Gruiformes

Family: Otididae

Genus: *Ardiotis*

Species: *nigriceps*

The Great Indian Bustard was first described to science as *Otis nigriceps* (Vigors 1830) from specimens collected at the Himalayan foothills of Northwest India. It later changed name to *Otis edwardsi* (Gray 1831), *Eupodotis edwardsi* (Blanford 1898), *Choriotis nigriceps* (Baker 1928; Ali and Ripley 1969) and finally *Ardeotis nigriceps* (Sibley and Ahlquist 1990). Etymology of its recent scientific nomenclature is *Ardea* (a heron), *otis* (bustard), *niger* (black), *ceps* (headed). Bustards belong to the family *Otididae* of the order *Gruiformes* (a 'taxonomic grab bag' owing to the wide disparity among its constituent members, see Sibley and Ahlquist 1990). The current classification recognizes 11 genera and 25 species. This group lacks hind toe, flies rarely and is strictly terrestrial (del Hoyo *et al.* 1996). The lineage originated 77 million years ago in Africa, at three focal points, Sub Sahara, East Africa and South Africa. *Ardeotis* with the largest generic range is hypothesized to be the earliest stock that spread across Eurasia, India and Australia, crossing oceanic barriers and speciating in discreet ranges.

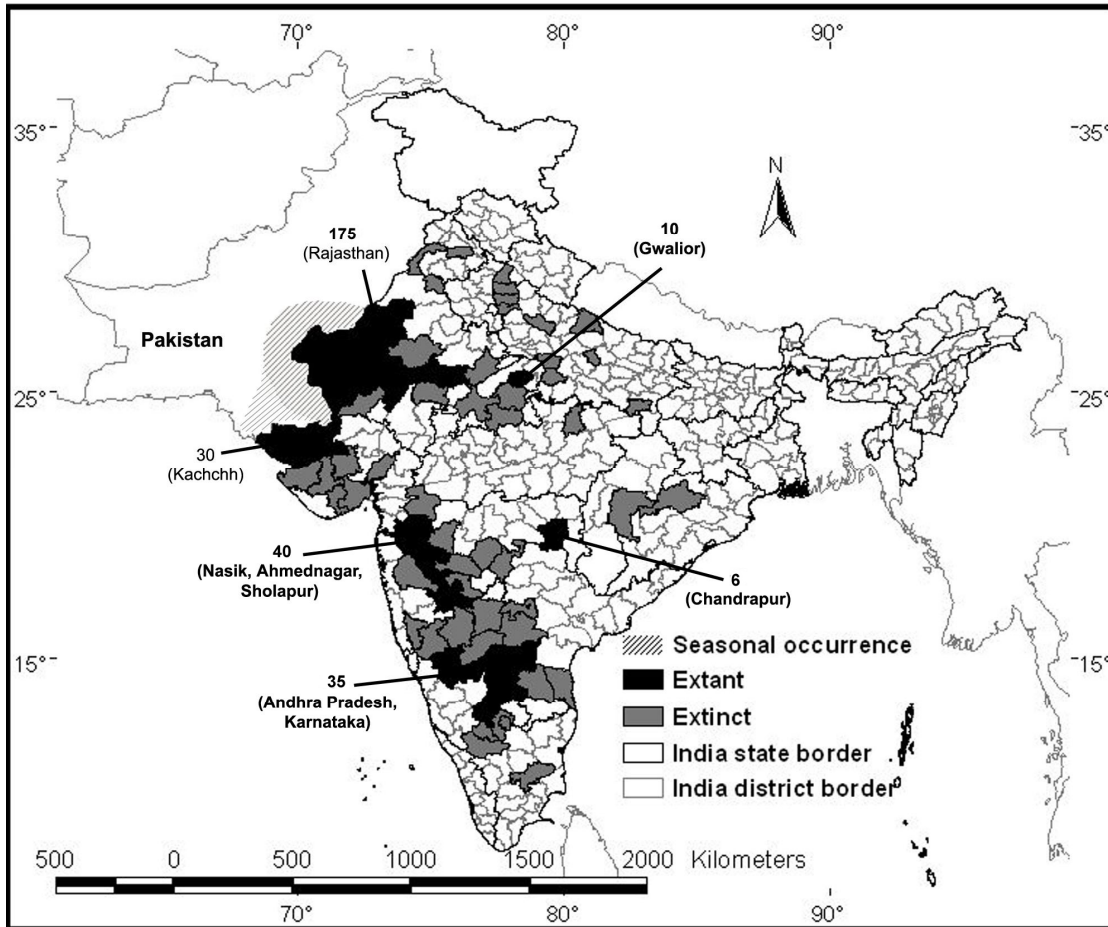
2. Distribution - Past and Present

Historically Great Indian Bustard was distributed throughout the western half of India; from Punjab and Haryana in north to Tamil Nadu in south, and from Gujarat and Rajasthan in west to Orissa in east; spanning eleven states (Rahmani 1989). The last three decades have seen a drastic reduction in the range occupancy of this species (Dutta *et al.* 2010). The current distribution is restricted to fragmented pockets in six states of the country (fig 1). In Rajasthan, the Desert National Park in the districts of Jaisalmer and Barmer along with the agro-pastoral landscapes of Bikaner holds the largest global population currently numbering between 100-125 birds, along with another 25-50 birds in Ajmer, Pali and Tonk districts (Rahmani 2006). All other populations

number less than 35 birds each (BirdLife International 2001). These populations are located within the states of a) Maharashtra, at the Bustard Sanctuary of Solapur and Ahmednagar districts having 30-35 birds, Nasik district having 5-8 birds and Chandrapur district having 4-6 birds (Thosar *et al.* 2007), b) Andhra Pradesh, at Rollapadu Sanctuary of Kurnool district and its adjoining areas of Anantpur district having about 30 birds (Rao and Javed 2005; Rahmani 2006), c) Gujarat, in Abdasa tehsil of Kachchh district having 25-30 birds (Singh 2001), d) Karnataka, where the population status is poorly known, but few birds (~4) have recently been reported from Sirguppa tehsil of Bellary district (Ahiraj 2008), and e) Madhya Pradesh, where the Great Indian Bustard population has faced a stark decline (Rahmani 2006) and numbers in Gwalior district are likely to be less than 10 birds. The Rajasthan and Kachchh populations are probably shared with eastern Pakistan where sporadic, seasonal occurrences of 15-20 bird sightings have been recorded (Khan *et al.* 2008).

Table 1: status of past and present population of Great Indian Bustard

No.	State	Past(1980s estimates)	Present estimated number
1.	Andhra Pradesh	80-100	35-40
2.	Karnataka	20-30	<20
3.	Maharashtra	c. 60	20-25
4.	Madhya Pradesh	30-35	<5
5.	Gujarat	c. 50	c.30
6.	Rajasthan	500	80-100



3. Habitat status

Bustards generally favour flat open landscapes with minimum visual obstruction and less disturbance. Plumage based ecological classification of the family *Otididae* hypothesizes *Ardeotis* to be more generalized than other genera (Johnsgard 1991). Earlier habitat studies found that Great Indian Bustard typically uses arid–semiarid areas dominated by grasslands with 30–70 cm herbaceous height interspersed with short shrub and extensive agriculture (Ali and Ripley 1969, del Hoyo *et al.* 1996). Its habitat requirements may vary with season and behaviour. While in the non–breeding season it vagrantly uses wide agro–grass–scrub landscapes (Rahmani 1989); in the breeding season (summer and monsoon) it congregates in traditional undisturbed grassland patches (Rahmani 1989; Johnsgard 1991) which are characterized by a mosaic of less grazed relatively tall grass (less than 50 cm) preferred by nesting females for concealment, interspersed with well-grazed short grass preferred by displaying males (Dutta *et al.* 2010). It is also known to nest in open barren land during summer. Bustard tend to avoid grasses above one meter height, also dense

scrub like thickets of *Prosopis juliflora* and *Acacia* are not used. The roosting sites are generally bare areas while resting sites are shaded (Rahmani 1989; Dutta and Jhala unpublished data). However, quantitative information on used range of habitat attributes and effect sizes of vegetation structure, land-use changes and disturbance on their population states are scarce. The breeding habitats need (exploded lek and nesting) are significantly different than the non breeding habitat requirement of the species. The former been dictated by habitat structure and less human disturbance the later been dictated by food availability.

4. Behavioural aspects

Great Indian Bustard is a diurnal species, typically active in the early morning (0600–1100) and evening (1700–2000) hours. They are gregarious, usually forming sexually segregated flocks that dissociate during the breeding season. Flocking is more prominent during roosting behaviour. Historically flocks of 20–50 birds have been commonly observed but the current estimated flock size is only 2–3 birds (Dutta, Jhala and Rahmani unpublished data), probably due to the overall population decline. Information on seasonal movement pattern is required for conservation planning at landscape level. Dietary observations reveal that the species is omnivorous; feeding on (1) plant matter such as grass seeds, *Zizyphus*, *Eruca sativa*; (2) agricultural crops such as groundnut, millets and legumes; (3) orthopteran and coleopteran insects, lizards and rodents (Bhushan and Rahmani 1992). Being a desert adapted species; it drinks water only if available but frequently during the hot summer (Rahmani 1989). Great Indian Bustard breeds principally between March and September, differing regionally based on rainfall. Breeding males establish territories in an exploded lek mating system (Gilliard 1969; Sankaran 1996), which females apparently attend for mating (Hooglund and Alatalo 1995; Sankaran 1994a, 1996). During this time, males display elaborately from specific spots by inflating their gular pouch to produce deep resonant calls, cocking their tail, and occasionally engaging in highly ritualized territorial fights with intruding males. Reproduction is slow as the female typically lays a single egg (rarely two) in secluded, open ground, and incubates for ~ 25 days without any cooperation from the male in nest guarding. Disturbance to nesting site is a major cause of egg and chick mortality. The precocial chick fledges in about 75 days and follows its mother almost for a year. Great Indian Bustard exhibits stark sexual dimorphism; males weighing double the females (~11–18 kg, see Elliot 1880; Vyas *et al.* 1983) and having prominent secondary sexual characters. Insemination of all breeding

females by only 1–2 males in Nanaj and Rollapadu (Rahmani and Manakadan 1986, Rahmani 1989) hints on a polygynous mating system, and probable intrasexual selection in this species for the more attractive male (Zahavi 1975, Johnsgard 1994).

5. Status of species and trend analysis

Knowledgeable estimate of the current global population is less than 300 birds. Their numbers were roughly equal to about 1260 individuals in 1969 (Dharmakumarsinhji 1971) that dwindled down to about 745 individuals by 1978 (Dharmakumarsinhji 1978a) and around 600 individuals at the turn of this millennium (BirdLife International 2001). At this rate extinction is imminent in small populations (<30 birds) within next few generations (Dutta *et al.* 2010). Even large populations (>100 birds) have high probability of getting extinct if poaching of adult birds takes place (Dutta *et al.* 2010). In a study conducted by Dutta *et al.* (2010) on simulations habitat availability and different carrying capacity, it was predicted that there is high probability of extinction of all the small population of Great Indian Bustard. Populations are extremely sensitive to human induced loss of adult female birds and breeding failure (nest, hatching and fledging failures; see Dutta *et al.* 2010). Therefore, it is extremely important to protect the breeding sites from all human-induced disturbances and reduce poaching to nil. Securing these two life history phases is likely to revive the declining trend of Great Indian Bustard populations.

Table 1 K–selected vital rate parameters of the Great Indian bustard used for viability analysis (Dutta *et al.*, 2010)

<i>Reproductive System & Rate</i>	
Age of producing 1 st offspring (sexual maturity)	3 years (♀) & 4 years (♂)
Max. age of reproduction	20 years
Average. no of progeny/year	1
Sex ratio at birth	1♀:1♂
% Adult ♀ breeding/year	50 ± 10 [§]
% ♂ in breeding pool	25
<i>Mortality rate</i>	
1st year	50 ± 10%
2nd year	10 ± 2% (♀) & 16 ± 3% (♂)
Adults	5 ± 1% (♀) & 8 ± 1.5% (♂)

6. International/National obligations

The Great Indian Bustard has been protected in India since Independence. Currently it has got the highest protection status as it is listed in Schedule I of the Indian Wildlife Protection Act. It is now in the Critically Endangered list of the IUCN. It is also listed in the CMS Convention, and CITES Appendix I, to both of which India is a signatory.

Great Indian Bustard has been identified as one of the species for recovery programme under the Integrated Development of Wildlife Habitats (Centrally Sponsored Scheme) of the Ministry of Environment and Forests, Government of India, 2009.

7. Biotic pressure and socio-economic profile

A) Assessment of threats

There has been a steady decline in abundance and range occupancy of Great Indian Bustard over the last 30 years, and in the last 3-4 years there has been a steep fall in its population.

Direct threats

Historically, Great Indian Bustard has been hunted as a game bird (Hume and Marshall 1878; Ali 1927; Rahmani 1989) and continues to be hunted in neighbouring Pakistan (Khan *et al.* 2008). The western Rajasthan and Kachchh populations are probably shared with Cholistan desert and Sindh of Pakistan, where 49 birds were hunted out of 63 that were sighted over a period of 4 years (Khan *et al.* 2008). Low intensity poaching still persists within India outside protected areas. Given the life history traits of Great Indian Bustard, this level of removal threatens its extinction in immediate future. Collection of Great Indian Bustard eggs for consumption is also prevalent in some parts of Karnataka and Andhra Pradesh, which directly threatens the breeding success. Fatal bird collisions with high tension electric wires, fast moving vehicles and other human structures continues in the industrial development zones near bustard areas. Such deaths have been reported from Kachchh (Gujarat) and Solapur (Maharashtra). Moreover, domestic dogs of farmers and pastoralists, and free ranging dogs of villages adjoining Great Indian Bustard areas have been observed disturbing the displaying males (which have extremely reduced movement during the breeding season) and (more seriously) causing nest damage. Unethical photography during the breeding season often acts as a constant source of disturbance; such instances have been reported

from Naliya grasslands (Gujarat). Due to the lack of legislative enforcement and protective measures in core breeding areas, such direct threats on Great Indian Bustard population continues unrestricted.

Habitat threats

Other than a legal status, Great Indian Bustard habitats do not enjoy any protection measure. According to reports of the Wildlife Institute of India (WII), less than 1% of the grassland comes under the Protected Area Network (Rodgers and Panwar 1988). As a result, most of the Great Indian Bustard landscapes have faced severe habitat loss and alteration over the recent past from: (1) widespread agricultural expansion and mechanization of farming (also see Vanak and Gompper 2010); (2) infrastructural development such as irrigation, roads, electric poles, windmills and constructions; (3) mining and industrialization; and (4) well intentioned but past habitat management were non compatible to Great Indian Bustard. Due to Government irrigation and housing policies, many typical bustard landscapes are changing at an accelerated rate. With increased availability of water, agriculture has spread over vast arid–semiarid grasslands. For example, the Indira Gandhi Nahar Project (IGNP) has caused drastic hydraulic changes and massive agricultural conversion in and around the Desert National Park. Moreover irrigation facilities and changing lifestyles have led to a shift in the crop pattern from bustard–friendly traditional monsoonal crops (*Sorghum*, millet etc.) to cash crops (sugarcane, grapes, cotton, horticulture etc.) which are not suitable for Great Indian Bustard. Due to fuzzy land distribution policies and the ambiguity arising from segregated ownership between local communities, Revenue Department and Forest Department, encroachment is a major problem in many bustard areas, especially in bustard sanctuaries of Maharashtra and Kachchh. In many protected areas (e.g., Gaga–Bhatiya in Gujarat and Rennibennur in Karnataka), open grassland habitats have been transformed into scrubland due to well–intentioned but ill–informed management practices such as exotic shrub/tree species plantation (*Eucalyptus*, *Glyricidia* and invasive *Prosopis juliflora*) by the State Forest Departments. Overgrazing on private and community lands has also led to degradation of some areas. It has been lately observed that along with the increasing native livestock population, semi–nomadic livestock from other areas (e.g., *Kathiawadi* livestock of Gujarat) are adding to the grazing pressure in the states of Maharashtra, Karnataka and Andhra Pradesh. Lastly, activities such as mining, stone quarrying, growth of industries and power projects along with the

expansion of roads, electric poles, windmills and other infrastructures have increased the severity of habitat degradation and disturbance in Great Indian Bustard landscapes.

B) Data deficiency

For effective conservation, biological and ecological information of a species is essential, but unfortunately such information is scanty in the case of the Great Indian Bustard. Some of the information gaps are: (1) habitat relationships and seasonal movement pattern of Great Indian Bustard are not reliably known. There is lack of centrally coordinated, scientific uniform population estimation protocol. (2) Bustards have coevolved with ungulates, and depend on grazers to maintain a suitable habitat structure. Since the last thousand years, community of wild grazers has been steadily replaced by domestic livestock in most of the bustards' range outside Africa (Skarpe, 1991). While regulated livestock grazing can maintain Great Indian Bustard habitat structure, over-grazing may lead to the loss of habitat heterogeneity, resource depletion and desertification. The effect of various intensities and regimes of grazing on Great Indian Bustard are unknown; nevertheless they are essential for developing Great Indian Bustard-compatible stocking rates and grazing system. (3) The species is known to seasonally disappear from particular landscapes. Information on linkages between populations and seasonal habitat preferences are unknown. (4) Although considerable portion of Great Indian Bustard diet is constituted of crops, the impact of pesticides on them has not been examined. (5) Quantitative information on the impact of predators such as wolf *Canis lupus pallipes*, Indian fox *Vulpes bengalensis*, and domestic dog as well as anthropogenic disturbances on Great Indian Bustard breeding success has not been investigated. (6) There is a lack of information on bustards in popular literature and common man knows little about it despite the bird being so widespread endangered. Bustard has shared its habitat with the local communities and their livestock for centuries together. The traditional knowledge arising out of this coexistence has not been documented. (7) There is a lack of understanding about changes in landuse pattern throughout the bustard landscape.

C) Conservation Initiative taken so far

Conservation of bustards and their preferred grassland resources was first brought into the focus of governance through a symposium meeting of eminent conservationists in Jaipur, Rajasthan during 1980 (Goriup and Vardhan,1983). Following this, the State Governments of India declared eight

bustard Sanctuaries in post 1980s. Most of these Protected Areas were either too small, targeting traditional breeding patches, or very large, covering entire agro-pastoral landscape inclusive even of large townships. Within these reserves, the recommendation was to maintain small scattered conservation refuges (preferably the traditional breeding spots that could be protected during the breeding season to exclude cattle and human disturbance) with large buffers (Rahmani 1989). Refuges were recommended to be managed so as to provide habitat requirements for crucial activities such as lekking, nesting, chick rearing and foraging (Rahmani 1989). However, the prevalent governance and policies have defeated Great Indian Bustard conservation due to various reasons:

D) **Legal limitations:** The prevalent legal system in the 1980s–1990s governing PAs was not sufficiently flexible to permit implementation of even these simple recommendations. Settlement of land rights between the local communities and Forest Department had been delayed in these sanctuaries, restricting the Government’s control over lands, and allowing only minimum scope of management. For small conservation refuges, the Forest Department had no authority on the surrounding private lands. Some of them underwent drastic land–use changes over years rendering the small refuges as relict habitats with substantially decreased Great Indian Bustard usage, such as the Lala Sanctuary (Gujarat).

E) **Lack of local support:** The wide ranging nature of Great Indian Bustard makes implementation of protection measures difficult without public support (Rahmani 2003). The species is also dependent on traditional farmlands and its conservation is compatible with low intensity human use of the landscape that requires minimum infrastructural development. While declaration, many Great Indian Bustard Sanctuaries were inclusive of, or surrounded by privately owned lands, exemplified by Karera Bustard Sanctuary in Madhya Pradesh and the Bustard Sanctuary of Maharashtra. Due to enhanced protection and restricted livestock grazing in the Karera Bustard Sanctuary (202 km²), the residing small blackbuck population exploded resulting in crop depredation in adjoining private agricultural lands. Blackbuck being a Schedule I species [Wildlife (Protection) Act, 1972] could not be hunted. This antagonized local agro-pastoral communities (Rahmani 2003) resulting in a backlash by the communities that caused the local extinction of Great Indian Bustard and reduction of blackbuck population through poaching.

Similarly, the large expanse of Bustard Sanctuary of Maharashtra (8,496 km² area, much of it being non-Great Indian Bustard habitat) has restricted private land owners therein to use their lands freely and profitably, as the stringent Indian legislation is extremely restrictive about land use in legally gazetted PAs [Wildlife (Protection) Act 1972]. This again has generated bitterness amongst the local populace. Because of stringent legislation, lack of awareness and misconception, local populace of several states consider Great Indian Bustard as a major obstacle in the development of the region, leading to the lack of local support for bustard conservation. Reduced benefits from the establishment of PAs have led the local people show non-cooperation towards the State Forest Departments.

F) Lack of effective grassland management: Management of Great Indian Bustard conservation areas has mostly been misdirected, ineffective and counterproductive, due to inadequate appreciation of grassland resources. Traditionally, grasslands and scrub have been considered as “wasteland” and the Forest Department policy has been to convert them to “forests” with plantation of fuel/fodder shrub/tree species, even exotics like *Prosopis juliflora*, *Gliricidium* and *Eucalyptus* spp., under social forestry and compensatory afforestation schemes [Indian Forest Act, 1927; Forest Conservation Act 1980]. Massive afforestation under CAMPA funds has resulted in loss of crucial Great Indian Bustard habitats, while lack of funds constraints effective conservation efforts such as land acquisition for the formation of undisturbed breeding refuges. In some small Great Indian Bustard refuges well-intentioned but ill-informed management practices such as development of large water bodies, network of roads, delineation of ‘reserve grasslands’ through trenching-cum-mounding and plantation, have resulted in severe habitat alteration (Pande and Pathak 2005) and are considered to have caused local extinction of the species from Ranibennur and Gaga-Bhatia Sanctuaries. Prevalent conservation-incentive schemes in Gujarat and Madhya Pradesh such as announcing reward for Great Indian Bustard eggs and appointing watchmen for egg monitoring have often been counterproductive even causing nest failures.

G) Institutional failures (accountability, inter-departmental coordination, funding): Great Indian Bustard requires a landscape level conservation policy on government-private mixed ownership land, which involves coordinated efforts from various technocratic and informal (community) institutions. Such a holistic approach is currently absent. Each Great Indian Bustard

range state has developed its own plan of action for the species in isolation from other states; however it is likely that individuals are moving between populations. Considerable portion of Great Indian Bustard habitats lies under the jurisdiction of Revenue Department. Massive encroachment of revenue lands have been reported from core Great Indian Bustard breeding areas in Abdasa (Gujarat), but due to the lack of inter-departmental coordination and delay in legal actions, these lands have not been reclaimed. Much of the problem stems from the absence of accountability (or specific responsibilities) of the relevant departments to ensure sustainable land resource management in Great Indian Bustard landscapes. In India, negligible proportion of grasslands is “protected” (<http://www.wii.gov.in/>). With a livestock population of >540 million and still growing, our grasslands are under substantial biotic pressure from grazing and land-use conversions. However, the country lacks a national grazing policy and grassland management policy (Rahmani 2006). Ironically in India only livestock is considered as wealth, not the pastures which they depend on. Most of these pasture lands are common property resources belonging to the villages, without any well defined ownership rights or responsibilities. Under such circumstances and widespread dissolution of informal (community) grazing institutions, pasture lands are likely to suffer from the “tragedy of commons” (Hardin 1968). Thus there is a need for establishing clear land tenure system for pastoral communities. Interest of local stakeholders on grassland conservation has so far been undermined. Local communities can be involved in an integrated management approach by securing their grassland dependant livelihoods using scientific and traditional knowledge bases. Joint Forest Management (JFM) is a relevant example of participatory habitat conservation for many forested areas, which has not been implemented with equal interest in grasslands. Not much interest has been shown on developing educational materials in local languages on grassland ecosystems and bustards, or awareness programmes for publicity in schools, colleges, and civil societies. Such practices will certainly help to gather support from local community, especially the young strata. In the current scenario, very few NGOs are working specifically for Great Indian Bustard conservation. Those who are working do not receive adequate support from Government authorities, and suffer from lack of communication between each other. However, NGOs have the potential of gaining local support for Great Indian Bustard conservation and facilitating problem solving processes between State Forest Departments and communities. Thus it is important to strengthen the network of State Forest Department, NGOs and communities for more effective and holistic conservation. For all these purposes

leading to Great Indian Bustard conservation, viz., research, monitoring, training/education and management, there is an urgent need to provide necessary financial support.

Section II: Prescription for recovery of Species

In light of the aforementioned species' ecological requirements and threats, the following recovery actions should be undertaken. These have been categorized into a national level plan, a state level plan and site specific plans.

Part I. Species level recovery

A. Study of population Ecology

Systematic, centrally organized status & distribution survey has to be implemented at the landscape scale at an initial stage for benchmark information. Satellite telemetry program has to be scientifically undertaken to understand seasonal movement patterns & life-history requirements.

B. Conservation breeding programme

However, owing to the extinction prone *k*-selected nature and threat from hunting, Great Indian Bustard is in urgent need for *ex-situ* conservation and subsequent supplementation of existing small *in-situ* populations. Although a few unscientific attempts to breed Great Indian Bustard in captivity have failed in the past (Putman 1976; Sankhala 1977; Rahmani 1986), scientific execution of conservation breeding is possible (Collar 1983) along the lines of successful breeding programs of houbara *Chlamydotis undulata* (Lawrence *et al.* 2008), great bustard *Otis tarda* (Great Bustard Group 2006–2007), and kori bustard *Ardeotis kori* (A.R. Rahmani personal observation). Since there is no captive population of Great Indian Bustard, extinction from wild implies total extinction. For the appropriateness and execution of conservation breeding of Great Indian Bustard, a workshop with national and international experts needs to be organized at the earliest. A workshop involving international and national experts has to be organized on conservation breeding that will formulate the breeding plan in a scientific & professional way, and decide the centre of location, technology, staff and infrastructure required.

Part II. Habitat level recovery

A) Core areas protection plan

Existing Great Indian Bustard breeding areas have to be excluded from all kind of human disturbances excepting low intensity traditional pastoralism, that too not during the breeding season. This includes restriction on infrastructural development and land–use diversion (ban on roads, high tension electric poles, intensive agriculture, wind power generators and construction). Active protection must be given to these areas by Forest Department staff. Carnivores like domestic dogs, fox and jackals are believed to be contributing to breeding failure. Since Great Indian Bustard is known to nest in specific spots over the years, these high priority spots and relevant surroundings within the breeding areas have to be freed from the above problem species prior to breeding. For this, coordination with municipal corporations and gram panchayats for removal of dogs, and translocation of problematic wildlife (fox, jackal) by competent Forest Department authority are required. Alternative livelihoods have to be provided to traditional hunters in some areas.

B) Landscape level conservation plan: Integrating livelihoods with conservation

As mentioned before, Great Indian Bustard requires a viable landscape level policy, and conservation practitioners must involve the local communities at various levels and roles. Hence, stakeholder analysis through interactions with priority stakeholders for linking local livelihoods with bustard conservation needs to be undertaken. Solutions obtained from such exercises can be implemented as pilot projects to validate their viability. For example, little bustard population has been dramatically revived within a few years following good practices like agro–environmental schemes (advocating private farmers for organic alfalfa cultivation in breeding areas) in France (Bretagnolle 2011). Also, a profitable and equitable mechanism to share revenues generated from eco-tourism with local communities (Narain *et al.* 2005) may go a long way in harnessing support for Great Indian Bustard conservation. Communities have to be sensitized parallelly through popular literature on the importance of grassland and conservation of bustard in local languages. For the awareness and capacity building of Forest Department officials and NGOs, training manuals have to be published and workshops have to be arranged in different range States. This will facilitate the process of building a network between Forest Department, NGOs and communities for integrated Great Indian Bustard conservation. Such networks can operate through

formal institutions like Bustard cell so that illegal activities are reported and reduced through prosecution. Government should urgently consider the need of developing environmentally viable grazing and land tenure policy particularly for Great Indian Bustard landscapes. Since Great Indian Bustard conservation requires coordinated efforts from various managerial (Forest, Revenue etc.) departments as well, such an arrangement can be facilitated by liaison advisory committee at the district level involving these department heads (for e.g., CWLW and Collector) for joint decisions on managing bustard habitats. Strict enforcement of legislation and accountability of concerned authority are required at all managerial levels. Management has to be linked with research–evidence for more effective conservation practices. This might require legislative amendments. For e.g., Instead of plantation of shrub/tree species in grasslands, CAMPA funds can be used for more rational management, such as acquisition of private lands to develop contiguous disturbance free Great Indian Bustard breeding areas, or habitat manipulations to suit the ecological requirements of grassland species.

C. Species and habitat recovery action through research and monitoring

There is also an urgent need to adopt a centrally standardized population monitoring protocol that can be systematically executed at local levels all over the country, along the lines of the ongoing tiger monitoring exercise. Such a monitoring protocol should use modern population estimation theory and techniques. Understanding the vital rate parameters (such as survival, recruitment, dispersal and effective population size) and their environmental correlates unfolds the causes of species decline. Once factors decreasing demographic rates are identified, they can be managed for the long term survival of the species. Such research will require biotelemetry (satellite and radio tagging) of several individuals, and will inform us about the seasonal movement patterns, connectivity/linkages between populations, and cross–country movements (summer movement of individuals towards Pakistan and subsequent poaching is currently the most serious threat to Great Indian Bustard). Great Indian Bustard populations are most sensitive to the loss of adult birds and breeding failure (Dutta *et al.* 2010). However, how various factors influence them needs to be understood to secure the “Achilles’ heel” of the species.

Existing and potential Great Indian Bustard breeding areas and non–breeding usage need to be clearly identified in each landscape. Such information can be obtained parallelly from the

population monitoring exercise. Once suitable habitats are identified, their status can be monitored over years to detect and confront incipient changes to suitable habitats. Effective management of habitat as if it benefits the species can only be accomplished through detailed research on species–habitat relationships. Studies need to be undertaken on seasonal and behavioural preferences of habitat attributes in different landscapes. Knowledge of critical resource requirements by Great Indian Bustard and subsequent carrying capacities of landscapes must be investigated through biotelemetry supported studies. Once limiting factors of a population are identified, managing those factors is likely to bring about faster revival of the species.

Part III. Institutional Framework Plan of Operations

Section II	Solutions	Actions	Responsible personnel/committee	Months	RJ	GJ	MH	AP	KA	MP	Priority	timeline since approval of SRP (in year)	Sites
Part 1 Species level recovery action A. Study of population ecology	Identification of less known breeding areas & important non-breeding areas outside Pas	Systematic, centrally organized status & distribution survey has to be implemented at the landscape scale at an initial stage for benchmark information	WII & BNHS will develop the survey protocol and submit it to MoEF. MoEF will involve WII, BNHS, WWF & local NGOs for field implementation		Y	N	Y	Y	Y	Y	Medium	<1 years	W & E Rajasthan, E Maharashtra, Andhra Pradesh, Karnataka & Madhya Pradesh
		Satellite telemetry program has to be scientifically undertaken to understand seasonal movement patterns & life-history requirements	WII & BNHS with support from MoEF & WWF		Y	Y	Y	Y	Y	Y	High	Within six months	W Rajasthan, Gujarat & W Maharashtra (Andhra Pradesh optional)
B. Management intervention)	Conservation breeding program	A workshop involving international and national experts has to be organized on conservation breeding that will formulate the breeding plan in a scientific & professional way, and decide the centre of location, technology, staff and infrastructure required	Organized by the BNHS and WWF with support of MoEF		Y	Y	Y	Y	Y	Y	High	< 6 months	
		Field implementation of conservation breeding program has to be commissioned										High	<1.5 years

	Awareness programs	Workshops have to be conducted and publicity manuals have to be produced for conservation-management of birds and habitats among the F.D.staff & communities	WII, BNHS & WWF with local NGOs		Y	Y	Y	Y	Y	Y	Medium	0-3	All sites
	Protection to birds	Local networks (bustard monitoring cells) have to be established for regular patrolling of Great Indian Bustard areas and sharing related information	State Forest Department with the help from BNHS and WWF and local NGOs		Y	Y	Y	Y	Y	Y	Medium	0-1 and continued annually	All sites
		Minimize Great Indian Bustard-unfriendly infrastructure (electric poles) from important areas	State Government (FD, PWD and other departments)		Y	Y	Y	Y	Y	Y	Medium		All sites
Part 2 Habitat level recovery A. Habitat protection & restoration)	Seasonal protection to known core areas that are existing PAs to create sacrosanct breeding refuges that are periodically freed from all disturbances to secure nesting success	New fencing in core areas and maintaining the existing ones		Jan							High	1-2 and continued	All sites
		Appoint forest guards to exclude disturbances to breeding birds		Feb									
		Remove dogs & other nest predators with the help of Veterinary Department & trained biologists		Mar			Y	Y					
				Apr	Y		Y	Y					
				May	Y	Y	Y	Y					
				Jun	Y	Y	Y	Y					
				Jul	Y	Y	Y	Y					

			Aug		Y	Y	Y						
			Sep		Y	Y	Y						
			Oct			Y	Y						
			Nov			Y	Y						
			Dec										
Acquiring private/community lands in crucial Great Indian Bustard breeding & adjoining areas	Non protected lands adjoining core areas that are also crucial for breeding have to be acquired if possible and seasonal core protection to these areas (aforementioned) have to be implemented			y	y	Y	y	y			High	1-5 years	All sites except W Rajasthan
Engaging conservation partners	Alternatively, flexible management of Great Indian Bustard landscapes on private public mixed ownership lands by innovative incentive (subsidy etc.) driven encouragement OR through declaration of community/conservation reserves, wherever possible & acceptable, should be done depending on sites.	State Government		y	y	Y	y	y			Medium	2-5 years	W & E Maharashtra, Gujarat, E Rajasthan, Andhra Pradesh & Karnataka
Link local livelihoods with Great Indian Bustard conservation in important breeding & non-breeding areas	Conduct stakeholder analysis to identify livelihood issues	WII, BNHS & WWF with local NGOs		y	y	y	y	y	y		Medium	1-5 years	all sites

		Provide incentives to farmers and pastoralists in important Great Indian Bustard areas to continue Great Indian Bustard–friendly traditional practices. Good practices include growing low height Great Indian Bustard friendly crops, organic (pesticide free) farming (Agri-environmental Incentive Schemes, fodder development schemes & Eco-tourism (will be detailed in annexure)	MoEF and State Government		y	y	y	y	y	y	Medium	1-5 years	W Maharashtra, Gujarat & Andhra Pradesh (medium-high)
		Restoration and maintenance of grasslands; no invasive shrub/tree plantation and removal of unwanted plants	FD		Y	Y	Y	Y	Y	Y	High	1-2 years and fine tuning after satellite tracking study (3-4 years)	all sites
B. Scientific management of bustard habitat		Developing landscape level management plan based on scientific inputs	WII, BNHS & WWF and State FD		y	y	y	y	y	y	Medium		
		Limit village livestock (particularly sheep and goat)	State Government		y	y	y	y	y	y	Medium	1-2 years and fine tuning after satellite tracking study (3-4 years)	all sites
		Limit dog number based on scientific inputs	State Government, (FD and veterinary department)		Y	Y	Y	Y	Y	Y	Medium	Immediate and continue	All sites

	policy making for grassland conservation	implementation of 'Project Bustards'	MoEF										
Part 3 (Plan of operation)	Committee structure	National, State & Local committees	MoEF and State Governments		Y	Y	Y	Y	Y	Y			
	monitoring conservation indicators and biological indicators	Centrally standardize population & habitat monitoring protocol using modern tools			Y	Y	Y	Y	Y	Y		1-1.5 years	

Recovery Actions and administration:

Based on the assessment of threats and review of conservation strategies, the following actions are recommended for the species recovery plan. State and local level Great Indian Bustard Conservation Committees have to be formed to plan, discuss, execute, assess, and review these actions. These committees should be supervised by a national level committee involving competent authorities. Ideally, the recovery plan should be revisited once in a year to review the progress and effects of such planning.

Sr. No.	Actions	MoEF	State Forest Department	NGOs/Research organizations					
				Guj	MP	Raj	MH	AP	KA
1	Preparation of Action Plan	MoEF	State Forest/Revenue/Panchayat	WII, BNHS, WWF, KERC, GEER,	WII, BNHS WWF,	WII, BNHS, WWF, TWSI	WII, BNHS, WWF Great Indian Bustard Foundation, MK Rao	WII, BNHS, WWF Thulsi Rao	WII, BNHS, WWF
2	Execution	MoEF	State Forest/Revenue/Panchayat	WII, BNHS, WWF, KERC GEER GUIDE	WII, BNHS, WWF Manish Kaneria	WII, BNHS, WWF, TWSI	WII, BNHS, WWF Great Indian Bustard Foundation,	WII, BNHS, WWF Thulsi Rao ASHRAM	WII, BNHS, WWF SWAN
3	Monitoring & Evaluation	Monitoring Committee, MoEF	State Forest/Revenue/Panchayat	WII, BNHS, WWF	WII, FES, BNHS, WWF	WII, TWSI, BNHS, WWF	BNHS, WWF WII Great Indian Bustard Foundation - n	BNHS, WWF WII Dr. Thulsi Rao	WII, BNHS, WWF, NCBS (Dr. Kavita Ishwaran)

Note- This list is of recommended members. Evaluation of the programme will be carried out by third party participation to be decided by the MoEF.

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Appendix I

Executive summary

The endemic great Indian bustard has slow life–history (*k*–selected) traits that endanger its persistence under prevailing levels of habitat loss and hunting. Current information on population and habitat status (crucial for its conservation) is unsubstantiated and the lack of monitoring schemes forces conservation decisions to rely on anecdotes. A global population of about 300 individuals is further fragmented in the states of Rajasthan (shared with Pakistan), Maharashtra, Andhra Pradesh, Gujarat, Karnataka, and Madhya Pradesh in India. The largest population of 100–125 birds exists in Rajasthan and remaining populations are ≤ 35 birds each. Prevalent Great Indian Bustard conservation strategies use legislation to secure traditional breeding areas by declaring small Protected Areas or protect vast areas with varied human land uses. The vagrant nature of Great Indian Bustard reduces the benevolent effect of small PAs, while large reserves alienate people by curbing legitimate subsistence rights through strict legislation. These factors along with ill-informed habitat management challenge the current PA approach, even causing local

extinctions. Population viability analysis shows that Great Indian Bustard populations are extremely sensitive to loss of adult birds and breeding failure, which are extremely high under prevalent human modifications of the landscapes. With current levels of hunting in Pakistan, extinction is a real threat. Indian conservation circles are therefore proposing grassland conservation plans with bustards as the “umbrella” species, which has prompted stakeholders to devise a Species Recovery Plan (SRP). The main purpose of the SRP is to secure the long-term persistence of Great Indian Bustard and its habitat. It broadly advocates a holistic landscape conservation approach that includes (a) research and monitoring, (b) protection, management and restricted human use of core Great Indian Bustard breeding areas, (c) linking local livelihood with bustard conservation by consolidating Government and community institutions in Great Indian Bustard landscapes, (d) conservation education and awareness of local communities, (d) training of managers, and (e) conservation breeding program as a security. The SRP is a result of inputs from a wide range of stakeholders including the government, NGOs, national and international scientists and civil society. It is therefore a very inclusive and realistic document. This SRP will serve as a reference for conservation managers, policy-makers, researchers, decision-makers and form the basis of future Great Indian Bustard conservation actions.

Appendix II

List of the participants of ‘**Consultative Workshop to Develop Guidelines for the Species Recovery Programmes for Three Resident Species of Bustard and Floricans in India**’ organized by MoEF, BNHS, WWF-India at WWF-India, New Delhi on November 1st and 2nd, 2011.

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