

assuring high pollen availability to the A-line plants till their peak flowering.

These results verify our earlier findings¹ in case of hybrid seed production of KBSH-1. A genotypic difference between the R line in these two hybrids did not show any difference in flowering in response to similar treatments. Hastening of flowering following GA₃ treatment to the seeds in sorghum² and rice³, and nitrogen to pearl millet and sorghum⁴ was reported. Hydration of seeds before sowing had preponed flowering in maize variety⁵ and parental lines of hybrid, Sartaj⁶. Therefore, it can also be concluded that seed priming with GA₃ and application of urea (1%) as spray can be recommended as an effective technology for manipulation (preponement) of flowering of late parent to achieve perfect synchrony for economic hybrid sunflower seed production.

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Status, threats and conservation of the Great Indian Bustard *Ardeotis nigriceps* (Vigors) in Pakistan

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The Great Indian Bustard (GIB; *Ardeotis nigriceps*) is endemic to the Indian subcontinent and is listed as a critically endangered species. The species is a summer visitor and breeder in Pakistan. Due to ineffective law enforcement and human persecution for its alleged

aphrodisiac value, the species is close to extinction from its native haunts. Therefore, investigative surveys were done in its potential areas in Cholistan. Forty-four pertinent people and 59 active hunting groups were interviewed in order to assess the status of the species and the problems linked with its exploitation and conservation. The results revealed that the population is on a continuous decline. In about four years, nearly 49 out of 63 birds sighted were killed. The bird is under intense pressure of human persecution and trade. The study further highlights the implications needed to reverse the fast extinction rate of the GIB from the province in particular and the country in general.

Keywords: Conservation, Great Indian Bustard, status, threat.

A COUNTRY'S health and nature of its people is reflected through its flora and fauna. This tenet needs greater attention because many species are now facing extinction. In the last few decades, a massive decline in several such species has been observed in Pakistan. This includes the extinction of Cheer Pheasant (*Catreus wallichii*), Comb Duck (*Sarkidiornis melanotos*), Pink-headed Duck (*Rhodonessa caryophyllacea*), Great Bustard (*Otis tarda*), Siberian Crane (*Grus leucogeranus*) and Yellow-rumped Honeyguide (*Indicator xanthanotus*)¹, and more recently, a catastrophic decline of Oriental White-rumped Vulture (*Gyps benghalensis*) and Long-billed Vulture (*Gyps indicus*)². The decline of these species is predominantly due to human activities, including hunting, vet use of diclofenac drug³, habitat alteration and poaching. If this trend is not reversed, the situation is expected to become precarious for other species that are currently near-threatened.

Presently, the Great Indian Bustard (GIB) is one such species that is facing extreme threat towards fast extinction, at present, it is declared as 'Critically Endangered'⁴. Blanford⁵ mentions the distribution of GIB in 'the plains of the Punjab between the Indus and the Jumna, also Eastern Sindh, Cutch, Kattiyawar, Rajputana, Guzerat, the Bombay deccan, the greater part of the central provinces, extending as far as east Sambalpur, the Hyderabad territories, parts of the Madras presidency and the Mysore state as far south as southern Mysore and perhaps further south'. Regarding its present population and distribution, Ali and Ripley⁶ mention them to be 'presently rare or absent over much of their former range, but still surviving in remote areas of Cholistan, Thar, Jaisalmer, Jodhpur and Bikaner, casually or regularly seen and bred'.

The species was listed as threatened in 1966, when described as 'very rare and apparently decreasing'⁷ and later placed in the highest category of threat, i.e. 'Endangered', when its numbers were reported as doubtful. The former and present ranges of the GIB have been considerably altered. At present, the highest number of the GIB is present in Jaisalmer and Bikaner districts of Rajasthan. These districts are adjacent to the Bahawalpur and Rahim

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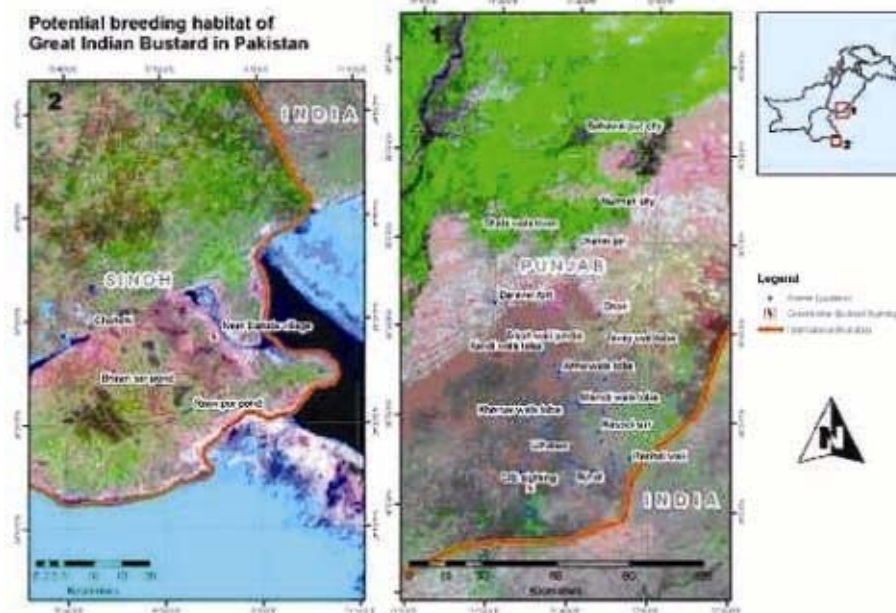


Figure 1. Potential breeding habitat of the Great Indian Bustard (GIB) in Pakistan.

Table 1. General information about the Great Indian Bustard as revealed from surveys

| Occupation | Atmospheric condition | Time of observation | No. of birds | Population trend | Threat | Arrival time | Departure time |
|-------------------|-----------------------|---------------------|----------------|--------------------|-------------------------|----------------|--------------------|
| Nomads (43.18%) | Clear (93.18%) | Morning (15.90%) | One (61.36%) | Uniform (6.81%) | Hunting, poaching (95%) | June (59.09%) | August (40.90%) |
| Poachers (29.54%) | Rainy (4.45%) | Afternoon (27.27%) | Two (22.76%) | Decreased (72.72%) | Habitat loss (5%) | July (34.09%) | September (54.54%) |
| Guides (6.81%) | Cloudy (2.27%) | Evening (36.36%) | Three (13.63%) | Not known (20.45%) | – | August (6.81%) | Not known (4.45%) |
| Others (20.45%) | – | Night (20.45%) | >Three (2.27%) | – | – | – | – |

Yar Khan districts of Punjab, Pakistan, with similar topographical features and a more natural habitat. The current population of the species at known localities in India perhaps constitutes fewer than 200 individuals⁸. Encroachment of the habitat of the GIB by humans resulting from the increase in agriculture and urban development, hunting and poaching have been acknowledged as the main causes for the rapid fall in population of the species from its former range. In this study, we report the present status and the factors threatening the status of the GIB in Pakistan.

The geographical location of the study area (Cholistan) is 70.5°–75.24°E and 28.61°–30.41°N. It is located in the southeastern part of the Pakistani Punjab Province on the eastern banks of the River Sutlej. Cholistan comprises an area of about 16,000 km^{9,10}. The study area includes three districts, i.e. Bahawalpur, Bahawalnagar and Rahimyar Khan. During the study period, survey trips were made to Cholistan to evaluate the existing population status and its trends. A small number of birds were spotted during

field reconnaissance. However, to overcome the inadequacy attributed to the scarcity of the birds and huge span of the area, interviews were conducted with a number of stakeholders. A total of 44 pertinent people and 59 hunting groups were interviewed in this study. In this connection, a questionnaire was drafted to assess the present status of the GIB, the problems linked with its exploitation and its conservation status in the area.

The questionnaire contained appropriate questions regarding the approximate density of the birds, their migration pattern and dates, specifically the hunting pressure in that locality and breeding activity of the birds in the area. Unreliable information regarding the species was ignored. The approach followed the rules set by Bibby *et al.*¹¹.

The results revealed that the GIB arrives in Cholistan during June (59.09%), and departs in September (54.54%). Most of the sightings were made during clear atmospheric conditions (93.18%). In most of the observations made by locals, a solitary bird (61.36%) was sighted (Table 1). In this connection, Rahmani and Manakadan¹² are of the view

Table 2. Data showing rank correlation between different parameters used in the study area

| Variable | Area | Hunting groups | 2001 | 2002 | 2003 | 2004 | Sighted |
|----------------|-------|----------------|-------|---------|-------|-------|---------|
| Hunting groups | 0.498 | | | | | | |
| 2001 | 0.313 | 0.979 | | | | | |
| 2002 | 0.446 | 0.998* | 0.990 | | | | |
| 2003 | 0.775 | 0.934 | 0.842 | 0.911 | | | |
| 2004 | 0.611 | 0.991 | 0.943 | 0.981 | 0.974 | | |
| Sighted | 0.451 | 0.999* | 0.989 | 1.000** | 0.913 | 0.982 | |
| Killed | 0.472 | 1.000* | 0.985 | 1.000* | 0.923 | 0.986 | 1.000* |

* $P < 0.05$, ** $P < 0.01$.

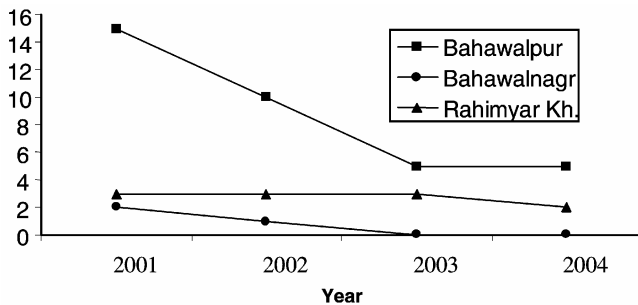


Figure 2. Population decline pattern of GIB during the study period.

that solitary sightings of GIB are frequent during the breeding season. According to a wildlife watcher (M. Hakim, pers. commun.), a single egg was observed in a nest near Islamgarh in August 2001. The GIB sightings were also made in Sindh Province as indicated in Figure 1.

The analysis revealed that hunting groups ($n = 59$) had a significant impact ($r = 1.00$) during the study period, i.e. number of birds killed by the hunting groups in 2001: ($n = 20$, $SD = 7.23$, $r = 0.979$); 2002 ($n = 14$, $SD = 4.73$, $r = 0.998$); 2003 ($n = 8$, $SD = 2.52$, $r = 0.934$) and 2004 ($n = 7$, $SD = 2.52$, $r = 0.991$). Additionally, highly significant correlation was observed between total bird sightings and birds killed in Cholistan during each of four years of the study, starting from 2001 ($r = 0.985$); 2002 ($r = 1.000$); 2003 ($r = 0.923$), and 2004 ($r = 0.986$). Collectively for four years the correlation between total sightings and cumulative number of birds killed, was also statistically highly significant ($r = 1.000$; Table 2). This clearly proves that most of the birds sighted by hunting groups in Cholistan are killed indiscriminately.

The study also revealed that the GIB is a regular summer visitor and breeder in Cholistan. In neighbouring Rajasthan, the GIB is reported to be the more in number during the hot months of May and June, with fewer birds seen during monsoon¹³. This information concurs with our findings of these birds in the Cholistan desert during summer. Every year, a considerable number of these birds enters Cholistan in search of food (grasshoppers, drupes of *Zizyphus* sp. and fruits of *Carissa* sp., which are the main diet of the GIB and are plentiful in Cholistan during June–September.

The habitat is ideal for the GIB to breed and fortunately large stretches are still intact. However, these birds

face a number of threats, including indiscriminate hunting, poaching, disturbance, etc.

There are two distinct practices of hunting pressure in Pakistan. The first is market-based hunting or trapping, referring exclusively to the organized hunting or trapping of selected species, driven by regional and global markets for their high-value demand. The second practice may be defined as hunting or trapping by locals as a tool to generate income.

In case of the GIB, hunting by locals is a greater threat considering the fact that they have meagre means and opportunities to earn, where a GIB sale can bring over US\$ 150 from the neighbouring market. Alternatively, locals may invite dignitaries to hunt GIB in their area, which brings fringe benefits to the villagers. These birds can easily be purchased from the bird traders in Multan and Bahawalpur during summer months. Sinha and Thakur¹⁴ have also mentioned about the hunting/trapping of GIB for its aphrodisiac value.

Every year around 20–25 birds enter the Cholistan desert and a few may return alive to their winter grounds. Nevertheless, during the study period (2001–04), a total of 63 birds entered the Cholistan desert, and 49 were killed and sold in the market.

The situation has become grave with the development of Indira Gandhi Nahar Project (IGNP) in Rajasthan, India. This is resulting in the alteration of the natural habitat of these birds in the western part of the Thar desert¹⁵, hence forcing them to move to the natural habitat in Pakistan. Its naturally low productivity and high longevity are factors that further exacerbate the impact of hunting^{16,17}. In the wake of shrinking habitat on one side (India) and indiscriminate hunting pressure on the other (Pakistan), the future of the GIB seems bleak. The overall population of the GIB is fast declining. In 2001, there were 600–700 birds in the wild⁴. However, the GIB census report in 2006 describes its total population⁸ as 200. This alarming rate of decline will result in grave consequences, considering the fact that the strongest hold of the species is Rajasthan that is adjacent to Bahawalpur District, where more than 75% of the birds are killed every year (Figure 2). Rahmani and Manakadan¹³ mention that the species ‘is locally extinct from almost 90% of its former range’ and, most ominously, that it has ‘disappeared from three sanctuaries made especially for its protection’. At this point it

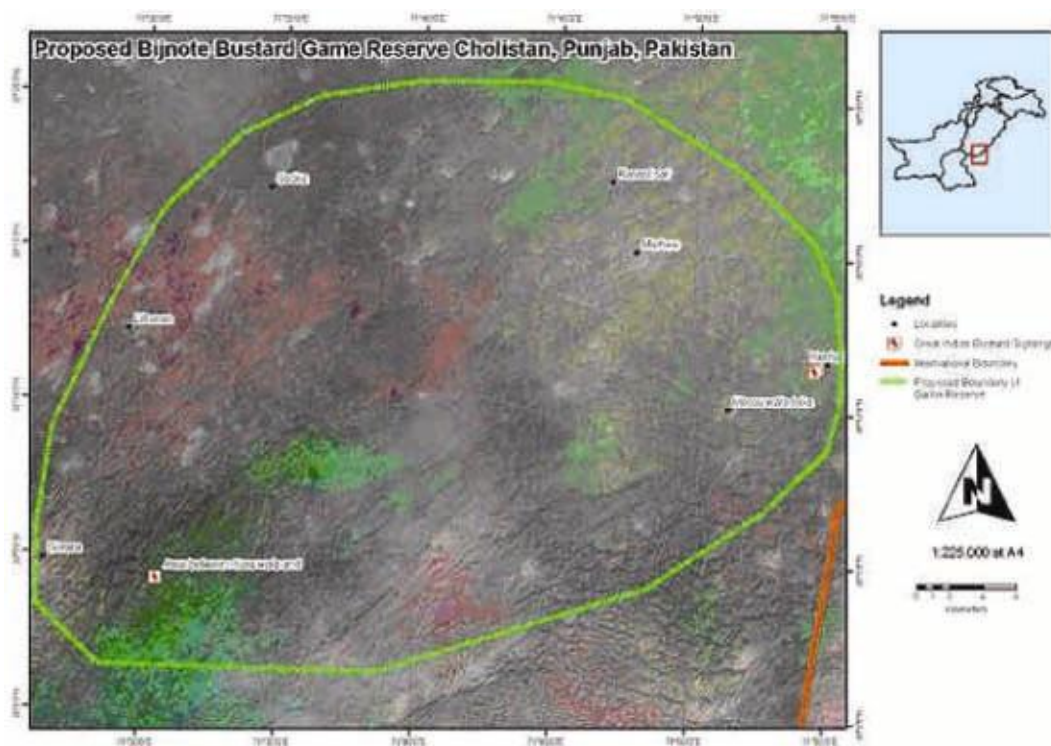


Figure 3. Proposed Bijnote Bustard Game Reserve in Cholistan.

would be, naïve to ignore the depleting genetic diversity of these birds, as a small number of them is left in the wild. Considering these facts the future of this bird in the Indian subcontinent is bound to be doomed soon, unless intense and concrete joint international conservation measures are initiated between India and Pakistan. In addition to strict law enforcement, a massive awareness campaign among locals, elites and policy makers to safeguard the species may bring some hope to save the future of the GIB in Pakistan.

On the basis of the present study the Bijnote Bustard Game Reserve has been proposed to be established in Cholistan desert¹⁸ (Figure 3). However, hunting and trade are still a common practice in the region.

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