The Bengal Florican, Houbaropsis bengalensis, is one of three bustards found in the Indian subcontinent. It is listed as Endangered on the IUCN Red List, being one of 29 threatened bird species in Nepal (BirdLife International 2001). It is included on Appendix I of CITES, and it is one of nine birds protected under the National Parks and Wildlife Conservation Act (1973) in Nepal (Rahmani et al. 1991, Baral et al. 2001). It was once common in the grasslands in north India and Nepal, and the Brahmaputra valley of Assam (Rahmani 2001). Being a habitat specialist of alluvial grasslands, dominated by Imperata cylindrica, Saccharum munja and Desmostachya bipinnata, the Bengal Florican is a classic example of a species with a narrow ecological niche, and which has become increasingly rare with a very small, rapidly declining population, largely as a result of widespread loss of its habitat (Rahmani 2001, BirdLife International 2001).

In Nepal, a study initiated by BirdLife International in 1982 located 30–50 floricans distributed in five sites: Royal Chitwan National Park (RCNP), Royal Bardia National Park (RBNP), Royal Suklaphanta Wildlife Reserve (RSWR), Koshi Tappu Wildlife Reserve (KTWR) and an unprotected area near Koshi Barrage (KB) in east Nepal (Inskipp and Inskipp 1983). The KB site appears to have lost its small population since 1980, following a change in the course of the river during the monsoon. In KTWR the species was once fairly common (Dahmer 1976) but it appears to have disappeared from this site, as there has been only one confirmed record in 1986, one in 1989 and no records since 1990 (Dodman and Guinan 1989, Weaver 1991, Baral et al. 2001). At present, the species is almost exclusively restricted to three areas: RCNP, RBNP and RSWR. Of these, RSWR holds the largest population, and the species is patchily distributed but locally common (Inskipp and Inskipp 1983, Baral 2001, Baral et al. 2001).

As the field situation can change rapidly, continual monitoring is essential to ensure conservation of this species. Prior to this study, considerable time had elapsed since the last surveys in Nepal, and there was
no up-to-date reliable information available on trends. This study attempted to fill this gap, and it provides an insight into the present status of Bengal Florican in Nepal.

**Study areas**

Royal Chitwan National Park (RCNP, 27°30’N 84°43’E, 932 km²) lies in the central part of Nepal, Royal Bardia National Park (RBNP, 28°38’N 81°20’E, 968 km²) lies in the western part, and Royal Sukhaphanta Wildlife Reserve (RSWR, 28°35’N 80°25’E, 305 km²) lies in the far south-western part of the country (Fig. 1). These areas have a subtropical climate, with more than 90% of the annual precipitation falling in the monsoon season between mid-June and September. There are two other distinct seasons: hot-dry from February to mid-June and cool-dry from late September to mid-February. The vegetation in the Nepalese terai is mainly dominated by sal Shorea robusta forest, plus ‘khair-sissoo’ Acacia-Dalbergia forest, grassland and wetlands. Internationally important large tracts of grassland occur inside these protected areas, among which Sukhaphanta (54 km²) is the largest. They are important for a number of threatened mammals (e.g. one-horned rhinoceros Rhinoceros unicornis, swamp deer Cervus duvauceli, Asian elephant Elephas maximus and tiger Panthera tigris) and birds (e.g. Slender-billed Vulture Gyps tinrostris, Swamp Francolinus francolinus, Bristled Grassbird Saxicola insignis) and Hodgson’s Bushchat Saxicola insignis).

**METHODS**

Areas of suitable habitat were visited during the breeding season when displaying territorial males are most visible. Floricans are very territorial during the breeding season (Ali and Rahmani 1982–1984, Sankaran and Rahmani 1986, Manakadan and Rahmani 1986), so different display sites were assumed to belong to different males. As females are more difficult to locate, population estimates were based on the assumption of an equal sex ratio. Observations were carried out in the early morning (06h30 to 10h00) and late afternoon (16h30 to 19h00) when the species is most active (Ali and Ripley 1969). Observations were made using binoculars from machans (towers) for a better view of the grasslands, generally with minimal disturbance to floricans. Some areas were also surveyed on elephant back and from vehicles. For each sighting of floricans, the number and sex of individuals, their activity, time, and weather was recorded, and the time spent in each area was noted, together with a general impression of the habitat. Group discussions were held with park officials, game scouts and local people to glean information on the presence of Bengal Florican and its conservation.

**RESULTS**

**Royal Sukhaphanta Wildlife Reserve**

Grasslands surveyed: Sukhaphanta, Singhpur, K araiya and H araiya; 5–14 May 2000

Twelve floricans (10 adult males and two subadult males) were recorded, including six at one site. Only two males were confirmed to be holding territories, as evidenced by aerial and ground displays. Most of the records were of birds in flight or display, with up to four males seen in flight at the same time. The presence of sub-adults suggested that some breeding had been successful. The survey results suggested that the population had remained stable since 1982. No floricans were recorded during a brief visit to K araiya. However, on one occasion, two males flew south-east from Sukhaphanta towards K araiya, and park officials and game scouts reported two males displaying at this site. At present, H araiya and Singhpur do not hold any floricans, but if managed suitably, they could provide additional habitat for floricans. Uncontrolled fire, the invasion of saplings and tall grasses (especially G rewia spp.), and natural predators were recorded as major threats to floricans at this site.

**Royal Bardia National Park**

Grasslands surveyed: K haunara, Bagaura and L amkauli; 28 April to 4 May 2000

We recorded five floricans, including two males and two females at L amkauli and one male at Bagaura. All the males were seen in areas of short grass (15–35 cm), whereas the females were in tall grass (>110 cm) by the side of the road. Because the grass was mostly short, and the visibility was good, it is assumed that all floricans were recorded. Most of the small grass patches and potential florican habitats outside and inside the park were also covered, but no floricans were seen. Discussions with park staff suggested the presence of floricans at K hauraha, but we did not record any. Short grasslands have been encroached by trees, bushes and tall grass species at K hauraha, and this might have made the habitat unsuitable for floricans. T he habitat at Bagaura and L amkauli seemed to be ideal for the floricans, being dominated by Imperata cylindrica and

**Table 1. Survey results and population estimates for Bengal Florican in Nepal.** (Key: aResources Nepal 1998; bInskipp and Inskipp 1983 and C. Inskipp in litt. 2002; cWeaver 1991; dpresent study; dash indicates no survey was conducted; eminimum population estimate based on number of confirmed adult males multiplied by two; fmaximum estimate incorporates unconfirmed records)

<table>
<thead>
<tr>
<th>Protected area</th>
<th>Grassland area (km²)</th>
<th>No. floricans recorded</th>
<th>Population estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>RBNP</td>
<td>2.9</td>
<td>8–21</td>
<td>-</td>
</tr>
<tr>
<td>RSWR</td>
<td>55.4</td>
<td>9–10</td>
<td>6</td>
</tr>
</tbody>
</table>

The results of the survey suggest that the population had remained stable since 1982. No floricans were recorded during a brief visit to K araiya. However, on one occasion, two males flew south-east from Sukhaphanta towards K araiya, and park officials and game scouts reported two males displaying at this site. At present, H araiya and Singhpur do not hold any floricans, but if managed suitably, they could provide additional habitat for floricans. Uncontrolled fire, the invasion of saplings and tall grasses (especially G rewia spp.), and natural predators were recorded as major threats to floricans at this site.
Saccharum spp. Khaara ha requires intensive management to improve suitability for floricans. However, the potential maximum population of floricans at RBNP is limited by the restricted area of habitat available.

**Royal Chitwan National Park**

Grasslands surveyed: Jay M angala, K achwani, D umaria, Jarneli, Ghatgain, Sukhebhar, Bhimle, K horia M olan and K hogendra M ali; 31 M arch to 8 A pril 2001

Three adult males and one female were recorded. Two males held territories, one in Sukhebhar and one in Khagendra M ali, as evidenced by aerial and ground displays. One male at Jarneli was seen in flight, and a female was recorded at D umaria. T here were additional reported sightings in K hogendra M ali and B himle. O f five areas where floricans were recorded by Inskipp and Inskipp (1983), only Sukhebhar and D umaria still appeared to support populations, but Inskipp and Inskipp (1983) did not record floricans at Jarneli. Grasslands at this site have been lost through succession into other habitats, and this process is likely to continue without suitable management interventions.

**Total population**

While it is difficult to accurately estimate the current population of Bengal Florican in Nepal, it has certainly declined over the past two decades (Table 1). We recorded 21–30 birds in the three sites we surveyed. Assuming an equal sex ratio, the population may be 32–60 birds. The small number of subadults recorded could imply poor breeding success or poor juvenile survival, but may simply reflect the difficulty of detecting individuals other than displaying males.

**DISCUSSION**

**Population and movements**

The status of the Bengal Florican and its habitat in Nepal has deteriorated since 1982, and the total population has declined. The population in Nepal was estimated to be 56–82 birds in 1982 (Inskipp and Inskipp 1983, Inskipp and Collar 1984), and N arayan (1995) estimated a total of probably 100 at four sites. In 2001, we estimated 32–60 individuals in three protected areas. The populations in Bardia and Suklaphanta do not appear to have changed significantly, while the population at Chitwan appears to be decreasing. This can be attributed to shrinkage of habitat and inappropriate grassland management regimes.

Only three out of 21 sightings during the survey were females. Ali et al. (1986) recorded three females out of 27 birds observed during the 1985 survey, while Inskipp and Inskipp (1983) counted 5–6 females amongst a total of 35–50 birds. T hese disparities are probably a result of differences in the behaviour and plumage of the sexes, and in reality females probably equal or outnumber males (N arayan 1992).

Ripley (1982) listed the species as resident in the Indian subcontinent. It is most likely resident in Nepal, but the possibility of local, or even long-distance movements should not be ruled out (Inskipp and Inskipp 1983). T he former are suggested by our observations of floricans flying south of Suklaphanta towards the Indian border, and we suspect that some birds may occupy territories in the grasslands of Laga Bagga, where Rahmani (2001) found one florican. T his protected area is contiguous with RSWR in Nepal, and would be better protected through a cooperative agreement between the two countries (Rahmani 1989).

Longer-distance movements are suggested by the absence of floricans from breeding areas in RBNP between November and February (Peet et al. 1999). Movements occur (probably) 50 km during the wet season floods (P. Davidson in litt. 2002).

**Grassland management**

Floricans were found in grasslands ranging in height from 10 to 110 cm. All the females recorded were located in tall grass, especially Saccharum spontaneum, while males favoured short Imperata spp. patches. Previous workers have also found that shorter grassland appears to be favoured by males whilst foraging or displaying (Inskipp and Inskipp 1983, Sankaran 1996, Peet et al. 1999). However, birds appear to seek shelter in taller grass during the heat of the day, and females (and males outside the breeding season) probably spend much of their time in taller grass (Ali et al. 1986). It has thus been suggested that the best locations contain areas of shorter grassland dominated by Imperata cylindrica, interspersed with patches of taller grassland (Peet 1997, Baral et al. 2001, P. Davidson in litt. 2002).

In RCPN and RBNP, local people are allowed to collect thatching material from the grasslands from late December to early January. After this, the grasslands undergo annual controlled burning. T his encourages the growth of Imperata spp. at the expense of taller grass species, and hence encourages shorter swards for the floricans. In RSWR, the main florican grasslands are not near human settlements, so there is little harvesting of grasses, and there is no annual controlled burning by the park authorities. Consequently, these areas are prone to accidental fires. Burning, clearing or grazing of grassland creates suitable habitat for floricans, and if this does not occur, the grassland grows too tall and dense and is apparently vacated by territorial males (N arayan and Rosalind 1990). T he population in D udwa N ational P ark (India) appeared to increase after controlled burning of the grassland (Javed and Rahmani 1998).

In RBNP, the park authority has recently initiated a programme of uprooting woody vegetation from grasslands. This will help to create more suitable habitat for floricans and other grassland-dependent species. Grassland management was initiated in RSWR and RCPN in 1996. However, many grassland areas were...
ploughed to prevent encroachment of Imperata spp. grassland, which resulted in the temporary loss of floricans (Baral 2001). Management practices commonly fail to consider the ecological requirements of the species, an oversight that can lead to local extinctions. Grassland management for floricans should aim to maintain areas of intact grassland that are not cut or burnt, on a rotational basis, whilst allowing other areas to be harvested by local people, and hence creating a mosaic of tall and short grass patches (Peet 1997, Peet et al. 1999, Baral 2001). Further alternatives to grass harvesting should be promoted in communities currently dependent on grassland resources (Peet 1997). Jnawali and Wegge (1999) have proposed clear-felling small blocks of Shorea robusta and Terminalia tomentosa forest to develop new areas of grasslands.

**Conservation and recommendations**

Grasslands are generally poorly represented in the region’s protected area system (Rahmani 1988, 1992, Eames 1995, 1999, 2001, Watson 1998, Buckton et al. 1999), and even those within protected areas continue to suffer degradation (Bell and Oliver 1992, Peet 1997). Most grassland patches are now small and isolated, making populations of Bengal Floricans more susceptible to local extinction. Moreover, many areas within the species’ range are prone to political instability, so that long-term protection of several sites cannot be guaranteed (Narayan 1995). A landscape ecology approach, integrating social, biological and physical environmental elements at scales compatible with management objectives, will be needed to effectively conserve Bengal Floricans and their grassland habitats. The Bengal Florican should be promoted as a flagship species. Annual monitoring of the population, and detailed ecological studies (making use of radio-telemetry) outside the breeding season are strongly recommended. A pilot study to manage part of the large area of grassland at RBNP specifically for floricans is recommended.

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