Community structure and habitat associations of lowland grassland birds in Nepal.

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CHAPTER 1
GRASSLANDS

1.1. Introduction
The Collins Cobuild Dictionary (Sinclair, 1991) defines grassland as 'land which is covered with
glass, especially grass that grows naturally and has not been planted by people'. This definition
captures the grasslands in lowland Nepal, although grasses here grow from 2 m to over 8 m tall.
More scientifically, the world conservation monitoring centre (WCMS 1992) has defined grassland
as 'a type of vegetation that is subject to periodic drought, is dominated by grass and grass-like
species and grows where there are fewer than 10-15 trees per hectare.' Similarly, Collar (1996) has
defined grasslands 'as those temperate, subtropical and tropical biomes in which the herbaceous
layer is the ecologically predominant component, with ligneous element sometimes present (i.e. in
savannahs) but never establishing a closed canopy.' Grasslands are present in every part of the
world and occur over a wide range of mean annual temperatures from 0°C to above 30°C. However,
the presence of grassland at a particular site reflects not only climate but also local
edaphic factors, topography, soil characteristics, fire history, grazing pressure and human activity
(Ripley 1992). Large areas of grassland are maintained by flooding and fire, both by nature and
human manipulation. These changes and manipulations provide forage for many wild and domestic
ungulates.

Grasslands vary enormously in form, type and height of the grasses. Grasslands are a unique and
often highly productive ecosystem. They support a fauna which is specially adapted to the
vegetation characteristics present in the various types of grassland. Animals living in the tall grasses
in Nepal have evolved to survive in a vegetation adapted to highly variable precipitation which is
much greater at ground level than in the tropical rainforests. The climate is far less equable in a
grassland climate compared to the climate in tropical rainforests and as a result the species show
many different adaptations to enable them to survive. Lowland grasslands in Nepal and India are
among the most productive grasslands in the world and support a vertebrate biomass greater than in
most other ecosystems (Seidensticker 1976). Formerly they covered a large area of the Indo-
Gangetic plains (Figure 1.1) which was drained by several thousand tributaries of the Ganga river
system.

People have used grasses and grasslands for millennia for their manifold uses (Chadwick 1995).
Indeed, the most important of human foodstuffs are the seeds of just three genera of grasses, Oryza,
Triticum and Zea. In addition, grasslands have been and continue to be prime areas for cattle herders
and ranchers (Leslie 1996). Grasses are also used in many parts of the world to make ropes,
furniture, thatched roofs, mats, sacs and various parts of traditional houses.
Figure 1.1. Proposed former distribution of riverine tall grasslands in southern Nepal, northern India and Bangladesh (adapted from Bell and Oliver 1992). Remaining tall grassland is almost entirely restricted to the protected areas indicated. Grassland would have occurred as an intermittent tract rather than continuous cover.
In the past when the human population was considerably smaller, there was enough land for new grasslands to develop in the place of grasslands that had disappeared through flooding, fire, cultivation, overgrazing or succession by forest. However, since the middle of the 19th century, as the human population and the demand for agricultural lands increased, natural grasslands became more and more scarce. Areas of natural grasslands worldwide have dropped at an alarming rate due to both the ease of transforming grasslands into agricultural lands and their colonization by woody species. These landscape and management changes have also influenced the species composition of remaining grasslands. As a result, semi-natural grasslands have shrunk to small isolated pockets in many parts of the world and face an uncertain future, with very little attention or effort to conserve them.

Some types of grassland are being lost completely. Soon they may have vanished from many countries, including Nepal. The remaining grasslands may be too small to sustain viable populations of specialised plants and animals. Furthermore, pressure is increasing on existing small grassland patches that can no longer support or sustain many threatened grassland animals. Many bird species are indeed specialists of grassland habitats and, as such, are vulnerable to slight changes in and loss of habitat. Grasslands remain the ultimate and only suitable habitat for quite a few bird species. No grassland means: no grassland birds.

1.2. Grasslands in the Indian subcontinent

While mountain habitats are relatively pristine and well-conserved, lowland regions, especially in the terai belt, have been severely impacted by the increasing human pressure. It is now realised that grassland habitats are perhaps the most threatened of all the habitats in the entire Indian subcontinent (Grimmett et al. 1998). No sizeable grasslands remain outside protected areas in this region. The loss of tall grassland habitat in the Indian subcontinent is attributed mainly to the increase of human population and their livestock (Rahmani, 1988 1992). Further, untimely burning in grasslands could be a major threat to grasslands and their avifauna (Khan 1988).

The Indo-Gangetic plain is one of the most densely populated and longest inhabited areas in the world (Rahmani 1988, 1992). In addition, India supports the world's largest livestock population. The subcontinent has its highest population density along the Indo-Gangetic plains where historically the tall grasslands were distributed. For example, 50% of Nepal's population, Uttar Pradesh and Bihar (India's two most populous states), West Bengal, and the most densely populated country in the world, Bangladesh, all lie in the Indo-Gangetic plains, former home to tall grassland habitat.

The population in Nepal terai has sprung from 2.9 million (35% of the total population) during 1952/54 to 8.63 million (46.7% of the total) in 1991 (CBS 1998). With the present rate of
Figure 1.2. Present distribution of tall grasslands in lowland Nepal. All areas shown are protected areas. Starting from west 1: Sukila Phanta, 2: Bardia, 3: Chitwan and 4: Parsa and 5: Koshi Tappu in the east. Dark shaded areas indicate grassland habitat.
population growth and intensive land utilisation in the Nepal terai, we can extrapolate the present population figure to 11.5 million in the Nepal terai (>50% of the total Nepal population).

With these areas ‘in progress’ and ‘developing’, one can easily gauge the level of threat and pressure on the remaining grassland habitats. Once a widespread habitat all along the southern rim of the Indian and Nepalese Himalayas, grasslands have been greatly reduced, fragmented and degraded by large scale expansion of agriculture, conversion to other kinds of land use, drainage, and overgrazing (Grimmett et al. 1998). Only about 1% of the Indo-Gangetic plain is under the protected area network (Rahmani 1995) where more than 15 globally threatened avian taxa are known to occur (Collar et al. 1994). The current trend of loss of original grass-cover in the Indian subcontinent may threaten the existence of several other wild fauna elements that are currently considered to be at low risk.

1.3. Grasslands in lowland Nepal

Geographically, Nepal lies in the centre of Asia and also in the centre of the Great Himalayan belt. The altitude increases gradually and often steeply over the varied topography from south to north. The southern plains of Nepal, called the terai, are covered with tropical moist deciduous forest mainly consisting of sal trees Shorea robusta. In these plains, south of the Himalayas, the flow of the rivers slows down, increasing their surface area vastly and creating large riverine floodplains. In these floodplains tall grasslands of great ornithological importance are situated, giving the area an exceptional high value for birds.

In the past, many of the riverine floodplains in lowland Nepal were covered by tall grasses standing as high as 8 m. Maintained by flood, fire and anthropogenic disturbance, these grasslands were a subject of curiosity to people. Bentham Hooker (1893) wrote: "These gigantic gramineae seem to be destroyed by fire with remarkable facility at one season of the year; and it is as well that this is the case; for whether as a retainer of miasma, a shelter for wild beasts, both carnivorous and herbivorous, alike danger to man, the grass jungles are most serious obstacles to civilisation." Hooker was right in so far as until the middle of the 20th century the frequent occurrence of malaria made the grasslands uninhabitable, keeping them untouched and uncultivated. As the human population of the area has dramatically increased after malaria eradication programme (Gurung 1983), the lowland grasslands, many of which are composed of at least 100 different grass species, are now almost exclusively restricted to protected areas of the terai and doon (Figure 1.2). Elsewhere the fertile soils where grasslands used to grow have been converted to agricultural fields (Bell 1987, Peet 1997).
Table 1.1. Globally threatened grassland birds of lowland Nepal

<table>
<thead>
<tr>
<th>English Name</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lesser Florican</td>
<td>Sypheotides indica</td>
</tr>
<tr>
<td>Bengal Florican</td>
<td>Houbaropsis bengalensis</td>
</tr>
<tr>
<td>White-rumped Vulture</td>
<td>Gyps bengalensis</td>
</tr>
<tr>
<td>Long-billed Vulture</td>
<td>Gyps indicus</td>
</tr>
<tr>
<td>Swamp Francolin</td>
<td>Francolinus gularis</td>
</tr>
<tr>
<td>Sarus Crane</td>
<td>Grus antigone</td>
</tr>
<tr>
<td>Jerdon's Babbler</td>
<td>Chrysoma altirostre</td>
</tr>
<tr>
<td>Slender-billed Babbler</td>
<td>Turdoides longirostris</td>
</tr>
<tr>
<td>Hodgson's Bushchat</td>
<td>Saxicola insignis</td>
</tr>
<tr>
<td>Grey-crowned Prinia</td>
<td>Prinia cinereocapilla</td>
</tr>
<tr>
<td>Bristled Grassbird</td>
<td>Chaetornis striatus</td>
</tr>
<tr>
<td>Finn's Weaver</td>
<td>Ploceus megarhynchus</td>
</tr>
</tbody>
</table>

Source: Asian Red Data Book on Birds (BirdLife International, *in prep.)*

Table 1.2. Nationally threatened grassland birds of lowland Nepal

<table>
<thead>
<tr>
<th>English Name</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Great Bittern</td>
<td>Botaurus stellaris</td>
</tr>
<tr>
<td>Black Bittern</td>
<td>Dupetor flavicollis</td>
</tr>
<tr>
<td>Yellow Bittern</td>
<td>Ixobrychus sinensis</td>
</tr>
<tr>
<td>Blue-breasted Quail</td>
<td>Coturnix chinensis</td>
</tr>
<tr>
<td>Small Buttonquail</td>
<td>Turnix sylvatica</td>
</tr>
<tr>
<td>Yellow-legged Buttonquail</td>
<td>Turnix tanki</td>
</tr>
<tr>
<td>Eastern Grass Owl</td>
<td>Tyto longimembris</td>
</tr>
<tr>
<td>Rufous-rumped Grassbird</td>
<td>Graminicola bengalensis</td>
</tr>
<tr>
<td>Striated Grassbird</td>
<td>Megalurus palustris</td>
</tr>
</tbody>
</table>

Source: Baral *et al.* (1996)
Sal forest is the climax vegetation type in lowland Nepal. Grasslands occur as a successional vegetation which in the natural state is maintained mainly by flood and fire reversing the vegetation succession. Large herbivores have also played a significant role in maintaining the grasslands. Wild Elephants *Elephas maximus* help minimise the woodland succession by pulling down trees growing in grasslands. Gaur *Bos gaurus*, Wild Buffalo *Bubalus arnee*, deer *Axis* sp., *Cervus* sp. and *Muntiacus muntjak* all help to stop woody vegetation from growing by trampling and browsing. Woody plants are generally more vulnerable to trampling than grasses. However, some effects of herbivores in fact may lead to increased succession. It has been recognised that shorter grass species are more palatable to wild animals than longer ones. Herbivores tend to eat more palatable grass species leaving unpalatable grasses, small shrubs and tree saplings with reduced competition. In an environment without competition, shrubs and trees become well established promoting woodland succession.

Rhinoceros *unicornis* significantly modifies grassland vegetation in places such as Chitwan and probably also Bardia where its population is significant. It has a habit of defecating in the same place for a long time until disturbed by other animals or individuals of its own species. Old dung also stimulates rhino to defecate again in the same place. Large mounds of rhino droppings can be frequently seen in the grasslands of Chitwan and Bardia. Rhino is primarily a grazer, however, in dry months its diet consists of varied items. During these months, they eat large amount of fruits that have fallen on the ground from trees of *Trewia nudiflora*. The undigested seeds are deposited in the dropping mounds, which act as a natural nursery for these trees. During the monsoon months, one can see thousands of young trees sprouting. Most are eaten by red bugs, locally called *lohita* and only a few trees survive and grow. Nevertheless, in an area like Sauraha where the rhino concentration is high (probably the highest in the world!), this type of woody plant succession is rapid. Within the last ten years, I have observed small grasslands being converted into complete woodlands. Similarly the presence of Wild Boar *Sus scrofa* and Sloth Bear *Melursus ursinus* may also be important in modifying grassland vegetation although their effects are little known at this stage.

1.4. **Grassland birds in lowland Nepal**

While most large mammals that inhabit lowland grasslands are well studied (Laurie 1979, Sunquist 1981, Mishra 1982, Dhungel and O'Gara 1985), little is known about the grassland avifauna in lowland Nepal. The grassland avifauna is best known by a number of species that are considered to be globally threatened (Collar *et al.* 1994) and threatened in Asia (BirdLife International *in prep.*, Table 1.1). What kinds of birds constitute the lowland grassland avifauna? What are the frequent species and which are rarely seen? What kind of avian associations can we observe? None of these questions has been answered and there is a considerable amount of work to be done on grassland avifauna in lowland Nepal.
In addition to a large number of globally threatened species, at least nine species that occur in grasslands are considered to be nationally threatened (Table 1.2, Baral et al. 1996).

1.5. Grass, wildlife and people

While grasslands are important for many birds as their prime habitat for feeding and breeding, they are equally important as habitat for large mammals like the Greater One-horned Rhinoceros and the Wild Buffalo (Laurie 1982, Heinen 1993a). In addition, they provide the local human population with materials for manifold household uses. Grass is vital for the local people to feed their livestock and there is a large demand for it (Sharma & Shaw 1993). Shorter grasses like *Imperata cylindrica* are used for thatching house-roofs and similar purposes. Grasses are used to weave mats, to make house walls, storage baskets, ropes, brooms, beds and chairs. The importance of the grasslands to the locals is well exemplified by the fact that each year more than 100,000 people enter the Royal Chitwan National Park in the ten days when collection of grasses is officially permitted (Gopal Prasad Upadhaya *pers. comm.* 1998).

The establishment of parks and reserves and subsequent reinforcement of the rules and regulations has restricted many people from using resources that were previously readily available to them (Banskota *et al.* 1996). Crossing the protected areas' boundary without a valid reason was legally prohibited. However, people living outside protected areas had no legal means to claim any compensation for the damages caused by wildlife from protected areas. As a consequence, there is increased dissatisfaction amongst local people who disobey protected area regulations and sabotage park and reserve properties, so posing serious problems for the park management. Because of such problems the protected area authority has tried to strike a balance between the conservation needs of protected areas and the immediate survival needs of people living adjacent to the parks and reserves in lowland Nepal. Permission to harvest grass is a compromise with the local people and also continues past tradition for the locals. After the thatch-grass (*Imperata cylindrica*, *Saccharum spp.*) is cut, the area is set deliberately on fire. Stems of hardy and fire-resistant grasses, for example *Narenga porphyrocoma* and *Themeda arundinacea*, are collected after fire has swept through the area.

During the grass-cutting season, 95% of the grassland vegetation is believed to be disturbed in lowland protected areas (Ram Prit Yadav *pers. comm.*). A revenue worth 7362 US$ was collected for the year 1993/1994 from entry fees during the grass-harvest time in Royal Chitwan National Park (Banskota *et al.* 1996). The net contribution to the local economy (the gross monetary value of the collected resources minus the labour and permit cost) for the year 1989/90 was estimated to be NRs. 7,754,990 (US$ 325,166) for the Royal Chitwan National Park, an amount which was double the operating costs of the whole park (excluding the army) (Sharma 1991).
In spite of such widespread use of grassland materials, very little scientific study has been made of the conservation and management of this habitat. Recently a study was carried out on the effect of management (cut/burn) and no-management on plots at Bardia (Peet, 1997). This study suggests that grassland patches could be left unmanaged in a two-year rotation without significantly altering the composition of the plant community, thereby providing refugia for cover-dependent animal species. The study also showed that the plant species' richness was significantly higher in managed plots, which were structurally more heterogeneous. Results of such studies are valuable and the managers will have to look at the applicability of these conservation recommendations. However, before any recommendations are put into practise detailed knowledge of how the grassland system has been maintained in lowland Nepal is needed. At present, fires in the protected areas seem essential to maintain the grassland ecosystem. Late fires, however, can be detrimental to young birds, amphibians, reptiles and mammals (Inskipp and Inskipp 1983, Bell 1987).

1.6. Scientific background

The ecology of grassland birds in the entire Indian subcontinent has been little studied. In India, studies were carried out in grasslands of Dudwa National Park (Uttar Pradesh) and Kaziranga National Park (Assam) on various aspects of grassland birds. All the recent avian grassland studies in India have so far focussed on the Great Indian Bustard *Ardeotis nigriceps*, Bengal Florican *Houbaropsis bengalensis*, Lesser Florican *Syphoetes indica*, and Swamp Francolin *Francolinus gularis* (Inskipp and Inskipp 1983, Rahmani and McGowan *et al.* 1994, Kaul and Kalsi 1990, Sankaran 1994, Iqubal *et al.* 1994, Javed and Rahmani 1991). In Nepal two grassland birds, *Houbaropsis bengalensis* and *Francolinus gularis*, were studied in detail prior to the present study; (Inskipp and Inskipp 1983, Weaver 1991 and Baral 1998b). No systematic study has been done on grassland birds in this region, other than these. Grassland birds in general have been described by Majumdar and Brahmachari (1988) and Rahmani (1988, 1992). Following the publication of *Birds to watch 2* by BirdLife International (Collar *et al.* 1994), considerable interest has been aroused in the research and conservation of grassland birds in the region. It is because of the recommendation of BirdLife International that I initiated this study of the protected grasslands areas of lowland Nepal in the beginning of 1996. Small papers have been published locally discussing issues on grassland birds and a specific report on *Saxicola insignis* has been also produced (Baral 1998c). During the field seasons, information was collected on the ecology and distribution of various species that will be published as separate papers in various journals of the region (Baral in prep.).

1.7. Aims of the present study

One of the main focal subjects for modern ecology is defining the patterns of nature and deriving generalisations that provide broadly applicable explanations of these patterns (MacArthur 1972, Cody and Diamond 1975, Whittaker 1977). Based on this fact I have aimed to present some generalisations on grassland birds and their communities in lowland Nepal.
This study is the first of its kind concerning the grassland birds of lowland Nepal. It’s goals are to answer the following questions:

1. Can a general bird community structure in lowland grasslands of Nepal be defined based on their status, trophic structure and guilds? (Chapter 3)
2. Can a bird community composition and structure in lowland grasslands of Nepal be defined based on environmental factors? (Chapter 5)
3. Are there any specific habitat associations used by any bird species? (Chapter 6) What are the effects of such habitat association on a spatio-temporal scale? (Chapters 5 and 6)
4. Can the impact of grass cutting and fire upon bird life and changes in bird communities be assessed? Do disturbance and grazing have any effects on bird communities? (Chapter 7)
5. Can the habitat requirements of some globally and nationally threatened grassland birds be identified? (Chapters 6 and 8)
6. Can some recommendations be given for the conservation and management of the grassland birds and their habitat? (Chapter 3 to 8) This will include mainly threatened (globally and nationally) birds and grassland specialists.