Birds, forests and conservation: Critical issues in Sariska Tiger Reserve, Rajasthan, India.

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While it is a common generalization that degradation of forests causes a general decline in bird life, little is known about the nature of this decline. We are still ignorant about the magnitude of this decline, the species that are particularly prone to local extinction or those that are relatively adaptable, the specific changes in forest vegetation that trigger these declines or even the size or intensity of disturbance that can affect different bird species. This is especially true for tropical countries where dependence of rural people on forests is very high and the number of bird species requiring study, phenomenal.

For the past year or so, we have been studying the exact contours of changes in bird communities triggered by intensive biomass extraction, in the form of grazing and fuelwood collection, in Sariska, a Tiger Reserve in Rajasthan, India. In this effort, Wildlife Conservation Society-India Program, Council for Social Development (Delhi), Wildlife Protection Society of India (Delhi), Rajasthan Forest Department and the Oriental Bird Club (U.K.) have generously supported us.

Sariska is one of the prime candidates for biodiversity conservation in north-western India, being one of the best-known protected areas in the semi-arid biome. Located in the Aravalli Hills of Rajasthan, Sariska represents the few remnants of tropical dry deciduous and scrub forest that still exist in this part of India. It harbours a rich diversity of flora and fauna including large and small mammals, notably the Caracal *Caracal caracal*, Fishing Cat *Prionailurus viverrinus*, and Tiger *Panthera tigris* and high densities of herbivores such as Common Langur *Semnopithecus entellus*, Sambar *Cervus unicolor*, and Bluebull (Nilgai) *Boselaphus tragocamelus.*

Available information (Sankar, et al. 1993) indicates that Sariska is extremely rich in avifauna and has been identified as one of the Important Bird Areas (IBA) in the state of Rajasthan by BirdLife International and Bombay Natural History Society (Islam and Rahmani 2004). Sariska supports avifauna typical of tropical dry deciduous forests, including a large number of resident Galliformes such as Painted Spurfowl *Galloperdix lunulata*, Common Buttonquail *Turnix suscitator*, Indian Peafowl *Pavo cristatus* and Grey Francolin *Francolinus pondicerianus* and, raptors such as the Crested Serpent-Eagle *Spilornis cheela*, White-eyed Buzzard *Butastur teesa* and the Brown Fish-Owl *Ketupa zeylonensis*, all of which are resident in the area. Rare wetland species such as the Black Stork *Ephippiorhynchus asiaticus*, Bar-headed Goose *Anser indicus* and the Great White Pelican *Pelecanus onocrotalus* have also been recorded from the waterbodies within Sariska during years of good rainfall. The globally threatened species reported from Sariska include the critically endangered White-backed Vulture *Gyps bengalensis* and Long-billed Vulture *Gyps indicus* (BirdLife International 2001).

The survival of Sariska Tiger Reserve as an area for biodiversity conservation is today threatened by an array of anthropogenic factors. Eleven small villages are located inside the core zone of the Reserve, all of whose inhabitants depend on its forests for their biomass needs, including fodder, fuelwood and medicinal plants. Livestock grazing for commercial production of milk, the only source of income available to local people is the most extensive pressure on Sariska's forests. Significant pressure for fuelwood has been noticed from outside the Reserve as well, as this is one of the few forested areas that remains intact in the north-eastern section of the Aravalli Hills. Another serious long-term threat to the ecological integrity of the area is mining. Quarrying for marble and stone may cause changes in the ground-water regime of the entire region, which in turn, is likely to affect flora and fauna inside Sariska. The pressure on the state government to open up more areas for mining has recently increased with rise in commercial demand for talc, marble and other minerals that occur in this area. Increasing traffic and tourism in Sariska also causes a great deal of disturbance and pollution in some of the best areas available for native fauna. In response to drought in past years, the forest department has initiated a number of management measures inside Sariska to increase the duration of water availability during the year, such as construction of a large number of check-dams and ponds. However, the effects of these water storage structures on the dynamics of a naturally drought-prone ecosystem, are yet largely unknown and have been questioned by ecologists.

It was in the context of the rich bird life of this protected area and the looming threats from human use that it faces, that we decided to evaluate the ecological impacts of forest use inside Sariska Tiger Reserve. Our approach was to compare occurrence of various bird species between areas facing high and those facing relatively low biomass extraction pressure. We also wanted to assess the changes in the forest vegetation, caused by such extraction, which could possibly account for the observed impacts of forest use on birds.

During March through May of 2003 and from October 2003 through February 2004, we carried out systematic and repeated bird observations in 90 carefully chosen sites scattered all over the core zone of the Reserve. These were located in the three most common forest types inside Sariska: scrub forests, slope forest and mixed riparian (streamside) forest. The sites were selected on the basis of widely accepted indicators of disturbance such as the incidence and scale of tree lopping and actual observations of human use such as livestock-grazing and fodder-collection. Bird species were observed and recorded along with observations of foraging by birds such as the plant parts being fed on and height of foraging above the ground. In addition, detailed notes were made on vegetation, separately on trees, shrubs, grasses and ground vegetation including all the features that are likely to affect bird habitat use.

Our results indicate that intensive human use is significantly changing bird species composition of this tropical dry ecosystem as was seen by the significant difference between bird communities of intensively used and relatively undisturbed areas inside the Tiger Reserve. Some bird species that appear vulnerable to local extinction in the face of continuing habitat degradation include

the White-bellied Drongo *Dicrurus caerulescens*, Red-vented Bulbul *Pycnonotus cafer*, Oriental Magpie-Robin *Copsychus saularis*, Hume's Warbler *Phylloscopus humei*, Brown-capped Pygmy Woodpecker *Dendrocopos nanus*, White-browed Fantail-Flycatcher *Rhipidura aureola*, Red-throated Flycatcher *Ficedula parva*, Grey-headed Flycatcher *Culicicapa ceylonensis*, Oriental White-eye *Zosterops palpebrosus*, Indian Treepie *Dendrocitta vagabunda* and Great Tit *Parus major*. Some of these species are frequently seen in scrublands and gardens of densely populated metros like Delhi. Thus the decline of such species in intensively used areas of the Reserve point to the extreme levels of degradation. Omnivorous and commensal species such as Common Myna *Acridotheres tristis*, House Crow *Corvus splendens* and House Sparrow *Passer domesticus* were found to increase in density in intensively used sites in comparison to relatively disturbed areas. Species preferring open forest such as the Eurasian Collared-Dove *Streptopelia decaocto*, Black Drongo *Dicrurus macrocercus*, Brahminy Starling *Sturnus pagodarum*, Indian Robin *Saxicoloides fulicata* and Black Redstart *Phoenicurus ochruros* were also found to be encouraged by forest degradation.

Interestingly, nectarivorous and insectivorous birds appear to be adversely affected by habitat degradation, a trend that remains to be confirmed by more detailed observations throughout the year. Changes in bird species composition were related to changes in canopy cover, height of trees and density of understorey (shrubs, saplings and grass), changes that were evidently brought about by intensive human use. Structurally, vegetation also changed drastically in response to human use. Specifically, there is significant reduction in canopy cover, density of trees, density of shrubs and saplings and average height of trees in intensively used forests in comparison to relatively undisturbed areas. In scrub forest, the number of tree species is much lower in used forests than in undisturbed areas.

During our year-long study, we observed important bird-plant interactions that probably form the basis for the long-term sustenance of this ecosystem. The flowers of kair *Capparis decidua* and palash *Butea monosperma* were food for a large variety of bird species during the harsh summer, including Indian Peafowl, Brahminy Starling and Rose-ringed Parakeet *Psittacula krameri*. Fruits of rohini *Mallotus phillippensis*, growing along streams were consumed by Indian Treepies and Red-vented Bulbuls. The flowering of date palms *Phoenix sylvestris* in March triggered a hive of activity of nectar-feeders such as Oriental White-eyes and Red-vented Bulbuls. In the monsoon, pods of hingot *Balanites aegyptiaca* and jaal *Capparis sepiaria* appeared to be other important food sources. In late monsoon and winter, flowers and fruits of ber *Zizyphus mauritiana* sustain many bird species such as Yellow-legged Green-Pigeons *Treron phoenicopterus*. Since many of these shrub species are dominants, the local disappearance of even one could cause cascading damage to the bird community. Many of these trees and shrubs are also evergreen and are therefore utilized by local villagers as cut fodder during summer, affecting their fruiting activity and possibly impeding their regeneration in intensively extracted areas.

During the study we discovered the critical importance of the habitat mosaic of scrub, slope and riparian forest for sustaining bird communities in Sariska, a naturally species-poor (in flora) and seasonally dry ecosystem. The common tree species in the riparian forests include date palm, arjun *Terminalia arjuna*, bahera *Terminalia bellerica*, pilkhan *Ficus infectoria*, gular *Ficus glomerata*, and bamboos *Dendrocalamus* sp. The study particularly indicates the importance of protecting the tall and dense riparian forest habitat, which is vital as a source of shade, water and food for mammals and birds during the harsh dry season. Riparian forests also harbour several habitat-restricted bird species such as the Brown Fish-Owl, Crested Serpent-Eagle, and Tickell's Blue-Flycatcher *Cyornis tickelliae* and migratory species such as Verditer Flycatcher *Eumyias thalassina* and Grey-headed Flycatcher, that cannot survive in other, more open habitats. Riparian forests are particularly threatened in Sariska due to their naturally small extent and because they attract villagers and livestock due to the presence of perennial springs and green fodder. Lately, pollution from tourism, such as washing and cooking, around perennial water sources such as Pandupol has emerged as an important threat. Observations indicate that riparian forest patches as seen in Sariska, are geographically scarce in the Aravallis. A trip to the hilly Nahargarh Sanctuary in the same eco-zone and close to Sariska revealed that the catchment area of the only perennial water source in the area had been completely denuded and was bereft of the diverse flora typically found in such spots inside Sariska. The importance of reviving and maintaining the extremely diverse vegetation along the springs and rivers in Sariska, as a critical element of landscape-level diversity, needs to be emphasized in future conservation planning for this region.

We also built up a detailed profile of the highly diverse bird community of this region, including the population status, seasonal movements and habitat preferences of bird species, including some that are highly endangered in India. We listed a total of 193 species including 121 residents, 64 winter migrants, 3 summer migrants and 5 passage migrants. This list adds 41 species to the checklist compiled by Kartik Sankar, et al (1993). Most of these additional species are migrants and some are naturally rare species such as the Eurasian Wryneck *Jynx torquilla*, Finn's Weaver *Ploceus megarhynchus*, Isabelline Wheatear *Oenanthe isabellina* and the Common Cuckoo *Cuculus canorus*. Sariska has substantial populations of two species of vultures, the Red-headed Vulture *Sarcogyps calvus* and Long-billed Vulture and a small population of Indian White-backed Vultures. This is significant in view of the recent large-scale declines in vulture populations elsewhere in northern India. The Indian Peafowl, increasingly threatened in Indian forests, is also abundant here. Trips to the Tiger Reserve always bring forth surprises such as a large noisy group of Rusty-tailed Flycatchers *Muscicapa ruficauda* and a Tickell's Thrush *Turdus unicolor* close to a waterhole in winter, or a breeding pair of Brown Fish-Owls in the secluded Bandipul Valley or large flocks of Common Rosefinches *Carpodacus erythrinus* that pass through Sariska during their annual migration from the Himalayas to Indian plains. We discovered, first hand, what a small patch of native forest could do to protect biodiversity at the regional scale and this further justifies the addition of Sariska to the national Important Bird Areas (IBA) list.

In another component of our study we attempted to devise quick-and-easy ways to monitor changes in habitat conditions using birds as indicators. This we did by comparing the efficiency of different techniques in recording bird diversity. We found that species lists obtained using line transects were similar to those obtained by point counts, though line transects consistently yielded greater numbers of individuals per unit time. We also studied the

distinctiveness of bird communities of different forest habitats in Sariska. We found that it would be necessary to cover different vegetation zones in any bird-monitoring programme as these zones were quite distinct in their bird compositions. Certain species were identified as possible indicators of habitat change, using simple presence-absence data, such as Hume's Warbler, Oriental White-eye, Indian Robin and Great Tit. Various species were found to respond to specific changes in vegetation structure such as reduction in canopy cover, height of trees, and density of understorey vegetation. An important finding of our study is the tremendous change in bird species composition even from week to week, making it difficult to comprehensively cover entire bird communities through brief snapshot surveys, a feature that may be common to many other forests of northern India.

Our study has also brought to light the physical extent and scale of habitat degradation over large parts of Sariska Tiger Reserve. We have estimated that forests in as much as one-third of the proposed National Park area (Core Zone I of the Reserve) may be highly degraded. Observations on vegetation reveal that there may be severe limitations in regeneration of tree and shrub species almost everywhere in Sariska. In addition, signs of lopping of trees and overgrazing were seen in most places apart from a few well-protected valleys.

We hope that our study will help to inform the ongoing debate in India on the ecological impacts of biomass extraction and provide justification for appropriate management steps that can be taken to save this area from further degradation. There is an acute need for providing alternatives to various biomass and livelihood needs of the villagers residing inside the Reserve, who are mainly dependent on livestock rearing for their income. Interviews indicate that many of the local people are willing to relocate outside the Reserve, but only on the basis of an equitable rehabilitation plan that is prepared and executed jointly with them. Tourism activities also have to be controlled and managed better if continuing habitat degradation is to be stalled in this prime biodiversity conservation area of the Aravallis.

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(*Copies of the technical reports for the project described here are available with Dr Ghazala Shahabuddin at ghazalafarzin@yahoo.com*).

Additional site records of Green Avadavat *Amandava formosa* (Latham, 1790) from Mount Abu, Rajasthan, India.

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Mount Abu (24°36'N and 72°45'E; 1,219 a.s.l.) is situated at the south-western limits of the Aravalli Hills in Sirohi district (Rajasthan, India). Though 328km^2 of Mount Abu are declared protected, officially only 112.98km^2 are notified as the Sanctuary area (R.F.S. 2003). This hill station comprises of chains of hills with altitudes ranging from 300m to 1,700m. Its unique habitat, in a state where the desert predominates, has attracted many ornithologists over the years: Butler (1875-1877), Devarshi and Trigunayat (1989) and Prakash and Singh (1995). Sharma (2002) prepared a complete list of fauna, including birds, for this Sanctuary. Butler (1875-1877), Prakash and Singh (1995) and Sharma (2002) listed the Green Avadavat *Amandava formosa* as a common resident of Mount Abu. They identified Oriya village as the main site for this species. Tiwari and Varu (1999) and Lodhiya (1999) added two more sites, namely Adhardevi Temple Forest and Delwara Temple area. At every instance, either a pair or flocks of up to four individuals were seen.

During our survey (15 February-15 June 2004) we located this species at two new locations: Palanpur Point and Achalgarh. Achalgarh had more than 50 individuals of this species. Palanpur Point had only two. Beside these, we saw six individuals on agricultural land near Pandu Caves and four individuals behind Teachers Training Centre. Both of these sites are close to Delwara or Kanyakumari Temple from where the species was earlier reported.

Sightings of Green Avadavat on Mount Abu

Important areas in Mount Abu where confirmed sighting of this species is possible, include:

Palanpur Point: It is located 3km from the bus stand of Mount Abu, on a small hill. The terrain is an undulating plateau, with open areas of sparse vegetation including bushes of *Lantana camara*. Two birds were seen here on the evening of 11 June 2004. The two, probably male and female, were feeding on the ground. As we approached they flew towards the *Lantana* and not were not seen afterwards.

Behind Teachers Training Centre: This area is near the Kanyakumari Temple, south of the Delwara Temples. The rear portion of the center is full of *Lantana* along with the semi-evergreen trees of Mango *Mangifera indica*. Around 11:00 hours we sighted one male on a branch of a mango tree. Due to some disturbance it flew towards the *Lantana* bushes, accompanied by three other birds, where all disappeared.

Pandu Caves: These lie behind the Kanyakumari Temple. In front of these caves there are small holdings of agricultural fields, that have a small seasonal *nallah* in the south, tall grasses interspersed with bushes in the north, semi-evergreen trees with ascending hills on the west and open land with pathway on the east. On 12.vi.2004 at 08:30hrs we saw 5 pairs of small birds flying in to the grasses in the *nallah*. In flight, the barring on their sides and black tips of their tails were clearly visible. We returned to the same spot