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Using Indicator Birds to Assess Management Impacts

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The Nishorgo Support Project (NSP) strived to develop a functional approach to co-management of PAs that would slow the loss of forest habitat and biodiversity. Within the five pilot PAs of NSP, a measurable improvement in forest habitat and biodiversity was expected by the project end in May 2008.

In general, the principal cause of forest loss at the pilot PAs is the human-induced removal of forest woody biomass, in the form of timber and firewood. Co-management was expected to help achieve a reduction in illegal logging and fuel wood removal, which would lead to a gradual re-establishment of forest habitats – especially natural regeneration of trees, shrubs and herbs – and improved levels of biodiversity.

It was in this context that the Nishorgo effort sought suitable indicators that could measure changes in habitat conditions, register impacts on biodiversity and serve to assist in communicating forest changes both inside the Nishorgo program and to the broader public. The Nishorgo team proposed that forest bird populations could serve as proxy indicators of forest structure, i.e., forest health, and biodiversity. Accordingly, eight species of primarily forest birds were selected and recorded in sample areas for four consecutive years. Local people were involved in the process, with the idea that they would be partners in the longer term conservation effort. Lessons from this endeavor are described below.

Starting Assumptions and Subsequent Adaptations

The pilot PAs where Nishorgo intervened were Lawachara National Park, Rema Kalenga Wildlife Sanctuary, Satchuri National Park, all in north-east Bangladesh; and Chunati Wildlife Sanctuary and Teknaf Wildlife Sanctuary in south-eastern Bangladesh, falling into the bio-ecological zones of Sylhet Hills and the Chittagong Hills, respectively (Nishat et al. 2002). These zones are characterized by mixed- or semi-evergreen forest types.

The two southern PAs can be characterized as heavily degraded, virtually without any tree cover apart from a few scattered patches. Compared to that, the forest cover in the three northern PAs is in better condition. Rema Kalenga WS being the most remote among the three still has some natural forest cover left as well as open clearings, Satchuri NP is a mixture of natural forest, and long- and short-rotation plantations. Natural forest does not exist in Lawachara National Park but it comprises mostly of old plantations of native species similar to a natural forest, with some more recent plantations of exotic species (NACOM 2003 a,b,c and CODEC 2003, 2004), together with regenerated natural vegetation.

The principal causes of forest loss in the pilot PAs are illegal felling and fuelwood collection (Mollah et al. 2004 a, b, c, d, e). As large trees have already been lost, fuelwood extraction is the main problem in the southern PAs, whereas illegal tree felling is the major concern in the

northern PAs. Illegal timber removal is destroying the overhead canopy and fuelwood removal involves cutting of young regenerating saplings that are necessary if forest is to re-establish.

TheNishorgo initiative assumed that through co-management, a broad-based action against illegal felling and indiscriminate fuelwood collection could be taken. This was to include the involvement of poor people (often the illegal fellers and fuelwood collectors) in alternative livelihood activities, which in turn would reduce their pressure on the forests, thereby native vegetation was expected to gradually re-establish and consequently support typical forest biodiversity within the PAs.

The challenge for Nishorgo was how to estimate with some level of confidence whether forest and biodiversity loss was being slowed and even reversed? The project team designed and implemented an impact monitoring program including social and biophysical indicators that, taken individually and together, would indicate whether the package of interventions was having the expected impacts (see Chapter 7). As part of this monitoring program, the team sought one or more biological indicators that could demonstrate change in forest conditions and be useful at the same time for communication purposes.

Measuring Biodiversity

The overall strategic objective of the Nishorgo effort was to increase biodiversity at the pilot sites. Measuring change in diversity of species, however, is a long-term and complex exercise. The team recognized that measurable changes in diversity and populations of species would be unlikely to take place within the five years of the Nishorgo Support Project.

Biodiversity and composition indicators are generally used to assess areas in need of or to determine priority for conservation (Hannon and McCallum 2004). An example of a biodiversity indicator is the number of extinct, endangered, threatened, vulnerable and endemic forest-dependent species by group (birds, mammals, vertebrates, and invertebrates).

In Bangladesh, the difficulty of estimating changes in such species diversity measures was made complicated by the lack of baseline knowledge of all existing species at each Nishorgo PA. The FD – and a number of participating university researchers – had called for detailed inventories for all the Nishorgo PAs. Even if detailed inventories had documented the majority of species present in the PAs, not only would this need to be repeated, but species counts might show little change associated with co-management in the short to medium term.

Most importantly, an inventory of biological diversity, even if it does generate reliable statistics, is just not cost-effective for the management needs of our Protected Area system. We needed indicators of change that could be measured regularly, and yet that still have statistical validity. Also, and equally importantly, the experience of other countries showed that we should take steps to develop indicators of change that could be tracked by local impacted people themselves, not just by an external group of scientists or planners. Accordingly Nishorgo sought indicators and a monitoring and analysis procedure simple enough to be incorporated into the Forest Department's monitoring scheme for PAs. Such simplicity would ensure continuation of the monitoring program in the long-term.

The Nishorgo Support Project chose the following criteria for identification of species as indicators of forest change:

- Responsive to interventions within the impact period: field interventions were for five years (2004 to 2008), so the indicator should be capable of changing within that time.
- Statistically verifiable: the indicator must be replicable and have an acceptable level of confidence about change in values over time.
- Easily comprehensible to the general public: the average citizen without scientific background must be capable of understanding the implication of an indicator. Such an indicator would be a critical means of conveying success or failure of these interventions to local, national and international stakeholders.
- Have communication value: not only should an indicator be easily understood, it was equally important to look for indicators that have social or cultural power as a tool for communications.
- Simple enough to engage local partners in monitoring: as part of co-management the involvement of local stakeholders in the monitoring process is crucial for use as a management tool and to heighten their conservation awareness. It was assumed that local co-managers could be trained and would be capable of collecting data for subsequent measurement of changes.

The choices for species indicators are numerous and range from biodiversity and composition indicators, population indicators, guild indicators, and condition indicators, species-at-risk, umbrella species, keystone species, etc (Hannon and McCallum 2004).

Population, guild or condition indicators are used in assessing conservation and management interventions (Hannon and McCallum 2004). Population indicators are those whose population dynamics reflect changes in dynamics of other species, and guild indicators represent population variation for a group of species showing similarity in resource use (a particular guild) to resource change (Hannon and McCallum 2004). For example, bird species can be categorized into different guilds – feeding guilds (based on diet: carnivore, frugivore, insectivore, granivore, etc.); foraging guilds (in forest based on vertical feeding zone: aerial, canopy, middle layer, lower layer and ground), or nesting guilds (ground-nester, canopy-nester, cavity-nester, and shrub-nester). A criticism against using guild indicators is that the population dynamics of one species within a guild often does not represent other species in that particular guild (Hutto 1998). As such one cannot say for sure that an observed increase in abundance of shrub-nesting bird X indicates the same for shrub-nesting species Y and Z.

Condition indicators are specialist species representing particular environmental conditions or habitat requirements and are responsive to disturbance (Hannon and McCallum 2004). The Nishorgo Support Project proposed to use condition indicator species because co-management was expected to improve several habitat conditions – a reduction in tree cover loss, and increase in ground vegetation (shrubs, herbs, tree-seedling and saplings) cover. The aim was to document whether any such changes have an impact on the population of condition indicator species.

Why Birds as Bio-Indicators?

The Nishorgo team undertook a literature review of all recorded mammals, birds, reptiles, and amphibians to identify condition indicator species for each of the five pilot PAs. Numerous animal species were rejected in this process, on the basis of the criteria listed above. In particular, it was difficult to make a clear cause and effect linkage between the expected habitat improvements and some of the candidate mammal species (e.g., Red Muntjac or Barking Deer Muntiacus muntjak).

Birds were considered to be more suitable as indicator species because many species are associated with particular habitats such as forest, wetland, or grassland (Browder *et al*. 2002), they could potentially demonstrate a cause-effect relationship as forest species are associated with particular habitat strata (upper, middle or lower canopy, or shrub or ground dwellers (Canterbury *et al*., 2000), and being relatively short lived forest birds were likely to be responsive to habitat changes within the project time-span (Browder *et al*. 2002). Moreover, Bangladesh has a small but active society of bird enthusiasts who could participate in initial measures and could collaborate with the local stakeholders around the PAs to bring them a new perspective and appreciation from visual and aural observation of birds.

Indicator species were selected through two discussion sessions in 2004 involving three birders with extensive experience in Bangladesh: Enam ul Haque, Paul Thompson and William Collis. Finally seven bird species were selected: Red Junglefowl (*Gallus gallus*) - ground, Oriental Pied Hornbill (*Anthracoceros albirostris*) - canopy, Red-headed Trogon (*Harpactes erythrocephalus*) – mid-storey, Greater Racket-tailed Drongo (*Dicrurus paradiseus*) – mid-storey, White-rumped Shama (*Copsychus malabaricus*) - understorey, Hill Myna (*Gracula religiosa*) - canopy, and Puff-throated Babbler (*Pellorneum ruficeps*) - ground. In addition White-crested Laughingthrush (*Garrulax leucolophus*), which is absent in the north-east, was added for the south-east as it is a charismatic and easily identified mid to understorey species. Photographs of these eight birds are shown in the color insert.

In general, all of the species selected have some characteristics in common – they are colorful birds or sing distinct songs (making them easy to detect during surveys), all are resident which would represent year-round habitats and could be surveyed in the breeding season, none of them are rare (rare species would need a greater survey effort to estimate populations), and they represent different strata of the forest.

Indicator Bird Survey

The survey team was formed by participants from Bangladesh bird club (Bbc), university students, and the local communities living around or close to these PAs, including local eco-guides and members of the Co-management Organizations, together with Forest Department staff. The survey team was led by Dr M. Monirul H. Khan of Jahangirnagar University. The local team members were trained during each survey so that they could play a significant role in the survey process. In each year 2005 to 2008 the survey was conducted during a seven-month period covering the breeding season of most species (February-August), with about 30 observation-days in the field per year. Strip transects were used to estimate indicator species population densities (see following table).

Name of Protected Area	Number of transects	Total transect length (km)	Range (km)
Lawachara National Park	6	3.72	0.50 – 0.89
Satchuri National Park	3	3.00	0.50 – 1.94
Rema Kalenga Wildlife Sanctuary	4	4.71	0.78 – 2.02
Chunati Wildlife Sanctuary	5	5.38	0.65 – 1.91
Teknaf Wildlife Sanctuary	**5**	**6.96**	**0.74 – 2.49**

Annual indicator bird monitoring process received technical guidance from team including students from Jahanginagar University and Eco-Guides from the communities. Here members of the team cross a stream at Rema-Kalenga Wildlife Sanctuary. [Monirul H. Khan]

Linking Participatory Bird Monitoring to Eco-tourism

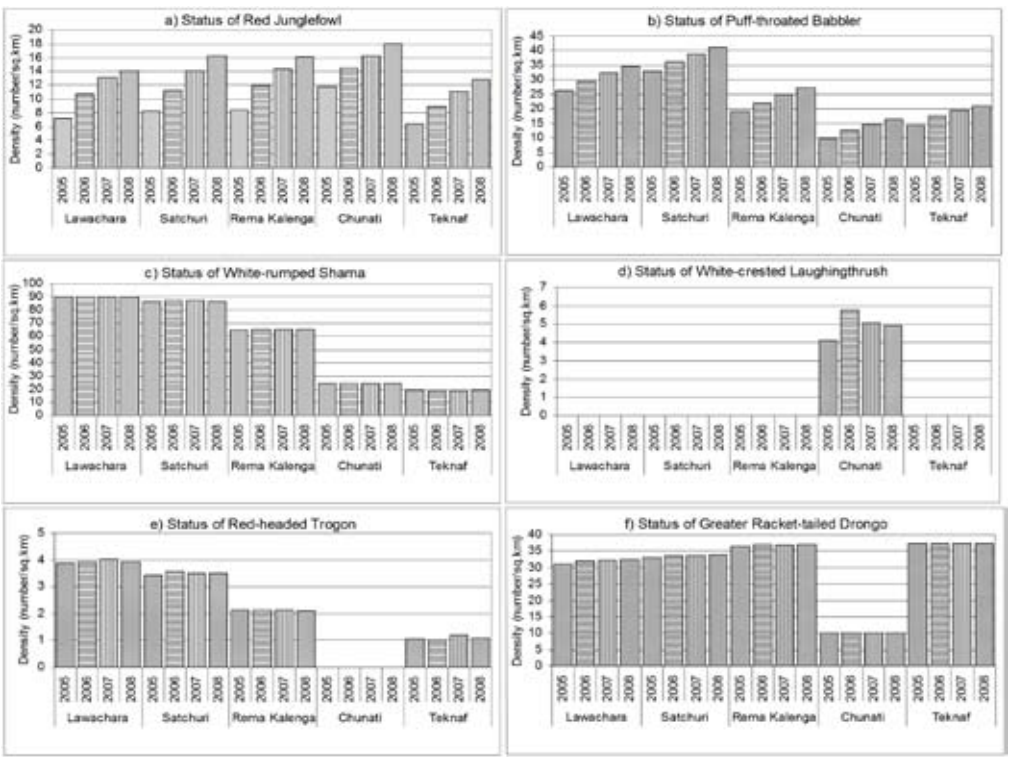
Bird monitoring requires that people be out in the forest observing nature. It was expected that local people would contribute their knowledge and gain new intimate local knowledge of forest ecosystems that could be harnessed for earning an income. The local participants in bird monitoring were trained to provide eco-guiding services, and so their interest in nature would be rewarded with an income.

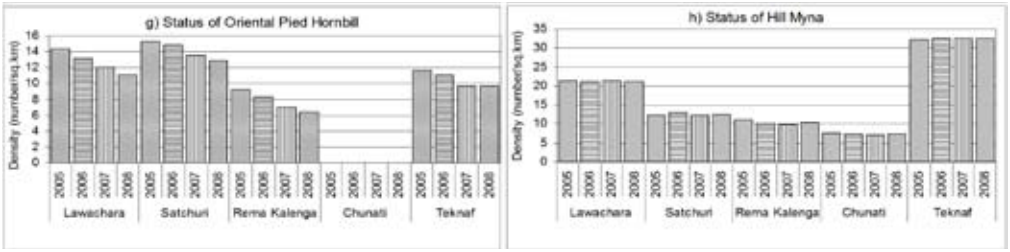
Management Impacts in Five Protected Areas

The population density, i.e., the number of individuals per square kilometer was estimated for four years (2005 to 2008) for each indicator bird species in each of the five PAs (Figure 1 a-i). The density estimates revealed that two of the indicator birds (Red Junglefowl and Puff-throated Babbler), that live on the ground and in the understorey of the forest, had increased in population over the last four years (Figure 1 a and b). This suggests that the forest understorey has started regenerating, increasing the carrying capacity and nesting sites for these two species. The community patrolling, awareness and other components of co-management have reducing the clearing of understorey vegetation for firewood as well as reducing hunting pressure.

Chunati Wildlife Sanctuary was the only PA where White-crested Laughingthrush was recorded. Its density estimates increased in the second year, but decreased in the subsequent two years (Figure 1c). The density of the middle storey birds did not show any change over the four-year period (Figure 1d to f), nor was there any change for one upper storey bird - Hill Myna. However, the population density of Oriental Pied Hornbill declined (Figure 1h), it depends on large fruiting trees and cavities in large trees for nesting. This indicates that the removal of large canopy trees (through illegal felling) has continued to affect this key species in four PAs. Due to the absence of top canopy trees in Chunati Wildlife Sanctuary, the survey team did not find any Oriental Pied Hornbill there.

Figure 1: Changes in Population Density of Eight Indicator Bird Species





During the avian breeding season (February-August) in the four survey years (2005-2008), a total of 239 species of birds were recorded in five PAs, of which 189 were residents, 39 winter visitors, six summer visitors and five vagrants (Khan, 2008). Most (55%) of the birds were insectivorous., and more bird species occur in the middle canopy (42%) and on the ground (33%) (Khan, 2008). Most species of birds were considered to be relatively rare (35%) in 2008's survey and the proportion of species considered to be rare increased gradually over the four years (Khan, 2008). The total bird species (239) recorded in five NSP sites in a limited period of time represents 37% of the birds recorded in Bangladesh (Siddique et al. 2008), and about 17% of those recorded in South Asia (Grimmett et al. 1998). A relatively high proportion of rare birds (35%) emphasizes the need for continuous monitoring of birds and the immediate need to restore the ecological condition of forests.

Implementation of Participatory Bird Monitoring Activities

In addition to providing a baseline and replicable method of surveying these indicator species, each year the same local participants or newly trained ones conducted the survey at each of the PAs, and the outcome of the surveys were reviewed and discussed with the communities.

The Project also used information on these indicator species for environmental education and awareness raising. For example, this information was used to support a Bangladesh Scouts rally focused on bird conservation: the team worked with local Scout troops and schools to teach children about the indicator birds and their implications in terms of forest health. A simple color checklist of those birds was also developed for young people so that they could record these species when they visit the PAs.

Lessons Learned

Forest birds can be an effective tool for monitoring forest health. All the indicator birds are primarily forest birds, so a change in the condition of their preferred forest strata is likely to have an impact on their population densities. This is evident in these five PAs if we compare the respective densities with the conditions of the PAs. In the field it was very obvious that Chunati WS has very few trees, hence two of the eight indicator species (Oriental Pied Hornbill and Red-headed Trogon) were not recorded there, and the densities of three (Greater Racket-tailed Drongo, Hill Myna and Puff-throated Babbler) were the lowest. A strong correlation between forest condition and the density of indicator bird species was also shown in the three northeastern sites where the ecosystems and forest conditions are now similar (despite their

different histories) and the densities of all the indicator species were also similar despite differences in areas of the PAs.

The familiarity of selected indicator birds to the participating local population eased the process of using them for monitoring purposes. The selected eight birds for forest health monitoring were found to be more or less known to the surrounding community as well as the local eco-guides. Apart from two species (Puff-throated Babbler and Red-headed Trogon; and of course White-crested Laughingthrush which is absent in the northeast), the other species were very well known. Interestingly, when increasing or decreasing trends in population densities of the eight birds were discussed with surrounding communities and local Forest Department officials, they unanimously agreed that the Red Junglefowl has increased. A similar finding was reached in independent research at Teknaf GR on assessing local ecological knowledge of indicator birds (Karim 2008). However, that study concluded that when selecting ecological indicators, a variety of species (a mixture of birds, mammals and reptiles) that are suitable for monitoring could have been selected for greater interest and participation of the communities.

Birds can focus and sharpen mass communication about forest management interventions. As evidence began to appear in bird surveys about re-establishment of Red Junglefowl and Puff-throated Babbler, stories of such changes were picked up in the regional and national newspapers. In 2007 and 2008, multiple articles appeared focusing on the increase in bird populations, particularly in the northern PAs. News articles focused on the simple story of there being more birds of certain kinds, rather than the more subtle story of improvements to lower story vegetation within the PA. Tracking these birds proved thus to be an important contribution to the overall effort to communicate both the existence and the progress of the forest PA program at a national level.

Involvement of local eco-guides in the bird monitoring process did not add notably to eco-guide marketability to tourists. The Nishorgo eco-guides showed interest and actively participated in the bird surveys. However, in a country like Bangladesh, where the concept of eco-tourism is yet to established, the ecological knowledge gained by the eco-guides did not seem to make them more marketable to visiting tourists. The kind of mass tourists visiting the PAs have little exposure to ecology or to wildlife, and did not as a result express interest in learning such information through the eco-guides. Thus the guides were not able to enhance their income or marketability noticeably from their knowledge gained from the bird monitoring process.

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