

**BIODIVERSITY ASSESSMENT (RODENTS AND AVIFAUNA)
OF FIVE FOREST RESERVES IN THE BRONG-AHAFO
REGION, GHANA**

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Abstract

A faunal inventory of five forest reserves in the Brong-Ahafo Region was undertaken to determine the ecological status or levels of degradation of the reserves using birds and small mammals as bio-indicators. The methodology involved live-trapping of small mammals and recording bird species using *ad hoc* observations timed transect walks along trails and transects. Fifty individuals of nine species of rodents were recorded, with *Mastomys erythroleucus* (multimammate mouse) being the most abundant. Small mammal species diversity was highest ($H' = 1.88$) and lowest ($H' = 0.98$) in Tain II and Tain I forest reserves, respectively. The presence of some savanna species in some of the reserves indicated high levels of degradation. Fifty-four bird species, representing 22 families, were recorded, with 16 of the species being under national conservation protection. It is recommended that the reserves be zoned into smaller management areas to enable more efficient management, through initiation of reforestation programmes, anti-poaching patrols, research, and long-term monitoring. There is the need for intensive education of the local inhabitants on wildlife conservation awareness.

Résumé

ATTUQUAYEFIO, K. D.: *L' évaluation de la biodiversité (rongeurs et avifaune) de cinq réserves de forêt dans la région de Brong-Ahafo du Ghana.* Un inventaire de la faune de cinq réserves de forêt dans la région de Brong-Ahafo était entrepris pour déterminer le statut écologique ou les niveaux de dégradation de réserves en utilisant les oiseaux et les petits mammifères comme les bio-indicateurs. La méthodologie entraînait l'attrapage-vif de petits mammifères et la notation d'espèces des oiseaux en adoptant les observations de façon *ad hoc*, la promenade transversale à l'heure fixée le long de pistes et de sections transversales. Cinquante individus de neuf espèces de rongeurs étaient notés avec *Mastomys erythroleucus* (la souris multimammate) étant la plus abondante. La diversité d'espèce de petits mammifères était le plus élevée ($E' = 1.88$) et plus faible ($E' = 0.98$) respectivement en réserves de forêt Tain I et Tain II. La présence de quelques espèces de la savane dans quelques réserves indiquait les niveaux élevés de la dégradation. Cinquante-quatre espèces représentant 22 familles étaient notés, avec 16 espèces étant sous la protection de la conservation nationale. Il est recommandé que les réserves soient groupés en zone de gestion plus petites pour permettre une gestion plus efficace par l'initiation de programmes de reboisement, les patrouilles anti-braconnages, la recherche, le monitoring de longue durée, etc. Il y a le besoin pour la formation intensive des habitants locaux sur la conscience de la conservation de la nature.

Introduction

The Brong-Ahafo Region of Ghana is located within Ghana's transitional forest zone, buffering two significant ecological zones: the southern

tropical high forest, and the northern savanna woodland. This transition zone plays an important role in preventing the movement of the savanna

into agricultural areas in the high forest zone. The zone is very susceptible to bushfires, having been rated as one of the highly bushfire-prone areas in the country (Gboloo, 1998). In recent times, the area has shown signs of degradation and general deterioration, largely as a result of frequent bushfires and other deleterious human activities like using undesirable traditional farming methods, illegal logging, fuelwood harvesting, mining and environmental pollution. An estimated 60 per cent of forest reserves in the Region have been affected by wildfires (Abbiw, 1990). Currently, there is hardly any sizeable intact forest outside forest reserves in the Region, except in sacred groves, which are themselves under serious threat (Abbiw, 1990).

Deforestation poses a serious threat to biodiversity of the Brong-Ahafo Region, which is the second largest region in Ghana, covering 17 per cent of total land area of the country. The high population growth rate in the Region (50 per cent over a 16-year period) is slightly lower than the national increase of 53.3 per cent over the same period, but it has put the Region's natural resources under undue pressure. In view of current global concern about the present high rate of deforestation in tropical countries, this is a cause for concern. There is the need to initiate urgent biodiversity conservation action in the Region in an effort to stem the tide of deforestation. The Region boasts of a number of protected areas (forest and wildlife reserves) and eco-tourist sites, notably the Bui National Park, Buabeng-Fiema Monkey Sanctuary, Digya National Park, Kintampo Falls, Tano Sacred Grove, Buoyem Bat Cave, and numerous forest reserves (Yirenskyi, 1998), which are all under threat from deforestation and deleterious human activities.

Biodiversity conservation initiatives in the Brong-Ahafo Region should necessarily involve comprehensive biodiversity assessment surveys to determine the current ecological status of the species and habitats to provide basic information for the formulation of a management plan for a particular site. Such studies utilise certain bio-

indicator species (e.g. birds and small mammals) whose ecological status provides a means of assessing environmental health which, in turn, may either reflect natural variability or anthropogenic environmental changes. Changes in bird abundance, diversity, and community structure at a site could reveal important information on its ecological status. Small mammal populations are also susceptible to environmental changes because of their small sizes and short generation times, and their long-term monitoring may provide important information that can be interpolated for patterns in wider mammalian diversity (Entwistle & Stephenson, 2000).

Unfortunately, current information on the biological diversity of the Brong-Ahafo Region is virtually non-existent or largely outdated. There is, therefore, an urgent need to update existing species lists to provide the needed information for the initiation of conservation and management plans for the Region's biodiversity. The primary aim of the study, therefore, was to conduct a faunal inventory (birds and small mammals) of five forest reserves (Yaya, Nsemere, Sawsaw, Tain I, Tain II) located within 300,000 ha of transitional forest in western part of the Region, comprising the districts of Berekum, Sunyani and Wenchi. Specific aims were to (i) characterise existing avifaunal and small mammal communities in the reserves, with emphasis on identification of species of special interest to national and global conservation, (ii) investigate the levels and causes of habitat degradation, and (iii) investigate aspects of the ecology of the small mammal community, which constitute an important part of the ecosystem.

Experimental

Study area

The study area ($7^{\circ} 22' - 7^{\circ} 40' N$; $2^{\circ} 05' - 2^{\circ} 40' W$) covers approximately 2164.8 km² with fairly-high elevation (305–610 m) and moderate climate with mean temperature of 26.3 °C. February and August are the hottest and coldest months, respectively, and total annual rainfall is 1500 mm. The major rainy season occurs from March to July, with a minor

TABLE 1
Description of the five forest reserves (study sites)

| Forest reserve | Location | Date established | Area (km ²) | Forest type/Status |
|----------------|--|------------------|-------------------------|--|
| Yaya | Mallamkrom (7° 27' N; 2° 08' W) | 1930 | 52 | Teak |
| Sawsaw | 7° 36' N; 2° 10' W | 1976 | 63 | Teak (4.0%), Savanna, Farmland |
| Nsemere | 7° 32' N; 2° 12' W | 1939 | 18 | Teak (small areas), <i>Mansonia</i> , Farms. |
| Tain I | Kwasi-Gyankrom (7° 25' N; 2° 14' W) | 1932 | 31 | Teak, <i>Chromolaena odorata</i> |
| Tain II | Oforikrom (7° 35' N; 3° 50' W) | 1934 | 509 | Teak, <i>Terminalia ivorensis</i> , <i>Cassia</i> , <i>Panicum maximum</i> |

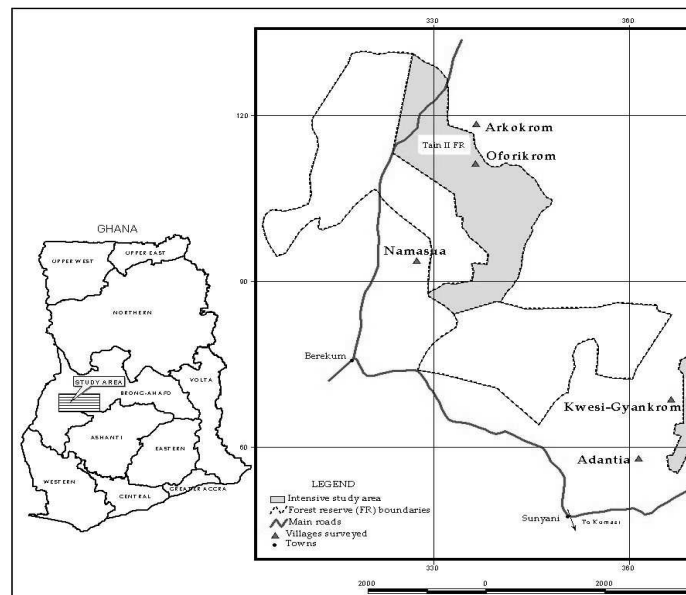


Fig.1. The study site

season in September and October. There is high relative humidity in the wet season (65-94%), reducing drastically during the dry harmattan season

(20%). The vegetation falls within the dry peripheral semi-evergreen/deciduous rain forest characterized by trees like *Azelia africana*, *Cola gigantea*,

Hildegardia barteri, *Mansonia altissima*, *Morus mesozygia*, *Nesogordonia papaverifera*, and *Pterygota macrocarpa* (Hall & Swaine, 1976). It is also classified as the *Antiaris-Chlorophora* association, dominated by *Antiaris toxicaria* (bark cloth tree), *Chlorophora [Milicia] excelsa* (odum), *Triplochiton scleroxylon* (wawa), *Griffonia simplicifolia* and *Trichilia prieuriana* (Taylor, 1960; Hall & Swaine, 1981).

The main ethnic groups are the Akan and Brong, but there is a large influx of about 10 other ethnic groups, mainly farmers from the northern regions. Agriculture is the major economic base, with major occupations being agricultural production and livestock rearing. Of the five forest reserves (study sites) (Table 1), the first four (Yaya, Sawsaw, Nsemere and Tain I) are located near Sunyani, while the last (Tain II) is located at Dormaa in the Berekum District, about 15 km west of Sunyani (Fig. 1).

Small mammal survey (rodent trapping)

Rodent live-trapping was conducted in various habitats within the five forest reserves over a 10-day period in September 1998, using Sherman Collapsible Live Traps (H.B. Sherman Traps Inc., Florida, USA) measuring 23 cm × 9 cm × 7.5 cm. Two 100-m trapping transects were established in each reserve, and the traps were positioned at 10-m intervals. The traps were baited with a mixture of groundnut paste and corn meal, and run for three consecutive nights. Captured animals were euthanized with chloroform, identified on the spot, if possible, sexed, aged, weighed and examined for reproductive condition (i.e. scrotal or abdominal testes for males and perforate vagina, pregnancy or lactation for females). For specimens that could not be readily identified, standard measurements (body, tail, ear, and hind limb lengths) for further identification were taken for later identification by comparison with voucher specimens stored in the vertebrate museum of the Department of Zoology, University of Ghana, Legon, and with the help of Kingdon (1997) and Haltenorth & Diller (1988). All captured specimens were serially labelled and preserved in formalin. The small mammal field

handling techniques used were as outlined in Wilson *et al.* (1997). The relative abundance (number of individuals of a particular species per 100 trap-nights) of the captured small mammal species in the various habitats was estimated as follows:

$$\text{Relative abundance (RA)} = \frac{\text{Number of individuals captured}}{\text{Number of trap-nights (TN)}} \times 100$$

where 1 trap-night = one trap set for one night

Species diversity was estimated using the Shannon Index (Stiling, 1998) as follows:

$$\text{Species diversity (H')} = - \sum_{i=1}^s p^i \ln p^i$$

where H' = species diversity, s = number of species, and pⁱ = proportion of ith species in the sample.

Avifaunal (bird) survey

All bird species seen or heard during *ad hoc* observations were recorded, as well as systematic surveys using timed transect walks along 1.5 km trails within each reserve. Bird abundance per habitat was recorded as number of species encountered per hour. Key references for bird identification were Mackworth-Praed & Grant (1973), Grimes (1987), and Serle *et al.* (1992).

Results

Fifty-five individuals of nine species of rodents were recorded in order of abundance (Table 2). *Mastomys erythroleucus*, *Dasymys incomtus* (shaggy swamp rat), *Mus* sp. (common mouse), *Lophuromys flavipunctatus* (brush-furred mouse), *Praomys tullbergi* (soft-furred rat), *Aethomys hypoxanthus* (bush rat), *Dephomys defua* (dephua mouse), *Hybomys univittatus* (hump-nosed mouse), and *Hylomyscus stella* (African woodmouse). Species diversity was highest (H' = 1.88) in Tain II Forest Reserve, and lowest (H' = 0.98) in Tain I.

The survey yielded a total of 54 bird species representing 22 families dominated by Ploceidae (9), Nectariniidae (7), Sylviidae (7), Ardeidae (6),

TABLE 2
Abundance and diversity of rodents in the five forest reserves (relative abundances in brackets)

| Species | Habitats | | | | | Total | Percentage occurrence |
|--|-------------------|-----------------|-------------------|--------------------|--------------------|-------|-----------------------|
| | Tain I (60 TN) | Yaya (30 TN) | Sawsaw (60 TN) | Nsemere (30 TN) | Tain II (60 TN) | | |
| <i>Mastomys erythroleucus</i> (Mulimammate rat) | 5 (8.3) | | 11 (18.3) | 4 (13.3) | 1 (1.7) | 21 | 38.2 |
| <i>Dasymys incomtus</i> (Shaggyswamp rat) | | | 3 (5.0) | 4 (13.3) | 2 (3.3) | 9 | 16.5 |
| <i>Mus</i> spp. (Common mouse) | | 2 (6.7) | 1 (1.7) | 2 (6.7) | 2 (3.3) | 7 | 12.7 |
| <i>Lophuromys flavipunctatus</i> (Brush-furred mouse) | | 5 (16.7) | 1 (1.7) | | | 6 | 10.9 |
| <i>Praomys tullbergi</i> (Soft-furred rat) | 3 (5.0) | | 1 (1.7) | | 1 (1.7) | 5 | 9.1 |
| <i>Aethomys hypoxanthus</i> (Rusty-nosed rat) | | 2 (6.7) | | | | 2 | 3.6 |
| <i>Dephomyys defua</i> (Dephua mouse) | 1 (1.7) | | | | 1 (1.7) | 2 | 3.6 |
| <i>Hybomys univittatus</i> (Hump-nosed mouse) | | | | | 2 (3.3) | 2 | 3.6 |
| <i>Hylomyscus alleni</i> (African woodmouse) | | | | | 1 (1.7) | 1 | 1.8 |
| Total | 9 | 9 | 17 | 10 | 10 | 55 | 100.0 |
| Species diversity (H') | 0.93 | 0.98 | 1.10 | 1.06 | 1.88 | | |

TABLE 3
Checklist of birds of the reserves and their conservation significance

| Species | Common name | Occurrence in reserves | | | Frequency | | Conservation significance (national) | |
|-------------------------------------|-------------------------------|------------------------|---|---|-----------|-------|--------------------------------------|----|
| | | Y | S | N | T. I | T. II | | |
| Falconiformes | | | | | | | | |
| 1. <i>Buteo augularis</i> | Red-tailed buzzard | | | | “ | | 1 | I |
| 2. <i>Polyboroides radiatus</i> | Harrier hawk | | | | | “ | 1 | I |
| Galliformes | | | | | | | | |
| 3. <i>Francolinus bicalcaratus</i> | Double-spurred francolin | | | | “ | | 1 | I |
| 4. <i>F. achantensis</i> | Ahanta francolin | | | | | “ | 1 | I |
| Columbiformes | | | | | | | | |
| 5. <i>Streptopelia semitorquata</i> | Red-eyed dove | | “ | | “ | “ | 3 | II |
| 6. <i>Turtur afer</i> | Red-billed wood-dove | | “ | “ | “ | “ | 4 | II |
| 7. <i>Treron australis</i> | Green pigeon | | “ | | | | 1 | II |
| Psittaciformes | | | | | | | | |
| 8. <i>Poicephalus senegalus</i> | Senegal yellow-bellied parrot | | | | “ | | 1 | II |
| Cuculiformes | | | | | | | | |
| 9. <i>Centropus senegalensis</i> | Senegal coucal | | “ | | “ | “ | 3 | |
| 10. <i>C. leucogaster</i> | Black-throated coucal | | | | | “ | 1 | |
| 11. <i>Chrysococcyx klaas</i> | Klass' cuckoo | | | “ | “ | “ | 3 | |
| Apodiformes | | | | | | | | |
| 12. <i>Cypsiurus parvus</i> | Palm swift | | | “ | “ | “ | 3 | |
| Bucerotiformes | | | | | | | | |
| 13. <i>Tockus semifasciatus</i> | Allied/Pied hornbill | | “ | “ | “ | “ | 4 | |
| 14. <i>Tauraco persa</i> | Green-crested touraco | | | | | “ | 1 | |
| Coraciiformes | | | | | | | | |
| 15. <i>Halcyon malimbicus</i> | Blue-breasted kingfisher | | | “ | | | 1 | |
| Capitonidae | | | | | | | | |
| 16. <i>Lybius vieilloti</i> | Vieillot's barbet | | | | “ | | 1 | |
| 17. <i>Tricholaemia hirsutum</i> | Hairy-breasted barbet | | | | | “ | 1 | |
| 18. <i>Pogoniulus leucolaima</i> | Lemon-rumped tinker-bird | | | “ | | “ | 2 | |
| 19. <i>P. scolopaceus</i> | Speckled tinker-bird | | | | | “ | 1 | |
| Piciformes | | | | | | | | |
| 20. <i>Campethera nivosa</i> | Buff-spotted woodpecker | | | | | “ | 1 | |
| Dicruridae | | | | | | | | |
| 21. <i>Dicrurus adsimilis</i> | Drongo | | | | “ | | 1 | |
| Passeriformes | | | | | | | | |
| 22. <i>Tchagra senegala</i> | Black-crowned tchagra | | | “ | | | 1 | |
| 23. <i>Bleda canicapilla</i> | Grey-headed bristlebill | | | | | “ | 1 | |

| | | | | | | | |
|--|-----------------------------------|----|----|----|----|----|----|
| 24. <i>Pycnonotus barbatus</i> | Common garden bulbul | “ | “ | “ | “ | 4 | |
| 25. <i>Thescelocichla leucopleurus</i> | Swamp palm bulbul | | | “ | | 1 | |
| 26. <i>Eurillas virens</i> | Little greenbul | “ | | | “ | 2 | |
| 27. <i>Stelgidillas gracilirostris</i> | Slender-billed greenbul | | | | “ | 1 | |
| 28. <i>Baeopogon indicator</i> | Honey-guide/White-tailed greenbul | | | | “ | 1 | |
| 29. <i>Pyrrhurus simplex</i> | Simple leaf-love | “ | | | | 1 | |
| 30. <i>Prinia erythroptera</i> | Red-winged warbler | “ | “ | “ | “ | 4 | |
| 31. <i>P. subflava</i> | West African prinia | “ | “ | “ | “ | 4 | |
| 32. <i>Camaroptera brevicaudata</i> | Grey-backed camaroptera | “ | “ | “ | “ | 4 | |
| 33. <i>Sylvietta brachyura</i> | Nuthatch warbler | | “ | “ | “ | 3 | |
| 34. <i>Hylia prasina</i> | Green hylia | | | | “ | 2 | |
| 35. <i>Cisticola cantans</i> | Singing cisticola | “ | | | | 1 | |
| 36. <i>Tersiphone rufiventer</i> | Red-bellied paradise flycatcher | | | | “ | 2 | |
| 37. <i>Bradornis pallidus</i> | Pale flycatcher | “ | | | | 1 | |
| 38. <i>Cinnyris chloropigius</i> | Olive-bellied sunbird | “ | “ | “ | “ | 4 | |
| 39. <i>C. cocciniigaster</i> | Splendid sunbird | “ | “ | “ | “ | 4 | |
| 40. <i>C. cupreus</i> | Copper sunbird | | “ | “ | | 2 | |
| 41. <i>Anthreptes collaris</i> | Collared sunbird | | | | “ | 1 | |
| 42. <i>Chalcomitra senegalensis</i> | Scarlet-breasted sunbird | | | | “ | 1 | |
| 43. <i>C. adelberti</i> | Buff-throated sunbird | | | | “ | 1 | |
| 44. <i>Cyanomitra olivacea</i> | Olive sunbird | | | | “ | 1 | |
| 45. <i>Vidua macroura</i> | Pin-tailed whydah | “ | | “ | | 2 | II |
| 46. <i>Coliuspasser macrourus</i> | Yellow-mantled weaver | | “ | “ | | 2 | II |
| 47. <i>Sitagra pelzelni</i> | Slender-billed weaver | | “ | | | 1 | II |
| 48. <i>Ploceus cucullatus</i> | Village weaver | | | | “ | 1 | II |
| 49. <i>Ploceus nigerrimus</i> | Vieillot's black weaver | “ | | | | 1 | II |
| 50. <i>Nigrita canicapilla</i> | Grey-crowned negro-finch | | | | “ | 2 | |
| 51. <i>Estrilda melpoda</i> | Orange-cheeked waxbill | “ | | “ | | 2 | II |
| 52. <i>Lagonosticta senegala</i> | Senegal firefinch | | | | “ | 1 | II |
| 53. <i>Lonchura cucullatus</i> | Bronze manikin | “ | | “ | | 2 | II |
| 54. <i>Oriolus brachyrhynchus</i> | Western black-headed oriole | | | | “ | 1 | |
| Total | | 5 | 21 | 12 | 29 | 31 | |
| Encounter rates (species/h) | | 15 | 31 | 24 | 15 | 16 | |

National Conservation Significance

I = Schedule I of the Ghana Wildlife Conservation Regulations

II = Schedule II of the Ghana Wildlife Conservation Regulations

NOTE

Y = Yaya Forest Reserve

S = Sawsaw Forest Reserve

N = Nsemere Forest Reserve

T.I = Tain I Forest Reserve

T.II = Tain II Forest Reserve

Estrildidae (4) and Capitonidae (4). The encounter rate of bird species in the various reserves are shown in Table 3. Sawsaw had the highest encounter rate, while Tain I had the lowest. No bird species was common to all the five reserves, but seven species were common to four reserves (i.e. they were not encountered in Yaya Forest Reserve). These were the red-billed wood-dove (*Turtur afer*), allied hornbill (*Tockus semifasciatus*), red-winged warbler (*Prinia erythroptera*), West African prinia (*Prinia subflava*), grey-backed camaroptera (*Camaroptera brevicaudata*), olive-bellied sunbird (*Cinnyris chlorophygus*) and splendid sunbird (*Cinnyris cocciniigaster*). Sixteen out of the total of 54 species of birds recorded in the survey are under national protection, because of their conservation importance (Table 3).

Discussion

Small mammal trapping success was 18.3 per cent which is quite high, considering the level of degradation of the area. Species diversity was also quite high. The presence of the following species: *Aethomys hypoxanthus* (bush rat), *Mastomys erythroleucus* (multimammate mouse), *Hylomyscus stella* (African woodmouse), *Praomys tullbergi* (soft-furred rat), *Lophuromys flavipunctatus* (brush-furred mouse) and *Mus* sp. (common mice) indicate high levels of degradation of the forest reserves. For example, *Mus* sp. and *L. flavipunctatus* are known savanna species which invade forest areas where there are grassy patches and dense tangles of vegetation, and where breaks in the canopy allow more light to reach the ground (e.g. when a tree has fallen) (Happold, 1975).

P. tullbergi is also known to be a common forest mouse, which is an opportunist savanna dweller where adjacent grassland develops along forest edges (Happold, 1975). *P. tullbergi* and *L. flavipunctatus* are known to flourish after forest clearance, usually increasing in numbers considerably. *M. erythroleucus* is a “tramp”

species which is found in close association with human habitations (Jeffrey, 1977). These are also referred to as anthropophilous species. In some cases, it may be difficult to determine whether “penetrants” into forest are true non-forest species (i.e. absent from the forest zone before anthropogenic ecological disruption (Grubb, 1982). When the forest zone is opened up by farming, settlement, road construction and timber extraction, some savanna fauna have penetrated what used to be forest (Booth, 1958; Happold, 1987).

As the results indicated, there is high abundance and fairly high diversity of small mammal and bird species. It is, therefore, recommended that more detailed studies of these groups be conducted in the reserves in order to enhance current species lists, and also to provide more information on nationally and internationally rare or threatened species occurring in the reserves. Long term monitoring programmes could then be established not only for such threatened species, but also for species considered good ecological indicators of habitat quality (e.g. small mammals), since the area is under serious threat of deforestation largely due to human activities.

There was evidence to indicate a high incidence of poaching and human encroachment in the reserves (spent cartridges, farms, fuelwood piles, timber trucks and tractors, burnt vegetation, etc.), which could be partly attributed to ineffective patrolling and monitoring. This could, in turn, be the result of lack of adequate numbers of trained personnel and also the very large areas covered by these reserves (e.g. Tain II), which make effective monitoring difficult. It is recommended that attempts be made to solve these problems to ensure more effective management of the reserves.

It could be suggested that zoning the reserves into smaller management or “core” areas, based on relative importance (e.g. in terms of levels of deterioration, presence of important or threatened

fauna, etc.) of the various habitats in a particular reserve should be carried out. This would enable more efficient management of the reserves, especially in the initiation of reforestation programmes, anti-poaching patrols, research and long-term monitoring. There is the need to involve the local community in the management of the forest reserves, and this would require intensive education of selected inhabitants (e.g. Forestry staff, community leaders, hunters, farmers, loggers, school children, etc.) on wildlife conservation awareness, the need for community participation in conservation activities, the effect of human activities on biodiversity, and the importance of biodiversity to human survival. The trained locals would be better able to impart their knowledge to other inhabitants of the local communities, since the elements of mutual suspicion and confrontation will be greatly reduced.

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