

NEGROS RAINFOREST CONSERVATION PROJECT

PERMIT REPORT FOR THE DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES



*Report for Gratuitous Permit No. 90 Issued by the Department of the Environment
and Natural Resources to the Negros Forests and Ecological Foundation, Inc.*

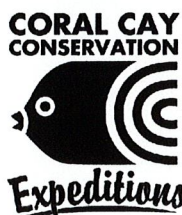
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Permit Report

Report submitted in compliance with section 14 of Gratuitous Permit No. 90 issued to the Negros Forests and Ecological Foundation Incorporated on the 22nd December 2000 by the Department of the Environment and Natural Resources. Gratuitous Permit issued to collect biological specimens for taxonomic studies and other conservation research purposes within the North Negros Forest Reserve as part of the Negros Rainforest Conservation Project.

Summary

This report summarises the ecological survey and collection work completed by the Negros Rainforest Conservation Project (NRCP) whilst working under Gratuitous Permit No. 90 (GP 90). The report briefly reviews the aims, objectives and approach of the NRCP, summarising the major results and collection activities under GP 90, and overviews the preliminary conclusions of the project to date.

The NRCP is located in the North Negros Forest Reserve (NNFR), where Coral Cay Conservation (CCC) supports the work of the Negros Forests and Ecological Foundation Inc (NFEFI) in a collaborative program of research, restoration, training and education, on Negros Island, Philippines.

The project utilises trained volunteers to collect baseline biodiversity data on major faunal and floral groups in order to increase the understanding of the ecological dynamics and community composition of the different habitat types within the tropical montane cloud forest of the NNFR. Distribution, diversity and abundance surveys are being completed on all major faunal and selected floral groups within the NNFR using standard and internationally recognised survey techniques.

Whilst only summary results are presented in this report, they begin to confirm that the NNFR is an important biodiversity hotspot with a huge diversity of endemic and endangered species but also underlines the data gathering capacity of the NRCP. Surveys thus far have revealed that the NNFR supports one percent of global bird species, eighty percent of butterflies located are endemic to the Philippines and many of the mammal species are Negros-Panay endemics.

This data will ultimately quantitatively underpin the conservation work of NFEFI and contribute to the development of integrated community-driven management recommendations for the conservation and sustainable use of the biodiversity of the reserve.

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1. The Negros Rainforest Conservation Project

1.1 Introduction

The Negros Rainforest Conservation Project (NRCP) is a joint programme of co-operative research, education and training between the Negros Forests and Ecological Foundation Inc. (NFEFI) and Coral Cay Conservation (CCC). The NRCP is based in the Tropical Montane Cloud Forests (TMCFs) of the North Negros Forest Reserve (NNFR), in Negros Occidental, Negros, Philippines (Figure 1.1).

1.2 Background

The moist forests of the Philippines, including the NNFR, are the eighth most vulnerable forest ecoregion in the world (WWF 2001). The NNFR is the largest remaining area of wet evergreen rain forest on Negros and the second largest in Negros-Panay Faunal region. It is of clear importance to the survival of many critically endangered species found only within the Negros-Panay Faunal region, the most threatened of the Philippines' 5 faunal regions (Heaney & Regalado 1998).

The Philippines is a mega-biodiversity hotspot and has higher percentages of endemism than any other biogeographic province in the whole of the Indo-Malayan Realm. Over 57% of species in the major faunal and floral groups occur nowhere else in the world (Oliver & Heaney 1996). Birdlife International currently identifies Negros Island as an Endemic Bird Area (EBA) and the NNFR as an Important Bird Area (IBA) (Stattersfield *et al*, 1998).

However, the Philippines also has one of the highest rates of tropical forest loss, declining from 70% to 18% cover in the last 100 years and Negros Island only has 4% of its original forest cover. Approximately 60% of the endemic Philippine flora are now extinct. This also poses a great threat to many endemic vertebrate species such as threatened hornbills (*Penelopides panini* and *Aceros waldeni*), and the endangered (WCSP 1997) Philippine spotted deer (*Cervus alfredi*), and Philippine warty pig (*Sus cebifrons*). Both species have been extirpated from 95% of their former range (Cox 1987). They are extinct on the islands of Cebu, Guimaras and Masbate having once been common through the West Visayas. Their status and distribution on Negros is very poorly known and information is urgently needed for effective conservation and management.

In addition to harbouring immense biological diversity, the NNFR is also a source of vital ecosystem goods and services. For example, it provides many non-timber forest products (NTFPs) such as Rattan and Bamboo, and also protects six vital watersheds for the north Negros area, providing a clean and controlled supply of water to the provincial capital and other areas. Large scale flooding as a result of deforestation is becoming more common, and consequently has huge social and economic costs. The case to preserve the remaining forested watersheds for environmental and socio-economic reasons is clear. The Foundation for the Philippine Environment (FPE) has therefore stressed the need to develop strategies to preserve and sustain the NNFR and its stakeholder communities.

The integrated importance of the social, economic and ecological values of the NNFR are now beginning to be recognised at international, national and local scales. The Department of the Environment and Natural Resources (DENR), and the Philippine National Biodiversity Strategy and Action Plan (NBSAP) have identified the need to conserve the forest resources via use of the collective efforts of empowered, self-reliant Filipinos (DENR/UNEP 1997). However, they lack the resources for effective implementation. NFEFI has assumed this role

for Negros and is dedicated to protecting, conserving and restoring the Negros environment in order to safeguard the sustainable use of its resources for future generations. In 1998 NFEFI asked CCC to assist in the provision of resources for the production of a sustainable management plan for the NNFR and this resulted in the establishment of the NRCP.

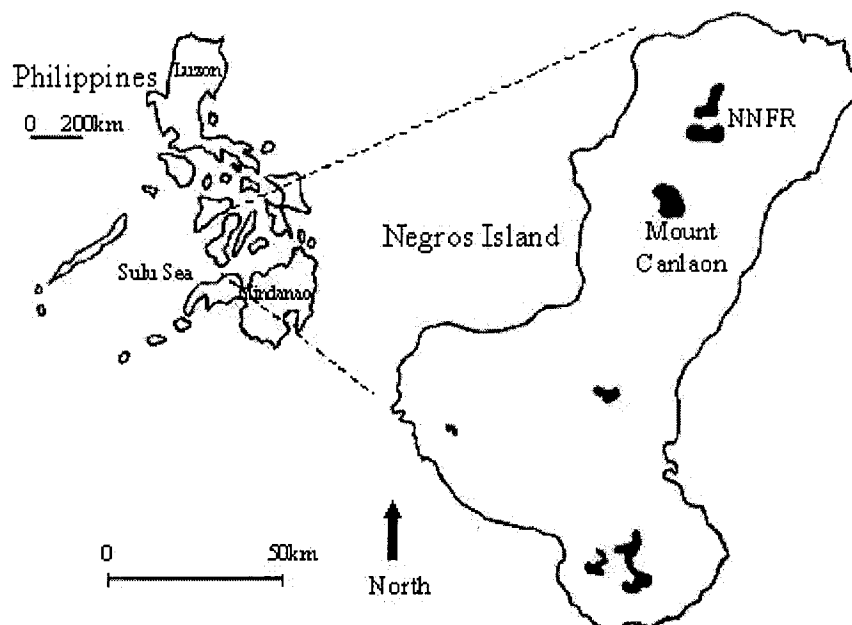


Figure 1.1. The remaining forest patches of Negros Island and the location of the North Negros Forest Reserve (NNFR) within Negros, Philippines.

The NRCP conducts its conservation work from a field centre located in the village of Campuestohan, on the southwest the perimeter of the NNFR. A program of biodiversity surveys and monitoring work has been established within the Municipalities of Talisay and Murcia, Province of Negros Occidental. This will provide ecological data, in order to make recommendations towards the sustainable management of the NNFR, and provide information for the co-operative development of environmental awareness and education initiatives.

1.3 Aims and objectives of the NRCP

The current aims and objectives of the NRCP are outlined as follows:

- To obtain base-line quantitative data on the biodiversity of the fauna and flora of the North Negros Forest Reserve, to create resource maps and an environmental database for the region.
- To conduct complimentary field based research into the habitat requirements and ecology of the species currently included in the NFEFI species recovery programme, the objective of which is to produce guidelines for effective forest management to aid in-situ conservation of specific species.
- To provide suitable education materials and programmes to improve environmental awareness amongst local communities, to offer training opportunities to host country counterparts in biodiversity assessment & management and to provide non-destructive alternative livelihood opportunities through the development of eco-tourism and sustainable forestry practices.

- To produce integrated community-driven management plans for the conservation, restoration and sustainable use of biodiversity in the region.

The results of the baseline survey work will contribute vital information to the development of sustainable management recommendations for this area of the NNFR, with the potential to combine the work of the NRCP with other data sources and develop a management plan for the whole NNFR. All results and reports produced by the NRCP will be submitted to NFEFI who will facilitate their dissemination and outputs therein to the local municipalities and will include the findings in its community education projects.

1.4 Collection Permit

The NRCP operates under the Wildlife Gratuitous Permit (GP) No. 90 as issued by the DENR to NFEFI authorising the same to collect certain biological specimens for research/scientific purposes. All collection activities undertaken by the NRCP adhere strictly to the terms and conditions of the above mentioned GP, and the NRCP only collects specimens for preservation when strictly necessary for taxonomic identification and conservation purposes.

1.5 Staffing

A CCC appointed Project Scientist (postgraduate biologist) co-ordinates and manages the research programme, supported by a Scientific Officer (with relevant graduate training and experience). The surveys utilise Filipino and international volunteers to collect the field data under the guidance and training of NRCP staff and research collaborators. Faunal and floral surveys are completed throughout the year and the ecological survey work has been designed to enable the collection of reliable quantitative and qualitative data by non-expert volunteers.

1.6 Aim of the Report

This report serves to fulfil the final conditions of GP 90 (section 14) as issued to NFEFI and summarises the significant results of the NRCP whilst working under GP 90. The report does not intend to provide detailed analysis and interpretation of all research work undertaken by the NRCP but simply indicates significant outputs arising from the collection activities of the NRCP (as detailed section 14 GP90).

The actual specimen collections completed by the NRCP were limited to just botanical and invertebrate whilst operating under GP 90. It was not deemed necessary to take any vertebrate specimens, and those specimens that were live captured were returned to their point of capture post data collection.

2. Summary Survey Methods

2.1 Transect Establishment

The NRCP has established six permanent survey plots (PSPs) within the montane rainforest of the NNFR according to standard biodiversity assessment methods for tropical forests (Stork & Davies 1996). The standard baseline transect survey technique utilises 1ha PSPs (Dallmeier 1992). These have been established as three parallel pairs of permanently marked strip transects (500m x 20m), with one pair situated in each of the three habitat types (disturbed, secondary & old growth forest) to be monitored in the study. Each of the PSPs has been adjusted for uneven terrain via slope correction (Dallmeier 1992) and has been subdivided into 25 sub-quadrats (20m x 20m). This is the standard area unit for stand parameters (see Hamann *et al*, 1999, Alder & Synnott, 1992), such as detailed tree inventory work (tagging, & identification).

The size of the NRCP forest PSPs, and the inventory survey protocols have been chosen in accordance with those used in the Philippine Plant Inventory Project (Madulid 1996; Pipoly & Madulid 1998) and to provide results that are comparable to other sites both locally and nationally (Hamann *et al*, 1999). They are also comparable to protocols implemented internationally (Dallmeier 1992, Alder & Synnott, 1992). The 1 ha plot size (with 20m x 20m subdivisions) is accepted as the standard design for forest inventory work and survey plots (Dallmeier 1992, Alder & Synnott, 1992).

Within each sub-quadrat of each PSP, all trees with a 10cm DBH or greater, have been measured and tagged with aluminium tree tags. This has been completed in order to conform to standard forest inventory methods (Pendry & Proctor 1997; Hamann *et al*, 1999; Dallmeier 1992). Also the three tallest trees in each 20m sub-quadrat are being measured for total height using clinometer methodology (Alder & Synnott, 1992).

2.2 Botanical Sampling

The collection of botanical specimens from each of the PSPs has recently been initiated (2001), and previously only pilot studies had been completed by Maribel Agoo (National Museum of Philippines, Manila) and Dr. Peter Wilkie (Royal Botanic Gardens, Edinburgh).

Botanical samples have been taken from tagged trees to enable species identification of all tagged trees within each PSP, and thus generate a complete botanical inventory (species composition) for each PSP within each forest habitat type (see Hamann *et al*, 1999). Thus far only a limited number of specimens have been collected, collated, dried and pressed according to standard field methods (Bridson & Forman 1992; Davies & Jermy 1996) at the NRCP. Samples have thus far been sent to Manila for further taxonomic work. Samples have been collected in triplicate, as done for previous studies (Hamann *et al*, 1999), enabling samples to be sent to research collaborators for identification and a reference collection to be maintained at the NRCP/Bacolod Office.

Each PSP is also being systematically surveyed throughout the year for all species in fruit and/or flower. Each PSP is walked once a month, and every tagged tree in fruit or flower recorded, with notes regarding their colour, size etc. This data will then be combined with the species identification data in order to improve understanding of the phenology of the different forest types.

2.3 Invertebrate surveys

Research work has focused on butterfly surveys which have been undertaken on all six PSPs using walking transect counts (Walpole & Sheldon 1999; Pollard 1977) with point counts (adaptation of transect counts), and baited traps (Ausden 1997). Several voucher specimens have been collected (to facilitate species identification), mounted and recorded photographically, and species identification has now been completed.

2.4 Bird Surveys

Bird counts have been completed both on the PSPs and at other observation locations within the NNFR. The semi-quantitative surveys are being undertaken primarily by MacKinnon lists (Bibby *et al*, 1992; Stork & Davies 1996; Gibbons *et al*, 1996). This survey method is ideal for rough terrain and dense vegetation where conditions make walking along a transect and short timed counts very difficult. The data produced is semi-quantitative and is directly comparable between sites with similar vegetation structure, and is surveyed using the same distance categories. Thus far, only a handful of surveys have been undertaken within the PSPs (or associated major habitat types), with the majority of surveys being undertaken at a small number of other sites.

Mist-netting work for birds and bats is also ongoing. This is useful for assessing bird (and bat) diversity in areas such as tropical forest, when used in combination with observational techniques (Stork & Davies 1996). Surveys in the different forest types have been undertaken using standard methods (Gibbons *et al*, 1996; Bibby *et al*, 1998). The mist netting offers a standardised technique that can be used to compare the bird and bat fauna of different areas (PSPs), and generate not only species diversity data but also population and productivity data.

2.5 Mammal surveys

The small mammal fauna of the NNFR has been sampled (live trapped) in order to determine a species inventory, and this broadly follows methods previously used (trap lines) in forested habitat in the Philippines (Heaney *et al*, 1989; Heideman *et al*, 1987). Live trapping for small mammals and mist-netting work (bats) has thus far been limited to generating species lists. The NRCF research team have also investigated the potential use of TrailMaster cameras for monitoring the habitats of larger terrestrial vertebrates that are the subjects of NFEFI's captive breeding programme.

2.6 Herpetile Surveys

Pilot studies to survey the amphibian and reptile faunas of the NNFR were initiated in early 2001 to test standard survey techniques types (O'Shea 1992; Heyer *et al*, 1994) within the different forest.

2.7 Soil Surveys

Soil samples have been taken from each PSP using soil augurs (Alder & Synnott 1992). Samples are being removed twice annually, from even numbered sub-quadrats (following Proctor *et al*, 1983a) within each PSP and each sample is taken from an augur depth of 20cm. Replicated samples have been sent for chemical analysis to determine pH, Phosphorus, Nitrogen, Potassium and organic matter. This will be completed at twice yearly intervals (once in the dry and once in the wet season). Structural analysis of the soil samples has also been undertaken (Rowell 1994).

3. Biodiversity Survey Results

The following section summarises the major empirical results and outputs from the ecological survey work undertaken by the NRCP staff and volunteers within the NNFR under GP 90. This represents a general overview of the results, with only summary analysis.

3.1 Transect Establishment and Botanical Inventories

The NRCP team has completed establishment of the six permanent sample plots (PSPs) each enclosing an area of one hectare (500m x 20m transect lines), with 20m sampling intervals, in three different forest types (Old Growth, Secondary (selectively logged) and re-growth forest). In excess of 17000 individual trees (2000-3000 per transect) have been tagged with unique identifier codes and measured (DBH) within these six plots. A summary of the PSP establishment is given in Table 3.1.

Table 3.1. Summary of the Permanent Sample Plot (PSP) locations within the NNFR.

Name	PSP Code	Forest Type	Date of Establishment	Grid reference	Altitude (m)
Dam	E	Re-growth	April 1999	N10°39'38 E123°09'47	950m
Dam	F	Re-growth	April 1999	N10°39'38 E123°09'36	950m
Eroplano	C	Secondary	August 1999	N10°40'17 E123°09'53	1100m
Eroplano	D	Secondary	August 1999	N10°40'13 E123°09'58	1100m
Mawa	G	Old Growth	February 2000	N10°38'47 E123°10'00	1400m
Mawa	H	Old Growth	February 2000	N10°38' E123°10'	1400m

Botanical samples are now being taken from tagged trees within the PSPs in order to produce a species inventory for each PSP (see Hamann *et al*, 1999) and thus each forest habitat type. Only limited scientific species identification work has been completed, however, all species have been identified using local names with the aid of local guides. These preliminary results appear to indicate that the flora of the forest areas surveyed by the NRCP research teams are very different in their relative species diversities (Table 3.2).

This will require further verification and analysis through the production of detailed species inventories for each PSP. Only a small number of botanical samples have been taken by the NRCP and these have been identified to species level by the Philippines National Museum. It is hoped that this work will continue in 2002.

Table 3.2. Species diversity and equitability for the three forest types surveyed within the NNFR.

	Forest Type		
	Old growth	Secondary (disturbed)	Secondary (regrowth)
1) Species number	75	95	92
2) Diversity index	12.54	21.57	20.63
3) Equitability index	0.167	0.227	0.224

1) Total species number, (2) & (3) Simpson's indices (Begon *et al*, 1990)

3.2.1 Fruit & Flower Surveys

Fruiting and flowering surveys have only been initiated so the data is limited. However, once collected for each PSP and combined with the species inventory data, the frequency of fruiting and flowering of the tree species can be integrated with other data sets, for example, to study distribution and habitat use of bird species with regard to the fruiting of tree species.

3.3 Invertebrate surveys

The ongoing butterfly inventory work of the NRCP has thus far resulted in the collection and identification of over 40 butterfly species and sub-species from 7 families (Figure 3.1) and nearly 80% of the species identified are endemic to the Philippines. It is also apparent that several species have restricted geographic distributions within the Philippines (Figure 3.2).

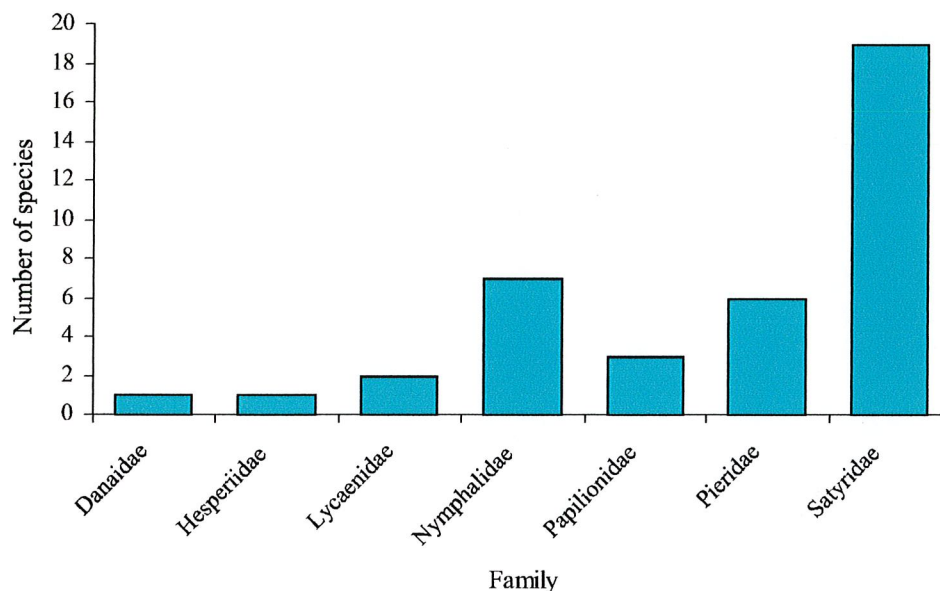


Figure 3.1. Frequency distribution of butterfly species within families located within the NNFR.

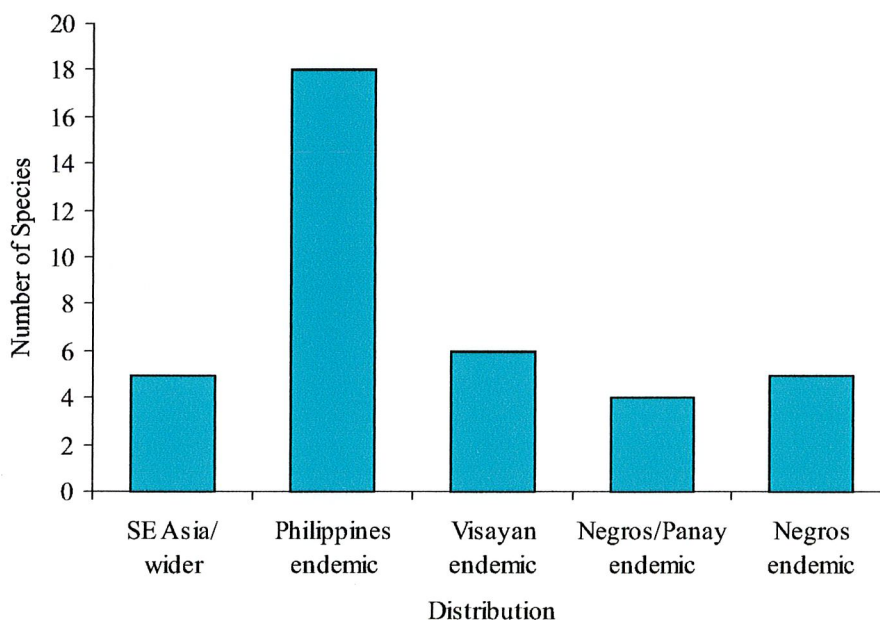


Figure 3.2. Classification of species identified according to their geographical ranges.

A comparative study of the butterfly faunas between the different forest types was also undertaken by Slade (2001). Altogether 701 individuals of 29 species from the five main Lepidopteran families (Satyridae, Nymphalidae, Pieridae, Papilionidae and Danaidae) were observed; 214 individuals of 27 species in the highly disturbed forest at the Dam, 256 individuals of 17 species in the intermediately disturbed forest at Eroplano, and 231 species of 18 species in the old-growth forest at Mawa. While the most individuals were recorded at Eroplano, the Dam had the highest species richness, and Mawa had the highest diversity (Simpson's Diversity Index). Mawa has a much more equitable distribution of species (Simpson's Equitability Index) compared to the other two sites, which accounts for the higher diversity value (Table 3.3). However, equitability was low for all sites, the highest equitability value being 0.439 (maximum equitability has a value of 1).

There are also differences in butterfly diversity, richness and equitability between the two transects at each of the sites, indicating possible responses to habitat heterogeneity within the sites. At the Dam site, TE has a higher equitability and therefore higher diversity than TF, and at Mawa, TG has fewer individuals, a slightly lower equitability, but higher species richness, and therefore a slightly higher diversity than TH. The Eroplano site has the least variability, with similar species richness, diversity and equitability.

Table 3.3. Number of individuals, species richness, diversity and equitability for each site, and each transect within the sites.

Indices	TE	TF	Dam	TC	TD	Eroplano	TG	TH	Mawa
Number Individuals	111	103	214	132	124	256	91	140	231
Species Richness	19	21	27	14	15	17	17	13	18
Diversity Index (Simpson's)	8.503	5.286	7.018	4.848	4.475	4.708	8.111	6.98	7.907
Equitability Index (Simpson's)	0.448	0.252	0.26	0.346	0.298	0.277	0.477	0.54	0.439

Of the 29 species recorded, 52% occurred in all three sites, 37% in only one site, and 19% in two sites. Voucher specimens have been collected for all species identified, and a full inventory of all species in family groups is given in Table 3.4. The results presented are partially based on the work of Slade (2001) who undertook research at the NRCP.

It is proposed that the collection of unidentified species will continue into 2002 in order to provide a complete inventory for each forest type. Collected specimens will be managed and maintained by NFEFI for use in their education work.

Table 3.4. Summary accounts of the butterfly species collected from the NNFR.

Family	Species	Distribution
Satyridae	<i>Mycalesis georgi canlaon</i>	Philippines
	<i>Mycalesis ita teatus</i>	Philippines
	<i>Mycalesis perseus caesonia</i>	Asia
	<i>Melanitis leda leda</i>	Asia
	<i>Melanitis boisduvalia boisduvalia</i>	Philippines
	<i>Melanitis atrax cajetana</i>	Philippines
	<i>Lethe chandica byzaccus</i>	Asia
	<i>Ptychandra leucogyne</i>	Philippines
	<i>Ypthima stelleria stelleria</i>	Philippines
	<i>Acrophtalmia yamashitai</i>	Visayans
	<i>Zethera musides</i>	Visayans
	<i>Elymnias sausoni</i>	Cebu, Negros
	<i>Ragadia luzonia negrosensis</i>	Philippines
	<i>Faunis phaon carfinia</i>	Philippines
	<i>Amathusia phidippus pollicaris</i>	Asia
	<i>Discophora ogina pulchra</i>	Philippines
Pieridae	<i>Eurema hecabe hecabe</i>	China & Philippines
	<i>Catopsilia pomona pomona</i>	Asia
	<i>Appias phoebe montana</i>	Philippines
	<i>Cepora boisduvalia novum</i>	Philippines
	<i>Delias henningia henningia</i>	Philippines & Borneo
	<i>Delias hyparete panayensis</i>	Asia
Papilionidae	<i>Papilio rumanzovia</i>	Philippines (exc. Palawan)
	<i>Papilio hystapes</i>	Philippines (exc. Palawan)
	<i>Troides rhadamantus</i>	Philippines (exc. Palawan)
	<i>Atrophaneura semperi baglantis</i>	Philippines
	<i>Graphium eurypylus gordion</i>	SE Asia
	<i>Graphium sarpedon sarpedon</i>	Asia
Nymphalidae	<i>Lexias satrapes amlana</i>	Philippines
	<i>Tanaecia howarthii</i>	Negros
	<i>Charaxes amycus negrosensis</i>	Philippines
	<i>Cyrestis maenalis negros</i>	SE Asia
	<i>Rhinopalpa polynice panayana</i>	SE Asia
	<i>Junonia almana almana</i>	Asia
	<i>Junonia hedonia ida</i>	SE Asia
	<i>Limenitis jumaloni jumaloni</i>	Negros & Sibuyan
	<i>Hypolimnias anomala anomala</i>	SE Asia
Danaidae	<i>Hypolimnias bolina philippensis</i>	Australia, SE Asia
	<i>Euploea mulciber kochi</i>	SE Asia
	<i>Ideopsis gaura canlaonii</i>	SE Asia
	<i>Parantica luzonensis luzonensis</i>	SE Asia
Lycaenidae	<i>Parantica vitrina oenone</i>	Philippines
	<i>Lampides boeticus</i>	Asia & Africa
	<i>Zizina otis oriens</i>	Asia
Hesperiidae	<i>Jamides alecto manilana</i>	Asia
	<i>Odontoptilum spp</i>	

3.4 Bird surveys

The collective observation and mist-netting surveys within the selected areas of the NNFR resulted in the positive identification of 123 bird species from 40 avian families. This represents approximately 20% of all species (576 in total) known to occur in the Philippines (Kennedy *et al.* 2000). The complete inventory (Table 3.6) includes 104 resident breeding species, which represents 55% of the 189 breeding resident species known to occur on Negros (Peterson *et al.* 2000).

Based on the work of Brooks *et al.* (1992) at least 19 forest species currently listed as threatened (vulnerable, endangered or critically endangered) are likely to be located in the NNFR (Table 3.5) based on known distribution and habitat preferences. A further 9 species, currently or previously listed as near-threatened are also likely to be present in the NNFR (Table 3.5).

Subspecies & Endemics

Within the current study over 30% of all full species identified within the NNFR are endemic to the Philippines, a further 35% of the inventory total were endemic sub-species restricted to smaller geographical ranges or island groups within the archipelago (Dickinson *et al.* 1991), such as the Negros-Panay Faunal region. The diversity of the avifauna of the Philippines is therefore further increased by this sub-specific differentiation of many polytypic species and Brooks *et al.* (1992) stresses the importance of Negros for sub-specific endemic bird species when conserving biological diversity.

The current work has identified 45 sub-species in the NNFR (Table 3), all of which are considered endemic to the Philippines (Dickinson *et al.* 1991, Kennedy *et al.* 2000) and nearly half would be considered as forest dependent species (based on Brooks *et al.* 1992). In addition to their endemism and habitat dependency, several sub-species are restricted to particular biogeographical areas within the Philippines (see Table 3). For example, *D. j. philippensis*, *C. s. panayensis*, *S. f. oenochlamys*, *P. t. nigrorum*, *E. p. panayensis*, *A. s. magnifica*, *D. t. dorsale*, and *Z. e. siquihorensis* are all restricted to the Negros-Panay Faunal region. Additionally *B. m. brunneiceps*, *T. p. nigrorum*, and *Z. p. pectoralis* are restricted to Negros Island only, based on known distributions from Kennedy *et al.* (2000).

Fortunately the avifauna of the Philippines has been previously been documented in some detail (Dickinson *et al.* 1991), and a previous inventory survey on the avifauna in a restricted area of the NNFR was completed by Brooks *et al.* (1992). This permits a (limited) comparison of species presence using the work of Dickinson *et al.* (1991) from which to generate expected species records for the NNFR (based on known distributions and habitat preferences) and observed records using the inventory data of Brooks *et al.* (1992) and the current study. Clearly it does not give an accurate indication of the change in species numbers over time but it does give some indication of the overall species numbers supported by the NNFR and its potential conservation value.

There are obviously certain caveats with a data comparison of this nature, regarding surveyor effort, habitat focus and survey area in data collection. However, it permits comparison of the threatened and near-threatened species recorded by both studies and the change in status of certain species (Table 3.5), and it serves to illustrate the relative importance of the NNFR for forest-dependent species, restricted range species (Figure 3.3) and endemic species (Figure 3.4). The current study recorded 45% of all species previously recorded and 55% of breeding resident species previously recorded on Negros Island as a whole. However, only 58% of the

forest-dependent species listed by Brooks *et al.* (1992) were recorded. It is also evident that the NNFR supports a high proportion of endemic species (Figure 3.4) in comparison to the total number recorded for the whole island. It should be stressed that these figures are based on full species and if sub-species are considered the totals rise in each category to 56 intra-archipelago endemics, 12 Negros-Panay endemics, and 3 endemics only found on Negros Island.

The current study recorded 62 of the 109 forest species previously listed by Brooks *et al.* (1992) and recorded 31 species that were listed as forest-dependent but not recorded by Brooks *et al.* (1992) in the NNFR, and 70% of these new records are endemic to the Philippines.

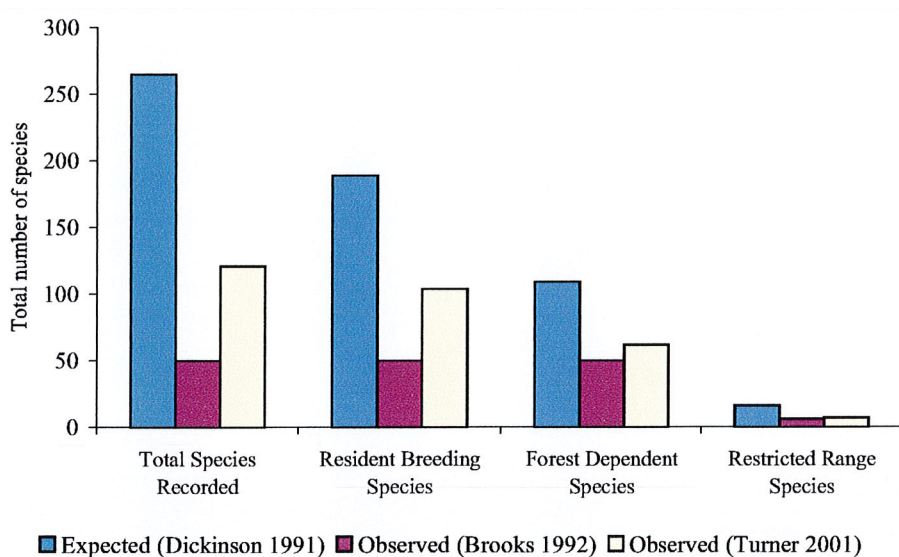


Figure 3.3. Comparison of numbers of species expected to occur in the NNFR (based on known distributions) and number of species observed in the NNFR.

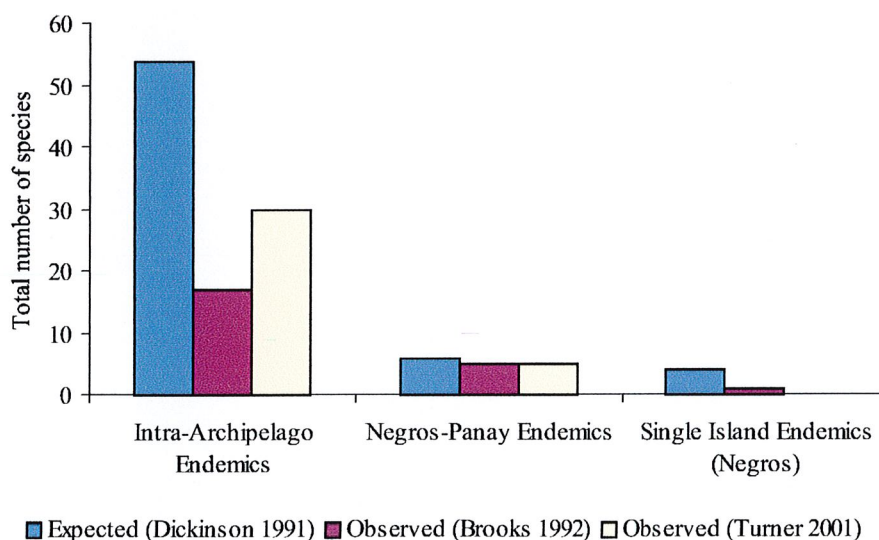


Figure 3.4. A comparison of endemic species expected to occur in the NNFR (based on known distributions) and number of species observed in the NNFR.

Expected Threatened Species of the NNFR	Restricted Range		Philippines	Brooks 1992 ⁺	Turner 2001 ⁺	Altitudinal Limit (m)	Geographical Range
	Range	Endemic					
Japanese Night Heron	<i>Gorsachius goisagus</i>	N	N	N (t)	N (vu)	1200	Luz, Mind, Neg & Pal
Philippine Hawk-eagle	<i>Spizaetus philippensis</i>	N	Y	N (nt)	Y (vu)	1900	Philippines
Negros Fruit-dove	<i>Ptilinopus arcamus</i>	Y	Y	N (t)	N (cr)	1100	Neg
Negros Bleeding-heart	<i>Gallicolumba keayi</i>	Y	Y	Y (t)	Y (cr)	1200	Neg & Pan
Philippine Cockatoo	<i>Cacatua haematurpygia</i>	N	Y	N (t)	N (cr)	1100	Philippines
Blue-naped Parrot	<i>Tanygnathus lucionensis</i>	N	Y	N (t)	Y (nt) [?]	1000	Philippines
Whitehead's Swiftlet	<i>Collocalia whiteheadi</i>	N	Y	N	N (vu)	>1000	Mind, Luz, Neg
Rufous-lored Kingfisher	<i>Halcyon winchelli</i>	N	Y	N (nt)	Y (vu)	1000	South Philippines
Visayan Tarictic Hornbill	<i>Penelopides p. panini</i>	Y	Y	Y (t)	Y (en)	1500	Neg & Pan
Walden's Hornbill	<i>Aceros waldeni</i>	Y	Y	Y (t)	Y (cr) [?]	1000	Neg & Pan
White-winged Cuckoo shrike	<i>Coracina ostenta</i>	Y	Y	Y (t)	Y (vu)	2000	Neg, Gui & Pan
Negros Striped-babbler	<i>Stachyris nigrorum</i>	Y	Y	N (t)	N (en)	>1000	Neg
Flame-templed Babbler	<i>Stachyris speciosa</i>	Y	Y	Y (t)	Y (en)	1000	Neg & Pan
White-throated Jungle-flycatcher	<i>Rhinomyias albigularis</i>	Y	Y	N (t)	N (en)	1500	Neg, Gui & Pan
Ashy-breasted Flycatcher	<i>Muscicapa randi</i>	Y	Y	N	N (vu)	1200	Neg & Luz
Celestial Monarch	<i>Hypothymis coelestis</i>	Y	Y	N (t)	N (vu)	1000	Mind, Neg, Sam & Luz
Visayan Flowerpecker	<i>Dicaeum haematostictum</i>	Y	Y	Y	Y (vu)	1000	Neg & Pan
Scarlet-collared Flowerpecker	<i>Dicaeum retrocinctum</i>	Y	Y	N (t)	N (vu)	1000	Neg & Pan
Green-faced Parrot-finch	<i>Erythrura viridifacies</i>	Y	Y	N (t)	N (vu)	>1000	Neg & Luz
Java Sparrow	<i>Padda oryzivora</i>	N	N	N	Y (vu)	1000	S.E. Asia
Expected Near -threatened species							
Tabon Scrubfowl	<i>Megapodius cumingi pusillus</i>	N	Y	Y (nt)	Y	1500	Philippines
Spotted Button-quail	<i>Turnix ocellata</i>	Y	Y	N	N (nt)	2200	Neg & Luz
Pink-bellied Imperial-pigeon	<i>Ducula poliocephala</i>	N	Y	Y	Y (nt)	1500	Philippines
Nicobar Pigeon	<i>Caloenas nicobrica</i>	N	Y	N (nt)	N	<1000	Min, Neg, & Pal
Blue-crowned Raquet-tail	<i>Prioniturus discurnus</i>	N	Y	N (nt)	Y	1500	Philippines
Philippine Needletail	<i>Mearnsia picina</i>	Y	Y	N	Y (nt)	1000	Min, Neg, Ceb, Sam & Ley
Indigo-banded Kingfisher	<i>Alcedo cyanopecta</i>	N	Y	N (nt)	N	1500	North Philippines
Spotted Wood-Kingfisher	<i>Actenoides bryndayi</i>	N	Y	N (nt)	Y	1200	Neg, Pan & Luz
Rufous-paradise Flycatcher	<i>Terpsiphone cinnamomea</i>	N	Y	N (nt)	Y	1200	Philippines

Status in parenthesis. ⁺ Collar & Andrew. (1988) and ^{*} Collar *et al.* (1999). t: threatened; vu: vulnerable; en: endangered; cr: critical; nt: near-threatened. The Philippine Mallard (*Anas luzonia*) and Streaked Reed Warbler (*Acrocephalus sorghophilus*) [listed as 'vulnerable'] are not included due to absence of preferred habitat in the NNFR. [?] Unconfirmed sighting (see text). Altitudinal and geographical range from Kennedy *et al.* (2000). Ceb: Cebu; Gui: Guimaras; Ley: Leyte; Luz: Luzon; Mind: Mindanao; Min: Mindoro; Neg: Negros; Pal: Palawan; Pan: Panay; Sam: Samar. Philippines: All Pleistocene island groups as defined by Peterson *et al.* (2000).

Table 3.5. Threatened and near-threatened species predicted to be present and those located in the NNFR, by Brooks *et al.* (1992) and the current study

Table 3.6. Inventory of bird species located within the NNFR.

Family	Common name	Scientific name
Accipitridae	Barred Honeybuzzard	<i>Pernis celebensis steeri</i>
Accipitridae	Brahminy Kite	<i>Haliastur indus intermedius</i>
Accipitridae	White-bellied Sea-Eagle	<i>Haliaetus leucogaster</i>
Accipitridae	Grey-headed Fishing-Eagle	<i>Ichthyophaga Ichthyaetus</i>
Accipitridae	Crested Serpent-Eagle	<i>Spilornis cheela holospilus</i>
Accipitridae	Japanese Sparrowhawk	<i>Accipiter g. gularis</i>
Accipitridae	Crested Goshawk	<i>Accipiter trivirgatus extimus</i>
Accipitridae	Chinese Goshawk	<i>Accipiter soloensis</i>
Accipitridae	Rufous-bellied Eagle	<i>Hieraaetus kienerii formosus</i>
Accipitridae	Philippine Hawk-Eagle	<i>Spizaetus philippinensis</i>
Falconidae	Philippine Falconet	<i>Microhierax erythrogenys</i>
Falconidae	Peregrine Falcon	<i>Falco peregrinus ernesti</i>
Megapodiidae	Tabon Scrubfowl	<i>Megapodius cumingii pusillus</i>
Phasianidae	Red Junglefowl	<i>Gallus g. philippensis</i>
Rallidae	Slaty-breasted Rail	<i>Gallirallus s. striatus</i>
Columbidae	White-eared Brown-Dove	<i>Phapitreron leucotis nigrorum</i>
Columbidae	Amethyst Brown-Dove	<i>Phapitreron amethystina maculipectus</i>
Columbidae	Pink-bellied Imperial-Pigeon	<i>Ducula poliocephala</i>
Columbidae	Reddish Cuckoo-Dove	<i>Macropygia phasianella tenuirostris</i>
Columbidae	Island Collared-Dove	<i>Streptopelia bitorquata dusumieri</i>
Columbidae	Spotted Dove	<i>Streptopelia chinensis tigrina</i>
Columbidae	Zebra Dove	<i>Geopelia s. striata</i>
Columbidae	Common Emerald-Dove	<i>Chalcophaps i. indica</i>
Columbidae	Negros Bleeding-heart	<i>Gallicolumba keayi</i>
Psittacidae	Blue-naped Parrot	<i>Tanignathus lucionensis salvadorii</i>
Psittacidae	Blue-crowned Racquet-tail	<i>Prioniturus discurus</i>
Cuculidae	Chestnut-winged Cuckoo	<i>Clamator coromandus</i>
Cuculidae	Hodgson's Hawk-Cuckoo	<i>Cuculus fugax pectoralis</i>
Cuculidae	Plaintive cuckoo	<i>Cacomantis m. merulinus</i>
Cuculidae	Brush Cuckoo	<i>Cacomantis variolosus sepulcralis</i>
Cuculidae	Gould's Bronze-cuckoo	<i>Chrysococcyx russatus</i>
Cuculidae	Common Koel	<i>Eudynamys scolopaea mindanensis</i>
Cuculidae	Philippine Coucal	<i>Centropus v. viridis</i>
Tytonidae	Grass Owl	<i>Tyto capensis amaurota</i>
Strigidae	Philippine Scops-Owl	<i>Otus megalotis nigrorum</i>
Strigidae	Philippine Hawk-Owl	<i>Ninox philippensis centralis</i>
Podargidae	Philippine Frogmouth	<i>Batrachostomus septimus menagei</i>
Caprimulgidae	Grey Nightjar	<i>Caprimulgus indicus jotaka</i>
Caprimulgidae	Philippine Nightjar	<i>Caprimulgus m. manillensis</i>
Apodidae	Island Swiftlet	<i>Collocalia vanikorensis amelis</i>
Apodidae	Philippine Swiftlet	<i>Collocalia mearnsi</i>
Apodidae	Glossy Swiftlet	<i>Collocalia esculenta marginata</i>
Apodidae	Pygmy Swiftlet	<i>Collocalia troglodytes</i>
Apodidae	Philippine Needletail	<i>Mearnsia picina</i>
Apodidae	Purple Needletail	<i>Hirunapus celebensis</i>
Apodidae	Fork-tailed Swift	<i>Apus p. pacificus</i>
Apodidae	Asian Palm-Swift	<i>Cypsiurus balasiensis pallidior</i>
Apodidae	Whiskered Treeswift	<i>Hemiprocne comata</i>
Alcedinidae	Rufous-lore Kingfisher	<i>Halcyon winchelli nigrorum</i>
Alcedinidae	White-collared Kingfisher	<i>Halcyon chloris collaris</i>

Family	Common name	Scientific name
Alcedinidae	Spotted Wood-Kingfisher	<i>Actenoides lyndsayi moseleyi</i>
Meropidae	Blue-tailed Bee-eater	<i>Merops p. philippinus</i>
Coraciidae	Dollarbird	<i>Eurystomus orientalis cyanocollis</i>
Bucerotidae	Visayan Tarictic Hornbill	<i>Penelopides p. panini</i>
Bucerotidae	Writhe-billed Hornbill	<i>Aceros waldeni</i>
Picidae	White-bellied Woodpecker	<i>Dryocopus javanensis philippinensis</i>
Picidae	Philippine Pygmy Woodpecker	<i>Dendrocopos m. maculatus</i>
Hirundinidae	Barn Swallow	<i>Hirundo rustica gutturalis</i>
Hirundinidae	Pacific Swallow	<i>Hirundo tahitica javanica</i>
Campephagidae	Bar-bellied Cuckoo-shrike	<i>Coracina striata panayensis</i>
Campephagidae	White-winged Cuckoo-shrike	<i>Coracina ostenta</i>
Campephagidae	Pied Triller	<i>Lalage nigra chilensis</i>
Campephagidae	Scarlet minivet	<i>Pericrocotus flammeus novus</i>
Pycnonotidae	Yellow-vented Bulbul	<i>Pyconotus g. goiavier</i>
Pycnonotidae	Philippine Bulbul	<i>Hypsipetes philippinus guimarasensis</i>
Dicruridae	Balicassiao	<i>Dicrurus balicassius mirabilis</i>
Corvidae	Large-billed Crow	<i>Corvus macrorhynchos philippinus</i>
Paridae	Elegant Tit	<i>Parus elegans albescens</i>
Sittidae	Velvet-fronted Nuthatch	<i>Sitta frontalis oenochlamys</i>
Rhabdornithidae	Stripe-headed Rhabdornis	<i>Rhabdornis mystacalis</i>
Timaliidae	Flame-templed Babbler	<i>Stachyris speciosa</i>
Tiuridae	White-browed Shortwing	<i>Brachypteryx montana brunneiceps</i>
Tiuridae	Oriental Magpie-Robin	<i>Copsychus saularis mindanensis</i>
Tiuridae	White-browed Shama	<i>Copsychus luzoniensis supercilialis</i>
Tiuridae	Pied Bushchat	<i>Saxicola caprata randi</i>
Tiuridae	Blue Rock-Thrush	<i>Monticola solitarius philippensis</i>
Tiuridae	Island Thrush	<i>Turdus poliocephalus nigrorum</i>
Sylviidae	Arctic Warbler	<i>Phylloscopus borealis ?</i>
Sylviidae	Philippine Leaf-Warbler	<i>Phylloscopus olivaceus</i>
Sylviidae	Lemon-throated Leaf-Warbler	<i>Phylloscopus c. cebuensis</i>
Sylviidae	Mountain Leaf-Warbler	<i>Phylloscopus trivirgatus nigrorum</i>
Sylviidae	Tawny Grassbird	<i>Megalurus timoriensis tweedalei</i>
Sylviidae	Striated Grassbird	<i>Megalurus palustris forbesi</i>
Sylviidae	Philippine Tailorbird	<i>Orthotomus canasteiceps rabori</i>
Sylviidae	Bright-capped Cisticola	<i>Cisticola excilis semifufa</i>
Sylviidae	Zitting Cisticola	<i>Cisticola juncidis tinnabulans</i>
Muscicapidae	Grey-streaked Flycatcher	<i>Muscicapa griseisticta</i>
Muscicapidae	Mountain Verditer-Flycatcher	<i>Eumyias p. panayensis</i>
Muscicapidae	Little Pied Flycatcher	<i>Ficedula westermanni rabori</i>
Muscicapidae	Mangrove Blue Flycatcher	<i>Cyornis rufigastrea philippinensis</i>
Muscicapidae	Citrine Canary-Flycatcher	<i>Culicapa helianthea panayensis</i>
Muscicapidae	Blue-headed Fantail	<i>Rhipidura cyaniceps albiventris</i>
Muscicapidae	Pied Fantail	<i>Rhipidura javanica nigritorquis</i>
Muscicapidae	Black-naped Monarch	<i>Hypothymis azurea</i>
Muscicapidae	Rufous Paradise-Flycatcher	<i>Tersiphone cinnamomea unirufa</i>
Pachycephalidae	White-vented Whistler	<i>Pachycephala homeryeri winchelli</i>
Motacillidae	Grey Wagtail	<i>Motacilla cinerea robusta</i>
Motacillidae	Yellow Wagtail	<i>Motacilla flava simillima</i>
Motacillidae	Olive Tree-Pipit	<i>Anthus h. hodgsoni</i>
Motacillidae	Richard's Pipit	<i>Anthus novaeseelandiae lugubris</i>
Artamidae	White-breasted Wood-swallow	<i>Artamus l. leucorhynchus</i>
Laniidae	Brown Shrike	<i>Lanius cristatus lucionensis</i>
Laniidae	Long-tailed Shrike	<i>Lanius schach nasutus</i>

Family	Common name	Scientific name
Sturnidae	Asian Glossy Starling	<i>Aplonis p. panayensis</i>
Sturnidae	Crested Myna	<i>Acridotheres c. cristatellus</i>
Sturnidae	Coledo	<i>Sarcops calvus melanonotus</i>
Nectariniidae	Plain-throated Sunbird	<i>Anthreptes malacensis chlorigaster</i>
Nectariniidae	Purple-throated Sunbird	<i>Nectarinia sperata</i>
Nectariniidae	Olive-backed Sunbird	<i>Nectaria j. jugularis</i>
Nectariniidae	Flaming Sunbird	<i>Aethopyga flagrans daphoenonota</i>
Nectariniidae	Crimson Sunbird	<i>Aethopyga siparaja magnifica</i>
Dicaeidae	Bicoloured Flowerpecker	<i>Dicaeum bicolor viridissimum</i>
Dicaeidae	Red-keeled Flowerpecker	<i>Dicaeum australe haematostictum</i>
Dicaeidae	Orange-bellied Flowerpecker	<i>Dicaeum trigonostygma dorsale</i>
Dicaeidae	Fire-breasted Flowerpecker	<i>Dicaeum ignipectus apo</i>
Zosteropidae	Everett's White-eye	<i>Zosterops everetti siquihorensis*</i>
Zosteropidae	Yellowish White-eye	<i>Zosterops n. nigrorum</i>
Zosteropidae	Mountain White-eye	<i>Zosterops montanus pectoralis</i>
Ploceidae	Eurasian Tree Sparrow	<i>Passer montanus saturatus</i>
Ploceidae	Java Sparrow	<i>Padda oryzivora</i>
Estrildidae	White bellied Munia	<i>Lonchura leucogastra manuli</i>
Estrildidae	Scaly-breasted Munia	<i>Lonchura punctulata cabanisi</i>
Estrildidae	Chestnut Munia	<i>Lonchura malacca jagori</i>

3.5 Mammal surveys

The preliminary inventory of mammals (Table 3.7) already indicates that the NNFR is a key site for the endangered mammal fauna of the Philippines, yet this is far from the definitive inventory. The Visayan Spotted Deer and Visayan Warty Pig; two of the most endangered animals in the world are known to be present in the NNFR. The NRCP has only located tracks of the deer, but there have been frequent sightings of the warty pigs and other larger mammal species.

With regard to mist-netting, the majority of the recordings consist of fruit bats, in particular, *Cynopterus brachyotis* and *Haplonycteris fischeri*. Another species, *Nyctimene rabori*, was previously thought only to occur in Southern Negros, being restricted to undisturbed, primary, lowland forest but has now been caught in heavily disturbed, regrowth forest near the NRCP research centre. This bat species is classified as IUCN critically endangered, being rare or uncommon in all known sites, and facing extinction on Negros (Heaney *et al*, 1998).

The observation and live trapping work has also located Long-tailed macaques (*Macaca fascicularis*) close to the research centre and within the survey sites between December and July. Two sites have been identified as being particularly important: Baldusa Falls and Hiyang-Hiyang. Common palm civets (*Paradoxurus hermaphroditus*), Malay civets (*Viverra zangalunga*) and an array of small mammals (Table 3.7) have all been caught are also known to be active in all areas surveyed. No specimens have been taken thus far.

Table 3.7. Preliminary inventory of mammal species located within the NNFR.

Family	Species	Status (IUCN)	Geographical Distribution	Endemic species
Cervidae	Visayan Spotted Deer (<i>Cervus alfredi</i>)	Endangered	Negros-Panay	yes
Suidae	Visayan Warty Pig (<i>Sus cebifrons</i>)	Endangered	Negros-Panay	yes
Pteropodidae	*Philippine dwarf fruit bat (<i>Haplonycteris fischeri</i>)	Vulnerable	Philippines	yes
	*Philippine tube-nosed fruit bat (<i>Nyctimene rabori</i>)	Endangered	Cebu, Negros	yes
	*Harpy fruit bat (<i>Harpyionycteris whiteheadi</i>)	Common	Philippines	yes
	*Short-nosed fruit bat (<i>Cynopterus brachyotis</i>)	Common	Southeast Asia	no
	*Musky fruit bat (<i>Pterochirus jagori</i>)	Common	Philippines	yes
	*Long-tongued nectar bat (<i>Macroglossus minimus</i>)	Common	Southeast Asia	no
Megadermatidae	*Common Asian ghost bat (<i>Megaderma spasma</i>)	Common	Southeast Asia	no
Rhinolophidae	*Yellow-faced horseshoe bat (<i>Rhinolophidae virgo</i>)	Common	Philippines	yes
Soricidae	*Asian house shrew (<i>Suncus murinus</i>)	Common	Asia	no
Muridae	*Oriental house rat (<i>Rattus tanezumi</i>)	Common	Asia-Pacific	no
	*Polynesian rat (<i>Rattus exulans</i>)	Common	Asia-Pacific	no
	*House mouse (<i>Mus musculus</i>)	Common	Global	no
Cercopithecidae	Long-tailed macaque (<i>Macaca fascicularis</i>)	Common	Southeast Asia	no
Viverridae	*Common palm civet (<i>Paradoxurus hermaphroditus</i>)	Common	Asia	no
	*Malay civet (<i>Viverra zangalunga</i>)	Common	Southeast Asia	no

Status from WCSP (1997), Geographical distribution from Heaney *et al* (1998)

* Species directly sampled from the different forest habitat types within the NNFR. All species were live-trapped and released after identification and documentation of biometric data. The presence of the other species list has been documented by direct or indirect observation (such as presence of tracks).

4. Discussion

4.1 Biodiversity Status of the NNFR

The preliminary results of the NRCP confirm that the NNFR is an important biodiversity hotspot supporting a huge diversity of endemic and endangered species. This best highlighted by the butterfly species data that indicates that approximately 84% of the species caught were endemic to the Philippines and over 35% were endemic to the Visayan region.

The biodiversity importance of the NNFR is further supported by the bird survey data that reinforces the findings of earlier work (Brooks *et al*, 1992; Dickinson *et al*, 1991), stressing the importance of the NNFR as a vital tract of montane forest habitat on which many avian species depend. Birdlife International identifies the NNFR and Negros as a whole as part of an Endemic Bird Area [EBA] and in terms of biodiversity conservation it has been classified as 'priority critical' (Stattersfield *et al* 1996). The initial outputs of the NRCP surveys reinforce this status with respect to the number of overall species, number of endemic species and numbers of endangered species, including the tarictic hornbill (*Penelopides panini*) and the flame templed babbler (*Stachyris speciosa*), sighted with in the survey areas of the NNFR.

The mammal survey work of the NRCP also serves to underline the biodiversity importance of the NNFR with observation studies locating two key areas of activity for Crab-eating macaques (*Macaca fascicularis*) in close vicinity to Campuestohan. The NRCP survey teams have also located several signs and evidence of the Visayan endemic and endangered (WCSP 1997) Philippine warty pig (*Sus cebifrons*). The Philippines has 3 species and 5 sub-species of wild pig, being the second most important country in the world for the diversity of these animals. However, *S. cebifrons* has been extirpated from over 95% of its former range in the Visayan region, and it is already extinct or close to extinction on four of the six islands on which it occurs. The NNFR may therefore represent one of the last remaining habitat strongholds for this species.

In addition to the faunal work, the botanical inventory work of the NRCP has lead to the establishment of extensive and detailed coded data records for all six PSPs established within three different forest habitat types. This will enable the NRCP team (on completion of flora identification work), to complete botanical inventories for each of the PSPs which would allow the relative frequency, density and dominance to be calculated for each species (Hamann *et al*, 1999). This data can also be examined to see whether individual species show pronounced seasonality in their fruiting and flowering. Such outputs can then be compared between habitat types and to previous studies (Hamann *et al*, 1999). This basic data will form the foundation for future management recommendations derived from the outputs of multivariate analysis relating habitat structure and composition to other abiotic and biotic variables.

4.2 NNFR Management

Ecologically sound forest management, whether for conservation alone or in conjunction with material extractions, will only be successful if the dynamic behaviour of the ecological systems can be adequately characterised and predicted: an emphasis that is likely to increase as sustainable management initiatives develop (Sheil 1995). PSP studies (as designed for the NRCP) provide us with an opportunity to assess ecological changes in the forest over time and

space, and therefore have a central role in many aspects of tropical forest conservation and management (Condit 1995).

The NNFR, like most forested areas that require sustainable management plans, have either been exploited for timber or are being converted to other economic land uses such as agriculture. In order to propose management recommendations for the conservation of biodiversity, its sustainable use and the equitable sharing of benefits it will be necessary to better understand the forest's ecological response to different intensities of logging or other extractive uses. Such an understanding can only be developed if extensive data on the forest are available, via PSP data and other sources. Such information is also invaluable for understanding the dynamics of the forest communities, and therefore developing sustainable management plans.

4.3 NRCP Future

In order to attain the necessary ecological information, the PSPs will have to be established for a number of years (>5yrs) in order to provide adequate data to give meaningful insight into the dynamics of the forest. However, data from PSPs will need to be combined with other sources of data/information (ecological, geographical, socio-economic) regarding the forest, its goods and services, and threats in order to develop an appropriate management plan. The current monitoring and survey strategy of the NRCP, will generate much useful empirical data for the development of management recommendations in the short term (1-3yrs) but a much greater insight will result from longer term studies (3-10yrs). In addition to this, the NRCP data sets will need to be combined with others (GIS, socio-economic) in order to develop a fully comprehensive management plan. Such an approach may permit the classification of remotely sensed imagery and the production of terrestrial habitat maps. It also provides a vital inventory for Philippines DENR/PAWB, and a baseline for comparison to other areas within this faunistic region of the Philippines.

Issuance of a new Gratuitous Permit will allow the NRCP to continue undertaking comprehensive density and distribution surveys for all faunal groups within each PSP. It will also permit completion of a complete botanical inventory of each PSP, which will enable the NRCP to better understand the dynamics of each forest habitat type and therefore be in a stronger position to propose management recommendations.

5. Acknowledgements

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