Protected Areas Management and Wildlife Conservation Project

ADB Loan Number 1767-SRI (SF)

Consultancy Services Report

BIODIVERSITY BASELINE SURVEY: HORTON PLAINS NATIONAL PARK

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ACKNOWLEDGEMENTS

It is a tribute to all members of the Biodiversity Baseline Survey team that this series of reports on each of the four protected areas surveyed has been produced within two months of completing the field surveys. The efforts and commitment of those who actually carried out the field work, often in demanding terrain and sometimes in very wet weather, were considerable. Members of the team are listed below and those who have contributed directly to the production of this document are named on the cover page as a contributor for the section covering their respective taxonomic group.

It has been a pleasure to work with the staff of the Department of Wildlife Conservation. The team appreciated the support of the four Park Wardens (A.H. Sumanasena, A.W. Rajapakse, Lakshman Pieris and Keerthi Chandraratne) and those of their staff who assisted with field work. Special thanks are due to the Director General (Dr Dayananda Kariyawasam) for his full engagement with the project; H.D. Ratnayake (Acting Director, Operations), S.R.B Dissanayake (Deputy Director, Research & Training) and M.S.L.R.P. Marasingha (Assistant Director) for their technical, logistic and other inputs; and to Kamani Abaysirigunawardena for applying her GIS skills to producing maps for these reports. Thanks are also due to Professor Sarath Kotagama for his guidance throughout the project and to Professor Linc Schmitt who spent a week's holiday generating statistical analyses of field data.

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CONTENTS

1. INTRODUCTION

Biodiversity Baseline Survey

The Biodiversity Baseline Survey is a discrete Contract within the Protected Area Management and Wildlife Conservation Project, funded by the Asian Development Bank, World Bank Global Environment Facility and the Government of the Netherlands. It has been undertaken by ARD Inc. for the Ministry of Environment in accordance with the *Contract for Consulting Services of Biodiversity Baseline Survey* (ADB Loan No. 1767 SRI (SF).

The overall aim of the Contract is to assess the current status of biodiversity within a small set of protected areas to inform their future management, using sound and practical scientific methods that can be repeated over time and applied more widely by the Department of Wildlife Conservation (DWC) to other protected areas under its remit. The Contract has been implemented during the period April 2006 – March 2007, with field work undertaken from the beginning of July 2007 until mid-January 2007.

Horton Plains National Park is one of **four protected areas** included in this Survey, chosen on account of its high importance for biodiversity within Sri Lanka's Wet Zone. The following **six taxonomic groups** were selected for purposes of the Survey on the basis of being (a) well known and of general interest to scientists and managers; (b) relatively easy to survey systematically and identify; and (c) potentially of value to protected areas management:

- Mammals
- Birds
- Amphibians
- Reptiles
- Freshwater fish
- Vascular plants

Purpose of this report in relation to contract objectives

This report documents the plant and animal species recorded by this Biodiversity Baseline Survey, assesses the richness of species found within the different habitats and considers the implications of these findings for the future management of the national park. Along with reports for the other three protected areas, it addresses six of the ten objectives outlined in the Contract (Box 1.1).

Box 1.1 **Contract objectives addressed in this report are highlighted**

1. Establish baseline data and survey protocols for future biodiversity monitoring.
2. Establish sound, repeatable field methods appropriate for local conditions.
3. Establish rigorous methods for collection and management of data and specimens.
4. **Inform management planning by defining habitat preferences and distribution of a range of fauna/flora/assemblages and threats to them.**
5. **Identify habitats with rare, endemic and ecologically/culturally important species, guilds and assemblages.**
6. **Identify natural assemblages of plants/animals.**
7. **Provide natural history information on a range of species.**
8. **Inform management practices and identification of management zones, based on #5-7 above.**
9. **Make information, especially on the importance of each PA, available for education outreach.**
10. Improve technical skills of Departmental staff by provision of on-the-job training.

This report should be read in conjunction with the Field Manual (DWC, 2007a), which documents the design of the Biodiversity Baseline Survey and methods used for sampling the different taxonomic groups in accordance with Objectives 1 and 2 of the Contract (Box 1.1). The Field Manual also describes how the field data are electronically stored and managed within a Biodiversity Information Management System and provides details about the preservation and curation of plant and animal specimens.

This report is intended for use by staff of the Department of Wildlife Conservation responsible for the management of Horton Plains National Park and the educational outreach of those who live around its perimeter or visit it. It should also be readily accessible to other professional individuals and organisations interested in adding to our knowledge of biodiversity within this site, be it through the collection of field data or further analyses.

Importantly, this report, together with the Field Manual and records from this baseline survey held in the Biodiversity Information Management System (DWC, 2007b, 2007c), provide the basis for monitoring future changes to the biodiversity of Horton Plains National Park and informing its management in so far as the constraints of the data allow.

2. HORTON PLAINS NATIONAL PARK

This section provides background information about the National Park that is relevant to this Survey. Unless otherwise indicated, it has been extracted from the current management plan (DWC, 2005) and further details can be found in the resource inventory of the previous management plan (DWC, 1997). Useful background information can also be found in IUCN (1990).

Designation, area and location

Horton Plains was designated a national park on 16 March 1988, having originally been established as a nature reserve on 5 December 1969 (Gazette Notification No. 14,883). Like other catchments in the hills, the area had received some protection under an Administrative Order issued in 1873, which prohibited felling of forests above 5,000 ft (IUCN, 1990). The place is named after Sir Robert Horton, a former British Governor, who travelled to the area to meet the Ratamahatmaya of Sabaragamuwa Province in about 1836 (Anderson, 1982).

The national park occupies an area of 3,160 ha and is contiguous with Peak Wilderness Sanctuary to the west. It lies in Nuwara Eliya District at the eastern extremity of the Central Highlands, some 32 km south of Nuwara Eliya.

Physical features

Horton Plains comprises a gently undulating highland plateau at the southern edge of Sri Lanka's central mountain massif. It is dominated by Kirigalpota (2,389 m) to the west and Totupolakanda (2,357 m) to the north, respectively second and third highest peaks in the country (Figure 1.1a). Tributaries of three major rivers drain the plateau, flowing into the Mahaweli Ganga to the north, the Kaleni Ganga to the west and the Walawe to the south (Figure 1.1b). Horton Plains serves as an important catchment area for these three rivers which have been harnessed for major irrigation and hydropower projects (Balasubramaniam *et al.*, 1989).

The geological structure of Horton Plains is made up of highly crystalline, non-fossiliferous rocks of Precambrian age, belonging to the Highland Series. They are composed of inter-banded metamorphosed sediments and Charnockite gneisses (Figure 1.1c).. The meta-sedimentary rocks are metamorphosed equivalents of sedimentary rocks such as shales, sandstones, limestones, sandy clays and calcareous sands (Coorey 1984). Soils are predominantly Red Yellow Podsols, derived from the feldspar-rich rocks of the Highland Series (Figure 1.1d). A layer of ironstone gravel, 20-30 cm thick, is found below the black organic-rich surface soil.

Climate

Horton Plains lies at the eastern extremity of the Wet Zone and experiences a subtropical monsoon climate, with a mean annual temperature of 15^{o}C and mean annual rainfall of 2150 mm. The weather is dominated by persistent cloud cover and strong winds, sometimes gale-force, during the south-west monsoon (Bastible and Gunawardena, 1996). The driest months are January and February, when temperatures may reach 27^{o}C.

Vegetation

The vegetation comprises Upper Montane Rain Forest (commonly referred to as Cloud Forest) and Wet Patana Grasslands, with a narrow ecotone belt of shrubs and herbs between the two (Figure 2.2). Forest and patana form a mosaic, with a tendency for Cloud Forest to be confined to the hilltops, mid- or upper slopes, and for the grasslands and dwarf bamboo to be on the lower slopes and in the valleys. Wetland habitats occur in the waterlogged depressions in the valleys and surrounding smaller streams. The Wet Patana Grasslands are a plagioclimax community maintained by fire and grazing

(Koelmeyer, 1957). They include tussock grass, carpet grass in areas of abandoned potato cultivation, and dwarf bamboo in valley bottoms. Main vegetation types are described, with images, in Box 2.1.

The grasslands were dominated by a bushy grass species before a potato seed farm was established in the late 1950s. After the removal of the farm in 1969, the potato cultivation beds reverted to grassland but of a different species composition. Extensive areas of Cloud Forest have suffered from canopy die-back, the cause of which is uncertain but may be related to water stress or air pollution. The area of forest die-back, first observed in the 1960s, had increased from 87 ha (2.7% of the National Park) in 1967 to 956 ha (30.7%) by 1998 (DWC, 2006).

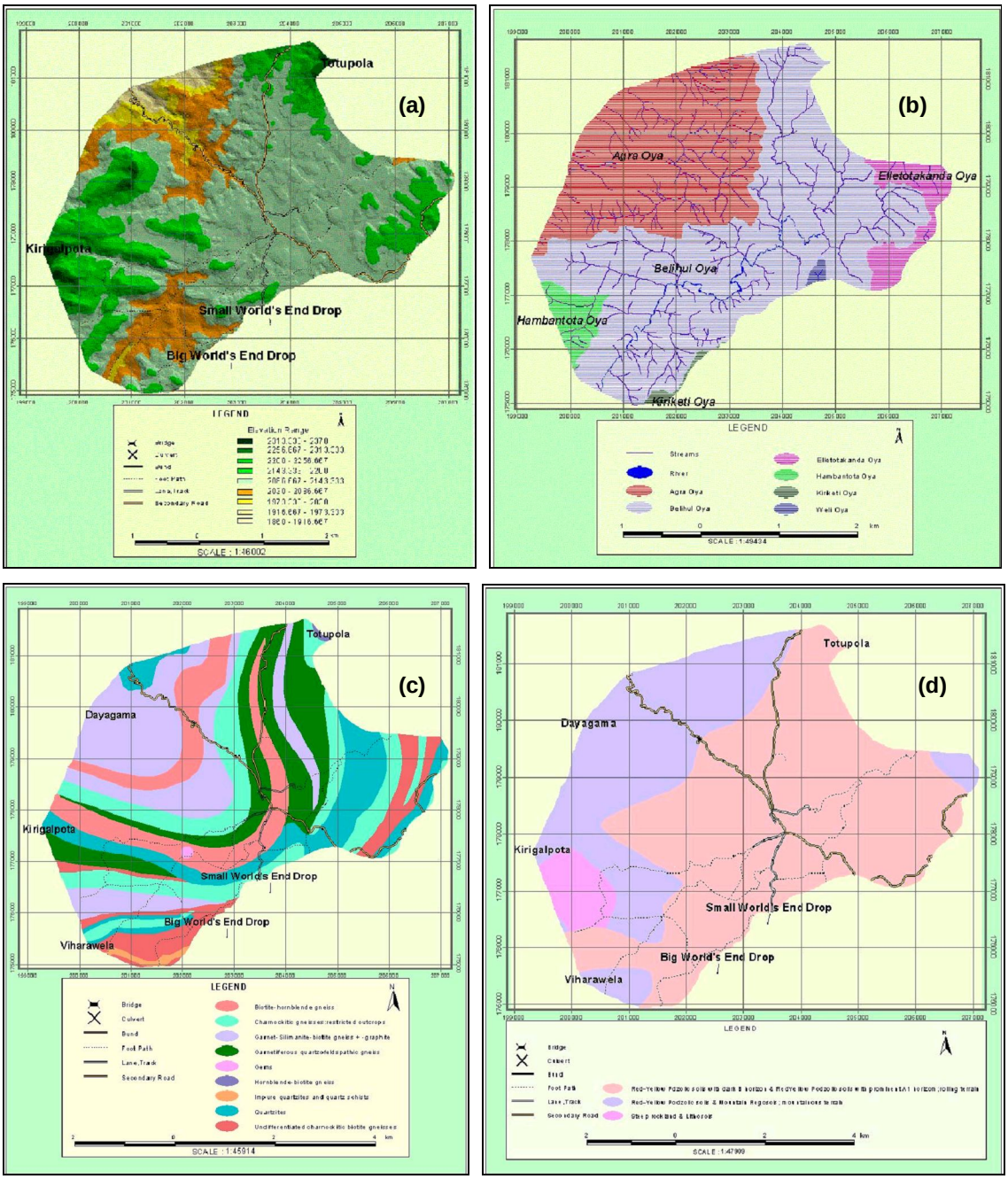


Figure 2.1 Maps of Horton Plains National Park showing (a) topography, (b) river sub-basins, (c) geology and (d) soils (Source: DWC, 2006)

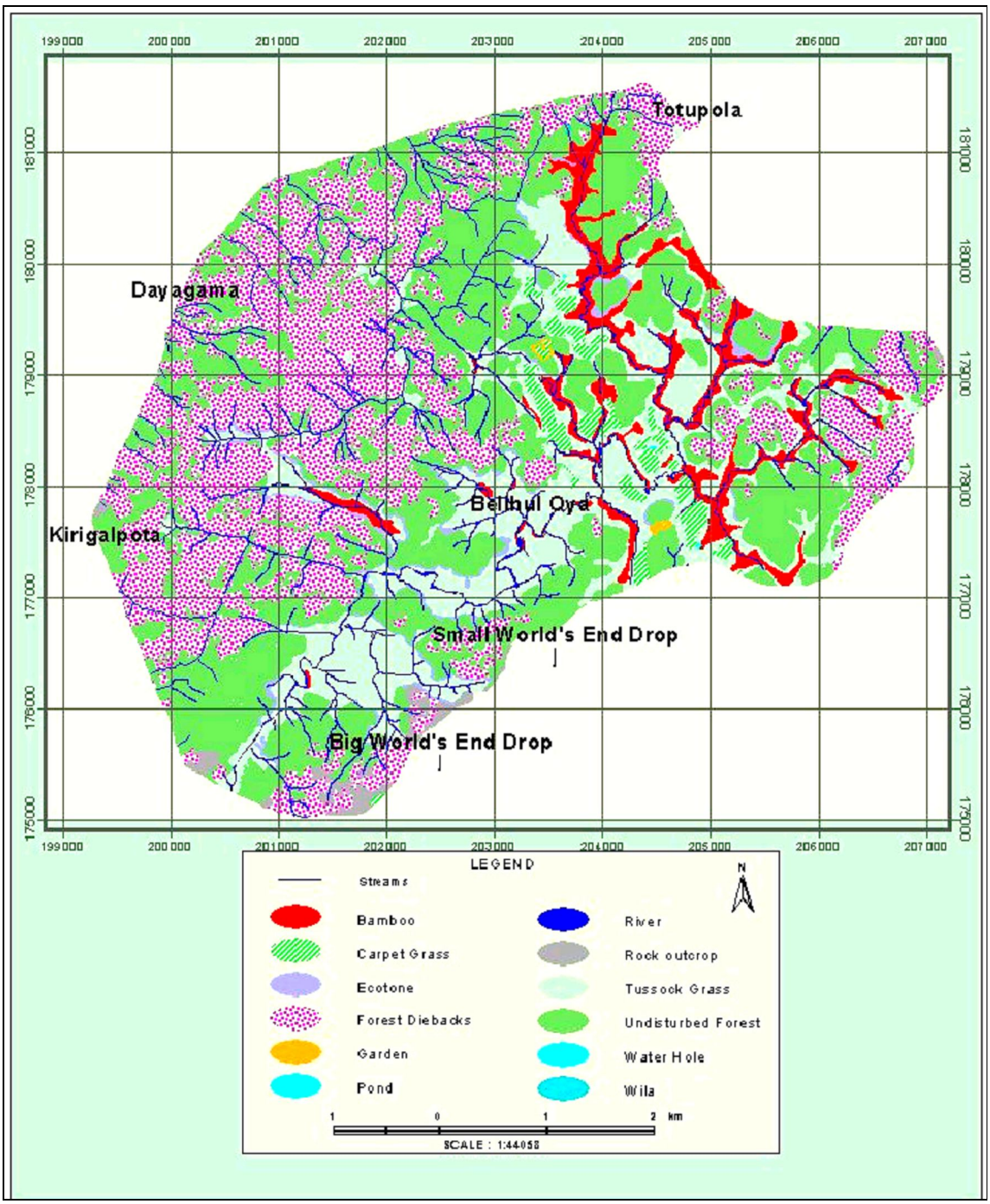
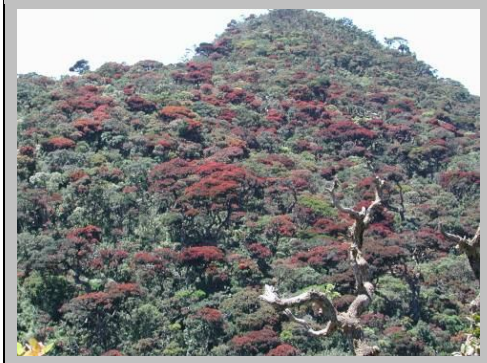


Figure 2.2 Vegetation map of Horton Plains National Park (Source: DWC, 2006)

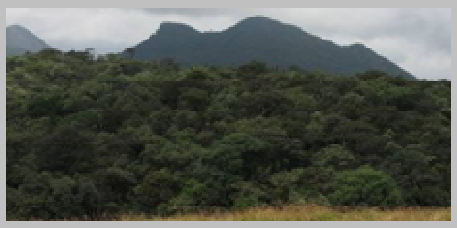
Box 2.1 **Descriptions and images of the main vegetation types in Horton Plains National Park[1] (Source: DWC, 2006)**



Cloud Forest (1,236 ha, 39.7% of total area)

Undisturbed old-growth forest is low in stature (15-20 m) and canopy trees are characteristically gnarled and twisted, like giant bonsai, due to the lower temperatures and high winds. The canopy is dominated by speciessuch as *Calophyllum walkeri, Michelia nilagirica, Syzygium rotundifolium, S. revolutum, Elaeocarpus montanus, E. glandulifer, E. coriaceous, Ilex walkeri, Cinnamomum ovalifolium, Litsea ovalifolia and Photinia* integrifolia. Emergent trees are usually absent.

The forest understory is somewhat dark but easy to access due to the low density of seedlings, saplings and herbaceous plants. Many bryophytes, epiphytes (orchids, lichens, bryophytes and ferns) and filmy ferns grow on the stems and branches of trees.

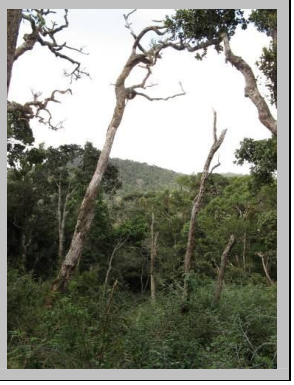


Cloud Forest Die-back (956 ha, 30.7% of total area)

The death of aging trees may be due to pathogenic/climatic die-back or natural senescence. Gaps in the canopy may be 500-1000 m^2 and occasionally exceed 1 ha. In some areas stands of dead trees are visible.

Access inside the forest is difficult due to dense undergrowth of species such as *Hedyotis* (Weraniya), *Strobilanthes spp.* (Nelu), *Sarcococca brevifolia, Euphorbia rothiana* and thorny species of *Thodalia* (Kudumiris) and *Rubus.*

In valleys and mid-slopes *Strobilanthus* spp. may dominate areas of canopy die-back areas are mainly found in. These species flower only once in a lifetime, following which the whole stand dies. Along the ridges and elsewhere, die-backareas are dominated by a mixture of species such as *Hedyotis, Knoxia, Rubus, Osbekia,* and *Sarcococca.*



Ecotone between forest and grassland
(45 ha, 1.5% of total area)

The transition zone between the Cloud Forest and Wet Patana Grasslands or disturbed areas is dominated by herbs and shrubs. Common species include *Eupatorium inulifolium, Berberis zeylanica, Rubus spp., Rhodomyrtus, Sarcococca* and *Euphorbia rothiana.*

Dwarf Bamboo (168 ha, 5.4% of total area)

The dwarf bamboo (*Arundinaria densifolia*) grows well on valley bottoms, surrounding depressions and small streams. In the past it occurred only close to streams but now has spread over a much larger area. The species is endemic to Sri Lanka and found only in Horton Plains.

Tussock Grass (574 ha, 18.4% of total area)

Grassland that has not been influenced by the potato cultivation is dominated by three species of tussock or clump grasses: *Chrysopogon nodulibarbis* and *Andropogon polyptychos* in drier locations; and the much broader leaved, taller and larger *Garnotia exaristata* in wetter situations. Tussock grasses are confined to lower slopes and valley bottoms.

Maha Ratmal (*Rhododendron arboreum*) is commonly found scattered throughout these grasslands..

Carpet Grass (64 ha, 2.0% of total area)

Carpet grass (*Axonopus fissifolius*), having the appearance of a lawn, has colonised abandoned potato terraces. The species is thought to have been introduced via manure used to fertilise the potatoes.

[1]The other significant habitat types, as shown in Figure 2, are rock outcrops (53 ha, 1.7%) and water bodies (14.8 ha, 0.5%) out of a total area of 3,114 ha, based on GIS analysis.

Flora and fauna

Biodiversity surveys and related research in recent decades include the National Conservation Review (Green and Gunawardena, 1997) and a floral survey, as part of mapping the habitat of Horton Plains (DWC, 2006). Existing knowledge about the diversity of plant and animal species is summarised in Table 2.1.

The integrity of the indigenous flora and fauna has been jeopardised to varying extents by deliberate introductions of exotic species in British colonial times. For example, gorse (*Ulex europus*) is expanding its range in grassland areas. The introduction of trout (*Oncorhynchus mykiss*) for sport fishing has resulted in the extinction of indigenous fish and, more recently, the endemic freshwater shrimp *Caridina singhalensis*. The latter was previously confined to a 10 km stretch of river (De Silva, 1982).

Horton Plains is renowned for its endemic slender loris (*Loris tardigradus*), which has been recorded only from this locality. The National Park is noted for its large sambar population, which supports a small leopard population.

Table 2.1 Diversity of plant and animal taxonomic groups recorded by previous surveys and as summarised in the current Management Plan

Survey/ Source	Taxon	Total number			
		Families	Genera	Species	Endemic species
Ratnayeke and Balasubramaniam (1989)	Woody plants	unavailable	unavailable	54	27
Floral and faunal inventory (MfC, 1994)	Flowering plants	20		102	14
	Gastropods			11	0
	Fish			1	0
	Amphibians			8	0
	Reptiles			9	7
	Birds			87	14
	Mammals			24	2
National Conservation Review (Green and Gunawardena, 1997)	Woody plants	33	56	79	42
	Butterflies	1	1	1	0
	Molluscs	2	2	2	1
	Amphibians	2	2	7	3
	Reptiles	2	4	4	4
	Birds	16	25	26	5
	Mammals	6	7	7	1
Management Plan (DCW, 2005)	Flowering plants	61	unavailable		
	Fish	1	1	1	0
	Amphibians		6	8	3
	Reptiles		6	9	7
	Birds			87	14
	Mammals			24	2
Habitat map (DWC, 2006)	Flowering plants	64	123	178	58

Management

The vision outlined in the Management Plan (DWC, 2005) for Horton Plains is to conserve its unique, rich biodiversity and cloud forest ecosystem as an environmentally friendly National Park. The management goals and objectives are reproduced in Box 2.2.

Three conservation themes have been identified, namely:

- conservation and protection of mountain biodiversity;
- management of visitor services and facilities; and
- establishment of a Montane Conservation Education Centre.

Box 2.2 **Management goals and objectives for Horton Plains National Park (DWC, 2005)**

Management Goals

- To conserve the biodiversity of the Horton Plains National Park landscape with special emphasis on the endemic flora and fauna.
- To protect the catchment of the three major rivers which originate inside the Horton Plains National Park.
- To enhance and manage visitor services.
- To develop a Montane Conservation Education Centre.

Management Objectives

- To conserve the biological diversity, catchment and scenic beauty of Horton Plains National Park, with special emphasis on the maintenance of diverse habitats and associated flora and fauna.
- To provide opportunities for conservation-compatible visitor facilities, nature interpretation and conservation education.
- To develop appropriate systems, staff structure and associated infrastructure for effective law enforcement, resource protection and adaptive management.

3. METHODS

Full details of the methodology developed for the Biodiversity Baseline Survey are provided in a separate Field Manual (DWC, 2007a). A brief overview is provided below, together with details of anything specific to the survey of Horton Plains.

Survey design and sampling procedures

The Biodiversity Baseline Survey covered terrestrial and aquatic habitats (i.e. rivers, streams, tanks, villus). Terrestrial habitats were identified using the outputs from the Habitat Mapping Project (MENR, 2006), based principally on the vegetation types while taking into account environmental gradients, such as altitude, aspect, geology and soils, for the location and alignment of transects.

Terrestrial habitats were sampled systematically for plants, amphibians, reptiles, birds and mammals using quadrats (100 m x 5 m) aligned at 150 m intervals along transects (1 km length). Four replicate transects were located within each habitat type. Opportunistic observations were also recorded along transects, between quadrats, and elsewhere within the National Park.

Freshwater habitats were treated as a single type, which was sampled systematically for fish diversity and opportunistically for other taxonomic groups. The head, mid- and lower reaches of at least four rivers or streams within each sub-basin were sampled for fish and various measures of water quality. Waterfalls were sampled from above and below, and ponds/lakes from different points around their periphery. From four to six attempts to catch fish were made at each sampling site.

The geographic coordinates of all sampling locations (i.e. quadrats and freshwater sites) are provided in Annex 1. Effort expended in sampling quadrats, freshwater and other sites using a variety of techniques is summarised in Annex 2.

Terrestrial habitats

A total of five vegetation types were used as a basis for sampling different terrestrial habitats for species diversity. These habitats are shown in Table 2, together with the number of replicate transects and quadrats located within each. The locations of these 20 transects are shown in Figure 3.1

Table 3.1 Numbers of quadrats and associated transects sampled within each habitat

Habitat type	No. transects[1]	No. quadrats
Cloud Forest	5	20
Disturbed Cloud Forest	5	20
Tussock Grass	4	15
Carpet Grass	5	20
Bamboo	2	5
Total	**20**	**80**

[1] Number of transects equates to the number of replicates in each habitat. Total number of transects is 20, which is less than the total number of replicates (21) as one replicate covered two habitats.

The results of a Principal Coordinates Analysis of plant quadrat data show a clear distinction between forest and grassland habitats but little differentiation within each. Further, separate analysis of forest and grassland quadrats shows little distinction between Cloud Forest and Disturbed Cloud Forest, in terms of floristics, but a clear separation of grassland into three clusters, namely Tussock Grass, Carpet Grass and Dwarf Bamboo (Figure 3.2), the first two principal coordinates of which account for 59% of the variation. As part of the verification process, it was necessary to reassign six Carpet Grass quadrats to Tussock Grass, Bamboo and Marsh habitats after referring back to field observations of the vegetation. The revised distribution of quadrats according to habitat type is summarised in Table 3.2.

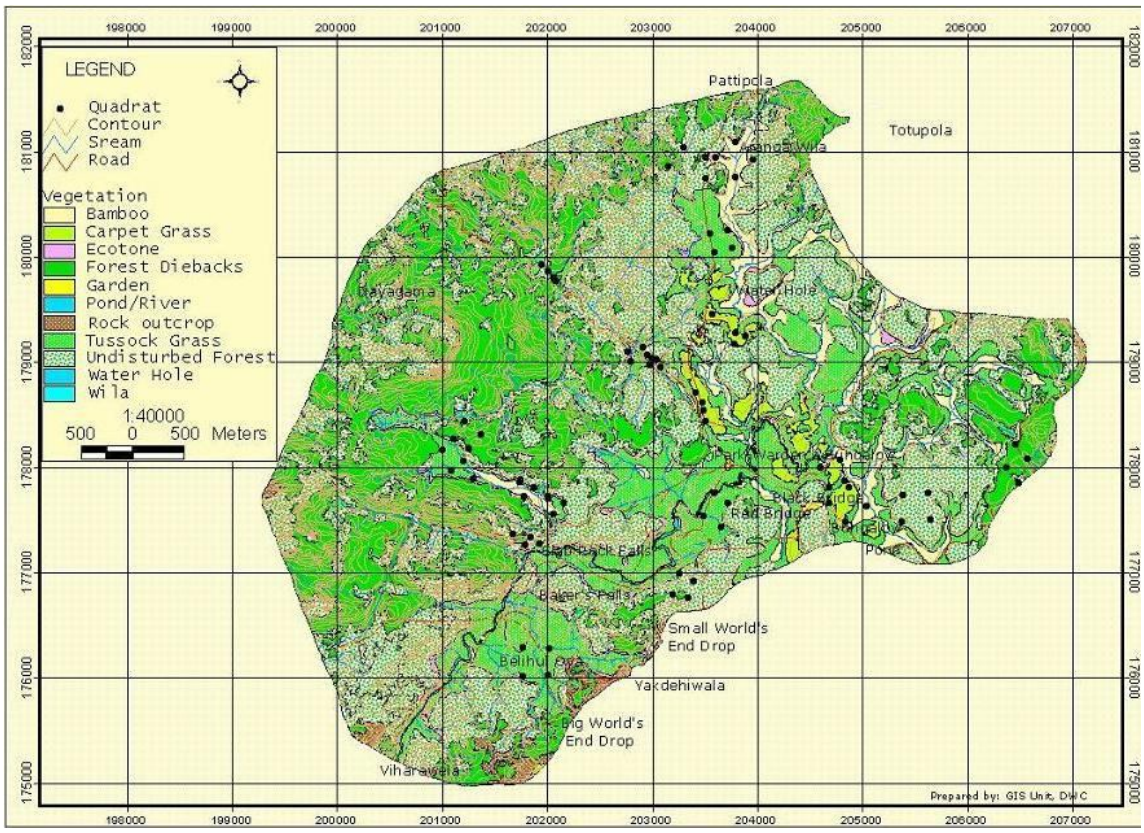


Figure 3.1 Locations of 80 quadrats sampled by Biodiversity Baseline Survey

Table 3.2 Revised allocation of quadrats to habitat types, based on Principle Coordinates Analysis

Habitat type	No. transects[1]	No. quadrats
Cloud Forest	5	20
Disturbed Cloud Forest	5	20
Tussock Grass	4	18
Carpet Grass	5	14
Bamboo	4	7
Marsh	1	1
Total	**20**	**80**

[1] Number of transects equates to the number of replicates in each habitat. Total number of transects is 20, which is less than the total number of replicates (24) as some replicates cover more than one habitat.

Freshwater habitat

A total of 25 sites in two river sub-basins were sampled for fish and water quality. Their distribution within the 6 river sub-basins within the National Park is shown in Figure 3.3. The two sub-basins were treated as a single drainage unit for analysis of water quality data in view of the limited sampling of the Well Oya. As only a single species of freshwater fish was recorded, no further analysis of assemblage structure was possible.

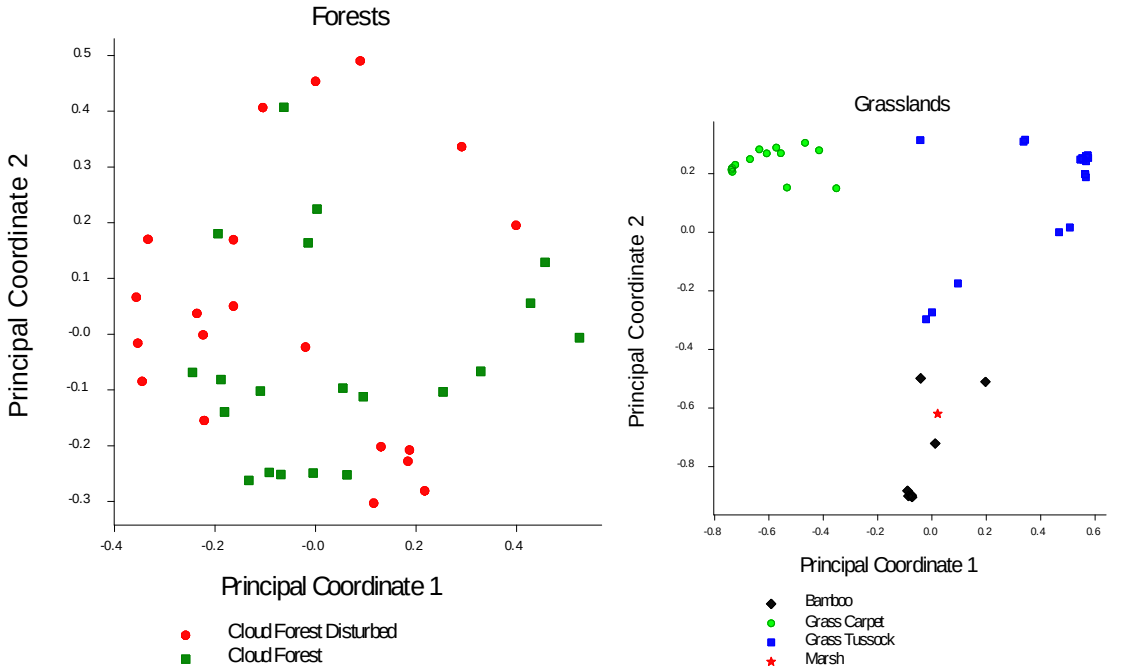


Figure 3.2 Clusters of quadrats, similar with respect to their floristics, can be identified from a Principle Coordinates Analysis of plant quadrat data.

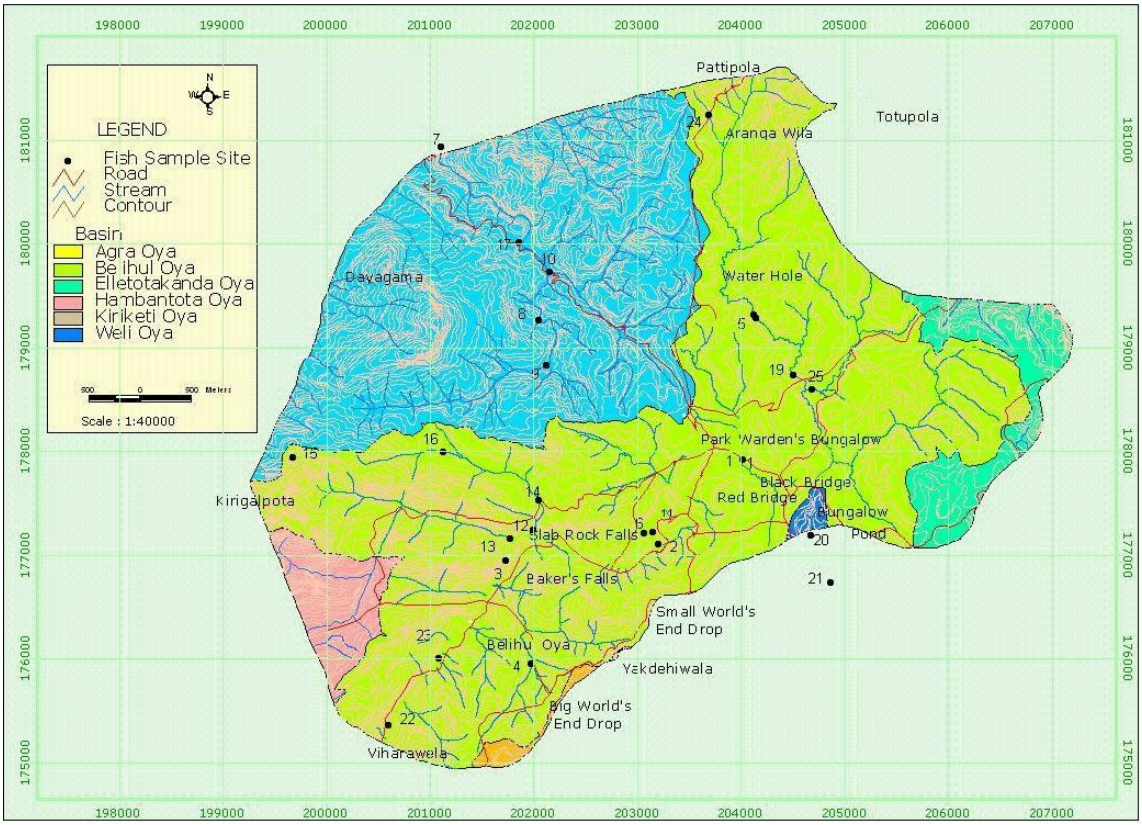


Figure 3.3 Location of 63 freshwater sites sampled by Biodiversity Baseline Survey

Biodiversity Information Management System

Field data are held in the Biodiversity Information Management System, a database application designed specifically for the Biodiversity Baseline Survey. The application is described briefly in the Field Manual (DWC, 2007a) and full details about its design and use are documented elsewhere. (DWC, 2007b, 2007c).

Herbarium and specimen collections

Numbers of herbarium and animal specimens collected during the Biodiversity Baseline Survey are summarised in Table 3.3 for each taxon. Details of voucher specimens are provided in Annex 3. Plant and animals specimens have been lodged with the National Wildlife Training, Giritale and, in the case of plants, a duplicate set has been deposited with the National Botanic Gardens, Peradeniya.

Table 3.3 Numbers of voucher specimens collected and identified for each taxon

Taxon	Voucher specimens		
	Total collected	No. identified	No. unidentified
Plants	22	15	7
Fish	40	40	0
Amphibians	15	12	3
Reptiles	6	6	0
Birds	0	0	0
Mammals	9	6	3

Data and analyses

Sample sizes and records

Field data comprise quantitative and opportunistic records. The sizes of datasets are summarised in Tables 3.4 and 3.5 for each taxonomic group. In Table 3.4 the number of records refers to records of species within quadrats; the number of individuals is the total number recorded for each species. In the case of birds, only those recorded within Bands 1 or 2 of Variable Circular Plots are treated quantitatively; those recorded in Band 3 (i.e. >20 m from the observer) are treated as opportunistic.

Table 3.4 Breakdown of quantitative and opportunistic records of plants and animals

Taxon	Total no. records	Total no. individuals	No. species identified	No. species unidentified
Quantitative records from within quadrats/sampling points				
Plants	1410	3510	*44	33
Fish	10	78	1	0
Amphibians	173	173	12	2
Reptiles	63	63	5	0
Birds	731	731	42	0
Mammals	75	77	12	0
Additional opportunistic records from outside quadrats/sampling points				
Plants	unavailable	unavailable	unavailable	unavailable
Fish	0	0	0	0
Amphibians	57	57	11	0
Reptiles	19	19	4	0
Birds	819	819	60	0
Mammals	63	1677	16	0

*Provisional data as identification of specimens ongoing at time of analysis and reporting.

Opportunistic records contribute considerably to species inventories in the case of plants, birds and mammals. In the case of mammals, such records are based largely on indirect observations of tracks and scats or pellets.

Table 3.5 Breakdown of quantitative and all records of species of plants and animals

Taxon	No. families	No. genera	No. species			
			Total	Endemic	Indigenous	Exotic
Quantitative records from within quadrats/sampling points						
Plants	≥25	≥40	*77	unavailable	unavailable	unavailable
Fish	1	1	1	0	0	1
Amphibians	1	5	13	13	0	0
Reptiles	3	5	5	5	0	0
Birds	19	39	42	9	33	0
Mammals	9	11	12	2	10	0
All records (including opportunistic)						
Plants	unavailable	unavailable	#185	62	109	14
Fish	1	1	1	0	0	1
Amphibians	1	6	14	13	1	0
Reptiles	3	6	6	5	1	0
Birds	21	56	64	13	51	0
Mammals	12	17	19	5	14	0

*Provisional data as identification of specimens ongoing at time of analysis and reporting.
#Complete data.

Adequacy of sample sizes

Species discovery graphs are shown in Figure 3.4 for each taxon except fish, based on the cumulative number of species recorded over the survey period in the entire National Park. In the case of plants, curves have been generated only for quadrat data as time (i.e. dates) of observation are not readily available for plotting opportunistic data. In the case of vertebrate taxa, curves are shown for quadrat data and for combined quadrat and opportunistic data. No graph is shown for fish as only one species (rainbow trout) was recorded, which endorses existing knowledge of the fish fauna.

Analyses

Analyses were undertaken principally at the protected area and habitat or sub-basin levels. While the former provides an overview of the biodiversity values of the site, the latter is likely to be more useful for informing management about diversity within different habitats and sub-basins. A summary matrix of species diversity within each habitat or sub-basin is provided in Annex 4.

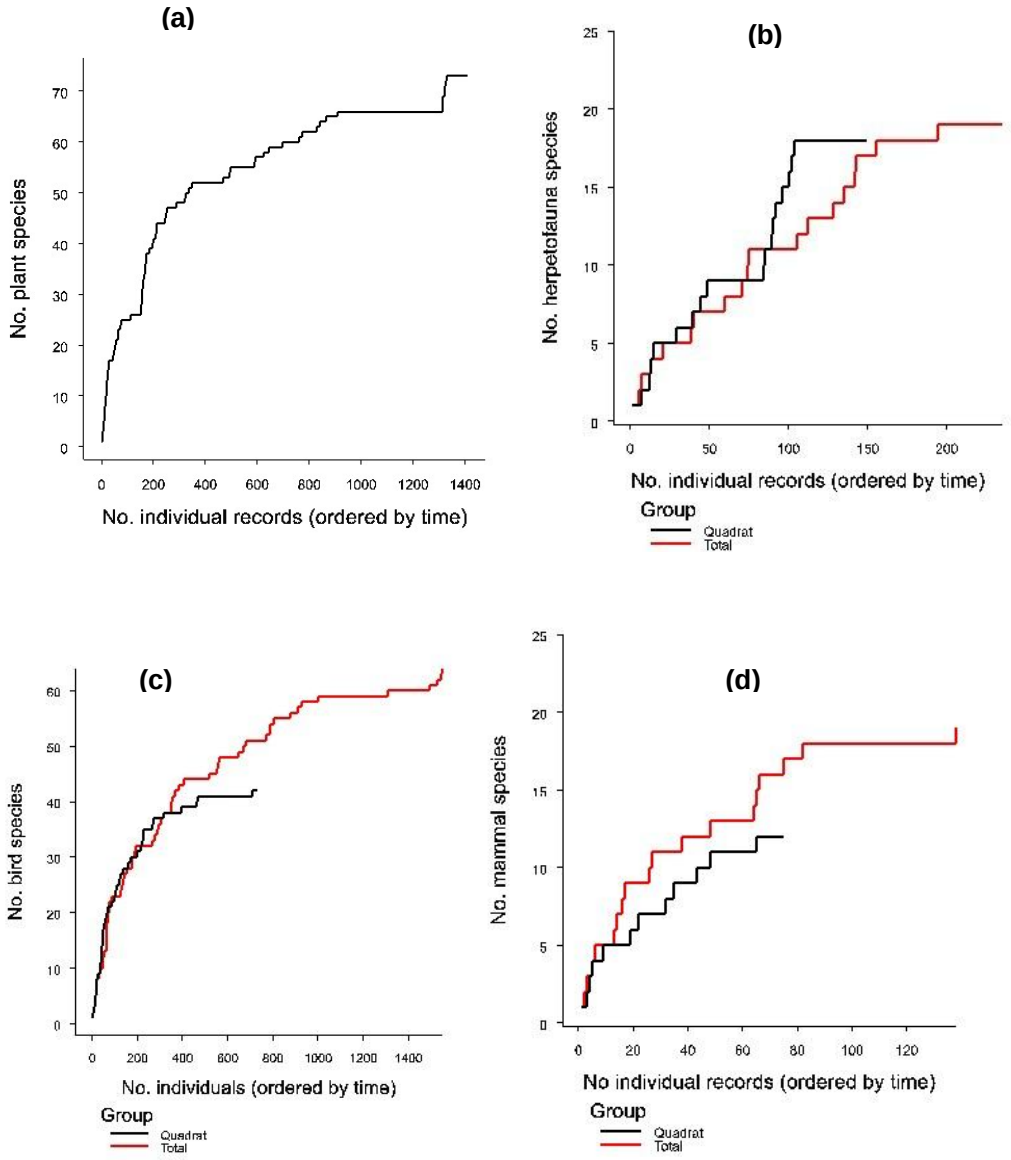


Figure 3.4 Species discovery curves for **(a)** plants based on quadrats; and for **(b)** herpetofauna, **(c)** birds and **(d)** mammals based on quadrats and combined quadrat and opportunistic records

4. PLANT DIVERSITY ANALYSIS

Introduction

The vegetation of Horton Plains National Park comprises a mosaic of Cloud Forest and different types of Wet Patana Grassland, often separated by an ecotone of shrubs and herbs. The floristic composition of the various vegetation formations are described in Section 2.4.

A total area of 4 ha was sampled within the different habitats, details of which are summarised in Annex 2. A list of 43 voucher specimens is provided in Annex 3.

Diversity within habitats

A total of 77 species of vascular plants were recorded from Horton Plains, of which 14 remain unidentified at species level and a further 19 remain unidentified at genus level. Details are provided in Annex 4.

Species richness and diversity indices are given in Table 4.1 for the different habitats in Horton Plains. Species richness and diversity are highest in the undisturbed and die-back Cloud Forest and lowest in Bamboo. Carpet Grass, which is not indigenous to Horton Plains, is somewhat lower in species richness and diversity than Tussock Grass. Diversity is the combination of two factors, the number of species present, referred to as species richness, and the distribution of individuals among the species referred to as evenness or equitability.

Table 4.1 Plant diversity indices for habitats, based on quadrat sampling

Habitat type	Cloud Forest			Grasslands			
(revised after PCA)	CF	CF-D	Total	Tussock	Carpet	Bamboo	Total
Total number of species	42	43	52	20	15	8	26
Number of endemic species							
Diversity indices							
Species richness	42	43	52	20	15	8	26
Shannon-Weinner diversity H	3.04	3.07	3.10	1.15	1.11	0.92	1.71
Shannon-Weinner evenness J	0.81	0.82	0.78	0.38	0.41	0.44	0.52
Simpson diversity 1/D	16.27	16.62	16.66	1.94	1.99	1.90	4.34
Alpha of log series	6.42	7.05	7.93	5.36	3.60	1.72	5.53

KEY: CF = Cloud Forest, D = Cloud Forest Die-back

Discussion

Significant findings

Floristically, the Cloud Forest is less diverse than the Lowland Rain Forest of Sri Lanka. This is due to lower temperatures and also, in the case of Horton Plains, situated on an undulating plateau, altitudinal range is only 600 m and range in aspect and slope is less than, for example, Peak Wilderness to the west. Thus, different plant associations are not found within this range of environmental gradients, including soil types and geology, other than in the vegetation of lower valley bottoms.

This Cloud Forest, however, is an extremely important and unique for its flora, which exhibits a high level of endemism. This is evident from the full dataset that includes opportunistic records (see Table 3.5): of the total of 109 indigenous species recorded throughout the national park during this Survey, 57% are endemic. This is a little higher than the 53% recorded by the National Conservation Review for woody plants (see Table 2.1). Both surveys indicate that endemism is very high in Horton Plains

in comparison to the overall level of 30% recorded for all indigenous flowering plants in the country (Dassanayake *et al.*, 1980-2000).

More detailed analysis and comparison between datasets generated from the Biodiversity Baseline Survey for Horton Plains and Peak Wilderness and from previous surveys are required to fully appreciate the outstanding and unique values of the individual protected areas within the Central Highlands.

Adequacy and shortcomings of survey data

It should be noted that identification of plant specimens was still ongoing at the time of completing this project and, therefore, the analysis is based on approximately only half the number of species recorded and finally identified from quadrats. **Thus, re-examination of the dataset once finalised is imperative.**

5. HERPETOFAUNA DIVERSITY ANALYSIS

Introduction

A total of 205 plots (5 x 5 m^2) were sampled daytime, using the Quadrat Cleaning Technique, and additional plots (2.5 x 10 m^2) were surveyed at night, using the Visual Encounter Technique, providing 365 records of 20 species of herpetofauna. Of the 205 plots searched, no herpetofauna were found in 130 (63%) of them. The distribution of sampling effort in each habitat is shown in Annex 2.

Thirty one voucher specimens were collected during this survey in order to confirm their identity. These are listed in Annex 3.

Diversity within habitats

A total of 20 species of herpetofauna were recorded during the Survey, details of which are provided in Annex 4 with respect to the different habitats. Only species that were positively identified, without doubt, are included in this list. The following points are noteworthy:

- There are 12 species previously not recorded from the national park.
- Of the total of 14 species of amphibians, 13 are endemic. Of the six species of reptiles, five are endemic and threatened (Annex 4). Interestingly, *Ptyas mucosa* (rat snake) was encountered in the Cloud Forest Die-back.
- The highly threatened endemic agamid lizard *Cophotis zeylanica* is a common arboreal reptile in the forest.
- The relict genus *Ceratophora* is represented by *C. stodartii* (rhino-horned lizard), which was often encountered found on tree trunks beside the road.
- The endemic and threatened snake *Aspidura trachiprocta* (common roughside) was a frequent road-kill along the Ohiya-Pattipola main road. The genus *Aspidura* is endemic to Sri Lanka.
- The endemic and threatened *Philautus femoralis* and *P. microtympanam* were frequently encountered. There remain a few species of Philautids that have not been possible to identify from available keys and guides.

Table 5.1 Herpetofauna diversity indices for habitats, based on plot sampling

Habitat type (revised after PCA)	Total	Cloud Forest		Grasslands		
		CF	CF-D	Tussock	Carpet	Bamboo
AMPHIBIANS						
Total number of species	13	8	6	7	1	5
Number of endemic species	13	8	6	7	1	5
REPTILES						
Total number of species	5	4	2	3	2	0
Number of endemic species	5	4	2	3	2	0
Diversity indices						
Species richness	5	4	2	3	2	0
Shannon-Weinner diversity H	1.42	1.28	0.62	1.00	0.64	
Shannon-Weinner evenness J	0.88	0.92	0.89	0.91	0.92	
Simpson diversity 1/D	4.13	4.50	1.86	3.50	3.00	
Alpha of log series	1.21	1.91	0.30	0.56	2.17	

KEY: CF = Cloud Forest, D = Cloud Forest Die-back

The results of an α diversity analysis are summarised in Table 5.1, based on quantitative data gathered from sampling plots using the Quadrat Cleaning Technique. Note that species richness (i.e. total number of species) is shown for amphibians and reptiles but that other diversity indices are provided only for reptiles because of sample size constraints for amphibians.

Discussion

Significant findings

- Most of the herpetofauna in Horton Plains National Park is endemic, 93% of recorded species in the case of amphibians and 83% of reptiles including a highly threatened species of agamid lizard.
- Some species of amphibians are believed to be new to science but further collection of specimens is necessary to complement description of the potential type specimens. Evidence of one definite species is limited to digital photographs as the specimen was encountered during a pilot survey, before permission for collecting specimens had been formally granted.
- Horton Plains provides excellent habitat for amphibians and they were encountered within all habitats of the national park.
- Diversity indices for reptiles are highest for undisturbed Cloud Forest, followed by Tussock Grass. Carpet Grass is least rich in species for amphibians and reptiles, and with regard to all other diversity indices for reptiles.

Adequacy and shortcomings of survey data

- The sampling effort is inadequate, as indicated by the species accumulation curve (Figure 3.4b). Further sampling is required, preferably at the end of a wet season.

6. BIRD DIVERSITY ANALYSIS

Introduction

Three main sampling methods were used to record bird diversity in Horton Plains National Park: variable circular plots (VCPs), mist netting, and opportunistic encounters. A total of 320 VCPs were sampled, providing 1,551 records. A total of 132 hours of mist netting (1,056 net metre hours) was carried out resulting in 29 captures. In addition 51 observations were made opportunistically. The distribution of sampling effort across habitats is summarised in Annex 2.

No voucher specimens or tissue samples were collected during this Survey.

Diversity within habitats

A total of 64 bird species were recorded, which included thirteen endemic and three globally threatened species. Of this total, only 42 were recorded in the first two bands of the VCPs and, therefore, subjected to further analysis. The balance of 22 bird species was treated as opportunistic observations. A list of species recorded within each habitat is provided in Annex 4.

Levels of species richness and endemism within the different habitats are summarised in Table 6.1, accompanied by various measures of diversity. Highest species richness was recorded in undisturbed and die-back Cloud Forest, and lowest in Bamboo.

Highest species diversity was recorded in Tussock Grass and lowest in Bamboo. The former could be an artefact of the sampling procedure as some of the VCPs in Tussock Grass were located adjacent to Cloud Forest and, therefore, many of the birds at the forest edge would have been recorded as grassland species.

Table 6.1 Bird diversity indices for habitats, based on quadrat sampling

Habitat type (revised after PCA)	Total	Cloud Forest		Grasslands		
		CF	CF-D	Tussock	Carpet	Bamboo
Total number of species	42	26	28	27	18	16
Number of endemic species	13	7	5	5	3	5
Diversity indices						
Species richness	42	26	28	27	18	16
Shannon-Weinner diversity H	2.92	2.45	2.64	2.72	2.58	2.41
Shannon-Weinner evenness J	0.78	0.71	0.79	0.82	0.89	0.87
Simpson diversity 1/D	12.47	8.39	9.25	11.45	12.03	10.23
Alpha of log series	7.97	5.94	6.49	8.66	4.87	5.55

KEY: CF = Cloud Forest, D = Cloud Forest Die-back

Discussion

Results from this Survey indicate that species richness at Horton Plains is relatively low for avifauna compared to other protected areas in the Wet Zone. This is due to several reasons:

- Horton Plains lies in a montane environment where temperatures are lower and food resources for certain of the avifaunal groups are likely to be scarcer.
- All of the VCPs sampled were located above elevation above 2,000 m, which is not frequented by large number of lowland bird species.
- The size of Horton Plains is relatively small, hence the number of species is likely to be lower than in a larger protected area of similar habitat.

- Sampling was conducted over a short period of time and often during periods of high rainfall, when birds tend to be active and, therefore, less readily observed and recorded.
- A number of migratory species known to frequent Horton Plains were not seen, presumably because only the later part of the sampling period coincided with the migratory season and heavy rains were experienced during at this time.
- It is also likely that the percentage of forest migrants is greater than the 4% recorded by this Survey, as sampling of the national park was not comprehensive and did not extend to lower elevations where several additional species are likely to be present.

Significant findings

- Of Sri Lanka's 220 breeding resident species, 26% were recorded within the national park. Of the country's endemic avifauna (26 species[1]), 50% of endemic species were recorded. The overall level of endemism in the national park is 20% (probably a little lower as not all species were inventoried), which is impressive for a montane environment. By comparison, the much larger (11,187 ha) Sinharaja National Heritage Wilderness Area, also in the Wet Zone, is the only known locality where as many as 21 endemic species are found, but this represents only 14% of its 147 avifauna species (Kotagama, 2006).
- A total of 32 species, including 6 endemics, were recorded for the first time in Horton Plains National Park, based on a comparison between the Survey results and those listed in inventory that accompanies the previous management plan (DWC, 1997).
- Three globally threatened endemic bird species were recorded during the Survey. This includes the rare and endangered *Myophonus blighi* (Sri Lanka Whistling Thrush).

Adequacy and shortcomings of survey data

This dataset provides a reliable, georeferenced baseline for Horton Plains National Park which can be used to inform its management. However, the data should be used judiciously, taking full account of the following limitations:

- The sampling effort was inadequate in both temporal (seasonal) and spatial terms, notable gaps being the migratory season and lowers altitudes as mention above.

[1] Whereas the total number of endemic bird species was considered to be 25, a recent revision of Asian babblers indicates that the Scimitar Babbler (*Pomatorhinus horsfieldii*) is an endemic species (Coller, 2006).

7. MAMMAL DIVERSITY ANALYSIS

Introduction

A total of 40 quadrats were sampled quantitatively for small mammals, using traps, and the length of each transect (20 km in total) was surveyed for signs of all mammals, based on direct and indirect observations (e.g. tracks and fresh droppings). Opportunistic encounters with mammals elsewhere in the national park were recorded. Mist netting was undertaken for bats, although somewhat limited due to the wet conditions, but nothing was caught. The distribution of sampling effort across the different habitats is shown in Annex 2.

Eight voucher specimens were collected from Horton Plains, details of which are given in Annex 3.

Diversity within habitats

A list of 19 mammal species recorded at Horton Plains National Park during this Survey and the habitats in which each was encountered is given in Annex 4. Twelve species of mammals were recorded from within quadrats and an additional seven species were recorded opportunistically during the survey period. Key points and noteworthy observations are as follows:

- Five mammal species are endemic, namely bear monkey (*Trachypithecus vetulus monticola*), red slender loris (*Loris tardigradus*), golden palm civet cat (*Paradoxurus zeylonensis*) and two rodents, *Mus mayori* and *Srilankamys ohiensis.*
- Nine mammal species are nationally threatened and five among them are globally threatened.
- Among small mammals, the most commonly trapped species were the spiny rat (*Mus. mayori*), common house rat (*Rattus rattus*) and ring-tailed civet (*Viverricula indica*). The highland shrew (*Suncus montanus*) was trapped only on two occasions; the bi-coloured rat (*S. ohiensis*) was opportunistically observed near the Maha-Eliya lodge. Many of these rodents and shrews were captured in both undisturbed and die-back Cloud Forest; and. *M. mayori* was recorded in grassland habitats more often than the other species. Black-naped hare was also recorded moderately often in the grasslands.
- Sambar (*Cervus unicolor*), the largest herbivore in this ecosystem, is very common. The population size is considered to be about 2000 and increasing (DWC 2005). About 1,350 individuals were observed during a night drive along the Ohiya road on a single night during the present survey. The deer tend to remain in the forest in day time and venture out into the open grasslands in the evening. Wild boar (*Sus scrofa*) was less frequently observed.
- Leopard (*Panthera pardus*) is the major predator. About 14 animals are said to inhabit the park (DWC, 1997). They feed mainly on sambar but also take wild boar and much smaller prey such as bear monkey, hare and even rodents. One of the most interesting observations during the present survey was that of a leopard carrying its quarry, a hare, in its jaws as it ran across the grassland into the forest.
- Fishing cat (*Prionailurus viverrinus*) was also seen opportunistically in a forest patch along the Pattipola road. This species is thought to be rare at Horton Plains, but its occurrence in the national park has been also reported by Miththapala (2006).
- Of the two civets, the ring tail (*Viverricula indica*) was the most commonly observed and trapped species. This species was most often caught in Carpet Grass habitat, which it may use as its hunting ground at night. It is likely to keep to the forest during the day. The golden palm civet (*Paradoxurus zeylonensis*) was also observed in small patches of forests alongside grassland habitats.
- Striped-necked mongoose (*Herpestes vitticollis*) was also opportunistically recorded on several occasions. On one occasion a mother and two young were observed in a thicket close to grassland habitat along the Ohiya road. Other recorded species were brown mongoose (*H.*

brachyurus) and ruddy mongoose (*H. smithii*). These species are more active during the night and many were encountered during night transects.

- A pair of otters was observed close to a stream along the Ohiya road. They took refuge in a burrow among the Tussock Grass on the stream bank. Doubtless, the clear water streams in Horton Plains provide ideal conditions for this species.
- The purple-faced leaf monkey is among the most often encountered of the mammals because of its large size and the very loud and gruff territorial call, which echoes for miles around the forest. The other primate, the endemic red slender loris, by contrast, is rare, nocturnal, seldom observed. Both these species are considered to be more dependent upon undisturbed Cloud Forest as opposed to die-back Cloud Forest.

Levels of diversity and endemism, together with measures of diversity, within the different habitats are summarised in Table 7.1 for all species of mammals combined, except bats for which there are no data. The results, which are based on relatively small samples, indicate that species richness and diversity are highest in undisturbed and die-back Cloud Forest. Bamboo is least rich in species, although some other measures of diversity are high. This may be an artefact of small sample sizes because the habitat was inadequately surveyed.

Table 7.1 Mammal diversity indices for habitats, based on quadrat sampling

Habitat type	**Cloud Forest**		**Grasslands**		
(revised after PCA)	**CF**	**CF-D**	**Tussock**	**Carpet**	**Bamboo**
Total number of species	8	7	6	5	4
Number of endemic species	2	1	1	0	1
Diversity indices					
Species richness	8	7	6	5	4
Shannon-Weinner diversity H	1.69	1.75	1.54	1.38	1.33
Shannon-Weinner evenness J	0.81	0.90	0.86	0.85	0.96
Simpson diversity 1/D	4.87	7.00	5.00	4.12	10.00
Alpha of log series	2.73	3.98	1.81	1.22	7.89

KEY: CF = Cloud Forest, D = Cloud Forest Die-back

Discussion

Significant findings

- Horton Plains is an important site for the protection of the country's mammal fauna, including the rare and endemic red slender loris. Nineteen species of mammals, including five endemics, were recorded during this Survey.
- Of the four species of rodents recorded, two are endemic and nationally threatened species (*Srilankamys ohiensi* and *Mus mayori*). *S. ohiensi* is a relict species also belonging to an endemic genus.
- Cloud Forest supports the richest assemblage of mammal species.

Adequacy and shortcomings of survey data

- There was flooding in certain marshy areas during the latter part of the Survey. It is likely that animals move to higher ground at such times, inevitably resulting in low capture rates.
- Mist netting could not be successfully carried out due to the rainy weather that prevailed during the survey period. Hence, although observed from a distance, no bat species could be identified and recorded during the survey.

- Several species that have been previously observed at Horton Plains, such as the toque monkey, barking deer, mouse deer, highland rat (*Rattus montanus*) and flame-backed squirrel (DWC 1997), were not recorded during this Survey. This is potentially alarming, particularly since the two rodents were ranked as common species in the previous survey, and warrants further investigation to establish whether or not this is due to limited sampling or represents a real change.

8. FRESHWATER FISH DIVERSITY ANALYSIS

Introduction

Horton Plains National Park has a rich variety of aquatic habitats consisting of rivers, streams, water falls and ponds/lakes. Its fish fauna comprises a single exotic species, rainbow trout (*Oncorhynchus mykiss*), introduced to the highlands of Sri Lanka in 1882 to support sport fishing. This species has received special attention in the past because of its threat to the endemic aquatic fauna in the Park (MfC, 1994; DCW, 1997; Bambaradeniya, 2006).

This survey concentrated on assessing the distribution of rainbow trout in the two largest sub-basins, in which most of the national park lies. A total of 25 sites were sampled (Annex 2).

Diversity within sub-basins

This Survey re-confirms that the rainbow trout is the only fish species present in the national park. Extensive checks were carried out in small tributaries of the main streams but there was no evidence of any other species being present.

Water quality

Mean values of various measures of water quality are provided in Table 8.1. In general, water quality in the two sub-basins covered by this Survey falls within accepted levels for aquatic life (CEA, 2003).

Table 8.1 Physical and chemical measures of water quality within drainage units (Values are means ±1SD.)

Water quality measure	**pH**	**Conductivity**	**Turbidity**	**Total Dissolved Solids**	**Dissolved Oxygen**	**Temperature**	**Depth**	**Fish species**
Sub-basin		**mhos /cm**	**NTU**	**ppt**	**ppm**	**^{o}C**	**cm**	**No.**
Agra Oya and Well Oya	8.36 ± 0.48	0.03 ± 0.02	21.04 ± 26.27	0.02 ±0.02	5.78 ±2.38	15.48 ±1.87	74.2 ±36.30	1

Discussion

While a species-rich fish fauna is unlikely to have prevailed in the past at Horton Plains because of its high altitude, it is likely that the predatory rainbow trout has wiped out the indigenous species as has occurred elsewhere in the country. Pethiyagoda (2006) notes that two unidentified species of fish, recorded from an altitude of 1,800m in the 1840s by Kelaart (1852), disappeared after the introduction of trout.

The continued presence of trout may be affecting the conservation status of the rare endemic shrimp (*Lancaris singhalensis*), for which Horton Plains is the only known locality, and several restricted-range endemic crab species, such as *Ceylonthelphusa sorror, Perbrinckia punctata* and *Perbrinckia glabra*, are also present (Petiyagoda, 2006). The adult trout population is estimated to be 1,000 trout and there is evidence that it is breeding naturally (Jinadasa *et al*, 2005). Gut analysis of trout collected from the present Survey also shows that the diet of this species consists of crabs and shrimps. Further investigation into the impact of trout on these endemic species is a priority.

Significant findings

- Horton Plains National Park contains only one fish species, the exotic rainbow trout (*Oncorhynchus mykiss*).
- There is probably a great threat from this exotic fish species to an endemic species of a shrimp, *Lancaris singhalensis* whose only known location is Horton Plains, and several restricted-range crab species, namely *Ceylonthelphusa sorror*, *Perbrinckia punctata* and *Perbrinckia glabra*.

Adequacy and shortcomings of survey data

- The other four sub-basins need to be surveyed.
- The dry season was not covered in this Survey.

9. OVERVIEW AND CONCLUSIONS

Data limitations

Examination of sampling effectiveness (Figure 3.4) indicates that further sampling of all plant and vertebrate groups, particularly bats and with the probable exception of fish, would be appropriate to better document the biodiversity of Horton Plains National Park. For fish, sampling effort provided comprehensive data to suggest that only the exotic rainbow trout species persists in the streams and drainages.

Comparative analyses

Flora and fauna diversity within habitats

In general, highest species richness for all groups occurs in Cloud Forest, be it undisturbed or die-back (Table 9.1). This is probably a consequence of greater its structural complexity as well as slightly greater sampling effort. This is reinforced by the measure of alpha diversity applied to the more numerous groups of birds and plants, which also indicates that diversity is highest in the Cloud Forests of Horton Plains. The slight anomaly is the high species richness and diversity for birds in Tussock Grass but, as noted in Section 6.2, the diversity of the avifauna may have been overestimated in the is habitat due to the proximity of Cloud Forest to some VCPs.

Table 9.1 Flora and fauna diversity within habitats

Habitat type (revised after PCA)	Total	Cloud Forest		Grasslands		
		CF	CF-D	Tussock	Carpet	Bamboo
Species richness						
Plants	78	42	43	20	15	8
Amphibians	13	8	6	7	1	5
Reptiles	5	4	2	3	2	0
Birds	42	26	28	27	18	16
Mammals	12	8	7	6	5	4
Diversity						
Plants α		6.42	7.05	5.36	3.60	1.72
Birds α	7.97	5.94	6.5	8.66	4.87	5.55

KEY: CF = Cloud Forest, D = Cloud Forest Die-back

Comparison between plant habitats shows that the grasslands of Bamboo, Carpet and Tussock are very different to undisturbed and die-back Cloud Forest, but also differ substantially from one another on the second coordinate. Bird assemblages also show a similar pattern, with those in Cloud Forest being very similar, but differing markedly from those of grassland habitats which also vary internally (Figure 9.1). These patterns within the plants are intuitively obvious when viewed in the field. However, of particular interest and importance is the very high similarity in floristic composition of the undisturbed Cloud Forest and Die-back Cloud Forest, which indicates there is little change in species composition despite the obvious die-back.

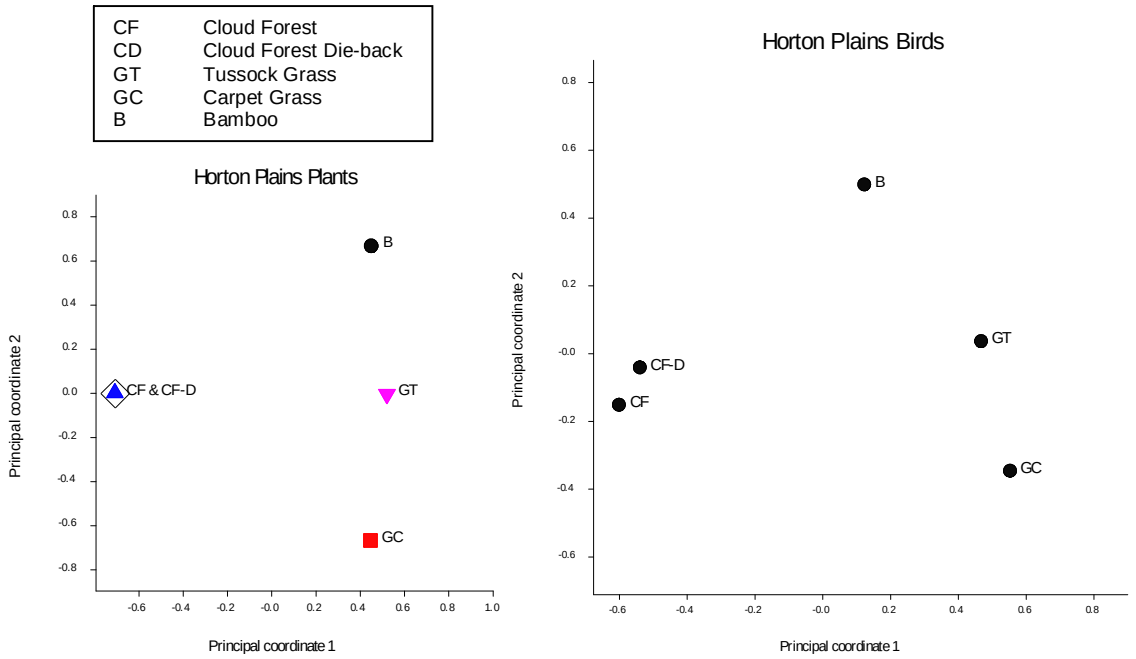


Figure 9.1 Plot of first two principal coordinates for plant assemblages [left] and bird assemblages [right] in the five habitat types at Horton Plains, using the Bray Curtis coefficient of similarity. These two axes account for over 60% of the variation in plants and 35% in birds.

Freshwater fish diversity within sub-basins

Rainbow trout is the only fish species to have been recorded in this high altitude protected area. The extensive sampling undertaken throughout much of Horton Plains indicates that indigenous species are no longer present.

Conclusions

Key findings arising from this Survey and their implications for conservation and management are summarised below. Future priorities for biodiversity monitoring and related research are identified.

Key biodiversity values

- Horton Plains supports a diverse flora and fauna, including many endemic species of which a few are known only from this locality. While its richness of species may be less than in other Wet Zone areas of conservation importance, principally for reasons of geography and climate (i.e. high altitude), many of its species are endemic and levels of endemism are likely to be proportionately higher than at lower elevations elsewhere.
- Some 57% of plants, 93% of amphibians, 83% of reptiles, 20% of birds and five mammal species are endemic, based on records from this Survey.
- Three endemic bird species are globally threatened; nine mammal species are nationally threatened, of which five are also globally threatened; and one species of agamid lizard is nationally highly threatened.
- Several species of amphibian are thought to be new to science, including one whose identity is limited to digital photographs. Voucher specimens exist for the rest.

Conservation and management implications

- Horton Plains and Peak Wilderness Sanctuary occupy a contiguous block of forest that encompasses the Central Highlands. This block of forest is among the most important in Sri Lanka for its wealth of species and protection of watersheds, as shown by the National Conservation Review (Green and Gunawardena, 1997). Results from the Biodiversity Baseline Survey indicate that there is an east-west spectrum of biodiversity. Further analysis of data from Horton Plains in combination with those from Peak Wilderness should provide a greater understanding of the uniqueness of individual components of this forest block, Horton Plains being one such component that is uniquely different from other components to the west. Such information will strengthen any proposed World Heritage nomination, as well as being vital for the effective collaborative management of the two protected areas in concert.
- The analysis of floristics and bird assemblages for Cloud Forest suggests that die-back has not resulted in lower species richness or diversity. These findings are preliminary, especially since the analysis was undertaken prior to complete identification of all plant voucher specimens. Previous reports suggest that die-back has occurred mainly on west-exposed windswept slopes. Observations from this Survey indicate that die-back takes place irrespective of aspect or slope. Of the numerous causes proposed for die-back, this Survey found no evidence to support the speculation that die-back is a consequence of natural senescence of old-growth cloud forest without natural regeneration of canopy species. No seedlings or saplings of canopy species were found in die-back areas.
- There is circumstantial evidence that the introduced, exotic rainbow trout is threatening an endemic species of shrimp and several crab taxa.
- Data gathered from this Survey can be used to inform management activities, notably through the management planning and implementation process, and to provide new information on biodiversity for community outreach work and for the benefit of visitors

Future directions and priorities

Baseline data and survey protocols have been established for future biodiversity monitoring. Future priorites are considered to be as follows:

- In the short-term, over the next five years, collate and analyse existing survey data in order to identify outstanding gaps for further surveys and research.
- In the longer term (7-10 years hence), monitoring should commence with repeat surveys undertaken in the same locations covered by this Survey and any subsequent surveys completed.

Specific research should include:

- Identification of the causal factors of Cloud Forest die-back and investigation into the apparent failure of seedlings to germinate and become established in canopy-gaps of die-back areas. This is an outstanding priority, given that die-back has been an issue for some four decades.
- More detailed analysis of the Biodiversity Baseline Survey results, along with those of previous surveys such as the National Conservation Review and Habitat Mapping Project (see Table 2.1), to assess what changes have taken place and to identify precisely what are the differences in species diversity between undisturbed and die-back Cloud Forest.
- Assessment of the conservation status of endemic species of shrimp and crab and the level of threat or impact from the trout. Consideration should also be given to a pilot removal of trout from a given stream in which these endemic species are present, while also examination the role of trout in aquatic systems at Horton Plains.
- Impacts of grazing by large herbivores (sambar and possibly wild boar) on the maintenance of grassland communities.

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Annex 1 Geographic coordinates of sampling locations

AQUATIC

Site No	NORTHING	EASTING
1	204017	177916
2	203205	177095
3	201733	176938
4	201978	175943
5	204122	179306
6	203061	177200
7	201110	180926
8	202048	179253
9	202121	178822
10	202152	179724
11	203150	177217
12	201990	177240
13	201771	177150
14	202050	177521
15	199672	177930
16	201126	177990
17	201855	180013
18	204140	179280
19	204502	178725
20	204671	177181
21	204861	176731
22	200599	175351
23	201083	176003
24	203688	181239
25	204679	178596

TERRESTRIAL LOCATIONS

Transect	Quadrat	Habitat	Code	GPS start E	GPS start N
1	A	Disturbed Cloud Forest	CF-D	205418	177468
1	B	Disturbed Cloud Forest	CF-D	205423	177725
1	C	Disturbed Cloud Forest	CF-D	205666	177744
1	D	Disturbed Cloud Forest	CF-D	205687	177491
2	A	Carpet Grass	GC	204880	177465
2	B	Marsh		204716	177652
2	C	Carpet Grass	GC	204911	177798
2	D	Bamboo	B	205078	177617
3	A	Carpet Grass	GC	204715	177802
3	B	Tussock Grass	GT	204635	177988
3	C	Bamboo	B	204820	178057
3	D	Tussock Grass	GT	204870	177863
4	A	Disturbed Cloud Forest	CF-D	206503	178209
4	B	Disturbed Cloud Forest	CF-D	206427	177983
4	C	Disturbed Cloud Forest	CF-D	206534	177837
4	D	Disturbed Cloud Forest	CF-D	206622	178068
5	A	Carpet Grass	GC	203601	179455
5	B	Carpet Grass	GC	203817	179280
5	C	Carpet Grass	GC	203912	179251
5	D	Carpet Grass	GC	203812	179175
6	A	Carpet Grass	GC	203577	180226
6	B	Tussock Grass	GT	203749	180259
6	C	Carpet Grass	GC	203786	180089
6	D	Tussock Grass	GT	203613	180049
7	A	Disturbed Cloud Forest	CF-D	203528	180765
7	B	Disturbed Cloud Forest	CF-D	203538	180961
7	C	Disturbed Cloud Forest	CF-D	203318	181056
7	D	Disturbed Cloud Forest	CF-D	203176	180877
8	A	Cloud Forest	CF	203628	180957
8	B	Cloud Forest	CF	203814	181106
8	C	Cloud Forest	CF	203991	180944
8	D	Cloud Forest	CF	203816	180771
9	A	Tussock Grass	GT	203741	177645
9	B	Tussock Grass	GT	203683	177417
9	C	Tussock Grass	GT	203515	177519
9	D	Tussock Grass	GT	203618	177744
10	A	Cloud Forest	CF	203278	176970
10	B	Cloud Forest	CF	203421	176897
10	C	Cloud Forest	CF	203364	176738
10	D	Cloud Forest	CF	203213	176766
11	A	Cloud Forest	CF	201940	177260
11	B	Cloud Forest	CF	201800	177250
11	C	Cloud Forest	CF	201682	177354
11	D	Cloud Forest	CF	201848	177326
12	A	Tussock Grass	GT	201776	176264
12	B	Tussock Grass	GT	202025	176250

Transect	Quadrat	Habitat	Code	GPS start E	GPS start N
12	C	Tussock Grass	GT	202023	176001
12	D	Tussock Grass	GT	201776	175983
13	A	Carpet Grass	GC	203536	178435
13	B	Carpet Grass	GC	203515	178540
13	C	Carpet Grass	GC	203502	178610
13	D	Carpet Grass	GC	203438	178707
14	A	Tussock Grass	GT	202928	179145
14	B	Tussock Grass	GT	202784	179095
14	C	Tussock Grass	GT	202992	178968
14	D	Tussock Grass	GT	202809	179001
15	A	Cloud Forest	CF	203096	178955
15	B	Cloud Forest	CF	203059	179024
15	C	Cloud Forest	CF	203013	179036
15	D	Cloud Forest	CF	202970	179064
16	A	Cloud Forest	CF	202091	179779
16	B	Cloud Forest	CF	202075	179812
16	C	Cloud Forest	CF	202020	179870
16	D	Cloud Forest	CF	201960	179931
17	A	Bamboo	B	202077	177539
17	B	Bamboo	B	202015	177696
17	C	Bamboo	B	201790	177708
17	D	Bamboo	B	201742	177850
18	A	Disturbed Cloud Forest	CF-D	202172	177650
18	B	Disturbed Cloud Forest	CF-D	202016	177713
18	C	Disturbed Cloud Forest	CF-D	201879	177799
18	D	Disturbed Cloud Forest	CF-D	201750	177871
19	A	Tussock Grass	GT	201300	177883
19	B	Tussock Grass	GT	201088	177960
19	C	Tussock Grass	GT	201001	178154
19	D	Bamboo	B	201206	178050
20	A	Disturbed Cloud Forest	CF-D	201112	178262
20	B	Disturbed Cloud Forest	CF-D	201212	178429
20	C	Disturbed Cloud Forest	CF-D	201371	178310
20	D	Disturbed Cloud Forest	CF-D	201259	178167

ANNEX 2 SUMMARY OF SAMPLING EFFORT: HORTON PLAINS NATIONAL PARK (Survey period: September - October 2006)

Key to habitats: **CF** Cloud Forest; **CD** Cloud Forest Die-back; **GT** Tussock Grass; **GC** Carpet Grass; **B** Bamboo; **M** Marsh; **Op** Opportunistic (all habitats)

Taxonomic group	Sampling effort achieved in the field									Method: description	No./km transect	Sampling intensity per habitat type (based on 4 replicates/habitat)
	Method	Sampling effort per habitat type (N = no. quadrats)										
		CF 20	*CD* 20	*GT* 18	*GC* 14	*B* 7	*M* 1		*Op*			
Small mammals	**No. traps set**	88	132	88	110	22	0			**Sherman traps:** located at 10 m intervals within 2 vegetation quadrats (100m x 5m), for 4 nights	22 traps	22 x 4 x 4 = 352 trap nights/ habitat
	Total no. trap nights	352	528	352	440	88	0					
	No. quadrats sampled	8	12	8	10	2	0					
Larger mammals	**No. traps set**	16	24	16	20	4	0			**Tomahawk traps:** located at each end of 2 vegetation quadrats (100m x 5m), for 4 nights	4 traps	4 x 4 x 4= 64 trap nights/ habitat
	Total no. trap nights	64	96	64	80	16	**0**					
	No. quadrats sampled											
Bats	**No. mist nets set**									**Mist nets:** 2 nets (at canopy and ground levels) manned by 2 persons at 6-9am and at 4.30-6.30pm at appropriate location along transect	2 mist nets	2 x 2 x 4 = 16 mist net sessions (totalling 40 mist net hours)/ habitat
	Total hours of mist netting	unavailable										
	No. quadrats											
	No. mist nets set									**Mist nets:** 2 nets (at canopy and ground levels) manned by 2 persons at 6-9am and at 4.30-6.30pm along selected waterholes, trails and near roosts	2 mist nets	2 x 2 x 4 = 16 mist net sessions (totalling 40 mist net hours)/ habitat
	Total hours of mist netting	unavailable										
	No. locations											
All mammals	**No. quadrats**									**Direct observations:** along 1 km transects, recording perpendicular distance from transect to mammal sighted/ spoor	1 km	4 km, variable width/ habitat
Birds on land	**No. VCPs completed**	80	80	72	56	28	4			**Variable Circular Plots:** 8 VCPs (radius = 0-10m, 11-20m and >20m) aligned at each end of 4 vegetation quadrats (100m x 5m): birds recorded for 10 mins within each VCP, once at dawn and once at dusk	8 VCPs	8 x 2 x 4 = 64 VCP visits/ habitat
	No. quadrats sampled	20	20	18	14	7	1					
	No. transects surveyed									**Direct observations:** record birds along 1 km transects between vegetation quadrats	600m	2.4 km/habitat
Birds on water	**No. locations on waterbodies counted**									**Total counts**: for discrete water bodies, using one or more stations from which to record birds, as appropriate.	n/a	n/a
	Total no. waterbodies surveyed											
Birds	**No. mist nets set**	5	6		4					**Mist nets:** 2 nets (at canopy and ground levels) manned by 2 persons during daytime (total of hours)at appropriate location adjacent to transect	2 mist nets	2 x 4 x 6 = 48 mist net hours/ habitat
	Total hours of mist netting	34	54		44							
	No. locations	1	2		2							
Reptiles and amphibians	**No. QCTs completed**	60	40	40	50	10	5			**Quadrat cleaning (daytime):** 5 quadrats (5m x 5m in open habitat, 10m x 2.5m in closed habitat) cleared in each of 2 vegetation quadrats (100m x 5m)	10 quadrats	10 x 4 = 40 quadrats (0.1 ha)/ habitat
	No. quadrats examined	12	8	8	10	2	1					
	No. nocturnal quadrats examined	unavailable								**100m x 5mm quadrats: s**earched at night time	1 quadrat	1 x 4 = 4 quadrats (0.04 ha/habitat)
Vascular plants	**No. transects established**	20 transects (1 km length) in total								**100m x 5m quadrats:** located at 150m intervals along 1km transect	4	4 x 4 = 16 quadrats (0.8 ha)/ habitat
	No. quadrats sampled	20	20	18	14	7	1					

Key to drainage units: 1 = Well Oya; 2 = Agra Oya												
Freshwater fish	**Sub-basin ref. no.**	1	2	3	4	5	6			**Water quality:** pH, conductivity, phosphate, nitrate, dissolved oxygen, turbidity, temperature recorded at head, mid- and lower reaches of river	n/a	3 x 4 = 12 samples/ subcatchment
	No. fish/water quality locations	5	20									

Annex 3 List and reference numbers of voucher specimens

Family	Genus	Species	Specimen numbers			
PLANTS						
Annonaceae	Uvaria	macropoda	WG49			
Connaraceae	Connarus	monocarpus	WG76			
Convolvulaceae	Evolvulus	alsinoides	WG53			
Cyperaceae	Cyperus	iria	WG 10			
Cyperaceae	Fimbristylis	ovata	WG 23			
Cyperaceae	Fimbristylis	pubisquama	WG 03			
Cyperaceae	Kyllinga	bulbosa	WG 04			
Ebenaceae	Diospyros	malabarica	WG48			
Euphorbiaceae	Drypetes	sepiaria	WG80			
Euphorbiaceae	Suregada	lanceolata	WG67			
Euphorbiaceae	Trewia	nudiflora	WG92			
Fabaceae	Crotalaria	verrucosa	WG99			
Fabaceae	Cynometra	zeylanica	WG63			
Fabaceae	Painteria	nitida	WG47			
Flacourtiaceae	Hydnocarpus	venenata	WG69			
Melastomataceae	Memecylon	capitellatum	WG123			
Moraceae	Streblus	taxoides	WG73			
Myrtaceae	Syzygium	zeylanicum	WG50			
Poaceae	Alloteropsis	cimicina	WG 07			
Poaceae	Chrysopogon	fulvus	WG 09			
Poaceae	Cyrtococcum	trigonum	WG 26			
Poaceae	Echinochloa	colona	WG 21			
Poaceae	Sporobolus	diander	WG 02			
Rubiaceae	Ixora	coccinea	WG68			
Rubiaceae	Nauclea	orientalis	WG52			
Rutaceae	Pleiospermium	alatum	WG78			
Sapindaceae	Sapindus	emarginata	WG90			
Sapotaceae	Manilkara	hexandra	WG81			
Sterculiaceae	Pterospermum	suberifolium	WG82			
Verbenaceae	Vitex	altissima	WG72			
HERPETOFAUNA						
Ranidae	*Philautus*	*microtympanum*	DWSL200601001			
Ranidae	*Philautus*	*microtympanum*	DWSL200601002			
Ranidae	*Philautus*	*microtympanum*	DWSL200601003			
Ranidae	*Philautus*	*sp1*	DWSL200601004			
Ranidae	*Philautus*	*alto*	DWSL200601005			
Ranidae	*Philautus*	*alto*	DWSL200601006			
Ranidae	*Philautus*	*sp2(alto)*	DWSL200601007			
Ranidae	*Philautus*	*schmarda*	DWSL200601008			
Ranidae	*Philautus*	*schmarda*	DWSL200601009			
Ranidae	*Philautus*	*microtympanum*	DWSL200601010			
Ranidae	*Ramanella*	*palmata*	DWSL200601011			
Ranidae	*Philautus*	*femoralis*	DWSL200601012			
Ranidae	*Philautus*	*frankenbergi*	DWSL200601013			
Ranidae	*Philautus*	*microtympanum*	DWSL200601014			
Ranidae	*Polypedates*	*eques*	DWSL200601015			
Ranidae	*Polypedates*	*eques*	DWSL200601016			
Ranidae	*Philautus*	*femoralis*	DWSL200601017			
Ranidae	*Philautus*	*sp1*	DWSL200601018			
Ranidae	*Philautus*	*sp1*	DWSL200601019			
Ranidae	*Philautus*	*alto*	DWSL200601020			
Ranidae	*Philautus*	*alto*	DWSL200601021			
Ranidae	*Philautus*	*schmarda*	DWSL200601022			
Ranidae	*Philautus*	*sp2(alto)*	DWSL200601023			
Ranidae	*Philautus*	*schmarda*	DWSL200601024			
Ranidae	*Philautus*	*alto*	DWSL200601025			
Ranidae	*Philautus*	*sp1*	DWSL200601026			
Ranidae	*Philautus*	*sp1*	DWSL200601027			
Ranidae	*Philautus*	*schmarda*	DWSL200601028			
Scincidae	*Lankascincus*	*taprobanensis*	DWSL200605012			
Colubridae	*Aspidura*	*trachyprocta*	DWSL200605013			
Colubridae	*Aspidura*	*trachyprocta*	DWSL200605014			
MAMMALS						
Muridae	*Mus*	*mayori*	HPM04	HPM05	HPM06	HPM10
Soricidae	*Suncus*	*montanus*	HPM07	HPM08		
Muridae	*Rattus*	*rattus*	HPM09			
Muridae	*Golunda*	*ellioti*	HPM11			

Annex 4 List of species recorded from Horton Plains National Park

Key to species geographic status:
E endemic; **I** indigenous; **X** exotic

Key to species conservation status:
Ex extinct; **C** critically endangered, **NT** nationally threatened, **NHT** nationally highly threatened, **GLR** globally at lower risk, **GE** globally endangered.

PLANTS

Taxon	**Total**	**CF** Cloud Forest	**CF-D** Cloud Forest Die-back	**GT** Tussock Grass	**GC** Carpet Grass	**B** Bamboo
Apiaceae Centella asiatica	1.5			6	13	
Aquifoliaceae Ilex walkeri	107	16	16			
Asteraceae Anaphalis sp 1	0.9			13	3	1
Berberidaceae Berberis ceylanica	1	1				
Buxaceae Sarcococca brevifolia	8	1				
Celastraceae Euonymus revolutus	7	2	2			
Celastraceae Microtropis zeylanica	7	5				
Celestraceae Euonymus revolutus	2	1	1			
Clusiacaea Calophyllum walkeri	7		1			
Clusiaceae Calophyllum walkeri	247	19	19			
Dennstaedtiaceae Exacum sp 1	0.0			1		
Dennstaedtiaceae Pteridium sp	0.6			4	1	
Elaeocarpaceae Elaeocarpus montanus	25	6	4			
Ericaceae Gaultheria leschena	0.2			4		
Ericaceae Rhododendron arboreum	43	9	7			
Euphorabiaceae Glochidion pycnocarpum	12		1			
Euphorbiaceae Glochidion pycnocarpum	251	19	19			
Fabaceae Ulex europaeus	0.2				1	
Gentianaceae Exacum sp 1	0.0			1		
Lauraceae Actinodaphne moonii	1	1				
Lauraceae Actinodaphne sp 1	59	14	8			
Lauraceae Actinodaphne sp 2	27	5	4			
Lauraceae Actinodaphne speciosa	186	18	16			
Lauraceae Cinnamomum ovalifolium	243	19	20			
Lauraceae Litsea ovalifolia	4	1	1			
Lauraceae Neolitsea fuscata	349	20	19			
Magnoliaceae Michelia nilagirica	14	5	5			
Melastomataceae Osbeckia sp 1	6/0.5	1	3	7	5	
Myrsinaceae Ardisia sp	2		1			
Myrsinaceae Ardisia sp 1	4		1			
Myrtaceae Rhodomyrtus tomentosa	11	5	4			
Myrtaceae Syzygium revolutum	220	18	17			
Myrtaceae Syzygium rotundifolium	110	15	14			
Poaceae Andropogon polyptycho	5.4			15	6	2
Poaceae Arundinaria densifol	11.5			2		7
Poaceae Axonopus fissifolius	25.4			2	14	
Poaceae Chrysopogon noduliba	39.4			18	10	2
Poaceae Garnotia exaristata	8.2			6	1	4
Rosaceae Photinia integrifolia	11	4				
Rubiaceae Hedyotis dendroides	34	9	8			
Rubiaceae Hedyotis neolessertiana	5	2	2			
Rubiaceae Hedyotis trimenii	58	12	7			
Rubiaceae Lasianthus sp 1	48	16	5			
Rubiaceae Lasianthus sp 2	2	1				
Rubiaceae Psychotria sp 1	44	12	10			
Rubiaceae Psychotria sp 2	3	2	1			
Rubiaceae Wendlandia bicuspidata	2	2				
Rutaceae Euodia lunu-ankenda	32	9	5			

Taxon	Total	CF Cloud Forest	CF-D Cloud Forest Die-back	GT Tussock Grass	GC Carpet Grass	B Bamboo
Sabiaceae Meliosma simplicifolia	62	12	5			
Sabiaceae Neolitsea fuscata	1	1				
Symplocaceae Symplocos bractealis	209	19	14			
Symplocaceae Symplocos cochinchinensis	172	18	15			
Symplocaceae Symplocos obtusa	146	14	14			
Symplocaceae Symplocos pendula	11	5	3			
Symplocaceae Symplocos sp 1	92	16	8			
Theaceae Eurya sp 1	37	11	6			
Theaceae Eurya sp 2	1	1				
H001	1		1			
H010	4		1			
H011	31		5			
H012	1		1			
H013	20		4			
H014	2		2			
H015	6	2	2			
HG001 / HG002	0.0				1	
HG003	0.6				9	
HG003 / HG001	0.0				1	
HG004	0.1				2	
HG006	0.1			1	2	
HG19-1	0.1			1		
HG19-2	0.2			2		1
HG19-3	0.0			1		
HG19-4	0.1			1		
HG19-5	0.2			2		
HG19-6	0.4			2		1
HG19-7	0.1			2		1
New 1	0.2				1	

HERPETOFAUNA

Taxon	Geographic Status	Threatened status - national	Total	Cloud Forest	Cloud Forest – Die-back	Tussock Grass	Carpet Grass	Bamboo
AMPHIBIANS								
Ranidae Fejervarya greenii	E	T	44			4		2
Ranidae Microhyla zeylanica	E	T	6			2		1
Ranidae Philautus alto	E		10		4			2
Ranidae Philautus femoralis	E		11	3				
Ranidae Philautus frankenbergi	E		6	1				
Ranidae Philautus microtympanum	E		52	2	2	3	2	3
Ranidae Philautus schmarda	E		14	3	2	1		
Ranidae Philautus sp1	E		11	2	2	3		
Ranidae Philautus sp2(alto)	E		2		1	1		
Ranidae Philautus steineri	E		1		1			
Ranidae Philautus variabilis	E		3	2				
Ranidae Polypedates eques	E	T	9	2		1		1
Ranidae Ramanella palmata	E	T	2	1				
Ranidae Rana temporalis			1					
REPTILES								
Agamidae Calotes nigrilabris	E	T	24	3		3	1	
Agamidae Ceratophora stoddartii	E	T	14	4	4			
Agamidae Cophotis zeylanica	E	HT	2	1				
Colubridae Aspidura trachyprocta	E	T	11	1		1	1	
Colubridae Ptyas mucosa								
Scincidae Lankascincus taprobanensis	E	T	12		3	1		

BIRDS

Family	Genus	Species	Geog. Status	Cons. status	Opportunistic	Number of quadrats within which species were recorded in each habitat type						Prior Records
						TOTAL [N=80]	B [N=10]	GC [N=15]	CF-D [N=12]	CF [N=14]	GT [N=5]	
Accipitridae	*Accipiter*	*badius*	I		1	1						
Accipitridae	*Buteo*	*buteo*	M		2	2						
Accipitridae	*Elanus*	*caeruleus*	I		4	4						✓
Accipitridae	*Ictinaetus*	*malayensis*	I			1				1		✓
Accipitridae	*Pernis*	*ptilorhyncus*	I		3	3						
Accipitridae	*Spilornis*	*cheela*	I		4	4						✓
Alaudidae	*Alauda*	*gulgula*	I		1	1						✓
Alaudidae	*Mirafra*	*assamica*	I		10	10						
Apodidae	*Apus*	*affinis*	I			20		3	1	1	1	
Apodidae	*Collocalia*	*unicolor*	I			13		2	1	1	1	✓
Apodidae	*Cypsiurus*	*balasiensis*	I		1	1						
Apodidae	*Tachymarptis*	*melba*	I			1		1				
Centropodidae	*Centropus*	*sinensis*	I			19	1					✓
Cisticolidae	*Cisticola*	*juncidis*	I			61	4	6	2		11	
Cisticolidae	*Prinia*	*inornata*	I			3			1			
Columbidae	*Chalcophaps*	*indica*	I		1	1						✓
Columbidae	*Columba*	*livia*	I		1	1						✓
Columbidae	*Columba*	*torringtoni*	E	VU		5				1	1	✓
Columbidae	*Ducula*	*aenea*	I			2			1			
Corvidae	*Corvus*	*macrorhynchos*	I			80		3		2	1	✓
Corvidae	*Dicrurus*	*paradiseus*	I		1	1						
Corvidae	*Hemipus*	*picatus*	I			7	1		2	2	1	
Corvidae	*Pericrocotus*	*cinnamomeus*	I		2	2						
Corvidae	*Pericrocotus*	*flammeus*	I			7			2	1	1	✓
Corvidae	*Urocissa*	*ornata*	E	VU	3	3						
Falconidae	*Falco*	*tinnunculus*	I			2					1	
Hirundinidae	*Hirundo*	*tahitica*	I			44	4	9		1	7	✓
Meropidae	*Merops*	*philippinus*	I			20		2		1	4	
Muscicapidae	*Copsychus*	*malabaricus*	I		2	2						
Muscicapidae	*Culicicapa*	*ceylonensis*	I			44	3		8	8	1	✓
Muscicapidae	*Cyornis*	*tickelliae*	I			3			1			
Muscicapidae	*Eumyias*	*sordida*	E	NT		33			10	5		✓
Muscicapidae	*Luscinia*	*brunnea*	M		1	1						
Muscicapidae	*Myophonus*	*blighi*	E	EN	4	4						
Muscicapidae	*Saxicola*	*caprata*	I			82	4	7	4		9	✓
Muscicapidae	*Turdus*	*merula*	I			8	1	1	1	1	1	✓
Muscicapidae	*Zoothera*	*spiloptera*	E	NT	3	3						
Nectariniidae	*Dicaeum*	*erythrorhynchos*	I			106	2	5	12	13	6	✓
Nectariniidae	*Nectarina*	*asiatica*	I			1			1			✓
Nectariniidae	*Nectarina*	*lotenia*	I			3			1		1	
Nectariniidae	*Nectarina*	*zeylonica*	I		1	1						✓
Paridae	*Parus*	*major*	I			28	1		7	6	2	✓
Passeridae	*Anthus*	*rufulus*	I			16	2	4	1		2	✓
Passeridae	*Lonchura*	*malacca*	I			3		2				
Passeridae	*Lonchura*	*punctulata*	I			6		2	2		1	
Passeridae	*Motacilla*	*cinerea*	M			14		1	2		4	
Phasianidae	*Galloperdix*	*bicalcarata*	E			8	1					
Phasianidae	*Gallus*	*lafayetii*	E			12		1			1	✓
Picidae	*Chrysocolaptes*	*lucidus*	I			25			3	1		✓
Pycnonotidae	*Hypsipetes*	*leucocephalus*	I			7				1		✓
Pycnonotidae	*Iole*	*indica*	I			9				2		
Pycnonotidae	*Pycnonotus*	*melanicterus*	I		1	1						
Pycnonotidae	*Pycnonotus*	*penicillatus*	E	NT		218	4	5	18	16	4	✓
Sittidae	*Sitta*	*frontalis*	I			12			3	5	1	✓
Sturnidae	*Acridotheres*	*tristis*	I		2	2						✓
Sylviidae	*Bradypterus*	*palliseri*	E	NT		10			5	1		✓
Sylviidae	*Orthotomus*	*sutorius*	I			129	3	3	11	12	2	✓
Sylviidae	*Pellorneum*	*fuscocapillum*	E		3	3						
Sylviidae	*Phylloscopus*	*magnirostris*	M			97	2		5	11	2	
Sylviidae	*Phylloscopus*	*nitidus*	M		1	1						
Sylviidae	*Pomatorhinus*	*horsfieldii*	E			50			5	1	1	✓
Sylviidae	*Rhopocichla*	*atriceps*	I			46	1		8	13	2	
Sylviidae	*Turdoides*	*rufescens*	E	NT		5				1		✓
Zosteropidae	*Zosterops*	*ceylonensis*	E			238	6	5	19	20	4	✓

Source of information for prior records: DWC (1997)

MAMMALS

Family	Genus	Species	Geographic Status	Conservation status - national	Conservation status – global	Opportunistic	Number of quadrats within which species were recorded in each habitat type					Prior records
							Cloud Forest	Cloud Forest Die-back	Carpet grass	Tussock Grass	Bamboo	
Cercopithecidae	*Trachypithecus*	*vetulus*	E	TR	EN	*	3(3)					√
Cervidae	*Cervus*	*unicolor*	I			*	5(3)	4(1)	6(1)	5(2)	(1)	√
Felidae	*Panthera*	*pardus*	I	TR	EN	*			1			√
Felidae	*Prionalurus*	*viverrinus*	I	TR	VU	*						√
Herpestidae	*Herpestes*	*smithii*	I			*						
Herpestidae	*Herpestes*	*brachyurus*	I			*			1(1)			√
Herpestidae	*Herpestes*	*vitticollis*	I	TR		*					(1)	
Leporidae	*Lepus*	*nigricollis*	I			*	(1)	1	6(1)	5(2)	1	√
Lorisidae	*Loris*	*tardigradus*	E	TR	VU	*						
Muridae	*Srilankamys*	*ohiensis*	E	TR		*						√
Muridae	*Rattus*	*rattus*	I				1(1)	3(3)		1(1)		
Muridae	*Mus*	*mayori*	E	TR			4(4)	3(3)		2(2)	1(1)	√
Muridae	*Golunda*	*ellioti*	I							1(1)		
Mustelidae	*Lutra*	*lutra*	I	TR	VU	*						√
Scuridae	*Funambulus*	*sublineatus*	I			*						√
Soricidae	*Suncus*	*montanus*	I			*	1(1)	1(1)				
Suidae	*Sus*	*scrofa*	I			*	1	1				√
Viverridae	*Paradoxurus*	*zeylonensis*	E	TR		*						
Viverridae	*Viverricula*	*indica*	I			*	1	1(1)	2(2)	1(1)		

The values show the numbers of quadrats in which a species was recorded; values in parentheses show those based on trapping or direct sightings.

Sources of information for prior records: DWC (1997), Green and Gunawardena (1997), Miththapala (2006).