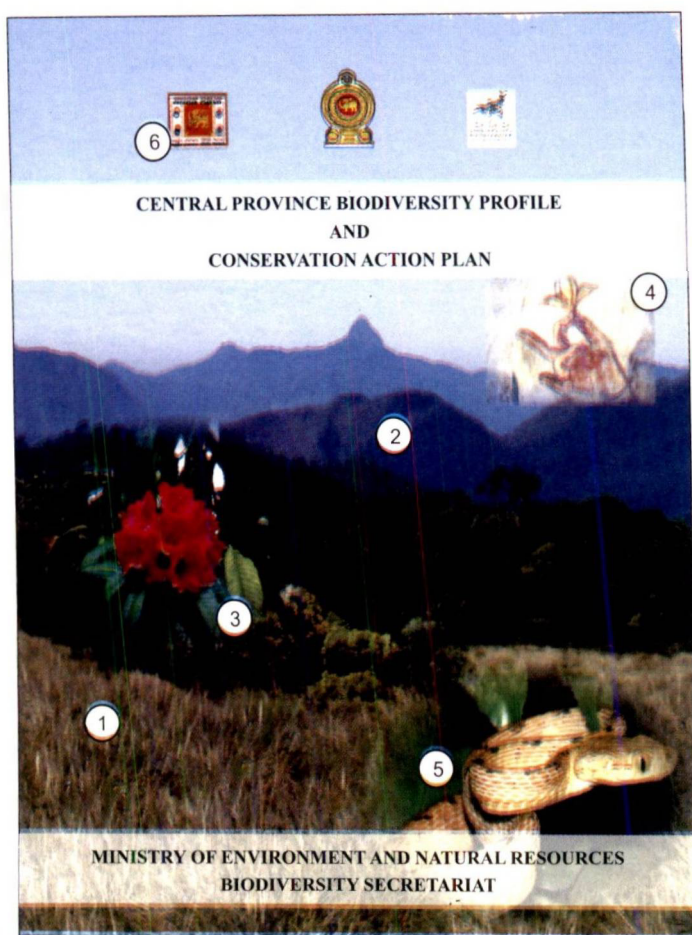




**CENTRAL PROVINCE BIODIVERSITY PROFILE
AND
CONSERVATION ACTION PLAN**



**MINISTRY OF ENVIRONMENT AND NATURAL RESOURCES
BIODIVERSITY SECRETARIAT**



1. Background : Peak Wilderness Sanctuary with Adam's Peak in the center
2. Foreground : Montane Evergreen Forest and Wet Patana Grassland at Horton Plains National Park.
3. Flower : *Rhododendron arboretum* ('Maratmal' or 'Asoka'), Provincial flower of the Central Province
4. Painting : Mythical flower held by an apsara at Sigiriya
5. Snake : *Boiga ranawanei* ('Ranawana's golden cat snake'), endemic to Central Province
6. Flag : Central Province

All photos © A.H.Magdon Jayasuriya

4

CENTRAL PROVINCE BIODIVERSITY PROFILE AND CONSERVATION ACTION PLAN

A.H.M. Jayasuriya



A publication of
Biodiversity Secretariat
Ministry of Environment & Natural Resources
Sri Lanka



The Ministry of Environment and Natural Resources acknowledges the ADB/GEF, The Government of Netherlands funded Protected Area Management and Wildlife Conservation Project (Component "C") for providing financial assistance.

Copyright © Ministry of Environment and Natural Resources, Colombo, Sri Lanka

Publisher The Biodiversity Secretariat, Ministry of Environment and Natural Resources,
Sri Lanka

Citation Jayasuriya, A.H.M.(2008): Central Province Biodiversity Profile and
Conservation Action Plan, The Biodiversity Secretariat, Ministry of
Environment and Natural Resources, Sri Lanka.

ISBN 978-955-9120-90-2

First Print December, 2008

Coordinated by S. Iresha Rajapakse
Hasula Wickremasinghe

Printed by Neo Graphics, Sri Lanka

Message from the Hon. Minister

Sri Lanka is a small island with rich biological diversity and high level of endemism. Biodiversity of the country is unique and hence it has universal value. Nevertheless, it is currently under threat from ever increasing human interferences. Due to this extraordinary endemism and also high level of threat the country is considered as one of the global biodiversity hotspots.

Biodiversity Conservation is not a new phenomenon to Sri Lanka. From ancient times Sri Lankans have had close relations with flora and fauna and they were very much concerned about their conservation and protection for the benefit of future generation. As we all know, the world's first recorded sanctuary, 'Mihintale' is located in Sri Lanka.

Sri Lanka has adopted a positive approach in formulating new policies and strategies towards conserving its biological wealth. We have signed and ratified the Convention on Biological Diversity (CBD) and are already in the process of implementing relevant provisions. I am proud to say that Sri Lanka is one of the very first countries that prepared a Biodiversity Conservation Strategy and Action Plan.

Nevertheless, we are facing severe problems in conserving our biological diversity. As outlined in the 2007 Red List of Threatened Fauna and Flora of Sri Lanka, the rate of biodiversity loss in Sri Lanka is increasing rapidly as can be seen in other countries in the world.

Therefore, we need to act now to reduce the biodiversity loss or hold the extinction of endangered species. I believe these Provincial Biodiversity Conservation Profiles and Action Plans are a key strategy to achieve this objective. Biodiversity issues are not concentrated to a particular locality of the country but are distributed in various provinces of the country in different scales.

I strongly believe that this document would be an excellent guide with immense value to all stakeholders who are working on conservation and sustainable use of biodiversity.

Patali Champika Ranawaka

Minister of Environment & Natural Resources

Message from the Secretary

Sri Lanka has signed and ratified the 'Convention on Biological Diversity' and is obliged to implement the relevant provisions of the Convention. This Ministry has developed the "Strategy for the Conservation and Sustainable use of Biological Diversity" as early as in 1994 by way of implementing Article 6 of the Convention. This was followed by the development of the 'Biodiversity Framework Action Plan' in 1998. In 1997, Sri Lanka finalized the preparation of complete Biodiversity Conservation Action Plan (BCAP) with the development of the "Addendum to the Biodiversity Conservation Framework Action Plan".

A consultative approach was followed in the preparation of this addendum. During the addendum preparatory process a series of workshops were held by the Ministry with relevant Provincial Administrations and all other relevant stakeholders of the province to discuss draft recommendations and they were revised when and where necessary. At these workshops it was highlighted that the addendum recommendations were focused on national level and adequate attention was not paid to provincial issues. As a solution to this issue, it was decided to develop Biodiversity Profile and Conservation Action Plans at provincial level. The Component C of the Protected Area Management and Wildlife Conservation Project of the Ministry provided necessary financial assistance.

The Ministry considers that the preparation of Biodiversity Profile and Conservation Action Plans at provincial level is a unique exercise as it is one of the first such activities done in the world. This Ministry has ensured that all stakeholders of the relevant province were involved in the preparatory process. Thus we can be happy that this unique exercise produced a document through the collective efforts of all stakeholders for the conservation of biodiversity at provincial level. I strongly believe that the final product is very comprehensive and meets the needs of the central province.

M. A. R. D. Jayatilake

Secretary, Ministry of Environment & Natural Resources

Foreword

Central Province which consists of Kandy, Matale and Nuwara Eliya districts cover an area of 5.674 sq kms. (8.6% of the country). The province covers almost all of the central hills and it bears the major water sources of Sri Lanka.

The mountainous terrain of Central Province, plays a major role as the water source for irrigation, power generation, domestic and industrial water needs, not only for people in the province but also for a majority of people in Sri Lanka; so in that perspective Central Province deserves to be named the “back bone” of the island.

Mountainous areas of the province are critically endangered due to the loss of bio diversity, habitat degradation of the forest and grass lands. The heart of Sri Lanka is threatened by encroachers due to shortage of land for an increasing population. Most of the arable lands of the province have already been cultivated and the remaining land is extremely limited for other activities.

There is hence an indispensable need of a proper biodiversity action plan and profile to secure the environment of Central Province. Dr. Magdon Jayasuriya, one of the eminent ecologists with vast experience in Sri Lanka has prepared this document with the Biodiversity Secretariat under the Ministry of Environmental and Natural Resources.

The generous contribution made by some of the stakeholders in relevant fields in the Central Provincial Council as desired by Hon. Sarath Ekanayake Chief Minister and Provincial Environmental Minister to prepare this document is highly appreciated.

I hope this document will motivate and sensitize the relevant agencies and others interested to make a better contribution to conserve biodiversity and make it sustainable in the Central Province.

P.G.Amarakoon

Chief Secretary – Central Province.

ACKNOWLEDGEMENTS

Many personnel effectively contributed to the successful completion of the profile and the contribution made by each of these individuals is stated below:

Individual	Institution	Contribution
Mr. Gamini Gamage	Director, Biodiversity Secretariat, MENR	Program coordination, provision of information and literature, overall supervision
Ms. S.I Rajapakse	Biodiversity Secretariat, MENR	Project Coordination
Ms. Hasula Wickramasingha	Biodiversity Secretariat, MENR	Project Coordination
Mr. A.M.U.D.Alahakoon	Commissioner of Local Government (Central Province)	Province coordination and provision of ideas
Mr. Y.M.T.Yaparathne	Asst. Secretary (Environment), Central Provincial Council	Province coordination, provision of information and literature
Mr. Palitha Rajapakse	Programme Assistant, Department of Local Government, Central Province	Provision of information
Mr. W.P.S.Perera	Programme Assistant, Chief Ministry (Environment Unit), Central Province	Assistance in province coordination
Mr. Nandi Amarasinghe	Director, Nation Builders Association, Kundasale	Provision of literature
Mr. H.M.Senadhira	Commissioner of Ayurveda, Central Province, Pallekele	Provision of information on medicinal gardens
Mr. M.G.C.Suriyabandara	Asst. Director, DWC, Rantembe	Information on Protected Areas-Wildlife Sector
Mr. S.H.Sirisena	Divisional Forest Officer, Kandy	Information on Protected Areas – Forest Sector

Individual	Institution	Contribution
Mr. Tilak Premakantha	Divisional Forest Officer, Nuwara Eliya	Information on Protected Areas – Forest Sector
Mr. L.A. Dissanayake	Divisional Forest Officer, Matale	Information on Protected Areas – Forest Sector
Mr. P.M.A.Karunaratne	Deputy Director, Environment & Forest Conservation Division, Mahaweli Authority of Sri Lanka, Mawatura.	Information on control of invasive plants (Giant Mimosa) and Memorial Gardens
Ms. Champika Hettiarachchi	Architect, Department of Engineering services, Central Province	Provision of information
Mr. R.A.Premaratne	Asst. Divisional Secretary, Panwila	Information on plant and animal symbols depicted on temple murals
Dr. A.D.N.Chandrasiri	Deputy Director (Research), VRI, Peradeniya	Information and literature on animal genetic resources
Mr. D.V.S.de S. Gamage	Research Officer, VRI, Gannoruwa	Information on animal genetic resources
Mr. G.G.C.Premalal	Research Officer, VRI, Gannoruwa	Information and literature on fodder genetic resources
Ms. Bashini Dissanayake	Livestock Officer, DAPH, Peradeniya	Information on animal genetic resources
Mr. Sampath de A. Goonatilake	Ecologist, IUCN Sri Lanka	Literature on fauna
Mr. Nalinda Peries	Project Managar, EML Consultants	Literature on fauna
Prof. Shantha Hennayake	University of Peradeniya	Review of the draft report

Facilities provided by Mr. Avanthi Jayatilake, Managing Director & Chief Executive Officer of the EML Consultants, help provided in preparing maps by Mr. Asoka De Alwis (GIS Division, EML Consultants) and document formatting by Ms. Dhammi Pindenya (ANR Division, EML Consultants) are very specially and thankfully acknowledged. In addition, many participants at the workshops held at the Central Provincial Council provided very useful information and guidance in order to facilitate the preparation of this profile.

TABLE OF CONTENTS

Message from the Hon. Minister	iii
Message from the Secretary	iv
Foreword	v
ACKNOWLEDGEMENTS.....	vi
ACRONYMS/GLOSSARY	xii
EXECUTIVE SUMMARY.....	xv
CHAPTER 1	1
1. INTRODUCTION	1
CHAPTER 2.....	2
2. PHYSICAL FEATURES	2
2.1 Climatic Zones	2
2.2 Temperature	2
2.3 Rainfall.....	4
2.4 Topography	4
2.5 Soils.....	4
2.6 Water bodies and stream network	8
CHAPTER 3	13
3. BIO-GEOGRAPHICAL REGIONS	13
3.1 Bio-geographical Regions (Bio-regions)	13
3.2 Floristic Regions	14
3.3 Agro-ecological regions	16
CHAPTER 4	19
4. MAJOR NATURAL ECOSYSTEMS	19
4.1 Introduction.....	19
4.2 Natural vegetation	19
4.3 A new classification and a map of natural vegetation of Sri Lanka.....	20

4.4 Major Natural vegetation types in Central Province.....	20
4.5 Plantation forests.....	29
4.6 Landuse pattern.....	30
CHAPTER 5.....	31
5. SPECIES PROFILE.....	31
5.1 National Conservation Review 1991-1996.....	31
5.2 Flora.....	31
5.3 Fauna.....	32
CHAPTER 6.....	42
6. GENETIC PROFILE.....	42
6.1 Agro-biodiversity.....	42
6.2 Livestock diversity.....	48
6.3 Anthropogenic diversity.....	53
CHAPTER 7.....	54
7. <i>IN SITU</i> CONSERVATION.....	54
7.1 Introduction.....	54
7.2 Forest genetic resources.....	54
7.3 Agro-biodiversity.....	64
7.4 Medicinal plant genetic resources.....	65
CHAPTER 8.....	68
8. <i>EX SITU</i> CONSERVATION.....	68
8.1 Plant genetic resources.....	68
8.2 Animal genetic resources.....	72
CHAPTER 9.....	74
9. CULTURE AND BIODIVERSITY.....	74
9.1 Historical accounts on biodiversity.....	74
9.2 Biodiversity in cultural activities.....	82
9.3 Traditional knowledge.....	89

9.4 Historical gardens, parks and trees.....	93
9.5 Memorial parks	95
9.6 Memorial trees	96
9.7 Monuments	97
CHAPTER 10.....	98
10. IMPACTS ON BIODIVERSITY.....	98
10.1 Human population.....	98
10.2 The 2007 Red List of Threatened Fauna and Flora of Sri Lanka.....	99
10.3 Distribution of threatened species in the Central Province.....	99
10.4 Invasive organisms.....	100
10.5 Poisonous plants.....	108
10.6 Cardamom cultivation.....	113
10.7 Chena cultivation	113
10.8 Ilicit felling.....	113
10.9 Forest fires.....	114
10.10 Over-exploitation of medicinal plants.....	114
10.11 Pollution by pesticides and chemical fertilizers.....	114
10.12 Forest die-back.....	114
10.13 Feral buffaloes.....	115
10.14 Over-visitation	115
CHAPTER 11	116
11. BIODIVERSITY RELATED INSTITUTIONAL ASPECTS	116
CHAPTER 12.....	118
12. POLICIES AND LEGISLATION ON BIODIVERSITY.....	118
12.1 Biodiversity-related policies	118
12.2 Legal framework on biodiversity.....	118

CHAPTER 13	120
13. RECOMMENDED ACTIONS FOR CONSERVATION AND SUSTAINABLE USE OF PROVINCIAL BIODIVERSITY	120
CHAPTER 14	122
14. ACTION PLAN	122
CHAPTER 15	126
15. GLOSSARY AND DEFINITIONS	126
REFERENCES	129
APPENDIX 1 Plant species recorded in Protected Areas in the Central Province investigated for the NCR Survey	136
APPENDIX 2 Animal species recorded in Protected Areas in the Central Province investigated for the NCR Survey	153
APPENDIX 3 Flora restricted to the Central Province	160

ACRONYMS/GLOSSARY

ADB	Asian Development Bank
AIS	Alien Invasive Species
AnGR	Animal Genetic Resources
AVC	Audio Visual Centre
BCA	Biological Control Agent
BCAP	Biodiversity Conservation Action Plan
BD	Biodiversity
BDFAP	Biodiversity Conservation in Sri Lanka: A Framework
BG	Botanical Garden
BGCI	Botanic Gardens Conservation International
BI	Biodiversity International
BMARI	Bandaranayake Memorial Ayurvedic Research Institute
BS	Biodiversity Secretariat
CARP	Council for Agricultural Research and Policy
CBD	Convention on Biological Diversity
CBO	Community Based Organization
CCD	Coast Conservation Department
CEA	Central Environmental Authority
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CP	Central Province
CPC	Central Provincial Council
CPRS	Central Poultry Research Station
CRI	Coconut Research Institute
CSUMPP	Conservation & Sustainable Use of Medicinal Plants Project
CWR	Crop Wild Relative
DAG	Department of Agriculture
DAPH	Department of Animal Production & Health
DArch	Department of Archeology
DC	Department of Customs
DEA	Department of Export Agriculture
DEnA	District Environmental Agencies
DFAR	Department of Fisheries & Aquatic Resources
DMEF	Dry Mixed Evergreen Forest
DNBG	Department of National Botanic Gardens
DWC	Department of Wildlife Conservation
EIA	Environmental Impact Assessment
FAO	Food and Agriculture Organization of the United Nations
FCRDI	Field Crops Research & Development Institute
FD	Forest Department
FFPO	Fauna and Flora Protection Ordinance
FPU	Forestry Planning Unit

FR	Forest Reserve
GEF	Global Environmental Facility
GND	Grama Niladhari Division
GSMB	Geological Survey & Mines Bureau
HARTI	Hector Kobbekaduwa Agrarian Research & Training Institute
HORDI	Horticultural Research and Development Institute
IBA	Important Bird Area
IDB	Industrial Development Board
IFS	Institute of Fundamental Studies
IPGRI	International Plant Genetic Resources Institute
IPKF	Indian Peace Keeping Force
IPM	Integrated Pest Management
ITI	Industrial Technology Institute
IUCN	World Conservation Union
LCD	Land Commissioner's Department
LRC	Land Reform Commission
LWEF	Lowland Wet Evergreen Forest
LWR	Livestock Wild Relatives
MAB	Man and Biosphere Reserve
MAG	Ministry in charge of Agriculture
MALF	Ministry of Agriculture, Lands & Forestry
MASL	Mahaweli Authority of Sri Lanka
MCA	Ministry of Cultural Affairs
MEEF	Mid-elevational Evergreen Forest
MENR	Ministry of Environment & Natural Resources
MEPA	Ministry of Environment & Parliamentary Affairs
MFAR	Ministry of Fisheries & Aquatic Resources
MFE	Ministry of Forestry & Environment
MHIM	Ministry of Health & Indigenous Medicine
MIM	Ministry in charge of Indigenous Medicine
MIP	Ministry of Irrigation & Power
MMEF	Moist Mixed Evergreen Forest
MOEF	Montane Evergreen Forest
MPCA	Medicinal Plants Conservation Area
MPI	Ministry in charge of Plantation Industries
NAQDA	National Aquaculture Development Agency
NARA	National Aquatic Resources, Research and Development Agency
NASCAG	National Species Conservation Advisory Group
NASTEC	National Science & Technology Commission
NBA	Nation Builders Association
NBG	National Botanic Gardens
NBSAP	National Biodiversity Strategies and Action Plans
NCR	National Conservation Review

NEA	National Environmental Act
NGO	Non Governmental Organization
NH	National Herbarium
NLDB	National Livestock Development Board
NP	National Park
NPQS	National Plant Quarantine Service
NSC	National Steering Committee on Biodiversity
NSF	National Science Foundation
NWFP	Non-wood Forest Products
NZG	National Zoological Garden
ORO	Other Research Organizations including Private Sector
OSF	Other State Forest
PA	Protected Area
PGR	Plant Genetic Resources
PGRC	Plant Genetic Resources Centre
PPD	Plant Protection Division
PR	Proposed Forest Reserve
RRDI	Rice Research & Development Institute
RRI	Rubber Research Institute
S	Sanctuary
SAVG	Savanna Grassland
SD	Survey Department
SLTB	Sri Lanka Tourist Board
SNR	Strict Natural Reserve
SPOF	Sparse and Open Forest
SRI	Sugarcane Research Institute
STC	State Timber Corporation
TL	Thermo-luminescence
TRI	Tea Research Institute
UDA	Urban Development Authority
UJ	University of Jaffna
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNEP-WCMC	UNEP World Conservation Monitoring Centre
UP	University of Peradeniya
VRI	Veterinary Research Institute
WB	World Bank
WHO	World Health Organization
WPTG	Wet Patana Grassland
ZADI	German Centre for Documentation and Information in Agriculture

EXECUTIVE SUMMARY

The Central Province covers an area of 5,674 sq.km. (8.6 percent of the country) and it consists of three districts, viz Matale, Kandy and Nuwara Eliya. The province is unique in Sri Lanka due to its central location and highly dissected mountain terrain offering some of the most picturesque sceneries. On the basis of height and landforms, the Central Highlands situated mainly within the Central Province, is the most remarkable topographical region in the island. The Central Massif consisting of high plains and peaks is predominantly located within the Province. The Dumbara Massif (Knuckles Region), a detached part of the Central Massif, is totally located within this province. The Central Highlands was protected as the water source for the country during its history. However, with the introduction of plantation agriculture by the British, the environment of the central province underwent significant transformation. All three main climatic zones, viz Dry, Intermediate and Wet zones are represented in the Matale and Kandy Districts, while Kandy and Nuwara Eliya Districts mostly belong to the wet zone. A large diversity of soil types consisting of thirteen soil types are represented within the province. A large proportion of these belong to Red Yellow Podzolic Soils, Reddish Brown Earths and Reddish Brown Latosolic Soils groups. The province accommodates upper basins of nine rivers of which the Mahaweli Basin is the largest, consisting of 73.1 percent of the total area. Bio-geographically, the province represents four out of fifteen bio-geographical regions, viz. Lowland Wet Zone, Sub-montane Wetlands, Wet Highlands and Intermediate Highlands. Meanwhile, ten out of fifteen Floristic Regions are represented within the province. The diverse agro-ecology in the province is indicated by the presence of fifteen agro-ecological regions that support high variety of crops that are being cultivated. Eight out of fourteen major vegetation types occur indicating high ecosystem diversity. In addition, a considerable extent of plantation forests, mainly managed by the Forest Department, and fuel wood plantations managed by the plantation sector, contribute to the forest cover. The National Conservation Review has recorded 648 species of woody flowering plants and 136 species of animals within selected faunal groups from 36 protected areas. Further studies based on literature survey have shown that 401 herbaceous and woody plant species are restricted to the Central Province out of which 218 species are endemic. Of the fauna, 93 species were found to be restricted within this province. The province also accommodates high agro-biodiversity including agricultural, plantation, medicinal and fodder crops, crop wild relatives, livestock and livestock wild relatives. It is remarkable that the protected areas cover about 31 percent of the total province area. Thirty five forest sector sites covering 105,596 hectares and four wildlife sector sites covering 68,768 hectares add up to 174,374 hectares of protected area system of the central province. In addition, many archeological reserves and other modified sites contribute to the mechanism of *in situ* conservation. The Home Garden is a popular agricultural practice within the concept of on-farm conservation for *in situ* conservation of agro-biodiversity, particularly the fruit, spice and beverage crops. “*In situ* Conservation of Crop Wild Relatives. Through Enhanced Information Management and Field Application” is a five-year (2004-2009) UNEP /GEF- supported global project that aims to effectively conserve and use crop wild relatives. The Sri Lankan component of this project is coordinated by the Ministry of Environment & Natural Resources and conducted by the Department of Agriculture. “Conservation and Sustainable Use of Medicinal Plants Project” was another GEF-supported project (1998-2003) that intended to secure conservation of globally and nationally significant medicinal plant species, and their habitats. Naula in the Central Province was one of the five Medicinal Plant Conservation Areas in Sri Lanka that were selected to develop within this project. Plant Genetic Resources Centre at Gannoruwa, with its modern facilities, handles the *ex situ* conservation of genetic resources of agricultural crops, while the main Research Station of the Department of Export Agricultural Crops, located in Matale, deals with conservation of spice and beverage crops, especially at the field level. Royal Botanic Gardens in Peradeniya and Hakgala Botanic Garden are the main institutes in the province that are dedicated for the conservation of ornamental plants and botanically important flora such as threatened, rare, endemic and exotic species while municipal parks at Matale, Kandy and Nuwara Eliya also contribute towards this purpose. The historical and

cultural aspects of the flora and fauna, prevalent nearly 350 years ago, have been elucidated by analyzing the observations made by Robert Knox during his years of captivity (1660-1679) in Sri Lanka. The factors that impact on biodiversity in the province have been identified, and of them growth of human population, invasive flora and fauna, agricultural practices such as chena cultivation and cardamom cultivation, encroachment of forest areas, illicit felling of timber, firewood gathering, over-exploitation of medicinal plants, forest fire, forest die-back, pollution by pesticides and chemical fertilizer, over-visitation of natural areas for recreation and increased feral buffalo populations have been shown to have negative impacts upon biodiversity. Biodiversity-related institutional aspects and policies and legislation on biodiversity have been dealt with respect to the findings of the Biodiversity Conservation Action Plan. The issue of biodiversity utilization (whether sustainably or otherwise) has become increasingly contentious in view of the growing divergence between adherents of two forceful conservation paradigms: preservation and sustainable use. The growing population and consequent demand for natural resources has led however, to the need to ensure that such use is 'sustainable', i.e. that resources are used today in a manner that assures their availability also to future generations. In this regard, important issues have been identified and suitable recommendations are proposed. At the culmination of assembling a treatment of this nature, a biodiversity conservation action plan was developed in consideration of issues that are relevant to biodiversity conservation, recommendations to minimize threats to biodiversity, institutional capacity and availability of resources within an identified level or region. However, the action plan should be further reviewed in consideration of the changing scenarios within the precinct of the province, in terms of availability of human and financial resources. In many actions, the responsible institutions are shown to be those belonging to the central government. However, the Central Provincial Council assumes the main coordinating function to bring synergy between the relevant institutions. The total time frame is given as five years. Attempts should be made to plan and initiate many actions as possible during the year 1 and proceed to achieve their goals through a definite time frame. It is proposed that this action plan be reviewed through an intensive consultation process in order to refine it with information on specific details and cost for each activity

CHAPTER 1

1. INTRODUCTION

At present, about 1.4 million life forms are known to the mankind. Biologists estimate that there are thousands of species waiting to be discovered especially in the tropical rain forests in different parts of the globe. Although new plant and animal species are being discovered, factors such as rapid increase of human populations, poverty, unemployment and widespread dependence of subsistence agriculture etc. impose threats on the survival of the global biodiversity. In developing countries such as Sri Lanka, the conservation of biodiversity has become a challenge to policy makers, especially due to the lack of essential data on biodiversity.

The island of Sri Lanka consists of a land extent of 65,610 km² including 2,905 km² of man-made inland reservoirs developed during the past two millennia, mainly for irrigation. Having a wide range of topographic and climatic variations, the island has contributed to a significant diversity of ecosystems. Sri Lanka also has very high endemism per unit area and is listed as one of the 25 biodiversity hotspots in the world.

There is an increasing commitment by the government to decentralize the state administration to the provincial and district levels. Devolution would mean that biodiversity conservation would have to become an integral part of the regional planning and development process. For instance, the National Environment Act (NEA) has provided for the establishment of District Environment Agencies (DEAs) at the district level. Various government bodies followed suit by decentralizing their activities; e.g. the Central Environmental Authority (CEA). The National Policy for Wildlife Conservation advocates a decentralized administration to enhance the flow of benefits from protected areas to neighboring communities.

However, the reality is that the biodiversity conservation has not progressed to the expectations along with the pace of decentralization of the administration. A major reason for this handicap is the non-availability of biodiversity information at sub-national levels such as provinces and districts. Therefore, the action launched by the Ministry of Environment (ME) to prepare biodiversity profiles at the province level is appropriate.

The present effort of preparation of a biodiversity profile for the Central Province is to equip the relevant stakeholders of biodiversity conservation with tools to manage and sustainably use the natural resources within their administrative units.

CHAPTER 2

2. PHYSICAL FEATURES

The Central Province covers an area of 5,674 sq.km. (8.6 percent of the country) and it consist of three districts, viz. Matale (1993 sq.km.), Kandy (1940 sq.km.) and Nuwara Eliya (1741 sq.km). The province is unique in Sri Lanka due to its central location and highly dissected mountain terrain offering some of the most picturesque sceneries. The province consisting of almost all of the central highlands was protected as the water source for the country during its history. However, with the introduction of plantation agriculture by the British, the environment of the central province underwent significant transformation.

2.1 Climatic Zones

Three main climatic zones, viz dry, Intermediate and wet zones are represented in the Matale and Kandy Districts, while Kandy and Nuwara Eliya Districts mostly belong to the wet zone (Figure 2.1). The extents and proportions of the three main climatic zones within the Central Province are shown in Table 2.1.

Table 2.1 Extents and proportions of climatic zones in Central Province

Climatic zone	Extent (hectares)	Proportion (%)
Wet Zone	257,671	45.0
Intermediate Zone	243,715	42.6
Dry Zone	71,314	12.4

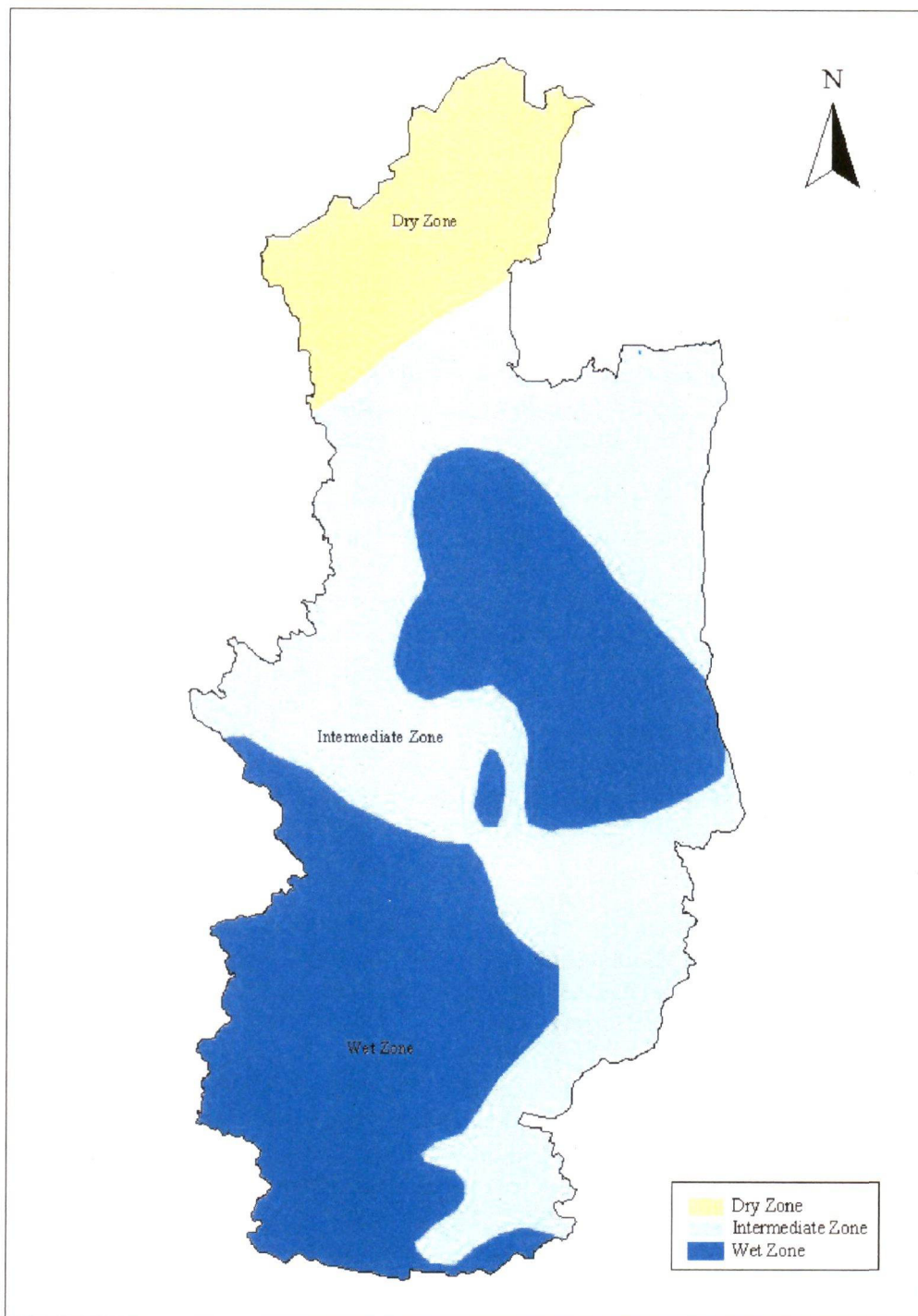
(Source: Jayasuriya et al 2006)

2.2 Temperature

The average annual temperature in Matale District is 20 - 25⁰C. During February-April the temperature is higher, fluctuating between 25 - 27.5⁰C. When the temperature is lower in December-January, the average temperature falls to about 20⁰C. With the onset of the SW monsoon in June-July, the temperature is relatively low. The temperature remains low in the Knuckles highland, while that in the Matale valley, at lower altitudes, the temperature is distinctly higher.

The Kandy District represents the highland wet zone where a cool and wet climate prevails. The average annual temperature is 22.5 - 25⁰C with its lowest during December - January and the highest during February - April. With the onset of the SW monsoon in June - July, the temperature drops relative to most of the other months.

The Nuwara Eliya District lies approximately within 1000-2500 m altitudes and its mean annual temperature is about 15⁰C while the daily variation of temperature is about 10⁰C. The temperature is in its lowest in December - January and on certain days, the night temperature in Nuwara Eliya can be as low as 0⁰C. The highest temperature during the year is between February and April.



Source: Jayasuriya et al. 2006

Figure 2.1 Climatic Zones of the Central Province

2.3 Rainfall

The Figure 2.2 shows the rainfall isohyets that influence the province and in general, the rainfall ranges between 1500 – 2500 mm. Some of the unique locations in the province make it climatologically most diverse; for example, Watawala receives the island's highest rainfall (5,024 mm) while Haragama, just a few kilometers away from Kandy receives only 1,890 mm of rainfall. However, the long term data reveal that during the previous 30 years the rainfall in the highlands on average has decreased by 150-200mm.

The Matale District receives an average annual rainfall of 1500 – 2000 mm. However, the Knuckles range receives distinctly more rainfall, i.e. 2500 – 3000 mm, while the northern and eastern lowlands of the district receive relatively low rainfall.

In contrast, the rainfall pattern in Kandy District is considerably uniform throughout the year, with no clear seasonal variations. The total annual rainfall of 2000 – 2500 mm is mainly distributed between the SW monsoon, in May – September (750 – 1000 mm), the NE monsoon in December – January (400 – 500 mm) and the intermonsoonal convectional rains peaking in October – November.

Due to its higher altitudes, the Nuwara Eliya District is subject to a year round rainfall averaging 2000 – 2500 mm and most of this rainfall is received during the SW monsoon and from the intermonsoonal convectional rains. At certain locations in the western parts of the district, what are called “mountain rains” bring about 3500 mm of rain.

2.4 Topography

On the basis of height and landforms, the Central Highlands situated mainly within the Central Province, is the most remarkable topographical region in the island (Figure 2.3). The Central Massif consisting of high plains and peaks is predominantly located within the Central Province. The Dumbara Massif (Knuckles Region), a detached part of the Central Massif, is totally located within this province.

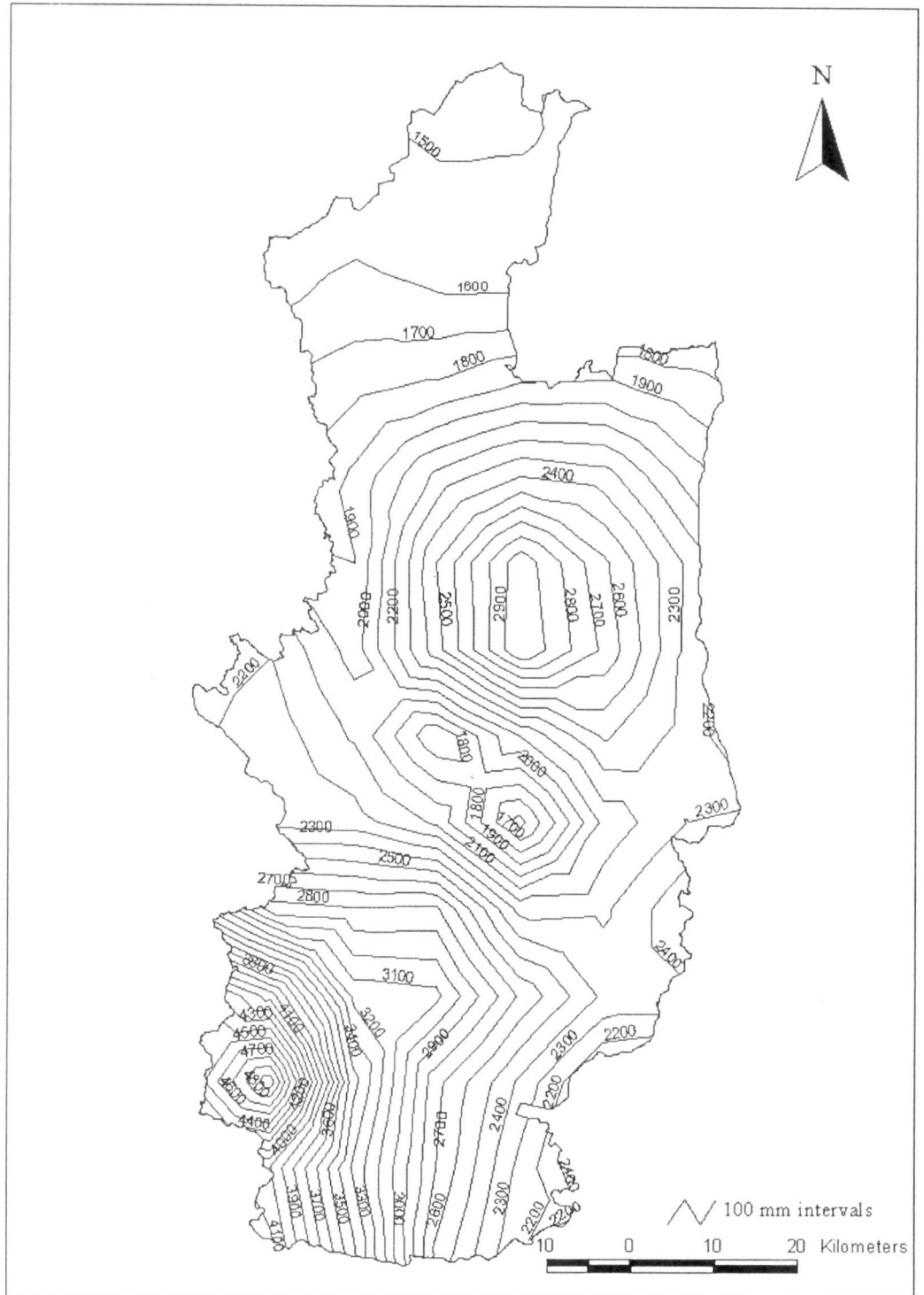
Generally, the Kandy District is represented by the Kandy plateau encircled by mountain ranges of Knuckles, Dolosbage and Pidurutalagala. However, the relief indicates a 600 – 900 m range in altitude and dissected high mountainous regions, residual mountains, steep slopes and dip slopes are found dispersed throughout the district.

The topography of the Matale District, situated in the southern flank of the northern plain of Sri Lanka and in the northern half of the central mountains, comprises topographical features of plateau and mountain regions. Outstanding among the topographical features is the Knuckles range, rising over 1500 m and representing the eastern part of the Matale District.

Nuwara Eliya District that lies between 1000 – 2500 m altitudes is the principal district that represents the island's highest range of mountains. The Pidurutalagala, Ragala and Horton Plains are the lands of highest altitudes that represent the apex of the anchor of mountains. The Elevation Model of the Central Province is shown in Figure 2.3.

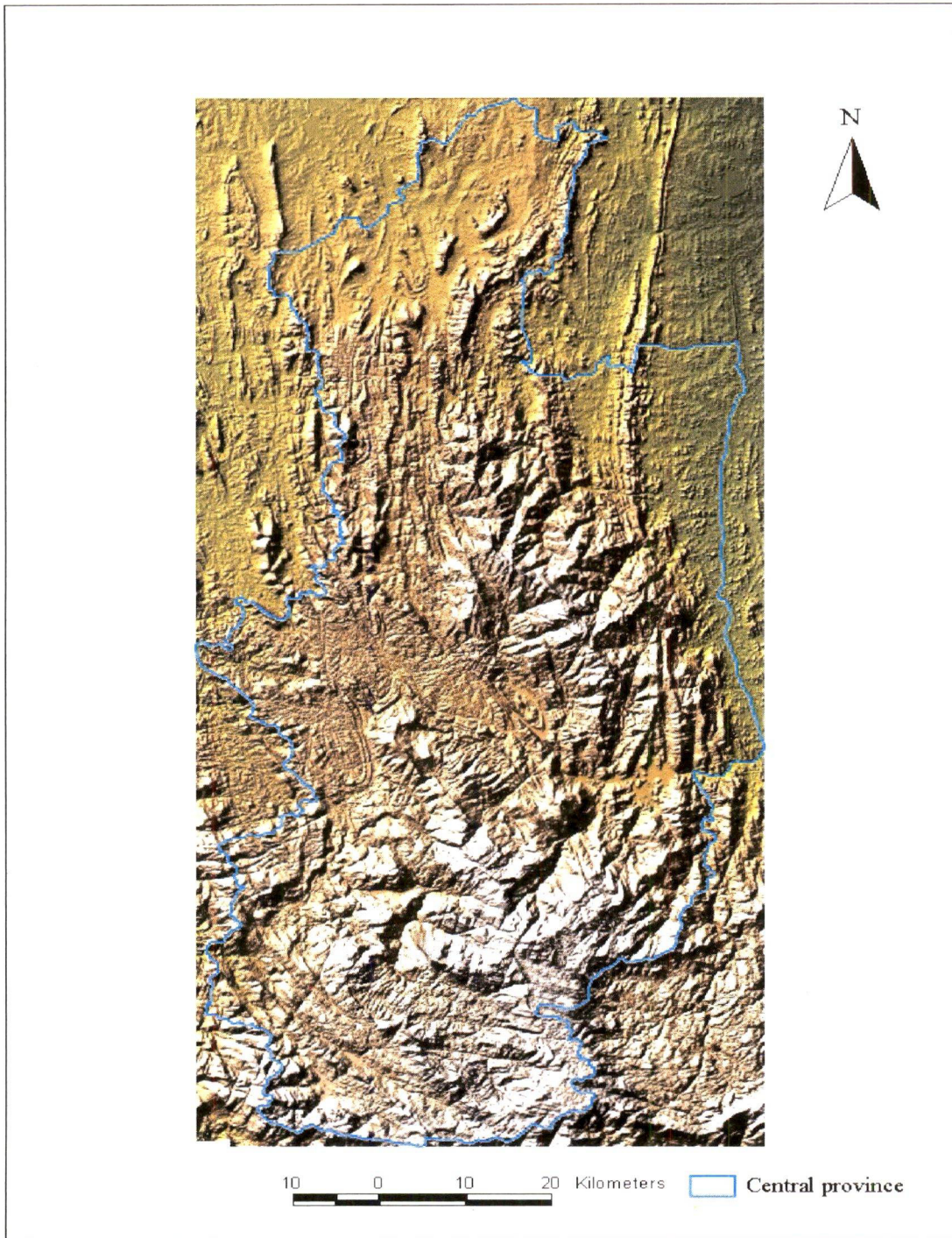
2.5 Soils

The soil map (Figure 2.4) indicates that 12 soil types are represented in the Central Province. The relative areas of these soil types are given in Table 2.2. However, this map also indicates that two of these main soil groups are predominant in the CP and they are distributed on the basis of topography and climate. These are the Red Yellow Podzolic soils and the Reddish Brown Earth; the former occurring in areas representing wet and semi-wet Intermediate Zone and the latter occurring in the Intermediate Zone. Eight soil types that belong to these two principal groups are represented in the Central Province. Of these soils, about 40% in the Matale District is covered with the main group of Reddish Brown and Low Humic Gley Soils.



Source: Survey Department 1988

Figure 2.2 Rainfall Isohyets in Central Province



Source: Jayasuriya et al. 2006

Figure 2.3 Elevation Model of the Central Province

The principal soil groups that represent the Nuwara Eliya District can be identified in terms of its relief and climatic features; these are Red Yellow Podzolic and Reddish Brown soils. Several soil sub-groups or types are also found distributed within the district. They are Mountain Regosols and Red Yellow Podzolic soils with semi-prominent horizon and Red Yellow Podzolic soils with prominent A1 horizon, Reddish Brown Latosolic and Immature Brown Loam. Of these soil groups, those that are distributed over an extent of 70% are Red Yellow Podzolic soils and Mountain Regosols with Red Yellow Podzolic soils. This soil group shows uniform distribution in the district. Red Yellow Podzolic soils with prominent A and B horizons are found in the south-eastern border, where the Nuwara Eliya DS Division is situated and covers an area of 11,186 hectares. The lands with this soil group are mainly utilized for growing tea. The Hanguranketa DS Division that lies in the northern part of the district has Red Brown Latosols blended with Immature Brown Loam and this soil combination covers an area of 90,000 hectares. This soil is utilized for growing vegetables and flowers. Beside these soil groups, several areas with latosols and erosional remnants also show minor distribution.

In Kandy District, Red yellow Podzolic and Reddish Brown Earth are dominant. The Reddish Brown Soils chiefly occur in the mountainous Intermediate Zone while the Red Yellow Podzolic Soils occur in the Wet Zone and mountainous inter-zonal areas between Wet and Intermediate Zones and they are widely distributed. Furthermore, there are many sub-soils belonging to these main soil groups especially in the mountainous terrains. The most widely distributed of these is the Red Yellow Podzolic Soils with Highland Regosols covering about 30% of the district area. The Immature Brown Loam and Low Humic Gley Soils occur in an extent of 17,802 hectares on the eastern and northern flanks of the former soil group. In the north western and central parts of the province, Reddish Brown Latosolic Soils and Immature Brown Loam are widely distributed over about 35% of the district's area.

Table 2.2 Soil types represented in the Central Province

Soil type	Extent(ha)	Proportion(%)
Red Yellow Podzolic Soils and Mountain Regosols; mountainous terrain	149,234	26.3
Red Yellow Podzolic Soils; steeply dissected, hilly and rolling terrain	101,790	18.0
Reddish Brown Earths and Low Humic Gley Soils; undulating terrain	90,065	16.0
Reddish Brown Earths and Immature Brown Loams; rolling hilly and steep terrain	75,627	13.3
Reddish Brown Latosolic Soils; steeply dissected, hilly and rolling terrain	49,751	8.8
Immature Brown Loams; steeply dissected, hilly and rolling terrain	40,249	7.1
Steep Rockland and Lithosols	17,121	3.0
Erosional remnants [Insebergs]	17,004	3.0
Red yellow podzolic soils with dark B horizon and Red Yellow Podzolic Soils with prominent A1 horizon; rolling terrain	11,186	2.0
Rock-knob plain	9,257	1.6
Red Yellow Podzolic Soils with Strongly Mottled Subsoil and Low Humic Gley Soils; rolling and undulating terrain	2,626	0.4
Alluvial Soils of variable drainage and texture; flat terrain	1,726	0.3

2.6 Water bodies and stream network

2.7 Rivers and river basins

The general pattern of stream flow could be considered broadly radial. There are 103 river basins that drain the landscape. The origins and the upper basins of some major rivers are located within the CP (Figure 2.5). These are predominantly perennial rivers and of them, the Mahaweli Basin is the largest and the most important in country's economy. Table 2.3 shows the river basins that are represented in the CP and their extents and the relative proportions within the province.

Table 2.3 Extents of river basins in Central Province

River Basin	Extent (hectares)	Proportion (%)
Mahaweli Ganga	223,796	73.1
Kala Oya	51,004	16.7
Kelani Ganga	12,739	4.2
Walawe Ganga	5,501	1.8
Maha Oya	4,092	1.3
Yan Oya	3,377	1.1
Deduru Oya	3,075	1.0
Kalu Ganga	1,494	0.5
Aruvi Aru	928	0.3

2.7.1 Tanks and reservoirs

Tanks, the ancient man-made water bodies, are few in the Central Province and they are mostly located in the dry parts of the Matale District. The larger or perennial tanks, such as Dewahuwa and Kandalama, are of great importance in agriculture. The perennial and seasonal tanks in the CP constitute 10,396 and 104 hectares respectively. In contrast, the reservoirs located in the CP are large, deep, and relatively recent man-made water bodies built particularly for hydropower generation. Being situated in the hill country, they all have precipitous slopes (Figure 2.6).

Table 2.4 Tanks and Reservoirs in Central Province

Tanks		Reservoirs
Matale District	Area (ha)	Matale District
Wewala Wewa	97	Bowatenna
Pahala Eraula	121	
Dewahuwa	945	
Nalanda Scheme	-	
Karaugahawela Wewa	242	
Mahawetenna Wewa	138	
Kandy District		Kandy District
Murapola/Kandetenna	332	Polgolla
		Victoria
		Randenigala
		Rantembe
		Nuwara Eliya District

		Kotmale
		Castlereagh
		Maussakele

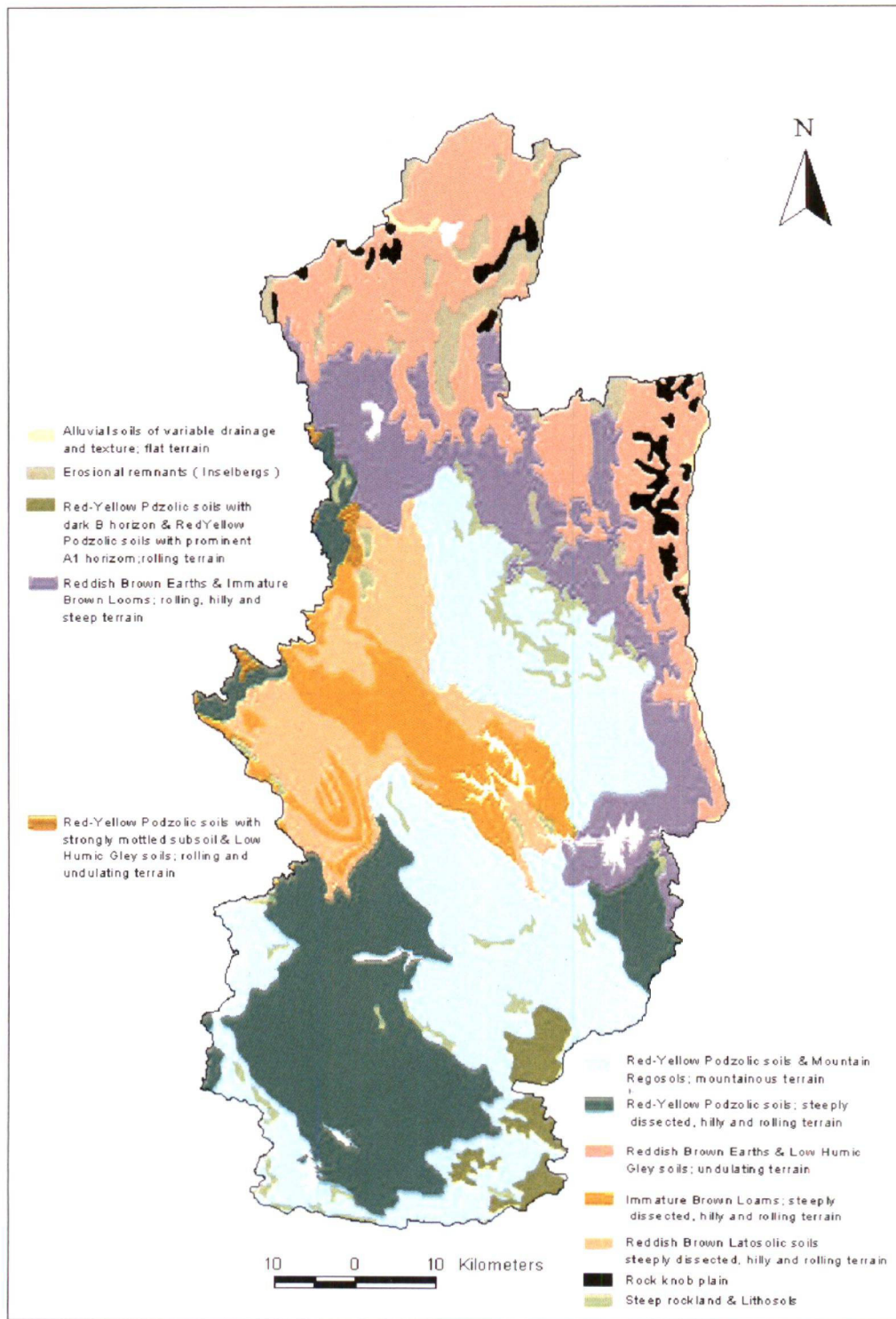
Source: Somasekaram et al, 1997

2.7.2 Land / Water Ratio

The extent of water bodies and total land area by districts of the Central Province are shown in Table 2.5

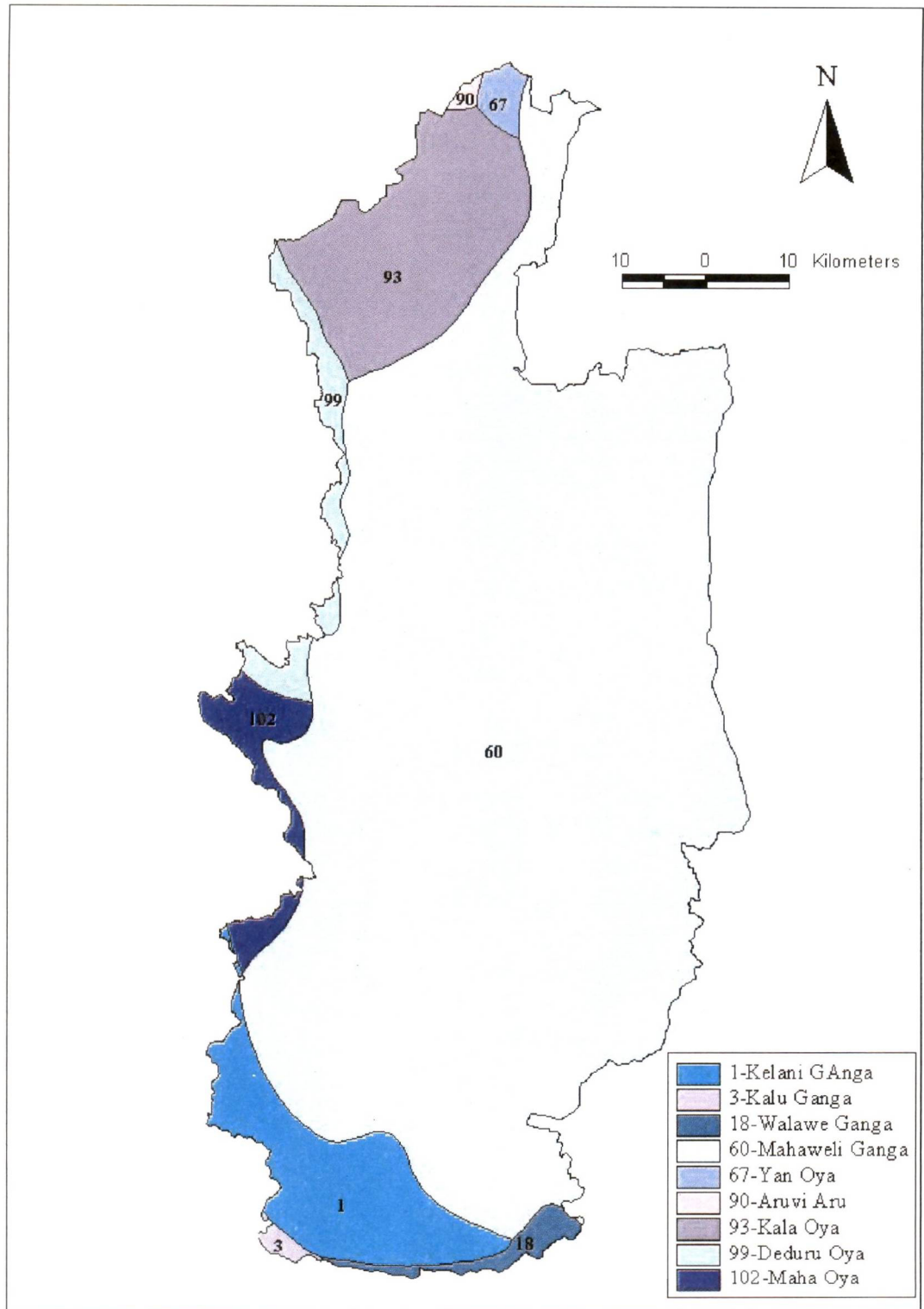
Table 2.5 Extent of land and inland water bodies of the Central Province

District/Province	Total Area (sq.km.)	Land Area (sq.km.)	Inland Water (sq.km.)	Percentage of Inland Water
Matale	1993	1952	41	2.05
Kandy	1906	1883	23	1.20
Nuwara Eliya	1720	1685	35	2.03
Central Province	5619	5520	99	1.76



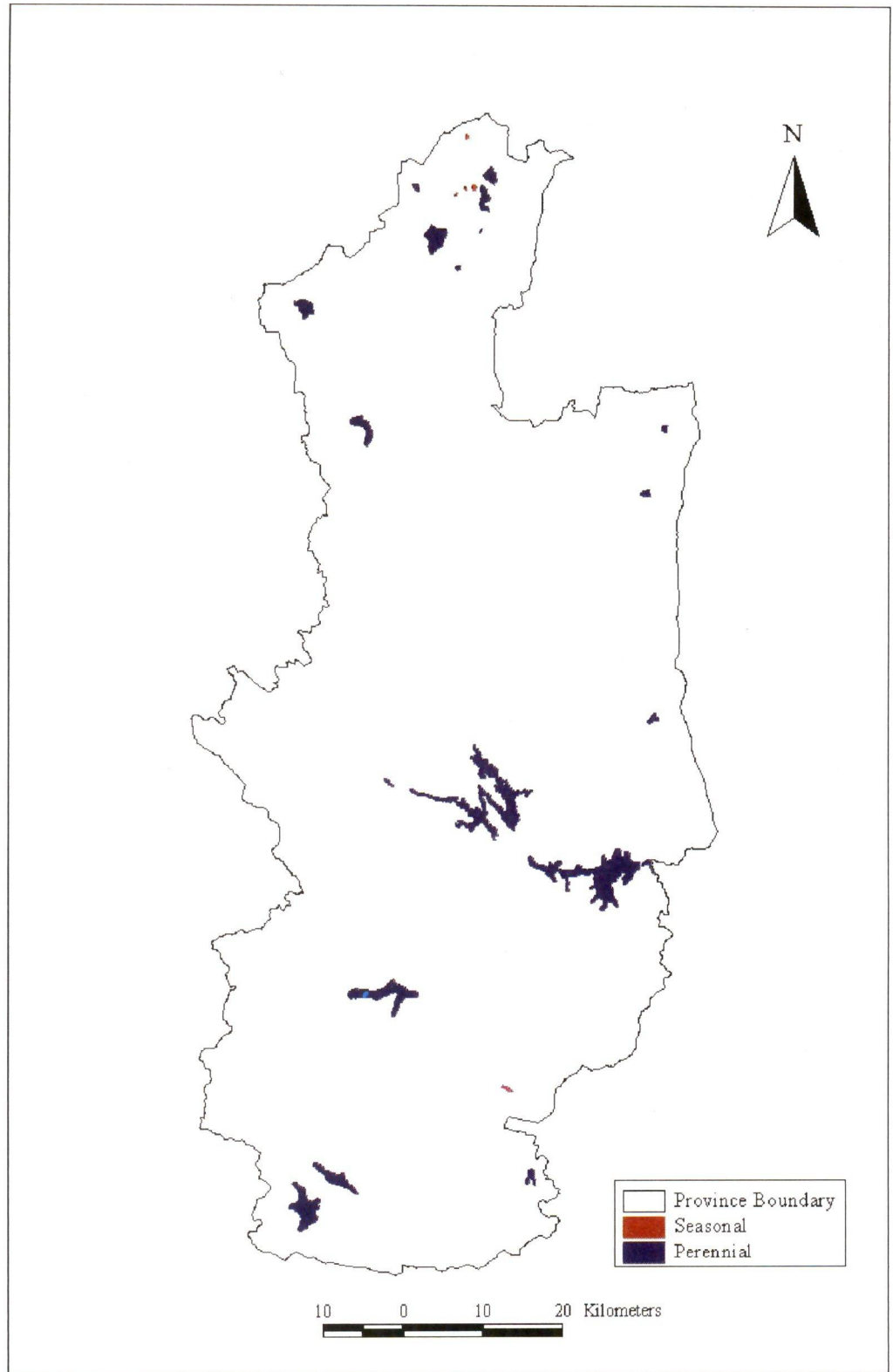
Source: Jayasuriya et al. 2006

Figure 2.4 Soil types represented in Central Province



Source: Jayasuriya et al. 2006

Figure 2.5 River Basins represented in Central Province



Source: Jayasuriya et al. 2006

Figure 2.6 Tanks and reservoirs in Central Province

CHAPTER 3

3. BIO-GEOGRAPHICAL REGIONS

Although a healthy 30 percent of Sri Lanka is forested or protected as wilderness (e.g. wetlands and grasslands), more than 95 percent of this is in the relatively biodiversity-poor seasonal “dry zone” (rainfall < 2,500 mm yr⁻¹). Of the wet zone’s 16,000 km², near-primary forest accounts for only about 750 km² (4.7 percent). This forest exists in several fragments, the largest of which are Peak Wilderness Sanctuary, the Knuckles Reserve, the Sinharaja World Heritage Site and Horton Plains National Park. The balance is in the form of fragments, posing severe conservation challenges. In addition to this, the wet zone contains some of secondary and partially harvested forest, which is nevertheless of great conservation value.

3.1 Bio-geographical Regions (Bio-regions)

In the BCAP (MENR 1998), many actions recommended for the conservation of biodiversity are focused on the conservation of species *in situ* and of habitats. In this context, the identification of biodiversity regions (= bio-regions) for priority action will help the regional administrators and planners to recognize and include in their programs the areas needing urgent action for biodiversity conservation. It would also enable national level state institutions directly concerned with biodiversity conservation to identify areas for priority action in terms of implementing the recommendations in the BCAP. Thus bio- regions were identified primarily to facilitate the identification of spatially defined areas for conservation action (MENR 1998). A careful analysis of current climatic and geo-physical classifications, the floral and faunal distribution patterns, and the biodiversity richness of different parts of the country led to the identification of the terrestrial bio-regions.

Fifteen bio-regions for Sri Lanka were identified and the BCAP recommends that these bio-regions should be treated as provisional (MENR 1998). An analysis of climatic and geo-physical classifications, the floral and faunal distributional patterns, and the biodiversity richness of different parts of the country led to the identification of the terrestrial bio-regions. The coastal and marine bio-regions were identified within a belt extending 300 m inland from the level of high tide through to 22.2 km (12 nautical miles) into the ocean. The bio-regions within this area were demarcated according to the presence of characteristic biological resources (e.g. coral reefs) and their uses, the presence of special habitats, and threats to biodiversity due to human activity.

In the Central Province, four bio-regions are represented as follows:

Bio-region 4 : Lowland Wet Zone. Tropical (lowland) wet evergreen forest; altitude up to 1000 m; annual rainfall 2500 – 5000 mm; no dry months.

Bio-region 5 : Sub-montane Wetlands. Sub-montane evergreen forest; altitude 1000 – 1500m; annual rainfall 2500 – 5000 m; no dry months.

Bio-region 6 : Wet Highlands. Montane evergreen forests; altitude 1500 – 2500 m; annual rainfall 2500 - 5000 mm; no dry months.

Bio-region 7 : Intermediate highlands. Dry patanas; altitude 1000 – 1500 m; annual rainfall 1900 – 2500 mm; less than 3 dry months.

3.2 Floristic Regions

Ashton & Gunatilleke (1987) proposed 15 Floristic Regions for the island and ten of these are represented in the Central Province (Figure 3.1). It also indicates that the CP is most diverse in terms of the floristic region diversity.

Floristic Region 2 : Dry and arid lowlands. Tropical dry mixed evergreen (*Manilkara* community), Mixed community (*Chloroxylon-Vitex-Berrya-Schleichera* series), Tropical thorn forest (*Manilkara-Chloroxylon-Salvadora-Randia* Series), Damana and Villu grasslands

Floristic Region 3 : Northern and intermediate lowlands. Tropical moist evergreen forests (*Filicium-Euphoria-Artocarpus-Myristica* series)

Floristic Region 4 : Eastern intermediate lowlands. Tropical moist semi-evergreen forests and Savanna forest.

Floristic Region 5 : Northern wet lowlands. Tropical wet evergreen forests

Floristic Region 9 : Foothills of Adam's Peak and Ambagamuwa. Tropical wet evergreen forests.

Floristic Region 11 : Kandy and Upper Mahaweli. Tropical wet evergreen forests and Humid zone dry patana grasslands.

Floristic Region 12 : Knuckles. Tropical sub-montane forests (*Myristica-Cullenia-Aglaiia-Litsea* Community) and Tropical montane forests.

Floristic Region 13 : Central mountains, Ramboda-Nuwara Eliya. Tropical montane forests and Upper wet patana grasslands.

Floristic Region 14 : Adams's Peak. Tropical montane forests and Tropical sub-montane evergreen forests.

Floristic Region 15 : Horton Plains. Tropical montane forests and Upper wet patana grasslands.

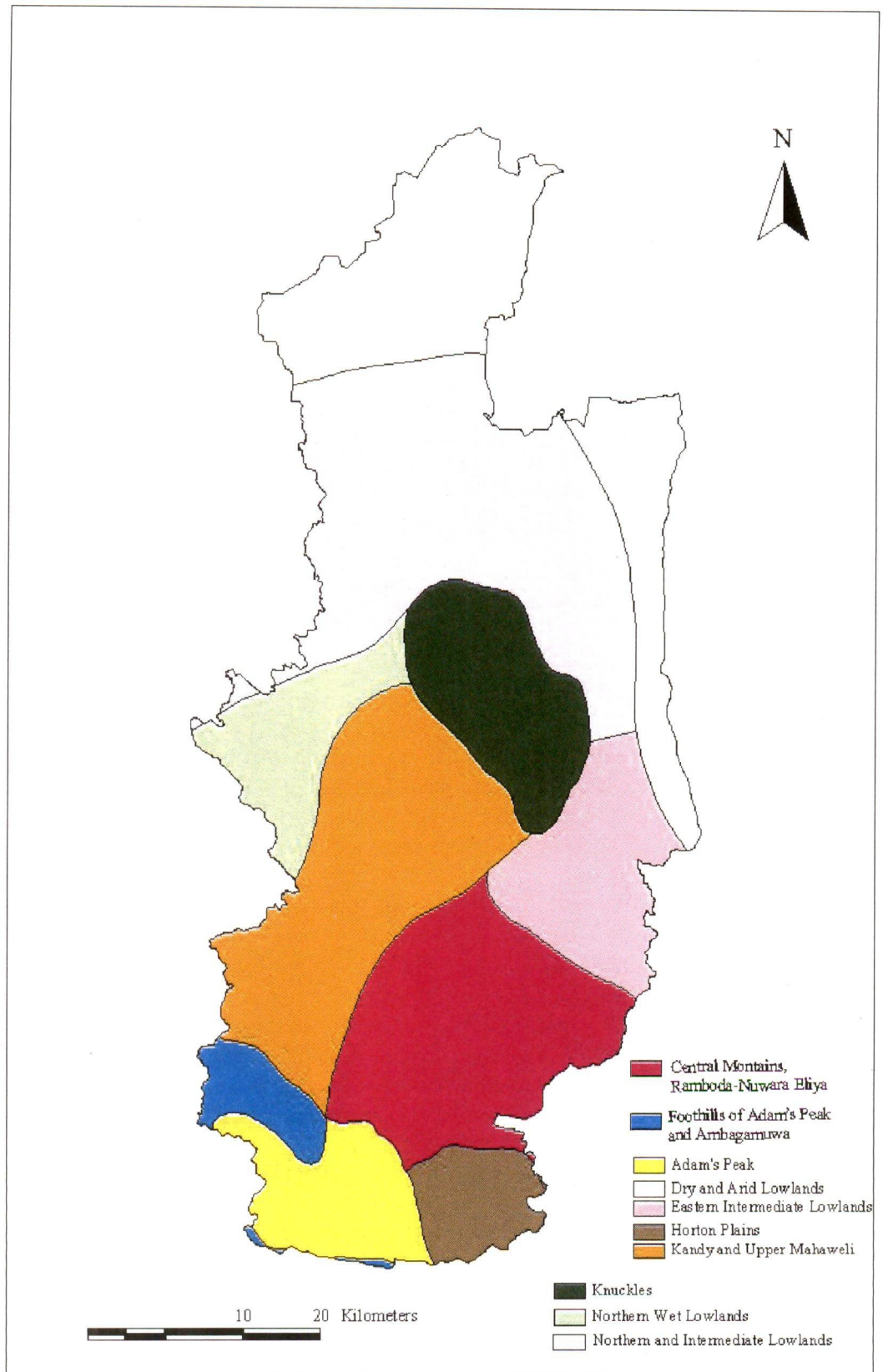


Figure 3.1 Floristic Regions in Central Province

The extents of the floristic regions in the CP are shown in the Table 3.1.

Table 3.1 Extents of Floristic Regions in Central Province

Floristic Region	Extent (hectares)	Proportion (%)
Northern and Intermediate Lowlands	122,907	21.5
Dry and Arid Lowlands	95,647	16.7
Kandy and Upper Mahaweli	90,319	15.7
Central Montains, Ramboda-Nuwara Eliya	81,168	14.2
Knuckles	44,306	7.7
Eastern Intermediate Lowlands	42,774	7.5
Northern Wet Lowlands	31,407	5.5
Adam's Peak	31,062	5.4
Horton Plain	18,799	3.3
Foothills of Adam's Peak and Ambagamuwa	14,312	2.5

3.3 Agro-ecological regions

An agro-ecological region represents a particular combination of the natural characteristics of climate, relief and soil which tends to find expression agriculturally in particular farming systems. The agro-ecological demarcation of Sri Lanka has been devised to meet the special requirements of research, extension, regional specialization of crops and regional development.

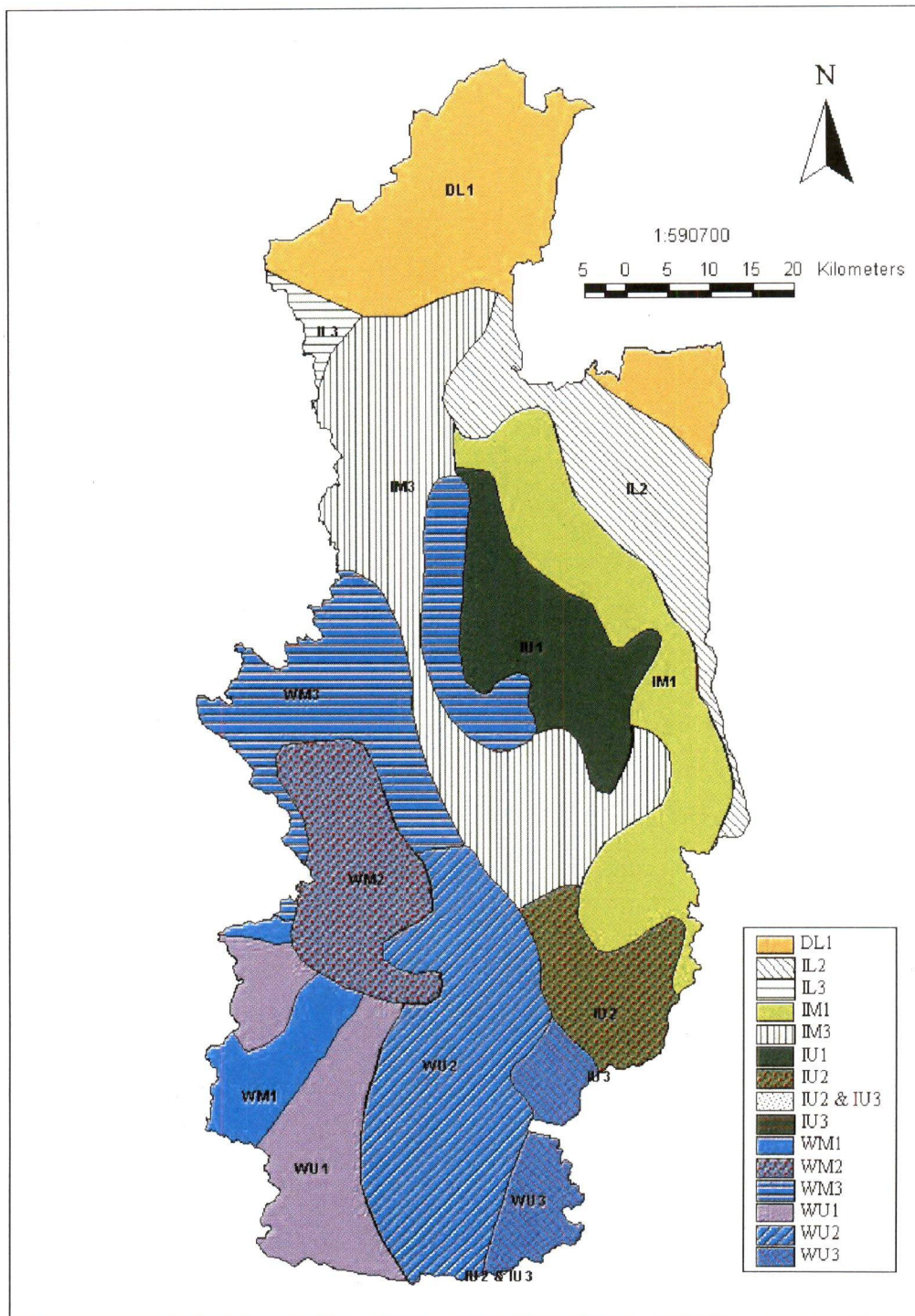
Based on parameters, such as rainfall, topography, soils and agricultural land use, Sri Lanka is divided into three major climatic zones, viz. i) Wet Zone, b) Intermediate Zone and c) Dry Zone. Secondly, these major zones subdivided into agro-climatic regions based on elevation which takes into account the temperature limitations for the more important plantation and arable crops grown in the country. The third stage of subdivision is into agro-ecological regions which represent approximately homogenous climatic conditions combined with the effects of soil, land form and agricultural activities. The natural environment in each agro-ecological region can thus be generalized in terms of its distinctive rainfall probability regime, soils and nature of terrain.

Each agro-ecological region is denoted by two letters and a number. The first letter refers to the Zone, Wet (W), Intermediate (I) and Dry (D). The second letter refers to elevation, Up country (U), Mid country (M) and Low country (L). The number reflects the degree of wetness of the modal rainfall probability regime, 1 representing the highest degree of wetness and 3 the lowest (Panabokke 1997).

Figure 3.2 shows that 15 agro-ecological regions are represented in the Central Province and their respective areas are given in the Table 3.2.

Table 3.2 Extents of agro-ecological regions represented in the Central Province

Agro-ecological region		Extent (hectares)	Proportion of the total area (%)
IM 3	[Intermediate Mid-country]	84,092	14.6
WU 2	[Wet Up-country]	73,628	12.9
DL 1	[Dry Low-country]	69,805	12.2
WM 3	[Wet Mid-country]	60,915	10.6
IM 1	[Intermediate Mid-country]	60,539	10.5
IL 2	[Intermediate Low-country]	44,364	7.7
WU 1	[Wet Up-country]	40,022	7.0
IU 1	[Intermediate Up-country]	37,850	6.6
WM 2	[Wet Mid-country]	36,160	6.3
IU 2	[Intermediate Up-country]	23,769	4.1
WU 3	[Wet Up-country]	19,061	3.3
WM 1	[Wet Mid-country]	17,659	3.1
IL 3	[Intermediate Low-country]	4,551	0.8
IU2 & IU 3	[Intermediate Up-country]	78	0.0
IU 3	[Intermediate Up-country]	2	0.0



Source: IWMI

Figure 3.2 Agro-ecological Regions in Central Province

CHAPTER 4

4. MAJOR NATURAL ECOSYSTEMS

4.1 Introduction

Despite its importance, remarkably little about Sri Lanka's biological diversity is known. Ecosystem diversity has been relatively well studied, but the total diversity of living organisms and interrelationships among them at a community or ecosystem level are poorly recognized or understood.

The diverse terrain and climatic variation within the small land area has resulted in an interesting array of ecosystems. The country has two basic eco-zones divided by a central mountainous region which intercepts the monsoonal winds, thereby creating an ever-wet southwestern quarter and a rain shadow in the remaining area. The far northwest and southeast, which escapes the mountains, has a climate bordering arid conditions. Within this broad differentiation is a multitude of ecosystem diversity. Forests are the predominant vegetation, varying from ever-wet rainforests – both lowland and montane – to dry evergreen and deciduous thorn forest. Grasslands and a complex network of wetlands, freshwater, coastal and marine ecosystems are interspersed with the forests.

The most conspicuous groups, such as the flowering plants, ferns and vertebrate animals, are the only ones relatively well studied. Collectively they probably account for only a very small percentage of the island's total species. The lower forms of flora and fauna such as the algae, fungi, lichens, bryophytes and invertebrates are poorly known. Even less known are microorganisms such as bacteria and some fungi.

Yet even among the flowering plants and vertebrate fauna it appears likely that many species remain undiscovered. Biologically rich places like the Knuckles, Peak Wilderness and Horton Plains are yet to be studied intensively. Systematic inventories in recent years in Ritigala, Sinharaja and Hinidun Kanda have led to the discovery of many new species. The recently revised classification of plants and animals of Sri Lanka have also resulted in the identification and documentation of new species (NARESA 1991).

4.2 Natural vegetation

The natural vegetation of Sri Lanka covers an area of 375 million hectares or 35.5 per cent of the land area of the country. This includes natural plant communities, both high and open forest (GOSL/UNDP/FAO 1986). A survey based on landsat imagery carried out in 1992 shows that close canopy natural forests (i.e with over 70 percent crown closure) occupy 23.88 per cent of the total land area. The additional "sparse forests" that consist of mainly the scrub vegetation covering 7.01 per cent of the land area bring the total forest in the country to 30.89 per cent (MALF 1995, MOFE 1999). In addition, grasslands and other minor vegetation types (e.g. Salt Marsh, Sand Dunes and Strand Vegetation etc.) add a considerable area to the natural vegetation cover.

The natural vegetation in Sri Lanka shows a striking diversity due to spatial variation mainly in thermal, hydrological and edaphic factors inducing the evolution of distinct biotic assemblages which are manifested by characteristic vegetation types.

4.3 A new classification and a map of natural vegetation of Sri Lanka

As yet, there is no precise natural vegetation map of Sri Lanka that is sufficiently detailed. However, the EML has produced such a map depicting the main natural vegetation types in Sri Lanka with some acceptable accuracy. Spatial datasets of closed canopy natural forest cover types, from 1:50,000-scale forest map of Sri Lanka (Legg & Jewell 1992, 1995), and 1:50,000-scale Topographic Map of Sri Lanka (Survey Department of Sri Lanka 2001) provided a useful basis to construct this map for the gap analysis (Jayasuriya et al 2006). This provisional natural vegetation map depicts 14 major natural vegetation types, leaving out the plantation forests and minor natural vegetation types. Furthermore, the Gap Analysis work also proposed a user-friendly classification of the 14 main terrestrial and semi-terrestrial vegetation types constituting nine forest types, four grassland types and the sand dunes (Jayasuriya et al 2006).

4.3.1 Dynamics of the natural vegetation

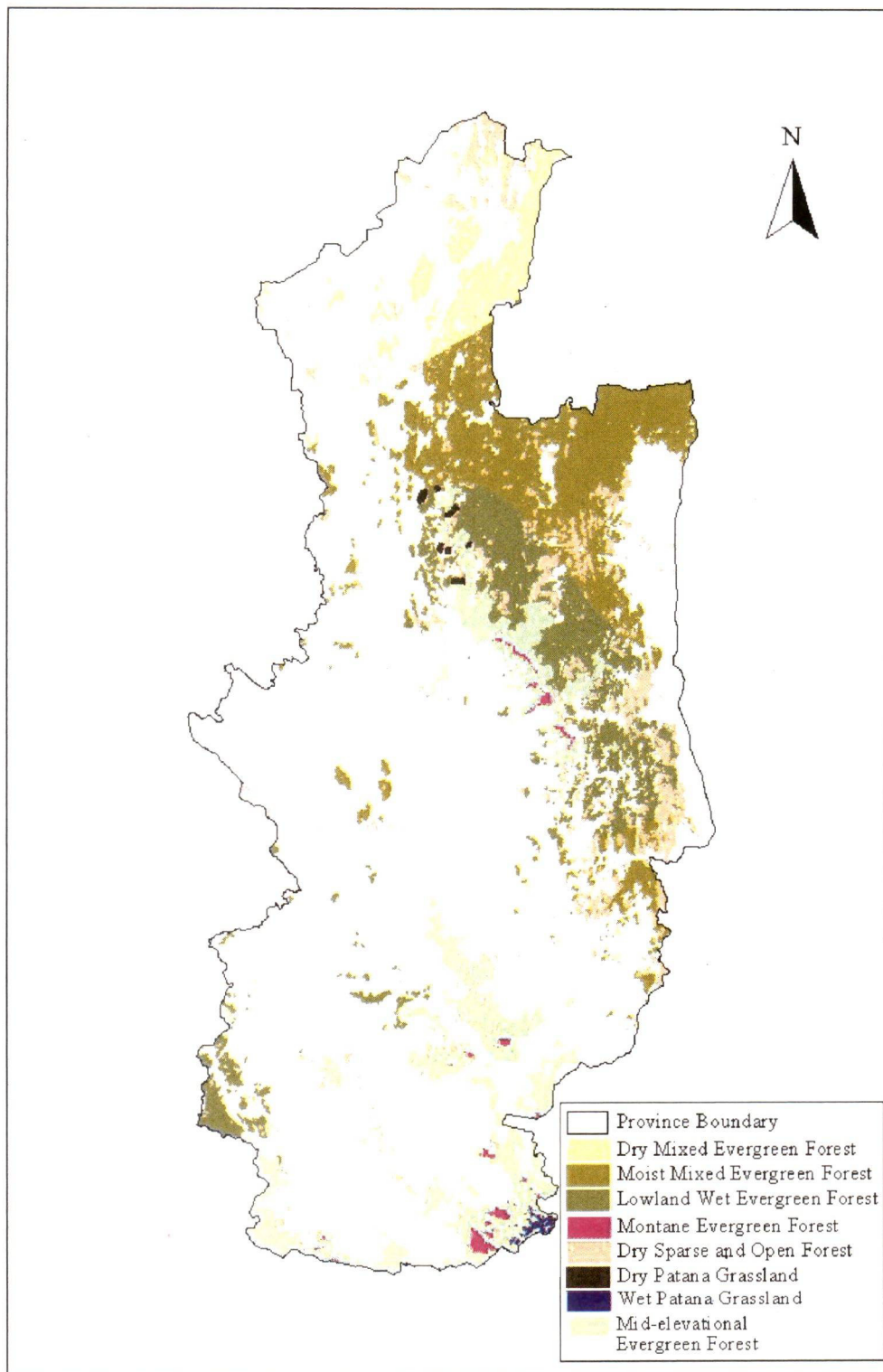
In the wet zone, as the Lowland Wet Evergreen Forest (<900 m) transforms into Mid-elevational Evergreen Forest (900-1400m) and Montane Evergreen Forest (>1500 m), there is a progressive decline in canopy height and a reduction in species density. The Dry Mixed Evergreen Forest that is characteristic of the dry zone vegetation has a canopy that is relatively open and often less than 20 m in height. Moist Mixed Evergreen Forest constitutes a distinct type in the lowland intermediate zone, while Dry Deciduous Thorn Scrub constitutes is characteristic of the semi-arid climatic zones located in the northwestern and southeastern sectors of the island. In addition, there are different types of grasslands in all climatic zones. The newly proposed map of the major natural vegetation types in Sri Lanka is contained in the gap analysis exercise (Jayasuriya et al 2006).

4.4 Major Natural vegetation types in Central Province

Eight major natural vegetation types are represented in the CP (Figure 4.1). The extents that are represented by various vegetation types are indicated in the Table 4.1. The nomenclature of the vegetation types are in accordance with the Gap Analysis (Jayasuriya et al 2006) followed by a description of the vegetation type that is also characterized by its species composition.

Table 4.1 Vegetation types represented in the Central Province

Vegetation Type	Extent (hectares)	Proportion (%)
Moist Mixed Evergreen Forest	47,584	29.5
Mid-elevational Evergreen Forest	45,011	27.9
Lowland Wet Evergreen Forest	30,941	19.1
Dry Sparse and open Forest	18,410	11.4
Dry Mixed Evergreen Forest	15,276	9.5
Montane Evergreen Forest	2,976	1.8
Dry Patana Grassland	697	0.4
Wet Patana Grassland	626	0.4



Source: Jayasuriya et al. 2006

Figure 4.1 Major Natural Vegetation Types in Central Province

4.4.1 Dry Mixed Evergreen Forest (DMEF)

DMEF is the most widespread matrix natural vegetation type in the dry zone. It is influenced by an average annual temperature of 27-28⁰ C and an annual precipitation of 1300-1850 mm. Most of the precipitation is seasonal during the NE monsoon and the second inter-monsoon from October to February and have a marked dry spell during the south west monsoon between May and August

DMEF is also, for the most part, a secondary forest having developed during the last 400-500 years after the fall of an extensive hydraulic civilization which existed in the dry zone from 300 BC to 1200 AD, thus indicating its remarkable ability to recover up to its original status. However, patches of climax or steady-state vegetation still survive, especially in some PAs.

DMEF is one of the most structurally well-developed forest types consisting of clearly distinguishable strata, namely the emergent, canopy, sub-canopy, shrub and herb levels. The lianas and other semi-woody climbers are also an important element in the DMEF. The general level of the canopy in a well-developed forest is approximately 20-25 m in height, while the emergents rise to about 3m or more above the canopy. The mixed composition of the DMEF consists of several evergreen and deciduous species of trees and shrubs.

The composition of a typical DMEF profile is as follows:

Emergents : Evergreen - *Manilkara hexandra* and *Scleichera oleosa*.

Emergents : Deciduous - *Chloroxylon swietenia* and *Berrya cordifolia*

Canopy : Evergreen - *Drypetes sepiaria*, *Dimocarpus longan*, *Diospyros ebenum*, *Alseodaphne semecarpifolia*, *Lepisanthes tetraphylla*, and *Strychnos nux-vomica*.

Canopy : Deciduous - *Mitragyna parvifolia* and *Vitex altissima*

Sub-canopy : Evergreen - *Diospyros ovalifolia*, *Pleurostyliia opposita*, *Psydrax dicoccus*, *Discospermum sphaerocarpum*, *Diospyros ferréa*, *Eugenia willdenowii*, *Dimorphocalyx glabellus*, *Walsura trifoliolata*, and *Pleiospermium alatum*.

Sub-canopy : Deciduous - *Lepisanthes tetraphylla*, *Cassia fistula*, *Sapium insigne*, *Pteroispermum suberifolium* and *Premna tomentosa*.

Shrub – *Phyllanthus polyphyllus*, *Tarenna asiatica*, *Polyalthia korinti*, *Glycosmis mauritiana*, *Memecylon capitellatum*, *Memecylon umbellatum* and *Stenosiphonium cordifolium*.

Lianas & climbers – *Ventilago maderaspatana*, *Scutia myrtina*, *Derris scandens*, *Salacia reticulata* and *Derris parvifolia*.

Herb – *Scleria lithosperma*, *Justicia procumbens* and *Cyrtococcum trigonum*.

Being an extensive forest type covering a vast area in the dry zone, the DMEF is influenced by variation in edaphic and hydrological factors that is manifested by a variety of plant species assemblages.

4.4.2 Moist Mixed Evergreen Forest (MMEF)

This is widespread in the intermediate zone extending from inner borders of DMEF in the dry lowlands to outer borders of the Mid-elevational Evergreen (sub-montane) Forests up to nearly 900 m of the hill country or the lowland rain forests or the grasslands elsewhere. The temperatures range between 20.5⁰ and 24.80⁰ C while 1875 to 2500 mm of annual rainfall is received in this

region. This vegetation type also occurs in the dry zone exclusively in association with isolated hills, rising above a reasonable elevation, where geographical variation in relief influences temperature depression and enhanced moisture regime, thus providing a appropriate niche for the development of the MMEF in the form of islands within a DMEF matrix of the dry zone.

Colloquially the MMEF is known as the “*Intermediate Forest*” as it manifest intermediate characters between DMEF and LWEF. The profile is clearly distinguishable into emergent, canopy, sub-canopy, shrub and herb strata. Their continuous canopies reach 15-20 m in height, while the emergents sometimes grow to over 30 m in height. The physiognomy and frequency of occurrence of the epiphytes and epiphyllous flora in MMEF is also intermediate between the two main neighbouring ecosystems, namely the DMEF and LWEF. Therefore it is also considered as a transitional or ecotone forest.

MMEF has a clear diversity of *plant communities* that is governed by mesoclimatic variation within the intermediate zone. For example, a community with affinities to wet lowland flora exists in Kurunegala aspect of the intermediate zone. The elements such as *Artocarpus nobilis*, *Filicium decipiens*, *Pometia pinnata*, *Semecarpus nigroviridis*, and *Mangifera zeylanica* etc. indicate wet lowland sources of enrichment. There are also broad-range species such as *Vitex altissima* and *Dimocarpus longan* etc., while species such as *Chukrasia tabularis*, *Ficus callosa*, *Tetrameles nudiflora* and *Pterospermum suberifolium* are typical intermediate zone elements. This community is generally evergreen in character with only a few deciduous species.

In contrast, another community showing affinities to dry lowland flora exists mainly in Ampara-Moneragala aspects of the dry zone and it accommodates species such as *Schleichera oleosa*, *Chloroxylon swietenia*, *Diospyros affinis*, *Diospyros ebenum*, *Pityranthe verrucosus* and *Cassine balae* etc. that indicates dry zone sources of enrichment with other species such as *Hydnocarpus venenata*, *Pterospermum suberifolium* and *Haldinia cordifolia* etc.

Meanwhile, as evidenced from studies conducted in Ritigala SNR (Jayasuriya & Pemadsa 1983 and Jayasuriya 1984) and the Kala Oya Upper Basin (EML 2005), a distinct community occurs in association with isolated hills in the dry zone that is dominated by canopy species such as *Dimocarpus longan*, *Pterospermum suberifolium*, *Diospyros oocarpa*, *Diospyros ovalifolia*, *Xylopiia nigricans*. *Vitex altissima*, *Diospyros ebenum*, *Berrya cordifolia*, *Discospermum shaerocarpum*, *Lepisanthes senegalensis*, *Walsura trifoliolata*, *Drypetes sepiaria*, *Psydrax dicoccos*, *Cleistanthus patulus*, *Cleistanthus pallidus*, *Mischodon zeylanicus*, *Drypetes gardneri*, *Pleurostylia opposita* and *Alseodaphne semicarpifolia* etc. The emergents, although uncommon, consist of massive trees such as *Tetrameles nudiflora*, *Antiaris toxicaria* and *Pterygota thwaitesii*. The high shrubs consist of *Dimorphocalyx glabellus*, *Mallotus rhamnifolia* and *Mallotus eriocarpus* etc., while low shrubs consist of species such as *Polyalthia korinti*, *Streblus taxoides*, *Glycosmis pentaphylla* and *Memecylon capitellatum*. The lianas, although uncommon, consist of species such as *Ventilago maderaspatana*, *Reissantia indica* and *Salacia reticulata*. The scanty ground layer consist of herbaceous species, e.g. , *Scleria lithosperma*, *Adiantum caudatum* and *Cyrtococcum trigonum* etc. Although many of these species have origins in the DMEF matrix, they distinctly differ quantitatively and furthermore, the MMEF is endowed with many characteristic and sometime unique species, e.g. *Cleistanthus patulus*, *Xylopiia nigricans*, *Mesua ferrea*, *Givottia rotteriformis*, *Artocarpus gomezianus* and *Celtis philippensis* etc.

In the Central Province, the MMEF occurs on the hills of the Dry Zone, e.g. Menikdena, Kaludiyapokuna and Inamaluwa in the Matale District.

4.4.3 Lowland Wet Evergreen Forest (LWEF)

LWEF is the widespread matrix vegetation in the southwest sector of Sri Lanka occurring in the wet lowlands up to an elevation of 900 m. The mean annual temperature is about 28⁰C and the

mean annual rainfall varies between 2300 – 5000 mm without a moisture-deficit period. The humidity varies between 75-85%; however, exceeding 90% during the seasons of high rainfall. This region is more influenced by the winds from the south- west rather than from the northeast. The warm, wet and tropical climate is ideal for the development of this most complex ecosystem.

Forest is markedly stratified and characterized by tall and dense canopy of about 30m with emergents reaching 45 m or more above the canopy skyline with their characteristic cauliflower or mushroom-like crowns. A sub-canopy of 15-30 m and a sparse shrub layer, which consists mostly of tree saplings, and a scanty herbaceous ground flora complete the forest profile. Lianas are an essential component while epiphytes, mainly composed of ferns, orchids, lichens, fungi and bryophytes, are also abundant in the LWEF. Numerous epiphyllous mosses and liverworts add diversity to its plant life forms.

The main constituents of the LWEF strata, based on the NCR survey (IUCN and WCMC 1997), are as follows:

Emergents – *Shorea dyeri*, *Shorea stipularis*, *Doona congestiflora* and *Doona affinis*.

Canopy – *Doona trapezifolia*, *Dipterocarpus zeylanica*, *Dipterocarpus hispidus*, *Palaquium petiolare* and *Mesua pulchella*.

High sub-canopy – *Cullenia zeylanica*, *Cullenia rosayroana*, *Bhesa ceylanica*, *Calophyllum bracteatum*, *Calophyllum thwaitesii*, *Mastixia tetrandra*, *Syzygium firmum*, *Chaetocarpus castanocarpus*, *Hydnocarpus octandra*, *Cryptocarya wightiana*, *Myristica dactyloides* and *Anisophyllea cinnamomoides*.

Low sub-canopy – *Wormia triquetra*, *Garcinia hermonii*, *Xylopiya championii*, *Cinnamomum dubium*, *Memecylon rostratum*, *Allophylus zeylanicus* and *Schumacheria castaneifolia*.

High shrub / treelet – *Gyrinops walla*, *Aporosa lanceolata*, *Gaetnera rosea*, *Gaetnera vaginans*, *Microtropis wallichiana*, *Litsea longifolia*, and *Ochlandra stridula*.

Low shrub - *Lijndenia capitellata*, *Psychotria dubia*, *Psychotria nigra*, *Thottea siquosa*, *Lasianthus oliganthus*, *Dracaena thwaitesii*, and *Dachapetalum gelonioides*.

Liana – *Connarus championii*, *Dalbergia pseudo-sisso*, *Salacia diandra*, *Kadsura heteroclita* and *Calamus zeylanicus*.

Herb – *Acrotrema* spp., *Neurocalyx* spp., *Acranthera ceylanica*, *Ophiorhiza mungos* and *Schizostigma hirsutum*.

Along with local and regional mesoclimatic variation in altitude and temperature within the wet lowlands, the geographical factors such as relief, gradient, soil depth, and distribution of minerals provide a variety of niches, e.g. ridges, slopes and valley bottoms influencing assemblage of species into distinct communities. Pemadasa (1995) recognized *Dipterocarpus* community prevalent in valley bottoms, *Mesua* – *Doona* community on hill slopes and *Vitex* – *Wormia* – *Chaetocarpus* – *Anisophyllea* community on eroded hill slopes especially on lateritic soils.

4.4.4 Mid-elevational Evergreen Forest (MEEF)

This is essentially a transitional vegetation type between LWEF and MOEF in the wet zone, occurring between 900-1400m in the three general mountain massifs of the island, namely, the Central Highlands, the Knuckles and the Rakwana Range. The mean annual temperature is 18 – 23° C while the mean annual rainfall 1750 – 2600 mm.

The nature of the structure and physiognomy of the MEEF is intermediate between the LWEF and MOEF. The forest profile is less distinctly stratified compared with that of the LWEF. The canopy reaches generally to 15-20 m without emergents, although in dipterocarp-dominated stands some *Doona* species emerge up to about 30 m. The sub-canopy and the shrub layers are less distinct; nevertheless they can be recognized in undisturbed sites.

The main constituents of the MEEF, based on studies conducted by Jayasuriya et al. (1993) are as follows:

Emergents – *Doona gardneri* and *Doona zeylanica*.

Canopy – *Elaeocarpus glandulifer*, *Myristica dactyloides*, *Cryptocarya wightiana*, *Palaquium hinmolpedde*, *Fahrenheitia zeylanica*, *Syzygium gardneri*, *Semecarpus nigro-viridis*, *Calophyllum acidus*, *Aglaiia congylos*, *Bhesa montana*, *Pseudocarapa championii* and *Cullenia ceylanica*.

Sub-canopy – *Nothopegia beddomei*, *Hortonia floribunda*, *Acronychia pedunculata*, *Celtis cinnamomea*, and *Euodia lunu-ankenda*.

Shrub - *Agrostistachys coriacea*, *Allophylus varians*, *Eurya spp.*, *Ilex denticula*, *Maesa indica*, *Psychotria nigra*, and *Saprosma foetens*.

Lianas and climbers – *Freycinetia walkeri*, *Pothos remotiflorus*, *Elaeagnus latifolia* and *Asparagus falcatus*.

Herb – *Scutellaria* spp, *Pogostemon* spp, and *Impatiens* spp.

Jayasuriya et al. (1993) demonstrated that the MEEF is the major forest type within 900-1400 m elevational belt that occurs between “*Lowland Evergreen Mixed Forests*” and “*Montane Evergreen Mixed Forerst*” and representing optimum vegetation on well-drained uplands lacking extremes of soil types. Furthermore, they consolidated the characterization of this distinct forest type by identifying some “indicator species” that occur exclusively within the MEEF. These indicator species are also endemic, eg. , *Aglaiia congylos*, *Cinnamomum litseaefolium*, *Elaeocarpus gandulifer*, and *Palaquium hinmolpedde*.

Existence of some plant communities within this forest type is evident. Although, the MEEF occurs in three disjunct land masses in Sri Lanka, viz. the Knuckles Range, Central Highlands and Rakwana Range, Greller et al. (1993) show that the formation of distinct plant communities within this vegetation type is not related to different geographical areas, but is apparently related to edaphic (soil depth) and climatic factors (rainfall). They also detected the presence of some stands dominated by *Doona* spp. (*D. gardneri*, *D. zeylanica* and rarely *D. oblonga*) which prompted them to propose the “*Lower Montane Notophyllous Evergreen Dipterocarp Rain Forest*”, as a separate forest type. Pemadasa (1995) in his vegetation classification accommodates MEEF in “*Elaeocarpus – Myristica – Pseudocarapa Community* within his broad category of “*Wet Midland Forest*” type.

4.4.5 Montane Evergreen Forest (MOEF)

The MOEF occurs above 1500m in the Central Highlands and the Knuckles Mountains. These regions are influenced by cool temperatures, the average being 15-16°C, and about 2000 mm of annual rainfall without any dry periods. The relative humidity is over 80%. Thus the cool and wet conditions with abundant mist, relatively strong winds and elevated solar radiation determine the nature and form of the plant life in MOEF. These forests are characterized by a relatively low canopy between 8 and 10 m in typical stands at higher altitudes, and they may grow higher to about 15 or even 20 m on leeward slopes or at lower altitudes within the range. The trunks and branches of the canopy trees are twisted and gnarled and their crowns are flat-topped; the leaves are

microphyllous and leathery to withstand strong wind. The forest profile is not clearly stratified, but the lower strata consisting of tree and shrub species are very dense. The trees and shrubs are covered with epiphytes, lichens and bryophytes, while the leaves harbour many epiphyllous mosses and liverworts indicating copious moisture condensation.

Based on the NCR (IUCN & WCMC 1997), the characteristic species composition of the MOEF is as follows, although it should be noted that the stratification indicated below is not clearly distinct:

Canopy- *Calophyllum walkeri*, *Michelia nilagirica*, *Cinnamomum ovalifolium*, *Neotitsea fuscata*, *Adinandra lasiopetala*, *Mastixia montana* and *Elaeocarpus coriaceus*.

Sub-canopy- *Actinodaphne* spp., *Symplocos* spp., *Syzygium* spp., *Glochidion pycnocarpum*, *Acronychia pedunculata* and *Eurya* spp.

High shrub- *Myrsine robusta*, *Euonymus revolutus*, *Arundina debilis*, *Maesa indica*, *Eurya* spp. and *Memecylon* spp.

Low shrub- *Psychotria* spp., *Lasianthus* spp., *Hedyotis* spp., *Osbeckia* spp., *Microtropis zeylanica* and *Berberis* spp.

Lianas and climbers- *Toddalia asiatica*, *Elaeagnus latifolia*, *Piper zeylanica*, *Smilax zeylanica*, *Rubus* spp. and *Strobilanthes* spp.

Herb- *Exacum walkeri*, *Disporum cantoniense* and *Arisaema leschenaultii*.

In highly wind-affected sites that are located on hilltops and wind gaps, the canopies become severely depressed, sometimes as low as 1.5 m, forming very dense and impenetrable thickets that are known as *Pygmy Forests* or *Elfin Woodlands*. In combination with its characteristic flora, the *Pygmy Forest* should be considered as a distinct community within the MOEF. However, Pemadasa (1995) proceeds to identify three communities, viz. *Knuckles ('Dumbara') Forests*, *Adam's Peak ("Samanola") Forests* and *Nuwara-eliya Forests*, within his *Wet Montane Forests* vegetation type. He further subdivides the Knuckles Forests into five sub-communities, viz. *Montane Dry Faciation*, *Montane Wet Faciation*, *Montane Thickets*, *Elfin Forest* and *Pygmy Forest*.

A recent study on habitat types in the Horton Plains (EML 2005b) recognized three habitat types (communities), namely: *Undisturbed Forest Community*, *Disturbed Forest Community (Canopy Die-back Areas)* and *Forest / Grassland Ecotone*.

4.4.6 Sparse and Open Forest (SPOF)

This is mainly an anthropogenic modification of the two main forest types that occur in the dry zone, viz. DMEF and MMEF, and in the wet zone, e.g. LWEF, MEEF and MOEF. Such modifications are a result of various deforestation processes, e.g. , large-scale harvesting of industrial wood, both at state-sponsored and illicit levels, wide spread clearing of forests for agriculture (mainly chena or shifting cultivation) and fire. When these destructive processes continue up to a point where the original vegetation type (e.g. DMEF) loses its character and quality, it becomes necessary to call it SPOF. Such a forest may assume the state of a degraded / remnant / modified / secondary forest or scrub / scrub jungle / scrubland or, in extremes, even a chena regrowth (EML 2005a). However, the SPOF is naturally in a state of flux due to its inherent ability to recover, especially in the dry zone, from extreme degradation up to a steady-state forest (climax) through a series of successions, if spared of repeated disturbance. The stature of the vegetation, including the height, density, profile, species composition and dominance changes along with this succession.

In the dry zone, in a SPOF that develops from a forest ecosystem due to degradation, the canopy is open at various levels due to the removal of a majority of the valuable timber trees that often causes an artificially elevated density of inferior and uneconomical timber species such as *Drypetes sepiaria* and the appearance of fast growing trees such as *Grewia damine* and *Cassia fistula* and even some exotic / naturalized trees such as *Azadirachta indica* and *Leucaena leucocephala* and some invasive shrub/herb species like *Lantana camara*, *Chromolaena odorata* and *Pennisetum polystachyon*. However, in a scrub that has developed by a process of succession in a denuded area, such as an abandoned chena, a high forest canopy does not exist at least at the early stages.

The general species composition of a dry zone SPOF is as follows:

Canopy - in remnant forests: Any of the characteristic canopy tree species of DMEF and MMEF, wherever appropriate.

Low canopy - in scrub: *Cassia fistula*, *Bauhinia racemosa*, *Azadirachta indica*, *Premna tomentosa*, *Pterospermum suberifolium*, *Syzygium cuminii*, *Mitragyna parvifolia*, *Grewia damine*, *Grewia helicterifolia*, *Alstonia scholaris*, *Ficus hispida* and *Macaranga peltata*.

Shrub - *Allophylus serratus*, *Murraya koenigii*, *Carmona retusa*, *Securenaga leucopyrus*, *Phyllanthus polyphyllus*, *Lantana camara*, *Carissa spinarum*, *Croton laccifer*, *Atalantia ceylanica* and *Clausena indica*.

Climbers - *Derris scandens*, *Scutia myrtina*, *Asparagus racemosa*, *Ichnocarpus frutescens*, *Toddalia asiatica*, *Mussaenda frondosa*, *Ipomoea obscura* and *Gloriosa superba*.

Herb - *Aegeratum conyzoides*, *Evolvulus alsinoides*, *Leucas biflora*, *Ocimum basilicum*, *Sida acuta* and *Justicia procumbens*.

However, in the Wet zone, process of vegetation succession and recovery takes more complex routes. In moderately degraded sites where the soil surface is not severely exposed, vegetation succession can be rapid with the appearance of pioneer species and then secondary species which are eventually replaced by primary species if left intact. In contrast, the highly degraded sites, e.g. abandoned chenas where the soil surface is exposed to elements of weather, will not recover up to the forest stature, but remain as fern-lands or grasslands. The sensitive Red-Yellow Podzolic soils, on exposure, changes into a hard laterite and becomes impoverished due to the erosion of its humus layer. This edaphic transformation is least conducive to the appearance of a forest vegetation, but usually supports only low stature vegetation such as fern-lands, dominated by *Dicranopteris linearis*.

4.4.7 Dry Patana Grassland (DPTG)

Patana Grasslands (DPTG and WPTG) are characterized in consideration of many factors, such as altitude, rainfall and its distribution, temperature and soil moisture that influence their formation (Mueller-Dombois and Perera 1971). The DPTG occurs mostly in the Uva Basin between 600-1660 m altitudes where the temperature ranges from 18-24°C depending on the altitude. This region receives an annual rainfall of 1450-1750 mm, mainly from the inter-monsoon during October-November and supplemented by the following NE monsoon. Furthermore, this region is subject to a short dry period in February and an extended dry period combined with desiccating wind during the NE monsoon from June to August. Although all patana grasslands occur on Red-Yellow Podzolic soils, the A horizon of the DPG is shallower than that of the WPTG and dark brown to yellowish brown in colour. The soil is relatively poor in organic components, minerals and moisture and it also has a relatively higher pH (6.6 - 6.7) and harder surface that is prone to heavy erosion and with more quartz/gravel composition and often with exposed rocks (Pemadasa 1995).

The vegetation is composed of tall grasses (1.5 m), dominated by *Cymbopogon nardus*, short grasses, many non-grass herbs, sporadic shrubs and rarely some trees. The species composition of the DPTG, based on studies conducted by Pemadasa (1995), is as follows:

Tall grasses: *Cymbopogon nardus*, *Themeda tremula*, *Arundinella villosa* and *Andropogon lividus*.

Short grasses: *Alloteropsis cimicina*, *Brachiaria distachya*, *Chrysopogon aciculatus* and *Eragrostiella secunda*.

Non-grass herbs: *Fimbristylis nigrobrunnea*, *Elephantopus scaber* and *Leucas zeylanica*

Shrubs: *Psiadia ceylanica*, *Vernonia wightiana*, *Knoxia platycarpa* and *Wikstroemia canescens*

Trees: *Glochidion montanum*:

Tall grasses: *Cymbopogon nardus*, *Themeda tremula*, *Arundinella villosa* and *Andropogon lividus*.

Short grasses: *Alloteropsis cimicina*, *Brachiaria distachya*, *Chrysopogon aciculatus* and *Eragrostiella secunda*.

Non-grass herbs: *Fimbristylis nigrobrunnea*, *Elephantopus scaber* and *Leucas zeylanica*

Shrubs: *Psiadia ceylanica*, *Vernonia wightiana*, *Knoxia platycarpa* and *Wikstroemia canescens*

Trees: *Glochidion montanum*

4.4.8 Wet Patana Grassland (WPTG)

WPTG Occurs in the Horton Plains and the vicinities of Nuwara Eliya above 2000 m. The mean temperature is 13-15°C subject to marked diurnal and seasonal variation. The night temperatures during December-February may be depressed below 5°C with frequent ground frost. The mean annual rainfall is >2000 mm, received through both monsoons and the inter-monsoon periods, with only a short dry period during February. It is evenly distributed with a minimum of 100 mm of monthly rainfall. The weather is dominated by continuous, and at times, gale-strength winds with persistent cloud cover. Mist is prevalent throughout the year, relatively more frequent at higher altitudes. Soils are relatively rich in organic components, minerals and moisture and the pH is low (4.5-4.7). The A horizon is blackish, 30-60 cm thick and spongy retaining much moisture (Pemadasa 1995).

A recent study of the habitat types in Horton Plains conducted by EML (2005b) recognized six grassland communities:

Tussock Grass Community: This occurs in previously undisturbed habitats that are dominated by tall grasses (1 m) such as *Chrysopogon nodulibarbis*, *Andropogon polytychos* and *Garnotia exaristata*. Other species: *Anaphalis spp.*, *Centella asiatica*, *Cynoglossum furcatum*, *Gaultheria leschenaultia*, *Satyrium nepalense*, *Duschesnea indica*, *Rubus leucocarpus* and *Pedicularis zeylanica*

Carpet Grass Community: This occurs in places which were previously cultivated with potato and the abandoned potato terraces are now colonized by carpet grasses dominated by *Axonopus fissifolius*. Other species: *Aristea eckloni*, *Emilia alstonii*, *Erigeron karvinskianus*, *Cyperus brevifolius*, *Parochetus communis*, *Anthoxanthum odoratum*, *Persicaria nepalensis* and *Knoxia hirsuta*

Grassland / Rhododendron Community: *Rhododendron arboreum* is the most outstanding tree species in this grassland landscape. It grows to a height of about 1-5 m and its trunk is generally gnarled and provided with a thick corky bark and in combination with its thick subterranean rootstock it is specially adapted to survive this fire-prone ecosystem. These trees occur singly or in clumps amidst the grassland matrix which mimics a savanna landscape.

Dwarf Bamboo Community: This occurs in valley bottoms, bordering depressions and streams and this boggy habitat is occupied by gregarious populations of a small slender bamboo species, *Arundinaria densifolia* that is endemic to the Horton Plains. Other species: *Centella asiatica*, *Eriocaulon brownianum*, *Exacum trinervium*, *Pleiocraterium plantaginifolium* and *Ranunculus sagittifolius*.

Grass and Fern Community: Some areas have been invaded by an invasive fern, *Pteridium aquilinum* that apparently dominates the landscape. Other species: *Chrysopogon nodulibarbis*, *Garnotia exaristata*, *Persicaria capitata* and *Duchesnea indica*.

Marsh /Peat Community: This Occurs in some valleys next to shallow and expanded streams in sheltered habitats. Several delicate herbaceous species grow in between clumps of grass , eg.: *Allium hookeri*, *Bupleurum ramosissimum*, *Centella asiatica*, *Senecio ludens*, *Carex* spp., *Cyperus brevifolius*, *Rhynchospora rugosa*, *Drosera burmannii*, *Eriocaulon brownianum*, *Juncus effuses*, *Juncus presmatocarpus*, *Lycopodium carolinianum*, *Alchemilla indica*, *Knoxia hirsuta*, *Neanotis monosperma*, *Lindernia rotundifolia*, *Valeriana moonii* and *Metathelypteris flaccida*.

4.5 Plantation forests

Reforestation trials were carried out in the Central Highlands to meet fuelwood demand of the households, tea industry and the railway. Plantation forests consist of mostly of even-aged monocultures of conifers, chiefly pine and Cyprus and araucaria, in smaller extents, teak, mahogany and eucalyptus etc in a total extent of 22,221 hectares in the CP. The plantation forests are managed by the FD. Table 4.2 shows the extents of plantation forests of main species by forest divisions in the three districts.

Table 4.2 Extents of plantation forests in forest divisions in Central Province (ha)

Species	Matale	Kandy	Nuwara Eliya	Total for CP
Teak	1821	-	3	1824
Eucalyptus	-	11	4411	4422
Pine	1367	2943	2273	6583
Fuel wood*	173	8	96	277
Others	72	22		94
Total	3433	2984	6783	13200

Source: FORDATA database, FD (Forest cover in 1992)

In addition about 5000 ha of fuel wood exist in tea estates and lands managed by Tobacco Company.

4.6 Landuse pattern

The population increase has changed the land use pattern due to intensified competition for land. The agriculture, land under forest and wildlife conservation, transportation, human settlements, homesteads and a variety of other uses, including undeveloped land account for the land use (NARESA 1991). Most of these land use types support anthropogenic ecosystems, such as plantations, homesteads and paddy fields. The Land use map produced by the Survey Department (1981-1984) indicates the land use pattern in the CP, as shown in Table 4.3.

Table 4.3 Land use pattern in Central Province with extents (ha)

Land use type	Matale District		Kandy District		Nuwara Eliya District	
	Extent	Cover %	Extent	Cover %	Extent	Cover %
Urban built up lands	570	0.2	1210	0.7	820	0.5
Homesteads	20650	10.3	37160	19.6	11400	6.7
Tea	5520	2.8	29340	15.5	62580	36.7
Rubber	2940	1.5	2970	1.6	300	0.2
Coconut	4970	2.5	3870	2.0	310	0.2
Mixed crops	4700	2.4	9060	4.8	490	0.3
Paddy	20820	10.4	20800	10.9	5350	3.1
Other crops	48000	24.12	32170	17.0	19070	11.2
Dense forest	48100	24.1	22230	11.8	30410	17.8
Open forest	9510	4.8	8120	4.3	10570	6.2
Forest plantations	2260	1.1	1380	0.7	7590	4.5
Scrub & Grasslands	25760	12.9	18120	9.6	17450	10.2
Water bodies/reservoirs	4410	2.1	2350	1.2	3500	2.1
Barren lands	1590	0.8	550	0.3	510	0.3
Total	199500	100	189130	100	170350	100

Source: Land Use Map, Survey Department (1981-1864)

CHAPTER 5

5. SPECIES PROFILE

5.1 National Conservation Review 1991-1996

The NCR was conducted mainly to address a major criticism of the first Forestry Master Plan for Sri Lanka in its failure to address the environmental aspects of forestry, particularly with respect to conserving the country's rapidly dwindling natural forests in the wet zone (FPU 1995). Therefore, the NCR was concerned with evaluating all remaining natural forests (including mangroves) with respect to their importance for biodiversity, in terms of ecosystem and species diversity, and their value for soil and water conservation. Its over-riding objective was to define a national system of conservation forests in which watersheds important for soil conservation and hydrology are protected, forest biodiversity is fully represented and cultural, economic and social needs are met.

Legally designated forests and OSFs of 200 ha or more were surveyed for biodiversity, except those in the north and east of the island which were politically inaccessible. The biodiversity assessment was restricted to woody plants, vertebrates, mollusks and butterflies. Despite such limitations, the NCR is among the most detailed, comprehensive and innovative evaluation of its kind carried out in any tropical country (IUCN & WCMC 1997).

The results of the NCR study clearly demonstrates the paramount importance of Sri Lanka's natural forests, both in terms of their role in maintaining ecosystem stability and functions and as a reservoir of high species diversity. It has also been possible to identify those forests of most importance for watershed protection and for biodiversity conservation at ecosystem and species levels. The close degree of complementary nature between the watershed and biodiversity values of forest highlights the importance of such an integrated approach to conservation. The NCR also professes that designing an optimum system of conservation forests is an iterative process, particularly as more data become available as conservation forests are established and surveyed for management planning purposes.

As province or district level biodiversity surveys have not been conducted in Sri Lanka, such information could readily be obtained by cumulating NCR data procured for PAs within a given province or district (IUCN & WCMC 1997). However, it will be necessary to survey additional literature, other sources of information and relatively recent research work in order to synthesize more comprehensive inventories of flora and fauna at province or district levels.

5.2 Flora

The Checklist of the Flowering Plants of Sri Lanka (Senaratna 2001) cites 4,143 species in 1,522 genera and 214 families. Of the total number of species, about 75 percent are indigenous while the rest are exotic in origin. Of the total number of indigenous plant species, 27.53 percent are endemic to Sri Lanka. Of the exotics, only about 32 percent are naturalized while about 68 percent are found only in cultivation.

By any yardstick of knowledge, Sri Lanka's vascular plant diversity and endemism are remarkable. A total of eighteen flowering plant genera are also endemic. While these endemic genera are for the most part monotypic, the dipterocarp genus *Stemonoporus* represents a remarkable radiation with 26 species evolved in the island; indeed, endemism in the Dipterocarpaceae is even more remarkable in that all 59 species in the island are endemic (Kostermans 1992). Usually associated

with lowland rainforests, a single species of dipterocarp, *Stemonoporus gardneri*, is recorded from the highest altitude for any member of the family, at 1,750 m in Sri Lanka's central hills.

Other remarkable radiations include *Sonerila* (22 spp., all endemic), *Strobilanthes* (30 spp., 25 endemic), *Diospyros* (33 spp., 20 endemic), *Memecylon* (32 spp., 30 endemic), *Hedyotis* (28 spp., 24 endemic) and *Impatiens* (25 spp., 16 endemic).

Of the 870 endemic flowering plant species, 115 are "point-endemics", being known from only a single locality, in some cases a single plant. It is of concern that 69 indigenous, 29 endemic and 33 point-endemics have not been collected in the past 75 years; many of these could be extinct (Pethiyagoda 2003).

Only the most rudimentary estimates exist of Sri Lanka's non-angiosperm floras, even though known diversity and endemism is high in several groups including the ferns, bryophytes and fungi. The recent original literature, while sparse and sporadic, has however, served to show that both diversity and endemism are significantly higher than were previously suspected (e.g. Hale 1981).

5.2.1 Checklist of the flora

The inventory of the flora (Appendix 1) was obtained from the NCR (IUCN & WCMC 1997) by extracting species recorded in the PAs located within the Central Province. There are 36 sites in the CP that have been surveyed for the NCR. It should be noted that the NCR investigated only the woody flowering plants (*Cycas circinalis* being an exception); however, herbaceous species with distinct suffrutescent stems have been taken into consideration (IUCN & WCMC 1997). The taxonomy was generally updated using Revised Flora of Ceylon (Volumes 1-14), edited by Dassanayake & Fosberg (1980-1991), Dassanayake, Fosberg & Clayton (1994-1995), Dassanayake & Clayton (1996-2000) and Dassanayake (2003). The Checklist compiled by Senaratna (2001) was useful in checking vernacular names and endemism of the species. Additional information was obtained from Kostermans (1981) for the Myrtaceae and Kostermans (1992) for the Dipterocarpaceae. The inventory consists of 648 species belonging to 98 families. Of these, 260 species are endemic to Sri Lanka, while 77 species are threatened. However, in order to achieve comprehensiveness in inventorying plant species, extensive reference of the National Herbarium collection, where latest plant records are expected to be available, is mandatory.

5.2.2 Flora restricted to the Central Province

In the absence of any ready references on the flora of the CP, Revised Handbook to the Flora of Ceylon was used to compile a list of plants that are **restricted** to the CP. Exotic cultivated plants and weeds were not listed. However, in some cases it was difficult to determine the origin of a given species, often due to extensive areas of distribution or the antiquity of the introductions, and in such cases, a judgment had to be made whether to list such species. It should also be noted that specimens of some species have been gathered and deposited at the NH subsequent to the preparation of various volumes of the Revised Flora, published between 1980 and 2000. Therefore, the possibility exists that some species that are listed here as '**restricted to the CP**' were subsequently recorded in other province(s). The plants are listed with local names, endemism, conservation status and the districts within the CP in which the plants have been recorded (Appendix 3). Accordingly 401 species, including 218 endemics, are restricted to the Central Province.

5.3 Fauna

In the case of the fauna, the lack of recent field exploration and reliable taxonomy is even more deeply felt. Not even rough estimates exist for diversity and endemism among the arthropods, except for butterflies, dragonflies, sphecid wasps and freshwater crabs, Diversity of ants, termites,

beetles, Diptera and other high tropical-diversity insect groups is almost entirely unknown and warrants urgent study (Pethiyagoda 2003).

Groups of 'macro' invertebrates assessed recently include the land snails and freshwater crabs. Almost the entirety of these faunas is endemic, with a high degree of point endemism (Naggs & Raheem 2000, Ng & Tay 2000). It is noteworthy that these limited assessments were far from comprehensive; nevertheless they have uncovered more than 40 new species (and over 5 genera) of endemic crabs; and about 100 new species of endemic land snails. The conservation status of all these species is almost unknown (Pethiyagoda 2003).

Freshwater fishes. With 82 species, including 44 endemics, Sri Lanka's primary freshwater fish fauna is not exceptional compared with that of southern India. Only a single fish genus, *Malpulutta*, is presently considered endemic to the island. The paucity of species could in part be due to depredation by alien invasive species, which began with the introduction of rainbow trout in the 1880's in the central mountains. Today more than 40 alien species are established in Sri Lanka's inland waters, and account for an overwhelming share of the fish biomass. At least two freshwater fish species (the spiny eel, *Macrogathus aral* and the carp, *Labeo lankae*) appear to have become extinct in the past decades, and this trend appears irreversible unless urgent management actions are taken. The point that several freshwater fishes (e.g. *Puntius asoka*, *P. bandula*, *P. srilankensis* and *Devario pathirana*) are point endemics occurring entirely outside protected areas underlines the need to develop new conservation initiatives for aquatic ecosystems. This is also supported by the high incidence of other well-studied aquatic groups, such as the crabs, in which point endemism is extremely high.

Amphibians. Amphibians represent one of the most interesting of Sri Lanka's faunal groups. The amphibian fauna is dominated by an endemic radiation of 66 species of direct-developing frogs of the genus *Philautus* (Meegaskumbura & Manamendra-Arachchi 2005). In addition to this, the island's wet zone contains an endemic subfamily and three endemic genera (*Nannophrys*, *Lankanectes* and *Adenomus*) of ranid frogs, and six caecilians (three of them discovered in 2002). According to the latest information, 103 amphibian species have been listed (Pethiyagoda et al. 2006). This remarkable diversity and endemism make Sri Lanka a global amphibian hotspot (the wet zone forest fragments contain almost 4% of the world's known frog species). While there is no evidence of amphibian population declines associated with recently observed global 'syndrome', an examination of 19th century museum collections suggest that at least 16 species of endemic frogs have become extinct in the past century (Manamendra-Arachchi & Pethiyagoda (2005).

Reptiles. A total of 184 reptile species occur in Sri Lanka, of which 105 are endemic. The endemics include 22 species of saurian reptiles and 10 species of serpentoid reptiles. There are 11 endemic genera that include three saurian genera: *Chalcidoceps* (1 species), *Lankascincus* (6) and *Nessia* (8), three agamid genera: *Ceratophora* (5), *Lyriocephalus* (1) and *Cophotis* (2) and five serpentoid genera: *Pseudotyphlops* (1), *Aspidura* (6), *Cercaspis* (1), *Haplocercus* (1) and *Balanophis* (1). These genera are also considered geographical relicts ((de Silva 2006). Initial studies suggest that both diversity and endemism could be much higher in some groups, such as the burrowing snakes (Uropeltidae), geckoes and snakes (Pethiyagoda 2003).

Birds. Kotagama et al. (2006) have listed 482 species within eleven categories: Breeding Residents (220), Winter Residents (127), Winter Vagrants (69), Status Uncertain (38), Vagrants (10), Summer Visitors (4), Passage Migrants (2), Breeding Resident & Winter Visitors (5), Breeding Resident & Summer visitors (1), Breeding Resident/Uncertain Winter Visitors (5) and Winter Visitor/Uncertain Breeding Residents (1). Kotagama et al. (2005) have also determined that the number of endemics are 25 definitive and 8 as proposed, making a total of 33 species. Kotagama and Kaluthota (personal communication) are currently preparing a map of IBAs. Seventy IBAs were identified and mapped (Jayasuriya et al 2006).

The present distribution of birds is determined by climatic and topographical delineations, recognized as zones, e.g. Dry Zone, Low Country Wet Zone etc. Based on these principles, Avifaunal Zones were proposed and then upgraded to Important Bird Areas (IBAs) in order to ensure habitat / ecosystem protection as the principle pathway for conservation of wild populations (Kotagama et al. 2006).

Mammals. There are 91 species of indigenous mammals in Sri Lanka, of which 16 species are endemic to the island. Another 12 species have been introduced, of which four species (*Bubalis bubalis*, *Equus caballus*, *Equus asinus* and *Rattus norvegicus*) have well established feral populations. In addition 26 species of marine mammals have been recorded (Weerakoon & Goonatilake 2006). Although the large mammals are arguably the best-known group among Sri Lanka's vertebrates, they are entirely shared with India. Sub-specific geographic diversity and endemism among the mammals are high, but again, handicapped by poor taxonomy. A total of three monotypic genera (the mouse *Srilankamys*, and the shrews *Solisorex* and *Feroculus*) and nine species of small mammals (adult body weight <100 g) are endemic to the island, but for the most part little is known of their distribution, biology and conservation status. As with other groups, almost all the endemic mammal species are restricted to the wet zone.

5.3.1 Checklist of the fauna

As in the case of flora, the checklist of the fauna of the Central Province was extracted from the NCR (Appendix 2). However, the NCR faunal survey was limited to mammals, birds, reptiles, amphibians and two selected invertebrate groups, viz. mollusks and butterflies. It will be necessary to conduct a thorough survey of literature and recent research work in order to synthesize a comprehensive inventory of the fauna of the CP. The faunal checklist consists of 401 species that includes 218 endemics.

5.3.2 Fauna restricted to the Central Province

The Central Hills contains a considerable proportion of endemic fauna belonging to both vertebrate and invertebrate groups. In the CP, the most important faunal diversity is concentrated in Montane Evergreen Forests (MOEF) and Mid-elevational Evergreen Forest (MEEF). A total of 94 faunal species in selected groups are apparently restricted to the Central Province.

Butterflies

As the knowledge on invertebrate groups, such as most insects, spiders and earth worms, is scanty, their restricted occurrence in the CP is not known. However, studies on butterfly species with restricted distribution in Sri Lanka by Perera & Bambaradeniya (2006) indicate that these species have definite affinities to specific bio-climatic zones, vegetation types that are represented in the CP, viz. LWEF, MEEF, MOEF, WPTG, MMEF, DMEF, SPOF and SAVG, as classified by Jayasuriya et al. (2006). Table 5.1 indicates the affinities between 17 butterfly species with restricted distribution and various bio-climatic zones and vegetation types that are represented in the CP.

Table 5.1 Butterfly species with restricted distribution patterns occurring in the Central Province.

Bio-climatic zone	Vegetation types	Species
Lowland Wet Zone	LWEF (Tropical Rain Forest)	<i>Jamides coruscans</i> (Ceylon cerulean), <i>Mycalesis rama</i> (Cingalese Bushbrown), <i>Hasora badra</i> (Ceylon Awl), <i>Papilio helenus</i> (Red Helen)
Montane Wet Zone	MOEF (Montane Forest) MEEF (Lower Montane Forest)	<i>Parantica taprobana</i> , <i>Vanessa indica</i> (Indian Red Admiral), <i>Lethe daretis</i> (Ceylon Treebrown), <i>Udara lanka</i> (Ceylon Hedge Blue)
	WPTG (Wet Patana Grassland)	<i>Baracus vittatus</i> (Hedge Hopper)
Lowland Dry & Intermediate Zone	DMEF & MMEF (Dry Zone Forests – vergreen/Deciduous) and SPOF (scrubland)	<i>Pathysa nomius</i> (Spot Swordtail), <i>Charaxes solon</i> (Black Rajah), <i>Amblypodia anita</i> (Purple Leafblue)
	(Grasslands)	<i>Zizula hylax</i> (Tiny Grass Blue), <i>Freyeria trochilus</i> (Grass Jewel), <i>Azanus jesous</i> (African Babul Blue)
	SAVG (Savanna) and DPTG (Dry & Intermediate Patana)	<i>Symphaedra nais</i> (Baronet), <i>Ypthima singala</i> (Jewel Four-ring)

Source: Perera & Bambaradeniya (2006); vegetation types are according to the classification by Jayasuriya et al. (2006); the types cited by Perera & Bambaradeniya are in parenthesis).

Spiders

Preliminary results of the studies on the spiders of Sri Lanka suggest that the endemic spider fauna are confined to the intact natural forests in the south-west and the Central Highlands. Suresh & Bambaradeniya (2006) record the occurrence of 8 endemic spider species exclusively in the CP. Three species of the primitive jumping spider genus *Onomastus* and the endemic *Oxytate taprobane* are apparently restricted to the CP (Table 5.2).

Table 5.2 Exclusive occurrence of spider species in the Central Province

Family	Species	Endemic (E)	Distribution
Salticidae	<i>Colaxes wanlessi</i> <i>Onomastus uinquenotanus</i>	E	Agra-bopat FR
	<i>Colaxes wanlessi</i> <i>Onomastus sp. A</i>	E	Hakgala SNR
	<i>Cloxes horton</i>	E	Horton Plains
	<i>Onomastus sp. B</i>	E	Knuckles Conservation Forest
	<i>Oxytate taprobane</i>	E	Central Highlands
Zodariidae	<i>Suffasia mahasumana</i>	E	Knuckles Range

Source: Suresh & Bambaradeniya (2006)

Freshwater crabs

For Sri Lanka, a total of 51 species of freshwater crabs, all being endemic, that also include 5 endemic genera have been recorded (Bahir & Pethiyagoda 2006). It is alarming to note that 37 species are threatened with extinction, with 26 species being 'point endemics' (each restricted to a single site). Although Bahir & Pethiyagoda (2006) have noted that 41 species are restricted to the wet zone, it is not currently possible to sort out those species that are restricted to the CP.

Land snails

Studies on land snail fauna in the Knuckles region reveal the occurrence of 49 species of which 37 species were fully identified while 12 were identified only up to the genus level (Ranawana 2006). As it is not evident that these species also occur outside the Knuckles region, those species that occur only in MOEF (Montane Forests – as cited by Ranawana) and MEEF (Sub-montane Forests – as cited by Ranawana) are tentatively regarded as species that are restricted to the CP. Seven such species are listed in Table 5.3.

Table 5.3 Land snails in MOEF and MEEF in the Knuckles region

Subclass Family	Species	Endemic (E)	Vegetation type
Pulmonata Ariophantidae	<i>Euplecta colletti</i>	E	MOEF MEEF
	<i>Euplecta prestoni</i>	E	MEEF
	<i>Macrochlamys nepas</i>	E	MOEF
Charopidae	<i>Thysanota elegans</i>	E	MEEF
Glessulidae	<i>Allopeas layardi</i>	E	MOEF, MEEF
Cyclophoridae	<i>Theobaldius subplicatus</i>	E	MOEF
Pupinidae	<i>Tortulosa nevillei</i>	E	MOEF

Source: Ranawana (2006); Classification of vegetation types corrected according to Jayasuriya et al. (2005)

Freshwater fishes

Senanayake & Moyle (1982), based on the distribution pattern of freshwater fish species, have identified three ichthyofaunal provinces, viz. Southwestern Province (SW), Mahaweli Province (M) and Dry Zone Province (D). The Southwestern Province consists of river basins from Nilwala Ganga in the south to Attanagalu Oya in the north, with the border of the second peneplain forming the boundary in the east. The Mahaweli Province is essentially the drainage basin of the Mahaweli Ganga. This province covers all three peneplains and the fish fauna in the first peneplain is largely identical to that in the Dry Zone Province. The Dry Zone Province covers all parts of the first peneplain except the area in the wet zone.

As a large part of the Central Province is represented in the Mahaweli ichthyofaunal province, the species of fishes that occur in the latter could be largely representative of the CP. Amarasinghe et al. (2006) have listed the endemic freshwater fish species in Sri Lanka and their occurrence in three ichthyofaunal provinces and accordingly, 10 endemic species occur in the Mahaweli ichthyofaunal province. Of them, 4 species are apparently restricted to this province, while 6 species occur either or both of the other provinces, i.e. South western (SW) and Dry Zone Ichthyofaunal Provinces (D) (Table 5.4).

Laubuca insularis, a new species of Cyprinid fish, first discovered in 1990 from Kalu Ganga; north of Pallegama in the Matale District, CP and later collected from Mahiyangana, is also included here (Pethiyagoda et al. 2008).

Table 5.4 Endemic freshwater fish species in the Mahaweli Ichthyofaunal Province.

D = Dry Zone Ichthyofaunal Province SW = South western Ichthyofaunal Province

Family	Species	Common name	Present also in other ichthyofaunal provinces: SW / D
Belontiidae	<i>Belontia signata</i>		SW & D
Balitoridae	<i>Schistura notostigma</i>		SW
Claridae	<i>Clarias brachysoma</i>		SW & D
Cyprinidae	<i>Garra phillipsi</i>	Phillip's garra	
	<i>Garra ceylonensis</i>	Stone sucker	SW & D
	<i>Labeo fisheri</i>	Mountain labeo	
	<i>Laubuca insularis</i>		
	<i>Puntius martenstyni</i>	Martenstyn's barb	
	<i>Puntius nigrofasciatus</i>	Black ruby barb	SW
	<i>Puntius singhala</i>		SW & D
	<i>Puntius srilankensis</i>	Blotched filamented barb	

Source: Amarasinghe et al. (2006) & Pethiyagoda et al. (2008).

Amphibians

Information on the distribution of the amphibian fauna in Sri Lanka cited by Dutta & Manamendra-Arachchi (1996) was processed to sort out the species that are restricted to the CP (Table 5.5). Apparently there are 32 species that are restricted to the CP. However, it should be noted that, with the recent acceleration of amphibian research in Sri Lanka, some of these 'restricted' species have been recorded elsewhere, outside their hitherto known distribution ranges.

Table 5.5 Amphibian fauna restricted to the Central Province

Family Species	Common name	Endemic (E)	Conservation Status
Bufonidae			
<i>Adenomus dasi</i>	Das's dwarf toad	E	Critically endangered
Microhylidae			
<i>Microhyla zeylanica</i>	Sri Lankan narrow-mouthed frog	E	Endangered
<i>Ramanella obscura</i>	Grey-brown pug-snouted frog	E	Near Threatened
<i>Ramanella palmata</i>	Half-webbed Pug-snouted frog	E	Endangered

Family Species	Common name	Endemic (E)	Conservation Status
Ranidae (Raninae)			
<i>Nannophrys marmorata</i>	Small wood frog	E	Critically endangered
Ranidae (Rhacophorinae)			
<i>Philautus adpersus</i>		E	Extinct
<i>Philautus alto</i>		E	Endangered
<i>Philautus asankai</i>		E	Endangered
<i>Philautus caeruleus</i>		E	Endangered
<i>Philautus dimbullae</i>		E	Extinct
<i>Philautus eximius</i>		E	Extinct
<i>Philautus femoralis</i>		E	Endangered
<i>Philautus frankenbergi</i>		E	Endangered
<i>Philautus fulvus</i>		E	Endangered
<i>Philautus hallidayi</i> (also recorded in Uva Province)		E	Vulnerable
<i>Philautus halyi</i>		E	Extinct
<i>Philautus hoffmanni</i>		E	Endangered
<i>Philautus macropus</i>	Web-toe tree frog	E	Critically endangered
<i>Philautus microtympanum</i>	Microtympanum tree frog	E	Endangered
<i>Philautus mooreorum</i>		E	Endangered
<i>Philautus pleurotaenia</i>		E	Endangered
<i>Philautus reticulatus</i>	Reticulate tree frog	E	Endangered
<i>Philautus rugatus</i>		E	Extinct
<i>Philautus rus</i>		E	Near Threatened
<i>Philautus sarasinorum</i>		E	Endangered
<i>Philautus schmarda</i>	Conical wart pygmy tree frog	E	Endangered
<i>Philautus silus</i>		E	Endangered
<i>Philautus steineri</i>		E	Endangered
<i>Philautus stuarti</i>		E	Endangered
<i>Philautus stellatus</i>		E	Extinct
<i>Philautus viridis</i>		E	Endangered
<i>Philautus zorro</i>		E	Endangered

Source: Dutta & Manamendra-Arachchi (1996), Pethiyagoda et al. (2006)

Reptiles

A compilation of the distribution of reptiles in seven vegetation zones in Sri Lanka by de Silva (2006) was processed to sort out those reptile species that are most probably restricted to the Central Province and accordingly there are 16 such species. Although these seven 'vegetation zones' do not totally agree with the classification proposed by Jayasuriya et al. (2006), two "zones", viz. 'D2 – Rain forest and grassland, 900 – 1500 m' and 'D3 – Rain forest and grassland, above 1500 m' were selected and equated to MEEF and MOEF respectively of the latter system to identify species restricted to the CP (Table 5.6). It is well appreciated that the major part of the MEEF and MOEF of the island are represented in the CP and hence any plant or animal species that is restricted in these major vegetation types, can be presumed also to be more or less restricted to the CP. However, as small proportions of these vegetation types also occur in other provinces, e.g. Uva and Sabaragamuwa, these reptile species can also occur in the latter provinces.

The recent discovery of a new species of agamid lizard, *Cophotis dumbara*, in the Knuckles is taxonomically and biogeographically very interesting (Samarawickrama et al. 2006). *Cophotis*, an endemic ovoviviparous Sri Lankan agamid lizard genus was hitherto considered to be a monotypic genus represented by a single species, viz. *C. ceylanica* distributed in the Central Highlands and Knuckles mountain forests. Similarly, the discovery of *Boiga ranawanei*, a colubrid snake from two locations in the Kandy District, one being the Gannoruwa Forest, elevates the conservation value of this forest, presently threatened due to intensive encroachments (Samarawickrama et al. 2005). The recent studies on the gecko genus *Cnemaspis* (Wickramasinghe & Munidradasa 2007) and the skink genus *Lankascincus* (Wickramasinghe et al. 2007) have revealed the occurrence of some of the newly discovered species that are restricted in the CP.

Table 5.6 Reptile species restricted to the Central Province

E = English, EN = Endemic, MEEF = Mid-elevational Evergreen Forest
MOEF = Montane Evergreen Forest, P = Present, S = Sinhala

Family/ Species	Local name	EN	MEEF	MOEF
Agamidae				
<i>Calotes nigrilabis</i>	Kalu kopul katussa (S) Black cheek lizard (E)	EN	P	P
<i>Ceratophora stoddartii</i>	Kagamuva ang-katussa(S)	EN	P	P
<i>Ceratophora tennentii</i>	Pethi ang-katussa (S) Leafnose lizard	EN	P	P
<i>Cophotis ceylanica</i>	Kandukara kuru-katussa (S) Pygmy lizard (E)	EN	P	P
<i>Cophotis dumbara</i>	Dumbara kuru-bodilima (S)	EN	P	P
Gekkonidae				
<i>Cnemaspis kandiana</i>	Kandukara divasari-huna (S) Kandyan day gecko (E)	EN	P	
<i>Cnemaspis ranwellai</i>		EN		
<i>Cnemaspis scalpensis</i>	Jerdonge divasiri huna (S) Jerdon's day gecko			
<i>Cyrtodactylus edwardtaylori</i>	Namunukula vak-aniya huna(S)	EN	P	

Family/ Species	Local name	EN	MEEF	MOEF
	Namunukula bent-toe gecko(E)			
Scincidae				
<i>Lankascincus deignani</i>	Deignange lakhiraluwa (S) Deignan's Lankaskink (E)	EN		
<i>Lankascincus munindradasai</i>	Munindradasage Lak-hikanala (S)	EN		P
<i>Lankascincus sripadensis</i>	Sripakandu dumberu Hikanaka (S)	EN		P
<i>Lankascincus taprobanensis</i>	Smooth Lanka skink (E) Sumudu Lakhiraluwa (S)	EN		P
<i>Nessia bipes</i>	Smithge sarpa-hiraluva (S) Smith's snakeskink (E)	EN	P	
Colubridae				
<i>Aspidura copei</i>	Kalu-medilla (S) Cope's roughside (E)	EN	P	
<i>Aspidura deraniyagalae</i>	Kandu medilla (S) Deraniyagla's roughside (E)	EN		P
<i>Aspidura drummondhayi</i>	Ketiwal-medilla (S) Guenther's Drummond	EN	P	
<i>Aspidura trachyprocta</i>	Dalawa medilla (S) Common roughside (E)	EN	P	P
<i>Boiga ramawanei</i>	Ranawana's Golden cat snake(E)	EN	P	
Elapidae				
<i>Bungarus ceylonicus karavala</i>	Hath karawala (S) Sri Lanka (Ceylon) Krait (E)	EN	P	P

Source: de Silva (2006).

Birds

Although the latest checklist of avifauna in Sri Lanka (Kotagama et al. 2006) is available, information on the species distribution based on IBAs or vegetation types is unavailable to be processed for this purpose.

Mammals

As for the distribution of the mammalian fauna in Sri Lanka, some information can be derived from the list of naturally occurring terrestrial mammals compiled by Weerakoon & Goonatilake (2006). This list provides distribution of each mammal species in terms of bioclimatic zone(s) in which a given species occur. Of the six bioclimatic zones, three zones, viz. Montane Zone (D), Montane Intermediate Zone (E) and Low and Mid Country Intermediate Zone (C) are considered to represent the Central Province, and hence four species that occur exclusively in these three zones are listed in Table 5.7.

Table 5.7 Mammal species restricted to the Central Province

Source: Weerakoon & Goonatilake (2006)

Bioclimatic Zones:

C = Low and Mid-country Intermediate Zone

D = Montane Wet Zone

E = Montane Intermediate Zone

Order Family Species	Common names E = English S = Sinhala	Endemic (EN)	Bioclimatic Zone
Insectivora Soricidae			
<i>Crocidura miya</i>	Sri Lanka Kunu-hik-miya (S) Sri Lanka long-tail shrew (E)	EN	D, E
<i>Feroculus feroculus</i>	Piri-hik-miya (S) Kelaart's long-clawed shrew (E)		D, E
<i>Suncus montanus</i>	Kandu Hik-miya (S) Highland shrew (E)		D,E
Chiroptera Vespertillionidae			
<i>Pipistrellus affinis</i>	Bora koseta-vavula (S) Chocolate bat (E)		D,E

CHAPTER 6

6. GENETIC PROFILE

6.1 Agro-biodiversity

Agro-biodiversity (agricultural biodiversity) primarily refers to the sustainable and productive use of genetic resource variability for crop production and livestock development, together with their progenitors and wild relatives. The issues of agricultural biodiversity are complex due to conflicts between the consumptive nature of agriculture and the sustainability in the use of biodiversity. It is clear that over the past several decades the links between agriculture and biodiversity have changed making it obligatory to give high consideration to concerns in agro-biodiversity in the National Biodiversity Conservation Strategy. The needs of agro-biodiversity must be addressed from an ecosystem, species and genetic perspective in order to focus on the interface between environment and agriculture. In addition, the systems of traditional knowledge and culture, which have contributed extensively to natural resource management and conservation systems of agriculture in the past, must be made integral components of a biodiversity conservation strategy (MENR 2005).

6.1.1 Agricultural crops

Thousands of years of settled agriculture have produced a storehouse of cultivated biological resources of crop plants, fruit trees, spices and livestock, and over a century ago, in the plantation sector, numerous local new cultivars developed. Jayasuriya and Rajapakse (2003) presented a comprehensive account on the plant genetic resources in Sri Lanka and this information is liberally used in the preparation of this chapter.

Sri Lanka has a rich treasure of rice genes (*Oryza sativa*). Several thousand years of selection, augmented by traditional farming practices and the country's ecogeographic variability have produced a wide variety of crop cultivars. Among the 120,000 cultivars in the entire world, this small island has recorded 2,800 varieties so far – vastly disproportionate to its size. These rice varieties show great adaptability to a wide range of soil conditions. Upland varieties show drought tolerance, and those grown in coastal and river floodplain areas can tolerate submergence and flash floods. Some can tolerate low temperatures of the highlands, while others have broad-based resistance to pests and tolerance to iron toxicity. There are several grain types, some with medicinal properties and fragrance and others that are used for cultural rituals (NARESA 1991). Helvetas Sri Lanka (2001) has recorded 136 Sri Lankan traditional rice cultivars with local names and duration classes, ie. 2, 3, 3-4, 4, 4-4½, 4½, 3½-5, 4-5, 5½, 6 months and age unknown.

Besides rice, Sri Lankan cereals include millets, sorghum and maize. The millets grown from ancient times are finger millet = 'kurakkan' (*Eleusine coracana*), proso millet = 'meneri' (*Panicum miliaceum*), little millet = heen meneri (*Panicum sumatrense*), kodo millet = Amu (*Paspalum scrobiculatum*), foxtail millet = 'tana hal' (*Setaria italica*), common millet (*Paspalum miliaceum*). Unlike rice, these cereals have undergone little selection by the farmers. However, Helvetas Sri Lanka (2001) has recorded 13 cultivars of finger millet in Sri Lanka with local names and duration classes, ie. 3½ and 4 months; 7 cultivars of foxtail millet in 3, 3½ and 4 month duration classes and 4 cultivars of maize in 3, 3-3½ and 4 month duration classes.

Legumes constitute an important source of protein. Some variability exists among soy bean = 'soya' (*Glycine max*), chick pea = 'rata tora' (*Cajanus cajan*), green gram = 'mun' (*Vigna radiata*), yard long bean = 'me karal' (*Vigna unguiculata*), black gram = 'ulundu' (*Vigna mungo*), horse gram = 'kollu' (*Macrotyoma uniflorum*), velvet bean = 'wanduru me' (*Mucuna pruriens*), lima bean = 'potu dambala' (*Phaseolus lunatus*), rice bean (*Vigna umbellata*), hyacinth bean = 'kiri dambala' (*Lablab purpureus*) and sword bean = 'awara' (*Canavalia gladiata*). Wild relatives of pigeon pea

such as *Atylosia*, *Rhynchosia*, *Vigna* and *Dunbaria* occur in the country. Winged bean (*Psophocarpus tetragonolobus*) shows much variability in pod size and color, seed color and flower color. Helvetas Sri Lanka (2001) has listed 6 cultivars of cowpea in 2, 2-3 and 3 months duration classes; 9 cultivars of green gram cultivars in 2-2½, 3-3½ and 4-4½ months duration classes; 2 cultivars of peanut in 3 and 4 months classes; 6 cultivars of Horse gram in 3 and 3-3 ½ months classes; 23 cultivars of string bean (*Vigna unguiculata*) in 2-2 ½, 3 and 3-3 ½ months classes and 19 cultivars of winged bean in 3, 3-3 ½ and 4-4 ½ months classes.

Among the fruit crops, several cultivars of banana = 'kesel' (*Musa x paradisiaca*) are cultivated in various agro-ecological regions. 'Unel' (*M. acuminata*) and 'Eti kehel' (*M. balbisiana*), the wild progenitors of cultivated banana are present in Sri Lanka. Other important fruit crops, such as mango = 'Amba' (*Mangifera indica*), papaya = 'papol' (*Carica papaya*), citrus (*Citrus* spp.), jackfruit = 'kos' (*Artocarpus heterophyllus*), durian (*Durio zibethinus*), Rambutan (*Nephelium lappaceum*) and avocado = 'ali pera' (*Persea americana*), guava = 'pera' (*Psidium guajava*), water melon = 'komadu' (*Citrulus lanatus*) and bael fruit = 'beli' (*Aegle marmelos*) exhibit various levels of variability. Among indigenous fruit crops that are mostly harvested in the wild, wood apple = 'divul' (*Limonia acidissima*), Nelli (*Phyllanthus emblica*), Veralu (*Elaeocarpus serratus*), gal siyambala (*Dialium ovoideum*), mora (*Dimocarpus longan*) and kon (*Schleichera oleosa*) are popular.

Numerous types of vegetables, both temperate and tropical, are also cultivated in the country, and cucurbits, e.g. snake gourd = 'pathola' (*Trichosanthus anguina*), ridge gourd = 'wetakolu' (*Luffa acutangula*), cucumber = 'pipincha' (*Cucumis sativus*) and bitter melon = 'karawila' (*Momordica charantia*), tomato = 'takkali' (*Lycopersicon esculentum*), egg plant = 'wambatu' (*Solanum melongena*), and okra = 'bandakka' (*Abelmoschus esculentus*) exhibit much genetic diversity. Some of the popular leaf vegetables with considerable genetic diversity are Mukunuwenna (*Alternanthera sessilis*), tampala (*Amaranthus* spp.) Gotukola, (*Centella asiatica*) and Katurumurunga (*Sesbania grandiflora*).

Among the root and tuber crops, much variability exists in yams (*Dioscorea* spp.), aroids, e.g. taro = 'gahala' (*Colocasia esculenta*), coco yam = 'kiri habarala' (*Xanthosoma sagittifolium*) etc., cassava = maiokka (*Manihot esculenta*), sweet potato = 'batala' (*Ipomoea batatas*), 'kidaran' (*Amorphophallus paenifolius*) and potato = 'arthapal' (*Solanum tuberosum*).

Spices have made Sri Lanka famous, while condiments are popularly used for local culinary purposes. Considerable genetic diversity occurs among pepper = 'gammiris' (*Piper nigrum*), cardamom = 'ensal' (*Elettaria cardamomum* var. *cardamomum*), betel = 'bulath' (*Piper betle*), tamarind = 'siyambala' (*Tamarindus indica*), goraka (*Garcinia quaesita* and *G. zeylanica*) and chilli 'miris' (*Capsicum annum*). About 500 local selections of pepper and five wild and two cultivated species of *Piper* (other than *P. betle*) have been identified.

Coconut = 'pol' (*Cocos nucifera*) is the most widely used edible oil, while Oil palm (*Elaeis guineensis*) is gaining popularity in Sri Lanka. Sesame = 'tala' (*Sesamum indicum*) is used to some extent, while groundnut = 'rata kaju' (*Arachis hypogea*), although a major oil seed in India, is used more as a snack rather than a source of edible oil in Sri Lanka. Similarly, mousey mi = 'mee' (*Madhuca longifolia*), although used in India, is insignificant as an edible oil in Sri Lanka.

6.1.2 Plantation crops

Plantation crops have been the mainstay of the economy, particularly coconut, tea and rubber – the latter two having been introduced within the past two centuries.

Coffee

Coffee was the first economic crop experimented under the British rule. George Bird introduced coffee cultivation in 1823 in Gampola, which soon became a home garden crop. Due to the high demand by 1835, coffee plantation spread to most parts of the country. The land required for coffee cultivation was sold to the British planters for nominal amounts. Due to the failure of the local people to prove the ownership of land, large extents were confiscated and were declared crown land. This situation created an uproar in the hill country against coffee cultivation by 1848. After the protest was suppressed by 1857, the area under coffee rose rapidly extending to higher elevations, e.g. 1500 m, covering Dimbula, Dickoya and the foothills of the Adam's Peak. Due to the spread of the coffee leaf rust (*Hemileia vastatrix*), the entire extent of coffee was destroyed within 25 years of its first appearance in 1969, and only a few hectares were left by 1890. Cinchona was interplanted in coffee but tea proved a more durable resource and caught on rapidly. The failure of coffee plantations marked the emergence of tea as a new plantation crop grown in the land earlier used for coffee (TRI 1986, Abeyawardana 2004).

Tea

The first authenticated batch of tea seeds to reach Sri Lanka was planted at the Royal Botanic Gardens at Peradeniya in December 1839. These were obtained from the Calcutta Botanic Gardens and were said to be the "Indigenous Assam Tea" (*Camellia sinensis* var. *assamica*). However, the first commercial planting of tea in Sri Lanka was undertaken by James Taylor only in 1867 on 19 acres of land on Loolcondra Estate, Hewaheta (TRI 1986). This new plantation was a challenging experiment. A majority of tea estates flourished in the Nuwara Eliya District and in a few other areas within the Central Province. By the end of the 19th century an extent of 150,000 hectares (370,500 acres) was under tea cultivation (Abeyawardana 2004). Tea is now grown on over 250,000 hectares. In 2001 the extent of tea was 21,022 hectares in Nuwara Eliya District, 9,440 hectares in Kandy District and 1,630 hectares in Matale District (Abeyawardana 2004). The germplasm originally introduced from has undergone selection through breeding programs, and the selected genotypes are being clonally conserved in various breeding stations and tea estates. Selection procedures and vegetative propagation have together produced a series of clones of high yield, resistance to pests, diseases, and drought, and high rates of fermentation (Jayasuriya and Rajapakse 2003, NARESA 1991).

Rubber

Para rubber (*Hevea brasiliensis*) was introduced to Sri Lanka in 1876 from Brazil via Kew Gardens in UK. Almost all the clones have been bred from this original seedling stock. Recently, new germplasm has been introduced from S. America and also from Malaysia. A total of 9046 clones are being maintained as live collections by the RRI in three locations in the Wet Zone.

Coconut

The conservation of coconut germplasm (*Cocos nucifera*) is carried out by the CRI at three locations in the Intermediate Zone. These field gene banks are nearly sixteen years old and they hold 39 local and introduced germplasm.

6.1.3 Medicinal crops

For nearly three millennia, plant and plant products have been systematically used by mankind for treating illnesses. In Sri Lanka, this traditional form of medicine has been in existence for almost as long, and over the centuries it has developed to such a level that it is now an established system of medicine. Over 1,400 plant species have been used in traditional medicine. These species include several endemic species that are becoming increasingly rare and under threat of extinction. Approximately 200 species of medicinal plants are in common use, and of these 50 are heavily used in ayurvedic and traditional health care systems. Nearly 80 medicinal plant species are now

considered threatened. In addition to recognizing their curative and therapeutic value, Sri Lankans use medicinal plants in rituals, cultural activities and in religious functions. Thus medicinal plants play an important part in the day-to-day life of the Sri Lankan people.

About 30 - 35% of the population in the country are primarily depend on Ayurveda and traditional systems of health care, and there is a long history of traditional knowledge associated with plant use. In the rural areas, people collect their requirements of medicinal plants from natural environments, such as forest, scrub and aquatic habitats. People would collect only their requirements for treating illnesses, or the physicians would collect only the minimum requirements for the preparation of medicine for the community. In this manner the concept of sustainable use is practiced, causing minimum damage to the biodiversity in their environment. Herbal medicine is fast becoming popular in the developed countries, and in the recent past, the global demand for medicinal plants has increased significantly. The increased demand for both local use and for export has induced unsustainable exploitation of medicinal plants from the wild causing a great strain on their natural populations and a serious threat to the survival of some species.

The local supply of medicinal plants for ayurveda cannot meet the demand and currently, about 60% of the requirements of medicinal plants are imported. The situation is compounded by the increasing degradation of habitats, unsustainable harvesting levels and methods, post-harvest losses and failure to use the products in an optimal way. About 80% of the locally supplied medicinal plants are collected from the wild. Of the 50 species most heavily used, 30 are collected from the forests.

Equally threatened is the knowledge, based on the traditional medicinal system. Only a small proportion of this traditional knowledge and the ethnobotanical information is documented; the majority remains recorded in ancient, obscure *ola* (palm leaf) manuscripts scattered around the country or in the memory of elderly physicians. These practitioners would normally pass on such information, except to those trusted acolytes, preferably from the family. This *guru-kula* system of ancient teaching of traditional knowledge is fast disappearing. This knowledge not only addresses health care of the community, but also addresses the sustainable management of the natural resources associated with the rural communities and therefore it is necessary to preserve this traditional knowledge.

Western medicine too makes extensive use of plant materials. The WHO has estimated about 21,000 plant species as having medicinal properties. Of these, about 5,000 species have been subjected to extensive chemical investigations to ascertain their medicinal properties. Some recent studies have shown that about 25% of all prescriptions are plant-based. Of the most commonly prescribed drugs in the USA, it is estimated that nearly 50% have been derived from wild plants.

Therefore, it is obvious that medicinal plant resources are a global treasure, to be preserved for the benefit of mankind. It is a precious repository of yet unknown galaxy of new drugs, waiting to be discovered and providing hope for the people who are sick with obscure diseases. Similarly, traditional knowledge is important. The need to conserve medicinal plants, and use them sustainably, is facilitated by the CBD, ratified by over 175 countries. CBD provides the background for sustainable use and for equitable sharing of benefits arising from the exploitation of medicinal plants (Mahindapala and Kumarasiri 2002).

6.1.4 Fodder crops

There is considerable research conducted to select and introduce suitable fodder species to the livestock industry. Premalal (2007) compiled useful information on green fodder on a CD that was produced and made available at the AVC, DOA with the support from the CARP.

In addition to numerous naturally occurring plants that are consumed by livestock, many exotics have been introduced as fodder while some other species that were introduced for other purposes, e.g. ornamental, also have proved to be suitable as fodder. Much research has been conducted on the suitability of these exotics as effective fodder resources (Table 6.1).

Table 6.1 Research aspects of fodder plant species

Plant species (local names in parenthesis)	Research aspects and recommendations	References
<i>Gliricidia sepium</i> (Weta-hiriya) <i>Calliandra calothyrsus</i> (Calliandra) <i>Cassia siamea</i> (Wa) <i>Cassia spectabilis</i> (Kaha-kona)	Biomass production and nutrient content of nitrogen-fixing and non-nitrogen fixing leguminous tree species	Gunaratne & Heenkende (2000)
<i>Erythrina</i> sp <i>Tithonia diversifolia</i> (Natta-suriya)	Nutritive and medicinal values	Jayawardena & Rajaguru (2000)
<i>Pennisetum purpureum</i> x <i>P. americanum</i> var. CO-3 (Hybrid napier grass)	On-farm management and persistence	Chamara et al. (1999)
<i>Pennisetum clandestinum</i> (Kikuyu grass)	Value in the montane zone of Sri Lanka	Andrew & Jayawardena (1971)
<i>Gliricidia sepium</i> , <i>Leucaena leucocephala</i> (<i>Ipil ipil</i>), <i>Erythrina</i> sp. (Dadap) <i>Calliandra calothyrsus</i> , <i>Flemingea</i> sp., <i>Sesbania</i> sp., <i>Acacia</i> sp.	As hedge rows and internal hedges	SAREC/NSF (1998)
<i>Chloris gayana</i> <i>Panicum maximum</i> (Guinea grass) <i>Cenchrus ciliaris</i> , <i>Pueraria phaseoloides</i> <i>Centrosema pubescens</i> <i>Desmodium ovalifolium</i>	Integration of livestock pasture and forestry (Pinus, Eucalyptus and Acacia plantations in the mid-country: These species are recommended as suitable for silvo-pastoral systems	Premalal & Perera (1995)
<i>Desmodium heterocarpon</i> (Et-undupiyali) <i>Desmodium heterophyllum</i> (Maha-undupiyali), <i>Clitoria laurifolia</i> (Andana-hiriya), <i>Paspalum germinatum</i>	These species were identified as suitable pasture species for saline soils in the southern parts of Sri Lanka	Amarasinghe et al. (2004)
Improved grass fodder: <i>Brachiaria brizantha</i> , <i>B. decumbens</i> <i>B. mutica</i> , <i>B. humidicola</i> , <i>B. miliformis</i>	These were compiled as useful fodder grass species	Premalal (2007)

Plant species (local names in parenthesis)	Research aspects and recommendations	References
<p><i>Pennisetum purpureum</i> (Napier grass) <i>Pennisetum purpureum</i> x <i>P. americanum</i> var. CO-3</p> <p>Other grasses: <i>Brachiaria ruziziensis</i>, <i>Panicum maximum</i>, <i>P. maximum</i> var. <i>trichoglume</i> (slender Guinea grass), <i>Cynodon dactylon</i> (Bermuda grass), <i>Andropogon gayanus</i>, <i>Axonopus affinis</i>, <i>Axonopus compressus</i> (Carpet grass), <i>Cenchrus ciliaris</i>, <i>Chloris gayana</i>, <i>Digitaria decumbens</i>, <i>Paspalum notatum</i>, <i>Pennisetum clandestinum</i>, <i>Stenotaphrum secundatum</i>, <i>Tripsacum laxum</i> (Guatamala grass), <i>Zea mays</i> (maize)</p>		

6.1.5 Crop Wild Relatives (CWR)

CWR include crop ancestors as well as other species more or less closely related to crops. They are a critical source of genes for resistance to diseases, pests and stresses such as drought and extreme temperatures. Real food security relies on the diversity of food crops. Therefore the failure of one or another major crop can result in a disaster when the food base is narrow and no replacement crops are available. Potato blight in Ireland in 1840s and coffee rust in Sri Lanka in 1870s have destroyed whole cultivations and brought about economic disasters, thus providing unique examples of negative impacts of genetic uniformity (Fowler & Mooney 1990). Potato and coffee were introduced to Ireland and Sri Lanka respectively with narrow genetic bases. Corn leaf blight in Florida, USA in 1970s and failure of *Besostaja* variety of wheat in Ukraine are recent examples. Wild relatives of potato from Mexico helped to rescue potato cultivation in Europe. Therefore, for sustainable agriculture a large number of crop varieties and their wild relatives should be conserved and utilized. Further, it is now widely accepted that the increase of food plant varieties may result in short and long term benefits to the community. It has, therefore, become extremely necessary to look for new alternative or non-conventional plant resources for diversification of present day agriculture. In this context, CWR and underutilized traditional food plants assume special significance. The BI (former IPGRI) has selected over fifty crops to be considered in its research and development programs.

Protecting CWR helps to ensure that adequate genetic diversity exists in a particular crop's gene pool. The increasing genetic uniformity of crop varieties, combined with the effects of climate change, makes crops more vulnerable to stress. CWR are valuable tools that we can use to adapt to changing environmental conditions and human needs and their conservation is vital for improving agricultural production, stabilizing food security and maintaining environmental integrity.

CWR, which are of agro-horticultural importance, occur in varied habitats ranging from highly disturbed sites such as roadsides to undisturbed natural vegetation that lie within protected areas. Open canopy forests, secondary forests, disturbed grasslands and shrub jungles are rich in CWR. However, those of fruit crops are largely associated with wet evergreen (LWEEF, MEEF, MOEF) to semi-evergreen intermediate forests (MMEF). However, due to various anthropogenic activities,

such as over-exploitation and deforestation, the natural populations of CWR are increasingly at risk of being disappearing from their natural habitats. In reality, a major portion of CWR occurs outside the protected areas and their conservation poses a considerable issue for the relevant stakeholders.

Sri Lanka is an important centre of diversity for CWR albeit very little attention has been paid to conserve and utilize them. Jayasuriya and Rajapakse (2003) identified and listed 288 CWRs in Sri Lanka. [However, a recent survey conducted by the CWR Project (see Chapter 7), shows that there are 671 CWR species, belonging to 54 families. Of them 512 are indigenous while 159 are exotic, having naturalized in Sri Lanka. Among the indigenous species, 122 (23.8%) are endemic to Sri Lanka. However, a list of these CWR is not available to be reproduced here]. According to Jayasuriya and Rajapakse (2003), there are a large number of wild species of agro-horticultural importance in different crop groups, viz. cereals (30), legumes (40), vegetables (31), fruit crops (94), root and tuber crops (16), oil seed crops (7), fiber crops (40), spices and condiments (19) and others (11). Majority of these occur in the Central Province, although some are exclusively found in the province, e.g. *Brachystema lankana* ('Pathan ala') and *Dioscorea trimenii* ('Dahaiya ala').

The identified CWRs are summarized in terms of genera and number of species in each genus, in parenthesis:

Cereals: *Coix* (2), *Digitaria* (2), *Echinochloa* (4), *Eleusine* (2), *Hygroryza* (1), *Leersia* (1), *Oryza* (5), *Panicum* (3), *Paspalum* (4), *Pennisetum* (2), *Setaria* (4).

Legumes: *Atylosia* (4), *Canavalia* (5), *Dolichos* (1), *Lablab* (1), *Macroptilium* (1), *Macrotyloma* (3), *Mucuna* (4), *Neonotoniana* (1), *Rhynchosia* (12), *Teramnus* (2), *Vigna* (6).

Vegetables: *Abelmoschus* (3), *Aerva* (1), *Alternanthera* (1), *Amaranthus* (2), *Asparagus* (3), *Basella* (1), *Centella* (1), *Citrulus* (1), *Dregea* (1), *Lasia* (1), *Luffa* (1), *Momordica* (2), *Mukia* (1), *Solanum* (8), *Trichosanthes* (4).

Root and tuber: *Alocasia* (3), *Amorphophallus* (1), *Brachystelma* (1), *Canna* (1), *Colocasia* (1), *Dioscorea* (9).

Oil seeds: *Sesamum* (2), *Madhuca* (7).

Spices and condiments: *Cinnamomum* (8), *Curcuma* (4), *Elettaria* (2), *Murraya* (1), *Myristica* (1), *Tamarindus* (1), *Zingiber* (3).

Fruits: *Antidesma* (5), *Artocarpus* (2), *Carissa* (3), *Chrysophyllum* (1), *Dialium* (1), *Drypetes* (4), *Elaeagnus* (1), *Elaeocarpus* (7), *Euphoria* (1), *Limonia* (1), *Flacourtia* (2), *Garcinia* (6), *Mangifera* (2), *Manilkara* (1), *Mimusops* (2), *Musa* (2), *Podadenia* (1), *Phyllanthus* (1), *Phoenix* (2), *Prunus* (2), *Psidium* (3), *Rubus* (9), *Salacia* (4), *Schleichera* (1), *Spondias* (1), *Syzygium* (23), *Zizyphus* (6).

Fiber: *Boehmeria* (3), *Corchorus* (6), *Crotalaria* (30), *Hibiscus* (1).

Others: *Borassus* (1), *Caryota* (1), *Cycas* (1), *Cymbopogon* (3), *Lentinus* (Mushroom) (1), *Saccharum* (2), *Vetiveria* (2).

6.2 Livestock diversity

Out of the 40 species of mammals and avian species of farm animals found in the world, only six mammalian species comprised of neat cattle (estimated 1,557,000 heads), buffalo (698,000), goat (495,000), sheep (11,000), pigs (71,000) and avian species of chicken (10,622,000) are widely used in Sri Lanka. Minor domesticated species comprise of ducks (9,900), geese, turkey, horses and ass (donkey) are found in small numbers scattered in isolated locations. Farm animals can be broadly

categorized into locally adapted, recently introduced and continually imported breeds (Chandrasiri 2004).

6.2.1 Locally adapted breeds

Cattle (*Bos indicus*)

Lankan / native cattle (*Bos indicus* var. *ceylonicus*): Morphological, physiological and production parameters of this breed have been studied. It is a triple purpose breed (milk, draught and meat). The beef industry in Sri Lanka mainly depends on the native cattle found in the dry zone. This breed is also used as pack animals in some rural areas.

White cattle: This is the predominant breed of cattle in the eastern Sri Lanka. Its origin is not clear. It is believed that these animals are descendents of the white dairy cattle herds maintained by the ancient kings.

'Cape cattle' or 'Hatton cow': This was excellent locally adapted dairy cattle, which is believed extinct now. It was bred during colonial regime by crossing the male calves born to European cows shipped to Sri Lanka via Cape of Good Hope in South Africa, thus the name 'cape'.

Lena iri: This breed is well adapted to harsh environmental conditions. They can be seen in the Western and Southern parts of Sri Lanka. The males are hardy and used as cart bulls.

Buffaloes (*Bubalus bubalis*)

Buffaloes are probably not native to Sri Lanka. Their history is linked to the earliest human immigrants to the island. The species was domesticated over 4,000 years ago and since then has been extensively used as dual-purpose (draught and milk) animals. It is believed that water buffaloes have been exported to China in historical times (Chandrasiri 2004). In Sri Lanka they exist in three groups:

Lankan buffalo (*Bubalus bubalis bubalis*): Although the Lankan buffalo is phenotypically similar to the swamp type, it has 48 chromosomes in contrast to 50 in the latter. Relationship analysis using DA genetic distance has also confirmed that the Lankan buffalo belongs to the river type (Barker et al. 1997). Some describe Lankan buffalo as a degenerated river buffalo. Although its morphological, physiological and production parameters have been studied, no other genetic characterization has been done on this breed.

Sri Lankan wild buffalo: Genetic relationship of this breed is not known and a systematic study on it has not yet been conducted. However, a close relationship between the river type and the Sri Lankan wild buffalo has been observed (Lau et al. 1998).

Feral or semi-wild buffalo: History of this group is not clear and no systematic studies have been carried out.

Goats

Indigenous goat: Morphological, physiological and production parameters of this breed have been studied.

Kottukachchiya goat: Above parameters of this breed have also been studied.

Sheep

Native sheep (Jaffna sheep): There is a small population of sheep in the Jaffna peninsula and its phenotypic characterization has been carried out.

Pigs

Indigenous pigs are known as 'blue pigs' or 'mini pigs'. Phenotypic characterization of this breed has not been carried out.

Ponies

Delf ponies or local ponies: There is a small population of these in the northern island of Delft. The name 'pony' is controversial as some believe that these are stunted horses due to their larger body size. However, no systematic study has been carried out on this breed.

Donkeys

Puttalam donkey: These are ash colored with a thin black stripe across the shoulder.

Mannar donkey: Although the body size is similar to that of Puttalam donkey, the body color is blackish brown and there is no black stripe across its shoulder.

The origin of these donkeys is not known. However, it is believed that they were brought to Sri Lanka by the Portuguese. They could be the descendents of either Nubian or Somalian donkeys. No systematic studies have been conducted on them. They are mainly used for draught purposes.

Poultry

Scavenging village chicken: They are widely distributed in the island and their production parameters have been studied.

CPRS white and brown layers: These egg layers were recently developed at the CPRS, Kundasale and can be considered as locally adapted poultry breeds. Production parameters of this breed have been carried out.

Naked neck: These are common in the Eastern Sri Lanka and no systematic study on them has been carried out.

Fighting cock: A few breeds of the fighting cocks exist in some isolated areas where cock fighting is illegally carried out. Their origin is not well known.

6.2.2 Recently introduced breeds

Cattle

Cattle (*Bos taurus*)

There are many recently introduced breeds of cattle in Sri Lanka. Friesian, Jersey, Ayershire, Dairy Short Horn, Red Poll, Dunandini, Holstein Friesian, AFS, AMZ, Brown Swiss, Meuse-Rhine-Yssel (MRY) are some of them.

Cattle (*Bos indicus*)

Sindhi, Sahiwal, Tharpakar, Haryana, Khillari, Kangayam and Gir are recently introduced breeds.

Buffaloes (*Bubalus bubalis*)

Few river types have been introduced and they are Murrah, Surti, Nili-Ravi and Medhana breeds.

Goats

Jamunapari, Saanen, Beetal, Boer and German Faun are some exotic breeds that were introduced recently.

Sheep

Polled Dorset, Wiltshire Horn, Bikaneri, Bannur, Madras Red and South Down are some exotic breed introduced to Sri Lanka.

Rabbits

Rabbit farming is not popular in Sri Lanka. However, breeds such as New Zealand White, New Zealand Red, Flemish Giant, Californian White, Vienna Blue, Belgium Red and Chinchila have been introduced during the last few decades.

Poultry

A reasonably large number of breeds of poultry have been imported to Sri Lanka. They belong to white egg layer, brown egg layer and meat types, e.g. White Plymouth Rock, Cornish, Light Sussex, White Leghorns, Rhode Island Red and Naked-neck.

Ducks

Duck farming has not gained popularity in Sri Lanka. However, few breeds such as Velovi, Petrose, Khaki Camble, Muscovy and Chery Valley have been imported.

Turkey

Turkey farming is not popular in Sri Lanka. Few breeds have been imported by the private and government sector organizations. Norfolk Black, Norfolk White, Bronze, BUT-8 and Nicholas 300 (White) are few of the.

Geese and Quail

Geese and quail farming are also not popular. In Sri Lanka, very few breeds have been imported and the most prominent quail breed is Japanese quail.

Swine

Large Black, Large White, Land Race, Middle White and Durock are the newly introduced swine breeds.

6.2.3 Continually imported breeds

Genetic materials in the form of live animals or semen of following livestock breeds are been imported to upgrade the local stocks.

Cattle : Holstein Friesian, Jersey, AMZ, AFS, Sahiwal

Boffaloes : Nili-Ravi, Murrah, Surti

Goats : Jamunapari, Saanan

Sheep : None

Pigs : Large White, Land Race, Duroc

Poultry	: Many strains of white egg layer, brown egg layer and meat types
Ducks	: Dual purpose commercial birds (gg and meat types)
Turkey	: Negligible

6.2.4 Distribution of livestock diversity

Distribution of various livestock breeds is influenced mainly by climate, agriculture, socio-economics and cultural diversity, among others. Chandrasiri (2004) presents a quantitative account of the distribution of various livestock populations in the country. The neat cattle and buffalo populations are highest in Kurunegala District (North Western Province), where intensive and semi-intensive management is associated with coconut cultivation. As paddy cultivation is prominent in this region plenty of crop residues are also available for cattle and buffaloes. In addition, most of the livestock farms belonging to the NLDB are also situated in this province. Mainly exotic breeds (*Bos taurus*), their crosses and Lankan buffaloes, their crosses with exotic types (Nili-Ravi and Murrah) are found in this area. The next highest cattle population is found in Anuradhapura District (North Central Province). The predominant type of cattle here is Lankan and their crosses with *Bos indicus* breeds. In Jaffna District intensively managed small herds of high producing *Bos taurus* crosses are common. The goat population is highest in Jaffna District. The predominant types are Saanan, Jamunapari and their crosses. The sheep population is also highest in Jaffna District. The predominant type is 'Jaffna sheep'. The pig population is highest in the western coastal area extending from Puttalam, Negombo and Kalutara. The predominant types are exotic breeds and the scavenging indigenous pigs. Poultry population is highest in Kurunegala and Gampaha District. Ducks are mainly found in Kandy and Gampaha Districts. Information on the distribution on other breeds of livestock is not available.

6.2.5 Livestock Wild Relatives

There are few LWR in the country and they are wild buffaloes, wild pigs (*Sus scrofa*), Sri Lankan jungle fowl (*Gallus lafayetti*), small ruminants of cervus family such as spotted deer (*Axis axis ceylonensis*), Hog deer (*Axis porcius oryzus*), sambhur (*Cervus unicolor unicolor*), barking deer (*Muntiacus muntjak malabaricus*), Mouse deer (*Moschiola memminna*), wild ducks such as common moorhen (*Gallinula chloropus*) and purple swamp hen (*Porphyrio porphyrio*). Except wild buffaloes, wild pigs and wild ducks other wild species are protected in Sri Lanka. Rearing, slaughtering and selling of any product of these animals are prohibited by law. Among conserved species, sambhur population is rapidly increasing, although species such as spotted deer and jungle fowl are threatened. None of these LWR is actively used in breeding programs (Chandrasiri 2004).

6.2.6 Feral populations of domestic animals

There is a relatively large feral buffalo population and small feral pony and donkey populations in Sri Lanka. Feral buffaloes have created a critical management issue due to the degradation of pasturelands and water resources in wildlife parks. It has been estimated that 40-60,000 feral buffaloes are grazing in these national parks while there are only about 1,500 wild buffaloes in the country. Population statistics of other wild animals such as wild pigs, wild donkeys, ponies and jungle fowl etc. are not available. The contribution of these wild species to food and agriculture is negligible. Among them, wild pigs have become a major threat to agriculture in many areas. The wild pigs and feral buffaloes could be incorporated into the food resources for the human beings. It is also possible for integration of these species into domestic animal production systems. Croosing of wild pigs with exotic pig breeds has been conducted and the meat of the crossbreeds is sold as wild boar meat, which is a delicacy in Sri Lanka (Chadrasiri 2004).

In addition to the feral buffaloes, the free grazing cattle have become a serious environmental issue in some areas. Overgrazing has facilitated soil erosion and establishment of invasive plants such as

Lantana camara, especially in some national parks, e.g. Uda walawe NP. The resultant reduction of food stocks for the wild animals, especially the elephants, in the national parks has prompted them to invade farmlands and villages in search of food, thus creating the serious issue of human-elephant conflict (Chandrasiri 2004).

6.2.7 Loss of animal genetic resources

Use of exotic AnGR on indigenous breeds have reduced the genetic diversity and even has threatened the existence of certain indigenous and locally adapted livestock breeds. It is believed that the famous 'Cape cattle / Hatton cow' that was a locally adapted superior dairy cow is now extinct due to the indiscriminate cross breeding using exotic germplasm. The Jaffna sheep, Kottukachchiya goat, Puttalam and Mannar donkeys, Delft ponies, and indigenous pigs are other local breeds that are presently threatened. Ducks, turkey, quail, Guinea Fowl, Rabbit and donkey breeds, that are reared in small numbers in isolation, do not significantly contribute to the food and agriculture production in Sri Lanka. None of these breeds are systematically conserved. Furthermore, Sri Lanka does not have any program in place to assist farmers or organizations to conserve any specific animal breeds (Chandrasiri 2004).

6.3 Anthropogenic diversity

Anthropogenic diversity and prehistoric evidence that led to anthropogenic diversity are relatively more relevant to the Uva Province and they are dealt to a great deal in the Biodiversity Profile for the Uva Province.

CHAPTER 7

7. *IN SITU* CONSERVATION

7.1 Introduction

Best strategy for the long-term protection of biological diversity is the conservation of communities and populations in natural sites or habitats where they occur, through on-site or *in situ* conservation. This is because it is only under natural conditions where these populations will be sufficiently large and diverse to prevent genetic erosion, and where species will be able to continue the process of evolutionary adaptations to changing environments in their natural state (MENR 2005).

Whenever the *in situ* conservation option is practiced, the 'protected area' concept becomes important. A holistic view to conservation of biological resources is not new to Sri Lanka as it was ingrained in the traditional practices of the people centuries before colonial rule commenced. However, current trends in the loss of biodiversity reveal that these once revered traditional values and practices have been often overlooked by development policies of successive governments (MENR 2005).

The BCAP (MENR 2005) considers *in situ* conservation under four major systems, viz. forests, wetlands, coastal and marine and agricultural.

7.2 Forest genetic resources

The natural forest cover has declined from an estimated 84% of the total land area in 1881 to about 24% at present. It has declined mostly in the wet zone where only 11.3 % area remains forested as compared to the 23.2% in the dry zone. The per capita forest cover is only 0.10 ha in Sri Lanka.

7.2.1 Growth of Protected Areas System in Sri Lanka

There was progressive growth in Sri Lanka's protected areas system since forest reserves were gazetted from 1850 onwards within the forestry sub-sector. However, none of these reserves was demarcated until 1885 and none notified with boundaries until 1890. With the enactment of the *Forest Ordinance* in 1907, wildlife was given legal provision through the establishment of sanctuaries – first at Yala, and then at Wilpattu - and the network of protected areas grew progressively. The beginning of this network was masked by the fact that game sanctuaries established from 1990 onwards were subsequently abolished under the new Ordinance and declared as national reserves or sanctuaries. The bulk of the forest reserves network was established in the 1920s, although a large number of smaller reserves were notified in the subsequent two decades. Many more reserves were proposed during this period but never actually notified. In 1938, Sri Lanka established five categories of PAs, under the *Fauna and Flora Protection Ordinance*: Strict Natural Reserves, National Parks, Nature Reserves, Jungle Corridors and Intermediate Zones. All were administered by the Department of Wildlife Conservation. Simultaneously, the Forest Ordinance established two categories of reserves: Forest Reserves and Proposed Reserves.

While there has been no appreciative growth in forest reserve network since the 1950s, there has been a significant shift in the function of forest and proposed reserves from production to conservation. This began in the mid 1970s with establishment of a network of 36 MAB reserves within which timber extraction was not permitted. The network expanded considerably during the 1980s, mostly in the basin and adjacent areas of the Mahaweli Ganga to protect water catchments and to provide refuge to animals displaced by the Accelerated Mahaweli Development Programme. In 1987, the National Wilderness Act added National Wilderness Areas to the list of PAs. In the

early 1990's the protected forests system expanded considerably, with the addition of 31 conservation forests in the wet zone and the Knuckles Conservation Forest in the intermediate zone.

Although about 23 percent of the country is under some sort of protection, only 12 percent is devoted to complete protection. Yet, this represents a significant commitment to the preservation of biological diversity. Sri Lanka is one of the only five countries in the world that has over 10 percent of land area allocated for strict conservation.

Designated areas administered by the Forest Department tend to be small and confined mostly to the wet zone, whereas those under the authority of the Department of Wildlife Conservation tend to be larger and occur mainly in the dry zone. It is significant that over 28 percent of the total land area of Sri Lanka is reserved and administered by the FD and the DWC. As such more than 60 percent of close canopy natural forest, or 55 percent of all natural forests, lie within the reserves of these two departments.

However, whether our PAs system can ensure the effective conservation of the biodiversity is questionable. Research suggests that in the tropics the minimum viable breeding population of 500 trees of low-density species require between 6-1,000 hectares for their conservation (Whitmore 1984). The minimum critical size required to conserve the elephants is at least 100,000 hectares of contiguous forest. Only two reserves in Sri Lanka meet this requirement.

About 40 percent of the PAs, are less than 1,000 hectares – nearly all of them are 'biological islands' amongst agriculture and other developments. However, it is disturbing that although about 9,462 km² of natural forest and scrubland amounting to around 15 percent of the island is declared as protected, only about 18 percent of this network fall within the biologically rich wet zone (IUCN & WCMC 1997). Furthermore, almost all forest reserves in the wet zone have suffered selective logging in the past (NARESA 1991).

7.2.2 Protected Areas in Central Province

Protected areas (PAs) within the CP are administered by the central government. The two main custodians, viz. Forest Department (FD) and Department of Wildlife Conservation (DWC), hold administrative and management responsibilities of the relevant PAs. However, it is observed that the Central Provincial Council bears certain responsibilities in this regard. The total area under the protection of the forest and wildlife sectors amounts to 174,374 hectares, ie. 31% of the total area of the province.

7.2.3 Forest Sector

The FD has recently classified its PAs into three classes, taking into consideration the conservation values and economic potentials of these PAs. However, the new classification and the map of the PAs belonging to these classes are not available. Therefore the PAs as listed in the National Conservation Review (NCR) are given in Table 7.1 (IUCN & WCMC 1997). These PAs consist of Forest Reserves (FR), Proposed Forest Reserves (PR) and Other State Forests (OSF), as classified then. It should be noted that OSFs have not been mapped. At present, the Knuckles, the most important and largest Forest Sector PA in the Central Province, is placed in the unique category of Conservation Forests. An extract of the PAs in the Central Province from the map of Forest Sector PAs in Sri Lanka is given in Figure 7.1. Thirty five forest sector PAs consist of 105,596 hectares.

Table 7.1 Forest Sector Protected Areas in the Central Province

EMD Number	Name of Protected Area	Designation	Notified Area (ha)
Matale District			
567	Amsawagama	OSF	450.0
654	Arangala	OSF	-
568	Beliyakanda	OSF	250.0
660	Elagamuwa	OSF	-
82	Elagomuwa	PR	870.1
569	Etabendiwela	OSF	325.0
560	Galboda	OSF	600.0
571	Gederagalpatana	OSF	1500.0
574	Hiriwaduna	OSF	950.0
144	Inamaluwa	PR	309.6
655	Kaludiyapokuna	OSF	-
656	Kosgahakele	?	-
572	Menikdeniya	OSF	450.0
561	Opalagala	OSF	350.0
335	Pallegama-Himbiliyakada	PR	4547.2
376	Potawa	PR	77.2
573	Puswellagolla	OSF	10000.0
562	Sacombe	OSF	250.0
570	Tottawelgoda	OSF	800.0
Kandy District			
79	Dotalugala (part in Matale Dist.)	PR	1871.7
522	Knuckles	OSF	30000.0
394	Rilagala (part in Nuwara Eliya Dist.)	PR	566.6
442	Udawattakele	FR	104.0
Nuwara Eliya District			
1	Agra-Bopats	PR	9105.4
40	Bogawantalawa	PR	4289.7
52	Conical Hill	PR	1569.7
96	Gal Oya	PR	9036.6
172	Kandapola Sita Eliya	FR	2721.2
192	Kelani Valley	PR	2944.9
197	Kikilimana	PR	4868.4
248	Mahakudagala	PR	1762.5
270	Meepilimana	FR	981.8
358	Pattipola-Ambewela	PR	1498.0
359	Peak Wilderness (part in Kegalle Dist.)	PR	5665.7
362	Pedro	PR	6879.7

Source: IUCN & WCMC 1997

Knuckles Conservation Forest

The Knuckles forest region, locally known as 'Dumbara', covering an area of about 21,000 hectares, lies in the Kandy and Matale Districts. It is separated from the Central Highlands by a deeply incised valley of the Mahaweli river, commonly referred to as the 'Dumbara Valley'. The general landscape of the area is extremely rugged, with at least 35 peaks rising above 900 m. The aggregation of spectacular peaks is a unique feature in the Knuckles forest range, found nowhere else in the island. The highest peaks of the Knuckles mountain range are Gombaniya (1900 m), Knuckles (1852 m), Kirigalpotta (1642 m), Dotulugala (1564 m) and Koboneelagala (1544 m).

The Knuckles forest region is an important watershed, with several streams draining east into the lower Mahaweli system (e.g. Hasalaka Oya, Maha Oya and Heen Ganga), south-west into the upper Mahaweli system (e.g. Hulu Ganga), and north-west into the Amban Ganga system (e.g. Teligomu Oya and Kalu Ganga). The Knuckles catchment area contributes to about 30% of the water in Victoria, Randenigala and Rantembe reservoirs of the Mahaweli system.

The biological and hydrological values of the Knuckles forest region were recognized more than a century ago, when the area above 1,500 m in the Knuckles range was declared as a Climatic Reserve in 1873. Since then, the area has received legal conservation status under the Forest Ordinance, administered by the FD. It was declared a Proposed Conservation Area in 1998 and subsequently as the *Knuckles Conservation Area* by a Gazette Notification No. 1130/22 part 1 of 5th May 2000 by the government to be effective from 10th April 2000. The area of the Conservation Area is 17,500 hectares. Subsequently, it was declared as a National MAB Reserve. Lately, it has also been nominated to be declared as an International MAB Reserve and a natural World Heritage Site.

The location of the Knuckles forest region in the wet and intermediate zones has resulted in a wide range of rainfall and temperature in different parts of the region. The highland areas of the Knuckles forest range are extremely wet throughout the year, with an average annual rainfall of about 5,000 mm, while the lower eastern slopes are relatively drier, with less than 2,500 mm. The area is also exposed to strong winds during monsoon periods. The wide range of climatic and landscape features in the Knuckles region has resulted in a variety of major natural vegetation types, e.g. MMEF, MEEF, MOEF, DPTG, SAVG, and SPOF, several minor natural vegetation types, e.g. pygmy forest, steppe (short-grass patana) and riverine forest and many habitat types. This vegetation heterogeneity harbors a rich composition of plants and animals, some of which are unique to the Knuckles forest region.

The Pitawala Patana (Dik-patana), situated between Riveston (Bata-anduwa gap) and Illukkumbura, has an association of grassland and forest. This grassland is a unique turf grass community (steppe) occurring on gently sloping tableland on rock that supports only a thin layer (5-10 cm) of soil. Being humic and spongy, this soil layer retains water for a relatively long time after rain and slowly releases seepage that creates shallow pools and streamlets over the tableland. Due to disintegration of the rocky substratum and subsequent weathering, schists of rock of various sizes appear, especially in association of seepage and streamlet habitats. This unique ecosystem, yet unknown elsewhere in Sri Lanka, also supports unique organisms, e.g. *Brachystelma lankana* (Asclepiadaceae) ('Patan ala'), a herb with edible tuber (Dassanayake & Jayasuriya 1974) and *Nannophrys marmorata* (Kirthisinghe's Rock Frog or Marbled Cliff Frog), that were discovered for the first time from this locality. The only known extant population of *Dipcadi montanum* (Hyacinthaceae) survives at Pitawala Patana. Relatively deeper soils occur in areas surrounding Pitawala Patana and in patches or islands within the patana area. The forest with somewhat depressed canopies (3-6 m high) occurs in such habitats and this forest is a transition between MEEF and MMEF. Many rare plant species have been recorded in this transition zone, and among them *Litsea ligustrina* (Lauraceae) was recorded after nearly 150 years, during the NCR survey (IUCN & WCMC 1997).

Although the hill ranges generally remain as uninhabited wilderness, traditional human settlements occur among the narrow river valleys. The villagers are involved in the cultivation of paddy in terraced fields, supplemented with chena cultivation. Commercial plantation of tea and cardamom are also located within the Knuckles forest range. Patches of plantation forests, dominated by pine (*Pinus caribaea*), are located in areas bordering the Knuckles range (Bambaradeniya & Ekanayake 2003).

A total of 1033 flowering plants in 141 families have been recorded from the Knuckles region. Among them, 225 (25%) are tree species, while the balance consists of shrubs, herbs and other life forms. Although the Knuckles forest region covers less than 0.5% of the island's land area, it represents almost one third of Sri Lanka's flowering plant species. Of the flowering plants, 160 (15%) are endemic to Sri Lanka, while about 3% are nationally threatened. A majority of these endemic species occur in the MOEF and MEEF vegetation types. Meanwhile, many plant species are known to be endemic to the Knuckles region. *Brachystelma lankana* (Asclepiadaceae), a small herb with edible tubers, is restricted to short-grass patana in the Knuckles (Dassanayake & Jayasuriya 1974). *Eugenia hypoleauca*, *Eugenia phillyraeoides* and *Syzygium fergusonii* (Myrtaceae) are restricted to pygmy forests, while *Syzygium potamicum* (Myrtaceae) has been recorded only in MEEF of the Knuckles (Kostermans 1981). *Strobilanthes pentandra* (Acanthaceae) is another herbaceous species restricted to the pygmy forests, while *Dipcadi montanum* (Hyacinthaceae) is specially adapted to survive in seepage over rocky surfaces in short-grass patana, a vegetation type unique in the Knuckles region.

The Knuckles forest region also supports a rich composition of animals. Of the vertebrates, 25 species of fishes have been recorded and 3 species, viz. *Garra phillipsii* (Phillip's Garra), *Puntius srilankensis* (Blotched Filamented Barb) and *Puntius martenstyni* (Martenstyn's Barb) are endemic to the Knuckles. Of the 20 amphibian species recorded from the Knuckles, *Nannophrys marmorata* (Kirthisinghe's Rock Frog) is endemic to the Knuckles. There are 24 endemics among 54 species of reptiles recorded from the Knuckles and of them *Ceretophora tennentii* (Leaf-nose lizard) and *Cophotis dumbara* ('Dumbara kuru-bodilima') are endemic to the Knuckles. A total of 128 species of birds (17 endemic) and 31 species of mammals (4 endemic) have been recorded from the Knuckles (Bambaradeniya & Ekanayake 2003).

Udawattakele Royal Forest Park

This is located within the city of Kandy, bordering the Temple of Sacred Tooth. Since the establishment of the Kandyan Kingdom in 1371 AD, King Wickramabahu built his palace within this forest and thereafter, the other Kandyan kings too had this as a part of the royal precinct and used it for recreation and for security. The ground behind the palace has been called 'Udawahala watta' from which Udawattakele had been derived. It was a prohibited forest (*tahansikele*) during the Kandyan administration. The first *vihara* of the Asgiriya chapter was established in Udawattakele during the reign of King Parakramabahu IV of Kurunegala (Abayawardana 2004). During the British era, in 1822, a part of the Udawattakele Forest was used as the burial site for the British elite and soldiers and named as the **Garrison Cemetery** (see section 9.5.3). The Udawattakele was declared a sanctuary by the government on 29th July 1938 (Abayawardana 2004).

Today it is essentially an urban park known as 'Udawattakele Royal Forest Park', administered by the FD. The extent of the reserve is 105 hectares and it has an road network which now serves as nature trails, while a Conservation Center, managed by the Divisional Forest Office, Kandy, provides information to the public and this facility includes literature, a library and video films.

Although the reserve has a good forest cover, a large proportion of it consists of introduced species, such as 'Hawari-nuga' (*Alstonia macrophylla*), 'Katta-kumanchal' (*Myroxylon balsamum*), African tulip tree (*Spathodea campanulata*) and 'Yoda Una' = Giant bamboo (*Dendrocalamus giganteus*) etc. Several ornamental creepers that have escaped from cultivation, e.g. *Philodendron*

hederaceum, *Epiprenum aureum*, *Scindapsis* spp., *Syngonium* spp., and similar herbaceous species, e.g. *Aglaonema commutatum* and *Dieffenbachia* spp., abound the reserve. All these belong to the family Araceae. However, extremely rare and highly threatened plants, e.g. *Phaleria capitata* (Thymelaeaceae) have been recorded in this reserve.

Kande Ela Forest Park

Established in 2006, this Forest Park is situated at Kande Ela in the Nuwara Eliya District. The park consists of about 4 hectares containing a small patch of natural forest and some forest plantation. A visitor center, located in the park, provides useful information on the conservation of soil, water and biodiversity, while areas to demonstrate soil conservation techniques including the use of bamboo species for this purpose, nursery practices, home garden model and a nature trail have been designed to educate visitors.

7.2.4 Wildlife Sector

The Wildlife Sector PAs in the Central Province are represented by four important areas consisting of 68,768 hectares (Table 7.2). However, a part of the Peak Wilderness Sanctuary also lies in the Sabaragamuwa Province (Ratnapura and Kegalle Districts).

Table 7.2 Wildlife Sector Protected Areas in the Central Province

EMD Number	Name of Protected Area	Designation	Notified Area (ha)
Nuwara Eliya District			
123	Hakgala (part in Badulla Dist.)	SNR	1141.6
140	Horton Plain	NP	3159.8
361	Peak Wilderness (parts in Ratnapura & Kegalle Districts)	S	22379.2
452	Victoria-Randenigala-Rantembe (part in Nuwara Eliya Dist.)	S	42087.1

Source: IUCN & WCMC 1997

Horton Plains National Park

The Horton Plains was declared as a nature reserve on 5th December 1959, but was elevated to the status of NP on 16th March 1988. Like other catchments in the hills, the area had previously received some protection under an administrative order issued in 1873, which prohibited clearing and felling of forests above 5,000 ft (1,524 m). This was based on the advice of the famous botanist Sir Joseph Hooker, who urged the then colonial government “ to have all Montane Forests above 5,000 ft. undisturbed “ (DWC 2001).

Horton Plains comprises a gently undulating highland plateau at the southern end of the central mountain massif of Sri Lanka. It is dominated to the north by Totupolakanda peak (2,357 m) and to the west by Kirigalpotta peak (2,389 m), Sri Lanka’s third and second highest peaks, respectively. The altitude of the park ranges from 1,800 to 2,389 m (top of Kirigalpotta). The plateau, at about 2,100 m, is the highest tableland in Sri Lanka. Two escarpments falling from the Horton Plains have contributed immensely to its awe inspiring physiognomy, ‘the small worlds end’ drops by 274 m and the ‘big worlds end’ by 884 m. They are also of outstanding scenic beauty and conservation importance, containing most of the habitats and endemic flora and fauna that represents country’s central mountains.

Tributaries of three major rivers originate from within the reserve, the Mahaweli Ganga flowing to the north, the Kelani Ganga to the west and Walawe to the south. Along with the adjoining Peak Wilderness, the Horton Plains constitutes Sri Lanka's most important catchment area of almost all major rivers. The importance of the "*Contiguous Forest Concept*" in an integrated approach to soil, watershed and biodiversity conservation was amply demonstrated by the NCR, and the role played by the Central Highlands in this regard ranks at the top (IUCN & WCMC 1997).

The main vegetation types that constitute the Horton Plains NP are the Montane Evergreen Forest (MOEF) and the unique Wet Patana Grassland (WPTG) (Jayasuriya et al. 2006). A recent study was conducted to map the habitat types of the Horton Plains and accordingly three habitat types (communities) among the MOEF were recognized, viz. *Undisturbed Forest Community*, *Disturbed Forest Community (Canopy Die-back Areas)* and *Forest / Grassland Ecotone* (EML 2005b). Furthermore, within the WPTG, six grassland communities were recognized, viz. *Tussock Grass Community*, *Carpet Grass Community*, *Grassland / Rhododendron Community*, *Dwarf Bamboo Community*, *Grass & Fern Community* and *Marsh / Peat Community* (EML 2005b).

Galwaysland National Park

This small wildlife reserve was declared as a NP on 18th May 2006 and it consists of only 29.32 hectares. The NP is located within the city of Nuwara Eliya and it enhances the tourism potential of the city. Although, located in the region of MOEF zone, the high level of disturbance and the presence of many forest plantation species, such as *Pinus*, *Araucaria* and *Eucalyptus* etc., the area has assumed the status of a secondary forest. As many bird species are found in the park, it has a high potential for bird-watching.

Victoria-Randenigala-Rantembe Sanctuary

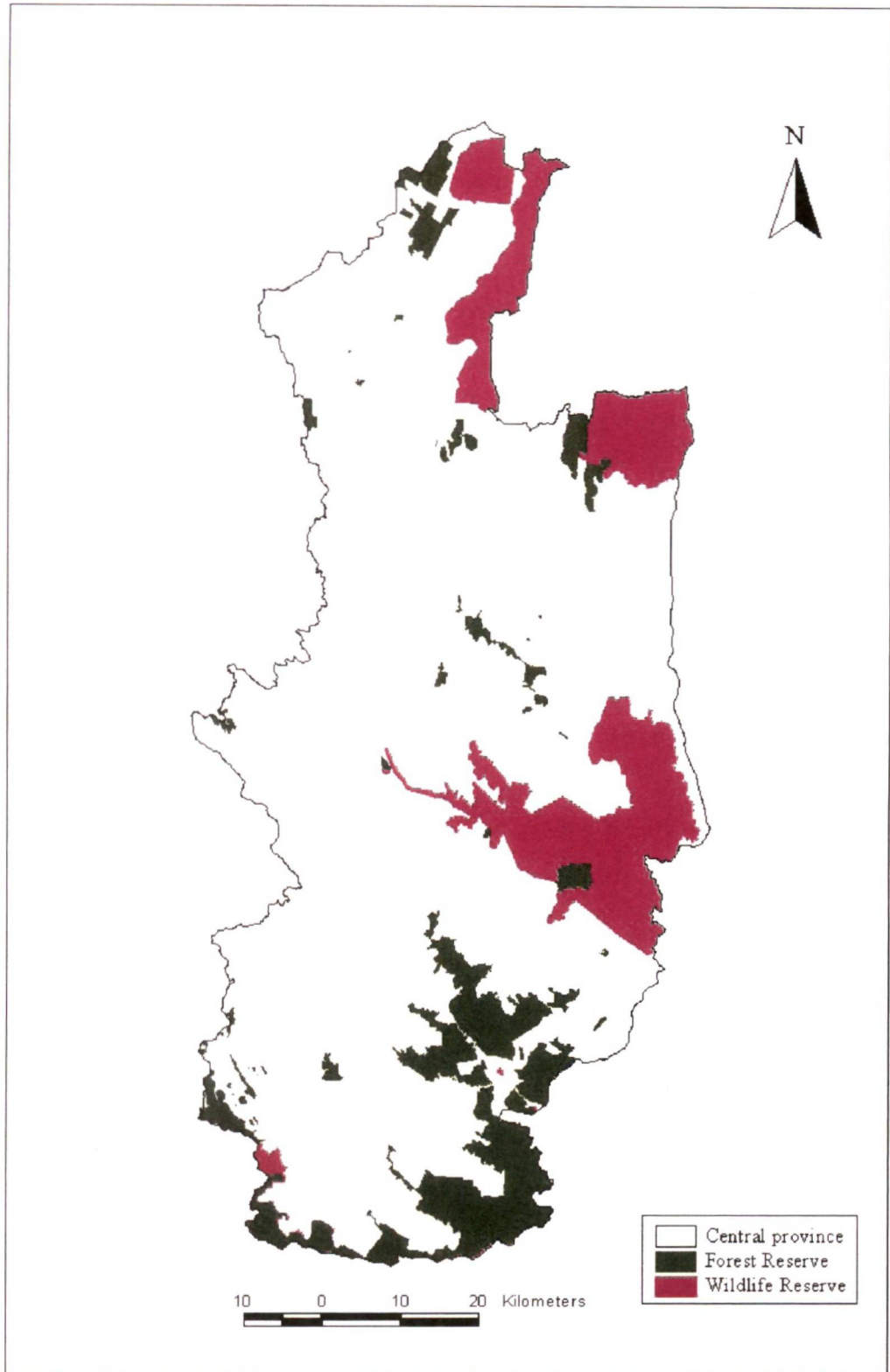
This is the largest Sanctuary in Sri Lanka, consisting of 42,078 hectares and located in both Central Province (Kandy and Nuwara Eliya Districts) and Uva Province (Badulla District). The Sanctuary was declared on 31st January 1987 and it was established to function as a catchment as well as to provide sanctuary for the animals displaced due to the impounding of the three reservoirs. The Sanctuary is located mainly in the intermediate zone, while a part of it lies in the wet zone. The Sanctuary area supplies many rivers, viz. Kurundu Oya, Belihul Oya, Hasalaka Oya, Galmal Oya, Hulu Ganga, Uma Oya and Minipe Giant Canal that enrich the three reservoirs, viz. Victoria, Randenigala and Rantembe.

As the Sanctuary consists of a large area with high diversity of vegetation types, species diversity of the plants and animals is also reasonably high. Over 300 species of fauna, in main faunal groups, have been identified: 71 butterflies, 30 freshwater fishes, 10 amphibians, 35 reptiles, 153 birds and 29 mammals.

There are many villages that are pocketed within the Sanctuary, and therefore, the Sanctuary is subjected to many anthropological activities, such as cultivation of up-country vegetables, chena cultivation, homesteads, animal husbandry, illegal extraction of timber and other forest products, firing and trespassing etc.

7.2.5 Archaeological Reserves

The role of the archeological reserves in biodiversity conservation has received only very little attention. Nevertheless, a considerable number of archeological reserves harbor rich natural biota that enhances the serenity of the associated environment. The conservation of a given archeological site essentially includes the protection of its associated flora and fauna and therefore, they serve the dual function of providing protection to the items of archeological importance and biodiversity associated within their reserve areas. The attempts to extend archeological sites into 'biodiversity parks' are scanty.



Source: Forest Department

Figure 7.1 Protected Areas in Central Province

Menikdena Archeological Reserve and Arboretum

This is a unique development in nature conservation conducted by a school in Sri Lanka. The Trinity College in Kandy initiated this project in 1994 with the permission of the Department of Archeology and technical guidance and support from PGRC and NH of the DAG and this project was completed in 1998. This reserve and the arboretum has thus being converted into a popular tourist spot in the region of Dambulla and it is considered as a unique model of an integrated biodiversity and archaeological conservation project conducted by a school. Presently, the site is managed by the DArch (Jayasuriya 1998, Jayasuriya et al. 1997).

Menikdena is located in the Matale District and it could be accessed from Matale-Dambulla road by turning west at Pannampitiya and proceeding for 2.5 km or from Kurunegala-Dambulla road by turning south at Pahalawewa, east of Galewela and proceeding for about 5 km. It was declared as an Archeological Reserve in 1957 which consists of 16.2 hectares (40 acres) accomodating mostly natural forest, in which remains of a monastery dating back to the reign of King Kithsiri Mevan (6th Century AD) are found. Among the architectural highlights at Menikdena, there are the ruins of five sacred structures that are spread over the monastery square of about 2 hectares. These are the Pratimagara (Image House), Stupa (Relic Chamber), Bodhigara (Tree Shrine), Uposathagara (Chapter House) and Dharmasalawa (Congregation Hall). The site is located in a picturesque environment bounded on the west by Menikdena Forest (450 hectares) and on the east by Menikdena wewa. The forest generally sprawls over the Menikdena Hill which peaks at 865 m. The main vegetation type is MMEF with patches of SAVG and a patch of MEEF capping the hill-top habitat.

The arboretum covers the total area of the archeological reserve in which a network of nature trails have been made and about 450 trees, lianas and large shrubs have been identified and labelled with aluminium identification boards. Each board indicates local name, botanical name with family, endemism and the reference number of the tree/liana/shrub. In effect, the site depicts a natural botanical garden (arboretum) which is of high educational value.

7.2.6 Other modified sites

In addition to PAs that are administered by the State, private or institute- owned natural areas that function as *in situ* conservation sites exist in the country. While some of these sites have been subsequently donated to some institutes or to the State for specific purposes, others are being owned by the respective institutes or private individuals who are practical nature conservanists.

Popham Arboretum

This was a private land owned by Mr. Fredrick Holmes Popham (Sam Popham), a British conservationist, who lived in Sri Lanka for many of his years and donated this property to the IFS, Kandy to be used for research and education. The site is located in Kandalama, Dambulla in the Matale District, 2 km east of the Matale-Dambulla road. The general altitude of the site is 178 m. The property, when initially acquired by Mr. Popham in 1963, was 2.8 hectares and later expanded to 3.5 hectares. After this property was donated, and due to Mr. Popham's impulsion, the IFS was able to acquire another 11 hectares of adjacent land in 1989 (Popham 1993, Popham & Neil 1994).

The initial 'unproductive' or wasteland', frequented with thorn scrub, was converted into a high stature forest with primary species through a natural process of succession, nurtured by human involvement (Popham 1997). The Popham's concept of '*nature under human supervision*' involves preliminary slashing of 'undesired species' ('thorny plants or objectionable scrub'), strict rejection of fire to 'clean' the slashed litter, but allowing natural decomposition to enrich the soil, leaving plant litter *in situ* without sweeping or displacing them, preference of spontaneous seedlings over replanting of seedlings, regular weeding, caring of the young during climatic stresses (watering during difficult early stages), encouraging early growth by stem-pruning and crown-lifting for

dominant tree species ('youngsters born to forest giants') and controlled thinning of excess saplings. This model finally created a patch of DMEF, the main climax vegetation type of the area, in a degraded site in the dry zone. The nature trails help visitors to observe various plants and bird life within the arboretum. Cramer (1993) has recorded 426 plant species in 167 genera and 56 families that belong to many life forms, such as trees, shrubs, lianas, creepers and herbs in the site.

It is evident that in the dry zone, a wasteland can be successfully converted to the status of a self-sustaining forest (DMEF) through Popham's concept of forest restoration in 25 years. However, recent experience in the woodlands has suggested that as little as 3 – 4 years is sufficient to initiate an effective conversion. This is proof that there is potential to rehabilitate what appears at first to be completely useless land which has been over-cultivated, perhaps regularly burnt, and is no longer able to produce crops. An important factor in this, however, is the availability of mother trees that can introduce new seed into such wastelands (Popham & Neil 1994). The Popham model of forest restoration has been recommended to establish genetic corridors between forest sites in the dry zone, especially for resurrecting privately owned degraded scrublands that lie within designated corridors (Jayasuriya et al. 2005).

Hantana Mountain Range

Hantana Mountain Range consists of about 1,200 hectares and its present land ownership is complex. During the British era, most areas of the range were cleared for coffee, tea and rubber and later abandoned and became wastelands. 432 hectares of the lower Hantana were allocated for the University of Ceylon (presently University of Peradeniya) in about 1939. Exotic trees, such as *Albizia* (*Albizia falcataria*), Flamboyant (*Delonix regia*) and Rain tree (*Samanea saman*) were cultivated from about 1952 in other areas and later the Caribbean Pine (*Pinus caribaea*) was introduced and gradually extended to the upper areas by the FD. Presently, the land ownership is vested in LRC, UP and private sector, while a considerable area is vested in the FD, although this area has not been surveyed accurately. The extent of the natural forests is limited to isolated patches in the upper areas. Present development activities by the private sector and plantation companies and haphazard allocation of the land by the LRC are posing considerable threats to the environment of the mountain range. These activities have intensified soil erosion, drying up and pollution of streams and landslides. In addition, almost annual wild fires, mostly anthropogenic in origin and occurring often in February-March, cause heavy damage to the environment. The spread of wild fires become acute in areas under pinus. The Kandy District Secretariat has recently initiated the 'Hantana Environment and Soil Conservation Project' and developed a reasonably conducive background for the conservation of this important site (Kandy District Secretariat 2006).

Ambuluwawa Biodiversity Complex

Ambuluwawa hill is situated on the west of Gampola and standing 1087 m above sea level, it demarcates the Kandy and Kegalle districts. Ambuluwawa development project was started in 1997 and since 1998, the National Botanic Garden (then belonging to the DAG) was involved in the development of the Ambuluwawa hill in Gampola as an alternate leisure park and a biodiversity park. However, many environmentalists criticized the 'development thrust and colossal consumption of funds' of this ambitious project and pointed out that the Ambuluwawa hill had been declared an erodible area under the Soil Conservation Act since 1960. Meanwhile some recommended a moderate and environment-friendly process for the development of this ecologically sensitive habitat. The development thrust was even extended to the initiation of a new journal, *Sri Lankan Biodiversity Review: Annual Bulletin of Ambuluwawa Biodiversity Complex*, by the DAG which became defunct after publishing its first volume in 2001. Finally in 2002, many reasons compelled the NBG/DAG to withdraw from the Ambuluwawa project.

7.3 Agro-biodiversity

7.3.1 Crop wild relatives (CWR)

The indigenous gene pool of medicinal plants, wild types and wild crop wild relatives occur mainly in the wild. The candidates targeted for *in situ* conservation are fruit crop genetic resources (e.g. wild banana), spices with recalcitrant seeds (e.g. cinnamon), wild relatives of rice, legumes, spices and medicinal plants. However, further information on Intra-specific variability will be necessary to initiate effective conservation of CWRs (Jayasuriya and Rajapakse 2003).

Crop Wild Relatives Project

'*In situ* Conservation of Crop Wild Relatives Through Enhanced Information Management and Field Application' is a five-year (2004 to 2009) UNEP/GEF supported project that aims to effectively conserve and use CWR. It brings together seven international organizations (UNEP, IPGRI, FAO, BGCI, UNEP-WCMC, IUCN and ZADI) and five countries – Armenia, Bolivia, Madagascar, Sri Lanka and Uzbekistan. Each country has a significant number of globally important and threatened CWR and is also among the world's biodiversity hotspots – places that have the highest concentrations of unique biodiversity on the planet. The project aims to protect natural populations of CWR while setting a precedent for conservation that the rest of the world can follow. The project has three broad goals:

To develop national and international information systems on CWR that include data on species biology, ecology, conservation status, distribution, crop production potential, uses, existing conservation actions and existing information sources.

To build capacity of national partners to use this information to develop and implement rational, cost-effective approaches to conserving CWR.

To raise awareness of the potential of CWR for improving agricultural production among policy-makers, plant breeders, educators and local users.

The project outcomes will provide the basis for strategies that could be applied in other countries with significant populations of CWR. In this way, these five nations, with little in common beyond the fact that they are located in centers of crop diversity and possess important and endangered CWR, will collectively make a major contribution to the conservation of CWR globally.

The Sri Lankan component of the CWR project is jointly conducted by the Ministry of Environment & Natural Resources and Department of Agriculture. The FD, DWC, CEA, DOC, DEA, BAMRI, IUCN, Universities and relevant NGOs are other project partners. It has completed an inventory of food CWR species at country and provincial levels. It also has initiated a coordinated effort to increase awareness, document populations, evaluate threats and conserve food CWR in Sri Lanka.

As the five countries were expected to prioritize CWR, Sri Lanka has selected rice, cowpea, black pepper, banana and cinnamon to be considered within this project. The DAg has recently established Agriculture Information Park at Gannoruwa to increase public awareness on modern agriculture, traditional farming systems and conservation of germplasm in genebanks etc. This facility also includes the potential role of CWR in crop improvement. So far, CWR of pepper, bean, okra, banana and rice have been established in the park. The DOA is also in the process of establishing a second such park in Bata ata in Hambantota District, which will also feature a section devoted to CWR. The success of the park has prompted plans by the DNBG to establish similar exhibits throughout the country and the idea has reached beyond the crop sector. Using a similar concept, the FD has established a Forest Education Park at Kande Ela in Ambewela (see 7.2.3.1)

7.3.2 On- farm conservation of landraces

Until early 1960's farmers were custodians of the complete range of genetic diversity available in the traditional cultivars. By early 1980's, almost 90% of landraces of rice was replaced with high yielding modern varieties and currently this has risen to about 98%. However, still there are localities where farmers maintain landraces for their consumption and other indirect benefits of due to special qualities contained in these traditional varieties, e.g. medicinal properties, higher market for traditional quality rice, cultural values and suitability of cultivation in particular ago-ecological conditions.

7.3.3 Home gardens

Home gardens are a source of economically and culturally important bio-resources, both wild and cultivated. Sri Lanka's agricultural habitats and home gardens have evolved over many centuries, and hence conserved a rich diversity of cultivated species (BCAP 2005).

Home gardens are commonly found in many rural areas of Sri Lanka. However, the concept of 'home gardens' is best developed in the Central Province, so much so that the term 'Kandyan Home Gardens' is used to indicate this *in situ* conservation method. The size of a home normal garden plot varies from 100 – 1000 m². As altitude increases, the home gardens become smaller with greater density of plants and plant species and lesser diversity within a species. A well-defined plant association and canopy structure that reflect a variety of complimentary functions are displayed in the system. At the perimeter, coconut and fruit trees predominate and canopy is progressively reduced with the occurrence of spice trees. Vegetables occupy the core areas around the dwelling. Near the well or open drainage areas, aroids and yams are grown. Medicinal plants are frequently grown in the shade while ornamental plants occupy the front portion near the house.

For several perennial fruit crops like banana, mango, Jackfruit, citrus, rambutan, durian, guava, avocado, papaya and mangosteen, the bulk of the genetic diversity is conserved in home gardens. Fuel wood is also an essential component of this self sustaining system. Therefore, the home gardens provide a valuable system for the conservation of agro-biodiversity. Nevertheless the importance of home gardens has still not been widely recognized and little inventory work has been done so far.

7.4 Medicinal plant genetic resources

Efforts have been taken to promote *in situ* conservation of medicinal plant genetic resources. These are essentially carried out with the collaboration of the main stakeholders of the *in situ* conservation, viz. FD and DWC.

7.4.1 Conservation and sustainable use of medicinal plants project

The CSUMPP was carried out between 1998 and 2003 with the support of the GEF to conserve medicinal plants and to promote their sustainable use. The project was implemented by the MPCA with the collaboration of the FD and the DWC. The project intended to secure conservation of globally and nationally significant medicinal plant species, and their habitats, through (a) *in situ* conservation by establishing five medicinal plant conservation areas (MPCAs) in different ecological zones of Sri Lanka, as a part of, or adjacent to existing natural forests which are the home for some of the threatened species of medicinal plants, (b) *ex-situ* cultivation and supporting propagation and agronomic research, and (c) by providing information and institutional support including promotion of appropriate legal and policy environment. An important element of the strategic approach adopted is to define and demarcate medicinal plant reserves in biogeographically representative areas and use these as centers for a wide range of activities covering conservation, propagation, basic processing, ethnobotanical and ecological studies and outreach programs. For this purpose, five MCPAs were established in Bibile (Uva Province) and Ritigala (North Central

Province) in the dry zone, Rajawaka (Sabaragamuwa Province) and Naula (Central Province) in the intermediate zone and Kanneliya (Southern Province) in the wet zone, adjacent to natural forests which harbor medicinal plant species (Mahindapala and Kumarasiri 2002).

Naula MPCA

This area is located in the Matale District and seven Grama Niladhari Divisions (Kumbiyangahaella, Maragamuwa, Pubbiliya, Nayakumbura, Kalundewa, Haduwa, Haduwela) were selected to be included in this MPCA.

Traditionally, medicinal plants in the area are well known to many people in and outside Naula. Two most popular sites were Kumaragala kanda and Pubbiliya forests. These two locations are constantly invaded by people for many purposes, such as collection of medicinal plants and firewood, felling of trees for timber and many other purposes. Powerful persons who are wealthy businessmen and politicians in the area ran these activities as organized businesses. Only a few genuine users visited forest areas to collect medicinal plants or their products. It is revealed that most of the above illegal activities are carried out by people from Dambulla, Naula, Matale and even from far places such as Elahera, Bakamuna and Radawewa. Small groups of two or three individuals carry out illegal collection of medicinal plants. Some of the most exploited medicinal plants are 'Bin kohomba' (*Munronia pinnata*), 'Aralu' (*Terminalia chebula*), 'Nelli' (*Phyllanthus emblica*), 'Bomi' (*Litsea glutinosa*), 'Bulu' (*Terminalia bellirica*), 'Sudu handun' (*Santalum album*), 'Gammalu' (*Pterocarpus marsupium*) etc. Although state agencies tried their best to stop such activities, no community organizations or organized collective efforts by people in the area were sufficient to oppose illegal activities. Felling of trees and setting fire during dry periods were other serious processes that destroyed the natural environment. Lack of non-farm income sources and lands and the poverty seem to drive people engaged in cutting of firewood and collection of bee honey from forests while some farmers have cleared virgin forest lands for chena cultivation. However, the most serious destruction was the setting of indiscriminate fire in the interior of thick jungles by intruders (EML 2002). Prior to the CSUMPP, there were no collective efforts by communities around these forests. Main reason was that they were unaware about the real value and extent of threat on medicinal plants in the area. Most of them were of the view that medicinal trees as trees grown only in wild (Kele gas). The government officials could not do much as there was no organized institutional framework to act against such malpractices. On the other hand people were aware about political patronage behind those businesses. Hence, they did not want to be involved in protecting forests. There were occasions where community leaders such as priests and traditional practitioners who lodged complains to GNs and other relevant authorities, but without success (EML 2002).

Evaluation of CSUMPP impacts in terms of natural environment, community livelihood and income, local knowledge and social capacity have shown positive development. It is said that the most visible impact is the improvement in the natural and physical environment due to reduction of deliberate fires, chena cultivation and felling of trees for timber and firewood. Since community is vigilant and aware, degree of such destructive activities has been greatly reduced. It has been observed that certain sections of the Kumaragala kanda were dry and brownish during most times of the year, but now they are relatively greener and the soil is moist. The economic benefits for local communities by engaging in various commercial ventures such as cutting of fire belts ('Gini pati'), packing of medicinal products, medicinal crop farming and bee keeping etc. have improved. More importantly, the project has made significant positive impacts on community's knowledge on medicinal plants, traditional medical systems, leadership skills and social status etc. However, the above impacts vary by place and type of activity. An assessment of levels of social and environmental benefits of the seven GNDs due to CSUMPP has shown positive trends in cutting fire belts, bee keeping, provision of agricultural implements, medicinal crop nurseries and processing, fuelwood cultivation, Ayurveda teacher-trainee system ('Gurukula Padanama'), School

medicinal plant gardens, commercial cultivation of medicinal crops, training/awareness programs and Watershed and stream bank restoration (EML 2002).

CHAPTER 8

8. EX SITU CONSERVATION

Ex situ conservation, or conservation outside the natural habitats, is regarded as a complimentary process along with *in situ* conservation in order to ensure effective long-term conservation of biodiversity. In today's context, despite efforts at *in situ* conservation, species may still be lost in the wild, and *ex situ* collections may turn out to be the only surviving germplasm of a given species. Furthermore, unpredictable events and natural hazards could result in the destruction of natural habitats and extinction of rare species. However, *ex situ* conservation is not regarded as a substitute for *in situ* conservation.

8.1 Plant genetic resources

Sri Lanka has a strong national program on *ex situ* conservation of plant genetic resources with regards to plants of agricultural/horticultural importance. The most common methods used for *ex situ* conservation are shown in Table 8.1

Table 8.1 *Ex situ* conservation methods

Method	Plant Genetic Resources Category	Organizations
Seed genebank	Agricultural crops and crop wild relatives (only orthodox seeds)	PGRC (DAg)
In vitro genebanks	Vegetative propagated crops	PGRC (DAg)
Cryopreservation	Vegetative propagated crops and seed crops	PGRC (DAgA)
Field genebanks	Fruit crops with recalcitrant seeds, vegetative propagated crops, plantation crops, medicinal plants, spice crops, fodder	PGRC & HORDI (DAg), TRI, RRI, CRI, SRI, BMARI, DEA, VRI
Botanical gardens	Botanical species, ornamental species, medicinal crops	BG
Arboreta	Forest trees	FD

8.1.1 Plant Genetic Resources Centre

The PGRC is an institute of the DAg that functions as a national and international center for conservation and exchange of crop genetic resources. It is situated in Gannoruwa in the Kandy District of the Central Province. The PGRC is the nodal organization that promotes and facilitates the conservation and sustainable utilization of PGR to improve agricultural productivity, thereby contributes to agricultural development and food security. PGRC was established in 1988 with a mandate to conduct exploration, collection, introduction, evaluation, documentation and conservation of genetic diversity of food crops and their wild relatives. Sixteen cold storage modules (4 units at 1⁰ and 12 units at 5⁰C) have been installed for conservation of seeds of orthodox species. Vegetative propagated materials and recalcitrant species are conserved in protected plant houses (green houses), tissue culture repository and/or in the field. PGRC also conducts research on various aspects of PGR conservation and improvement, such as the application of biotechnology for evaluation and improvement of selected crops (Jayasuriya and Rajapakse 2003). Table 8.2 indicates the germplasm conserved in PGRC

Table 8.2 Germplasm conserved in PGRC (November 2002)

Mode of conservation	Crop Group	Number	Total
Seed conservation (Genebank)	Rice and wild relatives of <i>Oryza</i>	4204	
	Other cereals	1029	
	Grain legumes	1704	
	Vegetable legumes	1058	
	Solanaceae vegetables	1093	
	Cucurbitaceae vegetables	651	
	Leaf vegetables	134	
	Other vegetables	298	
	Spices & condiments	292	
	Brassica vegetables	22	
	Oil seeds	340	
	Fiber crops	66	
	Others	221	11112
In vitro conservation	Root and tuber crops	141	140
Field genebank	Fruit crops	769	769
			12021

8.1.2 Botanical gardens

The botanical gardens in Sri Lanka were the precursor of the present DAG. During the colonial era, the botanical gardens served the mission of introduction and acclimatization of economically important plant species in Sri Lanka. The introduction of coffee, tea and rubber was so successful that even today its benefits to the local agricultural economy continue.

Botanical gardens are uniquely suited to undertake research on cultivation requirements, plant propagation, introduction of wild ornamental species to horticulture, and *ex situ* conservation of rare and endemic species. They are also capable of providing resurrected plant materials back into the wild for restoration of biodiversity and rehabilitation of natural habitats. Until recent times, botanical gardens have been under-utilized in maintenance of threatened species and conservation of genetic resources. Although they contain a large number of native plants, the gardens have traditionally not been integrated into overall biodiversity programs (MENR 2005).

From the inception, the botanical gardens were independently administered by the Royal Botanic Gardens at Peradeniya. Due to its expansion, the DAG was created in 1910 and the BG was placed under the administration of the former. With the independence in 1948, and the present system of government, the DAG was automatically placed under the Ministry of Agriculture. However, a new ministry, the Ministry of Botanical Gardens and Zoological Gardens Development, was established in 2005 and the BGs were placed under this ministry. This new ministry was abolished in 2007 and these institutions were placed in the Ministry of Sports and Entertainment.

Two BGs are located in the CP, viz. Royal Botanic Garden, in Peradeniya (Kandy District) and Hakgala Botanic Garden in Nuwara Eliya District (Table 8.3).

Table 8.3 Botanical gardens in Central Province

Location	Year of Establishment	Ecological zone	Area (ha)	Plant species category	Number of accessions
Peradeniya	1821	Mid-country wet zone	60.0	Trees, shrubs & herbs (Local and exotic) Medicinal plants	6500 200
Hakgala	1867	Up-country wet zone	30.0	Trees, shrubs & herbs (local and exotic)	5000
Pallekele Medicinal Garden	1990	Up-country intermediate zone	0.4	Medicinal plants	Abandoned

(Source: Jayasuriya & Rajapakse 2003)

8.1.3 Herbaria

The National Herbarium is located in the Royal Botanic Garden in Peradeniya and it is administered by the latter. It houses about 130,000 dried and preserved plant specimens that are available for botanical research. In addition, there are over 2,000 color illustrations on Sri Lanka's flora and a library consisting of over 2,000 books and botanical journals.

Hakgala Botanic Garden also started developing a herbarium of its own using some of the nineteenth century collections as its nucleus. Progressive addition of new collections, especially representing montane evergreen forests of the Central and Uva Provinces, is expected to contribute to its growth.

8.1.4 Municipal parks and other parks

As in most of the main cities, CP cities also maintain parks that can be considered as facilities for *ex-situ* conservation of plants, mainly trees. Matale, Kandy and Nuwara Eliya, within the administration of their Municipality Councils, maintain parks meant for public recreation.

8.1.5 Plantation crops

The plantation crop sector comes under the Ministry dealing with plantations. In this sector, TRI, RRI, CRI and SRI deal with research and development of the respective crops and the conservation of germplasm (MENR 2002). The TRI is located in Talawakele (Nuwara Eliya District) and one of its main branches is situated at Hantane (Kandy District).

Forest plantations

With the shift in emphasis of forest policy from production to protection, plantations have become particularly important in terms of timber production and as a source of wood products. The total area of forest plantations managed by the FD in 1999 was 135,623 hectares, but records indicate only 72,350 hectares of viable plantations in 2000 (Forest Department 2000). The exotics viz., Teak, Pine and Eucalyptus comprise much of these plantations. Among commonly cultivated Eucalyptus, are Toolur (*Eucalyptus grandis*), Tallow wood (*E. microcorys*) and Red gum (*E. camaldulensis*). The Caribbean Pine (*Pinus caribaea*) has also been extensively planted, especially in the Kandy and Badulla Districts. Other pines such as *Pinus tecunumanii*, *P. patula*, and *P. kesiya* have also been used at plantation level, but planting of pine has been practically discontinued after

1989. Other exotic species, e.g. Broad-leaf Mahogany (*Swietenia macrophylla*), *Acacia* spp., and *Cedrela toona*, also have been used for forest plantations on a lower scale.

8.1.6 Spice and beverage crops

DEA, located in Peradeniya, is mandated to develop and conserve crops such as coffee, pepper, cocoa, cardamom, cloves, nutmeg, cinnamon, lemon grass, betel and arecanut etc. Its main research station is located at Matale where germplasm of spice and beverage crops is maintained in field genebanks (Table 8.4).

Table 8.4 Field genebanks for spice and beverage crops

Location	Ecological zone	Crop species	Number of Accessions
Matale	Mid-country intermediate zone	<i>Elettaria cardamomum</i> (Cardamom)	10
		<i>Piper nigrum</i> (Pepper)	167
		<i>Theobroma cacao</i> (Cocoa)	65
		<i>Coffea</i> spp. (Coffee)	18
		<i>Areca catechu</i> (Betel nut)	65

(Source: Jayasuriya & Rajapakse 2003)

8.1.7 Medicinal crops

In Sri Lanka, a large number of plants have been used in traditional medicine for centuries. Therefore, collection, conservation and propagation medicinal crop germplasm are important to protect these species. At present, there are three major medicinal plant gardens, located in three different agro-ecological regions, and managed by the central government. Of these, only Pattipola is situated in the CP (Table 8.5).

Table 8.5 Field genebanks for medicinal crops (CP stations in italics)

Location	Province/District	Agro-ecological region	Extent (ha)
Pattipola	Central/Nuwara Eliya	Wet Zone Up country	7
Nawinna	Western/Colombo	Wet Zone Low Country	20
Haldummulla	Uva/Badulla	Intermediate Zone Mid Country	7
Girandurokotte	Uva/Badulla	Dry Zone Low Country	45

In addition, there are many medicinal plant gardens that are managed by various local authorities:

Medicinal plant gardens in Matale District

A garden was established at Naula under 'Sustainable Use of Medicinal Plants Project'.

Supported by the CP Department of Ayurveda, small medicinal plant gardens were established in some schools, e.g. Sangamitta Balika Vidyalaya in Matale and Madawala Ulpatha Vidyalaya.

Small medicinal gardens have been established in association with spice gardens, especially to attract tourists; e.g. Matale and Dambulla

Medicinal plant gardens in Kandy District

Gardens at Ayurveda Hospital at Pallekele and that at Gelioya are administered by the CP Council.

Gardens were established in Handaganawa and Bomure villages under 'Medicinal Villages Project'.

Supported by the CP DAy, small medicinal plant gardens were established in some schools, e.g. Marathugoda Vidyalaya in Harispattuwa, Jinaraja Vidyalaya and Saint Joseph's Balika Vidyalaya in Gampola.

Maintained by the Kandy Municipal Council, a medicinal plant garden, in association with plantation forestry, has been established at Walker Estate in Kandy. The extent of this garden is about 2 hectares.

Small gardens are maintained in association with Municipal Ayurveda Clinics in Getambe, Aruppola and Ampitiya.

A medicinal garden and a nursery are maintained by the NBA at Kundasale.

A Sandlewood garden was established under 'Sustainable Use of Medicinal Plants Project' at Dambulla. Research on the cultivation of Sandlewood is conducted by the University of Peradeniya at this site.

Small medicinal gardens have been established in association with spice gardens, especially to attract tourists; e.g. Ginigathhena.

Medicinal plant gardens in Nuwara Eliya District

A garden was established in Nildandahinna village under 'Medicinal Villages Project'.

8.2 Animal genetic resources

Although cryopreservation facilities are available for *ex situ* conservation of semen, these facilities are mainly used for breed upgrading programs by artificial insemination. Presently, other storage systems are not used in Sri Lanka. Although cryopreservation, storage and subsequent use is the responsibility of the state, involvement of the private sector and other stake holders is essential for a long-term program (Chandrasiri 2004).

8.2.1 KACPAW Organization

KACPAW (*Kandy Association for Community Protection through Animal Welfare*) is a voluntary organization which provides homes for orphan pets, especially dogs and cats. Unattended pets are collected, nourished, wormed, treated for ailments, sterilized and made available to those who will take care of them.

[Address: KACPAW Organization, Tekkawatta, Gohagoda, Katugastota].

8.2.2 Animal retaining centers

Cattle that are retained under the order of the courts, are temporarily kept at Livestock Farm, National Livestock Board, Haragama.

8.2.3 Fisheries Centers

A Provincial Fisheries Center is administered by the Ministry of Fisheries of the Central Province Council.

8.2.4 Aquaculture Development Centers

The National Aquaculture Development Authority is located at No. 758, Baseline Road, Colombo 09. The Regional Aquaculture Project Office is located at Agrarian Center, Digana, while Aquaculture Development Centers are located at Bambarakele, Nuwara Eliya and Ibbankatuwa, Dambulla.

CHAPTER 9

9. CULTURE AND BIODIVERSITY

Sri Lanka with a recorded history of over 2500 years and a prehistory of several millennia, acquired accumulated knowledge of managing and conserving its natural resources that include biodiversity. This knowledge had been gradually eroded due to foreign influences and a spell of colonial rule extending over 500 years. Despite these vicissitudes of history, people, particularly those in the rural interior, continued to retain a reasonable stock of traditional knowledge and customs related to biodiversity. The rich biodiversity is also reflected in the toponymy, culture and literature. It is now increasingly recognized that in sustainable development and in the conservation of nature, traditional knowledge and the life styles of the people with minimal demands on natural resources could form a vital role.

9.1 Historical accounts on biodiversity

Historical accounts on information related to biodiversity including food and agriculture provide important insights into the status of biodiversity that existed in historical times and enable us to understand subsequent transformation of the status of biodiversity that took place along with socio-economic changes up to the present times. Access to such information recorded before the times of European occupation is difficult and the publication of '*Thesaurus Zeylanicus*' by Burman (1737) is supposedly the first European work on Sri Lankan plants. Burman's thesis was based on the collection of botanical specimens by a German physician and botanist, Paul Hermann, employed by the Dutch East India Company and resident for seven years in Sri Lanka from 1672 to 1679 (Jayasuriya 2007). The observations made and recorded by Robert Knox in his 'An Historical Relation of the Island of Ceylon' (1681) provide most valuable information on the biodiversity and its utilization in Sri Lanka that existed in the 17th century (Robert Knox 1681). Since the ship that he traveled from India was caught in a violent storm and drifted to the Kottiar Bay in Trincomalee, Robert Knox became a prisoner of the local kingdom in 1660, at the age of 19 years, and retained as a prisoner for over 19 years until his final escape in 1679.

Robert Knox, with the knowledge he had gained during captivity in the 'Sinhale' (Kandyan provinces) drew on his store of memories and imparted to the readers a wealth of information. He recorded his observations on the geography, human society and its culture, local administration, agriculture, flora and fauna of the island in vivid details and published them in the above treatment in England, subsequent to his escape. Although he has apparently travelled widely in the country, Knox spent most of his captivity years in the central hills ('Kanda Uda Rata'), and therefore, his experience in biodiversity-related observations arguably pertains to the hill provinces, especially the Central Province.

9.1.1 Knox's observations on flora and agro-biodiversity

It is apparent that the Sri Lankan people have utilized a wide variety of plant products as their food resources. Information recorded by Knox, some in great detail, gives an important impression on the status of biodiversity and its utilization in Sri Lanka nearly 350 years ago. This information is cited in this treatment, however, with identification of plants and animals rectified and their taxonomic nomenclature updated wherever necessary. In presenting information on plants and plant products in this treatment, they are classified according to the system followed in Chapter 6: Genetic Profile.

9.1.2 Cereals, legume and oil seeds

Rice (*Oryza sativa*): Rice was the staple food and its cultivation was the main industry of the contemporary society around which the social activities and local culture were strongly wound. The main varietal classification of rice had been based on the duration, e.g. 'Ma-wee' (seven months), 'Hathial' (six months), 'Hondarawala' (five months), 'Heeneti' (four months) and 'Elpatkal' (three months). Knox also states that short duration varieties are superior in taste, but poor in yield. The choice of a rice variety depends on the availability of water as the latter is an essential factor during the full growth period of the rice plant. The use of 'long-duration' varieties during long rainy seasons and

'short-duration' varieties during relatively shorter rainy seasons and water conservation techniques employed by the farmers are noteworthy. In addition, special drought-resistant varieties that are suitable for highland conditions in chenas also existed, and they differ from other varieties in taste, fragrance and yield.

Other cereals: In some areas, rice, being seasonal, is inadequate to last the full year, and therefore these farmers cultivated other cereals to supplement their diet.

Finger millet = 'Kurakkan' (*Eleusine coracana*): This was the most popular cereal other than rice. One 'kurakkan' variety matures in three months, while another matures in four months.

Foxtail millet = 'Tana hal' (*Setaria italica*): Although this was rarely grown in the central region, it is relatively more popular in the northern regions. Its grains are finer than finger millet, but produce a better yield than the latter. Two varieties of foxtail millet existed, viz. 'three month' and 'four month' varieties.

Kodo millet = 'Amu' (*Paspalum scrobiculatum*): This cereal was also boiled and eaten like rice. It sometimes causes dizziness, vomiting and diarrhoea.

Proso millet = 'Meneri' (*Panicum miliaceum*): A cereal with tiny grains.

Indian corn = 'Iringu' (*Zea mays*)

Green gram = 'Mung' (*Vigna radiata*): A legume that was cultivated in chenas.

Sesame = 'Tala' (*Sesamum indicum*): The seed produces an oil that is applied on the body. A rejuvenating food can be prepared by roasting its seed, mixed with jaggery and made into balls.

Fruits

There was fair diversity of fruits in the country and if more care is taken for fruit trees and attention is paid for the diseases, an improved fruit production could have been achieved, as stated by Knox. Sinhala people considered fruits as an additional food source during lean periods, rather than consuming them as a desert. They planted only important fruit plants and let other useful plants grow spontaneously from the fallen seeds. A larger portion of the crop was cooked and this was called 'curry' in Portuguese (which has been derived from the Tamil word) and 'maluwa' in Sinhala.

If a fruit type of special qualities occurred in any part of the country, a representative of the king, known as 'Rate Bandara' visited the site and marked each of such trees with a rope with three knots to designate them as 'prohibited trees'. Even the owner of such trees had no right to use its produce. Any one touching such a 'prohibited tree' was severely punished, even by death. The owner of a 'prohibited tree' was required to crop the ripe fruits, wrap in white cloth and deliver to the Administrative Officer of the province, who inspected the fruits, re-wrapped them in white cloth and

sent to the king's palace. However, no remuneration was paid to the tree owner who delivered the fruits, even if he was from a distant place. Such a regulation only discouraged the citizens from growing fruit trees that are in excess of their requirement.

Jack fruit = 'Kos' (*Artocarpus heterophyllus*): A considerable part of the daily food requirement of the people was provided by Jack fruit. Poor people consumed jack fruit seeds either boiled or roasted in hot ash with fire above. Every household essentially had a heap of jack seeds in its kitchen. Jack seed was a convenient food for the travellers. The latex ('koholla') of the jack fruit was eaten when mixed with rice flour and this tasted like fried egg. This latex, when applied thickly on dried branches, was used to catch birds.

Knox also has noted the occurrence of exotic fruits, i.e. Rose apple = 'Jambu' (*Syzygium jambos*) and Guava = 'Pera' (*Psidium guajava*), that were probably introduced previously by the Portuguese.

Knox has also mentioned about several wild fruits such as 'Mora' (*Dimocarpus longan*), 'Dan' (*Syzygium caryophyllatum*), 'Karawala kebella' (*Antidesma bunius*), 'Kebella' (*Aporosa lindleyana*), 'Embilla' (*Antidesma alexiteria*), Myrabalan = 'Nelli' (*Phyllanthus emblica*) and 'Palu' (*Manilkara hexandra*).

Furthermore, there were other fruit and edible plants that Knox has previously observed in India, such as Coconut (*Cocos nucifera*), many cultivars of Banana (*Musa x paradisiaca*) which are distinguished by taste and local names, Sweet orange = 'Peni dodan' (*Citrus sinensis*), Sour orange = 'Embul dodan' (*Citrus aurantium*), Lime (*Citrus aurantifolia*), Citron = 'Pat narang' or 'Sidaran' (*Citrus medica*), many cultivars of Mango = 'Amba' (*Mangifera indica*), Pineapple = 'Annasi' (*Ananas comosus*), Water melon = 'Komadu' (*Citrullus lanatus*), Pomegranate = 'Delum' (*Punica granatum*), black and white varieties of grapes = 'midi' (*Vitis vinifera*), Cashew nut = 'Kaju' (*Anacardium occidentale*) and Sugar cane = 'Uk' (*Saccharum officinarum*).

Vegetables

Several vegetables, what are currently known as 'low country vegetables' were in existence during the time of Knox, e.g. Bitter gourd = 'Karawila' (*Momordica charantia*), Ridge gourd = 'Wetakolu' (*Luffa acutangula*), Drumstick = 'Murunga' (*Moringa oleifera*) and 'Kekiri' (*Cucumis melo*). They are generally regarded as plants that were introduced to this island from other countries.

Furthermore, several 'up country vegetables' and condiments that were introduced from Europe, e.g. carrot (*Daucus carota*), radish (*Raphanus sativus*) and Mint (*Mentha spicata*) and other introduced crops, e.g. Mustard = 'Aba' (*Brassica juncea*), Fennel = 'Suduru' (*Foeniculum bijolghota*), several cultivars of string bean (*Vigna unguiculata*), Cucumber = 'Pipincha' (*Cucumis sativa*) and Pumpkin = 'Wattakka' (*Cucurbita maxima*) etc. were also found in the island. Meanwhile, the Dutch, in their gardens, had some exotic crops, such as lettuce (*Lactuca sativa*).

A variety of green leaves (not named) and mushroom were important component of their daily diet, mainly collected from the woods by women, while men usually provided only rice and salt to the household.

Root and tubers

'Engili ala' (*Dioscorea alata*) is a yam cultivar with much lobed tuber and white tissue. Knox also mentioned about the occurrence of cultivars with red tissue. These probably belong to 'Raja ala' group of *D. alata*. He mentioned that the tubers of the wild yam species that occur in the forests penetrate deep into the soil. These were probably the 'Katu ala' (*Dioscorea pentaphylla*), 'Gonala' (*D. spicata* or *D. koyamae* or *D. oppositifolia* var. *dukhunensis*) and 'Hiritala' (*D. oppositifolia* var. *oppositifolia*) depending on the climatic zones that they grew in (Jayasuriya 1995).

Spices and condiments

Use of pepper = 'Gam-miris' (*Piper nigrum*), turmeric = 'Kaha' (*Curcuma longa*), mustard = 'Aba' (*Brassica juncea*), Lime = 'Dehi' (*Citrus aurantifolia*), cardamom = 'Kardamungu' or 'Ensal' (*Elettaria cardamomum*), Cinnamon = 'Kurundu' (*Cinnamomum verum*) and vinegar was recorded by Knox.

Stimulants

Betel = 'Bulat' (*Piper betle*), arecanut and tobacco = 'Dum-kola' (*Nicotiana tabacum*) were the most popular masticatory stimulants that had a special place in the local culture.

Flowers

There were numerous species of wild flowers, but people did not cultivate them. Some sweet-scented flowers were used by young men and women to decorate their hair. The red and white 'Roses' that he has mentioned were perhaps local flowers that resemble roses.

He particularly mentioned about the Four o' clock flower = 'Hendirikka' (*Mirabilis jalapa*), thus named as its flower opens at about 4 pm. The plant was cultivated in home gardens to indicate the time, especially in cloudy conditions when the sun is not visible. This contradicts Knox's earlier observation that people did not cultivate flowers. Incidentally 'Hendirikka' has its origin in the S. America and presumably introduced to this island by the Portugese.

Jasmine = 'Pichcha' (probably *Jasminium sambac*): This sweet-scented flower was a favourite of the king that special officers were appointed to supply a parcel of jasmine flowers to the palace every morning. Such flowers should be wrapped in white cloth and the pack tied to a shaft. King's lands, especially near rivers, were allocated to grow jasmine by these officers. They were also permitted to use lands that belong to people, but in that case flower plots have to be enclosed for that sole purpose. In respect of the king, other people were required to deviate from the spots in which jasmine grows.

Champak = 'Sapu' (*Michelia champaca*): Sweet-scented flower was worn in their hair by young people. This was the most popular flower for this purpose.

Medicinal plants

Although Knox has not noted professed physicians in the country, many were able to treat various ailments and the extensive use of plant products such as leaves and bark for medicinal purposes was noted. The use of 'Daluk' (*Euphorbia antiquorum*), Pepper (*Piper nigrum*), 'Goraka' (*Garcinia quaesita*) and 'Ja-pala' (*Croton tiglium*) to prepare purgative decoctions, leaves of 'Wara' (*Calotropis gigantea*) to treat vomiting, leaves of 'Mukunu-wenna' (*Alternanthera sessilis*) to cure sores and bark of 'Kamaranga' (*Averrhoa carambola*) and fresh turmeric (*Curcuma domestica*) to treat sore throat and tonsillitis was recorded by Knox.

Poisonous plants

A well known poisonous plant 'Niyangala' (*Gloriosa superba*) was recorded.

Other useful plants

Coconut = 'Pol' (*Cocos nucifera*): In Knox's words, coconut is the 'most excellent tree in the whole creation that God has made for man'.

Fish tail palm = 'Kitul' (*Caryota urens*): This was a popular source of sweet toddy, jaggery and even edible pith. The palm heart (terminal bud) was excellent to eat and resembles walnut or almond in taste. The mature trunk provided hard black timber that was commonly used to make

pestles to pound rice. Although it is not as long-lived as the Jack fruit tree, during its bearing years, the 'Kitul' tree is 'as profitable as a milking cow' (Knox).

Arecanut = 'Puwak' (*Areca catechu*): This extensively occurred in the southern and western parts of the country. It grew in association with villages, but was not found in the forests. The fruits were produced once a year and a single tree (palm) can produce 500 – 1,000 fruits which was sufficient for the year's consumption. As the island was poor in cash, dried arecanut was exported to coromandel coast in India. Knox also noted that moors and malabars carry dried arecanut to the sea ports from the inlands and exchanged salt, salted fish and textile with the inland people.

Talipot palm = 'Tala gaha' (*Corypha umbraculifera*): The leaves were of great use to the people. One leaf, being so broad and large, that it will cover some 15 – 20 men, and keep them sheltered from rain. The leaf was cut into triangular sectors of convenient sizes ('Tala pata'), which are very light, and folded closely like a 'ladies fan' and easily carried along. 'Tala pat' (plural) were also used to shelter the travellers from the hot sun. Soldiers always carried 'tala pat' to protect them from rain and to make tents on rainy nights. The tree was described by Knox as '*marvelous mercy which Almighty God hath bestowed upon this poor and naked people in this rainy country*'. Knox was so well taken up with this marvelous tree, that a 'tala pata' was taken along with him to England on his escape from Sri Lanka. He also noted that the pith of this palm is edible; the tree had to be cut before flowering and the pith cut into pieces, dried and pounded into a powder and baked to prepare a rotti which tastes much like white bread. This provided the people a source of food before the paddy is harvested.

Cinnamon = 'Kurundu' (*Cinnamomum verum*): This grew wild, very common on the western side of the Mahaweli Ganga, as Knox observed. However, the locals did not appreciate its value in contrast to the Dutch who made a roaring industry of the cinnamon in the west coast. The oil that was obtained by boiling the fruits was used as an ointment for aches and pains and to burn in lamps.

Gall nut = 'Aralu' (*Terminalia chebula*): The fruit was used as a purgative and to dye cloths. For the latter purpose, the fruits were grounded and soaked in water for one to two days, the cloths were dipped in this tannic solution, dried in the sun, dipped in black mud for one hour, washed in water and dried to turn cloths pale black. Second treatment in the tannic solution makes the cloths real black. A black ink that can be used for writing was obtained by keeping a rusty iron in this tannic solution.

'Dunu keyiya' (*Pandanus thwatesii*): The leaves were split and used to weave mats. Its roots were split and made into ropes.

'Gas keppetiya' (*Croton laccifer*): The wood, bark and leaves have a characteristic smell of medicine and sometimes used for such purposes (? purgative). It was not eaten by cattle or goats and therefore considered as poisonous to them. It was abundant every where, but not in the Uva and this may be the cause that the Uva cattle died when they were brought from Uva to other places. It was used as a flea repellent in domestic animals. The houses were kept clear of fleas by sweeping them with brooms made out of this shrub. Its wood can be burnt even when green and provided excellent fuel wood. The goldsmiths exclusively used coal made out of this wood.

Silk cotton = 'Kotta pulun' (*Ceiba pentandra*): This was only useful as a hedge tree. As people did not use beds and pillows, its cotton was never used to stuff pillows, as currently done in Sri Lanka. This was presumably introduced by the Portugese.

Cotton = 'Kapu' (*Gossypium arboreum*): The textile industry existed during ancient times. King Wijaya met the local princess Kuveni while she was weaving textile. Knox stated that plenty of cotton was grown in homesteads during the Kandyan kingdom, presumably in the dry zone, that was sufficient to make good and strong cloth for their own use and to sell to the people in the

upcountry where cotton was not popularly grown. However, such opportunities have not been utilized to improve their economy by the inhabitants.

Patana oak = 'Kahata' (*Careya arborea*): The bark burns well and was used as match. Knox apparently has not noticed the value of its young fruit as a vegetable as used by the present day villagers in Sri Lanka.

Upas tree = 'Riti' (*Antiaris toxicaria*): A useful sac that can carry 2 – 3 bushels of paddy can be made from a yard long straight piece of bark. Its outer bark was scraped off, and the rest was beaten to loosen the fiber, folded into two with inside out and the sides were stitched to form a wooly stretchable sac.

Ebony = 'Kaluwara' (*Diospyros ebenum*): It was very common in the forest (apparently in the dry and intermediate zones). The black heartwood was only used as ornaments in their straw tached houses and to make pestles to grind rice.

Citronella grass = 'Mana' (*Cymbopogon nardus*): Reported from Nilambe (Nilambe Nuwara, as the king had a supplementary palace for recreation). The landscape was extensively covered with 'mana' which was used to thatch houses. The existence of such grasslands (Dry Patana Grassland) over 300 years ago at mid elevations such as Hantane hill range negates the hypothesis that DPTG is a sequel of the abandonment of tea cultivation on such habitats.

Knox has further noted the occurrence of extensive fires during dry seasons and how the landscape turned into fresh grass after the subsequent rains. His observation that cattle eat this fresh grass, but would not eat when it matures, indicates that these fires were anthropogenic and the development of DPTG was a result of this phenomenon.

Cordage: Knox has cited several climbing or creeping plants that were useful as cordage. He also has noted several species of rattan that were of different sizes. The possible species of large rattans are 'Ma we-wel' = *Calamus thwaitesii*, 'Sudu we-wel' = *C. ovoideus*, 'Thambotu wel' = *C. zeylanicus*, while the smaller rattans were possibly 'Heen we-wel' = *C. rotung* and 'Kukulu wel' = *C. digitatus*. The rattans were used in building houses and for fences. He also has recorded the preparation of a thirst-quenching sour drink by boiling the kernels of the husked fruits of the rattans. Pitcher plant = 'Bandura wel' = *Nepenthes distillatoria* provided cords composed of black strands that are very durable even under wet conditions. 'Nil wella' = *Rhaphidophora pertusa* that is green when fresh and remains green even when it is dry provided tough cordage. Incidentally this is very rare plant now and has been found only in the wet lowlands. There were numerous more creepers, too many to mention, that are used for cordage; different species found in different frequencies in different parts of the island.

Timber

As some of the hard timber species, Knox mentioned 'Weera' (*Drypetes sepiaria*), 'Hoori' (*Albizia odoratissima*) and 'Hal milla' (*Berrya cordifolia*). The abundance of ebony was noted while choise timber species, suitable for any given purpose, i.e. light to heavy or soft to hard, were growing wild in the forests.

Other plant products

The availability cardamom, jaggery, oil, turmeric, rice and betel nut was mentioned, but the market opportunities being unavailable, people were not in a position to derive benefits out of these products. Pepper was observed to be growing very well, and along with cinnamon, their under-utilization as industrial crops was stated by Knox.

Knox also has made an important observation on the socio-economics of the inhabitants, in that they were a frugal and non-industrious society that does not strive for improved life conditions using the resources that they already have. However, it is clear that this 'sloth and lazy' society was the sequel of the contemporary governance that did not permit its citizen to become industrious as explained in Knox's words 'seeing as their estates increase, so do their taxes also'

Vegetation in general

The denseness of the forests was often mentioned by Knox. The riverine forests consisting of trees and shrubs that often overhanged water courses were mentioned while rivers had many fallen branches and logs, some being brought by floods. These observations clearly indicate the pristine nature of the country's natural vegetation that existed about 350 years ago.

9.1.3 Knox's observations on fauna and agro-biodiversity

Knox (1681) also dedicated chapters on the fauna, especially the economically and socially important species that he has observed in Sri Lanka. In this treatment, these animals are taxonomically classified.

Leeches

The abundance of land leeches (*Hirudo* sp.) was described in vivid details. The use of lime juice, salt and ash to repel them was recorded. The disappearance of the leeches during drought and their rapid appearance with the onset of rains seems to have baffled Knox and also the inhabitants; apparently they were unable to discover the phenomenon of hibernation. He furthermore noted the abundance of leeches in some localities and their complete absence in some adjacent localities, irrespective of the similar moisture and soil conditions.

Insects

Although many species of ants were noted by Knox, he cited small reddish ant = 'Tel kumbiya' (*Monomorium pharaonis*), very aggressive Red tree ant = 'Dimiya' (*Oecophylla smaragdina*), harmless Black ground ant = 'Kura', Black ant = 'Kalu kumbiya' (*Componotus compressus*) and 'Kadiya' (*Diacamma rugosum*) that is not normally aggressive, but can inflict a very painful bite if disturbed. The termite = 'Veya' (*Kelotermes ceylonicus*) and its life cycle was described, especially its destructive habit in households, building of termite mounds in jungles and their nuptial flights that provide ample food for the birds. It was also interesting that poultry was never fed by the people but ground ants provided an ample source of food for the poultry. Three species of economically important bees that provide honey were mentioned, i.e. common honey bee = 'Mee messa' (*Apis cerana*), hornet = 'Bambara' (*Apis dorsata*) and 'Kana meeya' (*Trigona iridipennis*). He has noted that people collect swarms of bees hanging on trees by holding torches underneath such swarms as to drop them to the ground and boiled bees are considered excellent food.

Spiders

The occurrence of the very poisonous tarantula = 'Divi makuluwa' (*Mygale fasciata*) was recorded. It lives in hollows of trees and its bite, although does not cause death, effect intense pain that would put a man 'out of his senses'.

Fish

Knox noted the abundance of fish in streams, rivers and ponds, specially the Mahaweli Ganga which abounds with fish as large as 'salmon'. He further described methods of fishing and emphasized on one method that uses an open ended basket. Currently, this method is not generally seen in the inland water bodies, but practiced in shallow lagoons in the coastal zone where this

unique basket or trap is known as 'karaka'. He has also observed that the moor and Malabar traders travelling to the inlands carry nets to catch fish in rivers, streams and ponds.

Reptiles

Of the snakes, Knox mentioned about the python = 'Pimbura' (*Python molurus*), cobra = 'Naya' (*Naja naja*), viper = 'Polanga' (*Vipera russelli*), krait = 'Karawala' (*Bungarus ceylonicus* and *B. caeruleus*), Rat snake = 'Gerandiya' (*Ptyas mocosus*) and water snakes = 'Diya-bariya' (e.g. *Xenochrophis asperimus*). He also mentioned that cattle often die of snake bites and when people were bitten, they were cured by charms and medicine, if treated without delay. Of the other reptiles, skink = 'Hikanala' (*Mabuya* sp.), water monitor = 'Kabaraya' (*Veranis benghalensis*), Iguana = 'Talagoya' (*Veranus dracaena*) were mentioned.

Birds

The common birds that Knox has mentioned are crows, sparrows, tom titts, snipe and wood pigeon. There were many pea cocks and parrots, while Ceylon Grackle = 'Mal Kawadiya' (*Eulabes ptilogenys*) that can be trained to talk excellently and Black-headed oriole = ('Kaha kawuda' - Knox) = 'kaha kurulla' (*Oriolus xanthornus*), also having the same talent, were less common. He stated that there were many species of birds, bigger than a sparrow, but specially mentions about the paradise flycatcher = 'Sudu redi hora' (*Tchitrea paradisi*). The description of the bird 'carlo' tallies that of Malabar pied hornbill = 'Poruwa Kendetta' (*Anthraceras coronatus*) which is found in the dry zone. Sighting of many species of water birds was recorded and it is interesting to note that these water birds were not eaten by people. The Indian cormorant = 'Diya kawa' (*Phalacrocorax carbo sinensis*) was described but Knox did not have the name for it. 'The water bird resembling a duck' is probably the teal = 'Seruwa' (*Anas crecca*).

It has been occasionally observed that the king's courtiers engage themselves in recreational game of holding a Red-vented bullbull = 'kondaya' or 'konda kurulla' whose leg is tied to a string which is also tied to his finger. When two of these birds are brought closer to each other, they peck at each other until they are separated. In rainy weather, peacocks were hunted by employing dogs, as this heavy bird is unable to fly far when its wings are wet.

Mammals

Domestic mammals, viz. cattle, buffalo, pig, goat and dog have been cited, while the wild species were black-naped hare, jungle squirrel, jackal, spotted deer, wild boar, wild buffalo, gaur, toque monkey, grey langur, purple-faced leaf monkey, sloth bear, leopard, elephant. He also has noted the lack of lion, wolf, horse, donkey and sheep in Sri Lanka. Several species of the deer group such as barking deer = 'Olu muwa' or 'Weli muwa' (*Muntiacus muntjak*), mouse deer = 'Miminna' (*Moschiola meminna*) were noted.

Gaur = 'Gavara' (*Bos gaurus*): This extinct mammal was in existence in Sri Lanka during the time of Knox and even until early nineteenth century. Although the herds of gaur have dwelled in the mountain rain forests (e.g. environs of Peak Wilderness, as indicated by place names such as Gavara-eliya and Gavara-tenna.), it is also said to have lived in the intermediate - dry zone (e.g. around Siyabalanduwa in Monaragala District), and hence it is not regarded as a reliable climatic indicator (Deraniyagala 1992). Knox has apparently observed the gaur only in captivity in king's zoo and described it as 'resembling a bull with its back standing up with a sharp ridge and with its legs white up to half way from the bottom. Deraniyagala (1992) mentions about the existence of gaur hunting as a sport where the King tested the courage and strength of his warriors which may also have led to the extinction of this animal.

Elephant = 'Aliya', 'Etha' (*Elephas maximus*): There were plenty of elephants in the country and they were caught and tamed on king's order and only for his use. Usually only the male elephants

with tusks were caught and they were kept as symbols of the state and the non-tuskers were used for labor. Wild elephants caused great damage to paddy fields and coconut and sometimes to their dwellings. Farmers repelled elephants from their fields at night by hollowing and lighting torches and sometimes shooting them with bow and arrow. Elephants are used by the king for sport, e.g. squirting water on men. King also used them to execute prisoners.

Small mammals: Musk shrew = 'Hik meeya' (possibly *Suncus murinus*), if unites on rice, the musky smell can never be gotten rid of and it will render such rice useless except to be thrown away to the chicken. Although musk shrew was not eaten by the people various species of rats were consumed.

Royal zoo

In addition to taming and using elephants, the king also maintained a collection of selected animals in the royal zoo. A spotted or speckled elephant that was not more than 8 feet tall was the king's favourite. A white (albino) deer, black leopard and a gaur were other rare specimens that were kept in the zoo.

King also had many birds such as geese, ducks, turkeys, and pigeons in the zoo.

The animals that were kept in the zoo were never killed for food by the king.

Along a main passage to Kandy city, fish was reared by the order of the king for his pleasure. Any passer-by was permitted to enjoy the sight of this fish and to feed them, but catching fish there was prohibited.

Animal husbandry and use of animal products

King had a flock of goats that was less than 100 in Kandy city and there were herdsmen to take them out to feed and to bring them into the shed in the evening. However, the goats were not killed for king's consumption. Next to King's herd of goats, Knox's was the largest and he killed them for his consumption. Except for the king, no other citizen was allowed to rear goats; however 'strangers' (like Knox) were allowed to do so.

Wild meat (deer and wild boar) was supplied continuously to the royal palace.

9.2 Biodiversity in cultural activities

The field of cultural biology appears to be relatively new and had hardly gained a niche in the modern scientific discourse. Sri Lanka's cultural biodiversity rests largely on the wealth of traditional knowledge passed down from generation to generation, gathered through long experience and ancient wisdom. This knowledge remains largely scattered and under the threat of total extinction in the wake of advancing technology and modernization.

The BCAP (MENR 2005) deals with the cultural aspects of biodiversity in Sri Lanka through five related fields, viz. flora, fauna, ecosystems, agriculture, culture and toponymy. The study required a survey of many diverse fields such as traditional medicine, agriculture, art, architecture and archeology. It also extended to literature, folklore, poetry and life style and local toponymy.

9.2.1 Flora in art and craft and other cultural activities

Cultural values are often attributed to different plants, and thus assigned higher or lower status than others. Plant species related to 'Esatu' (*Ficus spp.*) were treated as 'Vanaspathi' (lords of the forest). The religious value of the 'Bo' tree led not only to its protection but also to the protection of other forest patches around the temples which were used as sites of retreat and meditation. Thus the

temples have traditionally being the refuges for many rare plants. The potentials of temples as centers of biodiversity conservation had hardly been realized in recent times. In the case of flowers, those with fragrance were given higher status as those suitable for religious purposes. For example, 'Nelun' (*Nelumbo nucifera*) had been in the lead as it appeared in a wide variety of sculpture and painting, while 'Na' (*Mesua ferrea*), the national tree of Sri Lanka, and 'Sapu' (*Michelia champaca*) were culturally prominent trees.

A total of 170 medicinal plants quoted in the '*Saratha Sangrahaya*', and used by King Buddhadasa (5th Century AD) for the preparation of herbal medicines, were scientifically identified. In addition, 25 plants have been documented on forestry, urban and environmental biodiversity and bio-industry.

Flowers depicted in Sigiriya frescoes

The most famous features of the Sigiriya complex are the 5th century paintings found in a depression on the rock face more than 100 m above ground level. All that survive of this gigantic picture gallery are some female figures that represent *apsaras* or celestial nymphs, a common motif in the religious and royal art of Asia. These figures have also been interpreted as Lightning princesses (*vijju kumari*), Cloud damsels (*meghalata*) or Goddess Tara by various scholars. Most of the figures carry flowers and appear among or moving amidst clouds, interpreted by some as these *apsaras* scattering flowers over kings and heroes as a celebration of victory and heroism (Bandaranayake 2005).

The *apsara* holding one smaller flower in her right hand and three large flowers in the left hand portrays three kinds of flowers (Figure 9.1). The resemblance of the smaller flower, especially the shape of the corolla lobes and contorted aestivation, to that of 'Araliya' (*Plumeria rubra*) has prompted some authors to believe that "Araliya" was in existence in Sri Lanka even 1,500 years ago (Kottegoda 1994). However, very short or almost indistinct corolla tube and the unequal flare of the two lateral lobes drawn in the painting rule out the 'Araliya'. Furthermore, the corolla lobes of the 'Araliya' flower are contorted (twisted) and overlap regularly to the left, while the painting depicts irregular overlapping and overlapping to the right. These discrepancies indicate that the artist has not used an "Araliya" flower while painting the frescoes. Besides, 'Araliya' was not present in this part of the world at that time. Although 'Sapu' (*Michelia champaca*) flower also comes into one's mind, the fact that the painting depicts only five petals or corolla lobes, rules out that possibility too, and furthermore, 'Sapu' being another exotic flower, would not have occurred then in Sri Lanka, especially in the dry zone. Its closest indigenous relative, viz 'Wana sapu' (*Michelia nilagirica*) is restricted to the forests of the montane zone (MOEF) and therefore would not have been known in the dry zone. Therefore, this prominently portrayed single flower is determined as mythical. Two lateral flowers of the three large flowers, held by the left hand, and drawn out of proportion, resemble flower buds of 'Nelun' (*Nelumbo nucifera*), while the central flower resembles a half-open 'Olu' (*Nymphaea pubescens*) although the artist would have used his imagination of these flowers rather than looking at real specimens while drawing, as evidenced by some deviations from reality. As 'Olu' flower begins to open at sunrise, depiction of half-open flowers in the hands of the *apsaras* can make one imagine whether the act of scattering or offering of flowers was performed at the sunrise. Among her hairdress, a "Manel" flower (*Nymphaea nouchali*), in side view, can be identified. Meanwhile, another *apsara* holds the same mythical flower that is mentioned above by her right hand, although its five petals (or corolla lobes) appear to be relatively longer and narrower than the former. This 'apsara, also holds by her left hand a 'Olu' bud with its long stalk (petiole) although its sepals are unnaturally short. The same *apsara* has her hair decorated with two fully open 'Manel' flowers of which one facing the viewer shows clearly its blue-purple petals with yellow bases while the other shows its lower or adaxial side. There are three *apsaras* holding trays of flowers depicting the posture of offering flowers rather than casting them. One holds the tray with both her hands, while the other two *apsaras* hold their trays with their right hands and these trays contain fully open 'Olu' flowers, buds of 'Nelun' and at

rather than real. There are also faint traces of several female figures carrying similar mythical flowers and moving amidst clouds that are painted over the rock shelters in boulder gardens, very much like the *apsaras* on the main rock above. The prominence for large flowers of aquatic ornamental plants, viz “Nelun’ (Lotus), ‘Olu’ (Water lily) and “manel’ (Water lily) that are depicted in paintings and the importance of water gardens and perhaps moats and water palaces at Sigiriya point to an strong aesthetic and cultural relationship. The ornamental water plants no doubt would have been the most important floricultural component of the Sigiriya landscape. The ‘Nelun’ flower has also been used in some terracotta architectural ornamentation found at Sigiriya. The eyes of the beautiful *apsaras* have been compared with ‘Nelun’ and ‘Manel’ (*Nymphaea nouchali*) flowers as inscribed on the Mirror Wall (graffiti poems). Known as ‘Sigiri graffiti’, these writings date from 6th to the early 14th century. In summary, it can be stated that as far as depicting flowers in Sigiriya paintings, the motif among those great artists would probably have been one of impressions of the nature with a fair degree of imagination.



Figure 9.1 Sigiriya Frescoes (5th Century AD)

Art of Ola writing in literary heritage

The art of Ola writing is closely linked with the literary heritage of the country. The practice followed the use of strips of the leaf of the talipot palm (*Corypha umbraculifera*) as the basic substance used for writing. Sri Lanka has a long tradition in the art of writing on ‘Ola’. The text of Buddhist doctrine preserved by oral tradition for nearly 500 years and the Sinhala commentaries thereof were committed to writing in the first century BC at Aluvihara in the Matale District and it is assumed that these scriptures were written on Ola leaves. After recording the *Tripitaka* in books, the commentaries in Sinhala were also translated into Pali and were written in books in the 4th century by the commentator Buddhagosa. It is evident that all the Sinhala classical works of a later date were written on Ola.

The preparation of the palm leaf, the arrangement of leaves for writing and the meticulous care taken to uphold the tradition had been observed by several scholars (Coomaraswamy 1978, Abeywardana 2004, Central Provincial Council 1998).

During the Dutch and British administration, a large number of Ola manuscripts were taken out of the country and are now in foreign museums. It is however, fortunate that there are hundreds of

During the Dutch and British administration, a large number of Ola manuscripts were taken out of the country and are now in foreign museums. It is however, fortunate that there are hundreds of temple libraries retaining Ola books in their stocks, which will give an idea about this cherished tradition of writing on Ola.

The art of Ola writing is still practiced in Sri Lanka for limited purposes. Buddhist scriptures recited at all night *Pirit* ceremonies known as *Pirit poth* are still written on Ola. Amongst other uses are writing horoscopes on Ola and even wedding invitations in exceptional circumstances. This tradition is followed up to date in Aluvihara temple in Matale District. All the printed books of the *Tripitaka* were written on Ola during 1980-1990 and have been deposited in the International Buddhist Library at Aluvihara. Ola writing is also demonstrated to visitors at Aluvihara and newly written Ola manuscripts can be purchased there. These can be taken out of the country as souvenirs (Abeyawardana 2004).

Recording manuscripts on ola and preserving them in safe boxes was a feature of the revival ushered in by Ven. Velvita Saranankara Sangharaja. The temple libraries served as centers which retained ola manuscripts to disseminate education. One such place had been established at the Tampita Vihara in Dunkumbura within Tumpane between Galagedera and Hataraliyadda. There is a stock of rare manuscripts in this Vihara. The box used had been richly painted both inside and outside. Several ola manuscripts sandwiched between boards studded with gems are kept in this box. Hence it is of unusual antiquarian value. The traditional system of recording ola manuscripts is still being practiced at this vihara.

Dumbara mat weaving

Dumbara mat weaving is a highly localized craft practiced to-date in conformity with traditional practices handed down from historical times. The main concentration of this industry is in the Dumbara valley and the mat weavers were drawn from a separate community known as 'Kinnaras'. Mat weaving families are scattered in several villages in Dumbara; Henawala, Udispattuwa, Medamahanuwara and Putuhapuwa in Kandy District and Mallehewa in Matale District are well known hamlets of mat weavers. The finished products, e.g. mats, bags, screens, table mats, cushion covers etc., are marketed through the network of Laksala shops under government sponsorship (Abeyawardana 2004). The required fiber was traditionally obtained from 'Niyanda' (*Sansevieria zeylanica*) and hence this art of making colorful mats is known as 'Niyanda Rata' or 'Dumbara Rata'. However, 'Hana' (*Agave vera-cruz*) became a preferable source of fiber after this plant was introduced to Sri Lanka in 1890 and cultivated for fiber. Traditionally, the fiber was colored using herbal dyes, e.g. wood of Dodan kaha (*Memecylon capitellatum*) yielding intense yellow color. However, with the availability of synthetic dyes, the use of herbal dyes has been mostly abandoned (Jayasuriya 1984).

Sittara art

The temple murals which embellished the shrine rooms of Buddhist temples have been carried out in accordance with this tradition. *Sittara Art* appealed to devotees due to features such as selection of the themes, use of decorative motifs, costumes and jewellery and flora and fauna. Selection of color and the use of raw materials for the purpose served as an index to judge the practices relating to *Sittara* artists. A majority of the colors were obtained from plant products (Abeyawardana 2004).

White: Obtained from 'Makulu', a clay found in abundance in Maturata. In preparation of colors such as, grey, rose and red, white serves as the basic color.

Red: Color red is referred to as 'Ingul' or 'Hingul' or 'Imbul' in the ancient documents. In the botanical literature, 'Hingul' and 'Imbul' refer to *Aphanamixis polystachya* (Meliaceae) and *Bombax ceiba* (Bombacaceae) respectively.

Yellow: Yellow is extracted from the sap of the 'Gokatu' tree (*Garcinia Morella*) which is also called 'Kokatiya'. Paint used on timber is formed by mixing the sap with powdered *Hirigal* stone.

Black: The basic material used is lamp black mixed with milky latex of the Jack fruit tree (*Artocarpus heterophyllus*), 'Kekuna' oil (*Aleurites moluccana*) and resin obtained from various species of *Doona* and *Shorea*.

Blue: Obtained from 'Nil' which should be "Nil awariya" (*Indigofera tinctoria*) to which 'Aralu' (*Terminalia chebula*) is also added.

Green: Prepared by mixing blue with yellow.

9.2.2 Fauna in cultural activities

Animals have always been closely associated with Sri Lanka's culture and society. For example, *Saratha Sangrahaya* by King Buddhadasa (5th Century AD) has listed the medicinal properties of a number of animal species. In Sinhala folklore, one comes across many faunal ingredients that are used in traditional medicine for curative as well as for preventive purposes, e.g. 'Pimbura' = Python (*Python molurus molurus*) oil in traditional orthopedic treatment. Some animal sounds have been linked to events, e.g. Howling of 'Nariya' = Jackal (*Canis aureus*) and hoots of 'Ulama' = Spot-bellied Eagle Owl or Devil Bird (*Bubo nipalensis*) are interpreted as upcoming sad news, while the calls of 'Wehi-lihiniya' = Swallow (*Hirundo* spp.) and 'Poru kendetta' = Malabar Pied Hornbill (*Anthracoceros coronatus*) are taken as predictive of rain.

Certain animals, especially the elephant is also of high cultural value. During the time of the ancient kings, elephants were used in war, forming the first of the four battalions, viz. *Eth* (Elephant Tusker), *As* (Horses), *Riya* (Chariots) and *Pabala* (Infantry). However, at present, the elephants are mainly used in religious processions and for domestic work. The *Kandy Esala Perahera* epitomizes the role assigned to the elephant.

The traditional classification of fauna is distinctly different from that of modern classification and it is based on the nature and formation of limbs; i.e. *Apa* (no limbs), *Depa* (two limbs), *Sivupa* (four limbs) and *Bahupa* (many limbs). With regard to elephants, present day mahouts recognize 11 types and this is somewhat similar to what is given in the *Saratha Sangrahaya* as well as in the works of Deraniyagala. Similar classifications are also applied to cattle, buffaloes and cobras. In comparison with modern classifications, most traditional systems appear to be more detailed and scientific investigation of the bases of traditional classification systems will possibly reflect genetic diversity among these species.

Animal figures in art work

Use of animal signs in traditional crafts and paintings as well in flags, including the national flag, is remarkable. The traditional national flag that has a history of over two millennia depicts a lion at its center. This is believed to depict the mythical origin of the Sinhala race from a lion. The lion in the ancient flag was, however, different from that in the present national flag which has been designed by a Parliamentary Committee in the 1940s. The ancient flag had a slimmer lion, as those that could be seen in both national flags as well as in some regional (*dissawa*) flags, leading to the speculation as to whether in fact such a smaller and slimmer lion lived in Sri Lanka in the historic past. The fossil remains of a lion (*Leo leo sinhaleyus*) seem to support such a speculation (Deraniyagala 1963c). In the early literature too (*Anguttara Nikaya*) refers to four types of lions, viz. *Thruna Sinha* (grassland lion), *Kaala Sinha* (possibly a dark lion), *Pandu Sinha* (possibly bronze colored lion) and *Kesara Sinha* (lion with a mane). These lines of indirect evidence suggest that a lion has evolved in various habitats in Sri Lanka, possibly showing different morphologies, e.g. color and size. The use of real, modified and mythical animal symbols in art work was cited by

Abeyawardana (2004). Animals used in crafts, paintings and flags recorded in the CP are indicated in Table 9.1.

Table 9.1 Animals used in crafts, paintings and flags in the Central Province

Animal	Remarks	Location in CP
Bherunda Pakshiya	Mythical bird; a design on jewellery with gems originated during Kandyan period; carving on wood and ivory; symbol on Tun Korale flag.	Ambekka temple
Serapendia	Mythical animal with a head of a lion, body of a bird and scales of a fish; carved on brass; seen on temple murals	Temples at Bambaragala, Embekke, Hanguranketa, Malwatta and at Magulmaduwa
Et-kanda lihiniya	Mythical animal with head of a lion and body of an eagle carrying two elephants by its claws; carved on wood and brass; also on murals	Embekke temple
Girawa (parrot) – two birds joined together	Carved on brass lamp; seen on Bintenna flag	Lanka Thilaka temple
Hansaya (swan) – two birds joined together	Symbol of the law; seen on sandakada pahana during the Kandyan period; also carved on brass	Kandy, Ambekka
Gaja-sinha	Two elephant and lion sculptures; originally installed in the premises of the palace at Godagama of Gampola rulers; the area was known as Sinhapitiya.	One of the two sculptures placed at the palace and the other at the Wallahagoda devale; presently, both sculptures are at the National Museum, Kandy
Vrushaba Hasti Kunjaral	Entwined figure of an elephant and a bull	Embille Vihara, Matale
Lion	Sinhala Royal flag	
Lion	Flag of Kandy District	Kandy
Peacock and cobra	Flag of Nuwara Eliya District flag	Nuwara Eliya
Peacock and two cobras	Flag of Walapane	Walapane Disawa
Peacock	Flag of Visnu Devale	Kandy
Bull	Flag of Malwatta Vihara	Kandy
Human bust blowing a trumpet and the body of a eagle	Flag of Gadaladeniya Vihara	Gadaladeniya

Source: BCAP (MENR 2005)

Lacquer work

Although not exactly a vegetable product, lacquer or lac is dependent on vegetation for its production. It is a resinous substance of an orange-red color, secreted by various species of scale insects, chiefly *Laccifer* spp. The insects live on tender branches of some trees and shrubs, e.g. 'Kon' (*Schleichera oleosa*), 'Pihimbiya' (*Filicium decipiens*), 'Mora' (*Dimocarpus longan*), 'Kobbe' (*Allophylus cobbe*), 'Masan' (*Ziziphus jujuba*), 'Keppetiya' (*Croton laccifer*), 'Gas kela' (*Butea monosperma*), 'Suriya mara' (*Albizia lebbek*) and 'Andara' (*Acacia nilotica*), sucking the sap and forming a continuous waxy encrustation on them (Macmillan 1935). However, at present, manufactured paints are used in place of natural lacquer.

Village of Palle-Hapuvida in Matale District is famous for lacquer work. This industry was believed to have established in Palle-Hapuvida during the days of King Wijayapala (1634-1652), who ruled from Godapola. During the days of Kirthi Sri Rajasinha (1747-1782), it was the duty of the craftsmen of Palle-Hapuvida to provide lacquer items in the form of flag shafts, arrows and pingo shafts etc (Abeyawardana 2004).

Animal care and poisonous animals

The traditional medicine has extended to even animal care. Care for captive elephants is well documented. As the history maintains, King Buddhadasa himself treated even venomous snakes. The treatment to livestock is also documented in Ola leaf records in the possession of some rural physicians. In view of the importance of the problem of snake-bites and attacks by other poisonous animals in rural areas, many snakes, spiders, scorpions, wasps, hornets and bees are often clearly identified by the public. Hornet attacks on the visitors at Sigiriya are almost an annual incident. Over 10,000 persons attacked by poisonous animals, mainly the snakes, are reported for treatment at state hospitals and at least a thousand people die each year. The records of treatment by traditional practitioners are difficult to be obtained. Snake venom treatment forms a separate branch of the indigenous medical practice and a large proportion of rural people still prefer it than western medicine. The identification of different snakes for the respective treatments may provide a wealth of information. It would be of interest to codify this knowledge and subject them to scientific investigation, since it appears to have the potential to open new vistas in the medical practice in general. However, the tradition of 'Guru Musti' (retention of confidentiality of the science) confines the custody of the traditional knowledge to a limited number of practitioners and families.

9.2.3 Toponymy and biodiversity

Toponymy describes the place names, i.e. villages, townships and administrative divisions. In Sri Lanka, place names clearly reflect the strong link between its long cultural history and rich biodiversity (MENR 2005). The influence of the nature on the human society is further indicated by the derivation of personal surnames from place names that were based on different components of ecosystems including flora, fauna and landscapes such as crop fields, rocks and tanks, e.g. Dangahadeniya, Puwakpitiya, Palugaswewa, Palamakumbura and Talagala etc. The folklore, folk songs, literature and traditional poetry harbor a wealth of information related to biodiversity. Such knowledge may reveal distribution of species, e.g. Omaragolla indicating the presence of 'Omara' (*Polyalthia coffeoides*), or even extinction of some of them (e.g. Gavara that indicates the existence of 'Gavara' (*Bos gaurus*) during historical times (now extinct). A compilation of place names based on flora and fauna in the CP is not available to be included in this profile.

9.3 Traditional knowledge

Out of over 80,000 edible plants explored by man since the civilization only about 150 species have so far been considerably exploited. Today less than 30 plant species meet about 90 percent of the world food requirement (Mal 1994). Wheat, rice, maize, barley, sorghum, millet, potato, sweet

potato, yam, sugar cane and soybean provide three quarters of the plant kingdom's contribution towards human dietary energy requirements (FAO 1993).

Many species, once plentiful, are found in small populations and often threatened. Many medicinal, timber and ornamental species have been over-exploited and have been classified as endangered. Often, genetic degradation occurs from more purposeful human action intended to increase food production. Modern agriculture in Sri Lanka, particularly rice, relies increasingly on a few improved varieties. Thus traditional varieties are among categories of genetic resources that have been under the threat of genetic erosion in the last 20-30 years. The present traditional rice varieties under cultivation have dwindled to about five percent of total paddy area (NARESA 1991).

Currently the transfer of indigenous knowledge from generation to generation has almost come to a standstill due to the introduction of high yielding modern crop varieties and migration of some village farming people to cities. Therefore, in view of its value towards sustainable development, immediate steps should be taken to collect, document and preserve traditional knowledge before it is lost for ever (Helvetas Sri Lanka 2001).

Sri Lanka with a recorded history of over 2500 years and a prehistory of several millennia, acquired an accumulated wisdom of managing and conserving her natural resources and rich biodiversity. This knowledge base had been gradually eroded due to foreign influences and a spell of colonial rule extending over 500 years. Despite these vicissitudes of history, Sri Lankans and particularly those in the rural interior, continue to retain a reasonable stock of traditional knowledge related to biodiversity. There is a wealth of traditional knowledge passed down from generation to generation, gathered through experience and ancient wisdom. Traditional medicine depends heavily on the rich plant diversity in the island. The island's rich biodiversity is also reflected in its toponomy, culture and literature. This knowledge remains largely scattered and under the threat of total extinction in the wake of advancing technology may have the potential, if properly applied, for addressing many challenges confronted by the modern society and particularly those related to biodiversity conservation and sustainable development. The field of cultural biodiversity appears to be relatively new and had hardly gained a niche in the modern scientific discourse. It appears that, this wealth of traditional knowledge had hardly been recognized or harnessed in the past for development and in the conservation of nature and its riches, traditional wisdom and the life styles of people with minimal demands on natural resources, could perform a vital role (MENR 2005).

Among recent endeavors in documenting traditional knowledge, the work of Rajapaksha (1998) on traditional food plants in Sri Lanka is noteworthy. Information on 152 species of traditional food plants is systematically presented. The information includes technical and vernacular nomenclature, description, global and local distribution, use and a line drawing for each species.

Helvetas Sri Lanka (2001) has compiled useful information on traditional knowledge on the use of plant genetic resources relevant to agriculture. The traditional farming systems in Sri Lanka, *kem* methods and rituals used in traditional agriculture and preparation of traditional food are described in this compilation. Over 500 traditional cultivars, belonging to crop groups such as rice (135 cultivars), other cereals (31), pulses (73), vegetables (89), leaf vegetables (37), banana and plantain (54), fruits (62), yams (73) and spices (22) are listed with information sources (farmers). It also has information on about 400 medicinal plants and their uses in indigenous medicine with information sources (physicians/practitioners/users). It is interesting to note that the '*kem*' methods are mostly based on scientific principles.

The BCAP document (MENR 2005) includes a separate chapter on traditional knowledge. In this the cultural aspects of biodiversity were grouped in five sections, viz. flora, fauna, ecosystems, agriculture, culture and toponomy. The information gathered is not extensive, but summarily presented. However, each section is concluded with the recommendation of some appropriate actions that are selectively used in this exercise. Although the information contained in the BCAP

document is not reproduced here, some interesting parts such as toponymy and traditional classification of ecosystems (vegetation or habitat types) is summarily included here. Further, a recent publication in Sinhala by the Biodiversity Secretariat of the MENR (Vol. 1: 2005, Vol.2: 2006) on traditional knowledge in association with biodiversity give considerable quantity of information that are organized into five sections in each volume:

Wildlife, forest, marine and coastal biodiversity

Agricultural crops and livestock biodiversity; food technology and other fields

Plants and their usage

Handicraft and household activities

Omens in relation with biodiversity

Information on biodiversity-related traditional knowledge is generally available at national scale and such information specific to the CP will need more intensive research.

9.3.1 Traditional ecosystem classification

The traditional knowledge systems seem to have had an in-depth perception of ecosystem diversity (especially of the terrestrial environment) in Sri Lanka. This is evidenced by the indigenous terminology that identifies a great number of ecosystems or habitats (especially boundary or transitional ecosystems) than found in the modern classifications. Such 'sub systems' seem to have been identified or classified on the basis of a variety of factors such as physiognomy, functioning and successional stage, geomorphic setting, hydrological regime as well as human use and conservation status etc (MENR 2005). However, in reality, while some of these traditional ecosystems (vegetation types) are clearly congruent with scientifically classified vegetation types, others indicate variation of habitats, often influenced by anthropogenic factors. The traditional ecosystems cited in the BCAP document are given in Table 9.2, along with some additional information. An account of comparison with modern classification of natural vegetation types proposed in the Gap Analysis work (Jayasuriya et al 2006) is also included in the Table 9.2.

Table 9.2 Traditional classification of vegetation

Relationship with Gap - Relationship with Gap Analysis classification of natural vegetation types in Sri Lanka (Jayasuriya et al. 2006)

Traditional Ecosystem Type	Description	Relationship with Gap	Remarks
Hime	Wet zone low country to montane virgin high forest mosaic	LWEF MEEF MOEF	
Patana	Grassland	DPTG	
Talawa	Savanna: grassland with scattered trees on undulated landscape	SAVG	
Eliya	Open wet patana	WPTG	
Villu	Seasonally flooded grasslands of the dry zone flood plains, especially of the Mahaweli Basin	VILG	

Traditional Ecosystem Type	Description	Relationship with Gap	Remarks
Landa	Scrub area with occasional trees in undulating terrain	SPOF	Often indicates forest patches degraded due to anthropogenic effects
dawiya	Forest range associated with sacred value , e.g. Sri Pada Adawiya, Sinharaja Adawiya		
Thahanam-kele	'Forbidden forest' indicating protected forest or reserve		
Leheba	Isolated patch of forest		
Gomuwa	Cluster or association of trees depicting a park		
Golla	Grove of one kind, e.g. Kahata-golla, Kos-golla		
Gonna	Cluster or association of trees, often of one species		
Aramba	Cluster of trees of one species, e.g. Puwak aramba		
Gollewa	Dense scrub, often impenetrable		
Mandiya	Locality where a given species could be frequently found, e.g. Hal-mandiya		
Pelessa	A more or less specific area in which a given species of plant or animal is abundant, e.g. Iluk-pelessa, Kahakurullan-pelessa,		
Yaya	Tract of (usually cultivated) paddy land; also used to indicate a tract of forest having useful species of trees (fruit), e.g. Mora-yaya		
Kanattha	Early stage of succession in abandoned chena		
Ath-danduwawa	Middle stage of succession in abandoned chena that can supply sticks ('ath-dandu')		
Mukalana	Later stage of succession in abandoned chena that has achieved the status of a secondary forest		
Digiliya	Open disturbed grassy area suitable for feeding cattle		

Traditional Ecosystem Type	Description	Relationship with Gap	Remarks
Hela	Wet zone marsh, often with peat layer on top		
Owita	Transitional area between wetland and highland		
Deniya	Poorly drained valley or river flood plain with plants that are adapted to grow in such habitats		
Kalavita	Similar to Owita, but often used for threshing and winnowing paddy after the harvest (used in southern province)		
Wanatha	Cleared forest strip bordering a paddy field		
Kurulu paluwa	Strip of paddy land adjacent to a highland forest primarily dedicated to feed birds		
Badawetiya	Trees and shrubs forming a hedge, often containing many natural species		
Pitiya	Flat land at low elevations where no trees and shrubs are found and only low herbs are growing, e.g. Wewu-pitiya = seasonally exposed tank bed		
Tenna	Flat land in highlands, e.g. Iluk-tenna		
Wila	Natural, inland, perennial or seasonal freshwater aquatic ecosystem with hydrophytes and fish, e.g. lakes in Wilpattu		
Pokuna	Small, man-made pond		
Diya heba, heba or ebe	Small water hole		
Kadolana	Mangrove	MANF	
Kalapuwa	Lagoon		
Lena	Cave inhabited by people (prehistoric man or clergy), e.g. Beli-lena		
Guhawa	Cave inhabited by animals (bats, bears), e.g. Wedilunu guhawa		

(Source: MENR 2005)

9.3.2 Degradation of food culture and traditional knowledge

The traditional subsistence agriculture, farming systems, food types were drastically influenced during the British era in the 19th century. The emphasis then was on plantation agriculture, which included the cultivation of coffee, tea, rubber and coconut on a commercial scale, mainly in the wet

zone including the central hills. Botanical gardens at Peradeniya, Hakgala and Gampaha (Henaratgoda), located in different ecological zones of the country, were established to conduct adaptability trials to check suitability of exotic crops under local conditions. The British inducted South Indian Tamil populations to Sri Lanka to engage as estate laborers and to meet with their dietary requirements, rice was also imported. The variety of traditional diet was replaced with introduced food. This clearly had an effect on the traditional agriculture in the country.

Although the Portuguese and the Dutch, who ruled before the British introduced certain crops such as sweet potato, chillie and tobacco that originated in the New World, they did not drastically changed the local food culture; instead they were incorporated into the local systems. In contrast, the European food habits had serious implications on our traditional food culture and farming systems. The high social acceptance created a high demand for the exotic vegetables and fruits and resulted in the associated cultivation of a few selected food plants. Although this agricultural revolution enriched the country's crop diversity on the one hand, it tended to the diminished utilization of the traditional biodiversity on the other hand (Rajakaksha 2001).

Relatively recent global and national government policies, e.g. the Green Revolution in the 1960's, promoted monocropping that required high resource inputs and the use of high-yielding varieties that resulted in the disappearance of hundreds of food crops grown in farmers fields. The 'wheat flour culture' revolutionized, to a great deal, the local food habits and, as a result, the use of yams, aroids, millets, jack fruit, breadfruit, "Kitul" and 'Tala' palm hearts, 'Madu' and 'Beraliya' seeds and 'Hal' fruits as nourishing sources of starch and many wild leaf vegetables became less important. Meanwhile, the policy of striving for the self sufficiency in rice has had negative impact on other cereals such as millets. The open market policy of the late 1970's replaced local fruits with imported apples, grapes, oranges, mandarins and pomegranates in the urban markets and even village fairs.

9.4 Historical gardens, parks and trees

Establishment of gardens or parks had been a characteristic feature associated with many oriental kingdoms and this advance cultural practice has existed in ancient Sri Lanka. The 'Maha mewuna' garden at Anuradhapura is one of most famous that even exists now. The King Parakramabahu the great is said to have established thirty model gardens in Polonnaruwa and in addition a great garden consisting of one hundred thousand trees of each kind had been established by this king as recorded in the Mahawansa. Various useful trees and ornamental flowering species were used in these gardens.

9.4.1 Sigiriya Royal Gardens

Sigiriya provides a unique example of what is one of the world's oldest historic gardens, and the oldest surviving large scale garden form in Asia, whose layout and internal features are still in a fair state of preservation. Three distinct but inter-linked garden types are found here: water gardens, boulder gardens, and stepped or terrace gardens encircling the Sigiriya rock. A combination of these three garden types is also seen on a reduced scale in the palace gardens on the summit of the rock (Bandaranayake 2005).

Although it is very likely that terrace and boulder gardens were replenished with an array of flowering trees and shrubs, the original character of these remarkable creations are not known. However, the presence of flowering trees such as 'Kinihiriya' (*Cochlospermum religiosum*) and 'Gas-kela' (*Butea monosperma*) at the precincts of Sigiriya provides a reliable hint about the ancient aesthetics and gardening at Sigiriya.

9.4.2 Historical trees

Planting of trees to commemorate important historical events and designating existing trees connected to such events or special cultural practices have existed in ancient Sri Lanka. Abeyawardana (2004) cites many such trees of historical importance and the 'Bodhi' tree (*Ficus religiosa*) is much prominent among historical trees, perhaps due to its religious significance and longevity. Some such historical trees are listed in the Table 9.3.

Table 9.3 Historical trees in the Central Province

Tree/ Species	Location	Significance
Kandy District		
Rajahinha Bodhi (<i>Ficus religiosa</i>)	Getambe	King Rajasinha the II planted this tree to commemorate the victory against the Portuguese who were encamping at Gannoruwa. The battle was waged from a point near Getambe ferry
Kumarasinghe Bhodhi and Wijepala Bhodhi (<i>Ficus religiosa</i>)	Getambe	It is recorded that at the above battle King Rajasinha and his brothers Wijepala and Kumarasinha encamped at three spots. After the victory three Bhodhi trees were planted at the camping grounds and were named Rajasinha Bhodhi, Wijepala Bhodhi and Kumarasinha Bhodhi. The Bo tree close to the Visnu devalin Getambe is accepted as the Kumarasinha Bodhi.
Divurum Bhodhi (<i>Ficus religiosa</i>)	Ampitiya, near 5 th km post on Kandy-Talatuoya road	This Bo tree has been so named as it has served as the venue recommended for swearing as a requirement subsequent to trials of suspects during the Kandyan period.
Davy's Bo tree (<i>Ficus religiosa</i>)	Mawilmada, the land is presently owned by Ceylon Tobacco Company	At a battle between the Sinhala and British troops that took place in 1803, only Davy, the leader of the British troops, could save his life by hiding in a cavity of a large Bo tree. Since the Bo tree helped Davy to save his life at was named Davy's Bo tree.
Ratmalkaduwa Bodhiya (<i>Ficus religiosa</i>)	On a hillock 1.5 km beyond Ratmalkaduwa Mawatha to its left along the road leading to the Sinhapitiya township on Gampola – Dolosbage road	It is believed that Ven. Silawansa Dharmakirithi who originally lived in Gampola had planted Bo tree which he had brought from India before changing his residence to Gadaladeniya. In 1822 during the days of coffee plantation, land had been set apart for the Bo tree.
Kahatapitiya Kiri gaha ('Ruk attana' = <i>Alstonia scholaris</i>)	Located in Gampola town a few meters from the railway crossing near Kahatapitiya mosque	Folklore extends to the time of King Buwanakabahu IV of Gampola.
Godagamuwa Bo tree (<i>Ficus religiosa</i>)	Located 10 km from Gampola along Dolosbage road, close to Sinhapitiya	The ancient royal palace has been in the premises of this Bo tree which is considered as a symbol of the Gampola administration.

Tree/ Species	Location	Significance
Veliwita Bo tree (<i>Ficus religiosa</i>)	Veliwita village along Sangharaja Mawatha from Hataraliyadda	Veliwita is the birth place of Ven. Veliwita Saranankara Sangharaja who was instrumental in establishment of the higher ordination in 1753. Of the two commemorative Bo trees at this spot, one has been planted by the Sangharaja and the other by King Kirthi Sri Rajasinha. They were both saplings obtained from the Sri Maha Bodhi at Anuradhapura.
Jackfruit tree at Royal Botanic Garden at Peradeniya (<i>Artocarpus heterophyllus</i>)	Near the National Herbarium	One of the oldest surviving trees in the garden dating back to the time of the Royal Garden during the reign of King Kirthi Sri (1747 – 1780) and its age can be estimated to be around 250 years. The hardwood core of the tree has mostly decayed creating a large cavity
Nuwara Eliya Dist.		
Pusulpitiya Bo tree (<i>Ficus religiosa</i>)	Located between Nawalapitiya – Kotmale New Town via Hadunuwewa	This Bo tree is located at Pusulpitiya Vihara. It is one of the 32 saplings of the sacred Bo tree in Anuradhapura. The planting of the Bo tree dates back to the 3 rd century BC.
Hanguranketa Royal Sweet Waraka tree (<i>Artocarpus heterophyllus</i>)	Located opposite the Visnu Devala	The fruits of this tree were exclusively used for the consumption of royalty during the days of King Rajasinha II.
Panamrilla tree (‘Milla’ = <i>Vitex altissima</i>)	Located 200 m off 51 st km post on Ginigathena – Colombo road	This spot is considered an important landmark on the ancient route to Sri Pada and this fact is confirmed by the now abandoned flight of steps. This ‘Milla’ tree is dead and only the lower part of its trunk remains. A large cavity at the base of the tree was used to deposit coins by the pilgrims
Poro-maru tree at Akuruketa Kanda	Located near Ambagamuwa Rock Inscription - 6 km from Nawalapitiya towards Ginigathena and proceeding about 300 m from the road	Ambagamuwa Rock Inscription was established by King Vijayabahu I (1075 – 1113) along with many facilities provided for the pilgrims using this ancient route to Sri Pada. Although the local name ‘Porawamaru’ represents many hardwood trees such as <i>Diospyros insignis</i> and <i>Psydrax dicoccus</i> , the identification can be verified only after examining the tree.

Sources: Abayawardana 2004 and contributions by the author

9.5 Memorial parks

9.5.1 Mailapitiya Ranaviru Park

This memorial park was established to commemorate the soldiers who died during separatist war which prolonged for over two decades in Sri Lanka. MASL, among its many nature conservation activities, has supported tree planting at this park. Kohomba (*Azadirachta indica*) and Pihimbiya (*Filicium decipiens*) were initially used for this purpose.

9.5.2 War Memorial Cemetery in Kandy

This memorial cemetery was established in Kandy to commemorate personnel of the British forces who fell during the Second World War. It is located along Deveni Rajasinghe Mawatha (Lady Blakes Drive), maintained by the National Botanic Gardens and supported by the funds provided by the British government.

9.5.3 Garrison Cemetery

This site is located along Talwatta road a little distance from the Temple of the Tooth. This burial ground covers about 0.25 hectare and retains 172 tombs of British nationals who died during the earlier period of the British occupation of the Kandyan territory. Garrison is the old name of the camping ground of British soldiers before it was used as a cemetery from 1817 and it has been used up to 1878 till the establishment of the cemetery at Mahaiyawa. This cemetery is presently administered by the St. Paul's church (Abeyawardana 2004). The Forest Department claims that the Garrison Cemetery is a part of the Udawattakele Reserve (Forest Department 2006).

9.5.4 V.T.Nanayakkara Park at Matale

This park situated facing Kumbiyangoda road in close proximity to the Matale city center was formerly known as Saxon Park. Saxon was an Assistant Government Agent during 1890 – 1899. It was renamed to honor Mr. V.T.Nanayakkara who served as the Principal of Vijaya College (1931 – 1947) and as a Member of Parliament for Matale (1947 – 1952). Although it had been a picturesque park in the past, now it is sadly neglected. The Rest House is located in this park (Abeyawardana 2004).

9.5.5 Burial ground of heroes of Matale rebellion 1948

The ancient Hikgollakotuwa, an elevated land in the heart of Matale town had been renamed as Capt. McDowell Fort after he had constructed a fort during the early British period. This site had been selected for the burial of the heroes executed after the rebellion of 1848 (Abeyawardana 2004). Two exotic trees planted at this ground are of importance and one of them is *Parkia roxburghii* ('Toku gaha') and the other is *Elaeocarpus ganitras* ('Nil Veralu').

9.5.6 Victoria Park at Nuwara Eliya

When this was first established in 1897, it covered a larger extent that was gradually reduced as a result of utilizing the park land for other civic purposes. At present, the park area consists of 12 hectares and administered by the Nuwara Eliya Municipal Council. It is well maintained and has gained the admiration of the ratepayers as well as visitors.

9.6 Memorial trees

9.6.1 Memorial trees at Royal Botanic Garden, Peradeniya

At the Royal Botanic Garden at Peradeniya, there is a special section around the Great Circle (a large circular lawn at the center of the garden) that is allocated to plant memorial trees. The custom of planting memorial trees in the Botanic Garden to commemorate visits of Royalty, Heads of State and religious dignitaries, and events of national importance, dates back to the colonial era and still continues today (Ekanayake 1985).

The first tree to have been planted in pursuance of this custom is the 'Bo' tree (*Ficus religiosa*) venerated by the Buddhists as the 'Bodhi' under which Lord Gautama Buddha attained supreme enlightenment. A branch of the original tree in India was brought to Sri Lanka in the third century BC and planted at Anuradhapura. The specimen in the garden was planted in 1875 by King Edward VII. The second oldest memorial tree is a 'Na' tree (*Mesua ferrea*) planted by the Czar of Russia in 1891. Other memorial trees planted here are a 'Sal' = Cannon Ball tree (*Couroupita*

surinamensis) planted by their majesties King George V and Queen Mary in 1901; a 'Siyambala' tree (*Tamarindus indica*) planted by Rt. Hon. D.S.Senanayake, First Prime Minister of Ceylon, to commemorate Independence Day on 4th February 1948; 'Gotu nuga' = Krishna bo (*Ficus benghalensis* var. *krishnae*) planted by H.M. Queen Elizabeth II in 1954; a 'Kobo-neela' (*Bauhinia variegata*) planted by Hon. Mrs. Indira Gandhi, Prime Minister of India; and a 'Sandun' tree (*Santalum album*) planted in 1977 by H.E.J.R.Jayawardene, President of the Democratic Socialist Republic of Sri Lanka. Since 1950, many memorial trees have been planted by great personalities (Ekanayake 1985).

9.6.2 Memorial trees at Victoria Park, Nuwara Eliya

A Cyprus tree (*Cupressus macrocarpa*) was planted in 1917 at the Victoria Park in Nuwara Eliya to commemorate World War I of 1914. The tree is about 20 m high and a plaque at the foot of the tree gives a legend about the tree.

9.7 Monuments

It is noteworthy that some monuments have been erected at the Royal Botanic Garden at Peradeniya in memory of some great botanists. One of the most impressive buildings is Gardner's Monument constructed in 1855 on a hillock in the garden. Built in the style of a Greek temple, this dome-shaped structure is dedicated to the memory of Dr. George Gardner, Superintendent of the Gardens from 1844 to 1849. Overlooking the Great Circle, is situated a monument of Kandyan architectural design dedicated to the memory of Dr. G.H.K.Thwaites, Director of the Gardens from 1849 to 1880. These monuments are used as summer houses by visitors (Ekanayake 1985).

CHAPTER 10

10. IMPACTS ON BIODIVERSITY

10.1 Human population

Economic development in Sri Lanka, since gaining independence in 1948, was based upon agricultural, industrial and tourism development, increasing use of transportation and urbanization, and exploitation of forests, fishing, and other natural resources. All such developmental trends have had their impacts upon landscape and biological diversity in the island. High rates of population growth – currently nearly 20 million - have been accompanied by a progressive increase of anthropogenic impacts on nature and biodiversity. A growing human population in Sri Lanka, has caused the clearance of rural habitats for human settlements, agricultural land, industrial areas and related infrastructure such as road networks. The urban population in Sri Lanka has been steadily increasing over the years, and it is now believed to make up nearly 30 percent of the total population of the country. Movement of population towards the coastal regions and urban areas has increased the population pressure causing significant environmental implications in such areas. Urbanization has been transgressing over the last few decades into their surrounding rural areas.

Although poverty in Sri Lanka is largely a problem of the countryside, trends indicate that rural poverty is decreasing, and urban poverty is rising. In order to implement regulations, environmental standards have to be set, prescribing the maximum permissible levels of pollutants that affect the environment and biodiversity. Unplanned urban population growth has resulted in ecologically important areas being encroached upon, or otherwise used for house construction. Generally, the population growth results in demographic issues, trade pressures, political instability, perverse incentives, retarded economic performance, poverty, corruption, lack of law enforcement, poor protection standards, lack of awareness and lack of information.

According to information compiled for the 2007 Red List of Threatened Fauna and Flora of Sri Lanka, the loss of natural habitats, including their alteration and fragmentation is, by far, the most serious threat to a majority of the threatened species in the island. The island has lost approximately half the area of forests it had just over half a century ago, and currently retains only about 23.5% of forest cover. The loss of forest cover over the past five decades has averaged over 30,000 ha per year. Most of the remaining forests are fragmented and small with contiguous large tracts remaining only in the dry zone. The per capita land resource allocation in Sri Lanka (0.35 ha) is among the lowest in Asia, and the situation is even worse in the wet zone watershed areas, where the population density far exceeds the national average. The wet zone districts that harbor more than 50 species of threatened vertebrates and plants, respectively, have a relatively low forest cover. Near-primary forest cover in the wet zone accounts a little less than 5% of the total land area, what remains are small (less than a km²), isolated patches in a sea of human development. Even the existing protected forests in the wet zone, which harbor a high biodiversity, continue to be degraded due to illegal encroachment, and suffer further fragmentation. Typical examples of such forests in the CP include Hakgala SNR, Peak Wilderness Sanctuary and the Knuckles Conservation Area. The implication of habitat loss, especially in the wet zone of the island, is clearly evident by the fact that 21 species of amphibians and 72 species of plants have become extinct during the past two centuries. The human population density, forest cover, threatened vertebrates and threatened plants in the CP are given in the Table 10.1 (IUCN Sri Lanka & MENR 2007).

Table 10.1 Human population density, forest cover, threatened vertebrates and threatened plants in the Districts of the Central Province

District	Area (Km ²)	Human Population Density (per Km ²)	% Forest Cover	Threatened Vertebrates	Threatened Plants
Matale	1,993	233	40.5	57	71
Kandy	1,906	704	17	90	310
Nuwara Eliya	1,720	423	24.5	79	150
Central Province	5,619	451	26.4		
Sri Lanka	65,610	314	23.5	223	675

(Source: IUCN Sri Lanka & MENR 2007)

10.2 The 2007 Red List of Threatened Fauna and Flora of Sri Lanka

The National Species Conservation Advisory Group (NSCAG), established by the Biodiversity Secretariat of the MENR, requested the services of IUCN in 2004 to establish a digital database related to species, and up-date the 1999 national list of threatened plants and animals. The project was initiated in mid 2004, with funding from the ADB and the Royal Netherlands Embassy. This resulted in the publication of the 2007 Red List of Threatened Fauna and Flora of Sri Lanka (IUCN Sri Lanka & MENR 2007) through the efforts of IUCN and MENR, and supported by the NSCAG and a panel of experts.

The nationally threatened species were evaluated using the IUCN Global Red List categories and criteria, adapted at a regional level. Of the five IUCN Global Red List criteria, only the first four (A – Population reduction; B – Restricted geographic range; C – Small population size and decline; D – Very small or restricted population) were used to evaluate the status of species during this exercise. However, most species were evaluated using criterion B (Geographic range – Extent of Occurrence and Area of Occupancy). A species was considered as nationally threatened, when it was evaluated to be either Critically Endangered (CR), Endangered (EN), or Vulnerable (VU).

The findings of the assessment are alarming, when considering the fact that 33% (223 species) of inland vertebrate fauna and 61% (675 species) of the evaluated flora were found to be nationally threatened. The threatened fauna and flora include many endemic species. 21 species of endemic amphibians and 72 species of plants seem to have disappeared from the island (extinct) during the past century. These findings, along with those resulted from other important work on biodiversity conservation, such as the NCR (IUCN & WCMC 1997) and the Protected Area Gap Analysis (Jayasuriya et al 2006), would serve as the baseline for the development and implementation of suitable policies and actions to conserve the threatened species for the future.

10.3 Distribution of threatened species in the Central Province

An analysis of the geographical distribution of threatened butterflies, vertebrate fauna and flora in different administrative districts in the island revealed that the Central Highlands (Kandy, Matale, Nuwara Eliya), along with the lowland wet zone, harbor higher number of threatened taxa (Table 10.2) and the highest number of threatened plants occur in the Kandy District (IUCN Sri Lanka & MENR 2007).

Table 10.2 Distribution of threatened fauna and flora in the districts of the Central Province

District	Number of Threatened Species						
	Butterflies	FW Fish	Amphibians	Reptiles	Birds	Mammals	Flora
Kandy	10	6	7	21	27	30	310
Matale	3	3	9	11	11	23	71
Nuwara Eliya	5	0	16	11	22	30	150

(Source: IUCN Sri Lanka & MENR 2007)

10.4 Invasive organisms

Biodiversity faces many threats throughout the world. One of the major threats to native biodiversity is now acknowledged by scientists and governments to be biological invasions caused by alien invasive species (AIS). AIS is defined as “*a species introduced into a habitat and whose establishment and spread threatens the ecosystem, habitat or species with economic or environmental harm*” (McNeely 2001). The impacts of AIS are immense, insidious and usually irreversible. They may be as damaging to native species and ecosystems on a global scale as the loss and degradation of habitats. The scope and cost of biological invasions is enormous in ecological and economic terms. AIS are found in all taxonomic groups: they include introduced viruses, bacteria, algae, fungi, mosses, ferns, flowering plants, invertebrates, fish, amphibians, reptiles, birds and mammals. They have invaded native biota in virtually every ecosystem type on earth. Hundreds of extinctions have been caused by AIS. The most striking ecological cost of AIS is the loss of native species and ecosystems.

The degradation of natural habitats and agricultural lands, e.g. loss of forest cover and soil cover, pollution of land and waterways, has promoted the spread and establishment of AIS. Many AIS are colonizing species that benefit from the reduced competition that follows habitat degradation. Global climate change is also a significant factor that promotes the spread and establishment of AIS, e.g. increased temperatures may enable alien, disease-carrying mosquitoes to extend their ranges.

It has been well documented that AIS have resulted in massive and rapid losses of biodiversity, especially in island communities (Clout 1995). Sri Lanka, being a small island with rich biodiversity, its vast array of wetland and terrestrial ecosystems is inhabited by several species of alien biota, hence causing a threat to native biodiversity. Bambaradeniya 2002 cites 39 plant species (2 pteridophytes and 37 flowering plants) and 20 animal species (5 mollusks, 9 freshwater fish, 1 reptile and 5 mammals) as AIS in Sri Lanka (Tables 10.2 and 10.3 respectively).

Although all these nationally important AIS have not yet caused serious concern within the Central Province, at least some of them could potentially manifest their invasive effects in the future. Those species that have caused considerable concern within CP are cited below, more or less in order of importance, with some essential information.

Table 10.3 Alien invasive flora in Sri Lanka

* Species included in the list of 100 of the world's most AIS (IUCN ISSG 2001)

Species	Common name (habit)	Purpose of introduction / mode of spread	Distribution	Affected habitats /ecosystems
<i>Anona glabra</i> Annonaceae	Pond apple (shrub to small tree)	Unknown	Lowland wet zone	Mangrove associate near lagoons and marshes, inland marshes
<i>Alstonia macrophylla</i> Apocynaceae	'Hawari nuga' (tree)	Introduced into forestry as a timber species / high spontaneous regeneration	Lowland wet zone and intermediate zone	Secondary forests
<i>Alocasia macrorrhizos</i> Araceae	'Habarala' (Large succulent herb)	Unknown	Lowland wet zone	Marshes, abandoned paddy fields
<i>Alternanthera philoxeroides</i> Amaranthaceae	Aligator weed (aquatic - floating or semi-aquatic herbaceous runner)	Deliberate/ Introduced as a leafy vegetable	Island-wide	Marshes, fallow fields
<i>Colocasia esculenta</i> Araceae	Taro 'Alakola' (Succulent herb)	Unknown	Lowland wet zone	Marshes, abandoned paddy fields
<i>Chromolaena odorata</i> Asteraceae	Siam weed 'Podi singho maran' (shrub)	Unknown / wind-dispersed achenes aided by pappus	Dry, intermediate and lowland wet zones	Coconut plantations, SPOF, wastelands
<i>Eupatorium riparium</i> Asteraceae	Mist flower (herb)	Introduced as an ornamental / wind-dispersed achenes aided by pappus	Montane zone	Secondary forests, SPOF, roadsides
<i>Mikania cordata</i> * Asteraceae	Mile-a minute 'Watu palu'	Unknown / wind-dispersed achenes aided by pappus	Island wide	Wastelands
<i>Parthenium hysterophorus</i> Asteraceae	Parthenium weed (Erect herb)	Accidental with imported goats and condiments from India / spread by vehicles and hoofed animals	Dry and intermediate zones – island wide	Agricultural lands and wastelands
<i>Wedelia trilobata</i> *	Wedelia (creeping)	Introduced as an ornamental	Wet and intermediate zone	Forest edges and roadsides

Species	Common name (habit)	Purpose of introduction / mode of spread	Distribution	Affected habitats /ecosystems
Asteraceae	herb)		nes	
<i>Tithonia diversifolia</i> Asteraceae	Wild sunflower 'Natta-suriya' (shrub)	Introduced as an ornamental	Wet zone mid country	Wastelands and roadsides
<i>Xanthium indicum</i> Asteraceae	Cocklebur (herb to low shrub)	Unknown / fruits attached to skins of animals	Dry zone	Margins of tanks
<i>Millingtonia hortensis</i> Bignoniaceae	Indian cork tree (small tree)	Introduced as an ornamental	Southern dry and intermediate zones	SPOF and scrubland
<i>Opuntia dillenii</i> * Cactaceae	Prickly pear 'Katu pathok'	Introduced as a ornamental / fruits eaten and dispersed by animals	Semi-arid zone	Wastelands, DDTs
<i>Clusia rosea</i> Clusiaceae	'Gal goraka'	Introduced as a ornamental / seeds dispersed by birds	Wet zone mid country	Rocky habitats in disturbed forests
<i>Dillenia suffruticosa</i> Dilleniaceae)	'Diya para', 'Goda para' (small tree)	Ornamental / seeds dispersed by birds	Lowland wet zone	Marshes
<i>Leucaena leucocephala</i> * Fabaceae	Leucaena 'Ipil ipil' (small tree)	Introduced as a fodder and for soil rehabilitation /seeds	All lowlands	Wastelands, homesteads, SPOF
<i>Mimosa invisa</i> Fabaceae	'Hinguru wel' (large prickly creeper)	Unknown	Wet zone mid country	Disturbed habitats
<i>Mimosa pigra</i> * Fabaceae	Giant sensitive plant 'Yoda nidikumba' (large shrub)	Accidental, soil moving machinery / seeds dispersed by water and along with transport of river sand	Wet zone mid country and intermediate zone	River banks
<i>Myroxylon balsamum</i> Fabaceae	Balsam 'Katta kumanchal' (medium tree)	Forestry	Wet zone mid country	Disturbed MMEF
<i>Prosopis juliflora</i> * Fabaceae	Mesquite (large shrub to small tree)	Deliberate introduction	Semi-arid zone	Disturbed DDTs in saline habitats
<i>Ulex europeus</i> * Fabaceae	Gorse (shrub)	Ornamental / seeds	Montane zone	Disturbed WPTG, MOEF

Species	Common name (habit)	Purpose of introduction / mode of spread	Distribution	Affected habitats /ecosystems
Fabaceae				& wastelands
<i>Hydrilla verticillata</i> Hydrocharitaceae	Hydrilla (submerged herb)	Introduced by aquarists in ornamental fish trade / escape into water bodies	Lowland wet zone	Tanks, ponds, streams and canals
<i>Egira densa</i> Hydrocharitaceae	Canadian pondweed or Leafy Elodia (submerged herb)	Introduced by aquarists in ornamental fish trade / escape into water bodies	Lowland wet zone	Tanks, ponds, streams, canals and marshes
<i>Clidemia hirta</i> * Melastomataceae	Kosters' curse 'Katakalu bowitiya' (small shrub)	Unknown / fruits eaten by birds, seeds dispersed by internal transport	Lowland wet zone	Disturbed habitats, invades rain forests
<i>Miconia calvescens</i> * Melastomataceae	Miconia (large shrub)	Ornamental / seeds dispersed by birds	Wet zone mid country	Disturbed forests, shade lover
<i>Swietenia macrophylla</i> Meliaceae	Mahogany (large tree)	Timber tree in forestry	Lowland and mid country wet zone and intermediate zone	Disturbed MMEF
<i>Psidium littorale</i> * Myrtaceae	Strawberry guava (treelet)	Ornamental / seeds dispersed by birds	Montane zone	Disturbed MOEF
<i>Najas marina</i> Najadaceae	Pond weed (submerged herb)	Unknown	Coastal areas	Coastal aquatic habitats
<i>Imperata cylindrica</i> * Poaceae	Cogon grass 'Iluk' (herbaceous grass)	Probably natural	Dry and intermediate zones	SPOF, scrubland
<i>Panicum maximum</i> Poaceae	Guinea grass (tall herbaceous grass)	Fodder	Island wide	Wasteland, scrubland, SPOF
<i>Pennisetum polystachyon</i> Poaceae	'Pohon', 'Rila tana'	Probably as fodder	All zones except montane zone	Wasteland, roadsides, open habitats
<i>Phragmites karka</i> Poaceae	'Nala gas' (tall shrub-like grass)	Probably natural	Coastal habitats	Marshes

Species	Common name (habit)	Purpose of introduction / mode of spread	Distribution	Affected habitats /ecosystems
<i>Eichornia crassipes</i> * Pontederiaceae	Water hyacinth (floating herb)	deliberate introduction as ornamental / escape into water bodies	Island-wide	Tanks, ponds, marshes, canals and streams
<i>Cestrum aurantiacum</i> Solanaceae	(shrub)	Ornamental	Montane zone	Disturbed MOEF
<i>Typha angustifolia</i> Typhaceae	Bullrush 'Hambu pan' (tall herb)	Unknown	Dry and intermediate zones	Marshes, estuaries, abandoned paddy fields
<i>Lantana camara</i> * Verbenaceae	Prickly lantana 'Gandapana'	Ornamental	Dry and intermediate zones	Wastelands, scrublands, SPOF
<i>Pistia stratioides</i> Pteridophyte	Water lettuce (floating herb)	Unknown	Island-wide	Tanks and marshes
<i>Pteridium aquilinum</i> Pteridophyte	Herb	Ornamental	Montane zone	WPTG, MOEF
<i>Salvinia molesta</i> Pteridophyte	Salvinia (floating herb)	deliberate introduction / escape into water bodies	Island-wide	Tanks, ponds, marshes, canals and streams

(Source: Bambaradeniya 2002; revised here with additional information: additional species and families or groups added and nomenclature updated)

Table 10.4 Alien invasive fauna in Sri Lanka

* Species included in the list of 100 of the world's most AIS (IUCN ISSG 2001)

Species Group	Common name	Purpose of introduction / mode of spread	Distribution	Affected habitats /ecosystems
<i>Achatina fulica</i> * Mollusc	Giant African snail	Hobby / research	Island-wide	Natural and managed terrestrial habitats
<i>Laevicaulis alte</i> Mollusc	Slug	Accidental / horticulture	Island-wide	Natural and managed terrestrial habitats
<i>Deroceras reticulatum</i> Mollusc	Garden slug	Accidental / horticulture	Wet and intermediate zones	Disturbed and managed terrestrial habitats
<i>Deroceras</i>	Garden slug	Accidental /	Wet and	Disturbed and

Species Group	Common name	Purpose of introduction / mode of spread	Distribution	Affected habitats /ecosystems
<i>caruance</i> Mollusk		horticulture	intermediate zones	managed terrestrial habitats
<i>Pomacea bridgesi</i> Mollusk	Golden Apple Snail	Ornamental fish trade	Lowland wet zone to mid country	Canals, reservoirs
<i>Oncorhynchus mykiss</i> * Fish	Rainbow Trout	Sport fishery	Montane zone	Streams
<i>Chitala chitala</i> Fish	Clown Knife Fish	Ornamental fish trade	Lowland wet zone	Tanks, ponds, slow-flowing water courses, marshes
<i>Hypostomus plecostomus</i> Fish	Tank cleaner, Plecostomus Catfish	Ornamental fish trade	Lowland wet zone	Tanks, ponds, slow-flowing water courses, marshes
<i>Clarias batrachus</i> * Fish	Walking Catfish	Ornamental fish trade	Lowland wet zone	Marshes, streams, canals
<i>Poecilia reticulata</i> Fish	Guppy	Mosquito control and ornamental fish trade	Island-wide	Tanks, ponds, slow-flowing water courses, marshes
<i>Gambusia affinis</i> * Fish	Western Mosquito Fish	Mosquito control	Lowland wet zone	Marshes, streams, canals
<i>Oreochromis mossambicus</i> Fish	Mozambique Tilapia	Commercial fishery	Island-wide	Tanks, ponds, slow-flowing water courses, marshes
<i>Cyprinus carpio</i> * Fish	Carp	Commercial fishery	Island-wide	Tanks, reservoirs
<i>Trichogaster pectoralis</i> Fish	Snake-skin Gouramy	Commercial fishery	Dry and intermediate zones	Tanks, reservoirs, marshes, streams
<i>Trachemys scripta</i> * Reptile	Red-eared Slider Turtle	Ornamental fish trade	Lowland wet zone	Marshes, streams, canals
<i>Mus musculus</i> * Mammal	House Mouse	Accidental by ships	Island-wide	Natural and managed terrestrial habitats

Species Group	Common name	Purpose of introduction / mode of spread	Distribution	Affected habitats /ecosystems
<i>Rattus rattus</i> * Mammal	Ship Rat	Accidental by ships	Island-wide	Natural and managed terrestrial habitats
<i>Felis catus</i> * Mammal	Domestic / Feral Cat	Pet trade	Island-wide	Natural and managed terrestrial habitats
<i>Canis familiaris</i> Mammal	Domestic / Feral Dog	Pet trade	Island-wide	Natural and managed terrestrial habitats
<i>Bubalus bubalis</i> Mammal	Domestic / Feral Buffalo	Animal husbandry	Island-wide	Forests

(Sources: Bambaradeniya 2002 and Marambe et al. 2001)

10.4.1 Invasive flora in the Central Province

Parthenium hysterophorus (Parthenium weed, Congress weed)

The parthenium weed is among the latest recorded IAS in Sri Lanka, having been introduced from India with the arrival of IPKF in 1987, apparently with goats that were imported from India (Jayasuriya 2001). Some believe that initial seed may have arrived as a contaminant in mustard brought to the IPKF camps in northern Sri Lanka. The first discovery of the occurrence of this weed in Sri Lanka was made in Vavuniya in 1999 and since then many disjunct populations of this weed were reported from several other districts in the island (Jayasuriya 2001). This indicated that the seeds of the parthenium weed that were present as contaminants among various condiments, such as coriander, chilli, mustard and onion seeds, that were imported from India gave rise to some of these weed populations in various parts of the country.

It is considered as one of the worst weeds for agriculture, the environment and human and animal health in countries such as Australia and India that are affected with the parthenium weed. Its toxicity is due to sesquiterpene lactones and the chief allergen is parthenin, a highly toxic sesquiterpene lactone. The plant causes acute allergic dermatitis in humans, which under continuous exposure becomes chronic. The Ministry of Agriculture declared it as a noxious weed by a gazette notification No. 1163/23 of 20th December 2000 that also include regulations for prevention of further entry, spread and its eradication under the Plant Protection Act No. 35 of 1999.

In the CP, the occurrence of the parthenium weed was first detected in the year 2000 in Pallekele (Kandy District). The plant occurred in a small population in an area of about half hectare in the vicinity of a vehicle service station. The original seed was suspected to have come along with mud attached to a vehicle coming from an infected area.

The discovery of the occurrence of the parthenium weed in Sri Lanka and the immediate island wide public alert was followed by a series of concerted actions, mainly launched by the DAG, PGRC and supported by the MENR, MIP, UP and UJ. These actions included awareness, control, research and legal steps.

The NPQS/DAG conducted a three-year (2002-2004) project on biological control of the parthenium weed. It involved the importation of BCA from Australia and evaluating them under local conditions to use as a component of the IPM program to control the weed. The results of these investigations confirmed that the rust *Puccinia melampodii* and stem-galling moth *Epiblema strenuana* can be effectively used as potential BCA in IPM programs against Parthenium weed. In late 2004, the PPD/DAG started mass production of *E.strenuana* and a batch of the insect was released at Kandaketiya and started making observations (Ekanayake 200).

Results of the above concerted activities created an excellent and rapid public awareness and cooperation to control the weed and to expand the capacity to adopt legal steps to minimize the spread of the parthenium weed in Sri Lanka. Despite the short period of activities, an estimated 50 – 70 percent of the parthenium infestation was brought under control in major infested areas and totally eradicated from most of the isolated patches during 2002. However, constant short-term activities are needed to keep the weed populations at a low level until an effective self-sustained biological control program becomes a reality (Jayasuriya 2005).

***Mimosa pigra* (Giant mimosa, Giant sensitive plant, ‘Yoda nidikumba’, Balal-at nidikumba)**

This leguminous shrub was first detected in Tennekumbura, growing in gregarious populations on the riverbanks of the Mahaweli Ganga. However, it has now spread at an alarming rate into other areas in the CP. A distribution map provided by the Environment & Forestry Division of the MASL in 2006, indicates that the weed has already established in Gangawata Korale, Harispattuwa, Pata dumbara, Kundasale and Akurana DSDs in Kandy District, and Matale, Ukuwela and Rattota DSDs in Matale District. It has also been reported in Gampola, Nawalapitiya and Kotmale and in distant places such as Embilipitiya region in association with Walawe Ganga.

The weed was first identified in 1997 in Sri Lanka. Although the pathway of entry of this plant into the country is not well understood, it is widely believed that this was intentionally introduced to protect the river banks. The major mechanisms of spread have been identified as irrigation water, machinery, transport of river sand for construction purposes, and lopping of branches (with mature pods) for fuelwood (Marambe et al. 2000). Renewed attempts to control the weed were planned jointly by the MASL, MENR, DAG and UP.

***Lantana camara* (Prickly Lantana, ‘Ganda-pana’, ‘Hinguru’)**

Due to its horticultural value and attraction to butterflies and birds, Lantana was introduced to Sri Lanka in 1826. It was purposely established in sugarcane plantations in the Southern Province to protect sugarcane from the elephants. The plant is now distributed islandwide and commonly found in dense thickets along roadsides, wastelands and in open habitats. It has invaded open habitats in Udawalawe National Park, one of the major elephant sanctuaries in southern Sri Lanka, significantly reducing the grazing areas for elephants. An intensive eradication program that involved considerable costs was recently carried out.

***Salvinia molesta* (Salvinia)**

Salvinia was introduced to Sri Lanka in the late 1930s due to scientific interest, and later escaped and is currently a major aquatic weed, choking irrigation canals and water bodies and also invading paddy fields, especially in the northwestern parts of the island. Although there is no accurate information on the degree of infestation, in 1988 about 8000 hectares of paddy fields were reported to be infested with this weed (Amarasinghe & Ekneligoda 1997). Due to the detrimental effects of this aquatic plant on agricultural ecosystems, Salvinia came under strict control of the Plant Protection Ordinance in Sri Lanka. Although biological control with the insect, *Cyrtobagus salviniae*, was successful in several areas, it has failed in cooler climates and in areas with low water levels (Amarasinghe & Ekneligoda 1997).

***Eichhornia crassipes* (Water hyacinth, ‘Japan jabara’)**

This aquatic plant was introduced as an ornamental to Sri Lanka in 1905. However, two years after its introduction, a Water Hyacinth Ordinance was enacted in 1907, indicating its long-term detrimental effects. Despite this effort, Water hyacinth is a major aquatic weed today covering water bodies and choking irrigation canals. Biological control using the insects, *Neochetina eichhorniae* and *N. bruchi* was attempted in 1980s, but these two agents have not performed as expected. Thus, mechanical removal is used to clear affected water bodies, which in turn has resulted in its spread due to contamination of the machinery used for this purpose (Marambe 1999).

***Tithonia diversifolia* (Wild sunflower, ‘Naththa-suriya’, ‘Wal suriya kanthi’)**

This was introduced to Sri Lanka as an ornamental over a hundred years ago and later after its escape into roadside and wasteland habitats, it became popular green manure in the early 1980s. It is frequently seen in the mid country and occasionally even in Colombo.

10.4.2 Invasive fauna in Central Province

***Sarotherodon mossambicus* (Tilapia)**

Tilapia was introduced to aquatic ecosystems in Sri Lanka as a source of protein. Its non-selective feeding habits and prolific breeding have enabled this species to colonize tanks, reservoirs and slow-flowing water courses.

10.5 Poisonous plants

The poisonous products in plants are usually the secondary chemical compounds that form plant's chemical defense mechanism against herbivores. These secondary compounds are either toxic to most herbivores or disturb their metabolism greatly, preventing, for example, the normal development of larval insects. Consequently, most herbivores tend to avoid the plants that possess these compounds (Raven & Johnson 2002). Accumulation of these chemicals is sometimes indiscriminate within the plant body or often localized in specific organs. For instance, strychnine, highly poisonous alkaloid in ‘Goda kaduru’ tree (*Strychnos nux-vomica*) is concentrated in its seed, but practically absent in the rest of the fruit and leaves. Polyphenol compounds that can cause corrosive effects on skin and allergies are present in the bark of ‘Badulla’ (*Semecarpus nigro-viridis*). Certain vegetables are poisonous in the raw state, but not so when cooked (e.g. Cassava = *Manihot esculenta*)

In some plants the poisonous properties are due to stinging hairs, i.e. hollow siliceous hairs containing formic or other acid (e.g. ‘Ma ussa’ = *Dendrocnide sinuata*). Spicules of calcium oxalate that can cause severe irritation are present in some aroids (e.g. *Dieffenbachia* spp.).

Poisonous plants differ in degree of harmfulness, and the poisonous properties are sometimes influenced by genetic variation among populations, local condition of soil and climate, season and even by cultivation practices.

Macmillan (1935) has compiled a list of some poisonous plants in Sri Lanka. Some of these are exotic in origin and are found only in cultivation (e.g. ‘Hendirikka’ = *Mirabilis jalapa* and ‘Rath-Kaneru’ = *Nerium oleander*), while some others are naturalized in the country (e.g. Hak-kirilla = *Solanum mauritianum* and ‘Nai-habarala’ = *Alocasia cucullata*). Furthermore, Hasanuzzaman (2003) has also compiled a list of 33 poisonous plants in Bangladesh of which, over 20 species do also occur in Sri Lanka. The Table 10.4 consists of a list of poisonous plants in Sri Lanka compiled using above references to which many additional species that are known to be poisonous have been added by the author. The general distribution of each species in Sri Lanka is briefly stated and for this purpose, the Revised Handbook to the Flora of Ceylon was used. If a given naturally occurring

species is not known to occur in the CP, it is indicated in the last column. However, it should be noted that the fact that a species has not been recorded in a given province does not imply that it is absent in that province. Some uses of the plants that are stated in the table, e.g. arrow poison, are not necessarily practiced in Sri Lanka, but in other countries.

Table 10.5 Poisonous plants in Sri Lanka

Family Species	Local names E = English	Poisonous parts; Chemical Effect	Origin, if introduced; General distribution; Remarks on occurrence in CP
Anacardiaceae			
<i>Anacardium occidentalis</i>	Kaju Cashew (E)	Resin of the nut causes blisters on skin	Origin: Tropical America - cultivated nut tree
<i>Nothopegia beddomei</i>	Bala	Latex of bark causes allergic dermatitis in sensitive persons and blisters on skin	Intermediate zone
<i>Semecarpus nigro-viridis</i>	Badulla	Bark and pericarp contain polyphenols; causes allergic dermatitis in sensitive persons and blisters on skin	Endemic - Wet lowlands & intermediate zone
<i>Semecarpus subpeltata</i>	Maha-badulla, Kabara-badulla	As above, but said to be worst of all 'Badulla' spp.	Endemic - Wet lowlands - not recorded in CP
<i>Semecarpus spp.</i>	Generally 'Badulla'	Generally all Semecarpus spp. are similarly poisonous, but at varying levels	Most species are endemic - Mostly wet lowlands - Not recorded in CP
Annonaceae			
<i>Annona squamosa</i>	Seeni-atha Custard apple, Sweet-sop (E)	Root and seed	Origin: West Indies cultivated fruit
Apocynaceae			
<i>Cerbera odollam</i>	Gon-kaduru, Bola-kaduru	Latex acrid	Wetlands in wet and dry lowlands - not recorded in CP.
<i>Nerium oleander</i>	Rath-kaneru, Sudu-kaneru Oleander (E)	Roots and latex contain cardiac glucocides	Origin: the Mediterranean - cultivated flowering plant
<i>Ochrosia oppositifolia</i>	Moodu-kaduru, Gonna	Fruit	South western coastal zone - not recorded in CP.
<i>Petchia ceylanica</i>	Kukul-kaduru, Wal- kaduru, Wasa- kaduru	Latex	Endemic - Wet lowlands - not recorded in CP

Family Species	Local names E = English	Poisonous parts; Chemical Effect	Origin, if introduced; General distribution; Remarks on occurrence in CP
<i>Tabernamontana divaricata</i>		Latex used as arrow poison	Southern Himalayas – cultivated flowering plant
<i>Thevetia peruviana</i>	Kaneru Yellow- oleander (E)	Fruit/seed contain cardiac glucocide – Fatally poisonous	Origin: Tropical America – cultivated flowering plant
Araceae			
<i>Alocasia cucullata</i>	Nai-habarala, Panu-habalala	Fruits and probably stems	Wet lowlands
<i>Dieffenbachia seguine</i>	Dumb cane(E)	Leaves	Escape from cultivation in CP
Asteraceae			
<i>Parthenium hysterophorus</i>	Parthenium weed (E)	Whole plant, especially leaves and pollen – Poisonous substance: Parthenin (sesquiterpene lactone)	Origin: Tropical America- Accidentally Introduced to Sri Lanka via India – Dry lowlands, intermediate zone to mid country – Invasive plant
<i>Xanthium indicum</i>	Uru-kossa	Causes dermatitis in susceptible persons – Harmful to domestic herbivores probably aused by mechanical injury to gut by eating hook-covered fruit (involucre), rather than by any poisonous substance.	Origin: Tropical Asia – weed in dry zone
Caricaceae			
<i>Carica papaya</i>	Gas-labu, Papol Papaya, Papaw (E)	Papain, a proteolytic enzyme present in young fruit and leaves	Origin: Tropical America cultivated fruit
Colchicaceae			
<i>Gloriosa superba</i>	Niyangala	Rhizome – Colchicine (alkaloid) is the principle poison; fatally poisonous.	All lowlands and intermediate zone
Euphorbiaceae			
<i>Euphorbia antiquorum</i>	Daluk	Latex	Dry and intermediate lowlands
<i>Excoecaria agallocha</i>	Tela, Tela-kiriya Blinding tree, Agallocha (E)	Acrid sap causes blisters on skin	Associate of Mangroves

Family Species	Local names E = English	Poisonous parts; Chemical Effect	Origin, if introduced; General distribution; Remarks on occurrence in CP
<i>Manihot esculenta</i>	Manyokka, Maiokka. Cassava, Manioc, Tapioca (E).	Tubers contain cynogenic glucocide	Origin: South America – widely cultivated for food in low and mid country
<i>Manihot glaziovii</i>	Ali-manyokka, Gas- manyokka Ceara rubber (E)	Tubers contain cynogenic glucocide	Origin: South America – Introduced as a source of rubber – naturalized in lowlands to mid country
<i>Sapium indicum</i>	Kiri makulu	Latex acrid and poisonous	Coastal plant – not recorded in CP
<i>Tragia hispida</i>	Wel-kahambiliya	Plant covered with stinging hairs	Dry and intermediate zones
Fabaceae			
<i>Abrus precatorius</i>	Olinda. Indian liquorice, Crab's eye(E)	Seed coat – principle poison is abrin – not known to be fatal	Mainly in dry zone
<i>Acacia auriculiformis</i>		Pollen toxic to bees	Origin: Australia – Introduced in forestry
<i>Delonix regia</i>	Mayi, Malmara Flamboyant, Flame tree (E)	Pollen	Origin: Madagascar – cultivated flowering tree
<i>Derris scandens</i>	Kala-wel, Bokala- wel	Bark and roots used as fish poison	Dry and intermediate zones
<i>Derris trifoliolata</i>	Kala-wel	Bark and roots used as fish poison	Coastal and mangrove- not recorded in CP
<i>Lathyrus sativus</i>	Grass pea, Vetchling (E)	Seed poisonous to goats	Origin: Not known - cultivated as a vegetable
<i>Leucaena leucocephala</i>	Ipil-ipil	Poisonous to domestic herbivores – contain mimosine	Origin: Tropical America- cultivated for fodder, green manure and in forestry; currently naturalized
<i>Mucuna atropurpurea</i>	Gini-pus wel, Bu- chariya	Pod covered with irritant bristles	
<i>Mucuna gigantea</i>	Kana-pus wel	Pod covered with irritant bristles	
<i>Mucuna monosperma</i>		Pod covered with irritant bristles	
<i>Mucuna pruriens</i>	Achariya, Achariya- palu Cowage, Cowitch(E)	Pod covered with irritant bristles; bristles absent in some cultivars	Mainly in dry zone – often cultivated

Family Species	Local names E = English	Poisonous parts; Chemical Effect	Origin, if introduced; General distribution; Remarks on occurrence in CP
Flacourtiaceae			
<i>Hydnocarpus</i> <i>venenata</i>	Makulu	Fruits used as fish poison	Endemic - Lowlands
Lobeliaceae			
<i>Lobelia</i> <i>nicotianifolia</i>	Rasni. Wild tobacco (E)	Leaves and seeds are acid and poisonous	Montane and sub-montane zone.
Loganiaceae			
<i>Strychnos nux-</i> <i>vomica</i>	Goda-kaduru. Nux vomica(E)	Seeds – poisonous principle is strychnine (alkaloid)	Dry zone
Plumbaginaceae			
<i>Plumbago</i> <i>zeylanica</i>	Ela-netul. Ceylon leadwort (E)	Roots acrid and poisonous	Wastelands in dry zone – cultivated
Moraceae			
<i>Streblus asper</i>	Geta-netul Crooked-rough- bush(E)	Bark is an irritant poison	Dry lowlands to mid country
Nyctaginaceae			
<i>Mirabilis jalapa</i>	Hendirikka. Four o'clock flower, Marvel of Peru (E)	Roots and seeds	Origin: Peru in South America – cultivated as a flowering plant.
Passifloraceae			
<i>Adenia hondala</i>	Hondala	Fruits and seeds – Fatally poisonous	All lowlands
Solanceae			
<i>Datura metel</i>	Attana, Kalu-attana	All parts, especially seeds	Origin: probably India - cultivated – sometimes occur as an escape in wastelands in lowlands.
<i>Datura</i> <i>stramonium</i>	Thorn apple(E)	All parts, especially seeds	Origin: Tropical America – not recorded in CP.
<i>Datura</i> <i>suaveolens</i>	Rata attana. Trumpet flower (E)	All parts, especially seeds	Origin: Tropical America – Naturalized in CP (montane zone)
<i>Solanum</i> <i>nauritianum</i>	Hak-kirilla	Fruits	Origin: South America – naturalized in mid country.

Family Species	Local names E = English	Poisonous parts; Chemical Effect	Origin, if introduced; General distribution; Remarks on occurrence in CP
Urticaceae			
<i>Dendrocnide sinuata</i>	Ma-ussa Devil nettle (E)	Leaves, tender stems and inflorescences covered with fine stinging hairs	Wet and intermediate lowlands and mid country
<i>Girardinia diversifolia</i>	Gas-kahambiliya Nilgiri nettle(E)	Plant covered with stinging poisonous hairs	Waste grounds in montane and sub-montane zones
<i>Laportea bulbifera</i>		Stinging hairs on tender parts – the pain does not last for a long time	Montane and sub-montane zones

Sources: Macmillan (1935), Hasanuzzaman (2003) and contributions by the author

10.6 Cardamom cultivation

The cardamom cultivation is the most serious threat to the forest vegetation of the Knuckles Forest Region. About 50% of the cardamom cultivation occurs above 1000 m altitude. Therefore it is the MEEF vegetation that is exclusively degraded due to clearing of the forest understorey to promote the growth of the cardamom at the expense of saplings of canopy tree species. The cardamom cultivation on commercial scale was commenced in 1805. Although the FD had issued permits in 1960 to cultivate cardamom in an extent of only 75 hectares (615 hectares according to some), the present area of its cultivation stands at about 3000 hectares. In spite of several methods adopted by the FD to curtail the cardamom cultivation in the Knuckles, villagers are still continuing the practice, as the crop fetches a high price (Rs. 1400 per kg of dried cardamom – grade LLG 1 October 2007). According to a survey conducted by the FD early this decade, about 500 blocks of cardamom, each ranging from 2-200 hectares were located within the Knuckles forest range. The forest area of approximately 21% of these sites was in a heavily degraded state, while 12% of the sites consisted of an open canopy forest. The issue was further aggravated due to the location of about 90 cardamom processing and drying barns located in the Knuckles region, and all these barns were operated with fuel wood gathered from the forest (Bambradeniya & Ekanayake 2003).

Apart from the Knuckles Forest Range, MEEF patches in the Central Highlands (e.g. Kabaragala, Loolkandura (Loolcondara) are also similarly threatened by the cardamom cultivation.

10.7 Chena cultivation

In the dry and intermediate zones of the CP, the farmers do not prefer grasslands for cultivation due to poor soil fertility in the above habitats. Instead, they clear scrublands, possibly SPOF, for chena cultivation. Invariably, such sites have been chena lands in the past. Chena cultivation is usually done during the 'Maha' season and the farmers cultivate annual crops such as pumpkin, maize, sesame, manioc and several low country vegetables. As most of the chena lands belong to the state, this practice often is illegal.

10.8 Ilicit felling

This is generally a nation-wide problem for the biodiversity conservation. Besides deforestation, excessive exploitation of timber has had several adverse effects, so that even the forests that remain are heavily depleted in terms of biodiversity. The frequency of forest-related offences is generally indicative of the extent of the destruction caused to the forest resources. These offences include illegal entry into the PAs, felling and/or sawing trees inside PAs, clearing of forests either for

habitation or cultivation, setting fire to the forests, possession and transport of timber without a legal permit, collecting fuelwood inside PAs, running carpentry workshops in the vicinity of PAs, mining, quarrying and poaching etc. inside PAs. However, it should be noted that the recorded forest offences are only a tip of an iceberg, as there can be many more offences that go unnoticed and undetected.

10.9 Forest fires

The occurrence of forest fires, especially on grasslands, e.g. DPTG, during drought is a common phenomenon in the CP. Grassland fires in Hantana mountains is almost an annual event, occurring often during February-March. Apparently, the pine cultivation facilitates the spread of forest fires at Hantana. They are frequently caused by the hunters and livestock owners and by the chena cultivators in remote areas. Severe soil erosion due to fires is not very visible as 'Iluk' (*Imperata cylindrica*) and 'Mana' (*Cymbopogon nardus*) regenerate rapidly after the outbreak of fires. After ground fires many hard coated seeds germinate rapidly with the onset of 'Maha rains'. However, as they are unable to survive with competing grasses, such as 'Iluk' and 'Mana', many seedlings will be suppressed and destroyed by the ground fires of the following drought.

10.10 Over-exploitation of medicinal plants

Over-exploitation of NWFP had led to the destruction of many medicinal plants and other multiple use trees in their natural environment. (See Section 7.4.1.1).

10.11 Pollution by pesticides and chemical fertilizers

Although the paddy cultivation has been performed under traditional practices for several decades in the CP, the farmers have begun to use pesticides and chemical fertilizers since of recent times; often these are over-used due to lack of awareness and agricultural extension services. Chemical residues carried in run-off pollute streams, resulting in harmful impacts on aquatic life.

10.12 Forest die-back

This phenomenon, known also as 'canopy die-back, forest decline, species-level die-back, cohort senescence, stand-level die-back and 'waldersterben' (forest damage), due to which the forests lose their vivacity and the trees cease growing and leaves discolor and fall off leaving a bare framework of branches. This could either lead to die-back or cause 'stag headedness'. Horton Plains, Hakgala, Pidurutalagala, Pattipola-Ambewela, Ohiya and the Knuckles (Koboneelagala near Corbet's Gap) are known to be affected by forest die-back. The studies conducted in Horton Plains have shown that the forest die-back is not species-specific in that 38% of plant species are affected by it. Unfortunately, 37 species of all species studied, were die-back prone and 26 (70%) of this are endemic to Sri Lanka. Die-back can be disastrous, when a cluster of trees of the same species contract it. The whole cluster could die at the same time. *Calophyllum walkeri* ('Keena') and *Syzygium rotundifolium* in Totupolakanda are examples of such clusters and they have literally disappeared from this area. Areas with severe die-back were the western (windward) slopes of Totupolakanda. The peaks of the area are frequently covered with fog and this is known to be another instigating factor for die-back.

When this phenomenon was first observed in Sri Lanka in the 1960s, the research community came up with numerous hypotheses such as low absorption of nutrients by plants, the dropping of groundwater table, decesses, acid rain, damage caused by sambur, climatic change and lead toxicity. One striking find was the significantly high lead content in the soil, especially in the windward aspect of the forests, e.g. the ridges of Totupolakanda and Kirigalpotta, where die-back has done major damage. Furthermore, the amount of lead in trees of Hakgala was 15-30 ppm. The most plausible explanation seems to be that lead generated by industrial activities, especially in the

south-west, are carried over to these forest areas by the south-western monsoon. However, it has been suggested that other contributory factors such as high concentration of iron, manganese and aluminium can be toxic to some species. It is known that higher doses of iron reduce the amount of nitrogen absorbed by plants. These scenarios can also be made worse by high soil acidity and acid rain. The researchers suggest that more of the research conducted, should focus on the sources of lead.

10.13 Feral buffaloes

Pitawala patana in the Knuckles serves as the grazing land for a large number of buffaloes (feral and domestic) and cattle and the overgrazing has apparently denuded the natural integrity of this delicate and unique ecosystem. This has already caused notable reduction in the populations of 'Patan ala' (*Brachystelma lankana*), a plant endemic to the Knuckles (see Section 7.2.4.1).

10.14 Over-visitation

Over-visitation and associated effects, such as disposal of garbage, pollution of soil and water resources, disturbance to the fauna by noise and removal of plants and animals, impact negatively on the environment especially in the Peak Wilderness, Horton Plains and Pitawala Patana in the Knuckles.

CHAPTER 11

11. BIODIVERSITY RELATED INSTITUTIONAL ASPECTS

The BCAP (MENR 2005) has dealt with biodiversity-related institutional aspects at national level. It considers that the institutional analysis as the critical first step in the implementation of National Biodiversity Strategies and Action Plans (NBSAP) to identify institutional impediments, requirements and capacity enhancement. In most biodiversity-rich developing countries, resource constraints in institutions tend to be a major restraining factor in implementing biodiversity conservation actions. In order to circumvent such situations, the common remedy has been to establish new institutions, which by itself leads to further drain on scarce resources.

It is now generally accepted that implementation of NBSAP should be through strengths in existing institutions independent of any external funding, which often tends to favor a project-driven approach rather than a nationally committed plan of activities. Such an implementation framework will also facilitate the integration of NBSAP into sectorial and cross-sectorial plans, programs and policies. Integrating biodiversity concerns into various programs implemented by different institutions is critically important to ensure overall conservation of biodiversity in the country.

At the national level, the overseeing of the implementation of the BDFAP has been placed within the Ministry dealing with the subject of Environment, which is also the national focal point for the CBD. To ensure that this overall responsibility is effectively discharged, the BDFAP had proposed an institutional structure that comprises: a) a **Biodiversity Secretariat** within the confines of the Ministry to coordinate and promote the implementation of all programs and projects under the BDFAP; b) a **National Steering Committee** (NSC), an apex body for high level coordination and policy formulation at national level; c) several **Task Forces** to provide expert guidance to the BS in translating policy guidelines into viable implementation programs; and d) **Implementing Agencies** assigned with the implementation of programs and projects.

The following ministerial functions are of vital importance in relation to the conservation of biodiversity:

Environment

Natural Resources

Fisheries

Ocean Resources

Agriculture

Livestock

Health and Nutrition

Human Resources

Education

Culture

Archaeology

Land

Science and Technology

Availability of adequate institutional capacity for biodiversity conservation (as appropriate to their functions) in the aforesaid subjects is critical for the successful implementation of the BDFAP recommendations. There are also several ministries and other agencies that, although not directly concerned with biodiversity conservation, are involved in implementing policies, programs and plans which have significant implications for biodiversity conservation. These subjects are as follows:

Policy Development and Implementation

Tourism

Transport

Industries

Although the private sector has a major part to play in sustainable use of biodiversity, its contribution has been insignificant in the past. For instance in development of nature-based tourism, export of ornamental fish and aquatic plants, bioprospecting, forest plantation industry etc., the potential has to be identified, and that they are made aware, that making such a contribution is also in their long-term interest.

Community Based Organizations (CBOs) and Non Government Organizations (NGOs) have been increasingly engaged in conservation and related activities in partnership with and facilitated by the government during the past five years. Over 300 NGOs engaged in environmental programs are registered with the CEA, of which about half are involved in biodiversity conservation.

The ministries and relevant agencies that were designed to take a lead role in implementing BDFAP recommendations, as identified by the BCAP report (2005) are given in the Table 11.1.

Table 11.1 Institutions identified by the BCAP (2005) to take lead in implementation of BDFAP (with modifications)

Sector	Agency
Forest and wildlife	MENR, FD, DWC, LRC, CEA, NSF, Provincial Councils, Divisional Secretariats, Local Authorities, IDB, NBRO, Ministry of Industries, Ministry of Plantations, DAYur, UDA, Universities, CBOs, NGOs, Private sector
Wetlands	MENR, NARA, CEA, FD, DWC, SLTB, DFAR, NAQDA, Provincial Councils, Divisional Secretariats, Local Authorities, NSF, Universities, Task Force NWSC
Coastal and Marine	MENR, NARA, CCD, DFAR, DWC, FD, CEA, UDA, Ministry of Industries, SLTB, Provincial Councils, Divisional Secretariats, Local Authorities, Irrigation Department, NSF, ITI, NBRO, ICTAD, NASTEC, GSMB, Police Department, NAQDA, MPPA, Universities, CBOs, NGOs.
Agriculture (including plantation, fodder and medicinal crops)	MENR, DAG (PGRC, RRDI, HORDI, FCRDI), DEA, Ministry of Plantation Industries, TRI, RRI, CRI, SRI, Ministry of Indigenous Medicine, DAYur (BMARI), NARA, Department of Botanical Gardens, Department of Zoological Gardens, DWC, FD, DAPH, VRI, UDA

CHAPTER 12

12. POLICIES AND LEGISLATION ON BIODIVERSITY

12.1 Biodiversity-related policies

The absence of a comprehensive policy framework specifically formulated to address the gamut of issues related to biodiversity has been a setback to the efforts to implement BDFAP. Although there are various sectoral and theme-related policies, strategies and action plans that impinge on biodiversity, the absence of an integrated policy framework has led to the existence of many gaps in biodiversity conservation policy. Strategies and policies are not in place to establish conditions needed for compatibility between present use and the conservation of biodiversity, and sustainable use of its components. It is also clear that the necessity for national policies on specific issues such as germplasm conservation, information management, *ex situ* conservation, biosafety, and access to genetic resources and benefit sharing have not received adequate attention. Further national policies do not provide for information on conservation and sustainable use of biological resources that could facilitate national planning and decision-making.

The BCAP (2005) reviewed a total of 32 policies, strategies and action plans concerning conservation of biodiversity in Sri Lanka. It also conducted an analysis of the gaps and issues that prevail in these areas and proposed guidelines to formulate integrated policies and strategies for the thematic areas such as *in situ* conservation; *ex situ* conservation; access to genetic resources; sustainable use of components of biodiversity; Cartagena Protocol on biosafety; research, training, public education and awareness; SBTTA recommendations; impacts on biodiversity; traditional knowledge and lifestyle; monitoring and coordination and capacity building in relation to EIA.

Once the comprehensive biodiversity-related national policies are developed, delving into the development of such policies with regard to provincial requirements may be attempted within the provisions provided by the constitution of Sri Lanka.

12.2 Legal framework on biodiversity

As discussed in the BCAP (2005), the current events indicate that the existence of a legal framework will in itself not guarantee the achievement of conservation objectives, unless it recognizes the practical dimensions that define conservation issues. Whilst formal conservation legislation has been in operation in Sri Lanka since the late 19th Century, the conservation challenges are arguably more severe and numerous today. The reason for this may lie partly in external factors. A key lesson that should be recognized in future legal conservation frameworks is the inextricable link between ecosystems and people. A population density of over 300 people / km², and the high exposure to global markets have increased the competitive use of resources between people and other BD functions to a critical scale.

Prohibition alone therefore, will fail to address the real and legitimate development needs of human communities. Regulation and prohibition, although is a useful basis for resource use, will need to be combined with rules that strive to promote more participatory approaches for the stewardship of natural resources to enable sustainable tradeoffs between people's needs and aspirations, and the evolution of conservation objectives. This means that as much as rights and obligations may be stipulated in laws, most resource use problems will only be resolved through processes of dialogue that identify alternate means of reaching genuine needs, and this should be facilitated through the legal regime. Therefore there should also be a greater role for non-state sector actors in BD conservation given the multiplicity of threats to species.

BCAP (2005) has analysed the gaps and issues in the existing legislature and developed recommendations related to cooperation and partnership building between stakeholders. Accordingly, the key features to be resolved in the present laws include the following:

Jurisdictional overlaps and uncertainties – The sectoral division of responsibilities has resulted in multiple jurisdiction which often overlap or fragment the management of a natural system between several state agencies. This entrenched compartmentalization has severely hindered coordinated planning, more often, in fact leading to inter-agency competition and conflict.

Inability to balance conservation and developmental priorities – The emphasis on law enforcement, e.g. prohibition of unsustainable activities, failure to address the socio-economic factors that often underpin unsustainable resource use, failure to promote participatory dialogue to explore more creative solutions that could balance conservation objectives and legitimate development aspirations, and creation of unserviceable financial and human burden on the state through the need for constant enforcement disturb the balance between conservation and developmental priorities.

Poor governance – The type of governance resulting from political patronage and administrative inefficiencies in the system as a whole serve to undermine the rule of law.

CHAPTER 13

13. RECOMMENDED ACTIONS FOR CONSERVATION AND SUSTAINABLE USE OF PROVINCIAL BIODIVERSITY

The issue of biodiversity utilization (whether sustainably or otherwise) has become increasingly contentious in view of the growing divergence between adherents of two forceful conservation paradigms: preservation and sustainable use. The growing population and consequent demand for natural resources has led however, to the need to ensure that such use is 'sustainable', i.e. that resources are used today in a manner that assures their availability also to future generations.

The CBD envisages a transition from protecting the elements of biodiversity (e.g. animals, plants, landscapes) for their own sake, to one of providing economic incentives, while ensuring that benefits are equitably shared. It is necessary therefore that the demands for utilization of biological resources be balanced against public concern for their sustainable use within a framework of ethical principles.

The BCAP (2005) has analysed this thematic area with emphasis on gaps and made appropriate recommendations of which those that have relevance at provincial levels are cited along with recommendations that are special to the Central Province and prioritized according to the views of the participants at the final workshop in Table 13.1.

Table 13.1 Issues and recommendations related to sustainable use of provincial biodiversity

Issue	Recommendation
The shortage of cultivated timber and slow pace of harvesting from plantation forests has led to shortage of sawn-wood and increased illegal logging	Strive for efficiency in sustainable harvesting of state Forest plantations can supply sawn-wood at reasonable cost in order to minimize illegal logging of natural forests; promote private sector forest plantations.
Damage done to species, habitats and ecosystems in the past through unsustainable use has not been addressed through restoration programs	Conduct a study on serious impacts that occurred in the past in conservation areas, especially in fragile ecosystems; the study may be based on viability assessment methodology used in the Gap Analysis in Protected Areas (Jayasuriya et al. 2006), supported by ground truthing; plan and implement suitable restoration activities in such areas.
Clear-cutting while harvesting of timber in forest plantations	Spaced harvesting of timber
Over-dependence on firewood is leading to deforestation, especially in MOEF	Develop and implement a plan, and provide incentives, to establish community woodlots in un-utilized lands close to areas of high biodiversity to minimize extraction of firewood from such areas
Indigenous crop plants and their genetic variability are not conserved and protected	Inventorize indigenous crop genetic resources
Degredation of river bank habitats	Effective action on river bank conservation

Issue	Recommendation
Degredation of special ecosystems/habitats	Identification and conservation of special ecosystems/habitats
Harvesting of plants for food and other consumptive uses may not be sustainable	Assess viability of production from principal wild food plants, e.g. kitul, goraka, siyambala, divul, madu, patan ala etc., identifying distribution, socio-economic impact, harvesting levels, sustainability issues, and formulating regulations to assure sustainability.
The present legal and regulatory framework does not encourage research, education and awareness functions that are beneficial to biodiversity conservation	Develop a system that promote and support research, education and awareness relevant to biodiversity conservation and share of information between stakeholders.
Non-systematic agriculture, especially in Nuwara-Eliya District	Eco-friendly agriculture
Lack of attention on home garden production of timber	Promotion of home gardens for increased timber production
Extraction of ornamental plants, e.g. orchids, is a threat to their natural populations	Encourage cultivation at commercial scale.
Tourism in environmentally sensitive areas may not be sustainable; unregulated tourism development adversely affects ecosystems by altering landscape aesthetics	Institute a regulatory regime over development activities in pristine habitats
Lack of information on biodiversity	Compilation and promotion of use of biodiversity information
Continuous collection of wild fish may not be sustainable	Regulate the harvesting of freshwater fish from the wild and facilitate culture in captivity, for trade and ex situ conservation; licence collectors and establish quotas for collections of high-turnover and high-value species
Harvesting of medicinal plants from the wild is not regulated so as to assure sustainability	Following on from WB/GEF Medicinal Plant Conservation Project, and in association with the Ministry in charge of Indigenous Medicine, develop a database on distribution with GIS data and harvesting levels of medicinal plants.
Non-implementation of biodiversity regulations	Effective implementation of biodiversity regulations
The ornamental fish industry has introduced a large number of IAS	Establish and regulate a positive list of freshwater organisms that may be imported alive, so as to minimize the risk of further releases of potential IAS

CHAPTER 14

14. ACTION PLAN

A biodiversity conservation action plan is considered as the culmination of a comprehensive assessment of biodiversity. The Action Plan developed by the BCAP (2005) was adapted at the provincial level with refinements procured through consultative processes (Table 14.1). The relevant stakeholders in the CP made contributions in consideration of issues that are relevant to biodiversity conservation, recommendations to minimize threats to biodiversity, institutional capacity and availability of resources within an identified level or region. However, in consideration of the the changing situation, the proposed action plan should be further reviewed within the precinct of the CP, in terms of availability of human and financial resources.

In many actions, the responsible institutions are shown to be those belonging to the central government. However, the Central Provincial Council assumes the main coordinating function to bring synergy between the relevant institutions. The total time frame is given as five years. Attempts should be made to plan and initiate many actions as possible during the year 1 and proceed to achieve their goals through a definite time frame. It is proposed that this draft action plan be reviewed through an intensive consultation process in order to refine it with information on specific details and cost for each activity.

Table 14.1 Action plan for biodiversity conservation in the CP

Yr = Time frame (Number of years)

Classified Action	Responsible Institution	Yr
<i>In situ Conservation</i>		
Identify critically important sites, in terms of biodiversity, outside PAs and bring them under relevant PA categories.	FD, DWC, Universities, ORO	5
Attempt to identify biodiversity hotspots within CP and place them in appropriate conservation categories.	Universities, ORO	
Survey and mark PAs followed by gazetting of the boundaries.	LCD, SD, DWC,FD	
Identify and establish appropriate biological (genetic) corridors to bring about connectivity between existing PAs; for this purpose, patches of natural vegetation and managed landscapes should be used.	FD, DWC	5
Conduct viability assessment of critical PAs using Gap Analysis methodology; implement restoration of degraded PAs to ensure in situ conservation of critical biodiversity.	FD, DWC	5
Promote and support home gardens to achieve high productivity and diversity to ensure on-farm conservation of agro-biodiversity and agro-forestry.	HORDI/Dag, FD, CPC	
<i>Ex situ conservation</i>		
Coordinate with PGRC to conduct exploration of PGRs in the CP and conserve them at PGRC.	PGRC/Dag, CPC	1
Take action to upgrade the PGRC to a national institute for ex-situ conservation of PGRs that includes not only the agricultural crops, but	MENR, MAg, Dag	

Classified Action	Responsible Institution	Yr
also other crops, such as fodder, medicinal, plantation and export agricultural crops and also potentially important and threatened plants.		
Coordinate exploration and conservation of AnGR	CPC, VRI, DAPH, NGZ	
Establish refugia, e.g. arboreta and medicinal plant gardens, in temples and other places of religious worship, where possible.	CPC, MENR, MIM, FD	3
Promote in-vitro propagation of selected wild plant species that are of economic and conservation importance, e.g. medicinal (Bin-kohomba and Kothala-himbutu etc.) and ornamental species (orchids, Cryptocoryne spp.).	PGRC, DNBG, DA, MIM	5
Culture / conserve in captivity of animals of commercial / conservation importance, e.g. ornamental fish.	NARA, CPC	5
Impacts on Biodiversity		
Assess the impacts of national and urban developmental projects that are located in the CP, climate change, agrochemicals and pollutants on biodiversity.	MENR, CEA, UDA, Universities, ORO	5
Integrate biodiversity concerns into EIA	CPC, CEA	
Assess threats to natural species of flora and fauna occurring in the CP according to IUCN 2007 Red List	MENR, Universities	1
Introduce remedial measures to minimize threats to threatened flora and fauna (aquatic and terrestrial) including a mechanism to regulate and monitor the collection of protected plants and animals (hunting).	FD, DWC, MIM	3
Promote cultivation of native plants with high commercial demand, e.g. medicinal plants, and culture in captivity of such animals, e.g. ornamental fish.	MIM, NARA, UPC	5
Provide incentives for private sector's involvement in plantation forestry to meet with increasing demand for sawn timber in order to reduce dependence on natural timber species.	STC, MPI, FD, LCD	5
Establish community woodlots in un-utilized lands close to areas of high biodiversity to minimize extraction of firewood from such areas; commercial woodlots, e.g. Gliricidia, in wastelands; promotion of energy-saving hearths; alternate sources of energy for industries, e.g. mini-hydro power plants for tea industry	UPC, FD, LCD, MPI, NGOs	5
Regulate chena cultivation; re-use existing plots without opening new forest areas	CPC, FD, DWC	3
Proliferate organic farming; minimize pesticide use.	Dag, CPC	4
Prepare long-term plans to mitigate human-elephant conflict: Identify seriously affected areas; establish electric and live fences; translocate settlers in PAs and elephant corridors; implement Elephant Policy.	DWC, FD, MASL, MENR, CPC	3

Classified Action	Responsible Institution	Yr
Initiate a survey of IAS and their ecological and economic impacts; prioritize IAS for their control and management; implement quarantine regulations during import of materials; implement Plant Protection Act; conduct research on methods to control the spread of IAS.	DAG, NARA, DWC, FD, MENR, CPC	3
Parthenium weed problem in the CP (e.g. Kibissa): Intensive manual weeding and burning during successive seasons until the weed completely disappears. This has to be done cautiously, as the weed is known to cause skin and other health problems. Protective clothing should be worn and subsequently washed to prevent the possible allergies. To ensure effective control, plants must be removed before they seed and the whole plant must be pulled out to prevent regeneration from remaining parts.	CPC, Dag	2
Coordinated arrangements should be made with DAG to introduce and monitor the effects of BCA – Epiblema strenuana (stem-galling moth) and Puccinia melampodii (fungus) in all affected areas.	CPC, DAG	1
Spread of Giant Mimosa ('Yoda nidikumba'): Plan and implement suitable control measures	CPC, MASL, UP	1
Implement legal action against intentional anthropogenic firing of vegetation; create necessary awareness among relevant communities.	FD, CPC	3
Implement proposed activities to reduce cardamom cultivation and harvesting within reserve areas, especially in the Knuckles and some parts of the Central Hills. At suitable altitudes i.e. 900 – 1400 m, establish broad-leaf forest plantations to promote cardamom cultivation by the state and private sector.	FD	5
Enforce regulations to curb environmental pollution in reserve areas, e.g. Peak Wilderness, Horton Plains, Pitawala Patana (Knuckles) and Udawattakele. Establish / improve visitor centers and facilities in order to promote tourism and reduce environmental impacts due to over-visitiation	DWC, FD	3
Restore river and stream reservations	MIP, MASL	5
Implement Soil Conservation Act	DAG	3
Conduct further research on forest die-back.	Universities, GSMB	
Take measures to protect delicate ecosystem at Pitawala Patana from feral buffaloes and stray cattle.	FD	2
Traditional Knowledge and Cultural Biodiversity		
Prepare a provincial register of traditional knowledge.	CPC	2
Survey traditional knowledge and rituals associated with agriculture.	CPC, NGOs, DAG, Universities, ORO	2
Conduct research on traditional medicine and related practices based on plants and animals.	MIM, BMARI	3
Ensure preservation of archeological sites containing important biodiversity.	DArch	

Classified Action	Responsible Institution	Yr
Ensure preservation of cultural sites, e.g. temples with important paintings depicting biodiversity.	MCA	2
Education, Training and Awareness		
Establish school environmental clubs and link them with relevant agencies to enhance knowledge, skills and involvement in BD conservation activities.	CPC, MENR	2
Promote universities to conduct research on biodiversity-related matters in CP and involve local environmentalists, students and others followed by information sharing.	CPC	5
Institutional and Capacity Building		
Enhance capacity/coordination/mandate of environment division of CPC with assistance from MENR. Establish a Biodiversity Conservation Unit within the CPC to oversee the effective implementation and monitoring of the progress of the biodiversity conservation. This Unit should represent the government, private and NGO sectors. One of the first activities of the Unit would be to review this profile and to develop an operational document out of the Action Plan. The Unit should not be another body, but an effective institution with sufficient powers and authority to implement the Action Plan and to hold those who are responsible for the loss of biodiversity accountable.	CPC, MENR	5
An active role in coordinating all environment –related activities performed by national and local agencies within the CP, e.g. cross-sectorial plans, along with capacity building of CPC.	CPC	5
Utilization of biodiversity and economic aspects		
Link biodiversity interests into tourism (cultural sites, handicrafts, agro-biodiversity, traditional food, traditional medicine, bird watching, hiking etc.); promote eco-tourism for utilization of important sites (develop facilities such as road improvement, transport, hotel / lodging facilities, guide services and information)	SLTB, UPC, DWC, FD, MIM, DArch	5
Develop regulations to mitigate negative impacts of eco-tourism	CPC	2
Regulate extraction of natural biological resources [medicinal plant products, e.g. Asoka (ma-ratmal), Wel-madata (Manda-madini-wel), Kiratha etc.] and maximize benefits by value addition	CPC, Private Sector	5

CHAPTER 15

15. GLOSSARY AND DEFINITIONS

Biodiversity: (= biological diversity) The definition given by Article 2 of the Biodiversity Convention is “The variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems”. A simpler definition is the total range of the variety of life on earth or any given part of it.

Biodiversity hotspot: A location that features an exceptional concentration of species with exceptional levels of endemism and faces exceptional degree of threat.

Biogeography: The scientific study of the geographic distribution of organisms.

Bioregion: A territory defined by a combination of biological, social and geographic criteria, rather than geopolitical considerations; generally, a system of related, interconnected ecosystems.

Bioresources: (=biological resources) Those components of biodiversity of direct, indirect, or potential use to humanity.

Biosphere Reserve: An area of terrestrial or coastal / marine ecosystem, or a combination thereof, which is internationally recognized within the framework of UNESCO’s program on Man and Biosphere (MAB).

Buffer zone: The region bordering a protected area where restrictions are placed upon resource use or special development measures are undertaken to enhance the conservation value of the protected area.

Chena: (= shifting cultivation) Probably the oldest form of agricultural practice in Sri Lanka, widespread in the country until recently, but now confined largely to the dry zone. This involves clearing of a forest area for cultivation which may continue for two to three years after which it is abandoned for a new site.

Climax vegetation: The plant community which would finally develop in an area in the absence of human intervention.

Conservation of biodiversity: This covers human actions totally preserving any component of biodiversity to using biological resources provided that such use is within sustainable limits and does not cause erosion of biological diversity. In the CBD and in the BCAP, the expression “conservation and sustainable use of biological diversity” is frequently used to give emphasis to the aspect of conservation that includes the wise and sustainable use of the components of biodiversity.

Convention on Biological Diversity: This Convention was signed by over 150 countries at the Earth Summit (The United Nations Conference on Environment and Development) in Rio in 1992. The objectives of the Convention are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.

Cryopreservation: The long-term storage of germplasm using liquid nitrogen at -196°C .

Demographic: Pertaining to the science of vital and social statistics as of the births, deaths, marriages, etc. in human populations.

Ecosystem: A community of interdependent organisms and the environment they inhabit.

Ecotourism: As defined by IUCN's ecotourism program: "Environmentally responsible travel and visitation to relatively undisturbed natural areas, in order to enjoy and appreciate nature that promotes conservation, has low visitor impact and provides for beneficially active socio-economic involvement of local people.

Edaphic: Environmental conditions that are determined by the physical, chemical and biological characteristics of the soil.

Endangered: Taxa in danger of extinction and whose survival is unlikely if the causal factors continue to operate.

Endemic: Restricted to a specific locality or country or region.

Ethnobotany: The study of the relationships between people and plants in the broader sense. It requires a multidisciplinary approach, incorporating anthropology and ethnology, botany, linguistics and in some cases economics, pharmacology, medicine and agronomy.

Ex situ conservation: Keeping components of biodiversity alive outside their original habitat or natural environment.

Extinct: Species not definitely located in the wild during the past 50 years (criterion used by the CITES)

Genebank: A facility established for the ex situ conservation of individuals (seeds), tissues or reproductive cells of plants or animals.

Germplasm: The protoplasm of germcells containing the units of hereditary, the chromosomes and genes.

Global Environment Facility: A fund set up in 1992 and managed by the World Bank, UNDP and UNEP to assist developing countries to address issues relating to the conservation of biodiversity, climate change, ozone depletion and international waters.

Habitat: The natural dwelling place of an individual or group of organisms.

Home gardens: A traditional system of perennial cropping that uses a range of economically valuable plant species producing fruits, spices, timber, medicinal ingredients, etc. It offers a highly diversified and economically viable form of land use found around a house.

In situ conservation: The conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties.

Mahawansa: Chronicle of Sri Lanka's history covering the period 6th century BC to 4th century AD.

National Park: In Sri Lanka, a category of protected area designated under the FFPO. It falls within the IUCN Protected Area Management Category II – a natural area of land and / or sea, designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations, (b) exclude exploration or occupation inimical to the purpose of designation of the

area, and (c) provide a foundation for spiritual, scientific, educational and visitor opportunities. All of which must be environmentally and culturally compatible.

Phylogenetic: Pertaining to the evolutionary history of a particular group of organisms.

Protected area: An area of land (and / or sea) especially dedicated to the protection and maintenance of biological diversity, and of natural and cultural resources, and managed through legal or other effective means.

Red Data Books: Catalogs published by IUCN the World Conservation Union, or by national authorities listing species which are rare or in danger of becoming extinct globally or naturally.

Sanctuary: A category of protected area in Sri Lanka that may contain both state and private land.

Sustainable development: Development that meets the needs and aspirations of the current generation without compromising the ability of future generations to meet their needs.

Taxonomy: The grouping and naming of organisms on the basis of structural, genetic and ecological similarities.

Threatened: A general term used to denote species which are 'Endangered', 'Vulnerable', 'Rare', 'Indeterminate', or 'Insufficiently Known' (IUCN Red Data categories).

World Heritage Site: A site designated under the 1972 Convention on the Protection of the World Cultural and Natural Heritage.

REFERENCES

- Abeyawardana, H.A.P. (2004). Heritage of Kandurata. Kandurata Development Bank, Kandy, 397 pp.
- Amarasinghe, A.A.C.A., S.Premaratne & G.G.C.Premalal. (2004). Identification of suitable pasture / fodder varieties for saline soils in Sri Lanka. Proceedings of the Thirteenth Annual Students Research Sessions, Department of Animal Science, University of Peradeniya.
- Amarasinghe, U.S., R.R.A.R.Shiranth & M.J.S.Wijeyaratne (2006). Some aspects of ecology of endemic freshwater fishes of Sri Lanka. In C.N.B. Bambaradeniya (ed.). Fauna of Sri Lanka: Status of Taxonomy, Research and Conservation. IUCN, Colombo, viii + 308 pp.
- Amarasinghe, L. & I.A.Ekneligoda. (1997). Some recent observations on the biological control of *Salvinia*. *Krusha* 16: 44-50.
- Andrew, W.D. & A.B.P.Jayawardena (1971). Kikuyu Grass – *Pennisetum clandestinum* and its value in the montane region of Ceylon. *Tropical Agriculturist* 127 (1).
- Ashton, P.S. and C.V.S.Gunatilleke (1987). New light on the plant geography of Ceylon. I - Historical Plant Geography. *Journal of Biogeography* 14:249-285.
- Bahir, M.M. & R. Pethiyagoda (2006). Conservation of Sri Lankan freshwater crabs, 77-83. In C.N.B. Bambaradeniya (ed.). Fauna of Sri Lanka: Status of Taxonomy, Research and Conservation. IUCN, Colombo, viii + 308 pp.
- Bambaradeniya, C.N.B. (2002). The status and implications of alien invasive species in Sri Lanka. *Zoos' Print Journal* 17 (11): 930-935.
- Bambaradeniya, C.N.B. (ed.). (2006). Fauna of Sri Lanka: Status of Taxonomy, Research and Conservation. IUCN, Colombo, & Ministry of Environment and Natural Resources viii + 308 pp.
- Bambaradeniya, C.N.B. & S.P.Ekanayake (2003). A Guide to the Biodiversity of Knuckles Forest Region. IUCN – The World Conservation Union, Sri Lanka Country Office, Colombo, vi + 68 pp.
- Bandaranayake, S. (2005). Sigiriya. Central Cultural Fund, Colombo.
- Barker, J.S.F., S.G.Tan, O.S.Selvaraj and T.K.Mukherjee. (1997). Genetic variation within and relationships among populations of Asian water buffalo (*Bubalus bubalis*). *Animal Genetics* 28: 1-13.
- Burman. J. (1737). *Thesaurus Zeylanicus*. Amsterdam, 235 pp.
- Central Provincial Council (1998). *Nidahas Swarna Jayanthi Samaru Kalapaya*. Central Provincial Council, 346 pp. (Sinhala).
- Chamara, M.W.S., S.Premaratne & G.G.C.Premalal. (1999). On-farm management and persistence of hybrid napier grass (*Pennisetum purpureum* * *Pennisetum americanum* var. CO-3) at Kurunegala District. Proceedings of the Eleventh Annual Students Research Sessions. Department of Animal Science, University of Peradeniya.
- Chandrasiri, A.D.N. (2004). The state of animal genetic resources in Sri Lanka, VRI, DAPNH, 118 pp.

- Clout, M. (1995). Introduced species: The greatest threat to global biodiversity? *Species* 24: 34-36.
- Coomaraswamy, A. (1978). *Medieval Sinhalese Art*, Third Edition.
- Cramer, L.H. (1993). *A Forest Arboretum in the Dry Zone*. Institute of Fundamental Studies, Kandy, xiii + 241 pp.
- Dassanayake, M.D. (2003). *Revised Handbook to the Flora of Ceylon: Index to Volumes 1-14*. Oxford & IBH, New Delhi, 293 pp.
- Dassanayake, M.D. & A.H.M.Jayasuriya (1974). A new species of *Brachystelma* (Asclepiadaceae) from Sri Lanka. *Ceylon Journal of Science (Bio. Sci.)* 11 (1): 39-41.
- Dassanayake, M.D. & F.R. Fosberg, (eds.) (1980-1991). *Revised Handbook to the Flora of Ceylon, Vol. 1-7*. Amerind, New Delhi.
- Dassanayake, M.D., F.R. Fosberg, & W.D. Clayton (eds.) (1994-1995). *Revised Handbook to the Flora of Ceylon, Vol. 8-9*. Amerind, New Delhi.
- Dassanayake, M.D. & W.D. Clayton (eds.) (1996-2000). *Revised Handbook to the Flora of Ceylon, Vol. 10-14*. Amerind, New Delhi.
- Department of Wildlife Conservation (2001). *A guide to National Parks of Sri Lanka*. DWC, 88 pp.
- De Silva, A. (2006). Current status of the reptiles of Sri Lanka 134- 163 pp. In C.N.B. Bambaradeniya (ed.). *Fauna of Sri Lanka: Status of Taxonomy, Research and Conservation*. IUCN, Colombo, viii + 308 pp.
- Dutta, S.K. & Manamendra-Arachchi, K. (1996). *The amphibian fauna of Sri Lanka*. Wildlife Trust of Sri Lanka, Colombo, 230 pp.
- Ekanayake, D.T. (1985). *The Botanic Gardens of Sri Lanka*. Rotary Club, Kandy, 28 pp.
- Ekanayake, H.M.R.K. (2004). Biological control of *Parthenium hysterophorus*. Report submitted to CARP: 12/471/352, 2002-2004. CARP
- EML Consultants (2002). *Sri Lanka Conservation and Sustainable Use of Medicinal Plants Project – Case Study of Naula*. Ministry of Health & Indigenous Medicine. Report, 24 pp.
- EML Consultants (2005a). *Kala Oya River Basin – Survey of Biodiversity, Wetland Issues and Options for Sustainable Management*. Mahaweli Authority of Sri Lanka, Colombo, xxxiii + 406 pp.
- EML Consultants (2005b). *Habitat Maps for Selected Areas in Sri Lanka: Horton Plains National Park*. Draft Report. Ministry of Environment & Natural Resources, Battaramulla, 62 pp.
- FAO. (1993). *Harvesting Nature's Diversity*. FAO, Rome.
- Forest Department (2000). *Administration Report of the Conservator of Forests*. FD & MFE, Sri Lanka.
- Forest Department (2006). *Udawattakele Royal Forest Park. Forest Extension Action Plan – Kandy Division*, Forest Department, 19 pp.

Forestry Planning Unit (1995). Sri Lanka Forestry Sector Master Plan. FPU, MALF, Battaramulla, Sri Lanka, pp. 32-85.

Fowler, C. and P. Mooney. (1990). *The Threatened Gene: Food, Politics and the Loss of Genetic Diversity*. Lutterworth Press, Cambridge.

Geiger, W. (2007). *Mahawamsa. or The Great Chronicle of Ceylon (ca. 500 AD)*, with addendum by G.C. Mendis. Buddhist Cultural Centre, Dehiwela, 327 pp. (Information Department, Sri Lanka (English translation).

GOSL / UNDP / FAO (1986). *A National Forest Inventory of Sri Lanka*. GOSL/UNDP/FAO Project SRL/79/014.

Greller, A. M. and S. Balasubramaniam (1993). Physiognomic, floristic and bioclimatological characterization of the major forest types of Sri Lanka. In W. Erdelen, C. Preu, N. Ishwaran, C. M. Madduma Bandara (eds). *Proceedings of the International and Interdisciplinary Symposium on Ecology and Landscape Management in Sri Lanka*, Colombo, Sri Lanka, 12-26 March 1990. Margraf Scientific Books, D-97985 Weikersheim, pp 55-77.

Gunaratne, W.D.L. & A.P.Heenkende. (2000). *Eleventh National Workshop on Multipurpose Trees*, Kandy, 18 December 2000. Faculty of Agriculture, University of Peradeniya.

Hale, M.E. 1981. A revision of the lichen family Thelotremaaceae in Sri Lanka. *Bull. British Mus. Nat. Hist. (Botany ser.)* 8 (3): 227-332.

Hasanuzzaman, S.M. (2003). Bangladesh Chapter – Plant Genetic Resources in SAARC Countries: Their Conservation and Management, 1-239 pp. *Plant Genetic Resources in SAARC Countries: Their Conservation and Management*. SAARC Agricultural Information Centre, vi + 506 pp.

Helvetas Sri Lanka. (2001). *Sustainable farming systems through traditional plant genetic resources and indigenous knowledge based practices*. Helvetas Sri Lanka, 127 pp.

IUCN Sri Lanka (2000). *The 1999 List of Threatened Fauna and Flora of Sri Lanka*. Colombo: IUCN Sri Lanka. Viii + 113 pp.

IUCN Sri Lanka (2003). *Comparison of the Conservation and Legal Status of the Fauna and Flora of Sri Lanka*, IUCN Sri Lanka, Colombo. x + 163 pp.

IUCN Sri Lanka & Ministry of Environment & Natural Resources (2007). *The 2007 Red List of Threatened Fauna and Flora of Sri Lanka*, Colombo, Sri Lanka, xiii + 148 pp.

IUCN & WCMC (1997). *Designing an optimum protected areas system for Sri Lanka's natural forests*, Vol. 1 & 2. Forest Department, Ministry of Forestry and Environment, Battaramulla, x + 299 pp.

Jayasuriya, A. H. M. (1984), *Flora of Ritigala Strict Natural Reserve*. *The Sri Lankan Forester (The Ceylon Forester)* 16 (3 & 4): 61- 156.

Jayasuriya, A. H. M. (1998). *Menikdena Forest Garden – Peace in the Wilderness*. *Sunday Observer*, 08 March 1998.

Jayassuriya, A.H.M. (2001). New invasive weed in Sri Lanka: *Parthenium hysterophorus* L. (Asteraceae). Silver Jubilee Lecture Series – No. 1. Post Graduate Institute of Agriculture, University of Peradeniya, 14 pp.

Jayassuriya, A.H.M. (2005). *Parthenium* weed – status and management in Sri Lanka. 2005. Second International Conference on *Parthenium* Management, December 5-7, 2005, University of Agricultural Sciences, Bangalore, 36-43.

Jayasuriya, A.H.M. (2007). Flora. The National Atlas of Sri Lanka (2nd Edition). Survey Department, Colombo (in press).

Jayasuriya, A. H. M., A. M. Greller, S. Balasubramaniam, C. V. S. Gunatilleke, I. A. U. N. Gunatilleke and M. D. Dassanayake (1993). Phytosociological studies of Mid-elevational (Lower Montane) Evergreen Forests in Sri Lanka. In W. Erdelen, C. Preu, N. Ishwaran and C. M. Madduma Bandara (eds), Proceedings of the International and Interdisciplinary Symposium on Ecology and Landscape Management in Sri Lanka, Colombo, Sri Lanka, 12-26 March 1990. Margraf Scientific Books, D-97985 Wrikersheim, pp. 79-94.

Jayasuriya, A.H.M., D. Kitchener and C.M. Biradar (2006). Portfolio of Strategic Conservation Sites / Protected Area Gap Analysis in Sri Lanka. Ministry of Environment & Natural Resources, Battaramulla, Sri Lanka, xxiii + 260 pp.

Jayasuriya, A.H.M., H.W.Kannangara, N.M.Amarasuriya and N.B.Nillegoda (1997). Flora of Menikdena, Part I. Historical & Geographical Society, Trinity College, Kandy, 27 pp.

Jayasuriya, A. H. M. and M. A. Pemadasa (1983). Factors affecting the distribution of tree species in a dry zone montane forest in Sri Lanka. *Journal of Ecology* 71:571-583.

Jayasuriya, A.H.M. and R.M.T.Rajapakse (2003). Plant Genetic Resources in SAARC Countries: Their Conservation and Management - Sri Lanka Chapter, 481-506 pp. SAARC Agricultural Information Centre (SAIC), Bangladesh, 506 pp.

Jayawardena, V.P. & A.S.B.Rajaguru. (2000). Eleventh National Workshop on Multipurpose Trees, Kandy, 18 December 2000. Faculty of Agriculture, University of Peradeniya.

Kandy District Secretariat (2006). Hantana Mountain Range. Hantana Conservation Project, 18 pp.

Knox, R. (1681). An Historical Relation of the Island of Ceylon. Richard Chriswell, London

Kostermans, A.J.G.H. (1981). *Eugenia*, *Syzygium* and *Cleistocalyx* (Myrtaceae) in Ceylon, A monographical revision. *Quart. Journ. Taiwan Museum* 34 (3,4): 117-188.

Kostermans, A.J.G.H. (1992). A Handbook of the Dipterocarpaceae of Sri Lanka. The Wildlife Heritage Trust of Sri Lanka, Colombo, 244 pp.

Kotagama, S.W., R.I.de Silva, A.S.Wijesinha & V. Abeugunawardane (2006). Avifaunal list of Sri Lanka, 164-203. . In C.N.B. Bambaradeniya (ed.). Fauna of Sri Lanka: Status of Taxonomy, Research and Conservation. IUCN, Colombo, viii + 308 pp.

Kottegoda, S.R. (1994). Flowers of Sri Lanka. Royal Asiatic Society of Sri Lanka, Colombo.

Lau, C.H., R.D. Drinkwater, K.Yusoff, S.G.Tan, D.J.S. Hetzel and J.S.F.Barker. (1998). Genetic diversity of Asian water buffalo (*Bubalus bubalis*). Mitochondrial DNA D-Loop and cytochrome b sequence variation. *Animal Genetics* 29: 253-264.

Legg, C. & N.Jewell (1992). A new 1: 500,000 scale forest map of Sri Lanka. ODA Forest and Land Use Mapping Project, Forest Department, Colombo, 12 pp.

Legg, C. & N.Jewell (1995). A 1: 500,000 scale forest map of Sri Lanka: the basis for a National Forest Geographic Information System. Sri Lanka Forester, Special Issue (Remote Sensing): 3-21.

Mal, Bhag. (1994). Underutilized Grain Legumes and Pseudocereals; their potentials in Asia. FAO, Bangkok.

Macmillan, H.F. (1935). Tropical Planting and Gardening. Macmillan, London, 560 pp.

Mahindapala, R. and S. Kumarasiri (2002). Community participation and sustainable use of medicinal plants in Sri Lanka. IUCN Sri Lanka, Report, 8pp.

Manamendra-Arachchi, K. & Pethiyagoda, R. (2005). The Sri Lankan shrub-frogs of the genus *Philautus* Gistel, 1848 (Ranidae: Rhacophorinae), with descriptions of 27 new species. The Raffles Bulletin of Zoology Supplement 12: 163-303.

Marambe, B. (1999). Factors affecting the spread of alien invasive plants in Sri Lanka. In: B. Marambe (ed.). Proceedings of the First National Workshop on Alien Invasive Species. MFE, Sri Lanka, 29-34 pp.

Marambe, B., L. Amarasinghe, S. Dissanayake & H.Balasuriya (2000). Invasive behaviour of *Mimosa pigra* L. in Sri Lanka. In: B.Marambe (ed.). Proceedings of the Symposium on Alien Invasive Species in Sri Lanka, Ministry of Forestry & Environment and National Agricultural Society of Sri Lanka, Perdeniya, 59-63 pp.

McNeely, J.A. (2001). (ed.). The Great Reshuffling: Human Dimensions of Alien Invasive Species. IUCN, Gland, Switzerland.

Meegaskumbura, M. & Manamendra-Archchi, K. (2005). Description of eight new species of shrub frogs (Ranidae: Rhacophorinae: *Philautus*) from Sri Lanka. The Raffles Bulletin of Zoology, Supplement 12: 305-338.

Ministry of Agriculture, Lands and Forestry (1995). Sri Lanka Forestry Sector Master Plan. MALF, Battaramulla, Sri Lanka.

Ministry of Environment & Natural Resources (2002). State of the Environment in Sri Lanka. MENR, xvi + 245 pp.

Ministry of Environment and Natural Resources (2005). Biodiversity Conservation Action Plan (BCAP), unpublished report

Ministry of Environment and Natural Resources (2005). Traditional Knowledge in Association with Biodiversity, Vol. 1, MENR, Battaramulla, 77pp. (Publication in Sinhala).

Ministry of Environment and Natural Resources (2006). Traditional Knowledge in Association with Biodiversity, Vol. 2, MENR, Battaramulla, 82 pp. (Publication in Sinhala).

Ministry of Forestry and Environment (1999). Biodiversity Conservation in Sri Lanka: A Framework for Action. MFE, Battaramulla, Sri Lanka.

Mueller-Domois, D. (1968). Ecogeographic analysis of a climate map of Ceylon with particular reference to vegetation. The Ceylon Forester 8: 39-58

Nagg, F. & D.Raheem (2000). Land snail diversity in Sri Lanka. Natural History Museum, London. CD ROM.

NARESA (1991). Natural Resources of Sri Lanka. Natural Resources, Energy and Science Authority of Sri Lanka, Colombo, xii + 280 pp.

Naggs, F. & D.Raheem (2000). Land snail diversity in Sri Lanka. Natural History Museum, London. CD ROM

Ng, P.K.L. & W.M.Tay (2001). The freshwater crabs of Sri Lanka (Decapoda: Brachyura: Parathelphusidae). *Zeylanica* 6: 113-199.

Panabokke, C.R. (1997). Agro-ecological regions. In T. Somasekaram, M.P.Perera, M.B.G.de Silva & H.Godellawatta (eds.). *Arjuna's Atlas of Sri Lanka*. Arjuna, Dehiwala, viii + 220 pp..

Pemadasa, A. (1995). "Siri-laka Thuru-laka" (Vegetation of Sri Lanka - Publication in Sinhala). Sara Publishers, Kottawa, Sri Lanka, 234 pp. (Sinhala).

Perera, W.P.N. & C.N.B.Bambaradeniya (2006). Species richness, distribution and conservation status of butterflies in Sri Lanka, 53-64 pp. In

C.N.B. Bambaradeniya (ed.). *Fauna of Sri Lanka: Status of Taxonomy, Research and Conservation*. IUCN, Colombo, viii + 308 pp.

Pethiyagoda, R. (2003). Sri Lanka Ecosystem Components of the Western-Ghats & Sri Lanka Biodiversity Hotspot. (Draft Report).

Pethiyagoda, R., K. Manamendra-Arachchi, M.M. Bahir & M. Meegahakumbura (2006). Sri Lankan amphibians: Diversity, uniqueness and conservation, 125-133 pp. In C.N.B.Bambaradeniya (ed.). *Fauna of Sri Lanka: Status of taxonomy, research and conservation*. The World Conservation Union, Colombo, viii + 308 pp.

Pethiyagoda, R., M. Kottelat, A. Silva, K. Maduwage & M. Meegaskumbura (2008). A review of the genus *Laubuca* in Sri Lanka, with description of three new species (Teleostei: Cyprinidae). *Ichthyol. Explor. Freshwaters* 19(1): 7-26.

Popham, F.H. (1993). *Dambulla: A Sanctuary of Tropical Trees*. Sam Popham Foundation, U.K., 72 pp.

Popham, F.H. and P. Neil (1994). *Dambulla Arboretum - Sri Lanka*. *Arboricultural Journal* 18: 53-67.

Premalal, G.G.C. (1995). *Silvo-pastoral systems with plantation forests in Sri Lanka*. Sixth National Workshop, VRI, Peradeniya.

Premalal, G.G.C. (2007). *Green fodder and uses*. CD in Sinhala. AVC, DAG.

Rajapaksha, U. (1998). *Traditional Food Plants in Sri Lanka*. HARTI, Colombo, 529 pp.

Ranawana, K.B. (2006). Land Snails in Sri Lanka, 84-99 pp. In C.N.B. Bambaradeniya (ed.). *Fauna of Sri Lanka: Status of Taxonomy, Research and Conservation*. IUCN, Colombo, viii + 308 pp.

Raven, P.H. & G.B.Johnson. (2002). *Biology*. McGraw - Hill, New York, 1238 pp.

- Samarawickrama, V.A.M.P.K., V.A.M.P.K., N.M.Wijesena & N.L.Orlov (2005). A new species of genus *Boiga* (Serpentes: Colubridae: Colubrinae) from Sri Lanka. Russian Journal of Herpetology 12 (3): 213 - 222.
- Samarawickrama, V.A.M.P.K. (2006). A new species of the genus *Cophotis* (Squamata: Agamidae:Agaminae) from Sri Lanka. Russian Journal of Herpetology 13 (3): 207-214.
- SAREC / NSF. (1998). Farmers' Guide for Optimum Utilization of Farm Resources for Increased Productivity and Income. Leaflet No. 10. SAREC / NSF Buffalo Research and Development Programme. Peradeniya
- Senanayake, R. & P.B.Moyle (1982). Conservation of freshwater fishes in Sri Lanka. Biological Conservation 22: 181-195.
- Senaratna, L.K. (2001). A Checklist of the Flowering Plants of Sri Lanka. NSF, Colombo, ix + 451 pp.
- Somasekaram, T, M.P.Perera, M.B.G.de Silva and H. Godellawatta (1997). Arjuna's Atlas of Sri Lanka. Arjuna, Dehiwala, Sri Lanka, viii + 220 pp.
- Suresh, P.B. & C.N.B.Bambaradeniya (2006). Systematics and conservation of spiders in Sri Lanka: Current status and future prospects, 70-76. In C.N.B. Bambaradeniya (ed.). Fauna of Sri Lanka: Status of taxonomy, research and conservation. The World Conservation Union, Colombo, viii + 308 pp.
- Survey Department of Sri Lanka (1988). The National Atlas of Sri Lanka. Survey Department of Sri Lanka, Colombo, x = 141 pp.
- Survey Department of Sri Lanka. 2001. Topographical map of Sri Lanka. Survey Department.
- Trimen, H. (1893 – 1895). A Handbook to the Flora of Ceylon, Parts 1 – 3. Dulau, London.
- Trimen, H. and J.D.Hooker. (1898 – 1990). A handbook to the flora of Ceylon, Parts 4 – 5. Dulau, London
- TRI (1986). Handbook on Tea. TRI, Talawakele, 220 pp.
- Weerakoon, D.K. & W.L.D.P.T.S.de A. Goonatilake (2006). Taxonomic status of the mammals of Sri Lanka, 216-229 pp. In C.N.B.Bambaradeniya (ed.). Fauna of Sri Lanka: Status of taxonomy, research and conservation. The World Conservation Union, Colombo, viii + 308 pp.
- Whitmore, T.C. (1984). Tropical rainforests of the Far East. Oxford University Press.
- Wickramasinghe, L.J.M. & D.A.I. Munindradasa (2007). Review of the genus *Cnemaspis* Strauch, 1887 (Sauria: Geckonidae) in Sri Lanka with a description of five new species. Zootaxa 1490: 1-63.
- Wickramasinghe, L.J.M., R.Rodrigo, N.Dayawansa & U.L.D.Jayantha (2007). Two new species of *Lankascincus* (Squamata: Scincidae) from Sripada Sanctuary (Peak Wilderness) in Sri Lanka. Zootaxa 1612: 1-24.
- Wijerathna, A. and I. Rajapakse (2005). Central Province (Draft Report). Biodiversity Secretariat, Ministry of Environment and Natural Resources, 53 pp.

APPENDIX 1 Plant species recorded in Protected Areas in the Central Province investigated for the NCR Survey

Sources:

Species: IUCN & WCMC (1997) – Taxonomy updated

Local names & endemism: IUCN 2002 Global Red List

Conservation Status: IUCNSL 1999 List and IUCN 2002 Global Red List

IUCNSL 1999 List (IUCNSL)

: **HT** = Highly Threatened, **TR** = Threatened

IUCN 2002 Global Red List (IUCN Global)

: **CR** = Critically Endangered, **EN** = Endangered,

VU = Vulnerable, **LR/nt** = Lower risk/near threatened,

LR/cd = Lower risk/conservation dependent, **DD** = Data deficient

Family Species	Local names	Endemic To Sri Lanka (E)	Conservation Status	
			IUCNSL	IUCN Global
Acanthaceae				
<i>Ecbolium ligustrinum</i>				
<i>Stenosiphonium cordifolium</i>	Bu-nelu			
<i>Strobilanthes anceps</i>	Nelu	E		
<i>Strobilanthes calycina</i>	Nelu	E		
<i>Strobilanthes hookeri</i>	Nelu	E		
<i>Strobilanthes punctata</i>	Nelu	E		
<i>Strobilanthes sexennis</i>	Nelu	E		
<i>Strobilanthes viscosa</i>	Nelu	E		
<i>Strobilanthes sp. 1</i>	Nelu			
<i>Strobilanthes sp. 2</i>	Nelu			
Alangiaceae				
<i>Alangium salviifolium</i>				
Anacardiaceae				
<i>Mangifera zeylanica</i>	Amba			
<i>Nothopegia beddomei</i>	Bala			
<i>Semecarpus coriacea</i>	Badulla			EN
<i>Semecarpus gardneri</i>	Badulla	E		VU
<i>Semecarpus intermedia</i>	Badulla	E		
<i>Semecarpus marginata</i>	Badulla	E		VU
<i>Semecarpus nigro-viridis</i>	Badulla	E		VU
<i>Semecarpus obscura</i>	Badulla	E		
<i>Semecarpus parvifolia</i>	Badulla	E	TR	VU
<i>Semecarpus pubescens</i>	Badulla	E		VU
<i>Semecarpus walkeri</i>	Badulla	E		VU
Ancistrocladaceae				
<i>Ancistrocladus humatus</i>	Gona-wel	E		
Anisophylleaceae				
<i>Anisophyllea cinnamomoides</i>	Weli-penna	E		
Annonaceae				
<i>Alphonsea sclerocarpa</i>				
<i>Alphonsea zeylanica</i>			HT	
<i>Artabotrys hexapetalus</i>	Yakada-wel		TR	

Family Species	Local names	Endemic To Sri Lanka (E)	Conservation Status	
			IUCNSL	IUCN Global
<i>Artabotrys zeylanicus</i>	Kalu-bambara wel			
<i>Cyathocalyx zeylanicus</i>	Ee-petta, Kekala			
<i>Desmos zeylanica</i>		E		
<i>Goniothalamus gardneri</i>	Kalu-kera	E		EN
<i>Goniothalamus thomsonii</i>		E	TR	
<i>Goniothalamus thwaitesii</i>	Kau-kera			
<i>Miliusa indica</i>	Kukulu messa			
<i>Miliusa zeylanica</i>		E	TR	VU
<i>Mitrephora heyneana</i>				
<i>Phoenicanthus coriacea</i>	Keku	E	TR	
<i>Phoenicanthus oblique</i>		E		
<i>Polyalthia coffeoides</i>	Omara			
<i>Polyalthia korinti</i>	Mi-wenna, Ul-kenda			
<i>Uvaria macropoda</i>	Attu-muddah			
<i>Uvaria semecarpifolia</i>	Kara-bambara	E		
<i>Uvaria sphenocarpa</i>		E		
<i>Uvaria zeylanica</i>	Palanga, Palu-kan			
<i>Xylopia championii</i>	Dat-ketiya, Atu-ketiya	E		
<i>Xylopia nigricans</i>	Heen.kenda	E	TR	
<i>Xylopia parvifolia</i>	Netawu			
Apocynaceae				
<i>Aganosma cymosa</i>				
<i>Alstonia macrophylla</i>	Hawari-nuga			
<i>Alstonia scholaris</i>	Ruk attana			
<i>Anodendron paniculatum</i>	As-wel, Gerandi-dul			
<i>Carissa inermis</i>	Maha karamba		TR	
<i>Carissa spinarum</i>	Heen karamba			
<i>Cerbera odollam</i>	Gon kaduru			
<i>Chonemorpha fragrans</i>	Bu-kiri-wel			
<i>Cleghornia acuminata</i>		E		
<i>Hunteria zeylanica</i>	Mediya			
<i>Pagiantha dichotoma</i>	Divi-kaduru			
<i>Petchia ceylanica</i>	Kukul kaduru	E		
<i>Rauvolfia densiflora</i>				
<i>Vallisneria spiralis</i>				
<i>Willughbeia cirrhifera</i>	Kiri wel	E		VU
<i>Wrightia angustifolia</i>	Velai-pal-madankai(T)	E		
<i>Wrightia arborea</i>	Pal-madankai (T)			
Aquifoliaceae				
<i>Ilex denticulate</i>				
Araceae				
<i>Pothos remotiflorus</i>	Pota-wel	E		
Araliaceae				
<i>Schefflera exaltata</i>		E		
<i>Schefflera stellata</i>	Itta			
Arecaceae				
<i>Calamus digitatus</i>	Kukulu wel	E	HT	

Family Species	Local names	Endemic To Sri Lanka (E)	Conservation Status	
			IUCNSL	IUCN Global
<i>Calamus ovoideus</i>	Tambotu wel	E	HT	
<i>Calamus pseudotenuis</i>	Heen wewel			
<i>Calamus thwaitesii</i>	Ma-wewel			
<i>Caryota urens</i>	Kitul			
<i>Loxococcus rupicola</i>	Dotalu	E		CR
<i>Oncosperma fasciculatum</i>	Katu kitul	E		LR/nt
Aristolochiaceae				
<i>Aristolochia indica</i>	Sassanda, Sapsanda			
<i>Thottea siliquosa</i>				
Asclepiadaceae				
<i>Calotropis gigantean</i>	Wara			
<i>Gymnema lactiferum</i>	Kurinnan			
<i>Secamone emetica</i>				
<i>Wattakaka volubilis</i>	Anguna, Kiri-anguna			
Asparagaceae				
<i>Asparagus falcatus</i>	Hatawariya			
<i>Asparagus racemosus</i>	Hatawariya			
Asteraceae				
<i>Psiadia ceylanica</i>	Pupula			
<i>Senecio corymbosus</i>				
<i>Vernonia arborea</i>	Kobo-mella			
<i>Vernonia nemoralis</i>		E		
<i>Vernonia setigera</i>				
<i>Vernonia wightiana</i>	Konde	E		
<i>Vernonia zeylanica</i>	Pupula	E		
Balsaminaceae				
<i>Impatiens appendiculata</i>		E	TR	
<i>Impatiens henslowiana</i>				
Berberidaceae				
<i>Berberis ceylanicus</i>	Daru-haridra	E		
Bignoniaceae				
<i>Stereospermum colais</i>	Dunu-madala, lunu-madala			
Bombacaceae				
<i>Cullenia ceylanica</i>	Kata-boda	E		VU
Boraginaceae				
<i>Carmona retusa</i>	Heen tambala			
<i>Cordia dichotoma</i>	Lolu			
Burseraceae				
<i>Commiphora caudate</i>	Simbilla			
Buxaceae				
<i>Sarcocca zeylanica</i>		E		
Capparaceae				
<i>Capparis rhedii</i>				
<i>Capparis rotundifolia</i>	Karunchurai (T)			
<i>Capparia roxburghii</i>	Kau-illan-gedi			
<i>Capparis sepiaria</i>	Karunchurai (T)			
<i>Capparis zeylanica</i>	Welangiriya			

Family Species	Local names	Endemic To Sri Lanka (E)	Conservation Status	
			IUCNSL	IUCN Global
Celastraceae				
<i>Bhesa ceylanica</i>	Pelen	E		
<i>Bhesa Montana</i>		E		
<i>Cassine balae</i>	Neralu	E		
<i>Cassine congylos</i>		E		
<i>Euonymus revolutus</i>		E		
<i>Euonymus walkeri</i>		E		VU
<i>Glyptopetalum zeylanicum</i>			TR	
<i>Kokoona zeylanica</i>	Kokun	E	TR	
<i>Maytenus emarginata</i>				
<i>Microtropis wallichiana</i>				
<i>Microtropis zeylanica</i>		E		
<i>Pleurostyliia opposite</i>	Panakka			
Chloranthaceae				
<i>Sarcandra chloranthoides</i>				
Clusiaceae				
<i>Calophyllum acidus</i>				
<i>Calophyllum bracteatum</i>	Walu-keen	E		VU
<i>Calophyllum moonii</i>	Domba-keena	E	TR	VU
<i>Calophyllum thwaitesii</i>	Batu-keena	E	TR	VU
<i>Calophyllum tomentosum</i>	Tel-keena	E	TR	VU
<i>Calophyllum trapezifolium</i>	Keena	E	HT	EN
<i>Calophyllum walkeri</i>	Keena	E	TR	VU
<i>Garcinia echinicarpa</i>	Madol			
<i>Garcinia hermonii</i>	Madol	E	TR	LR/cd
<i>Garcinia Morella</i>	Kokatiya, Gokatu			
<i>Garcinia quaesita</i>	Goraka	E		VU
<i>Garcinia spicata</i>	Gona-pana, Elagokatu			
<i>Mesua ferrea</i>	Na			
Combretaceae				
<i>Anogeissus latifolius</i>	Dawu			
<i>Terminalia arjuna</i>	Kumbuk			
<i>Terminalia bellirica</i>	Bulu			
<i>Terminalia chebula</i>	Aralu			
<i>Terminalia zeylanica</i>	Hampalanda			VU
Connaraceae				
<i>Connarus championii</i>	Wel-radaliya	E		
<i>Connarus monocarpus</i>	Radaliya			
<i>Rourea minor</i>	Krindi-wel			
Convolvulaceae				
<i>Argyreia populifolia</i>	Gini-tilla	E		
<i>Erycibe paniculata</i>	Etambiriya			
Cornaceae				
<i>Mastixia macrophylla</i>				VU
<i>Mastixia Montana</i>		E		
<i>Mastixia nimalii</i>		E		VU
<i>Mastixia tetrandra</i>	Diya-taliya			VU
Cycadaceae				

Family Species	Local names	Endemic To Sri Lanka (E)	Conservation Status	
			IUCNSL	IUCN Global
<i>Cycas circinalis</i>	Madu			
Datisceae				
<i>Tetrameles nudiflora</i>	Hema, muguna			
Dichapetalaceae				
<i>Dichapetalum gelonioides</i>	Balu-nakuta			
<i>Dichapetalum helferanum</i>		E		
Dilleniaceae				
<i>Dillenia retusa</i>	Goda-para			
<i>Dillenia triquetra</i>	Diya-para			
<i>Schumacheria alnifolia</i>	Kekiri-wara	E		CR
<i>Tetracera sarmentosa</i>	Korasa-wel			
Dioscoreaceae				
<i>Dioscorea pentaphylla</i>	Kalu-ala, Kauwala			
<i>Dioscorea tomentosa</i>	Uyala			
<i>Dioscorea trimenii</i>	Dahaiya ala	E		
Dipterocarpaceae				
<i>Dipterocarpus zeylanicus</i>	Hora	E		EN
<i>Doona gardneri</i>	Ratu-dun	E	TR	CR
<i>Doona nervosa</i>	Kotikan Beraliya	E	TR	CR
<i>Doona trapezifolia</i>	Yakahalu	E	TR	CR
<i>Hopea jucunda</i>	Rat-beraliya	E		
<i>Shorea dyeri</i>	Yakahalu-dun	E	TR	EN
<i>Stemonoporus acuminatus</i>		E	TR	EN
<i>Stemonoporus affinis</i>		E	HT	CR
<i>Stemonoporus canaliculatus</i>		E	TR	CR
<i>Stemonoporus gardneri</i>		E	HT	EN
<i>Stemonoporus oblongifolius</i>		E	HT	EN
<i>Stemonoporus wightii</i>	Hal mendora	E	TR	
Dracaenaceae				
<i>Dracaena thwaitesii</i>				
Ebenaceae				
<i>Diospyros affinis</i>	Kalu-wella			
<i>Diospyros ebenoides</i>	Kalu-habaraliya	E	HT	EN
<i>Diospyros ebenum</i>	Kaluwara		TR	DD
<i>Diospyros ferrea</i>	Kalu-habaraliya			
<i>Diospyros hirsute</i>		E	TR	VU
<i>Diospyros insignis</i>	Porowa-mara			
<i>Diospyros malabarica</i>	Timbiri			
<i>Diospyros oocarpa</i>	Kalu-kudumberiya			
<i>Diospyros ovalifolia</i>	Kunumella			
<i>Diospyros racemosa</i>	Kahakala, Kaluwella			
<i>Diospyros sylvatica</i>	Hompella, Sudu- kudumberiya			
<i>Diospyros trichophylla</i>		E	TR	VU
Elaeagnaceae				
<i>Elaeagnus latifolia</i>	Katu-embilla			
Elaeocarpaceae				
<i>Elaeocarpus amoenus</i>	Titta-veralu	E		

Family Species	Local names	Endemic To Sri Lanka (E)	Conservation Status	
			IUCNSL	IUCN Global
<i>Elaeocarpus coriaceus</i>	Gal-veralu	E		EN
<i>Elaeocarpus glandulifer</i>	Gal-veralu	E		VU
<i>Elaeocarpus montanus</i>		E	TR	
<i>Elaeocarpus serratus</i>	Veralu			
<i>Elaeocarpus subvillosus</i>	Gal-veralu	E		VU
<i>Elaeocarpus zeylanicus</i>		E		
Ericaceae				
<i>Rhododendron arboreum</i>	Ma-ratmal, Asoka	E		
<i>Vaccinium symplocifolium</i>	Boralu			
Erythroxylaceae				
<i>Erythroxylum moonii</i>	Bata-kirilla			
<i>Erythroxylon obtusifolium</i>				VU
Euphorbiaceae				
<i>Actephila excelsa</i>	Et-pitawakka			
<i>Agrostistachys coriacea</i>	Beru	E		
<i>Agrostistachys indica</i>				
<i>Antidesma alexiteria</i>	Heen embilla			
<i>Antidesma pyrifolium</i>		E		
<i>Aporosa acuminata</i>				
<i>Aporosa cardiosperma</i>	Kan-potta			VU
<i>Aporosa lanceolata</i>	Heen-kebella	E		VU
<i>Blachia umbellata</i>	Kos-atta			
<i>Breynia retusa</i>	Wal-murunga			
<i>Breynia vitis-idaea</i>	Gas-kayila			
<i>Bridelia moonii</i>	Pat-kela	E		VU
<i>Bridelia retusa</i>	Keta-kela			
<i>Chaetocarpus castanocarpus</i>	Hedawaka			
<i>Chaetocarpus coriaceus</i>	Gal-hedawaka			VU
<i>Cleistanthus ferrugineus</i>		E		VU
<i>Cleistanthus pallidus</i>	Olu-peliya	E		
<i>Cleistanthus patulus</i>	Wa, Anguru-kuratiya			
<i>Croton laccifer</i>	Keppetiya			
<i>Croton officinalis</i>				
<i>Dimorphoclyx glabellus</i>	Ten-kuttiya, Weli-wenna			
<i>Drypetes gardneri</i>	Eta-weera, Gal-weera	E		
<i>Drypetes sepiaria</i>	Weera			
<i>Euphorbia antiquorum</i>	Daluk			
<i>Excoecaria crenulata</i>				
<i>Fahrenheitia minor</i>	Olu-petta	E		CR
<i>Fahrenheitia zeylanica</i>	Olu-petta			
<i>Flueggea leucopyrus</i>	Katu-pila			
<i>Glochidion coriaceum</i>		E		
<i>Glochidion nemorale</i>		E	TR	
<i>Glochidion pachycarpum</i>		E		
<i>Glochidion pycnocarpum</i>	Hunu-kirilla	E		
<i>Glochidion stellatum</i>	Kirilla	E		
<i>Glochidion zeylanicum</i>	Hunu-kirilla			

Family Species	Local names	Endemic To Sri Lanka (E)	Conservation Status	
			IUCNSL	IUCN Global
<i>Homalanthus populifolius</i>	Gini-kenda			
<i>Macaranga indica</i>	Kenda			
<i>Macaranga peltata</i>	Kenda			
<i>Mallotus eriocarpus</i>	Bulu-petta	E		
<i>Mallotus fuscescens</i>		E		VU
<i>Mallotus philippensis</i>	Hampirilla, Molabe			
<i>Mallotus repandus</i>				
<i>Mallotus resinusus</i>	Ma-endaru	E		
<i>Mallotus rhamnifolius</i>	Buluhulu-keppitiya			
<i>Margaritaria indicus</i>	Karaw			
<i>Micrococca oligandra</i>				
<i>Mischodon zeylanicus</i>	Tammenna			
<i>Phyllanthus baillonianus</i>	Kele-karapincha			
<i>Phyllanthus cinereus</i>		E	HT	
<i>Phyllanthus emblica</i>	Nelli			
<i>Phyllanthus polyphyllus</i>	Kuratiya			
<i>Phyllanthus reticulatus</i>	Kayila, Kayila wel			
<i>Ptychopyxis thwaitesii</i>	Wal-rambutan	E	CR	
<i>Sapium insigne</i>	Tel-kaduru			
<i>Suregada angustifolia</i>				
<i>Suregada lanceolata</i>	Kakkaipalai (T)			
<i>Tragia involucrata</i>	Wel-kahambiliya			
Fabaceae				
<i>Abrus melanospermus</i>	Ela-olinda			
<i>Acacia caesia</i>	Hinguru-wel			
<i>Acacia chundra</i>	Rat-kihiriya			
<i>Albizia lebbeck</i>	Suriya mara			
<i>Albizia odoratissima</i>	Huri-mara			
<i>Bauhinia racemosa</i>	Mayila			
<i>Bauhinia tomentosa</i>	Kaha petan			
<i>Caesalpinia bonduc</i>	Kumburu-wel			
<i>Caesalpinia hymenocarpa</i>	Goda-wawulketiya		TR	
<i>Cassia fistula</i>	Ehela			
<i>Cassia roxburghii</i>	Ratu-wa			
<i>Dalbergia lanceolaria</i>	Bol-mara			
<i>Dalbergia pseudo-sisso</i>	Bambara-wel			
<i>Derris canarensis</i>	Diya-kalawel			
<i>Derris parviflora</i>	Sudu-kalawel	E		
<i>Derris scandens</i>	Bokala wel, Kalawel			
<i>Dialium ovoideum</i>	Gal-siyambala	E		
<i>Dichrostachys cinerea</i>	Andara			
<i>Entada pusaetha</i>	Pus wel			
<i>Humboldtia laurifolia</i>	Gal-karanda		VU	
Flacourtiaceae				
<i>Casearia thwaitesii</i>				
<i>Casearia zeylanica</i>	Wal-waraka			
<i>Chlorocarpa pentaschista</i>	Gomma	E		
<i>Flacourtia indica</i>	Uguressa, Katu-			

Family Species	Local names	Endemic To Sri Lanka (E)	Conservation Status	
			IUCNSL	IUCN Global
	kurundu			
<i>Homalium ceylanicum</i>	Liyan			
<i>Hydnocarpus octandra</i>	Wal-divul	E		VU
<i>Hydnocarpus venenata</i>	Makulu	E		
<i>Scolopia acuminata</i>	Katu-kenda			
<i>Scolopia crassipes</i>		E		
<i>Scolopia pusilla</i>	Katu-keeriya	E		
<i>Trichadenia zeylanica</i>	Titta, Tolol	E		VU
Gesneriaceae				
<i>Rhynchoglossum notonianum</i>	Diya-nilla			
Hernandiaceae				
<i>Gyrocarpus americanus</i>	Diya-labu			
Hippcrateaceae				
<i>Loeseneriella arnottiana</i>			TR	
<i>Reisantia indica</i>				
<i>Salacia diandra</i>		E		
<i>Salacia oblonga</i>	Kotala himbutu		TR	
<i>Salacia reticulata</i>	Himbutu		TR	
Icacinaceae				
<i>Apodytes dimidiata</i>				
<i>Gomphandra coriacea</i>				
<i>Gomphandra tetrandra</i>				
<i>Nothapodytes nimmoniana</i>	Gandapana			
<i>Stemonurus apicalis</i>	Uru-honda	E		CR
Lauraceae				
<i>Actinodaphne ambigua</i>		E		
<i>Actinodaphne candolleana</i>		E		
<i>Actinodaphne elegans</i>		E		
<i>Actinodaphne glauca</i>		E		
<i>Actinodaphne molochina</i>		E		
<i>Actinodaphne moonii</i>		E		
<i>Actinodaphne speciosa</i>	Ali-kan	E		
<i>Actinodaphne stenophylla</i>	Nika-dawula	E		
<i>Alseodaphne semecarpifolia</i>	Wewarana			
<i>Cinnamomum capparucoronde</i>	Kapuru kurundu	E	TR	VU
<i>Cinnamomum dubium</i>	Sewel-kurundu	E		
<i>Cinnamomum liseaefolium</i>	Kudu-kurundu	E	TR	VU
<i>Cinnamomum ovalifolium</i>		E		
<i>Cinnamomum verum</i>	Kurundu			
<i>Cryptocarya wightiana</i>	Golu-mora, Gal-mora			VU
<i>Litsea gardneri</i>				
<i>Litsea glutinosa</i>	Borni			
<i>Litsea iteodaphne</i>	Kalu-nika	E		
<i>Litsea ligustrina</i>		E	TR	
<i>Litsea longifolia</i>	Rat-keliya	E		
<i>Litsea ovalifolia</i>		E		
<i>Litsea walkeri</i>		E		

Family Species	Local names	Endemic To Sri Lanka (E)	Conservation Status	
			IUCNSL	IUCN Global
<i>Neolitsea cassia</i>	Dawul-kurundu, Kududawula, Nikadawula			
<i>Neolitsea fuscata</i>		E		
<i>Persea macrantha</i>	Ululu			
Lecythidaceae				
<i>Careya arborea</i>	Kahata			
Leeaceae				
<i>Leea indica</i>	Burulla, Gurulla			
Linaceae				
<i>Hugonia ferruginea</i>				
<i>Hugonia mystax</i>	Bu-getiya wel			
Loganiaceae				
<i>Fagraea ceilanica</i>	Etamburu			
<i>Strychnos benthamii</i>		E		VU
<i>Strychnos minor</i>	Kaduru			
<i>Strychnos nux-vomica</i>	Goda kaduru			
<i>Strychnos potatorum</i>	Ingini			
<i>Strychnos tetragona</i>		E		CR
<i>Strychnos trichocalyx</i>	Gona-karamba	E		
<i>Strychnos wallichiana</i>	Eta-kirindi wel			
Loranthaceae				
<i>Dendrophthoe suborbicularis</i>		E		
<i>Macrosolen parasiticus</i>				
<i>Taxillus incanus</i>		E		
<i>Tolypanthus gardneri</i>		E		
Magnoliaceae				
<i>Michelia nilagirica</i>	Wana sapu			
Malpighiaceae				
<i>Hiptage benghalensis</i>	Puwak-gediya wel			
Malvaceae				
<i>Hibiscus eriocarpus</i>	Parutti (T)			
Melastomataceae				
<i>Axinandra zeylanica</i>	Kekiri-wara	E		VU
<i>Kendrickia walkeri</i>				
<i>Lijndenia capitellata</i>	Pini-baru	E		CR
<i>Lijndenia gardneri</i>		E		CR
<i>Medinilla fuchsoides</i>				
<i>Melastoma malabathricum</i>	Maha bowitiya			
<i>Memecylon capitellatum</i>	Dodan-kaha	E		
<i>Memecylon clarkeanum</i>		E		
<i>Memecylon cuneatum</i>		E		EN
<i>Memecylon ovoideum</i>		E	TR	VU
<i>Memecylon parvifolium</i>		E		
<i>Memecylon petiolatum</i>		E		
<i>Memecylon revolutum</i>		E	HT	EN
<i>Memecylon rostratum</i>	Heen kuratiya	E		VU
<i>Memecylon rotundatum</i>		E	HT	VU

Family Species	Local names	Endemic To Sri Lanka (E)	Conservation Status	
			IUCNSL	IUCN Global
<i>Memecylon sylvaticum</i>		E		VU
<i>Memecylon umbellatum</i>	Kora-kaha			
<i>Osbeckia aspera</i>	Bowitiya, Heen- bowitiya			
<i>Osbeckia lanata</i>		E		
<i>Osbeckia rubicunda</i>				
<i>Osbeckia walkeri</i>		E		
Meliaceae				
<i>Aglaia apiocarpa</i>				VU
<i>Aglaia elaeagnoidea</i>	Puwangu			
<i>Chukrasia tabularis</i>	Hulan hik			
<i>Cipadessa baccifera</i>	Hal-bembiya			
<i>Dysoxylum championii</i>	Gona-pana	E		VU
<i>Dysoxylum excelsum</i>				
<i>Dysoxylum ficiforme</i>				
<i>Munronia pinnata</i>	Bin-kohomba			
<i>Walsura trifoliolata</i>	Kiri-kon			
Menispermaceae				
<i>Anamirta cocculus</i>	Titta wel			
<i>Cissampelos pareira</i>	Diya-mitta			
<i>Coscinium fenestratum</i>	Weni-wel, Ban-wel		TR	
<i>Cyclea peltata</i>	Kehi-pittan, Kesi- pissan			
Monimiaceae				
<i>Hortonia floribunda</i>		E		
<i>Hortonia ovalifolia</i>	Weyiya	E		
Moraceae				
<i>Artocarpus gomezianus</i>	Kana-gona			
<i>Artocarpus nobilis</i>	Del, Bedi-del	E		
<i>Ficus amplissima</i>	Ela-nuga			
<i>Ficus arnottiana</i>	Patana bo, Kaudu bo			
<i>Ficus callosa</i>	Gonna, Wal-gona			
<i>Ficus diversiformis</i>		E		
<i>Ficus exasperata</i>	Bu-thediya			
<i>Ficus hispida</i>	Kota-dimbula			
<i>Ficus microcarpa</i>	Panu-nuga			
<i>Ficus nervosa</i>	Kalu-maduwa			
<i>Ficus tinctoria</i>	Ehetu, Gas-netul			
<i>Ficus virens</i>				
<i>Streblus asper</i>	Geta-netul			
<i>Streblus taxoides</i>	Pol katu, Gon-gotu			
Myristicaceae				
<i>Horsfieldia irya</i>	Iriya			
<i>Myristica ceylanica</i>	Malaboda			VU
<i>Myristica dactyloides</i>	Malaboda			LR/cd
Myrsinaceae				
<i>Ardisia gardneri</i>		E		
<i>Ardisia missionis</i>				

Family Species	Local names	Endemic To Sri Lanka (E)	Conservation Status	
			IUCNSL	IUCN Global
<i>Ardisia moonii</i>		E		
<i>Ardisia pauciflora</i>				
<i>Ardisia zeylanica</i>		E		
<i>Embelia ribes</i>	Wel-embilla			
<i>Maesa indica</i>	Mata-bimbiya			
<i>Myrsine robusta</i>		E		
Myrtaceae				
<i>Cleistocalyx nervosum</i>	Bata-damba	E	HT	
<i>Eugenia fulva</i>		E	HT	VU
<i>Eugenia hypoleuca</i>		E		EN
<i>Eugenia mabaeoides</i>		E		
<i>Eugenia rivolurum</i>		E	TR	VU
<i>Eugenia rotundata</i>		E	TR	VU
<i>Eugenia sripadense</i>		E		EN
<i>Eugenia terpnophylla</i>		E	TR	EN
<i>Eugenia thwaitesii</i>				
<i>Eugenia willdenowii</i>	Tembiliya			
<i>Rhodomyrtus tomentosa</i>	Wal pera			
<i>Syzygium aqueum</i>	Wal jambu			
<i>Syzygium assimile</i>	Damba	E	HT	
<i>Syzygium batadamba</i>		E		
<i>Syzygium cordifolium</i>	Wal jambu	E	TR	
<i>Syzygium cumini</i>	Ma-dan			
<i>Syzygium cylindricum</i>		E	TR	
<i>Syzygium fergusonii</i>	Wal karabu	E	TR	EN
<i>Syzygium firmum</i>	Wal jambu	E	TR	VU
<i>Syzygium gardneri</i>	Damba		TR	
<i>Syzygium hemisphericum</i>			TR	
<i>Syzygium lissophyllum</i>		E		
<i>Syzygium makul</i>	Alu-bo			VU
<i>Syzygium micranthum</i>		E	TR	VU
<i>Syzygium neesianum</i>	Panu-kera			VU
<i>Syzygium oliganthum</i>		E	TR	VU
<i>Syzygium revolutum</i>			TR	
<i>Syzygium rotundifolium</i>		E		VU
<i>Syzygium spathulatum</i>			TR	EN
<i>Syzygium spissum</i>		E		
<i>Syzygium turbinatum</i>		E	HT	EN
<i>Syzygium umbrosum</i>	Heen-damba, weli-damba	E	TR	EN
<i>Syzygium zeylanicum</i>	Maranda, Maran			
Ochnaceae				
<i>Gomphia serrata</i>	Bo-kera			
<i>Ochna jabotapita</i>	Mal-kera	E		CR
<i>Ochna lanceolata</i>	Bo-kera, Mal-kera			
Olacaceae				
<i>Olax imbricata</i>	Telatiya			
<i>Strombosia nana</i>		E		

Family Species	Local names	Endemic To Sri Lanka (E)	Conservation Status	
			IUCNSL	IUCN Global
Oleaceae				
<i>Chionanthus albidiflora</i>	Embul-korakaha	E		CR
<i>Jasminium angustifolium</i>	Wekanda, Wal-pitcha			
<i>Jasminium flexile</i>				
<i>Olea polygama</i>				
Pandanaceae				
<i>Frecinetia walkeri</i>		E		
<i>Pandanus thwaitesii</i>	Dunu-keyiya			
Passifloraceae				
<i>Adenia hondala</i>	Hondala			
<i>Passiflora suberosa</i>	Theentha			
Piperaceae				
<i>Piper sylvestre</i>	Mala-miris wel			
<i>Piper zeylanicum</i>		E		
Pittosporaceae				
<i>Pittospermum ceylanicum</i>	Ketiya			
<i>Pittosporum tetraspermum</i>				
Poaceae				
<i>Arundinaria debilis</i>		E		
<i>Davidsea attenuata</i>		E		
<i>Ochlandra stridula</i>	Bata	E		
<i>Pseudoxytenanthera monadelphica</i>				
Proteaceae				
<i>Helicia ceylanica</i>		E	HT	
Rhamnaceae				
<i>Rhamnus arnottianus</i>		E		
<i>Rhamnus wightii</i>				
<i>Scutia myrtina</i>	Tudari (T)			
<i>Ventilago gamblei</i>				
<i>Ventilago maderaspatana</i>	Yakada-wel			
<i>Zizyphus napeca</i>	Yak-eraminiya	E		
<i>Zizyphus oenoplia</i>	Heen-eraminiya			
Rhizophoraceae				
<i>Carallia brachiata</i>	Dawata			
<i>Carallia calycina</i>	Ubberiya	E		VU
<i>Cassipourea ceylanica</i>	Pana			
Rosaceae				
<i>Photinia integrifolia</i>	Lunu warala			
<i>Prunus ceylanica</i>	Kankumbal-ketiya	E		
<i>Prunus walkeri</i>	Kankumbal-ketiya	E		
<i>Rubus ellipticus</i>	Nara-bute			
<i>Rubus gardnerianus</i>				
<i>Rubus leucocarpus</i>				
<i>Rubus micropetalus</i>				
<i>Rubus rugosus</i>				
Rubiaceae				
<i>Aidia gardneri</i>		E		

Family Species	Local names	Endemic To Sri Lanka (E)	Conservation Status	
			IUCNSL	IUCN Global
<i>Anthocephalus chinensis</i>	Ela-bakmi			
<i>Benkara malabarica</i>	Pudan			
<i>Canthium campanulatum</i>		E		
<i>Canthium coromandelicum</i>	Kara			
<i>Canthium puberulum</i>		E		
<i>Catunaregam spinosa</i>	Kukuruman			
<i>Chassalia curviflora</i>				
<i>Diplospora erythrospora</i>		E		CR
<i>Discospermum sphaerocarpum</i>	Sudu-seru			
<i>Gaertnera rosea</i>		E		VU
<i>Gaertnera ternifolia</i>		E		EN
<i>Gaertnera vaginans</i>	Pera tambala			VU
<i>Gaertnera walkeri</i>		E		
<i>Haldinia cordifolia</i>	Kolon			
<i>Hedyotis dendroides</i>		E		
<i>Hedyotis flavescens</i>		E		
<i>Hedyotis lessertiana</i>				
<i>Hedyotis trimenii</i>		E		
<i>Ixora calycina</i>				EN
<i>Ixora coccinea</i>				
<i>Ixora jucunda</i>		E		VU
<i>Ixora pavetta</i>				
<i>Ixora thwaitesii</i>				
<i>Lasianthus gardneri</i>		E		VU
<i>Lasianthus obliquus</i>		E		
<i>Lasianthus oliganthus</i>		E		LR/cd
<i>Lasianthus strigosus</i>		E		
<i>Lasianthus varians</i>		E		EN
<i>Lasianthus walkeranus</i>				
<i>Lasianthus sp.</i>				
<i>Metabolus decipiens</i>		E		
<i>Mitragyna parvifolia</i>	Helamba			
<i>Morinda coreia</i>	Ahu			
<i>Morinda umbellata</i>	Kiri-wel			
<i>Mussaenda frondosa</i>	Mussenda, Wal-but sarana			
<i>Nargedia macrocarpa</i>		E	TR	VU
<i>Pavetta badullensis</i>		E		
<i>Pavetta indica</i>	Pavatta			
<i>Pavetta involucrata</i>		E		
<i>Prismatomeris tetrandra</i>				
<i>Psilanthus travancoresis</i>				
<i>Psilanthus wightianus</i>	Wal-kopi			
<i>Psychotria dubia</i>		E		VU
<i>Psychotria gardneri</i>		E		EN
<i>Psychotria nigra</i>				
<i>Psychotria plurivenia</i>		E	HT	EN

Family Species	Local names	Endemic To Sri Lanka (E)	Conservation Status	
			IUCNSL	IUCN Global
<i>Psychotria sarmentosa</i>	Gonika			
<i>Psychotria sohmeri</i>		E		
<i>Psychotria sordida</i>		E		EN
<i>Psychotria stenophylla</i>		E	TR	VU
<i>Psychotria zeylanica</i>		E		
<i>Psydrax dicoccos</i>	Gal-karanda, Seru			VU
<i>Psydrax montanus</i>		E		
<i>Rubia cordifolia</i>	Manda-madini wel			
<i>Saprosma foetens</i>		E		
<i>Saprosma glomeratum</i>		E	HT	
<i>Schizostigma hirsutum</i>		E		
<i>Tarenna asiatica</i>	Tarana			
<i>Tarenna flava</i>				
<i>Timonius flavescens</i>	Angana			
<i>Uncaria ellipticum</i>				CR
<i>Urophyllum ceylanicum</i>		E		VU
<i>Urophyllum ellipticum</i>				
<i>Wendlandia bicuspidata</i>	Wana-idala	E		
Rutaceae				
<i>Acronychia pedunculata</i>	Ankenda			
<i>Atalantia ceylanica</i>	Yaki-naran			
<i>Atalantia monophylla</i>				
<i>Atalantia racemosa</i>			TR	
<i>Chloroxylon swietenia</i>	Buruta			VU
<i>Clausena dentata</i>	Weda-pana, Et-kara-bembiya			
<i>Clausena indica</i>	Mee-gon karapincha			
<i>Glycosmis angustifolia</i>	Bol-pana			
<i>Glycosmis mauritiana</i>				
<i>Glycosmis pentaphylla</i>	Dodan-pana			
<i>Limonia acidissima</i>	Diwul			
<i>Luvunga angustifolium</i>		E		
<i>Melicope lunu-ankenda</i>	Lunu-ankenda			
<i>Micromelum minutum</i>	Wal-karapincha	E		
<i>Murraya koenigii</i>	Karapincha			
<i>Murraya paniculata</i>	Etteriya			
<i>Paramignya armata</i>		E		
<i>Paramignya monophylla</i>	Wellangiriya			
<i>Pleispermium alatum</i>	Tun-pat kurundu			
<i>Toddalia asiatica</i>	Kudu-miris			
<i>Zanthoxylum rhetsa</i>	Katu-keena			
Sabiaceae				
<i>Meliosma pinnata</i>	Wal-bilin			
<i>Meliosma simplicifolia</i>	El-bedda			
Sapindaceae				
<i>Allophylus cobbe</i>	Kobbe			
<i>Allophylus varians</i>		E		
<i>Allophylus zeylanicus</i>		E		CR

Family Species	Local names	Endemic To Sri Lanka (E)	Conservation Status	
			IUCNSL	IUCN Global
<i>Dimocarpus longan</i>	Mora			
<i>Dodonaea viscosa</i>	Eta-werella			
<i>Filicium decipiens</i>	Pihimbiya			
<i>Glenniea unijuga</i>	Wal-mora	E		VU
<i>Harpullia arborea</i>	Pandalu			
<i>Lepisanthes erecta</i>				
<i>Lepisanthes simplicifolia</i>		E	TR	
<i>Lepisanthese senegalensis</i>	Gal-kuma			
<i>Lepisanthes tetraphylla</i>				
<i>Pometia pinnata</i>	Na-imbul			
<i>Sapindus emarginata</i>	Penela			
<i>Schleichera oleosa</i>	Kon			
Sapotaceae				
<i>Chrysophyllum roxburghii</i>	Lawulu			
<i>Isonandra compta</i>		E		
<i>Isonandra lanceolata</i>	Kiri-warala			
<i>Isonandra montana</i>		E		
<i>Isonandra zeylanica</i>		E		
<i>Madhuca longifolia</i>	Mee			
<i>Manilkara hexandra</i>	Palu			
<i>Palaquium grande</i>	Kiri-hembiliya	E		VU
<i>Palaquium hinmolpedda</i>	Heen-molpedda	E		
<i>Palaquium petiolare</i>	Tawenna	E		LR/cd
<i>Palaquium rubiginosum</i>	Kiri-pedda	E		VU
<i>Palaquium thwaitesii</i>	Rathatiya	E		VU
Schizandraceae				
<i>Kadsura heteroclita</i>				
Simaroubaceae				
<i>Quassia amara</i>	Samadara			
Smilacaceae				
<i>Smilax perfoliata</i>	Maha-kabaressa			
<i>Smilax zeylanica</i>	Heen-kabaressa			
Solanaceae				
<i>Lycianthus bigeminata</i>				
<i>Solanum giganteum</i>				
<i>Solanum pubescens</i>				
<i>Solanum violaceum</i>	Tibbatu			
Staphyleaceae				
<i>Turpinia malabarica</i>	Eta-hirilla, Kankumbula			
Sterculiaceae				
<i>Helicteres isora</i>	Lihiniya			
<i>Pteropermum suberifolium</i>	Welang			
<i>Pterygota thwaitesii</i>	Gal-nawa		TR	
<i>Sterculia balanghas</i>	Nawa			
<i>Sterculia foetida</i>	Telambu			
<i>Sterculia urens</i>	Kavali			
<i>Sterculia zeylanica</i>		E	TR	

Family Species	Local names	Endemic To Sri Lanka (E)	Conservation Status	
			IUCNSL	IUCN Global
Symplocaceae				
<i>Symplocos bractealis</i>		E		VU
<i>Symplocos cochinchinensis</i>	Bombu			VU
<i>Symplocos cordifolia</i>		E		
<i>Symplocos coronata</i>		E		
<i>Symplocos cuneata</i>		E		
<i>Symplocos elegans</i>		E	HT	
<i>Symplocos hispidula</i>		E		
<i>Symplocos macrophylla</i>				
<i>Symplocos obtusa</i>		E		CR
<i>Symplocos pendula</i>				
Theaceae				
<i>Adinandra lasiopetala</i>		E		
<i>Eurya acuminata</i>	Wild tea (E)			
<i>Eurya ceylanica</i>		E		
<i>Eurya chinensis</i>				
<i>Eurya nitida</i>	Neya-dassa			
<i>Gordonia ceylanica</i>	Mihiriya	E		
<i>Gordonia elliptica</i>				
<i>Gordonia speciosa</i>	Rat-mihiriya		TR	
<i>Ternstroemia gymnanthera</i>				
Thymelaeaceae				
<i>Gnidia glauca</i>	Naha			
<i>Gyrinops walla</i>	Walla			
Tiliaceae				
<i>Berrya cordifolia</i>	Hal-milla			
<i>Diplodiscus verrucosus</i>	Dikwenna	E		
<i>Grewia bracteata</i>				
<i>Grewia carpinifolia</i>				
<i>Grewia damine</i>	Daminna			
<i>Grewia helicterifolia</i>	Bora-daminiya			
<i>Grewia orientalis</i>	Wel-keliya			
<i>Microcos paniculata</i>	Kohu-kirilla			
Ulmaceae				
<i>Aphananthe cuspidata</i>	Wal-moonamal			
<i>Celtis philippensis</i>	Meditella			
<i>Celtis timorensis</i>	Gu-renda			
<i>Holoptelea integrifolia</i>	Goda-kirilla			
Urticaceae				
<i>Dendrocnide sinuata</i>	Ma-ussa			
Verbenaceae				
<i>Callicarpa tomentosa</i>	Illa			
<i>Clerodendron infortunatum</i>	Gas-pinna			
<i>Premna latifolia</i>	Maha-midi			
<i>Premna procumbens</i>	Mulla			
<i>Premna tomentosa</i>	Bu-seru			
<i>Vitex altissima</i>	Milla			
<i>Vitex leucoxydon</i>	Nebada			

Family Species	Local names	Endemic To Sri Lanka (E)	Conservation Status	
			IUCNSL	IUCN Global
Violaceae				
<i>Rinorea virgata</i>				
Vitaceae				
<i>Cissus gardneri</i>		E		
<i>Cissus heyneana</i>	Wal-muddarappalam			
<i>Cissus latifolia</i>	Wal-diyalabu			
<i>Cissus quadrangularis</i>	Hirissa			
<i>Cissus repanda</i>				
<i>Cissus trilobata</i>				
<i>Tetrastigma nilagiricum</i>				

APPENDIX 2 Animal species recorded in Protected Areas in the Central Province investigated for the NCR Survey

Sources:

Species: IUCN & WCMC (1997) – Taxonomy updated

Local names & endemism: IUCN 2002 Global Red List

Conservation Status: IUCNSL 1999 List and IUCN 2002 Global Red List

IUCNSL 1999 List (IUCNSL)

: **HT** = Highly Threatened, **TR** = Threatened

IUCN 2002 Global Red List (IUCN Global)

: **CR** = Critically Endangered, **EN** = Endangered,

VU = Vulnerable, **LR/nt** = Lower risk/near threatened,

LR/cd = Lower risk/conservation dependent, **DD** = Data deficient

Family Species	Local names E = English	Endemism in Sri Lanka(E)	Conservation Status	
			IUCNSL	IUCN Global
Butterflies				
<i>Cethosia nietneri</i>	Ceylon Lace Wing (E)			
<i>Cirrochroa thais</i>	Yeoman (E)			
<i>Cupha erymanthis</i>	Rustic (E)			
<i>Delias eucharis</i>	Jezebel (E)			
<i>Euploea core</i>	Common crow (E)			
<i>Graphium agamemnon</i>	Green Jay, Tailed Jay (E)			
<i>Graphium doson</i>	Common Jay (E)			
<i>Graphium sarpedon</i>	Blue bottle (E)			
<i>Junonia (= Precis) iphita</i>	Chocolate Soldier (E)			
<i>Kaniska (= Vanessa) canase</i>	Blue Admiral (E)			
<i>Lethe drypetis</i>	Tamil Tree Brown (E)	E	TR	
<i>Lethe dynaste</i>	Ceylon Forester (E)	E	TR	
<i>Lioythea lepita</i>				
<i>Melanitis phedima</i>	Dark Evening Brown (E)			
<i>Papilio crino</i>	Banded Peacock (E)			
<i>Papilio helenas</i>	Red Helen (E)	E	TR	
<i>Papilio polymnestor</i>	Blue mormon (E)			
<i>Papilio polytes</i>	Common mormon (E)			
<i>Pachliopta (=Polydorus) hector</i>	Crimson Rose (E)			
<i>Troides helena</i>				
<i>Valeria ceylanica</i>				
<i>Vanessa cardui</i>	Painted Lady (E)	E	TR	
<i>Ypthima ceylonica</i>	White Four Ring(E)			
Molluscs				
<i>Beddomea trifasciatus</i>		E		
<i>Corilla beddomeae</i>			TR	
<i>Corilla erronea</i>			TR	
<i>Ena stalix</i>				

Family Species	Local names E = English	Endemism in Sri Lanka(E)	Conservation Status	
			IUCNSL	IUCN Global
<i>Euplecta colletti</i>		E	HT	
<i>Euplecta gardneri</i>			HT	
<i>Euplecta indica</i>		E		
<i>Euplecta subopaca</i>			TR	
<i>Euplecta turritella</i>			HT	
<i>Euploea phaenareta</i>				
<i>Rachis pulcher</i>				
<i>Theobaldius bairdi</i>		E	TR	
<i>Tortulosa eurytrema</i>			HT	
Amphibia				
<i>Microhyla zeylanica</i>		E		
<i>Philautus</i> (= <i>Rhacophorus</i> <i>cavirostris</i>)	Gas-mediya Tubercle Tree Frog (E)	E	TR	
<i>Philautus femoralis</i>	Vatahombu Stikitta Round-snout Pygmy Tree Frog (E)	E	TR	
<i>Philautus hypomelas</i>	Patala-rahita Atikitta Webless Pygmy Tree Frog (E)	E	TR	
<i>Philautus leucorhyncus</i>		E		
<i>Philautus microtypanum</i>		E		
<i>Philautus nasutus</i>	Ul-hombu Atikitta Sharp-snout Pygmy tree Frog	E	TR	
<i>Philautus variabilis</i>		E		
<i>Polypedates</i> (= <i>Rhacophorus</i>) <i>eques</i>		E		
<i>Ramanelia obscura</i>		E		
Reptiles				
Order: Sauria				
<i>Calotes nigrilabis</i>	Kalu-kopul Katussa Black cheek Lizard (E)	E	TR	
<i>Ceratophora aspera</i>	Raluhang Katussa, Kuru Ang-katussa Rough-horned Lizard (E)	E	TR	
<i>Ceratophora stoddarti</i>	Kagamuva Ang- katussa Rhino-horn Lizard (E)	E	TR	
<i>Ceratophora tennentii</i>	Peti-Ang-katussa Leaf-nosed Lizard (E)	E	HT	EN
<i>Cophotis ceylanica</i>	Kandukara Kuru Katussa Pygmy Lizard (E)	E	HT	
<i>Geckoella</i> (= <i>Gymnodactylus</i>) <i>triedrus</i>	Pulli Vaka-niya Huna Spotted bow-finger	E		

Family Species	Local names E = English	Endemism in Sri Lanka(E)	Conservation Status	
			IUCNSL	IUCN Global
	Gecko (E)			
<i>Otocryptis wiegmanni</i>	Pinum Katussa, Gomu Tali-katussa Sri Lanka Kangaroo Lizard (E)		TR	
Order: Serpentes				
<i>Aspidura trachyrocta</i>	Dalawa medilla Common Roughside (E)	E	TR	
<i>Dendrelaphis tristis</i>	Tura Haldanda. Common Bronze back (E)			
Birds				
<i>Alcedo atthis</i>	Mal Pilihuduwa. Common Kingfisher (E)			
<i>Apus melba</i>				
<i>Aviceda jerdoni</i>	Dumburu-konda Ukussa, Dumburu- Saratukussa. Jerdon's Baza, Brown Baza (E)		TR	
<i>Chalcophaps indica</i>	Neela Kobeiya. Emerald Dove (E)			
<i>Chloropsis aurifrons</i>	Rannala Kolarisiya. Golden-fronted Leafbird (E)			
<i>Chrysocolaptes lucidus</i>	Lepita Maha-kerala. Greater Flameback (E)			
<i>Collocalia unicolor</i>	Indu Upa-thurithaya. Indian Swiftlet (E)			
<i>Columba torringtoni</i>	Maila-goya Sri Lanka Wood Pigeon (E)	E	TR	VU
<i>Copsychus malabaricus</i>	Wana polkichcha. White-rumped Shama (E)			
<i>Culicicapa ceylonensis</i>	Alu-his Kaha Mesimara. Grey-headed Canary Flycatcher (E)			
<i>Cyornis tickelliae</i>	Tickel Nil-mesimara. Tickel's Blue Flycatcher (E)			
<i>Dicaeum vincens</i>	Nil pililichcha, Sri Lanka Pililichcha. Legge's Flower Pecker, White- throated Flower	E	TR	LR/nt

Family Species	Local names E = English	Endemism in Sri Lanka(E)	Conservation Status	
			IUCNSL	IUCN Global
	Pecker (E)			
<i>Dinopeum bengalense</i>				
<i>Elanus caeruleus</i>	Patan-ukussa, Patanukussa. Black-winged Kite (E)			
<i>Falco peregrinus</i>	Maha-kobei Ukussa, Bada-ratu Kobei Ukussa, Peri / shahin Kurulugoya. Peregrine Falcon, Shahin Falcon (E)		TR	
<i>Galloperdix bicalcarata</i>	Haban kukula. Sri Lanka Spur Fowl (E)		TR	
<i>Gallus lafayettii</i>	Sri Lanka Wali- kukula. Sri Lanka Jungle Fowl (E)		E	
<i>Gracula ptilogenys</i>	Mookalan Selalihiniya, Sri Lanka Lanka Selalihiniya. Sri Lanka Grackle, Hill Mynah (E)	E	TR	LR/nt
<i>Hemiprocne coronata</i>	Silu Ruk Thurithaya. Crested Tree Swift (E)			
<i>Hemipus picatus</i>	Wairapiya Mesi- sarathitha. Bar-winged Fly catcher Shrike (E)			
<i>Hieraetus pennatus</i>	Alu-penda Rajaliya, Kesarupa Rajaliya. Booted Eagle (E)			
<i>Hirundo tahitica</i>	Sethkara Wehi- lihiniya. Pacific Swallow (E)			
<i>Hypothymis azurea</i>	Kalu-gelasi Radamara. Black-naped Monarch (E)			
<i>Hypsipetes indicus</i>				
<i>Hypsipetes madagascariensis</i>				
<i>Ictinaetus malayensis</i>	Kalukussa. Black Eagle (E)			
<i>Loriculus beryllinus</i>	Gira-malitta Lorikeet, Sri Lanka Hanging Parrot (E)		TR	
<i>Luscinia brunnea</i>	Indu Nil Siti-kichcha. Indian Blue Robin (E)			
<i>Luscinia svecica</i>	Nil-gela Siti-kichcha.			

Family Species	Local names E = English	Endemism in Sri Lanka(E)	Conservation Status	
			IUCNSL	IUCN Global
	Blue-throat (E)			
<i>Megalaima flavifrons</i>	Mookalan Kottoruwa, Sri Lanka Ran- munatha Kottoruwa. Sri Lanka Yellow- fronted Barbet (E)	E	TR	
<i>Megalaima haemacephala</i>	Rath-laya Kottoruwa. Coppersmith Barbet (E)			
<i>Megalaimia rubricapilla</i>	Tathu-munath Kottoruwa. Crimson-fronted Barbet (E)	E		
<i>Megalaimia zeylanica</i>	Polos Kottoruwa. Brown-headed Barbet (E)			
<i>Merops leschenaulti</i>	Thambala-hisa Binguharaya. Chesnut-headed Bee- eater (E)			
<i>Merops orientalis</i>	Punchi Binguharaya. Green Bee-eater (E)			
<i>Merops philippinus</i>	Nilpenda Binguharaya. Blue-tailed Bee-eater (E)			
<i>Muscicapa latirostris</i>				
<i>Muscicapa sordida</i>				
<i>Nectarinia asiatica</i>	Dan Sutikka. Purple Sunbird (E)			
<i>Nectarinia lotenia</i>	Lotenge Sutikka. Loten's Sunbird (E)			
<i>Oriolus xanthornus</i>	Kaha-kurulla. Black-hooded Oriole (E)			
<i>Orthotomus sutorius</i>	Battichcha. Common Tailor Bird (E)			
<i>Parus major</i>	Maha Tikiritta. Great Tit (E)			
<i>Pellomeum fuscicapillum</i>	Hisa-dumburu Demalichcha, Sri Lanka Boraga- demalichcha. Sri Lanka Brown- capped Babbler (E)	E	TR	
<i>Pericrocotus flammeus</i>	Dilirath Miniviththa. Scarlet Minivet (E)			
<i>Phylloscopus magnirostris</i>	Mathusu Gassraviya. Large-billed Leaf			

Family Species	Local names E = English	Endemism in Sri Lanka(E)	Conservation Status	
			IUGNSL	IUCN Global
	Warbler (E)			
<i>Phylloscopus nitidus</i>				
<i>Pitta brachyura</i>	Avichchiya. Indian Pitta (E)			
<i>Pomotorhinus horsfieldii</i>	Da-demalichcha. Scimitar Babbler (E)			
<i>Pycnonotus luteolus</i>	Bema-sudu Kondaya. White-browed bulbul (E)			
<i>Pycnonotus melanicterus</i>	Kalu-hisasi Kondaya. Black-crested Bulbul (E)			
<i>Pycnonotus penicillatus</i>	Guru Kondaya, Lanka Peetha-kan Kondaya (E)		TR	LR/nt
<i>Rhopocichla atriceps</i>	Wathanduru Panduru- demalichchca. Dark-fronted Babbler (E)			
<i>Sitta frontalis</i>	Villuda-nalal Yatikuriththa. Velvet-fronted Nuthatch (E)			
<i>Spizaetus cirrhatus</i>	Konda Rajaliya, Kondakussa, Perali Kodakussa. Crested Hawk Eagle, Changeable Hawk Eagle (E)			
<i>Spizaetus nipalensis</i>	Maha Konda Rajaliya, Kandukara Konda Ukussa, Hela Kondakussa. Mountain Hawk Eagle (E)		TR	
<i>Streptopelia chinensis</i>				
<i>Thelderma schmardanus</i>				
<i>Turdus merula</i>	Kalu Kurulla, Kalu Bimsariya. Eurasian Black Bird (E)		TR	
<i>Zoothera spiloter</i>	Pulli walawicciya, Sri Lanka Tithpiya, Thirasikaya. Sri Lanka Spotted- wing Thrush (E)	E	TR	LR/nt
<i>Zoothera wardi</i>	Gomara thirasikaya. Pied Thrush (E)			
<i>Zosterops ceylonensis</i>	Kandu Mal-kurulla, Sri Lanka Sithsiya.	E	TR	

Family Species	Local names E = English	Endemism in Sri Lanka(E)	Conservation Status	
			IUCNSL	IUCN Global
	Sri Lanka White Eye, Ceylon Hill White Eye (E)			
Mammals				
<i>Axis axis</i>	Thith muwa. Spotted-deer (E)			
<i>Bubalus bubalis</i>	Mee-haraka. Domestic Water Buffalo (E)			
<i>Cervus unicolor</i>	Gona. Sambur (E)			
<i>Elephas maximus</i>	Aliya, Etha. Asian Elephant (E)		TR	EN
<i>Funambulus sublineatus</i>	Punchi Lena. Dusky-striped Jungle Squirrel (E)			
<i>Herpestes smithi</i>	Hothambuwa, Rath- mugatiya. Ruddy mongoose, Black-tipped mongoose (E)			
<i>Hystrix indica</i>	Ittewa. Porcupine (E)			
<i>Lepus nigricollis</i>	Wal Hawa. Black-naped Hare (E)			
<i>Macaca sinica</i>	Rilawa. Toque monkey (E)		VU	
<i>Manis crassicaudata</i>	Kaballaya. Indian Pangolin, Scaly Ant-eater (E)			LR/nt
<i>Muntiacus muntjak</i>	Olu muwa, Weli Muwa. Barking Deer (E)			
<i>Panthera pardus</i>	Kotiya, Diviya. Sri Lankan Leopard (E)		TR	EN
<i>Presbytes entellus</i>	Wandura. Grey Langur (E)			LR/nt
<i>Presbytes senex</i>				
<i>Ratufa macroura</i>	Dandu-lena. Giant Squirrel (E)			VU
<i>Sus scrofa</i>	Wal ura. Wild Boar (E)			
<i>Tatera indica</i>	Weli-meeya. Antelope Rat (E)			
<i>Tragulus meminna</i>	Mi-minna			

APPENDIX 3 Flora restricted to the Central Province

Main source: Revised Handbook to the Flora of Ceylon (1980-2000)

Remarks: PE = Point Endemic

NC 100 = Not collected since 100 years

Districts: K = Kandy, M = Matale, N = Nuwara Eliya

Family Species	Common name	Endemic (E)	Remarks	Districts
Acanthaceae				
<i>Barleria arnottiana</i> <i>var. arnottiana</i>		E		N
<i>Barleria arnottiana</i> <i>var. glabra</i>		E		K
<i>Barleria nutans</i>		E		K
<i>Barleria strigosa</i>		E		K
<i>Gymnostachyum ceylanicum</i>				K
<i>Gymnostachyum thwaitesii</i>		E	NC100	K
<i>Justicia glabra</i>				K,N
<i>Justicia procumbens</i> <i>ssp. latispica</i>				N
<i>Justicia royeniana</i>		E		K,N
<i>Lepidagathis hyalina</i>		E		K
<i>Lepidagathis ceylanica</i>		E		K
<i>Lepidagathis walkeriana</i>		E		K,N
<i>Rungia longifolia</i> <i>ssp. latior</i>				K,N
<i>Rungia parviflora</i> <i>ssp. pectinata</i>				K,N
<i>Rungia apiculata</i>				K
<i>Strobilanthes arnottiana</i>	Nelu	E		N
<i>Strobilanthes calycina</i>	Nelu	E		N
<i>Strobilanthes caudata</i>	Nelu	E		K
<i>Strobilanthes deflexa</i>	Nelu	E		K
<i>Strobilanthes gardneriana</i>	Nelu	E		K,N
<i>Strobilanthes hypericoides</i>	Nelu	E		K
<i>Strobilanthes laxa</i>	Nelu	E		N
<i>Strobilanthes nigrescens</i>	Nelu	E	PE	K
<i>Strobilanthes nockia</i>	Nelu	E		N
<i>Strobilanthes pentandra</i>	Nelu	E	PE	K
<i>Strobilanthes punctata</i>	Nelu Nelu	E		K
<i>Strobilanthes rhamnifolia</i> <i>var. rhamnifolia</i>	Nelu	E		K
<i>Strobilanthes sexennis</i> <i>var. argentea</i>	Nelu	E		N
<i>Strobilanthes sexennis</i> <i>var. cerinthoides</i>	Nelu	E		K
<i>Strobilanthes sexennis</i>	Nelu	E		N

Family Species	Common name	Endemic (E)	Remarks	Districts
<i>var. cordata</i>				
<i>Strobilanthes sexennis</i> <i>var. glaberrima</i>	Nelu	E		K,M
<i>Strobilanthes sexennis</i> <i>var. hirsutissima</i>	Nelu	E		N
<i>Strobilanthes sexennis</i> <i>var. oblongifolia</i>	Nelu	E		K,N
<i>Strobilanthes sexennis</i> <i>var. sexennis</i>	Nelu	E		N
<i>Strobilanthes thwaitesii</i>	Nelu	E		N
<i>Strobilanthes viscosa</i> <i>var. digitalis</i>	Nelu	E		K,M
<i>Strobilanthes walkeri</i> <i>var. macrosperma</i>	Nelu	E		K
Alliaceae				
<i>Allium hookeri</i>	Vil-loonu			N
Amaranthaceae				
<i>Achyranthes bidentata</i>				K,M,N
Annonaceae				
<i>Orophea polycarpa</i>				K
Apiaceae				
<i>Bupleurum ramosissimum</i>	Wal-endaru			N
<i>Heracleum ceylanicum</i>		E		K,N
<i>Pimpinella heyneana</i>	Wal-asamodagam			N
<i>Sanicula elata</i>				N
Aquifoliaceae				
<i>Ilex denticulata</i>				N
<i>Ilex knucklesensis</i>		E		M
Araceae				
<i>Arisaema constrictus</i>		E		N
<i>Cryptocoryne walkeri</i>		E		K
Asclepiadaceae				
<i>Brachystelma lankana</i>	Patan ala	E	PE	M
<i>Ceropegia elegans</i> <i>var. gardneri</i>		E		N
<i>Ceropegia gardneri</i>				K
<i>Dischidia nummularia</i>		E		M
<i>Gymnema lactiferum</i> <i>var. thwaitesii</i>		E		N
<i>Marsdenia brunoniana</i>	Et-anguna			M
<i>Tylophora zeylanica</i>		? E		K
Asteraceae				
<i>Adenostemma parvifolium</i>				N
<i>Anaphalis brevifolia</i>				N
<i>Anaphalis fruticosa</i>		E		K
<i>Anaphalis marcescens</i>				N
<i>Anaphalis pelliculata</i>		E		N
<i>Anaphalis subdecurrens</i>				N
<i>Anaphalis sulphurea</i>		E		N
<i>Anaphalis thwaitesii</i>		E		N

Family Species	Common name	Endemic (E)	Remarks	Districts
<i>Anaphalis zeylanica</i>		E		N
<i>Artemesia dubia</i>	Wal-kolundu			K,N
<i>Blumea angustifolia</i>		E		K
<i>Blumea barbata</i>				K
<i>Blumea crinita</i>		E		K,N
<i>Blumea membranacea</i>				K
<i>Centipeda minima</i>	Visaduli, Heen-kimbu, Visa chunniya			K
<i>Gynura hispida</i>		E		N
<i>Helichrysum buddleioides</i> <i>var. hookerianum</i>		E		K,N
<i>Lagenophora gracilis</i>				K,N
<i>Laggera alata</i>				K,N
<i>Myriactis wightii</i>				K,N
<i>Senecio corymbosus</i> <i>var. corymbosus</i>				K
<i>Senecio gardneri</i>		E		K
<i>Senecio ludens</i>				K,N
<i>Senecio zeylanicus</i>				N
<i>Spilanthes calva</i>	Maha-akmella			K,N
<i>Vernonia anceps</i>		E		K,N
<i>Vernonia gardneri</i>		E		K,N
<i>Vernonia lankana</i>		E		K,N
<i>Vernonia pectiniformis</i> <i>var. puncticulata</i>		E		K,N
Balsaminaceae				
<i>Impatiens cuspidata</i>		E		K,M,N
<i>Impatiens elongata</i>		E		K
<i>Impatiens leptopoda</i>		E		K,N
<i>Impatiens macrophylla</i>		E		K,N
<i>Impatiens subcordata</i>		E	NC100	K,N
Begoniaceae				
<i>Begonia tenera</i> <i>var. thwaitesii</i>		E		K,M,N
Berberidaceae				
<i>Berberis ceylonica</i>		E		N
<i>Berberis wightiana</i>				N
Boraginaceae				
<i>Cynoglossum furcatum</i>	Bu-katu-henda			N
Buxaceae				
<i>Sarcococca brevifolia</i>				N
Callitrichaceae				
<i>Callitriche stagnalis</i>				N
Campanulaceae				
<i>Asyneuma fulgens</i>				N
Capparaceae				
<i>Capparis floribunda</i>				K
Caprifoliaceae				
<i>Viburnum exubescens</i>				N
Caryophyllaceae				

Family Species	Common name	Endemic (E)	Remarks	Districts
<i>Cerastrum indicum</i>				N
Celastraceae				
<i>Cassine congylos</i>		E		K,N
<i>Celastrus paniculatus</i>	Duhundu			K
<i>Maytenus fruticosa</i>		E	NC100	K
Clusiaceae				
<i>Calophyllum trapezifolium</i>	Keena	E		K
Commelinaceae				
<i>Commelina paludosa</i>				M,N
<i>Murdannia simplex</i>				M,K
Convallariaceae				
<i>Disporum cantoniense</i>				K,N
Convolvulaceae				
<i>Argyreia hancorniaefolia</i>		E		K
<i>Argyreia splendens</i>			NC100	K
<i>Cuscuta reflexa</i>	Aga mula-neti wel			N
<i>Ipomoea pileata</i>				K,M
Cornaceae				
<i>Mastixia congylos</i>		E		K
<i>Mastixia Montana</i>	Diya-taliya	E		N
Crassulaceae				
<i>Kalanchoe floribunda</i>				K,N
Cucurbitaceae				
<i>Mukia leiosperma</i>				N
<i>Trichosanthes anaimalainsis</i>				K
<i>Trichosanthes integrifolia</i>		E	NC100	K
Cyperaceae				
<i>Carex arnottiana</i>		E		N
<i>Carex baccans</i>				K,N
<i>Carex filicina</i> <i>ssp. Ceylanica</i>		E		N
<i>Carex jackiana</i>				K,N
<i>Carex lateralis</i>				N
<i>Carex lenta</i>				N
<i>Carex lobulirostris</i>		E		N
<i>Carex longicuris</i>				N
<i>Carex longipes</i>				N
<i>Carex maculate</i>				K,N
<i>Carex rara</i>		E		N
<i>Carex spicigera</i> <i>ssp. Spicigera</i>		E		K,N
<i>Cyperus cyperoides</i>				N
<i>Cyperus polyphylla</i>				N
<i>Fimbristylis consanguinea</i>				N
<i>Fimbristylis monticola</i>				K,M,N
<i>Fimbristylis salbundia</i>				K,N
<i>Rhynchospora rugosa</i>				K,N
<i>Trichophorum subcapitatum</i>				N
Dipsacaceae				

Family Species	Common name	Endemic (E)	Remarks	Districts
<i>Dipsacus walkeri</i>		E		N
Dipterocarpaceae				
<i>Stemonoporus affinis</i>		E	PE	K
Ebenaceae				
<i>Diospyros koenigii</i>	Kaluwara	E		K
Ericaceae				
<i>Gaultheria leschenaultii</i>	Wal-kapuru			K,N
Eriocaulaceae				
<i>Eriocaulon brownianum</i>				N
<i>Eriocaulon catopsioides</i>		E		K
<i>Eriocaulon subglaucum</i>		E		N
<i>Eriocaulon trimeni</i>		E	PE NC100	M
Euphorbiaceae				
<i>Croton nigroviridis</i>		E		K,M,N
<i>Croton zeylanicus</i>			NC100	K
<i>Glochidion gardneri</i>		E		K
<i>Glochidion pachycarpum</i>		E		K,M,N
<i>Phyllanthus hakgalensis</i>		E	PE	N
<i>Phyllanthus oreophilus</i>		E		N
<i>Phyllanthus zeylanicus</i>		E		K
<i>Sauropus quagrangularis</i>				M
<i>Sauropus retroversus</i>		E		N
<i>Tragia muelleriana</i>				K,N
Fabaceae				
<i>Albizia chinensis</i>	Kabal mara, Hulan mara			K
<i>Crotalaria wightiana</i>				N
<i>Desmodium jucundum</i>		E		M
<i>Dumasia villosa</i> <i>var. leiocarpa</i>				K,N
<i>Dunbaria heynei</i>				K
<i>Indigofera constricta</i>				M
<i>Ormocarpum sennoides</i> <i>ssp. Hispidum</i>				M
<i>Rhynchosia acutissima</i>			NC100	K
Gentianaceae				
<i>Crawfordia championii</i>		E	PE NC100	N
<i>Exacum trinervium</i> <i>ssp. Pallidum</i>		E		K,N
<i>Exacum walkeri</i>		E		K,N
<i>Gentiana quadrifaria</i>				N
<i>Swertia zeylanica</i>		E		N
Geraniaceae				
<i>Geranium nepalense</i>				N
Gesneriaceae				
<i>Aeschynanthus ceylanica</i>		E		K,N
<i>Chirita walkeri</i> <i>ssp. walkeri</i>		E		K,N
<i>Didymocarpus floccosus</i>		E	? PE	K

Family Species	Common name	Endemic (E)	Remarks	Districts
<i>Didymocarpus zeylanicus</i>		E		K
Hyacinthaceae				
<i>Dipcadi montanum</i>				M
Hypericaceae				
<i>Hypericum mysorense</i>				N
Lamiaceae				
<i>Anisochilus paniculatus</i>				K
<i>Isodon callipes</i>		E		N
<i>Isodon nigriscens</i>		E		K,N
<i>Isodon walkeri</i>				K,N
<i>Mentha arvensis</i>				N
<i>Plectranthus glabratus</i>			? PE	N
<i>Pogostemon hirsutus</i>		E		K,N
<i>Pogostemon reflexus</i>		E		K,N
<i>Pogostemon rupestris</i>		E		K,N
<i>Scutellaria oblonga</i>				K,M,N
<i>Scutellaria robusta</i>		E		K
<i>Scutellaria violacea</i> var. <i>rotunda</i>		E		N
Lauraceae				
<i>Actinodaphne glauca</i>		E		N
<i>Actinodaphne glauca</i> var. <i>subtriplinervis</i>		E		K
<i>Actinodaphne molochina</i>		E		N
<i>Cinnamomum ovalifolium</i>		E		K,M,N
<i>Litsea glutinosa</i>	Bomi			K
<i>Litsea ligustrina</i>				M
<i>Litsea walkeri</i>		E		K
Lentibulariaceae				
<i>Utricularia hirta</i>				K,M
<i>Utricularia moniliformis</i>		E		K,N
Lobeliaceae				
<i>Lobelia leschenaultiana</i>				N
<i>Lobelia nicotianifolia</i> var. <i>trichandra</i>	Rasni			K,M,N
Loranthaceae				
<i>Barathranthus mabaeoides</i>		E		M
<i>Dendrophthoe suborbicularis</i>		E		K,N
<i>Macrosolen barlowii</i>		E		N
Melastomataceae				
<i>Medinilla maculata</i>		E		K
<i>Memecylon leucanthemum</i>		E		K,M
<i>Memecylon macrocarpum</i>		E		K
<i>Memecylon parvilolium</i>		E		N
<i>Memecylon rodtundatum</i>		E		N
<i>Memecylon sessile</i>				M
<i>Osbeckia buxifolia</i>				N
<i>Osbeckia parvifolia</i>				K,N
<i>Sonerila affinis</i>		E		K,N
<i>Sonerila firma</i>		E		K

Family Species	Common name	Endemic (E)	Remarks	Districts
<i>Sonerila gardneri</i>		E		K,N
<i>Sonerila glabricaulis</i>		E		K,N
<i>Sonerila harveyi</i>		E	NC100	K
<i>Sonerila hookeriana</i>		E		K,N
<i>Sonerila robusta</i>		E		K
<i>Sonerila wightiana</i>		E		K
Menispermaceae				
<i>Diploclisia glaucescens</i>				K
<i>Pachygone ovata</i>				K
Moraceae				
<i>Ficus exasperata</i>	Bu-thediya			K
<i>Ficus trimenii</i>				K
Myrsinaceae				
<i>Ardisia crenata</i>				K
<i>Myrsine thwaitesii</i>				K,N
Myrtaceae				
<i>Eugenia hypoleuca</i>		E		M
<i>Eugenia madugodense</i>		E		K,M
<i>Eugenia pedunculata</i>		E		K
<i>Eugenia phillyraeoides</i>		E	PE	K
<i>Eugenia pseudomabaeoides</i>		E	PE	K
<i>Eugenia sripadaense</i>		E	PE	K
<i>Syzygium assimile</i>	Damba	E		K,M,N
<i>Syzygium batadamba</i>		E		N
<i>Syzygium fergusonii</i>	Wal-karabu	E		M
<i>Syzygium gardneri</i>	Damba	E		M
<i>Syzygium montis-adam</i>		E	PE	K
<i>Syzygium oliganthum</i>		E		K
<i>Syzygium potamicum</i>		E	PE	M
<i>Syzygium sclerophyllum</i>		E		M,N
Oleaceae				
<i>Jasminium bignoniaceum</i> <i>ssp. zeylanicum</i>		E		N
<i>Olea paniculata</i>			NC 100	N
Orchidaceae				
<i>Acanthephippium bicolor</i>				K
<i>Bulbophyllum maskeliyense</i>		E		K,N
<i>Bulbophyllum purpureum</i>		E		K,N
<i>Bulbophyllum tricarinatum</i>		E	NC100	N
<i>Bulbophyllum trimenii</i>		E		K,N
<i>Calanthe purpurea</i>		E		K,N
<i>Cheirostylis flabellata</i>				N
<i>Coelogyne breviscapa</i>		E		K
<i>Coelogyne odoratissima</i>				N
<i>Coelogyne zeylanica</i>		E		K
<i>Cryptostylis arachnites</i>				K,N
<i>Cyrtosia javanica</i>				M
<i>Dendrobium diodon</i>		E		K,N
<i>Dendrobium nutans</i>				K,N
<i>Dendrobium panduratum</i>		E		K

Family Species	Common name	Endemic (E)	Remarks	Districts
<i>Dendrobium salaccense</i>			NC 100	K
<i>Diplocentrum recurvum</i>				CP
<i>Epipogium roseum</i>				K
<i>Eria baccata</i>				K,N
<i>Goodyera fumata</i>			NC 100	K
<i>Habenaria viridiflora</i>				M
<i>Hetaeria elongata</i>				K,M
<i>Liparis atropurpurea</i>				K
<i>Liparis barbata</i>		E		K,N
<i>Liparis brachyglottis</i>		E		M,N
<i>Liparis walkerae</i>				K,N
<i>Oberonia claviloba</i>		E		K
<i>Oberonia dolobrata</i>		E		K
<i>Oberonia forcipita</i>				K
<i>Oberonia fornicata</i>		E		K
<i>Oberonia longibracteata</i>		E		K,N
<i>Oberonia recurva</i>				K,N
<i>Oberonia schyllae</i>		E		K
<i>Oberonia wallie-silvae</i>		E		K
<i>Oberonia zeylanica</i>				K
<i>Octarrhena parvula</i>				K,N
<i>Papilionanthe subulata</i>				K,N
<i>Peristylis aristatus</i>				K
<i>Peristylis gardneri</i>		E		K,N
<i>Peristylis spiralis</i>				N
<i>Phreatia elegans</i>				K
<i>Podochilus malabaricus</i>				K
<i>Pteroceras viridiflorum</i>				N
<i>Robiquetia gracilis</i>				K,N
<i>Robiquetia rosea</i>		E		K,M,N
<i>Robiquetia virescens</i>		E		K,N
<i>Satyrium nepalense</i>	Hyacinth orchid (E)			K,N
<i>Schoenorchis chrysantha</i>			NC 100	N
<i>Sirhookera latifolia</i>			NC 100	N
<i>Taeniophyllum pusilla</i>				K
<i>Tainia bicornis</i>				K
<i>Vanda thwaitesii</i>		E	NC 100	K
<i>Zeuxine longilabis</i>				M,N
Orobanchaceae				
<i>Campbellia cytinoides</i>				N
<i>Christisonia albida</i>		E	PE NC 100	N
<i>Christisonia subacaulis</i>				K,N
<i>Christisonia thwaitesii</i>		E	NC 100	K
<i>Legocia aurantiaca</i>			NC 100	N
Piperaceae				
<i>Peperomia blanda</i> var. <i>blanda</i>			NC100	K
<i>Piper hymenophyllum</i>				K,M
Poaceae				

Family Species	Common name	Endemic (E)	Remarks	Districts
<i>Andropogon lividus</i>				N
<i>Arundinaria densifolia</i>		E	PE	N
<i>Arundinaria scandens</i>		E	PE	N
<i>Arundinella laxiflora</i>		E		N
<i>Brachiaria semiundulata</i>				N
<i>Calamagrostis srilankensis</i>		E		N
<i>Coelachne perpusilla</i>				N
<i>Coelachne simpliciuscula</i>				N
<i>Cyrtococcum trigonum</i>				K
<i>Dimeria ballardii</i>		E		N
<i>Dimeria pubescens</i>				K,N
<i>Eulalia thwaitesii</i>		E		N
<i>Hemisorghum venustum</i>				N
<i>Heteropholis nigrescens</i>		E		N
<i>Ichnanthus pallens</i>				K
<i>Leptaspis zeylanica</i>				K,M
<i>Microstegium nudum</i>				K,N
<i>Oplismenus thwaitesii</i>		E	NC 100	M
<i>Pseudechinolaena polystachya</i>				K,M
<i>Themeda villosa</i>				K
<i>Tripogon bromoides</i>				N
Podostemaceae				
<i>Farmeria metzgerioides</i>		E		K
<i>Polypleurum stylosum</i>				K
<i>Zeylanidium lichenoides</i>				N
<i>Zeylanidium olivaceum</i>				K,N
<i>Zeylanidium subulatum</i>				K
Primulaceae				
<i>Lysimachia laxa</i>				K,N
<i>Lysimachia procumbens</i>				K,N
Ranunculaceae				
<i>Anemone rivularis</i>				N
<i>Clematis gouriana</i>				N
<i>Clematis smilacifolia</i>	Nara wel			K
<i>Ranunculus wallichianus</i>				N
<i>Thalictrum javanicum</i>				N
Rhamnaceae				
<i>Rhamnus arnottianus</i>		E		N
<i>Sageretia hamosa</i>				N
Rosaceae				
<i>Agrimonia zeylanica</i>		E		N
<i>Alchemilla indica</i> var. <i>indica</i>				N
<i>Alchemilla indica</i> var. <i>sibthorpioides</i>		E		N
<i>Potentilla polyphylla</i>				N
<i>Potentilla sundaica</i>				N
<i>Prunus ceylanica</i> var. <i>ceylanica</i>				N

Family Species	Common name	Endemic (E)	Remarks	Districts
<i>Prunus ceylanica</i> <i>var. parvifolium</i>	Golu-mora, Kan-kumbal ketiya	? E		N
<i>Rubus fairholmianus</i>				N
<i>Rubus gardnerianus</i>				N
<i>Rubus micropelalus</i>				N
<i>Rubus moluccanus</i>				K
<i>Rubus niveus</i>	Rodu-katambilla			K,M,N
<i>Rubus rugosus</i>				N
<i>Sanguisorba indicum</i>		E		K
Rubiaceae				
<i>Canthium campanulatum</i>		E		K
<i>Canthium macrocarpum</i>		E	NC 100	K
<i>Galium asperifolium</i>				N
<i>Hedyotis cinereo-viridis</i>		E	NC 100	M
<i>Hedyotis coprosmoides</i>		E		N
<i>Hedyotis dendroides</i>		E		K,N
<i>Hedyotis evania</i>		E		K
<i>Hedyotis flavescens</i>		E		K
<i>Hedyotis gardneri</i>		E		K
<i>Hedyotis gartmorensis</i>		E		K
<i>Hedyotis marginata</i>		E		K
<i>Hedyotis neollessertiana</i>		E		K
<i>Hedyotis quinquenervis</i>		E		N
<i>Hedyotis tridentata</i>		E		K
<i>Hedyotis trimenii</i> <i>var. orbicularifolia</i>		E		K
<i>Lasianthus thwaitesii</i> <i>var. foetulentus</i>		E		N
<i>Lasianthus thwaitesii</i> <i>var. thwaitesii</i>		E	NC 100	K
<i>Neanotis richardiana</i>		? E		K
<i>Neanotis nummularia</i>		E		N
<i>Neanotis nummulariformis</i>		E		K,N
<i>Ophiorhiza nemorosa</i>		E		K
<i>Ophiorhiza pallida</i>		E		K
<i>Pleiocraterium</i> <i>plantaginifolium</i>		E		N
<i>Psychotria plurivenia</i>		E		K,N
<i>Psychotria sohmeri</i>				K,N
<i>Psydrax dicoccus</i> <i>var. lanceolatus</i>				K
Rutaceae				
<i>Clausena dentata</i> <i>var. pubescens</i>				K
<i>Paramignya armata</i>		E		N
<i>Zanthoxylum tetraspermum</i>				N
Sabiaceae				
<i>Meliosma simplicifolia</i> <i>ssp. pungens</i>				K,N
Scrophulariaceae				

Family Species	Common name	Endemic (E)	Remarks	Districts
<i>Pedicularis zeylanica</i>				N
<i>Torenia aerinea</i>		E		N
Symplocaceae				
<i>Symplocos elegans</i> <i>var. angustata</i>		E		K,N
<i>Symplocos obtusa</i> <i>var. cucullata</i>		E		K,N
Theaceae				
<i>Adinandra lasiopetala</i>		E		K,N
Thymelaeaceae				
<i>Wickstoemia canescens</i>				N
Urticaceae				
<i>Boehmeria macrophylla</i> <i>var. scabrella</i>				N
<i>Girardinia diversifolia</i>				K,N
<i>Elatostemma acuminatum</i>				K
<i>Elatostemma surculosum</i> <i>var. rigidiusculum</i>		E	NC 100	K
<i>Elatostemma walkerae</i>		E		N
<i>Laportea bulbifera</i>				N
<i>Lecanthus peduncularis</i>				M
<i>Pellionia heyneana</i>				K
<i>Pouzolzia bennettiana</i> <i>var. gardneriana</i>				N
<i>Pouzolzia bennettiana</i> <i>var. mysorensis</i>				K,N
<i>Pouzolzia triandra</i>				N
Valerianaceae				
<i>Valeriana moonii</i>		E		N
Violaceae				
<i>Rinorea decora</i>		E	NC 100	K,M
<i>Viola hamiltoniana</i>				N
Viscaceae				
<i>Viscum ramosissimum</i>				N
Zingiberaceae				
<i>Alpinia abundiflora</i>				K,N
<i>Alpinia rufescens</i>		E	PE NC 100	K
<i>Amomum hypoleucum</i>				K
<i>Amomum masticatorium</i>		E		K