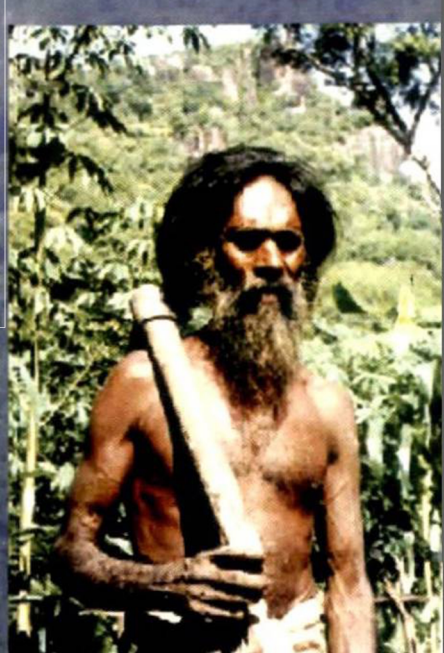
UVA PROVINCE BIODIVERSITY PROFILE AND CONSERVATION ACTION PLAN







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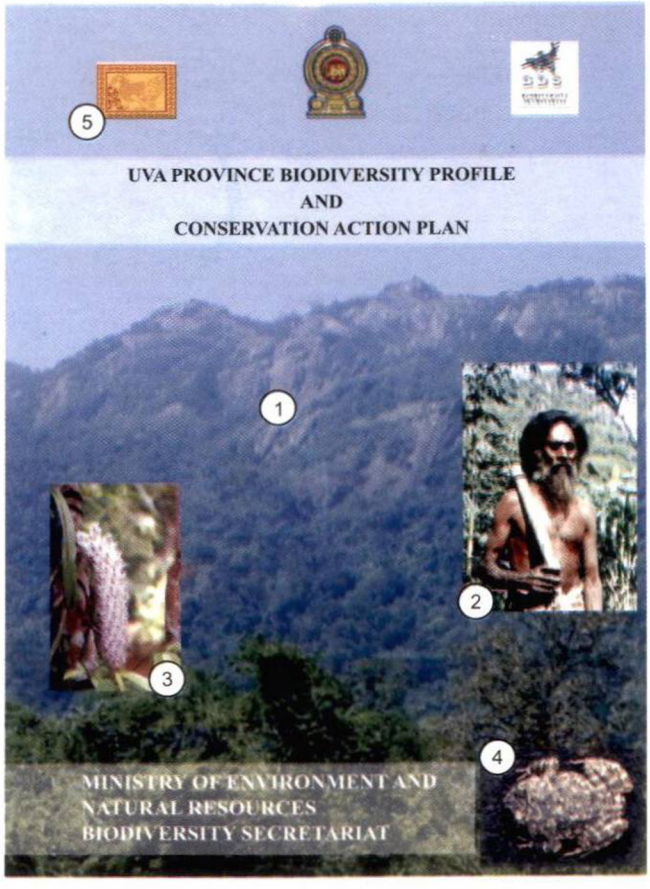

1. Background : Monaragala Hill Range

2. Human figure: Vedda or 'Wanniyalaetto tribe
   Photo credit : http://vedda.org/bio-diversity_plan.htm

3. Flower : Rhynchostylis retusa (Fox tail orchid)
   Photo credit : S.S.Fernando

4. Frog : Nannophrys naeyakai, endemic to Uva Province.
   Photo credit : S.S.Fernando

5. Flag : Uva

UVA PROVINCE BIODIVERSITY PROFILE AND CONSERVATION ACTION PLAN

A.H.Magdon Jayasuriya

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Ministry of Environment

A Publication of

Biodiversity Secretariat
Ministry of Environment & Natural Resources
Sri Lanka

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Message of the Hon. Minister of Environment & Natural Resources

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 hot- spots.

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 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

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Message of the Secretary to the Ministry of Environment & Natural Resources

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 Conservation Profiles and Action Plans (BDCPAP) 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 BDCPAP 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 Uva province.

M A R D Jayatilake
Secretary, Ministry of Environment & Natural Resources

Forward

On behalf of people of Uva province, I take this opportunity to express my gratitude to all heads of institutions, the officers and all personal who contributed by providing information, necessary instructions and cooperation to make the Biodiversity profile and action plan for Uva province a fruitful document.

This Biodiversity profile and action plan for Uva province is a product of series of workshops with heads of government and non government organizations of the province and experts of different fields under the guidance of the Biodiversity Secretariat of the Ministry of Environment and Natural Resources.

My special thanks also goes to Mr. Gamini Gamage, Director Biodiversity Secretariat for the leadership given and Dr. Magdon Jayasooriya, consultant of the project for collecting information on the physiological, biological, geological, ecological and historical aspects and managing them appropriately to prepare the profile and action plan in an excellent manner.

I hope all responsible parties will pay due attention to implement this action plan in all ongoing and future developmental projects of the province in environmental and bio friendly direction to achieve the goals of this action plan.

P B Amarasekara

Chief Secretary,

Uva Province

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Individual	Institution	Contribution
Mr. Gamini Gamage	Director, Biodiversity Secretariat, MENR	Program coordination, provision of information and literature, overall supervision
Ms. Dakshini Perera	Biodiversity Secretariat, MENR	Project Coordination
Ms. Darshani Samarakkody	Biodiversity Secretariat, MENR	Project Coordination
Mr. Chintaka Hettiarachchi	Actg. Deputy Chief Secretary (Planniong), Uva Provincial Council	Province coordination, provision of information and literature
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Director	Department of Agriculture, Uva Provincial Council	Information on agricultural crops
Director (Uva Province)	Urban Development Authority, UP, Badulla	Information on archeological sites
	University of Uva-Wellessa	Information on natural food plants and invasive plants
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. Dambane Gunawardena	Dambana, Mahiyangana	Information on ecosystem classification of the Vedda tribe
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Mr. Nalinda Peries	Project Managar, EML Consultants	Literature on fauna

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ACRONYMS

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 for Action
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
CDN	Ceylon Daily News
CEA	Central Environmental Authority
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CPRS	Central Poultry Research Station
CRI	Coconut Research Institute
CWR	Crop Wild Relative
DAg	Department of Agriculture
DAPH	Department of Animal Production & Health
DArch	Department of Archeology
DDTS	Dry Deciduous Thorn Scrub
DEA	Department of Export Agriculture
DEnA	District Environmental Agencies
DFAR	Department of Fisheries & Aquatic Resources
DFO	Divisional Forest Officer
DMEF	Dry Mixed Evergreen Forest
DNBG	Department of National Botanic Gardens
DC	Department of Customs
DWC	Department of Wildlife Conservation
EIA	Environmental Impact Assessment
EPA	Environmentally Protected Area
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
GSMB	Geological Survey & Mines Bureau
HARTI	Hector Kobbekaduwa Agrarian Research & Training Institute
HORDI	Horticultural Research and Development Institute
IBA	Impotant Bird Area
IDB	Industrial Development Board
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 Relative
MAB	Man and Biosphere Reserve
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
MIP	Ministry of Irrigation & Power
MIM	Ministry in charge of Indigenous Medicine
MMEF	Moist Mixed Evergreen Forest
MOEF	Montane Evergreen Forest
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
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
NPQS	National Plant Quarantine Service
NSC	National Steering Committee on Biodiversity
NSF	National Science Foundation
NP	National Park
NZG	National Zoological Garden
OPHS	Open Thorn Scrub
ORO	Other Research Organizations including Private Sector
OSF	Other State Forest
PA	Protected Area
PGRC	Plant Genetic Resources Centre
PGR	Plant Genetic Resources
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 Devepolment Programme
UNEP	United Nations Environment Programme
UNEP-WCMC	UNEP World Conservation Monitoring Centre
UP	Uva Province
UPC	Uva Provincial Council
UUW	University of Uva-Wellessa
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 Uva Province covers an area of 8,625 sq.km. (13.16 percent of the country) and it consists of two districts, viz Badulla and Monaragala. The province has a diverse landscape with high mountainous areas that originate some rivers that create some of the most picturesque waterfalls in the country. The province accommodates a reasonable portion of the central highlands that rapidly drops to the surrounding peneplain forming escarpments. The 'World's End' drop from the Horton Plains, 'Diyaluma', 'Dun hinda' and Rawana Falls are some of the best known waterfalls in the island that display the effect of these escarpments. The Uva Basin represents one of the two main basins situated on either side of the central backbone of the central massif. Although all three main climatic zones, viz Dry, Intermediate and Wet zones are represented in the Uva Province over half of the province belongs to the Intermediate Zone, while the Wet Zone covers only about 11.5 percent. A large diversity of soil types consisting of fifteen soil types are represented within the province. The Reddish Brown Earths cover over half of the province area, while Red Yellow Podzolic Soils, Erosional Remnants and Alluvial Soils are other main soils groups. The province accommodates upper basins of twenty one rivers, the main ones being the Mahaweli Ganga, Menik Ganga, Kumbukkan Oya, Gal Oya, Kirindi Oya and Walawe Ganga. Almost all others rivers are seasonal. Bio-geographically, the province represents five out of fifteen bio-geographical regions, viz Dry Zone, Intermediate zone, Lowland Wet Zone, Wet Highlands and Intermediate Highlands. Meanwhile, four out of fifteen Floristic Regions are represented within the province and they are Dry and Arid Lowlands, Eastern Intermediate Lowlands, Central Mountains, Ramboda-Nuwara Eliya and Horton Plains. The diverse agro-ecology in the province is indicated by the presence of fourteen agro-ecological regions that support high variety of crops that are being cultivated. The Uva Province has the highest diversity of natural vegetation; eleven out of fourteen major vegetation types exist within the province indicating high ecosystem diversity. A survey carried out in 1985 shows that the province had its forest cover of 48.3% of its total land area. This consisted of 32.6% of natural forests, 14.1% of open scrub and 1.6% plantation forests. The National Conservation Review has recorded 402 species of woody flowering plants, including 85 endemics and 30 threatened species, and 190 species of animals, including 36 endemics and 45 threatened species, in selected faunal groups. This survey was carried out in 29 protected areas in the Uva Province. Further studies based on literature survey have shown that 19 herbaceous and woody plant species are restricted to the Uva Province. Of the fauna, 33 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. The anthropogenic diversity in the Uva Province is analysed within a prehistoric context. It is remarkable that the protected areas cover about 32 percent of the total province area. Twenty one forest sector sites covering 22,639 hectares and fifteen wildlife sector sites covering 256,547 hectares add up to 279,186 hectares of protected area system of the Uva Province. Some of the largest protected areas are Ruhuna National Park (Blocks 2,3,4, & 5), Maduru Oya National Park (Block 1), Uda Walawe National Park, Gal Oya Valley National Park, Gal Oya Valley South-West Sanctuary, Gal Oya Valley North –East Sanctuary, Senanayake Samudra Sanctuary and Lunugamvehera National Park. In addition, many archaeological reserves also 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. "Conservation and Sustainable Use of Medicinal Plants Project" was a GEF-supported project (1998-2003) that intended to secure conservation of globally and nationally significant medicinal plant species and their habitats. Bibile in the Uva Province was one of the five Medicinal Plant Conservation Areas in Sri Lanka that were selected to develop within this project. Although there are no extant Botanical Gardens in the Uva Province, the Municipal Botanical Garden in Badulla had been a Botanic Garden in the late 19th century, administered by the Peradeniya Botanic Garden, but later disowned by the latter. The municipal parks, e.g. Nuwara Eliya also contribute towards the purpose of *ex situ* conservation of genetic resources of ornamental and botanically important plants. 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 use of flora and fauna in cultural activities and toponymy based on flora and fauna have been dealt with. 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, 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 fertizer, 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, 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 sustainable 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. An action plan was developed in consideration of issues that are relevant to biodiversity conservation, measures 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 Uva Provincial Council assumes the main coordinating function to bring synergy between the relevant institutions. The total time frame is proposed 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 km^2 that includes 2,905 km^2 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.

The government is the trustee of the nation's biodiversity and hence holds the ultimate responsibility for its conservation. However, there are statutory provisions and the policies relating to the devolution of power to the provincial governments. There is an increasing commitment by the government to decentralize the state administration to the provincial and district levels. Devolution would mean that environment conservation would 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 & Natural Resources (MENR) to prepare biodiversity profiles at the province level is very appropriate.

The present effort of preparation of a biodiversity profile for the Uva 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 Uva Province covers an area of 8625 sq.km. (13.16 percent of the country) and it consist of two districts, viz. Badulla (2872 sq.km.) and Monaragala (5753 sq.km).

2.1 Climatic Zones

All three main climatic zones, viz. dry, Intermediate and wet zones are represented in the UP (Figure 2.1). The extents and proportions of the three main climatic zones within the UP are shown in Table 2.1.

Table 2.1 Extents and proportions of climatic zones in Uva Province

Source: Jayasuriya et al 2006

Climatic zone	Extent (hectares)	Proportion (%)
Intermediate Zone	458,779	53.2
Dry Zone	304,552	35.3
Wet Zone	99,151	11.5

2.2Temperature

Temperature within the UP indicates notable variation, specially governed by the altitude. In the locations such as Diyatalawa in the Upper Uva at relatively higher altitudes, the temperature ranges within 60 – 75^0 F. In the locations at medium altitudes, e.g. Badulla, the temperature ranges between 70 – 75^0 F, while in the dry lowlands it is 80 – 85^0 F (Table 2.2). Accordingly, the areas such as Diyatalawa and Bandarawela with a cool dry climate are preferred holiday spots.

Table 2.2 Monthly temperature and rainfall patterns in two stations in UP

Station	Temp. & rainfall	J	F	M	A	M	J	J	A	S	O	N	D	Annual
Diyatalawa	Temp	64.7	65.8	67.7	69.2	70.4	70.4	70.4	69.8	69.4	68.4	67.0	65.4	68.2
	Rainfall	167	61	122	165	155	48	51	76	112	233	264	203	1633
Badulla	Temp	70.0	71.0	73.3	75.2	75.8	76.4	75.2	75.2	75.0	74.2	72.4	70.6	73.6
	Rainfall	217	79	127	175	119	38	53	79	491	226	259	284	826

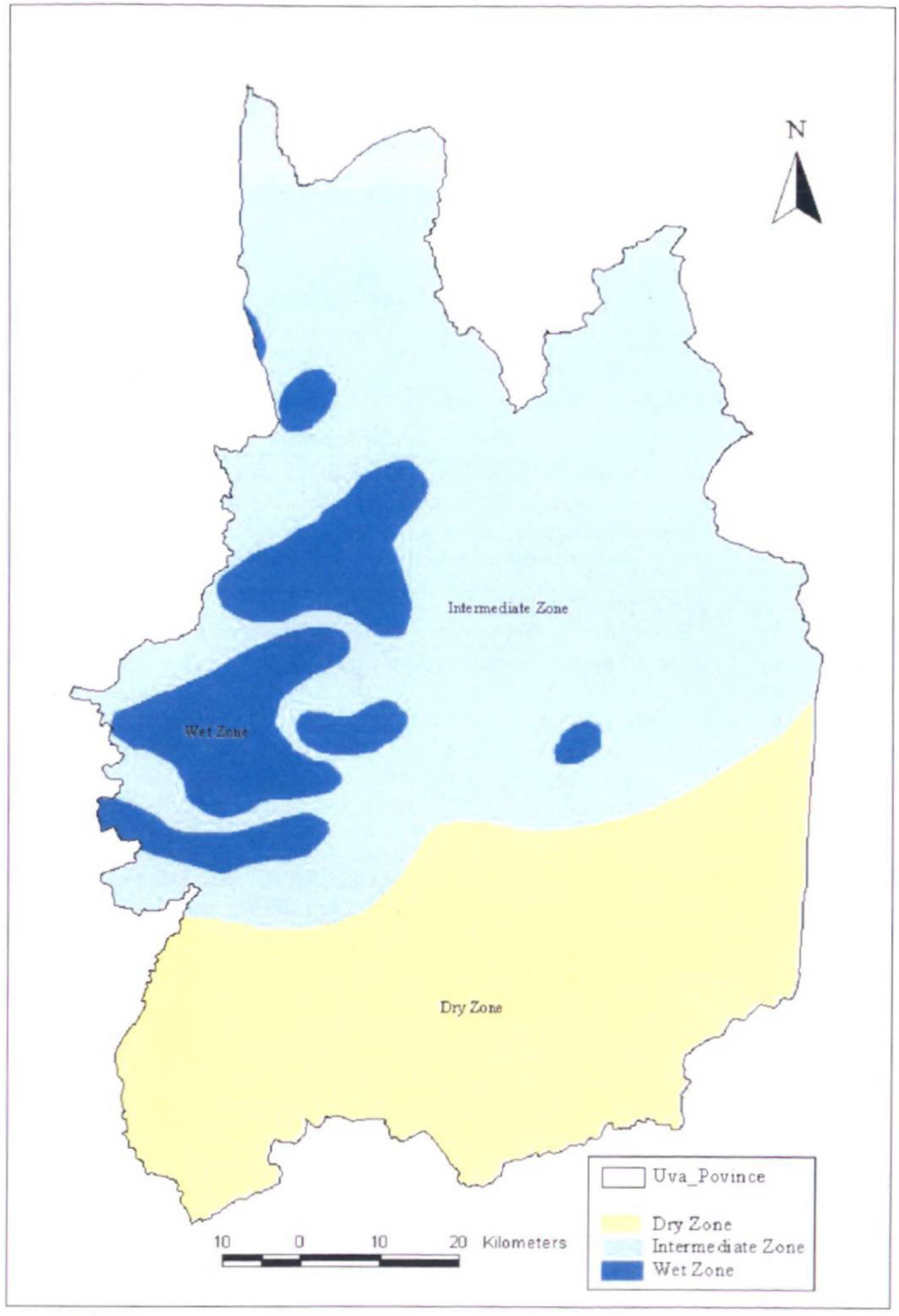

Figure 2.1 Climatic Zones of Uva Province

Source: Jayasuriya et al. 2006

2.2 Rainfall

The Figure 2.2 shows the rainfall isohyets that influence the province and it indicates remarkable variation in rainfall distribution in the UP. Table 2.3 shows the rainfall diversity even within the Upper Uva; especially the Uva Basin receives notably less rainfall in comparison with the ridges that surrounding it, i.e., Uda Pussellawa hills to the north, eastern slopes of the Pedro and Horton Plains highlands to the west, Idalgas-hinna and Haputale ridges to the south and Lunugala and Namunukula ridges to the east.

Although the dry winds that blows across the UP is characteristic, the regional climatic variation is also distinct, especially when the Upper Uva and Lower Uva areas are compared with each other. The Lower Uva, composed mainly of the Monaragala District, lie partly in the dry zone and partly in the intermediate zone.

In contrast, the Upper Uva, although having a drier climate, enjoys cooler conditions due to its landscape at high altitudes.

Although the Uva Basin is an important climatic region in Sri Lanka, it has been subjected to contrasting climatic classifications. In terms of gross classification consisting of three main climatic zones, Uva Basin has been placed in the wet zone by some authors, dry zone by some others, while according to some recent views it is placed in the intermediate zone (Domros 1974).

Subsequent to delivering copious precipitation into the western aspects of the central hills, the moisture-laden SW monsoon, between may–September, arrives in the Uva Basin as dry winds. The velocity and desiccation of this wind system become intense as it descend from the central hills into the Uva Basin and it imposes considerable impacts on the vegetation, agriculture and human communities. This dry wind system, known locally as 'Vesak Winds', sweeps the Lunugala and Namunukula hills in the Upper Uva and descends into the Lower Uva as very dry winds. These are also called 'hooting winds' (= 'hoova'), that supposedly coined the name 'Uva' for this unique region. The residual winds that reach the eastern coastal plains are known as 'Kachchan' winds by the Tamil communities in the east.

What is clear from this is that the Uva Basin receives only about 20% of its rainfall during 4-5 month period from the SW monsoon. Therefore some authors use 508 mm (20 inches) SW monsoon rainfall isohyet to mark the wet zone. The vegetation ecologists use this indicator to distinguish between Dry Patana Grasslands (DPGL) and Wet Patana Grasslands (WPGL).

In comparison with locations such as Watawala, Black water and Kenilworth Estate that receives about 60% of their annual rainfall from the SW monsoon, this monsoon is less important to the Uva Basin as a source of its annual rainfall as it receives a major portion of its rainfall from the convectional currents and convergence activities during the First Intermonsoon Period (March – April), cyclonic wind circulations during the Second Intermonsoon Period (October – November) and depressions (Survey Department 1988). As shown in Table 2.3, the annual rainfall received by Welimada (1504 mm) is less than that is received in some dry zone stations, e.g. Batticaloa (1651 mm). However, the Ledger Estate, situated less than 10 km North of Welimada, in the Uda pussellawa area, receives over 2500 mm of annual rainfall of which less than 12% is received during SW monsoon.

The Lower Uva generally exhibits a transition between dry and intermediate climatic conditions, as evident from the factors operating in places like Monaragala, Bibile and Buttala. Perhaps the success in cultivating sugarcane and orange in the Lower Uva is due to its special climatic conditions.

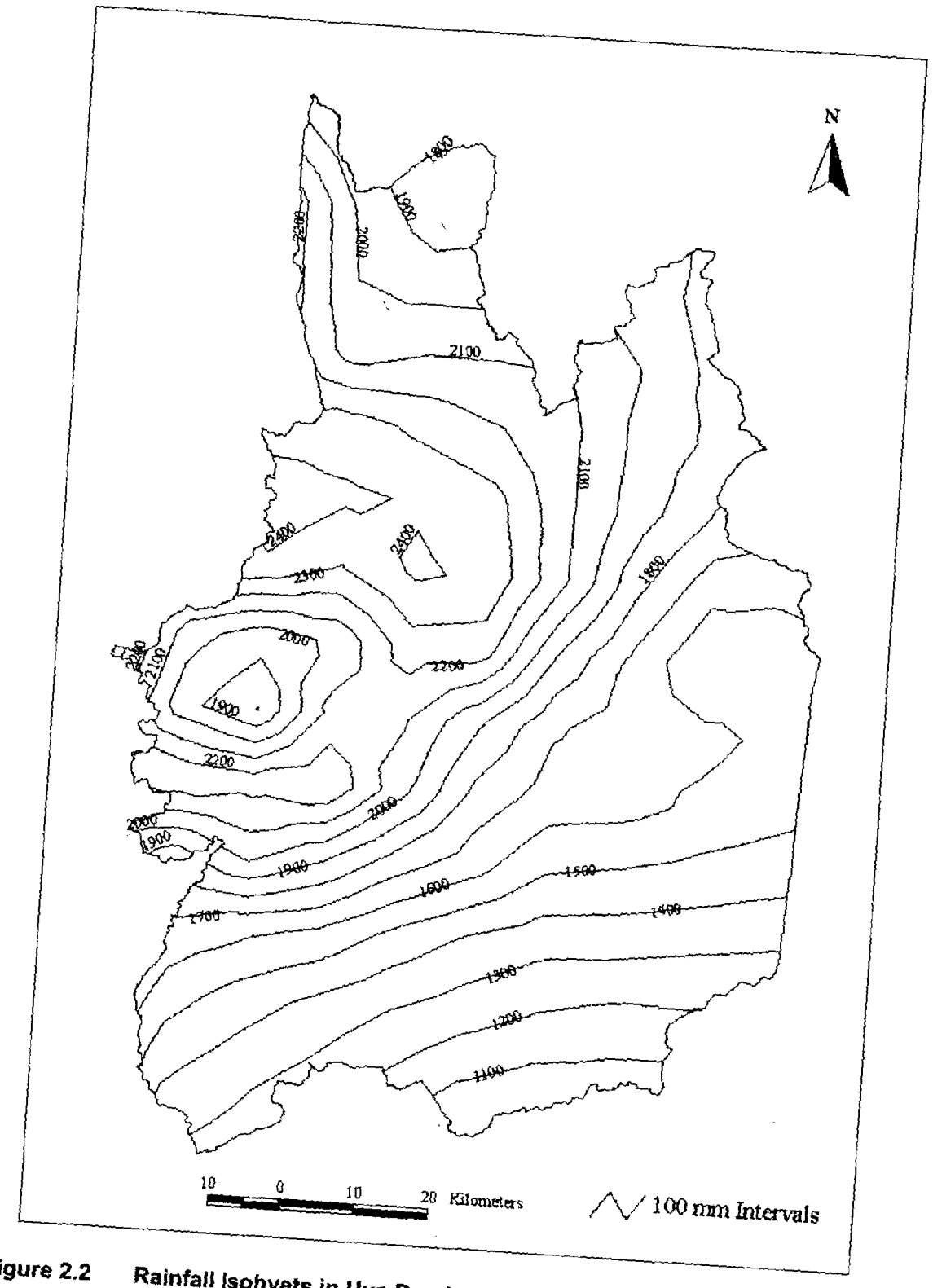

Figure 2.2 Rainfall Isohyets in Uva Province

Source: Survey Department 1988

Table 2.3 Annual and SW Monsoon rainfall in some stations in the Uva Basin

Basin region	Station	Annual rainfall (mm)	SW Monsoon rainfall (May-September)	Percentage of annual rainfall
Central region	Welimada	1504	312	20.7
	Diyatalawa	1731	360	20.8
	Badulla	1790	319	17.8
Southern ridge	Haputale	2116	373	17.6
Eastern ridge	Diyabubula	2385	477	20.0
Northern ridge	Ledger Estate	2711	325	12.0
Western ridge	Hakgala	2314	657	28.4

2.3 Topography

The province has a diverse landscape with high mountainous areas that originate some rivers that give rise to some of the most picturesque waterfalls in the country. It accommodates a reasonable portion of the central highlands that rapidly drops to the surrounding peneplain creating escarpments. The 'World's End' drop from the Horton Plains, 'Diyaluma', 'Dun hinda' and Rawana Falls are some of the best known waterfalls in the island, representing some of these escarpments. The Uva Basin represents one of the two main basins situated on either side of the central backbone of the central massif.

The landscape of the UP consists of the following components according to a review made by Cook (1931):

1. Uva Basin
2. Southern mountains
3. High plains
4. Eastern plateau
5. Lunugala ridge
6. Mahaweli river valley
7. Lowland plains

However, the Uva Basin is not a clearly defined basin with clear boundaries; but contains at least three sub-basins (Schweinfurth 1982). Welimada sub-basin forming the Uma Oya catchment, Badulla sub-basin forming the Badulu Oya sub-basin and the Uva highlands together constitute the Uva Basin.

In terms of altitude, the Upper Uva represents western highlands reaching above 300 m. There is a general altitudinal descend from the SW side to NE side of the Upper Uva region, while the average altitude of the Uva Basin is about 1000m. The western flank of the Uva Basin rises to over 2000 m up to Horton Plains highlands, peaks up to 2376 m at Hakgala and extends across Moon Plains to Uda pussellawa ridges. Meanwhile, the Lower Uva, consisting of southern and eastern peripheries, represents lowland plains below 300 m. However, many sporadic isolated hills generally ranging between 300 – 650 m., e.g. Monaragala and Kataragama etc. These, being weather-resistant hard rocks, are considered erosional remnants that have withstood erosion in the geological past. The Elevation Model for the UP is shown in Figure 2.3.

The mountainous wall extending across the Haputale gap situated on the eastern side and perpendicular to the high ridge between Pidurutalagala and Horton Plains offers a most scenic landscape in Sri Lanka. In its most areas, the landscape abruptly rises from the lowlands of the dry zone up to an altitude of 1000 – 1500 m; the Worlds End is such a remarkable escarpment above Belihul Oya area. Some of the tallest and best known waterfalls of the UP are Bambara kanda, Diyaluma and Ravana Ella. Sometimes, the coastal lowlands can be viewed through gaps, such as Ella, on the mountain ridges marking the southern margin of the Uva Basin. High instability of the escarpment terrain is evidenced by the frequency of landslides on the southern aspects, e.g. Beragala. The landscape from this southern mountainous wall towards Uva Basin descends gradually with gentle slopes, rounded hills and open valleys. The villages associated with this unique terrain still exist in the

Uva Basin and this agriculturally rich region provided the necessary resources for the Uva freedom struggle against the British.

The lowlands on the eastern aspects of the UP are known by some as 'Talawa'. This area is subjected to an intermediate zone climate and supports large extents of Savanna Grasslands (SAVG). The landscape is undulating or gentle to moderately sloped low hills with some relatively high isolated hills, e.g. Wadinahela (666 m), Govinda hela = Westminister Abbey (558 m), Monaragala, Nilgala and Inginiyagala. Some of the traditional abodes of the Vedda communities are located in this part of the country.

2.4 Soils

The soils of the UP exhibit high diversity among its diverse topography, especially the mountainous region, dry plains and river valleys. The soil map (Figure 2.4) indicates that 15 main soil groups are represented in the UP (Jayasuriya et al. 2006). The extents of these soil types are given in Table 2.4.

It is evident that the Reddish Brown Earths generally dominate the UP, constituting of over 50% of the area, mainly covering the dry and peripheral intermediate zones. The Immature Brown Loams, that occur chiefly in the intermediate zone in the form of a belt, are unstable and prone to erosion as seen in Randenigala area that suffered large scale landslides in early 2007. The high mountainous wet areas, such as Horton Plains, consist mainly of Red Yellow Podzolic soils, while the alluvial soils are formed in the dry lowlands along rivers. It is notable that the Rock-knob plains and Erosional Remnants add up to about 18% of the province, while all others are considered minor soil groups.

Table 2.4 Soil types represented in Uva Province

Soil type	Extent (hectares)	Proportion (%)
Reddish Brown Earths & Low Humic Gley soils; undulating terrain	292571	34.4
Reddish Brown Earths & Immature Brown Loams; rolling, hilly and steep terrain	132318	15.6
Rock-knob plain	90132	10.6
Red-Yellow Podzolic soils & Mountain Regosols; mountainous terrain	80302	9.6
Erosional remnants (Inselbergs)	66171	7.8
Red-Yellow Podzolic soils; steeply dissected, hilly and rolling terrain	63686	7.6
Reddish Brown Earths & Solodized Solonetz; undulating terrain	52720	6.2
Alluvial soils of variable drainage and texture; flat terrain	52037	6.1
Reddish Brown Earths, Noncalcic Brown soils & Low Humic Gley soils; undulating terrain	8870	1.0
Steep rockland & Lithosols	5352	0.6
Red-Yellow Pdzolic soils with dark B horizon & RedYellow Podzolic soils with prominent A1 horizom;rolling terrain	1964	0.2
Reddish Brown Earths with high amount of gravel in subsoil & Low Humic Gley soils; undulating terrain	1269	0.1
Red-Yellow Latosols; flat to slightly undulating terrain	752	0.1
Noncalcic Brown soils, soils on old alluvium & Solonetz; undulating terrain	715	
Solodized Solonetz and Solonchaks; flat terrain	502	0.1



Figure 2.3 Elevation Model of Uva Province

Source: Jayasuriya et al. 2006

From the colonial era, the hill slopes of the UP have been extensively cultivated with tea and therefore subjected to high soil erosion, while in the dry lowlands, soil groups that have been used for paddy cultivation for a long period of time. Degraded soils on large extents of savanna in Bintenna and Wellessa areas owe their present status to their extensive use by chena farmers. They prefer to rest the lands that are rich in soil nutrients rather than engage in intensive cultivation of chena lands that have already been cleared of forest vegetation.

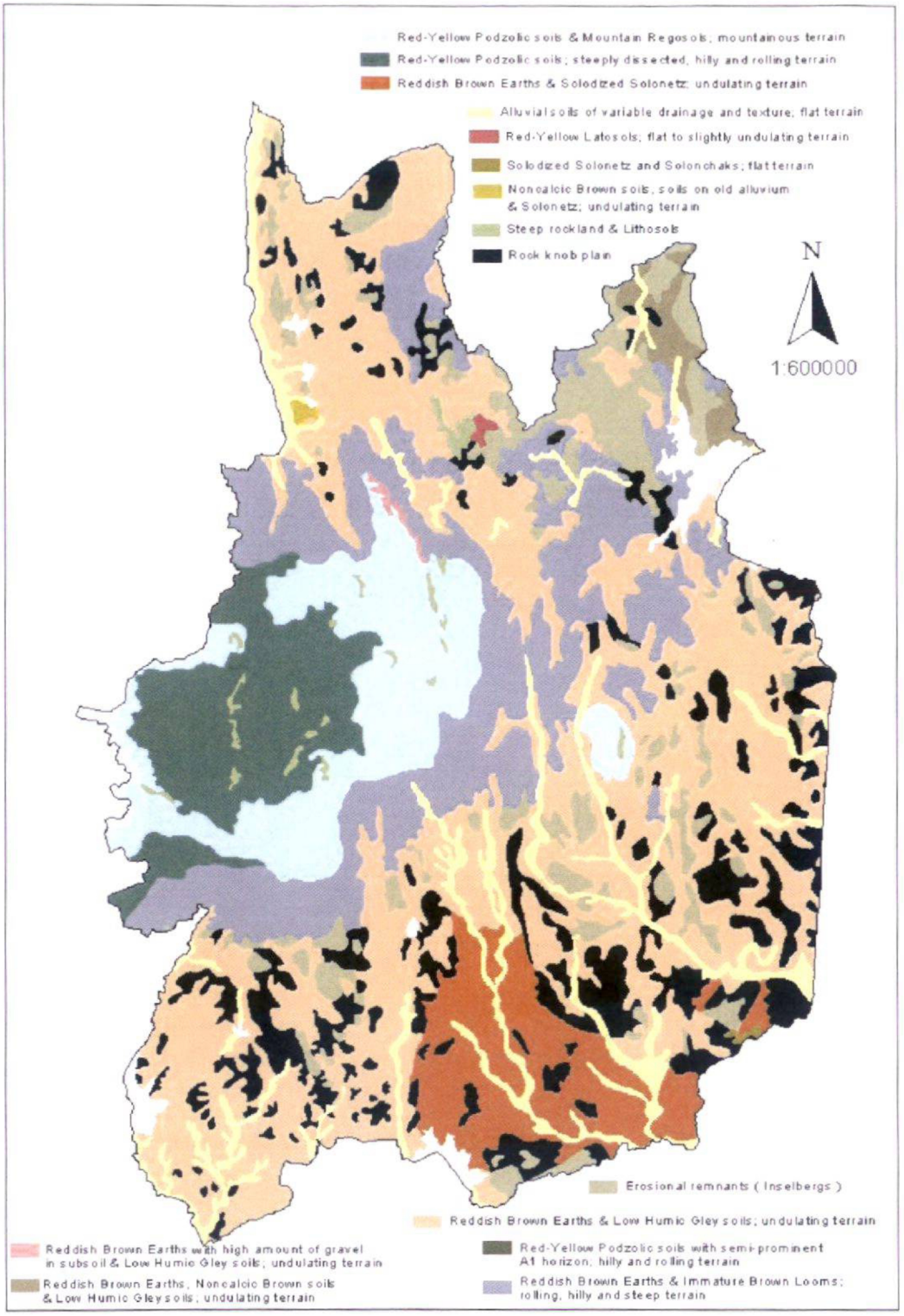

Figure 2.4 Soil Types represented in Uva Province

Source: Jayasuriya et al. 2006

2.5 Water bodies and stream network

2.5.1 Rivers and river basins

The river basin system that originates from the stream network represented in the UP is shown in Figure 2. 5. The river systems located within the UP mostly originate in the wet highlands and traverse the dry lowlands zone. However, a majority of the stream network undergoes seasonal drying up during water-deficit periods as a major portion of the Uva is subjected to a drier climate. The major water-surplus period is November – December, while the minor water-surplus period is March – April.

Mahaweli Ganga is the main river that is nourished by some of its main branches such as Uma Oya, Badulu Oya, Meda Oya and Loggal Oya located in the UP. Menik Ganga, Kirindi Oya and Kumbukkan Oya originate from the central hills within the UP, while Heda Oya, Vila Oya and Karanda Oya are small rivers that originate from the lowlands in this province and directly meet the sea. Table 2.5 shows the river basins that are represented in the UP, their extents and the relative proportions within the province.

Table 2.5 Extents of river basins in Uva Province

River Basin	Extent (hectares)	Proportion (%)
Mahaweli Ganga	184,234	21.36
Menik Ganga	121,939	14.13
kumbukkan Oya	110,817	12.84
Gal Oya	106,848	12.38
Kirindi Oya	88,408	10.21
Walawe Ganga	80,213	9.30
Heda Oya	41,870	4.85
Maduru Oya	32,305	3.74
Wila Oya	27,429	3.18
Karanda Oya	14,400	1.66
Mundeni Aru	14,303	1.65
Malala Oya	13,930	1.61
Unnichchnai	7,938	0.92
Kurundu Ara	6,729	0.78
Nabadagas Ara	3,803	0.56
Katupila Ara	3,289	0.44
Bagura Oya	1,626	0.18
Pannel Oya	1,359	0.15
Bambawe Ara	797	0.09
Butawa Oya	235	0.02
Karambe Ara	8	0.00

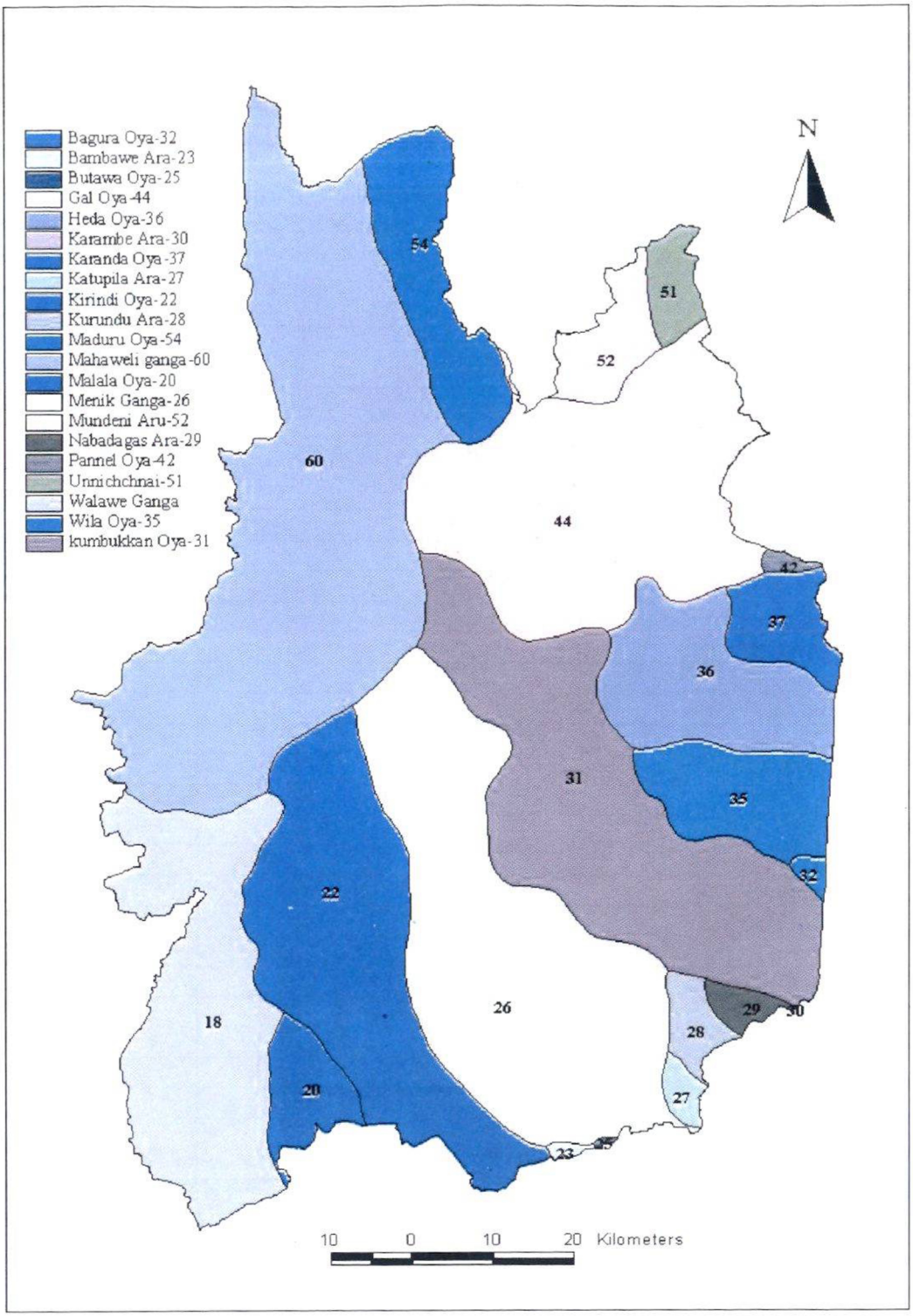

Figure 2.5 River Basins represented in Uva Province

Source: Jayasuriya et al. 2006

2.5.2 Tanks and reservoirs

Tanks, the ancient man-made water bodies, are found in considerable numbers in the Uva Province and they are mostly located in the dry parts of the province. The largest perennial tank, viz. Uda Walawe is of great importance in agriculture. The perennial and seasonal tanks in the UP constitute 18,011 and 385 hectares respectively (Figure 2.6). The tanks that are situated within the UP are listed in the Table 2.6.

Table 2.6 Tanks and Reservoirs in Uva Province with irrigable areas

(Source: Survey Department 1988)

	District and Name of tank/ irrigation scheme	Irrigable area (ha)
	Badulla District	
1	Sorabora Wewa	688
2	Dambarawa	563
3	Mapakada	548
4	Nagadeepa Scheme	1,791
5	Dehigama	121
6	Kande Ela	505
7	Demodara Peranikanda	202
8	Ambawala	387
	Monaragala District	
1	Badulla Oya	215
2	Muthukandiya Wewa	809
3	Ethimale Wewa	406
4	Kotiyagala Wewa	182
5	Yudaganawa Wewa	182
6	Halmilla Pillewa	81
7	Sudupanawela Wewa	141
8	Handapangala Wewa	402
9	Kandiyaoita Wewa	150
10	Dambe Wewa	93
11	Balaheruwa Wewa	85
12	Debara Ara Wewa	77
13	Hambegamuwa	130
14	Uda Walawe	12,270
15	Mahawewa	101
16	Karawila- Detagamuwa	--
17	Karawila- Mailagama	162

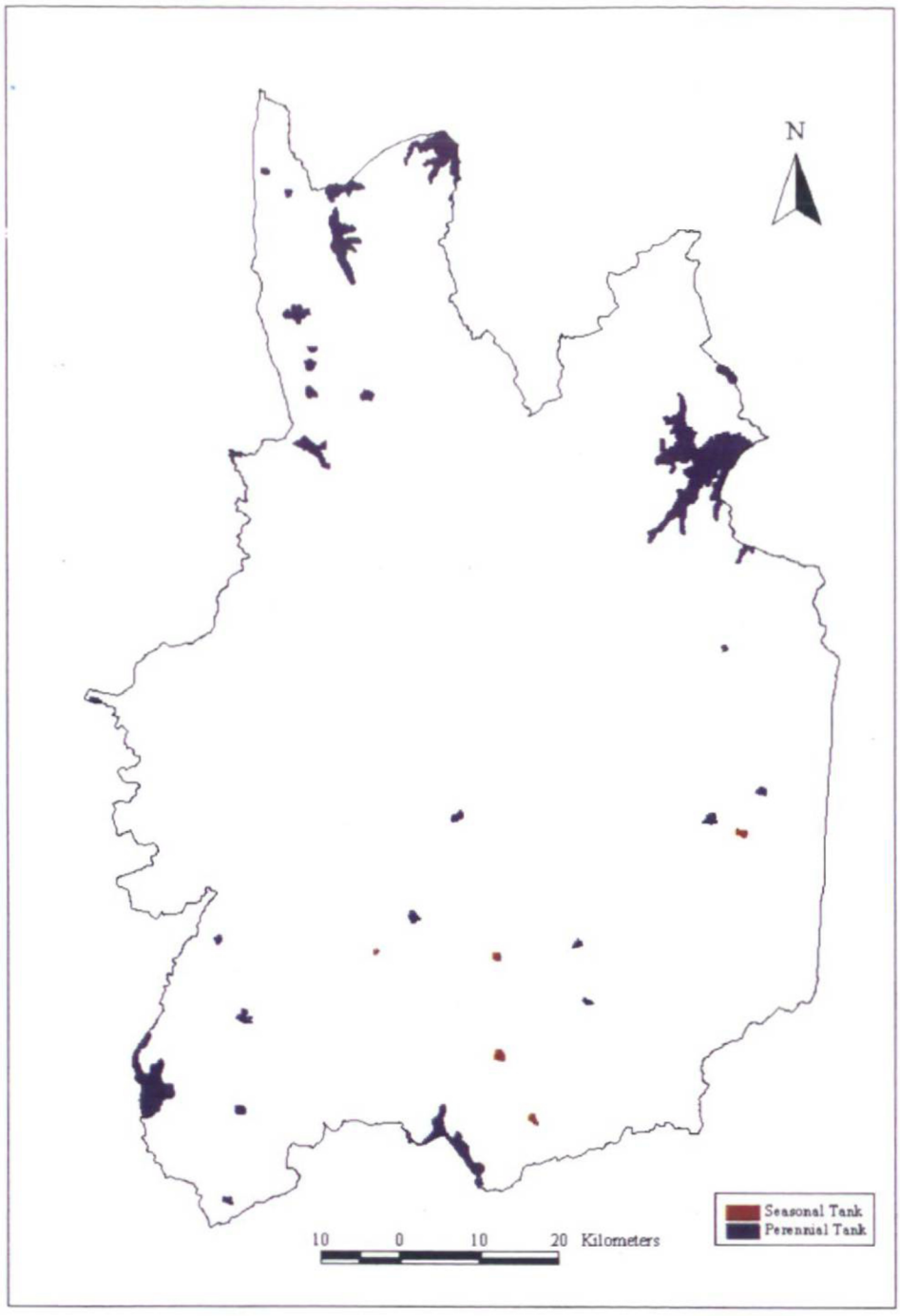

Figure 2.6 Tanks and reservoirs in Uva Province

Source: Jayasuriya et al. 2006

CHAPTER 3

3 BIO-GEOGRAPHICAL AREAS

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 km^2, near-primary forest accounts for only about 750 km^2 (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 areas needing urgent action for biodiversity conservation in their programs. 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 Uva Province, five bio-regions are represented as follows:

Bio-region 2 : Dry zone. Dry mixed evergreen forest; altitude 0 –500 m; annual rainfall 1250 – 1900 mm (mainly from Oct. – Jan.); 4 -5 dry months.

Bio-region 3 : Intermediate zone. Moist evergreen forest; altitude 0 – 1000 m; annual rainfall 1900 – 2500 mm; less than 3 dry months.

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-regions 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. Four floristic regions are represented in Uva Province (Figure 3.1) and they are:

Floristic Region 2: Dry and arid lowlands. Tropical dry mixed evergreen forests (*Manilkara* Community)

Mixed Community (*Chloroxylon-Vitex-Berrya-Schleichera* series)

Tropical thorn forests (*Manilkara-Chloroxylon-Salvadora-Randia* Series)

Damana and Villu grasslands

Flood plain wetlands, Riverine and gallery forests

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

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

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

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

Table 3.1 Extents of Floristic Regions in Uva Province

Floristic Region	Extent (hectares)	Proportion (%)
Dry and Arid Lowlands	593,980	69.0
Eatern Intermediate Lowlands	234,476	27.2
Central Montains, Ramboda-Nuwara Eliya	30,375	3.5
Horton Plains	1825	0.2

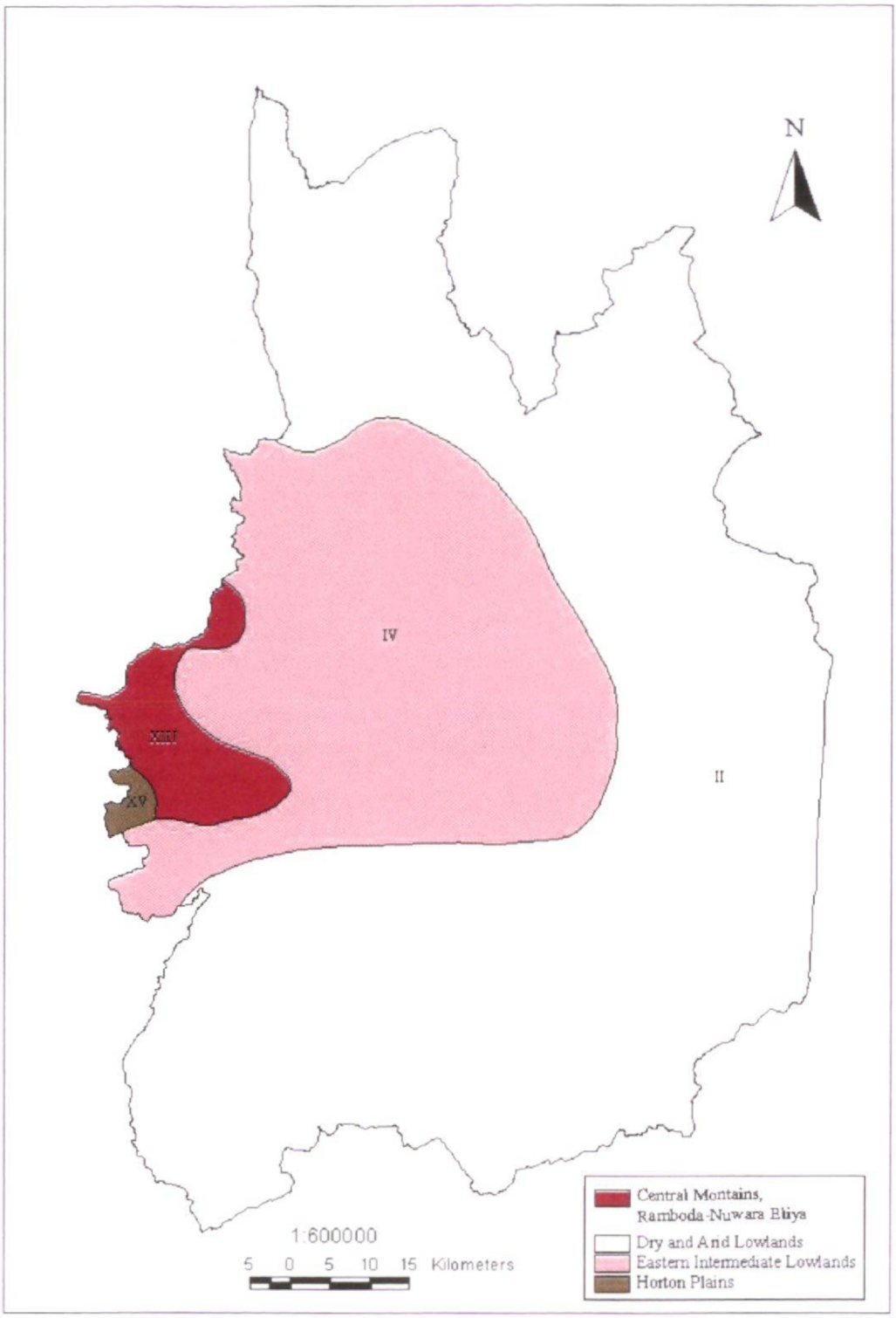

Figure 3.1 Floristic Regions in Uva Province

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 homogenious climatic conditions combined with the effects of soil, land form and agricultural activities. The natural environmement 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 14 agro-ecological regions are represented in the Uva Province and their respective areas are given in the Table 3.2.

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

Agro-ecological region		Extent (hectares)	Proportion of the total area (%)
DL 1	[Dry Low-country 1]	325,958	37.8
IL 2	[Intermediate Low-country 2]	193,847	22.5
IL 1 & IL 2	[Intermediate Low-country 1 & Intermediate Low-country 2]	64,695	7.5
IM 2	[Intermediate Mid-country 2]	61,928	7.2
IU 3	[Intermediate Up-country 3]	58,236	6.7
DL 2	[Dry Low-country 2]	44,190	5.1
IM 1	[Intermediate Mid-country 1]	41,907	4.8
IU 2	[Intermediate Up-country 2]	29,466	3.4
IU 2 & IU 3	[Intermediate Up-country 2 & Intermediate Up-country 3]	18.250	2.1
WU 3	[Wet Up-country 3]	12,590	1.5
DL 5	[Dry Low-country 5]	5,691	0.7
WM 3 & IM 2	[Wet Mid-country 3 & Intermediate Mid-country 2]	5,490	0.6
WM 3	[Wet Mid-country 3]	202	0.0
WU 2	[Wet Up-country 2]	40	0.0

It is evident that a major portion of the UP lies in the dry lowlands and intermediate lowlands and Intermediate midlands. Only a relatively small land area belongs to the wet highlands. As the province accommodates a broad intermediate agro-ecological region, the cultivation of appropriate crops, such as sugarcane, proliferated during recent times.

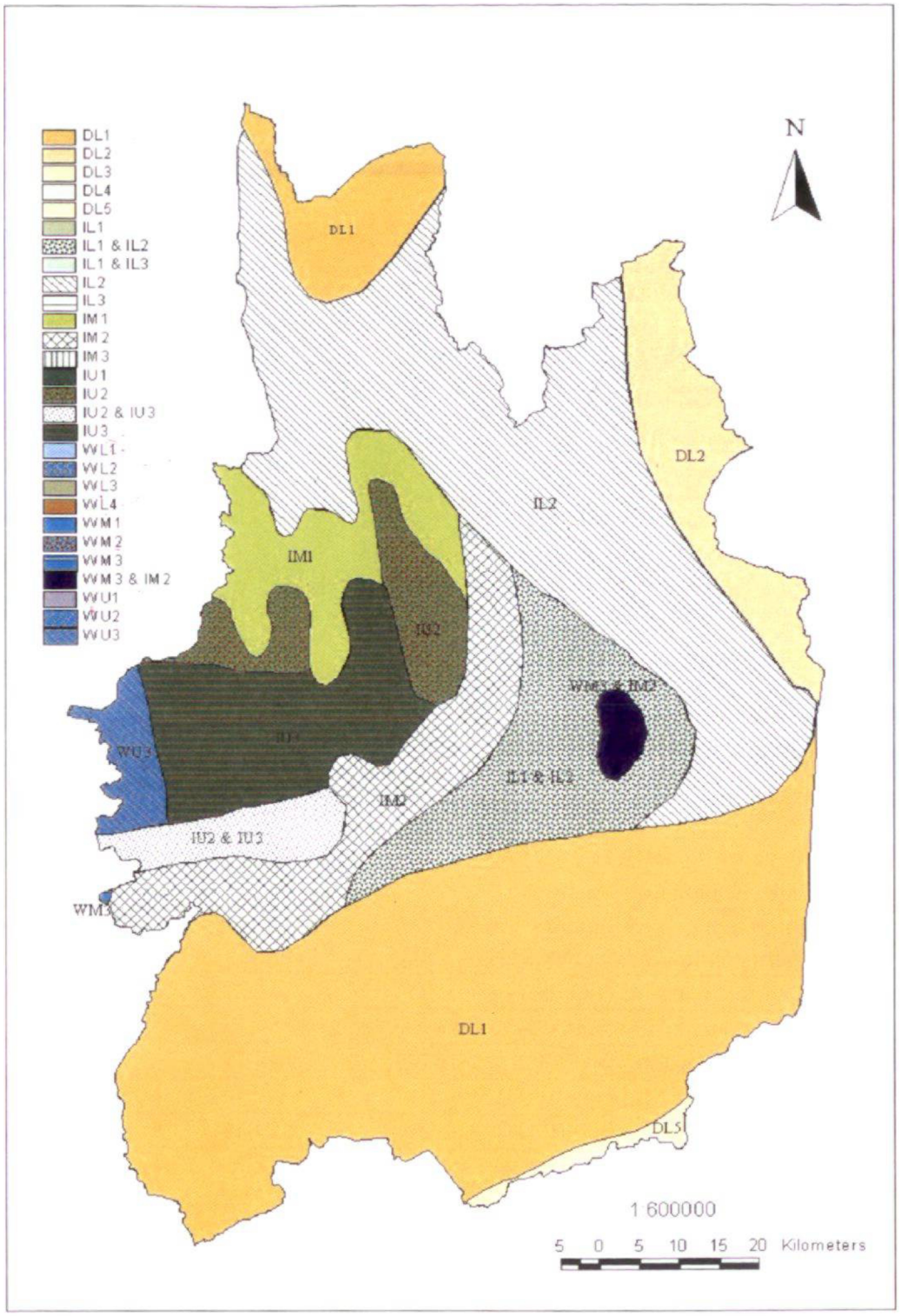

Figure 3.2 Agro-ecological Regions in Uva Province

Source: IWMI

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 inter relationships 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 types. Forests are the predominant vegetation, varying from ever-wet rainforests – both lowland and montane – to dry evergreen and deciduous thorn forest at the extremes. 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 (Jayasuriya 1984, Gunatilleke et al. 2005). 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 images carried out in 1992 shows that close canopy natural forests (i.e with over 70 percent crown closure) occupy 23.88 percent of the total land area. The additional "sparse forests" that consist of mainly the scrub vegetation covering 7.01 percent of the land area bring the total forest in the country to 30.89 percent (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 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 terrestrial 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 included in the gap analysis exercise (Jayasuriya et al 2006).

4.4 Major Natural vegetation types in the Uva Province

The UP has the highest diversity of natural vegetation; eleven out of fourteen major natural vegetation types are represented in it (Figure 4.1). High geographical and climatic diversity existing in the UP clearly support such high vegetation diversity that ranges from Montane Evergreen Forests (MOEF) and Wet Patana Grasslands (WPTG) that enjoy coolest and moist climate at highest altitudes to the Dry Deciduous Thorn Scrub (DDTS) on the south-eastern coastal plains that suffers from most arid climatic conditions in Sri Lanka. Even within some of these major vegetation types, influenced by a flux of environmental factors such as altitude, temperature, precipitation and wind etc., development of micro-zonal vegetation communities can be commonly observed. For example, variation in physiognomy, and even species composition, becomes clearly evident between the vegetation patches in a moist valley bottom and those in an adjacent highland. Tall moderately branched tree trunks, localized or less extensive root systems, protruded canopies and mesophyllous and thin leaves are some of the characteristics of vegetation communities that are minimally stressed, while dwarfed highly branched and gnarled tree trunks, extensive root systems, truncated canopies and microphyllous and leathery leaves depict stress from mechanical forces such as wind, low moisture and desiccation. This is also evident along steep slopes, e.g. escarpments.

Eleven major natural vegetation types are represented in the Uva Province (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. However, the synonyms for vegetation types are not included in this treatment.

Table 4.1 Vegetation types represented in the Uva Province

Vegetation Type	Extent (hectares)	Proportion (%)
Dry Mixed Evergreen Forest	116,726	38.9
Moist Mixed Evergreen Forest	79,421	26.5
Dry Sparse and open Forest	76,709	25.6
Savanna Grassland	9,086	3.0
Dry Patana Grassland	4,594	1.5
Dry Riverine Evergreen Forest	4,445	1.5
Mid-elevational Evergreen Forest	4,038	1.3
Dry Deciduous Thorn Scrub	2,424	0.8
Lowland Wet Evergreen Forest	2,308	0.8
Montane Evergreen Forest	99	0.0
Wet Patana Grassland	7	0.0

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 27-28^0 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 protected areas.

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, Pleurostylia opposita, Psydrax dicoccus, Discospermum sphaerocarpum, Diospyros ferrea, 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.

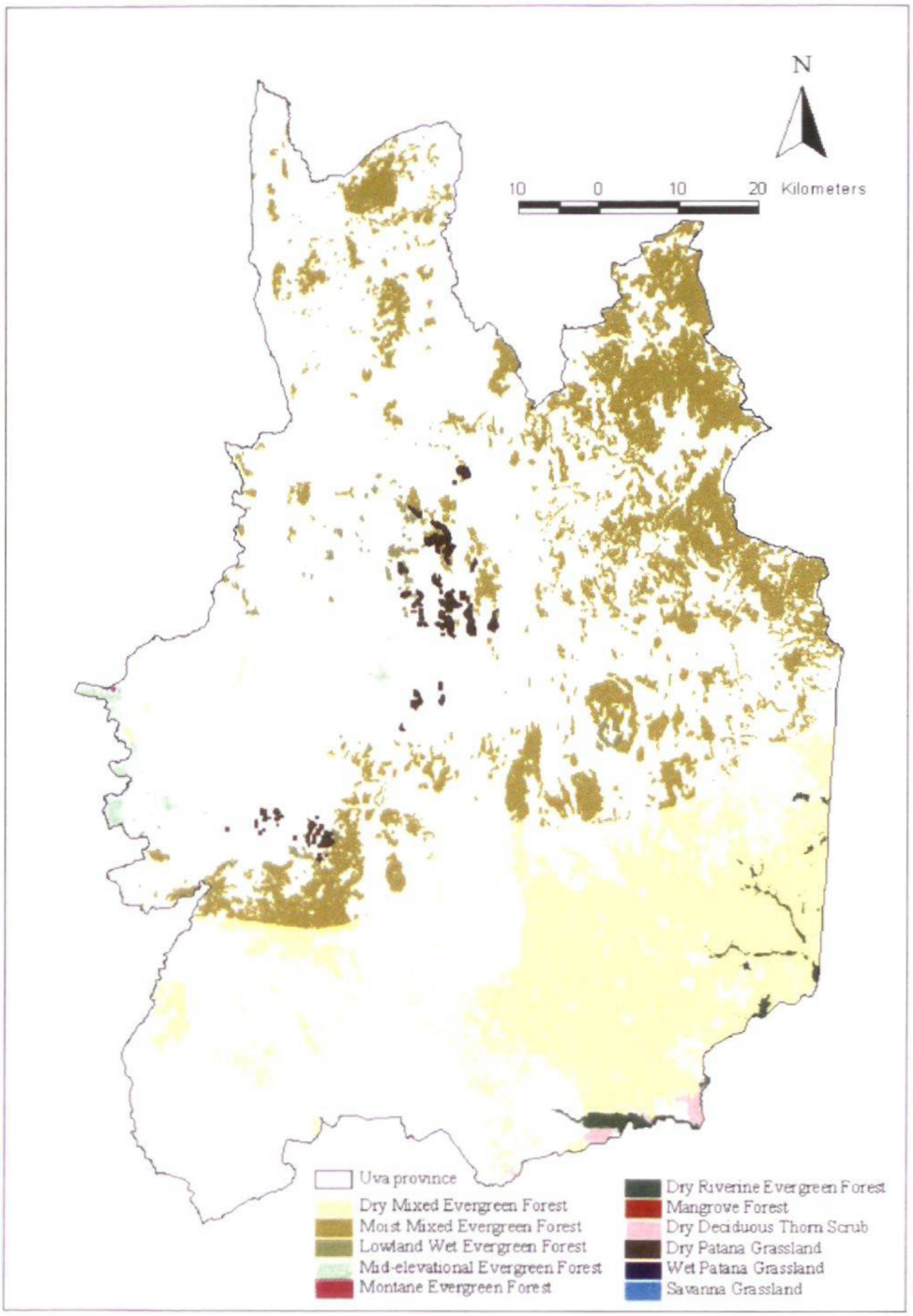

Figure 4.1 Major Natural Vegetation Types in Uva Province

Source: Jayasuriya et al. 2006

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 Forests (sub montane) up to nearly 900 m of the hill country or the lowland rain forests or the grasslands elsewhere. The temperatures range between 20.5^0 and 24.80^0 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 manifests 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, Xylopia 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 consists 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, Xylopia nigricans, Mesua ferrea, Givottia rotteriformis, Artocarpus gomezianus* and *Celtis philippensis etc.*

4.4.3 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^{0}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 and 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 the habitat types of 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.*

4.4.4 Dry Riverine Evergreen Forest (DREF)

The DREF is a hydrological, and perhaps edaphic, ecosystem influenced by high water table, and the mineral-rich alluvium that is seasonally deposited by river overflows in the vicinities of the perennial rivers in the dry zone. This forest flanks the river and constitutes the interphase between the river and the typical dry zone terrestrial vegetation bordering the river, thus forming a characteristic linear zone of which the width can be as narrow as few metres on steeper river banks or up to 100 m or more on flat to gently sloping river sides. In contrast with the surrounding dry zone vegetation, DREF is taller in stature, greener with a majority of its tree species being evergreen and possessing mesophyllous leaves and therefore easily detectable in the field from long distances and furthermore easily located in aerial photographs and satellite images.

The canopy is close reaching 10 - 25 m high with all the layers of a tall forest represented in its profile. The profile dominated by massive evergreen trees and its luxuriance makes it more akin to a rain forest. *Terminalia arjuna* is apparently the most important tree species, in terms of density, frequency, girth and stature, and thus giving character to the DREF. The trees are shallow-rooted and adapted to exploit ground water from the high water table that is characteristic of this ecosystem. The thick root systems of trees and shrubs which occur in the normal land-water interphase act as a protective armour forming a frontline defense against river bank erosion. There are also some plants that are adapted to disperse their fruits and seeds by water. The sub-canopy is clearly evident and the shrub layer is usually sparse, while lianas are often seen.

The main constituents of the DREF, based mainly on the studies conducted on the biodiversity of the Kala Oya Basin (EML 2005a) and Menik Ganga at Ruhuna National Park (IUCN & WCMC 1997) are as follows:

Canopy: *Terminalia arjuna, Berrya cordifolia, Polyalthia longifolia, Cassine glauca, vitex leucoxylon* and *Diospyros malabarica.*

High sub-canopy: *Diospyros ovalifolia, Aglaia eleagnoidea, Lepisanthes tetraphylla* and *Mischodon zelanicus.*

Low sub-canopy: *Nauclea orientalis, Pongamia pinnata, Garcinia spicata, Ficus hispida, Ficus racemosa, Dimorphocalyx glabellus*, and *Ixora pavetta.*

Shrubs: *Mallotus eriocarpus, Croton aromaticus* and *Polyalthia korinti.*

Lianas & climbers: *Reissantia indica, Salacia reticulata, Salacia oblonga, Derris parvifolia, Connarus monocarpus, Derris scandens* and *Caesapinia bonduc.*

4.4.5 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, Securenega 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.*

4.4.6 Dry Deciduous Thorn Scrub (DDTS)

The DDTS is regarded as a climatic climax in which the nature of the vegetation is determined by seasonal and relatively low annual rainfall (925-1330 mm) with a long dry season generally lasting from February to September (Mueller-Dombois 1968). Thus it is mainly a hydrologically influenced ecosystem that occurs only in rainfall-deficient or arid (semi-arid) zones of the island. The landscape is generally the lowland coastal or near-coastal plains and the mean annual temperature in this region is about 31^{0}C.

The DDTS is essentially a low (3-6 m), open to close unstratified woodland dominated by thorny species which are largely deciduous and distinctly xerophyllous. The vegetation is very dense forming

impenetrable thorny thickets tangled with frequent lianas and climbers. Few isolated trees or patches of trees emerging above the scrub-canopy mark the characteristic landscape of the DDTS; *Manilkara hexandra* being the most common emergent.

The species composition of the DDTS, mainly based on the studies conducted in the Kala Oya Basin (EML 2005a) and Ruhuna National Park (IUCN & WCMC 1997), is as follows:

Deciduous trees: *Chloroxylon swietenia, Sapindus emarginata, Crateva adansonii, Cordia gharaf, Cordia monoica, Sapium insigne* and *Premna tomentosa.*

Evergreen trees: *Manilkara hexandra, Drypetes sepiaria, Strychnos potatorum, Lepisanthes tetraphylla, Limonia acidissima* and *Salvadora persica.*

Treelets/Shrubs/lianas/climbers – thorny species: *Carissa spinarum, Capparis sepiaria, Capparis zeylanica, Catunaregam spinosa, Securenega leucopyrus, Dichrostachys cinerea, Atalantia ceylanica, Azima tetracantha, Gymnosporia emarginata, Scutia myrtina* and *Zizyphus oenoplia.*

Treelets/Shrubs/ lianas/climbers – non-thorny species: *Allophylus serratus, Diospyros ferrea, Erythroxylon monogynum, Murraya koenigii, Mallotus eriocarpus, Phyllanthus pinnatus, Ochna obtusata, Memecylon umbellatum, Carmona retusa, Cassia auriculata, Reissantia indica, Cissus quadrangularis, Hugonia mystax* and *Vernonia zeylanica.*

Herbs: *Tephrosia purpurea* and *Ocimum tenuiflorum.*

An edaphic variation of the typical DDTS exists in the coastal and near-coastal areas that has been named as ***Open Thorn Scrub (OTHS)***, first discovered in the Lower Kala Oya Basin and described by EML (2005a). This is a mosaic of close-canopy low DDTS (3-4 m) interspersed by large open areas supporting only low shrubs and herbs belonging to salt-tolerant species. Apparently, the relatively high salinity and shallow water table influencing these open "***Salt Marsh***" type vegetation and upland habitats with relatively deep water table and relatively low salinity influencing "Thorn Scrub" type vegetation underlie this interesting vegetation mosaic. Furthermore, the OTHS supports many salt-tolerant tree species such as *Salvadora persica, Crateva adansonii, Thespesia populnea, Limonia acidissima* and *Manilkara hexandra* and such shrubs/ climbers/herbs like *Azima tetracantha, Grewia tenax, Allophylus cobbe, Cissus vitiginea, Cissus quadragularis and Tylophora indica.* In contrast, the open "Salt Marsh" type areas support special salt-tolerant plants such as *Sueda vermiculata, Sueda monoica, Tamarix indica, Acacia eburnea* and *Canavalia rosea* etc. Many plants exhibit special adaptations to tide over the harsh dryness, e.g. succulent leaves (phyllodes) in *Aloe vera* and succlent stems (cladodes) in *Cissus quadrangularis and Euphorbia antiquorum.*

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^{0}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 *Andrpogon 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^{0}C subject to marked diurnal and seasonal variation. The night temperatures during December-February may be depressed below 5^{0}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 polyptychos 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.

4.4.9 Savanna Grassland (SAVG)

Savanna(h) is generally referred to a grassland/woodland mosaic in which the grassland component supports scattered trees. Unlike in Patana Grasslands in which the tree/woodland component assumes only a minor role and importance in the accompanying landscape, that of a SAVG plays an important and complimentary role along with that played by the grassland component. SAVGs occur on the lowlands lying on the northern and eastern aspects of the Uva Basin and also on adjacent hills in the interior up to an altitude of about 500 m and all these areas are generally located in the intermediate zone. This geographically diverse region receives an annual rainfall between 1400 – 2000 mm depending on the location.

Most believe that the SAVGs are pyrogenic, having originated on landscapes that are subject to regular (anthropogenic) fires and developed into a distinct fire-resistant vegetation type. The trees have thick protective corky bark and in some species the fire promotes subsequent germination of fruits/seeds by softening their pericarp/seed coat and breaking the dormancy. The underground stems of the savanna grass species also can survive, although their aerial parts are destroyed by the fire, and produce fresh culms helping the grassland to recover during the subsequent growing season. Grassland fires and the subsequent exposure result an erosion-prone landscape.

The common species in a SAVG are as follows:

Grassland: *Cymbopogon polyneuros, Cymbopogon nardus, Themeda triandra, Heteropogon triticeus, Aristida setacea, Imperata cylindrica* and *Panicum maximum* in disturbed places.

Tree/woodland: *Careya arborea, Terminalia chebula, Terminalia bellirica, Anogeissus latifolius, Pterocarpus marsupium, Phyllanthus emblica, Diospyros melanoxylon, Acacia chundra, Ficus arnottiana, Haldinia cordifolia, Pterospermum suberifolium, Bridelia retusa, Grewia damine* and *Zizyphus xylopyrus.*

"Talawa" is the Sinhala name used by the local people for SAVG, and often it has been applied in a confusing manner in the nomenclature of the grasslands. Pemadasa (1995), although correctly applied "Talawa" to name a variation of the SAVG (Upland Savanna), the National Atlas (1988), erroneously applied the name to wet lowland grasslands, even including Kekilla Fern-lands in it.

4.5 Forest cover

A survey carried out in 1985 shows that the UP had its forest cover of 48.3% of its total land area. This consisted of 32.6% of natural forests, 14.1% of open scrub and 1.6% plantation forests (Table 4.2).

Table 4.2 Forest cover in Uva Province

District	Land area (ha)	Natural forests		Open scrub		Plantation forests		Total	
		Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%
Badulla	282200	56720	20.1	11325	4.0	9475	3.3	77520	27.4
Monaragala	566000	219995	38.8	108180	19.1	4470	0.8	332945	58.7
Total	848200	276715	32.6	119505	14.1	13945	1.6	410465	48.3

4.6 Plantation forests

Reforestation trials were carried out in the Central Highlands to meet fuelwood demand of households, tea industry and the railway. Plantation forests consist of mostly of even-aged monocultures of confers, chiefly pine, and cyprus and araucaria in smaller extents, teak, mahogany and eucalyptus etc in a total extent of 13,945 hectares in the UP. The plantation forests are managed by the FD (Table 4.1).

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 district or province (IUCN & WCMC 1997). Furthermore, information on the distribution of the angiosperm flora could be obtained from the Revised Flora of Ceylon (Volumes 1-14). The reference of the National Herbarium collection also could be very useful in this regard.

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 only 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 UP. There are 30 sites in the UP 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. 402 species in 87 families are in record of which 85 species are endemic to Sri Lanka, while 30 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 Uva Province

In the absence of any ready references on the flora of the UP, Revised Handbook to the Flora of Ceylon was used to compile a list of plants that are **restricted** to the UP. *Habenaria roxburghii* (Orchidaceae) is a new record for Sri Lanka, hitherto known only from India (Fernando & Gunasekara 2005). 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, and therefore the possibility exists that some species that are listed here as **'restricted to the UP'** were subsequently recorded in another province(s). The plants are listed with local names, endemism, conservation status and the districts within the UP in which the plants have been recorded (Table 5.1). The conservation status was determined based on the IUCN 1999 List (IUCN SL 2003), as explained in the Table 5.1. The list consists of 19 species of which four species are endemic to Sri Lanka, while 10 species are threatened.

Table 5.1 Flora restricted to the Uva Province

Main source: Revised Handbook to the Flora of Ceylon (1980-2000)

Family Species	Common name	Endemic (E)	Conservation status	Districts
Amaranthaceae				
Cyathula ceylanica		E	HT**	B
Asclepiadaceae				
Holostemma annulare				B,M
Asteraceae				B
Adenostemma macrophyllum				
Glossogyne bidens			HT**	M
Caryophyllaceae				
Stellaria pauciflora			HT**	B
Cyperaceae				
Cyperus compactus			HT	B
Fimbristylis dichotoma ssp. podocarpa				B
Fabaceae				
Desmodium caudatum				B
Indigofera wightii			HT**	B
Malvaceae				
Dicellostylis axillaris		E	HT**	B
Thespesis lampas	Wal-kapu			B
Myrtaceae				
Eugenia haputalensis		E	PE	B
Orchidaceae				
Habenaria roxburghii				B,M
Peristylis trimenii		E	HT	B
Orobanchaceae				
Aeginetia pedunculata			HT	B
Rubiaceae				
Ceriscoides turgida			HT	B,M
Neanotis quadrilocularis				
Ophiorhiza rugosa var. angustifolia				B
Zingiberaceae				
Amomum pterocarpum				M

Conservation status (IUCN 1999 List):

HT - Highly threatened, not recorded after 1900, hence possibly extinct or nearing extinction.**

HT* - Highly threatened, most recent records between 1900-1950, hence possibly extinct or nearing extinction.

HT - Highly threatened

TR - Threatened

DD - Data deficient

PE - Point endemic (Revised Handbook to the Flora of Ceylon)

Districts: B = Badulla, M = Monaragala

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' include the land snails and freshwater crabs. Almost the entirety of these fauna is endemic, with a high degree of point endemism (Naggs & Raheem 2000, Ng & Tay 2001). 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 about 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, *Macrognathus 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. Srilanlensis* and *Danio pathrana*) are point endemics occurring entirely outside PAs 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 off 66 species of direct-developing frogs of the genus *Philautus* (Meegaskumbura & Manamendra-Archchi 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 atleast 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 Uva Province was extracted from the NCR (Appendix 2). 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 checklist consists of 190 species (25 butterflies, 12 molluscs, 5 amphibians, 22 reptiles, 103 birds and 23 mammals) of which 36 species are endemic to Sri Lanka and 45 species are threatened.

5.3.2 Fauna restricted to the Uva Province

Although it is difficult to determine animal species that are restricted to the UP with a high degree of accuracy, some attempts were taken to deduce such information with available data. 37 animal species (12 butterflies, 10 fishes, 4 amphibians, 2 reptiles, 5 birds and 4 mammals) appear to be restricted in the UP.

The Central Hills contains a considerable proportion of endemic fauna belonging to both vertebrate and invertebrate groups. In the UP, the most important faunal diversity is concentrated in MOEF on the western mountains.

5.3.2.1 Butterflies

As the knowledge on invertebrate groups, such as most insects, spiders and earth worms, is scanty, their restricted occurrence in the UP 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 and vegetation types that are represented in the UP, viz. MOEF, MEEF, LWEF, WPTG, MMEF, DMEF, DREF, SPOF, DDTS, DPTG and SAVG, as classified by Jayasuriya et al. (2006). Table 5.2 indicates the affinities between butterfly species with restricted distribution and various bio-climatic zones and vegetation types that are represented in the UP. However it should be noted that this relationship could well accommodate the possibility of some of these twelve butterfly species occurring in similar vegetation types in neighboring provinces.

Table 5.2 Butterfly species with restricted distribution in the Uva Province.

Source: Perera & Bambaradeniya (2006); vegetation types are according to the classification by Jayasuriya et al. (2005); the vegetation types cited by Perera & Bambaradeniya are in parenthesis).

Bio-climatic zone	Vegetation types	Species
Montane Wet Zone	MOEF (Montane Forest) MEEF (Lower Montane Forest)	*Parantica taprobana, Vanessa indica* (Indian Red Admiral), *Lethe daretis* Ceylon Treebrown), *Udara lanka* (Ceylon Hedge Blue)
	WPTG (Wet Patana Grassland)	*Baracus vittatus* (Hedge Hopper)
Lowland Dry & Intermediate Zone	DMEF, MMEF, DREF (Dry Zone Forests – Evergreen/Deciduous) SPOF (scrubland)	*Pathysa nomius* (Spot Swordtail), *Charaxes solon* (Black Rajah), *Amblypodia anita* (Purple Leafblue)
	DPTG (Grasslands)	*Zizula hylax* (Tiny Grass Blue), *Freyeria trochilus* (Grass Jewel), *Azanus jesous* (African Babul Blue)
	SAVG (Savanna and Dry & Intermediate Patana)	*Symphaedra nais* (Baronet), *Ypthima singala* (Jewel Four-ring)

5.3.2.2 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 UP.

5.3.2.3 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 considerable part of the Uva Province is represented in the Mahaweli ichthyofaunal province, the species of fishes that occur in the latter could be partly representative of the UP. 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 occur either or both of the other provinces, i.e. Southwestern (SW) and Dry Zone Ichthyofaunal Provinces (Table 5.3).

Table 5.3 Endemic freshwater fish species in the Mahaweli Ichthyofaunal Province.

Source: Amarasinghe et al. (2006).

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

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

5.3.2.4 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 UP (Table 5.4). The recent discovery of a new species of *Nannophrys*, i.e. *N. Naeyakai* from Kokagala in Badulla District is noteworthy (Fernando et al. 2007). 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 ranges.

Table 5.4 Amphibian fauna restricted to the Uva Province

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

(CP) = recorded also in Central Province

Family Species	Common name	Endemic (E)	Conservation Status
Ichthyophiidae			
Ichthyophis orthoplicatus	Brown yellowband	E	Vulnerable
Ranidae (Rhacophorinae)			
Nannophrys naeyakai	Sri Lanka Tribal Rock Frog	E	Critically Endangered
Philautus frankenbergi (CP)			
Philautus hallidayi (CP)		E	Vulnerable
Philautus silus (CP)		E	Endangered

5.3.2.5 Reptiles

Inference of restricted species using vegetation types (Jayasuriya et al 2006) or vegetation zones (de Silva 2006), i.e. the process used for the Central Province, is not adaptable for the Uva Province as vegetation types or zones that are more or less restricted to the UP do not occur. Therefore, information obtained from other sources (e.g. Wickramasinghe & Munidradasa 2007) were used to elucidate the species that are restricted to the UP.(Table 5.5).

Table 5.5 Reptile species restricted to the Uva Province

E = English
EN = Endemic
S = Sinhala

Family Species	Local name	EN
Gekkonidae		
Cnemaspis kumarasinghei	Kumarasinghage diva-huna (S) Kumarasinghe's day gecko (E)	EN
Cyrtodactylus edwardtaylori	Namunukula vak-aniya huna (S) Namunukula bent-toe gecko (E)	EN

5.3.2.6 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 not available to be processed for this purpose. However, following birds are known to be restricted in the UP:

Francolinus pictus watsoni ('Tith watu kurulla' (S), Painted francolin (E): A bird endemic to Savanna Grasslands in Nilgala.

Treton phoenicoptera chlorigaster ('See-padu batagoya' (S), Yellow-footed pigeon (E): A bird with similarly restricted distribution.

Rhipidura aureola (Bema-sudu pawan-penda or 'Sudu Awan-pendamara' (S), White-browed fantail (E): Chief distribution of this bird is the UP.

Taccocua leschenaultia ('Patana eti-kukula' (S): Chief distribution of this bird is the UP

Alcedo meninting phillipsi ('Nil-kan pilihuduwa' (S), Blue-eared kingfisher (E): Although this bird was known only in the UP, recently a few records have been made outside UP.

5.3.2.7 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 Uva Province, and hence those species that occur exclusively in these three zones are listed in Table 5.6.

Table 5.6 Mammal species restricted to the Uva 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**			
Crocidura miya	Sri Lanka Kunu-hik-miya (S) Sri Lanka long-tail shrew (E)	EN	D, E
Feroculus feroculus	Piri-hik-miya (S) Kelaart's long-clawed shrew (E)		D, E
Suncus montanus	Kandu Hik-miya (S) Highland srew (E)		D,E
Chiroptera **Vespertillionidae**			
Pipistrellus affinis	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*), cowpea (*Vigna unguiculata*), 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' (*Phaseulus 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 moths 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 gourd = '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' (*Amarathus* spp.), 'Gotukola' (*Centella asiatica*) and 'Katuru-murunga' (*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' (*Amorphorphallus paeniifolius*) 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 annuum).* 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' (*Sasamum 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. However, it was coffee that was first cultivated in the mid and upcountry which gave way to tea. The Assam tea (*Camellia sinensis* var. *assamica*) was introduced to Sri Lanka in 1839 and commercial cultivation was started in 1867. Tea is now grown on over 250,000 hectares. The germplasm originally introduced from has undergone selection through breeding programs, and the selected genotypes are been 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).

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.

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 nealy 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 as history, 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 heaviliy 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 uses 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 is primarily depends 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, only 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
Gliricidia sepium ('Weta-hiriya') *Calliandra calothyrsus* (Calliandra) *Cassia siamea* ('Wa') *Cassia spectabilis* ('Kaha-kona')	Biomass production and nutrient content of nitrogen-fixing and non-nitrogen fixing leguminous tree species	Gunaratne & Heenkende (2000)
Erythrina sp *Tithonia diversifolia* ('Natta-suriya')	Nutritive and medicinal values	Jayawardena & Rajaguru (2000)
Pennisetum purpureum x *P. americanum* var. *CO-3* (Hybrid napier grass)	On-farm management and persistence	Chamara et al. (1999)
Pennisetum clandestinum (Kikuyu grass)	Value in the montane zone of Sri Lanka	Andrew & Jayawardena (1971)
Gliricidia sepium *Leucaena leucocephala* (Ipil ipil) *Erythrina* sp. (Dadap) *Calliandra calothyrsus* *Flemingea* sp. *Sesbania* sp. *Acacia* sp.	As hedge rows and internal hedges	SAREC/NSF (1998)
Chloris gayana *Panicum maximum* (Guinea grass) *Cenchrus ciliaris* *Pueraria phaseoloides* *Centrosema pubescens* *Desmodium ovalifolium*	Integration of livestock pasture and forestry (Pinus, Eucalyptus and Acacia plantations in the mid- country: These species are recommended as suitable for silvo-pastural systems	Premalal & Perera (1995)
Desmodium heterocarpon ('Et-undupiyali') *Desmodium heterophyllum* ('Maha-undupiyali') *Clitoria laurifolia* ('Andana-hiriya') *Paspalum germinatum*	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: *Brachiaria brizantha* *B. decumbens* *B.mutica* *B.humidicola* *B.miliformis* *Pennesetum purpureum* (Napier grass) *Pennesetum purpureum x P. americanum var. CO-3* **Other grasses:** *Brachiaria ruziziensis* *Panicum maximum* *P. maximum* var. *trichoglume* (slender Guinea grass) *Cynodon dactylon* (Bermuda grass) *Andropogon gayanus* *Axonopus affinis* *Axonopus compressus* (Carpet grass) *Cenchrus ciliaris* *Chloris gayana* *Digitaria decumbens* *Paspalum notatum* *Pennesetum clandestinum* *Stenotaphrum secundatum* *Tripsacum laxum* (Guatamala grass) *Zea mays* (maize)	These were compiled as useful fodder grass species	Premalal (2007)

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 resistence 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 coffe 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 (LWEF, 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 familes. 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). A considerable number of these CWR occur in the Uva Province.

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), *Saccaharum* (2), *Vetiveria* (2).

6.1.6 Agro-biodiversity in Uva Province

Since the unsuccessful freedom struggle against the colonial rule in 1817, the traditional irrigation systems in Wellassa disintegrated and the traditional agriculture was replaced by plantation agriculture. The Upper Uva, with favorable agro-ecological environment, became important in commercial agriculture from late 19th century. These activities first started with coffee plantation and subsequently replaced with tea as the major industrial crop. The prevailing agro-biodiversity in the UP is summarized in Table 6.2.

Table 6.2 Agro-biodiversity in Uva Province

Crop type	Areas
Plantation crops	
Tea	Bandarawela, Badulla, Haputale, Madolsima, Lunugala, Demodara, Namunukula, Passara
Rubber	Monaragala, Badalkumbura, Bibile
Cocoa	Chiefly as a secondary crop in rubber lands
Sugarcane	Lower Uva: Handapanagala, Siyambalanduwa, Buttala, Sevangala
Cinnamon	Haldummulla
Cereals	
Paddy, Finger millet	Lower Uva
Vegetables – up country	
Bean, Leeks, Carrot, Cabbage, Beet, Tomato, Radish, Potato, Bell pepper, Salad cucumber etc.	Upper Uva
Vegetables – low country	
Pumpkin, Okra, Snake gourd, Ridge gourd, Bitter gourd, Pumpkin, Cucumber, String bean, Drum stick, Cow pea, Green gram, Black gram, Plantain etc.	Lower Uva
Root & tuber crops	
Sweet potato, Manioc, Aroids, Yams	Lower Uva
Floricultural crops	
Daisy, Carnation, Anthurium, Barberton Daisy, Rose, Orchids	Upper Uva
Fruit crops	
Pears, Avacado, Strawberry, Cherimoyer, Passion fruit	Upper Uva
Orange	Bibile
Mango, Pine apple, Banana, Papaya, Passion fruit, Anoda, Rose apple	Lower Uva
Lime	Widely distributed, especially Lowe Uva
Wood apple	Lower Uva: harvested from the wild
Tamarind	Lower Uva: harvested from home gardens and semi-wild
Gall-nut ('Aralu'), Myrabalans ('Bulu'), Neem ('Kohomba'),	Savannas in Lower Uva
Mousey mi ('Mi'), Matara tea ('Ranawara')	Lower Uva
Others	
'Kitul'	Kahataruppe, Kendagolla, Lunugala, Gampaha in Uva Paranagama, Haldummulla, Bibile
'Madu' (*Cycas circinalis*)	Widely distributed in Lower Uva, frequently in savannas

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

6.2.1.1 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 estern 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.

6.2.1.2 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 DNA 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.

6.2.1.3 Goats

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

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

6.2.1.4 Sheep

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

6.2.1.5 Pigs

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

6.2.1.6 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 systemnatic study has been carried out on this breed.

6.2.1.7 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 thay 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.

6.2.1.8 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

6.2.2.1 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.

6.2.2.2 Buffaloes (*Bubalus bubalis*)

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

6.2.2.3 Goats

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

6.2.2.4 Sheep

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

6.2.2.5 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.

6.2.2.6 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.

6.2.2.7 Ducks

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

6.2.2.8 Turkey

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

6.2.2.9 Geese and Quail

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

6.2.2.10 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 (egg 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 belongiong 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 rared 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

The prehistoric events are discussed here with more emphasis on anthropogenic development in relation to biological environment (e.g. use of flora and fauna) and less emphasis on technology (e.g. use of tools – lithic artifacts) and sociology.

6.3.1 Prehistory

Archeologists believe that humans existed 7000 years ago in this island, as evidenced by the bones discoverd in Bandarawela. The existence of the tribal communities in Sri Lanka before the arrival of the Aryans is evidenced from archeological and historical data. Of them, Vedda tribe goes far back into the history and they also exist today. They are supposed to have derived from the prehistoric humanoid 'Balangoda man' according to the archeological evidence and morphological features and the Uva had been their main region of distribution. The rock caves were their original habitats. The excavation of the deeper layers of such habitat have revealed important information on their life history and 'Telulla' cave in the Kirindi Oya basin, between Wellawaya and Tanamalwila was the first to be excavated in this regard (Sarasin and Sarasin 1908). The subsequently excavated 'Galge' caves, situated between Buttala and Kataragama had animal remains and quartz implements used by those

inhabitants (Deraniyagala 1988). These findings indicate the existence of the prehistoric man and the origin of the Vedda tribe in the Uva. The Nilgala cave, located in the Monaragala District, is also an important prehistoric site. The artefacts that were used during Middle Stone Age and, for the first time, sketetal remains of the prehistoric man were excavated here. Furthermore, the artefacts turned out of stone and bones and animal remains discarded after consumption were also found (Seligmann and Seligmann 1911). The findings at the Nilgala caves provided new dimentions to the research on the prehistoric man. The 'Gongine' cave located at Ekiriyankumbura area in the northern Uva was also investigated, but its lower strata have not yet been studied. However, the findings indicate that the information on prehistoric age is not limited to cave habitats, but also these stone artefacts were found on the soil surface in Kandy, Nawalapitiya, Horton Plains and Belihul Oya areas. It is also evident that the artefacts were made out of hardest materials of suitable sizes that were available in their habitats; e.g. implements made out of 'Kahanda' stone have been found in Bandarawela. In places that lack special hard minerals, they have used quartz that is freely available, especially in association with water courses. Seligmann and Seligmann (1911) also investigated 'Bendiya' cave close to Henebedda in Monaragala District, that was a contemporary Vedda settlement and 'Mullegama' cave closer to Embilinna. Hartley (1913, 1914) studied the implements collected from Bandarawela and hypothesized that the prehistoric man lived here or arrived as migrants to make suitable implements. He furthermore states that 'pygmy' implements that belonged to a Late Stone Age were discovered from hills around Bandarawela. It is also believed that 'microlithic' artefacts, indicating a Middle Stone Age, were among them. Of four or five sites that yielded most of these implements, the Church Hill, the site of the present Anglican church in Bandarawela along road to Welimada, has been specially mentioned and Hartley's collection amounted to nearly 5000 specimens and initiated a system of classification of stone artefacts in Sri Lanka. Deraniyagala, between 1944 and 1963, collected much information on the prehistoric man (Deraniyagala 1953). In addition to research conducted on the soil surface, he excavated several caves, some located in the Uva, e.g. 'Ravana ella' cave near Ella in Badulla District. The artefacts turned out of stone and animal bones. Animal remains discarded after consumption and most importantly the frontal bone of a skull belonging to a prehistoric man, which was smeared with red ochre, were found here. The Bellan-bendi-pelessa in the Udawalawe area that is situated beneath Kaltota escarpment was a roughly 6500 years old Mesolithic site that functionally appears to have been an open-air base camp where people lived perennially. The site was excavated during 1956 – 1965 and it yielded many artefacts and human skeletons indicating the existence of human settlements in the Uva and Sabaragamuwa during the Middle Stone Age. It is noteworthy that the remains of at least twelve humans have been secured from Bellan-bendi pelessa. These interments were located exclusively in the Mesolithic stratum directly overlying the limestone bedrock. Such interments of human remains within the occupational area has been a common practice in Sri Lanka's Mesolithic, parallels being found at Beli lena in Kitulgala and Bata-domba lena in Kuruwita. It appears that secondary functional burial had been performed, namely interment of selected sketetal parts after exposure. However, Deraniyagala (1992) has opined that cannibalism could have played a role in the disposition of human remains, particularly since some of the bones have been found among the food debris. The heavy attrition apparent on the molars of several humans excavated from Bellan-bendi pelessa (Deraniyagala 1963a) suggests that their diet was high in grit content, possibly due to the grindstones being of poor quality. The absence of evidence of caries or dental abscesses and the robusticity of the bones in general suggest a reasonably well balanced diet. It is likely that one of the functions of the grindstones found at the site was to process food plants. Among them are the nut-stones which could have been used for cracking 'Kekuna' (*Canarium zeylanicum*) nuts brought from the wet zone.

However, with the influx and the spread of the Aryan communities, the tribal communities disintegrated although the Vedda tribe survived maintaining their life style and the cultural ingredients. It is expected that further excavation of these sites will shed new lights on the life history of the prehistoric human societies (Deraniyagala 1953).

6.3.2 Vedda tribe

The Veddas are the extant aborigines of Sri Lanka. When decribed by early ethnographers they lived as relic hunter-gatherers in the eastern hinterland of the dry lowlands (Knox 1681; Davy 1821; Parker 1909; Seligmann and Seligmann 1911; Spttel 1924, 1961; Hill 1941). The term '*Veddo*' has derived from '*Beddo*', the people who lived in the forest (MENR 2005). As stated by Deraniyagala (1992), the distribution of the Veddas was mainly confined to the south western dry and intermediate zones that harbor a variety of vegetation types, viz. DMEF, MMEF, DREF, SPOF, DDTS, DPTG, VILG and SAVG. However, their range did extend beyond the periphery of this general area to the north towards Polonnaruwa and to the south down to Kataragama. It has been hypothesised that the Vedda distribution during past centuries was much more extensive than indicated above (*Mahavamsa* – Geiger 1950, Seligmann and Seligmann 1911) and that this south western region constituted a refuge in the face of the progressive spread of the Aryans with their iron technology and agricultural subsistence system, commencing ca. 500 BC (Hill 1941). Indeed, Deraniyagala (1958, 1960) and Kennedy (1974) have argued strongly in favor of the Vedda and Mesolithic human constituting a biological continuum, which suggests that the Vedda ancestors were once ubiquitous on the island, with the possible exception of the Jaffna peninsula where Stone Age remains have yet to be firmly documented.

The natural food resource potential of the geographical range of the Veddas is in many ways typical of the entirety of the lowland dry and intermediate zones. Hence, the hunting and gathering subsistence strategy of the Veddas was one that suited the physical and biological dynamics that prevailed in these zones. Furthermore, their life style and associated activities that were interwoven with hunting and gathering may be considered to provide pointers as to what subsistence activities would have been like prior to the advent of farming. A wide spectrum of fauna, ranging from bee grubs to big games such as sambhur, has provided the communities with food (Nevill 1887, Sarasin and Sarasin 1908, Seligmann and Seligmann 1911, Lewis 1915, Spittel 1924, Hill 1941). However, some delicacies among food resources have been identified, e.g. land monitor lizard = 'Talagoya', pangolin = 'Kabellawa', langur = 'Wandura', spotted deer = 'Tit-muwa', sambhur ='Gona', hornbill ='Kendetta', eel = 'Anda' were some of the favorites. In different areas, Veddas are said to have had different preferences, e.g. langur in Maha Oya, boar = "Wal ura' in Nilgala, although they are not particular in this regard (Sarasin and Sarasin 1893). Spotted deer and Sambhur provided most of the meat consumed (Seligmann and Seligmann 1911, Hill 1941).

The basic method of procuring large game has been with bow and arrow. The former was a powerful self-bow, approximating a man's height in length. It was made of the wood of 'Kobbe' (*Allophylus cobbe*), 'Kolon' (*Haldina cordifolia*) or 'Dunu madala = *Stereospermum colais*). Although 'Kekala' or 'I-petta' (*Cyathocalyx zeylanicus*) also has been cited, it occurs only in the wet zone and therefore would have been used by the Veddas of the Sabaragamuwa. Its suitability as a strong flexible wood is undoubted, as presently it is a choise species that is used for basket frames in the wet zone. The bowstring was made of the bast of gall-nut = 'Aralu' (*Terminalia chebula*), coated with the resin of gaub persimmon = 'Timbiri' (*Diospyros malabarica*) (Parker 1909, Seligmann and Seligmann 1911,

Lewis 1915, Spittel 1924, 1961). The arrow shaft was of fishing rod tree = 'Welang' (*Pterospermum suberifolium*) and fletched with the primaries of large birds such as peafowl and owl (Spittel 1961). The arrow heads were of iron (Deraniyagala 1942, 1963 b). These were acquired through barter with Sinhala people. Nevill (1887) mentions the use of arrow-heads made of the shells of the freshwater bivalves (*Unio lamellatus* and *U. marginatus*). Iron arrow-heads were bound to the shaft with "Aralu' bast impregnated with the resin of 'Timbiri' (Seligmann and Seligmann 1911). Despite the ready availability of the upas tree = 'Riti' (*Antiaria toxicaria*), a frequently used projectile poison in Southeast Asia, the Veddas did not use it – or any other arrow poison (Spittel 1961). It is also assumed that the 'Riti' in Sri Lanka belongs to a 'variety' that lacks poisonous principle. Pellet bows, possibly introduced by the Sinhala people, were also used by the Veddas, the bowstring having been made of the fiber of bow-string hemp = 'Niyanda' (*Sansevieria zeylanica*) (Sarasin and Sarasin 1908, Seligmann and Seligmann 1911, Spittel 1961).

Fish poisons were used to stupefy fish, which turned belly upwards when the water was churned or else they leaped on to the banks. The poisoning is said to have been ineffective in deep pools (Spittel 1961). The main fish poison used were the crushed leaves of 'Timbiri', fruit of "Kukuruman' (*Catunaregam spinosa*), roots of 'Kala wel' (*Derris scandens*) and 'Pus wel' (*Entada pusaetha*), the milky sap of the succulent shrub "Daluk' (*Euphorbia antiquorum*), and the bark of 'Dambu' (*Lepisanthes tetraphylla*) and 'Naha patta' (*Gnidia glauca*) (Parker 1909; Seligmann and Seligmann 1911; Spittel 1924, 1961). Of these 'Kukuruman' and 'Daluk' were considered the most effective.

Honey constituted an important source of nourishing food as well as preservative for other food items such as meat and fish of the Veddas. The main honey (and fruit) season in Vedda country is in June and July, when the hives of the common bee (*Apis cerana*) and the rock bee = 'Bambara' (*Apis dorsata*) are harvested. Honey was used to preserve meat for a long time in tree hollows sealed with clay (Knox 1681).

Most popular fruits were 'Palu' (*Manilkara hexandra*), 'Weera' (*Drypetes sepiaria*), 'Mora' (*Dimocarpus longan*) and 'Kon' (*Schleichera oleosa*), which ripen in June –July (Spittel 1924, Hill 1941). The fruits of the following were of lesser importance, nonetheless often harvested by Veddas: 'Gal-siyambala' (*Dialium ovoideum*), 'Ul-kenda' (*Polyalthia korinti*), 'Himbutu' (*Salacia reticulata*), 'Heen -karamba' (*Carissa spinarum*), 'Etamba' (*Mangifera zeylanica and M. pseudoindica*), 'Guru-keena' or 'Heen-keena' (*Calophyllum calaba*), 'Nebada' (*Vitex leucoxylon*), 'Heen-eraminiya' (*Ziziphus oenoplia*) , 'Timbiri' (*Diospyros malabarica*), 'Kiri-nuga' or 'Kiri-pela (*Ficus tsjahela*), 'Demata' (*Gmelina asiatica*) and 'Wal-mora' (*Glenniea unijuga*) (Sarasin and Sarasin 1893; Spittel 1924, 1961). Although the edible kernel of the seasonally abundant fruit of 'Bulu' (*Terminalia bellirica*) is possibly rich in protein as meat, it does not appear to have been exploited by the Veddas to a noticeable degree, whereas the Sinhala people do. The explotation of 'Bulu' could add significantly to the carrying capacity of the Savanna Grasslands where these trees grow in abundance due to their resistence to fires periodically caused by the Veddas and Sinhala villagers.

As for palm treackle or jaggery, the fish tail palm ='Kitul' (*Caryota urens*) is only occasionally found in the intermediate zone. Veddas seem to have been totally unacquainted with the tapping of its inflorescence to obtain the sweet sap, with which treackle and jaggery (rough sugar) are made, and the alcoholic sap (toddy). Alcohol of any form was not consumed by them, and hence it was not acquired by barter (Sarasin and Sarasin 1893).

Wild yams that provided the starch requirements for the Veddas were 'Katu-ala' (*Dioscorea pentaphylla*) 'Gonala' (*D. oppositifolia* var. *dukhunensis*) and 'Hiritala' or 'Kitala' (*D. oppositifolia*

var. *oppositifolia*). These species are common in the dry and intermediate zones. The Vedda populations of the Sabaragamuwa would have had access to the wet zone species such as *D.spicata* (also known as 'Gonala'), 'Kiri-gonala' (*D. koyamae*) and perhaps 'Katu-ala' that also occur in the wet zone. Other starch supplements are the seeds of 'Madu' (*Cycas circinalis*), that is common in the Vedda country and palm hearts (terminal bud) of 'Indi' (*Phoenix pusilla*), fruit of the wild breadfruit = 'Bedi-del' or 'Kele- del' (*Artocarpus nobilis*) which is a wet zone species extending to the intermediate zone. Additionally in the wet zone, they had access to the pith of the palms 'Kitul' (*Caryota urens*), 'Katu-kitul' (*Oncosperma fasciculatum*) and ''Dolalu' (*Loxococcus rupicola*). The roots, stalks and seeds of the lotus = "nelum' (*Nelumbium nucifera*), seeds (obtained by shelling the fruit) of water lily = 'Olu' (*Nymphaea pubescens*) and 'Manel' (*N.nouchali*) provided very nourishing diet. A variety of edible herbs frequently foraged in chena lands abandoned by Sinhala people were used and leaves of 'Tora' (*Cassia tora*) and 'Kura' or 'Kura tampala' (*Amaranthus viridis*) were specially mentioned by Spittel (1961). Certain mushrooms, e.g. *Lentinus regium*, were also eaten.

Cultivated grains such as rice and finger millet were obtained by barter with the Sinhala people; but coconut, a common source of fat and protein for the latter, was viewed with mistrust by the Veddas (Sarasin and Sarasin 1893). The products of the forest such as honey, wax, dried venison and elephant tusks were bartered for the products of civililization such as cloth, arrow-heads, axes, and perhaps salt (Knox 1681; Seligmann and Seligmann 1911; Spittel 1924,1961).

The use of masticatories was widespread among the Veddas (Sarasin and Sarasin 1893, 1908; Trimen 1893-1895; Trimen and Hooker 1898–1900; Parker 1909; Seligmann and Seligmann 1911; Spittel 1924, 1961). During spells of scarcity of food, hunger was appeased by chewing masticatories. Deraniyagala (1992) listed several such species indicating the parts that are used for this purpose: leaves of 'Gas-tala' (*Ocimum gratissimum*) and 'Maduru-tala' (*Ocimum tenuiflorum*), barks of 'Bolila' (*Anisochilus velutinus*), 'Dawata' (*Carallia brachiata*), 'Keppetiya' (*Croton lacciferus*), 'Opulu' (*Cynometra iripa*), 'Gal siyambala' (*Dialium ovoideum*), 'Nuga' (*Ficus fergusoni*), 'Demata' (*Gmelina asiatica*) and 'Aralu' (*Terminalia chebula*)', fruits of 'Len-teri' (*Areca concinna*) and 'Dotalu; (*Loxococcus rupicola*), seeds of 'Lakada', probably 'Galis' (*Gardenia crameri*), roots of 'Kapuru' (*Goniothalamus walkeri*) and bark, flowers and fruits of 'Atuketiya (*Xylopia parvifolia*). The masticatories were often mixed with slaked lime burnt from the shells, preferably, of *Cyclophorus involvus* and freshwater molluska (both gastropods and bivalaves). Spittel (1961) has noted that the Vedda's bark-stained teeth were remarkably free of decay.

Food was stored in bags made of the beaten bark of the 'Riti' tree (*Antiaris toxicaria*), while pouches of monkey skin were used for keeping the masticatories (Seligmann and Seligmann 1911, Spittel 1961). Beaten 'Riti' bark was also used for clothing, which was stritched the fibers of 'Kiri nuga' or 'Kiri pelle' (*Ficus tsjahela*) (Parker 1909, Seligmann and Seligmann 1911), Spittel 1961). Food was frequently eaten off the leaves of 'Kenda' (*Macaranga peltata*) (Spittel 1961). When water had to be carried, bottle gourd = 'Diya labu' (*Lagenaria vulgaris*) was used (Selgmann and Seligmann 1911). This, being only found in cultivation, would have been obtained from the chenas belonging to the Sinhala people.

The technique of making fire was by rubbing two dry barked sticks of 'Velang' (*Pterospermum suberifolium*), described in detail by Spittel (1924). It was also possible to produce spark by striking two flint stones ('kahanda') together. A fluff of cotton previously soaked in 'Kekuna' oil (*Canarium zeylanicum*) was used to ignite the spark and produce fire that is enhanced by adding dry leaves and

sticks and then hardwood logs to keep the fire going for months. Such a bonfire can keep the Vedda camp warm and protect residents from mosquitoes and other insects and wild animals.

Sarasin and Sarasin (1893) affirm that their list of plants exploited by the Veddas could have easily been doubled with further investigations. The Vedda's knowledge of plants was very wide, and it would be difficult to find a plant of any use that the people could not correctly name (Lewis 1915). It may be assumed, however, that the more significant species of plants exploited by the Veddas have been duly noted.

The process of acculturation of prehistoric culture in Sri Lanka from the end of the Stone Age up to the present under the influence of the protohistoric Iron Age and historical periods has not been delineated in any detail due to scanty documentation. The extant data indicate that the practice of swiddening has gained a firm hold on the subsistence strategy of the Veddas, although in varying degrees on intensity, from early on in the historical period. It is probable that the domestic dog had prehistoric origins in Sri Lanka; but the use of the stalking buffalo for hunting (Nevell 1887, Parker 1909) would appear to have been a more recent innovation (Deraniyagala 1992). These changes in subsistence practice were accompanied by a total replacement of stone tool technology with that of iron – notably the all-purpose light axe ('Keteriya') for chopping, and arrow-heads for projectile points, cutting and scraping (Seligmann and Seligmann 1908). The Vedda term for the iron axe was 'gal-rakki'. The term 'gal' refers to stone as a material; this probably indicative of derivation from a period when stone axes were in use, thus representing the sole overt link there was between Vedda culture and Sri Lanka's Stone Age (Nevill 1887, Parker 1909, Deraniyagala 1960). Iron tools were acquired through barter with the Sinhala people, and they were never manufactured by the Veddas themselves (Davy 1821; Seligmann and Seligmann 1911; Lewis 1915; Spittel 1924, 1961).

The overall relationship between the Veddas and the technologically advanced Sinhala people was one of symbiosis. Geneticaly, miscegenation has taken place between Vedda, Sinhalese and Tamil gene pools in historical times. It is known, or more often assumed, that some race admixture had taken place between the Sinhalese and Tamils both before and after their arrival in Sri Lanka, though the amount of such admixture does not appear to have been extensive, and in recent historical times has been extremely rare. Sinhala Vedda and Tamil Vedda crossing has been common, however, a fact which in very large part explains the virtual disappearance of the Veddas as a biological and ethnic entity. They have been almost completely absorbed by the Sinhalese and Tamils. This factor not withstanding, the Sinhalese, the Tamils and the very few remaining Veddas of the present sample, are all anthropometrically and morphologically quite distinct, very likely because of (a) the relatively small numbers of Veddas involved in the hybridization, and (b) the limited amounts of Sinhalese-Tamil hybridization. The distinctiveness of the three racial phenotypes is illustrated by the fact that in the present sample the Sinhalese and Tamils differ significantly in all seven body measurements, in seven of eleven head and face measurements, in four of five body indices, and in ten of twelve head and face indices. Further, the Veddas differ significantly from both the Sinhalese and Tamils in all body measurements, all head and face measurements, all body indices, and in ten of twelve indices of the head and face. Differences in anthroposcopic characters are also quite apparent (Stoudt 1961). The above view of the Veddas as a biological entity, however, requires to be tempered by an awareness that the term 'Vedda' of Sanskrit derivation could refer to any group that subsists on hunting and gathering. Kennedy (1974) quite validly concludes that 'whenever such a community of hunters and gatherers supplements or substitutes agricultural persuits in their economy, the term "Vedda' is seldom retained, especially when acculturation is associated with social intercourse with long established

food-producing communities". Hence, it follows that several groups at the Vedda-Sinhalese or Vedda-Tamil geographical interfaces were referred to as Sinhalese or Tamils respectively, not so much on the basis of their genetic make-up as on their cultural attribute of no longer practicing a hunting and gathering subsistence strategy. In such a situation, the difficulties inherent in defining the Vedda phenotype vis-à-vis that of the Sinhalese or the Tamils are not easily surmountable. It is in this regard that the data recently acquired on the typical traits of Balangoda Man (from Bellan-bendi pelessa, Beli-lena Kitulgala and Batadomba-lena) have been of considerable utility and appreciable resolution has been achieved on the question of the Vedda phenotype, dispelling some of the murkiness associated with employing the term 'Vedda' as a conceptual strut for biological investigations when it is a 'socio-economic term as well as a name for a racial polytype (Deraniyagala 1963b, Kennedy 1974).

It is apparent that the present Vedda community is the culmination of the gradual transformation of primitive communities that strictly utilized natural habitats such as forests and caves and lived a hunter/gatherer life style to one that built huts for shelter and engaged in hunting and agriculture due to interaction with the Aryan societies. The introduction of agriculture resulted in the establishment of semi-permanent settlements in those areas where swiddening (the swidden cycle was 10-14 years) assumed dominance over hunting and gathering (Spittel 1961). In coastal regions, numerous fishing traits were acquired through contact with Tamil fisherfolk. Linguistically, the Veddas ended up speaking a creole akin to Sinhala of the 10th-16th centuries AD (Parker 1909).

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) deals with *in situ* conservation classified in 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. Symultaneously, 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 Forest Department and the Department of Wildlife Conservation. 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 km^2 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 Uva Province

Protected areas (PAs) within the Uva Province 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 Uva Provincial Council bears certain responsibilities in this regard.

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. An extract of the Pas in the UP from the map of Forest Sector PAs in Sri Lanka is given in Figure 7.1. It should be noted that OSFs have not been mapped.

Table 7.1 Forest Sector Protected Areas in the Uva Province

Source: IUCN & WCMC 1997

EMD Number	Name of Protected Area	Designation	Notified Area (ha)
Badulla District			
39	Bibilihela (part in Monaragala Dist.)	PR	610
306	Namunukula	PR	279.3
327	Ohiya (part in Nuwara Eliya Dist.)	PR	1925.5
608	Welanwita	OSF	8500
Monaragala District			
589	Bogahapatana	OSF	325
593	Bolhindagala	OSF	375
575	Dewagiriya	OSF	600
579	Diggala	OSF	250
594	Golupitiyahels	OSF	200
584	Guruhela	OSF	275
585	Kitulhela	OSF	450
577	Koratalhinna	OSF	1500
582	Lolehela	OSF	400
581	Monerakelle	OSF	1650
591	Murutukanda	OSF	800
595	Radaliwinnekota	OSF	900
590	Randeniya	OSF	300
576	Ulgala	OSF	1500
583	Velihela	OSF	200
604	Viyanahela	OSF	900
588	Wadinahela	OSF	700

However, information provided by the DFO, Monaragala indicates that 145 forests have been listed, although their extents and reference numbers, such as EMD numbers, are not known. Although this list should be considered as the complete list of forest sites within the district, it is probable that some of these sites do not currently exist as forests due to various reasons, such as encroachments and land alienation etc. The survey and permanent boundary marking of at least more important of these sites will require considerable amount of time and resources. This information also indicates that surveying and boundary marking – by concrete posts - of 24 forests have already been completed and this process is nearing completion for 23 more sites.

7.2.4 Wildlife Sector

The Wildlife Sector PAs in the UP are shown in Table 7.2. An extract of the PAs in the UP from the map of the Wildlife Sector PAs in Sri Lanka is given in Figure 7.1. It is interesting to note that the UP includes some of the largest and important National Parks in Sri Lanka.

Table 7.2 Wildlife Sector Protected Areas in the Uva Province

Source: IUCN & WCMC 1977

EMD Number	Name of Protected Area	Designation	Notified Area (ha)
Badulla District			
123	Hakgala (part in Nuwara Eliya Dist.)	SNR	1141.6
239	Maduru Oya Block I (part in Ampara District)	NP	51469.4
392	Ravana Ella	S	1932
426	Tangamalai	S	131.5
Monaragala District			
97	Gal Oya Valley	NP	25899.9
98	Gal Oya Valley North-East (part in Ampara Dist.)	S	12432
99	Gal Oya Valley South-West (part in Ampara Dist.)	S	15281
187	Kataragama	S	837.7
231	Lunugamvehera (part in Hambantota Dist.)	NP	23498
399	Ruhuna Block 2	NP	9931
400	Ruhuna Block 3	NP	40775.4
401	Ruhuna Block 4	NP	26417.7
402	Ruhuna Block 5	NP	6656.2
408	Senanayake Samudra	S	9323.9
438	Uda Walawe (part in Ratnapura Dist.)	NP	30821

7.2.4.1 Gal Oya National Park

This park was established on 12th February 1954, mainly to protect the catchment area of the Senanayake Samudra Reservoir, and it was subsequently handed over to the DWC in 1965. The reservoir was constructed as part of a development scheme to open up some 162,000 ha of forest for agricultural and industrial purposes.

Although a major part of the park is contained in the Monaragala District, a small eastern part lies in the Ampara District. The park area is 25,900 ha and it totally encloses the Senanayake Samudra, which is not a part of the park. The altitude of the park ranges from 30 to over 500 m, while the reservoir lies at about 80 m. The mean annual rainfall is 1,766 mm. The park is considered to be among the most scenic landscapes in Sri Lanka. Senanayake Samudra reservoir supports an important fishery, and a valuable source of water for agriculture. The area comprises the catchment of the reservoir that has an impressive backdrop of rocky, forested hills (DWC 2001).

About 45% of Gal Oya National Park is forest, 33% savanna, 9% other grasslands, and 2% chena; the rest being water bodies.

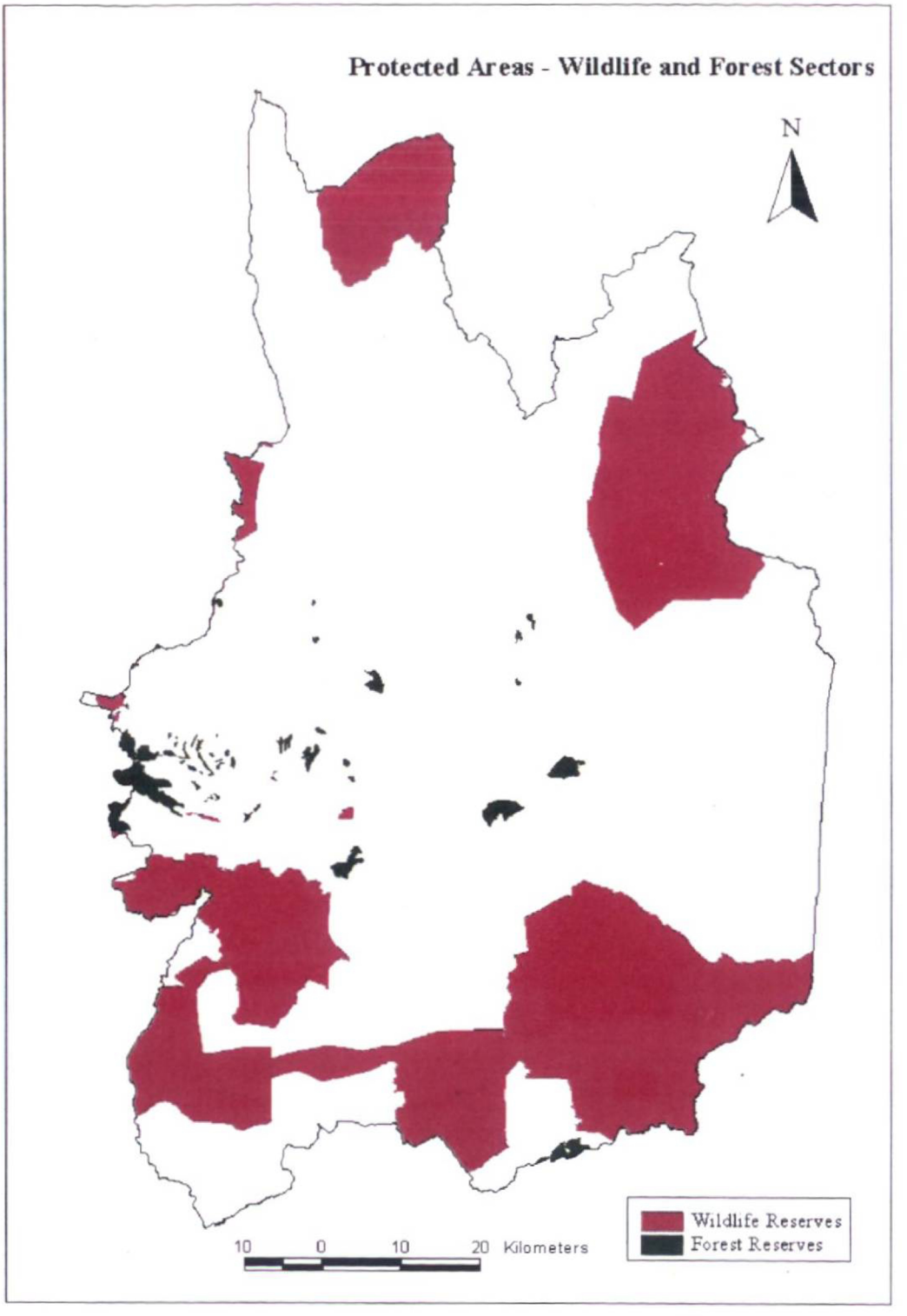

Figure 7.1 Protected Areas in Uva Province

Source: Forest Department

7.2.4.2 Lunugamvehera National Park

The park was established on 8th December 1995 and it lies within the DS Divisions of Tanamalwila, Wellawaya, Kataragama and Buttala in Monaragala District and Lunugamvehera in Hambantotat District. The total extent of the park is 23,490 ha of which a significant area (14%) is occupied by the Lunugamvehera reservoir. At full capacity, the reservoir occupies 3,283 ha and other small tanks within the park cover about 50 ha. Thus the total dry land area of the park is 20,158 ha.

Lying in the dry zone, conditions are characterized by an annual drought coinciding with the SW monsoon. The average annual rainfall at Tanamalwila is about 1,000 mm and the rainfall in the park area decreases from north to south and west to east. The average annual temperature is about 30^0C.

The physiography of the park is characterized by a vast featureless gently undulating plain with rock knob plains generally occupying the slightly elevated areas in south. The park is at an average altitude of 91 m with Sittarama being the highest peak that reaches 290 m.

The vegetation includes different stages of forest succession along with scrub / grassland mosaics. The chena cultivation has caused degredation of the forest vegetation to Dry Deciduous Thorn Scrub and grassland communities (DWC 2001).

7.2.4.3 Maduru Oya National Park

Maduru Oya NP was designed to protect the immediate catchments of five reservoirs, developed under the Accelarated Mahaweli Development Program. Conservation of these catchments is crucial to the success of the project. The park area provides refuge for wildlife, particularly elephants.

The Block I of the park, with an area of 51,469 ha and located in Badulla and Ampara Districts, was established on 9th November 1983 under the Fauna and Flora Protection Ordinance, having acquired from crown lands pursuant to the Mahaweli Authority Act, 1979. The park was extended by the addition of its Block II (7381 ha) on the east located in Ampara District on 16th September 1985 in order to provide additional habitat for wildlife and to ensure protection of the immediate catchment of the NDK reservoir. Major part of the park area lies between 30 m and 150 m, while Kokagala peaking at 657 m represents the highest altitude within the park area and furthermore, this 8 km long hill range provides an imposing topographic feature to the general landscape.

The park is located entirely within the dry zone, although its southern parts border on the intermediate zone. The climatic conditions are influenced largely by heavy precipitation received during October – January and the mean annual rainfall is 1,650 mm. The mean annual temperature is about 27^0C. The geological regime comprises alluvial deposits and Miocene limestone. Reddish Brown Earths, relatively fertile but easily erodable, is the predominant soil type. Water bodies, constituting over 15% of the park, include the Maduru Oya, Ulhitiya, Ratkinda, NDK and Henanigala reservoirs and tributaries of the Mahaweli and Maduru Oya river systems.

The climax vegetation in the area is DMEF. However, a major part of the forest vegetation had been heavily exploited in the past for chena cultivation. This has resulted in areas of secondary vegetation and vast stretches of open plains dominated by grasses such as 'Iluk' (*Imperata cylindrical*), 'Guinea grass' (*Panicum maximum*) and 'Pohon' (*Pennisetum polystachyon*). A highly threatened and endemic tree, viz. *Vatica obscura*, one of the very few species of the Dipterocarpaceae that occurs in the dry zone, is found in restricted location on the banks of the Maduru Oya and Gallodai Aru. A large 'Teak' plantation is included in the north eastern part of the park (DWC 2001).

7.2.4.4 Ruhuna National Park

Ruhuna (Yala) National Park consists of five Blocks. Block I was established on 25th February 1938, having previously been a resident sportsman's game reserve in 1900. Further blocks were established in subsequent years: Block II on September 1954 (originally proclaimed as Yala Sanctuary in 1900), Block III on 28th April 1967, Block IV on 9th October 1969 and Block V on 5th October 1973 (DWC 2001).

The area of the park is 97,881 ha in entirety, but only 14,101 ha (Block I) used for tourism. A larger proportion of the park area that consists of over 75% belongs to Uva Province; i.e. Block III (40775.4 ha), Block IV (26417.7 ha) and Block V (6656.2) lie in Monaragala District.

Mean annual rainfall varies between 900 mm in the south to 1300 mm in the north while the mean annual temperature is 27°C. The park comprises coastal plain with a number of scattered inselbergs, associated with which are a number of caves and pools (kema). There are also several freshwater lakes and brackish lagoons. The eastern boundary formed by the sea, is marked by sand dunes of up to 30 m high and broad sandy beaches. Reddish brown earth and non-calcic brown soils predominate but patches of loose, sandy soil are common along eastern border and the northern region consists mainly of clay. The altitude ranges from sea level to 90 m high inselbergs.

Yala is renowned for the variety of its wildlife, largely characteristic of Dry Deciduous Thorn Scrub, and its fine coastline and associated coral reefs. Large number of important ruins bears testimony to earlier civilization and indicates that much of the area was populated and well developed, with an irrigation system supplying water to the surrounding paddy fields, including those of Yala.

The vegetation consists of secondary forest, possibly a few hundred years old. It is predominantly Dry Decidous Thorn Scrub, interspersed with pockets of fairly dense DMEF.

7.2.4.5 Udawalawe National Park

Udawalawe was declared as the fifth National Park in Sri Lanka on 30th June 1972. Although it lies both in Sabaragamuwa and Uva Provinces, the latter covers most of the park area. The park includes the Udawalawe reservoir, together with much of its catchment area and its total extent is 30,821 ha. Its altitudes range from about 100 m on the plains to 373 m at top of Ulgala, the highest point within the park (DWC 2001).

The park is situated in the dry zone and the mean annual rainfall is 1,524 mm. A part of the western sector lies in the intermediate zone and receives a little more rainfall than the rest. Mean day and night temperatures are 29^0C and 34^0C, respectively.

Udawalawe National Park is renowned for its outstanding scenic beauty and wealth of faunal species, particularly mammals and birds. It has become a tourist attraction throughpout the year as it is blessed with rich flora and fauna, while the possibility to view the elephants at close range has become another main attraction. The park serves the dual purpose of ensuring a perennial supply of silt free water to the reservoir and providing a refuge for wildlife displaced by the opening up of land for agriculture and other purposes in the lower reaches of the Walawe Ganga.

The predominant vegetation of the park is the forest with scattered grasslands and thorn scrub. A rare and highly localized member of the Dipterocarpaceae viz. 'Uva mandora' (*Hopea cordifolia*) occur among the Dry Riverine Evergreen Forest (DREF) in this area.

7.2.4.6 Tangamalai Sanctuary

This sanctuary was declared in 1938 and is located in the Haputale Division. It consists of 117.9 ha (131.5 ha acc. IUCN & WCMC 1997) and the Adhisham bungalow, situated adjacent to the sanctuary enhances the tourism potential of this sanctuary. The general vegetation type is MOEF, however, disturbed to some extent and parts have been converted to pinus plantations (Information: Mr. M.G.C. Suriyabandara, DWC).

7.2.4.7 Ravana Ella Sanctuary

This is located in the Ella Division and it consists of 1932 ha. The sanctuary was declared on 18th May 1979 for purposes of catchment and conservation of wildlife. This area functions as a major catchment of the Kirindi Oya and being located in the escarpment between first and second peneplains, some waterfalls are located, most well-known being the Ravana Ella and Bambaragala Ella Falls.

The main vegetation types are MMEF, DPTG and SAVG that support high diversity of plants, amphibians, reptiles, birds and mammals. The 'Vawul Guhawa' (bat cave), a well known lhabitat for the bats is also located in this area.

7.2.4.8 Maragala Environmentally Protected Area

The CEA has taken steps to protect some identified areas as EPAs, as per National Environment Act No. 47 of 1980 and the authority vested on the Minister in charge of the Environment. Accordingly, among many other sites, Maragala in Monaragala has been declared as the fifth EPA. This decision has been taken in consideration of the unique biodiversity, archeological importance, catchment potentials and scenic beauty of this site. A Management Committee is to be formed comprising Monaragala District Secretary as the Chairperson to oversee the effects of the development projects implemented in this area (CDN, 30 September 2008).

7.2.5 Archeological 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 few. One rare example of this unique process of cooperative efforts towards conservation and sustainable use of biodiversity is the development of the Menikdena Archeological Reserve and Arboretum in the Matale District, jointly by the Trinity College, Kandy and the Department of Archeology (Jayasuriya et al. 1997).

159 archeological sites situated in 14 DS divisions in the Badulla District have been listed and of them 27 sites, all in the Badulla DS Division, are in private lands (information: Divisional Archaeological Office – Uva Province). It will be necessary to investigate the presence of important biodiversity, e.g. rare tree species, within these sites and take suitable measures for their combined conservation. A few of the archeological reserves in the UP harboring a considerable biodiversity are as follows:

7.2.5.1 Maligawila Archeological Reserve

This is situated near Okkampitiya and occupies an area of about 96 hectares. The vegetation represents DMEF that exists in patches interspersed with managed woodlands harboring a high avifaunal diversity. A high bird and butterfly species richness, including many endemics, has been recorded

The Maligawila Buddha statue, reaching 10.87 m (35' 8"), is one of the tallest Buddha statues in Sri Lanka. It was built either by King Aggabodhi (607 – 683 AD) or King Dappula (a regional king of the Ruhuna Kingdom) and its material consists of limestone. Just 800 m away from this statue and situated within the same reserve, is the most attractive and famous 'Dambegoda statue' depicting Maithri Bosath. This is over 6 m (20') tall and founded on a circular lotus rock of 1.52 m (5') high and 4.53 m (14'10.5") diameter and it is considered to be the largest known Bosath statue in the world. It has been further recorded that King Aggabodhi has built a hospital including an eye hospital at this site which was contemporaneously known as 'Kanagama'' (Information: Mr. M.Sandun J. Perera, Sabaragamuwa University).

7.2.5.2 Buduruwagala Archaeological Reserve

This reserve is situated in the vicinity of Wellawaya and its vegetation consists of DMEF and grasslands. The reserve also includes an ancient tank providing some habitat diversity that supports a wide array of flora and fauna.

The existence of the Mahayana philosophy during the middle period of the Anuradhapura Kingdom is indicated by unique sculptures at Buduruwagala (Imformation: Mr. M.Sandun J. Perera, Sabaragamuwa University).

7.2.5.3 Biso-pokuna Archaeological Reserve

This is situated at Galabedda in Monaragala and the site consists of a natural patch of forest.

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.

7.2.6.1 Buttala campus of the Sabaragamuwa University

The premises of the Faculty of Applied Sciences (Buttala campus) are situated about 1.5 km from Buttala junction along the Monaragala road (A4). It lies in a valley between two picturesque hillocks, viz. Rahatangala and Andampahuwa that are covered with dense forest vegetation. This site is proposed to be developed as a biodiversity park in order to promote research on the natural history of the UP. A considerable diversity of ecosystems consisting of MMEF on hillocks, rock outcrop vegetation, SPOF, managed woodlands, grasslands, teak plantations and home gardens can be seen in this landscape. A small stream and a network of gullies that originate from the hills pass through the campus premises. The high diversity of habitats supports high species diversity of flora and fauna. 137 species of birds including 14 migrants and 5 endemics, 27 reptile species (10 tetrapod and 17 serpentoid) including 3 endemics were recorded. Of the inveretebrates, 125 species of butterflies, including two endemics, are on record, while annual migrations of butterflies such as Lemon Imigrant

and Lesser Albatross are noteworthy (Information: de Alwis et al. 2006; de Alwis & Surasinghe 2006; M.Sandun J. Perera, University of Sabaragamuwa).

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).

7.3.1.1 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 snd 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.

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 m^2. 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. However, in the UP, the home gardens are less well-developed when compared with that in the CP. At the perimeter, 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, guava, avocado and papaya, 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 collabotation 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

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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).

7.4.1.1 Bibile MPCA

This area is located in the Monragala District falls within two DS Divisions, viz. Bibile DS Division (Karadugala, Nilgala, Bulupitiya, Pitakumbura, Thotillaketiya and Hawapola GNDs) and Madulla DS division (Nelliyadda, Urawula and Galgamuwa GNDs).

The sites belonging to the FD fall within the Bibile Forest Range in the Monaragala Forest Division. Nearly one third of the area of the MPCA is within the purview of the DWC. The boundary of the Gal Oya NP passes through the Nilgala, Galgamuwa, Pothuliyadda and Mullegama GN Divisions. Mullegama and Nilgala Wildlife Ranges fall within the MCPA. The general vegetation types that are represented in the area are SAVG, MMEF and DMEF with Damana grassland in the drier parts. SAVG of Bibile have not been included in the revised forest sector PAs and only representative of this ecosystem is the Nellikele MAB Reserve, consisting of 2279 hectares) in the Ampara District (IUCN 2002).

The wildlife conservation areas consist of the Gal Oya NP (25,900 ha) and three other Sanctuaries, viz. Senanayake Samudra Sanctuary (9,234 ha), Gal Oya Valley Northeast Sanctuary (12,432 ha) and Gal Oya Valley Southwest Sanctuary (15,251 ha) and all these sites collectively protect the catchment of the Senanayake Samudra (see also section 7.2.4.1).

The forests of the Bibile MPCA are extensively utilized by the villagers to extract NWFP, mainly products of medicinal value. CSUMPP carried out a socio-economic profile of the Bibile MPCA in relation to the utilization of timber and NWFP. Priority medicinal plants and multiple use trees used by villagers in the Bibile MPCA are listed in the Table 7.3.

Table 7.3 Priority medicinal plants and multiple use trees used in Bibile MPCA

Source EML 2002; species nomenclature and classification corrected

Species (Family)	Life Form	Local name	Part(s) used	Purch-asing price in 2002 Rs/Kg
Aerva lanata (Amaranthaceae)	Annual herb, 25-50 cm high	Pol-pala	All parts	20-30
Asparagus racemosus (Asparagaceae)	Herbaceous twining climber	Hathawariya	All parts	
Blumea axillaris (Asteraceae)	Annual herb, 30-60 cm high	Kukula, Kukuru-duru	Leaves	
Dialium ovoideum (Fabceae)	Tree	Gal-siyambala	Fruits	40-50
Diopyros melanoxylon (Ebenaceae)	Medium to large tree	Kadumberiya	Leaves	60-90
Garcinia quaesita (Clusiaceae)	Medium tree	Goraka	Pericarp	35-60
Indigofera tinctoria (Fabaceae)	Woody shrub, up to 2 m high	Nil-avariya	All parts	
Litsea glutinosa (Lauraceae)	Moderate sized tree	Bomi	Leaves, bark, roots and seeds	15-30
Memecylon umbellatum (Melastomataceae)	Strong woody shrub to small tree	Kora-kaha		
Munronia pinnata (Meliaceae)	Woody herb to 40 cm high	Bin-kohomba	All parts	700-900
Phyllanthus emblica (Euphorbiaceae)	Small to medium tree	Nelli	Leaves, bark, flowers, fruits, seed kernel	25-40
Pterocarpus marsupium (Fabaceae)	Tree	Gammalu	Latex, bark, wood	
Rauvolfia serpentina (Apocynaceae)	Perennial woody herb to 1 m high	Ekaweriya	Roots, seeds, leaves	
Salacia oblonga (Hippocrateaceae)	Large woody twining climber (liana)	Kothala himbutu	Root bark	
Terminalia bellirica (Combretaceae)	Tree	Bulu	Pericarp, bark, gummy exudates, seeds	2-6
Terminalia chebula (Combretaceae)	Tree	Aralu	Pericarp, bark	5-10
Tinospora cordifolia (Menispermaceae)	Herbaceous twining climber	Rasa-kinda	Stem	15-20
Trichosanthes cucumerina (Cucurbitaceae)	Herbaceous tendril climber	Dum-mella	All parts	

In addition to the priority forest produce (Table 8.4), the villagers collect several other items for domestic use and commercial purposes, e.g. seeds and fronds of 'Madu' (*Cycas circinalis*), unripe fruits of 'Tumba-karawila' (*Momordica dioica*), 'Weni-vel-geta (*Coscinium fenestratum*), 'Ma wewel' (*Calamus thwaitesii*), 'Heen wevel' (*Calamus rotang*), Katu ala (*Dioscorea pentaphylla*),

'Dahaiya ala' (*Dioscorea trimenii*), 'Hiritala' (*Dioscorea oppositifolia* var. *oppositifolia*), 'Gonala' *Dioscorea oppositifolia* var. *dukhenensis*), mushroom, gum etc. It is also interesting to note that in this region, more varieties and quantities of NWFP are collected and used compared to those in the wet zone sites, e.g. Kanneliya (IUCN 2002).

CSUMPP has made several important recommendations to ensure conservation of the Bibile MPCA. Being situated in the Gal Oya catchment, the MPCA has a significant hydrological value. The vast expanse of Savanna Grasslands over the landscape possesses exceptional scenic beauty. The FD has already selected a large portion of this unique area (about 12,000 hectares) to be proposed as a MAB Reserve. Therefore it is very much appropriate that the forests and the associated vegetation in the MPCA to be classified in the category of ***Conservation Forests***. A low impact utilization of the Conservation Forests by the local population, especially with regard to the extraction of NWPF, does not contradict with the Forest Policy of the government.

The proposed MAB Reserve extends beyond the MPCA and recent boundary surveys with erection of concrete pillars have covered nearly 100 km. The estimated length yet to be covered amounts to 250 km. This should be completed as a priority task. Boundary surveys should include also large vegetation patches not included in the proposed MAB Reserve.

Planting trees common to the locality can enrich selected degraded forests. The species for planting can be selected from the Table 8.4. The past experiences in enrichment planting have resulted in failure due to fire hazards. It has also been stressed that species alien to local habitats should not be used in enrichment planting. Stand enrichment by natural regeneration, small scale line planting supported by village nurseries and allocation of farmers woodlots on long-term lease that will generate income to the inhabitants have been proposed. Establishment of fire lines, upgrading roads, improvement of management and human resources, designation of Strict Conservation Areas, establishment of tree nurseries, planting of medicinal plants in home gardens and production of ayurvedic drugs by community centers have been recommended (IUCN 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* econservation 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 (DAg)
Field genebanks	Fruit crops with recalcitrant seeds, vegetative progagated 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

There are no genebank facilities for PGR conservation in the UP.

8.1.1 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 insututions were placed in the ministry of Sports and Entertainment.

8.1.1.1 Municipal Botanical Garden in Badulla

At present, there are no botanical gardens in the UP that are administered by the National Botanic Gardens. However, records indicate that there was a botanical garden in the late 19th century, presumably administered by the Peradeniya Botanic Gardens. Due to some reason or other, it was subsequently liberated from Peradeniya and managed by the local authorities. At present, it is known as the 'Municipal Botanical Garden' and administered by the Badulla Muncipal Council. It covers an area of about one hectare and has many of the trees of the original garden, curator's bungalow and some memorial trees.

These trees are mostly exotic, apparently over 100 years old and have attained huge sizes. A few of them were tentively identified as Cuban mahogany = 'Podi-kola Mahogany' (*Swietenia mahogoni*'), Honduras mahogany = 'Loku-kola mahogany (*Swietenia macrophylla*), Cotton tree = 'Katu imbul' (*Bombax ceiba*), Durian (*Durio zibethinus*), *Cochlospermum vitifolia*, Shower of gold = 'Ehela' (*Cassia fistula*), Star fruit = 'Kamranga' (*Averrhoa carambola*), 'Bilin' (*Averrhoa bilimbi*), 'Maila' (*Bauhinia racemosa*) and 'Kayam' (*Memecylon ? sylvaticum*). However, these trees lack labels that would have added great scientific and educational value to this garden.

A memorial tree – probably *Rhaphia*, strangulated by a banyan = 'Nuga' (*Ficus benghalensis*) - is among the few memorial trees in the garden. There is a stone plaque at the base of this tree with lettering '*This memorial tree was planted by H.J.Pinto Esquire, Chairman, Urban Council of Badulla in Commemoration of the Silver Jubilee of Their Majesties King George V and Queen Mary – 6th May 1935*'.

Furthermore, the Curator's residence is located within the garden. This is a tiled house built with bricks apparently in 1889, as inscribed in the wall. At present, it is not in use. There is a cemetery next to the garden and the grave of the famous Vedda chieftain Vannaku Tissa Hamy, buried on 20th August 1952 is located in it.

8.1.2 Parks and other modified sites

Urban parks and other modified lanscapes can function to some extent as biodiversity conservation sites. They are usually protected and maintained by the respective authorities, e.g. Municipal Councils, Urban Councils, universities etc.

8.1.3 Plantation crops

The plantation crop sector come under the Ministry dealing with plantation industries. In this sector, TRI, RRI, CRI and SRI deal with research and development of the respectice crops and the conservation of germplasm (MENR 2002).

8.1.4 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 in the country 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.

8.1.4.1 Forest plantations in the Uva Province

The status of forest plantations in the Monaragala District, based on information provided by DFO, Monaragala, is summarized in the Table 8.2. Categories of forest plantations, as classified by the FD, are as follows:

I. Reforestation of clear-felled plantation forest areas

II. Rehabilitation of unsuccessful forest plantation: The success of forest plantations is sometimes reduced to various levels due to factors such as damage caused by elephants, fire and drought.

III. Forestry in buffer zones: This is carried out in order to ensure effective conservation of important PAs and no timber-based commercial benefits are expected out of these buffer zones.

IV. Agro-forestry: This intends to increase productivity in agricultural lands and to facilitate soil and water conservation.

V. Enrichment planting: This intends to improve the quality of existing forest plantations.

Table 8.2 Status of forest plantations in Monaragala District at 2006

(Source: Divisional Forest Officer, Monaragala)

Category	Forest Range	Year of establishment	Species used	Current progress (%)
I	Wellawaya Tanamalwila Kataragama	2002-2006	Et-demata Kaya Tekka Hal-milla	50 - 90
II	Wellawaya Tanamalwila Siyambanduwa Bibile Kataragama	2003-2006	Et-demata Hal-milla Hulan-hik Kaya, Kohomba Lunu-midella Mahogany Tekka	70 - 90
IV	Wellawaya Tanamalwila Monaragala Siyambanduwa Bibile	2003-2006	Et-demata Hal-milla Kohomba Lunu-midella Mahogany Tekka	60 - 90
V	Wellawaya Tanamalwila Bibile	2003 - 2006	Bata-domba Bulu, Ehela Et-demata Hal-milla Hulan-hik Kumbuk Mee, Siyambala Telambu Mixed spp.	60 - 90

Bata-domba	- *Syzygium* sp.	Myrtaceae
Bulu	- *Terminalia bellirica*	Combretaceae
Ehela	- *Cassia fistula*	Fabaceae
Et-demata	- *Gmelina arborea*	Verbenaceae
Hal-milla	- *Berrya cordifolia*	Tiliaceae
Hulan-hik	- *Chukrasia tabularis*	Meliaceae
Kaya	- *Kaya senegalensis*	Meliaceae
Kohomba	- *Azadirachta indica*	Meliaceae
Kumbuk	- *Terminalia arjuna*	Combretaceae
Lunu-midella	- *Melia azedarach*	Meliaceae
Mahogany	- *Swietenia macrophylla*	Meliaceae
Mee	- *Madhuca longifolia*	Sapotaceae
Siyambala	- *Tamarindus indicus*	Fabaceae
Telambu	- *Sterculia foetida*	Sterculiaceae
Tekka	- *Tectona grandis*	Verbenaceae

8.1.5 Spice and beverage crops

Department of Export Agriculture (DEA), located in Peradeniya, is mandated to develop and conserve crops such as coffee, pepper, cocoa, cardamom, cloves, nutmeg, cinnamom, lemon grass, betel and arecanut etc. However, no research or experimental stations for these crops are located in the UP.

8.1.6 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 four field genebanks for medicinal crops which are located in different agro-elogical regions and of them two, viz. Haldummulla and Girandurukotte are situated in the UP (Table 8.3).

Table 8.3 Field genebanks for medicinal crops (UP stations in *italics*)

Location	Province/District	Agro-ecological region	Extent (ha)
Pattipola	Central/Nuwara Eliya	Wet Zone Up country – WU_3	7
Nawinna	Western/Colombo	Wet Zone Low Country WL_4	20
Haldummulla	Uva/Badulla	Intermediate Zone Mid Country IM_2	*7*
Girandurokotte	Uva/Badulla	Intermediate Zone Low Country IL_2	*45*

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).

CHAPTER 9

9 CULTURE AND BIODIVERSITY

Sri Lanka with a recorded history of over 2500 years and a prehistory of several mellenia, 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 and Uva Provinces.

9.1.1 Knox's obserevations 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.

9.1.1.1 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 choise 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' varierties.

Kodo millet ='Amu' (*Paspalum scrobiculatum*): This cereal was also boilt 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 yields an oil that is applied on the body. A rejuvenating food can be prepared by roasting its seed, mixed with jaggerry and made into balls.

9.1.1.2 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 occured 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-wraped them in white cloth and sent to the king's palace. However, no renumeration 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 were 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 fuit seeds either boilt 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 Protugese.

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*).

9.1.1.3 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*), Drums stick = '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 (*Daucas carota*), raddish (*Raphanus sativus*) and Mint (*Mentha spicata*) and other introduced crops, e.g. Mustard = 'Aba' (*Brassica juncea*), Fennel = 'Suduru' (*Foeniculum bijolgohota*), 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.

9.1.1.4 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).

9.1.1.5 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.

9.1.1.6 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.

9.1.1.7 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.

9.1.1.8 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'(*Euphobia 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 tonsilitis was recorded by Knox.

9.1.1.9 Poisonous plants

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

9.1.1.10 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 rotty 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 is 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 stritched 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 thwatesii*, '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.

9.1.1.11 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.

9.1.1.12 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'

9.1.1.13 Vegetation in general

The denseness of the forests was often mentioned by Knox. The riverine forests consisting of trees and shrubs that often overhanged these 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.

9.1.2 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.

9.1.2.1 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 leaches 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.

9.1.2.2 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.

9.1.2.3 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'.

9.1.2.4 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.

9.1.2.5 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 asperrimus*). 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.

9.1.2.6 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' (*Anthracoceras 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.

9.1.2.7 Mammals

Dometic 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. sqirting water on men. King also used them to execute prisoners.

Small mammals: Musk shrew = 'Hik meeya' (possibly *Suncus murinus*), if uninates 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.

9.1.2.8 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.

9.1.3 Animal husbandry and use of animal products

King had a flock of goats that was less than100 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 consumtion. Next to King's herd of goats, Knox's was the largest and he killed them for his consumtion. Except for the king, no other citizen was allowed to rare 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

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 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, 'Nelum' (*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.

It is significant that the variety of plants referred to in the folk poetry of the Uva, where many aspects of local culture still remains, reflects the regional diversity of flora. Thus in a compilation of folk poetry of Uva, the names of the following plants have occurred prominently:

'Buruta' (*Chloroxylon swietenia*), 'Na' (*Mesua ferrea*), 'Aralu' (*Terminalia chebula*), 'Kitul' (*Caryota urens*), 'Dunuke' (*Pandanus thwaitesii*), ' Thala' (*Corypha umbraculifera*), 'Madu' (*Cycas circinalis*), 'Kenda' (*Macaranga peltata*), ' Bo' (*Ficus religiosa*), 'Mee' (*Madhuca longifolia*), 'Kos' (*Artocarpus heterophyllus*), 'Del' (*Artocarpus nobilis*), 'Goraka' (*Garcinia quaesita*), 'Lolu' (*Cordia dichotoma*), 'Himbutu' (*Salacia reticulata*), 'Kumbuk' (*Terminalia arjuna*), 'Mee-amba' (*Mangifera indica*), 'Heen thambala (*Carmona retusa*), '"Paramadala' (unidentified), 'Bukeeriya' (*Amomum echinocarpum*), 'Ginithilla' (*Argyreia populifolia*), 'Una' (*Bambusa vulgaris*), 'Mora' (*Dimocarpus*

longan), 'Dotalu' (*Loxococcus rupicola*), and many names of fruits and vegetables. Most of these species are still found in the area.

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' = Jackawl (*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.

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 main). 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.

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* (Charriots) 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 (MENR 2005).

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 and even bees are often clearly identified by the public. 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) confine the custody of the traditional knowledge to a limited number of practitioners and families.

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.

9.2.3 Stone inscriptions of biodiversity in Uva Province

To indicate important information to the future generations, stone inscriptions of animal symbols were used in the long past in the Uva. Elephant, lion, cobra, sambur, fish and human; foot prints of elephant, horse, leopard, bird and human; sun, moon, winnowing basket ('kulla'), mammoty, and nut cracker ('giraya') were some of these common symbols (Table 9.1). Often these symbols indicate road directions, although they are believed to contain secret messages such as directions to hidden treasures.

9.2.4 Biodiversity in regional flags

In ancient Sri Lanka there were many flags symbolizing different administrative regions. The Uva also had some designated flags and mainly it was the swan that symbolizes the wisdom. In addition, Uva-wellessa was symbolized by the leopard flag, indicating fearless guarding of its range.

Table 9.1 Inscriptions of animal and other symbols in the Uva Province

District	Site	Inscription
Badulla		
Mahiyangana	Sandagana Veheragala	Horse, elephant, sun & moon
	Gonagala kanda	Sambur
	Ritigaha Aralugala	Sambur and human
Bandarawela	Ettalapitiya bathing spout	Elephant footprint
Uva-paranagama	Uva-paranagama	Mamoty, katte, nut cracker
	Uva-paranagama, Nidangala	Cobra
Hali ela	Hali ela, Digalla rock	Leopard
Kandaketiya	Owaliga godakanda	Elephant footprint
Meegahakiwula	Meegahakiwula, Komarika gala	Ox footprint
Ridi mahaliyadda	Pethiyagoda rock	Fish
Monaragala		
Badalkumbura	Badalkumbura, Galkulumulla rock	Winnowing basket
	Kota mudunagala rock	human
	Meeriya Oya rock	Human
Tanamalwila	Tanamalwila, Pokunugala rock	Leopard
Madulla	Arugala rock	Human
	Kapurugala kanda	Vedda and dog

9.2.5 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 futher 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, such as the folk poetry of Uva, harbor a wealth of information related to biodiversity. Such knowledge may reveal distribution of species, e.g. Omaragolla indicating the presence of 'Omara' (*Ploya1thia coffeoides*), or even extinction of some of them (e.g. Gavarawela that indicates the existence of 'Gavara' (*Bos gaurus*) during historical times (now extinct). Place names based on flora and fauna in the UP, as listed by the MENR (2005), are given in Table 9.2 and Table 9.3 respectively.

Table 9.2 Toponymy based on plant names in Uva Province

(Source: MENR 2005)

DS - Divisional Secretariat

DISTRICT & DS	Village name (hyphenated to separate plant species)
BADULLA DISTRICT	
Badulla DS	Alubo-golla, Badulla, Hapugaha-kumbura, Heennaran-golla,
	Iluk-tenna, Kenda-golla, Kurugaha-patana, Mailagas-tenna,
	Nagaha-patana, Nelum-wewa, Pinna-landa, Pussel-golla
	(Puswel-golla), Puwak-godamulla, Rambuk-potha,
	Tolabogas-watta
Bandarawela DC	Ambagaha-kumbura, Ambatenna-watta, Badulugas-tenna,
	Bogaha-ella, Damba-golla, Dehigas-ella, Delumgaha-watta,
	Dimbul-tenna, Dodamgaha-watta, Galerandugas-patana,
	Heraliyagas-kumbura, Himbutu-golla, Iluk-watta, Kaha-golla,
	Kahatagaha-arawa, Kalamadugas-tenna, Kapu-watta,
	Karagaha-wela, Karagas-tenna, Kebella-wela,
	Kekunagaha-watta, Kollu-watta, Kurundu-golla,
	Liyangaha-wela, Mal-watta, Mara-bedda.
	Nugagaha-kumbura, Ratmalgas-ella, Sapugas-ulpatha,
	Sapugas-watta.
Ella DC	Ambagas-ketiya, Bogaha-tenna, Damba-gollagama,
	Dehi-golla, Dimbulgas-tenna, Divulgas-tenna, Dodam-golla,
	Hal-pe, Karanda-golla, Kiriya-golla, Kos-watta, Kurundu-
	wattagama, Madugas-talawa, Malitta-golla, Mi-gollagama,
	Milla-gama, Na-ulla, Rukattana-watta, Talagaha-kumbura,
	Wewel-hinna.
Hali Ela DC	Alakola-golla, Ambagaha-helagama, Amba-gollapatana,
	Bogaha-landa, Bogaha-maditta, Bo-goda, Bulat-watta,
	Damba-golla, Dehi-golla, Dehi-vinna, Daluk-hinna,
	Dematawel- hinna, Dunuke-bedda, Enasal-bedda,

DISTRICT & DS	Village name (hyphenated to separate plant species)
	Enasal-watta, Eramudu-golla, Heennaran-golla, Iluka,
	Iluk-pelessa, Iluk-talagoda, Iluk-tenna, Imbul-goda,
	Kahata-golla, Kenda-golla, Kehel-ella, Kos-golla,
	Kos-gollapatana, Labu-hena, Moragaha-ella, Pan-wewa,
	Peragas-pitiya, Talagaha-watta, Tibbatu-kandura,Una-golla,
	Wewel-hinna.
Mahiyangana DC	Andaragas-pitiya, Batala-yaya, Damba-golla,
	Dawatagas-kanda, Dehi-golla, Demata-ella,
	Divul-pelessa, Diwulgas-pitiya, Dodam-watta, Kolon-yaya,
	Kon-kotamulla, Kottagas-mulla, Meegas-walana,
	Migaha-hena,Ratmal-galayaya, Welangas-pitiya, We-watta
Passara DC	Aba-tenna, Alakola-gala, Attana-golla, Bogaha-kiwula,
	Dambagas-goda, Damba-kote, Dehi-kindagama, Iluk-patana,
	Kahata-ruppe, Keena-goda, Kos-golla, Madugas-talawa,
	Madu-watta, Miriya-bedda, Milla-bedda, Puhul-watta,
	Sapu-rodagama, Tolabo-watta, Waraka-dowa, Werella - patana.
Rideemaliyadda DC	Aralu-pitiya, Bala-dangolla, Bogaha-yaya, Bulugaha-wela,
	Damgaha-watta, Damba-golla, Dan-kumbura,
	Demata-ketiya,Dawata-golla, Dodam-golla, Dodam-wagawa,
	Gas-golla, Gedumba-yaya, Ikiriya-goda, Kahata-wadiya, ,
	Kailawel-pitiya Kalugahakola-yaya, Kapu-watta,
	Kolon-bedda, Kongas-handiya, Kongas-pitiya,
	Kottagaha-arawa, Kottagas-pitiya, Madukotan-mulla,
	Nikapanduru-yaya,Peragolla-yaya, Pinna-golla
	Ritigaha-arawa, Siyambala-atta-goda,
	Siyambala-gaha-arawa, Thotilagas-mandiya,
	Uguressa-ketiya, Wara-pitiya, Weera-golla, Welan-ketiya,
	Wewel-ketiya.
Uva-paranagama DC	Ala-golla, Ambas-dowa, Dambagaha-pitiya, Dan-gamuwa,
	Dimbulwela-gama, Dodam-hena, Iluk-wela, Kahata-pitiya,
	Pera-wella, Puwakgaha-doragama.
Welimada DC	Amba-tenna, Bogaha-kumbura, Bora-landa,
	Himbutuwel-dowa, Kalubulu-landa, Kenda-golla, Kota-kitula,
	Pera-ulpathagama, Welangas-kandura, Welangas-patana,
	Werella-patana.
MONARAGALA DISTRICT	
Badalkumbura DC	Amba-dan-ara, Amba-landa, Ambawatta, Aralugas-mada,
	Bogaha-pelessa, Dambagaha-wela, Dodamgaha-duruwa,
	Domba-golla, Dummala-tenna, Horagas-ara, Iluk-mulla, Indi-landa, Iriyagas-kiwula, Kalugaha-wadiya, Kapu-kotuwa, Karagas-kandura, Karanda-gama, Karanda-watta, Kara-wila,
	Kenda-golla, Kenda-landa, Kesel-gala, Kesel-kotuwa,
	Kongaha-kumbura, Kos-golla, Madugas-mulla,
	Mailagas-tenna, Maila-hinna, Maiyokka-watta, Malgas-hinna,

DISTRICT & DS	Village name (hyphenated to separate plant species)
	Maussa-ketiya, Meenakola-watta, Migaha-gommana,
	Migaha-medagama, Moragaha-meda, Nagaha-duruwa,
	Naran-gederawatta, Naran-watta, Para-golla, Pol-watta,
	Puss-ellawa, Puwak-aramba, Ritigaha-bedda,
	Ritigaha-dowa,Suriyagas-ella, Tal-landa, Tala-watta,
	Wadagaha-kiwula, Wara-dola, Welan-hinna.
Bibile DC	Amba-golla, Bulu-pitiya, Dehiatta-wala, Dodam-golla,
	Hekolan-deniya, Iluk-kumbura, Iluk-patana, Karagaha-wela,
	Kehelatta-wela, Kolon-golla, Kolon-mulla, Mora-muttamulla,
	Una-golla.
Buttala DC	Ambakola-wewagama, Batu-kotuwa, Buruta-golla,
	Buruta-henagama, Dambe-goda, Dambe-yaya,
	Domba-wewawatta, Endaru-galayaya, Kaduru-welana,
	Kariwila-kotuwa, Kon-ketiya, Mora-mandiya, Mun-kotuwa,
	Murunga-watta, Nagas-yaya, Naran-wana, Pera-ketiya,
	Puhul-kotuwagama, Ratmal-pitiya, Talakola-wewa,
	Talakola-wewagama.
Kataragama DC	Kochchi-patana, Malittan-pelessa, Nagaha-veediya
Madulla DC	Aratugas-wela, Bakinigaha-wela, Bo-pitiya, Damba-galla,
	Iluk-landa,.Iluk-pitiya, Madugas-mulla, Madukotan-arawa,
	Nagaha-mada, Namal-oya, Ratmalgaha-ella, Tampala-wela,
	Weera-wila, Wewel-landa.
Medagama DC	Alan-mulla, Badulla-golla, Bakinigaha-wela, Bogaha-wela,
	Damba-kana ella, Dehihaha-arawa, Denigaha-pitiya,
	Divigas-ara, Ehelagaha-pitiya, Hevan-deniya
	Horagas-watta,Iluk-kumbura, Iriya-golla, Kalagaha-waka, ,
	Kalugaha-wadiya Kara-metiya, Keena-goda, Keena-landa,
	Kenda-vinna, Kinnara-bowa, Kongaha-landa, Kon-golla,
	Kos-watta, Madu-tenna, Malgas-talawa, Meegas-tenna,
	Miwana-kandura, Migaha-wagura, Mora-bedda,
	Moragaha-mada, Nagaha-goda, Nelli-golla, Nuga-mura,
	Polgaha-kandura, Polgaha-pitiya, Tittawel-kiwula.
Monaragala DC	Andara-mandiya, Batu-gammana, Bo-pitiya,
	Buthsarana-pitiya, Dehi-kindagama, Dodam-watta,
	Endaru-landa, Indigas-ella, Karambawel-goda, Kesel-watta,
	Kolon-golla, Kolon-vinna, Kumbuk-kana, Kurundu-goda,
	Madukote-watta, Makul-ara, Naran-wana, Pinna-golla,
	Polgas-yaya, Tolabo-gala, Wara-landa, Wetake-ara.
Siyambalanduwa DC	Ambagaha-pitiya, Amba-landa, Bo-wala, Dombagaha-wela,
	Demata-bedda, Kalugas-yaya, Karakolagas-pitiya,
	Karamba-godayaya, Kongas-pitiya, Kurundugaha-watta,
	Liyan-golla, Madu-gama, Na-maluwa, Na-pe,
	Nugagaha-bedda, Nugagaha-kiwula, Polkotan-arawa,
	Ritigaha-watta, Siyambala-(a)nduwa, Suriya-talawa,

DISTRICT & DS	Village name (hyphenated to separate plant species)
	Timbiri-ya, Wara-gama, Wara-landa, Wewel-hinna.
Tanamalwila DC	Angunukola-pelessa, Boda-gama, Kalawel-gala, Maila-wala,
	Mecgas-wewa, Nika-ara, Nika-wewa.
Wellawaya DC	Dehi-landayaya, Dodam-kolaniya, Hingure-gala, Iluk-ketiya,
	Induru-yaya, Kahatagaha-maditta, Kitul-kote, Kongaha-ruppe
	Kon-palana, Mee-deniya, Nuge-yaya, Paragaha-arawa,
	Paragas-mankada, Pera-ketiya, Polgas-pitiya, Pol-watta,
	Puss-ellawa, Ratakaha-mandiya, Salgaha-digana,
	Sapugaha-wela, Siyambala-gunaya, Wewel-kandura.

Table 9.3 Toponymy based on animal names in Uva Province

(Source: MENR 2005)

DISTRICT & Divisional Secretariat	Village name (*hyphenated to separate animal species*)
BADULLA DISTRICT	
Badulla DC	Hamba-wela.
Bandarawela DC	Bambara-gama, Gona-motawa, Monara-pitiyawatta,
	Walas-bedda.
Ella DC	Gawara-wela, Kabara-galapatana, Kowul-pitiya.
Hali Ela DC	Anda-wala
Mahiyangana DC	Ali-kandura, Gona-bokka, Kukula-polagama,
	Meedena-wetunapitiya
Passara DC	Ethun-demuwawa, Gerandi-ella, Gona-gala,
	Gona-kele watta, Gona-meda, Ibban-ella,
	Monarun-gala, Urumi-tenna
Ridimaliyadda DC	Lool-wetiya, Walaha-viddawela
Uva-paranagama DC	Bambara-pana, Kudamessa-landa
Welimada DC	Etholu-kanda
MONARAGALA DISTRICT	
Badalkumbura DC	Ali-mada, Bambara-gasdowa, Et-pattiya, Walas-ella
Bibile DC	Hiwal-wala, Kanawe-galla, Kokunne-wewa, Na-gala
Buttala DC	Gona-gan ara, Nari-galagama, Pimbura-landa
Kataragama DC	Kukul-katuwa.
Madulla DC	Gona-talawa, Meeya-gala.
Medagama DC	Diviya-pola, Monara-wana,
Monaragala DC	Aliya-gala, Aliya-watta, Iththe-katuwa, Kawuda-wa
	Koti-galhela, Maduru-ketiya, Monara-gala,
	Monara-kelewatta.
Siyabalanduwa DC	Kimbula-wela, Koka-viddamada, Kotiya-gala, Kukulan-mulla,
	Meeya-gala, Samanala-bedda, Ura-goda, Walaha-galahena,
	Walaha-galakanda, Walaha-patana
Tanamalwila DC	Kahakurullan-pelessa, Uru-hora.
Wellawaya DC	Anda-welayaya, Etha-dutuwewa.

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 degredation 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 condiderable 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 UP will need more intensive research. However, 'Uve Wansa-kathawa (1991) cites treatments for some ailments and this information has originated within Vedda communities in the Uva.

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 9.4, 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 9.4 Traditional classification of vegetation

(Source MENR 2005)

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
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
Landa	Scrub area with occasional trees in undulating terrain (*Often indicates forest patches degraded due to anthropogenic effects*)	SPOF
Adawiya	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	
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	

Traditional Ecosystem Type	Description	Relationship with GAP
	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	

9.3.2 Classification of vegetation among Vedda Tribe

According to the information provided by Mr. Dambane Gunawardena, the characterization of vegetation types is based on anthropological influences, such as status of recovery from disturbance, presence and type of food resources, e.g. animals, facilitation of human mobility in such vegetation types, etc., in addition to the vegetation itself. Five vegetation types are recognized in the Vedda country as follows:

I. **Kanattha:** Early stage of forest regrowth on abandoned chena, or an area cleared for any other purpose; for a period of 5-7 years; consists of small shrubs, including many thorny species, and creepers/climbers and hence the human mobility is somewhat cumbersome; provides shelter and fodder for animals.

II. **Landa or Landu kele:** After about 7 years, Kanattha transforms into a Landa that consists of small trees covered with creepers/climbers that are often thorny, hence difficult to creep through; visibility through 'Landa' is reduced to a great deal due to dense undergrowth; provides protective shelter for animals; this land has been traditionally used for chena cultivation.

III. **Degidiyala or Degidiyal kele:** An abandoned chena, after 20 – 50 years, transforms into a 'Degidiyala'; an advance stage of 'Landa'; trees with many low branches; creepers/climbers and throny shrubs/trees are sporadic; undergrowth scanty.

IV. **Mookalana** (= mature forest): This mature stage is achieved after about 50 years; trees laxly distributed and with high branches and hence the visibility is good; undergrowth scanty; floor with a thick layer of leaf-litter; frequency of small animals is low; bee and hornet hives are common; land is not used for chena cultivation.

V. **Maha mookalana or Raja maha mookalana:** Climax stage of 'mookalana', which is technically a '*steady state forest*' or '*climax forest*'; very large trees with large buttress roots are common, undergrowth very scanty; visibility is high; floor covered with a thick later of leaf litter.

In addition to this classification of common vegetation types, some minor types are recognized as follows:

I. **Talawa or wela:** Eroded lands covered with Iluk (*Imperata cylindrica*) and 'Ee-tana' (*Heteropogon contortus*); this is technically a *Damana*, a grassland among forest in the dry zone.

II. **Bedi-retiya or Bedi-Ketiya:** a strip of forest between two talawas.

III. **Bedi-kuttiya:** A patch of forest in a talawa.

IV. **Kahana or Kahan kele:** Lowland with accumulation of moisture; trees low or dwarf; thorny shrubs common.

V. The term **Bedda** is often used for forest; such terms as **Deniya** and **Bada-wetiya** are not used in the Vedda country.

9.3.3 Traditional food in the Uva Province

In the past, the village health conditions remained high due to consumption of a variety of least processed indigenous food and the use of traditional medical practices. Such food varieties also served as preventives and cures for many diseases based on bile and phlegm disorders and rheumatism (COMPAS 2005a).

It was also well known that good health and lack of it are greatly influenced by the food that one consumes. Therefore, advice on do's don't's regarding the consumtion of food is an essential part of the traditional treatment of many ailments. Growing and processing of food formed an important part of the culture.

Some traditional food practices still prevalent in rural communities were compiled in a survey conducted by the COMPAS (2005a). About 40 food preparations, mainly using indigenous edible plants, were described, e.g. 'Kohila' stem salada (*Lasia spinosa*), boiled yam of 'Katu ala' (*Dioscorea pentaphylla*), tempered fruits of 'Titta tibbatu' (*Solanum violaceum*), 'melluma' (partially cooked leaves) of 'Anguna kola' (*Wattakaka volubilis*), mellauma (partially cooked fruit) of 'Attikka' (*Ficus glomerata*), curry of 'Maila' flowers (*Bauhinia racemosa*) and 'Madu' pittu (steamed flour of seed of *Cycas circinalis*).

9.3.4 Traditional home remedies in the Uva Province

Usage of home remedies is very popular among the Sri Lankan people. For minor health problems such as headaches, toothaches, cut injuries and burns, many people do not seek treatment from a doctor, but rely on simple home remedies and such treatments often do not cost anything and also saves time. The required medicinal plants are often easily available. However, these home remedies and practices are transferred from generation to generation, but often not documented.

Some useful information in this regard has been compiled using knowledge and skills on traditional agriculture, health practices and ethno-veterinary practices in the UP (COMPAS 2005b). The objective of this exercise is to stop the erosion of such knowledge and to promote their useage among the present generations. The compilation includes several treatments for toothache, indigestion, earache, cut wounds and burns. Mainly plants and plant products are used as ingredients and the procedure of preparation and application is described, e.g. application of cinnamon oil soaked in cotton wool at the affected tooth for toothache, all parts of 'Rasa-kinda' (*Tinospora cordifolia*) ground with lime juice,

stirred in water and given to drink for indigestion and a few drops of juice of tender parts of 'Hi-ressa' (*Cissus quadrangularis*) and 'Iri-weriya' (*Plectranthus zatarhendi*) poured into the affected ear for earache (COMPAS 2005b).

9.3.5 Traditional ethno-veterinary practices in the Uva Province

The majority (80%) of cattle farmers live in remote areas with poor infrastructure facilities and for them the access to services from veterinarians is difficult and western treatment is expensive. Manty farmers lack knowledge and information about treatment of farm animals and such knowledge is possessed by a relatively small number of practioners. COMPAS (2005c) has attempted to collect and document traditional veterinary knowledge and expertise in order to sustain this useful knowledge among present and future generations. Indigenous plants and plant products form a major component of various veterinary treatments.

Many treatments for bowel, respiratory and skin diseases, ailments after the delivery of the calves, ulcers in the mouth, infestation with ectoparasites, wounds and snake bites and 'Kem' methods to cure cattle diseases are included in this compilation. Further, designs of 'yanthra' that are burnt on the skin of the cattle for various diseases are depicted. The compilation is concluded with the names and addresees of veterinary practitioners, mostly in the UP, who provided information.

9.3.6 Degredation 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.

After the suppression of the freedom struggle in Uva-Wellessa in 1818, just three years after the Kandyan convention, and the realization of the fact that the strength of the freedom fighters lay in the prosperity of Uva-Wellaessa ('Wellassa' means one hundred thousand paddy fields), the British systematically crippled the traditional agriculture in the region. Peasant families were annihilated, paddy fields and grain silos were burnt and tanks and irrigation systems were destroyed and in a short time the whole of the Magama and Uva-Wellessa regions were ruined. This seriously affected traditional farming systems, food culture and the traditional knowledge (Rajapaksha 2001).

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 (Rajapaksha 1998).

Relatively recent global and national government policies, e.g. the Green Revolution in the 1960's, promoted monocopping 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 and parks

Along with the influx of the Aryans and the increase in population, human settlements in the Uva also proliferated. Even prior to these events, Mahiyangana was populated as evidenced from information related to the arrival of the Buddhism to Sri Lanka. A garden measuring three 'yodun' long and one 'yodun' broad and consisting of 'Na' trees (*Mesua ferrea*) is reported to have existed along the bank of the Mahaweli Ganga and the use of this garden as the meeting place for the community is also reported.This supposedly indicate that the establishment of human settlements in association with rivers first took place in the Uva, even before the arrival of the Aryans. The internal trade, mainly based on barter system, seems to have existed in the Uva during the Anuradhapura Era and the existence of a port and a ship building site at Mahiyangana at that time indicates the possibility of trade by navigation.

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. The kings and the elite societies in the Uva also said to have systematically established gardens along with building temples, tanks, ponds and irrigation structures, agricultural fields and strategies to encounter enemy actions etc. Sites of such gardens in the Uva are characteristically rich in medicinal trees and some of these sites (along with their Divisional Secretariats in parenthesis), as evidenced by traditional information, are: Etambagaha kandura (Badulla), Embalawatta and Moraketiya (Mahiyangana), Kotagama, Dora-bora kanda and Nilgala (Bibile), Dematawel hinna (Haliela), Belum-gala (Meegahakiwula) and Mukalannawa (Kandaketiya). The richness in medicinal trees is also indicated by places named after these species, e.g. Araluketiya (Badalkumbura), named after 'Aralu' = *Terminalia chebula* and Bulupitiya (Bibile), named after 'Bulu' = *Terminalia bellirica*, etc. However, it is believed that the occurrence of a number of medicinally used plants in most localities in the Uva is due to natural assemblages of such species rather than relicts of ancient gardens.

9.5 Memorial and important trees

According to the Bodhiwansa, the kings at Kataragama have performed 'Bhodhi' tree (*Ficus religiosa*) planting ceremonies and saplings of the Sri Maha Bhodhi were planted at Kataragama, Mahiyangana, Muthiyangana and Buttala. The ancient 'Bhodhi' tree at Divurumwela (Divurumpola) Raja Maha

Vihara in Nugatalawa, Welimada is supposedly the tree at which Queen Seetha made her vows. The Vihara was said to have been built during the era of King Walagamba.

(See also Section: 8.1.1.1)

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. Movement of population towards the coastal regions and urban areas has increased the population pressure causing significant environmental implications in such areas. High rates of population growth during the past 50 years have been accompanied by a progressive increase of anthropogenic impacts on nature and biodiversity. 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. 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. The human population density, forest cover, threatened vertebrates and threatened plants in the UP 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 Uva Province
(Source: IUCN Sri Lanka & MENR 2007)

District	Area (Km^2)	Human Population Density (per Km^2)	% Forest Cover	Threatened Vertebrates	Threatened Plants
Badulla	2,803	294	19	67	90
Monaragala	5,545	75	40.5	35	56
Uva Province	8,348	149	33.3		
Sri Lanka	65,610	314	23.5	223	675

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

The National Species Conservation Advisory Group (NASCAG), 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 NASCAG 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 Uva Province

An analysis of the geographical distribution of threatened butterflies, vertebrate fauna and flora in different administrative districts in the island revealed that the Uva Province districts (Badulla and Monaragala) harbor only moderate numbers of threatened taxa (Table 10.2), compared with the districts covering the Central Highlands and the lowland wet zone that habor relatively higher numbers of threatened taxa (IUCN Sri Lanka & MENR 2007).

Table 10.2 Distribution of threatened fauna and flora in the districts of the Uva Province (Source: IUCN Sri Lanka & MENR 2007)

District	Number of Threatened Species						
	Butterflies	**FW Fish**	**Amphibians**	**Reptiles**	**Birds**	**Mammals**	**Flora**
Badulla	7	5	9	9	20	24	90
Monaragala	5	3	2	9	11	10	56

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 degredation of habitats.The scope and cost of biological invasions is enormous in ecolological 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 stiking ecological cost of AIS is the loss of native species and ecosystems.

The degredation 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 degredation. 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 alian 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 10.1 and 10.2 respectively).

Table 10.3 Alien invasive flora in Sri Lanka

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

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

Species **Family**	**Common name (Habit)**	**Purpose of introduction / mode of spread**	**Distribution**	**Affected habitats /ecosystems**
Anona glabra Annonaceae	Pond apple (shrub to small tree)	Unknown	Lowland wet zone	Mangrove associate near lagoons and marshes, inland marshes
Alstonia macrophylla Apocynaceae	'Hawari nuga' (tree)	Introduced into forestry as a timber species / high spontaneous regeneration	Lowland wet zone and intermediate zone	Secondary forests
Alocasia macrorrhizos Araceae	'Habarala' (Large succulent herb)	Unknown	Lowland wet zone	Marshes, abandoned paddy fields
Alternanthera philoxeroides Amaranthaceae	Aligator weed (aquatic - floating or semi-aquatic herbaceous runner)	Deliberate Introduced as a leafy vegetable	Island-wide	Marshes, fallow fields
Colocasia esculenta Araceae	Taro 'Alakola' (Succulent herb)	Unknown	Lowland wet zone	Marshes, abandoned paddy fields
Chromolaena odorata Asteraceae	Siam weed 'Podi singho maran' (shrub)	Unknown / wind-dispersed achenes aided by pappus	Dry, intermediate and lowland wet zones	Coconut plantations, SPOF, wastelands
Eupatorium riparium	Mist flower (herb)	Introduced as an ornamental / wind-dispersed achenes aided	Montane zone	Secondary forests, SPOF, roadsides

Species Family	Common name (Habit)	Purpose of introduction / mode of spread	Distribution	Affected habitats /ecosystems
Asteraceae		by pappus		
Mikania cordata * Asteraceae	Mile-a minute 'Watu palu'	Unknown / wind-disperesed achenes aided by pappus	Island wide	Wastelands
Parthenium hysterophorus 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
Wedelia trilobata * Asteraceae	Wedelia (creeping herb)	Introduced as an ornamental	Wet and intermediatezones	Forest edges and roadsides
Tithonia diversifolia Asteraceae	Wild sunflower 'Natta-suriya' (shrub)	Introduced as an ornamental	Wet zone mid country	Wastelands and roadsides
Xanthium indicum Asteraceae	Cocklebur (herb to low shrub)	Unknown / fruits attached to skins of animals	Dry zone	Margins of tanks
Millingtonia hortensis Bignoniaceae	Indian cork tree (small tree)	Introduced as an ornamental	Southern dry and intermediate zones	SPOF and scrubland
Opuntia dillenii * Cactaceae	Prickly pear 'Katu pathok'	Introduced as a ornamental / fruits eaten and dispersed by animals	Semi-arid zone	Wastelands, DDTS
Clusia rosea Clusiaceae	'Gal goraka'	Introduced as a ornamental / seeds dispersed by birds	Wet zone mid country	Rocky habitats in disturbed forests
Dillenia suffruticosa Dilleniaceae)	'Diya para', 'Goda para' (small tree)	Ornamental / seeds dispersed by birds	Lowland wet zone	Marshes
Leucaena leucocephala * Fabaceae	Leucaena 'Ipil ipil' (small tree)	Introduced as a fodder and for soil rehabilitation /seeds	All lowlands	Wastelands, homesteads, SPOF
Mimosa invisa Fabaceae	'Hinguru wel' (large prickly creeper)	Unknown	Wet zone mid country	Disturbed habitats
Mimosa pigra *	Giant sensitive plant 'Yoda nidikumba'	Accidental, soil moving machinery / seeds dispersed by water and along with transport of	Wet zone mid country and intermediate zone	River banks

Species Family	Common name (Habit)	Purpose of introduction / mode of spread	Distribution	Affected habitats /ecosystems
Fabaceae	(large shrub)	river sand		
Myroxylon balsamum Fabaceae	Balsam 'Katta kumanchal' (medium tree)	Forestry	Wet zone mid country	Disturbed MMEF
Prosopis juliflora * Fabaceae	Mesquite (large shrub to small tree)	Deliberate introduction	Semi-arid zone	Disturbed DDTS in saline habitats
Ulex europeus * Fabaceae	Gorse (shrub)	Ornamental / seeds	Montane zone	Disturbed WPTG, MOEF & wastelands
Hydrilla verticillata Hydrocharitaceae	Hydrilla (submerged herb)	Introduced by aquarists in ornamental fish trade / escape into water bodies	Lowland wet zone	Tanks, ponds, streams and canals
Egiria densa 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
Clidemia hirta * 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
Miconia calvescens * Melastomataceae	Miconia (large shrub)	Ornamental / seeds dispersersed by birds	Wet zone mid country	Disturbed forests, shade lover
Swietenia macrophylla Meliaceae	Mahogany (large tree)	Timber tree in forestry	Lowland and mid country wet zone and intermediate zone	Disturbed MMEF
Psidium littorale * Myrtaceae	Strawberry guava (treelet)	Ornamental / seeds dispersed by birds	Montane zone	Disturbed MOEF
Najas marina Najadaceae	Pond weed (submerged herb)	Unknown	Coastal areas	Coastal aquatic habitats
Imperata cylindrica * Poaceae	Cogon grass 'Iluk' (herbaceous grass)	Probably natural	Dry and intermediate zones	SPOF, scrubland
Panicum maximum	Guinea grass (tall	Fodder	Island wide	Wasteland, scrubland, SPOF

Species **Family**	**Common name (Habit)**	**Purpose of introduction / mode of spread**	**Distribution**	**Affected habitats /ecosystems**
Poaceae	herbaceous grass)			
Pennisetum polystachyon Poaceae	'Pohon', 'Rila tana'	Probably as fodder	All zones except montane zone	Wasteland, roadsides, open habitats
Phragmites karka Poaceae	'Nala gas' (tall shrub-like grass)	Probably natural	Coastal habitats	Marshes
Eichornia crassipes * Pontederiaceae	Water hyacinth (floating herb)	deliberate introduction as ornamental / escape into water bodies	Island-wide	Tanks, ponds, marshes, canals and streams
Cestrum aurantiacum Solanaceae	(shrub)	Ornamental	Montane zone	Disturbed MOEF
Typha angustifolia Typhaceae	Bullrush 'Hambu pan' (tall herb)	Unknown	Dry and intermediate zones	Marshes, estuaries, abandoned paddy fields
Lantana camara * Verbenaceae	Prickly lantana 'Gandapana'	Ornamental	Dry and intermediate zones	Wastelands, scrublands, SPOF
Pistia stratioites Pteridophyte	Water lettuce (floating herb)	Unknown	Island-wide	Tanks and marshes
Pteridium aquilinum Pteridophyte	Herb	Ornamental	Montane zone	WPTG, MOEF
Salvinia molesta Pteridophyte	Salvinia (floating herb)	deliberate introduction / escape into water bodies	Island-wide	Tanks, ponds, marshes, canals and streams

Table 10.4 Alien invasive fauna in Sri Lanka

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

* 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
*Achatina fulica** Mollusk	Giant African snail	Hobby / research	Island-wide	Natural and managed terrestrial habitats
Laevicaulis alte Mollusk	Slug	Accidental / horticulture	Island-wide	Natural and managed terrestrial habitats
Deroceras reticulatum Mollusk	Garden slug	Accidental / horticulture	Wet and intermediate zones	Disturbed and managed rerrestrial habitats
Deroceras caruance Mollusk	Garden slug	Accidental / horticulture	Wet and intermediate zones	Disturbed and managed terrestrial habitats
Pomacea bridgesi Mollusk	Golden Apple Snail	Ornamental fish trade	Lowland wet zone to mid country	Canals, reservoirs
Oncorhynchus mykiss * Fish	Rainbow Trout	Sport fishery	Montane zone	Streams
Chitala chitala Fish	Clown Knife Fish	Ornamental fish trade	Lowland wet zone	Tanks, ponds, slow-flowing water courses, marshes
Hypostomus plecostomus Fish	Tank cleaner, Plecostomus Catfish	Ornamental fish trade	Lowland wet zone	Tanks, ponds, slow-flowing water courses, marshes
*Clarias batrachus** Fish	Walking Catfish	Ornamental fish trade	Lowland wet zone	Marshes, streams, canals
Poecilia reticulata Fish	Guppy	Mosquito control and ornamental fish trade	Island-wide	Tanks, ponds, slow-flowing water courses, marshes
*Gambusia affinis** Fish	Western Mosquito Fish	Mosquito control	Lowland wet zone	Marshes, streams, canals
Oreochromis mossambicus Fish	Mozambique Tilapia	Commercial fishery	Island-wide	Tanks, ponds, slow-flowing water courses, marshes
*Cyprinus carpio** Fish	Carp	Commercial fishery	Island-wide	Tanks, reservoirs
Trichogaster pectoralis	Snake-skin Gouramy	Commercial fishery	Dry and intermediate	Tanks, reservoirs, marshes, streams

Species Group	Common name	Purpose of introduction / mode of spread	Distribution	Affected habitats /ecosystems
Fish			zones	
*Trachemys scripta** Reptile	Red-eared Slider Turtle	Ornamental fish trade	Lowland wet zone	Marshes, streams, canals
*Mus musculus** Mammal	House Mouse	Accidental by ships	Island-wide	Natural and managed terrestrial habitats
*Rattus rattus** Mammal	Ship Rat	Accidental by ships	Island-wide	Natural and managed terrestrial habitats
*Felis catus** Mammal	Domestic / Feral Cat	Pet trade	Island-wide	Natural and managed terrestrial habitats
Canis familiaris Mammal	Domestic / Feral Dog	Pet trade	Island-wide	Natural and managed terrestrial habitats
Bubalus bubalis Mammal	Domestic / Feral Buffalo	Animal husbandry	Island-wide	Forests

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

10.4.1 Invasive flora in the Uva Province

Parthenium hysterophorus (Parhenium 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 UP, the occurrence of the parthenium weed was first detected in the year 2000 in Kandaketiya (Badulla District). The plant occurred in gregarious populations on the bunds of irrigation canals of Badulu Oya – Bathmedilla Irrigation scheme. The weed has also spread to the paddy fields fed by the canals, first establishing on their bunds and then invading the paddy fields after the harvesting season when the latter is being used for highland crops during the Yala season. Seed dispersal in mud adhering to the hooves of cattle and human feet in the area was also observed. The imminent possibility of the water-carried seeds entering into the flow of the Mahaweli Ganga, situated only a few kilometers away, was noted and it was later found to be a reality. The appearance of small sporadic populations of the weed in Badulla and Bandarawela townships was reported in 2002. It has been observed that these weed populations occurred in the vicinities of building construction sites, some being found on old-standing sand mounds. This indicated the strong possibility of the parthenium seeds being distributed along with sand transported from Kandaketiya which is a popular sand-mining site of the Mahaweli Ganga. The memory of the familiarity of the parthenium weed in Kandaketiya among its villagers did not extend beyond three years before it was identified there in the year 2000. However, intensive inquiries revealed that during the Accelarated Mahaweli Development Project in 1980s, installation of the electricity distribution system (including pylons) from Randenigala power station (~ 12 km straight distance from Kandaketiya) was carried out by an Indian company and one of their camp sites was located in Kandaketiya and it is presumed that the parthenium seeds may have arrived with the food items and /or equipment brought from India (Jayasuriya 2005). In about the year 2000, the occurrence of the weed in Bibile urban areas was also reported (Jayasuriya 2005).

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 2004).

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 patched 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).

***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 the Uva Province

***Bubalus bubalis* (Feral buffalo)**

It has been imported to Sri Lanka from South and Southeast Asia since historical times for animal husbandry. Buffaloes were heavily used in the past for land preparation in paddy cultivation until they were, to a great deal, replaced with tractors. During the fallow periods, most rural farmers release their buffaloes to the wild and recapture them during the next cultivation season. This has resulted in the domestic buffalo interbreeding with native wild buffaloes, leading to large herds of feral populations that have become a threat to native ungulates in forest ecosystems. This has developed into a serious issue in many national parks such as Udawalawe and Yala.

***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. Table 10.3 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 UP, 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

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

Family *Species*	**Local names** **Sinhala** **English(E)**	**Poisonous parts** **Chemical** **Effect**	**Origin, if introduced-** **General distribution-** **Remarks on occurrence in UP**
Anacardiaceae			
Anacardium occidentalis	Kaju Cashew (E)	Resin of the nut causes blisters on skin	Origin:Tropical America - cultivated nut tree
Nothopegia beddomei	Bala	Latex of bark causes allergic dermatitis in sensitive persons and blisters on skinn	Intermediate zone
Semecarpus nigro-viridis	Badulla	Bark and pericarp contain polyphenols; causes allergic dermatitis in sensitive persons and blisters on skin	Endemic - Wet lowlands & intermediate zone
Semecarpus subpeltata	Maha-badulla, Kabara-badulla	As above, but said to be worst of all 'Badulla' spp.	Endemic - Wet lowlands – not recorded in UP
Semecarpus spp.	Generally 'Badulla'	Generally all *Semecrpus* spp. are similarly poisonous, but at varying levels	Most species are endemic - mostly Wet lowlands – not recorded in UP
Annonaceae			
Annona squamosa	Seeni-atha Custard apple, Sweet-sop (E)	Root and seed	Origin: West Indies cultivated fruit
Apocynaceae			
Cerbera odollam	Gon-kaduru, Bola-kaduru	Latex acrid	Wetlands in wet and dry lowlands – not recorded in UP
Nerium oleander	Rath-kaneru, Sudu-kaneru Oleander (E)	Roots and latex contain cardiac glucocides	Origin: the Mediterranean - cultivated flowering plant
Ochrosia oppositifolia	Moodu-kaduru, Gonna	Fruit	South western coastal zone – not recorded in UP
Petchia ceylanica	Kukul-kaduru, Wal-kaduru, Wasa-kaduru	Latex	Endemic – Wet lowlands – not recorded in UP
Tabernamontana divaricata		Latex used as arrow poison	Southern Himalayas – cultivated flowering plant
Thevetia peruviana	Kaneru Yellow- oleander (E)	Fruit/seed contain cardiac glucocide – Could be fatal	Origin: Tropical America – cultivated flowering plant
Araceae			
Alocasia cucullata	Nai-habarala, Panu-habalala	Fruits and probably stems	Wet lowlands – not recorded in UP.
Dieffenbachia seguine	Dumb cane(E)	Leaves	Escape from cultivation in CP – not recorded in UP.
Asteraceae			
Parthenium		Whole plant, especially	Origin:Tropical America-

Family *Species*	**Local names** **Sinhala** **English(E)**	**Poisonous parts** **Chemical Effect**	**Origin, if introduced-** **General distribution-** **Remarks on occurrence in UP**
hysterophorus	Parthenium weed (E)	leaves and pollen – Poisonous substance: Parthenin (sesquiterpene lactone)	Accidentally Introduced to Sri Lanka via India – Dry lowlands, intermediate zone to mid country – Invasive plant
Xanthium indicum	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			
Carica papaya	Gas-labu, Papol Papaya, Papaw (E)	Papain, a proteolytic enzyme present in young fruit and leaves	Origin: Tropical America cultivated fruit
Colchicaceae			
Gloriosa superba	Niyangala	Rhizome – Colchicine (alkaloid) is the principle poison; fatally poisonous.	All lowlands and intermediate zone
Euphorbiaceae			
Euphorbia antiquorum	Daluk	Latex	Dry and intermediate lowlands – not recorded in UP
Excoecaria agallocha	Tela, Tela-kiriya Blinding tree, Agallocha (E)	Acrid sap causes blisters on skin	Associate of Mangroves
Manihot esculenta	Manyokka, Maiokka. Cassava, Manioc, Tapioca (E).	Tubers contain cynogenic glucocide	Origin: South America – widely cultivated for food in low and mid country
Manihot glaziovii	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
Sapium indicum	Kiri makulu	Latex acrid and poisonous	Coastal plant – not recorde in UP.
Tragia hispida	Wel-kahambiliya	Plant covered with stinging hairs	Dry and intermediate zones – not recorded in UP
Fabaceae			
Abrus precatorius	Olinda. Indian liquorice, Crab's eye(E)	Seed coat – principle poison is abrin – not known to be fatal	Mainly in dry zone
Acacia auriculiformis		Pollen toxic to bees	Origin: Australia – Introduced in forestry
Delonix regia	Mayi, Malmara	Pollen	Origin: Madagascar –

Family *Species*	**Local names** **Sinhala** **English(E)**	**Poisonous parts** **Chemical Effect**	**Origin, if introduced-General distribution-Remarks on occurrence in UP**
	Flamboyant, Flame tree (E)		cultivated flowering tree
Derris scandens	Kala-wel, Bokala-wel	Bark and roots used as fish poison	Dry and intermediate zones
Derris trifoliolata	Kala-wel	Bark and roots used as fish poison	Coastal and mangrove - not recorded in UP.
Lathyrus sativus	Grass pea, Vetchling (E)	Seed poisonous to goats	Origin: Not known - cultivated as a vegetable
Leucaena leucocephala	Ipil-ipil	Poisonous to domestic herbivores – contain mimosine	Origin: Tropical America cultivated for fodder, green manure and in forestry; currently naturalized
Mucuna atro-purpurea	Gini-pus wel, Bu-chariya	Pod covered with irritant bristles	
Mucuna gigantea	Kana-pus wel	Pod covered with irritant bristles	
Mucuna monosperma		Pod covered with irritant bristles	
Mucuna pruriens	Achariya, Achariya-palu Cowage, Cowitch (E)	Pod covered with irritant bristles; bristles absent in some cultivars	Mainly in dry zone – often cultivated
Flacourtiaceae			
Hydnocarpus venenata	Makulu	Fruits used as fish poison	Endemic - Lowlands
Lobeliaceae			
Lobelia nicotianifolia	Rasni. Wild tobacco (E)	Leaves and seeds are acrid and poisonous	Montane and sub-montane zone.
Loganiaceae			
Strychnos nux-vomica	Goda-kaduru. Nux vomica(E)	Seeds – poisonous principle is strychnine (alkaloid)	Dry zone
Plumbaginaceae			
Plumbago zeylanica	Ela-netul. Ceylon leadwort (E)	Roots acrid and poisonous	Wastelands in dry zone – cultivated
Moraceae			
Streblus asper	Geta-netul Crooked-rough-bush(E)	Bark is an irritant poison	Dry lowlands to mid country
Nyctaginaceae			
Mirabilis jalapa	Hendirikka. Four o'clock flower, Marvel of Peru (E)	Roots and seeds	Origin: Peru in South America – cultivated as a flowering plant.
Passifloraceae			
Adenia hondala	Hondala	Fruits and seeds – Fatally poisonous	All lowlands
Solanceae			

Family *Species*	**Local names** **Sinhala** **English(E)**	**Poisonous parts** **Chemical Effect**	**Origin, if introduced-General distribution-Remarks on occurrence in UP**
Datura metel	Attana, Kalu-attana	All parts, especially seeds	Origin: probably India - cultivated – sometimes occur as an escape in wastelands in lowlands.
Datura stramonium	Thorn apple(E)	All parts, especially seeds	Origin: Tropical America – cultivated – rarely naturalized in UP (mid country)
Datura suaveolens	Rata attana. Trumpet flower (E)	All parts, especially seeds	Origin: Tropical America – naturalized in CP (montane zone) , not recorded in UP
Solanum nauritianum	Hak-kirilla	Fruits	Origin: South America – naturalized in mid country.
Urticaceae			
Dendrocnide sinuata	Ma-ussa Devil nettle (E)	Leaves, tender stems and inflorescences covered with fine stinging hairs	Wet and intermediate lowlands and mid country – not recorded in UP.
Girardinia diversifolia	Gas-kahambiliya Nilgiri nettle(E)	Plant covered with stinging poisonous hairs	Waste grounds in montane and sub-montane zones – not recorded in UP.
Laportea bulbifera		Stinging hairs on tender parts – the pain does not last for a long time	Montane and sub-montane zones – not recorded in UP.

10.6 Chena cultivation

Generally, the farmers do not prefer Savanna Grasslands or Damana 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. It is reported that during 2002, 15 unauthorized clearings, amounting to 25 hectares, were detected in the Nilgala Forest Beat.

10.7 Illicit 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.

10.8 Forest fires

The occurrence of forest fires on Savanna Grasslands (SAVG) and Damana Grasslands in the drier areas during drought is a common phenomenon in the UP, especially in the Bibile, Thanamalwila, Hambegamuwa and Wellawaya areas. Ground fires sometimes extend to the hilltops. They are caused by the collectors of medicinal fruits, e.g. 'Aralu' (*Terminalia chebula*) and 'Bulu' (*Terminalia bellirica*), hunters and chena cultivators. This is also practiced by the cattle owners to promote the growth of fodder grass. Severe soil erosion due to fires is not very evident 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.

10.9 Over-expolitation 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. This was revealed by an ethnobotanical survey and the results of a resource survey carried out by the CSUMPP. 'Bin kohomba' (*Munronia pinnata*) is most threatened, followed by 'Nelli' (*Phyllanthus emblica*), 'Aralu' and 'Ekaweriya (*Rauvolfia serpentina*). 'Gammalu' (*Pterocarpus marsupium*) and 'Aralu' (*Terminalia chebula*) are two tree species commonly felled by the poachers in the Lower Uva.

10.10 Excessive tourism

Over-visitation and associated effects, such as disposal of garbage, pollution of soil and water courses, disturbance to the fauna, especially the birds by noise, encroachment for erecting huts to sell items and removal of plants and animals impact negatively on the environment, e.g. Dunhinda falls.

10.11 Unsustainable agriculture

Encroachment of environmentally sensitive areas such as catchment areas that are protected by natural vegetation and use of steep slopes for agriculture, especially without soil and water conservation measures, promote soil erosion and depletion of water resources leading to severe land degredation.

10.12 Use of pinus and eucalyptus in forestry

It has been accepted that extensive monocultures of pinus and eucalyptus in forestry has caused depletion of water resources, soil erosion, forest fire and loss of agro-biodiversity. This has already resulted in severe degredation of the landscape, soil fertility, agricultural production and the rural poverty in the Uva Province.

10.13 Pollution by pesticides and chemical fertilizers

Although the paddy cultivation has been performed under traditional practices for several decades in the UP, 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 extention services. Chemical residues carried in run-off polute streams, resulting in harmful impacts on aquatic life.

10.14 Proposed project on sugar industry

An attempt to allocate 26,000 hectares for sugarcane plantation and a factory to produce sugar and sugar products in the Uva-wellessa is being currently exposed. The pros and cons of the proposed project are currently been debated by groups that are supporting and opposing the project. It is apparent that the implementation of this project will have environmental impacts. Destruction of Savanna Grasslands, depletion of water resources, soil erosion, sedimentation of water bodies, disruption of elephant migration routes, increased human-elephant conflicts and loss of scenic beauty are some of these impacts.

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 Sterering 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
Archeology
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 thay 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 impringe 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; Cartegena Protocol on biosafety; research, training, public education and aareness; 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. Whist 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 / km^2, 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:

Juridictional overlaps and uncertainities – The sectoral division of responsibilities has resulted in multiple juridiction 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 competion 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 Uva 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
Land degredation due to encroachment and increasing vegetable cultivation	Develop suitable agrarian policies for land use and land development and promote restoration forestry to protect catchments and to minimize soil erosion.
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, mora, gal-siyambala etc., identifying distribution, socio-economic impact, harvesting levels, cropping patterns, sustainability issues, and formulating regulations to assure sustainability.
Increased soil erosion, drying up of land and fire hazards due to pine plantation.	Conversion of pine plantations to broad-leaf forest plantaions
Indigenous crop plants and their genetic variability are not conserved and protected	Inventorize the indigenous crop genetic resources
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.
The shortage of cultivated timber and slow pace of harvesting of forest plantations has led to shortage of sawn-wood and increased illegal logging	Strive for efficiency in sustainable harvesting of state forest plantations so as to supply sawn-wood at reasonable cost in order to minimize illegal logging of natural forests; promote agro-forestry in home gardens.
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
Forest fire	Increase awareness among stakeholders, implement

Issue	Recommendation
	legal action
Human-elephant conflict	Adopt suitable long-term mitigatory measures to minimize the problem
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.
Rampant extraction of Fox tail orchid = 'Gurulu raja' (*Rhynchostylis retusa)*	Encourage cultivation at commercial scale.
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
Damage done to species, habitats and ecosystems in the past through unsustainable use has not been addressed through restoration programs	Conduct studies 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.
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
Botanic garden facilities are insufficient; botanic gardens do not fulfill the role as centers of *ex situ* conservation	Re-establish the botanic garden at Badulla within the ministry in charge of botanic gardens.
Lack of market promotion for biodiversity products	Promote market opportunities for kitul and cane products.
Lack of information on flora and fauna	Prepare inventories on flora and fauna and provincial Red Lists.

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 UP 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 UP, 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 Uva 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.

Table 14.1 Action plan for biodiversity conservation in the UP

Yr = Time frame (No.of years)

Classified action	**Responsible institution**	**Yr**
***In situ* Conservation**		
Prepare comprehensive inventories of the flora and fauna and Red Lists for the UP.	Universities, ORO	5
Identify critically important sites, in terms of biodiversity, outside PAs and bring them under relevant PA categories.	FD, DWC, ORO Universities,	5
Attempt to identify biodiversity hotspots within UP and place them in appropriate conservation categories.	Universities, ORO	5
Survey and mark PAs followed by gazetting of the boundaries.	LCD, SD, DWC,FD	5
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, UPC	5
***Ex situ* conservation**		
Re-establish the botanic garden at the site of the present Municipal Botanical Garden, Badulla.	DNBG	3
Coordinate with PGRC to conduct exploration of PGRs in the UP and conserve them at PGRC.	PGRC/DAg, UPC	1
Prioritize crop genetic resources for the UP. Encourage farmers to cultivate traditional rice varieties. Obtain required germplasm from PGRC. Search for suitable market for these traditional products.	UPC, PGRC/DAg	
Coordinate exploration and conservation of AnGR	UPC, VRI,	

Classified action	Responsible institution	Yr
	DAPH, NGZ	
Establish refugia, e.g. arboreta and medicinal plant gardens, in temples and other places of religious worship, where possible.	UPC, MENR, MIM, FD	3
Impacts on Biodiversity		
Assess the impacts of national and urban developmental projects that are located in the UP, climate change, agrochemicals and pollutants on biodiversity.	MENR, CEA, UDA, ORO Universities,	5
Integrate biodiversity concerns into EIA	UPC, CEA	
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
Covert pine plantations into broad-leaved forest plantations. Conduct research to introduce economically important species (e.g. timber, rattan, bamboo and 'weni wel') into pinus plantations	FD, UPC, Universities	5
Promote cultivation of native plants with high commercial demand, e.g. medicinal plants (e.g. 'Bin kohomba') and ornamental plants (e.g. 'Gurulu Raja')	MIM, DNBG, UPC	5
Promote culture in captivity of economically important animals, e.g. ornamental fish.	NARA, UPC	
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	UPC, 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, UPC	3
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, UPC	3
Parthenium weed problem in Kandaketiya and possibly other areas: 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.	UPC, DAg	2

Classified action	Responsible institution	Yr
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.	UPC, DAg	1
Research should be conducted on 1. Seed viability under local conditions, 2. Spread, 3. Human and animal health, 4. Effects on agriculture (allelopathy, crop yield due to competition etc.), 5. Effects on biodiversity. School students should be linked to such research work to promote student projects and training.	UUW	3
Implement legal action against intentional anthropogenic firing of vegetation; create necessary awareness among relevant communities.	FD, UPC	3
Traditional Knowledge and Cultural Biodiversity		
Prepare a provincial register of traditional knowledge.	UPC	2
Survey traditional knowledge and rituals associated with agriculture.	UPC, NGOs, DAg, ORO Universities,	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	
Ensure preservation of cultural sites, e.g. temples with important paintings depicting biodiversity.	MCA	2
Develop a Ceter for Indigenous people at Dambana	UPC, Universities	3
Education, Training and Awareness		
Establish school environmental clubs and link them with relevant agencies to enhance knowledge, skills and involvement in BD conservation activities.	UPC, MENR	2
Promote universities, especially University of Uva-Wellessa, to conduct research on biodiversity-related matters in UP and involve local environmentalists, students and others followed by information sharing.	UPC	5
Institutional and Capacity Building		
Enhance capacity/coordination/mandate of environment division of UPC with assistance from MENR.	UPC, MENR	5
An active role in coordinating all environment –related activities performed by national and local agencies within UP, e.g. cross-sectorial plans, along with capacity building of UPC.	UPC	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	UPC	2
Regulate extraction of natural biological resources (medicinal plant products, e.g. Aralu, Bulu, Nelli, Bin kohomba) and maximize benefits by value addition	UPC, Private Sector	5
Promote cane industry specially in Bibile area by promoting cultivation of 'Ma wewel' (*Calamus thwaitesii*) in home gardens and community woodlots	UPC, FD	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 1972. 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^{0}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 thay have developed their distinctive properties.

***Mahawansa*:** Chronicle of Sri Lanka's history covering the period 6th century BC to 4th centurt 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 desinated under the 1972 Convention on the Protection of the World Cultural and Natural Heritage.

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APPENDIX 1

Plant species recorded in Protected Areas in the Uva Province investigated for the NCR Survey

Sources:Plant species: IUCN & WCMC (1997) – with updated taxonomy
Local names & endemism: Revised Flora of Ceylon (1980-2000)
Conservation Status: IUCNSL 1999 List and IUCN 2002 Global Red List

IUCNSL 1999 List (IUCNSL): HT = Highly Threatened, **TR** = Threatened
IUCN 2002 Global List (IUCN GL): CR = Critically Endangered, **EN** = Endangered, **VU** = Vulnerable, **LR/nt** = Lower riak/near threatened, **LR/cd** = Lower risk/conservation dependent, **DD** = Data deficient

Family Species	Local Name	Endemic (E)	Consevation Status	
			IUCNSL	IUCN GL
Acanthaceae				
Crossandra infundibuliformis				
Eranthemum capense				
Stenosiphonium cordifolium	Bu-nelu			
Anacardiaceae				
Buchanania axillaris	Kiri-palu			
Mangifera zeylanica	Etamba	E		VU
Nothopegia beddomei	Bala			
Semecarpus coriacea	Badulla	E		EN
Semecarpus gardneri	Badulla	E		VU
Semecarpus nigro-viridis	Badulla	E		VU
Semecarpus parvifolia	Badulla	E	TR	VU
Spondias xerophila	Ambarella			
Annonaceae				
Alphonsea sclerocarpa				
Artabotrys hexapetalus	Yakada-wel		TR	
Artabotrys zeylanicus	Kalu-bambara-wel			
Miliusa indica	Kukulu-messa			
Polyalthia cerasoides	Patta-ulkenda			
Polyalthia coffeoides	Omara			
Polyalthia korinti	Mi-wenna, Ul-kenda			
Polyalthia longifolia	O-wila			
Uvaria sphenocarpa	Palanga, Palu-kan	E		
Xylopia nigricans	Heen-kenda	E	TR	
Apocynaceae				
Alstonia scholaris	Ruk-attana			
Anodendron paniculatum	As-wel, Dool			
Carissa inermis	Maha-karanda		TR	
Carissa spinarum	Heen-karanda			
Chonemorpha fragrans	Bu-kiri-wel			
Hunteria zeylanica	Mediya			
Pagiantha dichotoma	Divi-kaduru			

Family Species	Local Name	Endemic (E)	Consevation Status	
			IUCNSL	IUCN GL
Rauvolfia serpentina	Ekaweriya		HT	
Araliaceae				
Schefflera heterobotrya	Itta	E		
Schefflera stellata	Itta			
Arecaccae				
Calamus zeylanicus	Thambotu-wel	E	TR	
Caryota urens	Kitul			
Asclepiadaceae				
Gymnema pergularioides		E	HT	
Gymnema lactiferum	Kurinnan			
Secamone emetica				
Asparagaceae				
Asparagus falcatus	Hatawariya			
Asparagus racemosus	Hatawariya			
Asteraceae				
Blepharispermum periolare			HT	
Moonia heterophylla				
Vernonia cinerea	Monara-kudumbiya			
Vernonia zeylanica	Pupula	E		
Bignoniaceae				
Oroxylum indicum	Thotila			
Stereospermum colais	Dunu-madala			
Bombacaceae				
Bombax ceiba	Katu-imbul			
Cullenia ceylanica	Kataboda	E		VU
Boraginaceae				
Carmona retusa	Heen-tambala			
Cordia dichotoma	Lolu			
Cordia gharaf				
Cordia monoica	Naruvili (T)			
Cordia oblongifolia				
Erhetia laevis	Addula (T)			
Burseraceae				
Commiphora caudata				
Scutinanthe brunnea	Maha-bulu-mora			
Buxaceae				
Sarcocca zeylanica		E		
Capparaceae				
Capparis divaricata	Torikei		TR	
Capparis grandis	Mudkondai (T)			
Capparis rheedii				
Capparis rotundifolia	Karunchurai (T)			
Capparis sepiaria	Karunchurai (T)			
Capparis zeylanica	Dudu-welangiriya			
Crateva religiosa	Lunu-warana			

Family Species	Local Name	Endemic (E)	Consevation Status	
			IUCNSL	IUCN GL
Celastraceae				
Cassine glaucum	Neralu	E		
Euonymus revolutus		E		
Euonymus walkeri		E		VU
Maytenus emarginata				
Pleurostylia opposita	Panakka			
Chloranthaceae				
Sarcandra chloranthoides				
Clusiaceae				
Calophyllum calaba	Guru-keena	E	TR	
Calophyllum tomentosum	Tel-keena	E	TR	VU
Calophyllum walkeri	Tel-keena	E	TR	VU
Garcinia morella	Kokatiya			
Garcinia spicata	Ela-gokatu			
Mesua ferrea	Na			
Combretaceae				
Anogeissus latifolius	Dawu			
Terminalia arjuna	Kumbuk			
Terminalia bellirica	Bulu			
Terminalia chebula	Aralu			
Connaraceae				
Connarus monocarpus	Radaliya			
Convolvulaceae				
Argyreia populifolia	Gini-tilla	E		
Cucurbitaceae				
Trichosanthes cucumerina	Dummella			
Cycadaceae				
Cycas circinalis	Madu			
Daphniphyllaceae				
Daphniphyllum glaucescens				
Datiscaceae				
Tetrameles nudiflora	Hema, Muguna			
Dioscoreaceae				
Dioscorea spicata	Gonala			
Dioscorea tomentosa	Uyala			
Dracaenaceae				
Sansevieria zeylanica	Niyanda			
Ebenaceae				
Diospyros affinis	Kalu-wella			
Diospyros ebenum	Kaluwara		TR	DD
Diospyros ferrea	Kalu-habaraliya			
Diospyros malabarica	Timbiri			
Diospyros melanoxylon	Kadumberiya			
Diospyros montana	Sudu-kaluwara		TR	
Diospyros nummulariifolia	Kal-habaraliya		HT	EN

Family Species	Local Name	Endemic (E)	Consevation Status	
			IUCNSL	IUCN GL
Diospyros oocarpa	Ela-timbiri			
Diospyros ovalifolia	Kunumella			
Elaeagnaceae				
Elaeagnus latifolia	Katu-embilla			
Elaeocarpaceae				
Elaeocarpus amoenus	Titta veralu	E		
Elaeocarpus montanus		E	TR	
Ericaceae				
Rhododendron arboreum	Ma-ratmal	E		
Vaccinium symplocifolium	Boralu			
Erythroxylaceae				
Erythroxylum moonii	Bata-kirilla			
Eryrhroxylum zeylanicum		E		
Euphorbiaceae				
Agrostistachys indica				
Antidesma alexiteria	Heen-embilla			
Antidesma pyrifolium		E		VU
Blachia umbellata	Kos-atta			
Breynia retusa	Wal-murunga			
Bridelia retusa	Keta-kela			
Cleistanthus pallidus	Ulu-peliya	E		
Cleistanthus patulus	Wa, Anguru-kuratiya			
Croton aromaticus	Wel-keppetiya			
Croton laccifer	Keppetiya			
Croton officinalis				
Croton persimilis	Akurella	E		
Dimorphoclyx glabellus	Weli-wenna			
Drypetes sepiaria	Weera			
Euphorbia antiquorum	Daluk			
Fahrenheitia zeylanica	Olu-petta			
Flueggea leucopyrus	Heen-katupila			
Givotia mollucana	Puttalai (T)			
Glochidion coriaceum		E		
Glochidion stellatum	Kirilla	E		
Homalanthus populifolius	Gini-kenda			
Macaranga indica	Kenda			
Macaranga peltata	Kenda, Pat-kenda			
Mallotus eriocarpus	Bulu-petta	E		
Mallotus philippensis	Molabe, Hampirilla			
Mallotus resinosus	Ma-endarau	E		
Mallotus rhamnifolius	Bulu-hulu-keppetiya			
Mischodon zeylanicus	Tammenna			
Phyllanthus cinereus		E	HT	
Phyllanthus emblica	Nelli			
Phyllanthus pinnatus	Patossa			

Family Species	Local Name	Endemic (E)	Consevation Status	
			IUCNSL	IUCN GL
Phyllanthus polyphyllus	Kuratiya			
Phyllanthus rheedii				
Sapium insigne	Tel-kaduru			
Suregada lanceolata	Kakkaipalai(T)			
Tragia involucrata	Wel-kahambiliya			
Fabaceae				
Abrus precatorius	Olinda			
Acacia caesia	Hinguru-wel			
Acacia eburnea	Buffalo thorn, Cockspur thorn (E)			
Albizzia odoratissima	Suriya mara, Huri-mara			
Bauhinia racemosa	Maila			
Bauhinia tomentosa	Kaha-petan			
Butea monosperma	Kela			
Cassia auriculata	Ranawara			
Cassia fistula	Ehela			
Cassia roxburghii	Ratu-wa			
Cassia siamea	Wa, Aramana			
Cynometra iripa	Opalu		HT	
Cynometra zeylanica		E		
Dalbergia lanceolaria	Bol-mara			
Derris parviflora	Sudu-kalawel	E		
Derris scandens	Bokala			
Derris trifoliata	Kala-wel			
Dialium ovoideum	Gal-siyambala	E		
Dichrostachys cinerea	Andara			
Entada pusaetha	Pus-wel			
Flemingia strobilifera	Hampinna, Hampilla			
Mundulea sericea	Gal-buruta			
Pongamia pinnata	Magul-karanda			
Pterocarpus marsupium	Gammalu			
Saraca asoca	Asoka, Diya-ratmal			VU
Uraria picta				
Flacourtiaceae				
Casearia tomentosa	Kiri-makulu			
Casearia zeylanica	Wal-waraka			
Chlorocarpa pentaschista	Gomma	E		
Flacourtia indica	Katu-kurundu, Uguressa			
Hydnocarpus venenata	Makulu	E		
Scolopia acuminata	Katu-kenda			
Scolopia crassipes		E		
Scolopia pusilla	Katu-keeri	E		
Hernandiaceae				
Gyrocarpus americanus	Diya-labu			

Family Species	Local Name	Endemic (E)	Consevation Status	
			IUCNSL	IUCN GL
Hippcrateaceae				
Reisantia indica				
Salacia oblonga	Kotala-himbutu		TR	
Salacia reticulata	Himbutu		TR	
Icacinaceae				
Apodytes dimidiata				
Gomphandra tetrandra				
Nothapodytes nimmoniana	Ganda-pana			
Lamiaceae				
Ocimum gratissimum	Maduru-tala			
Plectranthus crameri		E		
Lauraceae				
Actinodaphne ambigua		E		
Actinodaphne glauca		E		
Actinodaphne speciosa	Ali-kan	E		
Alseodaphne semecarpifolia	Wewarana			
Cinnamomum capparu-coronde	Kapuru-kurundu	E	TR	VU
Cinnamomum citriodorum	Pengiri-kurundu	E	HT	EN
Cinnamomum liseaefolium	Kudu-kurundu	E	TR	VU
Cinnamomum ovalifolium		E		
Cinnamomum rivolurum		E		CR
Cryptocarya wightiana	Golu-mora			VU
Litsea gardneri	Talan	E		VU
Litsea glutinosa	Bomi			
Litsea ovalifolia		E		
Litsea quinqueflora	Kosbada, Landittan			
Neolitsea cassia	Dawul kurundu, Kudu-dawula			
Neolitsea fuscata		E		
Persea macrantha	Ululu			
Lecythidaceae				
Careya arborea	Kahata			
Leeaceae				
Leea indica	Burulla			
Linaceae				
Hugonia mystax	Bu-getiya			
Loganiaceae				
Fagraea ceilanica	Etamburu			
Strychnos benthamii		E		VU
Strychnos minor	Kaduru-wel			
Strychnos potatorum	Ingini			
Lythraceae				
Woodfordia fruticosa	Malitta			
Magnoliaceae				
Michelia nilagirica	Wal-sapu			

Family Species	Local Name	Endemic (E)	Consevation Status	
			IUCNSL	IUCN GL
Malpighiaceae				
Hiptage benghalensis	Puwak-gediya-wel			
Malvaceae				
Hibiscus eriocarpus	Parutti (T)			
Hibiscus surattensis	Heen-napiritta			
Sida rhombifolia	Kotikan-bevila			
Melastomataceae				
Memecylon angustifolium	Kora-kaha			
Memecylon capitellatum	Dodan-kaha	E		
Memecylon cuneatum		E		EN
Memecylon leucanthenum		E	HT	VU
Memecylon parvifolium		E		
Memecylon petiolatum		E		
Memecylon rotundatum		E	HT	VU
Memecylon umbellatum	Kora-kaha			
Osbeckia aspera	Heen-bowitiya			
Osbeckia buxifolia				
Osbeckia rubicunda				
Meliaceae				
Aglaia elaeagnoidea	Puwangu			
Chukrasia tabularis	Hulan-hik			
Cipadessa baccifera	Hal-bemiya			
Dysoxylum ficiforme				
Walsura trifoliolata	Kiri-kon			
Menispermaceae				
Anamirta cocculus	Titta-wel			
Cissampelos pareira	Diya-mitta			
Cyclea peltata	Kesi-pissan			
Hyserpa nitida	Niri-wel			
Monimiaceae				
Hortonia floribunda	Weyiya			
Moraceae				
Antiaris toxicaria	Riti			
Ficus amplissima	Ela-nuga			
Ficus arnottiana	Kaudu-bo			
Ficus benghalensis	Nuga, Maha nuga			
Ficus caulocarpa				
Ficus drupacea	Bu-nuga			
Ficus callosa	Wal-gonna			
Ficus hispida	Kota-dimbula			
Ficus microcarpa				
Ficus mollis	Wal-aralu			
Ficus trimenii			HT	
Streblus asper	Geta-netul			
Streblus taxoides	Gon-gotu, Pol-katu			

Family Species	Local Name	Endemic (E)	Consevation Status	
			IUCNSL	IUCN GL
Myristicaceae				
Myristica ceylanica	Malaboda			VU
Myrsinaceae				
Ardisia gardneri		E		
Ardisia missionis				
Maesa indica	Mata bimbiya			
Myrtaceae				
Eugenia mabaeoides		E		
Eugenia thwaitesii				
Eugenia willdenowii	Tembiliya			
Rhodomyrtus tomentosa	Wal-pera			
Syzygium cumini	Ma-dan			
Syzygium rotundifolium		E		VU
Syzygium umbrosum	Heen-damba	E	TR	EN
Syzygium zeylanicum	Maran, Maranda			
Ochnaceae				
Gomphia serrata	Bo-kera			
Ochna lanceolata	Mal-kera			
Oleaceae				
Jasminium angustifolium	Wal-pichcha, We-kanda			
Jasminium auriculatum				
Jasminium bignoniaceum			TR	
Passifloraceae				
Passiflora suberosa	Theentha			
Periplocaceae				
Hemidemus indicus	Iramusu			
Piperaceae				
Piper zeylanicum		E		
Pittosporaceae				
Pittosporum tetraspermum				
Polygalaceae				
Polygala arillata				
Polygala javana	Tilo-guru			
Primulaceae				
Lycimachia laxa				
Rhamnaceae				
Rhamnus wightii				
Scutia myrtina	Tudari (T)			
Ventilago maderaspatana	Yakada-wel			
Zizyphus mauritiana	Masan, Debara			
Zizyphus napeca	Yak-eraminiya	E		
Zizyphus oenoplia	Heen-eraminiya			
Zizyphus xylopyrus	Kakuru			
Rhizophraceae				

Family Species	Local Name	Endemic (E)	Consevation Status	
			IUCNSL	IUCN GL
Cassipourea ceylanica	Pana			
Rosaceae				
Rubus leucocarpus				
Rubus rugosus				
Rubiaceae				
Benkara malabarica	Pudan (T)			
Canthium coromandelicum	Kara			
Canthium puberulum		E		
Catunaregam spinosa	Kukuruman			
Diplospora erythrospora		E		
Discospermum sphaerocarpum	Sudu-seru			
Haldinia cordifolia	Kolon			
Hedyotis coprosmoides		E		
Hedyotis lessertiana				
Hedyotis trimenii		E		
Ixora coccinea	Rat-mal, Ratambala			
Ixora pavetta	Maha-ratambala			
Lasianthus foetulentus		E		
Lasianthus strigosus		E		
Metabolus decipiens		E		
Mitragyna parvifolia	Helamba			
Morinda coreia	Ahu			
Morinda umbellata	Kiri-wel			
Mussaenda frondosa	Mussenda			
Ophiorhiza pectinata				
Pavetta indica	Pavatta			
Psilanthus travancoresis				
Psilanthus wightianus	Kaddumallikai (T)			
Psychotria gardneri		E		
Psychotria nigra				
Psychotria zeylanica		E		
Psydrax dicoccos	Gal-karanda, Seru			VU
Psydrax montanus		E		VU
Rubia cordifolia	Manda madini-wel, Yogana wel			
Saprosma foetens				
Tamilnadia uglinosa	Et-kukuruman, Wadiga			
Tarenna asiatica	Tarana			
Tarenna flava				
Uncaria ellipticum				
Urophyllum ceylanicum		E		
Wendlandia bicuspidata	Rawan-idala			
Rutaceae				
Acronychia pedunculata	Ankenda			
Atalantia ceylanica	Yaki-naran			

Family Species	Local Name	Endemic (E)	Consevation Status	
			IUCNSL	IUCN GL
Atalantia monophylla	Perunkuruntu (T)			
Chloroxylon swietenia	Buruta			VU
Clausena dentata	Et-kara-bembiya, Weda-pana			
Clausena indica	Mee-gon karapincha			
Glycosmis angustifolia	Bol-pana			
Glycosmis mauritiana				
Glycosmis pentaphylla	Dodan-pana			
Limonia acidissima	Diwul			
Melicope lunu-ankenda	Lulu-ankenda			
Micromelum minutum	Wal-karapincha			
Murraya koenighii	Karapincha			
Murraya paniculata	Etteriya			
Pamburas missionis	Pamburu			
Paramignya beddomei				
Paramignya monophylla	Wellangiriya			
Pleispermium alatum	Tun-pat kurundu			
Toddalia asiatica	Kudu-miris			
Zanthoxylum rhetsa	Katu-keena			
Zanthoxylum tetraspermum				
Sabiaceae				
Meliosma pinnata	Wal-bilin			
Meliosma simplicifolia	El-bedda			
Salvadoraceae				
Azima tetracantha	Ichanku (T)			
Salvadora persica	Malittan			
Sapindaceae				
Allophylus cobbe	Kobbe			
Allophylus zeylanicus		E		
Dimocarpus longan	Mora			
Dodonaea viscosa	Eta-werella, Gona-gas			
Filicium decipiens	Pihimbiya			
Lepisanthes erecta				
Lepisanthese senegalensis	Gal-kuma			
Lepisanthes tetraphylla	Dambu			
Pometia pinnata	Na-imbul			
Sapindus emarginata	Penela			
Sapindus trifoliatus	Kaha-penela			
Schleichera oleosa	Kon			
Sapotaceae				
Isonandra compta		E		
Madhuca longifolia	Mee			
Manilkara hexandra	Palu			
Schizandraceae				
Kadsura heteroclita				

Family Species	Local Name	Endemic (E)	Consevation Status	
			IUCNSL	IUCN GL
Smilacaceae				
Smilax aspera				
Smilax zeylanica	Kabaressa			
Solanaceae				
Solanum pubescens				
Staphyleaceae				
Turpinia malabarica	Kan-kumbala			
Sterculiaceae				
Firmiana colorata	Bataliya			
Helicteres isora	Lihiniya			
Pteropermum suberifolium	Welan			
Pterygota thwaitesii	Gal-nawa	E	TR	
Sterculia balanghas	Nawa			
Sterculia urens	Kavali			
Symplocaceae				
Symplocos cochinchinensis	Bombu			
Symplocos elegans		E	HT	
Symplocos obtusa		E		CR
Theaceae				
Eurya acuminata	Wild tea (E)			
Eurya ceylanica		E		
Eurya chinensis				
Gordonia ceylanica	Mihiriya	E		
Gordonia dassanayakei		E		
Ternstroemia gymnanthera	Pene-mihiriya, Rattiya			
Thymelaeaceae				
Gyrinops walla	Walla			
Tiliaceae				
Berrya cordifolia	Hal-milla			
Diplodiscus verrucosus	Dik-wenna	E		
Grewia carpinifolia	Keliya			
Grewia damine	Daminna			
Grewia helicterifolia	Bora-daminiya			
Grewia rothii				
Ulmaceae				
Celtis philippensis	Medi-tella			
Celtis timorensis	Gurena			
Gironniera parvifolia	Ak-mediya			
Holoptelea integrifolia	Goda-kirilla			
Urticaceae				
Dendrocnide sinuata	Ma-ussa			
Pouzolzia bennettiana				
Verbenaceae				
Clerodendron infortunatum	Pinna			
Gmelina asiatica	Demata			

Family Species	Local Name	Endemic (E)	Consevation Status	
			IUCNSL	IUCN GL
Premna latifolia	Midi			
Premna tomentosa	Bu-seru			
Vitex altissima	Milla			
Violaceae				
Rinorea virgata				
Vitaceae				
Cayratia pedata	Gerandi-dool-wel			
Cissus heyneana	Wal-muddappalam			
Cissus latifolia	Wal-diya-labu			
Cissus quadrangularis	Hee-ressa			
Cissus repanda				
Cissus trilobata				
Cissus vitiginea	Wal-niviti			
Tetrastigma nilagiricum				
Zingiberaceae				
Zingiber cylindricum		E		

APPENDIX 2

Animal species recorded in Protected Areas in the Uva 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 GL)
: **CR** = Critically Endangered, **EN** = Endangered,
VU = Vulnerable, **LR/nt** = Lower riak/near threatened,
LR/cd = Lower risk/conservation dependent, **DD** = Data deficient

Group Species	Local names (English)	Endemic (E)	Conservation Status	
			IUCNSL	IUCNGL
Butterflies				
Cheritra freja	Common Imperial			
Cirrochroa thais	Yeoman			
Cupha erymanthis	Rustic			
Delias eucharis	Jezebel			
Dophla (=Euthalia) evelina	Red-spot Duke			
Euthalia aconthea	Baron			
Euploea core	Common crow			
Graphium agamemnon	Green Jay, Tailed Jay			
Graphium doson	Common Jay			
Graphium sarpedon	Blue bottle			
Huphina radina				
Hypolymnas bolina	Great Eggflyi			
Hypolymnas misipus	Danaid Eggfly			
Ixias marianne	White Orange Tip			
Kallima philarcus	Blue Oakleaf	E	TR	
Lethe rohria	Common Treebrown			
Loxura atymmus	Yamfly			
Melanites leda	Common Evening Brown			
Melanitis phedima	Dark Evening Brown			
Neptis jumbah	Chesnut-streaked Sailor			
Pachliopta (= Altrophneura) jophon	Ceylon Rose	E	TR	CR
Papilio crino	Banded Peacock			
Papilio polytes	Common mormon			
Symphaedra (= Euthalia) nais	Baronet			
Ypthima ceylonica	White Four Ring			
Mollusks				
Aulopoma grande		E		
Beddomea frifasciatus		E		
Cryptozona bistrialis				
Cryptozona semirugata				
Euplecta acuducta			TR	
Euplecta gardneri		E	HT	
Euplecta indica		E		

Group Species	Local names (English)	Endemic (E)	Conservation Status	
			IUCNSL	IUCNGL
Euplecta travancoricii				
Euplecta turritella			HT	
Mirus (= Ena) stalix		E	TR	
Oligospira skinneri		E	TR	
Rachistia pulcher				
Amphibia				
Philautus hypomelas	Patala-rahita Atikitta, Webless Pygmy Tree Frog (E)	E	TR	
Philautus leucorhinus		E		
Philautus nasutus	Ul-hombu Atikitta. Sharp-snout Pygmy tree Frog	E	TR	
Philautus variabilis		E		
Polypedates (= Rhacophorus) cruciger		E		
Reptiles				
Order: Sauria				
Calotes calotes	Pala katussa. Green garden lizard (E)			
Calotes liopepis	Sivuru-handalana katussa. Whistling lizard (E)	E	TR	
Calotes ceylonensis	Thola-visituru katussa. Painted lip lizard (E)	E	TR	
Ceratophora stoddarti	Kagamuva Ang-katussa. Rhino-horn Lizard (E)	E	TR	
Cnemaspis jerdoni	Jerdonge divasari-huna. Jerdon,s day gecko (E)		TR	
Cnemaspis podihuna	Podi-gal-huna, Kuda divasari-huna. Dwarf day gecko (E)	E	HT	
Cophotes ceylanica	Kandukara Kuru Katussa. Pygmy Lizard (E)	E	HT	
Gonydactylus frenatus	Mookalan huna, Maha-kele huna. Great forest gecko (E)	E	TR	
Hemidactylus leschenaulti	Kimbul huna, Gas huna, Kumbuk huna. Crocodile gecko (E)	E		
Hemidactylus maculatus	Devantha tit-huna. Spotted giant gecko, Rock gecko (E)	E		
Lankascincus fallax	Sulaba heeraluwa. Common skink	E		
Lankascincus gansi	Gansige lak-heeraluwa. Gans's skink (E)	E	TR	
Lyriocephalus scutatus	Karamal bodiliya, Geta-hombu katussa, Kandukara bodiliya, Sondura. Hump-snout lizard, Lyre-head lizard	E	TR	
Mabuya carinata	Sulaba hikanala Common skink (E)			
Mabuya macularia	Pingu hikanala Bronze Green Little Skink(E)			

Group Species	Local names (English)	Endemic (E)	Conservation Status	
			IUCNSL	IUCNGL
Mabuya madaraszi	Pulli hikanala. Spotted skink		TR	
Otocryptis wiegmanni	Pinum Katussa, Gomu Tali-katussa. Upland Kangaroo Lizard (E)	E	TR	
Ricpa punctata				
Sitana ponticeriana	Pulina tali-katussa, Weli-katussa, Pulli-bim katussa. Fan-throat lizard, Sand lizard (E)			
Order: Serpentes				
Chrysopelea ornata	Malsara. Ornate flying snake (E)		TR	
Hypnale hypnale	Polon-thelissa.Merrem's hump-nosed viper (E)			
Python molurus	Pimbura,Indian python (E)		TR	LR/nt
Birds				
Accipiter badius	Ukussa,Shikra (E)			
Alcedo atthis	Mal Pilihuduwa. Common Kingfisher (E)			
Anthracoceros coronatus	Poru-kendatta. Malabar Pied Hornbill (E)			
Apus affinis	Punchi Thurithaya. House Swift (E)			
Cacomantis passerinus	Kusalu Guru-koha. Grey-bellied Cuckoo (E)			
Cacomantis sonneratii	Vayira Guru-koha. Banded Bay Cuckoo (E)			
Caprimulgus asiaticus	Indu Bim-bassa. Common Nightjar (E)			
Caprimulgus atripennis	Jerdon Bim-bassa. Jerdon's Nightjar (E)			
Chalcophaps indica	Neela Kobeiya. Emerald Dove (E)			
Chloropsis aurifrons	Rannalala Kolarisiya. Golden-fronted Leafbird (E)			
Chloropsis cochinchinensis	Nil-piya Kolarisiya. Blue-winged Leafbird (E)			
Chrysocolaptes lucidus	Lepita Maha-kerala. Greater Flameback (E)			
Chrysomma sinense	Nethkaha Thana-demalichcha. Yellow-eyed Babbler (E)			
Collocalia unicolor	Indu Upa-thurithaya. Indian Swiftlet (E)			
Columba torringtoni	Maila-goya Sri Lanka Wood Pigeon (E)	E	TR	VU
Copsychus malabaricus	Wana polkichcha. White-rumped Shama (E)			
Coracina macei	Maha Kovul Saratiththa. Large Cuckooshrike (E)			
Coracina melanoptera	Kalu-his Kovul Sariththa. Black-headed Cuckooshrike(E)			

Group Species	Local names (English)	Endemic (E)	Conservation Status	
			IUCNSL	IUCNGL
Culicicapa ceylonensis	Alu-his Kaha Mesimara. Grey-headed Canary Flycatcher (E)			
Cyomis tickelliae	Tickel Nil-mesimara. Tickel's Blue Flycatcher (E)			
Dendroanthus indicus	Wana hela-penda. Forest Wagtail (E)			
Dicaeum agile	Mathudu Pililichcha. Thick-billed Flowerpecker(E)			
Dicrurus paradiseus	Maha Kawuda. Racket-tailed Drongo (E)			
Dinopium bengalense	Rath-kerala. Black-rumped Flameback (E)			
Ducula aenea	Neela Mahagoya. Green Imperial Pigeon (E)			
Dumetia hyperythra	Kusa-kaha Landu-demalichcha. Tawny-bellied Babbler (E)			
Elanus caeruleus	Patan-ukussa, Patanukussa. Black-winged Kite (E)			
Eumyias (= Muscicapa) sordida	Neelan Mesi-mara,Lanka Dull Blue Flycatcher (E)	E		
Ficedula subrubra	Kashmira Rath-mesimara. Kashmir Flycatcher (E)			VU
Galloperdix bicalcarata	Haban kukula. Sri Lanka Spur Fowl (E)	E	TR	
Gallus lafayettii	Sri Lanka Wali-kukula. Sri Lanka Jungle Fowl (E)	E		
Glaucidium radiatum	Wana upa-bassa. Jungle Owlet (E)			
Gracula ptilogenys	Mookalan Selalihiniya, Sri Lanka Lanka Selalihiniya. Sri Lanka Grackle, Hill Mynah (E)	E	TR	LR/nt
Gracula religiosa	Sela-lihiniya. Common Myna (E)			
Halcyon smyrnensis	Laya-sudu Medi-pilihuduwa. White-throated Kingfisher(E)			
Harpactes faciatus	Loha-wannichchiya. Malabar Trogon (E)			
Hemiprocne coronata	Silu Ruk Thurithaya. Crested Tree Swift (E)			
Hemipus picatus	Wairapiya Mesi-saratiththa. Bar-winged Fly catcher Shrike (E)			
Herococcyx varius				
Hieraaetus klienerii	Kusarath Rajaliya. Booted Eagle (E)		TR	
Hirundo daurica	Nithamba-rathu Wehilihiniya Red-rumped Swallow (E)			
Hirundo rustica	Alu-wehilihiniya. Barn Swallow (E)			
Hypothymis azurea	Kalu-gelasi Radamara. Black-naped Monarch (E)			

Group Species	Local names (English)	Endemic (E)	Conservation Status	
			IUCNSL	IUCNGL
Hypsipetes indicus				
Hypsipetes madagascariensis				
Ictinaetus malayensis	Kalukussa. Black Eagle (E)			
Lanius cristata	Bora-sabariththa. Brown Shrike (E)			
Lonchura kellaarti	Gela-kalu Weekurulla. Black-throated Munia (E)		TR	
Loriculus beryllinus	Gira-malitta,Lorikeet, Sri Lanka Hanging Parrot (E)		TR	
Luscinia brunnea	Indu Nil Siti-kichcha. Indian Blue Robin (E)			
Megalaima flavifrons	Mookalan Kottoruwa, Sri Lanka Ran-munatha Kottoruwa,Sri Lanka Yellow-fronted Barbet (E)	E	TR	
Megalaima haemacephala	Rath-laya Kottoruwa. Coppersmith Barbet (E)			
Megalaimia rubricapilla	Tathu-munath Kottoruwa. Crimson-fronted Barbet (E)	E		
Megalaimia zeylanica	Polos Kottoruwa. Brown-headed Barbet (E)			
Merops leschenaulti	Thambala-hisa Binguharaya. Chesnut-headed Bee-eater(E)			
Merops orientalis	Punchi Binguharaya. Green Bee-eater (E)			
Merops philippinus	Nilpenda Binguharaya. Blue-tailed Bee-eater (E)			
Motacilia cinerea	Alu-helapenda. Grey Wagtail (E)			
Muscicapa latirostris				
Muscicapa muttui	Laya-bora MesimaraBrown-breasted Flycatcher(E)			
Nectarinia asiatica	Dan Sutikka. Purple Sunbird (E)			
Nectarinia lotenia	Lotenge Sutikka. Loten's Sunbird (E)			
Ocyceros gingalensis	Alu-kendetta, Grey Hornbill (E)	E	TR	
Oriolus xanthornus	Kaha-kurulla. Black-hooded Oriole (E)			
Orthotomus sutorius	Battichcha. Common Tailor Bird (E)			
Parus major	Maha Tikiritta,Great Tit (E)			
Pavo cristatus	Monara / Sebada Indian Peafowl (E)			
Pellomeum fuscocapillum	Hisa-dumburu Demalichcha, Sri Lanka Boraga-demalichcha,Sri Lanka Brown-capped Babbler (E)	E	TR	
Pericrocotus cinnamomeus	Punchi Minivihtha. Small Minivet (E)			
Pericrocotus flammeus	Dilirath Minivihtha.			

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			IUCNSL	IUCNGL
	Scarlet Minivet (E)			
Pernis ptilorhyncus	Silu Bambarakussa. Oriental Honey Bazzard (E)			
Phaenicophaeus viridirostris	Watha-nil Malkoha. Blue-faced Malkoha (E)			
Phylloscopus magnirostis	Mathusu Gas-raviya,Large-billed Leaf Warbler (E)			
Phylloscopus nitidus				
Picoides maharattensis				
Picoides nanus				
Pitta brachyura	Avichchiya,Indian Pitta (E)			
Ploceus philippinus	Wadu-kurulla, Baya Weaver (E)			
Pomatorhinus horsfieldii	Da-demalichcha. Scimitar Babbler (E)			
Prinia sylvatica	Wana Priniya. Jungle Priniya (E)			
Psittacula calthropae	Alu-girawa. Layard's Parakket (E)		TR	
Psittacula cyanocephala	Pandu-girawa. Plum-headed Parakeet (E)			
Pycnonotus luteolus	Bema-sudu Kondaya. White-browed bulbul (E)			
Pycnonotus melanicterus	Kalu-hisasi Kondaya. Black-crested Bulbul (E)			
Pycnonotus penicillatus	Guru Kondaya, Lanka Peetha-kan Kondaya Yellow-eared Bulbul (E)		TR	LR/nt
Rhipidura aureola	Bema-sudu Pawanpenda. White-browed Fantail (E)			
Rhopocichla atriceps	Wathanduru Panduru-demalichchca. Dark-fronted Babbler (E)			
Sitta frontalis	Villuda-nalal Yatikuriththa. Velvet-fronted Nuthatch (E)			
Spizaetus cirrhatus	Konda Rajaliya, Kondakussa, Perali Kodakussa. Crested Hawk Eagle, Changeable Hawk Eagle (E)			
Spizaetus nipalensis	Maha Konda Rajaliya, Kandukara Konda Ukussa, Hela Kondakussa. Mountain Hawk Eagle (E)		TR	
Streptopelia chinensis	Alu-kobeiya. Spotted Dove (E)			
Strix leptogrammica	Bora Wana-bakamoona. Brown wood Owl (E)			
Surniculus lugubris	Kawudu-koha. Drongo cuckoo (E)			
Taccocus leschenautii				
Tephrodornis pondicerianus	Podu Wana Sariththa. Common Woodshrike (E)			
Terpsiphone paradisi	Asia Rahan-mara. Asian Paradise Flycatcher (E)			

Group Species	Local names (English)	Endemic (E)	Conservation Status	
			IUCNSL	IUCNGL
Treron bicincta	Laya-ran Batagoya. Orange-breasted Green Pigeon (E)			
Treron pompadora	Pompadoru Batagoya. Pompadour Green Pigeon (E)			
Turdus merula	Kalu Kurulla, Kalu Bimsariya. Eurasian Black Bird (E)		TR	
Upupa epops	Podu poroluwa. Common Hoopoe (E)			
Zoothera spilotera	Pulli walawicciya, Sri Lanka Tithpiya, Thirasikaya. Sri Lanka Spotted-wing Thrush (E)	E	TR	LR/nt
Zosterops ceylonensis	Kandu Mal-kurulla, Sri Lanka Sithsiya. Sri Lanka White Eye, Ceylon Hill White Eye (E)	E	TR	
Zosterops palpebrosus	Peradigu Sithasiya. Oriental White-eye (E)			
Mammals				
Axis axis	Thith muwa,Spotted-deer (E)			
Bubalus bubalis	Mee-haraka,Domestic Water Buffalo (E)			
Cervus unicolor	Gona,Sambur (E)			
Elephas maximus	Aliya, Etha. Asian Elephant (E)		TR	EN
Prionailurus (= Felis) rubiginosus	Kola diviya, Bala diviya. Rusty-spotted Cat (E)		TR	VU
Funambulus sublineatus	Punchi Lena. Dusky-striped Jungle Squirrel (E)			
Herpestes smithi	Hothambuwa, Rath-Mugatiya. Ruddy mongoose, Black-tipped mongoose (E)			
Hipposideros galeritus	Kiri-wawula, Podi-wawula. Dekhan Leaf-nosed Bat (E)		TR	
Hystrix indica	Ittewa.,Porcupine (E)			
Lepus nigricollis	Wal Hawa,Black-naped Hare (E)			
Lutra lutra	Diya-balla,Otter (E)		TR	VU
Macaca sinica	Rilawa,Toque monkey (E)		VU	
Manis crassicaudata	Kaballawa. Pangolin, Scaly Ant-eater (E)			LR/nt
Melursus ursinus	Walaha,Sloth Bear (E)		TR	VU
Muntiacus muntjak	Olu muwa, Weli Muwa. Barking Deer (E)			
Panthera pardus	Kotiya, Diviya. Sri Lankan Leopard (E)		TR	EN
Paradoxurus hermaphoditus	Uguduwa.Palm Cat (E)		TR	
Semnopithecus (= Presbytes) entellus	Wandura. Grey Langur (E)			LR/nt

Group Species	Local names (English)	Endemic (E)	Conservation Status	
			IUCNSL	IUCNGL
Ratufa macroura	Dandu-lena. Giant Sqirrel (E)			VU
Sus scrofa	Wal Ura,Wild Boar (E)			
Tatera indica	Weli-mecya. Antelope Rat (E)			
Tragulus meminna	Mi-minna Mouse Deer (E)			
Viverricula indica	Urulewa. Ring-tailed Civet (E)			