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To the Convention on Biological Diversity



2019

Sri Lanka's Sixth National Report
Biodiversity Profile - Sri Lanka
To the Convention on Biological Diversity
2019



Biodiversity Secretariat
Ministry of Mahaweli Development and Environment



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Biodiversity Profile - Sri Lanka

2019

Sixth National Report to the Convention on Biological Diversity





Biodiversity Profile

Sri Lanka's Sixth National Report to the Convention on Biological Diversity - 2019



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Make co-existence between people and nature



It is with pleasure that I give this message on the occasion of the publication of Sri Lanka's Biodiversity Profile as a supplement to the Sixth National Report to the United Nations Convention on Biological Diversity (UNCBD). Our country is blessed with a remarkable biodiversity that was nurtured by a cultured society over thousands of years. I am pleased to note that, we have today among our indigenous species 245 species of butterflies, 563 species of spiders, 230 species of land snails, 97 freshwater fishes, 119 species of amphibians, 219 species of reptiles, 214 species of resident birds and 123 species of mammals (inland and marine), an impressive array for an island .

However, the country's biological wealth has faced many challenges in the face of anthropogenic landuse changes, high human population pressure, and increased demand for biological resources, coupled with the effects of climate change and the introduction of Invasive Alien Species. Sri Lanka, along with the Western Ghats of India is now identified as a global biodiversity hotspot, because of significant threats to a rich biodiversity characterised by exceptional endemism.

Even so, I am encouraged to see the work done in this country to identify and asses the status of the country's rich biodiversity since ratifying the UNCBD in 1994. This report presents an update about the most recent milestones towards on that road, for which some of the data were collected during preparation of the Sixth National Report to the UNCBD.

The material presented on freshwater fishes, amphibians, reptiles, birds, mammals and several invertebrate groups supported by zonation maps of selected faunal taxonomic groups, will no doubt be of much use to scholars, students and administrators alike, and will help make informed decisions to meet the Sustainable Development Goals .

This report also indicates, that much more remains to be done to alleviate the many threats faced by the country's wild fauna and flora and the varied habitats in a variety of forests and grasslands, inland aquatic systems, and coastal and marine ecosystems. The overview of wild biodiversity provided herein also suggests to the discerning reader that biodiversity conservation could significantly help sustainable economic development of this country in the future.

Sri Lanka's National Biodiversity Strategic Action Plan (NBSAP) 2016-2022 prepared by the Ministry of Mahaweli Development and Environment and several programs initiated by this Ministry seek to address these needs. As identified in the NBSAP, actions are taken to protect the endangered plants and animal species along with their natural habitats by increasing protected areas and ex-situ conservation sites such as wet zone botanic gardens, dry zone botanic gardens etc.

I sincerely hope that these partnerships will continue to thrive and serve as a catalyst to conserve Sri Lanka's biodiversity, and also contribute to our collective endeavours to achieve a society that is environmentally, economically and socially sustainable.

Anura Dissanayake, Secretary, Ministry of Mahaweli Development and Environment

Message by Biodiversity Secretariat



Sri Lanka has made sustained efforts in fulfilling its commitments towards conservation of biodiversity, its sustainable use. As a Party to the CBD, Sri Lanka honours and strives to meet the international obligations and commitments under the Convention. But most importantly, we believe in conservation of biodiversity as a national priority and recognizes its crucial linkages with the livelihoods and well-being of people. Sri Lanka's National Biodiversity Strategic Action Plan (NBSAP), formulated through a comprehensive interagency process led by Ministry of Mahaweli Development and Environment. Sri Lanka has developed its own National Biodiversity Targets through an extensive consultative process in line with the Aichi Biodiversity Targets and sustainable development goals and approved by the Cabinet in 2017.

Article 26 of the United Nations Convention on Biological Diversity (UN CBD) requires the Contracting Parties to periodically present reports on measures that they have taken to implement the Convention's provisions. These reports are essential tools for the Conference of the Parties and the Convention Secretariat to monitor and review the implementation of the Convention towards the preparation of a Global Biodiversity Outlook. The decision taken at the CoP 13 meeting in Cancun, Mexico, each party has encouraged to submit their Sixth National Report by 31.12.2018 for the progress of implementation of strategic action plan based on the Aichi Biodiversity targets including relevant national targets. Towards fulfilment of these reporting obligations, we prepared our 6th national report following a consultative process involving a very wide range of stakeholders. Under this process, Sri Lanka has updated the country's biodiversity profile with active participation of renowned individuals in relevant institutions and experts dealing with biodiversity conservation. This report shows updated data on Fauna and Flora species in Sri Lanka after National Red List in 2012 and the status of different ecosystems. This report not only provides an opportunity to share experiences within Sri Lanka, it also provides us a great opportunity to share our experiences with the rest of the world.

On behalf of the Ministry of Mahaweli Development and Environment I would like to extend my special thanks to the distinguished individuals and experts of the relevant Ministries, institutions, agencies, as well as the representatives of the NGOs, CBOs and the private sector who took time out of their busy schedules to participate in workshops and meet with our consultants to provide very valuable data and information for developing this report.

I am grateful to Mr. Anura Dissanayake, Secretary, Ministry of Mahaweli Development and Environment who provided guidance throughout the process and ensured that planners and policy makers at the highest level participated in the consultative process. In addition, he also provided a valuable contribution to the process as the chairmen of the National Steering Committee on National Biodiversity strategic action plan (NBSAP) for Biodiversity Conservation. The guidance for the entire report preparation process provided by Mr. W.T.B. Disanayake, Additional Secretary (Environmental Policy and Planning) is greatly appreciated. My sincere appreciation is extended to the United Nations Development Programme (UNDP) for providing funding for preparation of the 6th National Report and Biodiversity profile. I am also thankful to all the consultants, of the Environmental Foundation Limited for timely completion. My special thanks are extended to the staff of the Biodiversity Secretariat of the Ministry of Mahaweli Development and Environment.

R.H.M.P. Abeykoon, Director (Biodiversity), Ministry of Mahaweli Development and Environment



Message by Resident Representative UNDP

Sri Lanka, a tropical island nation in the Indian ocean, is surrounded by endless beaches, tropical forests and a hill country carpeted with lush tea gardens and a variety of endemic flora and fauna.

Biodiversity provides countless benefits for humanity. It provides functioning ecosystems that supply oxygen, clean air and water, as well as food security and economic resilience. In this sense, managing biodiversity through integrated approaches is vital to ensuring solutions that protect both people and our planet.

The existing legal and sectoral policy frameworks in Sri Lanka comprises laws and policies that support biodiversity conservation in the country. Despite this, biodiversity remains at risk due to challenges in implementation and financing.

In the last two centuries, it has been reported that at least 70% of the country's Wet Zone has suffered deforestation. This has further resulted in habitat loss and has fueled issues such as the ever growing human-elephant conflict as well as severe drought in the Dry Zone. Around the world, deforestation undermines the livelihoods of over 1.6 billion people, threatens biodiversity and critical ecosystem services and magnifies the effects of climate change.

The estimated global annual financial needs for biodiversity conservation rests between USD 150 – 440 billion and the current annual global biodiversity funding is at USD 52 billion. To address existing resource gaps, the United Nations Development Programme (UNDP), with support from the Governments of Germany, Norway, Switzerland and Flanders launched the Biodiversity Finance Initiative (BIOFIN).

This initiative aims to develop and pilot new approaches to fill the financing gap, support the Convention on Biological Diversity parties in reporting on resource mobilization, and assist countries including Sri Lanka to better mobilize and align domestic and international finance for biodiversity, including the implementation of National Biodiversity Strategic Action Plans.

Investing in biodiversity means investing in sustainable development. Urgent action must be taken to protect our natural habitats and biodiversity that are a part of our common heritage. With only a decade left to achieve the Sustainable Development Goals, UNDP's focus is to provide integrated solutions to end poverty, protect the planet and ensure that all people enjoy peace and prosperity.

UNDP remains committed to supporting the Government of Sri Lanka and other partners to sustain biodiversity and ecosystem resilience to ensure sustainable development for all.

Robert Juhkam , UNDP Resident Representative



Elephant Skin (SS)

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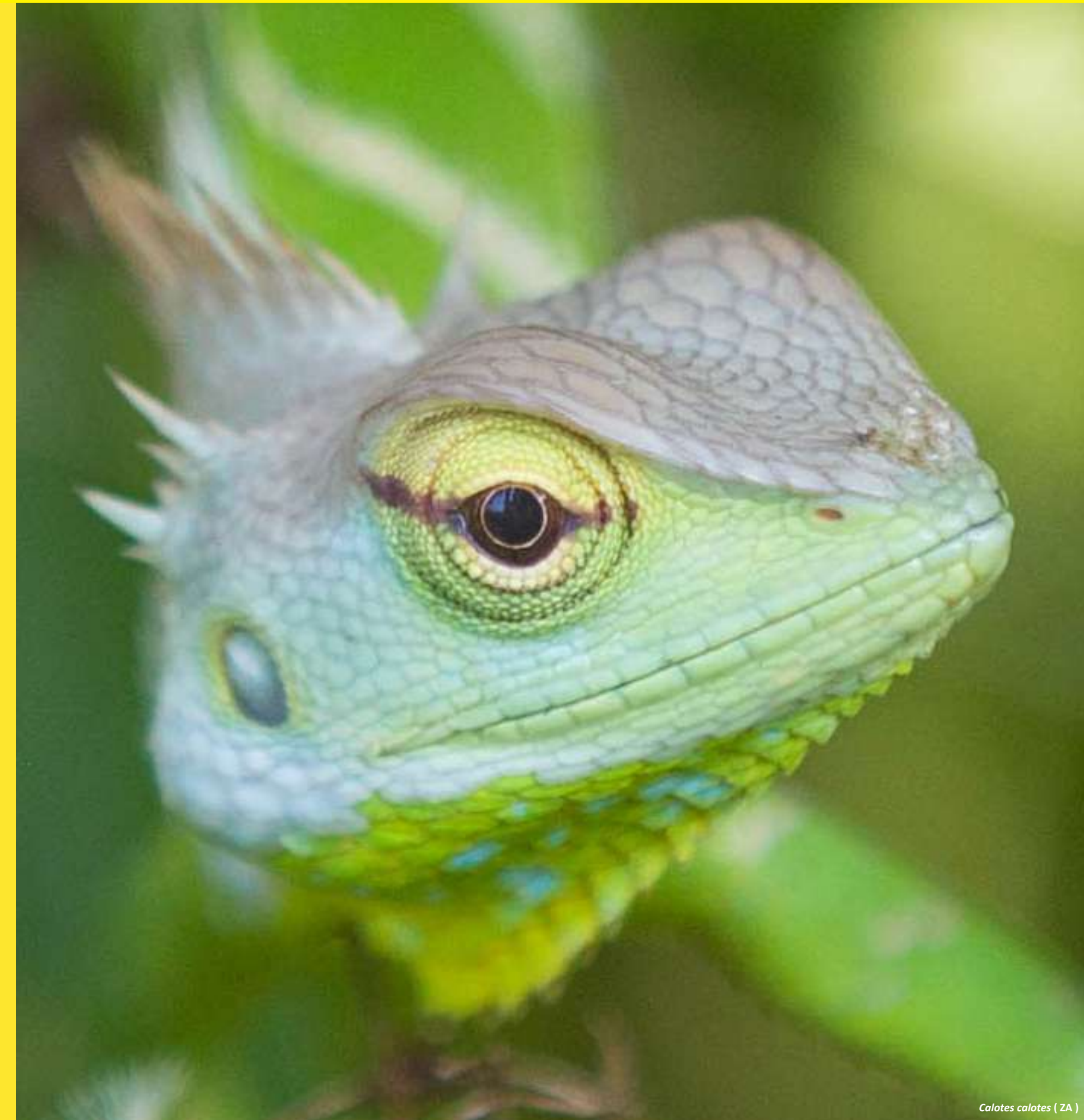
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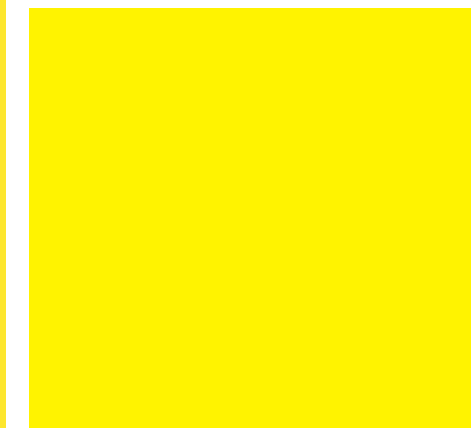


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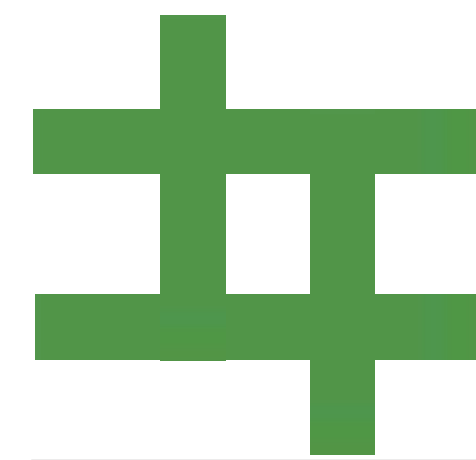
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LIST OF ACRONYMS

ASITU	Areas of Special Interest and Taxonomic Uniqueness
BIOFIN	Biodiversity Finance Initiative
BR	Breeding Residents
CBD	Convention on Biological Diversity
CEA	Central Environmental Authority
CHM	Clearing House Mechanism
CI	Conservation International
CoP	Conference of the Parties
CR	Critically Endangered
DD	Data Deficient
DWC	Department of Wildlife Conservation
E	Endemic
EEZ	Exclusive Economic Zone
EN	Endangered
ET	Exotic species
EIA	Environmental Impacts Assessment
FAO	Food and Agriculture Organization
FD	Forest Department
FRL	Forest Reference Level
HIEC	Household Income and Expenditure Survey
HWC	Human-Wildlife Conflict
IBA	Important Bird Area
IUCN	International Union for Conservation of Nature
KDN	Kanneliya-Dediyagala-Nakiyadeniya Complex
LC	Least Concerned
NBSAP	National Biodiversity Strategic Action Plan
NE	Not Evaluated
NR	National Report
NT	Near Threatened
M	Migrants
MAB	Man and Biosphere
MOE	Ministry of Environment
MoMD&E	Ministry of Mahaveli Development and Environment
PA	Protected Area
UNCBD	United Nations Convention on Biological Diversity
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UN-REDD	United Nations Programme on Reducing Emissions from Deforestation and Forest Degradation
VU	Vulnerable
WWCT	Wilderness & Wildlife Conservation Trust

An Update on the Current Status of Biodiversity of Sri Lanka

Sri Lanka's location, historic and geologic isolation from the continental landmass, topography and climate act to shape its biogeography and biodiversity, including conferring a remarkably high level of endemism, given its close proximity to the mainland. The island hosts several 'point endemic' species and even monotypic endemic genera. However this irreplaceable biodiversity is now under severe threat because of extensive anthropogenic landuse changes that began over two centuries ago, under colonial rule, and continues to this present date. Due to high levels of endemism, extensive loss and degradation of natural ecosystem, Sri Lanka has been identified as one of the 36 global biodiversity hotspots.

This book details, the biodiversity profile update component of the 6th National Report to the Convention on Biological Diversity (CBD). The data presented in this biodiversity update is up to date to the end of 2018. All existing information was collated from published literature and government information systems. Data were also collected from experts and were verified through a series of national level expert consultations held in Colombo and Kandy in 2018. New information to taxa was updated and was compared with two previous publications, the National Red List (2012) and the National Biodiversity Strategic Action Plan 2016-2022 (NBSAB) (2016).

This update also includes distribution maps for various taxonomic groups; distribution maps for butterflies, freshwater fish, birds, mammals and the flora of Sri Lanka were revised; and distribution

¹ Defined as species that are restricted to a very small spatial area, sometimes even as small as a few square kilometres.

maps were prepared for the first time, for freshwater crabs, odonates, land snails, amphibians, reptiles, orchids, marine and mangrove habitats. An assessment of the severity and spread of threats and issues to evaluated taxonomic groups and ecosystems is accordingly included, and an overall evaluation of the state of the environment is detailed.

This resulted in identifying critical landscapes that need enhanced protection, and key recommendations are provided to conserve the biodiversity of Sri Lanka.

Preparation of this compilation was possible due to the generous contribution of all biodiversity experts in the country. This compilation of information allows for informed decision making concerning present and future land use, as well as in reversing adverse decisions that have taken place. Outcomes also revealed the status of knowledge, the gaps and areas where future scientific investigations should focus on and where funds and resources to be directed. The knowledge on taxonomy and identification of species among these experts are at the highest standard possible. However, experts also agreed that current knowledge is mostly limited to taxonomy. Further details on biology, distribution and variables that determine distribution, habitat requirements to maintain viable populations, severity and spread of threats and accordingly conservation requirements have not been addressed for all taxa. To implement comprehensive landscape-level conservation strategies and actions, an immediate need for filling the vacuum mentioned above in knowledge exists.

Trithemis aurora (SW)



1

FAUNA OF SRI LANKA



1.1

Current Status and New
Additions to Selected
Taxonomic Groups

1.1.1 Scorpions



Reddyanus loebli (TR)

Table 1.1. Taxonomic additions and changes to scorpions of Sri Lanka since 2012. Data is provided for indigenous species, exotic species and endemics in parenthesis. 2012 data is from the National Red List of Sri Lanka, last compiled in 2012 (MOE, 2012), 2016 data is from the National Biodiversity Strategy and Action Plan (MoMD&E, 2016), and 2018 data was updated for the preparation of this 6th National Report (2019).

Taxonomic group	Red List 2012			NBSAP 2016			6 th NR 2018		
	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total
Scorpions	NA	NA	NA	17 (14)	1	18	18 (14)	1	19

As of 2018, 19 scorpion species are recorded from Sri Lanka, including 14 endemic species and an exotic species (Table 1.1; Appendix 1). The 19 species belong to four families, Buthidae (13 species), Chaerilidae (one species), Hemiscorpidae (one species), and Scorpionidae (four species). Figure 1.1 provides point locations for scorpions as provided by Prof. K.B. Ranawana.

Kovařík et al. (2016) described four new endemic species, *Charmus saradieli*, *Reddyanus ceylonensis*, *Reddyanus jayarathnei*, and *Reddyanus ranawana* in the family Buthidae. More recently, Kovařík et al. (2018) recorded *Liocheles australasiae* (Dwarf Wood Scorpion), for the first time from Sri Lanka.

The exotic scorpion, *Hottentotta tamulus* (Indian Red Scorpion), was recorded by Ranawana et al. (2013) for the first time from the Jaffna Peninsula, in the Northern dry zone of Sri Lanka. This species is considered as one of the most lethal scorpions in the world, with 8 to 40% fatality rate.

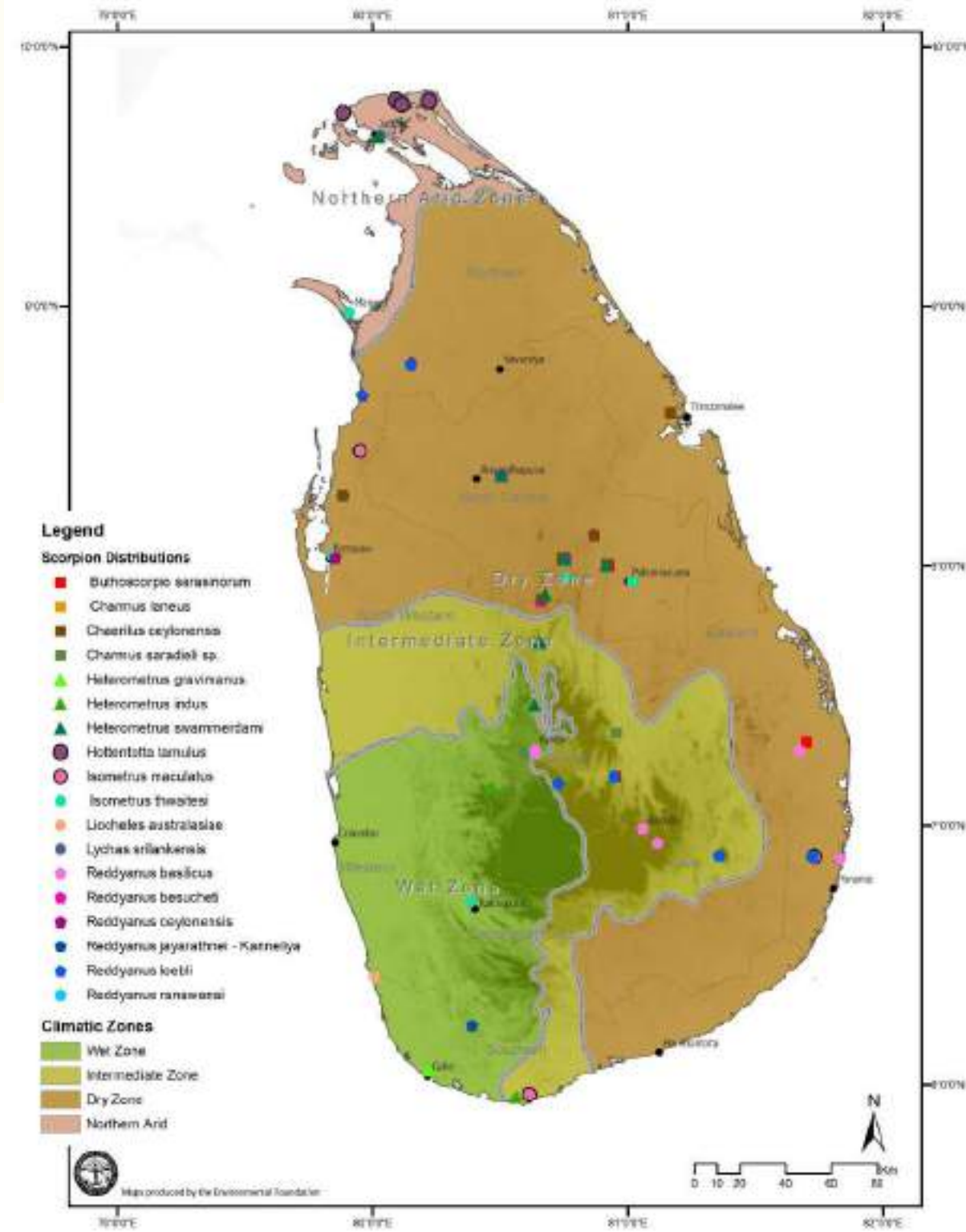


Figure 1.1. Point locations for scorpions. (Data provided by Prof. K.B.Ranawana.)

1.1.2 Spiders



Argiope aemula (PI)

As of 2018, 563 species of spiders from 49 Families were described from Sri Lanka, of which 275 are endemic species (Table 1.2; Appendix 2). This is an increase from the 499 species from 48 families listed in the National Red List 2012, compiled by Benjamin et al. (2012) also included 256 endemic species. Although Benjamin et al. (2012) provided species list for 501 species, there are repetitions for two species, namely, *Thiania bharnoensis* (Thorell, 1887) and *Parasteatoda tepidariorum* (Koch, 1841).

Since 2012, studies have led to several taxonomic revisions and addition of new species. Accordingly, four species, *Ascurisoma striatipes*, *Epectris mollis*, *Hispo bipartite*, and *Poecilotheria pedersenii*, were synonymised with *Cebrenninus striatipes*, *Opopaea mollis*, *Jerzego bipartitus*, and *Poecilotheria vittata*, respectively. Recent studies conducted by Benjamin (2015), Benjamin & Kanesharatnam (2016), Dong et al. (2016), Kanesharatnam & Benjamin (2016), Ranasinghe & Benjamin (2016), Polotow & Griswold (2017), Kanesharatnam & Benjamin (2018), Logunov & Azarkina (2018) and Ranasinghe & Benjamin (2018) described several new species, in the genera *Aprusia*, *Bavirecta*, *Brignolia*, *Bristowia*, *Campostichomma*, *Cavisternum*, *Devendra*, *Grymeus*, *Habrocestum*, *Ischnothyreus*, *Mogrus*, *Myrmarachne*, *Onomastus*, *Opopaea*, *Pelacinus*, *Pholcus*, *Schenkella*, *Silhouettella*, *Stenaelurillus* and *Xestaspis*. A new family, Udubidae was added to the Sri Lankan spider list by Polotow & Griswold (2017).

Table 1.2. Taxonomic additions and changes to spiders of Sri Lanka since 2012. Data is provided for indigenous species, exotic species and endemics in parenthesis. 2012 data is from the National Red List of Sri Lanka, last compiled in 2012 (MOE, 2012), 2016 data is from the National Biodiversity Strategy and Action Plan (MoMD&E, 2016), and 2018 data was updated for the preparation of this 6th National Report (2019).

Taxonomic group	Red List 2012			NBSAP 2016			6 th NR 2018		
	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total
Spiders	499 (256)	NA	501	NA	NA	NA	563 (275)		563

1.1.3 Millipedes



Paradoxosomatidae (HK)

Table 1.3. Taxonomic additions and changes to Millipedes of Sri Lanka since 2012. Data is provided for indigenous species, exotic species and endemics in parenthesis. 2012 data is from the National Red List of Sri Lanka, last compiled in 2012 (MOE, 2012), 2016 data is from the National Biodiversity Strategy and Action Plan (MoMD&E, 2016), and 2018 data was updated for the preparation of this 6th National Report (2019).

Taxonomic group	Red List 2012			NBSAP 2016			6 th NR 2018		
	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total
Millipedes	NA	NA	NA	NA	NA	NA	103 (82)	0	103

Millipedes are a group of arthropods belonging to the class Diplopoda in subphylum Myriapoda. Sri Lankan millipedes were first documented by Humbert in 1865, where he recorded 26 millipede species. The species list was then expanded by Pocock (1892), who added 10 millipedes new to science. Since then, there has been a limited number of studies, notably by Pocock (1898), Verhoeff (1930), Attems (1936), Carl (1922, 1932, 1941), Hoffman (1977) and Jeekel (1980). Recently, Zoyza et al. (2016) reviewed all published literature on millipedes of Sri Lanka and compiled a species list, which included 104 species in 44 genera, 18 families and nine orders. However, Zoyza et al. (2017) subsequently revised the number of species to 103 by adding one more species, *Spirostreptus kandyanus* (Humbert, 1865), and removing two species, namely *Thyropygus allevatus* (Karsch, 1881) and *Sphaeropoeus hercules* (Brandt, 1833), based on the misinterpretation of the statement by Hoffman (1982) as a synonymy.

Thus, the current (2018) list consists of 103 millipede species belonging to 43 genera, 17 families and nine orders, of which 82 (80%) are considered endemic (Zoyza et al., 2017; Table 1.3; Appendix 3). The nine genera, *Catapyrgodesmus*, *Cryocephalopus*, *Eustaledesmus*, *Lankadesmus*, *Lankasoma*, *Pocodesmus*, *Pyragrogonus*, *Singhalocryptus* and *Styloceylonicus* are endemic to Sri Lanka, in addition to the millipede family Lankasomatidae (Mauriès, 1981).



Arthrosphaeridae (HK)



Ceylonthelphusa rugosa (TR)

1.1.4 Crabs

Table 1.4. Taxonomic additions and changes to crabs (freshwater and marine) of Sri Lanka since 2012. Data is provided for indigenous species, exotic species and endemics in parenthesis. 2012 data is from the National Red List of Sri Lanka, last compiled in 2012 (MOE, 2012), 2016 data is from the National Biodiversity Strategy and Action Plan (MoMD&E, 2016), and 2018 data was updated for the preparation of this 6th National Report (2019).

Taxonomic group	Type	Red List 2012			NBSAP 2016			6 th NR 2018		
		Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total
Crabs	Freshwater	51 (50)	0	51	51 (50)	0	51	51 (50)	0	51
	Marine	369	0	369	NA	NA	NA	369	0	369
Total				420						420

As of 2018, 420 species of marine and freshwater crabs were described from Sri Lanka (Table 1.4; Appendix 4).

Of these, 51 species are freshwater crabs, including 50 endemic species (Table 1.4; Appendix 4), and 23 'point endemics', based on collection records (MOE, 2012). The five genera, *Ceylonthelphusa*, *Clinothelphusa*, *Mahatha*, *Pastilla*, and *Perbrinckia*, are endemic to Sri Lanka, and two species, *Clinothelphusa kakoota* and *Pastilla ruhuna*, are monotypic to their genera.

No taxonomic review was completed for Sri Lankan freshwater crabs since 2012. However, there are potentially five undescribed species (Pers. Com. Dinesh Gabadage) that could increase the total number, including the number of endemic species.

The coastal waters around Sri Lanka support 369 marine crabs (Table 1.4; MOE, 2012). There have been no recent attempts to update the marine crab list and taxonomy in Sri Lanka.

Table 1.5. Taxonomic additions and changes to dragonflies and damselflies (Odonata) of Sri Lanka since 2012. Data is provided for indigenous species, exotic species and endemics in parenthesis. 2012 data is from the National Red List of Sri Lanka, last compiled in 2012 (MOE, 2012), 2016 data is from the National Biodiversity Strategy and Action Plan (MoMD&E, 2016), and 2018 data was updated for the preparation of this 6th National Report (2019).

Taxonomic group	Type	Red List 2012			NBSAP 2016			6 th NR 2018		
		Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total
Odonates	Anisoptera (Dragonflies)	65 (15)	0	65				67 (16)	0	67
	Zygoptera (Damselflies)	53 (32)	0	53	124 (48)	0	124	63 (42)	0	63
Total				118			124			130

As of 2018, 130 species of dragonflies and damselflies were recorded from Sri Lanka (Table 1.5; Appendix 5), of which 58 species are endemic to the country. The latter include three damselfly genera, *Sinhalestes*, *Ceylonosticta* and *Platysticta*. *Sinhalestes orientalis* is monotypic for the genus *Sinhalestes*. All the Sri Lankan species (26), of the Platystictidae are endemic and belong to the distinct endemic subfamily Platystictinae.

Since the compilation of the National Red List in 2012, 14 species were added to the list of Odonata (Appendix 5), but two species were removed, indicating a net change of 12 species, and a total increase in the number of species from 118 to 130. This includes the addition of seven species to the genus *Ceylonosticta*. These changes were based on work by van der Poorten (2012), Bedjanič (2013), Conniff & Bedjanič (2013), Priyadarshana et al. (2015), Bedjanič et al. (2016), Priyadarshana et al. (2016), and Priyadarshana et al. (2018).

The 14 species that were added are, *Macromidia donaldi pethiyagodai*, *Archibasis lieftincki*, *Archibasis oscillans hanwellanensis*, *Paragomphus campestris*, *Gynacantha millardi*, *Platysticta secreta*, *Platysticta serendibica*, *Ceylonosticta alwisi*, *Ceylonosticta nancyae*, *Ceylonosticta rupasinghe*, *Ceylonosticta inferioreducta*, *Ceylonosticta mirifica*, *Ceylonosticta venusta*, and *Ceylonosticta goodalei*.

Two species have been removed from the list, *Platysticta greeni* (due to synonym of *Platysticta maculata*), and *Heliogomphus ceylonicus* (due to misidentification). Previous Sri Lankan representatives of the Protoneuridae, and Cordulidae families are now in Platycnemididae and Macromiidae, respectively.



Libellago greeni (AS)

1.1.5 Odonates



1.1.6 Termites

Termites are a group of insects in the infraorder Isoptera, epifamily Termitoidea, within the order Blattodea. The first study of termites of Sri Lanka was conducted by Wasmann (1893), followed by others later, from the 19th to the mid 20th century (Hemachandra et al., 2012). Since the early studies, there has been a gap, with only few sporadically published studies that focused mainly on termites associated with plantation crops available. The most extensive, contemporary work on Sri Lankan termites was done by Hemachandra et al. in 2012.

Hemachandra et al. (2012) compiled all published authentic information scattered in the literature on termites of Sri Lanka since 1893. They listed a total of 64 termite species belonging to 27 genera in four families, Hodotermitidae, Kalotermitidae, Rhinotermitidae and Termitidae (Table 1.6; Appendix 6). Of the 64 recorded species, 18 are endemic to Sri Lanka, whereas three species *Cryptotermes bengalensis*, *Cryptotermes cynocephalus* and *Coptotermes formosanus* are exotic (Hemachandra et al., 2012).

Then, Hemachandra et al. (2014) expanded the Sri Lankan termites list by recording eight species, namely *Odontotermes bellahunisensis*, *Odontotermes guptai*, *Odontotermes hainanensis*, *Hypotermes xenotermis*, *Nasutitermes kali*, *Ceylonitermes indicola*, *Bulbitermes* sp.1 and *Grallatotermes* sp. 1, as first records for Sri Lanka. Two of these genera, *Bulbitermes* and *Grallatotermes* were new to Sri Lanka (Hemachandra et al., 2014).

Thus, the 2018 list includes 72 termite species belonging to 29 genera in four families, of which 18 are endemic and three are exotic (Table 1.6; Appendix 6).

Odontotermes sp. (AS)

Table 1.6. Taxonomic additions and changes to termites of Sri Lanka since 2012. Data is provided for indigenous species, exotic species and endemics in parenthesis. 2012 data is from the National Red List of Sri Lanka, last compiled in 2012 (MOE, 2012), 2016 data is from the National Biodiversity Strategy and Action Plan (MoMD&E, 2016), and 2018 data was updated for the preparation of this 6th National Report (2019).

Taxonomic group	Red List 2012			NBSAP 2016			6 th NR 2018		
	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total
Termites	NA	NA	NA	NA	NA	NA	69 (18)	3	72



1.1.7 Thrips

Gigantothrips elegans (AS)

Table 1.7. Taxonomic additions and changes to thrips of Sri Lanka since 2012. Data is provided for indigenous species, exotic species and endemics in parenthesis. 2012 data is from the National Red List of Sri Lanka, last compiled in 2012 (MOE, 2012), 2016 data is from the National Biodiversity Strategy and Action Plan (MoMD&E, 2016), and 2018 data was updated for the preparation of this 6th National Report (2019).

Taxonomic group	Red List 2012			NBSAP 2016			6 th NR 2018		
	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total
Thrips	NA	NA	NA	NA	NA	NA	103 (0)	0	103

Thrips belong to the Order Thysanoptera in the class Insecta of the phylum Arthropoda. The order Thysanoptera is comprised of nine extant families (Mound & Morris 2004).

The first species list of thrips of Sri Lanka was published by Schmutz in 1913. Then, there was a long period during which no comprehensive research was conducted, except for a few studies conducted mainly on some agricultural and horticultural significant thrip species, until Thilakarathne et al. (2007) reviewed all published records on thrips of Sri Lanka and compiled a thrip species list, which formed the basis for field study on the diversity and ecology of thrips of Sri Lanka. This study lists a total of 78 species belonging to 46 genera and 3 families, viz. Aeolothripidae, Thripidae and Phlaeothripidae, in two suborders Terebrantia and Tubilifera.

Later, Tillekaratne et al. (2011) conducted a field survey on thrips in Sri Lanka and presented a species list of thrips, their distribution and their host plants. They recorded 72 thrip species in 45 genera during the survey from 324 host plant species in 83 plant families. Of the 72 thrips, 18 genera and 25 species were not previously recorded from Sri Lanka. No endemic thrips have been recorded from Sri Lanka (Tillekaratne et al., 2011).

Thus, as of 2018, 103 species of thrips belonging to three families have been recorded from Sri Lanka (Table 1.7; Appendix 7).



1.1.8 Ants

Polyrhachis sp. (AS)

Table 1.8. Taxonomic additions and changes to ants of Sri Lanka since 2012. Data is provided for indigenous species, exotic species and endemics in parenthesis. 2012 data is from the National Red List of Sri Lanka, last compiled in 2012 (MOE, 2012), 2016 data is from the National Biodiversity Strategy and Action Plan (MoMD&E, 2016), and 2018 data was updated for the preparation of this 6th National Report (2019).

Taxonomic group	Red List 2012			NBSAP 2016			6 th NR 2018		
	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total
Ants	194 (33)	0	194	NA	NA	NA	229 (33)	0	229

The study on ants of Sri Lanka was first begun by Bingham (1903), but received little attention for the next 50 years, until Wilson et al. (1956) conducted their studies. However, from 1950 to 2000, several taxonomic studies on ants of Sri Lanka was conducted by several authors; viz. Wilson et al. (1956), Wilson (1964), Jayasooriya & Traniello (1985), Bolton & Belshaw (1993), Dorow & Kohout (1995) and Dias & Chaminda (2000). Over the past two decades, the ants of Sri Lanka received more attention due to studies conducted by Dias et al. (2001), Dias & Chaminda (2001), Chaminda & Dias (2001), Dias (2005; 2006; 2008; 2011), Dias & Perera (2011), and Dias et al. (2011).

Dias et al. (2012) presented an ant species list and their conservation status, which included 194 species and 21 morpho-species in 61 genera and 12 subfamilies. Of these species and morpho-species, 33 are endemic to Sri Lanka. Later, Dias (2014) expanded the ant species list to 229 species in 66 genera and 12 subfamilies. Subfamilies include Aenictinae, Aneuretinae, Amblyoponinae, Cerapachyinae, Dolichoderinae, Dorylinae, Ectatomminae, Formicinae, Leptanillinae, Myrmicinae, Ponerinae and Pseudomyrmecinae. The subfamily Aneuretinae, which includes the monotypic genus *Aneuretus* (Sri Lanka Relict Ant (*Aneuretus simoni*) (Emery, 1893)) is endemic to Sri Lanka. Figure 1.2 shows sites from which this relict species, *Aneurectis simony* has been confirmed (Karunaratna and Karunaratne, 2013).

However, Brady et al. (2014), showed that Cerapachyinae and several genera of dorylomorphs are non-monophyletic, and subsumed the six previous dorylomorph subfamilies, Aenictinae, Dorylinae, Ecitoninae, Aenictogitoninae, Leptanilloidinae and Cerapachyinae, into a single subfamily, Dorylinae. Thus, two subfamilies, Aenictinae and Cerapachyinae, are currently considered invalid, and the total number of subfamilies recorded from Sri Lanka was reduced, from the 12 described by Dias (2014), to 10.

As of 2018, 229 species and seven morpho-species of ants in 10 subfamilies have been recorded from Sri Lanka, including 33 endemic species (Table 1.8; Appendix 8). Since the compilation of the National Red List in 2012, 35 ant species have been added and three species *Paratrechina indica*, *Paratrechina taylori* and *Tetraponera petiolata* were removed, from the Sri Lankan ants list (Dias, 2014).

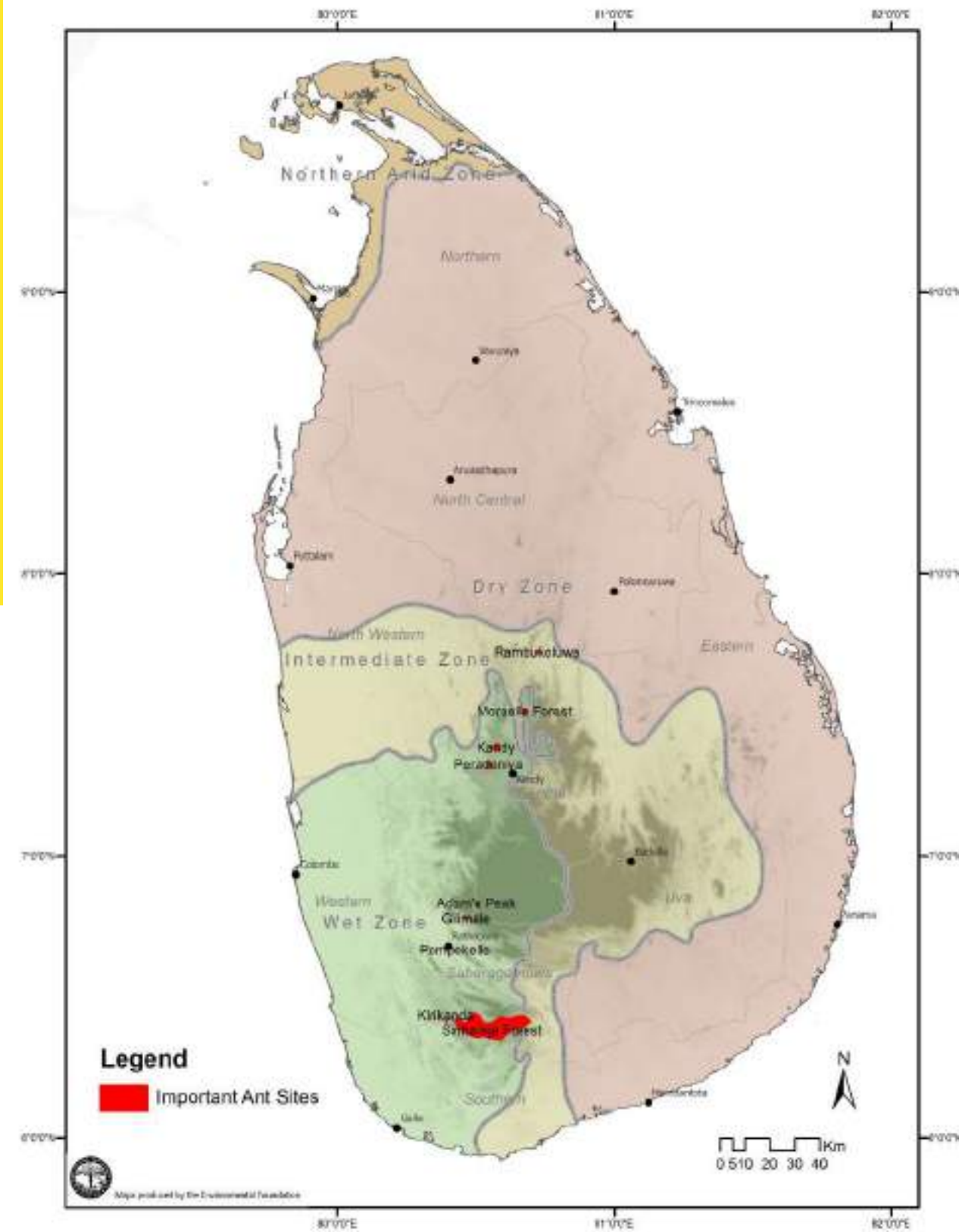


Figure 1.2. Collection locations of *Aneuretus simoni*, Sri Lankan Relict Ant. Map derived from Karunaratna and Karunaratne (2013).

1.1.9 Bees



Spotted Yellow Eye Hoverfly (L1)

Table 1.9. Taxonomic additions and changes to bees of Sri Lanka since 2012. Data is provided for indigenous species, exotic species and endemics in parenthesis. 2012 data is from the National Red List of Sri Lanka, last compiled in 2012 (MOE, 2012), 2016 data is from the National Biodiversity Strategy and Action Plan (MoMD&E, 2016), and 2018 data was updated for the preparation of this 6th National Report (2019).

Taxonomic group	Red List 2012			NBSAP 2016			6 th NR 2018		
	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total
Bees	130 (NA)	NA	130	130 (NA)	NA	130	159 (22)	0	159

Bees are in the order Hymenoptera and within the superfamily Apoidea, and are presently considered a clade, called Anthophila. Wijesekara (2001) compiled the first bee species list of Sri Lanka and published details and distribution records for 132 bee species, based on taxonomic literature. Later, Karunaratne et al. (2005) added 16 bee species, new to Sri Lanka, including a species, *Lipotriches edirisinghei*, new to science. They also updated the Sri Lankan bee list upto 148 species. In 2012, Karunaratne and Edirisinghe inserted a bee species list, to The National Red List 2012 of Sri Lanka, for the first time.

This included the conservation status for 130 species recorded from Sri Lanka. More recently, Karunaratne et al. (2017) added one new record of stingless bee species *Lisotrigona cacciae* to the Sri Lankan bee list, while Silva et al. (2018) rediscovered an endemic bee species *Tetragonula praeterita*, after 1860. However, *T. praeterita* has not appeared in any Sri Lankan bee species list after its first record from Sri Lanka, except for a single record by Rasmussen (2013) who reported the species in his publication on stingless bees of the Indian subcontinent, based on a single specimen deposited in the British Natural History Museum. The range distribution of this species, however, is now considered to be the entire island excluding the central hill zone (Figure 1.3).

The current species list (i.e. 2018 for the 6th National Report) was updated by reviewing Wijesekara (2001), Karunaratne et al. (2005), Karunaratne and Edirisinghe (2012), Karunaratne et al. (2017) and Silva et al. (2018). Ten species, *Xylocopa bhowara*, *Halictus trincomalicus*, *Lasioglossum (Ctenonomia) albescens*, *Lipotriches (Austronomia) ustula*, *Lipotriches austella*, *Nomia (Hoplonomia) strigata*, *Nomia elegantula*, *Nomia matala*, *Nomia rufa* and *Coelioxys intacta*, were added to the current species list based on the data available in Wijesekara (2001) and Karunaratne and Edirisinghe (2012). However, the taxonomic status and presence of these species in Sri Lanka need to be verified. Also, *Trigona* sp. has been identified as *Lisotrigona cacciae* Karunaratne et al. (2017).

Five species, namely *Nomia biroi*, *Nomia butteli*, *Nomia crassiuscula*, *Nomia oxybeloides*, and *Nomia puttalama* were excluded from the updated bees list, due to being synonymized with other known taxa from the group.

Thus, the current (2018 revision for the 6th National Report) list includes 159 bee species in 38 genera belonging to four families, Apidae, Colletidae, Halictidae, and Megachilidae, from Sri Lanka (Table 1.9; Appendix 9). These families include honey bees, stingless bees, sweat bees, carpenter bees, cuckoo bees, etc. Apidae and Halictidae are two larger bee families present in Sri Lanka, with each family consisting of 61 species. Megachilidae is represented by 36 species and Colletidae is represented by only two species (Appendix 9). Out of recorded species, 22 bees are endemic to Sri Lanka (Table 1.9; Appendix 9).

Figure 1.3 shows range distributions for five species of bees, provided by Prof. Inoka Karunaratne and Dr. R.W.K. Punchihewa.



Vespidae (US)

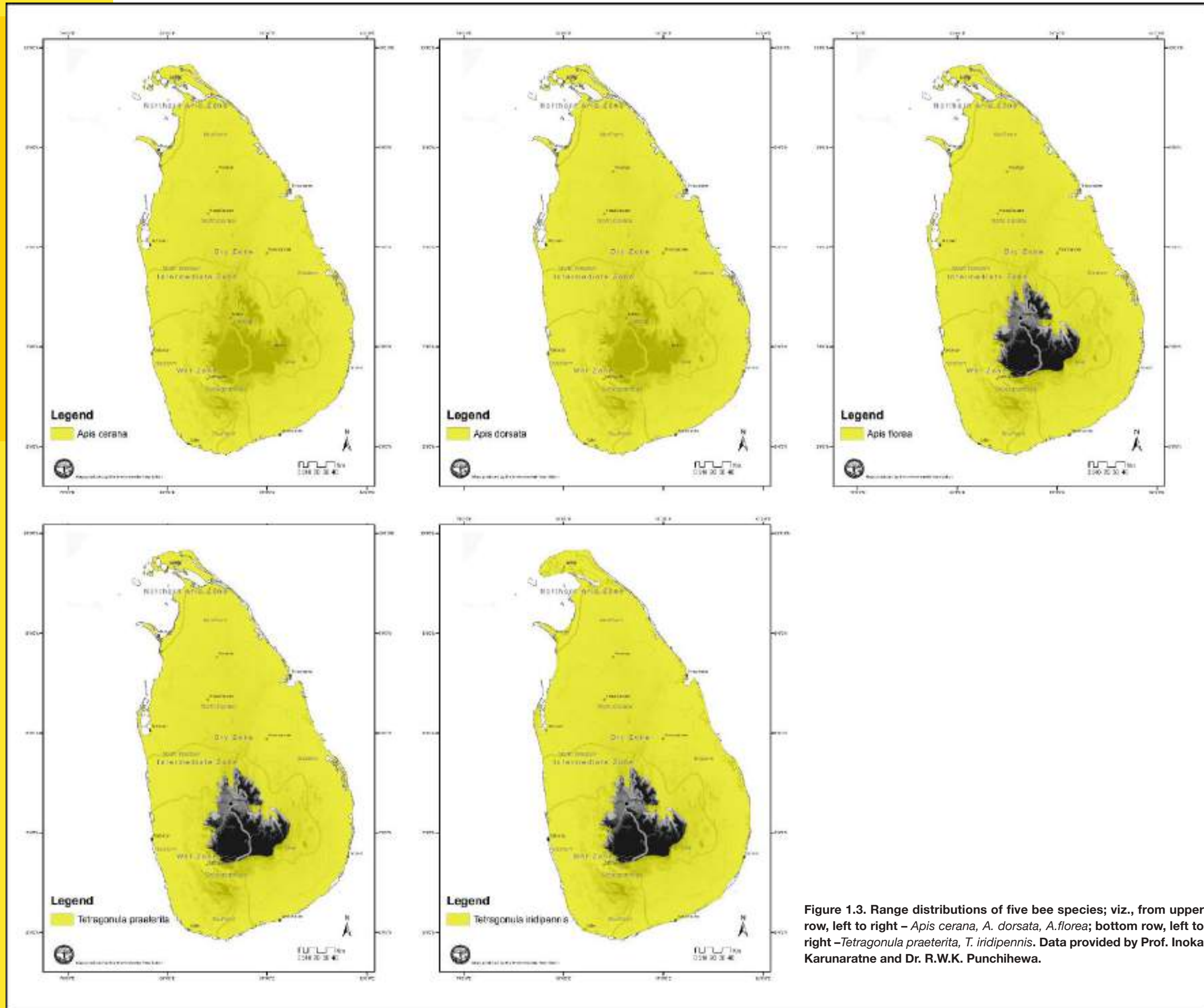


Figure 1.3. Range distributions of five bee species; viz., from upper row, left to right – *Apis cerana*, *A. dorsata*, *A. florea*; bottom row, left to right – *Tetragonula praerita*, *T. iridipennis*. Data provided by Prof. Inoka Karunaratne and Dr. R.W.K. Punchihewa.



1.1.10 Firefly Beetles

Table 1.10. Taxonomic additions and changes to firefly beetles of Sri Lanka since 2012. Data is provided for indigenous species, exotic species and endemics in parenthesis. 2012 data is from the National Red List of Sri Lanka, last compiled in 2012 (MOE, 2012), 2016 data is from the National Biodiversity Strategy and Action Plan (MoMD&E, 2016), and 2018 data was updated for the preparation of this 6th National Report (2019).

Taxonomic group	Red List 2012			NBSAP 2016			6 th NR 2018		
	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total
Firefly beetles	NA	NA		NA	NA		35 (2)	0	35

As of 2018, 35 species of firefly beetles from order Coleoptera, superfamily Elateroidea, which includes Lampyrid and Rhagophthalmid beetles, have been recorded from Sri Lanka (Table 1.10; Appendix 10). Of these, two species, *Harmatelia bilinia* and *Harmatelia discalis* are considered endemic to Sri Lanka (Wijekoon et al., 2012). The 35 species belong to two families, 34 species in Lampyridae and three species in Rhagophthalmidae (Appendix 10). Two taxa, *Stenocladus* sp. 1 and *Stenocladus* sp. 2 have been identified only into genus.

The range distributions of 11 species of fireflies have been mapped, based on data provided by Mr. W. M. C. D. Wijekoon and Dr. H. C. E. Wegiriya, which is shown by Figures 1.4a, 1.4b, and 1.4c.

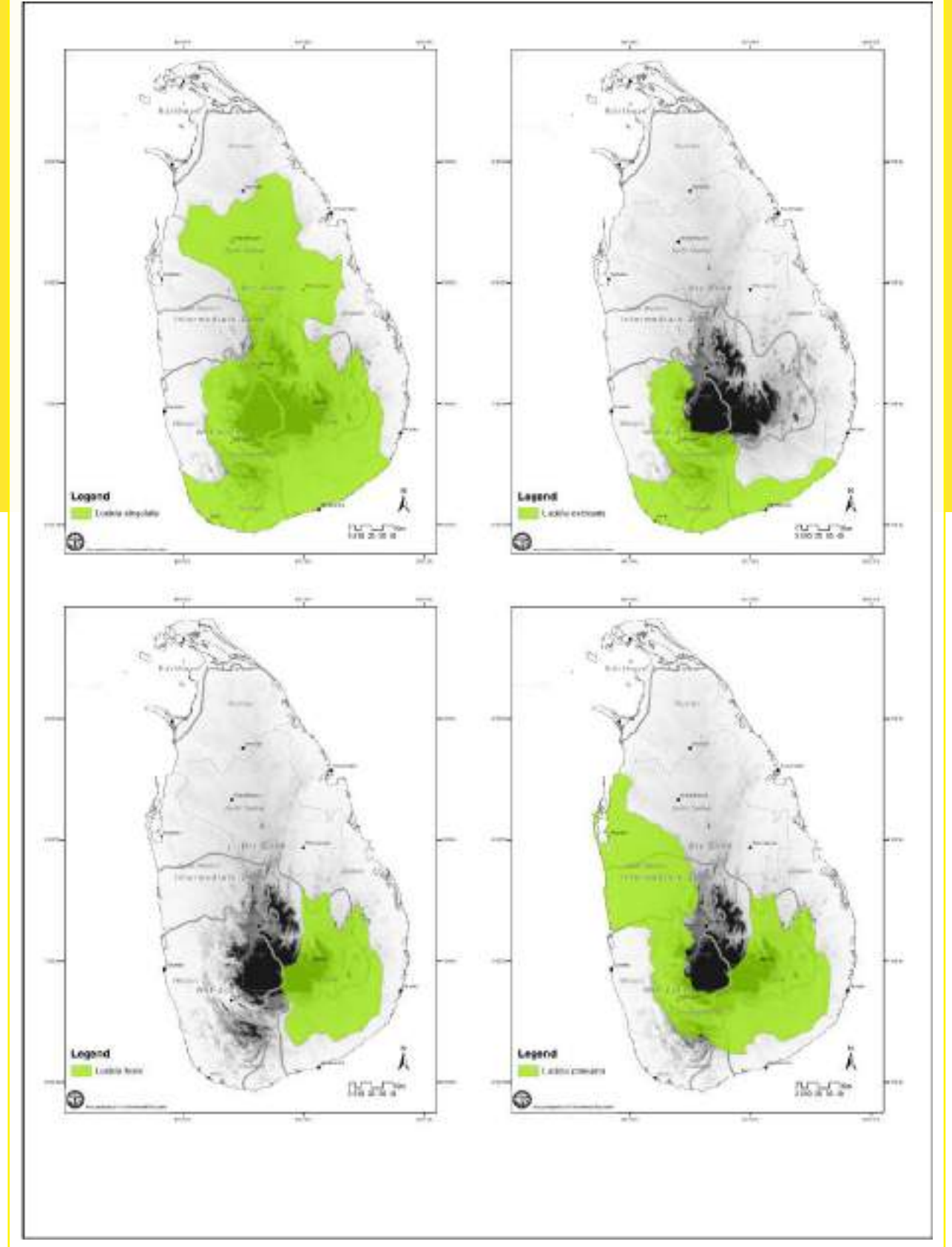


Figure 1.4a. Range distributions of four firefly species: viz. *Luciola cingulata*, *L. extricans*, *L. horni*, and *L. praeusta*. Data provided by Dr. H.C.E. Wegiriya and Mr. W.M.C.D. Wijekoon.

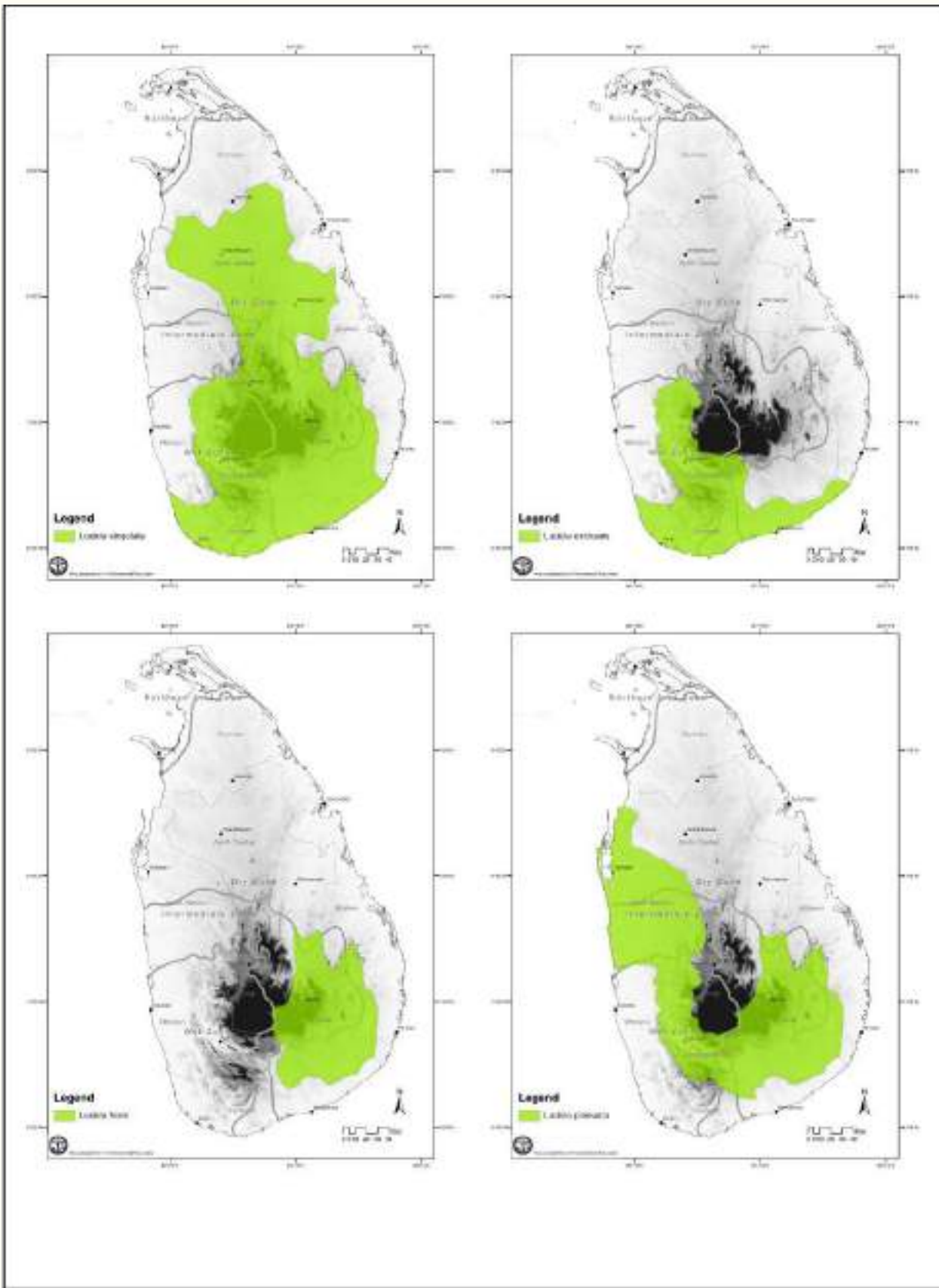


Figure 1.4b. Range distributions of four firefly species: viz. *Abscondita perplexa*, *A. promelaena*, *D. lutescens*, and *D. vitrifera*. Data provided by Dr. H.C.E. Wegiriya and Mr. W.M.C.D. Wijekoon.

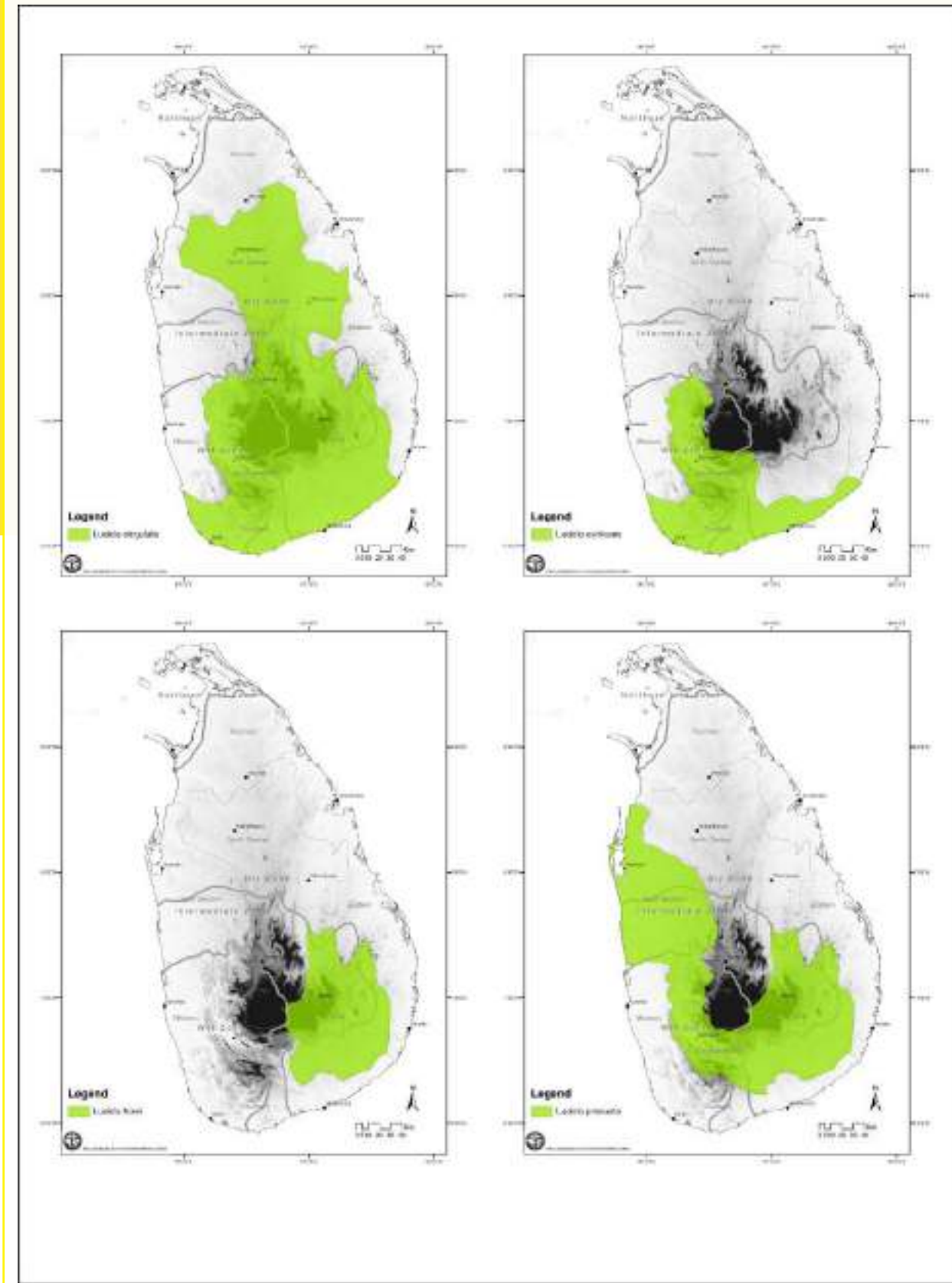


Figure 1.4c. Range distributions of four firefly species: viz. *Asymmetricata humeralis*, *Curtos costipennis* and *Lampigera tenebrosa*. Data provided by Dr. H.C.E. Wegiriya and Mr. W.M.C.D. Wijekoon.

1.1.11 Butterflies

Table 1.11. Taxonomic additions and changes to butterflies of Sri Lanka since 2012. Data is provided for indigenous species, exotic species and endemics in parenthesis. 2012 data is from the National Red List of Sri Lanka, last compiled in 2012 (MOE, 2012), 2016 data is from the National Biodiversity Strategy and Action Plan (MoMD&E, 2016), and 2018 data was updated for the preparation of this 6th National Report (2019).

Taxonomic group	Red List 2012			NBSAP 2016			6 th NR 2018		
	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total
Butterfly	243 (26)	2	245	243 (26)	2	245	245 (31)	3	248

As of 2018, 248 species of butterflies have been recorded from Sri Lanka (Table 1.11; Appendix 11). Of these, 31 species are endemic, 10 belong to the Lycaenidae (the species *Udara singalensis* is now considered as endemic to Sri Lanka), nine belong to Nymphalidae, eight to Hesperidae (*Coladenia tissa*, *Halpe ceylonica*, *Halpe egena*, and *Potanthus satra* are now considered endemic), two belong to Papilionidae, and two to Pieridae.

Three species are exotic, namely, *Catopsilia scylla*, *Cephrenes trichopepla*, and *Erionota torus*. Since the compilation of the National Red List in 2012, three butterfly species, *Arhopala bazaloide*, *Curetis siva*, and *Erionota torus*, have been recorded from Sri Lanka by Gunawardana et al., (2015) and van der Poorten and van der Poorten (2016), and were included in the list.

The species found in Sri Lanka, previously considered to be the Common Blue Bottle (*Graphium sarpedon*), is now identified as Narrow Banded Blue Bottle (*Graphium teredon*).



Trumala limniace (SW)



Chilades pandava (SW)

1.1.12 Land Snails



Beddomea albizonatus (UC)

As of 2018, 253 species of land snails have been recorded from Sri Lanka, of which 205 are endemic (Table 1.12; Appendix 12). The latter include five endemic genera; namely *Acavus*, *Oligospira*, *Aulopoma*, *Ravana*, and *Ratnadvipia*. *Ravana politissima* is monotypic within its genus.

The last published national list of land snails with 253 species appeared in the National Red List 2012 of Sri Lanka (MoE, 2012). Although the National Biodiversity Strategic Action Plan (MoMD&E, 2016) indicated 254 land snail species from Sri Lanka, the publication has not provided a list of species. According to De Alwis Goonatilake pers com. (2018), the additional species in this list was found to be *Allopeas panayensis*. However, Naggs and Raeem (2000) treated this taxon only as a variety of a valid species included in the 2012 list (*A. gracile* var. *panayensis*). Hence, the expert group maintain to follow MoE (2012) in treating 253 as the number of land snail species in Sri Lanka, including 205 endemic species (Perera, S.J. pers com., 2018). Whereas, inputs from MoMD&E (2016) were considered in finalizing the exotic species status of the slugs *Laevicaulis alte* and *Semperula siamensis*, while *S. maculata* is considered here as an indigenous slug due to the GBIF record of “Ceylon” as its type locality (GBIF, 2018).

Based on recent publications and global taxonomic revisions in this group (Raheem et al., 2009, 2014; Bouchet et al., 2017), 46 species of land snails have been identified as taxonomically uncertain. Thus, 26 land snail species from the National Red List of Sri Lanka (MoE, 2012) have now been proposed for removal, while several other species have been proposed to be aggregated, which will bring the total down to 186 species (D. Raheem pers com., 2018). However, until these proposals are published we have maintained the total at 253 species as given later in the Appendix 12. Aforesaid taxonomic treatments are represented in genera *Ariophanta*, *Eurychlamys*, *Lagocheilus*, and *Pterocyclos* of the current list (Appendix 12), compared to the last published national list of land snails (MoE, 2012).

Table 1.12. Taxonomic additions and changes to land snails of Sri Lanka since 2012. Data is provided for indigenous species, exotic species and endemics in parenthesis. 2012 data is from the National Red List of Sri Lanka, last compiled in 2012 (MOE, 2012), 2016 data is from the National Biodiversity Strategy and Action Plan (MoMD&E, 2016), and 2018 data was updated for the preparation of this 6th National Report (2019).

Taxonomic group	Red List 2012			NBSAP 2016			6 th NR 2018		
	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total
Land snails	232 (205)	21	253	230 (203)	24	254	230 (205)	23	253

1.1.13 Echinoids



Jacksonaster depressum tenue (GA)

Table 1.13. Taxonomic additions and changes to echinoids of Sri Lanka since 2012. Data is provided for indigenous species, exotic species and endemics in parenthesis. 2012 data is from the National Red List of Sri Lanka, last compiled in 2012 (MOE, 2012), 2016 data is from the National Biodiversity Strategy and Action Plan (MoMD&E, 2016), and 2018 data was updated for the preparation of this 6th National Report (2019).

Taxonomic group	Red List 2012			NBSAP 2016			6 th NR 2018		
	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total
Echinoids	55 (0)	NA	55				76 (1)		76

Echinoids, commonly known as sea urchins (including specific forms such as sand dollars, heart urchins, lamp urchins and their allies) belong to the class Echinoidea. The first recorded echinoid species from Sri Lanka, *Salmacis virgulatus* [now known as *S. virgulata* in Agassiz and Desor (1846)], was listed by Agassiz and Desor (1846). Then, Agassiz (1872) mentioned Ceylon (Sri Lanka) as localities for *Clypeaster humilis* (Leske, 1778), based on specimens collected by Humbert and de Lorient, and *Echinolampas ovata* (Leske, 1778), and based on a specimen in the British Museum collection, in his Revision of the Echini. However, the first Sri Lankan echinoids list was compiled by Bell (1882). Subsequent knowledge of Sri Lankan echinoids is mainly attributed to several other studies conducted at the end of the 19th and the 20th centuries by Walter (1885), Sarasin and Sarasin (1886; 1887; 1888), Bell (1887), Döderlein (1888), Ludwig (1890), Anderson (1894), Herdman et al. (1904), Southwell (1911), Clark (1915), Koehler (1914; 1922), and Mortensen (1948a; 1948b; 1950; 1951), Clark and Rowe (1971), and Price and Rowe (1996). These were followed by sporadically published records (see Arachchige et al. 2017 for review). However, most of these studies are not exclusive to Sri Lankan echinoids. Hence, there is a gap in knowledge from the mid 20th to the beginning of the 21st centuries, due to the lack of systematic studies, except for two checklists published in the IUCN Red List in 2006 and 2012. Jayakody (2012) listed 55 species belonging to 17 families, recorded from shallow coastal waters of Sri Lanka in the National Red List, 2012 (MOE, 2012).

Recently, Arachchige et al. (2017) reviewed all published records on the Sri Lankan echinoid fauna and listed 66 echinoid species and one subspecies belonging to 20 families in nine orders, recorded from Sri Lanka sensu stricto. Arachchige et al. (2017) excluded 49 species from the Sri Lankan echinoids list because of uncertainty in records (16 species) or due to junior synonymy with taxa recorded under different names (33 species).

These exclusions include:

- *Peronella oblonga*, *Elipneustes denudatus*, *Metalia latissima* and *Rhynobrissus pyramidalis* that occur outside Sri Lankan waters.
- *Asthenosoma intermedium*, *Microcyphus maculatus*, *Temnopleurus alexandri*, *Salmacis sphaeroides*, *Clypeaster australasiae* and *Mortonia australis* because of uncertain identifications.
- *Echinometra lucunter*, *Temnopleurus reevesii*, *Lytechinus thieryi*, *Fibularia cribellum*, *Fibularia volva* and *Fibulariella oblonga* on account of single unverified records.

Arachchige et al. (2017) also added 18 species and one subspecies to the Sri Lankan echinoids list and revealed that three holotypes and eight paratype specimens of echinoids have been collected from Sri Lanka. Six of these, *Stylocidaris tiara*, *Stylocidaris albidens*, *Araeosoma coriaceum indicum*, *Salmacis roseoviridis*, *Salmacis virgulata*, and *Microcyphus ceylanicus*, are type specimens of “regular” echinoids and five of these, *Clypeaster fervens*, *Peronella macroproctes*, *Echinocyamus sollers*, *Elipneustes rubens*, and *Brissopsis bengalensis*, are members of the infraclass, Irregularia. Only one subspecies, *Araeosoma coriaceum indicum*, appears to be endemic to Sri Lankan waters (Arachchige et al., 2017).

More recently, Arachchige et al. (2019) conducted an extensive field survey and added six species, *Echinocyamus megapetalus*, *Fibularia ovulum*, *Fibulariella angulipora*, *Echinodiscus cf. truncatus*, *Peronella oblonga*, and *Brissus cf. agassizii*, which were new to Sri Lanka and four unidentified (identified up to genus level) species which were concluded possibly new species of *Fibularia*, *Jacksonaster* and *Metalia*.

Thus, as of 2018, the total number of echinoid species (both “regular” and irregular) occurring in Sri Lanka, stands at 75 species and one subspecies which is endemic to Sri Lanka, belonging to 48 genera, 20 families in nine orders (Table 1.13; Appendix 13).

1.1.14 Fish



Rasboroides pallidus (SG)

Table 1.14. Taxonomic additions and changes to fresh and marine/brackish water fishes of Sri Lanka since 2012. Data is provided for indigenous species, exotic species and endemics in parenthesis. 2012 data is from the National Red List of Sri Lanka, last compiled in 2012 (MOE, 2012), 2016 data is from the National Biodiversity Strategy and Action Plan (MoMD&E, 2016), and 2018 data was updated for the preparation of this 6th National Report (2019).

		Red List 2012			NBSAP 2016			6 th NR 2018		
Taxonomic group	Type	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total
Fish	Freshwater	91 (50)	24	115	92 (55)	27	119	97 (61)	31	128
	Brackish & Marine	1377	NA	1377	1377	NA	1377	1384	NA	1384
Total		1468		1492	1469		1496	1481		1512

The 2018 updates reveal 1,512 fish species recorded from fresh, brackish and marine waters of Sri Lanka (Table 1.14). Of the total, 128 fish species live in freshwater bodies and of the above 128 species, 61 are restricted to freshwater bodies in Sri Lanka. Two genera, *Malpulutta* and *Rasboroides*, are endemic to Sri Lanka. *Malpulutta* is also a monotypic genus, represented by *Malpulutta kretseri*.

In addition, 31 introduced fish species inhabit the freshwater bodies.

Updates to the knowledge on freshwater fish species are provided by Batuwita et al. (2013), Ng & Pethiyagoda (2013), Wijethunga (2015), Sudasinghe et al. (2016), Sudasinghe & Meegaskumbura (2016), Batuwita et al. (2017), Eschmeyer et al. (2018), Roese & Pauly (2018), Sudasinghe (2018), and Sudasinghe et al. (2018). These updates include the addition of 16 species, and the removal of seven, from the species list published in the Red List 2012.

The species added are, *Devario annnataliae*, *Devario micronema*, *Devario monticola*, *Devario udenii*, *Labeo heladiva*, *Lophocampus ocellatus*, *Mystus nanus*, *Mystus zeylanicus*, *Ompok argestes*, *Ompok ceylonensis*, *Rasboroides pallidus*, *Redigobius bikolanus*, *Schistura scripta*, *Schistura madhavai*, *Sicyopterus lagocephalus* and *Stenogobius gymnopomus*.

Of these, nine are newly described, and 12 are endemic to the country.

The seven species that were removed are, *Devario aequipinnatus*, *Labeo dussumieri*, *Mystus vittatus*, *Mystus seengtee*, *Ompok bimaculatus*, *Sicyopterus halei* and *Stenogobius malabaricus*.

Batuwita et al. (2013) revised the danionine genera *Rasboroides* and *Horadandia* and added *Rasboroides rohani* and *Rasboroides nigromarginatus*. Sudasinghe et al. (2018) used an integrative taxonomic analysis of morphometry metrics and mitochondrial DNA sequences to show that actually *Rasboroides rohani* is a synonym of *Rasboroides pallidus* and that *Rasboroides nigromarginatus* is a synonym of *Rasboroides vaterfloris*. Ng and Pethiyagoda (2013) confirmed distinctiveness of *Mystus cf. seengtee* from *Mystus seengtee* and described it as *Mystus zeylanicus*. So, *Mystus seengtee* is now considered to be restricted to India. Sudasinghe et al. (2016) showed Sri Lankan striped *Mystus*, which has been misidentified as *Mystus vittatus*, is a distinct species and described as *Mystus nanus*. Sudasinghe & Meegaskumbura (2016) revealed that there are two species of *Ompok* in Sri Lanka, *Ompok argestes*, and *Ompok ceylonensis*. As per this study, *Ompok bimaculatus* is not a Sri Lankan *Ompok* species, and is found in India. Batuwita et al. (2017) reviewed the genus *Devario* and added four species, *Devario annnataliae*, *Devario micronema*, *Devario monticola* and *Devario udenii* to the Sri Lankan freshwater fish species list. In addition, *Devario aequipinnatus* was excluded from the list. More recently, Sudasinghe et al. (2018) reviewed Sri Lankan species in genus *Labeo* and described a new species, *Labeo heladiva* from Sri Lanka. Also, *Labeo dussumieri* was removed from the list as this species is no longer considered a valid species in Sri Lanka. *Sicyopterus halei*, and *Stenogobius malabaricus* are currently considered as synonyms of *Sicyopterus lagocephalus* and *Stenogobius gymnopomus*, respectively.

In addition, *Butis butis* (Hamilton, 1822) and *Eleotris fusca* (Forster, 1801) were not considered as freshwater fish species. Also, Batuwita et al. (2016) recorded *Butis gymnopomus* for first time from Sri Lanka. These three species were added to brackish and marine water species list.

Four species of sharks, namely, *Centrophorus moluccensis* (Bleeker, 1860), *Centrophorus granulosus* (Bloch & Schneider, 1801), *Megachasma pelagios* (Taylor, Compagno & Struhsaker, 1983), and *Planonasus parini* (Weigmann, Stehmann & Theil, 2013), were added to the marine species list of Sri Lanka by de Silva (2015).

There are no recent extensive studies that was conducted on brackish and marine fish of Sri Lanka, except few new records. Thus, the species list is mainly based on the National Red List 2012 (MOE, 2012), which includes a total of 1,384 brackish and marine fish species, which includes the four newly recorded *Butis gymnopomus* and sharks mentioned above (Table 1.14; Appendix 14).



Schistura notostigma (SG)



Pseudophilautus ocularis (DJS)

1.1.15 Amphibians

Table 1.15. Taxonomic additions and changes to amphibians of Sri Lanka since 2012. Data is provided for indigenous species, exotic species and endemics in parenthesis. 2012 data is from the National Red List of Sri Lanka, last compiled in 2012 (MOE, 2012), 2016 data is from the National Biodiversity Strategy and Action Plan (MoMD&E, 2016), and 2018 data was updated for the preparation of this 6th National Report (2019).

		Red List 2012			NBSAP 2016			6 th NR 2018		
Taxonomic group		Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total
Amphibian		111 (95)	NA	111	119 (105)	0	119	119 (106)	0	119

Based on collations of the published literature and data collected from expert consultation workshops for the preparation of this 6th National Report of Sri Lanka to the Convention of Biological Diversity (CBD) 2018, Sri Lanka supports 119 amphibian species, of which 106 (89%) are endemic (Table 1.15; Appendix 15). These include four endemic genera: *Adenomus*, *Lankanectes*, *Nannophrys*, and *Taruga*.

Since 2012, 13 new species of amphibians have been added to the species list by Wickramasinghe et al. (2013), Biju et al. (2014), Meegaskumbura et al. (2015), Wickramasinghe et al. (2015), Wijayathilaka et al. (2016), Jayawardena et al. (2017), Garg et al. (2018), and Senevirathne et al. (2018). The 13 new species that were added are *Indosylvirana serendipi*, *Lankanectes pera*, *Microhyla mihintalei*, *Pseudophilautus bambaradeniyai*, *Pseudophilautus dayawansai*, *Pseudophilautus jagathgunawardana*, *Pseudophilautus karunaratnai*, *Pseudophilautus newtonjayawardanei*, *Pseudophilautus puranappu*, *Pseudophilautus samarakoon*, *Pseudophilautus sirilwijesundarai*, *Pseudophilautus dilmah*, and *Uperodon rohani*. All of these are endemic to Sri Lanka.

As a result of some taxonomic revisions to this group by Biju et al. (2014), Meegaskumbura et al. (2015), Wijayathilaka et al. (2016), Jayawardena et al. (2017), and Garg et al. (2018), five species of amphibians were removed from the recent list of amphibians. These are *Adenomus dasi*, *Duttaphrynus atukoralei*, *Hylarana aurantiaca*, *Microhyla rubra*, and *Ramanella variegata*. Of these five species, first two were considered endemic to Sri Lanka.

1.1.16 Reptiles



Trimeresurus trigonocephalus (UC)

Table 1.16. Taxonomic additions and changes to reptiles of Sri Lanka since 2012. Data is provided for indigenous species, exotic species and endemics in parenthesis. 2012 data is from the National Red List of Sri Lanka, last compiled in 2012 (MOE, 2012), 2016 data is from the National Biodiversity Strategy and Action Plan (MoMD&E, 2016), and 2018 data was updated for the preparation of this 6th National Report (2019).

		Red List 2012			NBSAP 2016			6 th NR 2018		
Taxonomic group	Type	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total
Reptiles	Inland	190 (125)	NA		196 (131)	1	197	198 (135)	1	199
	Marine	21			21		21	21		21
Total		211		211	217		218	219		220

Based on the existing databases and current updates, 220 reptile species have been recorded from Sri Lanka (Table 1.16; Appendix 16). Of these, 135 species are endemic. Thirty five species belong to seven endemic genera, namely, *Aspidura*, *Ceratophora*, *Chalcidoseps*, *Cophotis*, *Lankascincus*, *Lyriocephalus* and *Nessia*. Two are monotypic genera are represented by *Chalcidoseps thwaitesi* and *Lyriocephalus scutatus*.

Twenty one marine reptile species were recorded from Sri Lanka's coastal area, with no additions or changes to the list since 2012.

Trachemys scripta or Red-eared Slider is an exotic terrapin that has been introduced into the country through the pet trade.

Updates to the knowledge on reptiles are taxonomic revisions by Amarasinghe et al. (2014), Vidanapathirana et al. (2014), Amarasinghe et al. (2015), Batuwita (2016), Batuwita & Udugampala (2016), Pyron et al. (2016), Wickramasinghe (2016), Wickramasinghe et al. (2016), Agarwal et al. (2017), Batuwita & Edirisinghe (2017), Batuwita et al. (2017), Wickramasinghe et al. (2017a), and Wickramasinghe et al. (2017b). Since the Red List 2012 was compiled, 13 reptiles have been described and added to the species list. These include *Aspidura ravanai*, *Calotes manamendrai*, *Calotes pethiyagodai*, *Cnemaspis kandambyi*, *Cnemaspis rajakarunai*, *Cnemaspis rammalensis*, *Dendrelaphis sinharajensis*, *Eutropis austini*, *Eutropis greeri*, *Nessia gansi*, *Rhinophis roshanpererai*, *Sitana bahiri*, and *Sitana devakai*.

Five species have been removed from the list during the revisions, namely, *Cnemaspis clivicola*, *Eutropis macularia*, *Platyplectrurus madurensis*, *Sitana ponticeriana*, and *Uropeltis ruhunae*.



1.1.17 Birds

Table 1.17. Taxonomic additions and changes to birds of Sri Lanka since 2012. Number of endemic (E) species, breeding residents (BR), migrants (M) and exotic species (ET) are provided. 2012 data is from the National Red List of Sri Lanka, last compiled in 2012 (MOE, 2012), 2016 data is from the National Biodiversity Strategy and Action Plan (MoMD&E, 2016), and 2018 data was updated for the preparation of this 6th National Report (2019).

		Red List 2012					NBSAP 2016					6 th NR 2018				
Taxonomic group		BR (E)	BR+M	M	ET	Total	BR (E)	BR+M	M	ET	Total	BR (E)	BR+M	M	ET	Total
Birds		219 (27+6)	21	213	NA	453	221 (34)	NA	276	1	498	214 (33)	30	266	NA	510

A total of 510 bird species have been recorded from Sri Lanka to date (Table 1.17; Appendix 17). Of these, 244 are known to have breeding populations in Sri Lanka, and 33 species are considered as endemic to the country (Table 1.17). The other 181 species are breeding residents to Sri Lanka, and 30 of these breeding residents are also represented by migrant populations. Another 266 recorded species are migrants, and this group includes regular migrants, irregular migrants and vagrants. However, some ornithologists consider the status of 45 species records as uncertain records for Sri Lanka.

Since 2012, four breeding resident bird species have been added to the list of birds in Sri Lanka, namely, *Dendrocygna bicolor*, *Anous stolidus*, *Anous tenuirostris*, and *Dinopium psarodes*. Until recently, *Dinopium benghalense* and *D. psarodes* were lumped as *D. benghalense* but *D. benghalense* psarodes has been elevated to a full species and accepted as Lesser Sri Lanka Flameback (*D. psarodes*) and considered to be endemic to Sri Lanka (del Hoyo et al., 2014). Black-rumped Flameback (*D. benghalense*) is also present in Sri Lanka and considered a native resident to Sri Lanka and India (BirdLife International, 2018).

Sri Lanka Scaly Thrush (*Zoothera imbricata*) was previously considered as endemic to Sri Lanka but is now accepted as a synonym of White's Thrush (*Zoothera aurea*), which is not an endemic species and has a wide distribution (BirdLife International, 2018).

Several other taxonomic revisions including the following are made :

- Common Hill Myna (*Gracula religiosa*) has been removed from the Sri Lankan bird list, considering that its distribution does not extend to Sri Lanka. Instead the *Gracula* population present in Sri Lanka is now recognized as Southern Hill Myna (*Gracula indica*), which is restricted to Sri Lanka and Western Ghats of India.
- Hypsipetes leucocephalus* and *H. ganeesa* were previously lumped as *H. leucocephalus* following Sibley and Monroe (1990; 1993) and del Hoyo et al. (2016). But now, both species are accepted as full species. However, Asian Black Bulbul (*H. leucocephalus*) was excluded from the list as the distribution of this species does not cover Sri Lanka. Instead, *H. ganeesa*, which is restricted to Sri Lanka and Western Ghats of India is included in the list as a species.
- Surniculus lugubris* and *S. dicruroides* were previously lumped as *S. lugubris* following Sibley and Monroe (1990, 1993), but now both are considered two distinct species (del Hoyo et al., 2014). The Drongo Cuckoo/Square-tailed Drongo-cuckoo (*S. lugubris*) was removed from the Sri Lankan bird list because this species is only found in South-East Asia (BirdLife International, 2018). Thus, the *Surniculus* population in Sri Lanka is accepted as Fork-tailed Drongo-cuckoo (*S. dicruroides*).
- Sri Lanka Bay-owl (*Phodilus assimilis*) was previously considered as a subspecies of *P. badius* but is now accepted as a distinct species, and added to the species list. *P. badius* is not included in the Sri Lankan bird list as its distribution is restricted to South-East Asia (BirdLife International 2018).
- Until recently, Greater Sri Lanka Flameback (*Chrysocolaptes stricklandi*) was considered a subspecies of *C. lucidus*, but is now considered a full species and endemic to Sri Lanka (BirdLife International, 2018).



Merops orientalis (MA)

Lepus nigricollis (ZA)

1.1.18

Mammals

Table 1.18. Taxonomic additions and changes to mammals of Sri Lanka since 2012. Data is provided for indigenous species, exotic species and endemics in parenthesis. 2012 data is from the National Red List of Sri Lanka, last compiled in 2012 (MOE, 2012), 2016 data is from the National Biodiversity Strategy and Action Plan (MoMD&E, 2016), and 2018 data was updated for the preparation of this 6th National Report (2019).

		Red List 2012			NBSAP 2016			6 th NR 2018		
Taxonomic group	Type	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total
Mammals	Inland	95(21)	12	107	96 (21)	12	108	94(19)	12	106
	Marine	30	NA	30	33	NA	33	29	NA	29
Total		125		137	129		141	123		135

As of 2018, a total of 135 mammal species have been recorded from Sri Lanka, with 129 indigenous and 19 endemic species (Table 1.18; Appendix 18). There are 29 marine mammal species and 12 exotic mammal species.

There are two monotypic endemic genera represented by *Srilankamys ohiensis* (Ohiya Rat, or Sri Lanka Bi-coloured Rat) and *Solisorex pearsoni* (Pearson's Long-clawed Shrew).

Martin et al. (2007) using phylogenetic analysis established *Muntiacus malabaricus* as a species distinct to Sri Lanka and the Western Ghats. Hence, what was previously known as *Muntiacus muntjac* (Barking Deer) is now recognised as *Muntiacus malabaricus*.

Five species have been added to the list since 2012 based on taxonomic revisions and new records by Ilangakoon (2012), Martenstyn (2013), Nanayakkara et al. (2014), de Vos (2017), and Yapa (2017). The added species are *Delphinus capensis*, *Miniopterus fuliginosus*, *Herpestes fuscus*, *Ziphius cavirostris*, and *Balaenoptera omurai*.

Seven species, namely, *Miniopterus schreibersii*, *Herpestes brachyurus*, *Paradoxurus montanus*, *Paradoxurus stenocephalus*, *Tursiops aduncus*, *Delphinus delphis* and *Balaenoptera borealis* have been removed from the mammal species list of Sri Lanka based on taxonomic revisions.

1.2 Distribution Maps of Selected Taxonomic Groups

Zonation maps were revised or prepared de novo for selected taxonomic groups by experts who attended a series of workshops. The experts were tasked with drawing the boundaries on Google Earth, based on their knowledge, and in consultation within their respective expert groups. The resulting Google Earth (.kml) files were then imported into ArcGIS software. The zonation boundaries were then aligned to biogeographical features to make them more accurate. For instance, the montane areas were defined using the 1,000 meter elevation contour derived from the 30 meter Digital Elevation Model. The climatic zonation map (Figure 1.5) was used to align wet zone forests, intermediate zone ecosystems and the dry zone to the respective taxonomic zones, based on these vegetation and habitat types. The ecoregion map for Sri Lanka was also used to define the arid zones, especially in the northern area of Sri Lanka. Details of specific zone boundaries and Areas of Special Interest and Taxonomic Uniqueness (ASITU) and their justifications for the respective taxa are provided in the following sections. Three main criteria were proposed to qualify a geographical area as an ASITU by the experts who attended the workshop. The criteria are as follows,

1. If the area hosts any point endemic species or any restricted range species.
2. If the area hosts high species diversity or unique species assemblage compared to the surrounding zone.
3. If the area hosts a unique occurrence of a species compared to the surrounding zone.

The final zonations are based on several subsequent consultations with, and feedback from, the experts.

Horton Plains, Hakgala (SS)

1.2.1 Freshwater Crab Zones of Sri Lanka

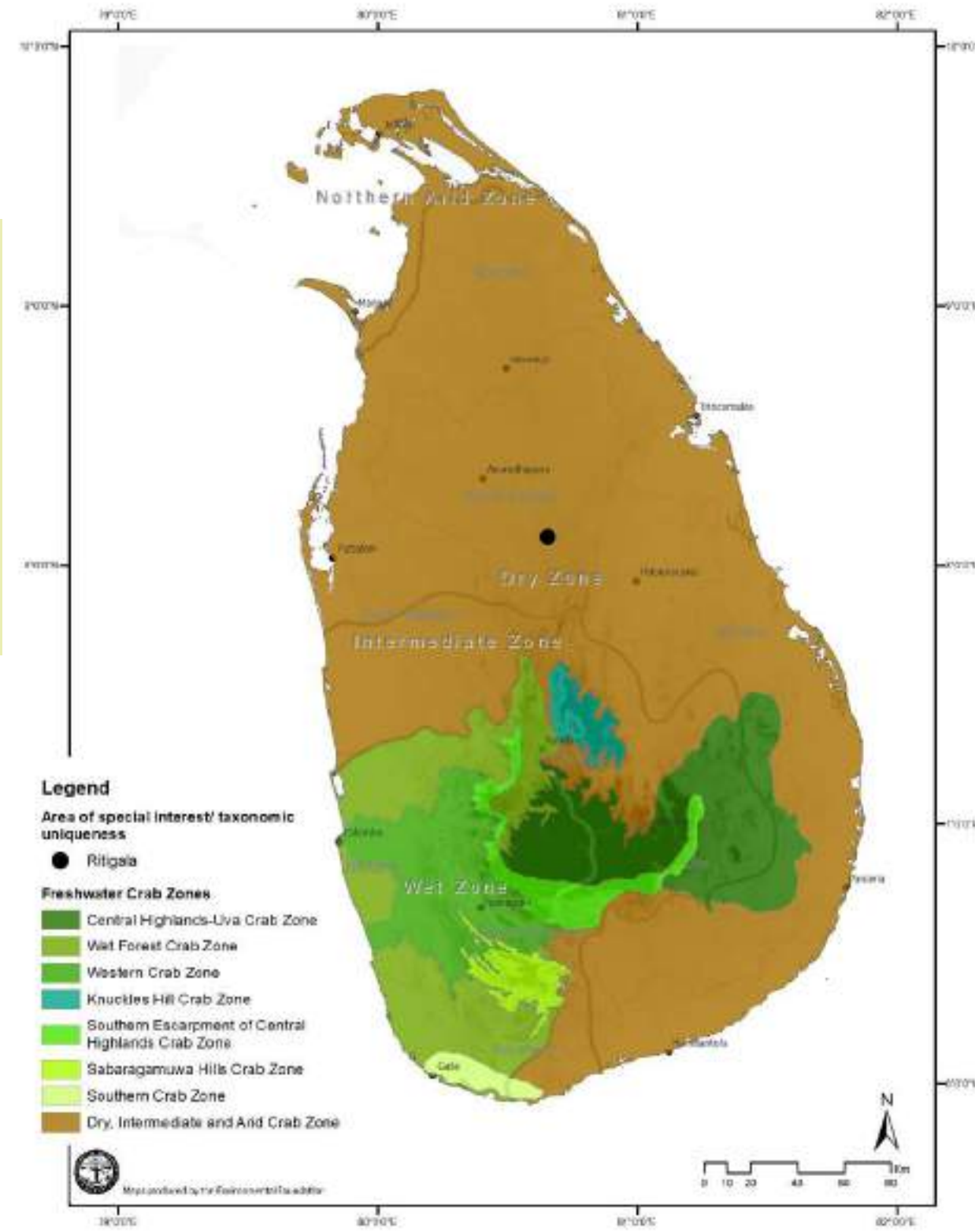
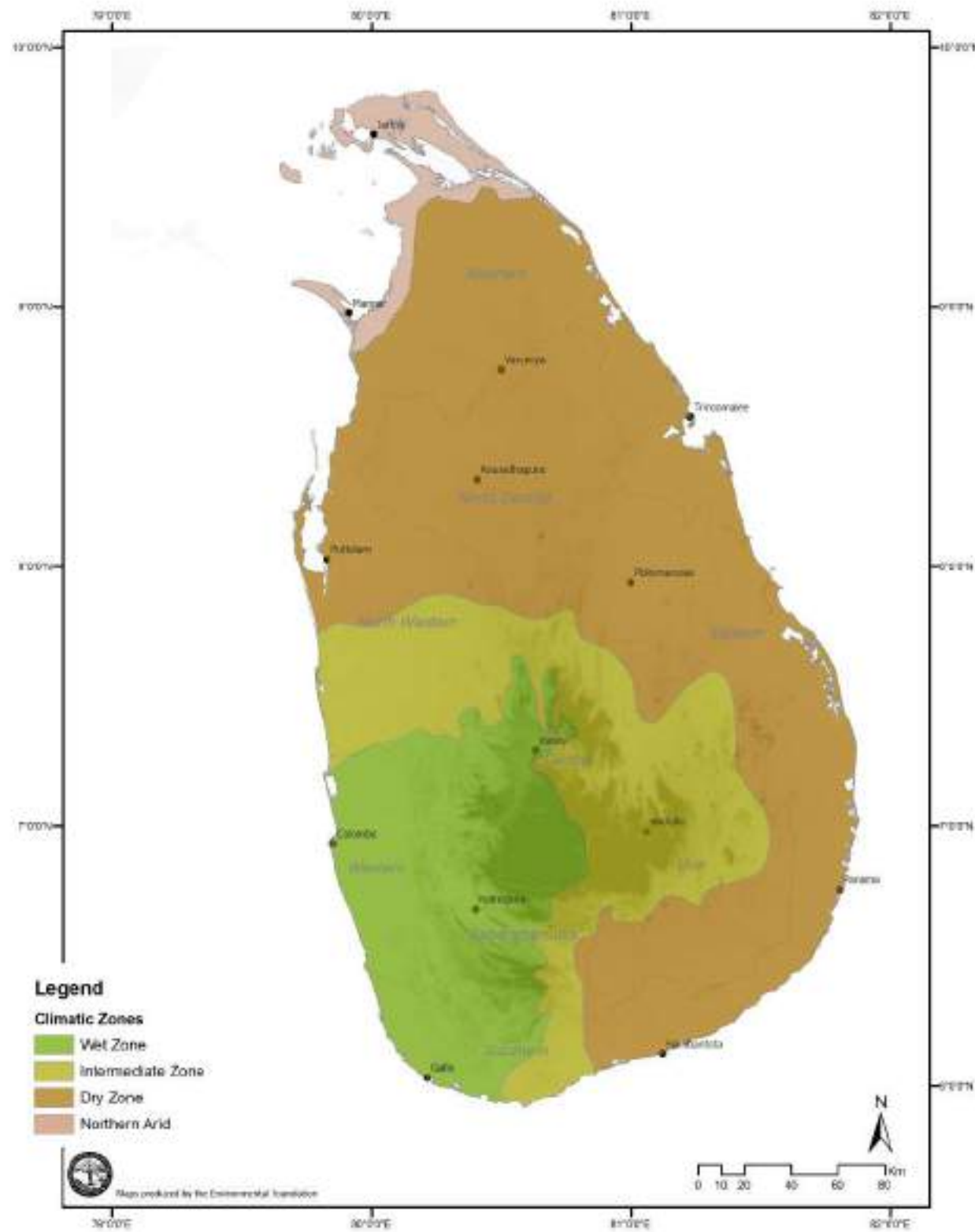


Figure 1.5. Climatic Zones of Sri Lanka, overlaid on the 30 m Digital Elevation Model to show topographic variation. The Climatic Zone map is derived from Muthuwatta & Liyanage (2013).

Figure 1.6. Freshwater crab zones of Sri Lanka, based on the biogeographic distribution of freshwater crab species. The zones are based on expert input during workshops and subsequent consultations. The freshwater crab zones are overlaid on the climatic zones of Sri Lanka, and the Digital Elevation Model.

This biogeographic distribution zone map for freshwater crabs of Sri Lanka represents the first such map for this taxonomic group. It recognizes eight zones and one area of special interest/taxonomic uniqueness (Figure 1.6). Six zones represent the wet climatic zone, one narrow zone lies along the escarpment between the second and third peneplains, and one zone represents the intermediate and dry climatic zones. Since freshwater crabs are still being surveyed and described, this zone map should be considered a work in progress.

Central Highlands-Uva Crab Zone

The Central Highlands-Uva Crab Zone represents the central massif, above 1,000 m and extends eastwards to include the lower hills in the eastern Uva region, including Balangoda, Kitulgala, Mawanella, Katugasthota, Rantambe, Karametiya, Radaliyadda, Monaragala, Pelwatta, Koslanda, and Ahaspokuna areas (Figure 1.6). The characteristic species assemblage in this zone include *Ceylonthelphusa alpina*, *Ceylonthelphusa armata*, *Ceylonthelphusa orthos*, *Ceylonthelphusa soror*, *Mahatha helaya*, *Mahatha iora*, *Mahatha regina*, *Oziothelphusa stricta*, *Perbrinckia enodis*, *Perbrinckia gabadagei*, *Perbrinckia glabra*, *Perbrinckia morayensis*, *Perbrinckia punctata*, *Perbrinckia scitula*, and *Perbrinckia uva*, that are restricted to the zone. Most of these species are critically endangered.

Wet Forest Crab Zone

The Wet Forest Crab Zone represents most of the wet climatic zone, below 1,000 m, except for the Western Crab Zone, Sabaragamuwa Hills Crab Zone, and Southern Crab Zone, which have been recognized as distinct zones (Figure 1.6 and see below). Characteristic species found in this zone are *Oziothelphusa populosa*, *Perbrinckia scansor*, and *Spiralothelphusa parvula*.

Western Crab Zone

This zone represents the wet climatic zone below 300 m, and includes the areas from Kalutara to Moratuwa, Peliyagoda, Karawanella, Deraniyagala, Niwithigala, Batamandiya, and Mathugama. Species characteristic of this zone are, *Ceylonthelphusa rugosa*, *Clinothelphusa kakoota*, *Oziothelphusa populosa*, *Perbrinckia cracens*, and *Spiralothelphusa parvula*.

Knuckles Hill Crab Zone

The Knuckles Hill Zone was identified as a distinct freshwater crab zone because several species are confined to this zone, viz. *Ceylonthelphusa callista*, *Ceylonthelphusa cavatrix*, *Ceylonthelphusa diva*, *Ceylonthelphusa durrelli*, *Ceylonthelphusa sanguinea* and *Mahatha Adonis*. This zone is represented by the Knuckles mountain range above 500 m, and includes Elagolla, Matale, Palapathwela, Dambaghamada, Meegolla, Kalugala and Kandegama.

Southern Escarpment of Central Hills Crab Zone

The Southern Escarpment of the Central Hills Crab Zone was proposed as a distinct freshwater crab zone because of its unique habitats, species distribution, and species composition. This zone includes Palabaddala, part of Peak Wilderness Sanctuary, Bambarakanda falls, Haldummulla, and Landuyaya areas. The elevation of this zone is between 1,250 m to 2,100 m. *Ceylonthelphusa orthos*, *Mahatha helaya*, and *Mahatha iora* are characteristic to this zone.

Sabaragamuwa Hill Crab Zone

The Sabaragamuwa Hill Crab Zone includes the area below 1,100 m in the wet climatic zone, and includes Hiniduma, Baduraliya, Kalawana, Godakawela, Middeniya, Katuwana, and Morawaka areas. Several species, viz. *Ceylonthelphusa savitriae*, *Oziothelphusa dakuna*, *Perbrinckia fenestra*, *Perbrinckia integra*, *Perbrinckia quadratus*, and *Perbrinckia rosae*, are restricted to this zone.

Southern Crab Zone

The Southern Crab Zone includes the area from Galle to Matara along the coastal region, and from Kottawa to Panaduwa along the northern boundary, below 100 m elevation (Figure 1.6). *Ceylonthelphusa kandambyi*, *Ceylonthelphusa sentosa*, *Mahatha lacuna*, *Oziothelphusa gallicola*, *Pastilla ruhuna*, and *Perbrinckia nana*, have only been recorded from this zone.

Dry, Intermediate and Arid Crab Zone

This zone represents most of the dry, intermediate and arid climatic zones, with a few exceptions that are included in other zones (Figure 1.6). *Ceylonthelphusa rugosa*, *Oziothelphusa hippocastanum*, *Oziothelphusa intuta*, and *Oziothelphusa minneriyaensis*, are largely confined to this zone.

Areas of Special Interest and Taxonomic Uniqueness (ASITU)

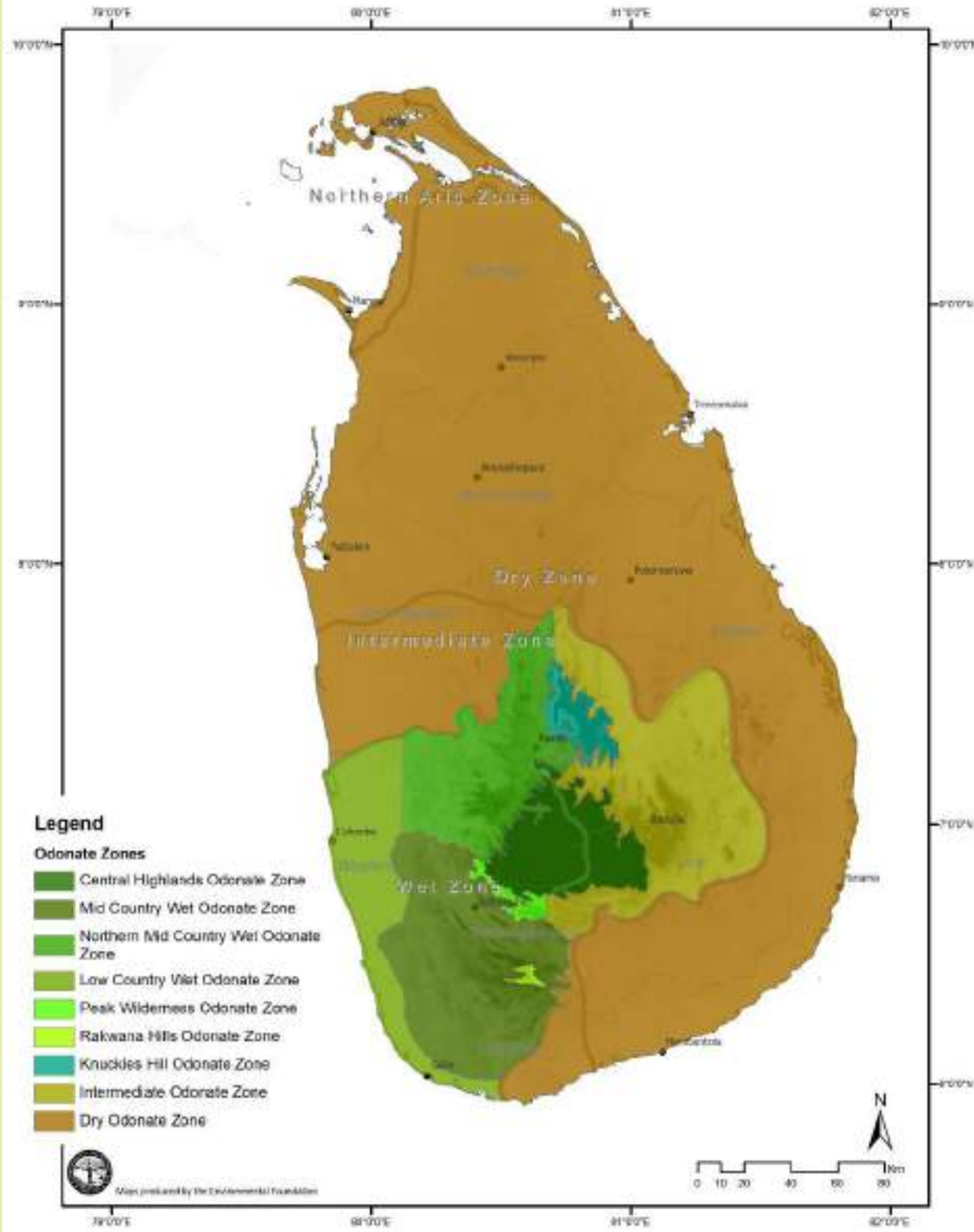
Ritigala

Ritigala was identified as a Special Interest and Taxonomic Uniqueness area for freshwater crab, considering the unique freshwater crabs in this zone, in comparison to the surrounding Dry Zone. *Oziothelphusa ritigala* is an endemic species restricted to the zone.



Riverston (ZA)

1.2.2 Odonate Zones of Sri Lanka



This biogeographic distribution zone map for odonates of Sri Lanka represents the first of its kind for this taxonomic group. It recognizes nine zones (Figure 1.7). Seven zones represent the wet climatic zone, and one zone represents the eastern region of the intermediate climatic zone. The dry and arid climatic zones and the rest of the intermediate zone is represented by one odonate zone.

Central Highlands Odonate Zone

This zone represents the submontane and montane habitats above 1,000 m elevation. The zone is characterized by montane odonates, viz. Mountain Reedling (*Indolestes gracilis*), Charming Forest damsel (*Ceylonosticta venusta*), and Red-veined Darter (*Sympetrum fonscolombii*), which are largely confined to this zone.

Mid Country Wet Odonate Zone

The Mid Country Wet Odonate Zone includes area in the wet climatic zone below the Kelani valley, in the Peak Wilderness mountain range below 500 m, below 900 m in the Rakwana hill range, and in the adjoining hills above 300 m. Ebony Gem (*Libellago corbeti*), Lieftinck's Sprite (*Archibasis lieftincki*), Fuhstorfer's Junglewatcher (*Hylaeothemis fuhstorferi*), Sri Lanka Vermilion Forester (*Lyriothemis defonsekal*) are largely confined to this zone. These species are endemic to Sri Lanka and considered to be critically endangered or endangered based on their restricted distribution.

Northern Mid Country Wet Odonate Zone

The Northern Mid Country Wet Odonate Zone was proposed as a distinct odonates zone because the endemic and critically endangered species, Nobel Shadowdamsel (*Ceylonosticta digna*), Paraproct-less Shadowdamsel (*Ceylonosticta inferioreducta*), and Wall's Shadowdamsel (*Ceylonosticta walli*) are restricted to this zone. The zone includes the areas to the north of the Kelani river valley, and is bordered by the Low Country Wet Zone, Mid Country Wet Zone, Peak Wilderness Zone, Central Hill Zone, Intermediate Zone, and Knuckles Zone (Figure 1.7).

Low Country Wet Odonate Zone

The Low Country Wet Odonate Zone comprises the areas along the coastal belt of the wet climatic zone. Species that inhabit open wetlands, can be found in this zone. Hanwella Sprite (*Archibasis oscillans hanwellanensis*) is an endemic subspecies confined to this zone.

Peak Wilderness Odonate Zone

The Peak Wilderness Odonate Zone includes the Peak Wilderness mountain range and Balangoda hills, above 500 m from the South and the West and above 1,500 m from other directions. The species composition in this zone is comprised largely of the montane odonates, but several endemic species, viz. Emerald Sri Lankan Spreadwing (*Sinhalestes orientalis*), Alwis's Shadowdamsel (*Ceylonosticta alwisi*), Ratnapura Shadowdamsel (*Ceylonosticta mirifica*), Nancy's Shadowdamsel (*Ceylonosticta nancyae*), Rupasinghe's Shadowdamsel (*Ceylonosticta rupasinghe*), Blue-shouldered Cornuted Shadowdamsel (*Ceylonosticta subtropica*), and several other as yet-undescribed *Ceylonosticta* species are confined to this zone.

Rakwana Hills Odonate Zone

The Rakwana Hills Odonate Zone was identified as a distinct odonate zone since two new and as of yet, undescribed, Platystictidae species are confined to the zone, with the potential for more discoveries. This zone includes the area that above 900 m in the Rakwana hill range. Most other montane odonates species can be found in this zone.

Knuckles Hill Odonate Zone

The Knuckles Hill Zone was considered a different odonate zone primarily because the endemic and critically endangered *Ceylonosticta adami* (Adam's Shadowdamsel) is largely restricted to this zone. Most other montane odonates are also found in this zone, including *Ceylonosticta submontana*, which is endemic to Sri Lanka and critically endangered. The zone includes areas above 900 m in the Knuckles mountain range.

Intermediate Odonate Zone

The Intermediate Odonate Zone is located mainly to the east of the Knuckles and Central hills within the intermediate climatic zone. This zone supports a high odonate diversity because this climatic zone is an ecotone, transitioning from the wet to dry climatic zones, along with an elevation gradient. Two endemic species, Austin's Shadowdamsel (*Ceylonosticta austeni*) and Eastern Forestdamsel (*Platysticta secreta*) are restricted to this area. *Ceylonosticta austeni* is also a critically endangered species. Predominantly wet zone species, Sinuate Clubtail (*Burmagomphus pyramidalis sinuatus*), Forest Shadow-emerald (*Macromidia donaldi pethiyagodai*), the endemic Rivulet Tiger (*Gomphidia pearsoni*), Sri Lanka Sabretail (*Megalogomphus ceylonicus*), Wijaya's Scissortail (*Microgomphus wijaya*) and Sri Lanka Cruiser (*Macromia zeylanica*) are also found in this zone.

Dry Odonate Zone

The Dry Odonate Zone has been identified as a distinct odonate zone because of an assemblage comprised of several species, viz. Azure Sprite (*Pseudagrion decorum*), Vagrant Emperor (*Anax ephippiger*), Light-tipped Demon (*Indothemis carnatica*), and Coastal Pennant (*Macrodiplox cora*), largely restricted to the zone. This zone includes all the dry and semi-arid zones, and parts of the intermediate climatic zones (Figure 1.7).



1.2.3 Butterfly Zones of Sri Lanka

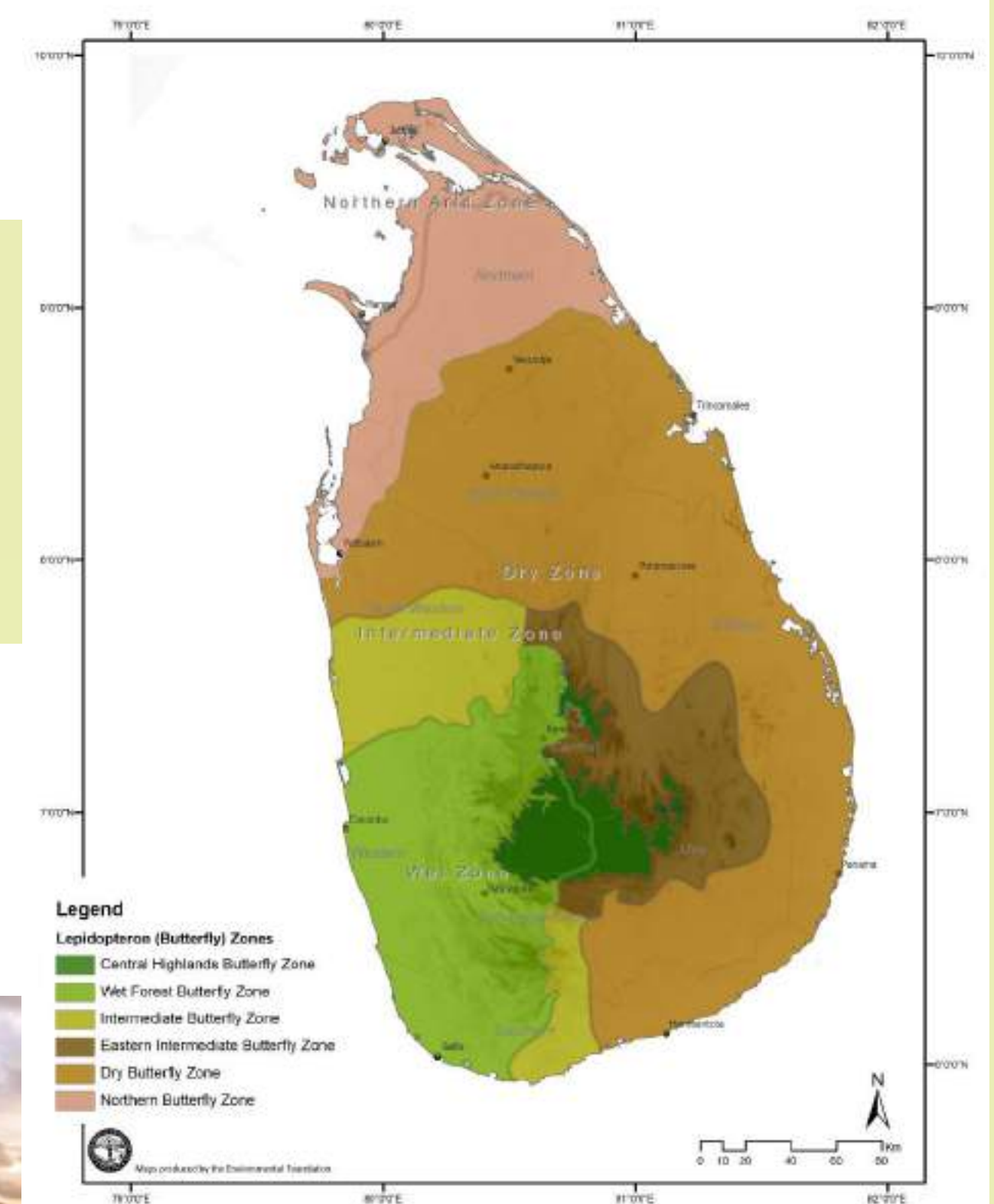


Figure 1.8. Butterfly zones of Sri Lanka, based on the biogeographic distribution of species. The zones are based on expert input during workshops and subsequent consultations. The butterfly zones are overlaid on the climatic zones of Sri Lanka, and the Digital Elevation Model.

Figure 1.7. Odonate zones of Sri Lanka, based on the biogeographic distribution of dragonfly and damselfly species. The zones are based on expert input during workshops and subsequent consultations. The odonate zones are overlaid on the climatic zones of Sri Lanka, and the Digital Elevation Model.

This biogeographic distribution zone map for butterflies of Sri Lanka (Figure 1.8) represents the second of its kind for this taxonomic group. Jayasinghe et al. (2013) presented the first biogeographic distribution zone map for butterflies of Sri Lanka. The most recent and most comprehensive account of butterflies was by van der Poorten and van der Poorten (2016), who used the climatic map of Sri Lanka to describe butterfly distributions. This zonation map recognizes six zones, with three zones in the wet climatic zone, two in the intermediate zone, and three zones in the dry climatic zone.

Central Highlands Butterfly Zone

This zone represents the submontane and montane rainforests in the central hills, above 1,200 m elevation (Figure 1.8). Protected areas such as Horton Plains National Park, Thangamale sanctuary, and Peak Wilderness sanctuary and higher elevations of the Knuckles mountain range are important areas for endemic butterflies in this zone (Jayasinghe et al., 2013). The zone supports several restricted-range, endemic species, viz. Greens Silverline (*Spindasis greeni*), Sri Lanka Tiger (*Parantica taprobana*), Sri Lanka Hedge Blue (*Udara lanka*), Sri Lankan Sinhalese Hedge Blue (*Udara singalensis*), and Sri Lanka Treebrown (*Lethe daretis*) and Small Leopard (*Phalanta alcippe*) (Jayasinghe et al., 2013). The Sri Lankan Green's Silverline is critically endangered in Sri Lanka and found after more than a century from the Horton Plains. Other restricted-range indigenous species found in this zone are Indian Fritillary (*Argynnis hyperbius*), Red Admiral (*Vanessa indica*), Painted Lady (*Vanessa cardui*), White Hedge Blue (*Udara akasa*), Plain Hedge Blue (*Celastrina lavendularis*). The last species is considered to be critically endangered, nationally. Butterflies are most abundant from January to April.

Wet Forest Butterfly Zone

This zone represents the lowland rainforests of the wet climatic zone, below 1,000 m elevation. Sinharaja Forest Reserve, Kanneliya Forest Reserve, Makandawa Forest Reserve, Athwelthota (Morapitiya-Runkanda), and Dombagaskanda (Bodhinagala) are some of the well-known forest areas that support endemic butterflies in this zone (Jayasinghe et al., 2013). Sinharaja and Kanneliya can be identified as sub-core areas within this wet zone. Some endemic species commonly found in this zone are Sri Lankan Rose (*Pachliopta jophon*), Sri Lankan Bird Wing (*Troides darsius*), Sri Lankan Forester (*Lethe dynsate*), Sri Lankan Cingalese Bushbrown (*Mycalesis rama*), Sri Lankan Paint Brush Swift (*Baoris penicillata*), Sri Lankan Ace (*Halpe ceylonica*), Sri Lankan Decorated Ace (*Thoressa decorata*). The Sri Lankan Paint Brush Swift is critically endangered and Sri Lankan Rose, Sri Lankan Forester, Sri Lankan Cingalese Bushbrown, Sri Lankan Ace, and Sri Lankan Decorated Ace are endangered species. Five-bar Swordtail (*Graphium antiphates*) is an indigenous butterfly that is restricted to this zone. Butterflies can be found throughout the year, except for a slight decline in numbers from May to July, due to monsoon rains.

Intermediate Butterfly Zone

This zone represents the northern and southern areas of the intermediate climatic zone (Figure 1.8), and includes Negombo, Muthurajawela, Badalgama, Pannala, Kekillapitiya, Dalupotha, Madipola, and Naula belongs to the northern area, and Udawalawa, Panamure, Agraphara, Kudawella, Dikwella, Maaliyadda, Talalla, Dondra in the southern area. There are no specific species which are restricted to the zone and species found in this zone are common species which inhabit wet and dry habitats. Butterflies are most abundant from December to June. Endemism is lower than in the Wet Zone, but higher than in the Dry Zone.

Eastern Intermediate Butterfly Zone

This zone includes the eastern region of the intermediate climatic zone and hills upto 1,200 m elevation in the eastern slopes, including Naula, Elaheera, Kolongoda, Udawela, Ulpathagama, Morayaya, Handaganawa, Bibila, Pitakumbura, Thalakolawewa, Kalthota, Uda Walawe Reservoir, and Panamure. It is differentiated from the rest of the Intermediate Zone (i.e. Intermediate Zone 2; Figure 1.8) because of a few species that are restricted to this zone, and the high diversity due to the ecotonal nature of the habitat, which includes a gradual transition from the wet habitats to the dry habitats and cooler hills and inclusion of savannah habitats. Some characteristic species found in this zone are Sri Lankan Jewel Four-ring (*Ypthima singala*), which is an endemic, endangered species, and Baronet (*Symphhaedra nais*) which is also indigenous and endangered (Autum Leaf). Butterfly abundance is highest from December to June.

Dry Butterfly Zone

This is the largest butterfly zone, and more or less confined to the dry climatic zone of Sri Lanka (Figure 1.8). Very few endemic butterflies (species as well as numbers) are recorded from this zone, and most of the species are similar to those recorded in the Indian subcontinent. The only known endemic species in this zone is Tamil Bushbrown (*Mycalesis subdita*), which is also restricted to this zone. Characteristic butterflies in this zone are Spot Swordtail (*Graphium nomius*), Yellow Orange Tip (*Ixias pyrene*), White Orange Tip (*Ixias marianne*), Small Salmon Arab (*Colotis amata*), Pioneer (*Belenois aurota*), and Common Gull (*Cepora nerissa*). Populations are most abundant from December to February and are usually higher than in the other zones during this time, but numbers decline from February until about September. Local migrations of butterflies begin from this zone.

Northern Butterfly Zone

The Northern Butterfly Zone was identified as a distinct butterfly zone, based on some species which are restricted to zone, viz. Crimson Tip (*Colotis danae*), Plain Orange Tip (*Colotis aurora*), Yellow Pansy (*Junonia hierta*), Joker (*Byblia lithyia*), Large Salmon Arab (*Colotis fausta*), Striped Pierrot (*Tarucus nara*), Sri Lankan Clouded Silverline (*Spindasis nubilus*), Scarce Shot silverline (*Spindasis elima*) and Plains Blue Royal (*Tajuria jehana*). The Yellow Pansy and Plains Blue Royal are considered critically endangered nationally, and are extremely rare. The zone boundary has been moved south of the northern arid climatic zone of Sri Lanka to include Arippu, and Iranamadu (Jayasinghe et al., 2013; Figure 1.8). Butterfly abundance is highest from December to January.



Graphium dason, *Polyura athamas*, and *Graphium sarpedon* (SW)

1.2.4 Land Snail Zones of Sri Lanka

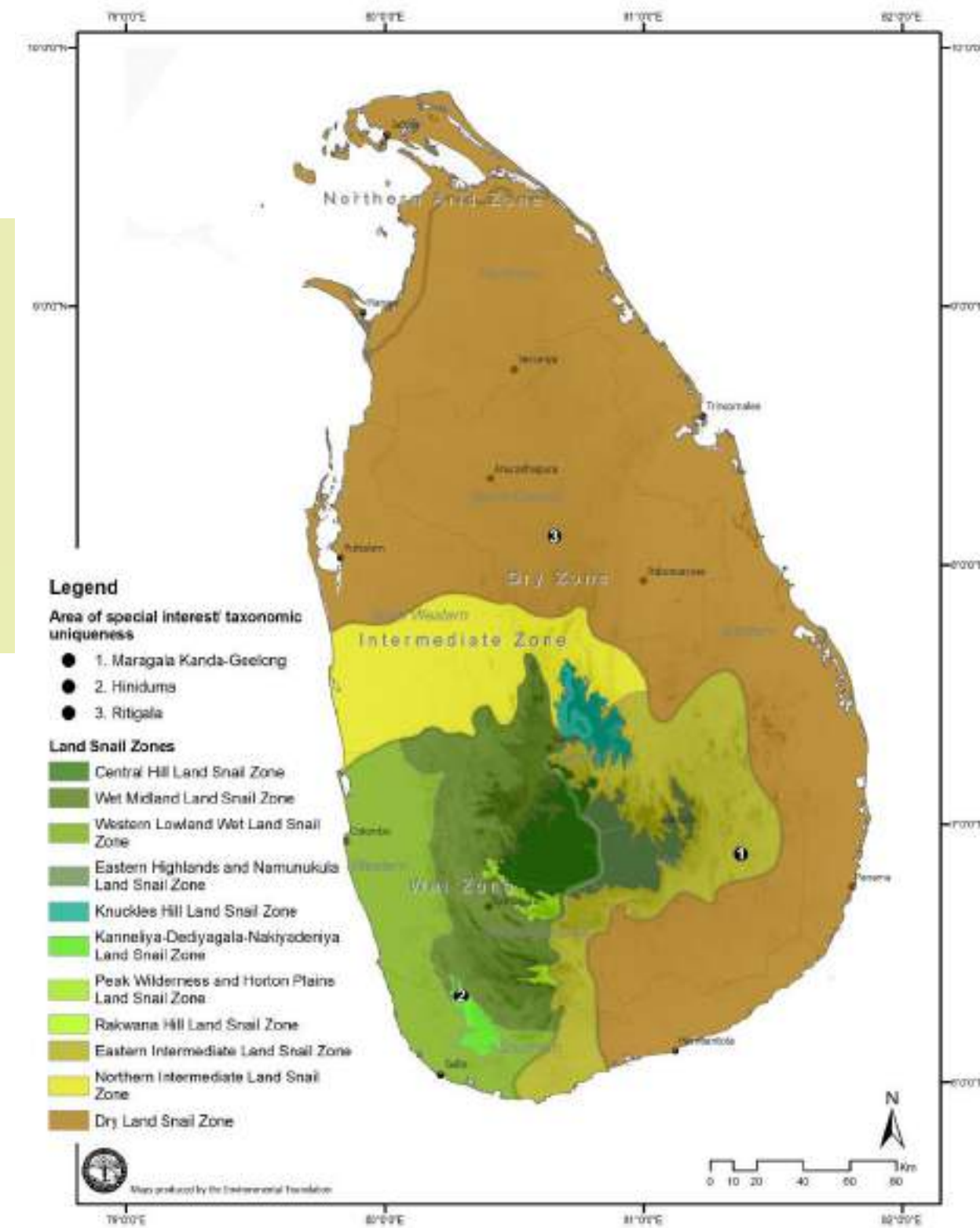


Figure 1.9. Land snail zones of Sri Lanka, based on the biogeographic distribution of land snail species. The zones are based on expert input during workshops and subsequent consultations. The land snail zones are overlaid on the climatic zones of Sri Lanka, and the Digital Elevation Model.

Although the general distribution of the Sri Lankan land snail fauna have been described for the four major climatic zones by Raheem & Naggs (2006a), biogeographic zones based on known ranges of land snail taxa are mapped here for the first time. These maps were generated based on published distribution ranges of few species (e.g. Hausdorf & Perera, 2000; Raheem & Naggs, 2006b; Raheem et al., 2017) together with intuitive discernment on the distribution of others agreed through consensus of an expert group.

It recognizes 11 zones and two areas of special interest/ taxonomic uniqueness (Figure 1.9). Seven zones represent the wet climatic zone, three zones represent the intermediate climatic zone and the eastern areas of the central massif, and one zone represents the dry and arid climatic zones.

Central Hill Land Snail Zone

This zone includes the submontane and montane forests of the central massif in the wet climatic zone; i.e. the western region above 1,000 m elevation (Figure 1.9). Even landuse areas such as home gardens, forest plantations and agro plantations are also considered important habitats for landsnails in this zone in addition to the montane cloud forests and sub-montane forests. Characteristic species in this zone are *Corilla beddomeae* and *Ravana politissima*, both of which are endemic to Sri Lanka and considered to be endangered. The limestone caves in the Pidurutalagala-Rikillagaskada range provide microhabitats for *Ravana politissima*. Leaf litter, tree trunks in the understory under closed canopy, rotting logs, and rocks are important microhabitats for the land snails in this zone.

Wet Midland Land Snail Zone

The Midland Land Snail Zone represents the foothills and low hills of the wet climatic zone, and was recognized for the presence of, *Ratnadvipia karui*, and *Acavus superbus*, two endemic species that are restricted to this zone. The mid-elevation evergreen forests and the other semi-forested home gardens, forest plantations and agro plantations are also suitable habitats for the landsnails in this zone.

Western Lowland Wet Land Snail Zone

The Western Lowland Wet Land Snail Zone was identified as a distinct land snail zone especially because *Acavus haemastoma* is restricted to this zone. This species is an endemic and endangered species. The zone also supports a diverse assemblage of other endemic species that are characteristic to the wet climatic zone forests. The zone represents the coastal belt of the wet climatic zone, and its lowland wet evergreen forests. The agro plantations (both mono and mixed cultures), home gardens, riverine evergreen forests are also important habitat for the landsnails in this zone.

Eastern Highlands and Namunukula Land Snail Zone

This zone was proposed as a unique land snail zone on the basis of its unique habitat composition, consisting of mid-elevation evergreen forests, moist-mixed evergreen forests, upland savannas, and forest plantations. *Oligospira skinneri*, *Corilla humberti*, *C. odontophora* are endemic land snails that are restricted this zone. Both *C. humberti* and *C. odontophora* are critically endangered.

Knuckles Hill Land Snail Zone

The Knuckles Hill Land Snail Zone was identified as a distinct zone because it supports endemic species such as *Oligospira poleii* and *Corilla gudei*, the latter being critically endangered. This zone represents the Knuckles mountain range above 900 m, with montane evergreen cloud and rain forests, rock outcrop forests, riverine evergreen forests and upland savannas and patana grasslands. Other land use areas such as forest plantations, secondary and sparse open forests, agro plantations, and home gardens also represent suitable habitat for the landsnails in this zone.

Kanneliya-Deraniyagala-Nakiyadeniya Land Snail Zone

This zone was proposed as a distinct land snail zone because of the presence of an aggregation of forest dwelling endemic land snails such as *Ratnadvipia karui* and *Corilla adamsi*, with the absence of generalist species. *R. karui* is critically endangered. In addition to the natural patches of lowland wet evergreen forests, other land use types such as home gardens, forest plantations, agro plantations, and Kekilla (Bracken Fern) patches, also provide suitable habitat for the snails.

Peak Wilderness and Horton Plains Land Snail Zone

The Peak Wilderness and Horton Plains National Parks are considered as a single land snail zone on the basis of the similarities in the land snail species composition in both parks, but are distinct enough from the surrounding areas. An assemblage of endemic land snails including species such as *Ariophanta ceraria* and *Euplecta gardeneri* are characteristic to cloud forests found in this zone. Both species have been categorized as vulnerable. The zone represents the montane evergreen cloud forests, mid-elevation evergreen forests and montane wet patana grasslands, but also includes home gardens, forest plantations and agro plantations that also support these snails.

Rakwana Hill Land Snail Zone

This zone was proposed as a distinct land snail zone on the basis of unique land snail assemblage, representing species from both the lowland and hill affinities, including endemic species such as *Oligospira skinneri* and *Corilla colletti*. This zone represents the areas above 1,000 m in the Rakwana mountain range.

Eastern Intermediate Land Snail Zone

This zone represents the intermediate climatic zone in the eastern and southern regions (Figure 1.9), dominated by moist-mixed evergreen forests and lowland savannas. The endemic species, *Corilla colletti* is largely confined to this zone.

Northern Intermediate Land Snail Zone

The Northern Intermediate Land Snail Zone represents the northern areas of the intermediate climatic zone (Figure 1.9), with its moist-mixed evergreen forests. The endangered, endemic species, *Corilla carabinata* is confined to this zone.

Dry Land Snail Zone

The Dry Land Snail Zone represents the dry and arid climatic zones (Figure 1.9), and consists of a wide array of habitats such as semi-evergreen monsoon forests, riverine forests, isolated hill forests, rock outcrop forests, arid-mixed evergreen forests, and secondary and sparse open forests. This zone harbours a characteristic assemblage of land snail species with more generalists and a lesser number of endemics

Areas of Special Interest and Taxonomic Uniqueness (ASITU)

Maragala Kanda-Geelong

The Maragala Kanda-Geelong, as a ASITU, supports isolated populations of *Acavus phoenix* and *Oligospira polei*. Both species are endemic to Sri Lanka, and the latter is endangered.

Hiniduma

The Haycock-Hiniduma area was proposed as a distinct land snail area because of the presence of the critically endangered *Glessula capillacea*, and several wet lowland endemic species.

Ritigala

Ritigala was identified as a ASITU because of the presence of disjunct populations of endemic and threatened land snail species with wet zone affinities such as *Acavus phoenix* (*A. phoenix* var. *castaneus*) and *Oligospira poleii*, the latter being endangered. Ritigala itself is an inselberg with patches of isolated moist-mixed evergreen forests, mid-elevation evergreen forests, montane evergreen (pigmy), surrounded by dry zone vegetation.



1.2.5 Ichthyological Zones of Sri Lanka

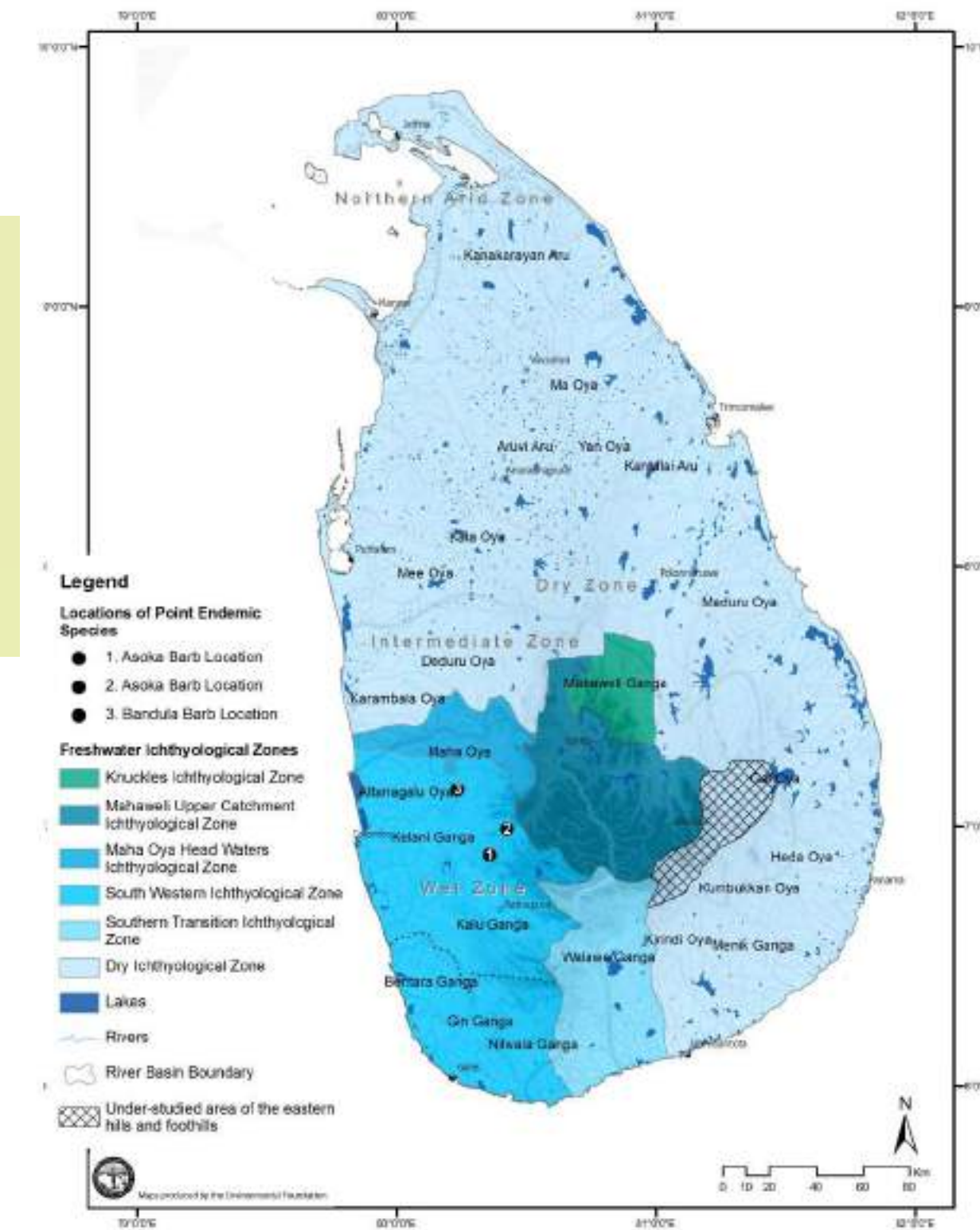


Figure 1.10. Ichthyological Zones for freshwater fish of Sri Lanka, based on zones proposed by the experts.

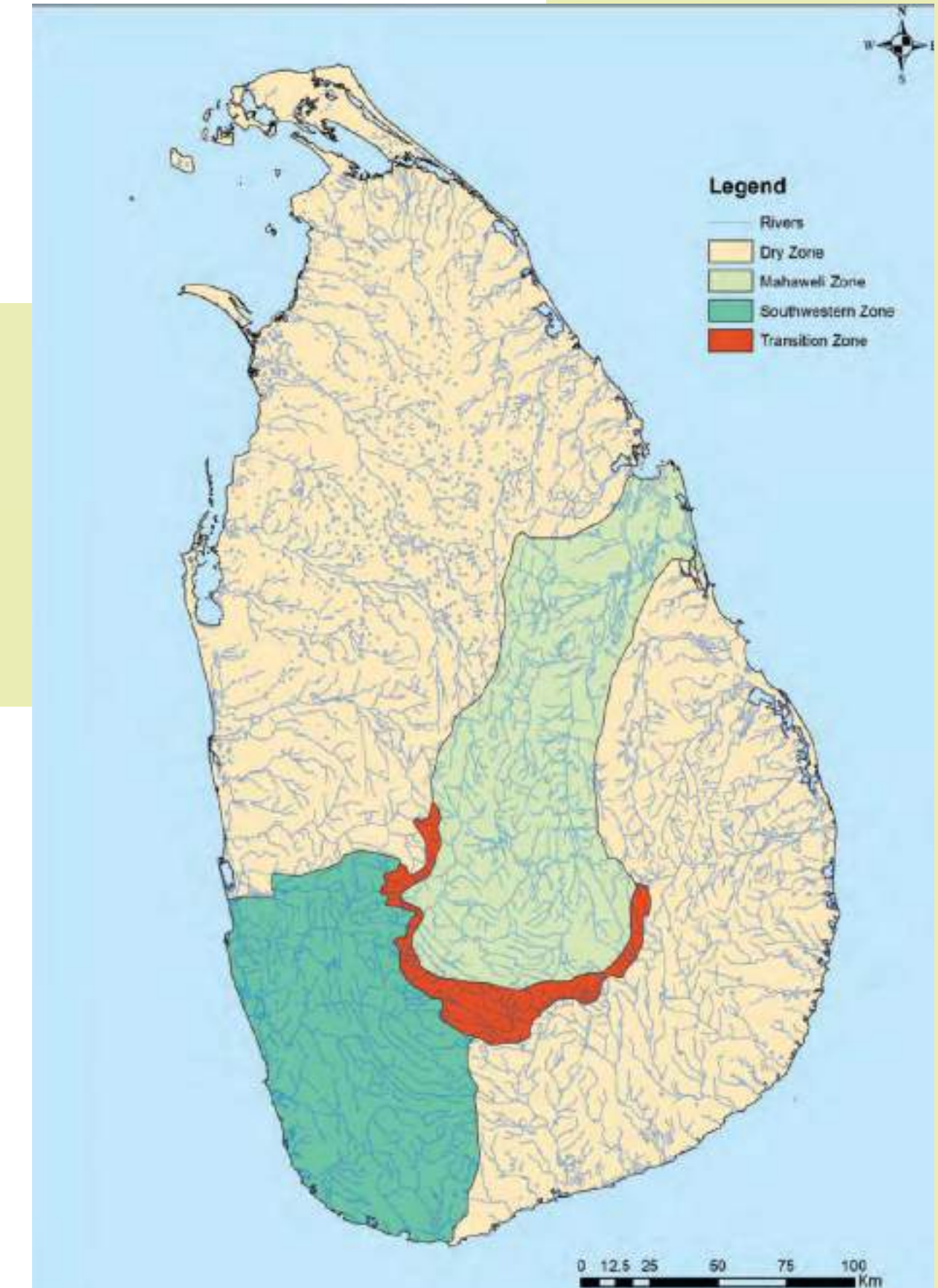


Figure 1.11. Ichthyological zone map by Senanayake & Moyle (1982), as reproduced in the National Biodiversity Strategy and Action Plan 2016-2025 (MoMD&E 2016).

The freshwater ichthyological zones (Figure 1.10) were developed by experts who participated at a workshop held to review and update information on freshwater fish distributions. Several changes were made to the previous map by Senanayake & Moyle (1982; Figure 1.11), which depicted four ichthyological zones for freshwater fish, namely, the Dry Zone, the Mahaweli Zone - representing Sri Lanka's largest river basin, the Southwestern Zone - representing the rivers in the first peneplain of the wet climatic zone, and the Transition Zone from the first to second peneplains.

The ichthyological zones proposed by the expert group are much more complex than the simplified zone map of Senanayake & Moyle (1982), and are based on the range distributions of fish in different basins and presence, and distributions of endemic species that form distinct assemblages. Several new species descriptions since the previous zone map was drawn, have also helped shape the new zonation map. Zone boundaries are thus aligned with river basin and elevational boundaries.

The current map identifies six zones that are focused on the river basins in the wet climatic zone, and the upper Mahaweli River basin. The dry zone and parts of the intermediate climatic zones have not been identified as a special zone by the expert group. In addition, the locations of point endemic species the Asoka barb and Bandula barb are denoted.

The justification for these zones and the freshwater fish assemblages that define them are presented below.

Knuckles Ichthyological Zone

The streams of the Knuckles mountains have several endemic fish species that justify designating them as a distinct Ichthyological Zone. These species include *Dawkinsia srilankensis*, *Systemus martenstyni*, *Laubuka insularis* and *Labeo fisheri* are restricted to this Ichthyological Zone.

Mahaweli Upper Catchment Ichthyological Zone

The headwaters of the Mahaweli River, adjacent to the Knuckles Zone, is similar to the latter, but lack *D. srilankensis* and *S. martenstyni*.

Maha Oya Headwaters Ichthyological Zone

This zone includes the basins of Maha Oya, and is an area transitioning from wet to dry climatic zone basins. It supports many of the wet zone endemic species, but has fewer species than the wet climatic zone basins, i.e. South Western Ichthyological Zone. An introduced species *Pethia padamya*, is now recorded in few streams of this zone.

South Western Ichthyological Zone

This zone covers the streams and rivers of the Aththanagalu, Kelani, Kalu Ganga (River), Benthara, Gin, and Nilawala Ganga (River) basins. This zone supports most of Sri Lanka's endemic freshwater fish species. Both zones also support species of *Rasbora* species. However, this zone can be subdivided as Western Ichthyological Subzone and Southern Ichthyological Subzone, considering intraspecific variations of Cyprinidae between the two subzones. *Malpulutta* is an endemic genus recorded from the Southern Ichthyological Subzone.

Southern Transition Ichthyological Zone

This zone was recognized to be distinct because of the presence of several restricted range species, viz. *Schistura madhavai*, and *Rasbora naggsi* which are range restricted species. The fish species composition shows some affinity to the wet climatic zone ichthyological zones, but also has some similar intraspecific variations to the South Western Ichthyological Zone.

Dry Ichthyological Zone

This zone can be distinguished from the surrounding zones, for containing low level of endemism. Most of the endemic species that occur in this zone e.g. *Dawkinsia singhala* and *Esomus thermoicos*, also occur in South Western Ichthyological zone, but most of the endemic South Western Ichthyological zone species do not occur in the Dry Ichthyological Zone. The only endemic species that seem to be restricted to this Dry Ichthyological zone is *Labeo lankae*. The occurrence of *Labeo lankae* is from the northern part of the Dry Climatic Zone drained by Malwathu Oya basin and possibly Kala Oya basin as well (Sudasinghe et al., 2018). Another endemic species that appeared to be recorded mostly from this zone is *Pethia melanomaculata*, though not entirely restricted (see Batuwita et al., 2015), and also *Laubuka lankensis* (though the taxonomy of the species in the genus *Laubuka* in Sri Lanka are doubtful: Hiranya Sudasinghe Pers. Com).



1.2.6 Amphibian Zones of Sri Lanka

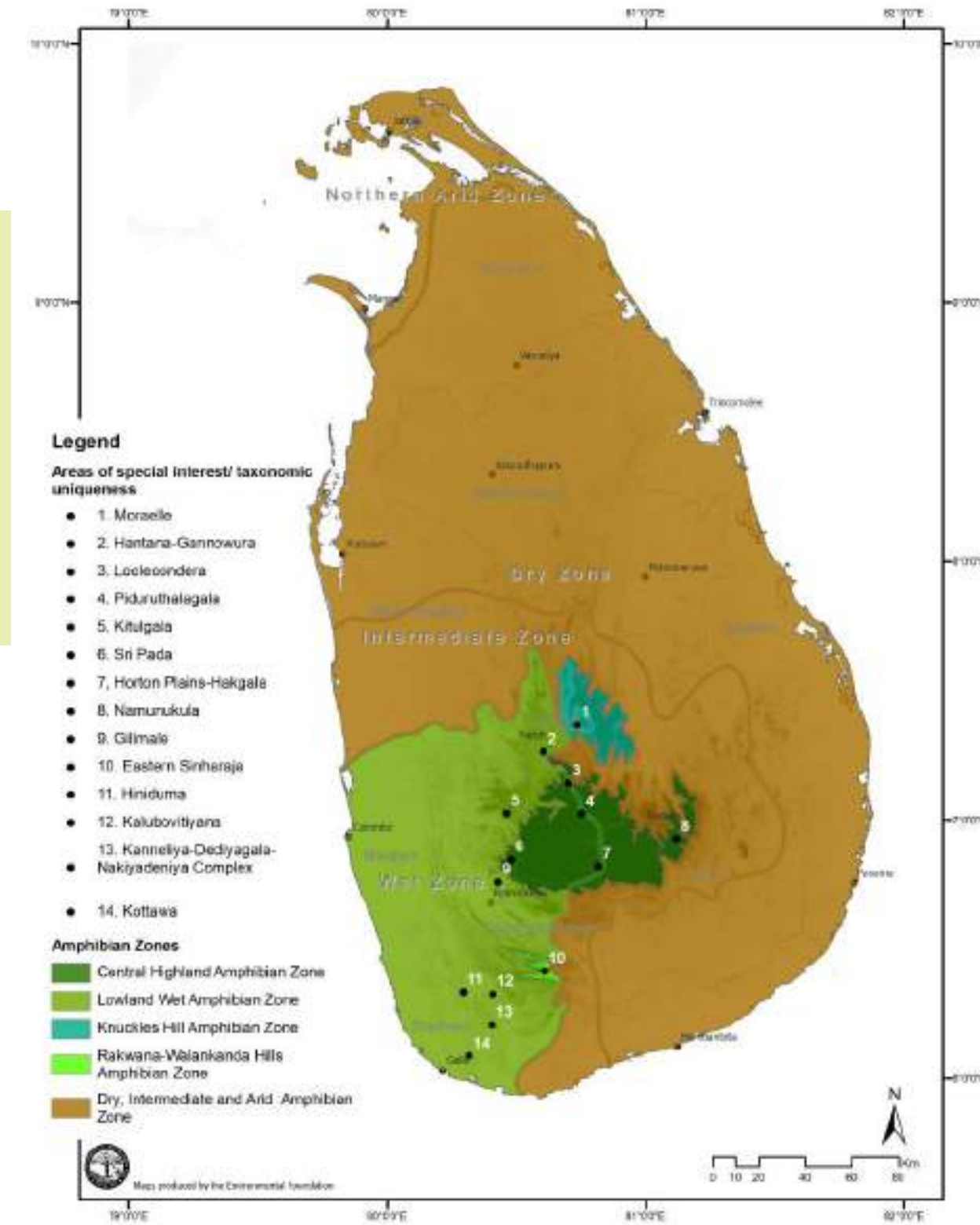


Figure 1.12. Amphibian zones and Special Interest and Taxonomic Uniqueness Areas of Sri Lanka, based on the geographic distribution of species. The zones are based on expert input during workshops and subsequent consultations. The amphibian zones, and Special Interest and Taxonomic Uniqueness Areas, are overlaid on the climatic zones of Sri Lanka, and the Digital Elevation Model.

This geographic distribution zone map for amphibians of Sri Lanka represents the first such for this taxonomic group. It recognizes five zones and fourteen areas of special interest and taxonomic uniqueness (Figure 1.12). Four of the zones are in the wet climatic zone and the fifth represents the dry and intermediate climatic zones.

Central Highlands Amphibian Zone

The Central Hill Amphibian Zone is defined by the 1,000 m contour, and represents the central mountains of Sri Lanka (Figure 1.12), and consists of the montane and sub-montane rainforests. The characteristic species that define this zone are *Microhyla zeylanica* (Sri Lanka Narrow-mouth Frog), *Minervarya greenii* (Sri Lanka Paddy Field Frog), *Pseudophilautus alto* (Horton Plains Shrub Frog), *Pseudophilautus femoralis* (Leafnesting Shrub Frog), *Pseudophilautus frankenbergi* (Frankenberg's Shrub Frog), *Pseudophilautus microtypanum* (Small-eared Shrub Frog), *Pseudophilautus viridis* (Dull Green Shrub Frog) and *Taruga eques* (Mountain Tree Frog).

Lowland Wet Amphibian Zone

This zone represents the wet zone area of Sri Lanka below 1,000 m elevation. The boundaries are based on the wet climatic zone. This zone is characterized by a rich amphibian fauna such as *Adenomus kelaartii* (Kelaart's Dwarf Toad), *Duttaphrynus nollertii* (Nollert's Toad), *Duttaphrynus kotagamai* (Kotagama's Dwarf Toad), *Pseudophilautus abundus* (Labugagama Shrub Frog), *Pseudophilautus cavirostris* (Hollow-snouted Shrub Frog), *Pseudophilautus cuspis* (Sharpe-snouted Shrub Frog), *Pseudophilautus folicola* (Leaf-Dwelling Shrub Frog), *Pseudophilautus schneideri* (Schneider's Shrub Frog), *Pseudophilautus sordidus* (Grubby Shrub Frog), and *Pseudophilautus stictomerus* (Orange Canthal Shrub Frog).

Knuckles Hill Amphibian Zone

The Knuckles Hill Amphibian Zone includes the Knuckles mountain range above 800 m (Figure 1.12). This zone was proposed because of the presence of distinct species assemblage of *Nannophrys marmorata* (Kirtisinghe's Rock Frog or Marbled Streamlined Frog), *Lankanectes pera*, *Pseudophilautus fulvus* (Knuckles Shrub Frog), *Pseudophilautus hankeni* (Hanken's Shrub Frog), *Pseudophilautus hoffmanni* (Hoffman's Shrub Frog), *Pseudophilautus macropus* (Bigfoot Shrub Frog), *Pseudophilautus mooreus* (Moore's Bubble-nest Frog), *Pseudophilautus steineri* (Steiner's Shrub Frog), *Pseudophilautus stuarti* (Stuart's Shrub Frog) and *Uperodon nagaoui* (Nagao's Pugsnout Frog). The national conservation status of all these species are critically endangered and restricted to the Knuckles mountain range. Undescribed taxa in the genus *Tharuga* to be described from this zone (Pradeep Samarawicrama, pers. com).

Rakwana-Walankanda Hill Amphibian Zone

This zone includes the hill areas above 900 m in the Rakwana mountain range with Delwala, Walankanda and Pannila forest reserves. This zone was proposed due to a distinct amphibian assemblage that includes several restricted-range and critically endangered, endemic amphibian species, viz. *Pseudophilautus decoris* (Elegant Shrub Frog), *Pseudophilautus lunatus* (Handapan Ella Shrub Frog), *Pseudophilautus poppiae* (Poppy's Shrub Frog), *Pseudophilautus procax* (Cheeky Shrub Frog), *Pseudophilautus simba* (Sinharaja Shrub Frog), *Taruga fastigo* (Morningside Tree Frog). In addition, endangered and vulnerable amphibians such as, *Pseudophilautus auratus* (Golden Shrub Frog), *Pseudophilautus reticulatus* (Reticulated Thigh Shrub Frog), *Pseudophilautus silvaticus* (Forest Shrub Frog), *Pseudophilautus singu* (Sri Lanka Short-horned Shrub Frog), *Pseudophilautus stictomerus* (Orange Canthal Shrub Frog), *Lankanectes corrugatus* (Corrugated Water Frog), *Fejervarya kirtisinghei* (Kirtisinghe's Frog) and *Pseudophilautus folicola* (Leaf-dwelling Shrub Frog) have also been recorded from this zone.

Dry, Intermediate and Arid Amphibian Zone

This zone includes the areas belonging to the dry, intermediate and arid climatic zones. Characteristic species in this zone are *Duttaphrynus scaber* (Ferguson's Toad), *Uperodon systoma* (Balloon Frog), *Sphaerotheca rolandae* (Marbled Sand Frog), *Sphaerotheca breviceps* (Banded Sand Frog), and *Pseudophilautus regius* (Polonnaru Shrub Frog).

Following locations were proposed as "Areas of Special Interest and Taxonomic Uniqueness" for amphibians.

Areas of Special Interest and Taxonomic Uniqueness (ASITU)

Moraella

Moraella was proposed as an amphibian special interest and taxonomic uniqueness area based on the unique amphibian species assemblage that includes *Adenomus kelaartii* (Kelaart's Dwarf Toad), *Pseudophilautus cavirostris* (Hollow snouted shrub frog), *Pseudophilautus folicola* (Leaf-dwelling Shrub Frog), and *Taruga longinasus* (Long-snout Tree Frog).

Hantana and Gannoruwa

Hantana and Gannoruwa areas are recognized as an Amphibian Special Interest and Taxonomic Uniqueness Area based on the presence of restricted-range species, and a high level of species diversity. *Pseudophilautus hallidayi* (Halliday's shrub frog), *Pseudophilautus rus* (Kandiyan Shrub Frog), *Pseudophilautus pleurotaenia* (Side-striped Shrub Frog), and *Pseudophilautus zorro* (Gannoruva Shrub Frog) are some of the characteristic amphibians found in this area.

Loolecondera

Lookandura or Loolecondera forest above 1,200 m was proposed as an Amphibian Special Interest and Taxonomic Uniqueness Area based on the presence of a point endemic amphibian species, *Pseudophilautus dilmah* (Dilmah Shrub Frog). In addition, few new species will be described from this location in near future (M. Wicramasinghe & K. Manamendra-Arachchi, Pers. Com.).

Pidurutalagala

Pidurutalagala Forest Reserve was proposed as a distinct Amphibian Special Interest and Taxonomic Uniqueness Area based on presence of high level of species diversity and restricted-range species. Some distinct species in this area are *Adenomus kandianus* (Kandy Dwarf Toad) and *Pseudophilautus frankenbergi* (Frankenberg's Shrub Frog).

Kithulgala

Kithulgala forest reserve was identified as Amphibian Special Interest and Taxonomic Uniqueness area based on the presence of high level of amphibian diversity and the presence of some restricted-range amphibians such as *Duttaphrynus kotagamai* (Kotagama's Dwarf Toad), and *Taruga longinasus* (Long-snout Tree Frog).

Sri Pada

Sri Pada Amphibian Special Interest and Taxonomic Uniqueness Area is justified based on presence of several point endemics, and restricted-range endemic species. *Adenomus kandianus* (Kandy Dwarf Toad) *Pseudophilautus bambaradeniyayi* (Bambaradeniya's Shrub Frog), *Pseudophilautus caeruleus* (Blue Thigh Shrub Frog), *Pseudophilautus dayawansai* (Dayawansa's Shrub Frog), *Pseudophilautus hypomelas* (Webless Shrub Frog), *Pseudophilautus jagathgunawardanai* (Jagath Gunawardana's Shrub Frog), *Pseudophilautus karunarithnai* (Karunarithna's Shrub Frog), *Pseudophilautus newtonjayawardanei* (Newton Jayawardane's Shrub Frog), *Pseudophilautus puranappu* (Puran Appu's Shrub Frog), *Pseudophilautus samarakoon* (Samrakoon's Shrub Frog), *Pseudophilautus stellatus* (Spotted Shrub Frog), *Pseudophilautus sirilwijesundarai* (Siril Wijesundara's Shrub Frog) etc. are restricted to this area. Other species restricted to this Amphibian Special Interest and Taxonomic Uniqueness Area are *Adenomus kelaartii* (Kelaart's Dwarf Toad), and *Pseudophilautus caeruleus* (Blue Thigh Shrub Frog). The area also covers the Peak Wilderness Sanctuary.

Horton Plains and Hakgala

This Amphibian Special Interest and Taxonomic Uniqueness Area within the Central Hill Amphibian Zone is justified because of the presence of unique species assemblages. Some characteristic species in this hotspot are *Pseudophilautus femoralis* (Leaf-nesting Shrub Frog), *Pseudophilautus schmarda*, *Pseudophilautus silus* (Pug-nosed Shrub Frog), *Uperodon palmatus* (Half-webbed Pugsnout Frog), *Microhyla zeylanica* (Sri Lanka Narrow-mouth Frog) and *Fejervarya greenii* (Sri Lanka Paddy Field Frog). The area includes Horton Plains National Park and Hakgala Nature Reserve, and is based in the 1,200 m to 2,300 m contour.

Namunukula

Namunukula mountain range (above 800 m) was proposed as an Amphibian Special Interest and Taxonomic Uniqueness Area considering the presence of restricted-range amphibian species, and the high level of amphibian diversity in this area. Some of the characteristic species that have been recorded from this Amphibian Special Interest and Taxonomic Uniqueness Area are *Pseudophilautus frankenbergi* (Frankenberg's Shrub Frog), *Pseudophilautus viridis* (Dull Green Shrub Frog), and *Taruga eques* (Mountain Tree Frog).

Gilimale

Gilimale Forest Reserve was proposed as Amphibian Special Interest and Taxonomic Uniqueness Area based on a point endemic species and the high amphibian diversity. *Polypedates ranwellai* (Ranwella's Tree Frog) is currently only known from Gilimale Forest Reserve. In addition, other characteristic amphibian species found in this area are *Pseudophilautus cavirostris* (Hollow-snouted Shrub Frog), *Pseudophilautus folicola* (Leaf-dwelling Shrub Frog), *Pseudophilautus schneideri* (Schneider's Shrub Frog), and *Pseudophilautus rus* (Kandiyan Shrub Frog).

Eastern Sinharaja

Eastern Sinharaja Amphibian Special Interest and Taxonomic Uniqueness Area includes areas belonging to Morningside, Gongala, and Hadapan Ella. This area was proposed as a distinct Amphibian Special Interest and Taxonomic Uniqueness area on the basis that the area hosts several point endemic species and restricted-range species and high amphibian diversity. *Microhyla karunaratnei* (Karunaratne's Narrowmouth Frog), *Pseudophilautus auratus* (Golden Shrub Frog), *Pseudophilautus lunatus* (Handapan Ella Shrub Frog), *Pseudophilautus ocularis*

(Golden Eye Shrub Frog), *Pseudophilautus papillosus* (Papillated Shrub Frog), *Pseudophilautus poppiae* (Poppy's Shrub Frog), *Pseudophilautus silvaticus* (Forest Shrub Frog), *Pseudophilautus samba* (Sinharaja Shrub Frog), and *Taruga fastigo* (Morningside Tree Frog), define Eastern Sinharaja area as an Amphibian Special Interest and Taxonomic Uniqueness Area.

Hiniduma

Hiniduma is characterized as a distinct Amphibian Special Interest and Taxonomic Uniqueness Area based on the presence of point endemic amphibians, restricted-range species and high level of amphibian diversity. *Pseudophilautus limbus* (Haycock Shrub Frog), and *Pseudophilautus nemus* (Whistling Shrub Frog) are only known from Hiniduma Forest Reserve. In addition, *Adenomus kelaartii* (Kelaart's Dwarf Toad), *Pseudophilautus singu* (Horned Shrub Frog), *Pseudophilautus tanu* (Slender Shrub Frog), and *Pseudophilautus hoipolloi* (Anthropogenic Shrub Frog,) define this area as a Special Interest and Taxonomic Uniqueness Area.

Kalubovitiyana

Kalubovitiyana is located in the Lowland Wet Amphibian Zone and consists of a high level of amphibian species diversity. Some characteristic species recorded from this area are *Adenomus kelaartii* (Kelaart's Dwarf Toad), *Pseudophilautus singu* (Horned Shrub Frog), *Pseudophilautus tanu* (Slender Shrub Frog), and *Pseudophilautus hoipolloi* (Anthropogenic Shrub Frog).

Kanneliya-Dediyagala-Nakiyadeniya (KDN) Complex

Kanneliya-Dediyagala-Nakiyadeniya Complex has been recognized as an area with unique assemblage of amphibians. The presence of species such as *Adenomus kelaartii* (Kelaart's Dwarf Toad), *Pseudophilautus singu* (Horned Shrub Frog), *Pseudophilautus tanu* (Slender Shrub Frog), and *Pseudophilautus hoipolloi* (Anthropogenic Shrub Frog), qualify this area as a special interest and taxonomic uniqueness area.

Kottawa

Kottawa Forest Reserve was proposed as distinct area for amphibians as the Kottawa Forest Reserve harbor high level of amphibian species. *Adenomus kelaartii* (Kelaart's Dwarf Toad), *Pseudophilautus singu* (Horned Shrub Frog), *Pseudophilautus tanu* (Slender Shrub Frog), and *Pseudophilautus hoipolloi* (Anthropogenic Shrub Frog) are some of the characteristic species found in this area.



1.2.7 Reptilian Zones of Sri Lanka

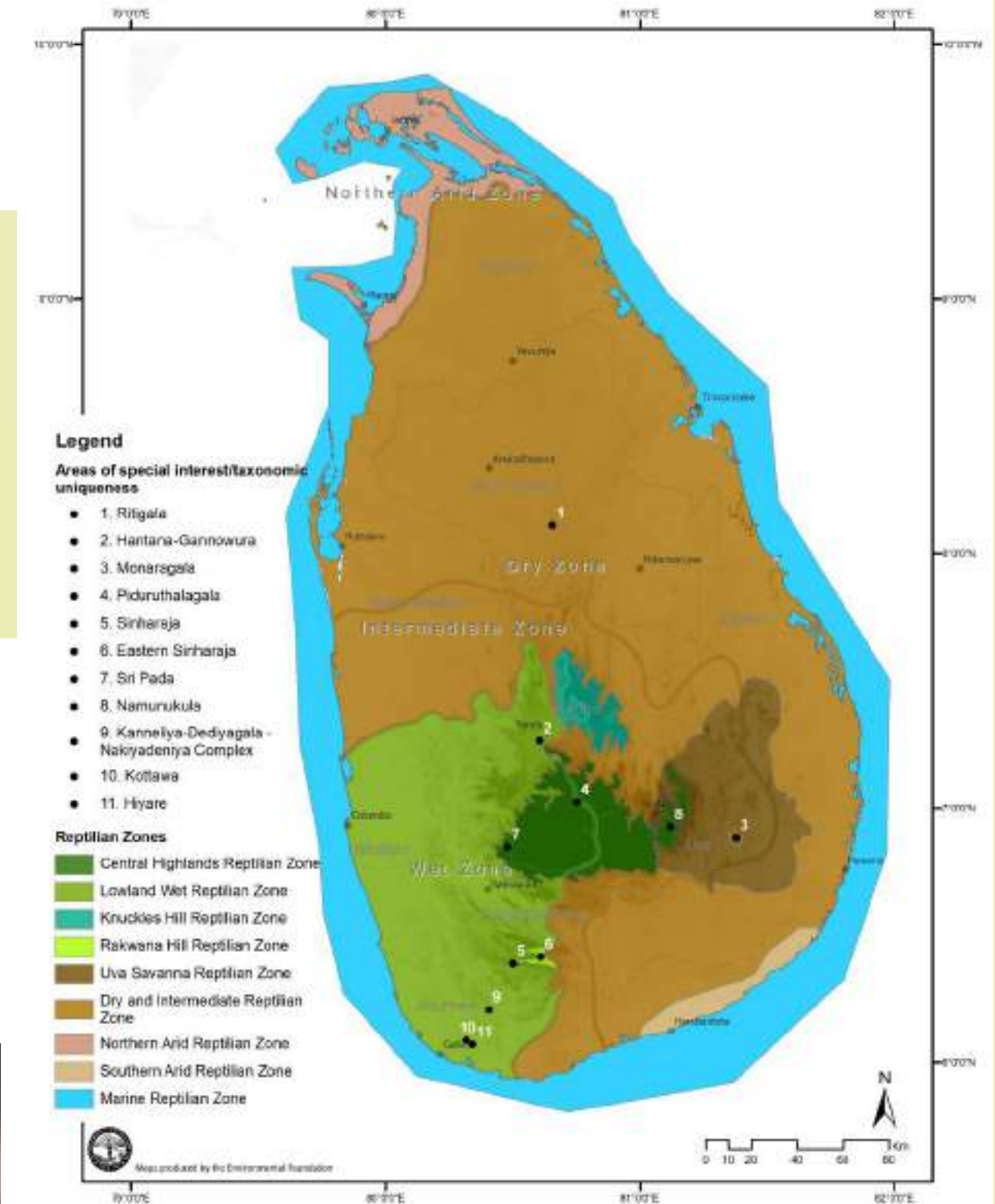


Figure 1.13. Reptile zones and Special Interest and Taxonomic Uniqueness Area of Sri Lanka, based on the biogeographic distribution of the species. The zones are based on expert input during workshops and subsequent consultations. The reptile zones and Special Interest and Taxonomic Uniqueness Area are overlaid on the climatic zones of Sri Lanka, and the Digital Elevation Model.

This biogeographic distribution zone map for reptiles of Sri Lanka represents the first of its kind for this taxonomic group. The distributions are represented by nine zones and twelve areas of special interest or taxonomic uniqueness (Figure 1.13). Three zones represent the wet climatic zone, and another four zones represent the dry and intermediate climatic zones. Marine zones have been identified for the marine snakes and turtles.

Central Hill Reptilian Zone

The characteristic species that define the Central Hill Reptilian Zone are *Calotes nigrilabris* (Black Cheek Lizard), *Ceratophora stoddartii* (Rhino-horn Lizard), *Cophotis ceylanica* (Pygmy Lizard), *Aspidura trachyprocta* (Common Roughside), and *Lankascincus taprobanensis* (Smooth Lanka Skink). All these are endemic species and categorized as Endangered (EN) in the National Red List 2012. The Central Hill Reptilian Zone is defined by the 1,000 meter elevation contour using the 30 meter Digital Elevation Model, and represents montane and submontane rainforests in the central mountains (Figure 1.13).

Lowland Wet Reptilian Zone

This reptilian zone represents the wet zone area of Sri Lanka below 1,000 m elevation (Figure 1.13). The boundaries are based on the wet climatic zone. This reptilian zone is characterized by *Ceratophora aspera* (Rough-horn Lizard), *Rhabdophis ceylonensis* (Sri Lanka Keelback), *Aspidura guentheri* (Ferguson’s Roughside), *Dendrelaphis sinharajensis* (Sinharaja Tree Snake), *Cyrtodactylus cracens* (Narrow-headed Forest Gecko), and *Rhinophis tricoloratus* (Deraniyagala’s Shield Tail), a critically endangered species, and several other endemic species.

Knuckles Hill Reptilian Zone

This zone includes the Knuckles mountain range above 900 m (Figure 1.13). The zone is characterized by *Ceratophora tennentii* (Leafnose Lizard), *Cophotis dumbara* (Knuckles Pygmy Lizard), *Chalcidoseps thwaitesii* (Fourtoe Snakeskink), *Calotes pethiyagodai* (Pethiyagodagē Nosilu Katussa), *Nessia bipes* (Smithge Sarpahiraluva), *Calotes manamendrai* (Manamendra-Arachchi’s Whistling Lizard), *Cnemaspis kallima* (Gammaduwa Day Gecko), *Cnemaspis philipsi* (Phillip’s Day Gecko), *Cnemaspis punctata* (Dotted Day Gecko), and *Aspidura desilva* (in press M. Wickramasinghe) which are endemic reptiles restricted to this zone.

Rakwana Hill Reptilian Zone

This zone was proposed as a distinct reptile zone based on a unique reptile assemblage that includes *Ceratophora karu* (Karunaratne’s Horn Lizard), *Ceratophora erdeleni* (Erdelen’s Horn Lizard), *Calotes desilvai* (Desilvas’ Whistling Lizard), *Cyrtodactylus subsolanus* (Rakwana Forest Gecko), and *Rhinophis erangaviraji* (Eranga Viraj’s Earth Snake), which are all restricted-range and critically endangered, endemic reptile species known only from this zone. The zone includes the hill areas above 900 m in the Rakwana mountain range (Figure 1.13).

Uva Savanna Reptilian Zone

Uva Savanna Reptilian Zone was identified as a separate reptile zone because of its unique habitat composition and species assemblage. This zone is dominated by savanna grasslands and surrounded by intermediate and dry climatic zones (Figure 1.13). *Calodactylodes illingworthorum* (Lankan Golden Gecko), *Cnemaspis podihuna* (Dwarf Day Gecko), *Hemidacty-*

lus hunae (Spotted Giant-gecko/ Rock Gecko), *Ophisops leschenaultii* (Leschenault’s Snake Eye Lizard), and *Ophisops minor* (Lesser Snake Eye Lizard) are characteristic species in this zone. The first two species are critically endangered and the third is endangered. Two undescribed taxa in Rhinophis to be described from this zone (Mendis Wickramasinghe, Pers. Com.).

Dry and Intermediate Reptilian Zone

This zone represents the area in the dry and intermediate climatic zones except the Knuckles Zone, south-eastern part of Central Hill Zone, part of the Uva Savanna Zone in the intermediate climatic zone, Southern Coastal Arid Zone, Northern Arid Zone and the Ritigala Reptilian Special Interest and Taxonomic Uniqueness Area (Figure 1.13). Some characteristic species in this zone are *Dasia halianus* (Haly’s Treeskink), *Eutropis beddomii* (Beddome’s Stripe Skink), *Hemidactylus leschenaultii* (Bark Gecko/ Sycamore Gecko), *Hemidactylus scabriceps* (Scaly Gecko) and *Otocryptis nigristigma* (Black Spotted Kangaroo Lizard).

Northern Arid Reptilian Zone

This was identified as a distinct reptilian zone based on few restricted-range species, viz. *Rhinophis* sp. (M. Wicramasinghe, Pers. Com.), *Eryx conicus* (Sand Boa), and *Echis carinatus* (Saw Scale Viper), and *Eutropis bibronii* which is found only from this zone and the Southern Coastal Arid Reptilian Zone. The Northern Arid Reptilian Zone extends along the north-west coastal belt, covering Mannar, Jaffna Peninsula, up to coastal area of Chalai (Figure 1.13). This zone is dominated by thorn, scrub bushes, and sand dunes, habitats which is unique compared to other climatic zones, including the Dry and Intermediate Zone.

Southern Arid Reptilian Zone

This zone is characterized by *Sitana bahiri*, *Indotylops* sp. (to be described by Mendis Wickramasinghe, Pers. Com.), *Eryx conicus* (Sand Boa) and *Echis carinatus* (Saw Scale Viper).

Marine Reptilian Zone

This zone (Figure 1.13) was proposed as a distinct reptilian zone on the basis of a unique seasnake distribution, and the presence of sea turtles.

Sea turtles species, *Caretta caretta* (Loggerhead Sea Turtle), *Chelonia mydas* (Green Turtle), *Eretmochelys imbricata* (Hawksbill Sea Turtle), and *Lepidochelys olivacea* (Olive Ridley Sea Turtle); and sea snake species, *Hydrophis curtus* (Shaw’s Sea Snake), *H. cyanocinctus* (Chitul), *H. fasciatus* (Striped Sea Snake), *H. jerdonii* (Jerdon’s Sea Snake), *H. lapemoides* (Persian Gulf Sea Snake), *H. mamillaris* (Bombay Gulf Sea Snake), *H. ornatus* (Gray’s Sea Snake), *H. platurus* (Yellow Bellied Sea Snake), *H. schistosa* (Hook-nose Sea Snake), *H. spiralis* (Narrow-banded Sea Snake), *H. stokesii* (Stoke’s Sea Snake), *H. viperinus* (Viperine Sea Snake) and *Microcephalophis gracilis* (John’s Sea Snake) are restricted to this zone. This zone includes the shallow coastal waters of continental shelf surrounding the island (Figure 1.13).

The following areas were proposed as ‘Reptilian Special Interest and Taxonomic Uniqueness Areas’ by the experts, during the preparation of 6th National Report to the Convention of Biological Diversity.

Areas of Special Interest and Taxonomic Uniqueness (ASITU)

Ritigala

Ritigala was identified as a Reptilian Special Interest and Taxonomic Uniqueness Area based on its unique reptile assemblage compared to the surrounding dry zone, and the presence of point endemic species. *Cnemaspis ritigalensis* (Ritigala Day Gecko) is a critically endangered endemic gecko species which is only known from this hotspot. Also, *Cnemaspis alwisi* (Alwis’s Day Gecko) has been recorded from this area. In addition, undescribed taxa of *Nessia* and *Lankascincus* to be described from Ritigala (M. Wickramasinghe, Pers. Com.).

Hantana and Gannoruwa

Hantana and Gannoruwa areas were proposed as a Reptilian Special Interest and Taxonomic Uniqueness Area based on the presence of restricted-range species, and high level of species diversity. *Cnemaspis scalpensis* (Gannoruwa Day Gecko) is restricted to Gannoruwa Forest Reserve. *Calotes liolepis* (Whistling Lizard/Forest lizard), and *Rhinophis philippinus* (Cuvier’s Earth Snake) are characteristic species found in this area.

Monaragala

The Monaragala Reptilian Special Interest and Taxonomic Uniqueness Area represents the Maragala Mountain, also known as Maragalakanda, and was identified as an important area for reptiles based on the presence of restricted-range species. Characteristic reptile species recorded from this area are *Calodactylodes illingworthorum* (Lankan Golden Gecko), *Cnemaspis kumarasinghei* (Kumarasinghe’s Day Gecko), *Hemidactylus hunae* (Spotted Giant Gecko/ Rock Gecko), and *Lankascincus taylori* (Taylor’s Lanka Skink).

Pidurutalagala

Pidurutalagala Forest Reserve was proposed as a distinct special interest and taxonomic uniqueness area for reptiles based on the presence of high level of species diversity and restricted-range species. *Ceratophora stoddartii* (Rhinohorn Lizard), *Cophotis ceylanica* (Pygmy Lizard), and *Cnemaspis gemunu* (Gemunu’s Day Gecko) are some key species in this area.

Sinharaja

Sinharaja Forest Reserve can be distinguished as a Special Interest and Taxonomic Uniqueness Area based on the presence of high level of reptile species diversity and the presence of restricted-range species. *Dendrelaphis sinharajensis* (Sinharaja Tree Snake), *Ceratophora aspera* (Rough-nosed Horned Lizard), *Lankascincus dorsicatenatus* (Catenated Litter Skink), and *Lankascincus greeri* (Geer’s Lanka Skink) are some of the distinct species in this area.

Eastern Sinharaja

Eastern Sinharaja Reptilian Special Interest and Taxonomic Uniqueness Area include Morningside, Gongala, and Hadapan Ella areas. This area was proposed as a distinct reptilian area on the presence of several point endemic species and restricted-range species, as well as high reptile diversity. *Calotes desilvai* (Desilvas’ Whistling Lizard/ Desilvas’ Forest Lizard),

Ceratophora erdeleni (Erdelen’s Horn Lizard), *Ceratophora karu* (Karunaratne’s Horn Lizard), *Cnemaspis pulchra* (Rakvana Day Gecko), and *Rhinophis erangaviraji* (Eranga Viraj’s Earth Snake) are only known from this area.

Sri Pada

Sri Pada area was considered as a special interest and taxonomic uniqueness area for reptiles based on some restricted-range species which are unique to this area, viz. *Aspidura ravanai* (Ravana’s Roughside), *Lankascincus munindradasai* (Munidradasa’s Lanka Skink), and *Lankascincus srpadensis* (Peakwilderness Lanka Skink). These species are considered critically endangered. The geography of this Reptilian Special Interest and Taxonomic Uniqueness Area is the Sri Pada sanctuary.

Namunukula

Namunukula mountain range was proposed as a Reptilian Special Interest and Taxonomic Uniqueness Area considering the presence of restricted-range species. Namunukula is characterized by *Aspidura deraniyagalae* (Deraniyagala’s Roughside), *Lankascincus taprobanensis* (Smooth Lanka Skink), and *Rhinophis drummondhayi* (Drummond-hay’s Earth Snake).

Kanneliya-Dediyagala-Nakiyadeniya (KDN) complex

Kanneliya-Dediyagala-Nakiyadeniya complex was proposed as a Special Interest and Taxonomic Uniqueness Area on the basis of unique species assemblage of reptiles. *Aspidura guentheri* (Ferguson’s Roughside), *Ceratophora aspera* (Rough Horn Lizard), *Cnemaspis silvula* (Forest Day Gecko), *Hemidactylus pieresii* (Pieres’s Gecko), *Rhinophis tricoloratus* (Deraniyagala’s Shield Tail), and *Rhabdophis ceylonensis* (Sri Lanka Blossom Krait) are some of the characteristic species found in the KDN complex.

Kottawa

Kottawa Forest Reserve was proposed as a Special Interest and Taxonomic Uniqueness Area based on the high species diversity of reptiles. *Aspidura guentheri* (Ferguson’s Roughside), *Ceratophora aspera* (Rough Horn Lizard), *Cnemaspis silvula* (Forest Day Gecko), *Hemidactylus pieresii* (Pieres’s Gecko), *Rhinophis tricoloratus* (Deraniyagala’s Shield Tail), and *Rhabdophis ceylonensis* (Sri Lanka Blossom Krait) are found in this area.

Hiyare

Hiyare Forest Reserve was identified as a Special Interest and Taxonomic Uniqueness Area based on the presence of high level of reptile species diversity. *Aspidura guentheri* (Ferguson’s Roughside), *Ceratophora aspera* (Rough Horn Lizard), *Cnemaspis silvula* (Forest Day Gecko), *Hemidactylus pieresii* (Pieres’s Gecko), *Rhinophis tricoloratus* (Deraniyagala’s Shield Tail), and *Rhabdophis ceylonensis* (Sri Lanka Blossom Krait) are some of the key species that define this area as a Special Interest and Taxonomic Uniqueness Area.

1.2.8 Avifaunal Zones of Sri Lanka

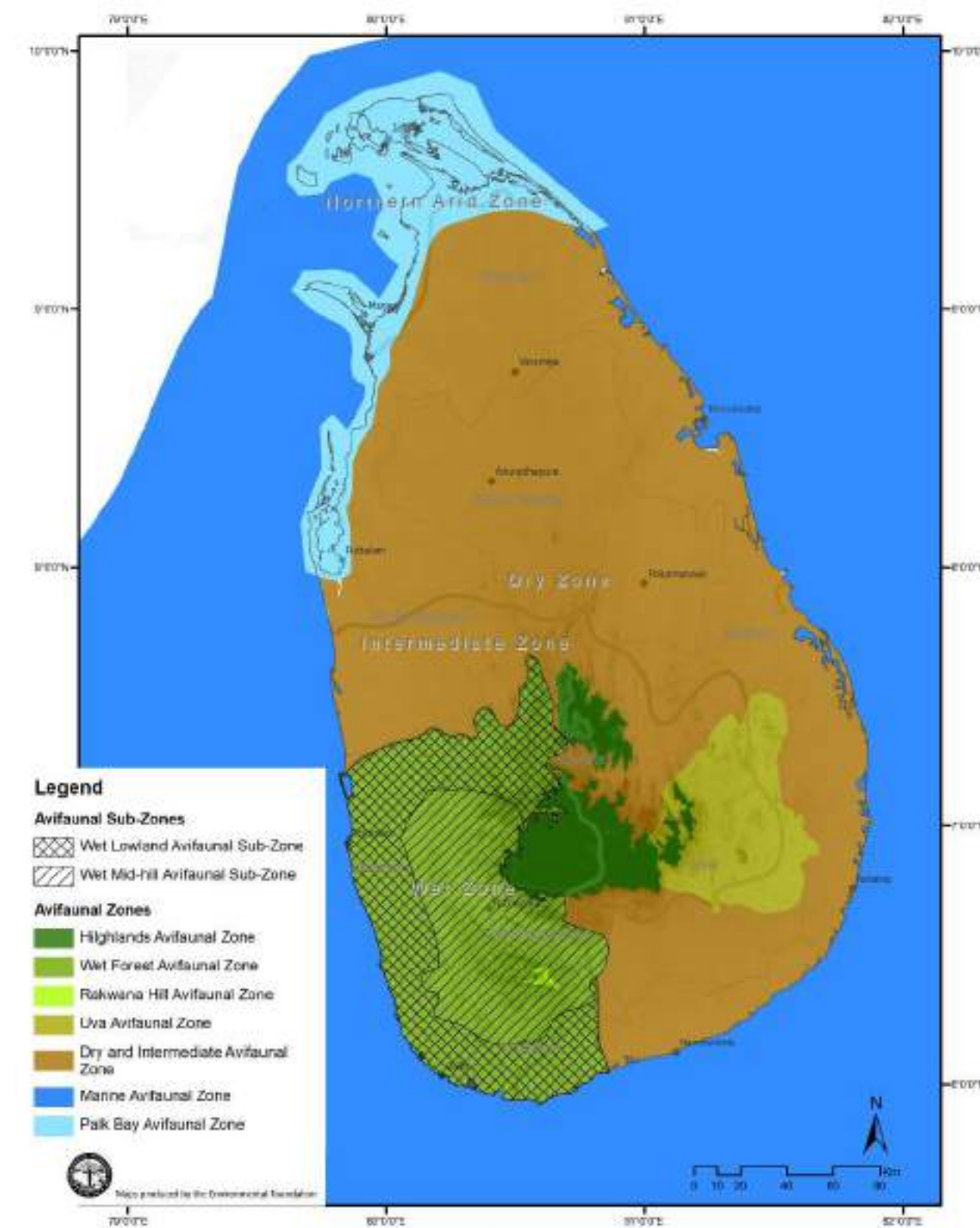


Figure 1.14. Avifaunal zones and hotspots of Sri Lanka, based on the biogeographic distribution of species. The zones are based on expert input during workshops and subsequent consultations. The avifaunal zones and hotspots are overlaid on the climatic zones of Sri Lanka and the Digital Elevation Model.

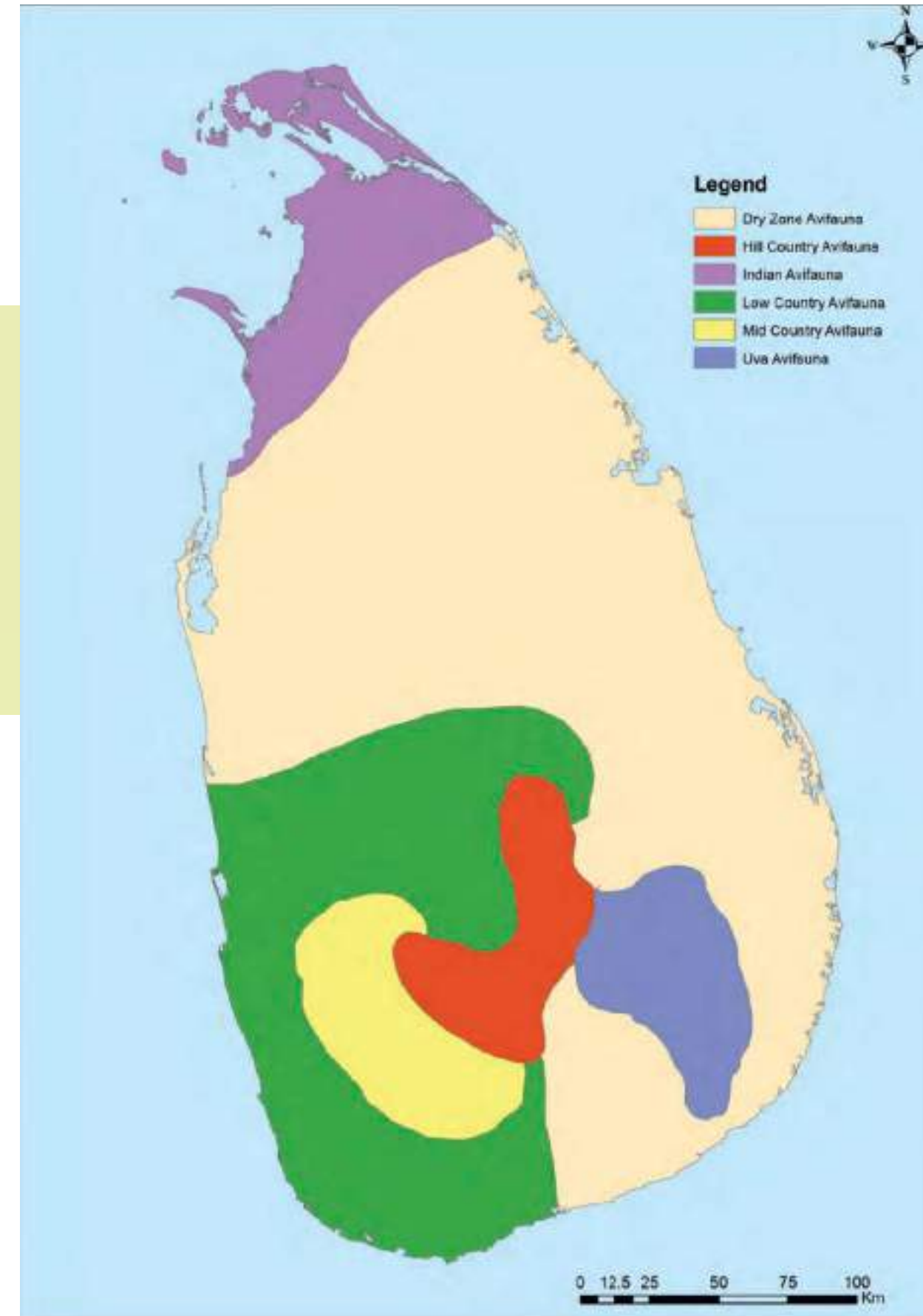


Figure 1.15. Avifaunal zone map by Kotagama (1993) as reproduced in the National Biodiversity Strategy and Action Plan 2016-2025 (MoMD&E 2016).

The avifaunal zones (Figure 1.14) were modified by experts who attended a workshop held to review and update information on bird distributions. Several changes were made to the previous map by Kotagama (1993; Figure 1.15), which depicted six avifaunal zones based on the distributions of resident birds. These zones are, Indian Avifauna in the north, Dry Zone Avifauna that covers much of the dry zone of Sri Lanka, Uva Avifauna that includes the low hills of the southeastern region of the Intermediate and Dry Zones, Low Country Avifauna that covers the lowland rainforests of the southwestern quarter, Mid Country Avifauna that includes the mid-montane rainforests and the Hill Country Avifauna that covers the montane rainforests.

The avifaunal zone map proposed by the expert group retained most of these zones, but proposed modifications to the boundaries, which were mostly done using the Digital Elevation Model, river basins, and the climatic zone boundaries to more accurately define the boundaries of the montane and submontane forests, especially in the wet zone (compare Figure 1.14 and 1.15).

The major changes or additions to the zonation map included: 1) the extension of the Indian Avifauna zone defined by Kotagama (1993) to include the marine habitats, and renamed the Palk Bay Coastal Avifaunal Zone; 2) the addition of the Southwestern Monsoon Pelagic Avifaunal Zone and Northeastern Monsoon Pelagic Avifaunal Zone to include the marine pelagic habitats; 3) the addition of the Rakwana Hill Zone; and 4) the Monaragala Hotspot that includes the Maragala Mountains.

The justification for these zones and the avifaunal characteristics that define them are presented below.

Highlands Avifaunal Zone

This zone was defined using the 1,000 m contour from the 30 meter Digital Elevation Model and also includes the Haputale and Namunukula hills with the Southwestern monsoon rain face (Figure 1.15). Much of the bird assemblage here is similar to rest of the hill country, but lacks the endemic species from the Uva hills. The birds endemic to this zone are *Elaphornis palliseri* (Sri Lanka Warbler), *Eumyias sordidus* (Sri Lanka Dull-blue Flycatcher), *Myophonus blighi* (Sri Lanka Whistling-thrush) and *Pycnonotus penicillatus* (Sri Lanka Yellow-eared Bulbul). Resident breeding populations of *Saxicola caprata* (Pied Bushchat) are characteristic to this zone.

Wet Forest Avifaunal Zone

This zone can be divided into two subzones, considering the restricted distribution of few endemic species, i.e. *Urocissa ornata* (Sri Lanka Blue Magpie), *Dicrurus lophorinus* (Sri Lanka Drongo), *Turdoides rufescens* (Sri Lanka Orange-billed Babbler), *Centropus chlororhynchus* (Sri Lanka Green-billed Coucal), and *Phaenicophaeus pyrrhocephalus* (Sri Lanka Red-faced Malkoha).

Uva Avifaunal Zone

This zone is a unique avifaunal zone in that it represents a dry savanna hill habitat. The boundaries have been modified from Kotagama (1993) to conform to the low Uva hills. Several species, viz. *Treron phoenicoptera* (Yellow-footed green pigeon), *Francolinus pictus* (Painted Francolin), and *Perdica asiatica* (Jungle Bush-quail) are confined to the zone.

Dry and Intermediate Avifaunal Zone

This zone includes areas belonging to the dry and intermediate climatic zones and is concordant with the justification for the Dry Zone Avifauna in Kotagama (1993).

Marine Avifaunal Zone

This zone was proposed as a distinct avifaunal zone considering sea birds distribution.

Palk Bay Coastal Avifaunal Zone

This zone includes Mannar Island, Adam's Bridge, Jaffna Peninsula, Chundikulam Lagoon, and surrounding shallow seas and northern coastal areas (Figure 1.14). The zone boundaries for the Indian Avifauna zone in Kotagama (1993) has been extended to include these marine areas. This zone consists of breeding habitats for several threatened species and important habitats for migratory birds. Aggregations of water birds can be seen in this zone. *Anous stolidus* (Brown Noddy), *Thalasseus bergii* (Great Crested Tern), *Coturnix coromandelica* (Rain Quail), *Francolinus pondicerianus* (Grey Francolin), and *Phoenicopterus roseus* (Greater Flamingo) are confined to this zone.

Avifaunal Sub-Zone

Wet Lowland Avifaunal Sub-Zone

This zone represents the lowland rainforests in the wet climatic zone, and the justification is concordant with the Low Country Avifauna of Kotagama, 1993. The boundaries have been modified to fit the biogeographic features up to the foothills of the second peneplain hills.

Wet Mid-hill Avifaunal Sub-Zone

This zone was extended to include the Kanneliya-Dediyagala-Nakiyadeniya (KDN forest complex) and the northwest Sinharaja ridge (upto Labugama), but overall the zone is concordant with the Mid Country Avifauna of Kotagama (1993). Some of the characteristic species in this zone are *Urocissa ornata* (Sri Lanka Blue Magpie), *Dicrurus lophorinus* (Sri Lanka Drongo), *Turdoides rufescens* (Sri Lanka Orange-billed Babbler), *Centropus chlororhynchus* (Sri Lanka Green-billed Coucal), and *Phaenicophaeus pyrrhocephalus* (Sri Lanka Red-faced Malkoha).

Rakwana Hill Avifaunal Zone

This zone was considered as a distinguished zone for avifaunal distribution based on its unique species assemblage that includes *Eumyias sordidus* (Sri Lanka Dull-blue Flycatcher) and *Pycnonotus penicillatus* (Sri Lanka Yellow-eared Bulbul). This zone represents the hill areas above 900 m in the Rakwana mountain range.

1.2.9 Mammalian Zones of Sri Lanka

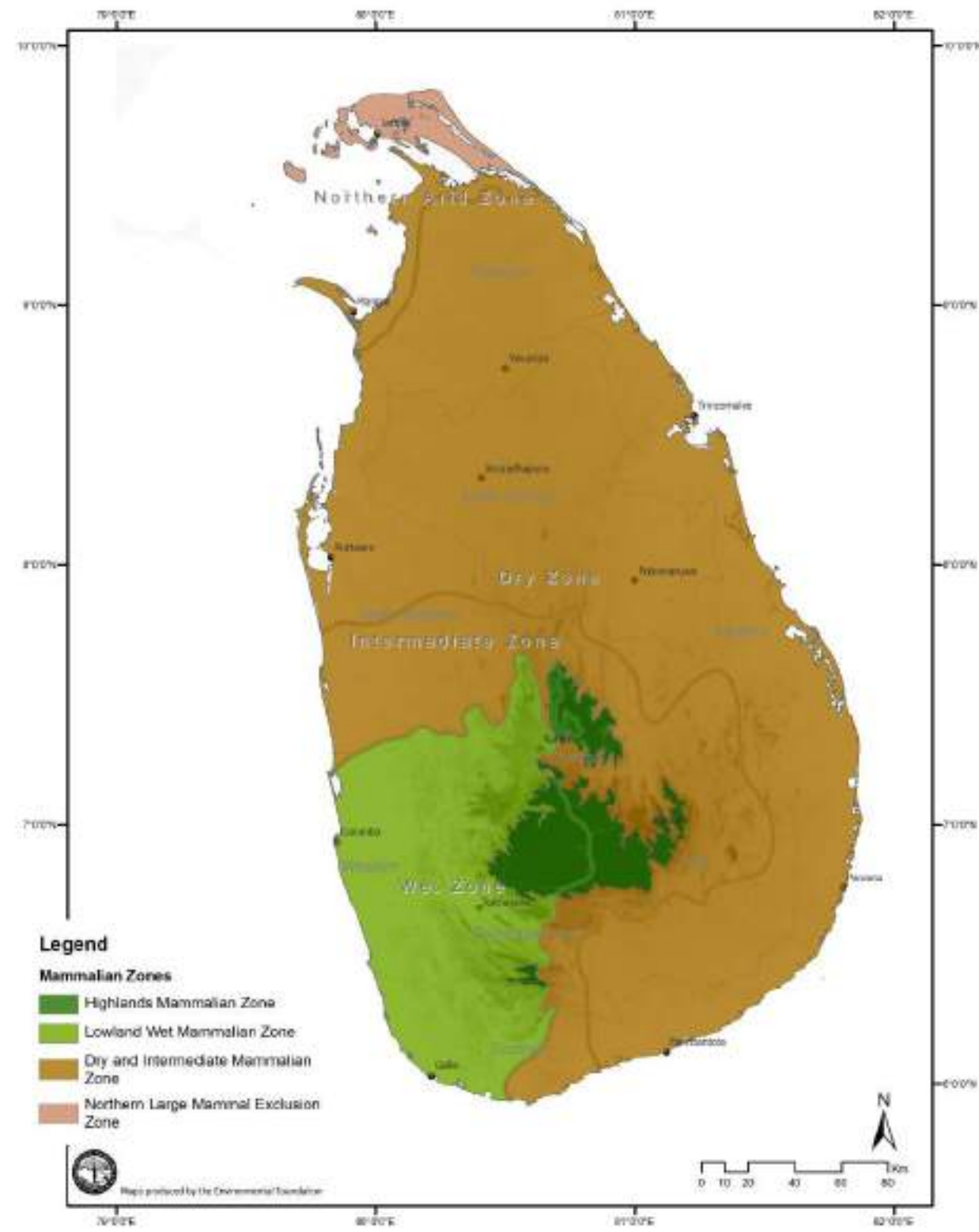


Figure 1.16. Mammalian zones of Sri Lanka, based on the biogeographic distribution of species. The zones are based on expert input during workshops and subsequent consultations. The mammalian zones are overlaid on the climatic zones of Sri Lanka, and the Digital Elevation Model.

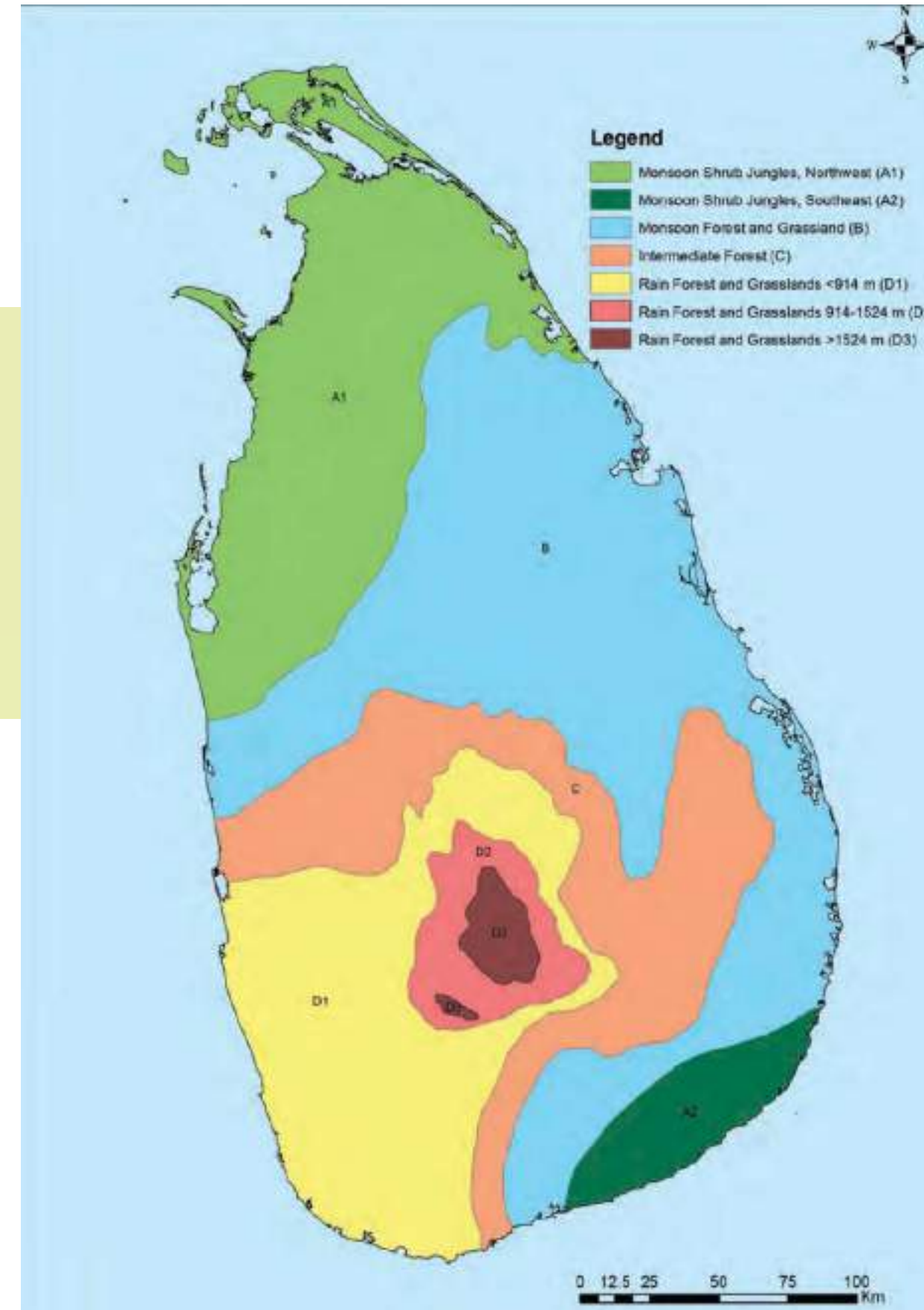


Figure 1.17. Mammal zone map by Eisenberg and McKay (1970) as reproduced in the National Biodiversity Strategy and Action Plan 2016-2025 (MoMD&E 2016).

The mammalian zones (Figure 1.16) were modified by experts during a workshop to review and update information on mammal distributions. The previous map of mammalian zones was prepared almost half a century ago, by Eisenberg & McKay in 1970 (Figure 1.17), and currently more information is available about mammal distributions, justifying the need for review and updates. The mammalian zones proposed by Eisenberg & McKay (1970) were based on the climate map of Muller-Dombois & Sirisena (1967). The seven zones recognized are, Monsoon Scrub Jungle in the northwest (A1), Monsoon Scrub Jungle in the southeast (A2), Monsoon Forest and Grassland (B), Intermediate Forest (C), Rain Forests and Grasslands < 3,000 ft (D1), Rain Forests and Grasslands between 3,000-5,000 ft (D2) and Rain Forests and Grasslands >5,000 ft (D3). They noted that most of the endemic and threatened mammals were restricted to the zones D1, D2 and D3 and more than 75% of the D1 zone falls within the Western Province (MoMD&E, 2016).

The revised mammalian zone map proposed by the expert group has simplified this map with four mammalian zones identified, based on species distributions and assemblage structure. The major changes to the revised map includes: 1) the shift in the boundary of the Monsoon Shrub Jungles (A1) in the previous map (Figure 1.17) further north to be more concordant with the xerotypic vegetation in the northern arid zone; 2) the amalgamation of the dry and intermediate zones, which were represented as distinct mammalian zones by Eisenberg and McKay (1970); 3) representing the rainforests in the wet climatic zone by two mammalian zones as lowland and submontane/montane forests, rather than three zones represented by lowland, mid-montane and high montane forests. The justification for these zones and the mammal faunal characteristics that define them are presented below.

Highlands Mammalian Zone

The Highlands Mammalian Zone is an amalgamation of zones D2 and D3 from Eisenberg and McKay (1970). The species compilation by Dittus (2017) shows that these montane forests have several endemic species that are restricted to the montane rainforests, notably two endemic genera, *Solisorex* and *Srilankamys*. In addition, the critically endangered subspecies of primates *Loris tardigradus nycticeboides* and *Macaca sinica opisthomelas* is confined to this zone.

Lowland Wet Mammalian Zone

The lowland and submontane rainforests represented by the Lowland Wet Mammalian Zone supports several endemic mammal species that sets it apart from the monsoon dry forests in the dry climatic zone. Dittus (2017) provides a species list by zone, and the species represented in Zone D1 (based on the Eisenberg and McKay 1970 map) are represented in this zone. The endemic and critically endangered *Semnopithecus vetulus nestor* is found within remnant forest in the Colombo area within the zone.

Dry and Intermediate Mammalian Zone

The Dry and Intermediate climatic zones of Sri Lanka were treated as separate mammalian zones by Eisenberg & McKay (1970), but the species assemblage in both zones are very similar (Dittus 2017). Thus, the two zones were amalgated in this analysis and are represented by a single zone, the Dry and Intermediate Zone. This zone also includes the Monsoon Scrub Jungle in the southeast (A2) from Eisenberg & McKay (1970).

Northern Large Mammal Exclusion Zone

The boundary of the Northern Large Mammal Exclusion Zone was adjusted to conform to the xerophytic vegetation zone, and to the southern extension of the Deccan Thorn Scrub Forests ecoregion that extends from the Indian Subcontinent to the northernmost areas of Sri Lanka (Wikramanayake et al., 2001). This zone lacks even some of Sri Lanka's widespread megavertebrates such as the Asian Elephant, Leopard, Sloth Bear, Water Buffalo, Sambar, and Spotted Deer. Instead, the zone supports populations of Wild Ass.

1.2.10 Marine Zones of Sri Lanka

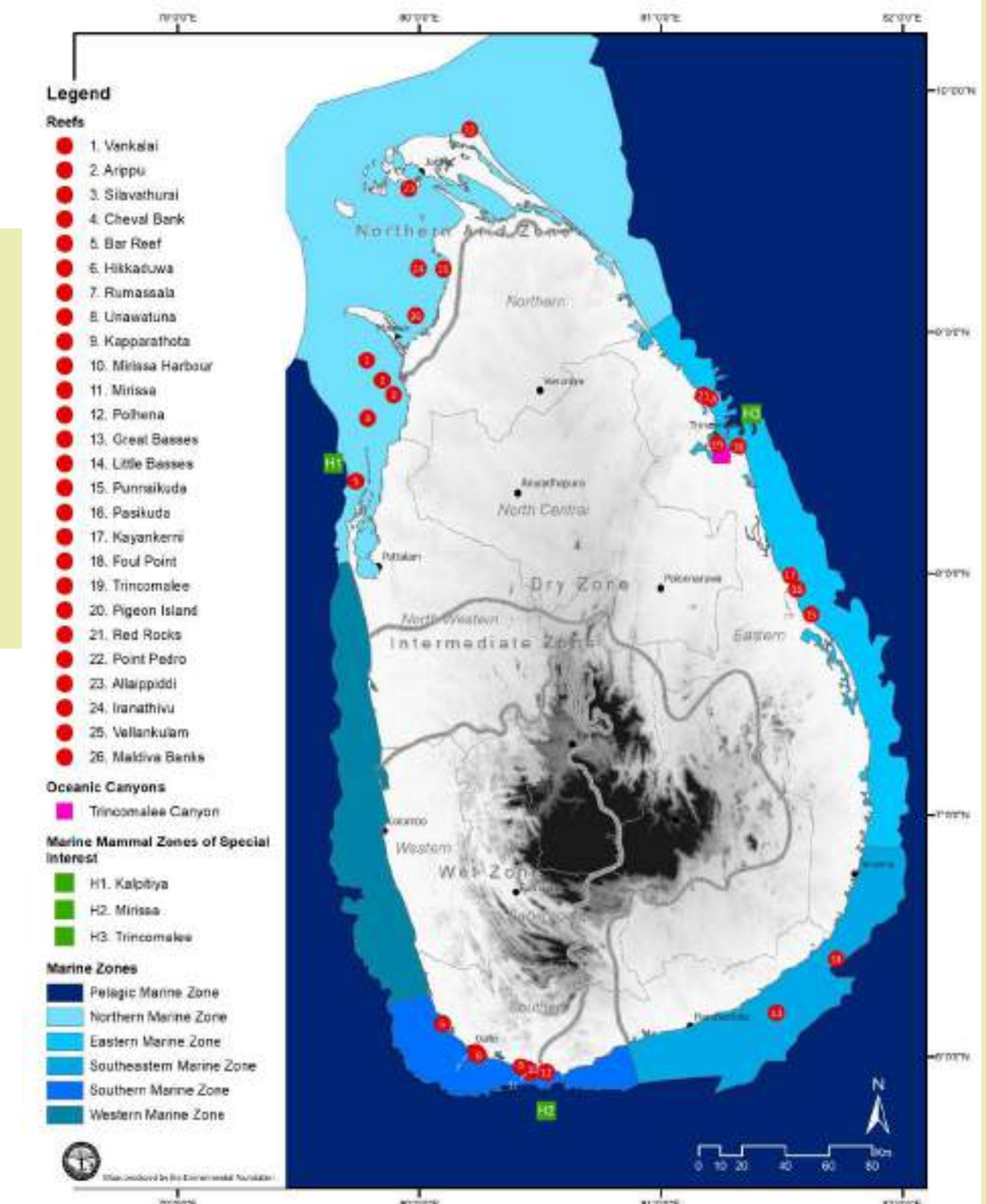


Figure 1.18. Marine zones of Sri Lanka, based on the distribution of key marine habitats. The zones are based on expert input during workshops and subsequent consultations.

The marine zone map of Sri Lanka was developed by experts who attended the biodiversity workshop held to review and update the information on marine taxa (Figure 1.18). This map represents the first map identifying key marine habitats in Sri Lanka. It recognizes six zones, three marine mammal hotspots, 26 coral reefs and one submarine canyon in Sri Lanka. The basis for identifying different marine zones was the uniqueness of marine habitat distribution, including the distribution of true coral reefs, sandstone, seagrass beds, sea bottom characteristics, and shore types, in these proposed zones. In addition, dynamics of wave action along the coastal belt of Sri Lanka was considered.

Pelagic Marine Zone

Pelagic Marine Zone extends from the edge of the continental shelf to the boundary of the Exclusive Economic Zone (EEZ). This zone consists of deep-sea environment, pelagic and mesopelagic environment, which harbor large number of migratory species.

Northern Marine Zone

The Northern Marine Zone covers the shallow continental shelf-area in the northern part of the island, extending from Pulmoddai to Talawila. This area consists of flat shallow sea bed, soft bottom communities, mangroves and seagrass habitats. There are also extensive coral reefs in the Gulf of Mannar and around the Jaffna islands consisting of both fringing reefs and extensive patch reef systems. Apart from this, the Mannar seagrass beds extends north west wards towards Rameswaram Island in India and extensive seagrass meadows are present Mannar to Jafna and around Jafna lagoons. The area is characterized by low wave energy compared to other zones.

The distribution of extensive seagrass meadows provides an ideal habitat for dugongs and sea turtles. *Neophocaena phocaenoides* (Finless Porpoise), *Sousa plumbea* (Humpback Dolphin), *Dugong dugon* (Dugong) and Saw Fishes are some of the major conservation significant species found in this zone.

Kalpitiya has been identified as a marine mammal hotspot and is known for large pods of *Stenella longirostris* (Spinner Dolphin). It also attracts large gatherings of *Physeter macrocephalus* (Sperm Whale) in the season, along with small groups of *Orcinus orca* (Killer Whales).

Vankalai reef, Arippu reef, Silavathurai reef, Cheval Bank reef, Bar Reef, Point Pedro reef, Allaippiddi reef, Iranathivu reef, Vellankulam reef and Maldiva Banks reef are some of the significant coral reefs in this zone.

Eastern Marine Zone

Eastern Marine Zone extends from Pulmoddai to Arugam Bay along the continental shelf of the Eastern Province of Sri Lanka. This zone consists of fringing and patch coral reefs, estuaries, seagrass beds, submarine canyons, and sandy shoreline (except in Trincomalee). Punnakuda reef, Pasikuda reef, Kayankerni reef, Foul Point reef, Trincomalee reef, Pigeon Island reef and Red Rocks reef are some of the main coral reefs in this zone. One of the key features of this zone is the Trincomalee submarine canyon, which is a multiple submarine canyon complex and the largest submarine canyon in the country. The Trincomalee submarine canyon creates a suitable habitat for marine mammals and has been identified as a marine mammal hotspot. Riverine estuaries and coastal lagoons provide extensive mangrove forests, with the Mahaweli River estuary containing some of the largest mangrove stands in Sri Lanka. Significant seagrass habitats can be found in places such as Batticaloa, Valachchenai and Vakarai.

South-eastern Marine Zone

This zone extends from Arugambay to Ambalantota and is characterized by high energy resulting in high swells and waves, and strong currents. The coastline is composed of barrier beaches, sand dunes, rocky shorelines, lagoons and riverine estuaries. There are a few fringing coral reefs, but overall reef development is poor. However, extensive rocky and boulder reefs provide important habitats for reef species. The Great and Little Besses reefs are important offshore rocky reef systems. Mangroves and coastal lagoons provide important habitats for water birds, while this area is also known for its populations of Estuarine Crocodiles.

Southern Marine Zone

The Southern Marine Zone extends from Ambalangoda to Ambalantota along the continental shelf, past the southern tip of Sri Lanka. This zone contains naturally occurring fringing coral reefs, deep rocky reefs and rock habitats. Hikkaduwa reef, Rumassala reef, Unawatuna reef, Kapparahota reef, Mirissa Harbour reef, Mirissa reef and Polhena reef are some of the main fringing coral reefs in this zone. Riverine estuaries with mangroves and coastal wetlands are found along the coast, with major wetland systems around estuaries formed by the Madu River, Gin Ganga, Nilwala River, Walawe River and Kalametiya. Patchy distributions of seagrasses are recorded in the Hikkaduwa, Weligama, Dondra, Ahangama and Rekawa Lagoon. The Southern Zone is an important area for marine mammals and includes both residential and transient populations. Mirissa has been identified as an important marine mammal hotspot for large whales, including *Balaenoptera musculus* (Blue Whales) and *Physeter macrocephalus* (Sperm Whales).

Western Marine Zone

This zone contains the coastal area extending from Ambalangoda to Talawila along the continental shelf. Western Zone does not contain true coral reefs, but contains extensive sandstone reefs with superficial coral cover. Some deep patch reefs and coral habitats are also found offshore, at depths of 15 to 30 m. Sandy beaches, rocky shorelines and riverine estuaries are other important features of the area. Negombo lagoon, Bolgoda estuary, Kalu Ganga estuary and the Bentota river estuary contain extensive estuarine mangroves. Negombo also has significant seagrass habitats. The high nutrient input from large rivers has resulted in high primary productivity that in turn sustain extensive fisheries in the area.



1.2.11 Mangrove Zones of Sri Lanka

The exact extent of mangroves are yet to be verified formally, but recent investigations carried out by the Department of Forest has revealed an extent of 19,726 ha of mangroves in Sri Lanka. However, most of the mangrove patches are smaller in extent, disjointed and disturbed. Few relatively undisturbed mangrove patches with a considerable extent (> 1,000 ha) are found in Northwestern (Gangewadiya), Northern (Vidaththalaithiv Nature Reserve) and Northeastern (Gangi, Upparu in Mahaweli river mouth) coastal belt. Due to low tidal amplitudes, landward distribution of mangroves is limited to less than 3 km in most instances. Extensive and continuous mangrove patches once seen along Dutch canal and Mundal lagoon area are now fragmented due to shrimp farming.

Species diversity and zonation

With 21 true mangroves recorded in the country so far, evidence suggests area specific and restricted distribution of some. *Nypa fruticans* restricted wetter coastal area; between north western to southern coast and some of the species restricted to the north eastern drier coastal parts of the island, such as *Cynometra iripa* and *Pemphis acidula*. Also, this phenomenon has resulted in unique species assemblages and compositions in different parts such as *Lumnitzera littorea* in a point locality of Madu Ganga, *Ceriops decandra* in Northeastern coastal belt around Trincomalee and Kinniya, some such as *Scyphiphora hydrophyllacea* enlisted as vulnerable (VU) due to their scarcity and found in few locations in Northwestern coast. Accordingly, two distinct zones of mangrove distribution were identified.

Nypa fruticans absent zone

This zone covers the dry and arid coastal zone of Sri Lanka to a larger extent (Figure. 1.19). In addition to the absence of *N. fruticans*, presence of *Ceriops decandra* in Northeastern coastal belt can be mentioned. The associated species of mangroves are equally distinct here, as the species composition is determined by the dry climatic zone. Ma dan (*Syzygium cumini*), Palu (*Manilkara hexandra*), Weera (*Drypetes sepiaria*), Indi (*Phoenix pusilla*) and other typical coastal flora are interspersed with true mangroves and in recent times, invasive species such as *Prosopis juliflora* is replacing natives. Here, mangrove ecosystems have evolved with salt marsh, and in the ecotone between the two ecosystems, species such as *Avicennia marina* is seen in stunted dwarf form.

Nypa fruticans present zone

N. fruticans demarcates the mangroves which traditionally received the supply of perennial rivers and hence the more freshwater influenced mangroves. A larger proportion of wet and intermediate zone falls within here and in addition to true mangroves, the associated species are also unique (Figure. 1.19). In wet and intermediate zone, Gon Kaduru (*Cerbera manghas*), Kottamba (*Terminalia catappa*), Domba (*Calophyllum inophyllum*), Diyadanga (*Dolichandrone spathacea*), Gansooriya (*Thespesia populnea*), are some examples of typical flora found as associates representing the climate. Here two invasive species, namely *Dillenia suffruticosa* and *Annona glabra* has invaded the mangroves, extensively and are fast altering the ecosystem, and in the case of *A. glabra*, monostands with new ecosystem characteristics are seen.

Here the mangroves are more disturbed and are fragmented mainly due to settlement, tourism and other coastal developments.

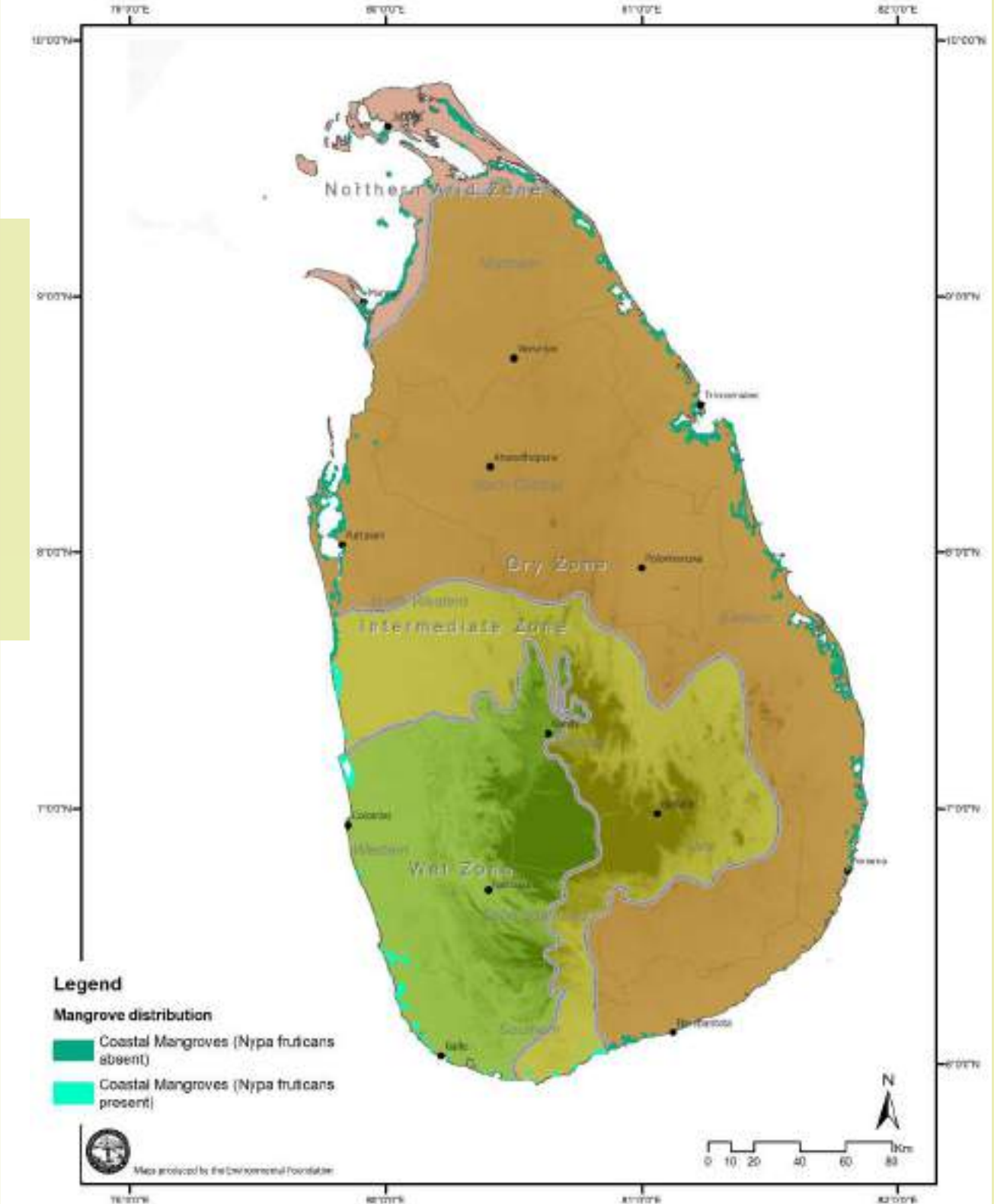


Figure 1.19. Mangrove zones of Sri Lanka, based on the distribution of key mangrove habitats. The zones are based on expert input during workshops and subsequent consultations.



2 FLORA OF SRI LANKA

Saraca asoca (SS)

2.1 Summary of Floristic Diversity in Sri Lanka

Sri Lanka is home to a high taxonomic diversity among floristic species, reflected in that 183 families, about 45% of the world's flowering plant families are found on the island. Further, 1121 Angiosperm genera (excluding exotics) and 3116 flowering plant species have been recorded in the country, with 901 of these being identified as endemic species.

The Families Poaceae (108), Orchidaceae (77) and Fabaceae (70) are the three families with the highest generic diversity. Thirty-six families are represented by only a single species and another 17 genera are recorded to be found only in Sri Lanka.

Above families also have the highest number of recorded species, with 262, 187 and 220 species belonging to Poaceae, Orchidaceae and Fabaceae, respectively. In terms of endemic species, the family Rubiaceae has 102 endemic species recorded within four endemic genera (Table 2.1).

Table 2.1 Summary of floristic diversity in Sri Lanka

Family	No. of Genera	No. of Genera with All Endemic Species	No. of Endemic Genera	Name of Endemic Genus	No. of Species	No. of Endemic Species
Acanthaceae	32	0	0		105	41
Achariaceae	4	4	1	<i>Chlorocarpa</i> Alston	5	5
Adoxaceae	1	0	0		2	0
Aizoaceae	2	0	0		4	0
Alismataceae	2	0	0		2	0
Amaranthaceae	17	0	0		27	2
Amaryllidaceae	3	0	0		7	0
Anacardiaceae	7	1	0		19	15
Ancistrocladaceae	1	1	0		1	1
Anisophyllaceae	1	0	0		1	0
Annonaceae	15	3	1	<i>Phoebanthus</i> Alston	40	18
Apiaceae	7	2	0		9	2
Apocynaceae	43	6	0		67	14
Aponogetonaceae	1	0	0		6	4
Aquifoliaceae	1	0	0		4	1
Araceae	16	1	0		44	22
Araliaceae	4	0	0		8	3
Arecaceae	7	3	1	<i>Loxococcus</i> H.Wendl. & Drude	16	10
Aristolochiaceae	2	0	0		3	0
Asparagaceae	8	0	0		14	1
Asteraceae	33	0	0		85	26

Family	No. of Genera	No. of Genera with All Endemic Species	No. of Endemic Genera	Name of Endemic Genus	No. of Species	No. of Endemic Species
Balanophoraceae	1	0	0		1	0
Balsaminaceae	2	0	0		23	16
Basellaceae	1	0	0		1	0
Begoniaceae	1	0	0		5	1
Berberidaceae	1	0	0		3	1
Bignoniaceae	3	0	0		4	0
Boraginaceae	9	0	0		21	1
Burmanniaceae	2	1	0		5	1
Burseraceae	4	1	0		5	1
Buxaceae	1	0	0		2	1
Cactaceae	1	0	0		1	0
Calophyllaceae	2	0	0		16	13
Campanulaceae	4	0	0		9	0
Cannabaceae	4	0	0		5	0
Capparaceae	4	0	0		15	0
Caprifoliaceae	2	1	0		2	1
Caryophyllaceae	6	0	0		12	0
Celastraceae	11	3	0		23	11
Centroplacaceae	1	0	0		3	2
Ceratophyllaceae	1	0	0		1	0
Chloranthaceae	1	0	0		1	0
Cleomaceae	1	0	0		6	0
Clusiaceae	1	0	0		8	5
Colchicaceae	2	0	0		2	0
Combretaceae	4	0	0		10	0
Commelinaceae	7	0	0		39	3
Connaraceae	3	1	0		4	2
Convolvulaceae	12	0	0		41	4
Cornaceae	2	0	0		6	3
Costaceae	1	0	0		1	0
Crassulaceae	1	0	0		2	0
Crypteroniaceae	1	1	0		1	1
Cucurbitaceae	13	0	0		24	1
Cymodoceaceae	3	0	0		3	0
Cyperaceae	24	0	0		169	11
Daphniphyllaceae	1	0	0		1	0
Dichapetalaceae	1	0	0		2	1
Dilleniaceae	4	2	1	<i>Schumacheria</i> Vahl	15	10
Dioscoreaceae	3	0	0		9	2

Family	No. of Genera	No. of Genera with All Endemic Species	No. of Endemic Genera	Name of Endemic Genus	No. of Species	No. of Endemic Species
Dipterocarpaceae	9	9	2	<i>Doona</i> Thwaites <i>Stemonoporus</i> Thwaites	58	58
Droseraceae	1	0	0		3	0
Ebenaceae	2	0	0		32	18
Elaeagnaceae	1	0	0		1	0
Elaeocarpaceae	1	0	0		9	8
Elatinaceae	1	0	0		2	0
Ericaceae	3	1	0		3	1
Eriocaulaceae	1	0	0		21	10
Erythroxylaceae	1	0	0		5	1
Euphorbiaceae	24	2	1	<i>Podadenia</i> Thwaites	69	16
Fabaceae	70	3	0		220	13
Flagellariaceae	1	0	0		1	0
Gentianaceae	8	2	0		18	7
Geraniaceae	1	0	0		1	0
Gesneriaceae	7	3	1	<i>Championia</i> Gardner	14	10
Gisekiaceae	1	0	0		1	0
Goodeniaceae	1	0	0		2	0
Haloragaceae	2	0	0		4	1
Hernandiaceae	2	0	0		2	0
Hydrocharitaceae	8	0	0		13	0
Hydroleaceae	1	0	0		1	0
Hypericaceae	1	0	0		2	0
Hyoxidaceae	2	0	0		2	0
Icacinaceae	3	0	0		3	0
Juncaceae	1	0	0		4	0
Lamiaceae	22	1	0		70	15
Lauraceae	9	3	0		40	29
Lecythidaceae	2	0	0		5	0
Lentibulariaceae	1	0	0		15	1
Linaceae	1	0	0		2	0
Linderniaceae	3	0	0		16	3
Loganiaceae	2	0	0		9	4
Loranthaceae	7	2	0		21	11
Lythraceae	9	0	0		16	0
Magnoliaceae	1	0	0		1	0
Malpighiaceae	1	0	0		2	0
Malvaceae	30	4	1	<i>Dicelostyles</i> (Thwaites) Benth.	72	9
Marantaceae	3	1	0		3	1

Family	No. of Genera	No. of Genera with All Endemic Species	No. of Endemic Genera	Name of Endemic Genus	No. of Species	No. of Endemic Species
Melastomataceae	7	1	0		71	57
Meliaceae	8	0	0		13	2
Menispermaceae	11	0	0		13	0
Menyanthaceae	1	0	0		4	0
Molluginaceae	2	0	0		6	0
Monimiaceae	1	1	1	<i>Hortonia</i> Wight ex Arn.	3	3
Moraceae	8	1	0		33	4
Musaceae	1	0	0		2	0
Myristicaceae	2	0	0		4	1
Myrtaceae	4	1	0		56	46
Nelumbonaceae	1	0	0		1	0
Nepenthaceae	1	1	0		1	1
Nyctaginaceae	2	0	0		4	0
Nymphaeaceae	1	0	0		3	0
Ochnaceae	2	0	0		4	1
Olacaceae	3	0	0		6	1
Oleaceae	4	0	0		10	1
Onagraceae	1	0	0		5	0
Opiliaceae	2	0	0		2	0
Orchidaceae	77	9	1	<i>Adrorhizon</i> Hook.f.	187	52
Orobanchaceae	8	0	0		18	3
Oxalidaceae	1	0	0		5	0
Pandanaceae	2	1	0		7	3
Papaveraceae	1	0	0		1	0
Passifloraceae	1	0	0		2	0
Pedaliaceae	2	0	0		3	0
Pentaphragaceae	3	1	0		7	3
Phrymaceae	1	0	0		1	0
Phyllanthaceae	17	1	0		69	27
Picrodendraceae	1	0	0		1	0
Piperaceae	3	0	0		12	4
Pittosporaceae	1	0	0		2	0
Plantaginaceae	9	0	0		23	2
Plumbaginaceae	1	0	0		1	0
Poaceae	108	5	1	<i>Davidsea</i> Soderstr. & R.P.Ellis	262	22
Podostemaceae	4	1	0		7	2
Polygalaceae	3	1	0		15	4
Polygonaceae	2	0	0		12	0
Pontederiaceae	1	0	0		2	0

Family	No. of Genera	No. of Genera with All Endemic Species	No. of Endemic Genera	Name of Endemic Genus	No. of Species	No. of Endemic Species
Portulacaceae	5	0	0		5	0
Potamogetonaceae	1	0	0		3	0
Primulaceae	6	0	0		24	9
Proteaceae	1	1	0		1	1
Putranjivaceae	2	0	0		6	3
Ranunculaceae	5	0	0		7	1
Rhamnaceae	7	0	0		14	3
Rhizophoraceae	5	0	0		10	3
Rosaceae	7	1	0		17	3
Rubiaceae	57	10	4	<i>Diyaminauclea</i> Ridsdale <i>Leucocodon</i> Gardner <i>Nargedia</i> Bedd <i>Scyphostachys</i> Thwaites	179	102
Ruppiaceae	1	0	0		1	0
Rutaceae	16	2	0		28	3
Sabiaceae	1	0	0		2	0
Salicaceae	6	1	0		11	5
Salvadoraceae	2	0	0		2	0
Sapindaceae	11	1	0		18	4
Santalaceae	6	1	0		11	1
Sapotaceae	7	1	0		25	16
Schisandraceae	1	0	0		1	0
Scrophulariaceae	3	0	0		3	0
Simaroubaceae	3	0	0		3	0
Smilacaceae	1	0	0		3	0
Solanaceae	3	0	0		11	0
Sphenocleaceae	1	0	0		1	0
Staphyleaceae	1	0	0		1	0
Stemonaceae	1	0	0		1	0
Stemonuraceae	2	1	0		3	1
Stylidiaceae	1	0	0		1	0
Surianaceae	1	0	0		1	0
Symplocaceae	1	0	0		13	10
Tamaricaceae	1	0	0		2	0
Tetramelaceae	1	0	0		1	0
Theaceae	2	1	0		5	4
Thymelaeaceae	4	0	0		4	0
Triuridaceae	2	0	0		3	0
Typhaceae	1	0	0		1	0
Ulmaceae	1	0	0		1	0
Urticaceae	12	0	0		27	2
Vahliaceae	1	0	0		1	0

Family	No. of Genera	No. of Genera with all Endemic Species	No. of Endemic Genera	Name of Endemic Genus	No. of Species	No. of Endemic Species
Verbanaceae	2	0	0		2	0
Violaceae	8	0	0		8	2
Vitaceae	6	0	0		17	3
Xanthorrhoeaceae	1	0	0		1	0
Xyridaceae	1	0	0		4	0
Zingiberaceae	7	0	1	<i>Cyphostigma</i> Benth	21	13
Zygophyllaceae	1	0	0		1	0
183	1121	106	17		3116	901

*Genus *Doona* sensu lato presently considered as synonym of *Shorea*. However, *Doona* sensu stricto consider as endemic to the Sri Lankan wet zone.

Data in Table 2.1 was provided by National Herbarium and updated based on expert input during workshops and subsequent consultations.

2.2 Floristic Zones of Sri Lanka



Drasella burmannii (SS)

When Ashton and Gunatilleke (1987) mapped the floristic zones of Sri Lanka, they recognized 15 distinctive floristic zones based upon the unique assemblages of flora. However, two of the 15 zones, the freshwater bodies and the coastal zone were not mapped. For the purpose of the updated biodiversity profile, a component of the 6th National Report to the Convention on Biological Diversity, the boundaries of these zones were refined based upon the expert knowledge shared by those working in the fields of flora and vegetation in Sri Lanka, and new knowledge accumulated since then.

The northern and the southern arid zones included in the present work (A1 and A2) were recognized as separate from the dry zone due to the presence of characteristic species unique to these arid regions (Figure. 2.1a). The mountain zone was divided into two sub-zones based on the different floristic compositions and climatic variations. Further, B2b was recognized separately due to its unique hill savanna vegetation. In Sri Lanka's arid and semi-arid zones, the vegetation types are floristically similar to those in southeast peninsular India as they share a similar climate. However, in Sri Lanka these forests are generally less degraded. Several floristic zones in Sri Lanka's montane region are defined on the basis of relative abundance of endemic species, mostly determined by rainfall, temperature, and topography.

Nomenclature of Sri Lanka's forest types in this review follows the classification given for all tropical Asia, elaborated in Ashton (2014). Sri Lanka's forest types mostly conform structurally and physiognomically to forest types occurring in similar rainfall and temperature regimes elsewhere in the Asian tropics, with two exceptions:

1. The upper dipterocarp forests of Sri Lanka's wet zone hills represent the lowest montane forest formation. Above them, in succession are the lower montane and upper montane forests, and finally tropical subalpine thicket above the frost line. The upper montane forests occur on shallow soils along ridges and narrow plateaus at 750-1,000 m elevation, notably in floristic zone C2 (Figure. 2.1b). These upper montane forests occur towards the eastern end of the Kiribatgala ridge and on the ridges surrounding Morningside Estate (Rakwana hills) in eastern Sinharaja; also at the eastern end of the Peak Sanctuary- visible where it occurs on the east side of the Balangoda-Bogawantalawa road; this forest type differs from upper dipterocarp forest in Peninsular Malaysia in its low stature, even notophyll-microphyll canopy, and usual dominance of a single *Stemonoporus* species. The genus *Stemonoporus* is endemic to Sri Lanka, and most of its species are in the mountains.

2. The altitudinal range of the upper montane forests vary with topography and proximity to the sea. At most inland stations, the lower-upper montane ecotone is at 1,700-2,000 m, but on isolated small mountains at lower latitudes, and especially near the coastline, the lower boundary of the montane ecotone can be as low as 850 m. This results, more or less, in a transition of montane forests to lowland forest and truncation of lower montane forest. The ecotone to subalpine thicket is determined by the usual altitude of the frost line; in low latitude equatorial regions it is at c.3,000-3,300 m, but this declines at higher latitudes and more seasonal rainfall regimes. The line of periodic winter frost in the Sri Lankan hills is as low as 1,800 m. As a result, subalpine thicket truncates upper montane forest both in Sri Lanka and the Western Ghats of India, so that most upper montane forest here is transitional to subalpine thicket with shorter trees and are less mossy than in the perhumid Far East. This is detectable owing to the frequency of species with subalpine characteristics, including recurved (spoon-shaped) leaves.

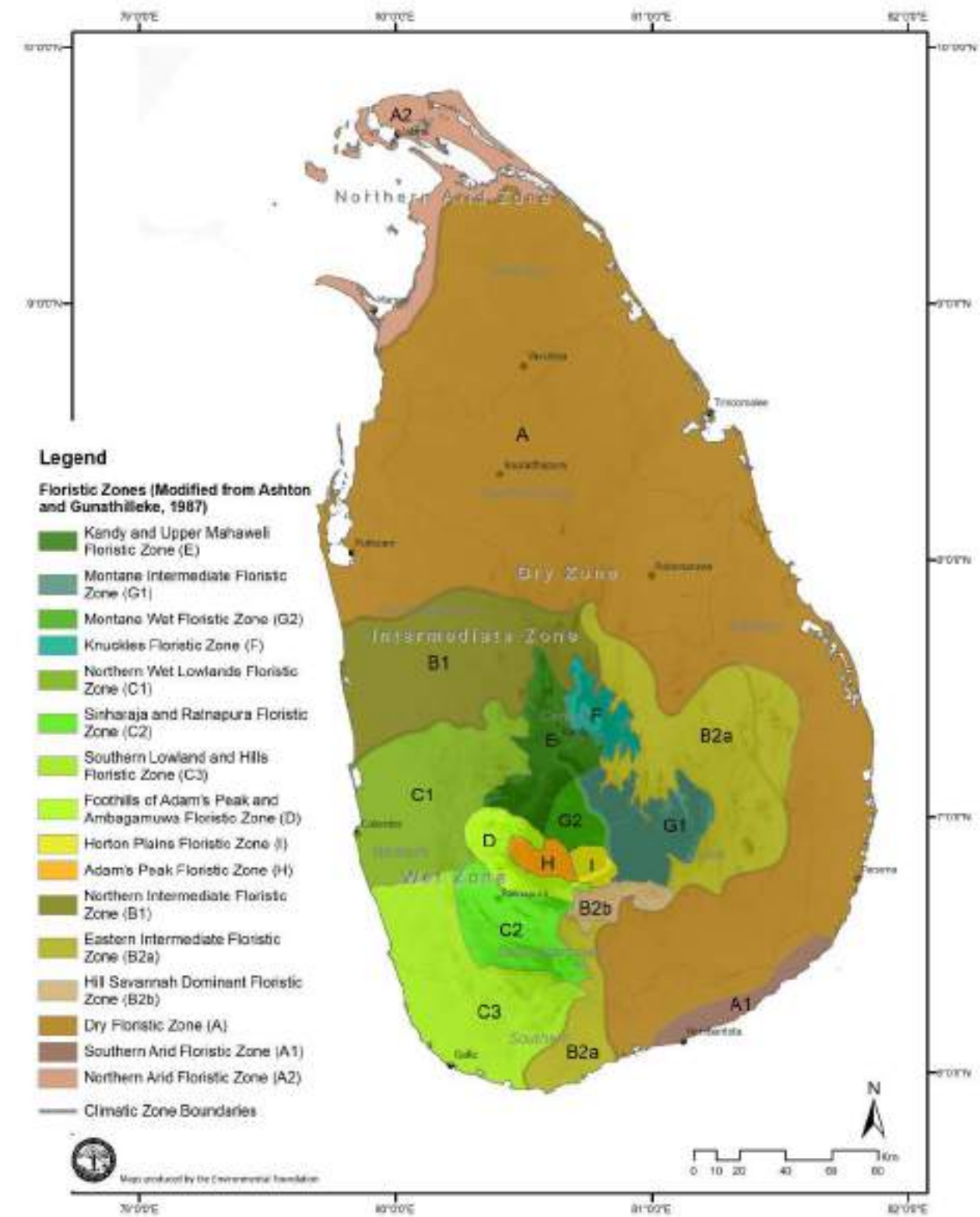


Figure 2.1a Floristic regions of Sri Lanka, based on the distribution of principal vegetation types and dominant plant communities. The zones are modified from Ashton and Gunatilleke (1987), based on discussions with experts.

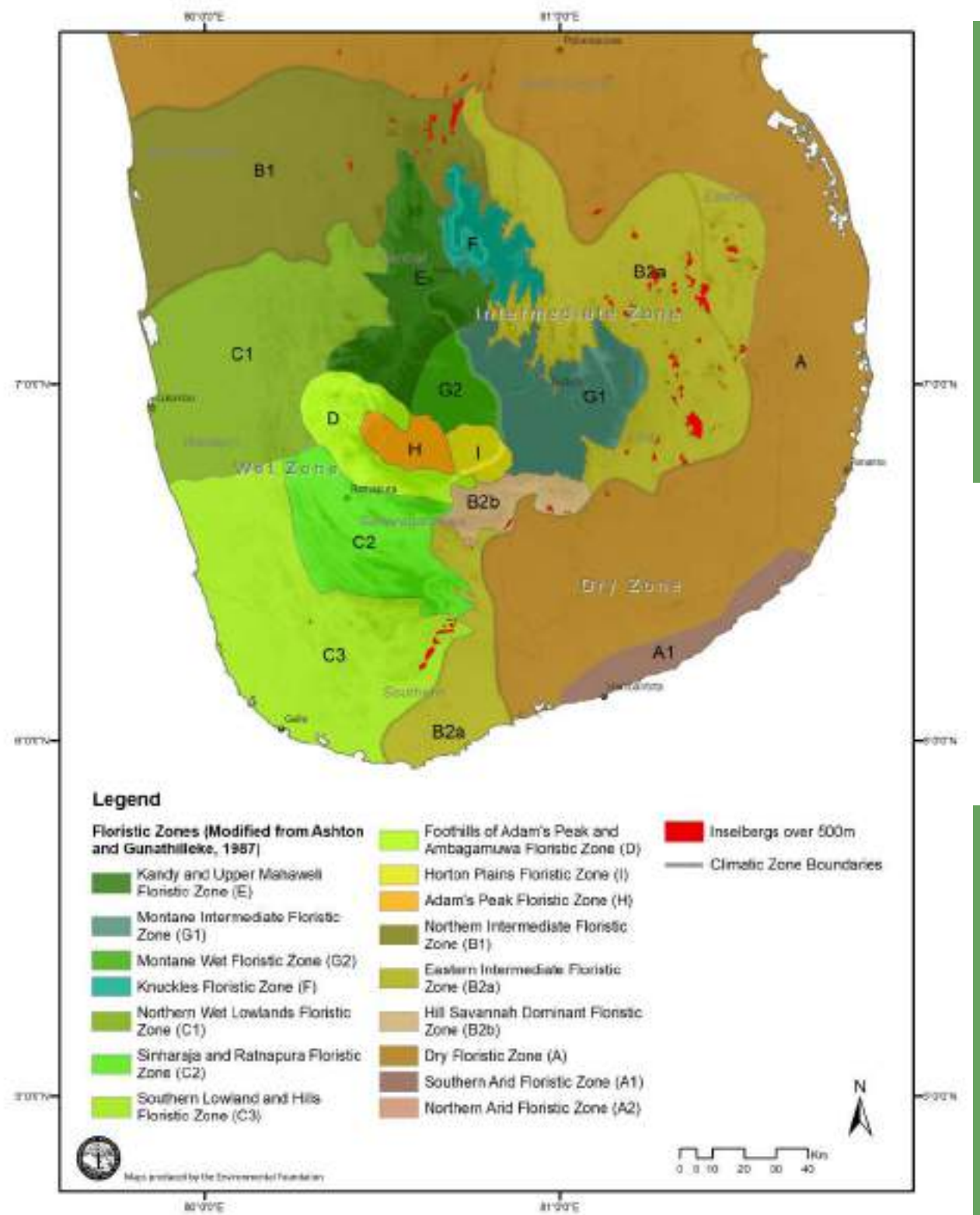


Figure 2.1b Floristic regions of Sri Lanka enlarged, based on the distribution of principal vegetation types and dominant plant communities. The zones are modified from Ashton and Gunatilleke (1987), based on discussions with experts.

Coastal and Marine Belt Region

The coastal and marine belt region can be recognized as a special floristic region considering the distribution of unique vegetation types which are restricted to this region. The region is characterized by the marine mangroves, salt marshes, sand dunes, and sandy beach vegetation that are found in the coastal belt of Sri Lanka. This region is very narrow and extends only 300 m along the coastal stretch of the country. Beach flora, such as *Pandanus odorifer*, *Barringtonia asiatica*, *Ipomoea pes-caprae*, *Scaevola taccada* and *Scaevola plumieri* are some of the species that are characteristic of this region.

Within the coastal and marine belt region two sub regions can be distinguished based on climatic conditions. One is the wet coastal and marine belt region which lies along the wet climatic zone of Sri Lanka. Some of the plant species found along the wet coastal and marine belt region are *Crinum asiaticum*, *Calophyllum inophyllum* and *Terminalia catappa*. Second is the dry coastal and marine belt region which lies along the dry climatic zone of Sri Lanka. Floristic species *Crinum latifolium* and *Crinum zeylanicum* are common types of sandy vegetation found in these dry areas. Sand Dunes are abundant within the zone, with species such as *Ipomoea pes-caprae*, *Spinifex littoreus* and *Phyla nodiflora*, *Hydrophylax maritima* and *Senna auriculata*.

Dry Floristic Zone (A)

The dry floristic zone is the largest floristic region found in Sri Lanka, covering a vast area of the north and east of the country. The region receives 1,000 mm-1,500 mm of rain annually, with most of the rain falling during the north-eastern monsoon period (October-February). The climate of the region is otherwise predominantly dry, hot and humid with average temperatures of 29°C – 31°C.

Several vegetation communities are found in this floristic zone. *Manilkara* dominant tropical semi-evergreen notophyll forests (dry mixed evergreen forests) are the most dominant vegetation in this region. Further, a *Chloroxylon-Vitex-Berrya-Schleichera* series are also present. There are fewer endemic species, compared to the forests of the wet zone. Three notable endemic plant species in the dry forests are *Derris parviflora*, *Rhinacanthus polonnaruwensis*, *Diplodiscus verrucosus*. The forest assemblage in the region is unique and requires further ecological study from which further sub-regions may be identified within the zone.

Damana is the main dominant type of grass vegetation in the dry floristic zone. Rivers, villus and flood-plain wetlands are other characteristic natural wetland types which define this zone. The network of protected areas along the Mahaweli River, consisting of Somawathiya, Thrikonamadu and the Flood Plains National Parks are examples of the river-associated network of villus. Interestingly, on the other hand the circular shaped villus found in the North-west of Sri Lanka is characterized by their isolation to a perennial water source, for example the villu ecosystem of Wilpattu (Pers. Com. Suranjan Fernando; Sevvandi Jayakody). There is no external visible inlet or outlet to these villu water bodies, which are like shallow basins.

Southern Arid Floristic Zone (A1) and Northern Arid Floristic Zone (A2)

The southern and northern arid floristic zones are the most arid landscapes found in the north and north-western part of the island and the south-eastern corner of the island. These arid regions receive below 1,000 mm (or 800 mm) of rainfall annually (Sri Lanka National Atlas, 2007). On average, the region experiences a dry period of more than 6 months annually. The vegetation of the arid zone consists mainly of thorn woodland, with thorn bearing shrubs and scattered trees across the landscape. *Manilkara hexandra*, *Catunaregam spinosa*, *Dichrostachys cinerea*, *Senna auriculata*, *Acacia planifrons*, *Acacia eburnea*, *Salvadora persica*, *Limonia acidissima*, *Azima tetracantha* and *Azadirachta indica* are some of the dominant species which define this region. Arid grasslands are scattered in a mosaic like structure within the zones, and are dominated by *Cynodon dactylon*, *Zoysia matrella*, *Eragrostis riparia* and *Chloris barbata*.

While the two arid zones are very similar, the Northern arid floristic zone is distinguishable due to the high incidence of species having affinities to mainland India in comparison to the southern arid floristic zone. The semi parasitic bush *Dendrophthoe ligulata* is endemic in Northern-arid floristic zone.

Northern Intermediate Floristic Zone (B1)

This region includes lowland areas in the northern part of the intermediate climatic zone. The region covers Daduru Oya, Karambala Oya and Ratmal Oya basins and is wetter than the other two regions in the intermediate climatic zone (B2a, B2b). In the tropical moist semi-evergreen forest community, the *Filicium- Dimocarpus -Artocarpus-Myristica* series is dominant. The forest community in the B1 region is distinct from the eastern intermediate lowland (B2a) and hill savannah dominant zone (B2b). Also Savannah vegetation cannot be found in this region.

Eastern Intermediate Floristic Zone (B2a)

This region can be differentiated from the Northern Intermediate Lowland Region since it has both tropical semi-evergreen forest transitioning into tall (dry) deciduous forest, and savannah forest. Tropical moist semi-evergreen forest species, and savannah forest species are found in this region. The characteristic species that define (B2a) are all deciduous: *Anogeissus latifolius*, *Terminalia bellirica*, *T. chebula*, *Phyllanthus emblica* and *Pterocarpus marsupium*.

Hill Savanah Dominant Floristic Zone (B2b)

This region can be identified as a distinct floristic sub region within the eastern intermediate floristic zone (B2) based on unique vegetation types found in this region. Hill savanna can be found along the southern flanks of the central mountain ridge, specifically in the Mahawalathenna plateau. *Careya arborea*, *Ficus arnottiana*, *Cymbopogon nardus*, and *Themeda triandra* are some of the dominant species found in this zone.

Northern Wet Lowlands Floristic Zone (C1)

This region is within the northernmost part of the wet climatic zone bordering the intermediate zone. It extends roughly from Avissawella up to Negombo and covers the Attanagalu Oya basin along its northern boundary. To its east are floristic zones D and E, which are not clearly defined. Mean altitude is below 900 m, with an average temperature of 29°C and annual rainfall varies between 2,000-5,000 mm.

This region shows more seasonality than C2 and C3 regions. Due to high urbanization, few forest patches remain in the Northern Wet Lowland Floristic Zone. The dominant formation in this region is mixed dipterocarp forest. Its flora shows more resilience to the dry spell. The vegetation is mainly dominated by *Dipterocarpus zeylanicus*, *D. hispidus* and *Vitex altissima*. The current absence of the genus *Doona* (Dipterocarpaceae) in this region is notable, although *Doona disticha* formerly occurred in Kegalle District, and other *Doona* species may survive in foothill fragments in the east. *Alphonsea hortensis* (Annonaceae) and *Eriocaulon fluviatile* (Eriocaulaceae) were recorded from this region a century ago.

Sinharaja and Ratnapura Floristic Zone (C2)

The Sinharaja and Ratnapura floristic zone is the core of the lowland wet evergreen forests covering the entirety of the Sabaragamuwa basin and its surrounding hilltops. The hills ascend in elevation towards the east, where they exceed 800 m and support several forest types, notably short-statured upper dipterocarp forests, often dominated by a single *Stemonoporus* species; lower montane forests; and savanna vegetation. The forests below c. 900 m are unique for the presence of the lowland mixed dipterocarp forest and the *Mesua-Doona* community. These communities within the C3 region are floristically unique, globally. They are the most species-rich among the Sri Lankan forests, with 90% tree species endemism.

Southern Lowland Hills Floristic Zone (C3)

This floristic zone in the southern lowland hill region is a curved belt along the southern coastline of the island, extending up to 30 km inland. The southern boundary of the zone runs from Hulandawa, Beliatta to Walasmulla –Middeniya and borders the intermediate zone (B2b). The north-eastern edge of the zone is bounded by the catchment area of the Gin River up to Matugama. The western boundary runs along the coast from Kalutara to close to Dikwella. When the south-western monsoon arrives, heavy rainfall first occurs within zone C3. The composition of forest types bear a lot of similarity to what is found in C2; however, C3 is wetter receiving heavier rainfall in comparison to C2. The climate of the southern lowland hills supports a high assemblage of biodiversity with an exceptionally high rate of endemism. Some range restricted endemics, which are all categorized as endangered are *Diospyros pemadasai*, *Schumacheria angustifolia*, *Stemonoporus kanneliyensis*, *Semecarpus parvifolia*, *Goniothalamus thomsonii*, *Calophyllum cordato-oblongum* and *Scyphostachys pedunculatus*.

Ashton and Gunatilleke (1987), when writing about this region, described it gleefully as; “This block is without doubt floristically the richest area of Ceylon, and indeed of all South Asia, as was pointed out by Broun at the end of the last century in his review of the forests of Ceylon in Trimen’s flora.”

Foothills of Adam’s Peak and Ambagamuwa Floristic Zone (D)

This region runs as a narrow arc about 10 km wide, which encircles the western flank of the central mountain range. Geographically the region runs from Maskeliya to the upper Kelani valleys in the northwest and south through lowland Ambagamuwa, Ginigathhena, Deraniyagala, through Kuruwita-Erathne and then eastwards through Rassagala (Balangoda) to mid zone of Belihul Oya (Ashton and Gunatilleke, 1987).

The region experiences high rainfall throughout the year. It is the wettest and least seasonal part of the lowlands in the whole county (Ashton and Gunatilleke, 1987). The deep valleys which flank the western part of the mountain range are refuted for highly localized endemic species. The high floristic diversity has resulted from the varied geographical and climatic conditions. Mixed dipterocarp forest is dominant in this region, to c. 800 m altitude. A unique assemblage of forest species is distributed along the altitudinal transition. *Stemonoporus gilimalensis* is restricted to the zone, and *Kokoona zeylanica* and *Doona* community are other rare species found within the zone. Due to the prevailing high atmospheric humidity, especially in the forest understory, a lush non-graminoid herbaceous flora is abundant in this zone, as are the epiphytic bryophytes ferns and angiosperms.

Kandy and Upper Mahaweli Floristic Zone (E)

This zone is an extension of the low wet zone, distributed in the second peneplain around the Kandy plateau and Dumbara valley, ranging from 400 m to 700 m altitude, with a rolling hill-valley terrain. The annual average rainfall varies from place to place, and its rainfall is more seasonal than the typical lowland wet zone area. Absence of genus *Doona* is noteworthy. The average temperature is slightly lower than C1-C3 wet zone due to the altitudinal effect.

The dominant vegetation type has been mixed dipterocarp forest similar in composition and richness to zone C1 but somewhat poorer in species, with *Dipterocarpus zeylanicus*, *Shorea dyeri*, *Mangifera zeylanica*, *Cyathocalyx zeylanica*, *Oncosperma fasciculatum*, *Bhesa ceylanica*, *Myristica ceylanica* and *Myristica dactyloides*.

In addition, there are humid zone dry patana grasslands in this zone. Some dominant dry patana species are *Arundinella villosa*, *Chrysopogon aciculatus*, *Chrysopogon nodulibarbis*, *Cymbopogon* sp., *Themeda tremula*, and *Andropogon lividus*.

Knuckles Floristic Zone (F)

This zone is a complex of several forest types, such as tropical lower montane forest, tropical upper montane forest, lowland tropical semi evergreen forest and lower montane tropical semi evergreen forest. Montane forests in this zone are only restricted to the peaks of a few mountains in the region owing to disturbance due to cardamom cultivation, and are less mossy than in G2, and especially H and I. *Brachystelma lankana* is endemic to the Knuckles area. *Myristica-Cullenia-Aglaiia-Litsea* communities are the dominant tropical lower-montane forest species found in this region. Tropical montane forest communities, such as Calophyllum communities, are also dominant in this region. Dry faces of lower montane forests of the Knuckles Zone are found in and around Udadumbara (Madugoda), Hunnasgiriya and Deinston estate; between 600 m-1,300 m. Structurally, they are classified as dry sclerophyllous lower montane forests and

are found only in this geographic unit of Sri Lanka. A considerable amount of upper montane ‘cloud’ forest is confined to this region, and high abundance of epiphytes are characteristic to the vegetation structure of this area. *Calophyllum walkeri* and *Syzygium* sp. are some dominant communities which are found here. In addition, *Eugenia* sp., *Magnolia nilagirica* and *Rhododendron arboreum* co-dominate in the forest complex of this region. *Plantago lanceolata*, *Plantago asiatica* and *Alchemilla* sp., are found to be characteristic herbaceous species in open areas of this region. Also, patana grasslands species, *Cymbopogon nardus* and *Tripogon bromoides* are common to this region. One side of the knuckles receives more dry winds, hence the assemblage of flora and its structural features are adapted accordingly. Forests have three strata; a canopy (15 m), sub canopy (5 m), and shrub/herb layer (2 m). The trees are gnarled and stunted due to strong winds. The leaves of most of the canopy trees are generally small, shiny and covered with a thicker cuticle. Buttress formation is rare or not at all. Presence of epiphytes such as orchids and lichens are not frequent as in the case of other lower montane forests elsewhere in the Knuckles region. This can be attributed to the desiccating winds during May-August. Typical lower montane (wet) elements like Calophyllum occur but at lower abundance. Common tree species include *Actinodaphne stenophylla*, *Drypetes gardneri*, *Mallotus philippensis*, *Syzygium spathulatum* and *Vitex altissima*. The ability to tolerate dry spells during May-September is characteristic of this area.

Montane Intermediate Floristic Zone (Haputale-Badulla) (G1)

This region is also similar to G2, consisting of tropical lower montane forest dominated by *Litsea ovalifolia* and *Neolitsea cassia* of Lauraceae (Cinnamom family). The species assemblage in semi disturbed areas and close to waterways are characterized by *Ligustrum robustum*, *Wendlandia bicuspadata* and *Garcinia morella*. Upper montane forests are characterized by a *Calophyllum walkeri* -*Syzygium* community, giving way to tropical subalpine thicket, where subject to occasional frost. The summer-zone dry patana grassland, located in the rain shadow area of the south-western monsoon, receives a more seasonal and lower rainfall in comparison to G2 (Pemadasa, 1984). *Dovyalis hebecarpa* is an endemic wild fruit species in this region.

Montane Wet Floristic Zone (Ramboda-Nuwara Eliya) (G2)

This region was originally defined as a single region along with region G1. During the expert meetings however, it was suggested to separate it into two sub-zones based on the vegetation difference due to its rainfall gradient.

The western part of the Central Highlands above 1,000 m altitude, reaching 2,518 m at Piduruthalagala, encompasses this region. The area receives high rainfall since it is situated along the south-western monsoon face of the central mountain ridge. Tropical lower and some upper montane forests are the main vegetation types in this region. Frost occurs above c.1,700 m in some years as in floristic zones G1 and I, resulting in the forest transition to subalpine thicket on exposed peaks such as Kikiliyamana, Great western and Hakgala.

A considerable amount of upper montane ‘cloud’ forest is confined to this region, and high abundance of epiphytes are characteristic to the vegetation structure of this area. *Calophyllum walkeri* and *Syzygium* sp. are some dominant communities which are found here. In addition,

Eugenia sp., *Magnolia nilagirica* and *Rhododendron arboreum* co-dominate in the forest complex of this region. *Plantago lanceolata*, *Plantago asiatica* and *Alchemilla* sp., are found to be characteristic herbaceous species in open areas of this region. Also, patana grasslands species, *Cymbopogon nardus* and *Tripogon bromoides* are common to this region.

Adam's Peak Floristic Zone (H)

Tropical lower and upper montane 'cloud' forests occupy most of the Adam's Peak region. This region was considered as a unique floristic region based on some restricted-range forest species such as *Stemonoporus rigidus*, *Schumacheria alnifolia*, and *Memecylon phyllanthifolium*, which are restricted to this region. Dipterocarpaceae species which have been recorded at the highest elevations in the world grow in the Adams Peak range (Greller and Balasubramanium, 1993). The southwestern margin of this zone occurs somewhere between 800-1,200 m, as an ecotone from the mixed dipterocarp forest of zone D (e. g., in Gilimale F.R.) and the beginning of the lower montane forest with an elevation range between 1,000 m -1,600 m. The habitat variation in this zone is well depicted by the distribution of species in the endemic genus *Stemonoporus*. *Stemonoporus elegans* (600 m-900 m), *S. gardneri*, *S. oblongifolius* and *S. cordifolius* (1,000 m-1,615 m) have been recorded in the lower montane forests above Carney estate (Palabaddala). *Stemonoporus cordifolius* also extends to the eastern end of the Peak wilderness to Maratanne near the Bogawanthalawa- Balandgoda road (Gunatilleke et al., 1996). *Stemonoporus rigidus* (1,000 m-1,300 m) has been recorded on Eratna-Malimboda trails in north-western side of Sri Pada, or Adam's Peak.

Horton Plains Floristic Zone (I)

The Horton Plains floristic region represents the highest plateau in Sri Lanka. Its vegetation is characterized by a thicket of upper montane subalpine transition and wet patana grasslands.

Montane forests in this region are dominated by non-dipterocarp species such as *Calophyllum walkeri*, *Syzygium rotundifolium*, *Syzygium sclerophyllum*, and members of Lauraceae, including *Litsea ovalifolia*, *Cinnamomum ovalifolium*, *Actinodaphne ambigua*, *Neolitsea fuscata* and *Actinodaphne speciosa* (Balasubramanium et al., 1993).

Yushania densifolia, a dwarf bamboo species and *Sphagnum ceylonicum* with Gondwanan affinities are restricted to the Horton Plains region. Further, *Chrysopogon nodulibarbis* and *Garnotia exaristata* are some of the dominant upper wet patana species found in this region.

Wet patana grassland is more or less restricted to this area. The vegetation is subjected to wide diurnal temperature variation, especially from the months of December to March. Sometimes night frost prevails in this area, and frost burns are often observed in some areas. The substratum of the wet patana grassland also has a very thick, black top soil layer of partly decomposed organic matter that accumulates due to slow decomposition as result of low temperature in the region.

Wet Zone Fresh Water Ecosystems (not shown in the map)

Wet zone freshwater ecosystems are delineated mainly by small streams and rivers which are confined to the wet zone (>2,500 mm annual rainfall, but having less than two months with >100 mm rain climatic boundary) from higher to lower elevation levels.

These waterways being perennial in nature, harbour many aquatic flowering plant species that remain confined to these streams. Four habitat types can be recognized within this floristic region: i) streams banks with their riparian zone below normal flood level; ii) the spray zone of waterfalls or torrents; iii) marshy or boggy habitats; and, iv) the stream itself.

From the family Aponogetonaceae, *Aponogeton rigidifolius*, *A. jacobsenii* and *A. kannangarae* are three endemic species confined to this zone. Many species, (13 of the 21 species) of the Eriocaulaceae, the pipewort family, are also restricted to this zone. *Eriocaulon fluviatile* too is found only in stagnant parts of slow flowing shaded forest streams.

All members of family Podostemaceae (river weed family), except *Dalzellia ceylanica*, are confined to the fast flowing rivers in this zone. Two genera in family Araceae, viz., *Cryptocoryne* (8/11 sp.) and *Lagenandra* (7/9 sp.) are restricted to this region. *Utricularia moniliformis* (Lentibulariaceae), an endemic, is commonly distributed in this zone. Two Cyperaceae species, *Mapania immersa* and *M. zeylanica* are also only found in slow flowing shady rivers in this region. Similarly, species of orchids, *Malaxis thwaitesii* are also known to grow on rocks in the middle of waterways. Species such as *Homonioia riparia*, *Madhuca neriifolia* and the endemic *Memecylon rivulare* are confined to the riparian zone (Dassanayake and Fosberg, 1980.)

Inselbergs

The dry and intermediate climatic zones have scattered rock outcrops, or inselbergs, some of which are over 500 m elevation. These tend to support a flora that is distinct from the vegetation communities in the surrounding landscapes, and can be treated as a separate floristic 'zone'.

2.3

Distribution of Endemic Plant Genera

Based on field surveys done to date, there are 17 endemic plant genera in 13 families in Sri Lanka. All of them are distributed in the floristic zones of the wet and intermediate climatic zones. Among these 15 genera, eight are monotypic. Among the endemic genera in Sri Lanka, family Rubiaceae has highest number of endemic genera (4). Family Dipterocarpaceae has the highest number of endemic species in the two endemic genera; *Doona* (10 sp.) and *Stemonoporus* (26 sp.), notably each of the following *Stemonoporus* species, *St. affinis*, *St. bullatus*, *St. gracilis*, *St. gilimalensis*, *St. kanneliyensis*, *St. latisepalum*, *St. marginalis*, *St. moonii*, *St. nitidus*, and *St. scaphifolius* is restricted to a single floristic zone. Similarly, *Dicellostyles axillaris*, *Scyphostachys pedunculatus* and *Hortonia ovalifolia* too have restricted distribution each being recorded only in a single floristic zone, Sadly *D. axillaris* and *S. pedunculatus* have not been collected recently. Distribution of selected endemic species in families, Rubiaceae, Orchidaceae, Monimiaceae, Malvaceae, Gesneriaceae, Flacourtiaceae, Arecaceae and Dilleniaceae are provided in Figure. 2.2a, while distribution of selected endemic species in Dipterocarpaceae family is provided in Figure. 2.2b.

Eranthemum capense L. Acanthaceae (PI)

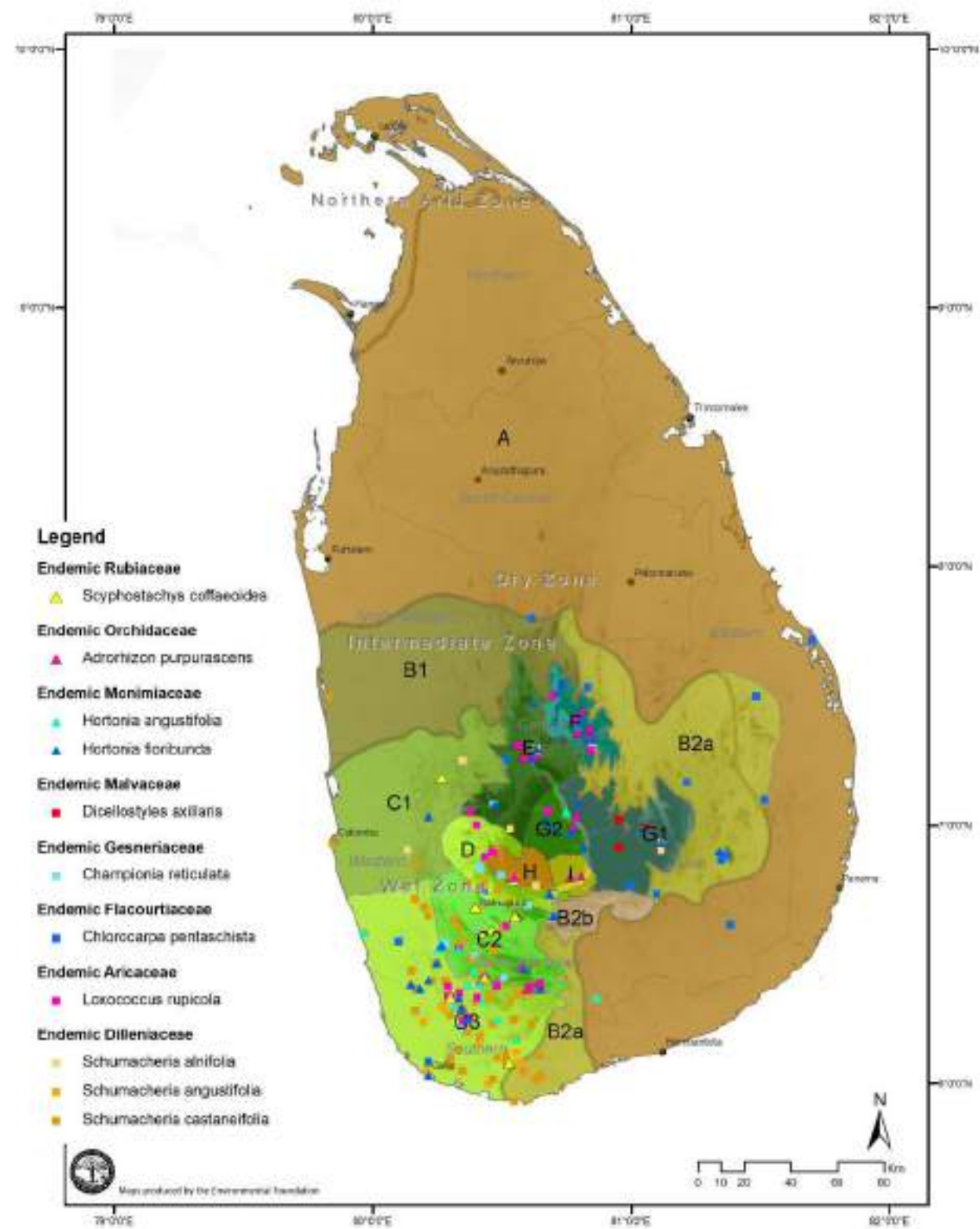


Figure 2.2a Distribution of selected endemic species in families, Rubiaceae, Orchidaceae, Monimiaceae, Malvaceae, Gesneriaceae, Flacourtiaceae, Arecaceae and Dilleniaceae. Locations are based on surveys conducted to date. The floristic zones are modified from Ashton and Gunathilleke (1987). The Zone Code refers to the floristic zones: Dry Floristic Zone (A), Southern Arid Zone (A1), Northern Arid Zone (A2), Northern Intermediate Floristic Zone (B1), Eastern Intermediate Floristic Zone (B2a), Hill Savannah Dominant Floristic Zone (B2b), Northern Wet Lowlands Floristic Zone (C1), Sinharaja and Ratnapura Floristic Zone (C2), Southern Lowland Hills Floristic Zone (C3), Foothills of Adam's Peak and Ambagamuwa Floristic Zone (D), Kandy and Upper Mahaweli Floristic Zone (E), Knuckles Floristic Zone (F), Montane Intermediate Floristic Zone (G1), Montane Wet Floristic Zone (G2), Adam's Peak Floristic Zone (H), Horton Plains Floristic Zone (I).-Data source Red list database Biodiversity Secretariat at MOE and National Herbarium, Peradeniya.

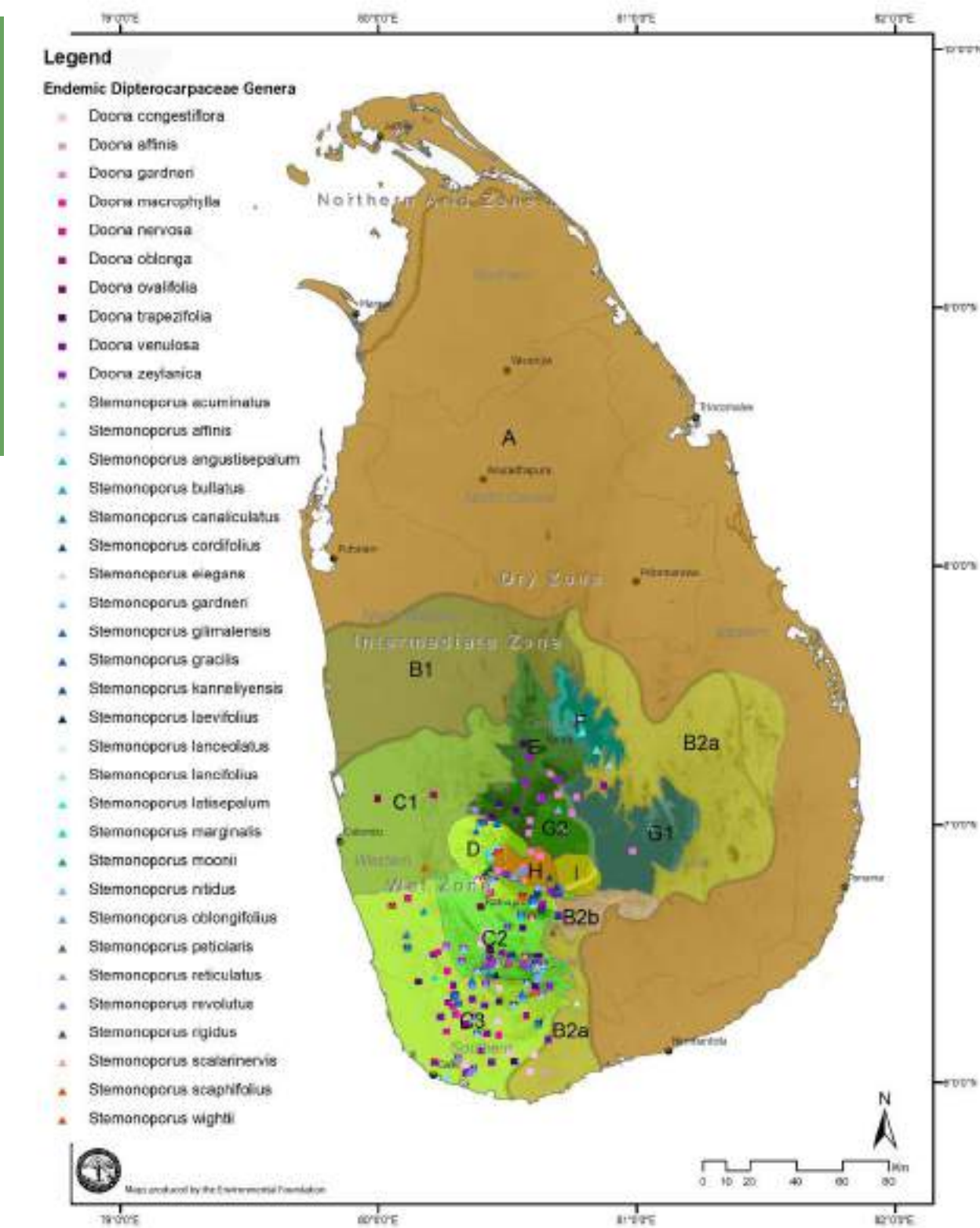


Figure 2.2b Distribution of selected endemic species in Dipterocarpaceae family. Locations are based on surveys conducted to date. The floristic zones are modified from Ashton and Gunathilleke (1987). The Zone Code refers to the floristic zones: Dry Floristic Zone (A), Southern Arid Zone (A1), Northern Arid Zone (A2), Northern Intermediate Floristic Zone (B1), Eastern Intermediate Floristic Zone (B2a), Hill Savannah Dominant Floristic Zone (B2b), Northern Wet Lowlands Floristic Zone (C1), Sinharaja and Ratnapura Floristic Zone (C2), Southern Lowland Hills Floristic Zone (C3), Foothills of Adam's Peak and Ambagamuwa Floristic Zone (D), Kandy and Upper Mahaweli Floristic Zone (E), Knuckles Floristic Zone (F), Montane Intermediate Floristic Zone (G1), Montane Wet Floristic Zone (G2), Adam's Peak Floristic Zone (H), Horton Plains Floristic Zone (I).-Data source Red list database Biodiversity Secretariat at MOE and National Herbarium, Peradeniya.

2.4 Orchids and their Distribution

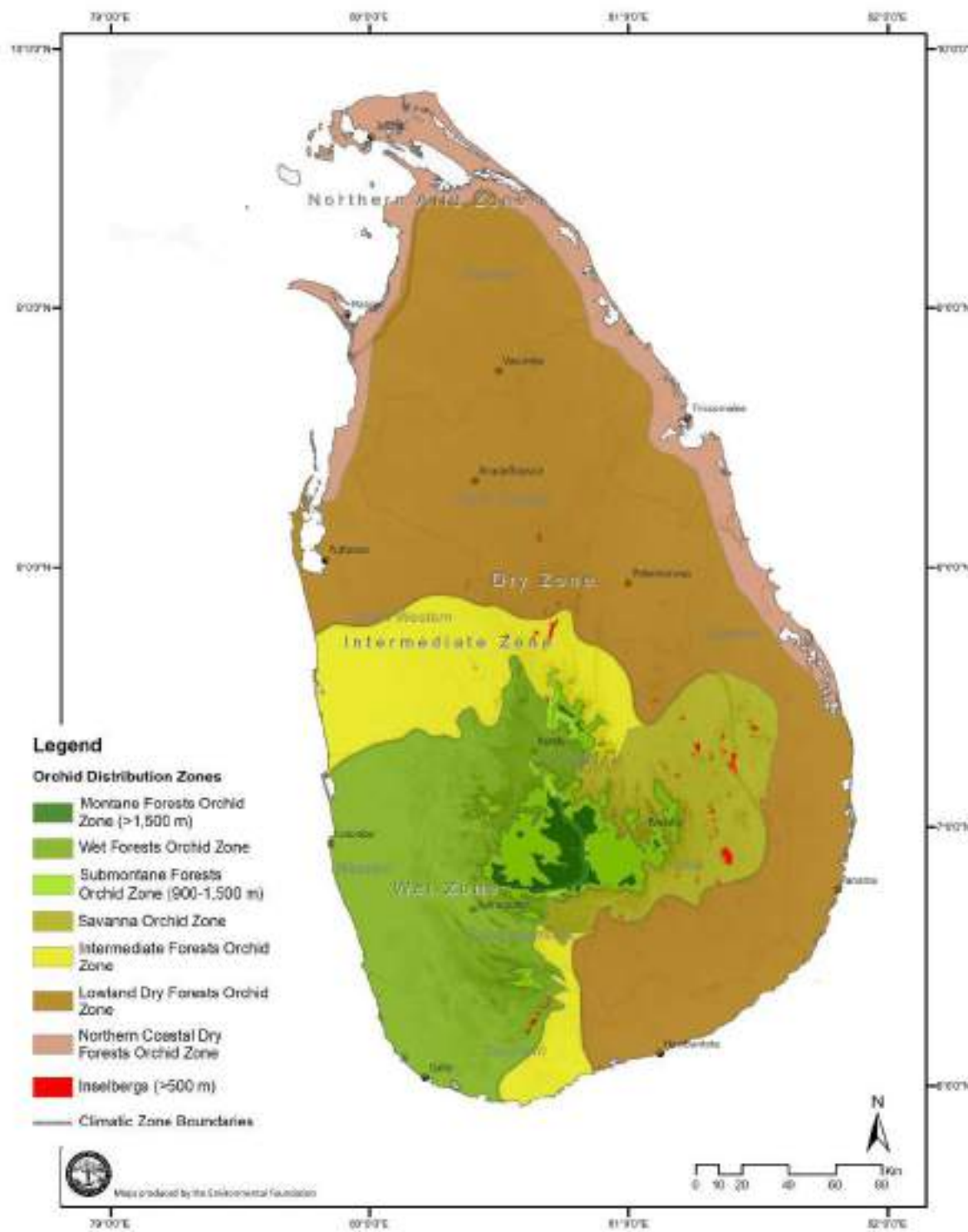


Figure 2.3 Orchid Distribution Zones, based on the geographic distribution of species. The zones are based on expert input gathered during workshops and subsequent consultations. The Orchid distribution zones are overlaid on the climatic zones of Sri Lanka, and the Digital Elevation Model.

The family Orchidaceae is one of the largest among the Sri Lankan flora (Fernando and Ormerod, 2008; Fernando, 2012). Out of the five sub families known in the world (Chase et al., 2015), four are present in Sri Lanka, and the current species diversity stands at 191 species. This includes four naturalised species *Arundina graminifolia*, *Cyclopogon obliquus*, *Dendrobium crumenatum* and *Spathoglottis plicata*. Sub family Cypridodiodeae is not present in Sri Lanka. The four subfamilies and the respective tribes found in Sri Lanka are;

APOSTASIOIDEAE: with a single genus and a species in Sri Lanka namely *Apostasia wallichii*.

VANILLOIDEAE: with two tribes and five species belonging to tribe Vanilleae.

ORCHIDOIDEAE: with three tribes and 38 species grouped as 21 species in tribe Orchideae, 16 species in tribe Cranichideae and one species under tribe Diurideae.

EPIDENDROIDEAE: with 11 tribes and 147 species grouped as 55 species under tribe Malaxideae, 44 under tribe Vandaceae, 13 under tribe Podochileae, 10 species under tribe Cymbidieae, nine species under tribe Collabieae, six species under tribe Arethuseae, three species under tribe Tropicidae, three species under tribe Gastrodieae, two species under tribe Nervilieae, one species under tribe Neottieae, and one species under tribe Epidendreae.

These 191 orchid species belong to 77 genera with one endemic genus (*Adrorhizon* Hook. f.) and 52 endemic species. Additionally, four exotic species that belong to four genera are already established in the wild. The latest additions to the list are, *Podochilus warnagalensis* (Priyadarshana et al., 2016) and *Oberonia meegaskumburae* (Priyadarshana et al., 2017). Evidence of several possibly new species are emerging, notably from wet and montane zones but taxonomic studies are ongoing.

One of the most diversely evolved to suit its habitat and therefore, being extremely sensitive to its habitat conditions as well as to micro climatic requirements, orchids are a highly threatened family among flowering plants that has an island wide distribution.

Sri Lanka, as an Island, possesses a wealth of significantly different orchid bioclimatic zones, and as per their physiological requirements, orchids have adopted to survive in each locality, with unique anatomical adaptations. These adaptations for survival and growth are not limited to growing in or on a desired surface, but also to attract specific pollinators and to disperse pollen. Additionally, particular symbiosis with certain, most probably, species-specific types of mycorrhizal fungi, in its initial stages of germination, ensures survival of orchids in each bioclimatic zone.

There are a few orchids that have a wider distribution and have evolved to permeate through orchid distributional zones. *Vanda tessellata* (Roxb.) Hook. 1830, which occupy large branches or tree trunks that mainly grow along or near larger water bodies is distributed in Intermediate zone to dry arid coastal zone, occupying country's lowlands except the Wet zone. Similarly, *Adrorhizon purpurascens* and *Sirhookera lanceolata* are found from lower evergreen wet forests to upper montane zones, growing either as epiphytic or lithophilic.

However, some species show site fidelity and this is quite evident in subtribe Adrorhizinae (*Adrorhizon purpurascens*, *Bromheadia srilankensis*, *Sirhookera lanceolata* and *S.latifolia*). *Bromheadia* genus is mainly restricted to Malaya peninsula, Philippines as well as Australia but is present in Sri Lanka as an endemic species, growing as an epiphytic in upper part of the tall trees along the streams in lowland wet forests. Both *Sirhookera* species are restricted to Western Ghats region in Southern India and Sri Lanka. *Adrorhizon purpurascens* is endemic to the island and can be found growing as an epiphytic or rarely as lithophyte, from lower montane to higher montane zones.

Some species such as *Disperis neilgherrensis*, *Spiranthes sinensis* and *Satyrium nepalense* share common climatic conditions such as colder higher altitudes and are found either in mountains of the Indian subcontinent including Himalayas or in montane zones in Sri Lanka which is an indication of the complexity of orchid distribution in Sri Lanka. Similarly, *Angraecum zeylanicum* is a species with an African affinity where the genus has a record of nearly 200 species found in tropical parts of the African continent and its immediate islands.

Vanda tessellata (SG)



Distinctive Orchid Zones

Wet Forests Orchid Zone

This zone extends from the Western and South Western coasts all the way up to 900 m to the central mountain slopes of the same cardinal faces (Figure. 2.3).

Epiphytic orchids such as, *Acampe ochracea*, *Angraecum zeylanicum*, *Bromheadia srilankensis*, *Cleisostoma tenuifolium*, *Oberonia weragamaensis*, *Podochilus saxatilis*, *Pomatocalpa maculosum*, *Thrixspermum walkeri* along with the *Dendrobium maccarthiae* prefer an exclusive zone within the Wet zone in Sabaragamuwa region to grow naturally on the thin twig ends of the larger trees that over hangs the fast-flowing rivers in the area. *Acanthephippium bicolor*, *Apostasia wallichii* and *Zeuxine reginasilvae* are some of the shady highly moisturized, wet soil loving terrestrials, while *Aphyllorchis montana* and *Didymoplexis pallens* are among few saprophytic orchids which grow under the similar conditions of terrestrials explained above. *Malaxis thwaitesii*, on the other hand is an exclusively lithophytic endemic orchid which has extreme ecological adaptations such as requiring not only a special area within the wet zone, but also prefers a micro climatic condition of moss laden stable rock surfaces within the spray zone or just above the water line of certain rivers and streamlets that has a gentler but continuous flow, with a thick forest canopy above, that provides shade throughout the day.

Due to the adaptation for wetter conditions, orchids that grow in this zone, whether epiphytic, lithophytic or terrestrial, require high levels of moisture in substrate as well as in the air. Especially without the required moisture saturation in the air, even in shady locations, they could wither and die as the epiphytic orchids with aerial root systems are highly dependent on saturated moisture in the air for their water requirement. Drier or lesser saturated air tends to syphon out the surface moisture out of the places where lithophytic or terrestrial orchids could potentially grow.

Sub Montane Forests Orchid Zone

Sub-montane forests extend from 900 m to 1,500 m where moist but much colder climate with thick evergreen forests exists and as a result supplies various types of hardwood canopy trees along with bamboo forest patches and dry or wet boggy grasslands.

This zone contains the highest number of orchid species in any given zone, as its lower boundary shares the low wet and low dry zones. Upper boundary extends to montane zone where certain species had adopted to extend their habitat in to a wider range. *Phaius wallichii* and *Calanthe sylvatica* are some of the examples that share the Subtropical lower wet zonal forest as well as the much higher sub-montane forests while *Arundina minor*, *Peristylus brevilobus* and *Coelogyne odoratissima* are a few good examples for the wider geographic range distribution towards the sub and montane zones.

Further, within these zones, there are distinctly different vegetation types that had allowed various types or species with specific habitat requirements such as epiphytic *Eria tricolor* that grows in thick forest patches while Terrestrial *Ipsea speciosa*, prefers the dry grass lands on rocky outcrops and *Tainia bicornis* preferring the wet forest floor within the forest canopy.

There are wet boggy type marshy islands in this zone that support a plethora of different types of orchids such as terrestrial *Peristylus cubitalis*, *Habenaria barbata* and *Peristylus brevilobus*. Widely available streams and stream banks support orchids such as *Phaius wallichii* as well as *Arundina minor*, while moist, thin mossy laden tree twigs support leafless micro orchid *Taeniophyllum alwisii*.

Montane Forests Orchid Zone

Montane forests extend from an altitude of 1,500 m and beyond where the highest peaks of central massif and Knuckle mountain tops represent the typical localities while the zone consists of plateaus such as Maha Eliya and Gawarawila plains, which are mainly dry as well as wet boggy type grassy areas interspersed with dwarf, pigmy type forest patches that have been adapted to tolerate dry spells and cold windy conditions.

This zone contains a lesser but a higher number of unique species such as *Phreatia elegans* and *Pteroceras viridiflorum* while *Bulbophyllum trimenii* and *Seidentadeniella filiformis* could exclusively be found as epiphytic in this zone. *Calanthe triplicata* is a terrestrial that grows in the shades under the trees. *Satyrium nepalense* and *Spiranthes sinensis* grow in and among moist open grasslands while *Peristylus cubitalis* could be found in moist peaty bogs.

Intermediate Forests Orchid Zone

This zone effectively gets divided into two, due to the centrally located highland massif which creates different types of climatic zones within the same rainfall conditions, but also due to higher altitudes that correspond to a drop in temperature as well as air pressure. This zone extends from the Western coast and wraps around the Northern and North Eastern foothills of the central massif while the lower portion of the zone extends from Southern coast and gets extended up to the Southern foothills of the central massif while bordered by the South Eastern foothills of the Rammale mountain range.

In this zone, mostly the terrestrial orchids, such as deciduous *Eulophia zollingeri*, and *Habenaria plantaginea*, along with seasonally flowering *Tropidia thwaitesii*, epiphytes such as *Vanda testacea*, *Oberonia thwaitesii*, *Cotonia peduncularis*, *Luisia birchea*, *Thrixspermum pugionifolium* and lithophytes such as *Vanilla walkeriae* that have been adopted to much drier conditions can be found.

Savanna Orchid Zone

Savannah forests start from the foothills of the central massif's Southern slopes and wraps itself around towards the Northern slopes passing the Eastern slopes as a continuous strip which extends up to 900 m of elevation. The region comprises of extended open grasslands and dry forest patches consisting of unique grassland with sparsely distributed trees nourished by rivulets, streams and waterfalls that create extremely unique riparian habitats for various types of orchids.

The extensive and intense forest fires that are a frequent phenomenon in this zone have made most of the terrestrial orchids to grow tubers or rhizomes just under the top soils so that they can survive prolonged periods unfavorable conditions.

The epiphytic orchids such as *Aerides ringens* and *Rhynchosstylis retusa* which grow exclusively in and around Bibile area and the terrestrials such as *Geodorum densiflorum*, *Habenaria roxburghii* and *Peristylus trimenii* are some of the finer examples of this zone.

Lowland Dry Forests Orchid Zone

The largest zonal land mass of the country in terms of the area. *Vanda spathulata* is an exclusively dry zone orchid that enjoys the full and bare exposure to the day long sun light, heat and dry windy conditions. *Eulophia epidendreae* on the other hand prefers full heat of the sun but on rock outcrops with accumulated debris which could provide it with a smaller amount of nutrition as well as moisture that it requires for survival. *Vanda tessellata* which is a characteristic species of this zone, prefers larger trees that grow near water bodies or paddy fields where it could receive a continuous supply of cool, moisturized air among its aerial roots.

Northern Coastal Dry Forests Orchid Zone

This zone consists of thin strip of coastal area that extends from Mannar area of North-west coast to Batticaloa in East coast including the Island of Mannar, Jaffna peninsula and islands around it.

The most significant orchids that grow in this zone are epiphytic and grow mostly on the Palmyra palms such as *Cymbidium finlaysonianum* and *Vanda tessellata*.



2.5 Ferns and Lycophytes

Species Diversity and Endemism

Sri Lanka is home to a unique diversity of pteridophytes (ferns and lycophytes) including about 400 taxa (Ranil et al., 2020), of which 47 (Ranil et al., 2016) are considered as endemic to the island (Table. 2.2). This unique diversity has been assembled as a consequence of the distinct geological history and tropical conditions of this island that is spatially close to the southern end of the Indian subcontinent. These 400 taxa include nearly 350 native taxa and number of naturalized exotics, natural hybrids and species with doubtful occurrences and uncertain taxonomic status. The present knowledge on diversity and taxonomy is mainly based on Shaffer-Fehre (2006) and Sledge (1956; 1960; 1965; 1968; 1973a; 1973b; 1981a; 1981b; 1982). Though Shaffer-Fehre (2006) is taxonomically outdated, it provides valuable and detailed species descriptions for 351 species belong to 30 families. Apart from that, Ranil et al. (2016) have conducted a comprehensive analysis on taxonomy and distributional ecology of 47 endemics. However, the total number of species is, to further increase following comprehensive island wide surveying of unexplored ecosystems (Ranil et al., 2010a; 2010b; 2014; 2017) and evaluation of 38 worldwide herbaria where Sri Lankan fern specimens were deposited during the colonial era.

Biogeographic Significance

Sri Lanka's pteridophytes are significantly important both on a regional and global scale because of the country's position as a major western outlier of the Asia-Pacific pteridophyte flora (Ranil et al., 2019b). The species found in the Sri Lankan/south Indian, or "Hindulankan" region, show a strong affinity with the Himalayan flora in north east India, the Malesian flora in South East Asia, and to a lesser degree with African elements in East Africa, Madagascar, Mascarenes, and Seychelles (Fraser-Jenkins, 1984; 2010) Also recent studies showed that the flora contains species with close relatives in Afromadagascar, especially Madagascar, India, and also tropical SE Asia, such as Myanmar, Thailand, and Malesia (Personal communication with Prof. Harald Schneider, 2019, September). Even though Holttum (1981) has suggested an affinity of Sri Lankan tree ferns species with African elements, Janssen et al. (2008) stated that Sri Lankan scaly tree ferns have no close relatives and may have evolved in-situ for long periods of time. However, the phylogenetic position of Sri Lankan unique ferns diversity remains to be elucidated.

Distributional Ecology

Though available information and herbarium records are adequate to understand the general and specific distribution pattern of ferns and lycophytes, mapping or reorganization of distinctive regions for Sri Lankan ferns has not been completed yet. However, Jayasekera and Wijesundara, (1993) have revealed that about 81% of pteridophyte specimens in the National Herbarium have been collected from the wet zone area of the country. Further, studies on distribution pattern of endemic pteridophyte flora of Sri Lanka revealed that those are more-or-less equally distributed among the wet zone areas of the up, mid and low countries with 34, 31 and 32 taxa, respectively (Ranil et al., 2008a). Majority of endemic pteridophytes (78%) of Sri Lanka had been collected from the Central Province where Nuwara Eliya district alone provided the highest number of endemic taxa collected, with 34 taxa from Sabaragamuwa and Southern provinces. Ranil et al. (2017) have studied the distributional ecology of tree ferns of Sri Lanka and the results further confirmed the importance of southern lowland rainforests and montane ecosystems for the occurrence of Sri Lankan fern flora. As Ranil et al., (2016) highlighted, all endemics species are recorded from the wet zone with 11 endemic species are confined to the Southern lowland rainforests, with the exception of only two species, *Pyrrrosia pannosa* (Mett. ex Kuhn) Ching and *Pyrrrosia gardneri* (Mett.) Sledge, found in the dry zone.

Therefore, a comprehensive analysis of the distribution of the Sri Lankan fern and measurements of biodiversity such as species richness, endemism, and phylogenetic diversity is a timely requirement.

Conservation Status

The threats to ferns and lycophytes include, spread of invasive species, deforestation, urbanisation, and global climate change. Out of the 336 native pteridophyte species evaluated, 219 (66%) species are listed as threatened under the IUCN Red List criteria (Ranil and Pushpakumara, 2012). Ranil et al., (2016) revealed that four endemic species have not been recorded during the last and present centuries (*Thelypteris gardneri* (Holttum) Panigrahi, *Thelypteris thwaitesii* (Hook.) C.F.Reed., *Asplenium disjunctum* Sledge and *Leptochilus walli* (Baker) C.Chr).

Future Perspectives

The current knowledge of pteridophyte flora is largely based on Shaffer Fehre (2006) which focus on morphology and specimens from existing herbarium collections, rather than new information. Relatively little is known about the processes that shaped the unique evolutionary history, ecology and genetic diversity, hence as a country we are not prepared for effective conservation. Moreover, relationships among the Sri Lankan species and those in other geographically related areas are poorly known. Therefore, comprehensive and in-depth studies of the Sri Lankan ferns will elucidate their phylogenetic relationships as well as their biogeographic history. Also, as Ranil and Pushpakumara (2012) highlighted, an island wide survey, updating and authentication of the national specimens collection and *in-situ* conservation should be initiated.

Table 2.2 Taxonomic additions and changes to Pteridophyte of Sri Lanka since 2012. Data is provided for indigenous species, exotic species and endemics in parenthesis. 2012 data is from the National Red List of Sri Lanka, last compiled in 2012 (MOE, 2012) and 2018 data was updated for the preparation of this 6th National Report (2019).

	Red List 2012			NBSAP 2016			6 th NR 2018		
Taxonomic group	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total	Indigenous (endemics)	Exotics	Total
Pteridophyte	336 (49)	NA	336	NA	NA	NA	350 + (47)	25	390 +

* These 390 taxa include nearly 350 native taxa and number of naturalized exotics, natural hybrids and species with doubtful occurrences and uncertain taxonomic status (Ranil et al., 2020).

2.6 Lichens



Cladonia coccifera (SS)

Lichens are symbiotic systems or life forms containing at least a fungal host and a mutualistic algal/cyanobacterial partner (Hawksworth et al., 1995; Nash 1996), although lichen symbioses can also involve bacteria, accessory algae, and endolichenic fungi (Grube et al., 2009). Most of the lichenized fungal species (mycobionts) (98%) belong to phylum Ascomycota, and a few to orders of phylum Basidiomycota and some to Mitosporic fungi (Hawksworth et al., 1995; Tehler, 1996).

G.H.K. Thwaites, superintendent and later director at the Botanical Garden at Peradeniya, made the first collection of lichens in central highlands of Sri Lanka between 1849 and 1880. This collection was studied and described by Leighton (1869) who was able to identify 196 lichen species. Of them 44 species were new to science including many Graphidaceae and Thelotremataceae.

Kurokawa and Mineta (1973) collected lichens mainly in montane forest in 1966/68 contributing to *Anaptychia* and family Parmeliaceae. Another lichen collection has been done under the Smithsonian Institution funded Flora of Ceylon Project from 1970 to 1976, mostly by Louis Wheeler in drier lowland areas. During 1976 to 1978, Hale collected lichens from canopies of virgin Dipterocarp trees being logged in Sinharaja forest. At that time he was able to add 76 species to the family Thelotremataceae and four additional species of *Relicina* (Hale, 1980, 1981).

Following a botanical excursion from the University of Vienna in 1984, Brunnbauer compiled an account of the literature on lichens in Sri Lanka in 15 articles (Brunnbauer 1984–1987), including 546 species and their synonymy at that time. This includes 550 species belonging to 122 genera and 48 families.

During 1999 to 2003, Wijerathne surveyed lichen flora at Ritigala Mountains and its vicinity. During their survey, they were able to describe 35 new lichen species to Sri Lanka (Wijerathne, 2003). In 2001, Orange et al. described two additional lepraoid lichens to Sri Lankan lichen flora. Jørgensen (2002) described a new genus *Kroswia*.

During 2004 to 2006, total of 1515 specimens of macrolichens belonging to 13 families 48 genera and 293 species were identified from Horton Plains National Park Sri Lanka. Amongst them, four genera were new to Sri Lankan (Jayalal et al., 2008). Results from this study suggest that the total lichen number could be c. 800 species. Further this study added several new lichen records and two *Anzia* species (Jayalal et al., 2012) to Sri Lankan lichen list. From 2011 onwards Weerakoon et al. have described 80 new species and c. 400 new records for the country. Fully identified specimens and types of new species are deposited at the National Herbarium (PDA) (Weerakoon et al., 2011). Thus, the updated list includes >850 lichen species belonging to 230 genera in 60 families.

2.7 Seagrasses and Seaweed



Halophila beccarii (SU)

Seagrasses

Sri Lanka belongs to tropical Indo-Pacific seagrass bioregion. Scientific investigations of seagrasses in Sri Lanka dates back to 1826 in 19th century (Dassanayake et al., 1995). Past studies have however, focused on species composition, abundance, distribution, nutrient dynamics and productivity of few areas, notably in Negombo estuary and Puttalam lagoon. The most recent investigation is an island-wide survey conducted by the UNESCO Man and Biosphere National Committee of Sri Lanka in 1991 (Abeywickrama and Arulgnanam, 1991). According to globally accepted records, 14 true seagrass species belonging to seven genera have been identified throughout the island. They are *Enhalus acoroides*, *Halophila beccarii*, *Halophila decipiens*, *Halophila ovalis*, *Halophila minor*, *Halophila gaudichaudii*, *Halophila stipulacea*, *Thalassia hemprichii*, *Cymodocea rotundata*, *Cymodocea serrulata*, *Halodule uninervis*, *Halodule pinifolia*, *Ruppia maritima*, and *Syringodium isoetifolium* (Silva et al., 2013; Udagedara et al., 2017 and Udagedara pers. com.). There are no species endemic to Sri Lanka as propagules distribute by ocean currents (Abeywickrama and Arulgnanam, 1991). Among these species, *H. stipulacea* is a new addition from the Northwestern coastal area of Sri Lanka (Dugong & Seagrass Conservation Project, 2019).

Conservation status of some of the species has been assessed, for example *H. beccarii* is endangered as per the National Red List (MoE, 2012) and vulnerable according to the Global Risk Assessment (Short et al., 2011). Altogether, six species of seagrasses were identified as near threatened and two species were considered as least concerned (MoE, 2012). Conservation status has been assessed for only nine species for the global seagrass evaluation due to data deficiency (MoE, 2012).

Seagrasses are recorded in calm shallow waters on sandy or clayey beds with silt. Known locations include estuaries (Negombo) lagoons (Puttalama, Jaffna, Valaichchenai, Batticaloa, and Koggala) bays (Weligama) and shallow seas of Gulf of Mannar and Palk Bay. Extensive seagrass meadows have been recorded in the Northwestern side of Sri Lanka extending from the Dutch bay in Kalpitiya to the western end of the Jaffna peninsula, and from Mannar to Northwest across the Palk Bay and to Rameswaram Island on the Indian coast. Distribution of sea grasses along the coasts of the Northeast to Southeast is limited, and no reliable records are available (Abeywickrama and Arulgnanam, 1991; Udagedara et al., 2017 and Udagedara et al pers. com). Thus, composition and distribution of sea grasses along the coastal zone of Sri Lanka is yet to be established covering the entire coastline. However, Gunatilleke et al (2017) and World Bank (2018) has estimated an extent of 23,819 ha of seagrasses in Sri Lanka, however, this estimate requires ground truthing.

There are a number of anthropogenic activities that negatively impact seagrasses. Pollution, oil spills, unplanned coastal developments, boat anchoring and propeller damage, destructive fishing practices such as push nets, algal blooms, emergence of macro algal stands and global climate change are key threats. In addition to that, large scale commercial trawling heavily impacts seagrasses in the Gulf of Mannar and Palk Bay area. According to Silva et al (2013), the decline in the seagrass ecosystems was around 96% in the Northern, Eastern and Western parts of Negombo Lagoon from 1997 and 2004 (Joseph, 2011; Udagedara and Kumara, 2013; Udagedara et al., 2017 and Udagedara et al pers. com.).

The focus on seagrass ecosystems was comparatively low until recently, resulting in very few and scattered sources of information and no systematic studies. Areas that were inaccessible during war harbor extensive seagrass meadows, where more studies should be done, however heavy exploitation of this area for fisheries activities today, including destructive fishing, further limits systematic studies. On a priority basis, actions such as underwater mapping, preparation of identification keys, documenting substrate and other physio chemical characterizes of sea grass meadows, species assemblages, phenology, genetic diversity etc. should be promoted. Attracting scientists to work on sea grasses, providing diving and snorkeling skills and equipment will pave the path for more research (Udagedara and Dahanayaka, 2017 and Udagedara pers. com.).

International collaborations and merging the outputs from sea grass monitoring networks and transboundary studies specially between Sri Lanka and India will enable greater awareness, strategic planning for both conservation of priority areas and sustainable fisheries. Importantly, the blue carbon potential of sea grass meadows needs to be established, the outcomes would enable unraveling the role played by sea grasses in global climate change (Udagedara and Kumara, 2013 and Udagedara and Dahanayaka, 2017).

Seaweed

Seaweeds are photosynthetic, eukaryotic macroalgae and are classified into three divisions considering the dominant pigments available. Species belonging to Chlorophyta/Green (Chlorophyll), Phaeophyta/Brown (xanthophylls) and Rhodophyta /Red (phycoerythrin and phycocyanin) are found in Sri Lanka. The current diversity of seaweeds in Sri Lanka stands at Chlorophyta (51), Phaeophyceae (21) and Rhodophyta (64). Seaweeds occur in all shallow coastal areas influenced by tide, including mangroves.

Studies by Paul Hermann (1646-1695), Linnaeus (1747), Linnaeus' son (Linnaeus fil 1782) and William Ferguson (1820-1887) were included in the list of Ceylon algae, compiled by G. Murray (1887). Taxonomic studies were also conducted by Harvey (1854), Barton (1903), and more recently by Coppejans et al., (1997) and Mallikarachchi (2004). The Sri Lankan seaweed flora has only been sporadically studied; therefore, extensive studies beyond taxonomy should commence while exploring opportunities for economic benefits from the export of seaweed.

3

THREATS AND ISSUES TO SELECTED TAXA AND ECOSYSTEMS

3.1 Threat Analysis

Sri Lanka remains an important biodiversity hotspot, home to a high level of endemism with an astoundingly unique and varied range of ecosystems for its relatively small geographic size. To be recognized as a hotspot, a region needs to meet certain strict criteria, i.e. more than 0.5% of the world's total vascular plants need to be found as endemics in that region and 70% of the region's original habitat has been lost.

The unique and wonderful island biogeography of Sri Lanka is highly threatened due to an array of ever intensifying threats. In particular, the loss, fragmentation and alteration of habitat, the presence of invasive species, the mismanagement of waste and the agrochemical pollution of streams and waterways, remain some of the most serious of threats for the survival of species.

Forest cover on the island has shrunk over the course of the last 100 years, with less than 27% of the forest cover remaining. According to the UNREDD report published by the Forest Department, Sri Lanka has been losing, on average, 8,000 ha of forest cover annually.

This chapter will address the threats and issues facing the fauna and flora of the island – each taxonomic group is evaluated separately to help draw a more accurate analysis and deepen the available knowledge on the pressures facing individual taxonomic groups. The data for this chapter was collected during a series of workshops held in Colombo and Kandy – where experts from various areas of taxonomic study after the discussion, scored threats based on their spread and severity.

The severity of a threat was based on the effect of a threat upon the survival of a species or taxonomic group. The decline of populations and changes to animal behavior were considered during the scoring process. A score of five meant the threat is very severe, four meant it is severe, three moderate, two minimal and one very minimal.

The spread measures the spatial distribution of a threat and was scored on a scale of one to six (Table 3.1).

Score	Percentage of area affected
1	<10%
2	11-25%
3	26-50%
4	51-75%
5	76-99%
6	100%

Table 3.1 Scores used for measuring the spread of threats

The experts scored the severity and spread of each threat upon the identified distribution zones for their area of study, however, for the lesser known taxa, due to a dearth of available data, threats were addressed clustered. Further, for clarity in representation, threats have been categorized into generic terminology, for example heavy fertilizer use, industrial effluents and agrochemical pollution, are collectively considered as chemical pollution.

3.1.1 Arachnids: Spiders and Scorpions

A handful of studies have been conducted on spider fauna of Sri Lanka, which itself is a threat as we are yet to know the diversity and distribution. Despite this, charismatic spider species such as the Tarantulas are heavily trafficked and are removed from their natural habitats to be kept in homes as exotic pets.

In the Wet Zone, land chunking, especially for development, and gradual loss of forest patches, have threatened ground spiders as well as those that inhabit trees (Figure. 3.1). Further, the loss of suitable habitats due to land modification for vegetable cultivation in the Peak Wilderness, Ohiya, and the Horton Plains has affected spider populations.

Though no studies have been conducted, increasing pollution may have an effect on spider distribution. In the Dry Zone, intentional forest fire is a threat to spiders too.

Similar to spiders, scorpions remain an area of very limited study, this means the full scope of threats facing the species is not fully understood to date. The poaching of scorpions is rife; scorpions are victims of intentional killing since local people often kill a scorpion at sight. Further, wide spread loss of forest cover in Sri Lanka is affecting the survival of the species since scorpions like to reside in mature forest habitats which have a good leaf litter layer at the forest floor.

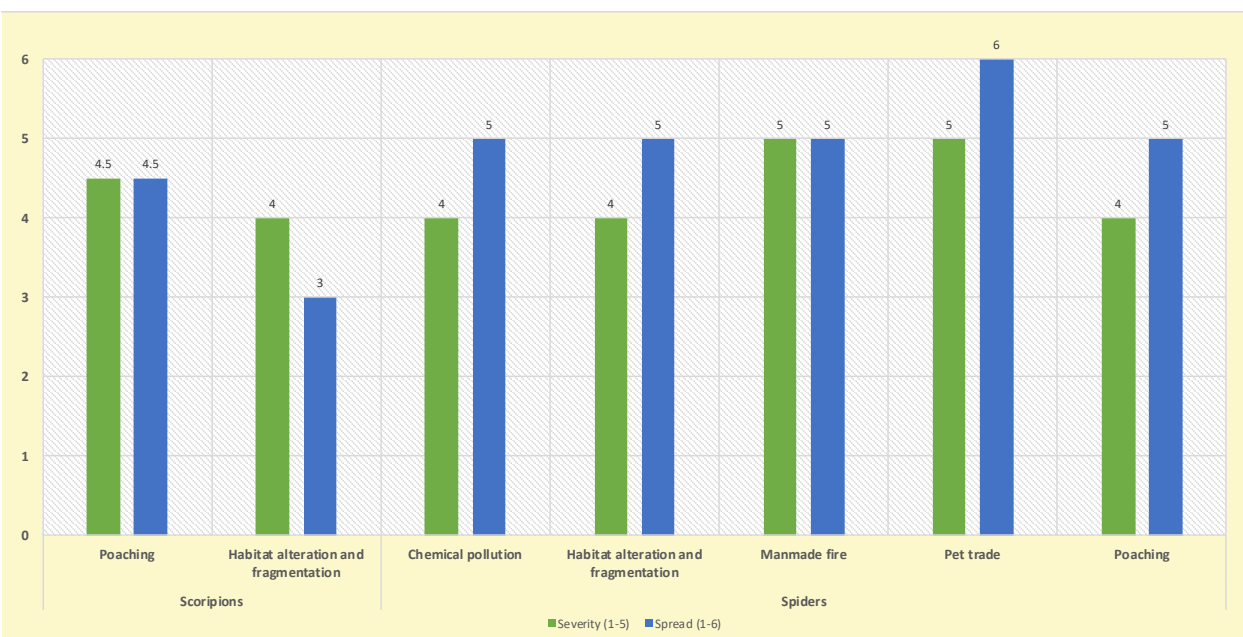


Figure 3.1 Spread and severity of threats to spiders and scorpions

3.1.2 Freshwater Crabs

In Sri Lanka, 51 species of freshwater crabs have been recorded, with 50 endemic species and 23 point endemics. This astoundingly high level of endemism means that the conservation of fresh water crab fauna is imperative to preserve the diversity of the species nationally and internationally. Also, this narrow distributional range means that many point endemic species are highly sensitive to micro level habitat alterations such as soil erosion and siltation, in montane and sub montane regions.

It is recognised that agrochemical pollution of waterways in the Central Hill- Uva Zone and the Wet Zone, and the accidental catching of crabs by fishermen are some of the most serious threats affecting the survival of crab fauna. Moreover, increased land clearance in the highlands has led to the erosion of river banks, in the process degrading the threatened freshwater crab habitats. Water diversion from mountain streams for human settlement, agriculture and energy generation, results in frequent drying up of streamlets and marshes, the typical habitats for freshwater crabs. Crab habitats are also threatened by solid waste dumping. Another specific threat to crab fauna is gem mining, especially along the Mahaweli, Kalu and Walawe rivers of the country (Figure 3.2).

Lastly, freshwater crabs remain an area of very limited study, hence, the extent of threats facing the taxa is yet to be fully understood.



Ceylonhelphusa rugosa (TR)

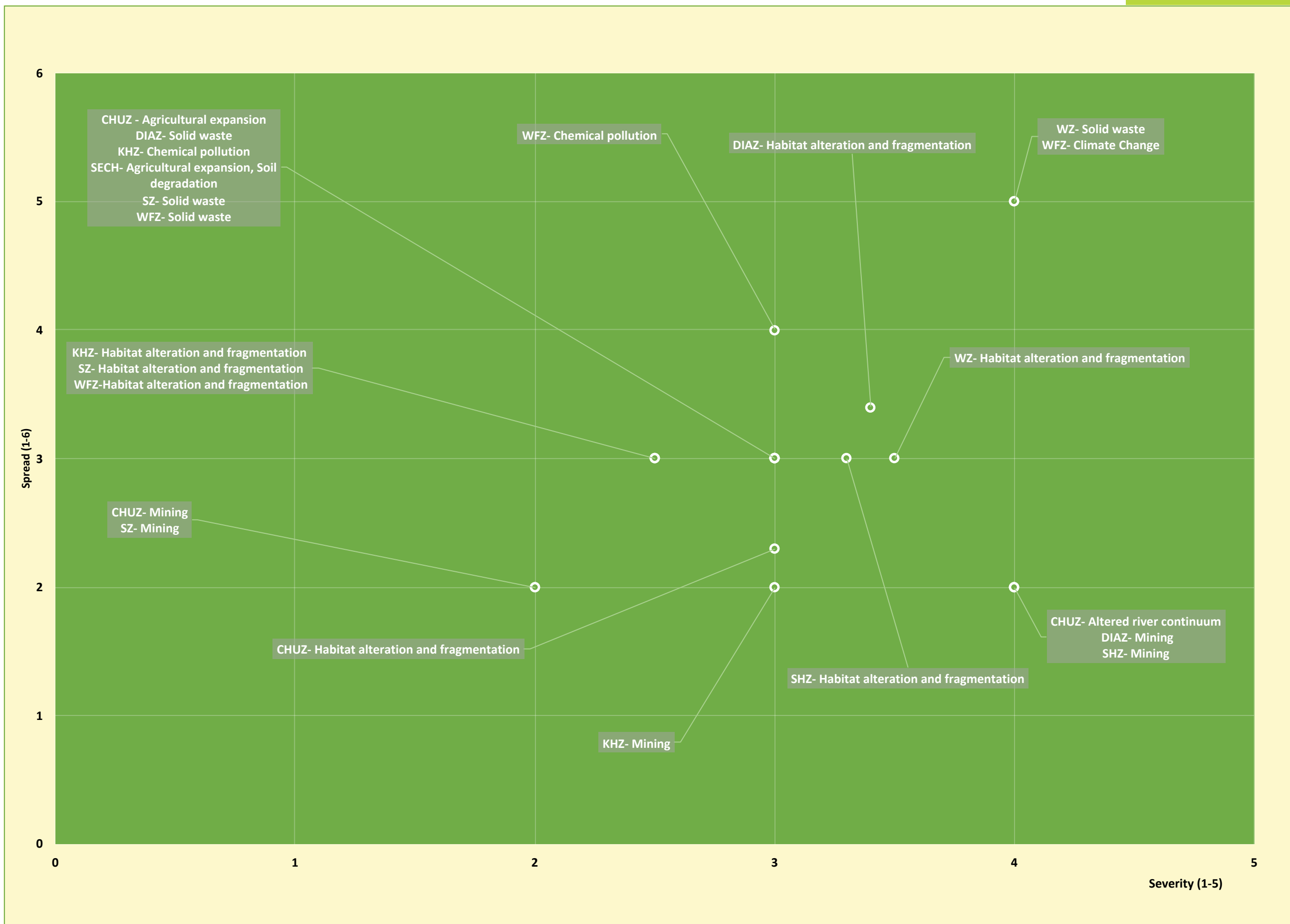


Figure 3.2 Spread and severity of threats in different Freshwater Crab zones.

Central Highlands-Uva Crab Zone CHUZ/ Wet Forest Crab Zone WFZ/ Western Crab Zone WZ/ Knuckles Hill Crab Zone KHZ / Southern Escarpment of Central Hills Crab Zone SECH/ Sabaragamuwa Hill Crab Zone SHZ/ Southern Crab Zone SZ/ Dry, Intermediate and Arid Crab Zone DIAZ



Urothemis signata (SW)

3.1.3 Odonates: Dragonflies and Damselflies

In all zones, the clearance of riparian and riverine vegetation along the rivers and streams have very badly affected Odonates. Similarly, clearance of watershed areas, siltation and the gradual drying up of swamps and reservoirs are significant threats to Odonata species in the Dry and Intermediate Zones.

Excessive use of detergents, agrochemicals, industrial pollutants, coupled with discharge of sewage into waterways, have altered water quality, which affect the larval stages of Odonates. This kind of chemical pollution is observed to be spread most widely across the Low Country and Mid Country Wet Zones.

Additionally, dredging of waterways and excessive clearing of vegetation, specially in Colombo and its suburban wetlands, are a threat to Odonata diversity and abundance in the Low Country Wet Zone.

Further, the construction of mini hydro power plants, the damming of rivers and the construction of other structures across free-flowing waterways, is observed to affect Odonates species, in particular in the Peak Wilderness Zone, the Northern Mid-country Zone, the Mid Country Wet Zone and in the Central Highlands.

Ultimately, for Odonata species, the changing climate patterns across the island is the most serious of all threats in terms of both severity and spread. The Central Hill Zone, Knuckles Hills Zone, Peak Wilderness Zone and the Rakwana Hill Zone are all identified as the most vulnerable to climate change (Figure 3.3).

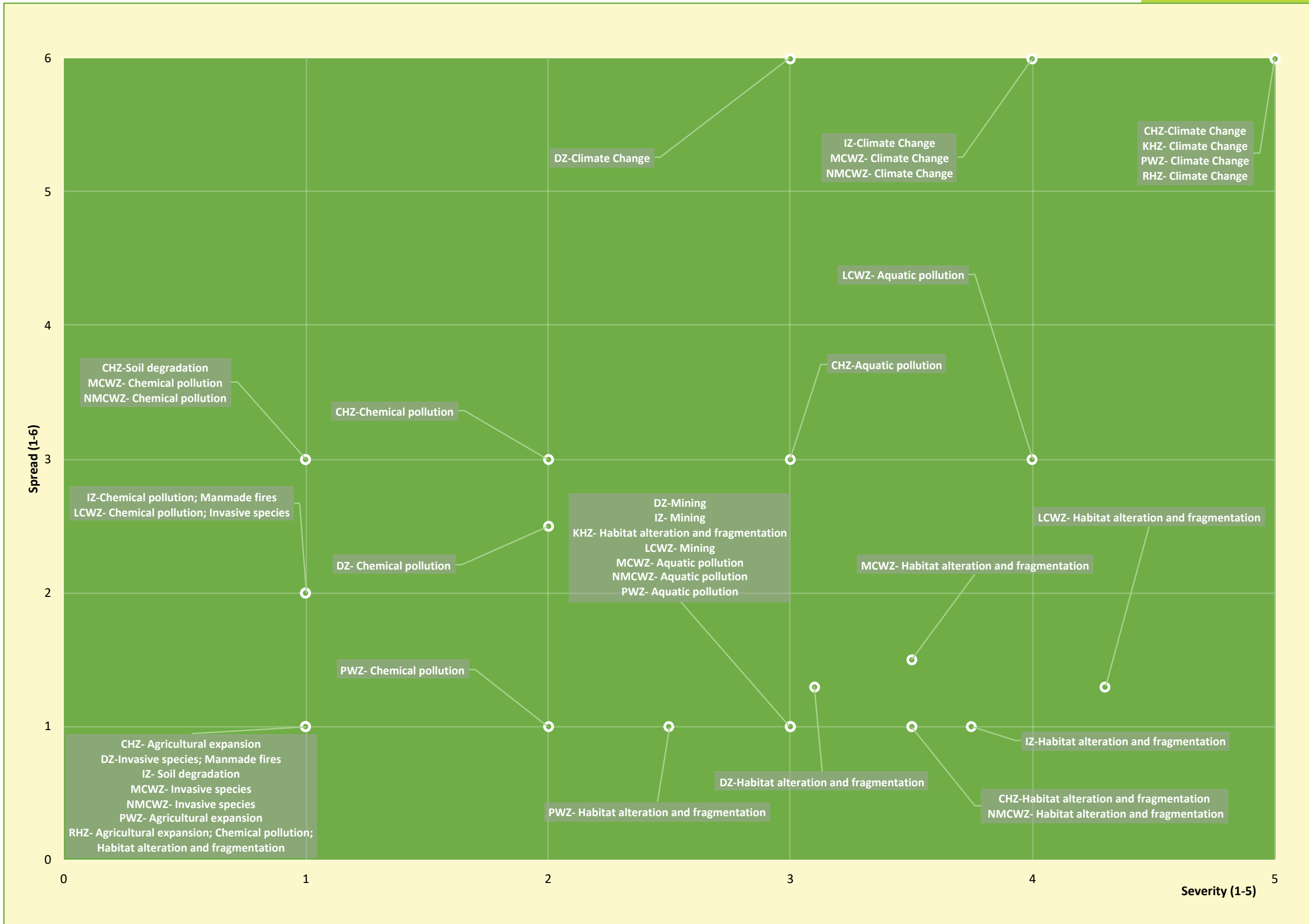


Figure 3.3 Spread and severity of threats in different Odonata zones.

Central Highlands Odonate Zone CHZ/ Mid Country Wet Odonate Zone MCWZ/ Northern Mid Country Wet Odonate Zone NMCWZ/ Low Country Wet Odonate Zone LCWZ/ Peak Wilderness Odonate Zone PWZ/ Rakwana Hills Odonate Zone RHZ/ Knuckles Hill Odonate Zone KHZ/ Intermediate Odonate Zone IZ/ Dry Odonate Zone DZ

3.1.4 Insects: Bees, Termites, Tiger Beetles, Firefly Beetles, Leafhoppers and Moths

The insect fauna of Sri Lanka is exceptionally rich representing 53% of the total species diversity of the island, and therefore, measures to protect and curtail the threats to the insect diversity of the island is imperative (Dangalle et al., 2014).

A lack of information on the insect fauna of Sri Lanka itself is arguably the most significant threat facing insect species. Only a handful of charismatic insect species have been studied in detail. Of the studied species, both honey and pollen bees are threatened by climate change, habitat alteration and fragmentation, all which affect their sources of food and nesting sites. The spread of invasive species tend to destroy native floral habitats, affecting the quality of food and nesting site availability for both honey and pollen bees. The relationship between native flora, and that of invasive flora and its impact upon honey and pollen bees is an area where further study is required (Figure 3.4).

Invasive grass species such as *Panicum maximum* have substantially changed the habitats and have become dominant species suppressing main nectar and pollen plants such as *Mimosa pigra*. All insects are threatened by the excessive use of agrochemicals. However, target use of termiticides in construction sites is one of the most significant threats for the termite fauna of Sri Lanka. The threat brought on by the use of termiticides is worsened since there is very little regulatory mechanisms calling for the sound application of termiticides.

In the case of fireflies, chunking of lands such as coconut and rubber estates in the Wet Zone and the clearing of primary and secondary forests have contributed to the loss of their habitat. The light pollution is also one of the threats that faces fireflies in more urban habitats which directly affects the mating behavior by disturbing mating at night. Artificial lights, street lamps and flash lights contribute to severe light pollution (Figure 3.5).

Leafhoppers (Hemiptera: Cicadellidae) and their distribution is documented in Sri Lanka with 17 sub families 120 genera and 257 species recorded (MoE, 2012). The threats faced by leaf hoppers are primarily due to lack of information regarding their host plants, extensive use of agrochemicals, burning of grasslands and other forest patches as well as monocultures. Absence of information regarding their role in ecosystems hampers the effective conservation of leaf hoppers and allies.

Tiger beetles are threatened by coastal development, which results in coastal erosion and water pollution. Removal of coastal vegetation such as *Iponea pes-caprae* can destabilise sandy beaches and sand dunes.

Moths are threatened by chemical pollution brought on by pesticide use in cultivated areas and montane regions. Light pollution is of much concern for the survival of moths, since moths are attracted to light sources and they become subjected to predation in turn. The alteration, fragmentation and loss of habitat are of the most concern to moth species. For example, the loss of Dawata trees (*Carallia brachiata*) in home gardens affects the survival of the Blue Tiger Moth (*Dysphania Palmyra*) since, Dawata is the host plant for this species.

Climate change remains a threat with unknown consequences due to data deficiency. However, the changing weather patterns could potentially impact upon the insecta severely.

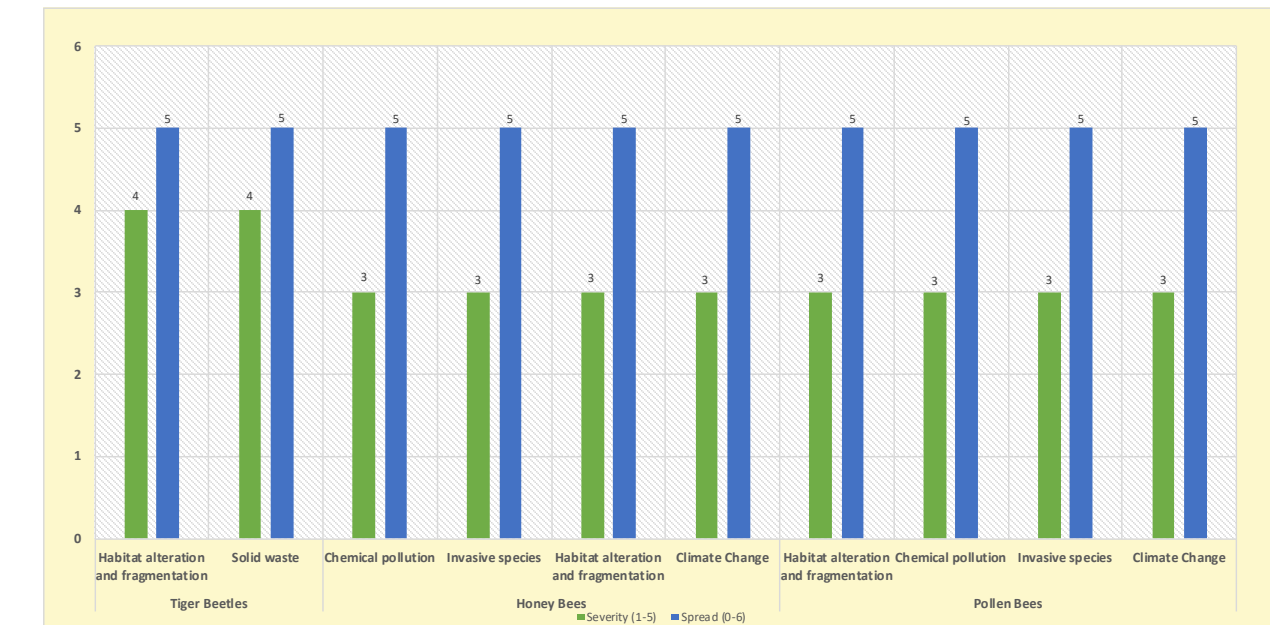


Figure 3.4 Spread and severity of threats to tiger beetles, honey bees and pollen bees

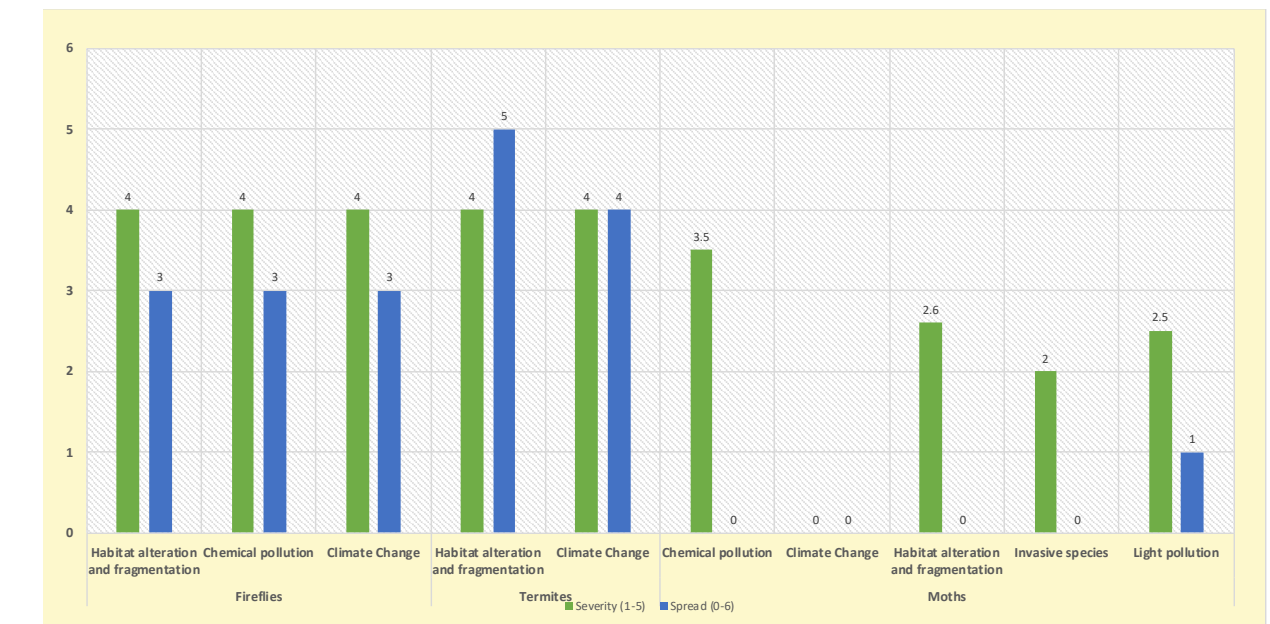


Figure 3.5 Spread and severity of threats to fireflies, termites and moths

3.1.5 Butterflies

Butterflies all over the country are threatened by chemical pollution. The use of insecticides in agriculture and mosquito control has resulted in a decline of butterflies. Further, habitat alteration, mainly due to introduction of invasive flora that replace host plants, coupled with habitat fragmentation, has jeopardized butterfly abundance and their distribution.

In recent years, prolonged droughts and skewed rain patterns have hampered breeding as well as feeding.

In the case of butterflies, certain invasive species, such as *Lantana camara* and *Stachytarpheta jamicensis*, have facilitated their distribution. Endemic butterflies have specific host plants and many of these endemic species have a threatened status due to loss of habitat and due to competition induced by invasives.

Further, the gradual urbanisation of rural areas leading to the loss of roadside vegetation is another threat faced by butterflies. Further, land clearance for development has resulted in the loss of larval food plants and nectar plants. Additionally, the loss of mud puddles, and fruits like jackfruit (*Artocarpus heterophyllus*), which are important components of an ecosystem, have made it difficult to maintain a healthy butterfly population (Figure 3.6).



Euploea core and *Tirumala limniace* (ZA)

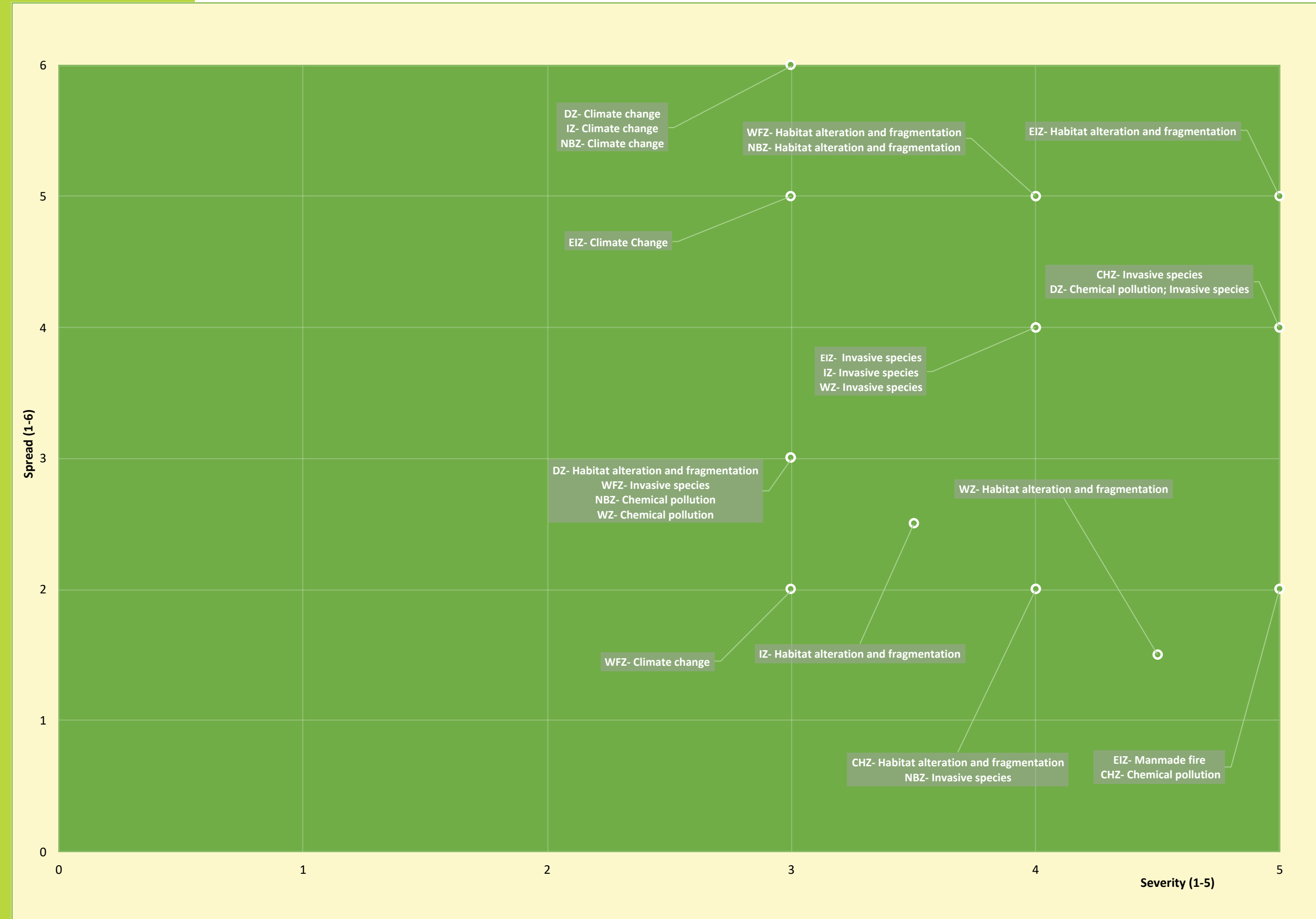


Figure 3.6 Spread and severity of threats in different butterfly zones.

Central Highlands Butterfly Zone CHZ/ Wet Forest Butterfly Zone WFZ/ Intermediate Butterfly Zone IZ/ Eastern Intermediate Butterfly Zone EIZ/ Dry Butterfly Zone DZ/ Northern Butterfly Zone NBZ

3.1.6 Land Snails

Sri Lanka is home to a diverse population of land snails, with 253 species recorded on the island, of which 205 species are endemic. However, the land snails of Sri Lanka are vulnerable to an array of threats, including the loss and fragmentation of habitat and climate change. Since land snails are sensitive to changes in humidity and agrochemical pollution due to high use of pesticides, they remain threats of most concern.

Land snails are also threatened by the demand for their shells and the indiscriminate killing of the species, since they are seen as pests especially in cultivated areas, due to a lack of awareness. Further, land snails have been affected by the presence of invasive species such as *Lissachatina fulica* and introduced species of slugs, which create a competition for food and niches. Introduced species of land snail have been found to be cannibalistic towards native species. For example *Gonaxis kibweziensis* which was introduced as a bio control agent for *Lissachatina fulica* in the Peradeniya Botanical Garden has spread, and has become a threat (Figure 3.7).



Beddomea albizonatus (ZA)

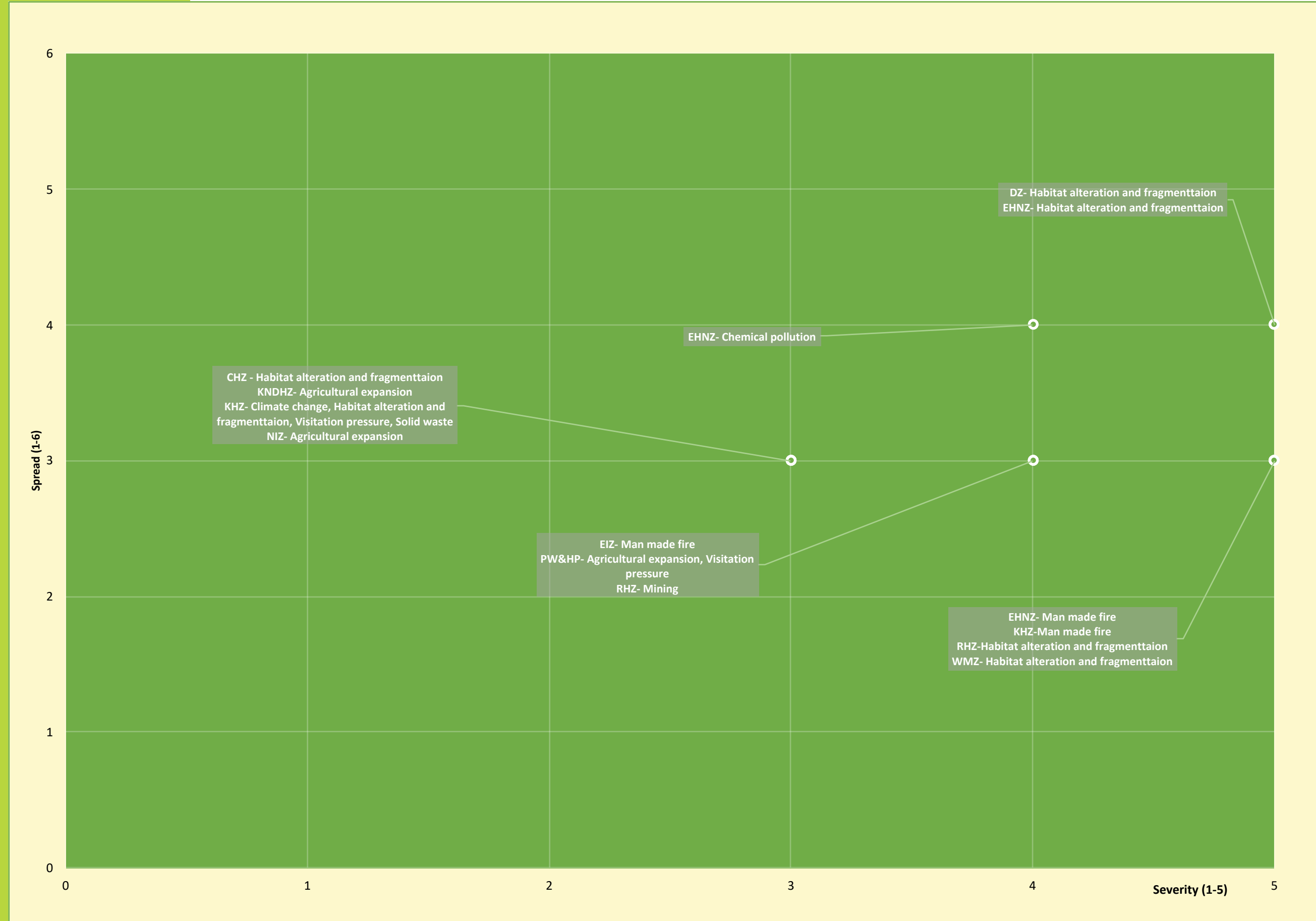


Figure 3.7 Spread and severity of threats in different land snails zones.

Central Hill Land Snail Zone CHZ/ Wet Midland Land Snail Zone WMZ/ Eastern Highlands and Namunukula Land Snail Zone EHNZ/ Knuckles Hill Land Snail Zone KHZ/ Kanneliya-Deraniyagala-Nakiyadeniya Land Snail Zone KNDHZ/ Peak Wilderness and Horton Plains Land Snail Zone PW&HP/ Rakwana Hill Land Snail Zone RHZ/ Eastern Intermediate Land Snail Zone EIZ/ Northern Intermediate Land Snail Zone NIZ



Rasbora pallidus (SG)

3.1.7 Freshwater Fish

Freshwater fish arguably face the greatest risk due to an assortment of factors, of all the taxonomic groupings. All identified zones are affected by one threat that has profound impacts on species, i.e. altered river continuum. Sri Lanka has been altering rivers and distribution of water since the start of construction of reservoirs about 2,300 years ago. However, in the last 50 years, the country has dammed all major rivers, either for mega or mini hydro power development, without due considerations of the impacts on ecology. For instance, to date, no proper fish passes have been constructed to facilitate a lateral movement of species, and the monitoring mechanism to check if minimum water flow is maintained in rivers, once the water is diverted to tunnels, is at a primitive stage.

Coupled with the disturbances to river continuum and its fluxes, chemical pollution, habitat loss, habitat alteration, especially along riparian zones, extraction of resources such as sand, gems, clay and aquatic flora, ornamental fish collection; the dumping of garbage both organic and inorganic; spread of invasive species that act as novel predators, gene polluters; niche competitors and invasive flora that change the habitat character; destructive fishing practices such as dynamiting; poisoning and unsustainable harvesting of fish for both consumption and the ornamental trade; and climate change have all been identified as threats affecting the health of the aquatic ecosystems of Sri Lanka. However, ichthyologists have recognized that these threats are interrelated, and it is when multiple threats affect a single ichthyologic environment that it poses the most serious risk to the survival of freshwater fish species.

Chemical pollution impacts upon the survival of freshwater fish in the Dry and Knuckles Zones, 51 to 75% of the range is affected by the improper use of agrochemicals and fertilizers, while industry effluents and drainage waste from canals also contribute to chemical pollution. In the North Central and Southern regions, the situation is aggravated by the dumping of garbage which creates flotsam in lower courses of rivers, resulting in a slow water flow. Experts attribute poor enforcement of rules and regulations at the regional and provisional levels, combined with a lack of awareness and understandings among the farmers and policymakers, as factors that allow for the continued, unregulated use of agrochemicals in important aquatic habitats.

Habitat alternation and fragmentation due to deforestation, land reclamation, development projects such as large-scale road expansion projects; and irrigation projects, encroachment of aquatic habitats mainly wetlands and mangroves, agriculture and livestock and unsustainable water extraction, all contribute to loss of suitable habitat for aquatic organisms to live, feed and spawn in. Moreover, ichthyologists have observed that there has been a rapid conversion of rubber plantations into palm oil plantations in the Mahaweli Upper Catchment Zone and South Western Zone, resulting in hastened deforestation, leading to increased siltation in streams and rivers, and an adverse impact upon the aquatic biodiversity (Figure 3.8).

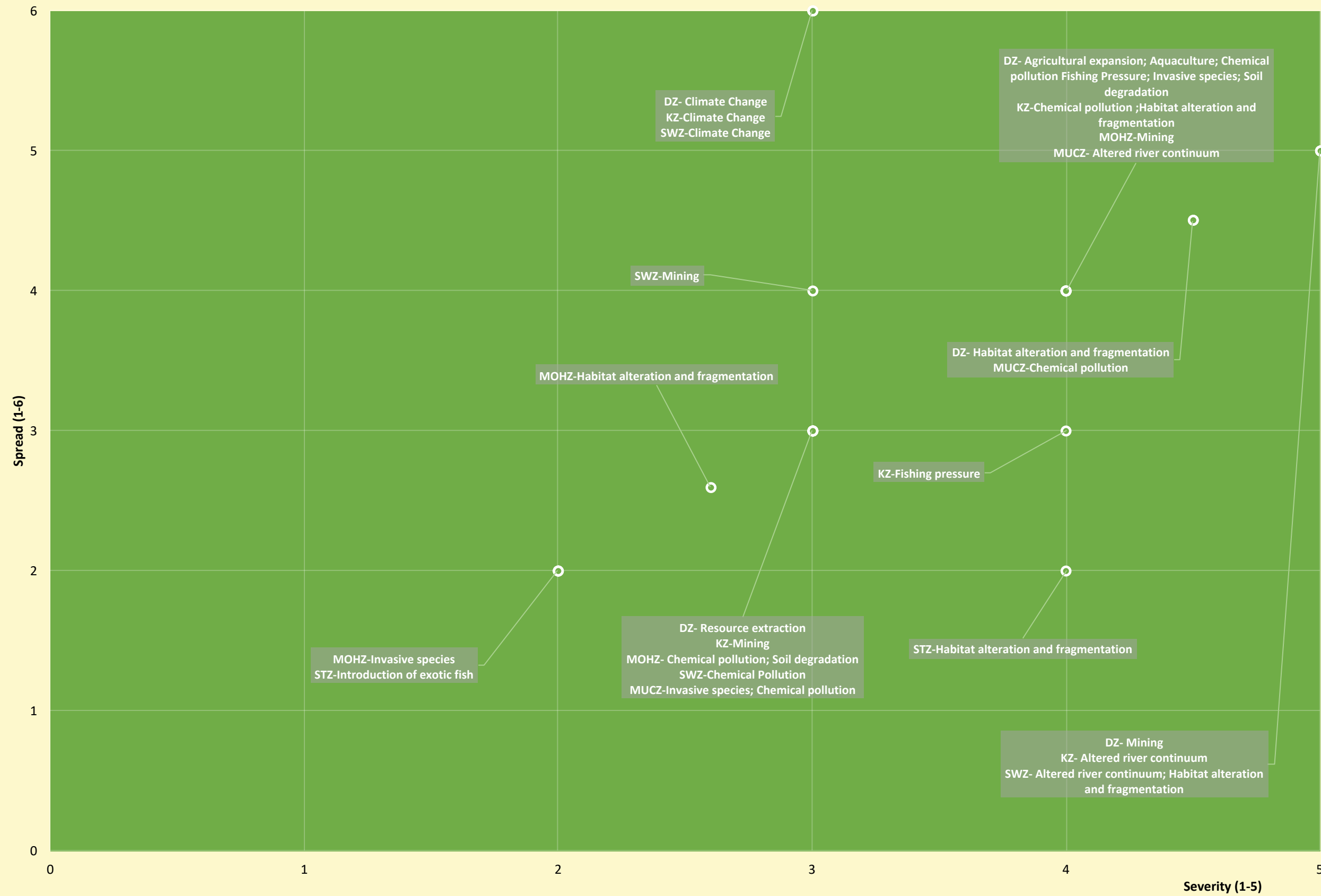


Figure 3.8 Spread and severity of threats in different freshwater fish zones.

Knuckles Ichthyological Zone KZ/ Mahaweli Upper Catchment Ichthyological Zone MUCZ/ Maha Oya Headwaters Ichthyological Zone MOHZ/ South Western Ichthyological Zone SWZ/ Southern Transition Ichthyological Zone STZ/ Dry Ichthyological Zone DZ



3.1.8 Amphibians

Amphibians face a range of threats and their severity and spread varies from zone to zone.

The Central Highlands Zone is identified as the most vulnerable region, since changing climatic patterns, agricultural expansion projects and forest dieback are all drastically affecting the survival of amphibian species. Survival of the amphibian biota in the Wet Zone of the country is also of concern, since chemical pollution, ad hoc disposal of solid waste and the pressures brought on by fishing, are taking a toll on several species. For example, the aquatic species *Lankanectes corrugatus*, which is frequently found in streams at the edge of paddy fields is threatened by the increased release of industry effluents and agrochemicals into streams and waterways.

Air pollution in cloud forests, forest die back, garbage dumping by visitors and increased predation by crows, are identified as significant threats in the Horton Plains. In the Knuckles Zone, the threat of agricultural expansion is seen to be severe with threats brought on by cardamom plantations specifically highlighted. For example, the critically endangered species *Nannophrys marmorata*, which is a point endemic to the Knuckles mountain range at elevations of 200 to 1,220 m, is directly and indirectly impacted by the continued habitat alteration and fragmentation within the zone. *N. marmorata* is the only known amphibian genus in the country to have tadpoles that are adapted to survive in semi-terrestrial conditions. The altered rainfall patterns thought to be brought on by climate change have led to extended periods of drought, coupled with periods of intense rainfall which has the potential to wash away breeding sites and eggs of these tadpoles. If measures are not taken to manage the threats in the region, it may lead to the extinction of the unique biota found within the zone.

In the Sinharaja region, the heavy use of agrochemicals, habitat fragmentation brought on by construction, agricultural expansion and tree felling, are the most significant threats. In Maragala and Ritigala ASITU, extreme use of agrochemicals and land encroachment for agriculture, and livestock, are significant threats. In the Lowland Wet Zone, multiple threats have been identified, notably solid waste and chemical pollution, mining constructions and agriculture practices, which lead to soil degradation and the fragmentation of habitats. Illegal and destructive fishing practices further affect amphibians, in particular, the use of dynamites in waterways. Climate change is identified as a key driver affecting the overall presence and abundance of amphibians in the country (Figure 3.9).

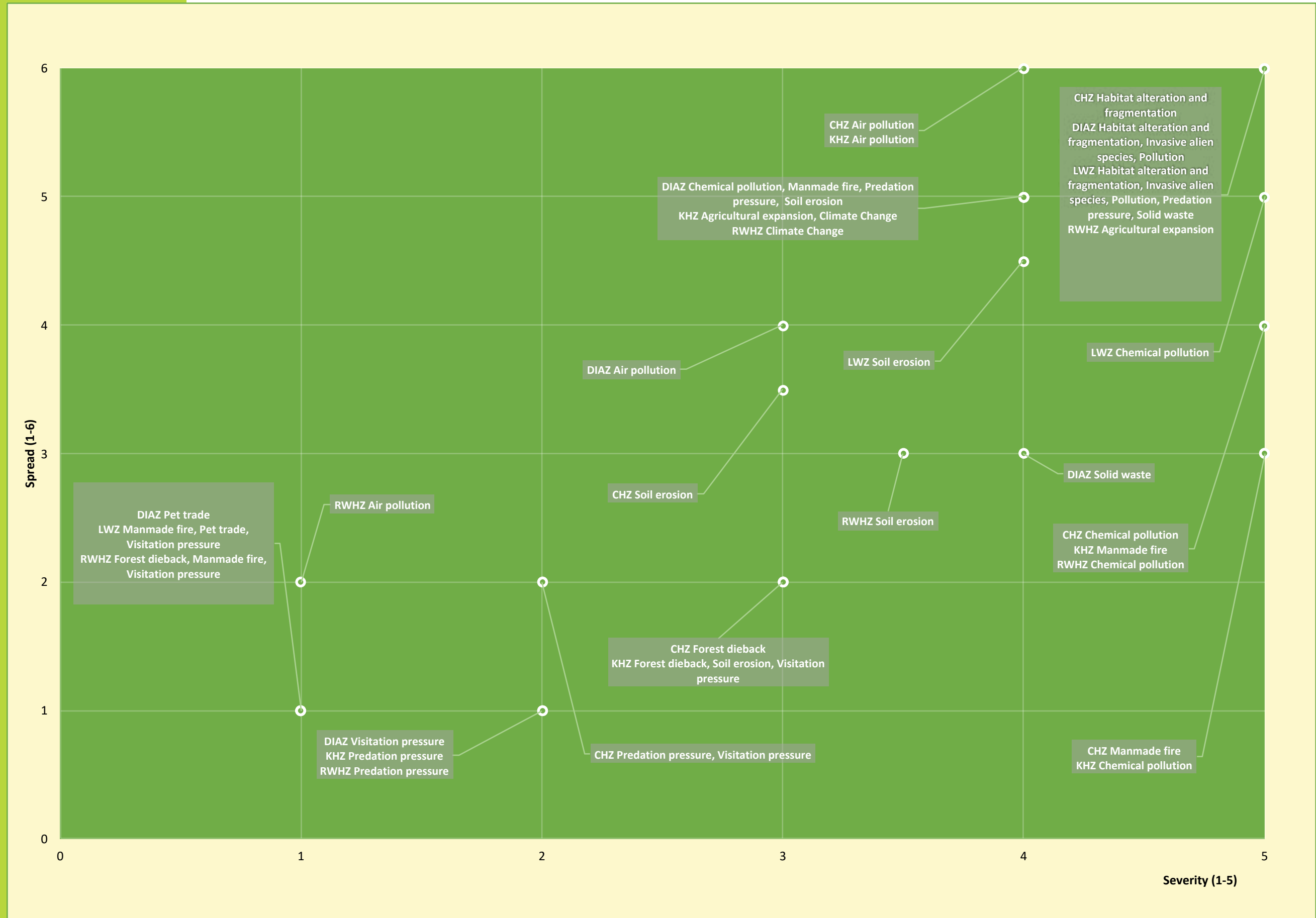
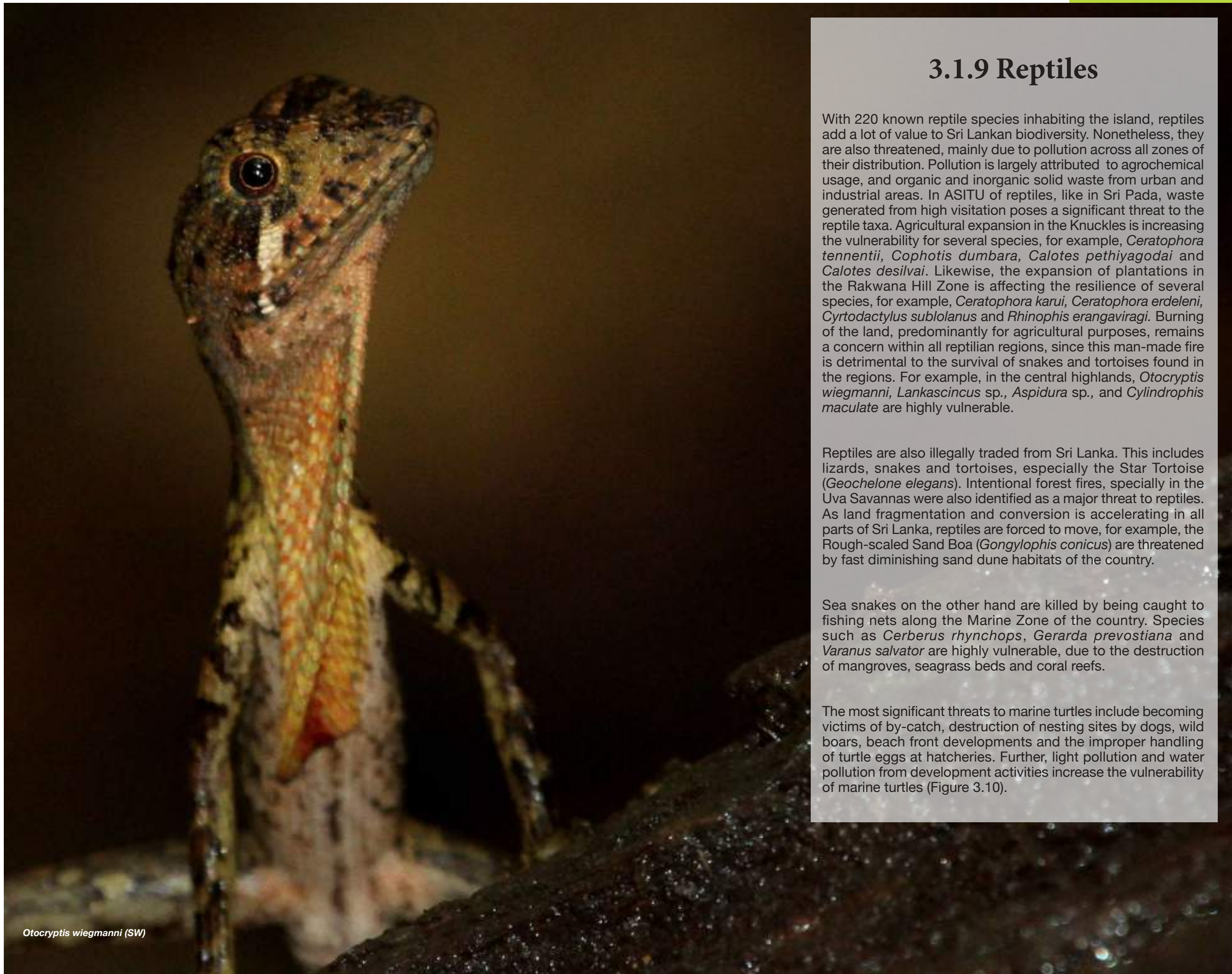


Figure 3.9 Spread and severity of threats in different amphibian zones.

Central Highlands Amphibian Zone CHZ/ Lowland Wet Amphibian Zone LWZ/ Knuckles Hill Amphibian Zone KHZ/ Rakwana-Walankanda Hill Amphibian Zone RWHZ/ Dry, Intermediate and Arid Amphibian Zone DIAZ



Otocryptis wiegmanni (SW)

3.1.9 Reptiles

With 220 known reptile species inhabiting the island, reptiles add a lot of value to Sri Lankan biodiversity. Nonetheless, they are also threatened, mainly due to pollution across all zones of their distribution. Pollution is largely attributed to agrochemical usage, and organic and inorganic solid waste from urban and industrial areas. In ASITU of reptiles, like in Sri Pada, waste generated from high visitation poses a significant threat to the reptile taxa. Agricultural expansion in the Knuckles is increasing the vulnerability for several species, for example, *Ceratophora tennentii*, *Cophotis dumbara*, *Calotes pethiyagodai* and *Calotes desilvai*. Likewise, the expansion of plantations in the Rakwana Hill Zone is affecting the resilience of several species, for example, *Ceratophora karui*, *Ceratophora erdeleni*, *Cyrtodactylus sublolanus* and *Rhinophis erangaviragi*. Burning of the land, predominantly for agricultural purposes, remains a concern within all reptilian regions, since this man-made fire is detrimental to the survival of snakes and tortoises found in the regions. For example, in the central highlands, *Otocryptis wiegmanni*, *Lankascincus* sp., *Aspidura* sp., and *Cylindrophis maculate* are highly vulnerable.

Reptiles are also illegally traded from Sri Lanka. This includes lizards, snakes and tortoises, especially the Star Tortoise (*Geochelone elegans*). Intentional forest fires, specially in the Uva Savannas were also identified as a major threat to reptiles. As land fragmentation and conversion is accelerating in all parts of Sri Lanka, reptiles are forced to move, for example, the Rough-scaled Sand Boa (*Gongylophis conicus*) are threatened by fast diminishing sand dune habitats of the country.

Sea snakes on the other hand are killed by being caught to fishing nets along the Marine Zone of the country. Species such as *Cerberus rhynchops*, *Gerarda prevostiana* and *Varanus salvator* are highly vulnerable, due to the destruction of mangroves, seagrass beds and coral reefs.

The most significant threats to marine turtles include becoming victims of by-catch, destruction of nesting sites by dogs, wild boars, beach front developments and the improper handling of turtle eggs at hatcheries. Further, light pollution and water pollution from development activities increase the vulnerability of marine turtles (Figure 3.10).

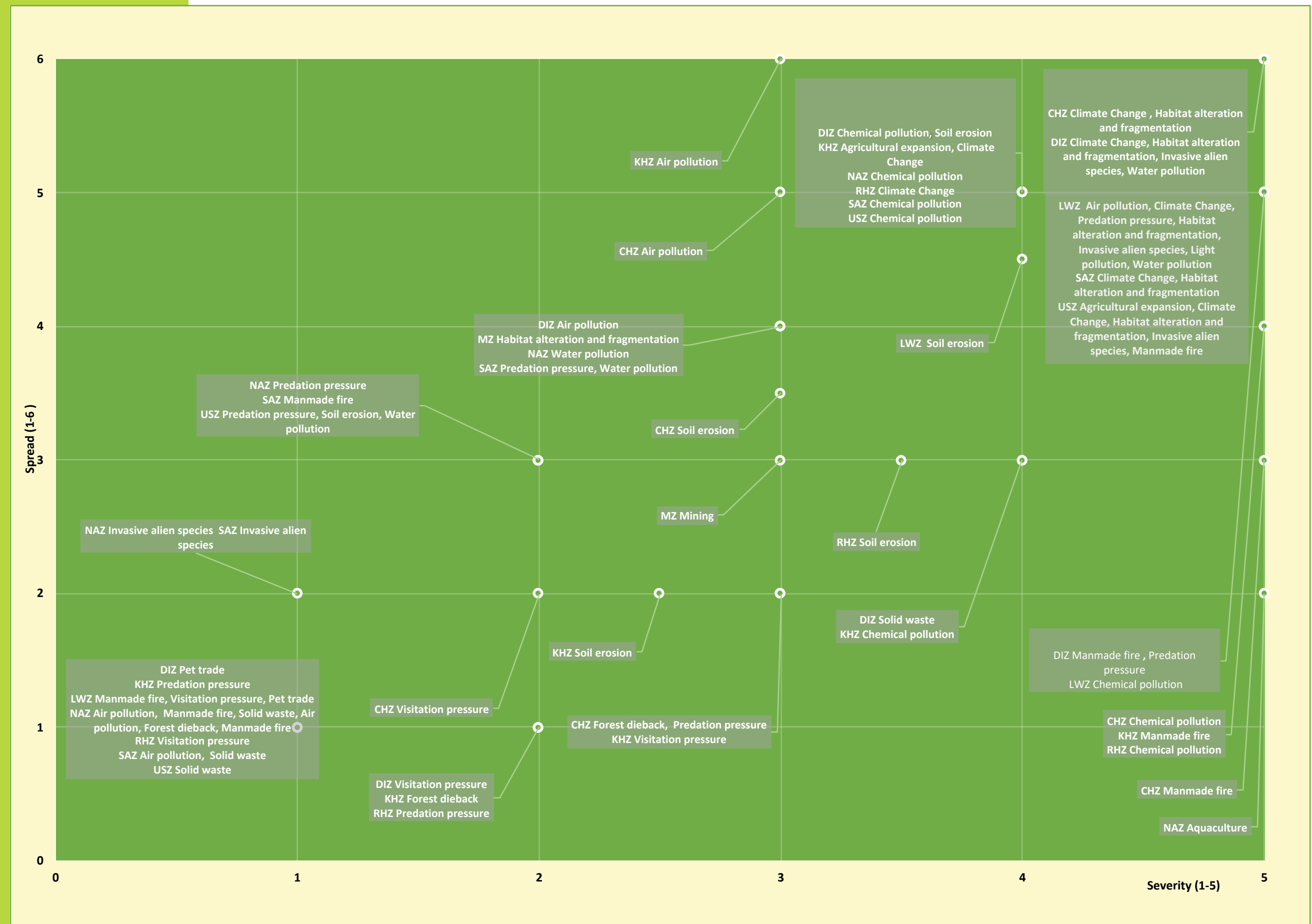


Figure 3.10 Spread and severity of threats in different reptile zones.

Central Hill Reptilian Zone CHZ/ Lowland Wet Reptilian Zone LWZ/ Knuckles Hill Reptilian Zone KHZ/ Rakwana Hill Reptilian Zone RHZ/ Uva Savanna Reptilian Zone USZ/ Dry and Intermediate Reptilian Zone DIZ/ Northern Arid Reptilian Zone NAZ/ Southern Arid Reptilian Zone SAZ/ Marine Reptilian Zone MZ

3.1.10 Birds

Avifauna of Sri Lanka face significant threats due to habitat fragmentation and deterioration in all areas. This is mainly due to encroachment of all types of vegetation for agriculture, road and other infrastructure developments, and livestock expansion. In fragmented ecosystems, richness of birds are further deteriorated due to the spread of invasive species, and the felling of trees including shags, which are important breeding grounds.

Agricultural and industrial expansion has also contributed to solid waste dumps and increased water pollution, which was also identified as a significant threat.

In pelagic areas, oil pollution and fishing pressure, coupled with increasing damages to coastal ecosystems such as mud flats, sand dunes and temporary sand bars, affect migratory birds. Accumulation of solid waste along the coastal belt, coupled with increased human occupation, are other significant threats. In recent years, development plans such as wind power and coastal aquaculture, are of concern, especially on the north-western coast of the island. The release of sewage and oil into wetlands of Colombo causes the destruction of the urban wetland ecosystems of Colombo which was recently recognised as a Ramsar Urban Wetland (Figure 3.11).



Pelecanus philippensis (MA)

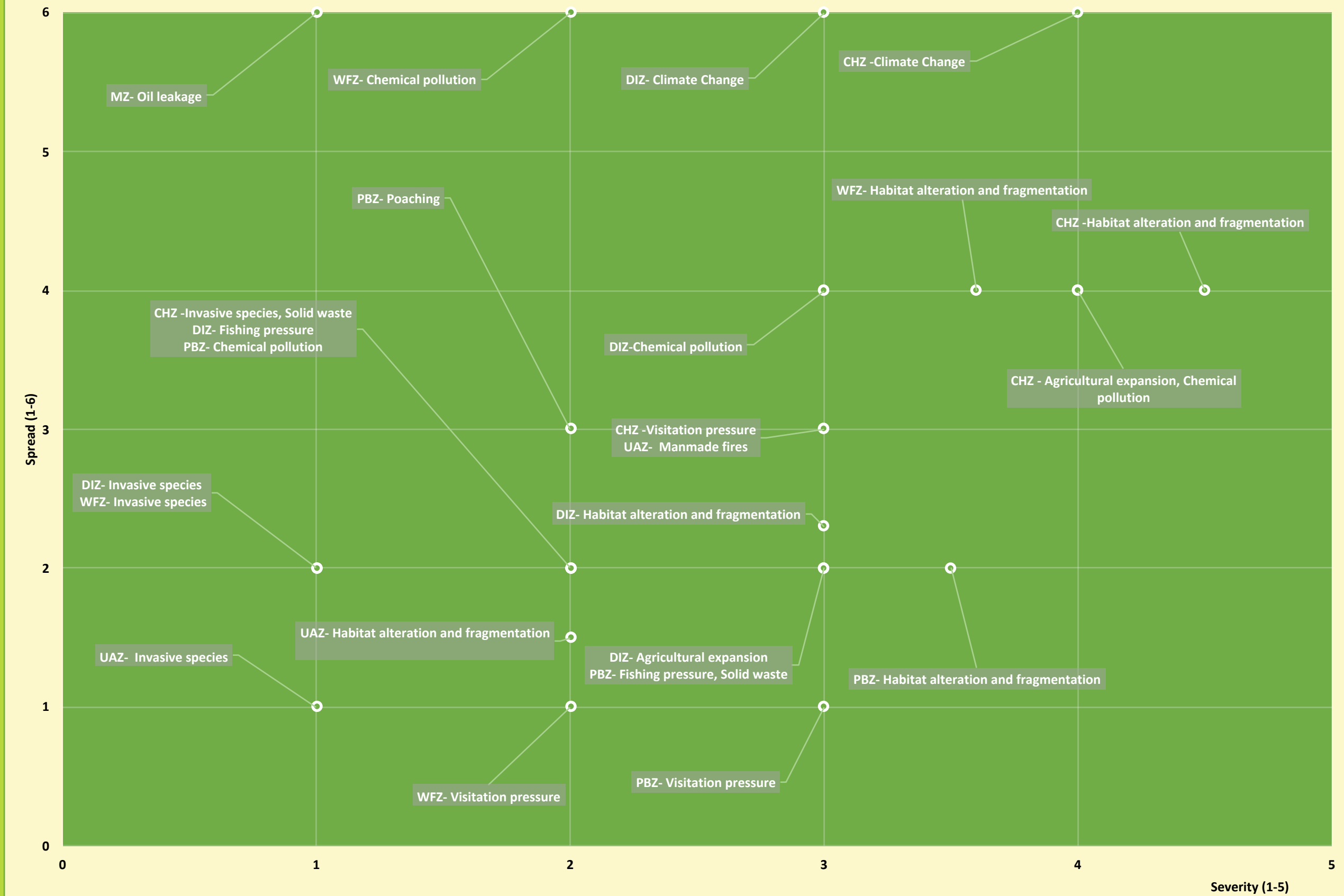


Figure 3.11 Spread and severity of threats in different avifaunal zones.

Highlands Avifaunal Zone CHZ/ Wet Forest Avifaunal Zone WFZ/ Uva Avifaunal Zone UAZ/ Dry and Intermediate Avifaunal Zone DIZ/ Marine Avifaunal Zone MZ/ Palk Bay Coastal Avifaunal Zone PBZ

3.1.11 Mammals

The fragmentation and alteration of ecosystems are widespread across all the mammalian zones, where it is most severe in the Wet Zone, with the cause identified as the development of small tea plantations in the low country. In fact, a recent report by Dittus (2018) noted that nearly 60% of mammalian taxa inhabiting rainforests are threatened with extinction. In the Dry Zone, habitat fragmentation is identified as severe, with the development of road and railroad networks, irrigation canals, and power lines recognised as the attributing factors. Large migratory mammals such as elephants are having their migratory routes disrupted due to this land encroachment. In addition to elephants, other mammals such as leopards, monkeys and sambar are increasingly threatened by land clearances, especially in the North Coastal Arid and Central Highland Zones.

The Human-Wildlife Conflict (HWC), is a serious concern in Sri Lanka, and is a threat to the survival of keystone mammalian species. This conflict between people and wildlife is spurred on by competition that arises as a result of a reliance upon shared resources, and when humans are threatened for their wellbeing by the wildlife in their surroundings.

The HWC is identified by mammal experts as most aggravated in the Dry Zone, with the severity and significance rated at the extreme end of the spectrum. Elephants, leopards, sloth bears and wild boar are all identified as agents in this conflict. Human-elephant conflict is of the utmost concern in the Dry Zone, with development and changes in land use management only serving to intensify the conflict threatening the survival of the species. In the Wet Zone, the existing HWC is largely due to the raiding of crops and home gardens by purple-faced leaf monkeys, toque macaques, porcupines, wild boars and palm squirrels.

Mammals are also poached both for food and also for wildlife trafficking. The poaching for venison and wild boar is severe in the Highlands and Dry Zone. These species are poached largely at a subsistence scale, as a source of game meat which remains popular amongst local communities who reside in these regions as well as amongst urban dwellers.

Pollution is also recognised as a widespread threat to mammals, especially garbage dumps, which attract wild animals that subsequently die due to polythene indigestion. Additionally, agrochemical usage for paddy cultivation and other crops adversely impact upon small mammals, due to the loss of microhabitats. For example, bats are severely impacted by the loss of their niches.

In both the Dry Zone and the Highlands, there is concern over the presence of feral species such as domestic dogs and cats due to the risk of disease transfer and the development of hybrid species.

In the Northern Coastal Arid region, mammals are threatened by climate change, especially severe drought. The feral population of horses inhabiting Delft Island, require water to be pumped during the dry season to allow for their continued survival (Figure 3.12).

Equus caballus (ZA)

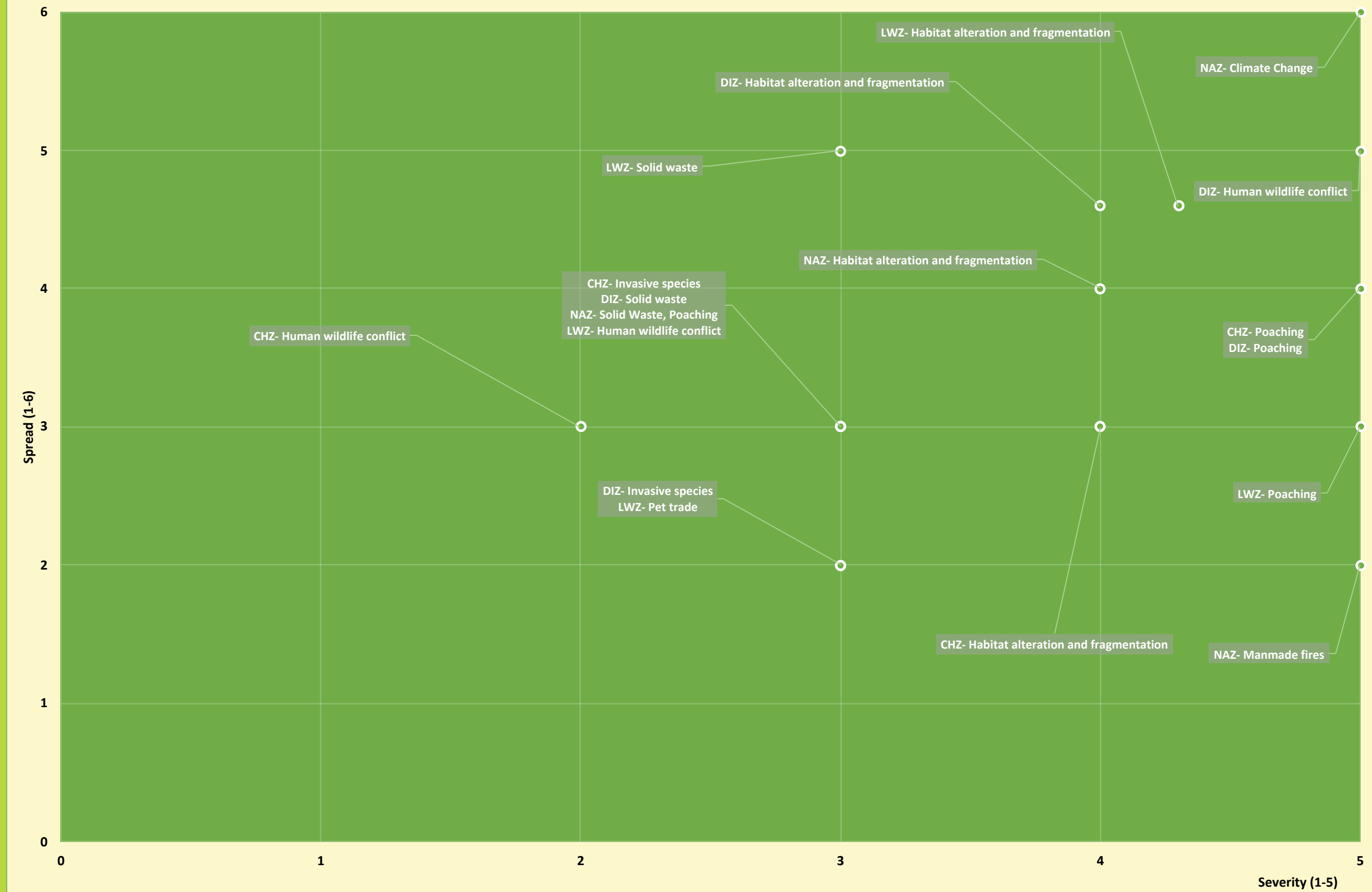


Figure 3.12 Spread and severity of threats in different mammal zones

Highlands Mammalian Zone CHZ/ Lowland Wet Mammalian Zone LWZ/ Dry and Intermediate Mammalian Zone DIZ/ Northern Large Mammal Exclusion Zone NAZ



Panthera pardus kotiya (JG)

Human- Leopard Incidents in the Central Highlands

An increase in human leopard interactions is a growing concern in Sri Lanka. Leopards (*Panthera pardus kotiya*) are large wide ranging, territorial mammals, that require space to hunt and sustain themselves. Sri Lanka's changing landscape, especially post war, is resulting in loss of forest cover, due to conversion of forests for agricultural and development projects. Changes in human societal activities is also resulting in leopards and humans coming into contact more often. This increased overlap in land use has given rise to higher incidence of human-leopard contact, especially in the Central highlands. Leopards are also being incidentally caught in snares set for other wildlife and this has become a concern within the Central Highlands, especially in the tea plantation areas of Gampola, Nawalapitiya, Maskeliya and Nuwara Eliya.

The Department of Wildlife Conservation (DWC) has seen an increase in the reported human-leopard interactions between 2010 and 2015, with five human-leopard incidents, where a human was injured by a leopard, was reported within the Central Highland region of the country [Wilderness & Wildlife Conservation Trust (WWCT) & DWC].

During this same five year period, 20 dead leopards were reported from the Central Highlands, of which 16 were incidentally caught in snares (WWCT & DWC). It is necessary to note, that killing a leopard is prohibited by law in Sri Lanka, therefore, it is possible that the reported incidents are only a minimum, with more cases going unreported and thus undocumented.

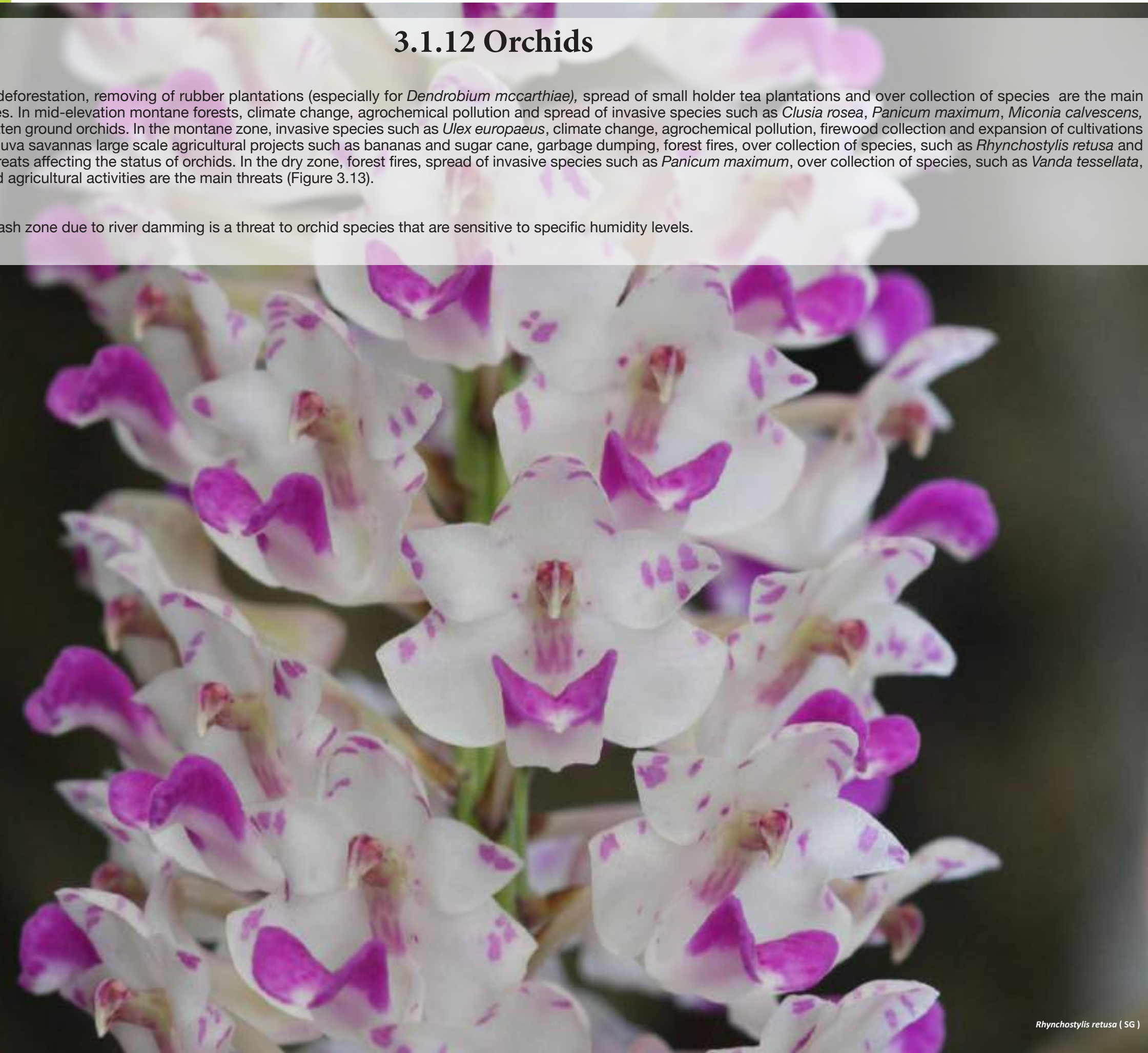
Unless the prevailing rise in human-leopard incidents is addressed specifically with strategic intervention, this situation could well escalate to conflict levels.

In response to these increased incidents of human-leopard interaction, the WWCT together with the DWC have developed a Protocol Manual / Guideline for Human-leopard Incident Management (2016). The protocol manual is similar to what is used in India, where human leopard conflict has been an ongoing issue for some time. The protocol lays out response mechanisms to follow if and when an incident occurs, laying out various scenarios of human-leopard conflict incidence, e.g. trapped leopard, human attack, attack on livestock etc. Targeted and long-term awareness to plantation communities on dealing with encountering a leopard, and avoiding such an encounters are also ongoing. Snare removal and the illegalities of such action needs to be addressed. Institutional progress driven by the National Biodiversity Strategic Action Plan (NBSAP) is observed here with progress in implementing Target 4, Action 8, which calls for the development and implementation of species level management plans for mitigation of conflict caused by threatened species. Further, DWC veterinary staff are to be better equipped, with appropriate equipment made available at regional offices, so that the regional veterinary staff can respond quickly in the event where a leopard was found to be snared. This allows for a higher success rate in the leopard being saved.

3.1.12 Orchids

In lowland wet zones, deforestation, removing of rubber plantations (especially for *Dendrobium mcccathiae*), spread of small holder tea plantations and over collection of species are the main threats to orchid species. In mid-elevation montane forests, climate change, agrochemical pollution and spread of invasive species such as *Clusia rosea*, *Panicum maximum*, *Miconia calvescens*, and *Clidemia hirta* threaten ground orchids. In the montane zone, invasive species such as *Ulex europaeus*, climate change, agrochemical pollution, firewood collection and expansion of cultivations are the main threats. In uva savannas large scale agricultural projects such as bananas and sugar cane, garbage dumping, forest fires, over collection of species, such as *Rhynchostylis retusa* and logging are the main threats affecting the status of orchids. In the dry zone, forest fires, spread of invasive species such as *Panicum maximum*, over collection of species, such as *Vanda tessellata*, gravel, sand mining and agricultural activities are the main threats (Figure 3.13).

Additionally, loss of splash zone due to river damming is a threat to orchid species that are sensitive to specific humidity levels.



Rhynchostylis retusa (SG)

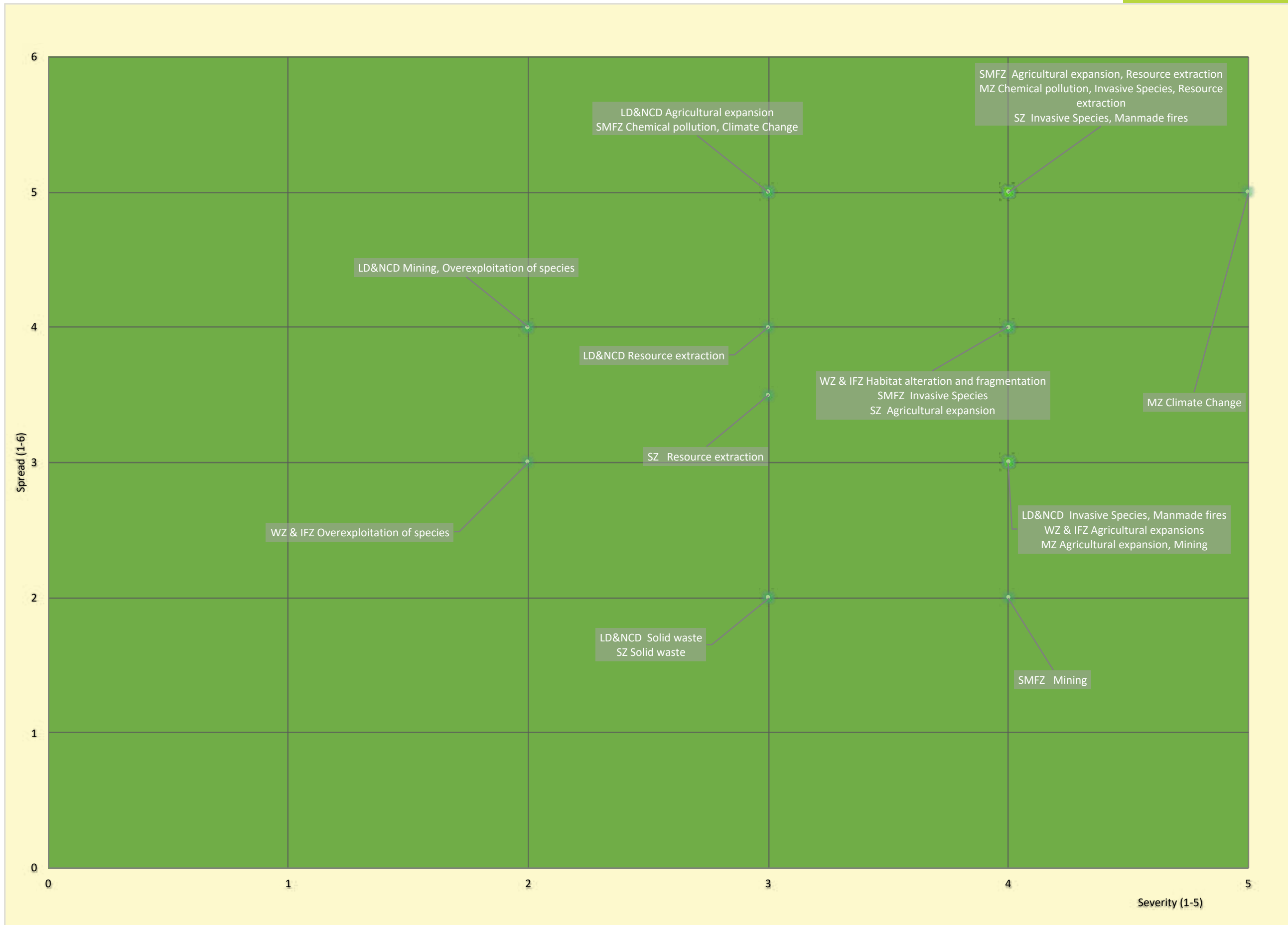


Figure 3.13 Spread and severity of threats in different orchids zones

Lowland Dry and Northern Coastal Dry Orchid Zone LD&NCD / Wet and Intermediate Forests Orchid Zone WZ & IFZ / Submontane Forest Orchid Zone SMFZ / Montane Forests Orchid Zone MZ / Savanna Orchid Zone SZ

3.1.13 Ferns and Lichens

In the Wet Zone highlands above 1,000 m the most significant threats are climate change, habitat alteration and the frequent intentional fires that destroy the landscape.

In the Wet Zone below 1,000 m, river diversions for the construction of mini and mega hydro projects have resulted in the loss of spray zones in segments of rivers which are deprived of natural flow affecting both ferns and lichens.

Ferns and lichens have both been affected, due to a reduction in fog interception due to anthropogenic activities. Deforestation in areas such Kanneliya and air pollution are other significant threats.

Lack of awareness and indiscriminate collection of ferns are other threats in all parts of their range. In recent years, garbage and polluted water are threatening these sensitive taxa further (Figure 3.14).

Threat	Wet Zone - below 1000 m (Severity)	Wet Zone - below 1000 m (Spread)	Wet Zone highland - above 1000 m (Severity)	Wet Zone highland - above 1000 m (Spread)
Air pollution	4	5	4	4
Altered river contonium	4	3	4	4
Climate Change	3	4	5	6
Habitat alteration and fragmentation	5	5	4.5	5
Soil degradation	4	5	4	4
Forest fire	4	4	4	4

Figure 3.14 Spread and severity of threats to ferns and lichens

3.1.14 Marine Ecosystems

Marine ecosystems face a range of threats such as overfishing and the use of destructive fishing methods, coastal zone development, pollution, unregulated tourism and climate change.

Unsustainable levels of exploitation have resulted in the depletion of most fish stocks. Coastal fisheries, including reef-based fisheries are particularly vulnerable to overfishing due to high fishing effort and easy access to fishing grounds. Growth in global demand for fishery commodities has been a major driving force in increasing fishing pressure on sensitive species and ecosystems. This includes both consumption as food and ornamental species for aquariums and as souvenirs. In Sri Lanka, this is particularly evident with regard to sharks and rays, tuna, billfish, reef fish and reef invertebrates, such as chanks and sea cucumbers. The use of destructive fishing methods has resulted in extensive habitat damage and depletion of both target species and by-catch species. Dynamite fishing is a major threat to coral reefs, especially in the southern, eastern and northwestern coasts. Bottom-set nets, modified purse seine nets, gill nets, and spear fishing have also resulted in overfishing and habitat destruction. The continued use and expansion of the bottom trawl fishery in the northern and northwestern coastal areas poses a significant threat to marine habitats, along with poaching by foreign fishing vessels. The ecologically rich marine habitats of the Northern Zone are at the highest risk due to the use of illegal and damaging fishing practices, with Mannar islands, Maldiva banks, Iranthivu reef, Vellankulam reef and the seagrass beds, and mangroves in Vidathalivuvu, all severely affected. The Indo-Pacific Finless Porpoise, Dugongs and Indian Ocean Humpback Dolphins, all reside in the Northern Zone and their survival in Sri Lankan waters directly depends on the prevailing unsustainable fishing practices. According to data compiled by Pelagikos (Pvt) Limited, between the years of 1987 and 2017, 17 dugong deaths were recorded from the fishing inlet of Pukkulum on the north-western coast of Sri Lanka. During the same period, several more Dugong deaths were recorded along the north-western coastline (Figure 3.15). In the South- Eastern Zone, both the Little Basses and Great Basses reefs are facing pressure due to overfishing of high value species such as Groupers. The South- Eastern Zone is moderately impacted by fishing activities, with the entirety of the range of the reefs impacted by the pressures brought on by fishing.

Coastal development has resulted in direct and indirect degradation of marine ecosystems. Development projects are concentrated in the Northwestern, Northern and Southern Zones, with the proposed aquaculture farms and salterns, the expansion of the Point Pedro harbor and the drilling for oil off the coast of Kalpitya, being major concerns. The expansion of ports and coastal structures can directly destroy marine habitats, while changes to coastal currents as a result of such structures may lead to sedimentation or erosion. Dredging of sand in inshore waters is a major threat, due to both habitat destruction and increased siltation. Large scale reclamation of coastal areas can cause major habitat degradation, sedimentation of inshore waters, and changes in water chemistry that can lead to long term impacts on sensitive marine ecosystems such as coral reefs.

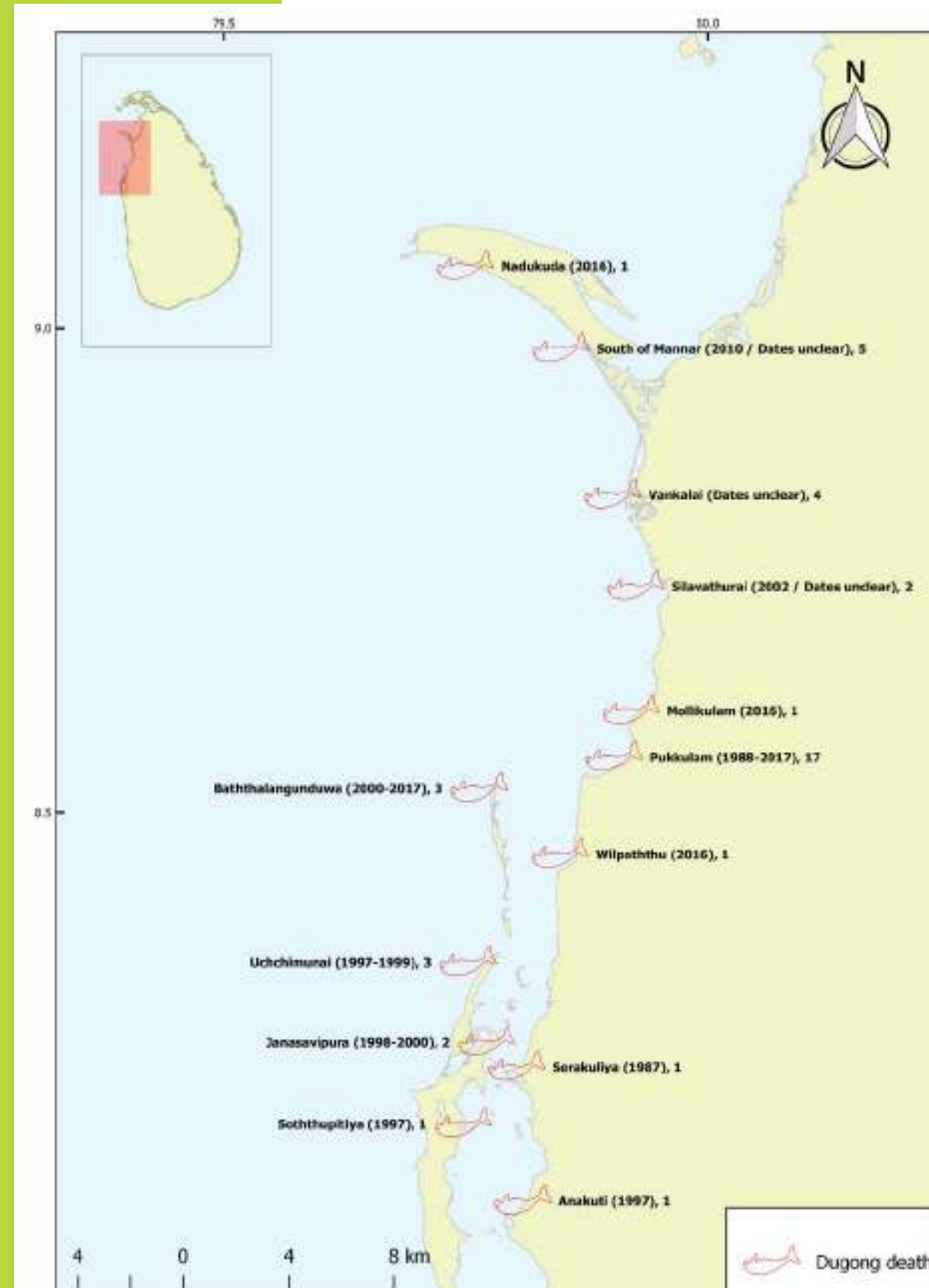


Figure 3.15 Reported sites of dugong deaths (Source: Pelagikos (Pvt) Ltd, Sri Lanka)

Marine pollution is a serious concern in all the Marine Zones, although severity is higher closer to urbanized areas with high population density. Both direct and indirect pollution has impacted water quality in coastal areas. Solid waste pollution is a major threat to marine mammals, turtles and seabirds. Increasing levels of sewage, and chemical and industrial waste has resulted in pollution of coastal waters with negative impacts on sensitive ecosystems such as coral reefs. High levels of nutrients from coastal and agricultural runoff can lead to eutrophication, high algal growth rates and toxic algal blooms that may result in fish deaths. Micro-plastics are also becoming a major threat, with little to no solution.

The growth of marine and coastal tourism, often in a haphazard and unregulated manner, has also resulted in threats to marine species and ecosystems. Indiscriminate anchoring of boats has damaged coral reefs, along with high numbers of snorkelers in shallow coral reef areas resulting in damage to coral reefs. Unregulated whale watching has been reported as a direct threat to marine mammals, with many boat operators not observing guidelines for animal interactions and minimum distances. Solid waste pollution is also worst in popular tourist areas, in addition to compounding issues related to coastal development through the large-scale development of hotels and other infrastructure in environmentally sensitive areas. Other indirect impacts of tourism include a growing demand for seafood, especially in overexploitation of species such as lobsters and large reef fish. The Southern Zone and parts of the Eastern and Northern Zones are the most seriously impacted by the rapidly growing tourism industry. The Southern Zone is the most at threat, with a long history of tourism development in areas such as Hikkaduwa, Rumassala, Unawatuna, and Mirissa. Glass bottom boats have resulted in damage to the Hikkaduwa reef, while snorkelers have caused damage to reefs all along the coast by breaking corals. In the Northern Zone, both the Bar reef and the marine hotspot off the coast of Kalpitya remain under moderate pressure due to the demands brought on by dolphin watching, snorkeling and diving operations.

Invasive species are also a problem in some areas, and the spread of invasive species may be accelerated by increased pollution, degradation of ecosystems and loss of other species. The Eastern, Southern and Northern Zones are all affected by the occurrence of invasive species. Rumassala and Unawatuna reefs in the Southern Zone and Pigeon Island in the Eastern Zone, are threatened by invasion of Corallimorphs that compete with live corals. Population increases of Crown-of-thorns Starfish has been reported from the Bar reef in the Northern Zone and the Pigeon Island in the Eastern Zone. High growth rate of algae as a result of coral mortality, high nutrient levels and a decrease in herbivores can be considered as a major problem on reefs in the Northern Zone, such as Bar reef, Silavathura reef and Arippu reef. This may also impact the ability of these reefs to recover following incidents of mass coral mortality.

Finally, changes in climatic patterns may pose the greatest threat to marine ecosystems in the future. Major coral bleaching events in 1998 and 2016, as a result of increased sea surface temperature, resulted in large-scale mortality of corals around Sri Lanka. Coral reefs along the south coast, including popular reefs such as Hikkaduwa, Rumassala, Unawatuna, Weligama and Polhena have been severely degraded as a result of coral bleaching, while the Bar reef in the Northern Zone was also similarly impacted, where more than 90% of all corals were lost during the 2016 coral bleaching event (Figure 3.16). Other reefs in the Northern Zone such as Silavathura reef, Arippu reef and Vankalai reef have also been affected by coral bleaching. Coral reefs in the Eastern Zone have been far less impacted by coral bleaching. However, with predicted increases in bleaching frequency and intensity with the rising global temperatures, these reefs may also be affected in the future.

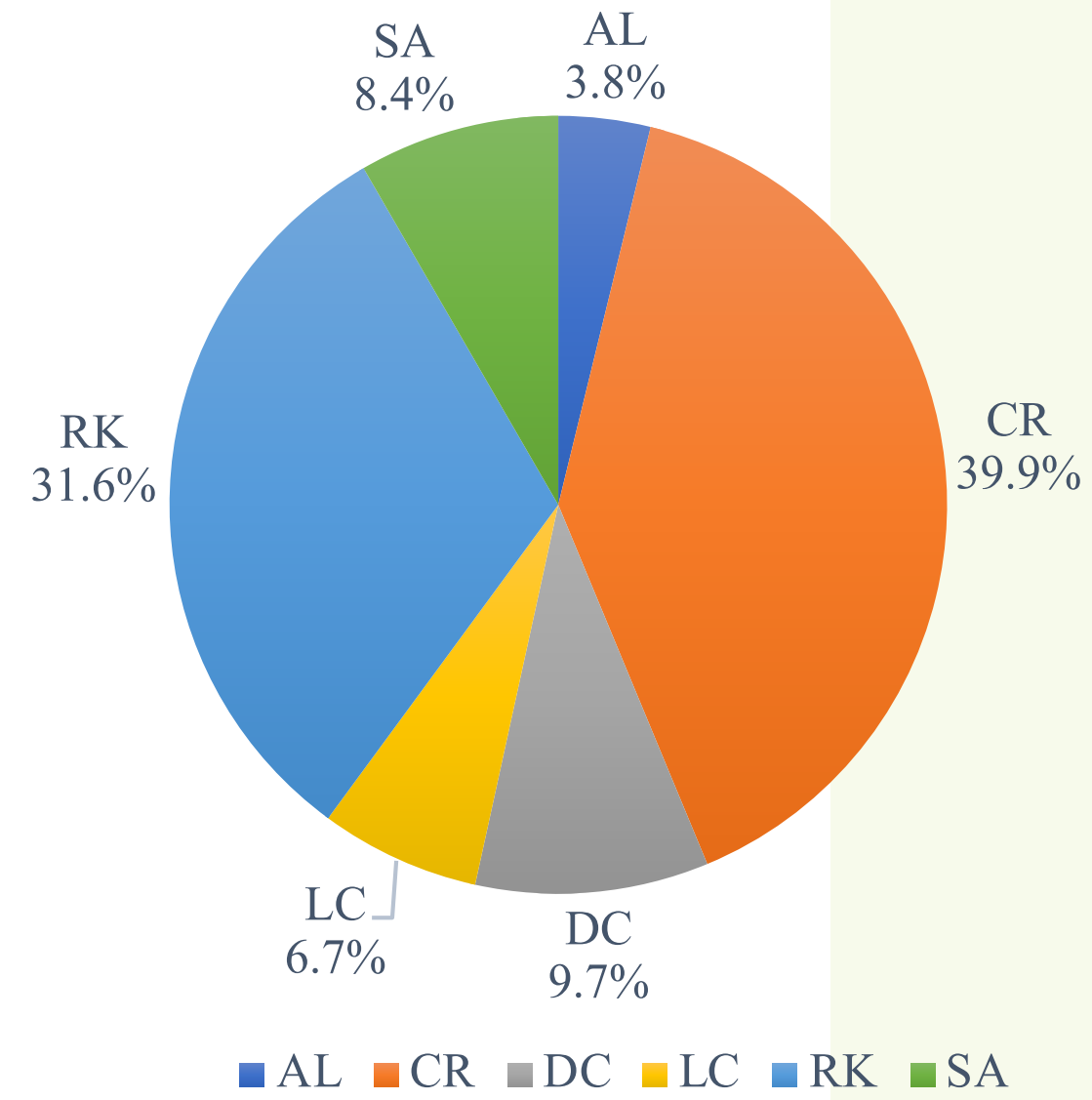


Figure 3.16 Average percentage substrate cover at Bar Reef in March 2017. (AL=Algae; CR=Coral Rubble; DC=Dead Coral; LC=Live Hard Coral; RK=Rock; SA=Sand) (Arachchige and Perera 2017).

The degradation of marine ecosystems due to increasing threats (Figure. 3.17) can have devastating ripple effects on coastal livelihoods. Decreasing fish catches and the potential loss of tourism revenue, are both likely outcomes that can negatively impact the income and food security of coastal populations.

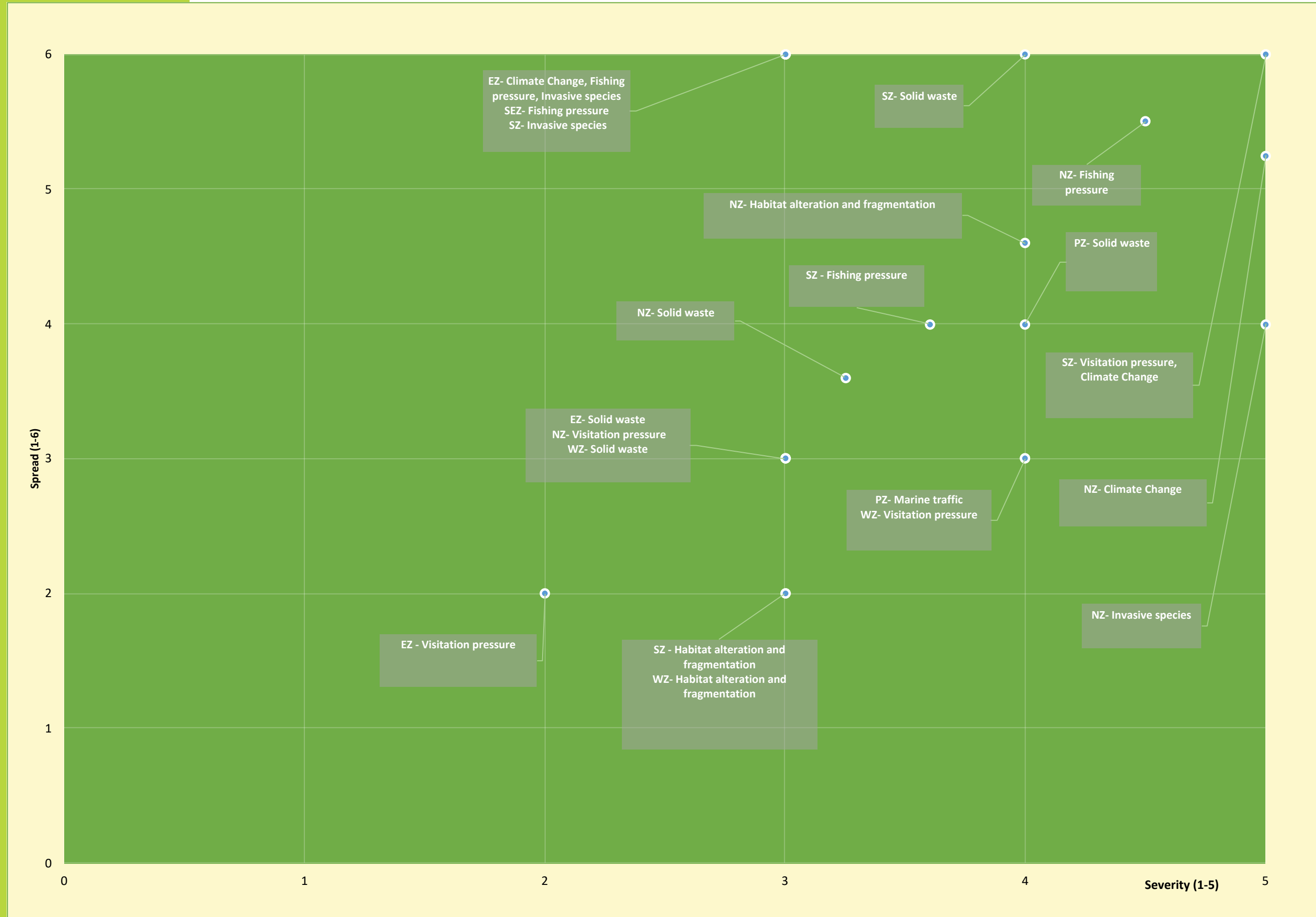


Figure 3.17 Spread and severity of threats in different marine zones

Pelagic Marine Zone PZ/ Northern Marine Zone NZ/ Eastern Marine Zone EZ/ South-eastern Marine Zone SEZ/ Southern Marine Zone SZ/ Western Marine Zone WZ



3.1.15 Lowland Wet Evergreen Forests

In lowland wet evergreen forests the gradual expansion of tea has led to habitat fragmentation, the spread of invasive species such as *Dillenia suffruticosa*, *Alstonia macrophylla* and *Clidemia hirta*. Mining for gems, droughts and floods associated with extreme weather conditions and tourism pressure are also other key threats identified. The potential expansion of oil palm (*Elais guineensis*) in this ecosystem as a cash crop can be a significant threat that can further fragment the remaining forest patches (Figure 3.18).

In C1, C2 and C3 zones (Figure 2.1), tea cultivation is the most significant threat that disturb the lowland wet evergreen forests by resulting in loss of habitats and soil fertility. Further, high rates of evaporation caused by the changes in the climatic patterns also affect the survival of above mentioned forest ecosystems.

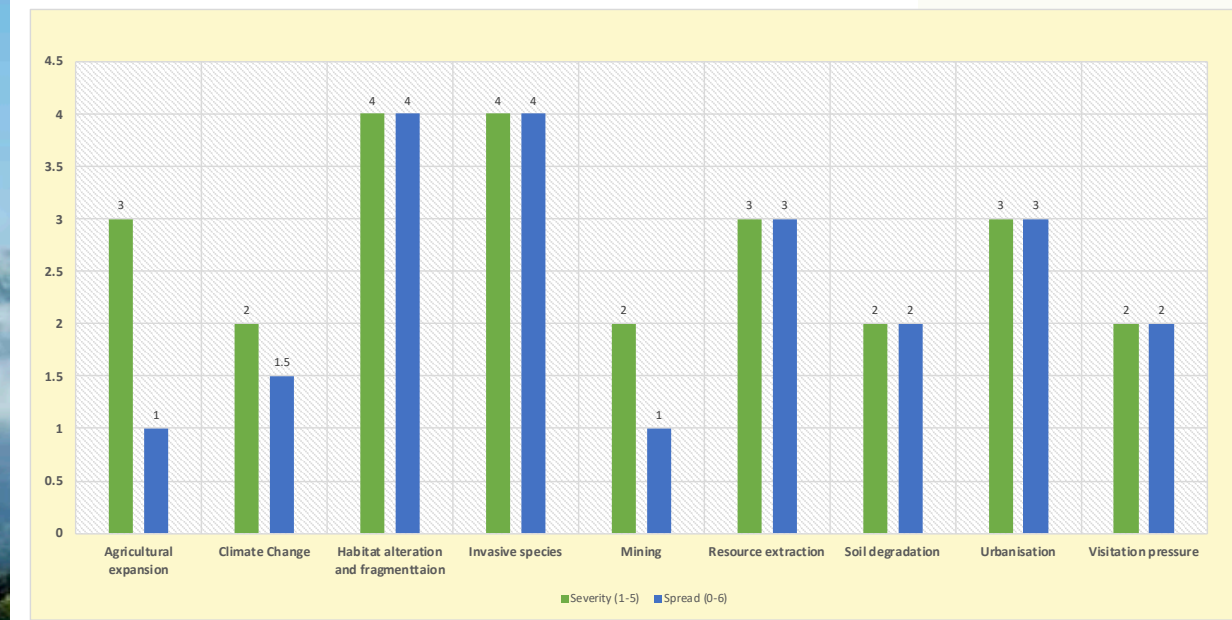


Figure 3.18 Spread and severity of threats to lowland wet evergreen forests

3.1.16 Mid-elevation Evergreen Forests

Mid-elevation evergreen forests are very much threatened by expanding tea plantations and other agricultural crops. Disturbance to this forest types has accelerated the spread of invasive species such as *Megathyrus maximus*, *Austro eupatorium inulifolium*, *Miconia calvescens* and *Clusia rosea*.

Logging predominantly for firewood in Ella, Dolosbage and Passara is another threat. Substantial canopy loss has occurred due to the conversion of forest landscapes to cultivated lands such as cardamom plantations. Moreover, in recent years' developments such as power lines, roads and hydro power projects (e.g. Uma Oya) coupled with the rapid expansion of tourism (e.g. Ella) have resulted in the decline of mid elevation evergreen forests (Figure 3.19).

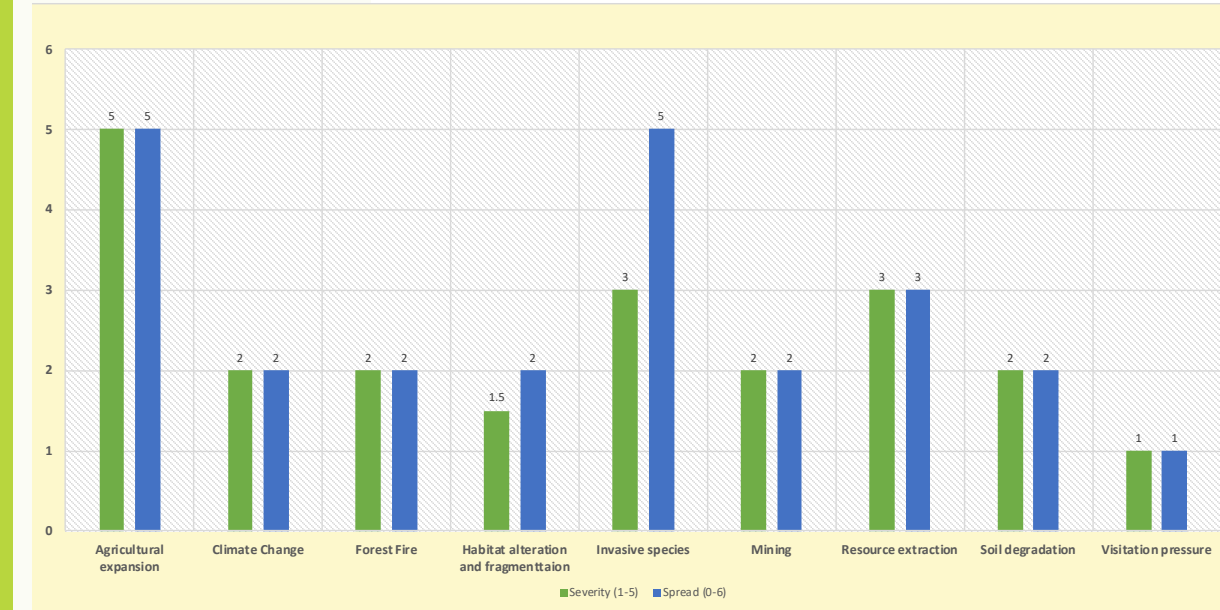


Figure 3.19 Spread and severity of threats to mid-elevation evergreen forests

3.1.17 Montane Forests

In montane forests such as the Knuckles, Peak wilderness and Horton Plains, forest dieback remains a concern. Spread of invasive species, such as *Ageratina riparia* and *Austro eupatorium inulifolium*, have substantially affected and altered the floristic character of montane forests. Mining along Upper Hakgala, Kandapola-Seetha Eliya and the illegal extractions of forest products such as orchids, ornamental flora, medicinal plants and firewood are also significant threats. Application of weedicides to maintain pilgrim routes with increasing tourism and the carving out of footpaths are leading to the further fragmentation of sensitive habitats. Waste disposal, especially during the pilgrimage periods in Peak Wilderness area, needs to be addressed immediately if these ecosystems are to be conserved (Figure 3.20).

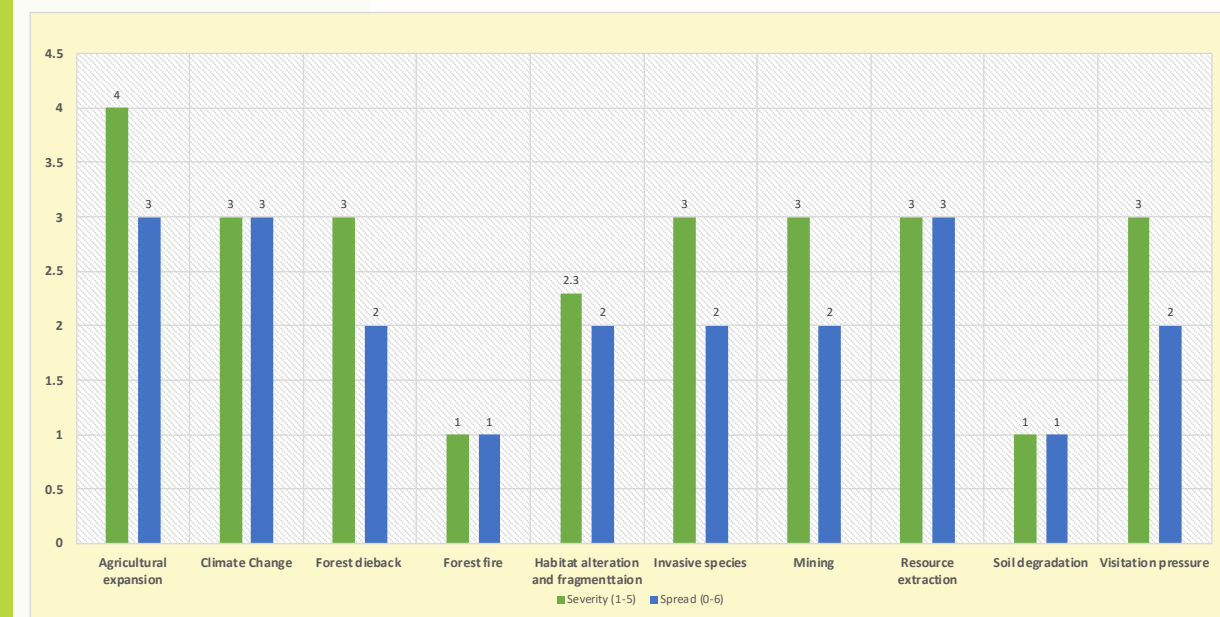
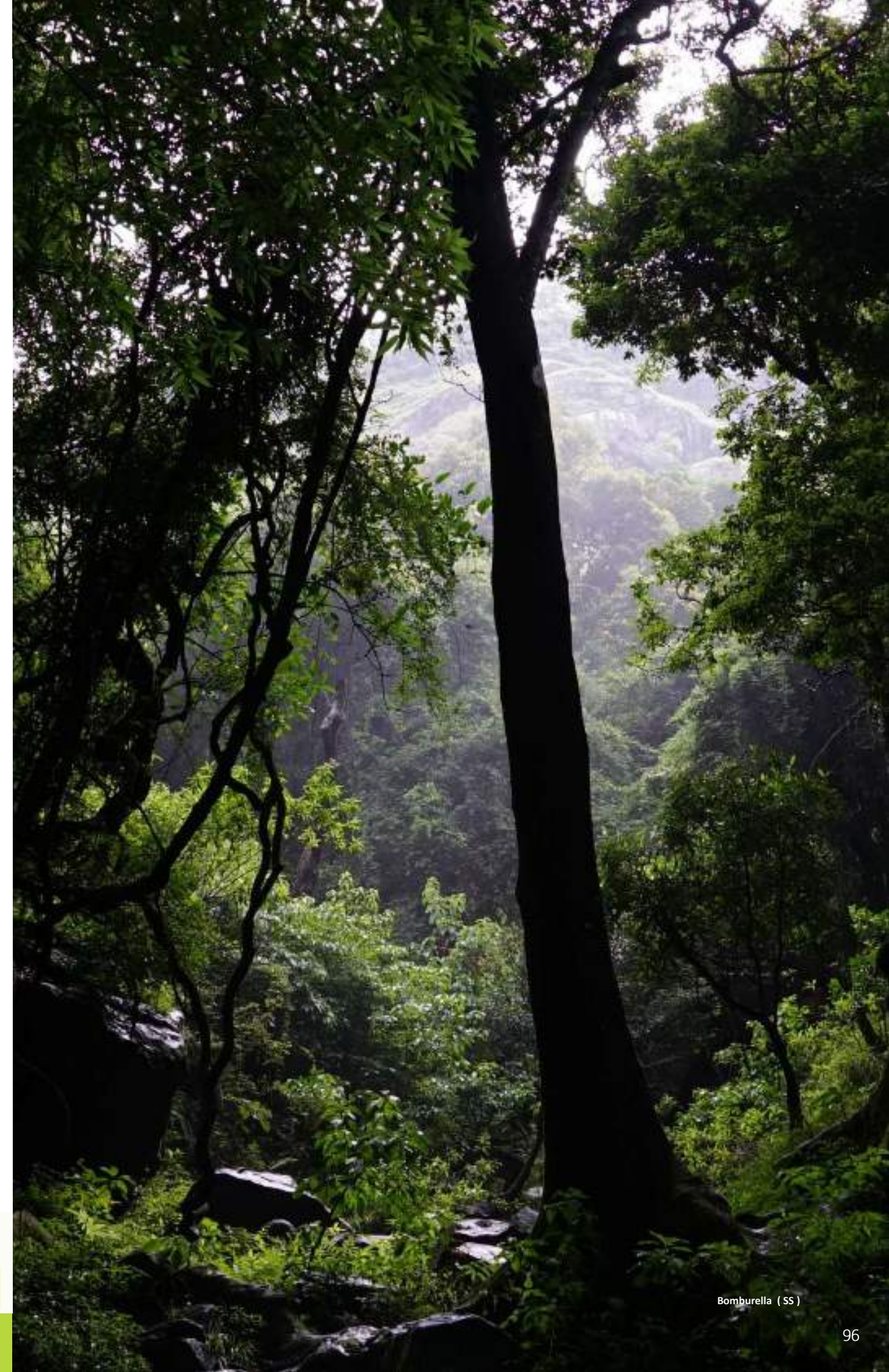


Figure 3.20 Spread and severity of threats to Montane Forests



3.1.18 Moist-mixed Evergreen Forests

In Moist-mixed evergreen forests, habitat fragmentation and chemical pollution have occurred due to chena cultivation and the large scale agricultural expansion for crops such as banana and sugar cane. Moreover, this forest type is gradually deteriorating due to soil erosion and intentional fires, which are ignited to clear and revitalise the land. High visitation in areas such as Illukkumbura is also a potential threat that threaten the water quality as pollutants enter into rivers in this forest type (Figure 3.21).

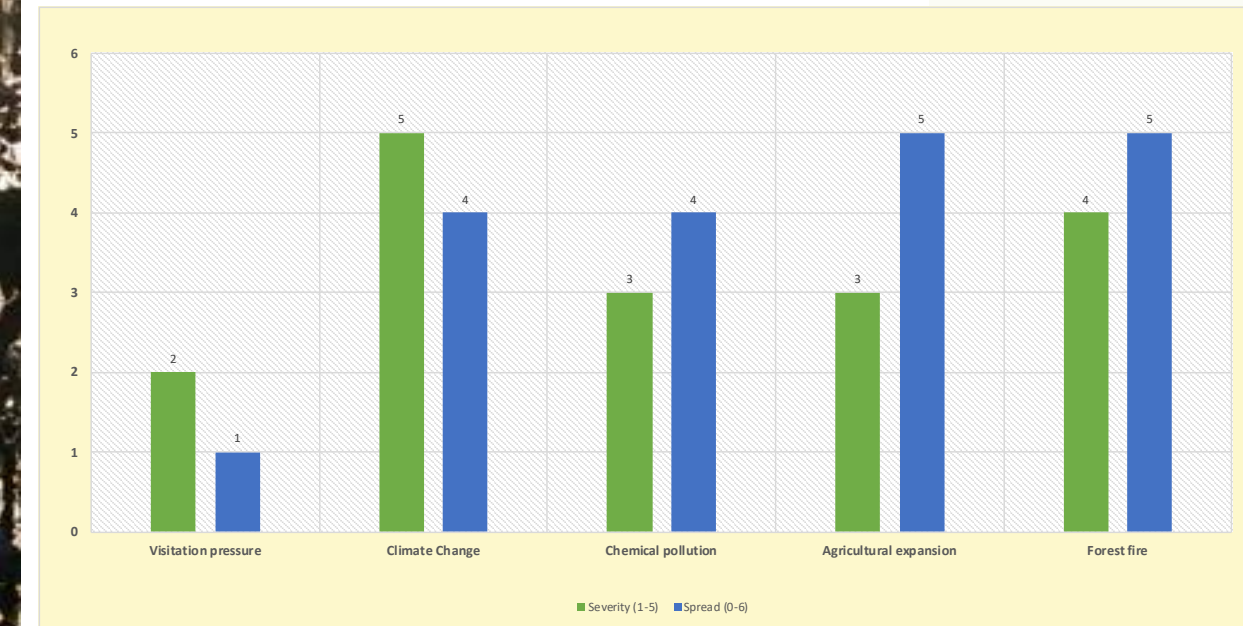


Figure 3.21 Spread and severity of threats to moist-mixed evergreen forests

3.1.19 Dry-mixed Evergreen Forests

Dry mixed evergreen forests are affected by multiple threats. Human encroachment for agriculture and settlements, have meant the dry mixed ever green forests have been replaced with cash crops such as papaya, soursop and guava. The dry mixed evergreen forest ecosystem is further under threat due to invasive species such as *Prosopis juliflora*, *Lantana camara* and *Opuntia dillenii* changing the forest structure. Illegal extraction of forest products such as *Munronia pinnata* and *Salacia reticulata* coupled with logging for *Chloroxylon swietenia* and *Diospyros ebenum* have fragmented the ecosystem. Die back of canopy species such as *Manilkara hexandra* remain as an unexplained threat in dry- mixed evergreen forests. Cattle and goat grazing within protected areas is also a significant threat, brought on due to livestock encroaching upon the borders of protected areas (Figure 3.22).

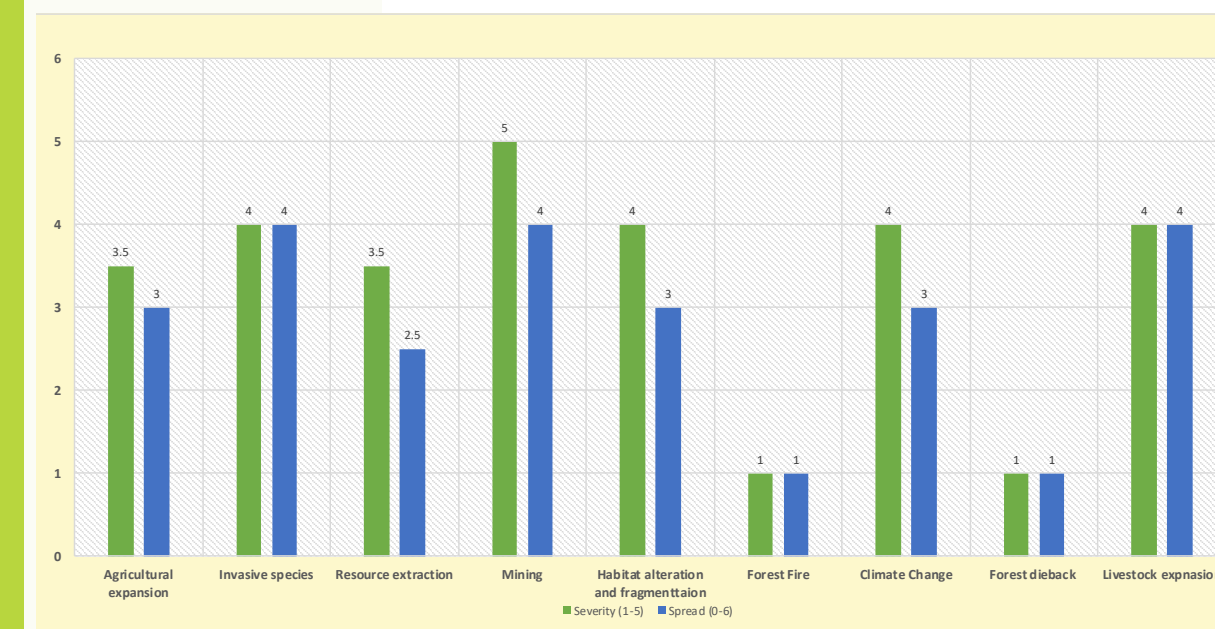


Figure 3.22 Spread and severity of threats to dry-mixed evergreen forests

3.1.20 Arid- mixed Evergreen Forests

In arid mixed evergreen forests, invasive species such as *Prosopis juliflora*, *Lantana camara* and *Opuntia dillenii* have invaded the ecosystem threatening the floristic composition. In areas such as Bundala National Park, the entire arid-mixed evergreen forest is now invaded by invasive species. Resettlements in this area has resulted in intensive fire wood collection and the expanding human settlements have led to the increased fragmentation of this forest type (Figure 3.23).

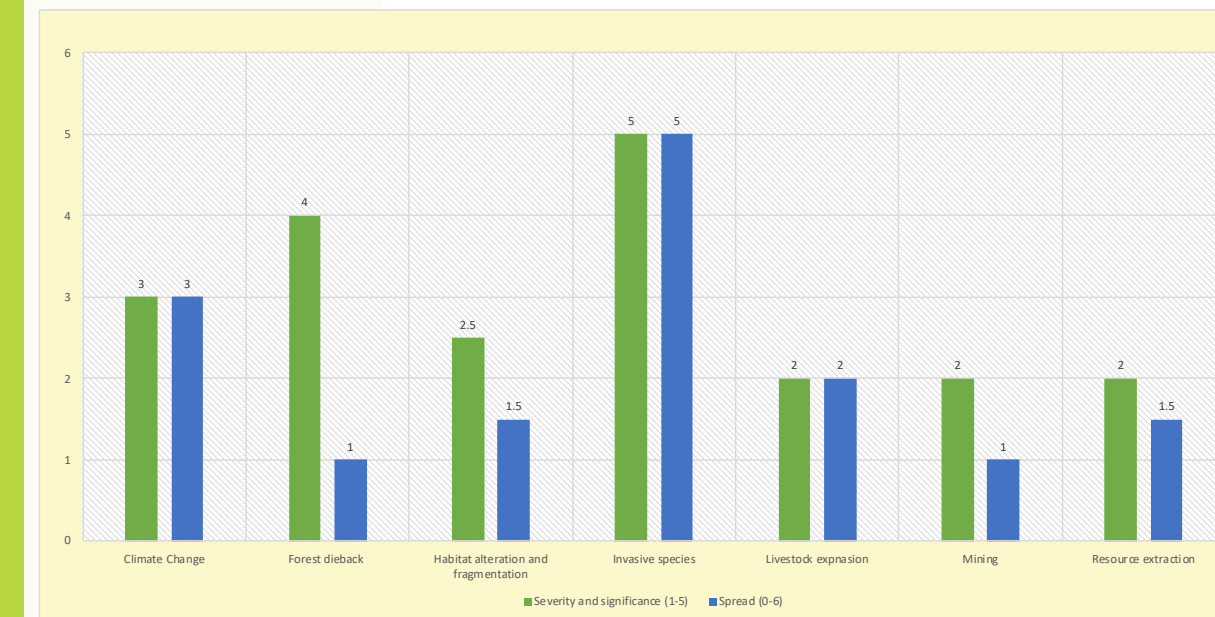


Figure 3.23 Spread and severity of threats to arid-mixed evergreen forests



3.1.21 Wet Patana

Pemadasa (1984) describes three types of grassland vegetation, that is the wet and dry patanas, savannas and lowland grasslands which includes the damana and talawas grassland pastures as types of dry zone grasslands.

Whilst all ecosystem types are affected by threats driven by expanding human populations, climate change and increasing demands for natural resources, some ecosystems have already succumbed to the pressure. For an example, wet patana (G2 and I in Figure 1.23) formerly present around the Nuwara Eliya region is extinct since the habitat has been altered drastically due to the cultivation of vegetables and tea plantations. Wet patana grasslands are now restricted almost exclusively to Horton Plains. The wet patana grassland ecosystem has also extensively been altered due to the spread of invasive species such as *Pennisetum clandestinum*. Mining and illegal extraction of forest produce such as orchids, along with unsustainable tourism practices in Horton Plains, such as the dumping of waste and trampling of sensitive plants has meant the wet patana grasslands are under significant threat (Figure 3.24).

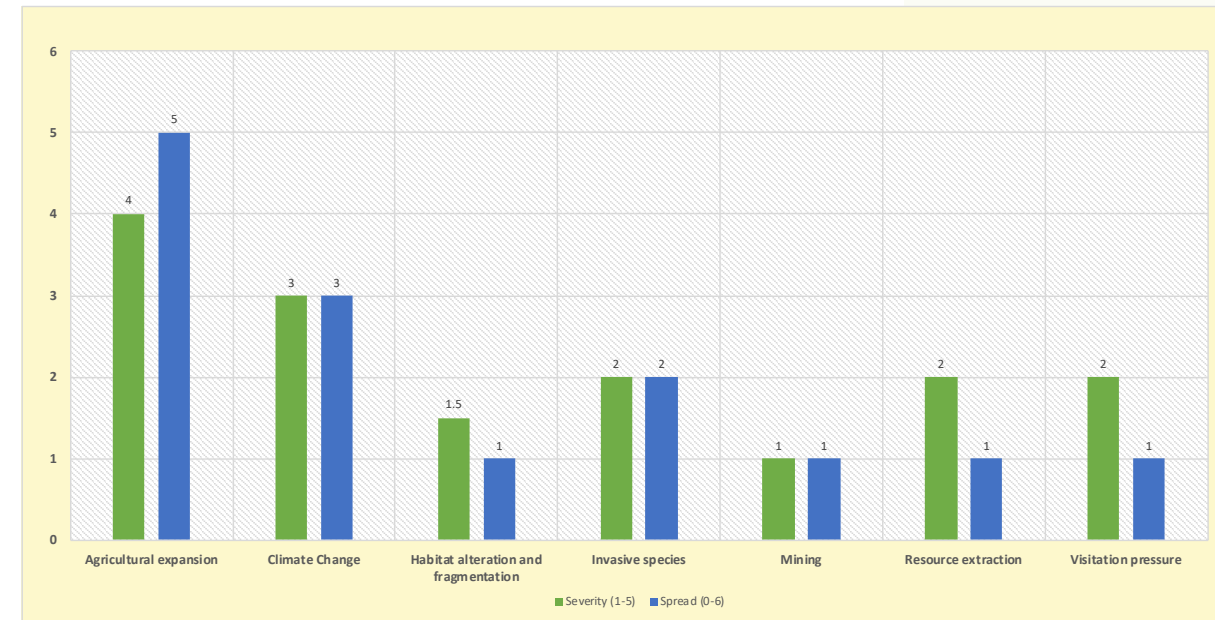


Figure 3.24 Spread and severity of threats to wet patana

3.1.22 Dry Patana

Dry patana (E and G1 in Figure 2.1) grasslands are threatened by multiple invasive species such as *Panicum maximum*, *Tithonia diversifolia* and *Chromolaena odorata* and the prevalence of frequent man-made fires. Cash crop cultivation, mining, settlement and other development activities and water scarcity brought on by climate change are the other threats in this ecosystem (Figure 3.25).

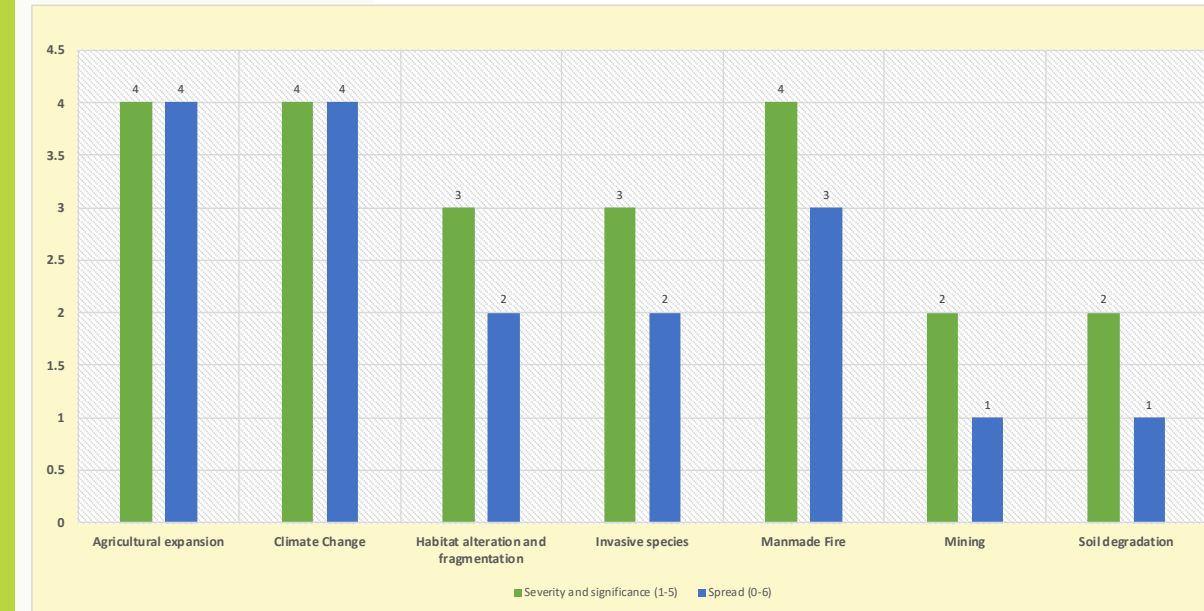


Figure 3.25 Spread and severity of threats to dry patana

3.1.23 Upland and Lowland Savannas

The savanna (upland savanna is B2b and Lowland savanna is B2a in Figure 1.23) is a unique landscape and can be described as an ecosystem that incorporates features of both grassland and forested ecosystems. The identifying component of savannas is the presence of trees which play an ecologically important role comparative to patanas and lowland grasslands. Therefore, the dynamism of savanna landscapes, allows for the resources found within the ecosystem to be utilised for multiple purposes which in turn puts the ecosystem at risk. For example, savannas are vulnerable due to the extraction of resources such as timber and firewood, the ecosystem is also at risk due to increased encroachment due to expanding home gardens. Man-made fires are also a concern, as the burning of the land to enrich the soil is regularly practiced and this has an adverse impact on all other forms of flora and fauna found within the ecosystem. Further, the spread of *Megathyrus maximus* commonly known as elephant grass is of considerable concern, since it is displacing the native savanna grasses. Secondary impacts such as pest and disease transmission and resource monopolization by invasives also require attention (Figure 3.26).

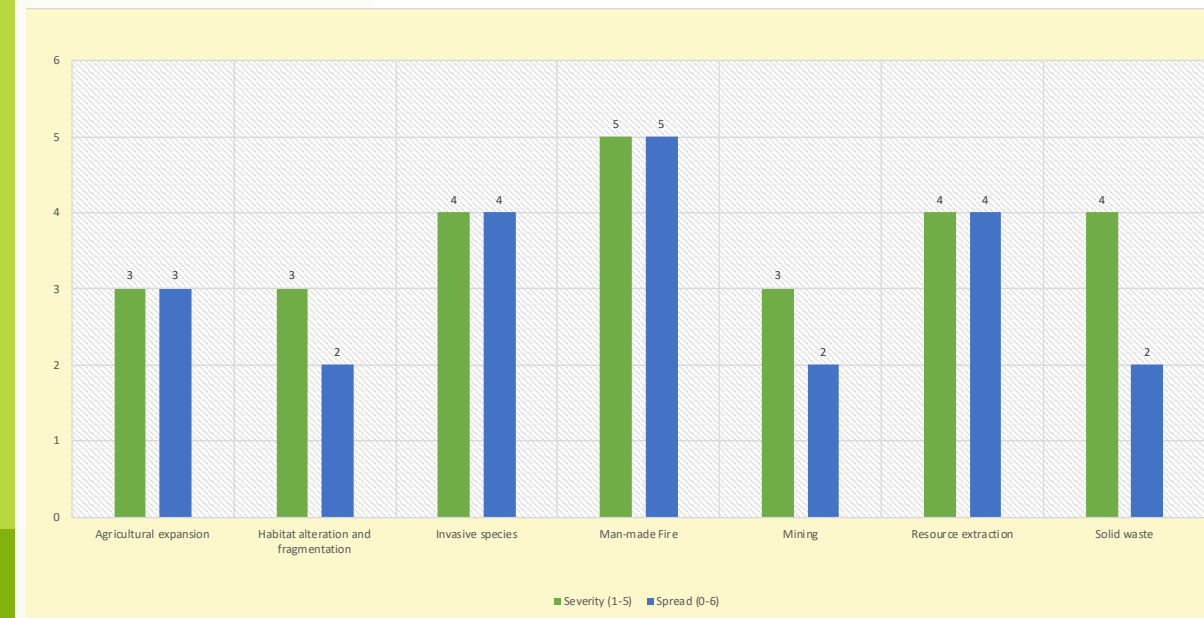
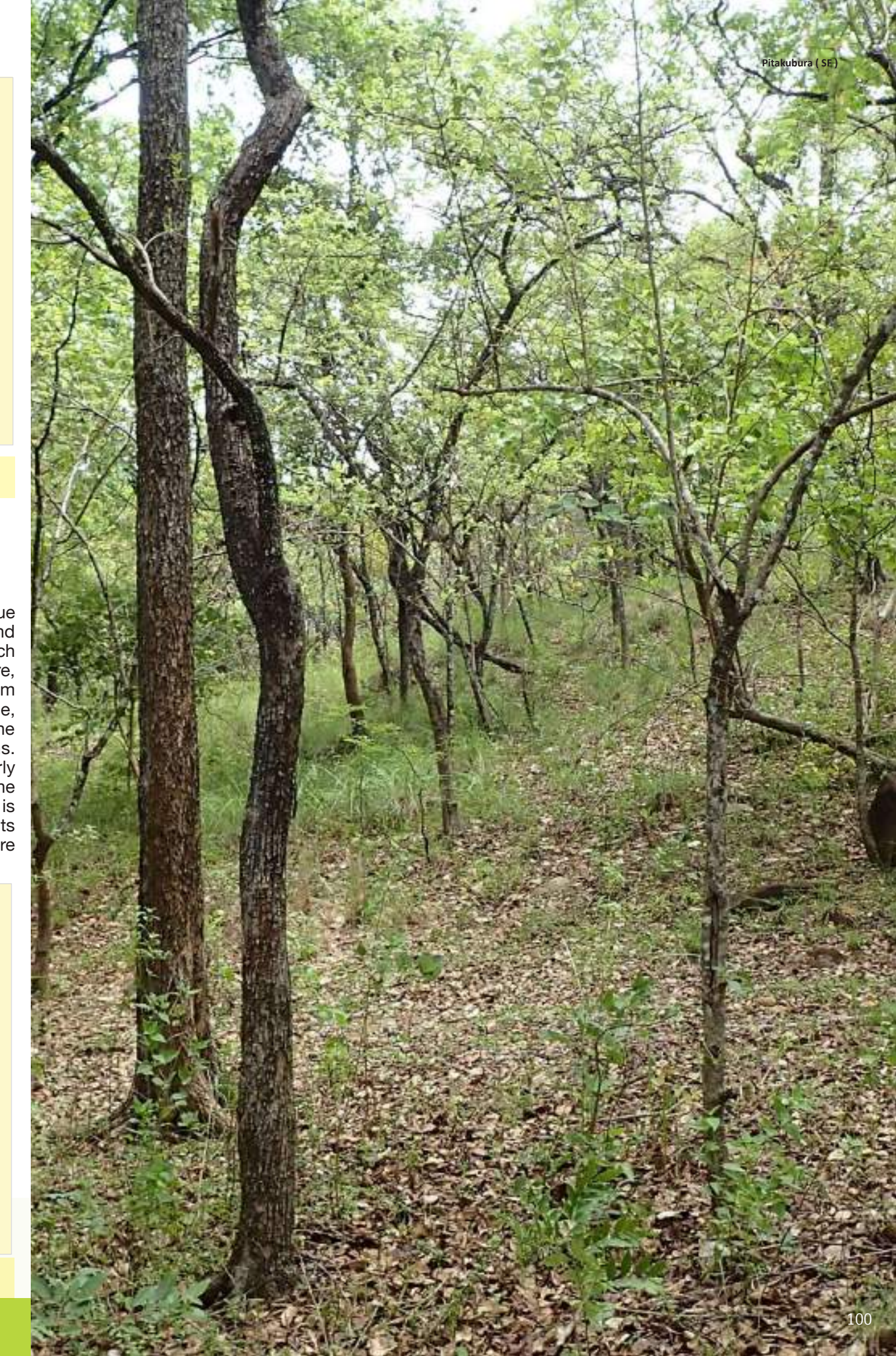


Figure 3.26 Spread and severity of threats to upland and lowland savanna



3.1.24 Dry (Damana) Grasslands

The damana grasslands, a dry zone – lowland grassland type is found extensively in the Batticaloa and Ampara districts. However, the damana grasslands have been affected by cattle grazing, a consequence of the expansion of the dairy industry in this region. Moreover, the alteration of the habitat due to man-made fires, logging and the dumping of garbage are prevailing threats for Dry damana grassland ecosystems. Wild elephants and buffalos are recognised as two species that have a close relationship with damana grassland ecosystems with these species helping to maintain the health and vitality of both the grasslands and the grasslands being important grazing grounds for the species, though extensive grazing can affect the long-term viability (Figure 3.27).

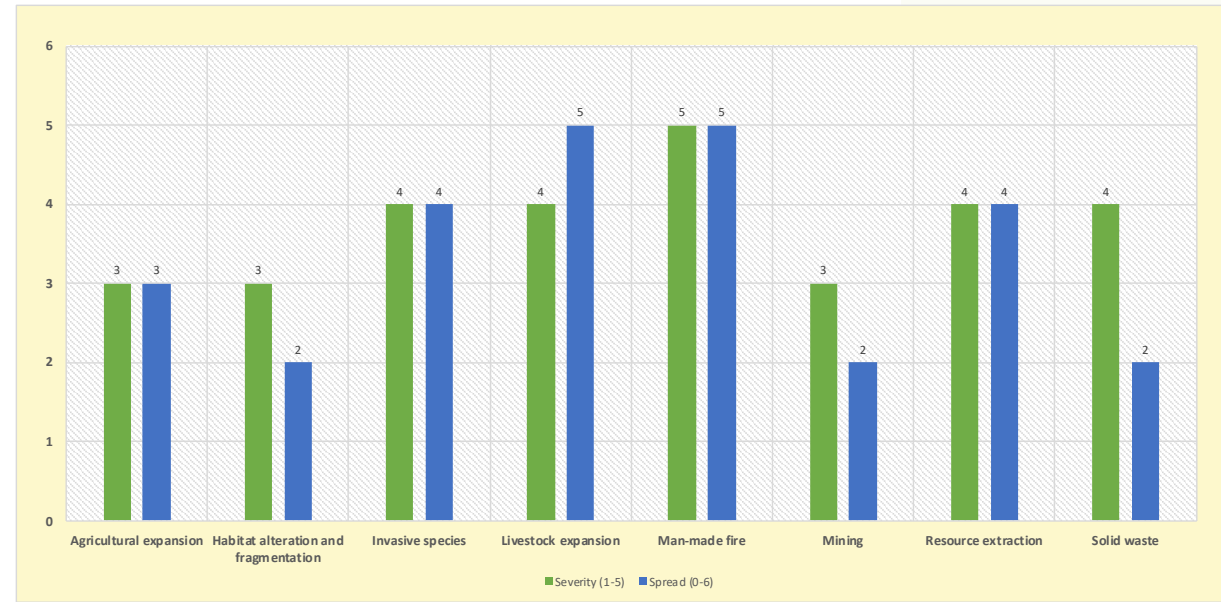


Figure 3.27 Spread and severity of threats to dry (damana) grasslands

3.1.25 Wet and Intermediate (Thalawa) Grasslands

The thalawa grasslands is another example of a dry zone grassland – and is found in the Ampara and Batticaloa districts. Pemadasa (1984) notes that an extensive patch of talawas grassland is also found in Haldummulla. The thalawa ecosystem is under threat due to a very similar array of threats as the damana grasslands, with the expansion of livestock, with cattle grazing having an enormous impact upon the health of the grasslands. The presence of the invasive *Magathyrus maximus* is destructive of the native species such as *Cymbopogon nardus* and its subordinates such as *Andropogon lividus*, *Arundinella villosa*, *Chrysopogon aciculatus* and *Themeda tremula*.

The burning of the lands, for shifting cultivation is identified as the most significant of all the threats in terms of both spread and severity. The illegal extraction of timber and non timber products are unsustainable practices which are further degrading the thalawa ecosystem (Figure 3.28).

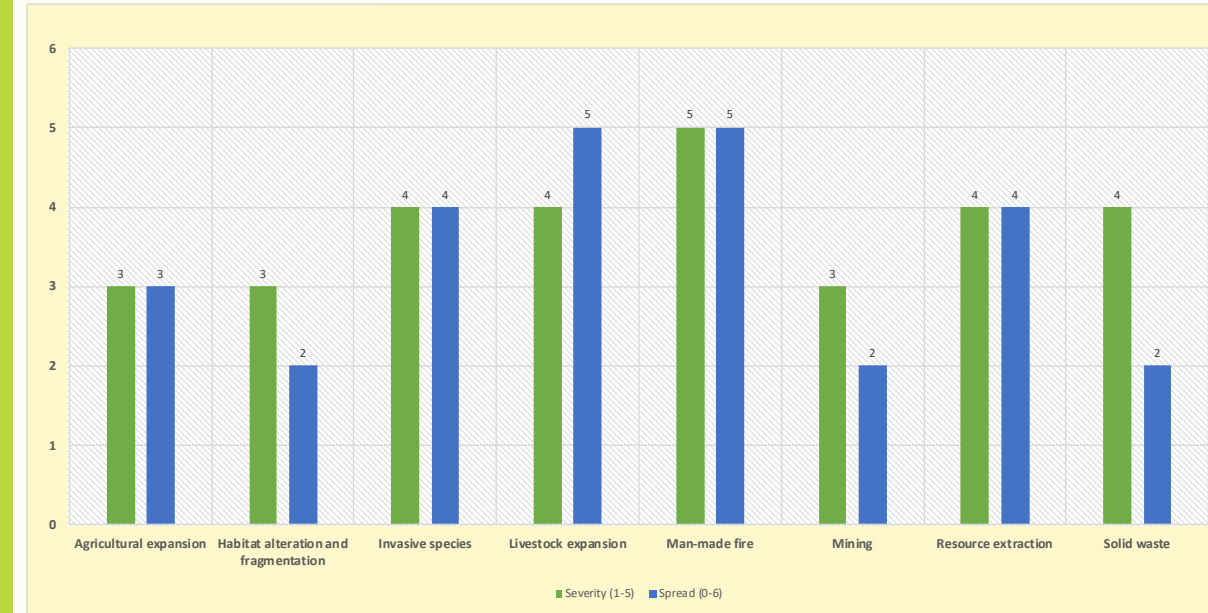


Figure 3.28 Spread and severity of threats to wet and intermediate (thalawa) grasslands

3.1.26 Villus

Villus are found associated with few rivers such as Kala Oya, Mahaweli and Kumbukan Oya. Villus are impacted by water diversion that results in no water or excessive water to villu ecosystems. Since villus in a given watershed are interconnected during rainy seasons spread of invasives, siltation and effluent water all impact dynamics of villu ecosystems. Sand and clay mining has destroyed villus in the Mahaweli and Kala oya basins. Forest clearances, settlements and road construction in the Wilpattu ecosystem have further threatened the integrity of villu ecosystems. The clay lens of villus which enable retention of water have been destroyed in some villus inside Wilpattu National Park to construct water holes.(Figure 3.29).

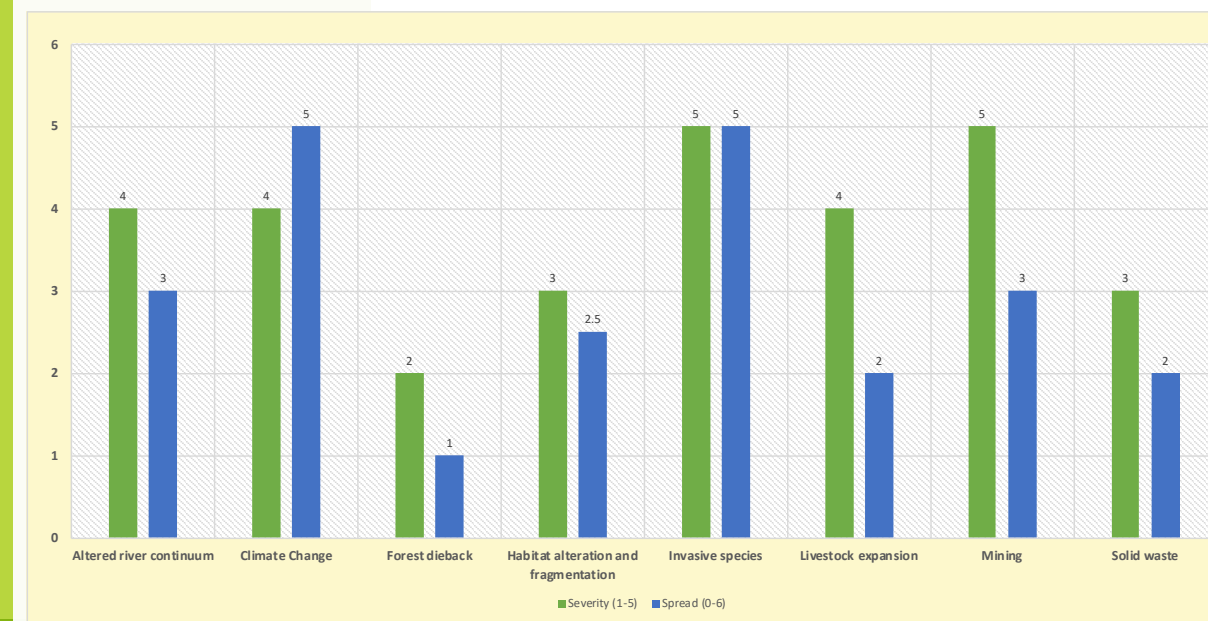
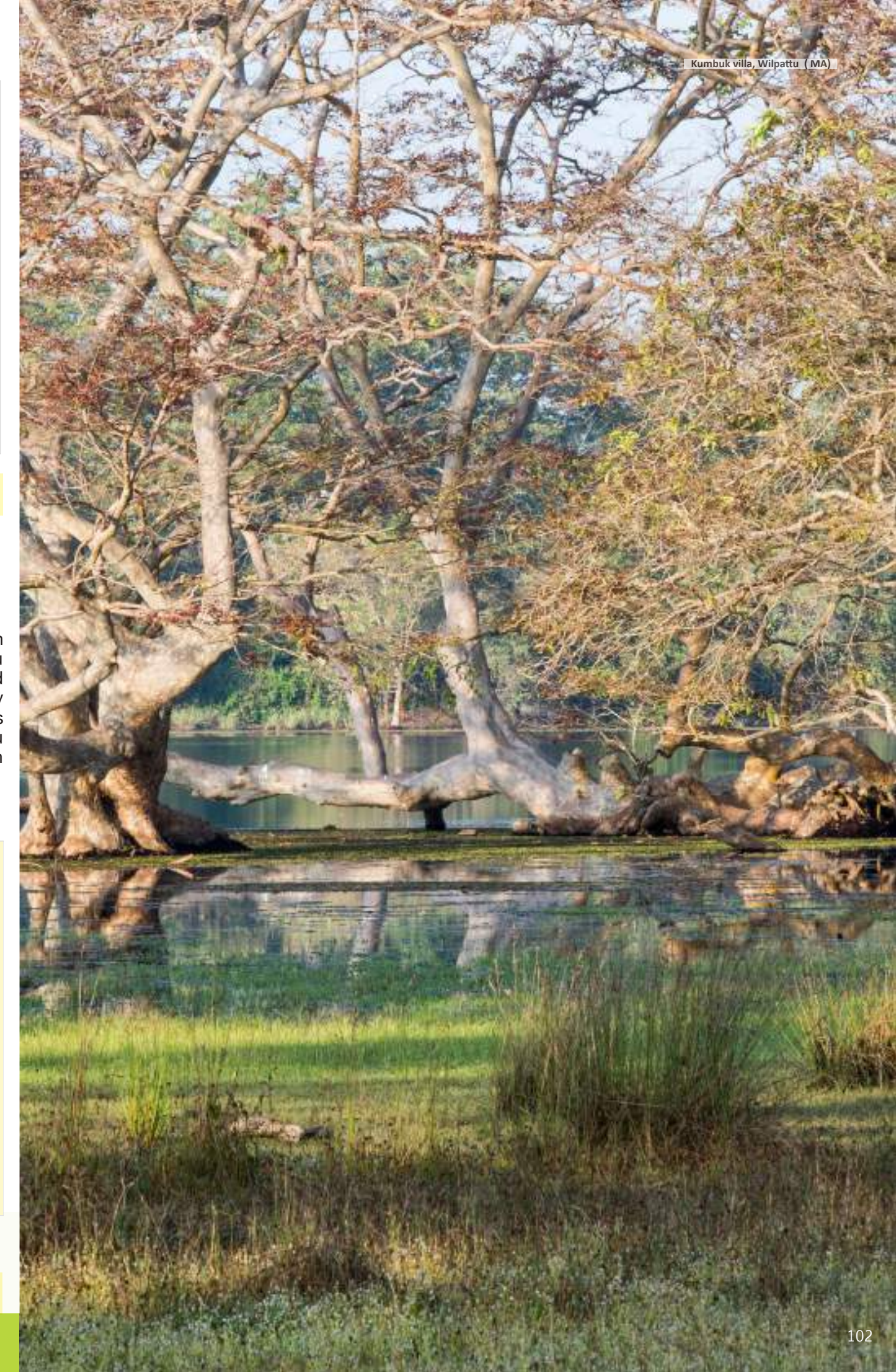


Figure 3.29 Spread and severity of threats to villus





3.1.27 Rivers and Streams

River diversions affecting the continuum and dynamics of rivers is the most significant threat to rivers and streams. Coupled with unpredictable climatic phenomena such as extreme droughts and floods, rivers and streams are losing the characteristics zones such as spray zone due to these disturbances. Siltation is another significant threat and allochthonous matter entering into rivers and streams due to land degradation and erosion is responsible for loss of bank flora. Additionally, extraction of target species such as *Cryptocoryne parva*, *Aponogeton rigidifolius* and *Lagenandra thwaitesii* from riparian and riverine areas is a major threat. In all rivers and streams, the direct diversion of waste can be considered as the threat that can have a profound impacts on direct and indirect services from rivers and streams (Figure 3.30).

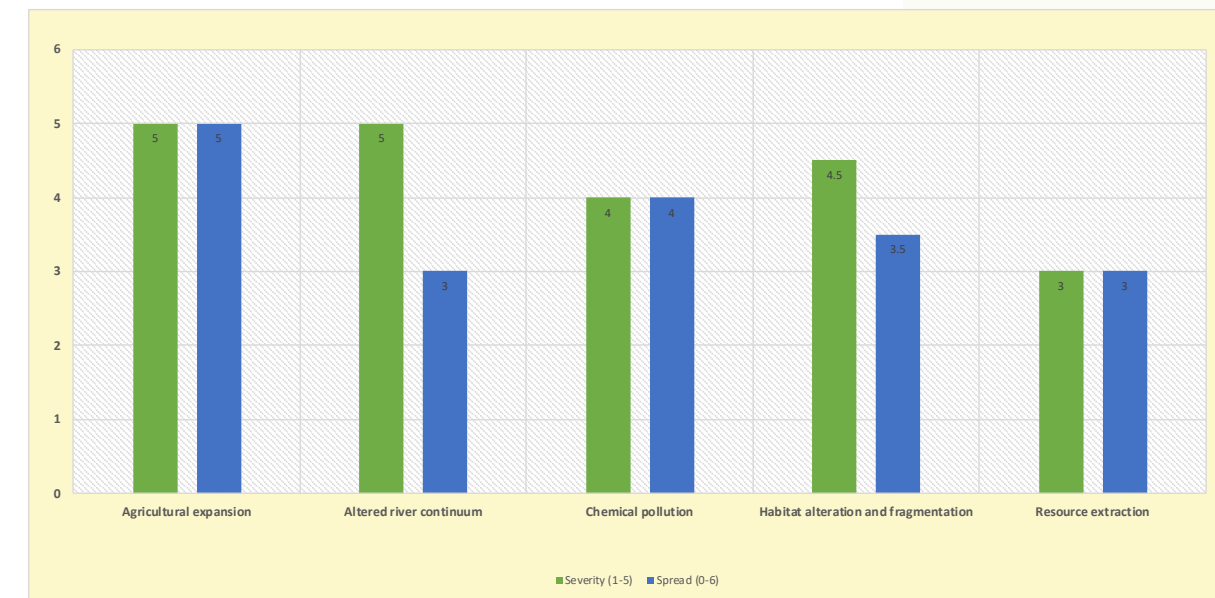


Figure 3.30 Spread and severity of threats to rivers and streams

3.1.28 Reservoirs, Tanks, Lakes and Ponds

Sri Lanka is dotted with man-made reservoirs and some are as old as 2000 years. The reservoirs except the newly constructed ones are in either a naturalised or semi-naturalised state. The main threat to them is disruptions to the cascade system as a result of urbanisation.

Additionally, the connectivity of cascades has been disturbed by siltation of reservoirs, mainly the sinks of cascades. The presence of invasive species is a significant threat in particular the mat forming species such as *Eichhornia crassipes* and *Salvinia molesta*. Gradual encroachment of reservoir catchment and intensive farming even within reservoir beds during the dry season are fast becoming common practices ruining the flora, water quality and access to wild animals. Introduction of aquatic organisms for aquaculture without proper assessments also changes the reservoir biodiversity.

Reservoirs are also threatened by petroleum residues, detergents and solid waste, specially in the urban reservoirs (Figure 3.31).

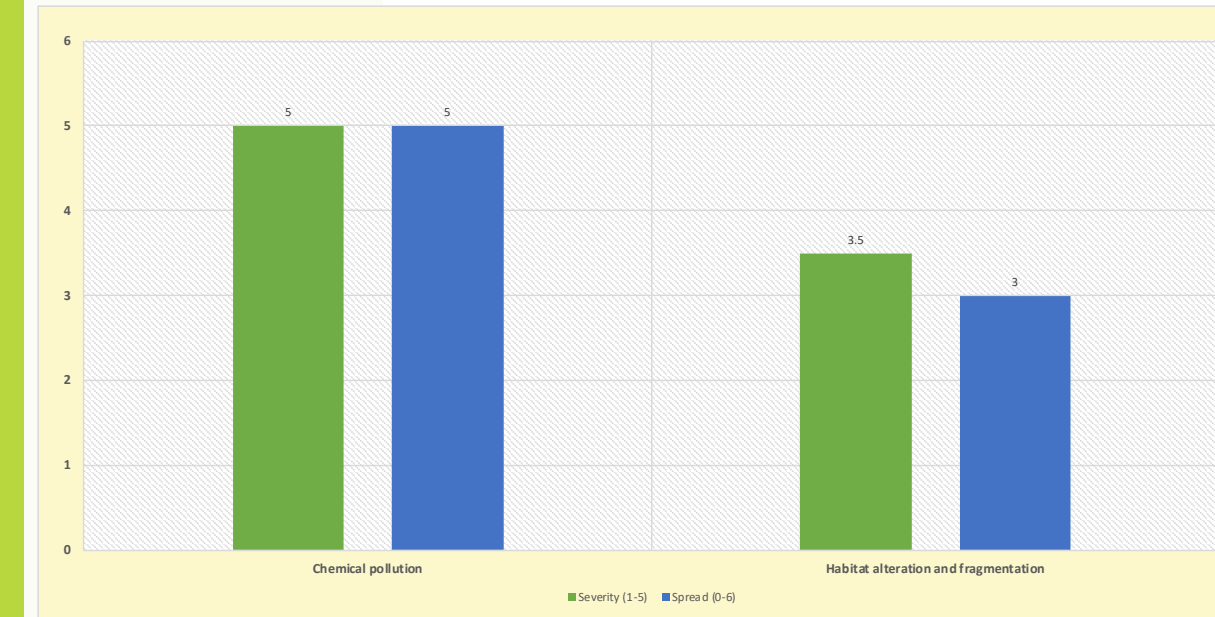


Figure 3.31 Spread and severity of threats to reservoirs, tanks, lakes and ponds

3.1.29 Marshes

Land reclamation, garbage dumping and chemical pollution are the main threats to marshes. All coastal marshes are affected by invasive species, mainly *Annona glabra* which is responsible for creating mono stands in many marshes. Most marshes in western and southern provinces are converted to commercial lands, highways, and other developed areas, threatening the connectivity and natural flow of water. Additionally, marshes in the dry zone are threatened by agricultural expansions (Figure 3.32).

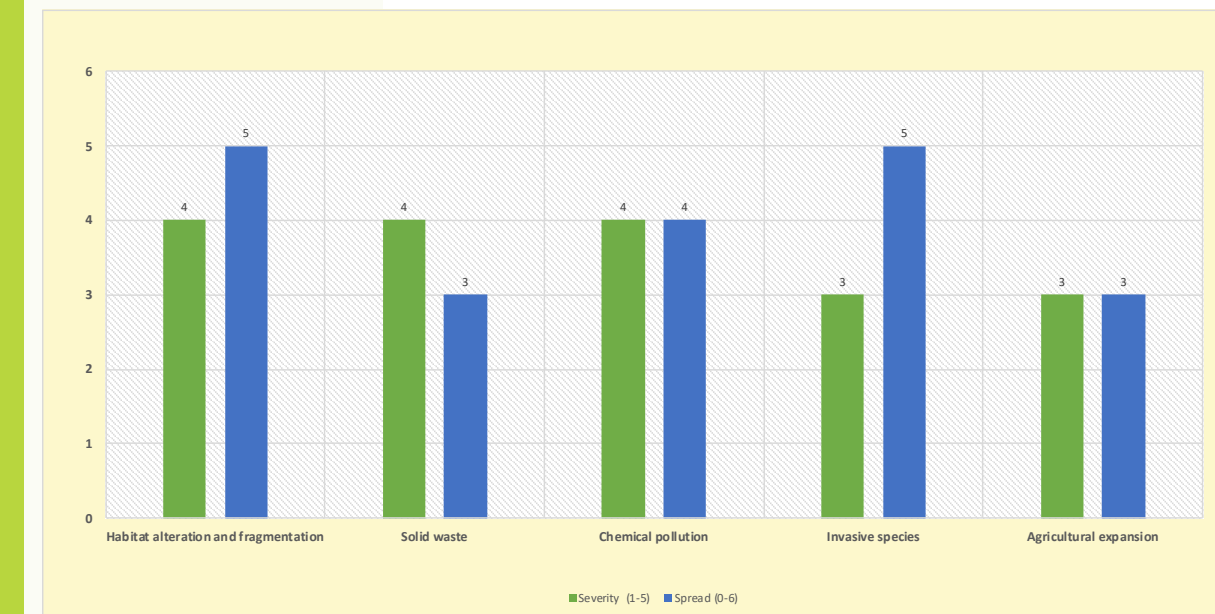


Figure 3.32 Spread and severity of threats to marshes





3.1.30 Sand Dunes

In areas such as Pooneryn in the North, all sand dunes have been destroyed due to excessive sand mining and this is a threat that continues to date. Also, the development of settlements near sand dunes results in the flattening of dunes, while disturbances to the wind flow and the removal of flora from dunes are also of concern.

In areas like in Bundala National Park, sand dunes have been destroyed due to off-road driving, a consequence of tourism and related developments (Figure 3.33).

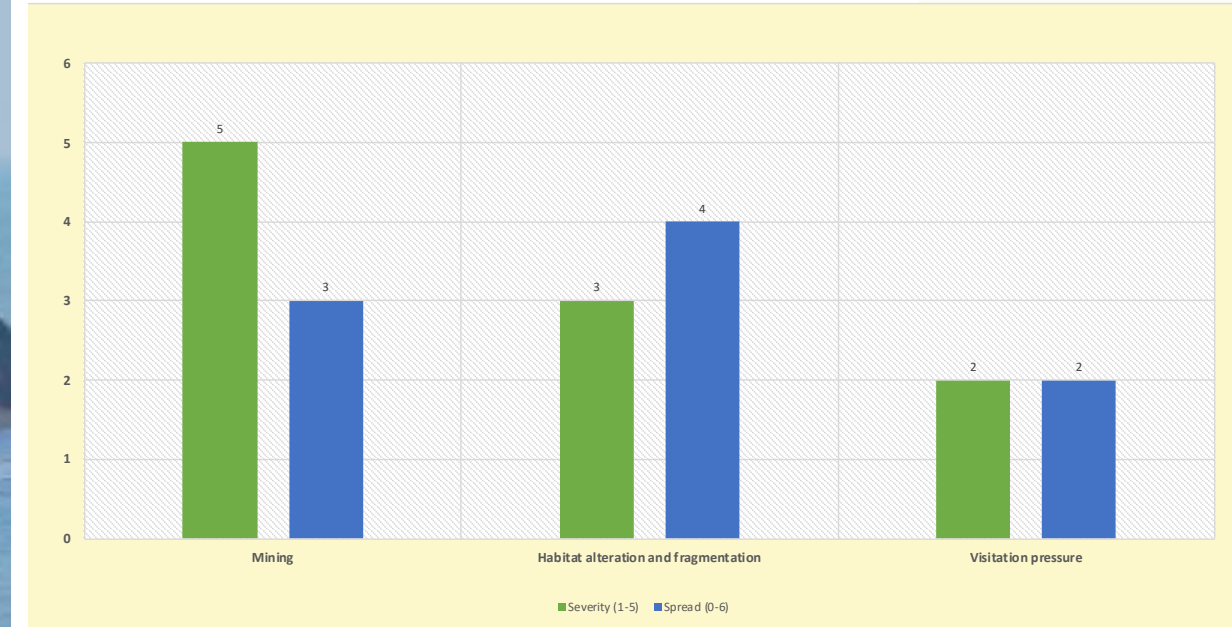


Figure 3.33 Spread and severity of threats to sand dunes

3.1.31 Beaches

The disappearance of beaches in Sri Lanka is due to erosion and settlements along the coast line. Beach vegetation is lost due to settlements and tourism infrastructure developments that lead to accelerated erosion, which has been a concern along the entire southern coastline. Though sand mining in beaches is happening, it is a localised event, primarily a concern along the southern coast of the island. Garbage dumping is the most significant threat specially in western, southern, eastern and northern zones of the country. Consequently, microplastic pollution is an emerging threat that affect both marine and human health (Figure 3.34).

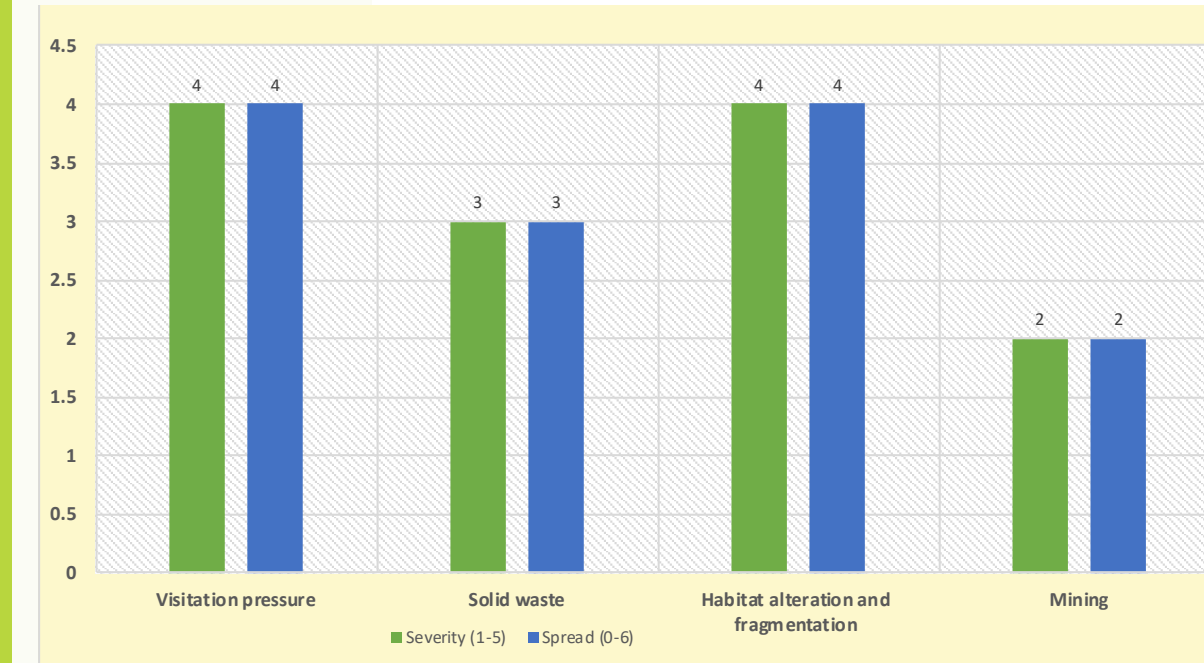


Figure 3.34 Spread and severity of threats to beaches

3.1.32 Seagrass, Salt Marshes and Mangroves

Sri Lanka is fast losing mangroves, salt marshes, seagrass and sand dune ecosystems due to multiple, inter connected threats. The fact these ecosystems are edaphically, physio-chemically and ecologically interconnected has been ignored in recent development projects, in particular the development of aquaculture in the country.

The growth in the shrimp farming industry between 1986-2016 saw Sri Lanka lose a significant percentage of its mangroves and salt marshes. This loss was propelled by the aquaculture of *Penaeus monodon* (Tiger Shrimp) and crabs specially in the north Western and Eastern provinces of the island. Mangrove ecosystems remain highly threatened, especially with the proposed aquaculture farms to be developed in Vidithalaithivu, one of the largest intact mangrove ecosystems, declared as a Nature Reserve in Sri Lanka.

Additionally, the continued encroachment, land grabbing and alteration of mangrove and salt marsh habitats for settlements in the Western and Southern provinces is a concern. In particular, the mangrove ecosystems around Negombo, Kalutura and Galle are most at risk (Figure 3.34).

Accumulation of solid waste and substantial pollution of brackish water in estuaries is another critical threat to all coastal habitats. At present, estuaries in Negombo and Chilaw are badly affected from pollutants, with long shore currents periodically bringing in solid waste from trans boundary countries, further worsening the situation.

Mangroves and salt marshes are also affected by river diversions. In certain areas river diversions have resulted in an influx of freshwater changing the salinity levels, thus decreasing the quality of the water within the ecosystem e.g. Bundala. Attempts in the Northern Province to construct barrages to stop saltwater intrusion into lagoons can also be viewed as a threat to mangroves. Although Sri Lanka represents one third of the world's mangroves species diversity, we are yet to ascertain and establish the extent of it, which itself is a threat.

Salt marshes are understudied and its extents have not been mapped accurately to date. Moreover, some land use maps produced for Sri Lanka do not recognise or identify salt marshes. In recent years salt marshes as well as mangroves are threatened by increasing clearance for salterns in areas such as Puttalam. Seagrass beds have been badly affected by fishing practices, especially the continuing of bottom-set trawling in the north western coast of the island. The use of push nets and dynamite fishing also contribute to the destruction of seagrass beds.

Additionally, flash floods and increasing levels of suspended solids due to soil erosion have threatened the survival of seagrass species, sensitive to excessive siltation.

Studies have estimated a 20% decline in seagrass distribution in the Indo-Pacific region. In Sri Lanka, Negombo Lagoon alone has lost 20% of its total seagrass cover due to micro-algal proliferation resulting from eutrophication. Additionally, seagrass ecosystems are significantly affected by large-scale commercial trawling, especially in the Gulf of Mannar area where extensive seagrass meadows are available.

Seagrass beds are also affected by salterns, aquaculture and land reclamation. In areas such as Negombo, Puttalam and Mannar, waste dumping has destroyed seagrass beds. In recent years, several harbour and fish landing site developments coupled with increasing number of mechanised boats are polluting the remaining seagrass beds with chemical residue.

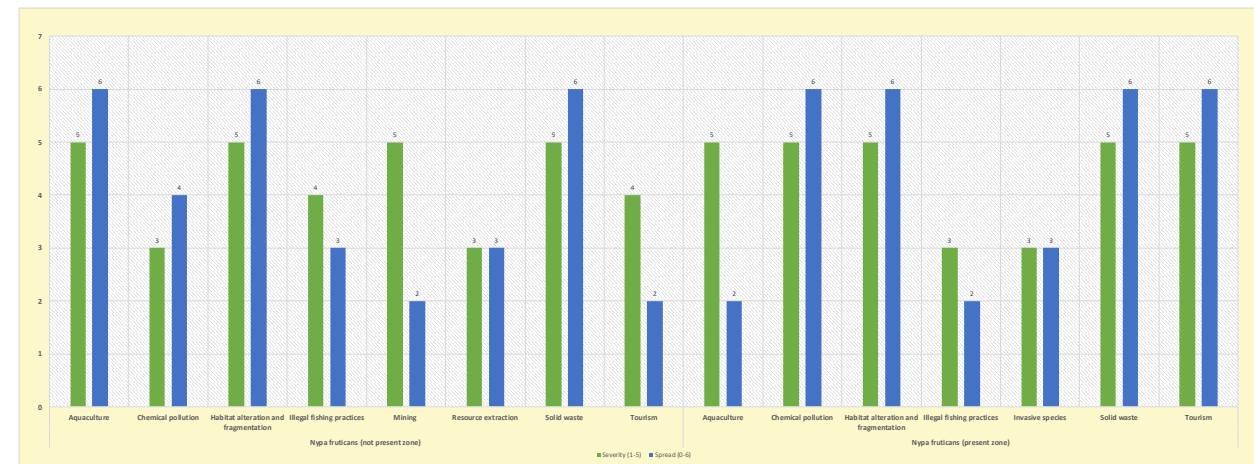


Figure 3.35 Spread and severity of threats to mangroves



Kala Oya (SJ)

4

CURRENT STATE OF THE ENVIRONMENT

Sri Lanka has been recognized as possessing globally important biodiversity by several yardsticks of measurement (CI, 2018). The island's biogeography, geological history, terrain, and climate combine to confer Sri Lanka with a large number of endemic species (MoE, 2012).

The island's biogeographic history dates back to the Cretaceous period, when it was part of the Deccan Plateau that detached from Gondwanaland and began a slow drift northwards for about 50 million years, until it collided with the Eurasian continent. The island itself became separated from the mainland about 20 million years later, during the late Miocene. Since the initial separation, there have been several connections and separations from the mainland, as the sea levels rose and fell. The recurrent land bridges between the mainland and the island during these episodes allowed species exchanges between the island and the mainland, until the final separation during the Pleistocene (Deraniyagala, 1992). However, the rainforests in the southwestern quarter of the island have remained separated from the other nearest rainforests of the Western Ghats Mountain Range, along the western coast of the Indian Subcontinent, since the late Miocene, over 7 million years ago.

As a relatively small island in the Indo-Malayan Biogeographic realm, Sri Lanka does not have the high species richness—especially along the rainforests along the mountain ranges—of the continental landmass, or on other larger islands of East Asia, such as Sumatra or Borneo (Figure 4.1) (MacArthur and Wilson, 2001). However, the degree of endemism is high (Figure 4.2), a result of the millennia of evolution and speciation in isolation. Most of the endemism is confined to the southwestern rainforests and the central mountains (Figure 4.3), which are represented by the Sri Lanka Lowland Rain Forests and Montane Rain Forests ecoregions (Figure 4.4).

Over 75% of the endemic flora and fauna species in Sri Lanka are found in these two rainforest ecoregions (MoE, 2012a). But, ongoing biological explorations keep uncovering new species to the lists of endemic species. The profile below provides the most recent updates to the lists of new species descriptions.

Among the endemics, there are several endemic genera representing most of the taxonomic groups (MoMD&E 2016). Many of these genera are in the lowland and montane rainforest ecoregions (Figure 4.5); the evolutionary consequence of animals and plants that have become isolated, evolved, and adapted to these habitats and climatic conditions since the late Miocene. The small lizards in the family Agamidae are an example of the extent of this speciation: there are three endemic genera, namely *Lyriocephalus*, *Cophotis* and *Ceratoophora*, represented by eight species. Moreover, of the 17 species of agamid lizards in Sri Lanka, 14 are endemic to the island.

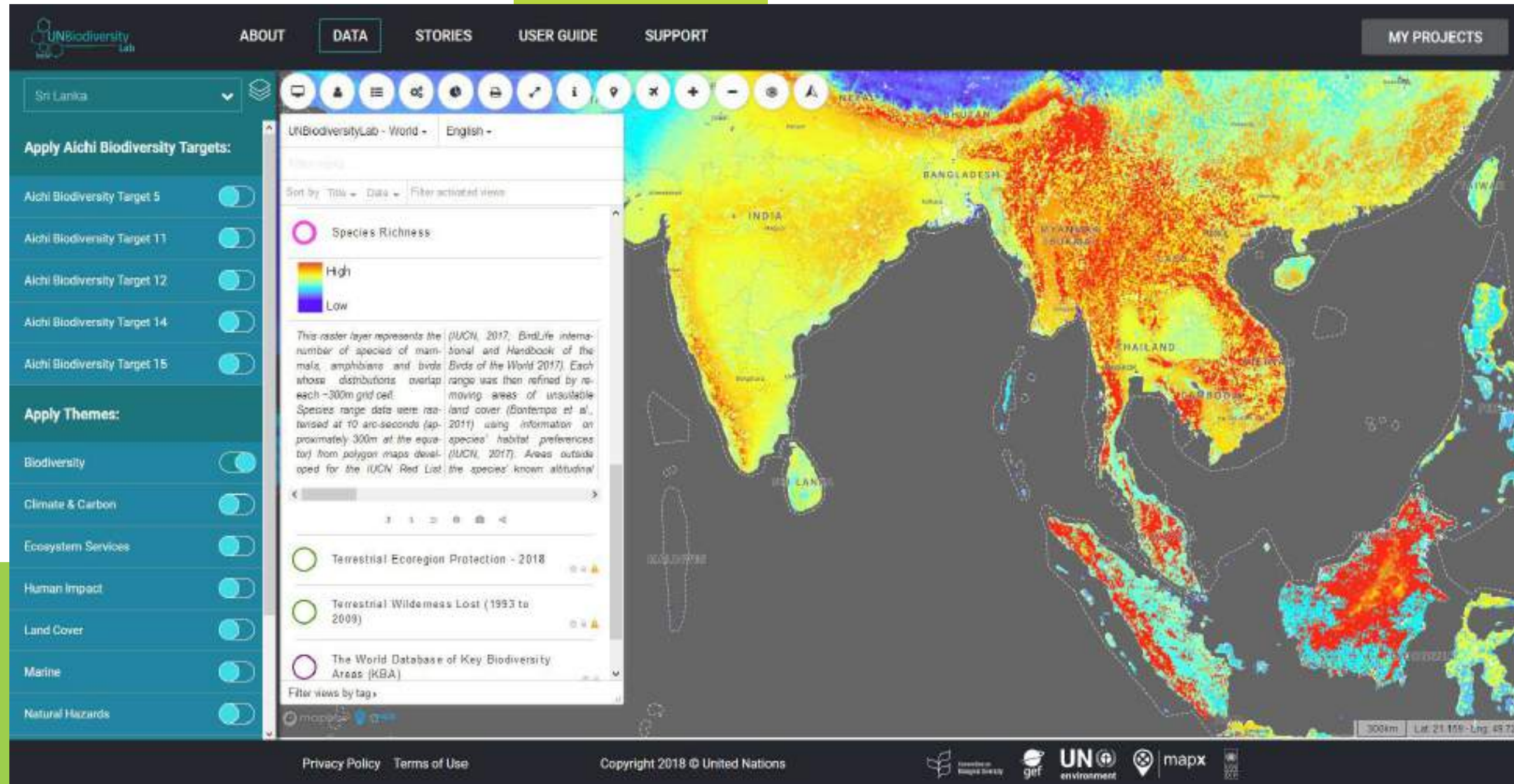


Figure 4.1. Distribution of species richness across Asia. Species richness is moderate in Sri Lanka, relative to the other regions, especially in the large islands and tropical rainforests along mountain ranges of Southeast Asia. Relatively small islands, such as Sri Lanka, have less species richness compared to the much larger islands such as Sumatra or Borneo, a function of the species-area effect (MacArthur and Wilson, 2001).

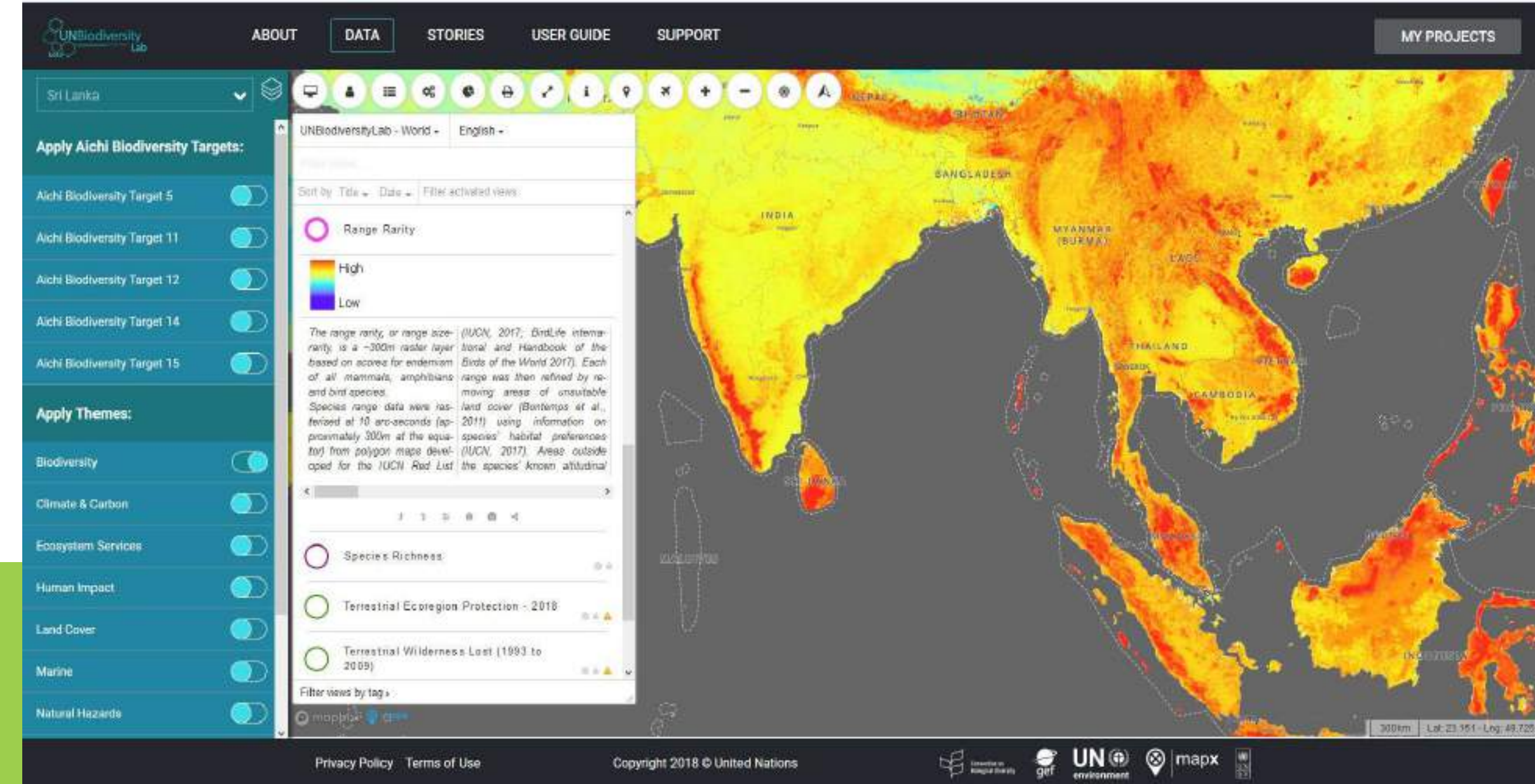


Figure 4.2. Distribution of endemism across Asia. Despite the relatively low species richness in Sri Lanka, endemism is very high. The millennia of isolation from the mainland has allowed species to evolve and adapt in isolation, giving rise to species that are found only in Sri Lanka and nowhere else on Earth. These endemic species are Sri Lanka's 'irreplaceable' biodiversity, and conservation priorities.

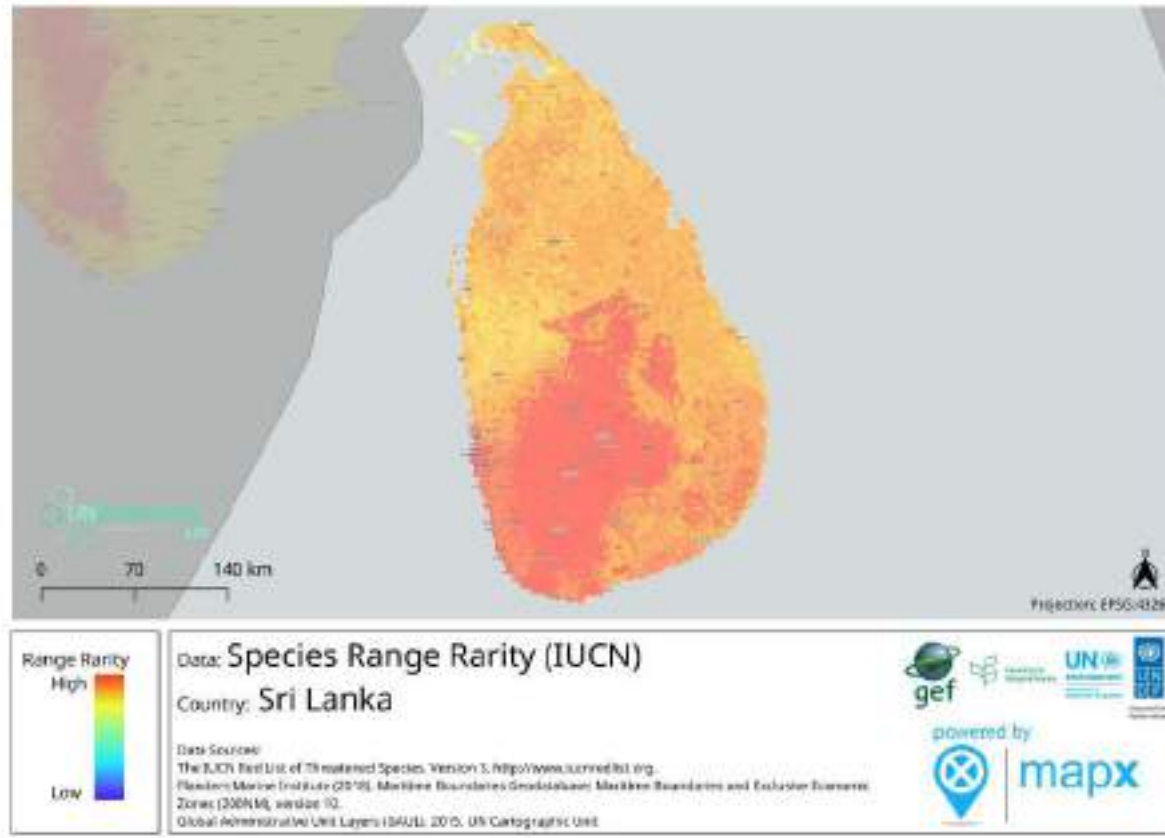


Figure 4.3. Species range rarity of Sri Lanka. Most of Sri Lanka's endemic species are confined to the rainforests in the southwestern quarter of the island and in the central mountains. Though most of the land bridge with the mainland, these rainforests have remained isolated from the other nearest rainforests, along the Western Ghats Mountain Range that stretch along the western coast of the Indian Subcontinent. Thus, the species adapted to the two rainforest regions were unable to disperse and colonize the respective rainforests in Sri Lanka and the mainland.

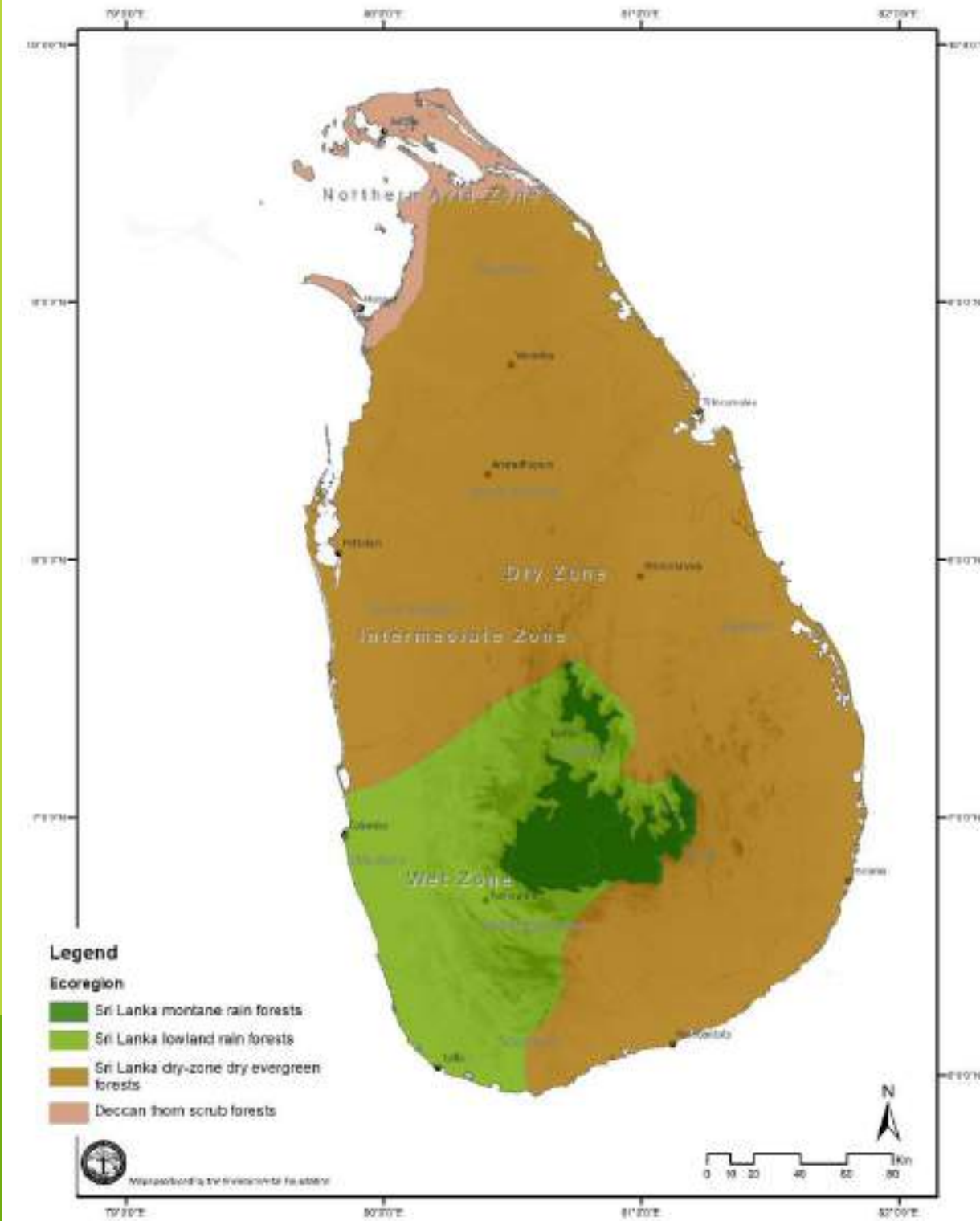


Figure 4.4. The ecoregions represented in Sri Lanka. Ecoregions, defined as 'relatively large units of land or water containing a distinct assemblage of natural communities sharing a large majority of species, dynamics, and environmental conditions' represent a biogeographic regionalization of the Earth's biodiversity. Ecoregions have been defined for the terrestrial, marine, and freshwater ecosystems of the world. The terrestrial ecosystems of the world are represented by 867 ecoregions, classified into 14 different biomes such as forests, grasslands, or deserts. Sri Lanka is represented by four ecoregions and shares the northernmost ecoregion with the mainland. For more information on ecoregions (refer Olson et al., 2001).

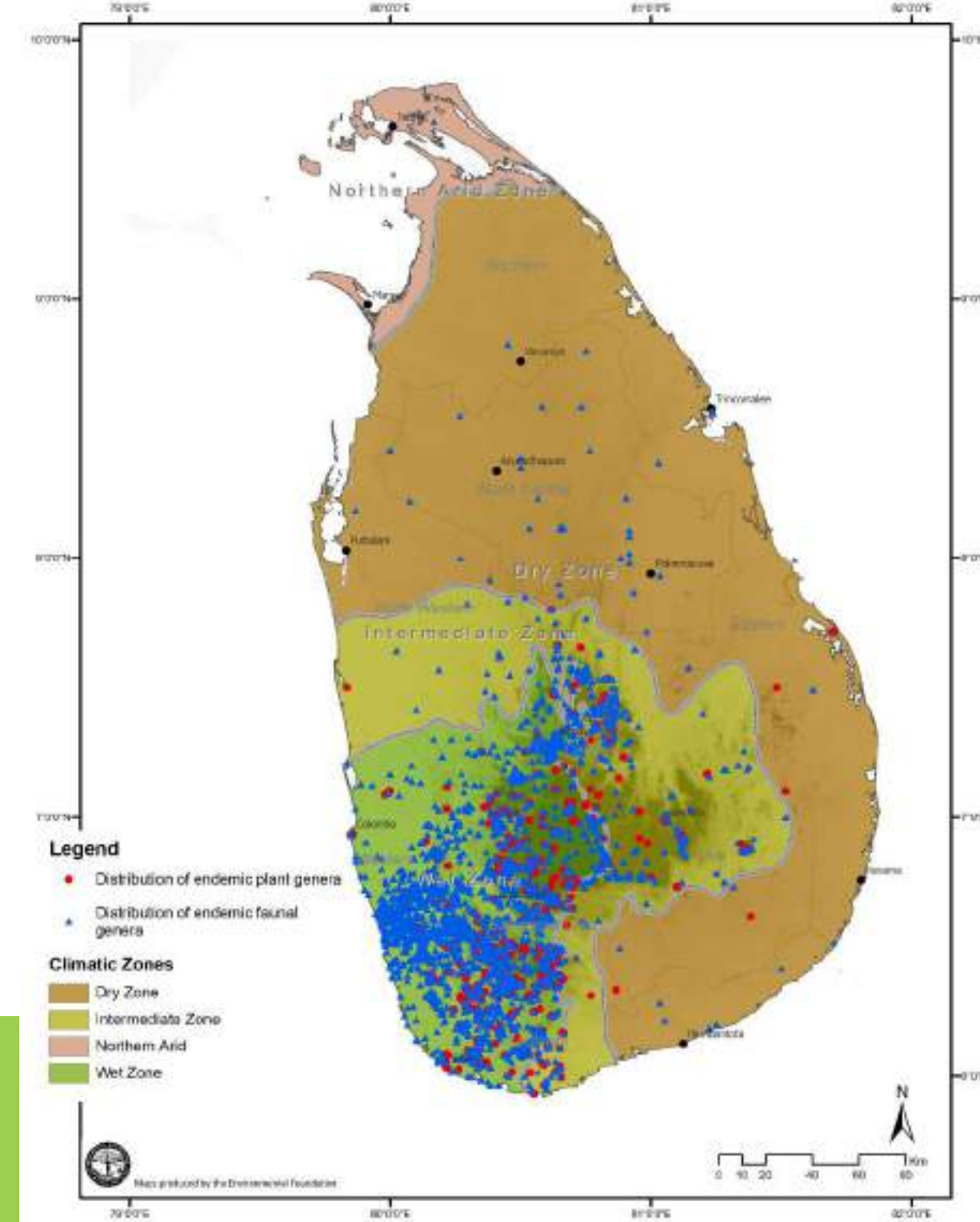


Figure 4.5. Distribution of endemic faunal and floral genera of Sri Lanka. The rainforests of the southwestern quarter and the central mountains contain most of the endemic biodiversity, including the endemic genera. This is due to the evolution and ecological adaptation of animals and plants to the rainforest habitats and climatic conditions.

The Sri Lanka Dry-Zone Dry Evergreen Forests ecoregion also harbours important biodiversity, including one of Asia's largest and most viable Asian elephant (*Elephas maximus*) population, and an endemic subspecies of the common leopard (*Panthera pardus kotiya*). The oceans around the island also support 34 marine mammal species, including non-migratory populations of blue whales (*Balaenoptera musculus*), the largest mammal to inhabit this planet.

However, habitat loss, degradation and fragmentation is threatening the survival of many species, especially the endemic species. A recent analysis using IUCN data shows that the wet zone species are most threatened (Figure 4.6).

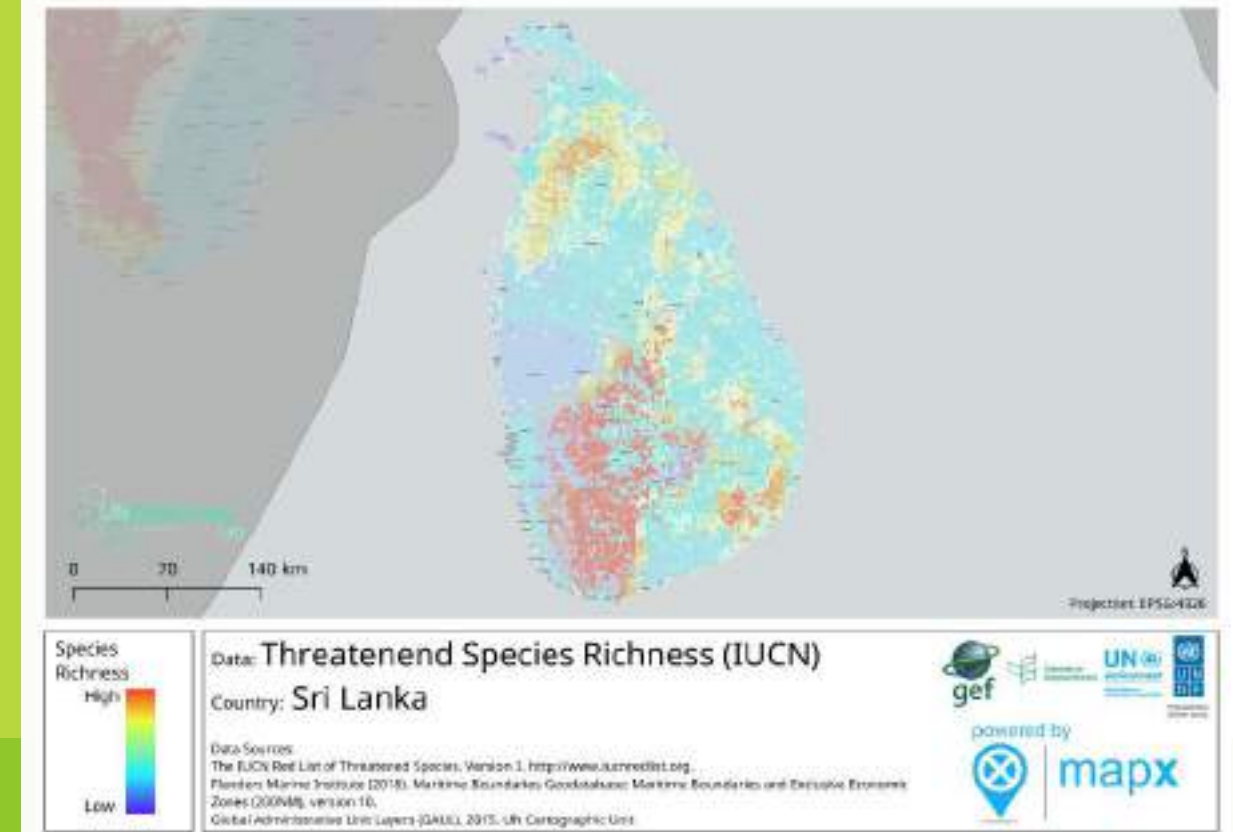


Figure 4.6. Threatened species richness of Sri Lanka. IUCN data analysis shows that the species in the wet zone, the southwestern quarter, are most threatened, primarily due to habitat loss, degradation and fragmentation. Because most endemism is in the wet zone, most of Sri Lanka's endemic biodiversity are now threatened.

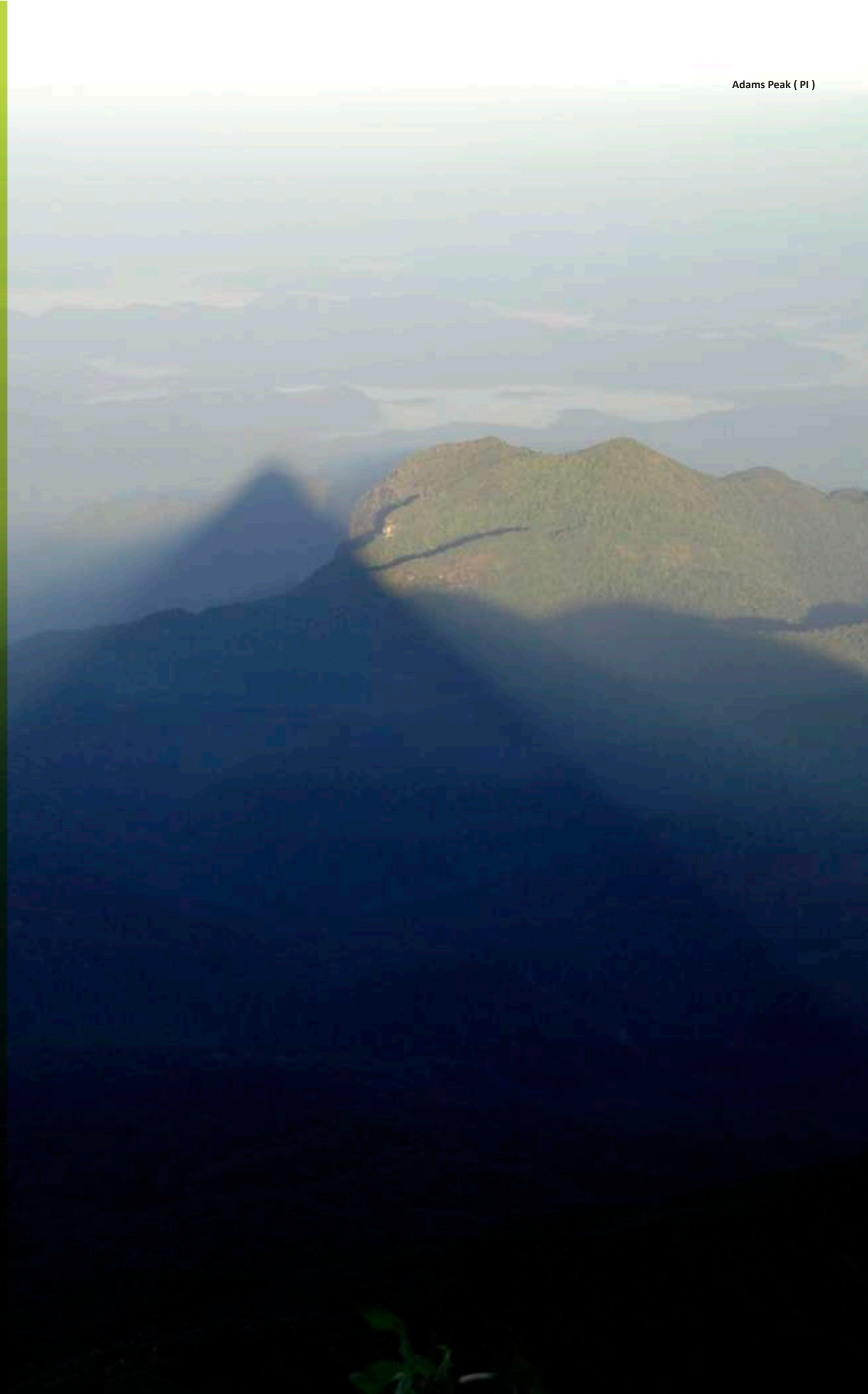
4.1 Biodiversity: Ecosystem Services

Natural ecosystems provide a multitude of ecosystem services, from supporting services such as nutrient recycling and primary production to provisioning services such as natural forest products, clean water, energy, and regulating services such as sustained water, pollination, carbon sequestration, disease control, and a range of cultural services. Sri Lanka has also been declared to be highly vulnerable to the impacts of climate change, with 2019 Climate Risk Index ranking Sri Lanka as the second most vulnerable country to extreme weather events. Intact natural ecosystems help to build resilience against climate change.

Sri Lanka's hydrological services are linked to the two predictable, alternating monsoons and the topography created by the central mountains. The mountains capture orographic rainfall from the monsoons and distributes the water to most of the island via a system of rivers that originate from the central mountains and radiate out. The rivers form 103 river basins (Figure 4.7).

However, Sri Lanka is already experiencing water stress, as competing users vie for access to water. The northcentral regions of the country, which has a high water demand because of wet paddy cultivation, are experiencing the most stress (Figure 4.8). But, when combined with human population density, most of the country is projected to experience water stress (Figure 4.9). Since climate impact projections for Sri Lanka suggest that the island will experience a gradual increase in ambient air temperature, changes in the spatial and temporal distribution pattern of rainfall, and more frequent extreme weather events, ecosystem-based adaption strategies will be necessary to build climate resilience.

A growing body of scientific evidence now exists to show that intact ecosystems help build climate resilience. Forested watersheds are important to sustain water supplies to support people, economic development and biodiversity, especially in the face of climate change. Mangroves and other coastal vegetation, wetlands, and offshore coral reefs, protect coasts from the impacts of wave surges, extreme storms expected under climate change scenarios, and tsunamis. Sri Lanka's coastlines are highly vulnerable to these natural disasters (Figure 4.10), and conserving, and even restoring, these ecosystems remain imperative.



Adams Peak (P1)

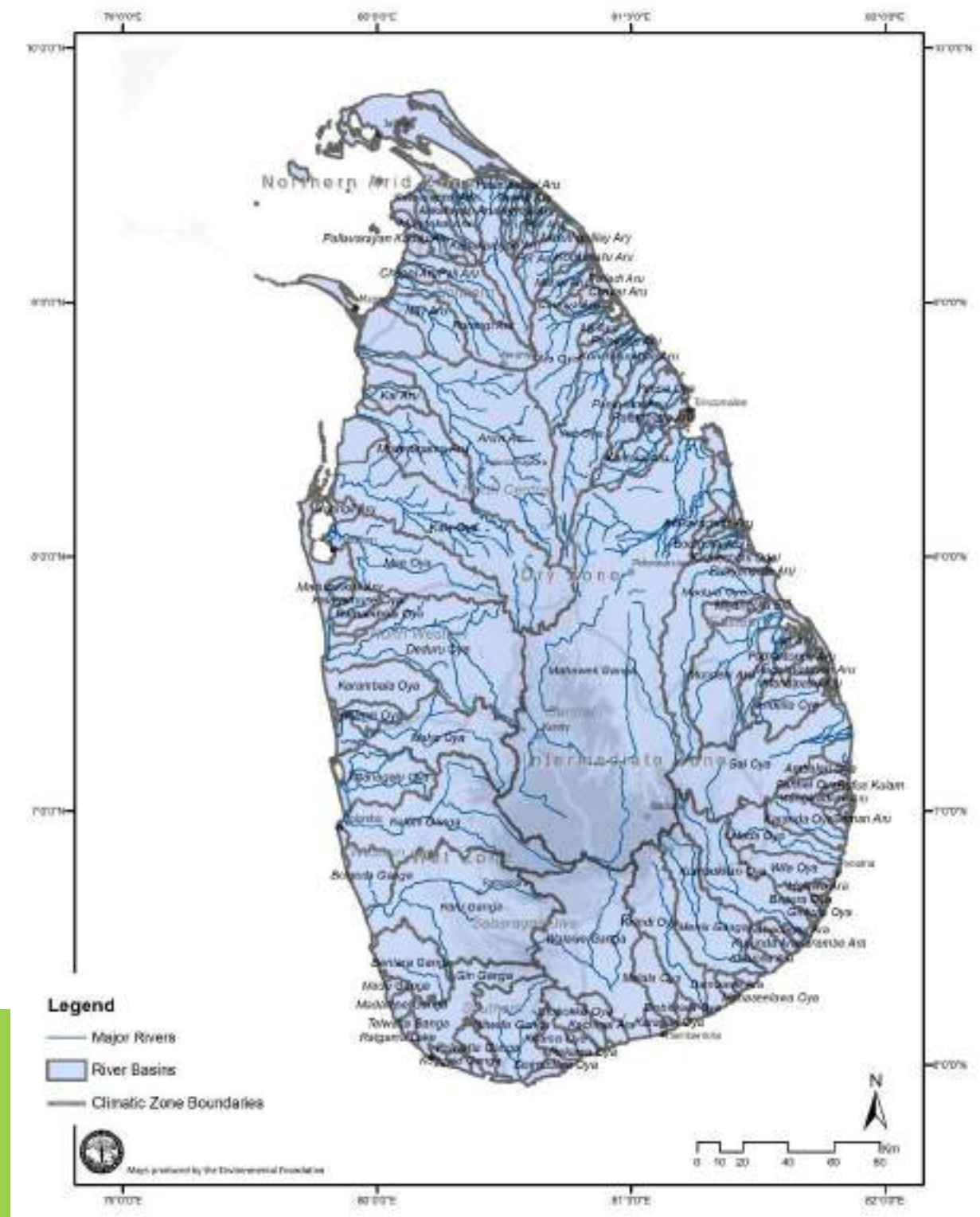


Figure 4.7. River basins of Sri Lanka. There are 103 major river basins. The major rivers originate from the central mountains and radiate outwards. The central mountains capture orographic rainfall from the monsoons and the rainwater is then distributed out to most of the island.



Figure 4.8. Water stress regions in Sri Lanka. The north central regions of the country has a high water demand especially because of large extents of wet paddy cultivation. Paddy fields are usually kept flooded to inhibit growth of weeds. Thus, in general, over 6,000 litres of water is required to produce 1 kilogram of rice in this region. Such agricultural practices that demand high quantities of water will become inefficient and maladaptive with the vagaries of climate change.

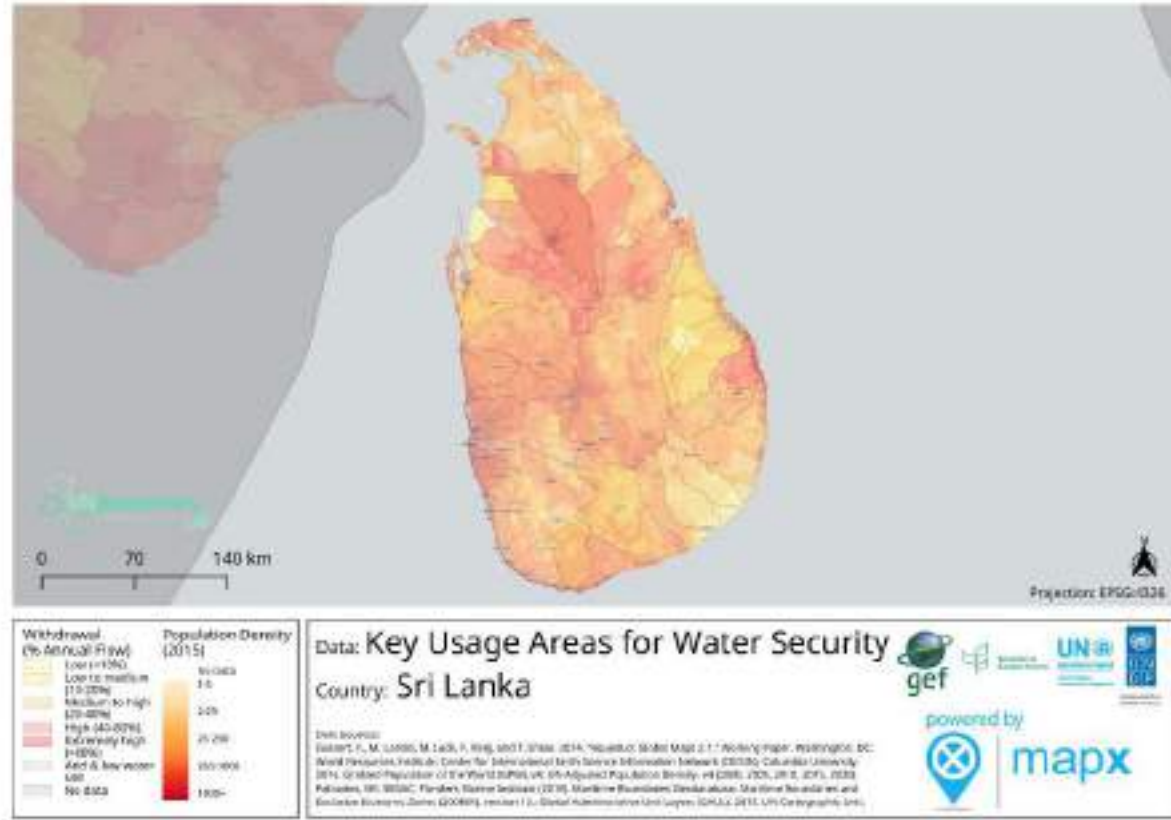


Figure 4.9. Areas of water usage in Sri Lanka based on water withdrawals and population densities. When combined with population density, much of the country is projected to experience water stress.

Forests sequester atmospheric carbon, and help to reduce Green House Gases, notably CO₂, thereby contributing towards climate change mitigation. As a signatory to the UN Framework Convention on Climate Change (UNFCCC) Sri Lanka has prepared a Forest Reference Level (FRL) to benchmark performance, monitor and measure reforestation of Sri Lanka's forests, and to meet the Nationally Determined Contribution to increase forest cover to 32% by 2030. This includes a subsequent pledge to restore 200,000 ha of forest landscapes under the Bonn Challenge. These restoration programmes will contribute towards carbon sequestration, and, if done strategically, restoring habitat for the island's threatened, endangered, and endemic species, while also sustaining ecosystem services for people and economic development.

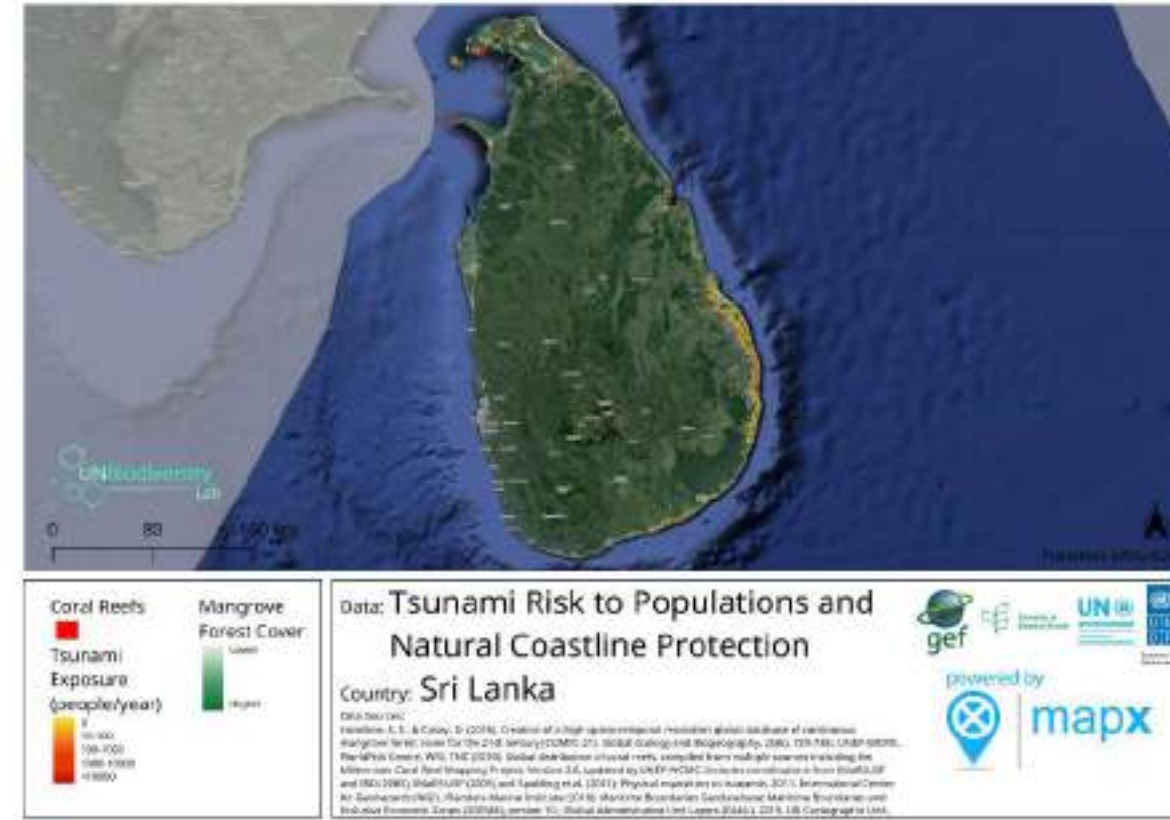


Figure 4.10. Tsunami risk to populations and to the coastlines of Sri Lanka. There is a large body of science to confirm that mangroves and other coastal vegetation, and coral reefs, protect coasts from the impacts of wave surges, extreme storms expected under climate change scenarios, and tsunamis. Thus, conserving, and even restoring, these ecosystems are imperative to protect the coastlines and coastal communities, and infrastructure.

Above ground biomass per hectare is highest in the Wet Zone and the Dry Zone, in the regions within the protected areas (Figure 4.11). The highest, above ground biomass is in the rainforests protected under jurisdictions of the Department of Wildlife Conservation and the Forest Department, i.e. the protected areas, such as Knuckles Conservation Area, Peak Wilderness Nature Reserve, and Sinharaja National Heritage Wilderness Area. Some other high biomass areas are concordant with plantations, including rubber, tea, and palm oil, which do not contribute toward conserving Sri Lanka's natural biodiversity.

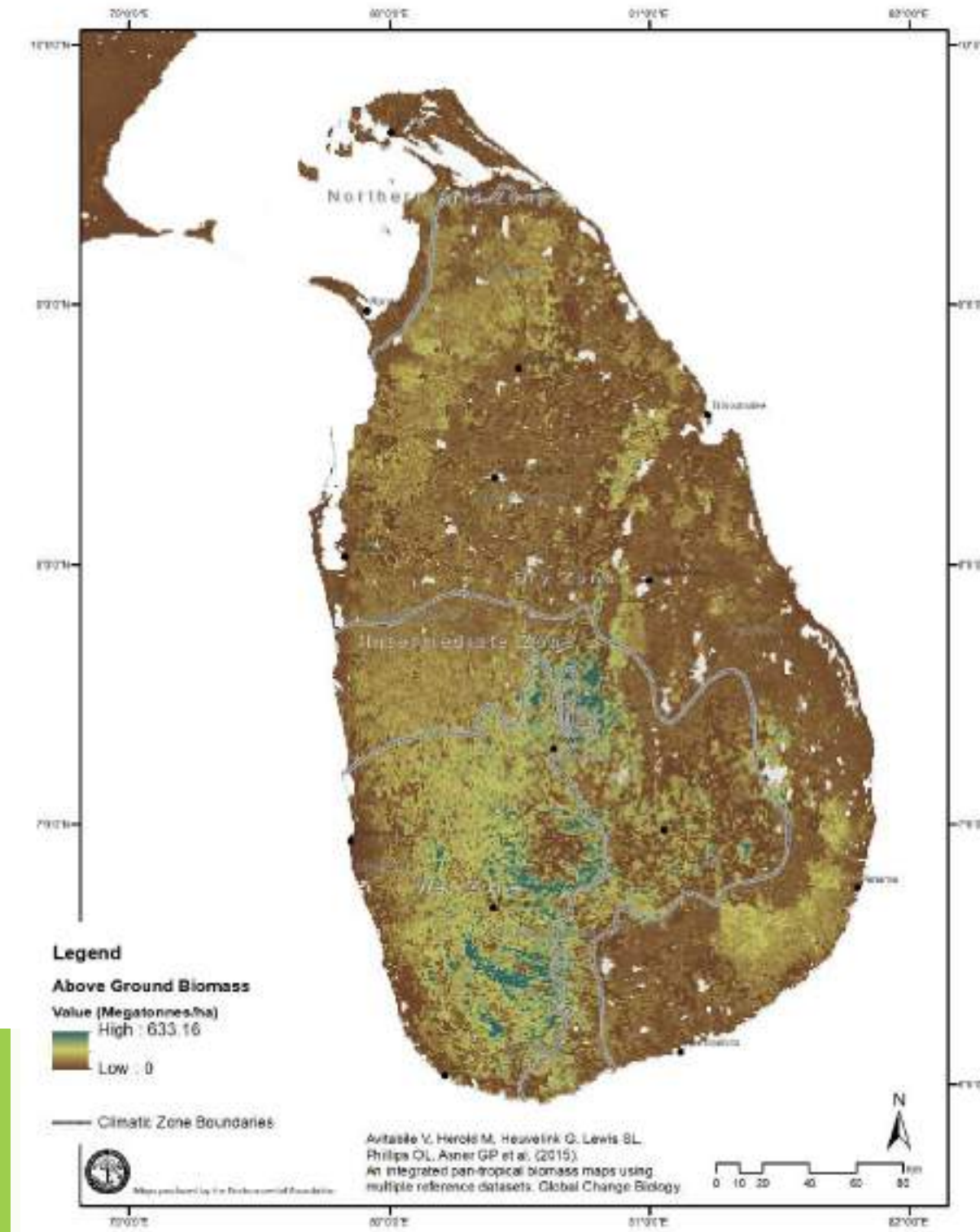


Figure 4.11. Above ground biomass in Sri Lanka. Above ground biomass per hectare is highest in the Wet Zone and in the Dry Zone where the forests are protected under the jurisdictions of Department of Wildlife Conservation and the Forest Department. In the Wet Zone, biomass is highest in protected areas such as the Knuckles Conservation Area, Peak Wilderness Nature Reserve, and Sinharaja National Heritage Wilderness Area. Thus, protected areas contribute towards sequestering carbon and conserving and protecting biodiversity.



Lepidochelys olivacea (US)

The National Conservation Review—a biodiversity survey and analysis of most of the island's protected areas—conducted in the 1990s indicated that many of the remaining forests in the wet Zone were also important for the ecosystem services, especially for flood control, erosion control and headwater protection (Figure 4.12).

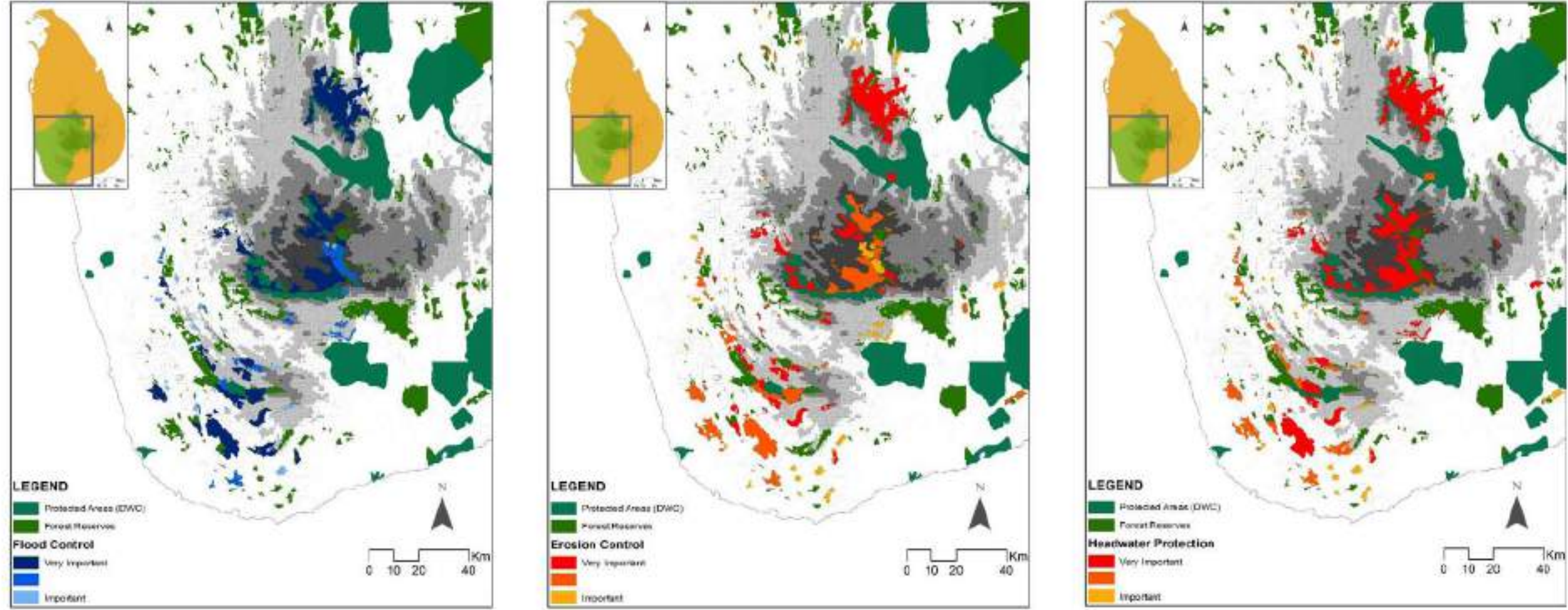


Figure 4.12. Contribution of forests to key ecosystem services (flood control, erosion control and headwater protection). The forest patches that remain in the Wet Zone protected areas have been identified as being extremely important for the ecosystem services they provide, including for flood control, erosion control and headwater protection. The analysis was conducted as part of the National Conservation Review, a biodiversity survey and analysis of most of the island's protected areas, conducted in the 1990s. Although most of these forests are protected, encroachment and illegal felling of trees and clearing for tea and other plantations threaten the ecological viability of these forests, and their ability to sustain the ecosystem services. Loss of the ecosystem services will result in wide-ranging societal impacts and harm, especially as floods, landslides and loss of sustained water provision are compromised.

A landslide risk assessment shows that landslide risk is highest in the montane areas where the ground biomass is low, indicating that slopes which are denuded have a greater likelihood of experiencing landslides (Figure 4.13).

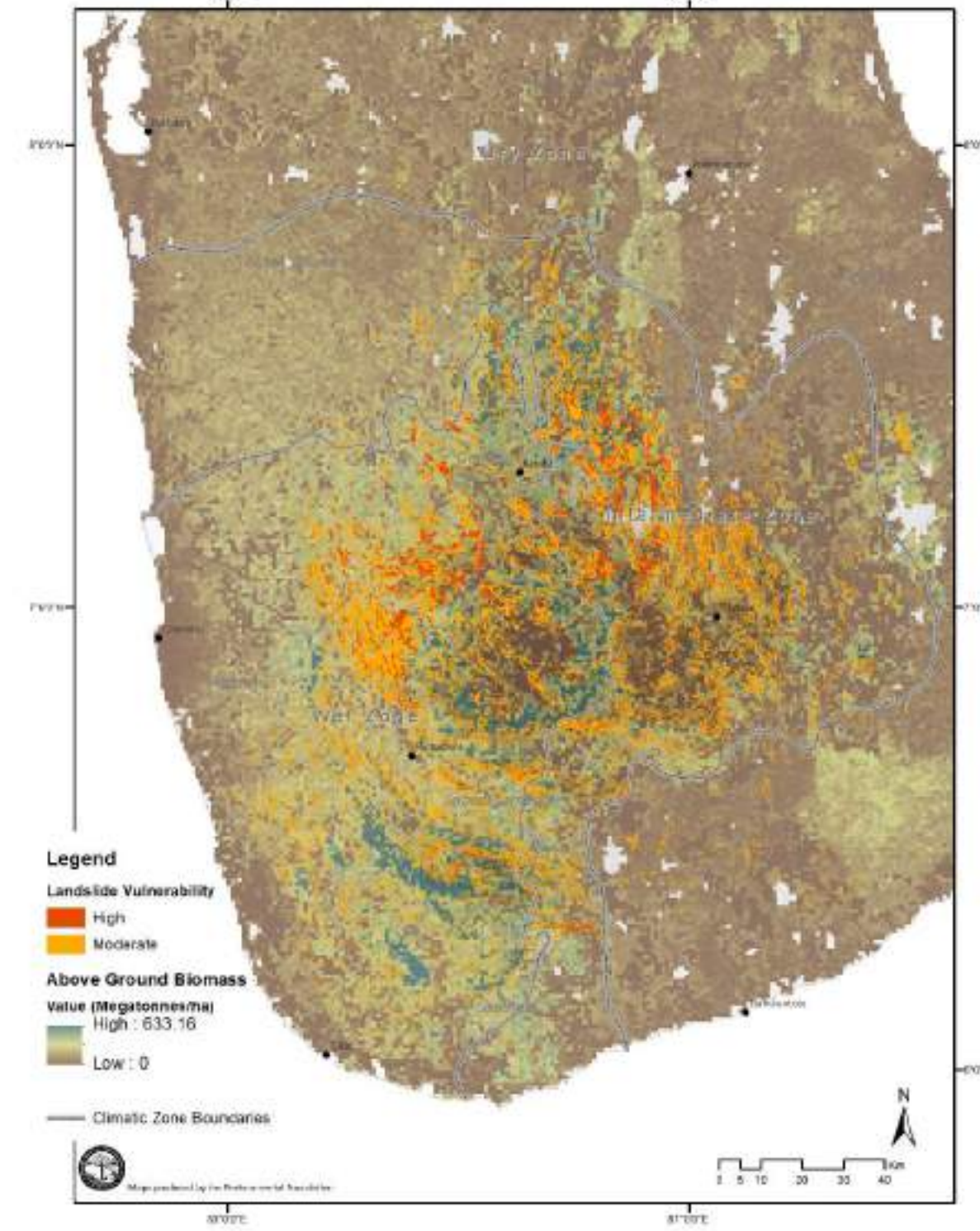


Figure 4.13. Landslide vulnerability within Sri Lanka. Landslide risk is highest in the montane areas where the ground biomass is low, indicating that slopes which are denuded have a greater likelihood of experiencing landslides. The landslide susceptible map developed by National Building Research Organization at the scale of 1:50,000.

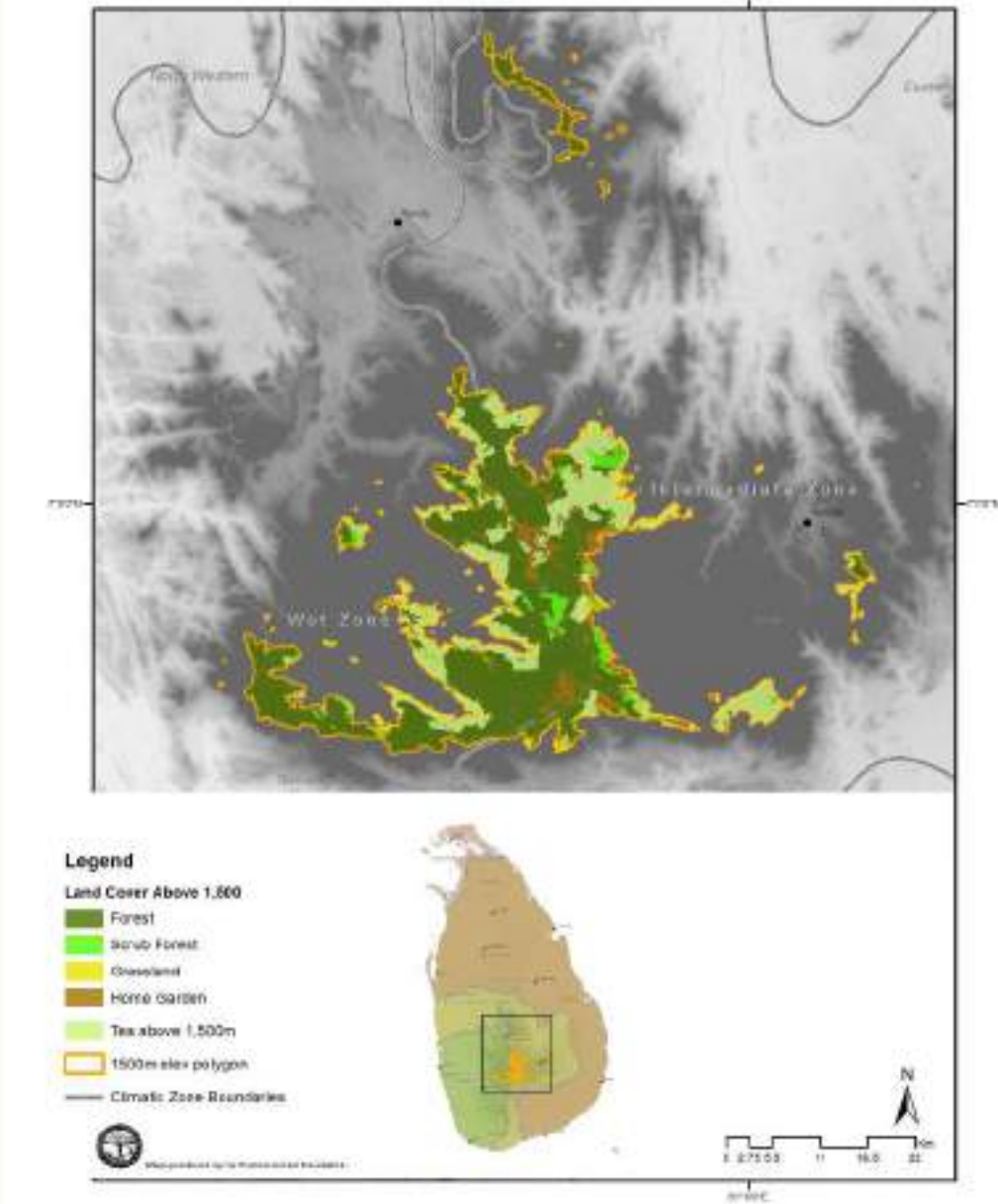


Figure 4.14. Land cover above 1,500 m. The montane cloud forests above 1,500 m trap moisture from the low clouds (i.e. fog and mist) and sustain the water flows in headwater streams. A few patches of natural forests remain in the highest elevations, but much of the forests close to the 1,500 m elevation contour has been cleared for tea plantations. The low stature of the tea plants remains ineffective in intercepting moisture. Thus, clearing forests in the cloud forest zone contributes to degradation of the hydrology, which has cascading implications for water availability in the lower areas.

The forests above 1,500 m perform critically important ecological functions by trapping mist and fog. These montane cloud forests trap moisture from the low clouds—fog and mist—and feed the headwater streams to sustain water flows. Although a few patches of natural forests remain in the highest elevations, most of the forests close to the 1,500 m elevation contour have been cleared for tea plantations (Figure 4.14). The low stature of the tea plants does not allow these plants to intercept moisture as effectively as the taller trees of natural forests. Thus, clearing forests in the cloud forest zone contributes to degradation of the hydrology, which has cascading implications for water availability in the lower areas.

4.2 Protected Areas Network

Sri Lanka has an extensive system of protected areas. The Department of Wildlife Conservation (DWC) is mandated with managing the system of strict natural reserves, nature reserves, national parks, sanctuaries, and jungle corridors (Figure 4.15). Wilpattu and Yala National Parks are among the oldest formally declared protected areas in Asia. However, most of the coverage is in the Dry Zone of the country, and the representative protection in the Wet Zone remains low.

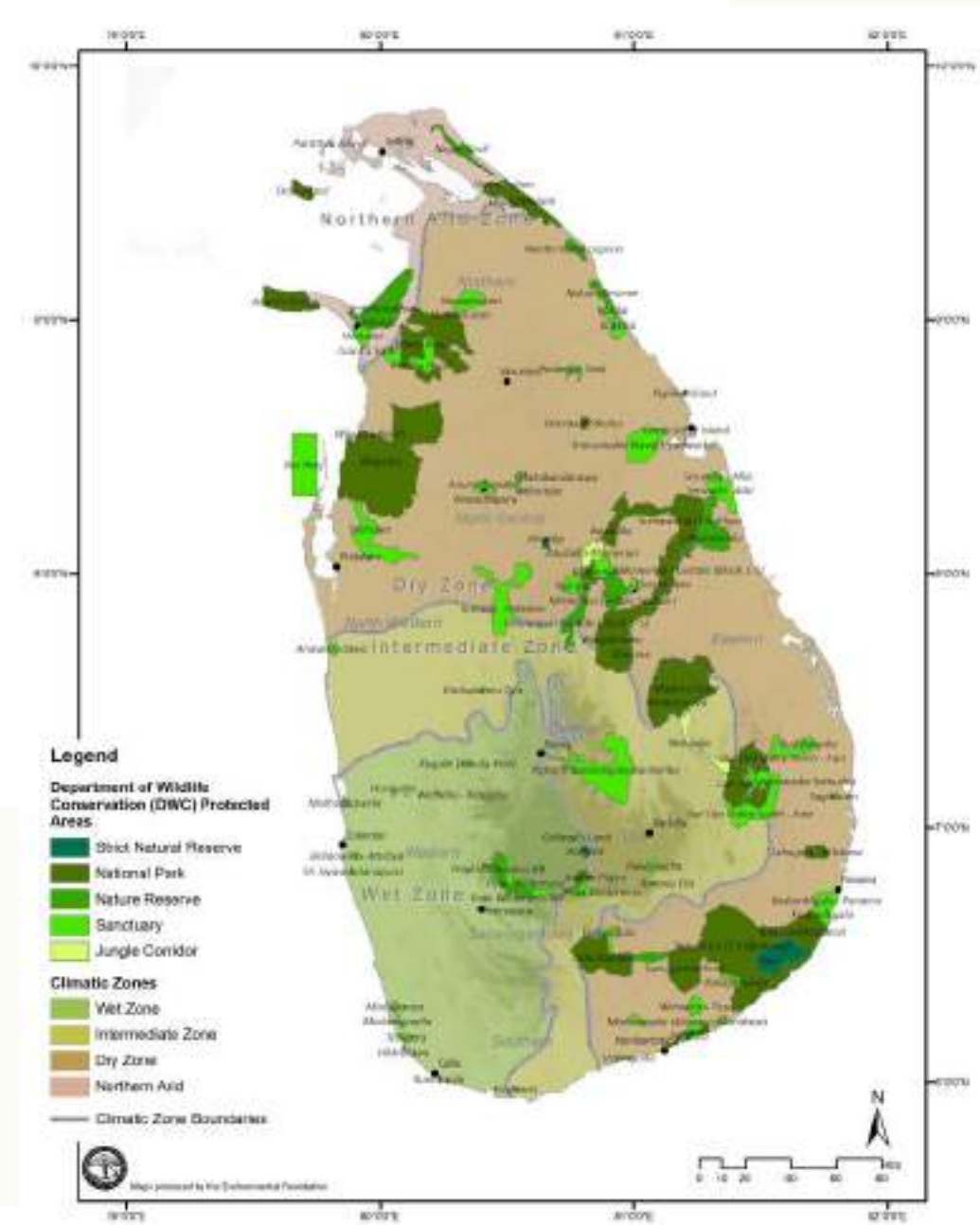


Figure 4.15. Protected areas under the Department of Wildlife Conservation (DWC). Sri Lanka has an extensive system of protected areas comprising of strict natural reserves, nature reserves, national parks, sanctuaries, and jungle corridors that covers about 13% of the island, and under the management jurisdiction of the DWC. But, most of these protected areas are in the Dry Zone, and the Wet Zone, which supports most of the endemism that is under-represented.

The Forest Department (FD) also manages a system of forest reserves, reserved forests, and conservation forests, World Heritage sites, and National Heritage Wilderness Areas (Figure 4.16). Several of these larger protected areas are in the Dry Zone, but there are more, albeit smaller, protected areas in the Wet Zone, providing greater coverage and protection to these forests. Because of the moratorium on logging imposed since the 1990s the Forest Department's land estate has become a de facto protected areas system for biodiversity conservation.

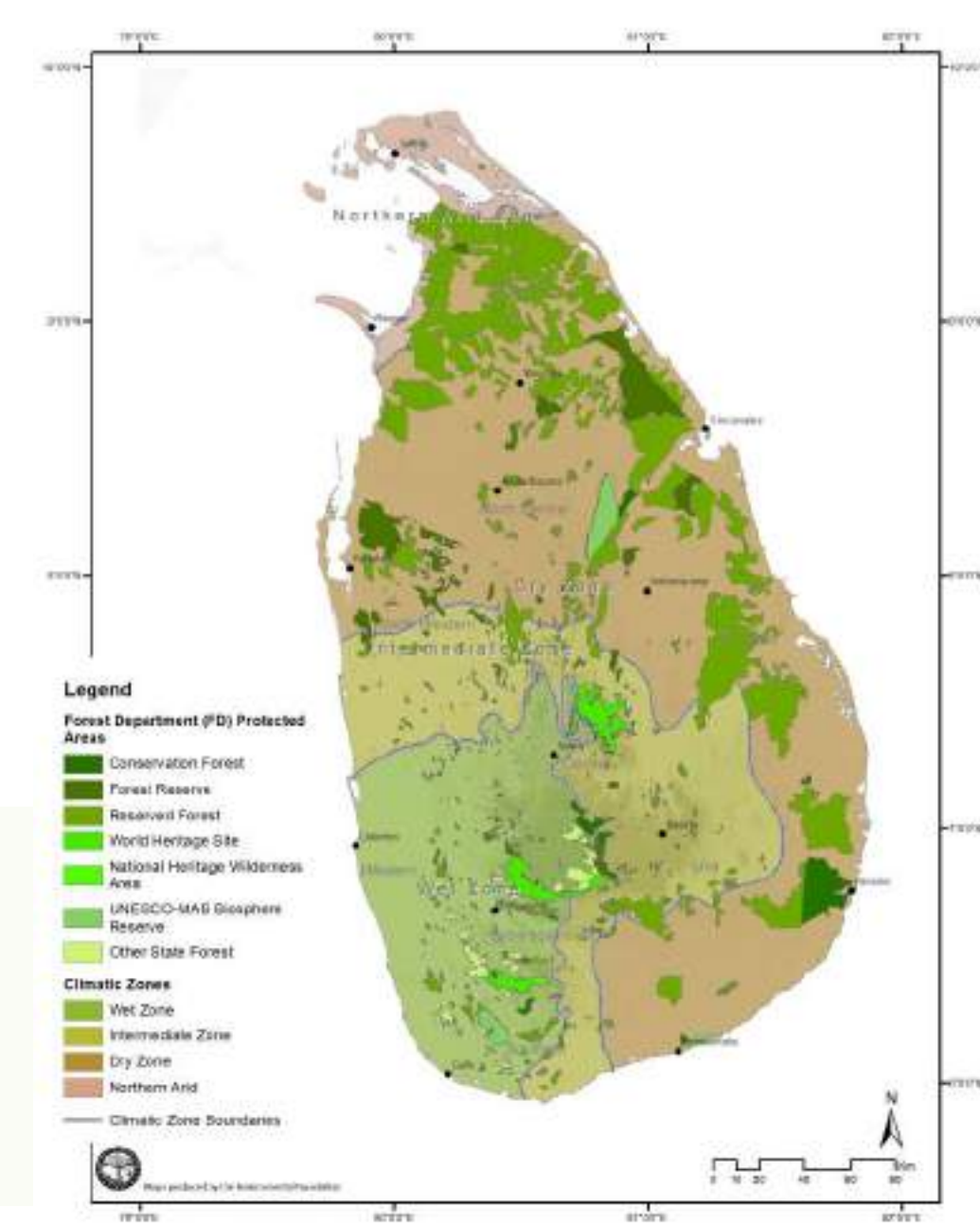


Figure 4.16. Forest areas under the Forest Department (FD). The forest reserves, reserved forests, and conservation forests, World Heritage Sites, and National Heritage Wilderness Areas under the management jurisdiction of the FD cover about another 12% of the island. Because of the moratorium on logging imposed since the 1990s these FD lands are de facto protected areas for biodiversity conservation.

Together, the DWC and the FD cover close to 30% of the country's land area. Several DWC and FD protected areas are contiguous, and form larger complexes, especially in the Dry Zone (Figure 4.17).

There are also 10 Environmental Protection Areas that have been declared by the Central Environmental Agency (CEA) under the National Environment Act 1980 (Figure 4.17).

Aichi Target 11 calls for bringing at least 17% of the terrestrial and inland waters, and 10% of coastal and marine areas under protected areas status by 2020. The target emphasizes the necessity to include areas of particular importance for biodiversity and ecosystem services, under effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, integrated into landscape and seascape scales for biodiversity conservation. Such conservation targets should consider representation of biodiversity in ecoregions. In this context, the Sri Lanka Dry-Zone Dry Evergreen Forests ecoregion has about 37% protected areas coverage and the relatively small Sri Lanka Montane Rain Forests ecoregion about 21% (Figure 18). But the Sri Lanka Lowland Rain Forests, which contain most of the endemic species have only 9% protected areas coverage. The Deccan Thorn Scrub Forests ecoregion, which represents the xeric shrub lands in the extreme northern parts of the island, has only 3% coverage in Sri Lanka, but the ecoregion extends into the Indian subcontinent, where coverage is greater.

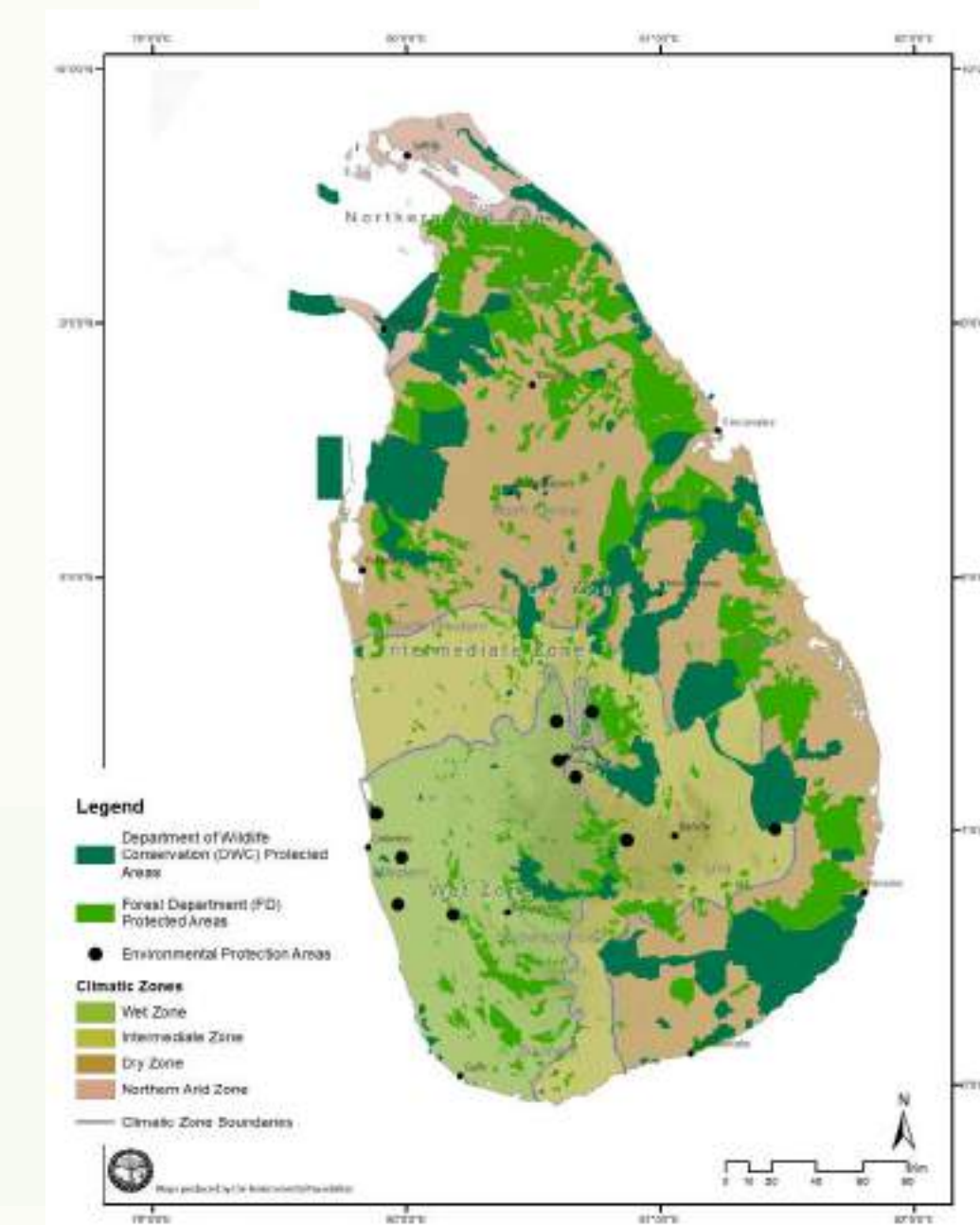


Figure 4.17. Protected areas under DWC and FD. The protected areas managed by the DWC and the FD cover about 30% Sri Lanka's land area. Several of these form large, contiguous protected area complexes and should be managed as such.

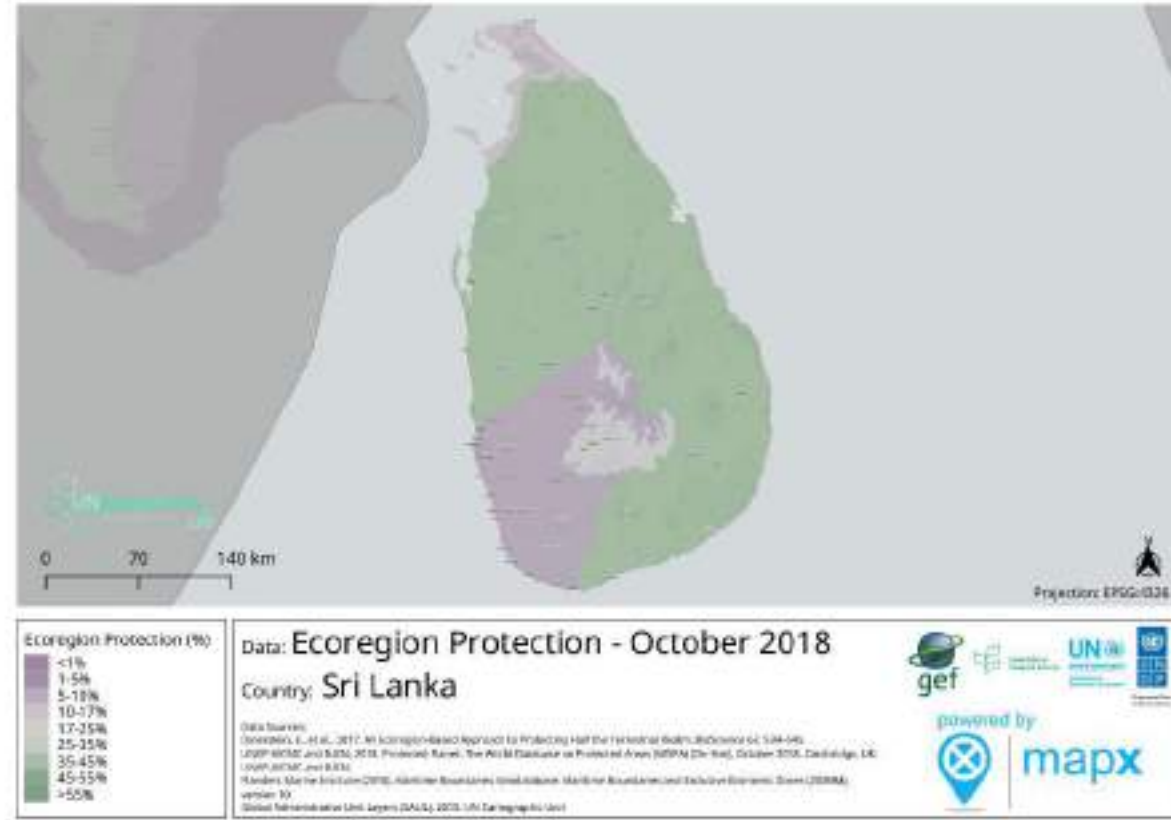


Figure 4.18. Percentage of ecoregion protection within Sri Lanka. Under Aichi Target 11, at least 17 of the terrestrial and inland waters, and 10% of coastal and marine areas, should be under protected areas status by 2020. The target emphasizes the necessity to include areas of particular importance for biodiversity and ecosystem services under effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, integrated into landscape and seascape scales for biodiversity conservation. Of the four ecoregions in Sri Lanka, the Sri Lanka Dry-Zone Dry Evergreen Forests ecoregion with about 37% of protected areas coverage, and the small Sri Lanka Montane Rain Forests ecoregion with about 21% protected areas coverage, have already achieved this target. However, the Sri Lanka Lowland Rain Forests, which contain most of the endemic species, has only 9% protected areas coverage. The Deccan Thorn Scrub Forests ecoregion, which represents the xeric shrub lands in the extreme northern parts of the island, has only 3% coverage in Sri Lanka, but the ecoregion extends into the Indian subcontinent, where coverage is greater.

4.3 Status of Land Cover

There is uncertainty about the true extent of remaining forest cover in Sri Lanka. In 2010, forest cover was estimated at 26.6% of the country's area (FAO, 2010). A more recent assessment conducted to establish a forest reference level for Sri Lanka, under its obligation to the UN Framework Convention on Climate Change (UNFCCC), places forest cover at 29.7% of the total land area. This database and accompanying map is, however, unpublished and unavailable for use and assessment. Thus, analyses of land cover have to be done using the 2010 FAO map, which shows that the larger blocks of forests and forest habitats are in the Dry Zone, with very little forests remaining in the wet zone, especially in the lowlands (Figure 4.19). The remaining forests in the Wet Zone are highly fragmented and scattered as small patches. Most of the remaining forest patches, including the larger patches in the Dry Zone are within protected areas (Figure 4.20), and very little forests remain outside the protected areas.

An analysis of tree cover loss, used as a proxy for forest change, in both Department of Wildlife Conservation and Forest Department protected areas, using the Global Forest Watch database shows that most of these protected areas have lost tree cover since 2010. The Global Forest Watch is an online database that uses frequently updated Landsat satellite imagery to monitor tree cover loss across the pantropical region, and (Figure 4.21) shows the protected areas that have lost tree cover, in at least 50 ha of forests, from within the protected areas.

Overall, about 23,000 ha of forests have been lost or degraded from these protected areas. On average 438 ha (+159) were lost or degraded each year from Department of Wildlife Conservation protected areas (national parks, nature reserves, wildlife sanctuaries, strict nature reserves and jungle corridors), while 2,558 ha (+ 885) per year was lost from Forest Department lands. The protected areas that have been impacted include Sri Lanka's flagship protected areas.



Bambarakanda (PK)

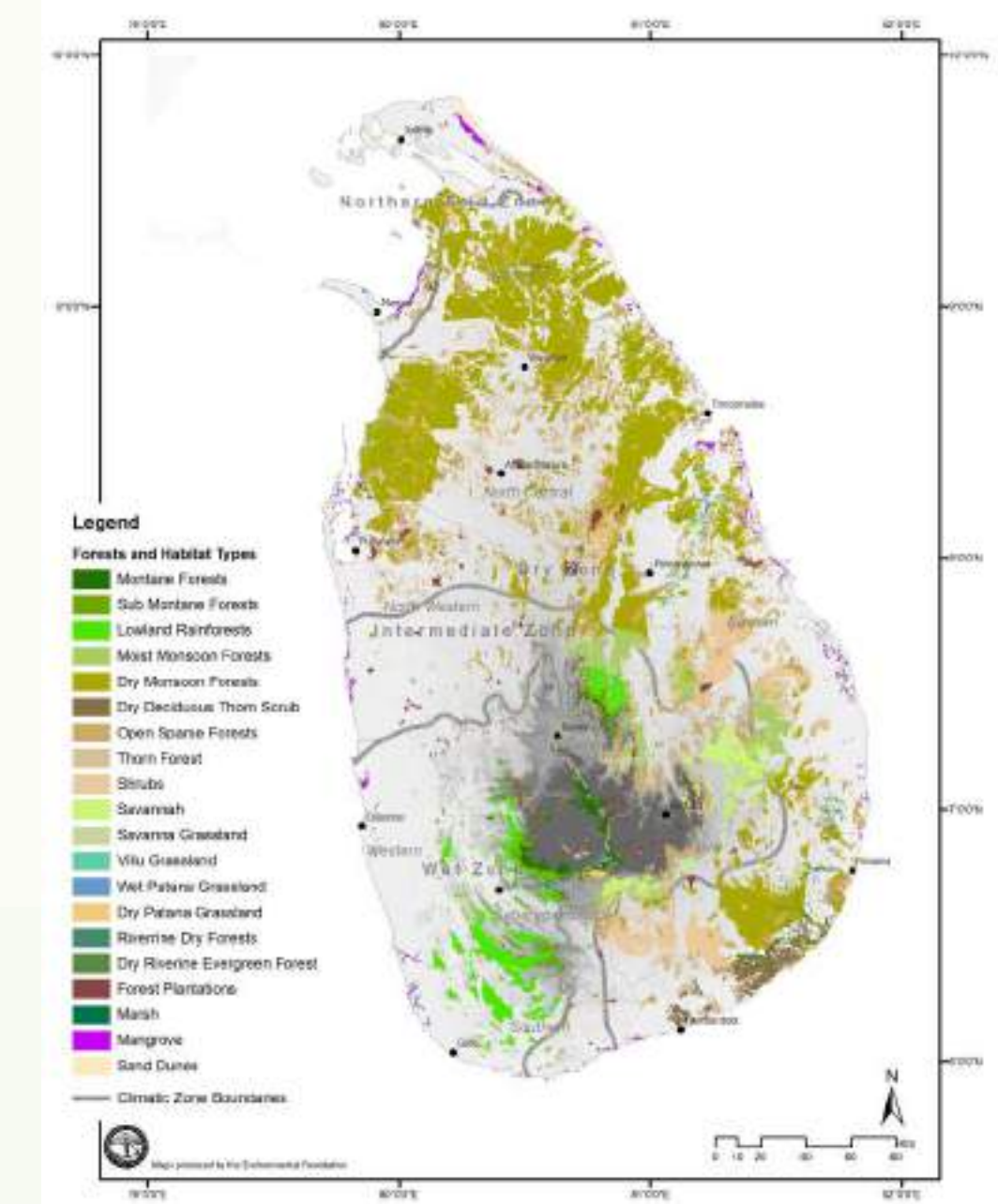


Figure 4.19. Distribution of forest cover and forest types of Sri Lanka, based on the land use and land cover map prepared by FAO, 2010. This analysis estimates the forest cover at 26.6% of the country's area. The map shows that the larger blocks of forests and forest habitats are in the Dry Zone, with very little forests remaining in the wet zone, especially in the lowlands.

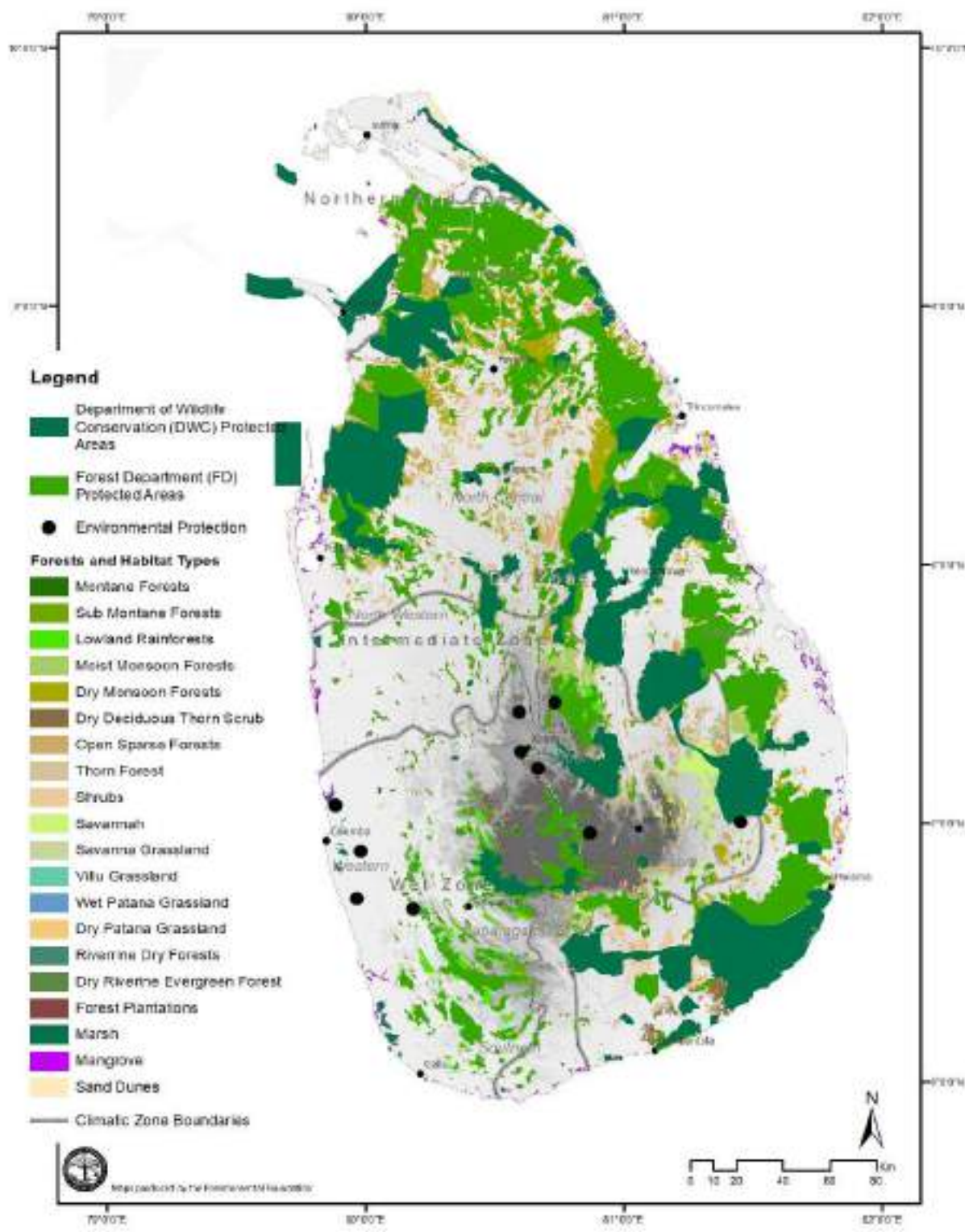


Figure 4.20. Main forests and habitat types of Sri Lanka. The remaining forests and protected areas of Sri Lanka, show that most of the remaining forest patches, including the larger patches in the Dry Zone are within protected areas, with very few forests remaining outside the protected areas.

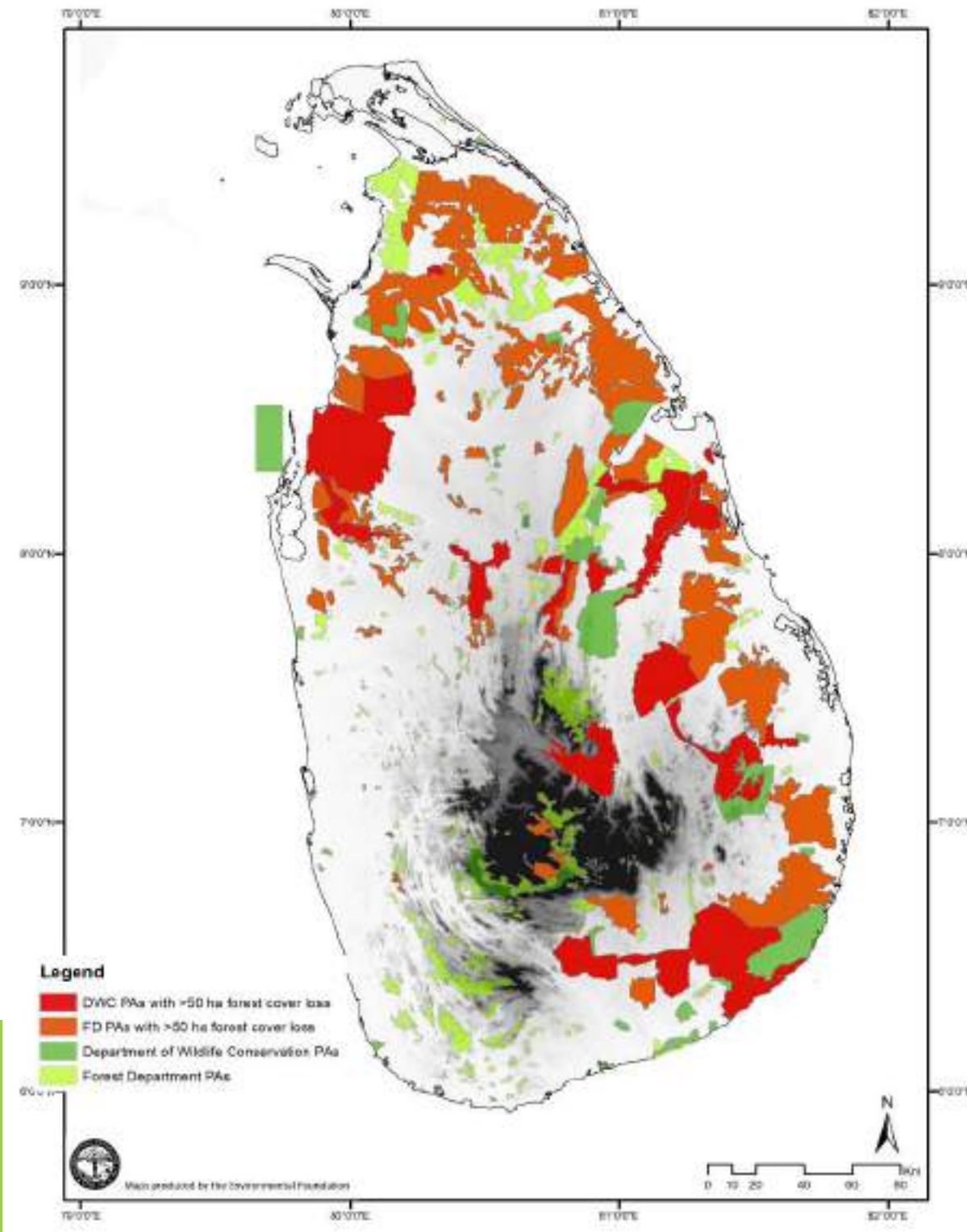


Figure 4.21. Analysis of tree cover as a proxy indicator for forest loss or degradation from the Global Forest Watch database. This shows that since 2010, many protected areas under the management jurisdiction of the Department of Wildlife Conservation and Forest Department have lost forest cover. The protected areas shown in red and orange have lost over 50 ha of forest cover since 2010.

Horton Plains (ZA)

4.4 Infrastructure and Development Plans

The recently revised National Physical Plan for Sri Lanka includes new expressways, an east-west economic corridor and several large metro regions around Sri Lanka's coast (Figure 4.22). Many of this planned infrastructure overlaps with existing forested areas and also with protected areas. Thus, there will invariably be some loss of forested areas, unless appropriate planning is undertaken at finer site scales to integrate the gray and green infrastructure and ensure that ecological connectivity is maintained. Loss of additional wildlife habitat can result in an increase in human-wildlife conflict, loss of ecosystem services and important biodiversity, and hinder achieving the forest targets pledged as nationally determined contributions to the global community.



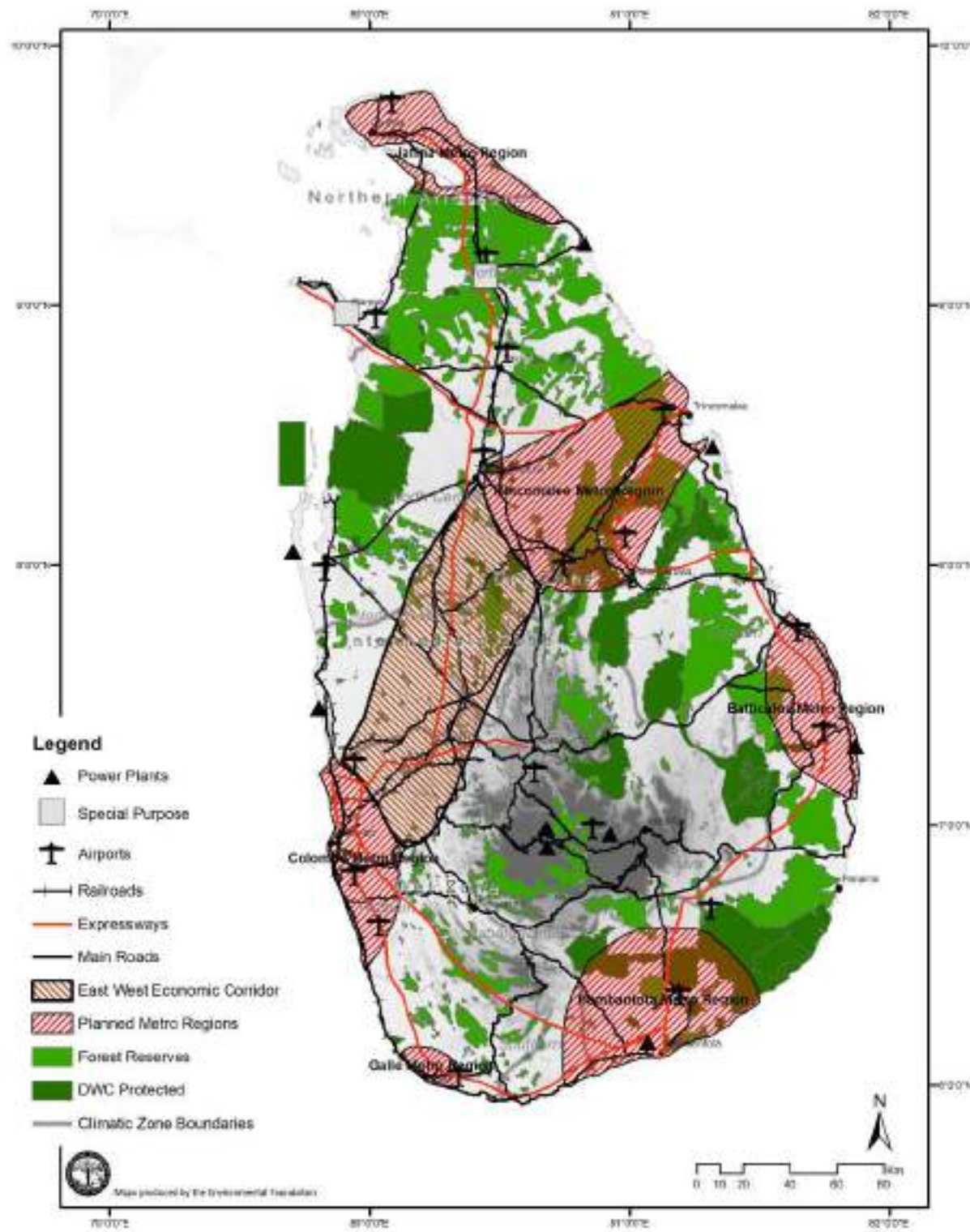


Figure 4.22. Selected, large scale physical plans for Sri Lanka. Large infrastructure and development areas planned under the National Physical Plan for Sri Lanka, overlay on existing protected areas. The infrastructure includes new expressways, an economic corridor and metro regions around Sri Lanka's coast, that also overlap with existing forested areas and protected areas. Unless appropriate planning is undertaken at site scales to integrate the gray and green infrastructure and ensure the ecological connectivity is maintained, there could be loss of forests and wildlife habitat, an increase in human-wildlife conflict and loss of ecosystem services.

4.5

Socio-economic Indicators and Protected Areas

Human population density is highest in the south western and northern districts (Figure 4.23a). These same south western districts are also where endemism is highest, and the existing levels of protection is lowest (Figure 4.23b). Thus, anthropogenic activities now place Sri Lanka's endemic biodiversity under threat from habitat loss and degradation.

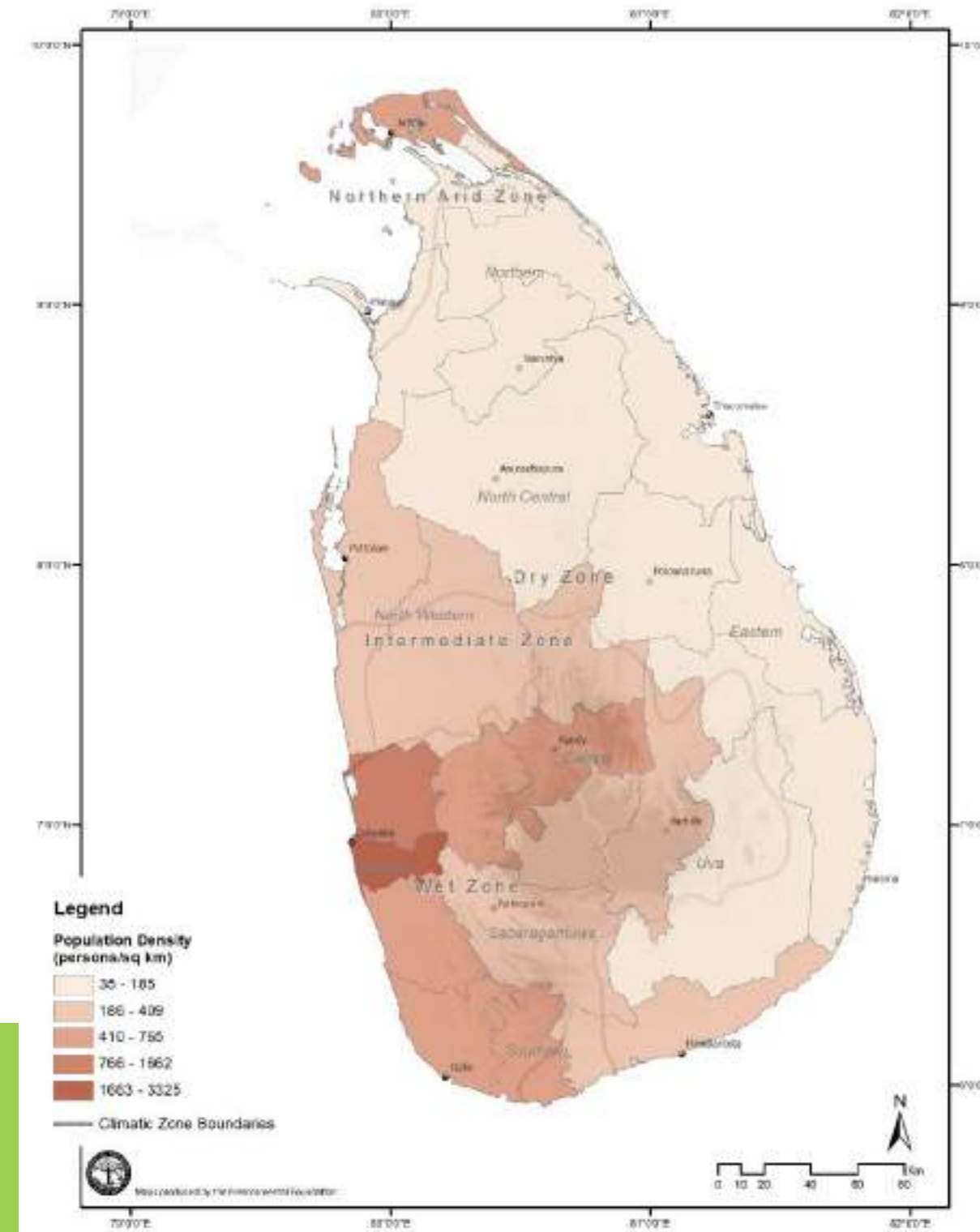


Figure 4.23a Human population density is highest in the southwest and the extreme north.

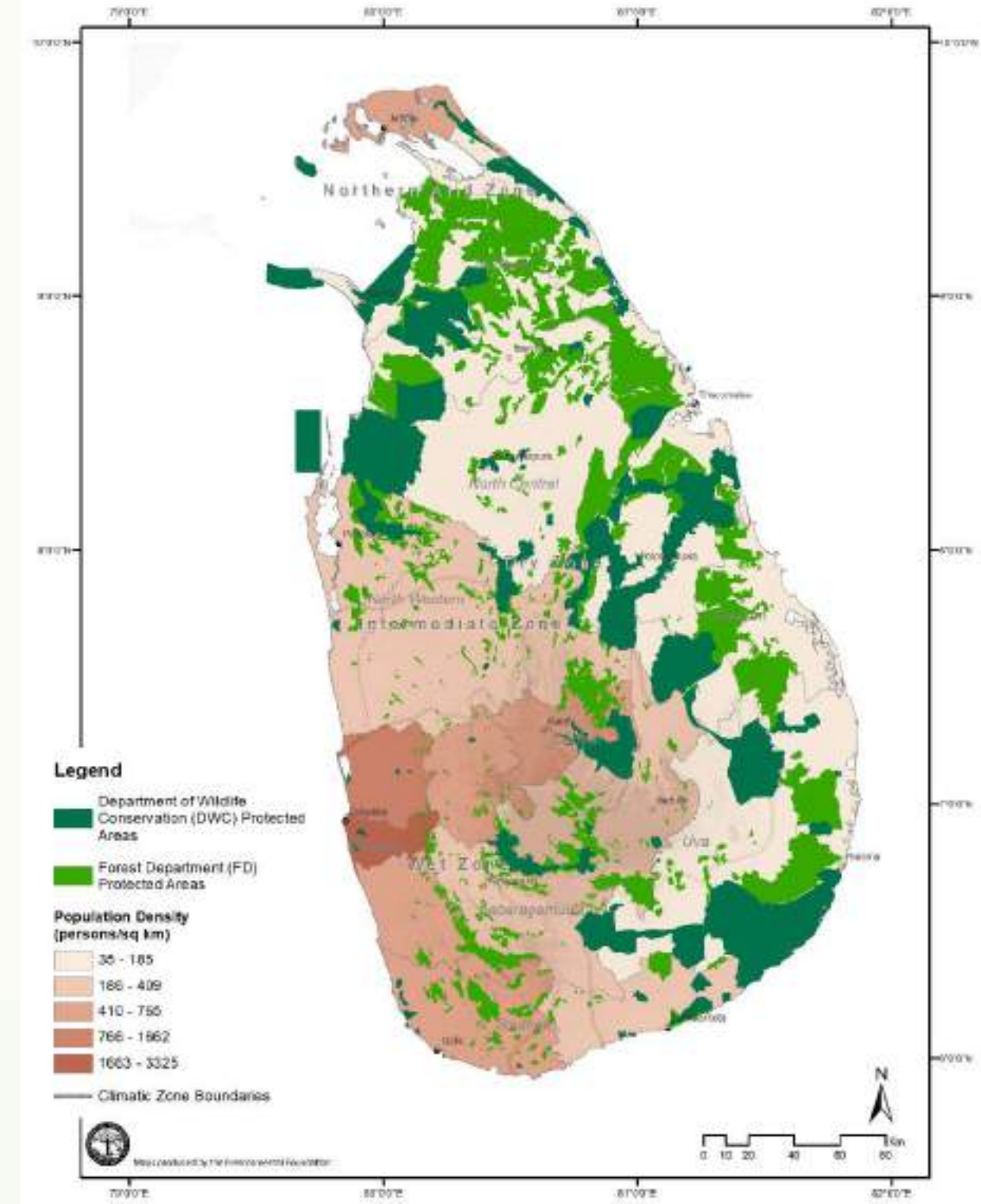


Figure 4.23b The southwestern districts, in the Wet Zone are where endemic biodiversity is highest, but also where the level of protection is lowest. Anthropogenic activities already place Sri Lanka's endemic biodiversity under threat from habitat loss and degradation.

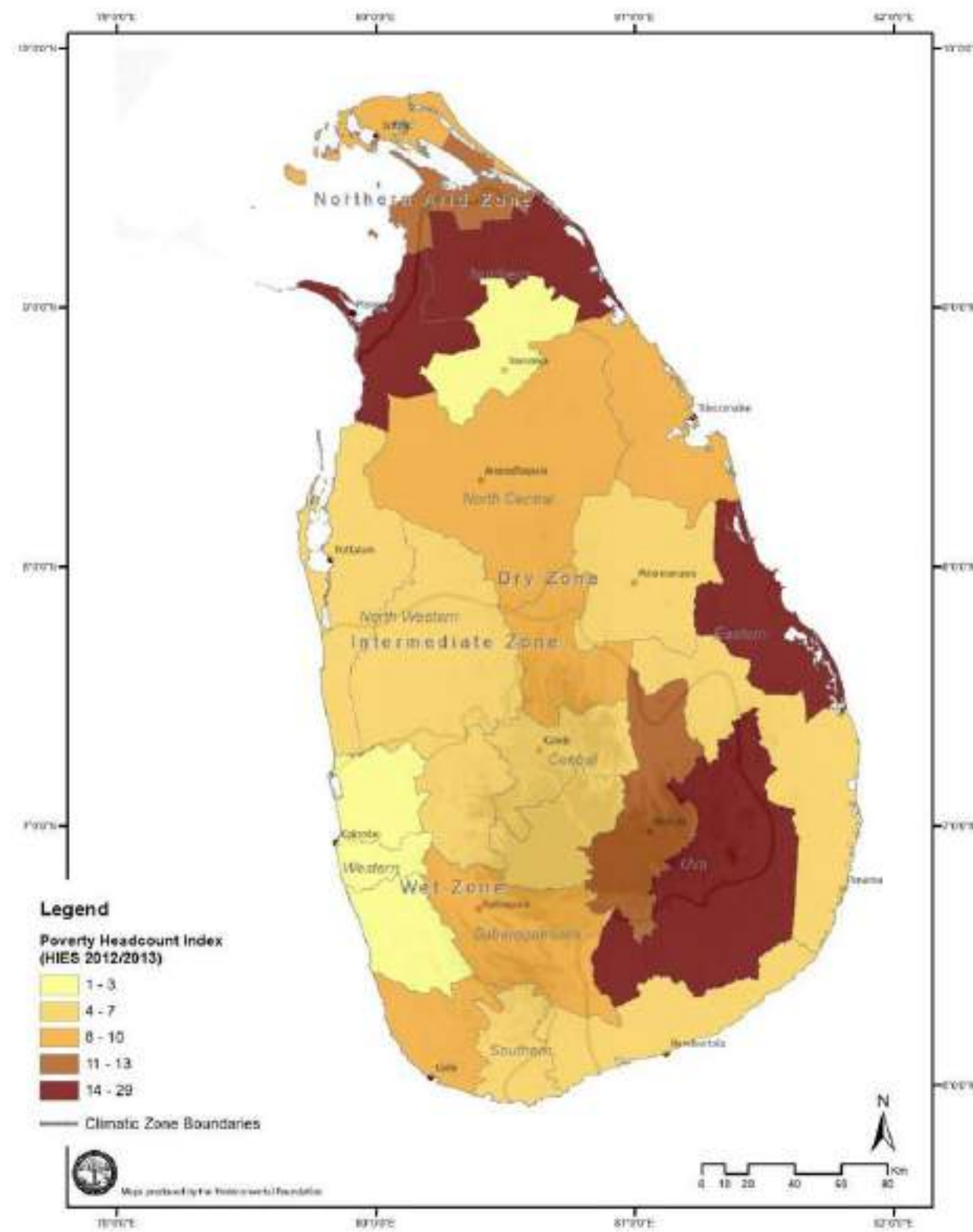


Figure 4.24a The poverty map of Sri Lanka by district shows the results of the Household Income and Expenditure Survey (HIES) indexed to a headcount ratio, i.e. the number of poor people to the total population in the District (Department of Census and Statistics 2015).

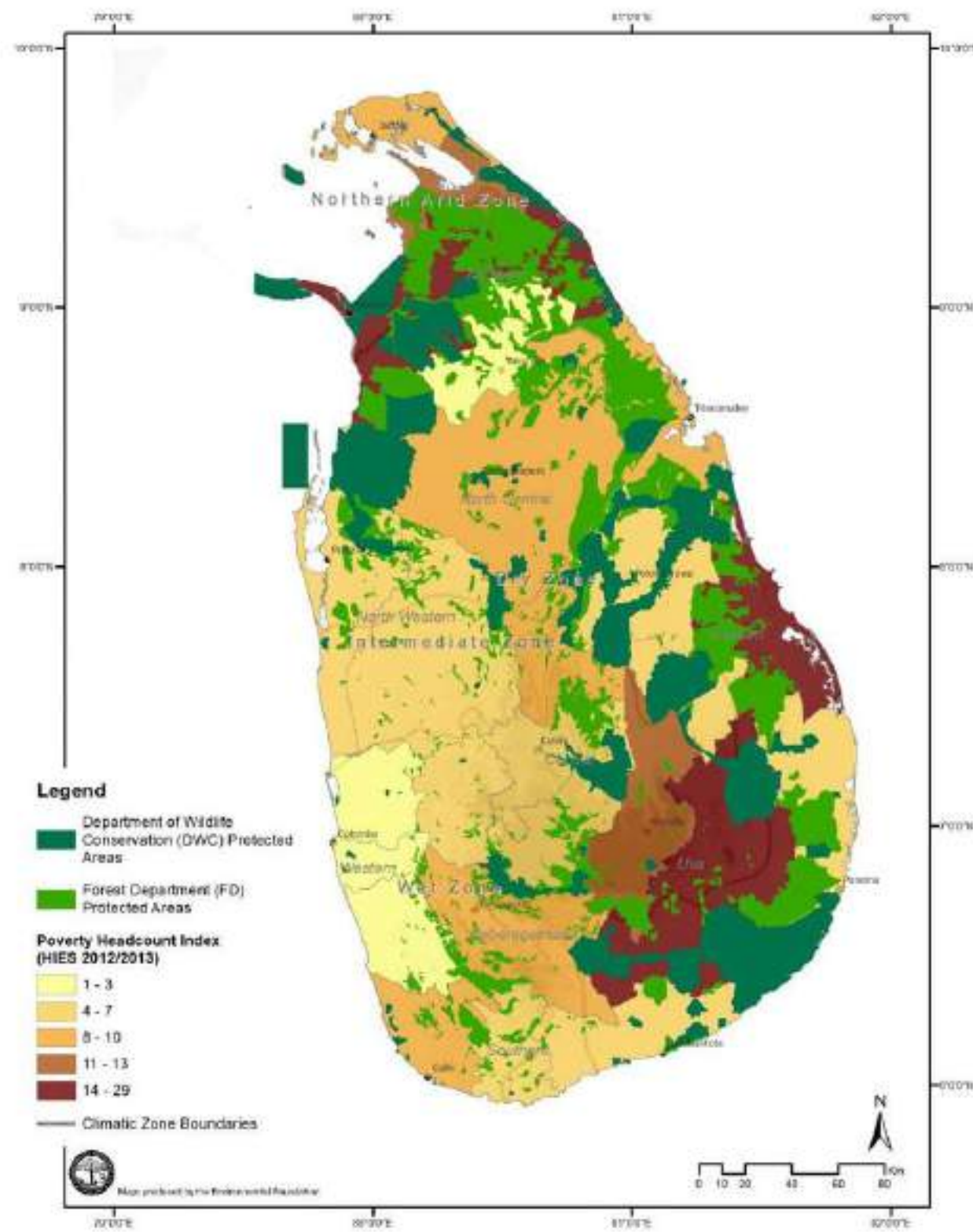


Figure 4.24b Protected areas (DWC and FD) overlaid on the poverty map. Levels of poverty are highest in areas concordant with protected areas, but these districts also have low population densities. The overlap of poverty and presence protected areas does not imply a causality.

4.6 Climate, Climate Change and Biodiversity

Sri Lanka's climate is reflected in the three broad climatic zones, i.e. the Wet Zone, Dry Zone, and the Intermediate Zone. Annual rainfall, precipitation from the south west monsoon, soil type, and vegetation are important determinants of these zones (Punyawardena, 2007). The Wet Zone receives over 2,500 mm of mean annual rainfall, with no pronounced or prolonged dry period. The Dry Zone receives less than 1,750 mm of mean annual rainfall, and there is a pronounced dry season from May to September. The Intermediate Zone receives between 1,750 to 2,500 mm of mean annual rainfall, with a short dry season (Figure 4.25). Within these climatic zones, rainfall can be variable, with some areas receiving much higher rainfall, sometimes as much as 5,000 mm, annually because of the complex interactions of the monsoon winds and topographical relief of the central mountains that intercept monsoon winds and create patterns of orographic rainfall and rain shadows.

Climate change projections, conducted to enable the national adaptation strategy, have revealed several general trends (Jayawardene et al., 2017; National Adaptation Plan for Climate Change Impacts in Sri Lanka, 2016). These include a gradual rise of atmospheric temperature that affects the entire country and changes in the spatial and temporal distribution of rainfall (variation in rainfall is likely to be greater in the montane regions, with an increase in the frequency and severity of extreme weather events).

A recent study that projected rainfall data from 1970 to 2000 has indicated that by 2050, the currently accepted climatic zones could shift significantly (Muthuwatta and Liyanage, 2013). The projections indicate that by 2050 there could be an increase in average rainfall in the southern and south-eastern parts of the country. Consequently, the Dry Zone will shrink at the expense of the expansion of the Intermediate Zone to include the eastern areas of the country (Figure 4.26).

Climate projections also indicate changes in temperature across the island. Projections made under the more extreme climate change scenario (A2), show that the average annual temperature could increase by 1.6°C in the north, northeastern, and northwestern regions of the country (Figure 4.27; de Silva, 2006). Even under the milder, and more environmental friendly B2 scenario, the increase in temperature is expected to increase by 1.2°C, with a smaller change in the spatial footprint. Under the A2 scenario, the highest increase in temperature is predicted in the northern and north central region (Figure 4.27), with the greatest impact being in the Anuradhapura district, where the average temperature can increase by about 2.1°C.

During the north east monsoon period, from December to February, the overall increase in mean annual air temperature across the island is predicted to increase by 1.6°C (A2) and 1.3°C (B2). During the southwest monsoon period, from May to September, the overall increase in mean annual air temperature is predicted to increase by 1.6°C under the A2 scenario and 1.2°C under the B2 scenario. Thus, under the A2 scenario, with no climate mitigation, the overall increase in temperature will exceed the 1.5°C threshold set at the 2015 Paris Conference of the Parties (CoP) on climate change.

Climate change is expected to affect the survival and distribution of species, the function, ecological integrity and shifts in ecosystems and sustainability of ecosystem services (Kapos et al., 2009). The changes projected under the climate scenarios will also very likely affect the distribution of Sri Lanka's biodiversity. The distribution of Sri Lanka's biodiversity is heavily determined by climatic conditions that in turn determine the habitat types and ecosystems. The endemic species, in particular, are adapted to

narrow ecological niches. Climate change can cause these habitats to change or shift, although in the latter case the highly fragmented nature of the wet zone forests constrains the possibility of habitat shifts. Shifts in climatic conditions will also drive anthropogenic land use changes, especially agricultural land use. Thus, biodiversity conservation strategies should be flexible and adaptive to accommodate these changes, and appropriate strategies will have to be developed. Ecosystem based conservation strategies, especially those at landscape or basin-scales are more suitable as adaptive strategies since larger ecosystems are more resilient and enable species movements into climate refugia (Perez et al., 2010; Mawdsley et al., 2009; Hannah et al., 2002).

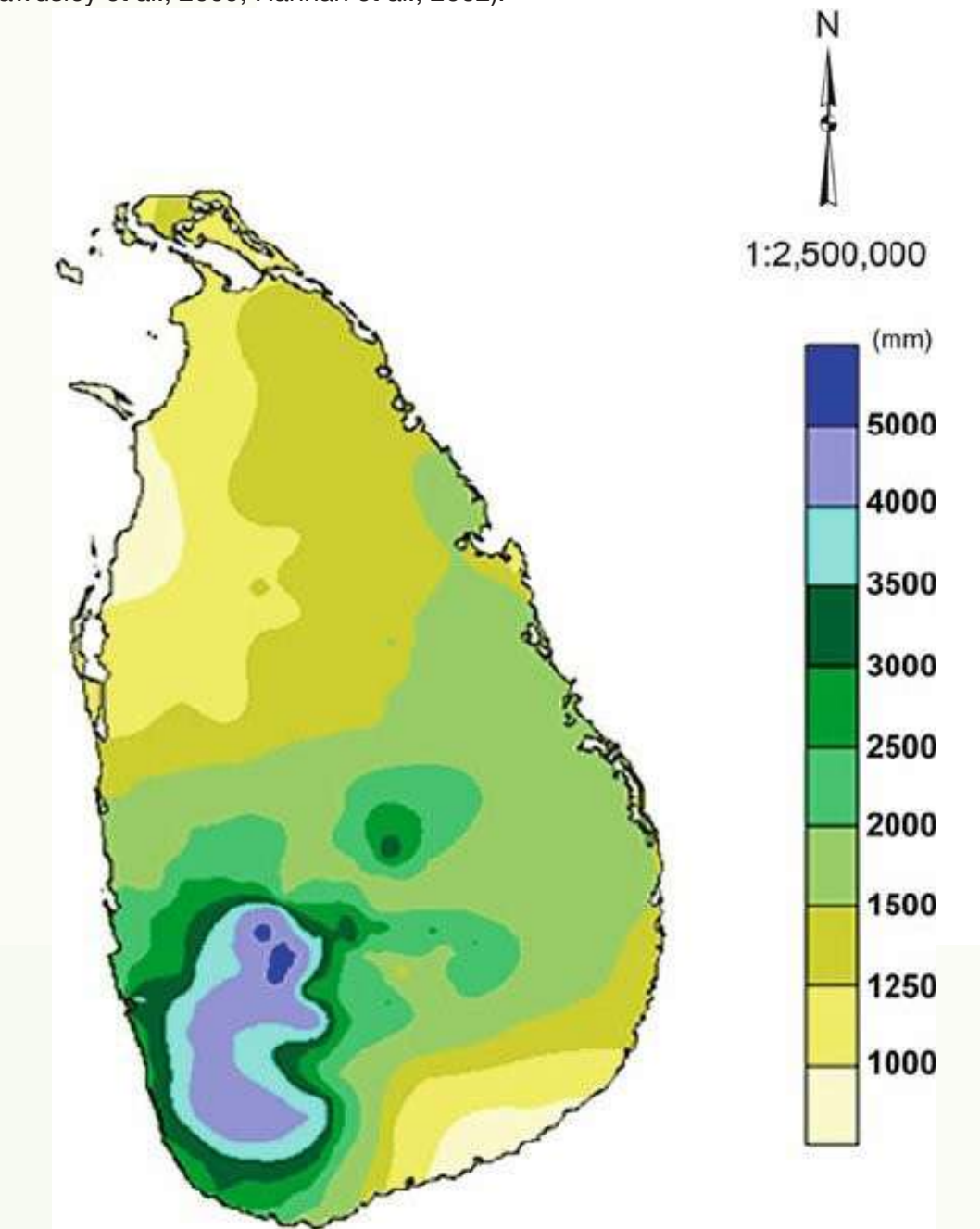


Figure 4.25. Mean annual rainfall in Sri Lanka. Rainfall is a major determinant of the three broad climatic zones, the Wet Zone, the Dry Zone, and the Intermediate Zone, of Sri Lanka. The Wet Zone receives over 2,500 mm of mean annual rainfall, whereas the Dry Zone receives less than 1,750 mm of mean annual rainfall. The Intermediate Zone receives between 1,750 and 2,500 mm of mean annual rainfall. But within these climatic zones, there is considerable variability in rainfall, with some areas receiving as much as 5,000 mm annually, because of the complex interactions of the monsoon winds and topographical relief of the central mountains that intercept monsoon winds and create patterns of orographic rainfall and rain shadows (Marambe et al., 2015).

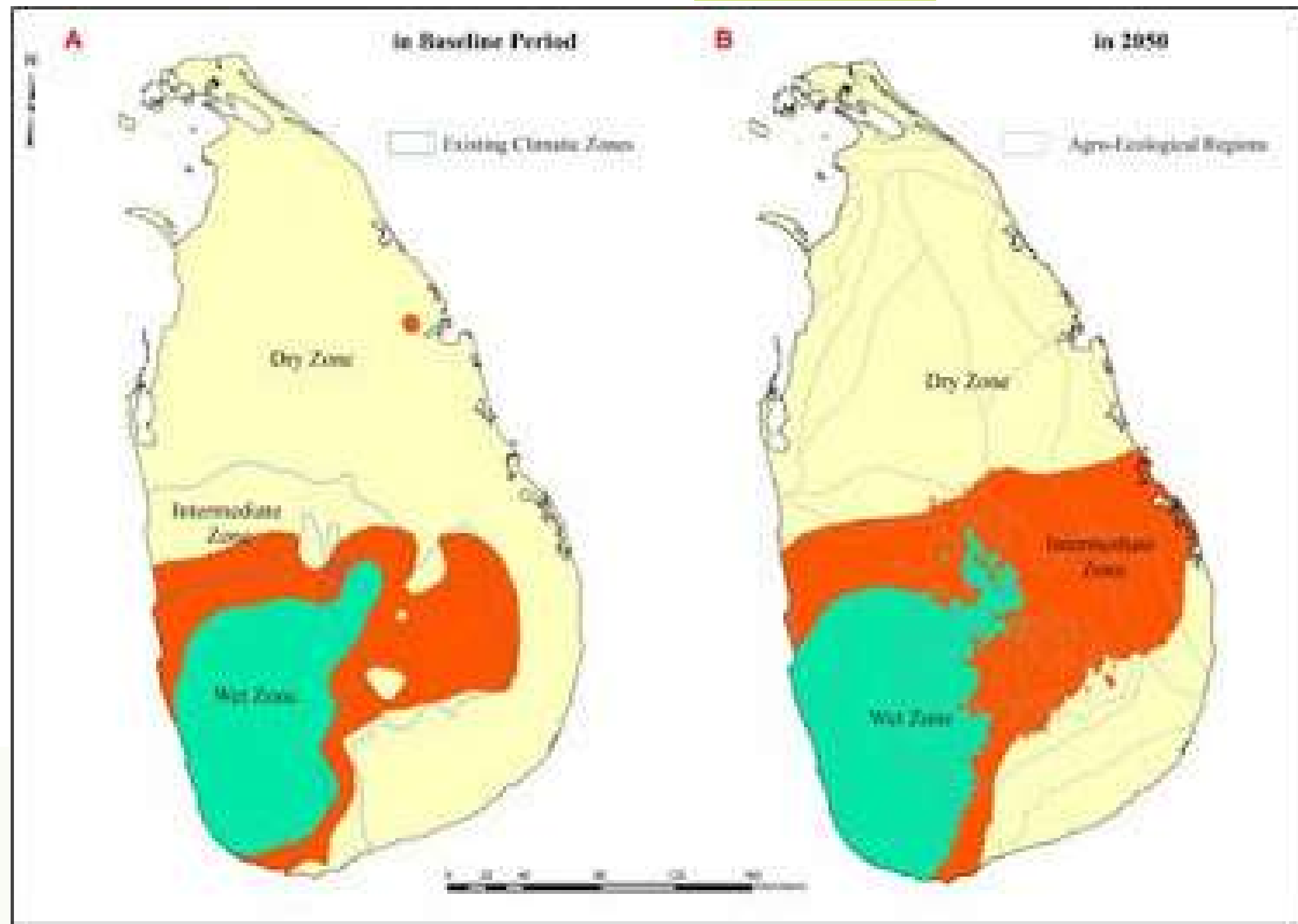


Figure 4.26. Projected shifts in the climate zones, based on projected rainfall data from 1970 to 2000. By 2050, the Intermediate Zone could extend to the east coast because of an increase in average rainfall in the southern and south-eastern parts of the country (Muththuwatta and Liyanage 2013)

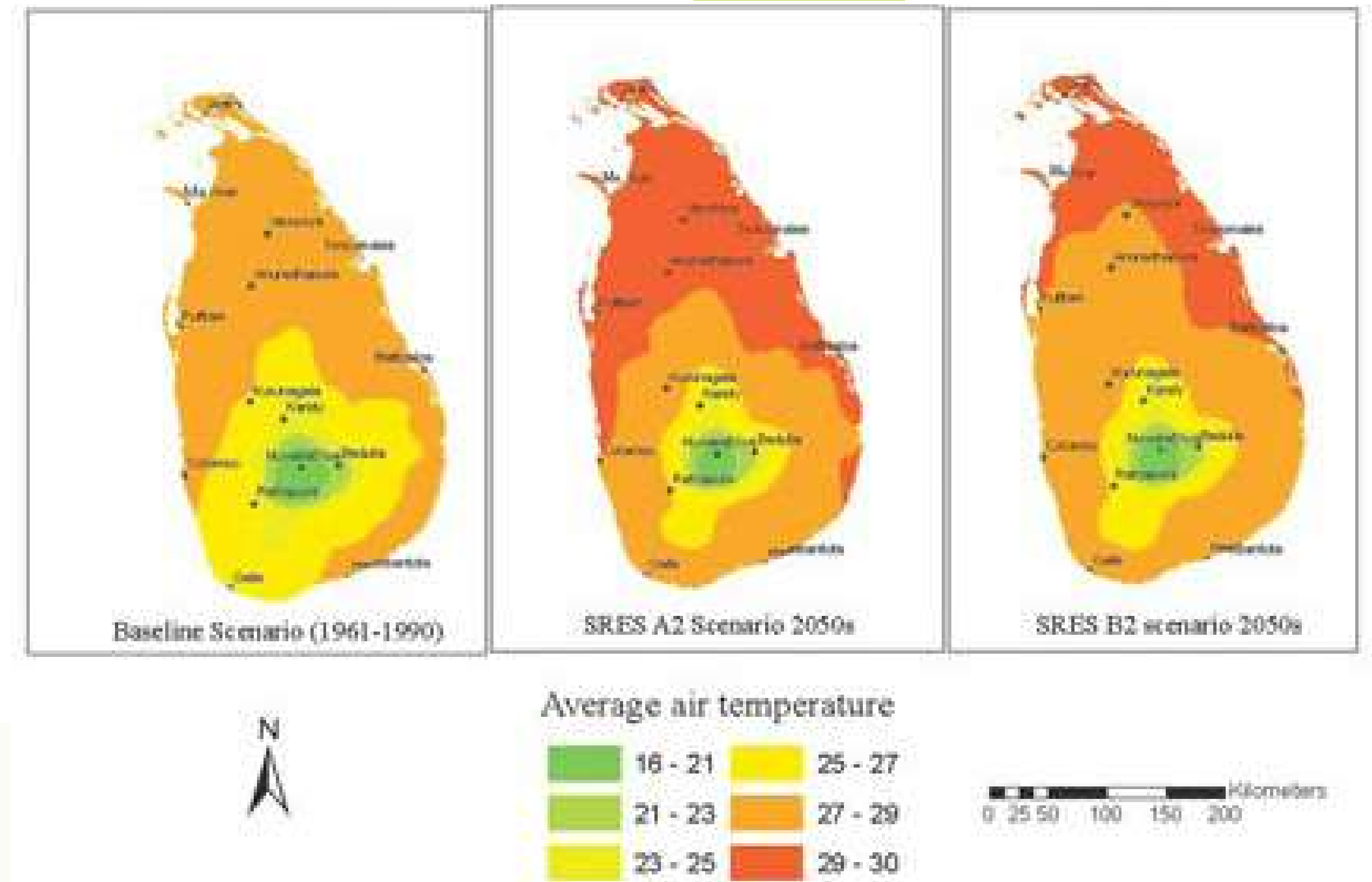


Figure 4.27. Projected changes in temperature across the island under the extreme (A2) and milder (B2) climate projection scenarios. Under the A2 climate change scenario, the average annual temperature could increase by 1.6°C in the north, north-eastern, and north-western regions of the country, whereas under the B2 scenario, the temperature is expected to increase by 1.2°C, with a smaller change in the spatial footprint (De Silva 2006).

4.7

Conservation Planning for Forested Landscapes and Irreplaceable Biodiversity

Overall, the protected areas in the Dry Zone are larger, and cover a greater area of the ecoregion. Many protected areas under the management jurisdictions of the Department of Wildlife Conservation and the Forest Department are contiguous and form larger protected areas complexes. Better coordination is necessary between these two departments to manage these complexes as a single ecological unit. Currently, electric fences erected to prevent elephant movement lie along the boundaries that define the forest reserves and national parks, preventing movement of elephants and other larger mammals even within the protected areas.

A habitat connectivity model, using Circuitscape software (McRae and Shah, 2009) shows that there is considerable ecological connectivity that potentially links the protected areas and protected areas complexes at larger landscape scales (Figure 4.28). The analysis was conducted using Sri Lanka's flagship megavertebrates, notably the Asian Elephant, Leopard, and Sloth Bear (*Melursus ursinus*). The analysis indicates that there is potential to plan and manage conservation landscapes in the east, north, and north west. But the west-central and north-central region has less suitable habitat and ecological connectivity, since most of the natural habitats have been extensively cleared for paddy cultivation and other agriculture. These landscapes will also capture many of the inselbergs and the unique floral and faunal assemblages and taxa they contain.

Since the forests in the Wet Zone and the central mountains are fragmented, creating landscapes with ecological connectivity based on the current distribution of terrestrial biodiversity is not possible. However, because these forests contain the island's irreplaceable biodiversity (i.e. the endemic species and genera), the remaining smaller patches should be protected. Because the majority of the endemic species are small and less vagile than the megavertebrates used to define the landscapes in the Dry Zone, even small patches of Wet Zone forests become important conservation refugia.

Sri Lanka has made commitments to the global community to increase forest cover and restore over 200,000 ha of forests to create forested landscapes. This restoration should first concentrate on the Wet Zone forests, to increase the extent of habitat for endemic species and re-create ecological connectivity. Rainforests, when intact, also support the highest biomass, providing additional justification for restoring these forests as a carbon sequestration strategy and contributing to mitigating climate change, and for the ecosystem services they provide. Based on these justifications, four provisional landscapes have been proposed for the Dry Zone, and several forest patches have been proposed in the Wet Zone and montane areas as conservation priorities (Figure 4.29). These provisional conservation areas will require finer-scale planning to integrate the green and grey infrastructure that will make biodiversity conservation compatible with development and human-wellbeing, and mutually supportive for a sustainable future for Sri Lanka.

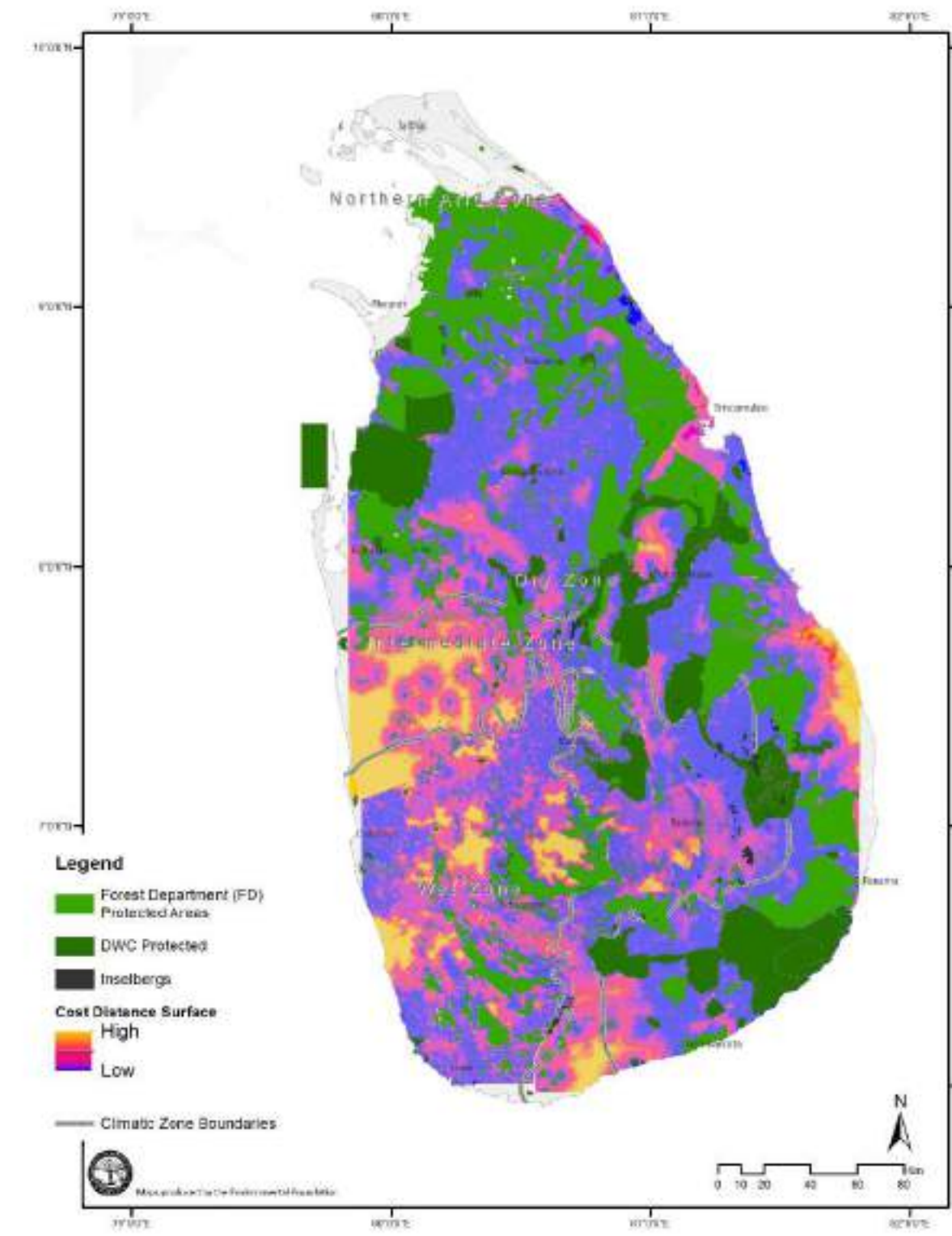


Figure 4.28. An ecological connectivity map created using Circuitscape software. The blue shades represent greater ecological connectivity and permeability, while the red areas indicate lower ecological connectivity. The protected areas are shown in green. Thus, the habitats outside the protected areas, depicted in blue shades, should be conservation priorities for a landscape conservation strategy, as proposed in the NBSAP (Wikramanayake and Buthpitiya, 2017).

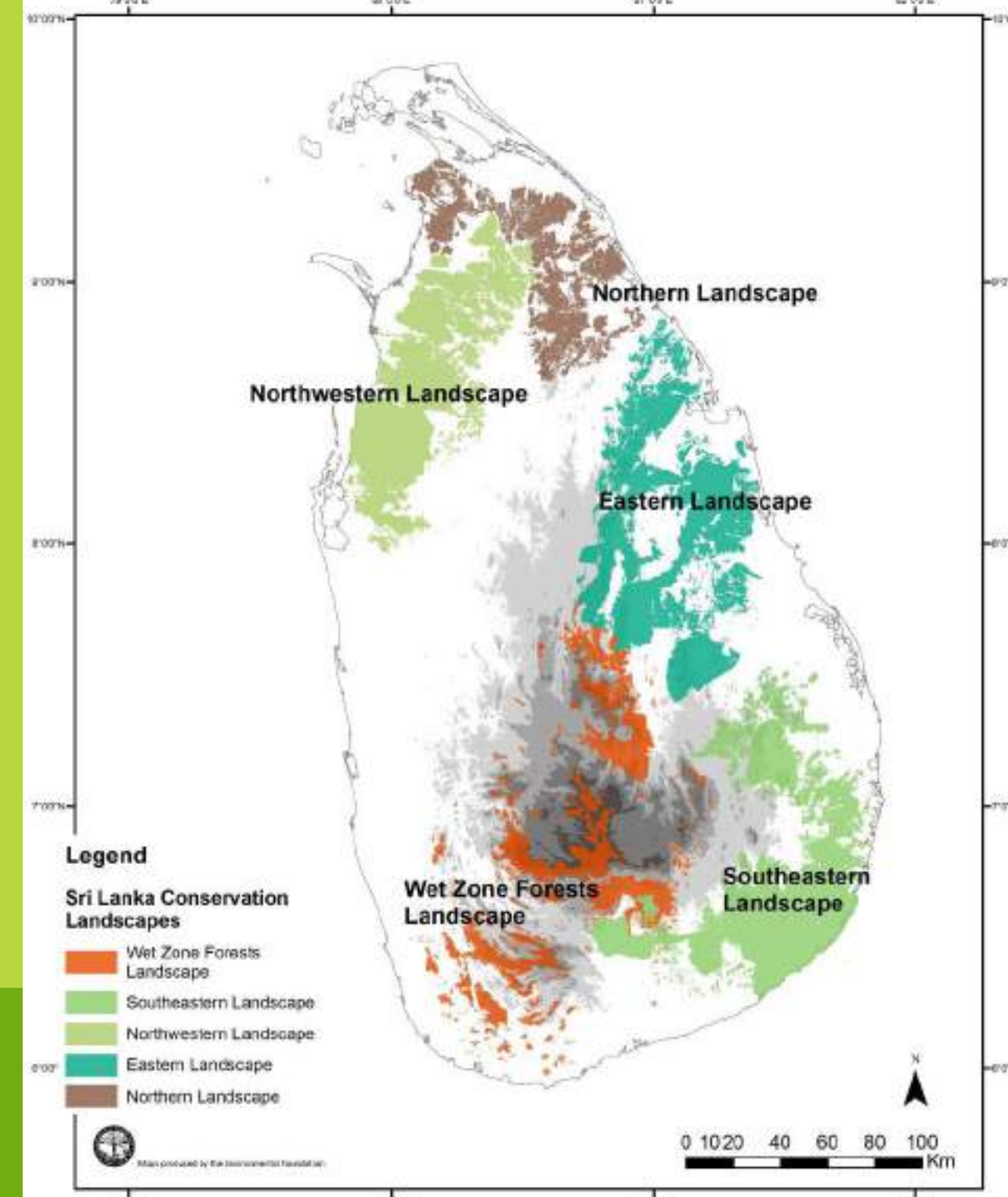


Figure 4.29. Conservation landscapes proposed as part of an overall conservation strategy based on the distribution of biodiversity, habitats, protected areas, and conservation potentials and priorities.

5

CONSERVATION REQUIREMENTS



Wallet Wreck (MW)

Conservation Requirements for Selected Fauna

Taxonomic Group	Main conservation requirements	Areas for further research and study	Specific locations/areas to be prioritised for conservation (declared as PAs etc.,)
Scorpions	<ul style="list-style-type: none"> Conservation and protection forests habitats, especially in wet zone Protection of the remaining, fragmented forest patches in Kandy district Protection of rock crevices 	<ul style="list-style-type: none"> Field surveys to identify population and distribution patterns 	<ul style="list-style-type: none"> All forest habitats (especially with mature trees)
Spiders	<ul style="list-style-type: none"> Awareness of the ecosystem services to the local community 	<ul style="list-style-type: none"> Life history, ecology, breeding, feeding and predation of species 	<ul style="list-style-type: none"> Gannoruwa forest Moraella forest Isolated, unprotected forest patches around the country
Freshwater Crabs	<ul style="list-style-type: none"> Increased public awareness Establishment of research centres and publication of studies 	<ul style="list-style-type: none"> Further studies on distribution, reproduction, captive breeding and food sources Identification and description of new species 	<ul style="list-style-type: none"> Habitats of <i>Pastilla dacuna</i> sp. Avissawella Diyahoda ella Urban area in Labugama Peak Wilderness Morningside Pitawala pathana Seera Ella Kirimatiya Kanda and Riverstone areas Horton plains Ruupaha Elk plain Ritigala area Minneriya Dolukanda area Monaragala
Odonates	<ul style="list-style-type: none"> Proper land use planning Conservation of wetlands Improve habitat connectivity through riparian vegetation and green cover along elevation gradient Prevent riparian vegetation clearance in rivers/streams Reforestation of riparian areas Monitor mini-hydro power plants to ensure maintenance of ecological flow Conserve watershed areas of tanks Promote soil conservation practices in agricultural lands to minimize agricultural runoff to water bodies Promote eco-friendly home gardens Conduct capacity building for odonata research and conservation 	<ul style="list-style-type: none"> Breeding biology of odonates Habitat requirements of adult and larval stages of odonates Impact of different aquatic pollutants and soil erosion on odonata communities Impact of changing climatic patterns and the ability of odonates to adapt to it Methods to manage habitats to improve odonate diversity in anthropogenic areas Distribution and status of threatened and data deficient species Larval taxonomy of Sri Lankan odonates Biogeography of Sri Lankan odonates and presence of evolutionary significant units Importance of odonates in disease vectors and pest control (this can be used to promote odonata conservation) 	<ul style="list-style-type: none"> Thammannagala and Minneriya Kiri Oya, outside Minneriya NP Panwila and Pulmude Coastal wetlands of Mannar and Chundikulam region Forests in Welu Oya, Kalthota areas Riverine forest in Ranella area Colombo wetland complex Bolgoda wetland complex (entire area) Kirala kale and Nadugala marshes Gongala mountain Small forest fragments surrounding Sinharaja Surrounding riparian habitats and forest fragments surrounding Kitulgala/Makandawa forest reserve

Taxonomic Group	Main conservation requirements	Areas for further research and study	Specific locations/areas to be prioritised for conservation (declared as PAs etc.,)
Termites, Thrips, Ants, Bees, Cantharoid Beetles, Moths	<ul style="list-style-type: none"> Conserve habitats Promote sustainable use of agrochemicals Reduce light pollution (e.g. use of lights that emit less UV and reduce use of mercury vapour lights) 	<ul style="list-style-type: none"> Complete study of the diversity and distribution of specified taxa Field studies to investigate the direct and indirect impacts of pesticide and other anthropogenic effects Further studies on nesting, reproduction, feeding patterns 	<ul style="list-style-type: none"> Specific parts of the coastal zone after a complete study Wet environment, decaying debris Montane area
Butterflies	<ul style="list-style-type: none"> Active legal action against illegal land clearance and construction Control spread of invasive plant species Careful designing and monitoring of irrigation projects to maintain freshwater flows Reforest monoculture plantations and Pinus plantations with native vegetation Regulate collection of firewood Conduct reforestation programs to ensure canopy cover Prohibit encroachment by proper boundary demarcation Link disjunct natural forest habitats using corridors Demarcate upper catchment areas and plant native vegetation 	<ul style="list-style-type: none"> Effects of varying rainfall patterns on population densities and seasonal dynamics of species Breeding ecology and dynamics of species with very low population densities (e.g. Green's silverline, White Hedge Blue, Plain Hedge Blue) Canopy studies in rain forests to identify new species 	<ul style="list-style-type: none"> Arippu (Flood plain of Malwathu Oya) Poonarin peninsular including sand dunes
Landsnails	<ul style="list-style-type: none"> Prevent fragmentation and loss of habitats Promote sustainable use of agrochemicals Monitor illegal wildlife trading of shells, Regulate spread of invasive species Increased awareness on native snails. 	<ul style="list-style-type: none"> Conduct further research on the ecology and distribution of land snails of Sri Lanka, with particular emphasis on the endemic and relict taxa which in turn would help to identify the land snails hotspots for conservation and to understand their evolutionary biogeography. 	
Echinoids	<ul style="list-style-type: none"> Reduce coastal pollution Eliminate destructive fishing practices (e.g. bottom trawling) Monitor and regulate coastal constructions and law enforcement for illegal construction Increase awareness and education on lesser known marine taxa 	<ul style="list-style-type: none"> Assessment of population dynamics of sea urchins Studies on ecology and biology of Sri Lankan echinoids specially on irregular echinoids Conduct species surveys and population studies in Northern and Eastern Provinces 	<ul style="list-style-type: none"> Gulf of Mannar area Southern coast Eastern coast

Taxonomic Group	Main conservation requirements	Areas for further research and study	Specific locations/areas to be prioritised for conservation (declared as PAs etc.,)
Freshwater Fish	<ul style="list-style-type: none"> Implement National Biodiversity Strategic Action Plan Proper law enforcement and amendment of existing rules and regulations Erect fish passes at every barrier along the river 	<ul style="list-style-type: none"> Studies on larval and migration patterns of gobies including their reproduction in natural habitats, and impacts of varying environmental factors (e.g. hydrology, climate change) on their biology 	<ul style="list-style-type: none"> From natural habitats to confluential points Lowland marshlands All the known localities of this species should be protected. Known locations outside of PAs
Amphibians	<ul style="list-style-type: none"> Demarcate buffer zone, Improve habitat quality Enforce law to prohibit illegal activities such as felling, man-made fires and encroachment Strengthen monitoring mechanisms by increasing staff and facilities in DWC and FD Prevent cardamom cultivation and gem mining in sensitive areas Improve garbage disposal systems, Reduce reliance on agrochemicals and promote indigenous agricultural practices, Improved sanitation Regulate the entrance of domesticated animals into protected areas 	<ul style="list-style-type: none"> Island-wide species surveys, Population studies Behavioural and breeding ecology, Impacts of climate change, forest die-back and air pollution Further studies on isolated mountains 	<ul style="list-style-type: none"> Increase the conservation status in canyon catchment area Upgrade Maragala-Geelong complex to PA status
Reptiles	<ul style="list-style-type: none"> Strengthen law enforcement Establish a joint monitoring mechanism Promote eco-friendly farming practices, Introduce sustainable tourism practices Establish sustainable waste management practices, Demarcate boundaries, including buffer zone and exhibit sign boards Create alternative livelihoods for the community Establish habitat connectivity 	<ul style="list-style-type: none"> Conduct distribution studies, population density studies and baseline surveys Study on insect repellent light sources Research on impacts of farming practices on Herpetofauna 	<ul style="list-style-type: none"> Gammaduwa Zonation and establishment of a SNR in Udamaliboda Dolosbage hills Sooriyakanda, Gonagala, Handapan ella Morapitiya -Runa Kanda Kavudarimune (Poonarin)
Birds	<ul style="list-style-type: none"> Identify non-protected hotspots for birds and declare as PAs Elevate the legal protection status of existing PAs Reduce fragmentation effect of habitats by connecting habitats by green corridors 		

Taxonomic Group	Main conservation requirements	Areas for further research and study	Specific locations/areas to be prioritised for conservation (declared as PAs etc.,)	
Birds (contd.)	<ul style="list-style-type: none"> Streamline the EIA process, reviewing process, environmental monitoring and enforcements in development projects Regulate adverse tourism activities, Redesign the road network to reduce pressures from over-visitation Declare internationally recognised PAs (Ramsar, MABs, IBAs, UNESCO world heritage sites) Enrich the habitats and connectivity in home gardens and agricultural areas in the buffer zone of parks. Amend the legal framework to address current conservation issues and support better enforcement Prevent filling of inland and coastal wetlands and alteration of coastal habitats Establish mechanisms to protect breeding habitats of Critically Endangered species Regulate the usage agro-chemicals affecting wild bird populations, Promote multi-crop plantation by introducing economic benefits and subsidies Better regulation of traditional and commercial fishing practices Recognize and protect the major migratory routes and stop-over sites for migratory sites 	<ul style="list-style-type: none"> Better regulation of traditional and commercial fishing practices Determine effects of pollutants and agro-chemicals of avifauna Breeding ecology and phenological studies of endemics and threatened species Determine migratory routes and stop-over sites of migratory birds Population trend analysis for raptors and insectivorous species, Impact of human induced fires on avifauna (Savannah) Targeted studies on the impact of infrastructure developments and energy production technologies 		

Taxonomic Group	Main conservation requirements	Areas for further research and study	Specific locations/areas to be prioritised for conservation (declared as PAs etc.,)
Mammals	<ul style="list-style-type: none"> Enforce laws and regulations stringently Protect all unprotected but important natural habitats including wetlands, hillocks, villus, and forest patches under appropriate forestry categories Eradicate alien species in forest plantations (e.g. Eucalyptus, Pine) Streamline EIA processes to assess cumulative impacts Strengthen monitoring and demarcate boundaries to prevent illegal encroachment Create habitat corridors to link PAs. Provide measures to ensure safe and free movement of wildlife to seasonal tanks Implementing measures to reduce Human-wildlife conflict. 		

Conservation Requirements for Selected Flora

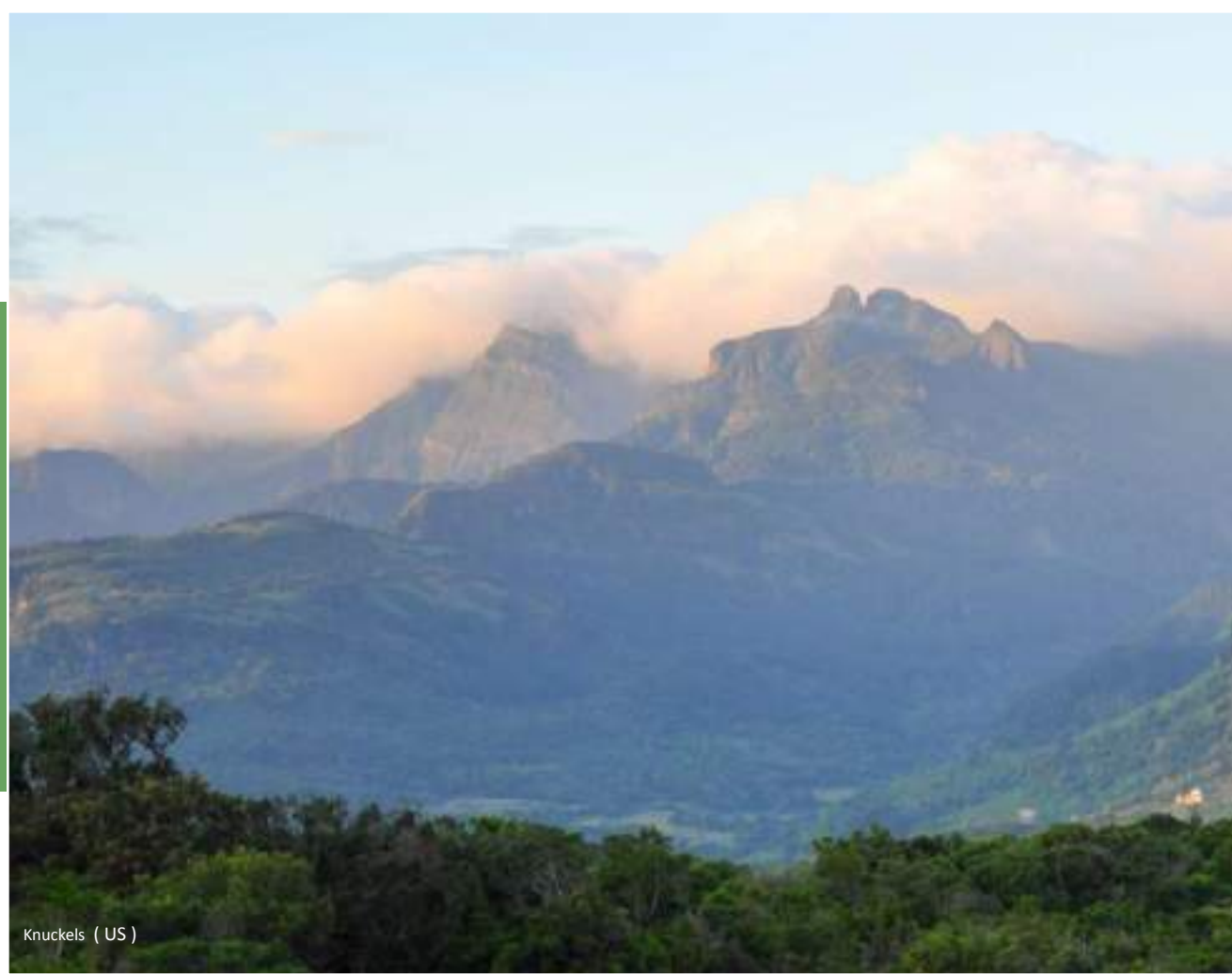
Taxonomic Group	Main conservation requirements	Areas for further research and study	Specific locations/areas to be prioritised for conservation (declared as PAs etc.,)
Higher Flora	<ul style="list-style-type: none"> Implement measures proposed in the UN-REDD action plan Provide incentives to communities residing around the riverine forests to protect the ecosystem Gradually convert exotic forest plantations in buffer zones into natives Mitigate soil erosion and restore bank vegetation both within and outside riverine forests in all forests under Land Reclamation Corporation 	<ul style="list-style-type: none"> Clearly defined forest boundaries Multistorey agroforestry Field based taxonomic studies, backed by molecular data. 	<ul style="list-style-type: none"> Knuckles Conservation Forest and its buffer zone Namunukula Sooriyakanda All forest plantation over 5000 ft Eastern slopes of Pidurutthalagala Eastern and western slopes of Ambagamuwa Dolosbage and Windsor Forest Kokagala Monaragala Dolukanda Isolated hill tops and wet isolated forest patches of Passara and Lunugala areas Nadunkerny forested area Moragahakanda area Kiriama Ulpata forests Kaluganga development area (outliers) Vegetation around hotwater spring in Mahaoya Tampitiya Lahugala Kithulana Ulanuge Bundala Palatupana Mannar area Manampitiya Handapanvilluwa Ussangoda Yudaganawa
Orchids	<ul style="list-style-type: none"> Halt deforestation, unplanned development and habitat loss Reduce man-made forest fires Reduce extensive use of agrochemicals that affect pollinators Mitigate spread of invasive plants Reduce land clearances, especially in the upper catchment areas Strict enforcement of law to prohibit illegal collection for private horticulture collections. Mitigate impacts of climate change 	<ul style="list-style-type: none"> Extensive study of ecology of species, their symbiosis relationships with other species and pollinators Micro habitats for different species Socio-economic-political aspects towards orchids and their conservation in terms of economic benefits such as growing as ornamental or medicinal crops 	<ul style="list-style-type: none"> Rakwana Hills Nilgala area Moraella Forest in Knuckles Region Peak Wilderness foothills Kitulgala region Weliyoa Kalthota savanna forests

Taxonomic Group	Main conservation requirements	Areas for further research and study	Specific locations/areas to be prioritised for conservation (declared as PAs etc.,)
Ferns and Lichens	<ul style="list-style-type: none"> Increased awareness of scientists and general public 	<ul style="list-style-type: none"> Extensive research on Bryophytes Updated checklist for selected taxa Updated herbarium specimen collection Ecosystem valuation studies 	<ul style="list-style-type: none"> Central Highlands

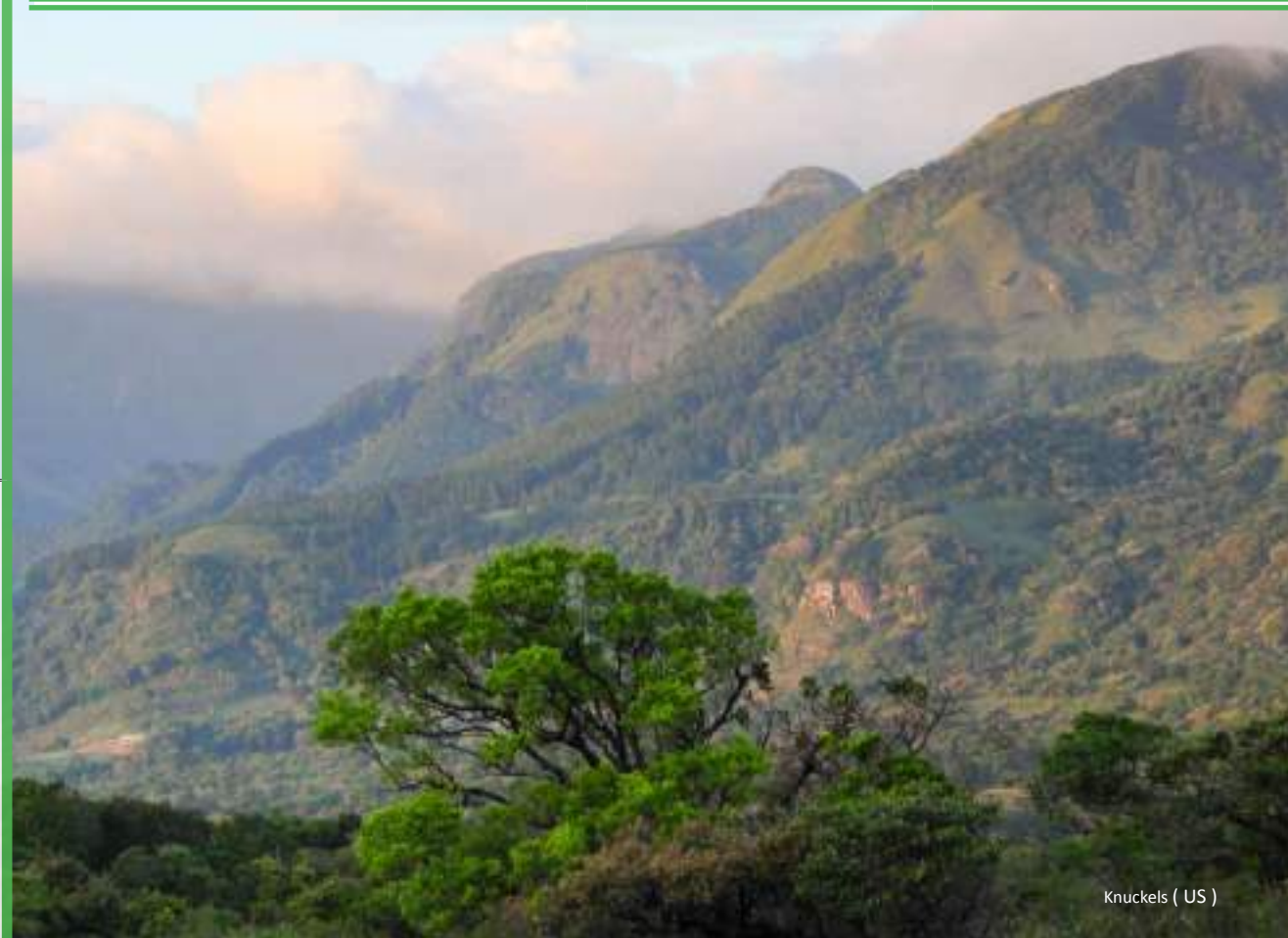
Conservation Requirements for Selected Ecosystems

Taxonomic Group	Main conservation requirements	Areas for further research and study	Specific locations/areas to be prioritised for conservation (declared as PAs etc.,)
Mangroves	<ul style="list-style-type: none"> Strengthen EIA process and prevent haphazard development projects (e.g. shrimp aquaculture farms) Reduce pollution Control spread of invasive plant species Conduct awareness programs (schools, local community, relevant stakeholders) Develop a strong interagency coordination between relevant stake holders Conduct training sessions for boat operators, fishermen etc., Conduct mangrove replanting programs only following proper site selection 	<ul style="list-style-type: none"> Conduct a national baseline study of mangrove ecosystems 	<ul style="list-style-type: none"> Tambalagamuwa Bay Wilpattu and Gange Wadiya Bundala Adams Bridge Delft
Seagrass	<ul style="list-style-type: none"> Improve natural seawater inflow Reduce land-based pollution Avoid operation of harmful fishing gears and activities such as dynamiting and bottom trawling Prevent seaweed cultivation over seagrass beds Increasing public awareness of the value of seagrass ecosystems among coastal and other communities. 	<ul style="list-style-type: none"> Impacts of sedimentation and hydrological changes Seasonal changes in species diversity Systematic research should be promoted to document the current distribution pattern and habitat status of seagrass beds. Extensive study of the ecology of species, their symbiosis relationships with other species. 	<ul style="list-style-type: none"> Kadolkelle Pambala Puttalam Lagoon Battalangunduwa to Mannar Islands. Mannar Islands to Jaffna Lagoon especially Vedithalathiwu area (including Delft) Habitats having <i>Halophila beccarii</i>.

Taxonomic Group	Main conservation requirements	Areas for further research and study	Specific locations/areas to be prioritised for conservation (declared as PAs etc.,)
Seagrass (contd.)	<ul style="list-style-type: none"> Demarcation of existing seagrass beds and strengthening protection. Restoration of degraded seagrass meadows. 	<ul style="list-style-type: none"> Island wise comprehensive genetic study along with comprehensive mapping is essential. Restoration feasibility through scientific basis and technology transfer mechanism. Climate change vulnerability studies, adaptation measures and carbon storage potential in seagrass meadows. 	
Marine	<ul style="list-style-type: none"> Reduce fishing pressure eliminate destructive practices (e.g. bottom trawling, dynamite fishing etc.) Reduce pollution Monitor and regulate fishing activities Reduce pressure from tourism on coastal and marine habitats Prepare a marine spatial plan for identified six zones 	<ul style="list-style-type: none"> Assess impacts of fisheries and potential alternatives Extent and distribution of seagrass and dugongs Wave dynamics, Reassessment of biodiversity and abundance in every zone Marine mammals in Trincomalee Canyon, Population, distribution and migration patterns of marine mammals, Impacts of tourism pressure on marine mammals (e.g. pollution due to tourism boats) 	<ul style="list-style-type: none"> Silavatura area



Knuckles (US)



Knuckles (US)

6

KEY RECOMMENDATIONS

1. In summary, loss of biodiversity in Sri Lanka is mainly due to following six threats.
- 1.1. River diversion
 - 1.2. Habitat fragmentation and loss of physio chemical characteristics of ecosystems
 - 1.3. Pollution from both organic and inorganic waste
 - 1.4. Over exploitation
 - 1.5. Spread of invasive species
 - 1.6. Climate change

The threats mentioned above, unless addressed now, will result in irreversible loss of biodiversity and in turn, the direct and indirect services from species and their ecosystems. A careful look at the current policies and legislations also reveal, despite few gaps, Sri Lanka has sufficient provisions and institutional set ups to **initiate strategic actions against these six threats**. Hence, it is recommended that all stakeholders address these threats. This report provides the baseline as well as information regarding the severity and spread of threats specific to each taxa in each zone. It is suggested that agencies mandated to conserve biodiversity and ecosystems, allocate financial and human resources accordingly.

2. **Synergy between agencies** and open, honest discussions in engaging grass root level communities is vital. This report revealed the disparities in level of knowledge on national policies, action plans between national level stakeholders and others. Despite the presence of channels for greater engagement, a reluctance and a mistrust between developers and conservationist has often resulted in catastrophic environmental consequences. Ministry of Land and Ministry of Environment need to create a pathway for greater synergies and for win-win solutions. Most importantly, an apex body that has the power to coordinate the activities of various government departments vested with the responsibility of environment needs to be established as wildlife, forest, biodiversity and marine environments have never been under one agency.

3. Similarly, youth should be encouraged to be engaged and involved in decision making. Youth are under-represented and their level of awareness on biodiversity is not satisfactory. Hence, **resources should be allocated to stimulate youth for greater involvement** and to change their attitudes towards nature.

4. **Valuation of ecosystem services and use of such data in decision making processes** is vital.

5. **Conducting strategic environmental assessments for energy, fisheries and aquaculture, irrigation, agriculture and coastal development** to create synergies between institutions is vital. This will enable the formulation of an overall plan, for the development of the country whilst safeguarding the biodiversity and the services from ecosystems. As river diversions have emerged as one of the greatest threats to biodiversity, above mentioned strategic assessments will enable correct decision making.

6. This report also revealed that **funds are available for biodiversity and ecosystem conservation** and opportunities for funding has been revealed from the Biodiversity Finance Initiative (BIOFIN). However, **channeling of funding to grassroot level communities and areas of conservation importance** still remains a challenge as well as sharing of income and wealth management by resource users to curb the need for constant funding by the government sector. Hence, **alternative approaches such as greater involvement of national planning, banking sector as well as private entities should be encouraged and the environmental sector should cooperate with such initiatives**.

7. Implementing the Clearing House Mechanism (CHM) and data sharing will enable **implementing already existing plans** and building on existing knowledge. Most urgently, an institution by mandate, should be vested with this responsibility of data governance and data transparency.

8. This report also recommends allocation of funding and resources for **research beyond charismatic species**. Research should also focus on broader ecological roles played by species, habitat needs, in-situ and ex-situ conservation, restoration of ecosystems, genetic diversity and uses.

9. **Greater attention to ocean, species and their conservation** is also recommended. Identifying the drivers that stress the ocean and its habitants and implementing appropriate remedial measures are important.

10. Seeking novel pathways for protection of ecosystems is paramount. This report revealed that a greater part of endemic flora and fauna are distributed in the wet and montane zones that have the least percentage of protected areas. Hence, **safeguarding biodiversity outside protected areas and systematic interventions to link and expand the five protected area clusters (Figure 4.29.) identified in this report** should be commenced without further delay.

REFERENCES

Calotes versicolor (SW)





Ramalina sp. (SS)

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APPENDIX 1

Family	Scientific Name	Common Name	Species Status
Buthidae	<i>Buthoscorpio sarasinorum</i> (Karsch, 1892)		Endemic
Buthidae	<i>Charmus laneus</i> Karsch, 1879		Endemic
Buthidae	<i>Charmus saradieli</i> Kovařík, Lowe, Ranawana, Hoferek, Jayarathne, Plíšková, & Štáhlavský 2016		Endemic
Buthidae	<i>Hottentotta tamulus</i> (Fabricius, 1798)	Indian Red Scorpion	Exotic
Buthidae	<i>Isometrus maculatus</i> (De Geer, 1778)	Lesser Brown Scorpion	Indigenous
Buthidae	<i>Isometrus thwaitesi</i> Pocock, 1897		Endemic
Buthidae	<i>Lychas srilankensis</i> Lourenço, 1997		Endemic
Buthidae	<i>Reddyanus basilicus</i> (Karsch, 1879)		Endemic
Buthidae	<i>Reddyanus besucheti</i> (Vachon, 1982)		Endemic
Buthidae	<i>Reddyanus ceylonensis</i> Kovařík, Lowe, Ranawana, Hoferek, Jayarathne, Plíšková, & Štáhlavský 2016		Endemic
Buthidae	<i>Reddyanus jayarathnei</i> Kovařík, Lowe, Ranawana, Hoferek, Jayarathne, Plíšková, & Štáhlavský 2016		Endemic
Buthidae	<i>Reddyanus loebli</i> (Vachon, 1982)		Endemic
Buthidae	<i>Reddyanus ranawanai</i> Kovařík, Lowe, Ranawana, Hoferek, Jayarathne, Plíšková, & Štáhlavský 2016		Endemic
Chaerilidae	<i>Chaerilus ceylonensis</i> Pocock, 1894		Endemic
Scorpionidae	<i>Heterometrus gravimanus</i> (Pocock, 1894)		Indigenous
Scorpionidae	<i>Heterometrus indus</i> (De Geer, 1778)	Giant Forest Scorpion	Endemic
Scorpionidae	<i>Heterometrus serratus</i> (Pocock, 1900)		Endemic
Scorpionidae	<i>Heterometrus swammerdami</i> Simon, 1872		Indigenous
Hemiscorpionidae	<i>Liocheles australasiae</i> (Fabricius, 1775)	Dwarf Wood Scorpion	Indigenous



Charmus laneus (AS)

Appendix 01:
List of Scorpions of Sri Lanka

Family	Scientific Name	Common Name	Species Status	National Conservation Status
Theridiidae	<i>Kochiura aulica</i> (C. L. Koch, 1838)		Indigenous	DD
Theridiidae	<i>Latrodectus erythromelas</i> Schmidt & Klaas, 1991		Endemic	DD
Theridiidae	<i>Latrodectus hasselti</i> Thorell, 1870	E: Red-back Spider	Indigenous	CR
Theridiidae	<i>Molione trispinosa</i> (O. P.-Cambridge, 1873)		Endemic	DD
Theridiidae	<i>Moneta spinigera</i> O. P.-Cambridge, 1870		Indigenous	DD
Theridiidae	<i>Nesticodes rufes</i> (Lucas, 1846)		Indigenous	DD
Theridiidae	<i>Parasteatoda tepidariorum</i> (C. L. Koch, 1841)		Indigenous	DD
Theridiidae	<i>Parasteatoda mundula</i> (L. Koch, 1872)	E: Comb-footed Platform Spider	Indigenous	EN
Theridiidae	<i>Phoroncidia nasuta</i> (O. P.-Cambridge, 1873)		Indigenous	DD
Theridiidae	<i>Phoroncidia septemaculeata</i> O. P.-Cambridge, 1873		Endemic	DD
Theridiidae	<i>Phoroncidia testudo</i> (O. P.-Cambridge, 1873)		Indigenous	DD
Theridiidae	<i>Phoroncidia thwaitesi</i> O. P.-Cambridge, 1869		Endemic	DD
Theridiidae	<i>Phycosoma spundana</i> (Roberts, 1978)		Indigenous	EN
Theridiidae	<i>Platnickina mneon</i> (Bösenberg & Strand, 1906)		Indigenous	CR
Theridiidae	<i>Propostira quadrangulata</i> Simon, 1894		Indigenous	DD
Theridiidae	<i>Steatoda rufoannulata</i> (Simon, 1899)		Indigenous	DD
Theridiidae	<i>Taphiassa punctigera</i> Simon, 1895		Endemic	DD
Theridiidae	<i>Theridion albomaculosum</i> O. P.-Cambridge, 1869		Endemic	DD
Theridiidae	<i>Theridion ceylonicus</i> Dunlop & Jekel, 2009		Endemic	DD
Theridiidae	<i>Theridion gabardi</i> Simon, 1895		Endemic	DD
Theridiidae	<i>Theridion modestum</i> (Simon, 1894)		Endemic	DD
Theridiidae	<i>Theridion nilgherinum</i> Simon, 1905		Indigenous	DD
Theridiidae	<i>Theridion nodiferum</i> Simon, 1895		Endemic	DD
Theridiidae	<i>Theridion quadratum</i> (O. P.-Cambridge, 1882)		Indigenous	DD
Theridiidae	<i>Theridion teliferum</i> Simon, 1895		Endemic	DD
Theridiidae	<i>Theridula gonygaster</i> (Simon, 1873)	E: Cobweb Spider	Indigenous	EN
Theridiidae	<i>Theridula opulenta</i> (Walckenaer, 1841)		Indigenous	DD
Theridiidae	<i>Thwaitesia margaritifera</i> O. P.-Cambridge, 1881		Indigenous	DD
Theridiosomatidae	<i>Andasta semiargentea</i> Simon, 1895		Endemic	DD
Theridiosomatidae	<i>Ogulnius pullus</i> Bösenberg & Strand, 1906		Indigenous	DD
Theridiosomatidae	<i>Theridiosoma genevensium</i> (Brignoli, 1972)		Endemic	DD
Thomisidae	<i>Amyciae forticeps</i> (O. P.-Cambridge, 1873)		Indigenous	LC
Thomisidae	<i>Boliscus decipiens</i> O. P.-Cambridge, 1899		Endemic	DD
Thomisidae	<i>Borboropactus asper</i> (O. P.-Cambridge, 1884)		Endemic	DD
Thomisidae	<i>Camaricus formosus</i> Thorell, 1887		Indigenous	DD
Thomisidae	<i>Cebrennius striatipes</i> (Simon, 1897)		Indigenous	DD
Thomisidae	<i>Cymbacha simplex</i> Simon, 1895		Endemic	DD
Thomisidae	<i>Diaea placata</i> O. P.-Cambridge, 1899		Endemic	DD
Thomisidae	<i>Epidius longipalpis</i> Thorell, 1877		Indigenous	DD
Thomisidae	<i>Epidius parvati</i> Benjamin, 2000		Endemic	DD
Thomisidae	<i>Holopelus piger</i> O. P.-Cambridge, 1899		Endemic	DD
Thomisidae	<i>Indoxysticus minutus</i> (Tikader, 1960)		Indigenous	CR
Thomisidae	<i>Lysiteles catulus</i> Simon, 1895		Indigenous	DD
Thomisidae	<i>Monaeses attenuatus</i> O. P.-Cambridge, 1899		Endemic	DD
Thomisidae	<i>Monaeses cinerascens</i> (Thorell, 1887)		Indigenous	DD
Thomisidae	<i>Monaeses greeni</i> O. P.-Cambridge, 1899		Endemic	DD

Family	Scientific Name	Common Name	Species Status	National Conservation Status
Thomisidae	<i>Oxytate subvirens</i> (Strand, 1907)	E: Sri Lanka Elongated Green Crab Spider; S: Digu Kola Kakulu Makuluwa	Endemic	NT
Thomisidae	<i>Oxytate taprobane</i> Benjamin, 2001		Endemic	CR
Thomisidae	<i>Pagida salticiformis</i> (O. P.-Cambridge, 1883)		Endemic	DD
Thomisidae	<i>Peritraeus hystrix</i> Simon, 1895		Endemic	DD
Thomisidae	<i>Phrynarachne ceylonica</i> (O. P.-Cambridge, 1884)		Indigenous	DD
Thomisidae	<i>Phrynarachne decipiens</i> (Forbes, 1883)		Indigenous	CR
Thomisidae	<i>Phrynarachne fatalis</i> O. P.-Cambridge, 1899		Endemic	DD
Thomisidae	<i>Phrynarachne rothschildi</i> Pocock & Rothschild, 1903		Endemic	DD
Thomisidae	<i>Platythomisus sudeepi</i> Biswas, 1977		Indigenous	
Thomisidae	<i>Runcinia bifrons</i> (Simon, 1895)		Indigenous	DD
Thomisidae	<i>Stiphropus sigillatus</i> (O. P.-Cambridge, 1883)		Endemic	DD
Thomisidae	<i>Tagulis mystacinus</i> Simon, 1895		Endemic	DD
Thomisidae	<i>Talaus oblitus</i> O. P.-Cambridge, 1899		Endemic	DD
Thomisidae	<i>Tarocanus capra</i> Simon, 1895		Endemic	DD
Thomisidae	<i>Thomisus callidus</i> (Thorell, 1890)		Indigenous	DD
Thomisidae	<i>Thomisus elongatus</i> Stoliczka, 1869		Indigenous	DD
Thomisidae	<i>Thomisus granulifrons</i> Simon, 1906		Indigenous	DD
Thomisidae	<i>Thomisus pugilis</i> Stoliczka, 1869		Indigenous	DD
Thomisidae	<i>Thomisus spectabilis</i> Doleschall, 1859		Indigenous	DD
Thomisidae	<i>Thomisus stoliczkae</i> (Thorell, 1887)		Indigenous	DD
Thomisidae	<i>Tmarus fasciolatus</i> Simon, 1906		Indigenous	DD
Thomisidae	<i>Tmarus taiwanus</i> Ono, 1977		Indigenous	CR
Titanoecidae	<i>Pandava laminata</i> (Thorell, 1878)		Indigenous	DD
Udubidae	<i>Campostichomma alawala</i> Polotow & Griswold, 2017		Indigenous	
Udubidae	<i>Campostichomma harasbedda</i> Polotow & Griswold, 2017		Indigenous	
Udubidae	<i>Campostichomma manicatum</i> Karsch, 1892		Endemic	
Udubidae	<i>Campostichomma mudduk</i> Polotow & Griswold, 2017		Indigenous	
Uloboridae	<i>Hyptiotes analis</i> Simon, 1892		Endemic	DD
Uloboridae	<i>Miagrammopes ferdinandi</i> O. P.-Cambridge, 1870		Endemic	DD
Uloboridae	<i>Miagrammopes thwaitesi</i> O. P.-Cambridge, 1870		Indigenous	DD
Uloboridae	<i>Uloborus bigibbosus</i> Simon, 1905		Indigenous	DD
Uloboridae	<i>Uloborus umboniger</i> Kulczynski, 1908*		Endemic	DD
Uloboridae	<i>Zosis geniculata</i> (Olivier, 1789)	E: Grey House Spider/ Common House Cribellate Orb Weaver; S: Podu Peeru Dal Viyanna	Indigenous	LC
Zodariidae	<i>Cryptothele ceylonica</i> O. P.-Cambridge, 1877		Endemic	DD
Zodariidae	<i>Habronestes bradleyi</i> (O. P.-Cambridge, 1869)		Indigenous	DD
Zodariidae	<i>Hermippus cruciatus</i> Simon, 1905		Indigenous	DD
Zodariidae	<i>Suffasia attidiya</i> Benjamin & Jocqué, 2000		Endemic	CR
Zodariidae	<i>Suffasia mahasumana</i> Benjamin & Jocqué, 2000		Endemic	DD
Zorocratidae	<i>Devendra amaiti</i> Polotow & Griswold, 2017		Indigenous	
Zoropsidae	<i>Devendra pardalis</i> (Simon, 1898)		Endemic	DD
Zoropsidae	<i>Devendra pumilus</i> (Simon, 1898)		Endemic	DD
Zoropsidae	<i>Devendra saama</i> Polotow & Griswold, 2017		Indigenous	
Zoropsidae	<i>Devendra seriatus</i> (Simon, 1898)		Endemic	DD

APPENDIX 3



Arthrospheidae (HK)

Appendix 03:
List of Milipedes of Sri Lanka.

APPENDIX 4



Oziotelphusa hippocastagum (ZA)

Appendix 04: List of Freshwater Crabs of Sri Lanka.

Family	Scientific Name	Species Status
Arthrospiraeridae	<i>Arthrospiraera attemsi</i> Jeekel, 2011	Native
Arthrospiraeridae	<i>Arthrospiraera brandtii</i> (Humbert, 1865)	Native
Arthrospiraeridae	<i>Arthrospiraera corrugata</i> (Butler, 1872)	Endemic
Arthrospiraeridae	<i>Arthrospiraera dentigera</i> Verhoeff, 1930	Endemic
Arthrospiraeridae	<i>Arthrospiraera inermis</i> (Humbert, 1865)	Native
Arthrospiraeridae	<i>Arthrospiraera leopardina</i> (Butler, 1872)	Endemic
Arthrospiraeridae	<i>Arthrospiraera noticeps</i> (Butler, 1872)	Endemic
Arthrospiraeridae	<i>Arthrospiraera pillifera</i> (Butler, 1872)	Endemic
Arthrospiraeridae	<i>Arthrospiraera ruginosa</i> Jeekel, 2001	Endemic
Arthrospiraeridae	<i>Arthrospiraera rugos</i> Verhoeff, 1930	Endemic
Arthrospiraeridae	<i>Arthrospiraera versicolor</i> (White, 1859)	Endemic
Cambalopsidae	<i>Podoglyphiulus ceylanicus</i> Attems, 1909	Endemic
Cambalopsidae	<i>Trachyjulus aelleni</i> Mauries, 1981	Endemic
Cambalopsidae	<i>Trachyjulus ceylanicus</i> Peters, 1864	Native
Cambalopsidae	<i>Trachyjulus costatus</i> Verhoeff, 1936	Endemic
Cambalopsidae	<i>Trachyjulus humberti</i> Carl, 1911	Endemic
Cambalopsidae	<i>Trachyjulus lankanus</i> Mauries, 1981	Endemic
Cambalopsidae	<i>Trachyjulus minor</i> Silvestri, 1923	Endemic
Cambalopsidae	<i>Trachyjulus willeyi</i> Carl, 1941	Endemic
Cambalopsidae	<i>Trachyjulus willeyi montanus</i> Mauries, 1981	Endemic
Cryptodesmidae	<i>Pocodesmus greeni</i> (Pocock, 1892)	Endemic
Cryptodesmidae	<i>Singhalocryptus alticola</i> Hoffman, 1977	Endemic
Cryptodesmidae	<i>Singhalocryptus ceylonicus</i> (Pocock, 1892)	Endemic
Fuhrmannodesmidae	<i>Lankadesmus cognatus</i> (Humbert, 1865)	Endemic
Glomeridesmidae	<i>Termitodesmus ceylonicus</i> Silvestri, 1911	Endemic
Glomeridesmidae	<i>Termitodesmus escherichi</i> Silvestri, 1911	Endemic
Harpagophoridae	<i>Harpurostreptus robustior</i> Attems, 1936	Endemic
Harpagophoridae	<i>Harpurostreptus attemsi</i> Carl, 1941	Endemic
Harpagophoridae	<i>Harpurostreptus hamifer</i> (Humbert, 1865)	Native
Harpagophoridae	<i>Harpurostreptus krausi</i> Demange, 1962	Native
Harpagophoridae	<i>Harpurostreptus matarae</i> Carl, 1941	Endemic
Harpagophoridae	<i>Humbertostreptus lunellii</i> (Humbert, 1865)	Endemic
Harpagophoridae	<i>Ktenostreptus anderssoni</i> Demange, 1961	Endemic
Harpagophoridae	<i>Ktenostreptus anulipes</i> Attems, 1909	Endemic
Harpagophoridae	<i>Ktenostreptus centrurus</i> (Pocock, 1892)	Endemic
Harpagophoridae	<i>Ktenostreptus costulatus</i> Attems, 1914	Endemic
Harpagophoridae	<i>Ktenostreptus lankaensis</i> (Humbert, 1865)	Native
Harpagophoridae	<i>Ktenostreptus rugulosus</i> Attems, 1936	Endemic
Harpagophoridae	<i>Ktenostreptus specularis</i> Attems, 1936	Native
Harpagophoridae	<i>Leptostreptus caudiculatus</i> (Karsh, 1881)	Native
Harpagophoridae	<i>Leptostreptus exiguus</i> (Attems, 1950)	Endemic
Harpagophoridae	<i>Leptostreptus fuscus</i> Attems, 1936	Endemic
Harpagophoridae	<i>Phyllogonostreptus nigrolabiatus</i> (Newport, 1844)	Native
Harpagophoridae	<i>Stenurostreptus stenorhynchus</i> (Pocock, 1893)	Endemic
Harpagophoridae	<i>Thyropygus poseidon</i> attems, 1936	Endemic
Lankasomatidae	<i>Lankasoma anderssoni</i> Mauries, 1981	Endemic
Lankasomatidae	<i>Lankasoma brincki</i> Mauries, 1981	Endemic
Lankasomatidae	<i>Lankasoma cederholmi</i> Mauries, 1981	Endemic
Lankasomatidae	<i>Lankasoma oreites</i> Mauries, 1981	Endemic
Lankasomatidae	<i>Lankasoma mahleri</i> Mauries, 1982	Endemic
Lankasomatidae	<i>Cingaosoma anderssoni</i> Mauries, 1982	Endemic
Pachybolidae	<i>Xenobolus carnifex</i> (Fabricius, 1775)	Native

Family	Scientific Name	Species Status
Paradoxosomatidae	<i>Anoplodesmus anthracinus</i> (Pocock, 1895)	Native
Paradoxosomatidae	<i>Anolodesmis humberti</i> (Carl, 1902)	Endemic
Paradoxosomatidae	<i>Anoplodesmus layardi</i> (Hubert, 1865)	Endemic
Paradoxosomatidae	<i>Anoplodesmus luctuosus</i> (Peters, 1864)	Native
Paradoxosomatidae	<i>Anolodesmus inornatus</i> (Humbert, 1865)	Endemic
Paradoxosomatidae	<i>Anoplodesmus sabulosus</i> Attems, 1898	Endemic
Paradoxosomatidae	<i>Anoplodesmus saussurii</i> (Humbert, 1865)	Native
Paradoxosomatidae	<i>Anoplodesmus simplex</i> (Humbert, 1865)	Endemic
Paradoxosomatidae	<i>Anoplodesmus thwaitesii</i> (Humbert, 1865)	Endemic
Paradoxosomatidae	<i>Chondromorpha kelaarri</i> (Humbert, 1865)	Native
Paradoxosomatidae	<i>Chondromorpha stadelmanni</i> (Verhoeff, 1930)	Endemic
Paradoxosomatidae	<i>Chondromorpha xanthotricha</i> (Attems, 1898)	Native
Paradoxosomatidae	<i>Desmoxytes planata</i> (Pocock, 1895)	Native
Paradoxosomatidae	<i>Orthomorpha greeni</i> (Pocock, 1892)	Endemic
Paradoxosomatidae	<i>Orthomorpha mikrotropics</i> Attems, 1898	Endemic
Paradoxosomatidae	<i>Pyragrogonus willeyi</i> (Carl, 1932)	Endemic
Paradoxosomatidae	<i>Singhalorthomorpha cingalensis</i> (Humbert, 1865)	Endemic
Paradoxosomatidae	<i>Singhalorthomorpha serrulata</i> (Attems, 1931)	Endemic
Paradoxosomatidae	<i>Singhalorthomorpha skinneri</i> (Humbert, 1865)	Endemic
Paradoxosomatidae	<i>Strongylosoma nietneri</i> (Peters, 1864)	Endemic
Polyxenidae	<i>Silvestrus ceylonicus</i> (Pocock, 1892)	Endemic
Pseudospirobolellidae	<i>Pseudospirobolellus avernus</i> (Butler, 1876)	Native
Pyrgodesmidae	<i>Archandrosdesmus kandyanus</i> Carl, 1932	Endemic
Pyrgodesmidae	<i>Catapyrgodesmus ceylonicus</i> Silvestri, 1920	Endemic
Pyrgodesmidae	<i>Cryptocephalopus jonesii</i> Verhoeff, 1937	Endemic
Pyrgodesmidae	<i>Eustaledesmus parvus</i> Silvestri, 1920	Endemic
Pyrgodesmidae	<i>Klimakodesmus permutatus</i> Attems, 1936	Endemic
Pyrgodesmidae	<i>Pyrgodesmus obscurus</i> Pocock, 1892	Endemic
Pyrgodesmidae	<i>Styloceylonius lobatus</i> Verhoeff, 1936	Endemic
Pyrgodesmidae	<i>Urodesmus serratus</i> Verhoeff, 1936	Endemic
Siphonophoridae	<i>Pterozonium picteti</i> (Humbert, 1865)	Native
Siphonophoridae	<i>Siphonophora humberti</i> Pocock, 1892	Endemic
Spirobolidae	<i>Spirobolus crebristriatus</i> Humbert 1865	Endemic
Spirobolidae	<i>Spirobolus longicollis</i> Pocock, 1892	Endemic
Spirobolidae	<i>Spirobolus longicornis</i> Pocock, 1892	Endemic
Spirobolidae	<i>Spirobolus obtusospinosus</i> Voges, 1878	Endemic
Spirobolidae	<i>Spirobolus spirostreptinus</i> Karsch, 1881	Endemic
Spirobolidae	<i>Spirobolus taprobanensis</i> Humbert, 1865	Endemic
Spirostreptidae	<i>Spirostreptus ceilanicus</i> (Brandt, 1841)	Endemic
Spirostreptidae	<i>Spirostreptus contemptus</i> Karsch, 1881	Endemic
Spirostreptidae	<i>Spirostreptus kandyanus</i> Humbert, 1865	Native
Spirostreptidae	<i>Spirostreptus insculptus</i> Pocock, 1892	Endemic
Spirostreptidae	<i>Spirostreptus modestus</i> Humbert, 1865	Endemic
Stemmiulidae	<i>Diopsiulus annandalei</i> Silvestri, 1916	Endemic
Stemmiulidae	<i>Diopsiulus ceylonicus</i> (Pocock, 1892)	Endemic
Stemmiulidae	<i>Diopsiulus greeni</i> Carl, 1941	Endemic
Stemmiulidae	<i>Diopsiulus jeekeli</i> Mauries, 1981	Endemic
Stemmiulidae	<i>Dipsiulus madaraszi</i> Silvestri, 1916	Endemic
Trigoniulidae	<i>Cingalobolus bugnioni</i> Carl, 1918	Endemic
Trigoniulidae	<i>Lankabolus greeni</i> (Pocock, 1892)	Endemic
Trigoniulidae	<i>Trigoniulus corallinus</i> (Gervais, 1841)	Native

APPENDIX 5

Family	Scientific Name	Species Status	National Conservation Status
Gecarcinucidae	<i>Ceylonthelphusa alpina</i> Bahir & Ng, 2005	Endemic	CR
Gecarcinucidae	<i>Ceylonthelphusa armata</i> (Ng, 1995)	Endemic	CR
Gecarcinucidae	<i>Ceylonthelphusa callista</i> (Ng, 1995)	Endemic	CR
Gecarcinucidae	<i>Ceylonthelphusa cavatrix</i> (Bahir, 1998)	Endemic	CR
Gecarcinucidae	<i>Ceylonthelphusa diva</i> Bahir & Ng, 2005	Endemic	CR
Gecarcinucidae	<i>Ceylonthelphusa durrelli</i> Bahir & Ng, 2005	Endemic	CR
Gecarcinucidae	<i>Ceylonthelphusa kandambyi</i> Bahir, 1999	Endemic	EN
Gecarcinucidae	<i>Ceylonthelphusa kotagama</i> (Bahir, 1998)	Endemic	CR
Gecarcinucidae	<i>Ceylonthelphusa nata</i> Ng & Tay, 2001	Endemic	CR
Gecarcinucidae	<i>Ceylonthelphusa orthos</i> Ng & Tay, 2001	Endemic	CR
Gecarcinucidae	<i>Ceylonthelphusa rugosa</i> (Kingsley, 1880)	Endemic	NT
Gecarcinucidae	<i>Ceylonthelphusa sanguinea</i> (Ng, 1995)	Endemic	CR
Gecarcinucidae	<i>Ceylonthelphusa savitriae</i> Bahir & Ng, 2005	Endemic	CR
Gecarcinucidae	<i>Ceylonthelphusa sentosa</i> Bahir, 1999	Endemic	EN
Gecarcinucidae	<i>Ceylonthelphusa soror</i> (Zehntner, 1894)	Endemic	EN
Gecarcinucidae	<i>Ceylonthelphusa venusta</i> (Ng, 1995)	Endemic	CR
Gecarcinucidae	<i>Clinothelphusa kakoota</i> Tay & Ng, 2001	Endemic	CR
Gecarcinucidae	<i>Mahatha adonis</i> Ng & Tay, 2001	Endemic	NT
Gecarcinucidae	<i>Mahatha helaya</i> Bahir & Ng, 2005	Endemic	CR
Gecarcinucidae	<i>Mahatha iora</i> Ng & Tay, 2001	Endemic	CR
Gecarcinucidae	<i>Mahatha lacuna</i> Bahir & Ng, 2005	Endemic	CR
Gecarcinucidae	<i>Mahatha ornatipes</i> (Roux, 1915)	Endemic	NT
Gecarcinucidae	<i>Mahatha regina</i> Bahir & Ng, 2005	Endemic	CR
Gecarcinucidae	<i>Oziothelphusa ceylonensis</i> (Fernando, 1960)	Endemic	NT
Gecarcinucidae	<i>Oziothelphusa dakuna</i> Bahir & Yeo, 2005	Endemic	CR
Gecarcinucidae	<i>Oziothelphusa gallicola</i> Bahir & Yeo, 2005	Endemic	CR
Gecarcinucidae	<i>Oziothelphusa hippocastanum</i> (Müller, 1887)	Endemic	EN
Gecarcinucidae	<i>Oziothelphusa intuta</i> Bahir & Ng, 2005	Endemic	CR
Gecarcinucidae	<i>Oziothelphusa kodagoda</i> Bahir & Ng, 2005	Endemic	CR
Gecarcinucidae	<i>Oziothelphusa minneriyaensis</i> Bott, 1970	Endemic	EN
Gecarcinucidae	<i>Oziothelphusa populosa</i> Bahir & Yeo, 2005	Endemic	EN
Gecarcinucidae	<i>Oziothelphusa ritigala</i> Bahir & Yeo, 2005	Endemic	EN
Gecarcinucidae	<i>Oziothelphusa stricta</i> Ng & Tay, 2001	Endemic	NT
Gecarcinucidae	<i>Pastilla ruhuna</i> Ng & Tay, 2001	Endemic	EN
Gecarcinucidae	<i>Perbrinckia cracens</i> Ng, 1995	Endemic	CR
Gecarcinucidae	<i>Perbrinckia enodis</i> (Kingsley, 1880)	Endemic	CR
Gecarcinucidae	<i>Perbrinckia fenestra</i> Bahir & Ng, 2005	Endemic	CR
Gecarcinucidae	<i>Perbrinckia fido</i> Ng & Tay, 2001	Endemic	CR
Gecarcinucidae	<i>Perbrinckia gabadagei</i> Bahir & Ng, 2005	Endemic	VU
Gecarcinucidae	<i>Perbrinckia glabra</i> Ng, 1995	Endemic	CR
Gecarcinucidae	<i>Perbrinckia integra</i> Ng, 1995	Endemic	EN
Gecarcinucidae	<i>Perbrinckia morayensis</i> Ng & Tay, 2001	Endemic	CR
Gecarcinucidae	<i>Perbrinckia nana</i> (Bahir, 1999)	Endemic	EN
Gecarcinucidae	<i>Perbrinckia punctata</i> Ng, 1995	Endemic	CR
Gecarcinucidae	<i>Perbrinckia quadratus</i> Ng & Tay, 2001	Endemic	CR
Gecarcinucidae	<i>Perbrinckia rosae</i> Bahir & Ng, 2005	Endemic	CR
Gecarcinucidae	<i>Perbrinckia scansor</i> (Ng, 1995)	Endemic	EN
Gecarcinucidae	<i>Perbrinckia scitula</i> Ng, 1995	Endemic	CR
Gecarcinucidae	<i>Perbrinckia uva</i> Bahir, 1998	Endemic	CR
Gecarcinucidae	<i>Spiralothelphusa fernandoi</i> Ng, 1994	Indigenous	EN
Gecarcinucidae	<i>Spiralothelphusa parvula</i> (Fernando, 1961)	Endemic	EN



Potamarcha congener (SW)

Family	Scientific Name	English Name	Species Status	National Conservation Status
Calopterygidae	<i>Neurobasis chinensis chinensis</i> (Linnaeus, 1758)	Oriental Green-wing	Breeding Resident	VU
Calopterygidae	<i>Vestalis nigrescens</i> Fraser, 1929	Black-tipped Flashwing	Endemic	VU
Chlorocyphidae	<i>Libellago adami</i> Fraser, 1939	Adam's Gem	Endemic	VU
Chlorocyphidae	<i>Libellago corbeti</i> van der Poorten, 2009	Ebony Gem	Endemic	CR
Chlorocyphidae	<i>Libellago finalis</i> (Hagen, 1869)	Ultima Gem	Endemic	VU
Chlorocyphidae	<i>Libellago greeni</i> (Laidlaw, 1924)	Green's Gem	Endemic	EN
Euphaeidae	<i>Euphaea splendens</i> Hagen, 1853	Shining Gossamerwing	Endemic	NT
Lestidae	<i>Indolestes divisus</i> (Hagen, 1862)	Metallic-backed Reedling	Endemic	EN
Lestidae	<i>Indolestes gracilis gracilis</i> (Hagen, 1862)	Mountain Reedling	Breeding Resident	VU
Lestidae	<i>Lestes elatus</i> Hagen, 1862	White-tipped Spreadwing	Breeding Resident	LC
Lestidae	<i>Lestes malabaricus</i> Fraser, 1929	Malabar Spreadwing	Breeding Resident	DD
Lestidae	<i>Lestes praemorsus decipiens</i> Kirby, 1894	Scalloped Spreadwing	Breeding Resident	NT
Lestidae	<i>Sinhalestes orientalis</i> (Hagen, 1862)	Emerald Sri Lankan Spreadwing	Endemic	DD
Coenagrionidae	<i>Aciagrion occidentale</i> Laidlaw, 1919	Asian Slim	Breeding Resident	VU
Coenagrionidae	<i>Agriocnemis femina</i> (Brauer, 1868)	White-backed Wisp	Breeding Resident	CR
Coenagrionidae	<i>Agriocnemis pygmaea</i> (Rambur, 1842)	Wandering Wisp	Breeding Resident	LC
Coenagrionidae	<i>Amphialagma parvum</i> Selys, 1876	Little Blue	Breeding Resident	DD
Coenagrionidae	<i>Archibasis lieftincki</i> Conniff & Bedjanić, 2013	Lieftinck's Sprite	Endemic	NE
Coenagrionidae	<i>Archibasis oscillans hanwellanensis</i> Conniff & Bedjanić, 2013	Hanwella Sprite	Breeding Resident	NE
Coenagrionidae	<i>Ceriagrion cerinorubellum</i> (Brauer, 1865)	Painted Waxtail	Breeding Resident	VU
Coenagrionidae	<i>Ceriagrion coromandelianum</i> (Fabricius, 1798)	Yellow Waxtail	Breeding Resident	LC
Coenagrionidae	<i>Ischnura rubilio</i> Selys, 1876	Dawn Bluetail	Breeding Resident	NT
Coenagrionidae	<i>Ischnura senegalensis</i> (Rambur, 1842)	Common Bluetail	Breeding Resident	LC
Coenagrionidae	<i>Mortonagrion ceylonicum</i> Lieftinck, 1971	Sri Lanka Midget	Endemic	EN
Coenagrionidae	<i>Paracercion malayanum</i> (Selys, 1876)	Malay Lilyquater	Breeding Resident	LC
Coenagrionidae	<i>Pseudagrion decorum</i> (Rambur, 1842)	Azure Sprite	Breeding Resident	DD
Coenagrionidae	<i>Pseudagrion malabaricum</i> Fraser, 1924	Malabar Sprite	Breeding Resident	LC
Coenagrionidae	<i>Pseudagrion microcephalum</i> (Rambur, 1842)	Blue Sprite	Breeding Resident	LC
Coenagrionidae	<i>Pseudagrion rubriceps ceylonicum</i> Kirby, 1891	Orange-faced Sprite	Breeding Resident	LC
Platycnemididae	<i>Copera marginipes</i> (Rambur, 1842)	Yellow Featherleg	Breeding Resident	LC
Platycnemididae	<i>Elatoneura oculata</i> (Kirby, 1894)	Two-spotted threadtail	Endemic	EN
Platycnemididae	<i>Elatoneura caesia</i> (Hagen, 1860)	Jungle Threadtail	Endemic	VU
Platycnemididae	<i>Elatoneura centralis</i> (Hagen, 1860)	Dark-glittering Threadtail	Endemic	VU
Platycnemididae	<i>Elatoneura leucostigma</i> (Fraser, 1933)	Smoky-winged Threadtail	Endemic	CR
Platycnemididae	<i>Elatoneura tenax</i> (Hagen, 1860)	Red-striped Threadtail	Endemic	EN
Platycnemididae	<i>Onychargia atrocyanana</i> Selys, 1865	Marsh Dancer	Breeding Resident	VU
Platycnemididae	<i>Prodasineura sita</i> (Kirby, 1894)	Stripe-headed Threadtail	Endemic	LC
Platystictidae	<i>Ceylonosticta adami</i> Fraser, 1933	Adam's Shadowdamsel	Endemic	CR
Platystictidae	<i>Ceylonosticta alwisi</i> Priyadharshana and Wijewardhane, 2016	Alwis' Shadowdamsel	Endemic	NE
Platystictidae	<i>Ceylonosticta anamia</i> Bedjanić, 2010	Ana Mia's Shadowdamsel	Endemic	CR
Platystictidae	<i>Ceylonosticta austeni</i> Lieftinck, 1940	Austin's Shadowdamsel	Endemic	CR
Platystictidae	<i>Ceylonosticta bine</i> Bedjanić, 2010	Bine's Shadowdamsel	Endemic	CR
Platystictidae	<i>Ceylonosticta brincki</i> Lieftinck, 1971	Brinck's Shadowdamsel	Endemic	CR
Platystictidae	<i>Ceylonosticta digna</i> (Hagen, 1860)	Nobel Shadowdamsel	Endemic	CR
Platystictidae	<i>Ceylonosticta goodalei</i> Priyadharshana and Wijewardhane, 2018	Goodale's Shadowdamsel	Endemic	NE
Platystictidae	<i>Ceylonosticta hilaris</i> (Hagen, 1860)	Merry Shadowdamsel	Endemic	CR
Platystictidae	<i>Ceylonosticta inferoeducta</i> Bedjanić and Conniff, 2016	Paraproct-less Shadowdamsel	Endemic	NE

APPENDIX 9



Vespidae (US)

Family	Scientific Name	National Conservation Status
Colletidae	<i>Hylaeus krombeini</i> Snelling, 1980	CR
Colletidae	<i>Hylaeus sedens</i> Snelling, 1980	CR
Halicitidae	<i>Austronomia krombeini</i> Hirashima, 1978	NT
Halicitidae	<i>Austronomia notiomorpha</i> Hirashima, 1978	NT
Halicitidae	<i>Austronomia</i> sp. 1	
Halicitidae	<i>Austronomia</i> sp. 2	
Halicitidae	<i>Ceylalictus appendiculata</i> (Cameron, 1903)	
Halicitidae	<i>Ceylalictus cereus</i> (Nurse, 1901)	EN
Halicitidae	<i>Ceylalictus horni</i> (Strand, 1913)	CR
Halicitidae	<i>Ceylalictus taprobanae</i> (Cameron, 1897)	EN
Halicitidae	<i>Curvinomia formosa</i> (Smith, 1858)	EN
Halicitidae	<i>Curvinomia iridiscens</i> (Smith, 1857)	EN
Halicitidae	<i>Gnathonomia nasicana</i> Bingham, 1897	EN
Halicitidae	<i>Gnathonomia</i> sp. 2	
Halicitidae	<i>Halictus (Seladonia) lucidipennis</i> Smith, 1853	LC
Halicitidae	<i>Halictus trincomalicus</i> Cameron, 1903	CR
Halicitidae	<i>Homalictus paradnanus</i> (Strand, 1914)	EN
Halicitidae	<i>Homalictus singhalensis</i> (Blüthgen, 1926)	CR
Halicitidae	<i>Hoplonomia westwoodi</i> (Gribodo, 1894)	LC
Halicitidae	<i>Lasioglossum (Ctenonomia) amblypygus</i> (Strand, 1913)	VU
Halicitidae	<i>Lasioglossum (Ctenonomia) cire</i> (Cameron, 1897)	VU
Halicitidae	<i>Lasioglossum (Ctenonomia) clarum</i> (Nurse, 1902)	NT
Halicitidae	<i>Lasioglossum (Ctenonomia) semisculptum</i> (Cockerell, 1911)	CR
Halicitidae	<i>Lasioglossum (Ctenonomia) vagans</i> (Smith, 1857)	VU
Halicitidae	<i>Lasioglossum (Ctenonomia) albescens</i> (Smith, 1853)	EN
Halicitidae	<i>Lasioglossum (Evyllaes) carinifrons</i> (Cameron, 1904)	LC
Halicitidae	<i>Lasioglossum (Nesohalictus) halictoides</i> (Smith, 1858)	VU
Halicitidae	<i>Lasioglossum (Nesohalictus) serenum</i> (Cameron, 1897)	LC
Halicitidae	<i>Lasioglossum (Sudila) alphenum</i> (Cameron, 1897)	LC
Halicitidae	<i>Lasioglossum (Sudila) aulacophorum</i> (Strand, 1913)	EN
Halicitidae	<i>Lasioglossum (Sudila) bidentatum</i> (Cameron, 1898)	CR
Halicitidae	<i>Lasioglossum (Sudila) kandiense</i> (Cockerell, 1913)	CR
Halicitidae	<i>Leuconomia</i> sp.	
Halicitidae	<i>Lipotriches (Austronomia) ustula</i> (Cockerell, 1911)	EN
Halicitidae	<i>Lipotriches austella</i> (Hirashima, 1978)	EN
Halicitidae	<i>Lipotriches basipicta</i> (Wickwar, 1908)	
Halicitidae	<i>Lipotriches bombayensis</i> (Cameron, 1908)	
Halicitidae	<i>Lipotriches cromberi</i> (Cockerell, 1911)	EN
Halicitidae	<i>Lipotriches edirisinghei</i> Pauly, 2006	VU
Halicitidae	<i>Lipotriches exagens</i> (Walker, 1860)	EN
Halicitidae	<i>Lipotriches fervida</i> (Smith, 1875)	
Halicitidae	<i>Lipotriches fulvina</i> (Cameron, 1907)	EN
Halicitidae	<i>Lipotriches pulchrivertris</i> (Cameron, 1897)	CR
Halicitidae	<i>Lipotriches sp. nr. Comperta</i> (Cockerell, 1912)	CR
Halicitidae	<i>Lipotriches rustica</i> (Westwood, 1875)	

Family	Scientific Name	National Conservation Status
Halicitidae	<i>Maynenomia</i> sp. 1	
Halicitidae	<i>Maynenomia</i> sp. 2	
Halicitidae	<i>Nomia (Hoplonomia) strigata</i> (Fabricius, 1793)	CR
Halicitidae	<i>Nomia crassipes</i> Fabricius 1798	NT
Halicitidae	<i>Nomia elegantula</i> Friese, 1913	CR
Halicitidae	<i>Nomia matalea</i> Strand, 1913	EN
Halicitidae	<i>Nomia rufa</i> Friese, 1918	CR
Halicitidae	<i>Pachyhalictus bedanus</i> (Blüthgen, 1926)	CR
Halicitidae	<i>Pachyhalictus kalutarae</i> (Cockerell, 1911)	VU
Halicitidae	<i>Pachyhalictus sigiriellus</i> (Cockerell, 1911)	CR
Halicitidae	<i>Pachyhalictus vinctus</i> (Walker, 1860)	CR
Halicitidae	<i>Pachynomia</i> sp.	
Halicitidae	<i>Pseudapis oxybeloides</i> (Smith, 1875)	LC
Halicitidae	<i>Sphecodes biroi</i> Friese, 1909	CR
Halicitidae	<i>Sphecodes crassicornis</i> Smith, 1879	VU
Halicitidae	<i>Sphecodes decorus</i> (Cameron, 1897)	
Halicitidae	<i>Steganomus nodicornis</i> (Smith, 1875)	EN
Halicitidae	<i>Systropha tropicalis</i> Cockerell, 1911	EN
Megachilidae	<i>Anthidiellum butarsis</i> Griswold, 2001	
Megachilidae	<i>Anthidiellum krombeini</i> Griswold, 2001	
Megachilidae	<i>Anthidiellum ramakrishnae</i> (Cockerell, 1919)	CR
Megachilidae	<i>Coelioxys angulata</i> Smith, 1870	VU
Megachilidae	<i>Coelioxys apicata</i> Smith, 1854	CR
Megachilidae	<i>Coelioxys capitata</i> Smith, 1854	VU
Megachilidae	<i>Coelioxys confusus</i> Smith, 1875	EN
Megachilidae	<i>Coelioxys fenestrata</i> Smith, 1873	EN
Megachilidae	<i>Coelioxys fuscipennis</i> Smith, 1854	CR
Megachilidae	<i>Coelioxys intacta</i> Friese, 1923	CR
Megachilidae	<i>Coelioxys minutus</i> Smith, 1879	EN
Megachilidae	<i>Coelioxys nitidoscutellaris</i> Pasteels, 1987	CR
Megachilidae	<i>Coelioxys taiwanensis</i> Cockerell, 1911	EN
Megachilidae	<i>Euasps edentata</i> Baker, 1995	EN
Megachilidae	<i>Exanthidium rotundiventre</i> Pasteels, 1987	
Megachilidae	<i>Heriades binghami</i> Dover, 1925	NT
Megachilidae	<i>Lithurgus atratus</i> Smith, 1853	VU
Megachilidae	<i>Megachile albolineata</i> Cameron, 1897	
Megachilidae	<i>Megachile amputata</i> Smith, 1857	CR
Megachilidae	<i>Megachile ardens</i> Smith, 1879	CR
Megachilidae	<i>Megachile ceylonica</i> Bingham, 1896	
Megachilidae	<i>Megachile conjuncta</i> Smith, 1853	NT
Megachilidae	<i>Megachile disjuncta</i> Fabricius, 1781	NT
Megachilidae	<i>Megachile hera</i> Bingham, 1897	VU
Megachilidae	<i>Megachile kandyca</i> Friese, 1918	CR
Megachilidae	<i>Megachile lanata</i> (Fabricius, 1775)	VU
Megachilidae	<i>Megachile mystacea</i> Fabricius, 1775	CR
Megachilidae	<i>Megachile nana</i> Bingham, 1897	VU
Megachilidae	<i>Megachile nigricans</i> Cameron, 1898	CR
Megachilidae	<i>Megachile reeperi</i> Friese, 1918	CR
Megachilidae	<i>Megachile relata</i> Smith, 1879	CR

Family	Scientific Name	National Conservation Status
Megachilidae	<i>Megachile umbripennis</i> Smith, 1853	VU
Megachilidae	<i>Megachile vestita</i> Smith, 1853	EN
Megachilidae	<i>Megachile vigilans</i> Smith, 1878	EN
Megachilidae	<i>Pachyanthidium</i> sp. 1	
Megachilidae	<i>Pseudoanthidium</i> sp. 1	
Apidae	<i>Amegilla (Glossamegilla) violacea</i> Lepeletier, 1841	VU
Apidae	<i>Amegilla (Zebramegilla) fallax</i> Smith, 1879	NT
Apidae	<i>Amegilla (Zebramegilla) subcoerulea</i> Lepeletier, 1841	CR
Apidae	<i>Amegilla (Zonamegilla) cingulifera</i> Cockerell, 1910	EN
Apidae	<i>Amegilla (Zonamegilla) cingulata</i> Fabricius, 1775	
Apidae	<i>Amegilla (Zonamegilla) comberi</i> Cockerell, 1911	NT
Apidae	<i>Amegilla (Amegilla) confusa</i> Smith, 1854	
Apidae	<i>Amegilla (Amegilla) quadrifasciata</i> de Villers, 1789	
Apidae	<i>Amegilla (Micramegilla) mucorea</i> (Klug, 1845)	
Apidae	<i>Amegilla (Zonamegilla) niveocincta</i> (Smith, 1854)	CR
Apidae	<i>Amegilla (Zonamegilla) perasserta</i> Rayment, 1947	
Apidae	<i>Amegilla (Zonamegilla) puttalama</i> Strand, 1913	VU
Apidae	<i>Amegilla (Zonamegilla) subinsularis</i> (Strand)	EN
Apidae	<i>Amegilla (Zonamegilla) zonata</i> Linnaeus, 1758	VU
Apidae	<i>Amegilla</i> sp.[manuscript name scintillans of Lieftinck, 1977]	
Apidae	<i>Apis cerana</i> Fabricius, 1793	VU
Apidae	<i>Apis dorsata</i> Fabricius, 1793	EN
Apidae	<i>Apis florea</i> Fabricius, 1787	EN
Apidae	<i>Braunsapis cupulifera</i> Vachal, 1894	CR
Apidae	<i>Braunsapis flaviventris</i> Reyes, 1991	
Apidae	<i>Braunsapis mixta</i> Smith, 1852	LC
Apidae	<i>Braunsapis picitarsis</i> Cameron, 1902	EN
Apidae	<i>Ceratina (Ceratinidia) hieroglyphica</i> Smith, 1854	LC
Apidae	<i>Ceratina binghami</i> Cockerell, 1908	LC
Apidae	<i>Ceratina (Pithitis) smaragdula</i> Fabricius, 1787	EN
Apidae	<i>Ceratina (Simoceratina) tanganyicensis</i> Strand, 1911	CR
Apidae	<i>Ceratina (Xanthoceratina) beata</i> Cameron, 1897	CR
Apidae	<i>Ceratina (Xanthoceratina) picta</i> Smith, 1854	
Apidae	<i>Lisotrigona cacciae</i> (Nurse, 1907)	
Apidae	<i>Nomada adusta</i> Smith, 1875	
Apidae	<i>Nomada antennata</i> Meade-Waldo, 1913	CR
Apidae	<i>Nomada bicellularis</i> Ducke, 1908	EN
Apidae	<i>Nomada ceylonica</i> Cameron, 1897	
Apidae	<i>Nomada lusca</i> Smith, 1854	
Apidae	<i>Nomada priscilla</i> Nurse, 1902	CR
Apidae	<i>Nomada wickwari</i> Meade-Waldo, 1913	CR
Apidae	<i>Tetralonia commixtana</i> Strand, 1913	CR
Apidae	<i>Tetralonia fumida</i> Cockerell, 1911	CR
Apidae	<i>Tetralonia taprobanicola</i> Strand, 1913	CR
Apidae	<i>Thyreus ceylonicus</i> Friese, 1905	NT
Apidae	<i>Thyreus histrio</i> Fabricius, 1775	NT
Apidae	<i>Thyreus insignis</i> (Meyer, 1921)	EN
Apidae	<i>Thyreus ramosellus</i> Cockerell, 1919	EN

Family	Scientific Name	National Conservation Status
Apidae	<i>Thyreus sumniculus</i> Lieftinck, 1959	CR
Apidae	<i>Thyreus takaonis</i> Cockerell, 1911	LC
Apidae	<i>Tetragonula iridipennis</i> (Smith, 1854)	LC
Apidae	<i>Xylocopa aestuans</i> (Linnaeus, 1758)	
Apidae	<i>Xylocopa amethystina</i> Fabricius, 1793	VU
Apidae	<i>Xylocopa auripennis</i> Lepeletier, 1841	CR
Apidae	<i>Xylocopa bhowara</i> Maa, 1938	VU
Apidae	<i>Xylocopa bryorum</i> Fabricius, 1775	CR
Apidae	<i>Xylocopa coerulea</i> (Fabricius, 1804)	
Apidae	<i>Xylocopa dejeanii</i> Lepeletier, 1841	EN
Apidae	<i>Xylocopa fenestrata</i> Fabricius, 1798	NT
Apidae	<i>Xylocopa nasalis</i> Westwood, 1842	CR
Apidae	<i>Xylocopa nigrocaerulea</i> Smith, 1874	
Apidae	<i>Xylocopa ruficornis</i> Fabricius, 1804	EN
Apidae	<i>Xylocopa tenuiscapa</i> Westwood, 1840	LC
Apidae	<i>Xylocopa tranquibarica</i> Fabricius, 1804	CR
Apidae	<i>Tetragonula praeterita</i> (Walker 1860)	

APPENDIX 10



Eugeusis palpator (AS)

Family	Subfamily	Scientific Name	Species Status
Lampyridae	Lampyrinae	<i>Diaphanes lutescens</i> (Walker, 1858)	Indigenous
Lampyridae	Lampyrinae	<i>Diaphanes olivieri</i> (Gorham, 1895)	Indigenous
Lampyridae	Lampyrinae	<i>Diaphanes taprobanus</i> (Walker, 1858)	Indigenous
Lampyridae	Lampyrinae	<i>Diaphanes vitrifera</i> (Walker, 1858)	Indigenous
Lampyridae	Lampyrinae	<i>Lamprigera diffinis</i> (Walker, 1858)	Indigenous
Lampyridae	Lampyrinae	<i>Lamprigera lutescens</i> (Walker, 1858)	Indigenous
Lampyridae	Lampyrinae	<i>Lamprigera lutosipennis</i> (Walker, 1858)	Indigenous
Lampyridae	Lampyrinae	<i>Lamprigera tenebrosus</i> (Walker, 1858)	Indigenous
Lampyridae	Lampyrinae	<i>Lucernuta ablonga</i>	Indigenous
Lampyridae	Lampyrinae	<i>Lucernuta lateralis</i>	Indigenous
Lampyridae	Luciolinae	<i>Abscondita chinensis</i> (Laporte, 1867)	Indigenous
Lampyridae	Luciolinae	<i>Abscondita perplexa</i> (Walker, 1858)	Indigenous
Lampyridae	Luciolinae	<i>Abscondita promelaena</i> (Walker, 1858)	Indigenous
Lampyridae	Luciolinae	<i>Abscondita sp.</i> (Olivier, 1911)	Indigenous
Lampyridae	Luciolinae	<i>Asymmetricata humeralis</i> (Walker, 1858)	Indigenous
Lampyridae	Luciolinae	<i>Asymmetricata impressa</i> (Olivier, 1910)	Indigenous
Lampyridae	Luciolinae	<i>Curtos costipennis</i> (Gorham, 1880)	Indigenous
Lampyridae	Luciolinae	<i>Luciola antennalis</i> (Bourg, 1905)	Indigenous
Lampyridae	Luciolinae	<i>Luciola candezei</i> (Olivier, 1902)	Indigenous
Lampyridae	Luciolinae	<i>Luciola cingulata</i> (Olivier, 1885)	Indigenous
Lampyridae	Luciolinae	<i>Luciola doriae</i> (Olivier, 1885)	Indigenous
Lampyridae	Luciolinae	<i>Luciola extricans</i> (Walker, 1858)	Indigenous
Lampyridae	Luciolinae	<i>Luciola horni</i> (Bourgeois, 1905)	Indigenous
Lampyridae	Luciolinae	<i>Luciola intricate</i> (Walker, 1858)	Indigenous
Lampyridae	Luciolinae	<i>Luciola nicollieri</i> (Bourgeois, 1922)	Indigenous
Lampyridae	Luciolinae	<i>Luciola nigripes</i> (Gorham, 1903)	Indigenous
Lampyridae	Luciolinae	<i>Luciola ochracea</i> (Gorham, 1895)	Indigenous
Lampyridae	Luciolinae	<i>Luciola praeusta</i> (Kiesenwetter, 1874)	Indigenous
Lampyridae	Ototretadrilinae-Ototretinae complex	<i>Harmatelia bilinia</i> (Walker, 1858)	Endemic
Lampyridae	Ototretadrilinae-Ototretinae complex	<i>Harmatelia discalis</i> (Walker, 1858)	Endemic
Lampyridae	Ototretadrilinae-Ototretinae complex	<i>Stenocladus Sp. 1</i> (Fairmaire, 1878)	Indigenous
Lampyridae	Ototretadrilinae-Ototretinae complex	<i>Stenocladus Sp. 2</i> (Fairmaire, 1878)	Indigenous
Rhagophthalmidae	Rhagophthalminae	<i>Diaptoma greeni</i>	Indigenous
Rhagophthalmidae	Rhagophthalminae	<i>Diaptoma adamsi</i>	Indigenous
Rhagophthalmidae	Rhagophthalminae	<i>Ochotyra semiusta</i> (Pascoe, J, 1862)	Indigenous

APPENDIX 11



Polyura bharta (SW)

Family	Scientific Name	English Name	Sinhala Name	Species Status	National Conservation Status
Papilionidae	<i>Graphium agamemnon</i> (Linnaeus, 1758)	Tailed Jay	Pendathi Jawaseriya	Native	LC
Papilionidae	<i>Graphium antiphates</i> (Cramer, [1775])	Five-bar Swordtail	Iri Jawaseriya	Native	EN
Papilionidae	<i>Graphium doson</i> (C. & R. Felder, 1864)	Common Jay	Sulaba Jawaseriya	Native	LC
Papilionidae	<i>Graphium nomius</i> (Esper, 1785)	Spot Swordtail	Thith Jawaseriya	Native	VU
Papilionidae	<i>Graphium tereon</i> Felder & Felder, 1864	Narrow-banded Bluebottle	Nil Jawaseriya	Native	LC
Papilionidae	<i>Pachliopta aristolochiae</i> (Fabricius, 1775)	Common Rose	Sulaba Sewwandiya	Native	LC
Papilionidae	<i>Pachliopta hector</i> (Linnaeus, 1758)	Crimson Rose	Dilirath Sewwandiya	Native	LC
Papilionidae	<i>Pachliopta jophon</i> (Gray, [1853])	Sri Lankan Rose	Sri Lanka Sewwandiya	Endemic	EN
Papilionidae	<i>Papilio clytia</i> Linnaeus, 1758	Mime	Rawatthi Papliya	Native	LC
Papilionidae	<i>Papilio crino</i> Fabricius, 1793	Banded Peacock	Mayura Papliya	Native	VU
Papilionidae	<i>Papilio demoleus</i> Linnaeus, 1758	Lime Butterfly	Pangiri Papliya	Native	LC
Papilionidae	<i>Papilio helenus</i> Linnaeus, 1758	Red Helen	Kala Papliya	Native	VU
Papilionidae	<i>Papilio polymnestor</i> Cramer, [1775]	Blue Mormon	Nii Papliya	Native	LC
Papilionidae	<i>Papilio polytes</i> Linnaeus, 1758	Common Mormon	Sulaba Papliya	Native	LC
Papilionidae	<i>Troides darsius</i> (Gray, [1853])	Sri Lankan Birdwing	Sri Lanka Siyothwana	Endemic	LC
Pieridae	<i>Appias albina</i> (Boisduval, 1836)	Common Albatross	Sulaba Sudana	Native	LC
Pieridae	<i>Appias galene</i> (C. & R. Felder, 1865)	Sri Lankan Lesser Albatross	Sri Lanka Sudana	Endemic	LC
Pieridae	<i>Appias indra</i> (Moore, 1857)	Plain Puffin	Ranwan Sudana	Native	CR
Pieridae	<i>Appias libythea</i> (Fabricius, 1775)	Striped Albatross	Iri Sudana	Native	LC
Pieridae	<i>Appias lycinda</i> (Cramer, [1777])	Chocolate Albatross	Dumburuwan Sudana	Native	LC
Pieridae	<i>Belenois aurota</i> (Fabricius, 1793)	Pioneer	Upsarawi	Native	LC
Pieridae	<i>Catopsilia pomona</i> (Fabricius, 1775)	Lemon Emigrant	Kahawan Pimi-seriya	Native	LC
Pieridae	<i>Catopsilia pyranthe</i> (Linnaeus, 1758)	Mottled Emigrant	Lapawan Pimi-seriya	Native	LC
Pieridae	<i>Catopsilia scylla</i> (Linnaeus, 1763)	Orange Migrant	Depaha Pimi-seriya	Exotic	LC
Pieridae	<i>Cepora nadina</i> (Lucas, 1852)	Lesser Gull	Heen Sudda	Native	CR
Pieridae	<i>Cepora nerissa</i> (Fabricius, 1775)	Common Gull	Sulaba Sudda	Native	LC
Pieridae	<i>Colotis amata</i> (Fabricius, 1775)	Small Salmon Arab	Heen Rosa-sudana	Native	LC
Pieridae	<i>Colotis aurora</i> (Cramer, 1780)	Plain Orange Tip	Ranbawan Thuduwa	Native	VU
Pieridae	<i>Colotis danae</i> (Fabricius, 1775)	Crimson Tip	Dilirath Thuduwa	Native	VU
Pieridae	<i>Colotis etrida</i> (Boisduval, 1836)	Little Orange Tip	Lohitha Thuduwa	Native	NT
Pieridae	<i>Colotis fausta</i> (Olivier, 1804)	Large Salmon Arab	Maha Rosa-sudana	Native	VU
Pieridae	<i>Delias eucharis</i> Drury, 1773	Jezebel	Piilla Risiya	Native	LC
Pieridae	<i>Eurema blanda</i> (Boisduval, 1836)	Three-Spot Grass Yellow	Thethith Thruna-peethaya	Native	LC
Pieridae	<i>Eurema brigitta</i> (Stoll, [1780])	Small Grass Yellow	Heen Thruna-peethaya	Native	LC
Pieridae	<i>Eurema hecabe</i> (Linnaeus, 1758)	Common Grass Yellow	Dethith Thruna-peethaya	Native	LC
Pieridae	<i>Eurema laeta</i> (Boisduval, 1836)	Spotless Grass Yellow	Nothith Thruna-peethaya	Native	VU
Pieridae	<i>Eurema ormistonii</i> (Watkins, 1925)	Sri Lankan One-Spot Grass Yellow	Sri Lanka Thruna-peethaya	Endemic	VU
Pieridae	<i>Hebomoia glaucippe</i> Linnaeus, 1758	Great Orange Tip	Maha Ramba-thuduwa	Native	LC
Pieridae	<i>Ixias marianne</i> Cramer, 1779	White Orange Tip	Ela Ramba-thuduwa	Native	LC
Pieridae	<i>Ixias pyrene</i> Linnaeus, 1764	Yellow Orange Tip	Kaha Ramba-thuduwa	Native	LC
Pieridae	<i>Leptosia nina</i> Fabricius, 1793	Psyche	Onahaari	Native	LC
Pieridae	<i>Pareronia ceylanica</i> C. & R. Felder, 1865	Dark Wanderer	Ayaalaya	Native	LC
Pieridae	<i>Prioneris sita</i> (C. & R. Felder, 1865)	Painted Sawtooth	Piilla-risiwenna	Native	EN
Nymphalidae	<i>Acraea terpsicore</i> (Linnaeus, 1758)	Tawny Coster	Lasiseriya	Native	LC
Nymphalidae	<i>Argynnis hyperbius</i> (Linnaeus, 1763)	Tropical Fritillary	Kotithi Alankaarikaya	Native	EN
Nymphalidae	<i>Ariadne ariadne</i> (Linnaeus, 1763)	Angled Castor	Heen Thambuwa	Native	LC

Family	Scientific Name	English Name	Sinhala Name	Species Status	National Conservation Status
Hesperiidae	<i>Hyarotis adrastus</i> (Stoll, [1780])	Tree Flitter	Ruk-seriya	Native	LC
Hesperiidae	<i>lambrix salsala</i> (Moore, [1866])	Chestnut Bob	Thambalawan Bimas-uruwa	Native	LC
Hesperiidae	<i>Matapa aria</i> (Moore, [1866])	Common Red Eye	Rathasiththa	Native	VU
Hesperiidae	<i>Notocrypta curvifascia</i> (C. & R. Felder, 1862)	Restricted Demon	Ketipati Dessa	Native	VU
Hesperiidae	<i>Notocrypta paralyos</i> (Wood-Mason & de Nicéville, 1881)	Common Banded Demon	Digupati Dessa	Native	VU
Hesperiidae	<i>Oriens goloides</i> (Moore, [1881])	Common Dartlet	Thana-serithiwenna	Native	NT
Hesperiidae	<i>Parnara bada</i> (Moore, 1878)	Smallest Swift	Tikiri seriya	Native	NT
Hesperiidae	<i>Pelopidas agna</i> (Moore, [1866])	Little Branded Swift	Hichchi Thurithaya	Native	NT
Hesperiidae	<i>Pelopidas conjuncta</i> (Herich-Schäffer, 1869)	Conjoined Swift	Gumana Thurithaya	Native	VU
Hesperiidae	<i>Pelopidas mathias</i> (Fabricius, 1798)	Small Branded Swift	Heen Thurithaya	Native	NT
Hesperiidae	<i>Pelopidas subochracea</i> Moore, 1878	Large Branded Swift	Maha Thurithaya	Native	VU
Hesperiidae	<i>Potanthus pallida</i> (Evans, 1932)	Pallid Dart	Palaawan Thana-Seriththa	Native	DD
Hesperiidae	<i>Potanthus pseudomaesa</i> (Moore, [1881])	Common Dart	Medi-Kandukara Thana-Seriththa	Native	VU
Hesperiidae	<i>Potanthus satra</i> Fruhstorfer, 1911	Sri Lankan Dart	Niwarthana Thana-seriththa	Endemic	LC
Hesperiidae	<i>Sarangesa dasahara</i> Moore, 1886	Common Small Flat	Thudunamiya	Native	NT
Hesperiidae	<i>Spialia galba</i> (Fabricius, 1793)	Grizzled Skipper	Gomara-Pimma	Native	LC
Hesperiidae	<i>Suastus gremius</i> (Fabricius, 1798)	Oriental Palm Bob	Maha Thaala-Haraya	Native	LC
Hesperiidae	<i>Suastus minuta</i> (Moore, 1877)	Small Palm Bob	Heen Thaala-Haraya	Native	EN
Hesperiidae	<i>Tagiades japedus</i> (Stoll, [1781])	Common Snow Flat	Awapaha Thuhinaya	Native	LC
Hesperiidae	<i>Tagiades litigiosa</i> Möschler, 1878	Water Snow Flat	Thadapaha Thuhinaya	Native	VU
Hesperiidae	<i>Tapena thwaitesi</i> Moore, [1881]	Black Angle	Siwuresiya	Native	EN
Hesperiidae	<i>Taractrocera maevius</i> (Fabricius, 1793)	Common Grass Dart	Bimseriya	Native	LC
Hesperiidae	<i>Telicota bambusae</i> (Moore, 1878)	Dark Palm Dart	Thadapaha Panduru-seriya	Native	VU
Hesperiidae	<i>Telicota colon</i> (Fabricius, 1775)	Pale Palm Dart	Sudumali Panduru-seriya	Native	NT
Hesperiidae	<i>Thoressa decorata</i> (Moore, 1881)	Sri Lankan Decorated Ace	Sri Lanka Sithuruseriya	Endemic	EN
Hesperiidae	<i>Udaspes folus</i> (Cramer, [1775])	Grass Demon	Bamanaya	Native	LC

APPENDIX 12



Acavus superbus (Pl)

Appendix 12:
List of Land Snails of Sri Lanka.

Family	Scientific Name	Common Name	Species Status	Ntional Conservation Status
Cyclophoroidea	<i>Lagocheilus occulta</i> (Sykes, 1897)		Endemic	CR
Cyclophoroidea	<i>Lagocheilus vesca</i> (Sykes, 1897)		Endemic	EN
Cyclophoroidea	<i>Leptopoma apicatum</i> (Benson, 1856)	E: Leptopoma's Operculate Snail	Endemic	DD
Cyclophoroidea	<i>Leptopoma elatum</i> (Pfeiffer, 1852)		Endemic	DD
Cyclophoroidea	<i>Leptopoma semiclausum</i> (Pfeiffer, 1855)	E: Leptopomoid's Operculate Snail	Endemic	EN
Cyclophoroidea	<i>Leptopomoides flammeus</i> (Pfeiffer, 1855)		Endemic	CR
Cyclophoroidea	<i>Leptopomoides halophilus</i> (Benson, 1851)		Endemic	DD
Cyclophoroidea	<i>Leptopomoides orophilus</i> (Benson, 1853)		Endemic	DD
Cyclophoroidea	<i>Leptopomoides poecilus</i> (Pfeiffer, 1855)		Endemic	CR
Cyclophoroidea	<i>Leptopomoides taprobanensis</i> (Preston, 1909)		Endemic	CR
Cyclophoroidea	<i>Micraulax coeloconus</i> (Benson, 1851)	E: Micraulax Opeculate Snail	Indigenous	CR
Cyclophoroidea	<i>Pterocyclos bifrons</i> (Pfeiffer, 1855)		Endemic	DD
Cyclophoroidea	<i>Pterocyclos bilabiatus</i> (Sowerby, 1835)	E: Ptero's Operculate Snail	Indigenous	EN
Cyclophoroidea	<i>Pterocyclos cingalensis</i> (Benson, 1853)		Endemic	NT
Cyclophoroidea	<i>Pterocyclos cumingi</i> (Pfeiffer, 1851)		Indigenous	NT
Cyclophoroidea	<i>Pterocyclos troscheli</i> (Benson, 1851)		Endemic	NT
Cyclophoroidea	<i>Theobaldius annulatus</i> (Pfeiffer, 1847)	E: Theobald's Operculate Snail	Endemic	LC
Cyclophoroidea	<i>Theobaldius bairdi</i> (Pfeiffer, 1854)		Endemic	VU
Cyclophoroidea	<i>Theobaldius cadiscus</i> (Benson, 1860)		Endemic	CR
Cyclophoroidea	<i>Theobaldius cratera</i> (Benson, 1856)		Endemic	DD
Cyclophoroidea	<i>Theobaldius cytopoma</i> (Benson, 1860)		Endemic	EN
Cyclophoroidea	<i>Theobaldius layardi</i> (Adams, 1868)		Endemic	VU
Cyclophoroidea	<i>Theobaldius liliputianus</i> (Preston, 1909)		Endemic	DD
Cyclophoroidea	<i>Theobaldius loxostoma</i> (Pfeiffer, 1854)		Endemic	CR
Cyclophoroidea	<i>Theobaldius parapsis</i> (Benson, 1853)		Endemic	DD
Cyclophoroidea	<i>Theobaldius parma</i> (Benson, 1856)		Endemic	EN
Cyclophoroidea	<i>Theobaldius subplicatulus</i> (Beddome, 1875)		Endemic	VU
Cyclophoroidea	<i>Theobaldius thwaitesi</i> (Pfeiffer, 1855)		Endemic	CR
Diplomatiniidae	<i>Nicida catathymia</i> (Sykes, 1898)	E: Sri Lanka Nicida's Operculate Snail	Endemic	NT
Diplomatiniidae	<i>Nicida ceylanica</i> (Beddome, 1875)		Endemic	CR
Diplomatiniidae	<i>Nicida delectabilis</i> (Preston, 1905)		Endemic	CR
Diplomatiniidae	<i>Nicida lankaensis</i> (Preston, 1905)		Endemic	CR
Diplomatiniidae	<i>Nicida pedronis</i> (Beddome, 1875)		Endemic	DD
Diplomatiniidae	<i>Nicida prestoni</i> (Sykes, 1897)		Endemic	CR
Pupinidae	<i>Tortulosa aurea</i> (Pfeiffer, 1855)	E: Sri Lanka Tortu's Operculate Snail	Endemic	CR
Pupinidae	<i>Tortulosa austeniana</i> (Benson, 1853)		Endemic	CR
Pupinidae	<i>Tortulosa barnaclei</i> (Tomlin, 1928)		Endemic	CR
Pupinidae	<i>Tortulosa blanfordi</i> (Dohrn, 1862)		Endemic	DD
Pupinidae	<i>Tortulosa colletti</i> (Sykes, 1898)		Endemic	CR
Pupinidae	<i>Tortulosa congener</i> (Sykes, 1905)		Endemic	CR
Pupinidae	<i>Tortulosa connectens</i> (Fulton, 1903)		Endemic	DD
Pupinidae	<i>Tortulosa cumingi</i> (Pfeiffer, 1857)		Endemic	EN
Pupinidae	<i>Tortulosa decora</i> (Benson, 1853)		Endemic	EN
Pupinidae	<i>Tortulosa duplicata</i> (Pfeiffer, 1855)		Endemic	CR
Pupinidae	<i>Tortulosa eurytrema</i> (Pfeiffer, 1852)		Endemic	DD
Pupinidae	<i>Tortulosa greeni</i> (Sykes, 1899)		Endemic	EN
Pupinidae	<i>Tortulosa haemastoma</i> (Pfeiffer, 1857)		Endemic	EN

Family	Scientific Name	Common Name	Species Status	Ntional Conservation Status
Pupinidae	<i>Tortulosa hartleyi</i> (Tomlin, 1928)		Endemic	DD
Pupinidae	<i>Tortulosa layardi</i> (Pfeiffer, 1851)		Endemic	EN
Pupinidae	<i>Tortulosa leucocheilus</i> (Adams & Sowerby, 1866)		Endemic	DD
Pupinidae	<i>Tortulosa marginata</i> (Pfeiffer, 1854)		Endemic	EN
Pupinidae	<i>Tortulosa nevillei</i> (Sykes, 1898)		Endemic	EN
Pupinidae	<i>Tortulosa nietneri</i> (Nevill, 1871)		Endemic	DD
Pupinidae	<i>Tortulosa prestoni</i> (Sykes, 1905)		Endemic	DD
Pupinidae	<i>Tortulosa pyramidata</i> (Pfeiffer, 1852)		Endemic	EN
Pupinidae	<i>Tortulosa rugosa</i> (Fulton, 1904)		Endemic	DD
Pupinidae	<i>Tortulosa smithi</i> (Sykes, 1905)		Endemic	CR
Pupinidae	<i>Tortulosa sykesi</i> (Fulton, 1904)		Endemic	CR
Pupinidae	<i>Tortulosa templemani</i> (Pfeiffer, 1854)		Endemic	CR
Pupinidae	<i>Tortulosa thwaitesi</i> (Pfeiffer, 1852)		Endemic	CR
Truncatellidae	<i>Truncatella ceylanica</i> (Pfeiffer, 1856)		Endemic	DD

APPENDIX 13

Appendix 13: List of Echinoids of Sri Lanka.



Salmaeis virgulata (GA)

Family	Scientific Name	English Name	Sinhala Name	Species Status	National Conservation Status
Colubridae	<i>Ahaetulla pulverulenta</i> (Duméril & Bibron, 1854)	Brown Vine Snake	Henakandaya	Indigenous	LC
Colubridae	<i>Argyrogena fasciolata</i> (Shaw, 1802)	Banded Racer	Wal Gerandiya	Indigenous	DD
Colubridae	<i>Boiga barnesii</i> (Günther, 1869)	Barnes's Cat Snake	Panduru Mapila	Endemic	VU
Colubridae	<i>Boiga beddomei</i> (Wall, 1909)	Beddoms Cat Snake	Kaha Mapila	Indigenous	NT
Colubridae	<i>Boiga ceylonensis</i> (Günther, 1858)	Sri Lanka Cat Snake	Nidi Mapila	Indigenous	LC
Colubridae	<i>Boiga forsteni</i> (Duméril, Bibron & Duméril, 1854)	Forsten's Cat Snake	Naga Mapila	Indigenous	NT
Colubridae	<i>Boiga trigonatus</i> (Schneider, 1802)	Gamma Cat Snake	Ran Mapila	Indigenous	LC
Colubridae	<i>Chrysopelea ornata</i> (Shaw, 1802)	Ornate Flying Snake	Malsara	Indigenous	VU
Colubridae	<i>Chrysopelea taprobanica</i> Smith, 1943	Striped Flying Snake	Dangara Danda	Indigenous	LC
Colubridae	<i>Coelognathus helena</i> (Daudin, 1803)	Trinket Snake	Katakaluwa	Indigenous	LC
Colubridae	<i>Dendrelaphis bifrenalis</i> (Boulenger, 1890)	Boulenger's Bronze Back	Pandura Haldanda	Indigenous	NT
Colubridae	<i>Dendrelaphis caudolineolatus</i> (Günther, 1869)	Gunther's Bronze Back	Viri Haldanda	Indigenous	VU
Colubridae	<i>Dendrelaphis oliveri</i> (Taylor, 1950)	Oliver's Bronze Back	Oliverge Haldanda	Endemic	DD
Colubridae	<i>Dendrelaphis schokari</i> (Kuhl, 1820)	Common Bronze Back	Tura Haldanda	Endemic	LC
Colubridae	<i>Dendrelaphis sinharajensis</i> Wickramasinghe, 2016	Sinharaja Tree Snake	Sinharaja Tura Haldanda	Endemic	NE
Colubridae	<i>Dendrelaphis tristis</i> (Daudin, 1803)	Front Spot Bronze Back	Handa Haldanda	Indigenous	LC
Colubridae	<i>Dryocalamus gracilis</i> (Günther, 1864)	The Scarce Bridal	Megata Radanakaya	Indigenous	DD
Colubridae	<i>Dryocalamus nympha</i> (Daudin, 1803)	Bridal Snake	Geta Radanakaya / Geta Karawala	Indigenous	LC
Colubridae	<i>Liopeltis calamaria</i> (Günther, 1858)	Reed Snake	Punbariya	Indigenous	NT
Colubridae	<i>Lycodon carinatus</i> (Kuhl, 1820)	The Sri Lanka Wolf Snake	Dhara Radanakaya	Endemic	EN
Colubridae	<i>Lycodon aulicus</i> (Linnaeus, 1758)	Wolf Snake, House Snake	Alu Radanakaya	Indigenous	LC
Colubridae	<i>Lycodon osmanhilli</i> Taylor, 1950	Flowery Wolf Snake	Mal Radanakaya	Endemic	LC
Colubridae	<i>Lycodon striatus</i> (Shaw, 1802)	Shaw's Wolf Snake	Kabara Radanakaya	Indigenous	LC
Colubridae	<i>Oligodon arnensis</i> (Shaw, 1802)	Common Kukri Snake / Banded Kukri	Arani Dath Ketiya	Indigenous	LC
Colubridae	<i>Oligodon calamarius</i> (Linnaeus, 1758)	Templeton's Kukri Snake	Kabara Dath Ketiya	Endemic	EN
Colubridae	<i>Oligodon sublineatus</i> Duméril, Bibron & Duméril, 1854	Dumerul's Kukri Snake	Pulli Dath Ketiya	Endemic	LC
Colubridae	<i>Oligodon taeniolatus</i> (Jerdon, 1853)	The variegated Kukri Snake / Russell's Kukri Snake	Wairi Dattketiya	Indigenous	LC
Colubridae	<i>Ptyas mucosa</i> (Linnaeus, 1758)	Rat Snake	Gerandiya	Indigenous	LC
Colubridae	<i>Sibynophis subpunctatus</i> (Duméril, Bibron & Duméril, 1854)	Jerdon's Polyodont	Dathigomaraya	Indigenous	NT
Colubridae	<i>Amphiesma stolatum</i> (Linnaeus, 1758)	Buff Striped Keelback	Aharukuka	Indigenous	LC
Colubridae	<i>Aspidura brachyrrhos</i> (Boie, 1827)	Boie's Roughside	Le Madilla	Endemic	VU
Colubridae	<i>Aspidura copei</i> Günther, 1864	Cope's Roughside	Kalu Medilla	Endemic	DD
Colubridae	<i>Aspidura deraniyagalae</i> Gans & Fetcho, 1962	Deraniyagala's Roughside	Kandu Madilla	Endemic	CR
Colubridae	<i>Aspidura drummondhayi</i> Boulenger, 1904	Guenther's Drummond - Hay's Roughside	Ketiwalmedilla	Endemic	EN
Colubridae	<i>Aspidura guentheri</i> Ferguson, 1876	Ferguson's Roughside	Kuda Madilla	Endemic	NT
Colubridae	<i>Aspidura trachyprocta</i> Cope, 1860	Common Roughside	Dalawa Madilla	Endemic	EN
Colubridae	<i>Aspidura ravanai</i> Wickramasinghe, Vidanapathirana, Kandambi, Pyron & Wickramasinghe, 2017	Ravana's Roughside	Ravanage Madilla	Endemic	NE
Colubridae	<i>Aspidura ceylonensis</i> (Günther, 1858)	The black Spine Snake / Mould Snake	Kurunkarawala	Endemic	EN

Family	Scientific Name	English Name	Sinhala Name	Species Status	National Conservation Status
Colubridae	<i>Aretium schistosum</i> (Daudin, 1803)	He Olive keelback Watersnake	Diyawarna	Indigenous	LC
Colubridae	<i>Rhabdophis ceylonensis</i> (Günther, 1858)	Sri Lanka Keelback	Nihaluwa	Endemic	EN
Colubridae	<i>Macropisthodon plumbicolor</i> (Cantor, 1839)	The Green Keelback	Palabariya	Indigenous	NT
Colubridae	<i>Xenochrophis asperimus</i> (Boulenger, 1891)	The Checkered Keelback	Diya Polonga / Diya Bariya	Endemic	LC
Colubridae	<i>Xenochrophis cf. piscator</i> (Schneider, 1799)	Checkered Keelback	Diya Bariya	Endemic	LC
Elapidae	<i>Bungarus caeruleus</i> (Schneider, 1801)	The Common Krait	The Karawala	Indigenous	LC
Elapidae	<i>Bungarus ceylonicus</i> Günther, 1864	Sri Lanka Krait / Ceylon Krait	Mudu Karawala/ Hath Karawala	Endemic	VU
Elapidae	<i>Calliophis haematoetron</i> Smith, Manamendra-arachchi & Somaweera, 2008	Bloody Vented Coral Snake	Bada Rathu Depath Kaluwa	Endemic	CR
Elapidae	<i>Calliophis melanurus</i> (Shaw, 1802)	Sri Lanka Coral Snake	Depath Kaluwa	Indigenous	NT
Elapidae	<i>Naja naja</i> (Linnaeus, 1758)	Indian Cobra	Naya	Indigenous	LC
Elapidae	<i>Hydrophis stokesii</i> (Gray, 1846)	Stoke's Sea Snake	Maha Valakkadiya	Indigenous	LC
Elapidae	<i>Hydrophis schistosus</i> Daudin, 1803	Hook Nose Sea Snake	Valakkadiya	Indigenous	LC
Elapidae	<i>Hydrophis bituberculatus</i> Peters, 1873	Peter's Sea Snake	Peterge Muhudunaya	Indigenous	DD
Elapidae	<i>Hydrophis cyanocinctus</i> Daudin, 1803	The Chitul	Wairan Muhudunaya	Indigenous	LC
Elapidae	<i>Hydrophis fasciatus</i> (Schneider, 1799)	Striped Sea Snake		Indigenous	LC
Elapidae	<i>Hydrophis lapemoides</i> (Gray, 1849)	Persian Gulf Seasnake	Persiyanu Bokke Muhudu Naya	Indigenous	LC
Elapidae	<i>Hydrophis mamillaris</i> (Daudin, 1803)	Bombay Gulf Sea Snake	Bombay Muhudu Naya	Indigenous	DD
Elapidae	<i>Hydrophis ornatus</i> (Gray, 1842)	Gray's Sea Snake	Grayge Muhudu Naya	Indigenous	LC
Elapidae	<i>Hydrophis spiralis</i> (Shaw, 1802)	Narrow Banded Sea Snake	Sihin Mudhu Naya	Indigenous	LC
Elapidae	<i>Hydrophis stricticollis</i> Günther, 1864	Gunther's Sea Snake	Guntherge Muhudunaya	Indigenous	DD
Elapidae	<i>Hydrophis jerdonii</i> (Gray, 1849)	Jerdon's Sea Snake	Jerdonge Muhudu Naya	Indigenous	LC
Elapidae	<i>Hydrophis curtus</i> (Shaw, 1802)	Shaw's Sea Snake	Shawge Kuda Muhudunaya	Indigenous	LC
Elapidae	<i>Hydrophis platurus</i> (Linnaeus, 1766)	Yellow Bellied Sea Snake	Badakaha Muhudu Naya	Indigenous	LC
Elapidae	<i>Hydrophis viperinus</i> (Schmidt, 1852)	Viperine Sea Snake	Polon Muhudunaya	Indigenous	LC
Elapidae	<i>Microcephalophis gracilis</i> (Shaw, 1802)	John's Sea Snake	Kudahis Muhudu Naya	Indigenous	LC
Homalopsidae	<i>Cerberus rynchops</i> (Schneider, 1799)	Dog-faced Water Snake	Kuna Diya Kaluwa	Indigenous	LC
Homalopsidae	<i>Gerarda prevostiana</i> (Eydoux & Gervais, 1837)	Gerard's Water Snake	Prevostge Diyarariya	Indigenous	EN
Homalopsidae	<i>Enhydryis enhydryis</i> (Schneider, 1799)	Rainbow Mud Snake	Dedunu Diyarariya	Indigenous	DD
Gerrhopilidae	<i>Gerrhopilus ceylonicus</i> (Smith, 1943)	Smith's Blind Snake	Smithge Kanaualla	Endemic	DD
Gerrhopilidae	<i>Gerrhopilus mirus</i> (Jan, 1860)	Jan's Blind Snake	Heenkanaualla	Endemic	CR
Viperidae	<i>Daboia russellii</i> (Shaw & Nodder, 1797)	Russell's Viper	Tith Polonga	Indigenous	LC
Viperidae	<i>Echis carinatus</i> (Schneider, 1801)	Saw Scale Viper	Vali Polonga	Indigenous	VU
Viperidae	<i>Hypnale hypnale</i> (Merrem, 1820)	The Merrem's Hump nose Viper	Polon Theilissa	Indigenous	LC
Viperidae	<i>Hypnale nepa</i> (Laurenti, 1768)	Sri Lankan Hump-nosed viper	Mukalan Theilissa	Endemic	EN
Viperidae	<i>Hypnale zara</i> (Gray, 1849)	Zara's Hump-nosed Viper	Zara's Mukalan Theilissa	Endemic	VU
Viperidae	<i>Hypnale sp. 'amal'</i> Maduwage, Silva, Manamendra-Arachchi & Pethiyagoda, 2009	Amal's Hump-nosed Viper	Amal Mukalan Theilissa	Endemic	CR
Viperidae	<i>Trimeresurus trigonocephalus</i> (La-treille, 1801)	Green Pit Viper	Pala Polonga	Endemic	LC
Typhlopidae	<i>Indotyphlops malcolmi</i> (Taylor, 1947)	Malcolm's Blind Snake	Malcomge Kanaualla	Endemic	DD
Typhlopidae	<i>Indotyphlops braminus</i> (Daudin, 1803)	Common Blind Snake	Dumuta Kanaualla	Indigenous	LC
Typhlopidae	<i>Indotyphlops lankaensis</i> (Taylor, 1947)	Lanka Blind Snake	Lak Kanaualla	Endemic	CR
Typhlopidae	<i>Indotyphlops leucomelas</i> (Boulenger, 1890)	Pied Gerrhopilus	Dewarna Kanaualla	Endemic	CR
Typhlopidae	<i>Indotyphlops porrectus</i> (Stoliczka, 1871)	Stoliczka's Blind Snake	Stoliczkege Kanaualla	Indigenous	EN
Typhlopidae	<i>Indotyphlops tenebrarum</i> (Taylor, 1947)	Taylor's Blind Snake	Taylorge Kanaualla	Endemic	DD
Typhlopidae	<i>Indotyphlops veddae</i> (Taylor, 1947)	Veddha's Blind Snake	Veddage Kanaualla	Endemic	DD
Typhlopidae	<i>Indotyphlops violaceus</i> (Taylor, 1947)	Violet Blind Snake	Dan Kanaualla	Endemic	DD

APPENDIX 17



Nisaetus cirrhatus (ZA)

