

Sri Lanka's Rainforest Initiative

To assure the integrity of ecosystems and evolutionary processes—
not just for our time, but in perpetuity.

The rainforests of the island of Sri Lanka contain an extraordinary variety of plants and animals: so much so that together with the Western Ghats of southwest India, Sri Lanka is considered to be one of only 25 global biodiversity hotspots¹⁻⁵. Yet, the island's rainforests (that contain most of this diversity) have declined from c. 16,800 km² two centuries ago, to just 750 km² today— *i.e. to less than five percent of their former area*. To make matters worse, even the surviving rainforests are heavily fragmented into more than 60 discrete 'islands', the largest three of which account for 55 percent of Sri Lanka's total rainforest area (see map).

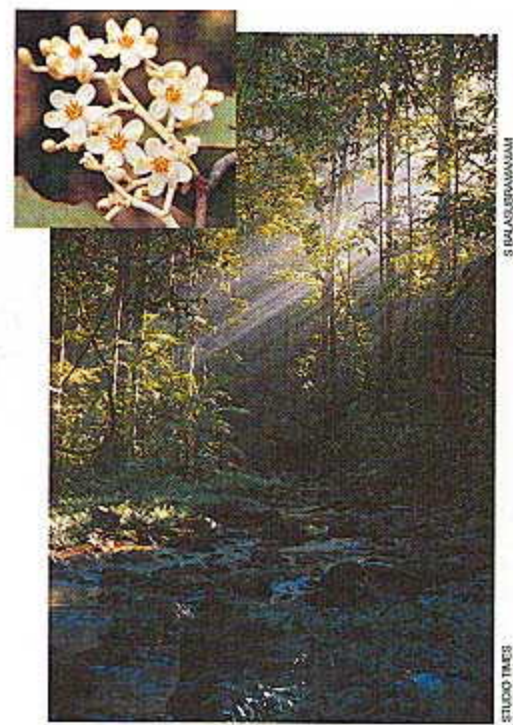
Sri Lanka's rainforests are confined to its southwestern 'wet zone' (*i.e. rainfall higher than 2,000 mm per year*). Because of the abundance of water for agriculture and industrialization, this is also the most densely populated part of the country. The wet zone's population density of 655 people per km² is much higher than the national average of 298 per km², which is already the highest among the world's biodiversity hotspots⁶.

Much of Sri Lanka's phenomenal taxonomic diversity has been discovered only through exploration and research conducted in the past decade. Sadly, these studies have also shown that several extinctions have occurred already, including at least two species of freshwater fishes¹⁵ and sixteen species of amphibians¹⁴. Many other faunal and floral groups have never been subjected to systematic exploration.

The Government of Sri Lanka is determined to stop this trend. During the past year, with assistance from international donors, we have instituted several new measures, such as—

- ↑ Forest cover in Sri Lanka, demarcating the south-western 'wet zone' (*i.e. annual rainfall > 2,000 mm*). The dry zone contains much more forest, though much poorer than the wet zone in terms of biodiversity
- ← A close-up view of the south-western west zone, showing the paucity of rainforest, and the high degree of fragmentation.

- Developing policies and revising legislation relating to biodiversity, forestry, nature-based tourism and *ex situ* conservation with the intention of establishing closer participation with local communi-



Rainforest: the Sinharaja World Heritage Site. Inset: flowers of *Doona macrophylla*, one of c. 50 species of Dipterocarpaceae endemic to Sri Lanka, as is the genus *Doona* itself.



Perbrinckia sanguinea, a freshwater crab endemic to a few km² of the Knuckles hills. This is one of four genera and 35 species of freshwater crabs endemic to Sri Lanka, 28 of which have been discovered only in the past decade: several more species remain to be described.



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The study of Sri Lanka's plants goes back a long way, as this title page from Linnaeus's *Flora Zeylanica* (1747) shows. As a result of this pioneering work—Linnaeus's only tropical flora—Sri Lanka figured prominently in his *Species Plantarum* (1753), which was to become the foundation of systematic botany. The specimens for *Flora Zeylanica* were collected in Sri Lanka by Paul Hermann in the 1670s.



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The stark boundary between the c. 1,800 m altitude Namunukula montane cloud-forest and the surrounding tea plantations exemplifies the predicament of rainforest fragments in Sri Lanka. The bare patches of tea show the effect of almost 300 tons of soil per hectare (on average) being eroded annually over the past century.

ties and NGOs, assuring sustainability and improving the quality of engagement with the private sector;

- Developing strategies to cope with the social aspects of biodiversity conservation, such as dealing with the human-elephant conflict and facilitating sustainable access to non-timber forest produce by local communities;
- Facilitating community and private-sector initiatives in sustainable forestry so as to reduce the pressure of illegal harvesting on natural forests;
- Promoting the *ex situ* cultivation of plants used in traditional (*ayurvedic*) medicine so as to reduce pressure on wild stocks
- Demarcating 13,000 km of forest boundaries so as to minimize problems of encroachment;
- Commencing work on a National Institute of Biodiversity to serve as a focal point for biodiversity research in the country; and
- Developing participatory management plans for as many forests as possible.

However, we recognize that this is not enough. Sri Lanka's rainforests, and the unique biodiversity they contain, continue to face grave and urgent threats that can only be addressed through intensive scientific research, effective management systems and significant investment of money and effort. We realize that the depredation caused to our nation's biodiversity after two centuries of unrestrained abuse cannot ever be reversed. And we know that however well we 'protect' our remaining forests, biodiversity will continue to be lost unless we address the

Sri Lanka Biodiversity Overview

	No. of species	% endemic
Flowering plants ^{7,8}	c. 3,100	c. 27
Reptiles ¹⁰	173	47
Birds ¹¹ (resident)	227	12
Frogs ¹⁴	c. 150	c. 90
Freshwater crabs ¹²	35	97
Butterflies ¹⁹	234	13
Dragonflies ²⁰	117	44
Land snails ⁹	c. 300	c. 90



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Philautus femoralis, a tree frog endemic to Sri Lanka's montane cloud forests. As at 1993, only 35 species of amphibians were known from Sri Lanka. An island-wide survey between 1993 and 2001 however, served to discover an extraordinary diversity among the frogs, especially tree-frogs of the genus *Philautus*. Researchers now estimate that the island's frog fauna (including extinct species known only from old museum collections), exceeds 150 species. Most *Philautus* are 'direct-developers': i.e. they lay their eggs not in water, but among leaf litter on the rainforest floor. The eggs hatch directly into froglets, bypassing the aquatic tadpole stage that other 'conventional' frogs undergo.



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A nest of *Aneuretus simoni*, the only living representative of the ant subfamily Aneuretinae, which is endemic to Sri Lanka. The species is known from only two small rainforest fragments; should it be lost here, one of the world's 11 subfamilies of ants, whose closest known relatives date back 30 million years, will have been lost forever.



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The land-snail genus *Acavus* is endemic to Sri Lanka. A 'Gondwanan relict', its closest living relatives occur in South America, Southwestern Africa, Madagascar, the Seychelles and Eastern Australia— a reminder that until about 150 million years ago, these land-masses were joined together in the supercontinent Gondwana.

A recent survey of Sri Lanka's terrestrial snails served to uncover more than 50 new species, taking the island's total snail fauna to c. 300 species. More than 90% of these species are endemic to Sri Lanka, and the vast majority of them restricted to rainforests.



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Known as Serendip to ancient Greece, Sri Lanka has been for millennia the focus of a thriving spice trade. (L-R) cinnamon, black pepper and cardamom (*Cinnamomum verum*, *Piper nigrum* and *Elettaria cardamomum*), all indigenous to Sri Lanka's rainforests; wild cinnamon is endemic to the island. Lured by spices, the Portuguese began the colonization of Sri Lanka in 1505— an occupation that was to continue under the Dutch and later the British, for almost 450 years until Independence in 1948.

underlying threats. We are therefore readying ourselves to face a new challenge and moving towards a new paradigm—to assure the integrity of vital ecosystems and evolutionary processes, not just for our time, but in perpetuity.

What then, are the problems that confront Sri Lanka's rainforests and their biodiversity? As we understand them today, the most pressing issues are as follows —

Loss of habitat. The extremely high human-population densities in the wet zone and continued population increase represents an escalating threat to remaining forest fragments. Thus there is an urgent need to identify and inventorize all remaining forest fragments, rank them according to their importance to biodiversity conservation and level of threat, bestow appropriate conservation status on them and develop management plans to ensure their integrity.

Fragmentation. The continuous attrition caused by 'island effects' will in the long-term lead inevitably to the loss of biodiversity in forest fragments. This can only be addressed by urgent baseline studies and inventorying of the existing biodiversity, followed by continuous monitoring and intensive management, especially to assure the survival of point-endemic species restricted to particular habitat fragments. Fragments separated by short distances should be linked through suitable habitat corridors and 'stepping stones'. Further, the boundaries of forest fragments must be extended so as to increase their area and minimize external threats.

Sri Lanka at a Glance (2001)	
1. Land area (km ²)	65,232
2. Population (millions)	19.5
3. GNP (per capita, in USD)	900
4. Life expectancy (years)	72.5
5. Infant mortality (/1,000 live births)	16
6. Forest area (km ²)	20,400
7. Protected area* (km ²)	8,000
8. Rainforest area** (km ²)	750
9. Mangrove area** (km ²)	90
10. Wetland area** (km ²)	60
11. Inland water area** (km ²)	2,900
12. Biodiversity conservation staff	4,250
13. Biodiv. cons. budget (mn US\$) [†]	3.9

* Included in (6) above.
 ** Included in (1) above.
 † Million USD; excludes capital expenditure and ODA.



SAMUEL YANUZE



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Primates endemic to Sri Lanka —
 Above: Purple-faced leaf monkeys, *Semnopithecus vetulus*. Restricted almost entirely to rainforests, three subspecies are recognised from the island's different ecoregions.
 Below: toque [an archaic word for 'bonnet'] monkeys, one of the few endemic species abundant in all forested parts of Sri Lanka.



The pitcher plant, *Nepenthes distillatoria*: dependent on this endemic rainforest plant is a mosquito, the larvae of which are adapted to life in the acidic liquid that collects in the pitcher.



Sri Lanka's national bird, the endemic Sri Lanka jungle fowl (*Gallus lafayettii*), is a common inhabitant of rainforests. At least 23 bird species are endemic to the island: a systematic comparison of Sri Lanka's resident avifauna with that of southern India is likely to demonstrate however, that endemism is in fact much higher.

Buffer Zones. All Sri Lanka's rainforest fragments are surrounded by agricultural land, and lack effective habitat buffers. The establishment of buffer zones through the provision of incentives to landowners to restore and reforest their lands is an urgent need. This is especially important also because of the high use of pesticides and herbicides in Sri Lanka and because clear-cutting of forest continues to be a problem.

Inventory. The National Institute of Biodiversity is being established to serve as a center for taxonomic studies, maintain biodiversity inventories and GIS, and to serve as the national bio-repository. During the past decade, *ad hoc* research initiatives by individuals and NGOs have demonstrated that Sri Lanka's biodiversity is much higher than was previously thought (see box on p. 2). However, the diversities of several important groups of animals, including insects such as ants, beetles, termites and moths, have never been assessed. Ferns and mosses were last 'assessed' more than a century ago. While many species remain to be discovered, large numbers of species have disappeared even before they could be formally named: this is especially worrying as the island contains several important 'point-endemic' species, such as the ant *Aneuretus simoni*, the only surviving member of the subfamily Aneuretinae¹⁶. It is

Ongoing Initiatives

- Sulfur content of diesel will be halved by January 2003 (leaded gasoline was discontinued in mid-2002).
- A \$10 million fund is being established for empowering communities living in the buffer zones of protected areas to develop sustainable livelihoods.
- The boundaries of all protected areas (c. 13,000 km) are being demarcated.
- Public-private and community partnerships are being actively encouraged.
- Carbon trading mechanisms are being enabled so as to encourage appropriate energy and forest-sector projects.
- A framework plan for biodiversity conservation is in place and being implemented, as are policies for wildlife conservation and environment.
- *Ex situ* conservation is being enabled through special legislation.



The blue magpie, *Urocissa ornata*, is endemic to Sri Lanka's lowland rainforests...



Above: the 32 km² Horton Plains National Park (> 2,100 m a.s.l.) contains some of Sri Lanka's last remaining tropical montane cloud forest (TMCFs). Hundreds of plant and animal species are endemic to this habitat, facing mounting pressure from dozens of alien invasive species. Below: spreading crowns of the specialised TMCF tree, *Calophyllum walkeri*, an endemic adapted to deriving water from mist.



42 of Sri Lanka's 82 terrestrial snake species are endemic, including the green pit-viper, *Trimeresurus trionocephalus*. Some 600,000 snakebites occur annually, 1% of them fatal: a world high. Although only five snake species are fatally venomous, high mortality has resulted in snakes being killed at sight, with serious consequences for their conservation.



Rhinophis drummondhayi, one of 15 species of this fossorial group (Uropeltidae) of snakes found in Sri Lanka, all but one of which are endemic to the island.



Seven of Sri Lanka's c. 20 species of geckoes, including this rainforest species, *Geckoella triedrus*, are endemic to the island; several species remain to be described.

particularly important to avoid conservation activity being focused only on charismatic animals such as mammals and birds, especially as less obvious faunas and floras are often more at risk¹⁷. Additionally, the study of biodiversity of the rainforest canopy, which is in many parts of the tropics among the richest harbors of biodiversity, has barely begun. Much remains to be discovered: an much more is there to be conserved.

Invasive organisms. Alien invasive species pose an urgent and immediate threat to Sri Lanka's biodiversity. This is most clearly seen in aquatic habitats, where African tilapia fishes introduced in the 1950s (together with c. 30 other fish and mollusk species)¹⁵, have completely altered aquatic communities. Additionally, forests, aquatic ecosystems and agriculture are threatened by over 300 exotic plant species that are invasive to varying degrees⁷. Given this background, the maintenance of the integrity of ecosystems is a formidable challenge.

Poverty. The Government of Sri Lanka recognizes that the reduction of poverty is the key to improving environmental quality. Likewise, the threats to forest ecosystems too, are directly linked to poverty. For example, over 50 percent of Sri Lanka's homes (12 million of its people) still use firewood as their primary fuel, although almost no firewood is cultivated. Sri Lanka also has the highest population density of the world's biodiversity hotspots, and its population is growing at c. 1.7 percent per year¹⁸. This inevitably leads to more demand for land. Initiatives to improve the quality of life of people living in proximity to forests are therefore a key to effective long-term conservation.

A solution. The *Rainforest Initiative* was instituted to generate international awareness of Sri Lanka's unique and fast-disappearing rainforest biodiversity, and to underline the Government's determination urgently to address this crisis. We recognize that our nation's biodiversity, of which we are sovereign custodians, is the common heritage of mankind. It is also gravely at risk. We must, therefore, develop closer engagement and collaboration across a wide field of disciplines and interests to address the urgent issues that confront us, and work towards preserving this gravely endangered treasure for generations yet to come.



Lizards of the agamid genus *Ceratophora*, such as *C. aspera* here, have bizarre rostral appendages. Five species are known from this genus, which is endemic to Sri Lanka's rainforests.



The sole surviving representatives of two genera of agamid lizards endemic to Sri Lanka's rainforests. The live-bearing *Cophotis ceylanica* (above), is restricted to the montane cloud forests of the central hills, while *Lyriocephalus scutatus* is found only in lowland rain forests.



Srilankamys ohiensis, an endemic genus and species of mouse restricted to high-altitude (c. 2,000 m a.s.l.) cloud forests. The small mammals of Sri Lanka, including the mice and shrews, are yet to be systematically explored.



The leopard, *Panthera pardus*, is the top carnivore in Sri Lanka's rainforests. Though they are protected and occur almost everywhere in Sri Lanka, leopards continue to be hunted illegally for their skin and meat.

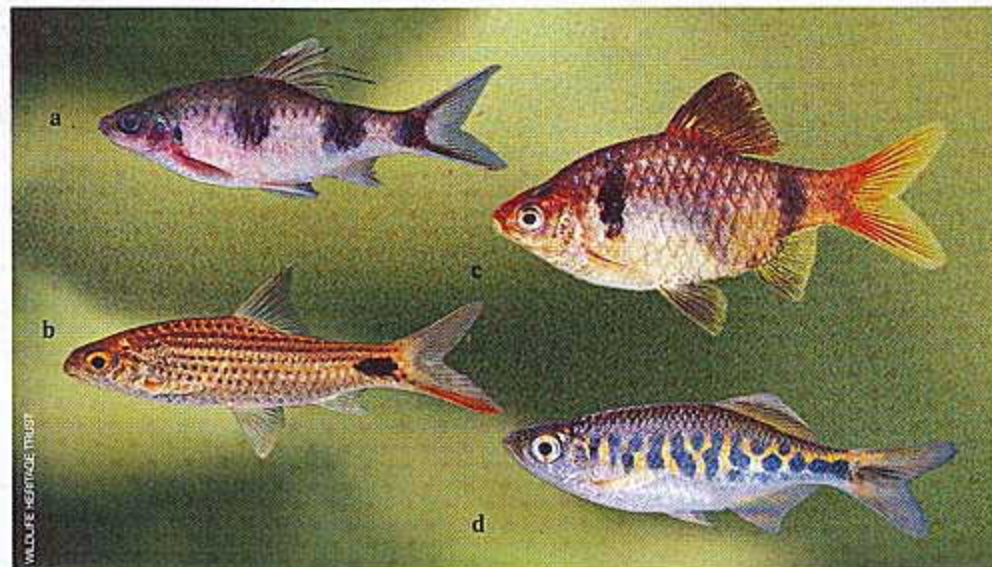


Despite Sri Lanka's freshwater fishes being 'well known' thanks to many species being part of the international ornamentals trade, new species continue to be discovered. These include several 'point-endemics'—species restricted to a single locality. These fishes are each restricted to a total range of less than c. 5 km², an indication of the threat they face from habitat degradation; they were all discovered during the past two decades.

a: *Puntius srilankensis*; b: *P. asoka*; c: *P. bandula*; d: *Danio pathirana*.

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Nessia monodactyla: the limbless skinks of the endemic Sri Lankan genus *Nessia* form a remarkable radiation of eight species in Sri Lanka's rainforests. Two genera and 22 of the 28 skink species on the island are endemic.



Krombeinictus nordenae, an endemic genus and species of sphecid wasp that lives in branches of the endemic rainforest tree *Humboldtia laurifolia*. This species is remarkable for being the only sphecid wasp progressively to feed its larvae, and to do so with pollen, rather than paralyzed prey, as do all other sphecid wasps.



The Blue Oakleaf, *Kallima philarchus*. Both the butterfly and its food plant, a species of *Strobilanthes*, are endemic to Sri Lanka.