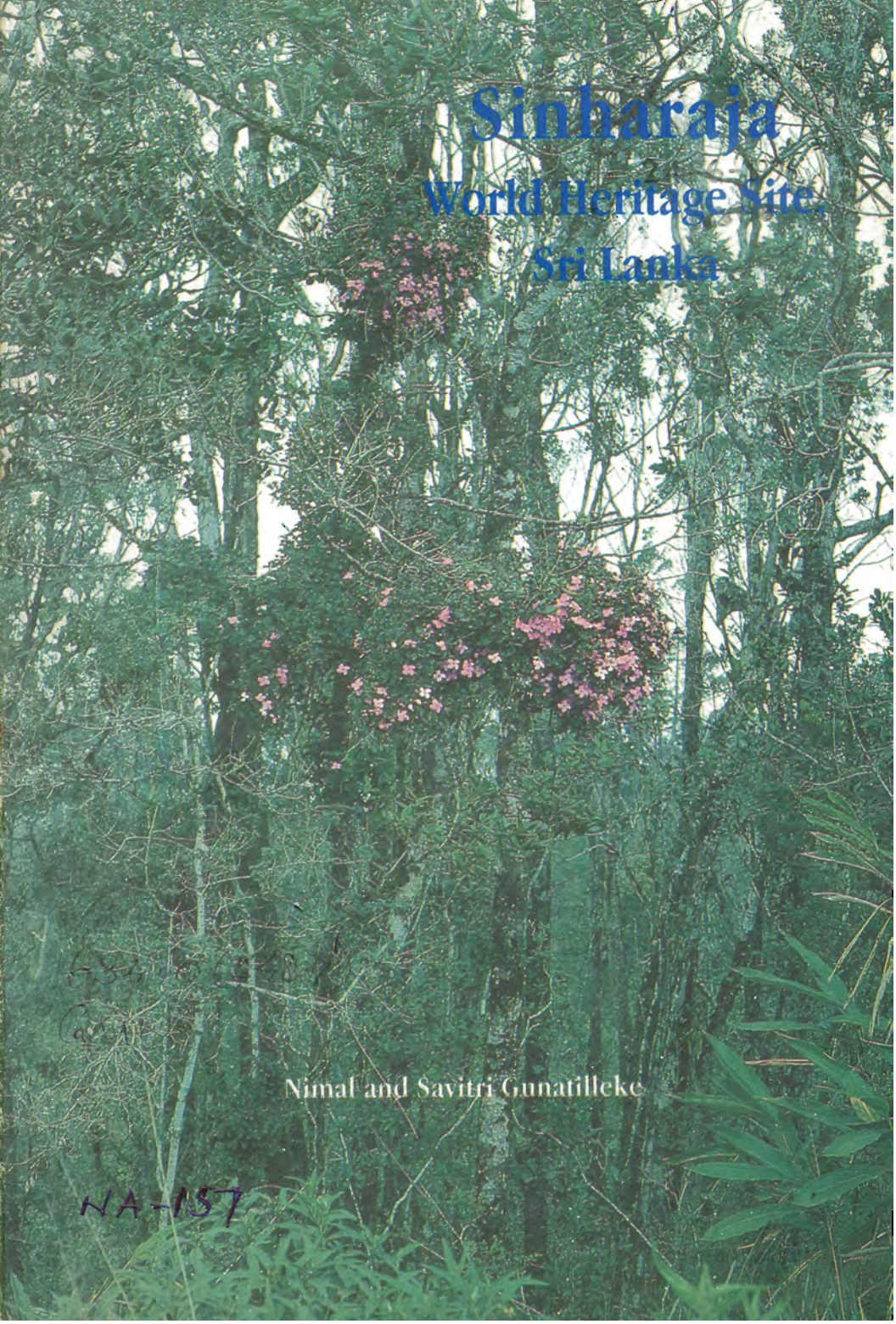

Sinharaja

World Heritage Site, Sri Lanka

Nimal and Savitri Gunatilleke

Sinharaja

World Heritage Site, Sri Lanka

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Natural Resources, Energy & Science Authority of Sri Lanka

1996

To the people of Sinharaja

and

all who contributed to its conservation

CONTENTS

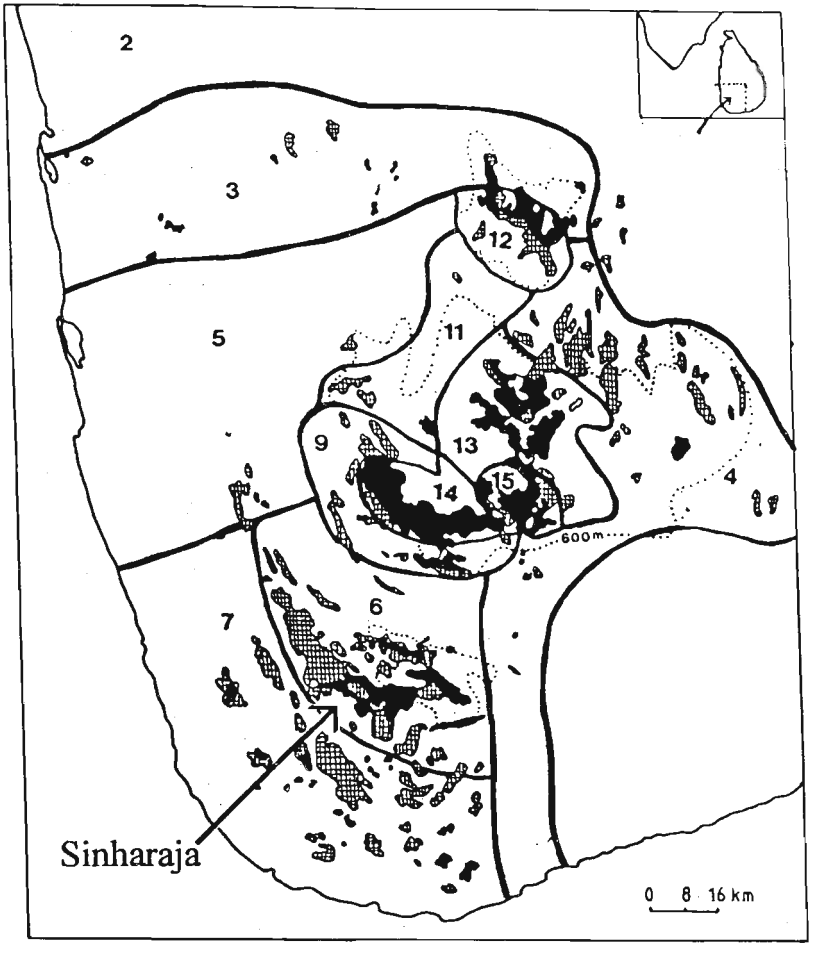
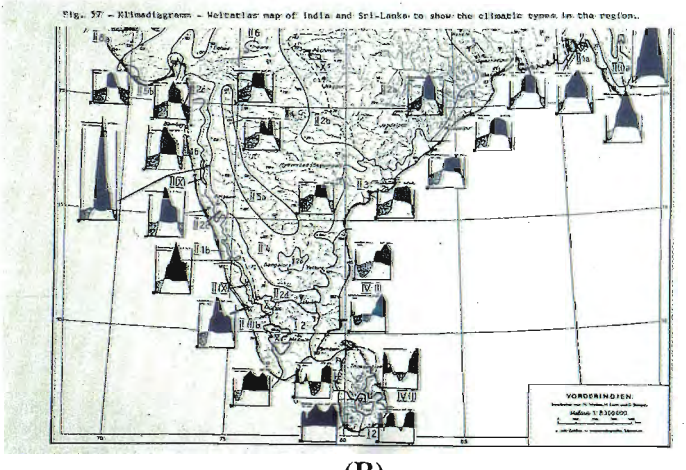


Figure 1. Distribution of relatively undisturbed primary forests (shaded areas) and selectively logged and/or disturbed forests (checked areas) in the different floristic regions (2, 3, 5-7, 9, 11-15) of south-west Sri Lanka. Sinharaja, in floristic region 6, is the largest block of relatively undisturbed forest in the lowland wet zone of Sri Lanka.

SINHARAJA: FACTS AND FEATURES

Location:	South-west Sri Lanka; between latitudes 6°21'- 6°27'N and longitudes 80°21' - 80°38'E.
Area:	112 sq. km including 23 sq. km of sub-montane forests and grasslands in the east.
Altitude:	210 m - 1180 m a.m.s.l.
Vegetation:	Lowland and submontane tropical wet evergreen forests and submontane pathana grasslands.
Flora:	Relict of Deccan - Gondwana flora belonging to Indo-Malayan Realm, species with disjunct distribution, high species endemism, threatened species.
Useful Plants:	Soft-hardwoods and quality timber species, wild relatives of fruit and spice plants; rattans, food, ornamental and medicinal plants.
Other values:	Watershed protection, wildlife refuge, educational training and research, tourist attraction.
Threats:	Deforestation, agriculture, mining for precious stones, over-visitation, hunting.
Conservation:	A National Wilderness Heritage Area, Man and Biosphere Reserve and a World Heritage Site. A Conservation Management Plan prepared by IUCN, Sri Lanka and implemented by the Forest Department of the Ministry of Agriculture, Forestry and Lands.

(A)



(B)

Plate 1. **(A)** Undulating terrain of Sinharaja forest. Localized distribution of species on ridge tops, saddles, valleys and water courses increase the biological diversity of the forest.

(B) Walter's climate diagrams for Peninsular India and Sri Lanka. In the whole of South Asia an ever wet, aseasonal climate is present only in southwest Sri Lanka. Lowland rain forests of Sinharaja represent the natural climax vegetation in this climate.

GEOGRAPHY

Sinharaja tropical wet evergreen forest and grassland are located within the Sabaragamuwa and Southern administrative provinces of south-western Sri Lanka. A mere 9% of these forests are now remaining in the island and that too, is partially degraded and fragmented due to timber extraction and village expansion schemes. With its recently annexed eastern extension of 23 sq.km. of submontane wet evergreen forests, grasslands and some degraded and abandoned agricultural lands, the **total conservation area of Sinharaja** now stands at **112 sq. km**. This represents the largest sliver of relatively undisturbed lowland and submontane rain forests now remaining in Sri Lanka.

From west to east, there is an increasing **elevational gradient** from 220 m to 1180 m. From the southern slopes of Sinharaja arise the **headwaters** of Gin Ganga and its northern and western slopes drain into a major tributary of the Kalu Ganga. These streams also delineate the **boundaries of the forest** except on the eastern side which is now expanded to include the Morningside estate with abandoned tea and cardamom plantations. Nearly 40 small villages are dotted around the perimeter of the forest. Most of them are ancient hamlets, each with 20 - 50 or more families, most of whom are at least partially dependent on the forest for their subsistence.

Physiography of Sinharaja forest represents a series of parallel strikes in SE-NW direction with highly dissected ridges, steep slopes and isolated valleys. There are at least 10 prominent peaks scattered throughout the forest with a **high-altitude plateau** (1100m) in the east known as Tangamale Plains.

An aseasonal perhumid **climate** prevails within Sinharaja forest with a **mean annual precipitation** ranging from 3600 - 6000 mm with distinct monsoonal peaks in May and November. The relatively dry periods are from January-

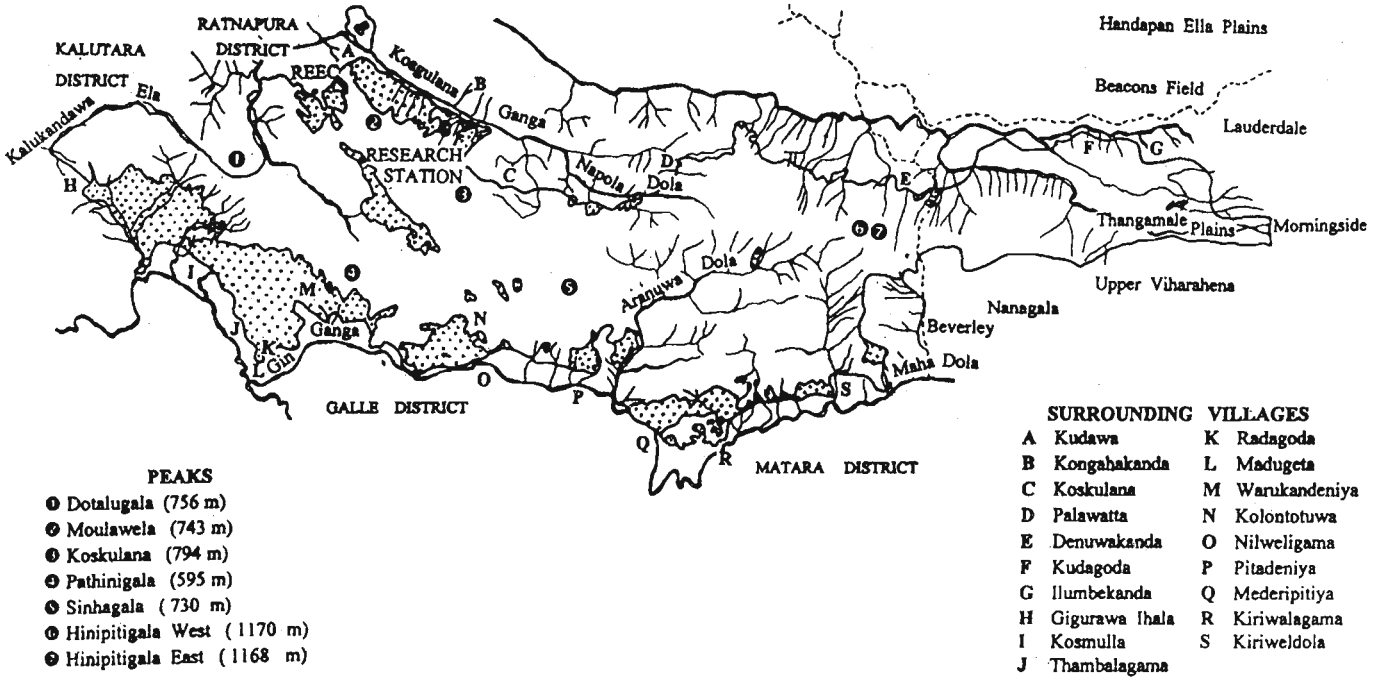


Figure 2. Distribution of the undisturbed and selectively logged parts of the forest (clear areas) and secondary vegetation and plantations (dotted areas) in the Sinharaja reserve. Other salient features shown include, surrounding villages, peaks and streams.

March and August. **Mean annual temperature** ranges from 19°C - 31°C. However, in the eastern highlands from where no records are available, it could be lower. Stronger winds and mist-laden cloudy skies are frequent in the eastern sector of the forest.

Geologically, Sinharaja lies in the transition zone between two main local **geological formations** known as the Highland Group and the Southwestern Group consisting predominantly of Khondalites and Charnokites of Precambrian crystalline origin. Sinharaja also represents a distinctive zone of basic rocks which include Hornblendes, basic Charnokites, Pyroxine amphibolites and Scapolite bearing calc granulites. The **soils** are mostly ultisols with abundant lateritic formations (Gunatilleke and Gunatilleke, 1985; de Zoysa and Raheem, 1990).

VEGETATION

Based on physiognomic, ecological and floristic criteria, the vegetation of Sinharaja can be divided into the following categories:

Lowland Tropical Wet Evergreen Forests - *Mesua-Doona (Shorea)* Formation.

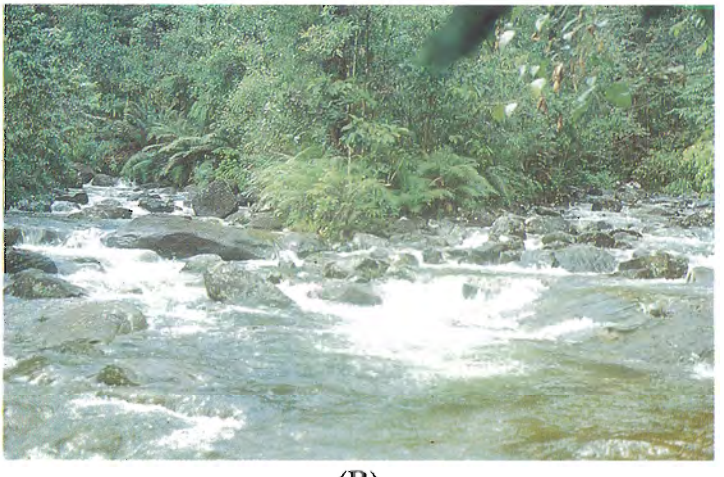
Submontane tropical Wet Evergreen Forests - *Shorea-Calophyllum-Cullenia* Formation.

Submontane *Pathana* grasslands.

Secondary forests and fernlands of anthropogenic origin.

The lowland wet evergreen forests are dominated by the *Mesua - Doona* Forest formation with no emergent layer. It has a canopy of 30-35 m which is codominated by several species each of *Shorea* and *Syzygium,* two species of *Mesua, Palaquium petiolare*, and *Anisophyllea cinnamomoides*. The

(A)



(B)

Plate 2. **(A)** A grove of canopy dominant *Shorea trapezifolia* (Dipterocarpaceae) in flower on the ridge crest. This species, endemic to Sri Lanka, flowers annually.

(B) Streams of the Sinharaja forest drain to the Gin ganga on the south and to the Kukulu ganga on the north. These streams and their banks are the habitats for a number of endemic plants and animals.

subcanopy stratum is dominated by *Chaetocarpus castanocarpus, Myristica dactyloides, Cullenia rosayroana,* and *Mesua ferrea.* An **understorey** tree stratum dominated by *Garcinia hermonii* and *Xylopia championii,* is distinguishable. A sparsely distributed **shrub and herbaceous layer** dominated by members of Rubiaceae, Euphorbiaceae and Zingiberaceae is also evident. *Coscinium fenestratum, Dalbergia championii, Entada* sp. and *Artabotrys zeylanica* are among the common woody climbers. A rich epiphytic flora of lichens, liverworts, mosses, filmy ferns and orchids is also present. **The submontane tropical wet evergreen forests** with a canopy height of 25 - 30 m are dominated by *Shorea gardneri* and are physiognomically similar to their lowland counterparts in valleys and lower slopes but are generally gnarled and twisted in the windswept higher areas. The peripheral areas of the primary forests are replaced by **secondary scrub vegetation** consisting of species of *Alstonia, Melastoma, Osbeckia, Macaranga, Mussenda, Wendlandia, Hedyotes, Ochlandra, Toddalia, Pteris* and *Dicranopteris.*

The wet pathana grasslands are dominated by *Chrysopogon zeylanicum* and several species of *Eriocaulon.*

FLORA

The rain forest flora of southwestern Sri Lanka represented by Sinharaja is a **relict of the ancient Deccan-Gondwana flora** and both the species richness and endemism are concentrated in these primaeval forests. **Endemicity** is extraordinarily high at specific and intraspecific rank suggesting their evolution during isolated raft of the Deccan plate in upper Cretaceous and early Eocene periods.

The **phytogeographic affinities** of Sri Lankan rain forest elements with those of Madagascar, Seychelles, South India and Malesia are of considerable interest to historical

(3A)

(4A)

(4B)

Plate 3. **(A)** Part of the selectively logged forest in Sinharaja. The canopy openings are visible even 15 years after logging. Species of large diameter rattan colonize such gaps, using the remaining trees to support them.

Plate 4. *Acranthera zeylanica* (Rubiaceae) **(A)**, *Anoectochilus setaceus* (Orchidaceae) **(B)**, both ornamental species growing in moist, shady habitats of the forest. *A. setaceus* relatively common in the past is becoming rare due to unregulated collection for its ornamental and medicinal value.

biogeographers. According to some phytogeographers, the Deccan plate played a major role in the northward migration of Gondwanic families Dipterocarpaceae and Dilleniaceae and of suprageneric taxa notably of Palmae, Monimiaceae, Proteaceae, Myrtaceae and Bombacaceae. Sinharaja rain forest is among the last vestiges of this original **Deccan-Gondwanic flora**. Sinharaja forest is included in the floristic regions 6 and 7 of the island (Ashton and Gunatilleke, 1987).

The total angiosperm flora of the Sinharaja reserve including all woody and non-woody life forms in both primary and secondary vegetational elements could be estimated to be around 700 species based on several floristic surveys and herbarium collections. This represents about one fifth of the total **angiosperm flora** of the island of which nearly 90% are concentrated in the perhumid south western quarter of the island. Inclusion of the **lower vascular taxa** such as pteridophytes, bryophytes, microfungi and lichens may increase this figure to 1000 or even more. The epiphytic and epiphyllous flora is relatively poorly studied but considered to be quite rich and diverse. On one occasion, as many as 13 different epiphyllous bryophyte species were encountered on a single leaf of *Mesua ferrea*. An enumeration of woody species over 30 cm girth at breast height in 25 ha of lowland primary forest of Sinharaja revealed the presence of 211 species belonging to 119 genera and 43 families. **The dominant tree families** at Sinharaja are Clusiaceae, Dipterocarpaceae, Sapotaceae, Bombacaceae and Myrtaceae. The **shrub flora** is dominated by Rubiaceae, Euphorbiaceae and Melastomataceae. Dipterocarpaceae, Myrtaceae, Euphorbiaceae, Clusiaceae, and Rubiaceae are among the most **speciose families** within the forest. In Dipterocarpaceae, genus *Shorea* is best represented in this forest with 13 species, all endemic to the island. Similarly **speciose genera** such as *Syzygium, Calophyllum, Diospyros, Memecylon, Semecarpus, Stemonoporus* and *Palaquium* have high endemism within them. **In the tree flora of Sinharaja, 64% of the species are endemic to Sri Lanka and the contribution of endemics to the tree**

(A)

(D)

(C)

(B)

Plate 5. *Coscinium fenestratum* (Menispermaceae) (weniwelgeta), a woody, dioecious climber **(A)** of canopy gaps and forest fringes, much sought after for its medicinal value. Its stems directly harvested from the wild, stored at a rural collecting center **(B)** until they are bulk transported to the urban centers. Fruit (young-**C**; mature-**D**) pulp of the species is eaten and its seeds dispersed by pole cats and bats. Rats and porcupines predate on fruits fallen beneath the mother plant.

(A)

(B)

(C)

Plate 6. (A) An edible mushroom (athuru hathu) from the forest, a popular delicacy among villagers around Sinharaja.

(B) A portion of a village hut thatched with mature leaves of *Agrostistachys intramarginalis*, a common understorey shrub species in the Sinharaja forest.

(C) A treelet of *Agrostistachys intramarginalis* displaying its flame coloured young leaves.

(A)

(B) (C)

Plate 7. **(A)** A fishtail palm or Kitul *(Caryota urens),* whose inflorescences are tapped by villagers. Its sugary exudate may be concentrated and often set in hemispheres to make a candy called 'jaggary' (hakuru), or fermented to give an alcoholic brew called 'toddy'.

(B) A villager preparing a young inflorescence for tapping. It is protected from the rain by the leaf base of the betel nut palm *(Areca catechu).*

(C) Jaggary making is a thriving cottage industry around Sinharaja. A villager pouring the kitul treacle concentrate into coconut shells to set. This gives their hemispherical shape.

density and basal area is 86% and 91% respectively. Restricted or localized distribution of species is unusually high in Sri Lankan rain forests including Sinharaja.

Since most other low and mid-altitudinal rain forests of Sri Lanka have been degraded due to timber extraction, Sinharaja forest remains the main refugium for long-term survival of the endemic-rich lowland rain forest flora of Sri Lanka. **Based on phytosociological surveys, it has been estimated that out of 135 endemic woody species, 15 are in the endangered, 48 in the vulnerable and 64 in the rare categories of the IUCN Red Data Book classification** (Gunatilleke and Gunatilleke, 1991). The variegated ebony also known as calamander *(Diospyros quaesita)*, one of the most beautiful luxury hardwoods in Sri Lanka is among the species in the endangered category.

USEFUL PLANTS

Over 80 species in both primary and secondary forests in Sinharaja are reported to have food and medicinal value (Gunatilleke and Gunatilleke, 1993). In addition, a number of species are collected from the forest for a variety of other purposes (Gunatilleke, 1988). Among the **most sought after plant species other than for timber,** are *Caryota urens* for its sugary sap, *Calamus* spp. for rattans, *Coscinium fenestratum* and *Elattaria cardomomum* for their medicinal and/or spice value and a host of orchids and other herbaceous plants for their ornamental value. Wild relatives of clove (*Syzygium* sp.), nutmeg (*Myristica* sp.), cinnamon (*Cinnamomum* spp.), cardamom (*Elattaria* sp.), pepper (*Piper* sp.), durian (*Cullenia* spp.), mango (*Mangifera* sp.), bread fruit (*Artocarpus* sp.), and citrus (*Atalantia* sp.) have been recorded from this forest.

Plate 8. Selective logging being carried out from 1972-1977 at Sinharaja, for supply of timber for the wood working complex at Kosgama. (Photograph by Mr. W.R.H. Perera).

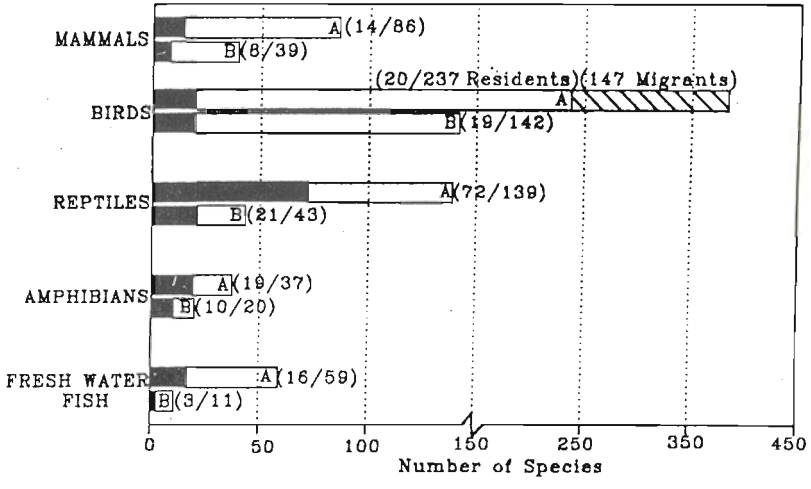


Figure 3. Vertebrate diversity in Sri Lanka **(A)** and the Sinharaja forest **(B).** The black areas within each bar indicate the number of endemic species in each category. The first number within parentheses gives the number of endemic species and the second the total number of species (endemics and non-endemics).

SOCIAL AND ENVIRONMENTAL VALUE

Tributaries of two rivers, the Gin ganga and Kukulu ganga, originate from Sinharaja forest and therefore, it is of **hydrological importance** to south-western Sri Lanka. These rivers are also ear-marked for hydroelectric power generation in the future. The impact of the proposed reservoirs on Sinharaja forest vegetation are claimed to be minimal. However, their environmental impact is being currently assessed. **During the period between 1970-77, about 1400 ha of the north-western quarter of the forest was selectively logged using heavy machinery.** 40 km of logging roads constructed during the logging project provide relatively easy access to the interior of the forest and are now maintained for educational, research and tourism purposes. The eastern relatively inaccessible part of the forest is aesthetically more attractive and richer in wild animal life. The mist-clad, high altitude forests and grasslands of the adjacent **Handapan Ella plains** with its own floral and faunal richness, aesthetic value with beautiful water-falls and of hydrological significance should be included in the Sinharaja National Heritage Wilderness Area to increase its conservation value further.

Sinharaja World Heritage Site also has a rich **faunal component**. 262 species of **vertebrates** which represents 36% of the island's total has been recorded from Sinharaja. 43% of them are endemic to Sri Lanka (de Zoysa and Raheem, 1990). 147 species of **birds** including 18 of the 20 endemic to Sri Lanka are reported from Sinharaja. Similarly, nearly half of the endemic **amphibian fauna** and among the **invertebrates**, 65 species of butterflies which include 2 endemic species and 19 endemic sub-species are found in Sinharaja.

The northwestern part of the Sinharaja forest with its network of road systems, **research and educational facilities** attracts large numbers of local and foreign tourists. Sinharaja has become one of the most popular outdoor

Plate 9. A reforestation trial in a 16 year old *Pinus caribaea* plantation in the buffer zone of Sinharaja. Species planted are a mixture of indigenous timber (**A** = *Shorea disticha*, **B** = *Shorea trapezifolia*, **C** = *Shorea megistophylla*, **D** = *Mesua ferrea* and **E** = *Dipterocarpus zeylanicus*) and non-timber (**F** = *Elettaria cardomum*, **G** = *Arundina graminifolia*) species.

educational centers for school children in Sri Lanka. Another visitors' camp has been opened up on the southern sector at Pitadeniya on the banks of the Gin Ganga. This is becoming increasingly popular among tourists and school children from southern districts. Similar facilities need to be established in other areas to minimize the impacts of over-visitation.

ECONOMIC ASSESSMENT

Socio-economic profiles and demographic trends of the villages are being documented at present. Preliminary results have shown that 8% of the households in a few selected villages were completely dependent on the resources of the rain forest for their subsistence while others depend on the forest to varying degrees for their home needs such as fuelwood, bathing and drinking water, food and medicine. Among the **income generating products** gathered from the forest are sugar syrup and candy from the palm, *Caryota urens*, rattans for basketry and furniture from species of *Calamus*, resins from dipterocarps, medicinal plants and precious gem stones.

An economic assessment of goods and services offered by the forest is under way and according to the preliminary findings, majority of the peripheral households have indicated their unwillingness to pay for these goods and services which they have been traditionally enjoying for generations. Alternative methods of assessing the value of services and goods provided by the forest to the rural communities need to be employed to prevent gross under-valuation of these important local benefits.

(A)

(B)

Plate 10. **(A)** Pitadeniya foresters lodge and the visitors camp located on the left bank of the Gin ganga on the southern border of Sinharaja. It caters to visitors from the Southern Province. Several hiking trails have been established from here and overnight accommodation facilities are available.

(B) Sinharaja Visitors Center in an idyllic setting, equipped with a spacious lecture hall, exhibition galleries and resting facilities for visitors, close to the forest entrance from Kudawa, on the north-western side of the reserve.

THREATS

The main threats to the forest are from the **agricultural expansion** of villages surrounding the forest. The legal status provided under the **Natural Wilderness Heritage Area Act** prohibits its conversion to other land uses. The forest boundary has been surveyed and clearly demarcated using concrete posts and a buffer zone strip of *Pinus caribaea*.

Collection of fuelwood and other non-timber forest products including medicinal plants, rattans, mining for precious stones and hunting pose a continued threat to the conservation of the forest.

Over-visitation in the northwestern sector also poses problems of pollution to streams, damage to fragile habitats such as ridge tops, collection of rare and ornamental plants, litter accumulation etc.

Invasive exotic species such as *Clidemia hirta* (Melasomataceae) are spreading deep in to the forest particularly along the logging roads and in tree fall gaps in the north-western sector of the forest.

CONSERVATION

The declaration of the Sinharaja forest as a **National Wilderness Area** in 1987 has provided greater legal status for preservation of the reserve in its present form. Inclusion of Sinharaja in the list of World Heritage Sites also affords international recognition of its conservation value. A **management plan** has been drawn up in 1985 by the Ministry of Lands and Land Development with assistance from the IUCN. Its implementation is being carried out by the Forest Department of Sri Lanka in several phases. An **educational and research center** equipped with pamphlets, brochures and guides and a **field research station** with basic facilities have been established during the initial phases.

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