

LORIS



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Appropriate Technology Services
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PAINTING "BIRDWING"
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ANIL GUNAWARDANA

The Editor invites literary contributions not only from members of the Society but also from the general public interested in wildlife natural history and conservation. Manuscripts should be typed with double spacing. Photographs should be black-and-white glossy prints. Drawings should be in Indian ink.

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ROLE OF NON-GOVERNMENTAL ORGANISATIONS IN WILDLIFE CONSERVATION

— Dr. Ranjan Fernando

To understand the roles that N.G.O.O. can play in wildlife conservation, it is necessary for us to understand what an N.G.O. is, whom or what it represents, what its obligations are and what its legitimate rights are.

An N.G.O. will be a group of persons having common interests or objectives working together to promote the improvement and fulfilment of their interests and objectives. They should be doing so as public-spirited individuals expecting no particular reward from the government or from those who will benefit from their activities and efforts.

They should be free to express their views and opinions on matters that concern them, without constraint or being stifled by bureaucracy.

An N.G.O. could represent persons who are beneficiaries of State or other establishments, they could represent persons who are adversely affected by government policy, they could represent persons whose interests are not hitherto represented by the State [e.g. creation of the Ordinance] they could represent voiceless animals or plants, they could represent the interests of inanimate objects like archaeological ruins and works of art and so on.

With this very wide representation, they could work in collaboration with government institutions and establishments but they are not obliged to safeguard the interests of government—they should remain free to even criticise government attitude where necessary.

To appreciate the role of an N.G.O. in wildlife conservation, we must understand the significance of wildlife conservation in the context of the situation in the country today.

The term 'wildlife' has been used rather loosely in this country over the last 100 years. In fact, this Society has had its origin as the Game Protection Society way back in 1894, i.e. 95 years ago. At that time, the term 'wildlife' implied those animals which were targets for the hunters i.e. the leopard, the bear, the wild boar and sambhur and even the elephant. Hardly any notice was taken of the smaller animals like the shrews, bats, earthworms and insects. It also includes the trees and the rest of the natural fauna & flora of the jungles.

The value of wildlife was then measured in terms of "hides and horns" or the trophies collected.

But, since then, most aspects of Sri Lankan life-style has changed. Social values have changed, religious sentiments have changed, population demands have changed and the limited amount of prime land was decreased phenomenally. Therefore, wildlife today has become more closely linked to land and habitat than individual animals.

About 50 years ago, all the natural forests of this country were under control of the Forest Department. An N.G.O., during that time, realised that some of these forests should be preserved for posterity, in their natural form, and not used for commercial exploitation as is the commitment of the Forest Department. This N.G.O. urged the then government to enact a law that would create specially protected areas whereby animals and plants will be protected. This is how the Fauna and Flora Protection Ordinance was passed in 1937 and the Department of Wildlife was created later. This Society is the N.G.O. which urged the declaration of the F & F Ordinance nearly 50 years ago and this indicates the type of influence that an N.G.O. can bring about even to government Policy.

Now let us try to understand "why is it necessary to save wildlife why should N.G.O.O. take an interest in doing so how can they do so ?

During the last 25 years, our country has lost over 50% of the forest it had 50 years ago and, if we keep losing forest at this rate, it will take less than another 25 years for us to lose our natural forests.

There are some State authorities who feel that Sri Lanka still has 39% forest cover; this is totally wrong unless we include the monoculture tea and the rubber plantations also in this group.

That is why both government and non-governmental organisations have to work together if we are to conserve our wildlife and our country's natural resources.

The government recognises the contribution that N.G.O.O. can make towards influencing wildlife conservation policies. That is why the Advisory Council for the Preservation of Fauna & Flora has 3 NGO members on it. The N.G.O. members reflect public opinion with regard to wildlife conservation and is in a position to advise the Ministry on constant changes that are desirable for amending the Ordinance. Declaring new areas as conservation areas, releasing areas that cannot be maintained as conserved areas though declared so and more or less updating the strategies for conserving wildlife according to the day-to-day changes in the country, are matters on which the NGO could enlighten the State.

As I mentioned earlier, an N.G.O. can represent different strata of public opinion. Being in the field of wildlife conservation for several decades, we realised that there was a feeling among some of our people that wildlife was being conserved for the benefit of the rich and the elite and as such there was not much sympathy towards the conservation measures adopted by government. In fact, even Members of Parliament and some Ministers attached very little importance to this aspect and felt that priority should be given to the needs of the people of their electorates rather than the interest of wildlife conservation.

It was in this context that we realised, over 10 years ago, that educating the people and explaining the significance of conservation to them was far more rewarding and necessary than trying to impose the Rules and Regulations though, of course, the rules were also necessary.

What we realised then, holds good more so today. The most receptive individuals to the type of education were the school going population and so we inaugurated the School Nature Club (SNC) programme whereby we carried the message of wildlife conservation to rural folk at grass-root level. With the assistance of members of the staff of the respective schools (eg. Rahula, Mahamaya, Bollossagama, Kalutara Vidyalaya, Badulla, etc.) we inaugurated these Clubs and helped them with tree planting efforts, poster competitions, essay competitions, conducting Turtle hatcheries, natural science exhibitions etc. and awarded them prizes for their contributions.

Film shows, slide shows, lectures, outdoor camps and wildlife excursions were also other activities we conducted for these Clubs.

Some of the SNCs started producing their own magazines too.

Educating the younger generation is a very important and rewarding role that an N.G.O. can do towards wildlife conservation. Students of today will be the administrators of tomorrow and therefore time and resources spent on educating them is time well-spent.

The dearth of reading material (in Sri Lanka) was a great handicap to publicising the importance of wildlife conservation. More and more literature is necessary. Our Society began publicising the first ever Sinhala magazine 10 years ago and we have been distributing 6000 copies of them regularly to 3000 schools every year.

This is another field in which other N.G.O.O. can also take the initiative as we ourselves find our limited resources inadequate to cope with the demand from the whole country.

Regular contributions to the newspapers is another way in which the general public can be persuaded to help wildlife conservation. We are aware that the media are very sympathetic to this cause since of late—but finances are required.

Some of you must be aware that there have been occasions when public opinion has been able to stop even large scale industries here and abroad. The saving of the Sinharaja forest from selective logging is such an example, in Sri Lanka. The Coal-powered thermal generation plant, the salt-based industry in Karagan levaya and the proposed Forestry Sector Master Plan are other instances of such occasions.

In the snow-covered seas off Greenland, it was a regular annual feature for seal-cubs to be slaughtered for their skins. About 3 years ago NG organisations joined in a massive protest physically preventing the seal-hunters from reaching their hunting grounds and the hunt had to be called off.

A few years ago an International Tourist Organisation wanted to construct a Tourist Hotel in the Galoya National Park, against all accepted principles controlling National Parks. Even Cabinet approval had been obtained for this proposal when our Society canvassed strongly against this proposal and had it cancelled.

N.G.OO. are not always successful in this type of campaign but that is no reason for discouragement—A point in illustration is the fate that has befallen the Flood Plains National Park.

To record a more positive achievement — it was an N.G.O. that saved what is today the Udawalawe National Park from being given up as a lost cause 18 years ago. At that time, even the Department of Wildlife felt that the Udawalawe Park should be given up because it had been over-run by squatters and illicit cultivators with the blessings of an influential monk of the vicinity. But, an N.G.O. intervened at that stage and insisted that the Park would rejuvenate by itself

if the Department could clear it of the squatters, and this is exactly what happened and what we see today as the Udawalawe Park is the result of this decision which was influenced by an N.G.O. and executed by the Dept.

Individuals too can contribute a great deal by their dedication.

For instance, lawyers can help the Wildlife Department staff in filing complaints, framing charges and conducting cases in Courts where State Counsel are not always available to help them. In fact, one of our Committee Members from Ratnapura had helped the Department in obtaining nearly 100 convictions for offences committed in the District during the last few years. Several of our lawyer members all over the Island have also offered their assistance on a voluntary basis and this procedure was accepted by the Attorney General too.

N.G.OO. have to be watchful, not only of destruction to wildlife such as the killing and or selling of the products of protected animals but they have also to be very conscious of the abuse and illicit use of protected areas. We have to accept that the Department of Wildlife Conservation has only about 500 employees to protect almost 2500 sq. miles (i.e. about 1/10th the land mass of this country). This is not possible with the other limitations such as dearth of vehicles communication systems and conducive living conditions for its employees. Hence it is only public spiritedness of the general public who go to form N.G.OO. that can protect our wildlife from this type of destruction. It must remember that wildlife cannot survive without adequate land and if we permit land degradation, that is tantamount to permitting wildlife destruction.

Illicit removal of timber from nature reserves, poaching and encroachments cannot be practised in any locality without the knowledge or the connivance of the local inhabitants—hence the importance of establishing N.G.OO. at grass-root level.

The present Administrative machinery provides for such grass-root level of participation in that there is provision for NGO representatives to be on District Development Councils, and Provincial Councils where wildlife conservation at District level can be discussed and any conflicts sorted out—this is an effective manner of influencing policy-making at grass-root level and an N.G.O. can play a very useful role.

Unfortunately, there is no such NGO participation at this level—perhaps for the want of participants. It is essential that the State administration encourages NGO participation at planning levels as this would minimise the incidence of plans and projects failing at the stage of implementation.

The practise of planning and mapping out strategy for projects within the premises of office rooms and attempting to implement them at grass-root level has very often ended in failure because of the non-participation of the public in the planning stage. In this context the NGO representatives shoulder a great responsibility in voicing their reservations, if any, at the opportune instant rather than pay mere lip-service and subsequently find that they have failed in their obligations.

To site a very healthy incident I wish to illustrate the matter of granting gemming rights on stream-reservations near Kalawana. When the request for permission was made by the State Gem Corporation, the NGO representative on that D.D.C. protested vehemently and was able to prevent the free issue of permits as requested. From this incident, you will realise that to be able to do so the NGO should be in a position to act independently of any State or administrative control, in such instances.

The role of an NGO does not end with its rights to make submissions, representation, canvas opinions and publicising and encouraging healthy dialogue; on the contrary it has a great responsibility too. It must act with a sense of responsibility and in a manner such that its credibility cannot be disputed.

In its action an NGO should be guided only by its obligations to the general public, whom it represents and should refrain from taking partisan decisions based on other extraneous influences—it is only then that it would retain its credibility.

Since of late, we find International Organisations such as the "Green Peace" organisation dealing with matters of global concern. This is only to be expected as the effects (good and bad) of developmental science has very extensive widespread influences, of global extent.

Wildlife conservation which was practised at District, regional or national level has now to be practised at global level on account of global effects of advancing technology and development.

(eg. Ramsar Convention, CITES Convention)

Hence, Sri Lanka has to join hands with NGO of other nations to help in wildlife conservation in their countries and reciprocating assistance for ourselves. Therefore as an NGO we have to be geared and ready for such a situation. As responsible N.G.OO. we have to acquaint ourselves of problems facing wildlife conservation in other parts of the world and plan to take remedial measures to prevent them in our own country. It is only then, that we would be fulfilling our national and international obligations as a Non-Governmental Organisation committed to wildlife conservation.



ONE LARGE NATURE RESERVE OR SEVERAL SMALL ONES? APPLYING THE ISLAND BIOGEOGRAPHIC THEORY TO SRI LANKA

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Organisms on island have always aroused the curiosity of scientists. Charles Darwin and Alfred Russell Wallace were among the first to study the unique ecological characteristics of islands.

Late Robert H. Mac Arthur, and E.O. Wilson in 1963 put forward the 'Theory of Island Biogeography',¹ which explained that the number of plant and animal species of a given 'island' is in equilibrium respect to immigrations and extinctions of species. An island in this context can be any 'habitat island' (e.g. an isolated cave ecosystem, a frigid mountain top, a lake or a wildlife refuge surrounded by developed land) as well as an oceanic island. The larger an island, the greater the 'equilibrium number' of species and vice versa. Also, large islands have greater immigration rates and lesser extinction rates. Likewise, islands nearer to a source area or a mainland have greater immigration rates and lesser extinction rates compared to those located far.

The theory has attracted much attention of scientists and some of them—e.g. Jared Diamond of the University of California, Los Angeles—have attempted to apply it to the design of nature reserve.² Generally, a large single reserve is preferred as it can support a greater number of species at equilibrium, according to the species-area relationships. Yet, the application of this theory to conservation practice has created a controversy over, whether one large refuge is better than several small ones of equivalent total area for conserving species.

Ronald Miller of the University of Florida,³ and D. R. Helliwell of The Bramleys, Cumbria, England⁴ for example, seem to advocate the idea of having the largest possible reserve. On the other hand, C. R. Margules of CSIRO, Australia⁵ and, Daniel Simberloff of the Florida state University⁶ are of the view that several small refuges can be better at times.

Dr. C. B. Dissanayake is Professor and Head of the Dept. of Geology, University of Peradeniya.

The present study attempts to discuss the design of nature reserves in Sri Lanka according to the Theory of Island Biogeography.

Sri Lanka is an island on the continental shelf in close proximity to India and is probably, separated from the Indian Subcontinent during the Miocene times, 12 to 25 million years ago. Having evolutionary links of biotic elements with the neighbouring land masses such as India, Africa and Malaysia, Sri Lanka has since then evolved its own biota.

The country shows a great diversity compared to its size. This diversity is reflected in geology, topography and drainage, and climate in addition to plant and animal life.

There is a central hill country of the island surrounded by a more or less flat 'peneplain'. Both the central hill country and the flat peneplain or the 'low country' have topographic variations. Climatically, the country is divided

broadly into two principal divisions: the dry zone and the wet zone although further climatic divisions of the country are recognised. Moreover, there are about 12 Great Soil Groups some of them conforming to the broad climatic zones.

The above abiotic environment has been nurturing a variety of plant and animal life of Sri Lanka.

Professor B. A. Abeywickrama in 1956 recognised 2617 inland terrestrial plant species of Sri Lanka and about 856 or 16% of these species are endemic.⁷ These plants are widely distributed. For example about 16% of these plant species belong to the dry zone, while 11% are in the wet zone. Also about 18.5% of the species are common to the low country and nearly 23% of the species of the island are confined to the montane zone. Further the low country wet zone specifically harbours 26% of the flora and only, 4.5% of the terrestrial plant species of Sri Lanka are commonly distributed throughout.

If the idea of 'plant communities' is considered, there are 12 plant communities/ecosystems in Sri Lanka as interpreted by N. P. Perera⁸ in 1975. The distribution of these plant communities have been determined by climatic, geomorphic and drainage factors etc.

These plant communities are associated with a co-evolved rich fauna. As Professor Hilary Cruz has shown in 1973, there are 628 species of land vertebrates in Sri Lanka 16% of them being endemic.⁹

If mammals alone are considered there are 119 species and sub-species together, excluding marine mammals but, inclusive of the fresh water otter. The approximate geographical distribution of these mammals is as follows: dry zone low country 20, dry zone hill country 3, dry zone common 6, wet zone low country 9, wet zone hill country 12, wet zone common 7, low country dry and wet zones 13, hill country dry and wet zones 13 plus about 36 wide species.

As for ichthyofauna there are 64 true fresh fish species in Sri Lanka 24% of these species being endemic as shown by Ranil Senanayake and Peter B. Moyle¹⁰ in 1982. These fish are distributed within four 'Ichthyological Provinces' of the island recognised by the above mentioned two authors.

These facts explain these species diversity and their uneven geographical distribution under a wide variety of environmental conditions in Sri Lanka.

At present about 11% of the country is covered by wildlife reserves managed by the Department of Wildlife Conservation. These reserves include 7 National Parks, 4 Strict Nature Reserves, one Nature Reserve and about 45 Sanctuaries.¹¹

However, these wildlife Sanctuaries cannot be considered 'true' nature reserves as normal economic activities such as agriculture is allowed in the Sanctuaries although animal life is legally protected against capture, killing, trapping etc. Moreover, most of the Sanctuaries are today in developed lands.

There are some Jungle Corridors declared for the movement of elephants yet, these Jungle Corridors no longer exist due to encroachment by human activities.

If we include the proposed new National Parks and Nature Reserves of the Mahaweli Project area the total area of our wildlife reserves will increase by a small percentage. The Floodplains National Park and the Somawathie National Park are newly proposed for the Mahaweli Development Area. The existing Wasgomuwa Strict Nature Reserve will be declared a National Park too, whereas, two new Nature Reserves namely; Minneriya-Giritale Nature Reserve and Triconamadu Nature Reserve will be two other wildlife habitats.

In Sri Lanka there are 36 'Man and Biosphere Reserves' under the jurisdiction of the Conservator of Forests,¹² covering nearly 2% of the area of the island. These reserves are primarily managed to protect and study plant life although their value for the conservation of animal life cannot be ignored.

Moreover, the watersheds of the Labugama and Kalatuwawa reservoirs protected by the National Water Supply and Drainage Board include about 2100 hectares of rain forest. Despite that these watersheds are not meant for the conservation of species, they can be regarded as nature reserves because of their role in protecting our wet zone gene-pools.

In addition, there are new conservation forestry areas being reafforested in the area of the Accelerated Mahaweli Project. These are the watersheds of the Victoria and other reservoirs plus the banks of the trans-basin canals

Most of these 'nature reserves' of Sri Lanka are found in the dry zone. Yet, all the ecological units of the country are at least to some extent covered by them and their present status is the result of a long evolutionary process of conservation tradition and legislation in response to the problems of man-nature interface.

In view of the manifold development schemes etc. of Sri Lanka there is the need to think of planning for conserving our invaluable biotic resources.

If the application of the Island Biogeographic Theory envisages having the largest possible single reserve to conserve species, it would not be applicable to Sri Lanka where population pressure etc. are considerable.

The present theory simply takes into account the 'species' as the basic unit of conservation. Yet, as examined in this study the assemblages of plant and animal communities are to be conserved as the co-existence and co-evolution of species are equally important as floristics, to the conservationist. This cannot be considered according to the present theory.

Even if a single large reserve is created in Sri Lanka, thus, it would not be large enough to cover all the ecosystems of the island, some of them being very unique such as the 'pigmy forest' of the Knuckles area, and the fragile Horton Plains ecosystem. So are the Sinharaja Forest and the Peak Wilderness area.

Some scientists e.g. Daniel Simberloff—think that several smaller nature reserves can be better as natural disasters etc. cannot wipe out species when their habitats are fragmented. (However, it may be understood here that each single unit should have a minimum size). Simberloff also mentions management aspects.

For Sri Lanka, a system of scattered reserves can be better for management reasons too. According to our management problems and difficulties, several small reserves can be better looked after by the nation against poaching of animals and illicit felling of trees etc.

I. G. Simmons has pointed out a US example of applying the present theory to design clusters of reserves.¹³ One big reserve concept may be suitable, perhaps, for such biomes as the African savannas as exemplified by the Serengeti National Park. Thus, the application of this theory to Sri Lanka can only be done after considering the entire environmental conditions together with historical and socio-economic aspects peculiar to us. Such an evaluation will be something similar to the integrated ecological approach suggested by Peter Bartelmus¹⁴.

According to P. G. Risser of Illinois Natural History Survey, 'decision making about natural resources is largely political, supported by information about how ecosystems behave'¹⁵. Thus, species-area relationship is insufficient on this issue.

On account of the above criteria it may be concluded that several scattered nature reserve representatives of the different ecological units are better for Sri Lanka for nature conservation.

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SOME PHYSIOGRAPHICAL AND OTHER RELATED ASPECTS OF THE KNUCKLES REGION

— S. C. Edussuriya

I. INTRODUCTION

The Knuckles mountain range is a detached block of the Central Highlands of the island and it runs in an approximately NW to SE direction to a distance of about 12 miles, stretching from Laggala to Urugala respectively and together with its principal extensions covers an area of roughly 62 sq. miles. Although the British named it 'Knuckles', probably due to the resemblance that the five prominent peaks have when viewed from a distance to the Knuckles of one's hand; the ancient name had been 'Bata-dandu Kanda' (බටදඳු කන්ද), probably due to the prevalence of large tracts of bamboos on the lower slopes of the western face of the range.

The uniqueness in the variations of vegetation and climatic conditions of this fascinating mountain region is principally due to its,

- (i) Geographic location
- (ii) Altitude
- (iii) Positioning in respect of the two principal wind currents across the island.

The vitality of the tropical forest cover still could be seen at a cursory glance, by the manner in which healthy trees grow on numerous steep cliffs and ledges which do not contain much fertile soil. The author has had the good fortune to visit various parts of this magnificently rugged region of the country on twelve separate occasions but the fascination by its beauty has not ceased yet.

II. THE MOUNTAINS

The main mountain range has several peaks rising to above 5,000 ft. level. These are, Dotulugala (5,164'), Kobonilagala (5,098'), Knuckles (6,112'), Gombaniya (6,248'), and Kirigalpotta

(5,403'). The tallest peak Gombaniya, has adjacent to it an extremely rugged rock escarpment referred to as Yakungegala, which has a sheer vertical drop to the eastern side of easily over a thousand feet. The wild, isolated beauty of that area surpasses that of the 'World's End' drops in the Horton Plains and has to be seen with one's own eyes to be believed.

Between Yakungegala and the Knuckles peak, there is a relatively level area devoid of any significant peaks, which is referred to as the Selvakande Plateau. This plateau has unique characteristics of its own with reference to the vegetation.

The western slopes of the main range generally have gentle inclines, whilst the eastern face is predominant with the type of sheer, rugged drops described earlier to the plains of the Dry Zone. Many of the peaks of the range have a characteristic moderately—sloping, triangular—faceted western faces and east—facing scarps, which are sometimes wedge—shaped (Cooray, 1961). Some examples of this effect are Kalupahana, peak, Lakkagala and the Sphinx Rock near Corbet's Gap.

There are two main deviations from the main range. One is the narrow saddle that runs north-eastwards from the centre area of the Selvakande Plateau and has the imposing Kalupahana peak (5,341') in the centre and the three peaks Wamarapugala (5,110'), Lakkagala (4,324') and Labullessapatana (4,901') within close proximity to each other. The local population from the scattered villages on the eastern foothills, refer to Kalupahana as the 'Thunhisgala' (තුන්විසකල) meaning the 'three-headed peak', which is observed to be correct. They also claim that Lakkagala is easily visible from the eastern seaboard on clear days and had been used as a significant

landmark by the ancient navigators and hence the name. Another fascinating aspect of Lakkagala is the unbelievable manner in which it alters its appearance, when viewed from different directions.

Another deviation from the southern end of the main range, is the ridge extending north-eastwards that runs nearly parallel, but longer than the Kalupahana saddle and the Dumbanagala (5,383') and Galtuna (3,784') as the prominent peaks. This deviation at its extremity meets another range that runs parallel to the main range, having the noteworthy peaks Telambugala (4,368'). Velangala (3,871') and Kehelpothdoruwegala (5,016'). The last one is a sharply rising rocky peak with sharp edges on the sides and is referred to by Cooray as, 'the Matterhorn mountain of the whole area'

On the western slope below the Telambugala peak is located the well-known Nitre Cave. This cave has been formed by the solution of a limestone band and slopes upwards from the entrance and extends to a distance of about 150 feet. The floor of the cave is covered with a 1'—1½' layer of 'guano' or bat's dung. It is said that before the influx of artificial fertilizer, the villagers in the vicinity had been in the habit of removing the guano on pack bulls, to fertilize their cultivations. The accessibility to the Nitre Cave is quite difficult and one could well imagine the discomfort of the animals with a load on their backs.

III. STREAMS & RIVERS

The distinct NW to SE positioning of the Knuckles range with its chain of high peaks, the isolation from the rest of the Central Highlands and the abrupt positioning to the Eastern Plains; makes it a perfect impregnable barrier to the NE and SW monsoonal rains, which occur during two separate periods of the year, each lasting approximately 5 months. Accordingly, the whole region is a watershed with a complex tributary system that feeds the Mahaveli river at various points.

The water collected from the western slopes of the range flow down a myriad of streams into the Hulu Ganga, which flows through a massive basin referred to as the Hulu Ganga Valley and

finally joins the Mahaveli south of Teldeniya and above the Victoria Reservoir. It should be pointed out that at present, this is the catchment area most affected by human habitation and activity, with some of the tea estates reaching beyond the 4,500' contour.

On the eastern slopes, the major tributary systems are the Heen Ganga and the Kalu Ganga. The former collects its waters from the southern sector of the eastern slopes from rapidly flowing streams such as Mimure Oya, Kaikawala Oya and Maha Oya which drop rapidly from the steep hills; and finally joins Mahaweli a little above Hembarawa, after flowing under the Yodala aqua-duct cum road bridge combination. Kalu Ganga on the other hand, drains off the entire northern sector of the eastern slopes into Amban Ganga which in turn joins Mahaweli above Manampitiya.

A noteworthy aspect is, whilst the NE monsoonal rains affect both the eastern as well as the western slopes of the main Knuckles range, the SW monsoonal rains affect mainly the western slopes and only limited areas of the eastern sector. Thus, the distinction from the Wet Zone to the Dry Zone characteristic is quite noticeable on the ridge areas itself of the mountain range. Owing to this, the grand phenomenon of the dissipation and the total disintegration of the dark rain-bearing clouds that boil over the range during the SW monsoons, occurs in a most fascinating manner. One could safely conclude that 'our Dry Zone is really dry'.

IV. VEGETATION

The uniqueness of the Knuckles region described earlier, combined with the heavy rainfall has produced clear-cut differences in the main vegetational types. They could be classified under the following formations;

- (i) Lowland Tropical Wet Semi-evergreen Forest.
- (ii) Sub-montane Tropical Wet Semi-evergreen Forest.
- (iii) Montane Tropical Wet Evergreen Forest
(Rosayro, 1958)

In a very general manner, it could be said that on the main ridge of the Knuckles range the vegetation corresponds to the type (iii), on the Eastern slopes to the type (ii) and on the Western slopes to the type (i). Very large tracts of midland of Sub-montane Tropical Wet Evergreen forests on the Western slopes have already been replaced by the tea estates. Due to the occurrence of very high rainfall zones within typically NE monsoonal regimes, type (iii) forests occur in areas which should normally have been covered with a drier type of Semi-evergreen or Semi-deciduous forest.

A special mention must be made of the occurrence of a Pigmy forest and an Elfin forest on a particular region of the Selvakande Plateau, which had been extensively studied by Rosayro during the famous Knuckles expedition in 1956. He has concluded that the Pigmy forest is confined to this location only and the reasons for this specialized character being attributed to an adaptation to continuous exposure to winds of gale force prevalent in the region (Rosayro, 1958). However, the author has noticed a similar Pigmy forest on the way to the Kalupahana peak, as similar weather conditions prevail in that region and the altitudes too being the same. This area is reached by traversing what might be a good example of a healthy Elfin forest that occurs on the knife-edged ridge leading to the Kalupahana mountain. No conclusions are arrived at until more competent persons examine this area which is accessible with some difficulty.

V. HUMAN ACTIVITY

Before delving into this aspect of the paper I wish to quote an observation of the Knuckles region made by Rosayro after his expedition in 1958.

".....the main mountain mass of the area is known to have been relatively unaffected by the factors associated with human activity and occupation. Except for a few villages in the valley of the Heen Ganga, and the expansion of tea (and earlier, coffee) cultivation on the Western, Southern and to some extent, south-eastern periphery, the original vegetation has been unaffected by any intensive human activity such as cultivation or felling".

(Rosayro, 1958)

Unfortunately, during a 30 year period the pristine glory of this magnificent region has been rapidly eroded by human activity alone. It is a well known fact that time has never been charitable to the forest. Terrain which had hitherto been safe from man's encroachment, became progressively more vulnerable as he acquired the skills necessary to construct dwellings and cultivated even in inhospitable regions. The author had been a witness to this systematic degradation of a unique national heritage, which is likely to bring about an ecological disaster in the near future.

The region has witnessed the failure of coffee cultivation in the past, which was replaced by the Tea estates that contributed to the removal of the forest cover on the western slopes, northern extremity and the southern areas. The recent forest inroads have been made by the Cardamom cultivation, which requires the shade of a tree canopy and as such, it is like the unseen cancer. Unless one goes into the forest proper, the damage is not visible.

Cardamom has been grown on a commercial scale in Southern India and Sri Lanka after 1800, and in Sri Lanka it has been initially planted in the Laggala Rattota region. The vigorous pursuit for this cash-crop is understandable, as it presently fetches Rs. 200-300 per kilo in the Colombo auctions.

For the purposes of this paper, the author has made an attempt to categorise into three groups all those who obtain financial benefits from this region.

- (i) *Exploiters*—Total outsiders who obtain large scale benefits by operating on a highly commercialised manner and who inevitably introduce an alien workforce. ex. Tea estate owners, big-time Cardamom growers.
- (ii) *Extractors*—The parasites of the society lacking any manner of scruples and who make advantage of their position and influence to extract what is valuable, invariably using the villagers.

(iii) *Inheritors*—The villagers within the region, who if at all, are the only ones who could stake a claim for the benefits from the forest and who generally reap the benefits according to their personal needs and abilities.

Out of the above, the category (i) has done extensive and irreparable damage and are presently engaged in a similar process. The tea estates have over a period of time shifted their boundaries upwards and into the forest proper, to serve the dual purpose of having more acreage and to use the forest timber for the factories as well as for the domestic purposes of the estate labour. Certain estates have cultivated types of Eucalyptus on the western slopes of the range for their domestic requirements. But this process of cutting away the natural forest and growing monocultures will be disastrous to the ecosystem; as the complex natural forests are better suited than man-made forest plantations as watersheds, especially at higher elevations and on very steep slopes (Balasubramaniam, 1988).

The large-scale Cardamom grower on the other hand, has penetrated deep into the confines of the forest and has established colonies of labour and each of these plantations are several hundred acres. One owner has clear-felled and flattened out an area of about 5 acres for a heli-pad at the precise altitude of 3,800 ft. in order to facilitate his otherwise strenuous journey. One could very well imagine the scale of this operation and the destruction caused daily to the forest, considering the fuel-wood requirement for the Cardamom barns (the drying process is continuous), and also the domestic fuel-wood requirement for the large labour population.

The *modus-operandi* of the category (ii) is rather a surreptitious one, as they are well aware of the illegal nature of all their activities, and they venture out only when the assistance of some officials is obtained or when they have the necessary political backing. Very recently, one such person has removed large quantities of cane from the forest, using some of the villagers. The road

that is being extended upto Mimure, will only facilitate the removal of large quantities of timber via Corbet's Gap.

Newly built roads provide access to areas of virgin forest where man has never before set foot. There, either man's enterprising and commercial spirit gains the upper hand and the original dirt path is soon turned into an asphalt road that facilitates the removal of the forest's products (Jenik, 1979).

The category (iii), as opposed to the earlier ones, had always learnt to live in harmony with the forest, as he obtained a great deal from the forest for his sustenance. He was well aware of it that the forest must survive for his survival. However, when certain socio-economic changes take place, this concept too changes and he too gets converted into a 'smaller-scale Exploiter'. This aspect must be studied carefully by Socio-economists to find ways and means of making the villager 'a protector' of the forest, as he feels for it unlike the first two categories.

As expressed by a friend of mine, Dr. Senewi Epitawatte (Senior lecturer, University of Sri Jayawardanapura), "if the ancestral activities of the villager are to be curbed for a matter of national importance and if these restrictions have caused an economic loss to him, then he should be compensated for. If not, his hostility towards the government and the officials enforcing the laws promulgated, could be directed at the very forest from which he earlier drew a sustenance".

VI. CONCLUSION

In this paper I have striven to present my personal experiences together with those of specialists who went on early expeditions, of a region that has become rather familiar to me over two decades and for which I feel in a manner unparalleled for any other. Despite the various protests and representations made to those concerned in order to drive home the value and importance of this region, it was quite painful to experience on each successive occasion that I set foot to the region, the not so slow but steady destruction continuing.

At last, someone has realised the direct impact that the Knuckles region has as a watershed for the Mahaveli river and thus the effect on the many projects. However, better late than never.

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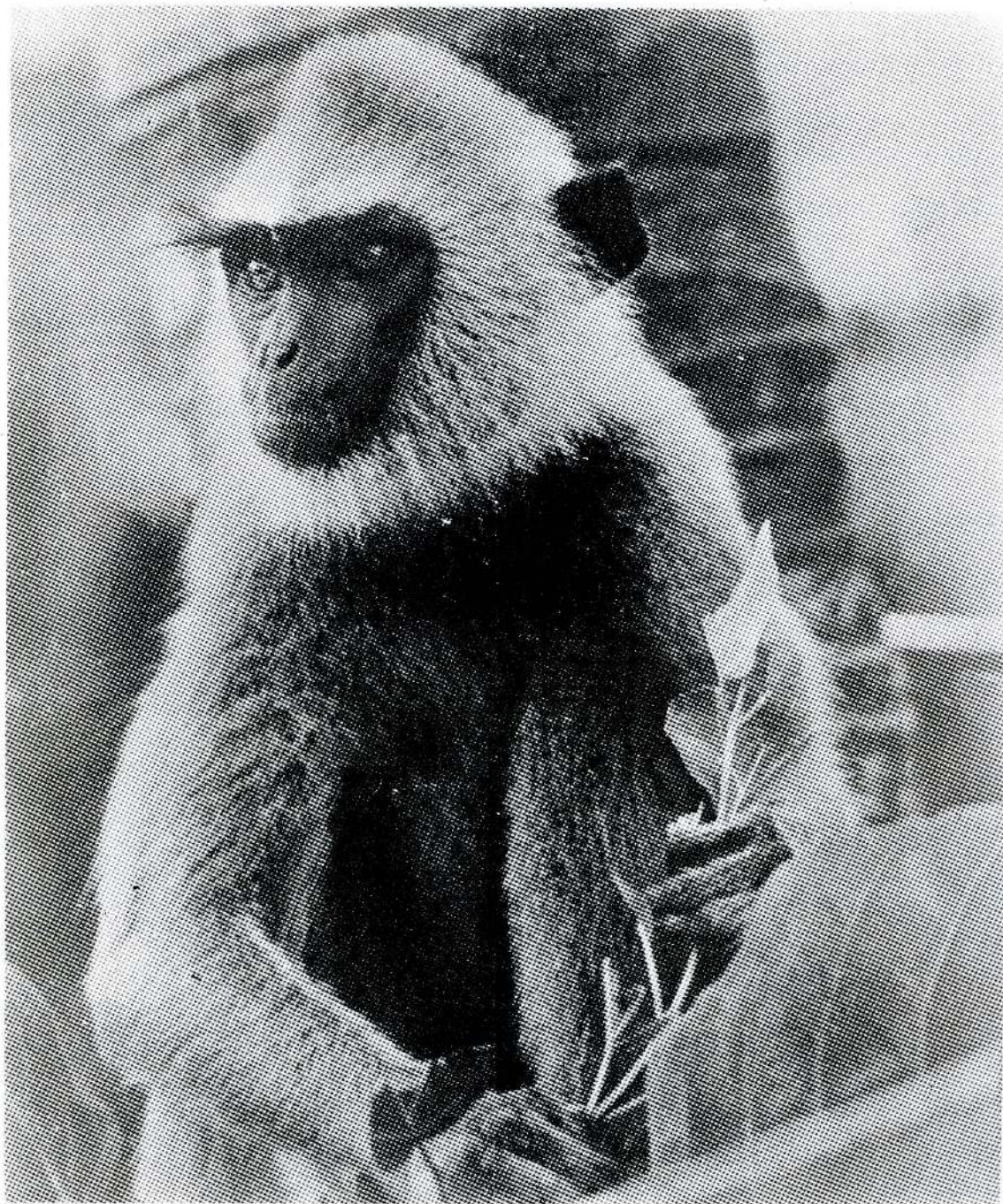
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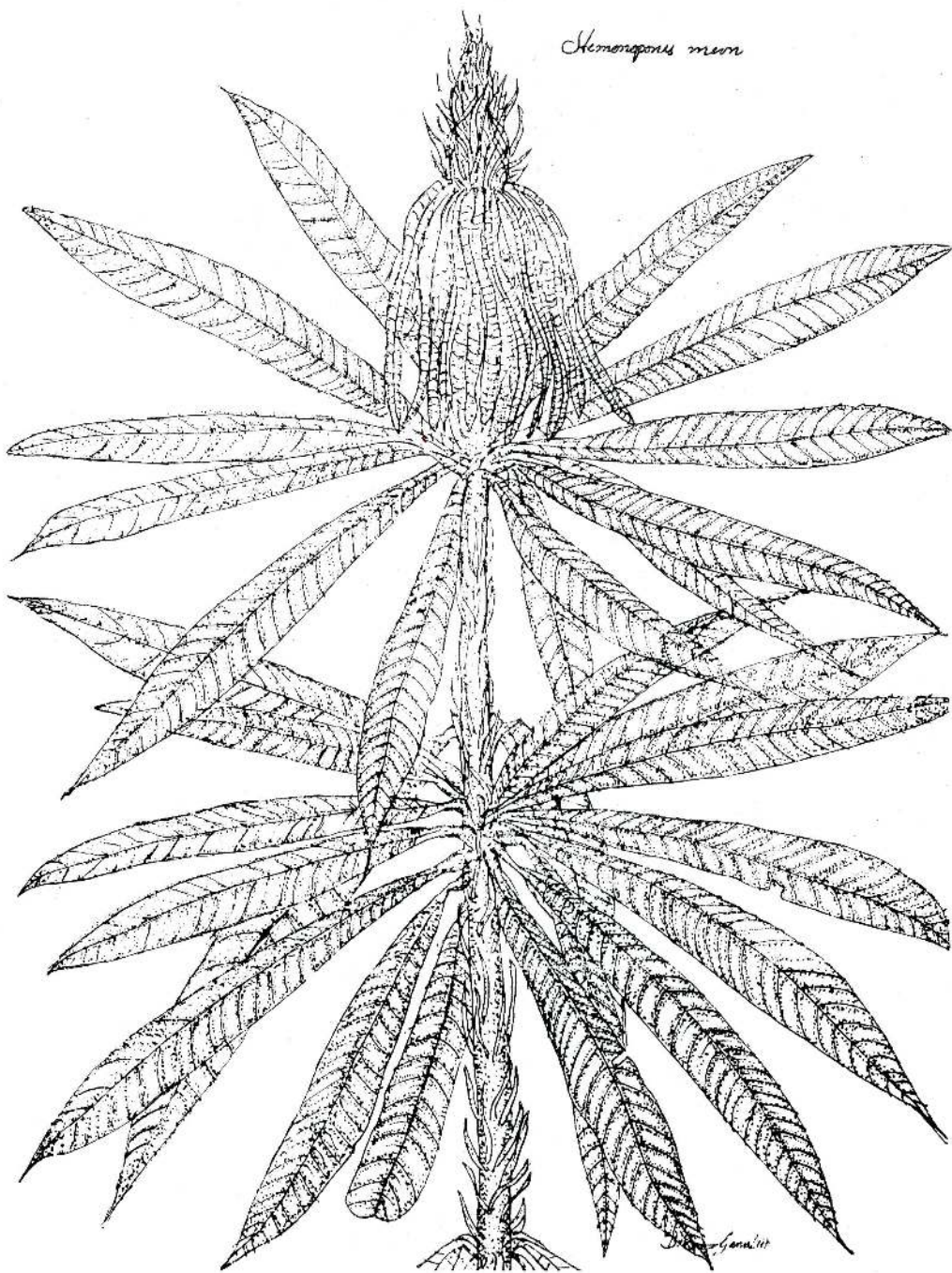
Treks in the Knuckles region by the Author

Year	Details of route A places	Duration
1. 1987 (July)	Nilloomalay estate, Mettappuwa, climbed a minor peak near Gombaniya and returned.	— 2 days
2. 1967 (Aug.)	Loolloowatte, Corbet's Gap. Mimure, Ranamure, Pallegama.	— 3 days
3. 1968	Bambarella, Lebanon estate, Kalupahana, Mimure, Corbet's Gap. Loolloowatte.	— 3 days
4. 1969	From Mettappuwa climbed to the ridge of the main range and proceeded along the District boundary passing Gombaniya & Yakungegala areas, Kalupahana, Mimure, Dandenikumbura, Udattawa, Hasalaka.	— 7 days
5. 1970	Tried to repeat the 1969 trek along the ridge commencing from a more northern point and failed. Went back to Bambarella, then to Kalupahana, Mimure, Corbet's Gap. Loolloowatte.	— 5 days
6. 1972 (Jan.)	Bambarella, Kalupahana, Etanwela, Laggala.	— 3 days
7. 1972 (June)	Bambarella, Kalupahana, Mimure, Corbet's Gap. Rangala.	— 3 days
8. 1977	Rangala, Corbet's Gap. Mimure, Kalupahana, Bambarella.	— 3 days
9. 1980	Bambarella, Kalupahana Peak, Mimure, Corbet's Gap. Loolloowatte.	— 4 days
10. 1982	Bambarella, Kalupahana Peak, Mimure, Nitre Cave, Dandenikumbura, Corbet's Gap. Loolloowatte.	— 6 days
11. 1983	Bambarella, Kalupahana Peak, Mimure, Nitre Cave, Corbet's Gap. Loolloowatte.	— 6 days
12. 1988	Loolloowatte, Corbet's Gap. Mimure, Dandenikumbura, Kalupahana, Bambarella.	— 4 days



GREY LANGUR

Photograph—Anil Gunawardana



STEMONOPORUS MOONII

Drawing by—D. Gamalath

PINUS AND EUCALYPTUS PLANTING IN SRI LANKA

— **Nimal Gunatilleke**
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Growing of *Pinus* and *Eucalyptus*, both exotics, has aroused strong feelings among people both for and against it. Those who strongly support the cultivation of these exotics, point on the one hand to their remarkably rapid growth in poor soils where no other tree could match their performance and on the other to a multitude of uses they offer, such as paperpulp, construction timber, resins, oils and honey. Those who oppose the cultivation of these exotics are concerned about the ecological degradation, brought about by creation of vast expanses of monocultures and their likely adverse effects on hydrology, soil fertility and wildlife, both animals and plants.

The proponents of *Pinus* and *Eucalyptus* growing allege that the ill-effects mentioned above are not experimentally validated and that the critics are prejudiced and driven by their emotions and sentiments against exotics. They question why the other tree crops like rubber, coconut and tea are immune from this kind of criticism. Furthermore, the proponents often challenge their opponents to recommend alternative indigenous species of comparable performance to replace them. The debate on pros and cons of planting *Pinus* and *Eucalyptus* arise in seminar after seminar, workshop after workshop, both groups strongly adhering to their own subjective feelings. This debate is also not exclusive to Sri Lanka but, widespread in the tropics, so much so that FAO undertook a "dispassionate and objective analysis" of available information the ecological effects of *Eucalyptus* in particular, comparing them with those of pines and other broad leaved species. Having scanned over 200 publications from across the world, from New Zealand to Peruvian Andes, the authors M. E. D. Poore and C. Fries published a condensed synthesis in 1985 titled 'The Eco-

logical Effects of *Eucalyptus*' as the FAO Forestry Paper No. 59. This report deals with ecological effects of planting *Eucalyptus* (and *Pinus* too) on water, soil erosion, soil fertility and other living organisms.

In their conclusion the authors had to say the following: 'Having reviewed the evidence very thoroughly, we must stress that there can be no universal answer, either favourable or unfavourable, to the planting of *Eucalyptus*. Nor should there be any universal answer: each case should be examined on its own merits'.

The authors infer that most ecological effects can only be evaluated with reference to what society wants; for example: is wood or water more important in a particular locality? Rapid growth of *Pinus* and *Eucalyptus* is necessarily associated with a greater consumption of water and the question has to be asked before planting whether wood or water is the more important under a given circumstance. High consumption of water and nutrients is a characteristic to be evaluated if the purpose of planting fast growing species is to dry out a swamp, reduce eutrophication or to obtain fuelwood and timber to meet the ever-increasing demand of the local populace. However, their planting is to be deprecated and may rightly be criticized, if it draws down the water table in an area where water is in short supply and needs to be conserved.

Planting of *Pinus* and *Eucalyptus* or any other fast-growing tree crop for that matter, should be done after having objectively weighed the advantages and disadvantages. The FAO report says that the studies done so far on socio-ecological effects of fast-growing species are not sufficient to make any valid generalisations. It recommends

fundamental research into elucidating the ecosystem processes such as water cycle and catchment hydrology, nutrient cycling, physical aspects of shelter belts, biological utility in agroforestry systems etc.

Among the salient findings of this report are the following which are on the whole, equally applicable to both eucalyptus and pines.

The young rapidly growing eucalypt plantations consume more water, and regulate stream flow less well than the natural forest. Some Australian studies have shown that eucalypt plantations may reduce the water yield of the catchments more than pines. In regions with deeper soils and higher rainfall regimes, both *Pinus* and *Eucalyptus* plantations cause greater soil water deficit, thus reducing ground water recharge and stream flow, thus reducing in the volume of an aquifer can have harmful effects on downstream domestic and irrigation water supply.

Eucalyptus (and *Pinus* too) are not good trees for erosion control. They compete vigorously with ground vegetation in situations where water is in short supply. Suppressed undergrowth and burning of surface litter accentuate erosion.

Cropping of *Pinus* and *Eucalyptus* on short rotation lead to rapid depletion of the reserve of nutrients in the soil and for this reason, they have been planted in some instances to reduce eutrophication or excessive nutrient build up in lakes and swamps.

These general findings have a significant bearing on the past, present and future plantations of *Pinus* and *Eucalyptus* in the upcountry areas of Sri Lanka which form the hydrel catchments for all her major perennial rivers.

Between the period 1950 and 1983, the Forest Department records 30,451 ha. of eucalypt and 22,922 ha. of pine plantations most of which were raised in both upcountry and low country wet zone hydrel catchments. These have been planted to meet the timber and fuelwood requirements. Anyone going to Ohiya or Pattipola these days could see the clear felling operations of

eucalypt plantations. Some of these plantations indeed have an impressive undergrowth of natural montane species, yet they all are clean weeded and planted all over again with *Eucalyptus*.

The mixed planting is now well established and adorning the hill slopes of several provinces of China which were once in degraded condition. It is probably a matter of selection of comparable species and adaptation of the silvicultural practices through a combination of common sense and well planned research to suit our own situation.

At this critical time when multi-billion rupee investments on massive downstream irrigation systems have already been made, natural forests in their catchments are fast degrading, and large scale reforestation programmes have been launched to replenish the dwindling forest cover, a symposium has been organised to review the research done so far in Sri Lanka and elsewhere, primarily on reforestation with *Pinus*. This symposium to be held on 15 and 16th July 1988 is organised jointly by the University of Peradeniya and the Overseas Development Agency of the United Kingdom which is funding a reforestation programme in 4000 ha. of the catchment of the Victoria reservoir.

Our deliberations need to be directed to harnessing the existing knowledge on reforesting with *Pinus* in Sri Lanka and also to develop research priorities on alternative reforestation models incorporating a blend of exotic and indigenous species. A multidisciplinary study of catchment hydrology, nutrient cycling, soil fertility, forestry practices and socio-economics of exotic monocultures and promising mixtures of exotics and native species is proposed by the University of Peradeniya with possible assistance from overseas agencies.

It is hoped that a longterm research programme on appropriate reforestation models for greening, the denuded landscape in the heart of Sri Lanka is carried out.

REFORESTATION WITH PINUS—SOME QUESTIONS AND ANSWERS

— Dr. Nimal Gunatilleke
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There is increasing concern among environmentalists on the one hand, on the over-expansion of *Pinus* monocultures in the Sri Lanka landscape and on the other, the large scale land degradation due to deforestation. Further, acute shortages of wood products experienced by the people demand rapid reforestation. At this crucial juncture, it is indeed pertinent to take stock of our *Pinus* plantations with respect to the changing needs of the country and if possible to reach a consensus among concerned citizens on suitability of *Pinus* and its silvicultural practices for future large scale afforestation as recommended in the much debated Forestry Master Plan for Sri Lanka. The Forestry Master Plan proposes reforestation of 58,000 ha. or 33% of the total vulnerable area of the upcountry primarily with *Pinus* and *Eucalyptus* monocultures over the next 20-30 years and several donor agencies are taking a keen interest in Sri Lanka's future programmes. The British Overseas Development Authority is planning to reforest some 4000ha in the Victoria catchment area with *Pinus caribaea*. Fundamental questions need to be answered.

1. Is there a place for *Pinus caribaea* in the general scheme of reforestation in Sri Lanka?

It very much depends on the purpose for which it is grown. Its exceptionally fast growth rate on degraded sites providing 50% canopy cover in 6 years when planted at a spacing of 2.4m x 2.4m makes it an ideally suited pioneer shade tree crop for the wet zone of Sri Lanka. As a continuous cropping monoculture for paper pulp and other uses, its suitability is still to be proven because most *Pinus caribaea* plantations are still in their first rotation with inadequate silvicultural treatment. In this regard, *Hevea* rubber

has a better place than *Pinus caribaea* in the general scheme of reforestation in the wet and intermediate zones of Lanka.

2. If not, why not? Does pine actually damage its environment; or are there better ways of achieving the same objectives that pine plantations are established for?

Pinus plantations were initially established for obtaining long-fibre paper pulp. This primary objective for which it was planted could well be achieved. Ironically, the Forestry Master Plan (Annexure III p. 39) says the following about the pulpwood requirement of the country. "As there is practically no demand for pulpwood and no large scale use of pulpwood expected in Sri Lanka, the main goal of Forest Plantations is to produce either peeler logs and sawlogs or fuelwood". If this statement is factually correct, we must seriously look for other tree species which not only have equally promising growth rates and good establishment but also superior quality wood for timber or fuelwood than those of *Pinus caribaea*. Unfortunately however, for the acute timber and fuelwood needs of the people, *Pinus caribaea* is not the best answer. According to a State Timber Corporation spokesman, 'the low density and other poor properties render the timber of *Pinus caribaea* unsuitable for structural purposes or even furniture'. In fact, for the lowland wet zone and eastern Intermediate Zone, *Hevea* rubber with its multiplicity of uses such as timber fuelwood and its economically valuable latex which can be tapped during its growing period is a far better choice than *Pinus caribaea*. Indiscriminate planting of *P. caribaea* in monocultures for paper pulp, timber, resin and conservation of soil and water merely because of its good establishment and faster growth rate may eventually degrade the environment in which it is grown.

The present silvicultural practice recommended for *Pinus* (and *Eucalyptus* too) species is one of clear felling on moderate slopes of 10-29° in blocks of 5 ha. On slopes over 30° clear felling is not permitted, but only selective cutting of over-mature trees. Unfortunately, these regulations are not strictly adhered to as witnessed in Ohiya-Pattipola logging sites. where on slopes greater than 30° single units larger than 5 ha. have been clear felled. The extent of soil erosion is self-evident to anyone visiting compartment 1 at Ohiya which has been clear felled in 1987 and replanted. More than the planting of *P. caribaea*, the silvicultural method recommended for it is unsuitable viz., (i) wide spacing between plants to suit economic needs in environmentally vulnerable areas were closer planting is more desirable to provide better soil protection and a more efficient watershed. (ii) removal of more valuable native species regarded as 'weeds' during thinning operations and (iii) clear felling in short rotations. Cropping of *Pinus* (and *Eucalyptus*) on short rotation depletes water and nutrients from the environment rapidly. During the period between clear felling and adequate regrowth, the bare ground is exposed to the elements and soil erosion is severe as seen in Ohiya-Pattipola logging areas. All these factors in combination can lead to pernicious consequences in the long-term.

3. Is it feasible to phase out existing plantations over a period of time and replace them with something else?

This is something that land use planners, foresters, researchers and policy makers should give serious thought to. Are economic *Pinus* or *Eucalyptus* plantations of about 1100 trees per hectare at a regular spacing of 2.4m x 2.4m and a clear felling cycle of every 20-25 years as recommended by the Forestry Master Plan really suitable in these environmentally vulnerable hydrel catchment areas? In such areas should not the existing and recommended silvicultural practice be modified to (i) reduce the spacing so that stocking density is greater, (ii) allow native species to establish naturally in the under growth and (iii) refrain from any felling operations? If fire can be controlled, some common native species

do establish under *Pinus* and *Eucalyptus* shade. Changing the existing silvicultural practice may perhaps be considered by the forestry planners as a luxury that we cannot afford. However in the long term national interest it is imperative that hydrel catchments of the multimillion Mahaweli project function at maximum efficiency to supply adequate water to down stream development. The suitability of *Pinus* as well as its current silvicultural practice for this important role are both questionable. Meeting short-term timber and fuel wood demands from hydrel catchment plantations would certainly lead to their degradation as efficient watersheds. Bearing in mind the purpose of these upcountry *Pinus* plantations, the natural regeneration of broad leaved species in them should be encouraged so that they would be eventually converted to self perpetuating mixed plantations. These vulnerable watersheds should be clearly identified by the policy makers with the assistance of land given absolute protection. Alternatives to meet the timber and fuelwood requirements must be explored outside these critically located watersheds.

4. If there is a place for pine, are there specific purposes or locations for which it is particularly suited?

The superior growth performance of *Pinus* even in poor impoverished soils, make it a suitable pioneer nurse tree crop in almost any location in the wet zone, provided fire is kept off these plantations.

The Forestry Master Plan recommends 10m wide peripheral fire breaks around the entire forest estate and internal fire breaks of the same width dividing the estate into blocks of about 50 ha. In addition, it recommends secondary breaks by omitting one row of trees every 300m. This may sound reasonable for fire prevention but as highlighted at the Symposium, it is disastrous for soil conservation in high rainfall, steep sloped mountainous terrain of our up country. An alternative to this would be to grow a suitable ground cover crop in these strips and then plant indigenous broadleaved species like Sapu, Lunumidella, Pihimbiya, Dun or exotics like Albizia,

Toona, Grevillia and *Clusia* in them. This method will not only reduce fire risks in *Pinus* plantations but introduce mixed tree farming as well.

5. Does pine impoverish the soil, making it more difficult to plant successor species?
Do pine needles ever mulch down?
Do they inhibit microbial activity?

Soil studies under *Pinus* in Sri Lanka are still preliminary and limited to a short period only. Hence no definite conclusions can be made on long-term effects. Bearing this in mind, available from our studies show that the amount of nutrients recycled in a pine plantation in the low country wet zone over a period of one year is lower than that recycled in a natural forest. Frequent fire during growth and clear felling at maturity accentuate the nutrient impoverishment on these soils. We have also found that highly mobile nutrients like nitrate irons are significantly lower in concentration in the *Pinus* plantation than in the natural forest, indirectly suggesting greater run off and denitrification which gradually lead to loss of soil fertility. Pine needles decompose slowly particularly during drier periods than their counterparts. Consequently, the formation of organic matter is slowed. Inhibition of microbial activity in *Pinus* plantations has not been examined but predominance of a single tree species subject to frequent burning could greatly reduce microbial diversity in these plantations.

6. Can pine be planted in combination with other species so as to obviate some or all of the drawbacks associated with it?

There is every indication from both local and overseas studies that *Pinus* can be grown in combination with a host of other species to obviate the drawbacks associated with it. The question is how this combination can be made silviculturally feasible and economically viable in commercial forestry. This is where, researchers in forestry can play a major role in conducting a series of mixed species trials and studying their growth performance, nutrient cycling, hydrology, plant-animal interactions and most importantly their benefits to the local community. Further, the light and nutrient requirements, canopy architecture and dominance of individual species as well as their compatibility

together, should be investigated. At present, *Pinus* monocultures have very little to offer to the villagers as compared to *Hevea* rubber monocultures which provide them regular employment by tapping latex and indirectly part of their fuel wood and fodder requirements. Mixed farming *Pinus* with suitable fruit trees such as durian, jak, bread fruit, mangoes etc. provide further needs of the village community than with *Pinus* alone.

7. Can wildlife survive or thrive in a pine forest?

Under the present circumstances, the survival of wildlife, both plants and animals, in *Pinus* plantation is poor, mainly due to regular fires that prevent their establishment. Moreover, plants with edible fruits and tubers are lacking or limited. *Pinus* itself does not produce any plant product sufficiently palatable to our local fauna. Animals such as wild boar, rabbits, porcupines, pangolins do roam in *Pinus* forests but their main habitats are usually the adjacent degraded natural forests scrublands and/or grasslands from which they operate.

8. Do pine needles encourage too fast a run-off by ground water?

Although there is no direct evidence backed by data to support this thesis, indirect evidence suggests that pine needles do encourage faster run-off than the leaf mulch of a natural forest, or for that matter a mixed home garden. By having water repellent, resinous substances which decompose slowly, conversion of *Pinus* needles to organic matter which increases infiltration, is a slow process.

9. Are there special techniques in the planting of pine eg. spacing of trees, orientation of rows etc. which minimise later problems?

This aspect of *Pinus* planting needs to be researched upon. A combined study of examining the growth performance, soil fertility and nutrient cycling, hydrology, and how the current silvicultural practices affect these factors should be given high priority concurrently with reforestation programmes. Having grown *Pinus* and *Eucalyptus* as large scale monocultures over 20 years or more in short rotations in the catchment areas, this silvicultural practice needs serious

re-examination in the light of decreasing natural forest cover and expanding cash crop or vegetable monocultures such as, potatoes and tobacco etc. suitable plantations to substitute the dwindling natural forests of the mountain areas need to be established for the prime purpose of ensuring and regulating dry weather water flow. If *Pinus* is to be grown for this purpose it should be done at closer spacing between plants.

10. Should the pine be regarded primarily or exclusively as a pioneer species, to be removed as soon as successor species have established themselves?

The answer is an emphatic yes for the upcountry hydrel catchment areas. In the watershed plantation forests *Pinus* need not be removed but in them long lived successional species should be allowed to take over. However, outside the catchment areas an appropriate hectareage should be set aside for paper pulp production taking into consideration the increasing needs of the local paper industry. The observations made by the Forestry Master Plan in this regard that there is practically no demand for pulp wood and that no large scale use of pulpwood is expected in Sri Lanka, is difficult to accept. Although the foreign imports are cheaper at present, continuous dependence on it may be disastrous in the long term. In other areas, particularly in the wet and intermediate zones where *Pinus* does well as a pioneer, gradual phasing out should be done with both exotic and indigenous broad-leaved species that are more suitable for peeler logs, saw logs and fuel wood. According to the Forestry Master Plan projections, the country will be facing an acute shortage of fuelwood and industrial logs beyond year 2000 unless adequate planting of suitable species is carried out now. In this respect *Pinus caribaea* is not found to be a suitable species for either fuelwood or industrial logs. Therefore conversion of existing and scheduled *Pinus caribaea* plantation in the low country to mixed utility wood forests is a vital requisite if we are to meet these needs of the early 21st century and beyond.

11. If the answer to 10 is affirmative:

- (a) for how long should the pine be left standing?

- (b) what should be done with the timber when felled?

- (c) what should be planted in its place?

(a) In *Pinus* plantation grown for commercial forestry after 6-8 years of growth in the absence of fire damage, the *Pinus* casts sufficient shade for underplanting of broad-leaved species. Once the latter are well established and mature *Pinus* may be removed with minimum damage to the successional broad-leaved species. The design of the most appropriate mixed planting and timing for extraction need to be worked out by research trails.

(b) *Pinus* wood thus obtained may be used for paper pulp and light construction purposes to supplement the hardwood timber in the market. Removal of logs by cables, causing minimum damage to the soil by avoiding road construction need to be experimented. The logs can be brought down to a logging yard located at a lower level by gravity movement along a cable as done for tea in some estates in the past.

(c) A carefully selected ensemble of broadleaved hardwood species giving due consideration to the needs of local people should be planted. The site available for planting and its proximity to village should determine the combination of species in a plantation. Along the road side easily accessible areas multi-purpose trees should be planted. In the more inaccessible and remote areas species suitable for timber alone or in mixture could be grown.

12. Can one calculate the economic return on pine plantations; or the cost-effectiveness of growing pine compared with other species?

The economic return on *Pinus* (and *Eucalyptus*) plantations under intensified scientific forest management has been calculated by the Forestry Master Plan. According to this, such a plantation would give a 20.2% Financial Internal Rate of Return (FIRR) and 28.4% Economic Internal Rate of Return (EIRR). According to the same report, the non-forest wood resources such as village home gardens gives the best profitability

of 35% FIRR and 54.6% EIRR. This, they claim, is because the resource is already there in home gardens and with moderate additional inputs, the yield can be considerably increased.

13. Is pine suitable for community forestry schemes? Is there a potential cottage industry based on resin-tapping or on any other pine products? Can pine needles not be used for anything?

I very much doubt the suitability as well as the acceptability of *Pinus* to villagers as a species for community forestry schemes. For such schemes, species with multiple uses to the village folk be more desirable. As resin tapping is still new to Sri Lanka, the short-term potential of it as a cottage industry, in my opinion, is rather low. Even if there is a use for pine needles, their removal from the plantations could enhance runoff and soil erosion-unless replaced by a better mulch. The fire risk of accumulating needles on ground should somehow be reduced by encouraging suitable undergrowth.

14. Is there a danger in relying too heavily on a single species, *Pinus caribaea* in terms of vulnerability to disease and genetic poverty?

Indeed there is a potential danger in relying too heavily on any single species or a single cultivator or a clone in terms of vulnerability to disease and genetic impoverishment. This is true not only for *Pinus* but for every cultivated crop species all over the world. Mixed cropping with different species and in the case of a single species by using a wider range of varieties and clones is always a recommended safeguard against outbreaks of disease and genetic erosion.

15. Is there a serious fire hazard associated with pine? If so, can be it contained by correct planting techniques?

It was convincingly shown at the Symposium, that fire hazard is the most serious set back for *Pinus* planting in Sri Lanka. According to the Forestry Master Plan, a quarter of the annual planting area has been burnt at least once which amounts to 1500-200 ha. per year. At the present scale of planting, the area estimated to be burnt

by year 2000 would be between 3300 and 4400 ha. per year. In monetary terms this amounts to, according to the Forestry Master Plan, a value between 30 and 40 million rupees per year and would increase to 66-88 million rupees per year by the year 2000 if the present system of fire protection is not further improved. Prevention by modern fire fighting methods under Sri Lankan conditions is equally expensive. Feasibility of mixed planting with species mentioned earlier would certainly be a worthwhile exercise considering its benefits from the reduction of fire hazards alone.

16. Is it true that pine is not self-propagating in Sri Lankan conditions?

The experience of the Forest Department research personnel is that there is no self-propagation of *Pinus caribaea* in Sri Lanka. The reasons for this has hitherto not been investigated. However, *Pinus patula* has been successfully self-propagated in Sri Lanka.

17. Can any native Sri Lankan species perform the role demanded of pine-at least as well or better without the concomitant drawbacks?

It depends on the objective of planting *Pinus*. If it is for water and soil conservation or for timber, *Pinus* as it is planted now is a poor choice. The native species could perform better. If it is planted for initial site rehabilitation, *Pinus* species have an edge over others in the absence of any systematic longterm research on native or naturalised pioneer species particularly using modern methods of propagation. There are a number of potential candidates from both native and naturalised species for this slot. Some potential species are *Macaranga peltata* (Kenda), *Trema orientale* (Gedumba), *Muntingia calabura*, *Mallotus* (Bu Kenda). The fire risk is minimal and contribution to soil fertility and human formation is greater with these broad leaved species.

18. It has been mentioned that a grassland could give a better "water yield" than a forest. Can you explain this with respect to the relative suitability of these two types of vegetation cover in our catchment areas?

The water falling on any part of the earth's surface has at least four consequences. Part of it can get trapped in the above ground vegetation and be released slowly to the soil like a sponge; another part can percolate into the soil and eventually reach the table beneath, another part can return to the atmosphere through evapotranspiration. Finally a major part perhaps, could run over the soil surface and swell the streams and reservoirs and eventually enter the ocean.

Water yield usually refers to the fourth component which is the amount of water that is collected off the soil surface after a rain storm. A grassland has very little vegetation cover compared to a forest to trap moisture and most of our 'Pathana' grasslands have very poor humus containing top soil (and/or a hard pan) which makes percolation of rain water through the exposed soil-crust rather difficult. As a result, there is a greater runoff from pathana grassland than from a forest. Natural forests densely packed with multilayered trees and clothed with epiphytes trap more water within it than a forest plantation which is cleared of undergrowth either by silvicultural practice or by fires. In other words, poorer the vegetation greater the yield water and according to the same token a bare rock or a concrete surface can give an even better water yield than a grassland!

'Water yield' in my opinion is a deceptive parameter to go by in catchment hydrological studies. The sponge effect of the dense multilayered forest is the most important factor which regulate water yield and slowly releases water particularly during the dry periods. Therefore although the water yield of a forest is lower than that of a grassland the former vegetation, considering its water regulation and soil conservation properties is better in catchments. In addition, it has greater biological diversity to offer as well.

In summary, quoting the former conservator of forests Mr. W. R. H. Perera popularly known as the father of *Pinus* in Sri Lanka, '*Pinus* species may not be the best or even the second best species for forestation but in the absence of any other tree species which perform so well on this barren landscape it is continued to be planted by the

Forest Department to obtain a rapid forest cover to rehabilitate the denuded landscape particularly in the hydro-catchment areas'. However, the original objective of planting *Pinus* was to obtain long-fibre pulp for the paper manufacturing industry, but having raised the plantations additional uses such as furniture making, resin tapping have been 'found' for it. However, according to State Timber Corporation reports, the wood products of *Pinus caribaea* are not as durable as those of *Pinus insularis* and the former as a fuel wood species is also unsatisfactory.

Several speakers at the symposium presented evidence to show that all *Pinus* plantations are not 'biological deserts' and these plantation do indeed support an undergrowth of a variety of local plant species and some animals *provided*, they are protected from fire. Although *Pinus* is considered to be fire resistant, considerable loss, sometimes over 60%, does occur. The thick mat of highly inflammable *Pinus* needles accumulated on the forest floor is extremely conducive to widespread fires. The common consensus among forestry professionals, scientists and the environmentalists was that *Pinus caribaea*, due to its rapid growth in poor soils is a good pioneer tree species but there is a growing need to gradually convert *Pinus* monocultures into mixed plantations of superior quality timber to meet the rapidly growing wood demand also to bring about greater stability and biological diversity in our landscape. The forest Department has already taken some steps in this direction by underplanting some *Pinus* plantations with Mahogany but much more research in this area is urgently needed.

Having grown *Pinus* monocultures for over 20 years now, the participants felt that a serious rethinking is necessary for its continued planting in present form under heavy losses incurred particularly by fire. Dearth of scientific knowledge on other equally promising species which are less prone to fire was apparent and to bridge this gap, a comprehensive research programme is being drawn up by the scientists of the University of Peradeniya to supplement what is being done at present by the Forest Department and other organisations.

FIRE AND ECOLOGICAL PROBLEMS WITH PINES

Appropriate Test Agency Services

121, POINT-ELITE ROAD
NALLUR, JAFFNA

No. 121/2000/1-2-3-4-5-6-7-8-9-10

— **Ajith H. Perera**
Faculty of Agriculture
University of Peradeniya

Pines in Sri Lanka are accused of creating "biological deserts". This allegation cannot be universally valid since there are many pine plantations which support high biological diversity. Yet the majority of plantations are in fact devoid of undergrowth and do not sustain animal/bird life.

undergrowth, propagules, soil biota and increase nutrient losses and soil erosion. A vicious circle is thus triggered, which go on to degrade the reforested sites progressively. This process will undoubtedly create "biological deserts" in the long term.

The key to this enigma is forest fires. Readily combustible pine litter accumulate in large quantities. This support annual fires in the plantations unless protected rigorously. Pine fires destroy natural forests.

Therefore, strict fire protection is an absolute necessity in pine plantations, especially in the context of long-term objectives of protective reforestation; watershed protection and buffering

* * * * *

“Nature never did betray
The heart that loved her”

Wordsworth

* * * * *

WHAT IS A SANCTUARY ?

— Thilo Hoffmann

Very few people seem to know the answer to the above question. Most people think that there is no habitat protection in a sanctuary and even some scientific papers are perpetuating this erroneous impression.

The only fundamental difference between a national park with 100% habitat protection, and a sanctuary is the fact that the latter may contain private land and also provide for limited traditional usage where appropriate, e.g. grazing, and that people enter a sanctuary without a permit. But there is total habitat protection in those parts of a sanctuary which are State land. This is by far the greatest portion of practically all sanctuaries, and many are State land only, for instance the Peak Wilderness, Kokkilai, Kalametiya, Giant's Tank, Wilpattu North, the two Sober Islands and Naval Headworks at Trincomalee etc., etc.

In all parts of a sanctuary (whether private or State) the following acts are prohibited:

1. To fire any gun or disturb any wild animal or interfere with the breeding of wild animals and birds.
2. To hunt, shoot, kill or take any wild animal.
3. To take or destroy the eggs of birds or reptiles or the nest of any bird.
4. To construct or use any hide or ambush.
5. To set, lay or spread any pitfall, trap, snare or other instrument for the killing or capturing of wild animals, birds or reptiles.

On *State land* within any sanctuary (which in most cases is practically the total extent of the sanctuary), the following acts are prohibited:

1. To fell, girdle, lop, tap, burn, or in any way damage or destroy any plant.
2. To clear or break up any land for cultivation or mining or any other purpose.

3. To kindle or carry any fire.
4. To possess or use any trap or explosive or poison used for the purpose of injuring or destroying animal or plant.
5. To make any fresh clearing.
6. To erect any building.
7. To construct or use any road or path.

The above provisions if properly enforced, *guarantee complete habitat protection* in any sanctuary which consists exclusively or mainly of State land, i.e. in practically every instance. Fishing is only permitted on permit.

In their Environmental Assessment of the Accelerated Mahaweli Development Project (1980) Tippetts - Abnett - McCarthy - Stratton (TAMS) state that in a sanctuary animals cannot be disturbed but all other human activities, including *habitat elimination* and private ownership of land, are allowed. The provisions of the Ordinance listed above, show clearly that habitat elimination is completely out of the question on State land in a sanctuary. Private ownership of land is only allowed in so far as it concerns land which may have been privately owned at the time when the sanctuary was declared; no State land in a sanctuary is ever transferred to private ownership or even leased. Thus private land ownership is negligible or non-existent in most sanctuaries.

The 1980 original TAMS misrepresentation (the authors could not possibly have consulted Fauna & Flora Protection Ordinance) is obviously based on hearsay and has been repeated in some other papers such as TAMS Environmental Impact Assessment on the proposed coal-fired power plant at Trincomalee, the Sector Paper on Natural Forests for the National Conservation Strategy and most probably in Scientific papers abroad.

JUNE, 1988

IN WILDERNESS IS THE PRESERVATION OF THE WORLD

— Dr. Arthur C. Clarke
Chancellor
University of Moratuwa

A world which contained only human beings would not be worth living in; nor would it be habitable for very long. This is a lesson that our urban-centered, technologically - orientated culture is painfully relearning, though our ancestors knew it well enough. A holy man once told the ruler of Ceylon: "Oh great King, the birds of the air and the beasts have as equal right to live and move about in any part of this land as thou. The land belongs to the people and all other beings; thou art only the guardian of it."

That was twenty-five centuries ago, when co-existence of man and beast presented few problems. But in the last twenty-five years the (human) population of Ceylon—now Sri Lanka—has doubled. Though the small island is not yet overcrowded, and much of its natural beauty is still intact, it now provides text-book examples of many modern dilemmas:- development *versus* environment; farm *v* forest; indigenous culture *v* tourism.....

It is impossible to return to the past, and no-one would really wish to do so. For centuries Ceylon's population was kept steady by the malaria-carrying mosquito: there are some forms of wild-life that should *not* be conserved. But there are countless beautiful, harmless and often valuable creatures whose very existence is now threatened by greed, indifference or ignorance. (And even by superstition; one local tortoise is prized for its flesh—those who eat it believe that their skin becomes equally well-armoured against injury!).

The elephant is, of course, the most spectacular as well as the most famous of Sri Lanka's animals; its enormous appetite for succulent green-stuffs puts it into direct competition with the farmer. It is impossible not to feel sympathy for a small cultivator who may be ruined overnight by a marauding herd—and can one blame him if he loads a blunderbus with rusty nails to protect his crops? Fortunately the elephant is so useful—and so revered—that it is probably safe from total extinction.

But remembering what happened to the incalculable billions of passenger pigeons in the United States only a century ago, one cannot help fearing for the future of Sri Lanka's smaller and less publicised animals, as the forests are cleared, the coral reefs smashed up to make lime, and the new industrial estates pollute land, air and water. Though some creatures seem to thrive in man-made environments, they are usually the less attractive representatives of the animal kingdom; crows, sparrows, rats, cockroaches.....the beautiful birds and butterflies, the shy loris, the handsome leopard and its elegant prey the spotted deer, all vanish before the advancing bulldozer. As do my own favourites of Sri Lanka's forest dwellers, its mischievous yet endearing monkey people. I still grieve for Silkie, a baby langur who spent most of her brief life nestled inside my shirt.

It has been wisely said that in wilderness is the preservation of the world. In Sri Lanka, we are engaged in the preservation of wilderness. For as King Devanampiyatissa was told five centuries before the birth of Christ, we are its guardians—*not* its owners.

ENDANGERED SPECIES IN SRI LANKA

— Richard Fitter

Chairman, Fauna and Flora Preservation
Society, London

Sri Lanka was a pioneer of Wildlife conservation in Asia, its Wildlife Society being not only the oldest in Asia but one of the first in the world. Today it has a fine series of national parks, nature reserves, wildlife sanctuaries and other protected areas, with a department of government solely devoted to their upkeep, unlike many other Asian countries, which have combined wildlife with forestry, which often means that wildlife is subordinated to commercial forestry considerations. Even so, like all other countries, Sri Lanka still has its endangered species, many of which, in a heavily cultivated countryside, are largely confined to the protected areas.

At present 14 species in Sri Lanka, 13 animals and one plant, are judged by the International Union for Conservation of Nature (IUCN) to be endangered on a world scale. There are five mammals, two birds, five reptiles, one insect and one palm. However, this list is undoubtedly incomplete, for although IUCN'S Red Data Books for mammals and birds are complete, those for the other groups are not.

Two of the five mammals are marine species, the blue whale *Balaenoptera musculus*, which has only comparatively recently been found to occur in the Bay of Bengal off the north-east coast of Sri Lanka, and the dugong *Dugong dugon*. The three terrestrial species are the sloth bear *Melursus ursinus*, leopard *Panthera pardus* and the Ceylon race of the Asian elephant, which is actually the type subspecies *Elephas maximus maximus*. All these are currently protected.

The elephant provides one of the major problems for conservationists in Sri Lanka, both official and voluntary, as the steady reduction of its habitat cause it from time to time to break out into cultivated areas and cause severe damage

to crops and property. Ultimately the only way of preventing the constant friction may be to erect elephant-fences around extensive tracts of wild country, mainly in the national parks.

Only two birds are at present on the world endangered list for Sri Lanka, the peregrine falcon *Falco peregrinus*, one of the most widespread species in the world, and an endemic race of the broad-billed roller *Eurystomus orientalis irisi*, which at one time was feared to be extinct, but has in fact been reported several times in the past ten years. Like all birds in Sri Lanka, except for a few species deemed to be potentially harmful, these two species are protected.

The endangered reptiles comprise two crocodiles, the mugger *Crocodylus palustris* and the estuarine crocodile *C. porosus*, and four marine turtles, the green *Chelonia mydas*, the leatherback *Dermochelys coriacea*, the hawksbill *Eretmochelys imbricata* and the olive ridley *Lepidochelys olivacea*. All the turtles are threatened to some degree by overcollection of eggs on their nesting beaches and in some parts of the country their flesh is eaten too. The proper protection of the marine turtles, together with the dugong and the many valuable coral reefs, which are steadily being quarried away for their limestone, calls for the setting up of marine national parks and sanctuaries. Will Sri Lanka, the pioneer of national parks in Asia, also pioneer marine national parks in the Indian Ocean area?

The Red Data Book for invertebrates is still in its early stages, and the only Sri Lanka species which has so far qualified is the relict ant *Aneuretus simoni*, confined to the south of the island, especially around Ratnapura, Gilimale and Adam's Peak, where its range is said to be contracting.

It is the only survivor of a group of ants of great scientific interest as a link between a very primitive family and a more advanced one.

The Plant RDB is also highly selective at present, and for Sri Lanka only includes the palm *Areca concinna*, with a single population, of about 1000 trees, in swampy woodland along a backwater

in the Kalutara district. Until 17 years ago, it was known to botanists only from the original gathering in the last century. It has also been found that all the trees in botanic gardens labelled as this species appear to be *A. triandra*, perhaps because the same confusion is made in Blatter's *Palms of British India and Ceylon*.

SOME THOUGHTS ON CONSERVATION AND DEVELOPMENT

— Jayantha Jayewardene

Managing Director Mahaweli Economic Agency

Quite often we hear of conservationists objecting to development plans arguing that detrimental changes will occur in the environment due to these development activities. In such instances it is necessary to look carefully at these plans and assess the short-term and long-term benefits of both conservation and development. More weightage must of course be given to the long-term benefits when such an analysis is made. It is only after a very close and objective look at both sides, that a decision should be made on whether it is beneficial to continue with the proposed development or whether the need for conservation outweighs the benefits of this development.

Two important factors regarding conservation that should be considered are; what are we trying to conserve and for whose benefit is this conservation. Conserve for posterity is a plea that is heard quite often. Must we conserve everything for posterity. The Dodo is extinct but have recent generations missed it in any way. Will posterity need everything that we decide to conserve. For example, every attempt is being made to conserve the present wild elephant population in this country. I agree that the wild Sri Lankan elephant must be, if possible, conserved at all times. The question is why are we trying to conserve the wild elephant? What use is it going to be to the future generations of this country. In the past, when there was no suitable machinery, the elephant was used for heavy work like logging, heaving stones, etc. The elephant is used less and less for this type of

work now. Elephants were caught from the jungles and tamed for these domestic purposes. Now the wild elephant will not be required for domestic use in such large numbers as before. Another aspect of conserving for the mere sake of conservation is that only a very small percentage of the people will benefit from the elephant let alone get an opportunity of seeing them in the wild. It is therefore necessary for us to look at elephant conservation intelligently. What is the minimum population that can reproduce in sufficient numbers to maintain its number in the future. Where can these herds be located—National Parks, forest reservations, large forests that will not be needed for future development and corridors to connect their habitats. This needs careful planning by experts in this field.

I think that we sometimes place too much emphasis on conserving that which is not so important and ignoring the need to conserve that which effects the present and future generations of our people. In and around Nuwara Eliya one sees large extents of forests being cleared off the hill slides—Blackpool area for example—for the cultivation of vegetables. The detrimental effects of this action are worth considering. The thick mulch-covered floor of the montane forests soak up the rain water and releases it into the streams to make up the flow in the dry weather that keeps water flowing in the rivers fed by these streams. This 'dry weather flow' is very essential for the people. When these forests are denuded

not only does the rain water not go into the earth to reappear later in the streams, but this water runs off the surface of the earth taking off loose soil with it. This soil not only makes the water in the streams and ravines muddy but also deposits itself in the bed of the reservoirs. This action after some time silts up these dams and reduces their water carrying capacity and thereby their usefulness. Over a period of time as the good top soil is washed away, the land becomes unsuitable for cultivation as originally intended and is then neglected and grows into grass land or patna which is of no use to anybody.

From this there are two important points that conservationists, planners and decision makers should take note of. One is that the felling of these forests, for whatever purpose, should be stopped immediately. The other is that action should be taken to replant, as much as possible with the same species, the forests that have been denuded up to now so that these areas can be brought back to their earlier degree of usefulness. The earnest efforts of conservationists should be engaged on these two urgent aspects of conservation. If something is not done in this respect the people of this country will definitely be affected adversely in the future.

As we are all aware, the population of this country is increasing rapidly. Our initial task is to feed this growing population. Rice the staple food of the Sri Lankan people, if not grown here, has to be imported at great cost spending valuable foreign exchange. The Accelerated Mahaweli Development Programme is at present the only planned effort that provides for feeding the increasing population. A segment of this effort is the development of hitherto unutilized and under-utilized lands to settle landless people for the cultivation of paddy and other food crops under irrigation. The development of new lands involves the clearing of jungle lands as well. Some of these jungles have been the habitat of elephants for a long time. The conflict starts here. Should some of the traditional habitats of the elephants be cleared to meet the important need to feed the people? It is argued that if more intensive agriculture is engaged in whereby the yields in the areas presently cultivated in paddy is increased,

there should be no need to develop new lands to increase paddy production. Taking into consideration the projected populations and the food that they would consume, not only would it be necessary to maximize production in all cultivated lands but it would also be necessary to cultivate all cultivable lands.

This brings us to the question of what are cultivable lands and what are the purposes and uses of the other lands. In Sri Lanka land has been taken up for villages, towns and cities. A large area has to remain in forest cover. The tea, rubber and coconut industries also take up a large area of the country. National Parks, which are a part of our avowed conservation policy, take up another chunk of land. Road, Canal, Streams and other reservations cannot be used for the cultivation of crops. The balance land is that which is available for the cultivation of food crops. All this land however should not be used indiscriminately for plantation crops and other forms of agriculture. The first choice should be lands that can be cultivated twice each year through rainfall and irrigation with stored water. This ensures the maximum utilisation of the scarce land resources. Rainfed agriculture in the balance cultivated areas of the country should be continued. That method of agriculture which necessitates the indiscriminate destruction of the forests (chena cultivation) should however be discouraged. This form of agriculture yields poor results, is detrimental to the forest and its soils, destroys indiscriminately the habitat of wild life and changes the environment and ecosystem.

A pleasing aspect of Sri Lanka's new development strategy is that at the planning stage, prior to development, the planners have taken into consideration the effects of the development programme on the environment and the needs of conservation. A special team of experts were commissioned to look into this in detail and most of their recommendations have been incorporated into the development plans of the Mahaweli Programme. One major impact of this is the formation of the Maduru Oya National Park which consists of a land area larger than the area taken up for development in its vicinity.

FLORA AND FAUNA CONSERVATION

— Dr. B. L. Perera

The relentless destruction of the wildlife of Sri Lanka is presently a subject of much concern to the Country as well as of great concern to Conservationists. In the recent years with a theme for self sufficiency in food production in the forefront, the need for extension of agricultural land and the necessary waterways had paved the path for a bleak future for our wildlife. Travelling around the Country it is sad and disappointing to witness the destruction of our wilderness that once flourished with wildlife. If one considers the reasons which apart from awareness in agriculture itself had contributed to it, we could still employ ways and means of saving what remains of Our Flora and Fauna, and infact institute measures to extend the narrowed range of certain species of plants and animals, or infact save some from going into extinction.

Both in the wet zone and the dry zone the farmers still use though against the law, the Trap gun to protect their crops from wild animals⁵. I have seen the Foxtail Orchid (Lat. *Rhyncostylis retusa*) protected since 1st March 1938 being sold at Bibile, *Eulophia* Orchid species being sold at Kandy, Lustre of the Moon Orchid (Sin. Sandha Raja, Lat. *Xeuxine regia*) again a protected orchid being sold at Nugegoda and *Eria lindlyii*, Bamboo Orchid (Lat. *Arundina gramaifolia*), the Golden Dendrobe (Lat. *Dendrobium heterocarpum*), *Arundina minor*, Lily of the Valley Orchid (Lat. *Eria bicolor*) sold at Adam's Peak during the pilgrim season. Some of the orchids are protected and beautiful the others being common.¹⁸³ These plants are ripped off from their environment and replanted in uncongenial conditions and thereby destined to die with a mere loss of their numbers.

The sale of these plants are unchecked. The legislation for the protection of the animals as it stands at present are weak, or not implemented. Hence the legislation must be amended appropriately. The penalties for breaking the legislation should be increased in the face of the dwindling wildlife and additionally displayed in eye-catching signs aside the legislation. The Public must be made aware of their false beliefs that endemic plants could be grown outside the districts where they are found and also of the heavy penalties their transport could meet with. Through the media of Television the Public must be educated on the protection enjoyed by Orchids in general.² The Flora & Fauna Protection Ordinance must be revised to include other beautiful orchids such as the beautiful *Bulbophyllum wightii* and wild flowers such as the *Rhododendron zeylanicum* (Sin. Asoka Mal, Ma Ratmal) with its flamboyant flowers.

During the Pilgrim season, trees are cut down in the Peak wilderness at various levels along the path to build new boutiques. The felling of these trees cause destruction of many endemic and non-endemic plants both common and rare ones as well as the destruction of host plants on which the epiphytic orchids (and other epiphytes) grow. This practice of erecting new boutiques can be stopped by erecting permanent & semi-permanent structures for this purpose and enforcing the law against building of such structures by unauthorised persons.

In the past large plots of land had been leased out from jungle areas for agricultural and animal farming purposes. After few years of using, the land is abandoned or neglected. This practice must be prohibited if more jungle land is to be conserved. The abandoned plots must be replanted with the flora that existed in this area before clearing occurred.

I was very dismayed to see the ruthless destruction of the virgin forests at Rangala, Hunnasingiriya and Mahiyangana in the last few years. The destruction of top soil resulting from erosion as an aftermath of deforestation is detrimental to the established commercial crops and responsible for harm done to the Bird Life too. A past time practice of burning the mana grass in all these areas had caused additional damage to the wild life. On following the Rainfall charts for the last few years, it is observed that there is diminished rain over the Knuckles. These highly unnecessary practices should be prohibited if the Flora and the Fauna in this region are to recover over the next few decades.

In spite of the wide destruction, there are fairly wide areas of thick jungle in certain areas of the Country for eg. in Hunnasingiriya, Rangala, Nuwara Eliya District and parts of the Dry Zone. A strategic point in the Dry Zone is the Bundala Sanctuary, a haven for waders and other water birds. At least certain well selected areas must be converted into National Parks and few other areas converted into sanctuaries. The agriculturally orientated villagers must be educated through the Television, that the indiscriminate destruction of the Jungle will one day convert the presently arable land into dry unarable land. This is already seen taking place in the Teldeniya area where the Victoria Dam was constructed with the expectation of supplying water to the area.

As regards our Avifauna, it is very disappointing to know from the results of the second Duck Count in the Island⁶ that (1) heavy shooting of Birds had occurred in the Telwatte Sanctuary area (2) same had been occurring in the area between Galle and Ambalantota, (3) Painted storks, Pelicans and other birds are also killed at Rekawa Kalapuwa, which since conducting the count had been converted into a Sanctuary. (4) Severe disturbance of Bird Life by shooting from Kala Oya to Mundal Lake. Although at present guns are not used as a result of the state of civil unrest, Wild Animals including the birds should be protected from being destroyed by shooting.

It was a promising and successful effort that resulted in the declaration of the Maduru Oya area as a National Park. Improvements in this park must however be done and it must be protected from poaching with utmost efforts as it is a haven for the destitute Elephants made homeless by the expanded Mahaweli Scheme. Happy news were also heard of two proposed National Parks in the Lower Mahaweli Flood Plains and Villu regions. After much ado, Horton Plains were made a national park in 1988. The Sri Lankan people must be educated as to what means and efforts other countries are employing to save the wildlife.

Wherever possible the Farmers should be encouraged Biological Control. (7) The latter accumulate in the bodies of birds resulting in the decreasing of the fertility rate and the egg shells becoming thin. D.D.T. and other insecticides accumulate over the years in the Humans to reach toxic levels.

It must also be stressed that the time had come to practise more direct conservation techniques to conserve animals, especially those that are in the Red Data Books. They should be bred in captivity and released into the jungle in batches to maintain their numbers in the wild. The numbers of the Red Faced Malkoha and the Broad Billed Roller as well as their range should be extended in this way. The sight recordings of the Comb Duck had been far and few in the last two decades. Efforts must be made to obtain batches of these birds from India with the help of the wild life Department of India. In this way, the once supposed to be resident status of this birds could be re-established. The environment of the Flamingos must be protected immediately as it is being threatened by the local people in these areas.⁹ The Wild Elephant and the Sea turtle are both protected by the present Ordinance on the Protection of the Fauna and Flora of Sri Lanka. However in the handicraft shops in Colombo and other towns, ornaments made of elephant tusks and turtle shells are available in abundance. The sale of these products must be forbidden henceforth.

It is OUR Responsibility and Pride to PROTECT Our Flora and Fauna as part of Our Heritage. If no attempts are made to achieve these ends in the near future, the day is not far, when OUR ISLAND will be barren of these admirable gifts of Nature.

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THE STATUS OF FAMILY DIPTEROCARPACEAE BLUME IN SRI LANKA (1987)

— Athula S. Wijesinha

INTRODUCTION

The family Dipterocarpaceae has a significant place among the flora of Sri Lanka, and in addition it is presently a major timber supplier of the world. A considerable proportion of the wet zone forests in Sri Lanka are dominated by the Dipterocarpaceae species. It spreads from Sinharaja to Dolukanda, Lunugala to Kauckles, and Maduru Oya to Peak Wilderness and likely all over the island. But almost all the Dipterocarpaceae species have already faced a tragic deterioration and their conservation is very essential.

TAXONOMY

The family consists of 58 species* in 9 genera. All the species and two genera of the family (*Doona* & *Stemonoporus*) are endemic to the island. Family Dipterocarpaceae is frequently facing various taxonomic changes since its establishment of Blume in 1825. Its taxonomic history is listed in fig. 1.

After the monumental works by Thawaites (1958/1864) and Trimen (1893), Ashton (1972) presented major taxonomic revisions in the family. His generic concept leads to the reduction of *Balanocarpus* to *Hopea*, and of *Isopetra* and *Doona* to *Shorea*. Ashton (1980) referred to these changes in his section of *A Revised Handbook to the Flora of Ceylon, Vol. 1* which was published under the Flora of Ceylon Project.

* Some vernacular name: Beraliya, Dorana, Dummala, Durulla, Dun, Hal, Halmendora, Hora, Hulanidda, Mendora, Namendora, Tiniya, Yakahalu.

Fig. 1

Genera	Thwaites 1858 & 1864)	Trimen (1893)	Ashton (1980)	Kostermans (1981 & 1987)
Dipterocarpus	06	05	04	04
Doona	10	11]	—	[10
Shorea (Isopetra)	03	05]	15	[06
Hopea	03	03]	04	[04
Balanocarpus	—	01]	—	[02
Vateria	01	01	01	01
Vatica (Isauxis)	02	03	03	04
Stemonoporus	11	13]	15	26
Monoporandra	03	02]	—	—
Sunaptea (Cotylelobium)	—	02	02	01
Total species	38	46	44	58

Family Dipterocarpaceae in Sri Lanka (1858—1987)

It was timely understood by some taxonomists that Ashton's treatment of the family was unsatisfactory. (Kostermans 1979). Then a series of taxonomic revisions of the family was forwarded by Kostermans. Kostermans (1981 a) reinstated the genus *Balanocarpus* and described a new species *Balanocarpus kitulgallensis*. Kostermans (1981 b & c) revised completely the endemic genus *Stemonoporus* adding 11 new species. Kostermans (1979) and Gunatilleke rediscovered *Stemonoporus moonii* in a marshy forest at Bulathsinhala which was formerly recognized by Ashton as an excluded species. *Stemonoporus lewisianus* was originally described by Trimen, was later referred by Ashton to *Cotylelobium* and reinstated as *Vatica lewisiana* by Kostermans (1981 b & c). In the genus *Hopea*, Kostermans (1982 a) upgraded the status of the subspecies *Hopea jucunda modesa* to the species status *Hopea modesa*. Kostermans (1982b) excluded from the list, the only non-endemic species of the family which was

formerly recognized by Ashton as *Vatica chinensis*, and introduced an endemic new species *Vatica paludosa*, Kostermans (1983) described new species *Shorea hulanidda* under the revision of the genus *Shorea*. He reinstated the endemic genus *Doona* and included 10 species. (Kostermans 1984). Recently genera *Sunaptea* and *Cotylelobium* were fused under the reinstated genus *Sunaptea* and new combinations were presented. (Kostermans 1987).

CHECKLIST

A checklist is herewith forwarded for the family according to these latest revisions. But no attempt was done here to present vernacular names for each species because the vernacular names mostly misleads. To avoid this difficulty the present writer expects to propose a Sinhala systematic nomenclature for the family in his forthcoming paper.

DIPTEROCARPACEAE BLUME, 1825

I. *Balanocarpus* Bedd., 1873

1. *B. brevipetiolaris* (Thw.) Alston, 1931
2. *B. kitulgallensis* Kosterm., 1981

II. *Dipterocarpus* Gaertn., f., 1805

3. *D. glandulosus* Thw., 1858
4. *D. hispidus* Thw., 1858
5. *D. insignis* Thw., 1858
6. *D. zeylanicus* Thw., 1858

III. *Doona* Thw., 1858

7. *D. affinis* Thw., 1858
8. *D. congestiflora* Thw., 1858
9. *D. gardneri* Thw., 1885
10. *D. macrophylla* Thw., 1864
11. *D. nervosa* Thw., 1858
12. *D. oblonga* Thw., 1885
13. *D. ovalifolia* Thw., 1864
14. *D. trapezifolia* Thw., 1858
15. *D. venulosa* Thw., 1864
16. *D. zeylanica* Thw., 1852

IV. *Hopea* Roxb. 1819

17. *H. cordifolia* (Thw.) Trimen, 1893
18. *H. discolor* Thw., 1858
19. *H. jucunda* Thw., 1864
20. *H. modesa* (ADC) Kosterm., 1982

V. *Shorea* Roxb. ex. Gaertn. 1805

21. *S. dyeri* Thw., 1885
22. *S. hulanidda* Kosterm., 1983
23. *S. lissophylla* Thw., 1864
24. *S. oblongifolia* Thw., 1858
25. *S. pallescens* Ashton, 1972
26. *S. stipularis* Thw., 1858

VI. *Stemonoporus* Thw., 1854

27. *S. akuminatus* (Thw.) Bedd., 1870
28. *S. affinis* Thw., 1854
29. *S. angustisepalum* Kosterm., 1980
30. *S. bullatus* Kosterm., 1980

31. *S. canaliculatus* Thw., 1858

32. *S. cordifolius* (Thw.) Alston, 1931

33. *S. elegans* (Thw.) Alston, 1931

34. *S. gardneri* Thw., 1854

35. *S. gilimalensis* Kosterm., 1982

36. *S. gracilis* Kosterm., 1981

37. *S. kammeliyensis* Kosterm., 1980

38. *S. laevifolius* Kosterm., 1981

39. *S. lanceolatus* Thw., 1854

40. *S. lancifolius* (Thw.) Ashton, 1972

41. *S. latisepalum* Kosterm., 1980

42. *S. marginalis* Kosterm., 1981

43. *S. moonii* Thw., 1858

44. *S. nitidus* Thw., 1858

45. *S. oblongifolius* Thw., 1854

46. *S. petiolaris* Thw., 1858

47. *S. reticulatus* Thw., 1858

48. *S. revolutus* Trimen ex Hook. f., 1900

49. *S. rigidus* Thw., 1854

50. *S. scalarinervis* Kosterm., 1981

51. *S. wightii* Thw., 1864

VII. *Sunaptea* Griff.,

53. *S. scabriuscula* Trimen, 1885

VIII. *Vateria* L., 1737

54. *V. copallifera* (Retz.) Alston, 1931

IX. *Vatica* L., 1771

55. *V. affinis* Thw., 1864

56. *V. lewisiana* (Trimen ex Hook. f.) Livera, 1924

57. *V. obscura* Trimen, 1885

58. *V. paludosa* Kosterm., 1982

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THE 5TH WATERFOWL CENSUS IN SRI LANKA (JANUARY 1988)

— Thilo Hoffman

Like in recent years this annual event had to be confined to the west and south coasts, i.e. from the spit of land north of Kalpitiya through to Yala National Park. The important regions in the North could once again not be visited. Members covered the different areas in geographical sequence as follows:

Some NCP Tanks	...	Dr. T. S. U. de Zylva
North of Kalpitiya to Chilaw	...	Thilo Hoffmann
Chilaw to Colombo	...	Douglas Ranasinghe
Colombo	...	Jagath Gunawardena
Beira Lake System	...	Ismeth Raheem and P. B. Karunaratne
Panadura to Galle	...	Ranjen Fernando and friends
Galle to Ambalantota	...	S. C. Seneviratne
Major Tanks in South	...	Bennie Abeyratne
Ambalantota to Bundala	...	Yasa Ratnayake
Kirinda to Yala	...	R. Y. Dias Abeyesinghe

Contrary to expectations, fewer members volunteered for this year's count, and again rather large areas had to be covered by individuals, entailing hard work and much travelling. One observer per major wetland would be ideal.

The results of the count in families or groups, e.g. waders) are shown (in the table which is based on geographical areas. 77 species were observed

8 more than last year. All in all just under 110,000 birds were counted or estimated, the biggest group being waders (about 49,000). Waders were present in fair numbers, though by no means in abundance. The greatest number (nearly 32,000) were counted in the extensive area between Udappu and north of Kalpitiya/Puttalam, which had not been properly covered in earlier years. Along

the southern portion of the west coast and the western sector of the south coast, there were few waders, as usual. The second best area (nearly 15,000 waders) was the Hambantota-Bundala region with its many brackish water wetlands; however, counters reported high water levels and thus lower counts than expected. Kalametiya was disappointing.

A feature of this year's count was the near absence of rare species; and very few Snipes were seen. Some of the less common birds noted may be listed as follows:

Oystercatcher	(21)
Ringed Plover	(1)
Bar-tailed Godwit	(2)
Spotted Redshank	(2)
Sanderling	(75)
Terek Sandpiper	(54)
Ruff	(16)

(last year 176)

Ducks accounted for only 26,121 birds, a level similar to last year when, however, only the South was covered: this year the Chilaw-Kalpitiya area produced more than 50 % of the Ducks, i.e. over 15,000 birds compared with only a little over 10,000 for the entire area Galle to Yala. Like in earlier years, it must be assumed that large numbers of Ducks would winter in the Mannar and Jaffna Districts. In fact the writer obtained confirmation of this from a resident of Jaffna who used to accompany him on earlier counting trips in that area. Only the common Ducks were noted this year, namely the resident Tree Duck (Lesser Whistling Teal), Pintail, Garganey and the resident Cotton Teal. Not a single Wigeon was seen (this species is obviously restricted to the North), nor any of the rarer species.

The third biggest group (nearly 19,000) are *Gulls and Terns*, whereby the Terns with well over 18,000, vastly outnumber the Gulls. A particularly interesting feature of this year's count is the presence of large numbers of *Common Terns* (over 6,500), all of them in the Kalpitiya area; less than a week after the count Ben King of the American Museum of Natural History

observed 3,000 at Hambantota-Bundala. This species has always been regarded as a winter visitor in small and irregular numbers, often being absent. The writer has observed this Tern at Colombo and elsewhere regularly every winter during the last 10 years or more, but to see thousands of these birds together on sand banks in the north-western lagoons around Kalpitiya was nevertheless something of a surprise. It may be recalled here that the writer has also closely observed a breeding colony of the Common Tern on a bare coral island off the east coast in May and June 1980 (Ceylon Bird Club Notes 1980; 27,31). Of the Gulls only the Brown-headed (742) was noted.

Most of the *Hérons* normally found in Sri Lanka were observed during the count (total nearly 5,000), but remarkably few Cattle Egrets were seen. This very common small Egret is mostly found in paddy fields and other inland wetlands at this time of the year, which were not covered by the count.

Very few *Storks* (only 341) were counted, which is rather surprising and certainly not representative. Both the Painted Stork (210) and the Open-bill Stork (120) are present in Sri Lanka in much larger numbers than these figures would indicate, and the same could be said of the White-necked Stork (6). Similarly, numbers of the White Ibis (81) are uncharacteristically low. No Glossy Ibis was noted this year. Amongst the *Cormorants* (just over 6,000), the low number of Darters (58) stands out. The 1,200+ *Flamingoes* were at Karagan Lewaya.

Much disturbance was reported from the wetlands in the South, particularly also in the two Sanctuaries of Kalametiya and Bundala where felling and digging up of shell-beds (for lime, as well as fishing and shooting take place. Regular weekend shooting is also a great disturbance in the beautiful cluster of tree-fringed and lotus-covered tanks around Anaivilundawa near Battulu Oya. There are plans to turn an important wetland, namely Karagan Lewaya at Hambantota, into a private saltern for the setting up of a salt-based industry. The Bird Club and other NGOs are opposing this transformation.

Colombo, March 1988.

ASIAN MIDWINTER WATERFOWL CENSUS

	Tanks NCP		Kalpitiya Chilaw		Chilaw Colombo		Colombo		Bolgoda System		Panadura Galle		Galle A'Tota		L/Tanks South		A'Tota Kirinda		Kirinda Yala	
	01	02	03	04	05	06	07	08	09	10										
Total	01	02	03	04	05	06	07	08	09	10										
Grebes (1 species)	240	0	90	12	0	0	28	0	110	0										
Pelicans (1)	768	0	1	42	0	0	82	29	611	3										
Cormorants (4)	6086	2032	907	338	21	67	276	237	2083	3										
Heron (12)	4919	1427	1563	632	184	104	163	122	508	60										
Storks (5)	341	13	29	20	58	5	39	25	127	23										
Ibises (2)	591	20	274	0	13	0	119	0	139	26										
Flamingos (1)	1200	0	0	0	0	0	0	0	1200	0										
Ducks (4)	26121	75	15217	212	13	263	745	1,020	8446	55										
Rails, Coots, Jacana's (5)	1968	236	877	237	3	57	163	150	95	0										
Waders (32)	48770	1	31782	168	82	172	1175	101	14849	68										
Gulls, Terns (10)	18755	0	16753	0	30	351	143	66	937	149										
GRAND TOTAL	109759	3803	67493	1403	404	1019	2933	1750	29125	387										

THE BATAPOLA MARSHLAND - A CASE FOR THE CONSERVATION OF INDIGENOUS FRESH WATER FISH IN SRI LANKA,

— H. M. D. Soysa

There is a great marsh land about one square mile in extent in Batapola in the Galle district. It comprises a soft mud covered with water and vegetation and is dangerously boggy in most places. Because of these very unfavourable conditions paddy or other crops cannot be cultivated in this place nor can it be used for any other purpose such as building houses etc. Therefore, this large extent of marsh is considered a wasteland by the people in the area and abandoned to nature.

However, there is an extremely valuable resource hidden in this seemingly useless place in the vast number of indigenous fish that thrive there. There are large ponds and pools within the marsh which are eminently suitable habitats for fish. There are many kinds of fish commonly found in the paddy growing regions of the low country in these waters in great profusion, all good edible fish but most and best of all is the Loola or snakehead (*Ophiocephalus striatus*.) There are also many water snakes, frogs, tortoises, prawns and other forms of aquatic life the study of which could be of great interest to the field of fresh water biology, particularly as these species are now almost extinct in most other places mainly due to the indiscriminate use of harmful agrochemicals.

The loola grows to a length of about 12 to 18 inches and such a full sized fish may weigh about two or two and a half kilos. It is a well known fresh water fish relished by many people.

Almost daily about 20 to 30 fishermen and village boys can be seen scattered here and there in the watery tracts of the Batapola marsh catching loolas with rod and line. Usually each fisherman bags three or four large loolas in a day's fishing. On a very good day more are caught and some

fishermen use three or four rods at one time. However, many small fish are also caught and some are injured by the hooks and escape into the mud and die.

Fishing goes on throughout the year without respite for the fish except during the short rainy season. The loolas provide a good income for the fishermen and are also a source of protein for them—all entirely free but for the effort of catching the fish.

Fortunately for the fish and the fishermen large scale methods of extraction using nets, traps and baling out the water cannot be practised because of the extremely boggy nature of the marsh.

However, the increasing pressure of fishing even with rod and line could reduce the population of fish to a point of gradual extinction in a few more years, unless some measure of control is adopted to prevent the over exploitation of this valuable resource.

Accordingly, I would like to suggest the following measures to protect and preserve these fish and their unique habitat for the benefit of the present and the future as well:-

- (1) A proper scientific study of the Batapola marsh should be made by the Ministry of Fisheries and/or a Sri Lankan University in association with the Wildlife and Nature Protection Society of Sri Lanka in order to evaluate the feasibility of establishing a breeding centre for indigenous fresh water fish especially loolas with a view to distribute fingerlings in areas where the species is greatly depleted or even extinct.

- (2) The Batapola marsh in the years back was well known for its profusion of teal, waders, cranes, herons, blue coot and various species of water birds, but now unfortunately reduced to a mere handful of these birds due to their indiscriminate and wholesale destruction by man. I therefore propose that the full extent of this marsh land is declared a bird sanctuary, thus becoming the only one of this kind in the entire low-country wet zone after the sad demise of the once famous Telwatte bird sanctuary. (Vide my letter in Loris Vol XVII. No. 6 December 1987)
- (3) A certain suitable area of the marsh should be declared an aquatic sanctuary where fish and other aquatic creatures could live freely protected from man, breeding and increasing their numbers to replenish the waters. This sanctuary could be a small area and the much greater portion should be kept open for occasional fishing with rod and line only.
- (4) In the area permitted for fishing a short close season should be enforced in the difficult times of drought and the breeding season of fish when they are very vulnerable and easily caught in large numbers.
- (5) A size limit of fish that can be taken should be scientifically determined and fishermen persuaded to practice the thoughtful and human act of putting back the small fish which are not fatally injured by the hook, into the water so that they may grow and increase their numbers.
- (6) The Fisheries Extension Officer of the area should explain the dangers of over fishing and the simple principles of conservation to these fishermen and with their co-operation and support agree on catch limits which should be scrupulously observed by them in their own interests in order to preserve this valuable national asset for future generations on a self sustaining basis.
- (7) Weedicides and Pesticides and other pollutants which have proved to be the most potent factor in the destruction of our low country fresh water fish should be kept away as far as possible from these waters.

My suggestions to protect and preserve the fish and other fauna in this place will not in any way deprive the people of their rights to earn a living by fishing and eat high quality fish. On the contrary if they are accepted and implemented the fish production will be greatly increased and sustained for many years to come.

ENVIRONMENTAL IMPACT ASSESSMENT OF THE PROPOSED SALTERN AT KARAGAN LEWAYA HAMBANTOTA

— **Rajiv de Silva and**
— **D. S. Rahaman**

Dear Editor,

Further to the ecological study of the Karagan Lewaya and with additional information available we have submitted an Environmental Impact Assessment of the proposed saltern at Karagan Lewaya, Hambantota, to the Wildlife and Nature Protection Society of Sri Lanka.

We would like to clarify the following point. That is; a follow up survey was recommended after the rains and after the system has stabilised. However due to the prevailing political situation in the area, a follow up survey was not carried out. But for analysis we have used the Midwinter bird count figures for 1987 and 1988. And since

there is a high correlation between the densities of birds and the invertebrates they feed and also since the chemistry of the water is predictable and since sufficient data on coastal lagoons exists or comparison, the accuracy of the report is in no way affected significantly.

The conclusions and the recommendations are as follows.

In the present term the Karagan Lewaya drains the adjacent area and acts as an irrigation outfall for a few tanks during times of rain. The proposed saltern would necessitate the constructions of bunds and the buffering of salt water. This would seriously impair the flood plain effect of the Lewaya, and increase the risk of flood in the adjacent area which also includes the Hambantota town. The proposed project would therefore have an adverse effect on the said parameter.

The Karagan Lewaya has a unique marine eco-system which varies in a cyclic manner. The proposed project would alter the cyclic changes and thus alter the existing eco-system. This will affect the food stock available during the seasonal bird migration. The Karagan Lewaya is a vital staging and feeding area for the migratory birds. The conservation of these migratory birds, many of which breed in the arctic spend the winter in tropical latitudes, is an international responsibility, as recognized in the Ramsar Convention on the conservation of Wetlands of international importance, especially as waterfowl habitat. The proposed project will cause biological changes within the lewaya as well as bringing population pressure, which will adversely effect the population of resident and migratory birds.

If the said project also includes the production of caustic soda, and/or the evolution of chlorine, and/or and the concentration of metallic ions (eg. Ca^{++} , Mg^{++} , Cu^{++} , Hg^{+}), and/or

the discharge of chemical pollutants, these pollutants are likely to concentrate and the effects on the environment will be catastrophic and not acceptable.

To sum up the proposed saltern will have an irreversible and adverse effect on the biology of the lewaya.

Recommendations

To ecologists, coastal engineering projects appear to fall into two categories:

- (i) those which have to be carried out in a particular region, but only possible at a particular point—e.g. development of deep-water port facilities; and
- (ii) those which have to be carried out in a region, but not critically dependent on location.

Environmentalists in the first case try to minimize environmental damage, and in the second case the location where minimum environmental impact occurs is selected.

Therefore, based on the same criterion and in view of the above stated conclusions, we highly recommend that the said project planners locate the project elsewhere.

It is likely that the existing salterns at Bundala, Maha Lewaya, and Koholankala could be developed to accommodate the proposed industry. This would curtail the affects to the already developed locations.

It is also of our opinion that in view of the significance of Karagan Lewaya, consideration to be given bring the lewaya up to the status of a bird sanctuary.

34/10, Watson Peiris Mawatha,
Moratuwa.

THE FLAMINGOES AT BUNDALA

— John and Judy Banks

Dear Editor,

The December 1987 LORIS has just reached us in Jersey, Channel Islands (20th May) and we have read Dr. B. L. Perera's article on the Flamingoes at Bundala with considerable interest. However, we are most concerned that he has perhaps, reached the wrong conclusions concerning the low mounds of mud seen by us at Bundala Lewaya. He has suggested that they might be the remains of nests, but we do not agree. Indeed, we think it is very unlikely that the Greater Flamingo might breed anywhere in Sri Lanka.

During the period 1981 to early 1987 we spent a great deal of time observing the birds and animals in, and around, Bundala Sanctuary. Except when the North East Monsoon made ground conditions excessively muddy, and impassable for our VW microbus, we used to spend 7-10 days each along the coastal strip between Kalametiya and Palutapana on the outskirts of Yala. On every trip we spent many hours looking at various flocks of flamingoes through high powered telescopes whether the birds were at Karagan, Koholankala, Malala, Embilikala, Bundala or Palutapana Lewayas. We were hoping to see a few Lesser Flamingoes amongst the large flocks of Greater Flamingoes but, alas, the smaller species was always conspicuous by its absence. However, we often saw a number of juvenile/immature Greater Flamingoes. We did not, at any time, observe any evidence that the flamingoes might be breeding locally.

The Bundala area is visited very frequently by the naturalists Mike and Daphne Northway and they have both confirmed, on more than one occasion, that they have never seen any signs of

flamingoes nesting at Bundala. What, then, is the explanation for the low mounds of mud, in fairly large clusters, which were seen by us, at Bundala, when the water receded through evaporation? We have found a clue in "Roberts Birds of South Africa," as revised by McLachlan and Liversidge (1978), from which the following is a quotation from the chapter on Greater Flamingoes:-

"Usually feed in shallow water, the head bent down and forward so that the upper mandible is beneath the lower. In this way they may move forward zig-zagging head from side to side. More often they stand in one place and rotate while stamping up and down, thus forming a circular mound of mud."

The underlining of the above quotation has been done by us to draw particular attention to a possible answer to the riddle of the mud mounds seen by us at Bundala. They are more likely to have been mounds created by feeding birds rather than the remnants of nests.

If, indeed, the flamingoes have ever nested at Bundala, their breeding site could not have gone un-noticed even by casual visitors. The Greater Flamingo—indeed, all species of flamingo—breed in colonies. The nests have to be made, the eggs laid and incubated, and the downey young would have to be cared for until they grow their feathers and learn to fly. The Greater Flamingo starts nest building a few days before the first egg, or two, is laid and nest construction continues during the 30-32 day incubation period. The first contour feathers appear some 4 weeks after hatching and

it may take a further 2-3 weeks before the young birds learn to fly. Therefore, the breeding process covers more than 8 weeks, maybe as many as 10-12 weeks, and it is inconceivable that a nesting colony at Bundala remain unobserved for such a period of time, especially as their 'cities' are said to cover several acres.

The suspicion that Greater Flamingoes breed somewhere in Sri Lanka has arisen because of the presence of a fair number of grey-brown and small birds in the flamingo flocks. According to Grzimeck's Encyclopedia (Vol. 7), the first juvenile plumage is predominately a greyish-brown. When they are three quarters to one and a half years old, the juveniles moult into a pale plumage, somewhat like that of the adults, in which only a few features still have grey-brown spots near their tips. Adult plumage is attained at the age of three or four years. The young birds continue to grow after they are able to fly and, indeed, the males only reach full size when they are one and a half or two years old. The species breeds after 5-6 years and, in Zoos flamingoes have been known to live for about 30 years.

Furthermore, flamingoes are a migrant species, which fly southwards to escape the northern winters. Most of the migrant birds species are accompanied by their young on their southward migrations and there is no reason to suppose that the young flamingoes might be left behind on the breeding grounds when the adults (parents) migrate. On the contrary, the juveniles would have to accompany their parents on migration because even at 70 days of age, and flying, the young have not developed the beak filtration mechanism, the lamellae, and can hardly take up the food characteristic for the adults. They rely on the adults for a highly nutritious liquid secreted by the parents. Therefore, there is a strong possibility that the young flamingoes so often seen at Bundala were not bred in Sri Lanka but have made long migration to the island, with their parents, from the breeding ground—probably the Rann of Kutch in India.

It is an undoubted fact that quite a large number of flamingoes remain at Bundala throughout the year. Dr. B. L. Perera asks why is it that flamingoes linger in such numbers at Bundala as late as the end of June. Indeed, we have observed fairly large numbers in the Bundala area throughout the year. Bearing in mind that the species does not nest until about 6th year, we would venture to suggest that the birds which remain in Sri Lanka would be the juvenile and immature flamingoes, with no interest or urge for breeding. Some of the loiterers might also be old birds past their prime and those suffering from gun-shot injuries.

Legge (1880) expressed the view that flamingoes probably did breed in Sri Lanka at some unspecified location on the East Coast, probably near Batticaloa. This might have been the case some 100 years ago but flamingoes are very sensitive to disturbance, particularly early in the breeding season, and whereas some of the lagoons along the eastern coastline were probably very remote and unvisited by humans in Legge's time, this is certainly not the case today. If there were any lonely nesting sites in Legge's time those same sites are now subjected to considerable human disturbance. Also, flamingoes are very skittish of aircraft and panic when one appears. This fear of aircraft had disastrous effects on the breeding colonies of the Bahamas flamingoes; an aircraft will cause a breeding colony of flamingoes to desert their nests in a frenzy. If any breeding occurred in Sri Lanka in recent years, it is unlikely that it now continues having regard to the activity in the air since the emergency arose in the northern and eastern parts of Sri Lanka. The dislike of flamingoes to disturbance while breeding is another argument against a breeding colony at Bundala.

There are provisions in the Fauna & Flora Protection Ordinance to afford adequate protection for the Bundala Sanctuary—and other sanctuaries—if only the existing laws could be enforced. There is absolutely no need whatsoever to afford National Park status to Bundala and, indeed, it would not necessarily mean that the

area receives greater protection than it does at present. Trees have been felled and removed illicitly from Wilpattu, Yala and Gal Oya. Gem mining has long been a practice at Gal Oya, Wasgomuwa, Yala (Kumbukan Oya) and Uda Walawe. There are brick kilns in Flood Plains National Park and a number of ganja plantations within Blocks 3 and 4 of Yala. Making an area a National Park does not prevent poaching and did not protect Podi Pootuwa, once the pride of Yala, from a poacher's bullet. Those who think that elevating Bundala to National Park status will automatically give this valuable National Asset much needed protection are living in a fool's paradise. If the powers that be really want to protect Bundala Sanctuary from human depredation, they only have to enforce the provisions of the Fauna & Flora Protection Ordinance as they apply to the protection of Sanctuaries.

Jersey,
Channel Islands
21st May 1988.

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SYMPLOCOS FURCATA
WHITE

WILD FLOWERS

It flowers in April on the Horton Plains and the massed effect of its white sweetly-scented flowers is then very beautiful.

Courtesy of Jessie & Thomas Bond

THE WORLD CONSERVATION STRATEGY

A SURVIVAL PLAN FOR MAN

World Conservation Centre

Avenue du Mont-Blanc

Switzerland

The Swiss-based International Union for Conservation of Nature and Natural Resources (IUCN) was founded in 1948 and includes among its member organisations, states, government agencies, scientific bodies and citizens' organisations pledged to conserve nature and natural resources and to work toward sustainable development globally. Since 1980 IUCN charter has called for implementation of *The World Conservation Strategy*, a plan to ensure that worldwide man does not destroy the environment leaving a legacy of destitution and cyclical poverty for the generations to come.

The World Conservation Strategy may sound daunting but in a scientific sense the requirements can be broken down into three main points:

1. Maintenance of essential ecological processes and life support systems.
2. Preservation of genetic diversity.
3. Sustainable utilisation of species and ecosystems.

The earth's diminishing resources and increasing population are posing a threat to the traditional view of the environment. At one time nature could often heal the scars of man's development policies or lack of them but the threat to the African Black rhino and the loss of great swaths of tropical rainforest have sent a clear warning. What we do not look after today will never be seen on the face of the earth again. Entire species are being wiped out before scientists are even able to catalogue their uses for man. The extinction of dinosaurs occurred over a remarkably long period of time compared with the huge losses of flora and fauna the earth is now sustaining.

In fact what the *World Conservation Strategy* says in layman's terms is that mankind must keep his options open. Genetic diversity must

be maintained and yet in a world increasingly demanding attention to crises perhaps the man-in-the-street is suffering from crisis exhaustion.

While environmental scientists can offer some solutions, it is questionable whether conservation strategies will ever be widely subscribed to unless the general public perceives that there is a crisis. Certainly newspaper headlines in only the past few years have begun to indicate a restless and growing willingness of governments and individuals to recognise that we are facing environmental problems on a scale never before witnessed on earth and that if action is not taken we may leave only an uncertain world of cyclical poverty, concrete and tar, without the natural resources required for the human race to sustain itself long term. Such a world would clearly be unacceptable to most. The question is can enough change be implemented to ensure this will not happen? *The World Conservation Strategy* is heralding new opportunities but on the eroded and devastated farm and forest lands of Haiti, who is listening? And in the tropical forests of Central and South America, what action is being taken today? Indeed, some change is apparent with many governments recognising that destruction of natural resources can lead to social upheaval and abject poverty but much remains to be done. And perhaps the first thing to be done is to recognise that the *World Conservation Strategy* exists as a social and political document of the rights of mankind. A recognition that when the environment is sufficiently degraded man will no longer be able to survive. Fortunately we have a few years yet to come to that understanding, but the genetic clock is ticking and it is only a short time to the hour. For more information contact:

Drake McHugh, Media Coordinator.

ETHNOBOTANY: DISCOVERING THE SECRETS OF FOREST PLANTS

— Jacqueline Sawyer
W. W. F.

The world's tropical rainforests cover less than 10% of the earth's surface, but contain over 50% of the world's species. 11-15 million ha of these forests are destroyed every year. Species loss however is not the only cause for concern. Native forests people, who best know not only what the forests contain, but also how to make use of it, are dying out as a result of introduced diseases and tribal acculturation. Yet their knowledge is essential if tropical plant diversity is to be protected and the flora itself to be used for the benefit of mankind in general.

Ethnobotany as carried out by organizations such as WWF, the National Geographic Society and leading botanical institutes such as the Harvard Botanical Museum, represents an attempt to prevent the loss of this flora and the knowledge of it from becoming total. A field of study which has only come into its own during the last 50 years, ethnobotany seeks to discover how tribal people make use of tropical plants. It is hoped that in addition to identifying numerous species of tropical flora and establishing means of sustainably exploiting them, ethnobotany will also be able to select those species most worthy of research in medical, agricultural and industrial contexts.

Ethnobotany also represents a race against time. Species may be disappearing at a greater rate than ever before, but in relative terms the knowledge of these species, as possessed by native people, is disappearing even more quickly. For instance, over 90 different Amazonian tribes are thought to have disappeared since the turn of the century. When a tribe or native people ceases to survive, so too does its oral tradition. The ethnobotanical lore of a people, which constitutes part of this oral

tradition, will therefore be lost too. The result of thousands of years of trial and error in using local flora, this loss is immense in terms of both quantity and quality. Moreover, even when a native people continues to survive, there is no guarantee that so too will its knowledge and traditions. Instead, it is likely that as primitive people become assimilated into Western civilisation, their cultures will be forgotten. A particularly pertinent example of this is provided by the witch doctor or Shaman. Traditionally his medical understanding of plants is passed on to an apprentice and so on down through the generations. Today though, young men are not interested in becoming the witch doctor's apprentice, since it is becoming customary for native people to turn to Western medicines—originally introduced by missionaries, when they fall ill. The situation is becoming so serious that Mark Plotkin, Director of Plant Conservation at WWF-US, would like to see a scholarship programme established to encourage young Indians to learn about plants from the old witch doctors.

We already understand, and have benefited greatly from, some of the uses to which tropical flora can be put. We know too that further potential use is incalculable, but includes for example the development of medicines to treat and cure all types of illnesses, the discovery of new crops for cultivation, and even the introduction of substances, synthesized from plant products, as alternatives to petroleum-based chemicals. But all this will depend largely on the extent to which, and on the speed at which, ethnobotanists can gather information on the flora of the world's rapidly diminishing rainforests.

GOLDEN PALM CIVET, *Paradoxurus zeylonensis*

(Pallas in Schreber, 1778.)

International Union for Conservation of
Nature and Natural Resources.

Draft Action Plan

International Union for Conservation of Nature
and Natural Resources

Scientific interest:

The Golden Palm Civet is the only member of the Paradoxurinae which is endemic to Sri Lanka.

Distribution:

Fifty years ago it was considered as not uncommon, but very locally distributed, both in the hills and in the low country. It seemed more common in the hills around Kandy and in the Dimbulla and Dickoya districts of the Central Province. One was recorded from Colombo, where it was considered as uncommon. In Kalutara (West Province) it is very rare, but it has been recorded from Ratnapura (low country wet zone) and several places in the North-Central and Easter Provinces (Phillips, 1935).

Status:

Only known from 12 museum specimens, the last recorded sighting dating from 1972. Eisenberg and Lockhart (1972) saw only two specimens

during an intensive 14 months ecological reconnaissance study of Wilpattu National Park in 1968/69. According to D. P. Wijesinghe (in litt., 1987) it is still widely distributed in the island but more common in the wet zone than in the dry zone, and believed to be quite common in the Sinharaja Forest. Here Baker (1971) caught a live specimen which was kept in captivity. V. Nugegoda (in litt., 1987) believes the best area in which to see this species is the north-west of the country.

This palm civet has been kept in zoos at Frankfurt (West Germany), London (UK), and most recently at Dehiwela zoo, Colombo. At Dehiwela it was bred in 1983.

Occurrence in protected areas:

Rare in Wilpattu National Park, probably also in Gal Oya and in Ruhuna National Park.

Recommended action:

Research to clarify whether viable and stable populations of the species occur in some of the established reserves in Sri Lanka.

Continuing efforts to establish a breeding colony in captivity.

* * * *

INTERNATIONAL SCENE

Extracts from UNEP NEWS

Compiled by Lal Anthonis

NEW LEMUR DISCOVERED ON MADAGASCAR

A new type of lemur was discovered in the forests of Madagascar, the sole habitat of the shy, monkey-like creature, earlier this year. The new lemur, discovered by scientists from the universities of Antananarivo and Strasbourg differs from its two apalemur cousins in the shape of its head and in having gold fur on its belly. There are now 36 different strains of lemur on the Indian Ocean island.

A FIFTH OF EARTH'S SPECIES ON BRINK OF EXTINCTION

One fifth of all species on the earth could be lost by the end of the century, according to a report produced by the Worldwatch Institute in Washington. If wildlands continue to be converted to farms and pastures in illplanned development schemes in tropical countries, the rate of plant and animal extinctions is likely to reach several hundreds a day in the next 20 to 30 years, said the report, "On the Brink of Extinction". Conservation efforts were unlikely to succeed unless they were integrated with vigorous family planning programmes, land reform and better farming methods in developing countries, where biological diversity is richest, said the report.

EXPERTS URGE ACTION TO SAVE RAIN FORESTS

International forestry experts urged major reforms to protect tropical forests from destruction after a two-day conference in Italy in July. The experts, who included government ministers and representatives of development aid agencies said the forests were disappearing at a rate of

70,000 square kilometres a year and their loss "constituted one of the most serious environmental threats of our time". Calling for an end to policies which encouraged over-harvesting of forest resources, they said deforestation was causing soil erosion, undermining agriculture and exacerbating rural poverty. It was also contributing to the extinction of many plant and animal species and threatening the livelihood of 200 million forest dwellers.

SHOWDOWN OVER THE IKEGO HILLS

A long campaign to save a key parcel of open space near Yokohama in Japan has reached another decisive stage. Citizens in the town of Zushi have been struggling since 1982 to save the forests on the Ikego hills from development. Now the national government seems about ready to force the issue.

The Japanese government wants to build a mid-rise housing complex in the hills for some 800 U.S. naval personnel. The U.S. has asked for an appropriate site, but Japan chose this particular one. It is in a former ammunition dump, but ironically, this use kept large portions of the area relatively natural for almost 50 years. The Ikego hills are now an island of woodland in a sea of development. The area supports the highest diversity of birdlife on the Japanese main land. The housing would preempt the heart of the tract.

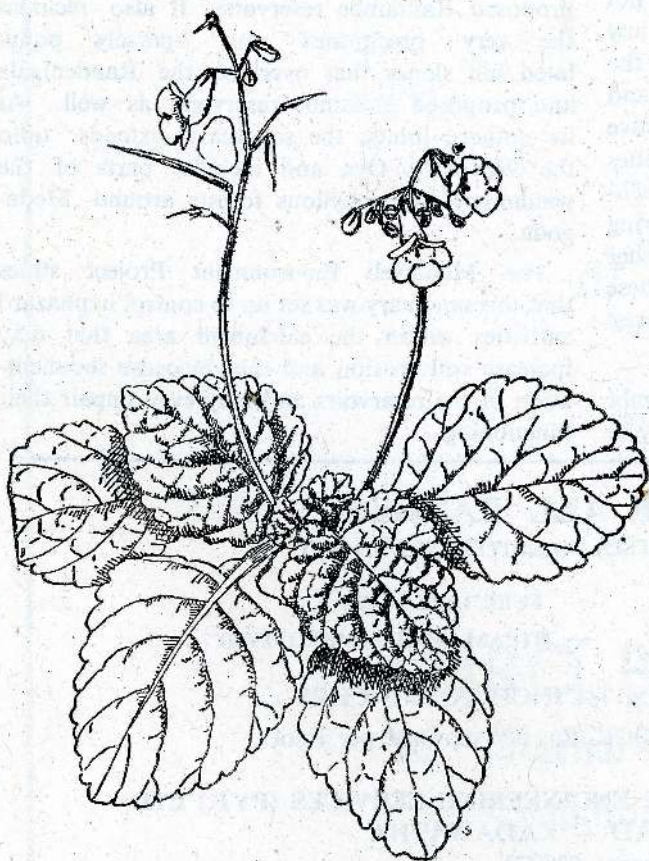
The government of Japan seems intent on pressing ahead despite overwhelming local opposition and desire to have the area protected as a Life Science park. Reasonable alternative locations for the housing have been suggested.

The mayor of Zushi and its city council oppose the development, after climatic election contests over the issue. More than one million signatures have been collected on petitions to save the Ikego hills. Mediation efforts have found the national government intransigent. Groundbreaking may begin soon.

The mayor recently came to Washington, D. C., with a large company of towns people seeking help and hoping to persuade the U.S. Defence Depart-

ment to reject this site. A number of U.S. environmental groups, including the Sierra Club, feel the U.S. should not be a party to the destruction of this critical piece of open space. Those who agree should write to:

Mr. Frank Carlucci
Secretary of Defence
The Pentagon
Washington, D.C. 20301-1155



DIDYMOCARPUS HUMBERTIANUS

WILD FLOWERS

A perennial herb growing on wet rocks, chiefly a mid-country plant but extending up to about 5,000 ft; in flower most of the year. It is very common in the forests of the Knuckles Range about Rangala.

Courtesy of Jessie & Thomas Bond

NEWS FROM THE MAHAWELI CENTRE OF THE MAHAWELI AUTHORITY OF SRI LANKA

A Sanctuary in Lands around Victoria—Rantambe and Randenigala

The fears expressed by some residents, particularly those living around the Victoria and Randenigala and Rantambe Reservoirs, that they will as a consequence of the area being declared a sanctuary be displaced from their land are baseless.

The project emphasised that what is not permitted within private lands is the killing of any form of wildlife. Majority of land within the Sanctuary are State Lands. All forms of land utilisation, in serious conflict with the objective of conservation would be restricted. Activities in these lands among others include the encroachment and cultivation of land, cutting and clearing of vegetation, gemming, poaching and other development activities. The curtailment of these activities are necessary in the long term interest of conservation of reservoir environments.

The Victoria — Radenigala — Rantambe Sanctuary was opened on January 30 this year

and administered under the Mahaweli Environment Project (MEP) by the Ministry of State, under the Fauna and Flora Protection Ordinance.

This Sanctuary is approximately 41,000 hectares in extent and spans the Mahaweli Ganga between Katugastota and the ancient anicut at Minipe in the administrative districts of Kandy Nuwara Eliya and Badulla in addition, to encompassing the Victoria and Randenigala reservoir and the proposed Rantambe reservoirs. It also includes the very precipitous and sparsely populated hill slopes that overlook the Randenigala and proposed Ratambe reservoirs as well. At its northern limits, the sanctuary extends upto the Wewelobe Oya and includes parts of the windswept sclerophyllous forests around Medugoda.

The Mahaweli Environment Project states that this sanctuary was set up to control haphazard activities within the catchment area that may increase soil erosion and thereby cause sedimentation of the reservoirs and may even impair their functioning.

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