EPM 25

A PRELIMINARY REVIEW AND ANALYSIS OF THE LITERATURE ON NATURAL RESOURCES, THEIR USE AND TRENDS IN SRI LANKA

In Partial Preparation for the Development of a National Conservation Strategy for Sri Lanka

Random DuBois
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International Institute for Environment and Development
1717 Massachusetts Ave. N.W.
Washington, D.C. 20036
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PREFACE

The following paper represents a brief review of the literature and certain relevant documents in preparation for the author's participation in development of a National Conservation Strategy in Sri Lanka. The author in no way means to present this as a comprehensive treatment of the available information describing the present status of natural resources and development trends in the country. Rather, this should be considered as only the first step in developing a broader information base required for the NCS process. In light of this "disclaimer" recommendations for NCS priorities are only tentative and are herein proposed strictly for discussion purposes.

Not even a little water that comes from rain must flow into the ocean without being made useful to man.

- Parakrama Bahu I
King of Ceylon, 1153-1186

O great King, the birds of the air and the beasts have an 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 and thou art only the guardian of it.

- Arahat Mahinda to
King Devanampiyatissa, 522 BC

1. THE PHYSICAL SETTING

Sri Lanka is an island nation situated in the southwestern corner of the Bay of Bengal. The island's locational coordinates are between 5°55'N and 9°50'N latitude and 79°42' and 81°53'E longitude. At its greatest extent the island measures 230 km. in width and 450 km. in length and the estimated total area is 65,635 km^2.

The island's geological origins appear to be similar to that of the southeastern coastal region of India from which it appears to have separated in the late Miocene (Crusz, 1973).

The geology of the island consists largely of pre-Cambrian rocks which have been modified through metamorphism, granitization and deformation. The central portion of the island is characterized by quartzites, schists and limestones (Khondalite series) through which extruding granitic blocks have formed the Central Massif. The major exception to these generalities occurs in the Jaffna Peninsula in the North where the

geological formation is of sedimentary origin consisting largely of horizontal Miocene limestones.

The general physiography of the island has been attributed to a combination of eustatic changes in sea level, subsidence, erosion and faulting (Crusz, 1973). The effects of these processes have resulted in three major peneplains. The first consists of a lowland terrace and coastal plain ranging in elevation from sea level to approximately 120 meters, and is characterized by little relief. The second terrace rises abruptly from the first, averaging 490 meters in elevation and typifies a region of immature relief and drainage pattern. The final terrace forms the central highlands and averages 1200m in elevation before culminating in the Central Massif. It is this highest peneplain and central mountainous region that forms the upper drainage basins of most of the country's major rivers (ECAFE, 1955).

The principal governing agent of the country's climatic regime is the Asian monsoon. In Sri Lanka the affect of the SW monsoon is to bring moisture-laden air from the Indian Ocean to the island's western region (Yala). While the onset and duration of the SW monsoonal rains is highly variable, the normal period generally extends from May to September. The island is also affected by the NE monsoon in a period lasting from November to March (Maha). In between these two periods the two transition months, October and April, are characterized by variable winds and sporadic rainfall (ECAFE, 1955).

Average rainfall in the SW and NE monsoonal periods is 2870 mm and 1650 mm respectively (ECAFE, 1955). The country's physical relief in combination with the Asian monsoonal cycle has resulted in two

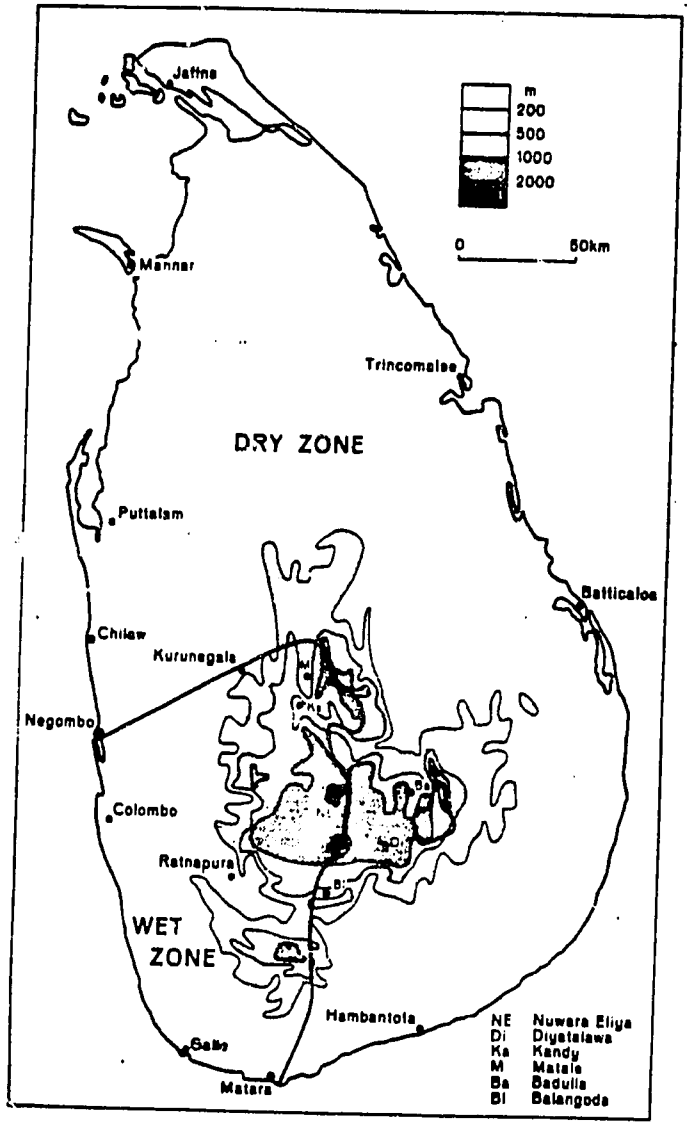
distinct rainfall distribution zones. The southwest portion of the island is the primary recipient of the heavy rains associated with the SW monsoon. In addition, this region also receives NE monsoon rains as many of the highland areas directly affected by its onset drain to the southwest. In contrast, the central highlands act as a barrier to SW monsoon rains impeding their reaching the north and central eastern areas of the island. The net result of this distribution pattern is to create two areas commonly designated as the Wet and Dry Zones. While several different criteria have been employed to formally delimit these zones, Domros (1974) has argued for agricultural purposes the occurrence of an "effective dry period," defined as that period characterized by three or more consecutive months where maximum rainfall fails to exceed 102 mm, is the most appropriate criterion (Figure 1).

This pattern of precipitation distribution has had a profound influence on the nation's historical economic development which subsequently evolved into present-day land use patterns. Briefly stated, the water surplus in the Wet Zone served as a key resource to attract early colonial settlers to that region of the island. It provided the conditions required to grow perennial rather than annual crops and eventually gave rise to large-scale plantation agriculture first introduced by the British which remains a fundamental element in the nation's modern economy.

In contrast, the Dry Zone, characterized by seasonal water deficits (together with malaria and a harsh climate) constrained development efforts. Land use activity consisted primarily of subsistence agriculture dominated by localized slash and burn (chena) and rice production.

FIGURE 1

THE DIVISION OF CEYLON INTO THE WET ZONE AND DRY ZONE ON THE BASIS OF THE 'EFFECTIVE DRY PERIOD'



FROM: Domros, 1974.

Due to the existing water constraints rice harvest is limited to one annual crop in the absence of irrigation.

The significance of the aforementioned zonation will be discussed further in the section Economic Base.

2. A BRIEF HISTORY

To fully comprehend present-day land use patterns and trends a cursory examination of Sri Lanka's historical development is required.

Most available archeological evidence indicates that the island's earliest settlements occurred in the Dry Zone. Farmer (1963) described two main nuclei of Sinhalese culture located in Zone's lowlands whose survival depended on large tank works for irrigation. While the origins of the early Sinhalese are unclear, the two most widely accepted theories suggest they were either an indigenous race or, based on the Dravidian roots of their language, migrated to Sri Lanka from Northern India.

Sri Lanka's largest minority, the Tamils, were thought to have crossed over from the mainland and populated the northern portion of the island approximately in 450 A.D. (Farmer, 1963).

By the 13th century the epicenter of Sinhalese settlement migrated to the Wet Zone while the Tamils continued to settle the northern and eastern coastal margins of the island.

In 1505, the arrival of the first Portuguese, in search of cinnamon and other spices, signified the beginnings of a period of European colonial rule which endured more-or-less continuously until 1948. The major hallmarks of the Portuguese period included the introduction of Roman Catholicism and the earliest roots of today's cultural distinction

between Kandyan and low-country Sinhalese. This distinction apparently arose from the Portuguese's failure (followed by the Dutch) to conquer the highland Sinhalese.

In 1658, the Kandyans, with the assistance of the Dutch, were able to rid the island of the Portuguese but quickly discovered their immediate replacement by the Dutch. Farmer characterized Dutch rule as largely an extension of Portuguese legacy consisting primarily of efforts aimed at strengthening trade links with the growing commercialized (and controlled) low-land community. The origins of the country's Malay and Burgher (mixed European-Sinhalese extraction) communities can be traced to this same period.

Of the three colonial powers, the British were the most influential in shaping Sri Lanka's subsequent economic development. The British, already in India and fearing the loss of Ceylon's harbours to the French, captured Trincomalee from the Dutch in 1795. Within the next two years Dutch rule effectively ended and by 1802, a convention signed between the British and the Kandyan chiefs, brought the entire island under one colonial power's rule for the first time in the country's history.

Many of the origins of present land-use patterns can be traced back to the British period. Though the introduction of cinnamon plantations originated with the Dutch, the country's intensive plantation economy began with the British. Among the many crop-types introduced into the country were: coffee, sugar, indigo, and opium. While coffee was the major export crop until 1875, by the turn of the century its importance in terms of value and volume had been displaced by both rubber and tea.

One outcome of the plantation's rapid rise in importance in the island's development was the creation of a labour shortage in the last quarter of the 19th century. This shortage was partially resolved by the importation of large numbers of Indian Tamils whose presence remains in the country's central highlands.

A second legacy from the development of large-scale plantations in the central highlands was the creation of land scarcity due to the concurrent growth in population and cash crop production.

Finally, despite this growing land hunger and increased dependence on the importation of such staples as rice and wheat, efforts directed at opening and developing the underpopulated Dry Zone were relatively inconsequential during the period of British rule.

Largely as a result of these development precedents, in 1948 the newly-independent nation inherited an economy built on a dualistic agricultural base. A plantation economy dominated the Wet Zone producing crops (rubber, tea, coconut derivatives) destined primarily for export markets, while a subsistence economy, based on rice production, was characteristic of the Dry Zone. The new government was also forced to recognize that the majority of Sri Lankans chose to live in the southwestern coastal and highland regions and largely ignored the remaining underpopulated (if not unpopulated) portions of the island comprising an area estimated to be 75 percent of the total land mass.

These glaring contrasts together with an ever-growing population, rising unemployment and the continuing dependence on foreign imports of basic foodstuffs (rice and grains) were and continue to be the critical issues which most directly affect the status of the country's natural

resources. The impact of these issues on Sri Lanka's natural resource base occurs either from a population's adjustment response to them as livelihood constraints or through a government policy seeking their resolution. The remaining portion of this paper will examine both types of impacts in greater detail and discuss the potential role of the NCS for mitigating these impacts in the future.

3. NATURAL RESOURCE PROFILES

A. Water

Due to the centralized location of the island's highlands surface drainage exhibits a radial distribution pattern (Figure 2). Total surface drainage is estimated to be 39.7 million acre-feet, or approximately 38 percent of the island's total precipitation volume. An estimated 21.5 million acre-feet, or 54 percent of the total, is drained by the 20 Wet Zone rivers while the remaining 83 Dry Zone rivers account for only 18.2 million acre-feet or 46 percent (Sri Lanka Foundation Institute, 1978).

What makes this disparity even more striking and underscores the overriding significance of the precipitation distribution patterns is the comparison of drainage volumes relative to the size of areas drained. The Wet Zone, representing only 24 percent of the total land area, accounts for 54 percent of insular surface runoff. The rivers of the two zones also differ in their seasonal characteristics.

In the Dry Zone few of the rivers possess headwaters in the island's Wet Zone resulting in a highly seasonal runoff. The exception

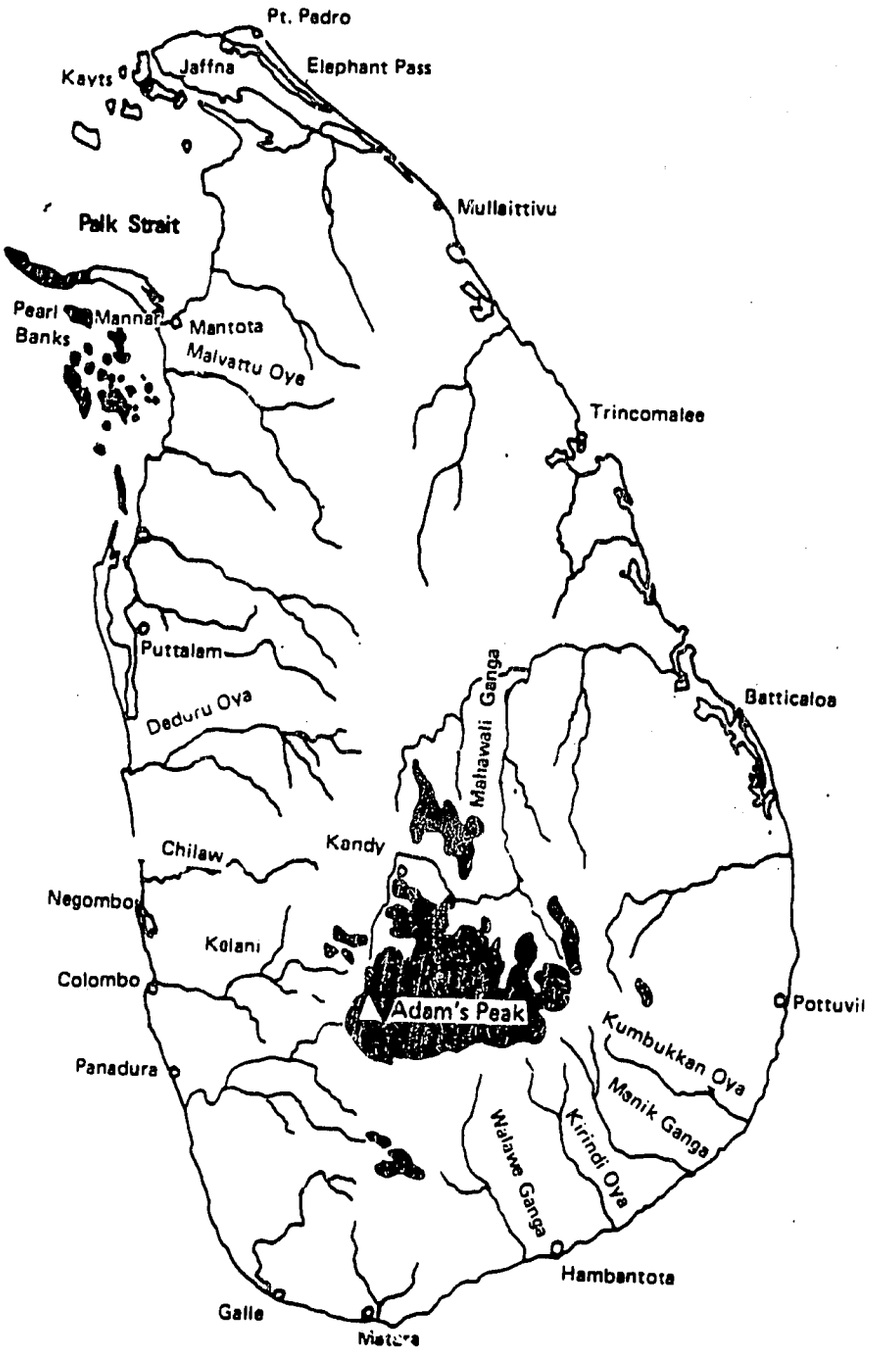


FIGURE 2
Map of Sri Lanka

SOURCE: Fernando et al., 1982.

to this generalization is the Mahaweli Ganga, the country's longest river (328 km.) and the only major river draining through the country's dry regions with its headwaters in the Wet Zone.

Sri Lanka's ground water resources are generally scarce due to the crystalline rock structure which forms much of the island's basement rock. The major exceptions are the Jaffna Peninsula where porous limestone is prevalent and narrow belts associated with rivers and reservoirs (Farmer, 1967).

As a result of the heavy seasonal monsoon rains, coastal soils and the insular physiography, flooding is regarded as a major natural hazard associated with most of the country's larger rivers (ECAFE, 1955).

B. Soils

Fifteen great soil groups have been identified in Sri Lanka (ACRES, 1979). However, for purposes of simplification (and in the absence of more detailed information), we will have to employ the earlier classification scheme developed by Moorman and Panabokke (1961).

In this scheme two major classes of Wet Zone soils were identified. In the lowlands and adjacent hills red-yellow podzolic soils predominated composed of a variety of subgroups. These soils were considered relatively infertile but responded well to fertilizers and could sustain rubber and tea production. It was also noted that they were erosion-prone and antierosion measures were recommended for slope utilization.

In the higher reaches of the Zone the soils were principally composed of brown looms typical of young slopes and derived largely from colluvium. These were highly regarded for the production of both garden and plantation crops.

Over much of the north and south central and eastern portions of the Dry Zone soils were reddish-brown earths which varied in quality. Poor soils were associated with quartzite outcroppings and rough topography. In other parts of the Dry Zone, most notably north of the Gal Oya region and areas in the Jaffna Peninsula, the occurrence of non-calic brown soils on top of acidic parent materials limited agricultural development. Other infertile soils were found in the western coastal strip where red-yellow latosols are common (Farmer, 1967).

In addition to these major soil crops alluvial soils are common to the Mahaweli Ganga delta region and numerous filled-in lagoons in both the eastern and western portions of the island.

Drainage is a problem in most of the coastal regions of the island and must be provided for to maximize land use potential.

C. Natural Vegetation

Very little remains from the Wet Zone's original vegetative cover but remnant patches indicate extensive forests ranging from a wet evergreen forest in the lowlands to a wet evergreen montane forest in the central highlands were common (Farmer, 1967).

Most of the original highland forest was cleared in the mid and late-1800's for coffee production followed by tea.

The island's remaining wet forest is confined to the Peak-Wilderness-Horton Plains-Hakgala complex and Sinharaja protected by reserves or parks. Of the estimated 141,000 ha. of wet forest remaining in the country 129,000 ha. is in a protective reserve (TAMS, 1980).

The Dry Zone is characterized by a dry mixed forest which becomes a low-thorn-scrub jungle near the coast (Figure 3).

Much of this Zone's vegetation is thought to be a product of centuries of slash-and-burn land use. A total cover of 1.4 million hectares remains in the Dry Zone of which 83 percent is in a reserve or park (TAMS, 1980).

In addition to the forest classifications described above two other significant vegetation "types" with origins attributible to traditional human land use occur in Sri Lanka. These are the savanna-like grasslands which occur in the eastern portions of the Dry Zone low lands (known as damanas) and the highland grasslands (patanas). Their occurrence has thought to have been due to fires set by humans to maintain cultivable land (Farmer, 1967).

Over 3,100 species of vascular plants occur in Sri Lanka of which approximately 28 percent are thought to be endemic to the country (Crusz, 1973). Of these, some 50 percent are confined to the Wet Zone habitats. The majority of non-endemic species share either Indian or Himalayan affinities with the remaining few associated with Malaysian, African and Australian regions.

D. Wildlife

Very little information was obtained in time to treat wildlife resources adequately.

There exist 628 known species of terrestrial vertebrates (84 mamals, 379 birds, 133 reptiles, and 32 amphibians) of which 16 percent are thought to be endemic to the island (Crusz, 1973). Of these some 25

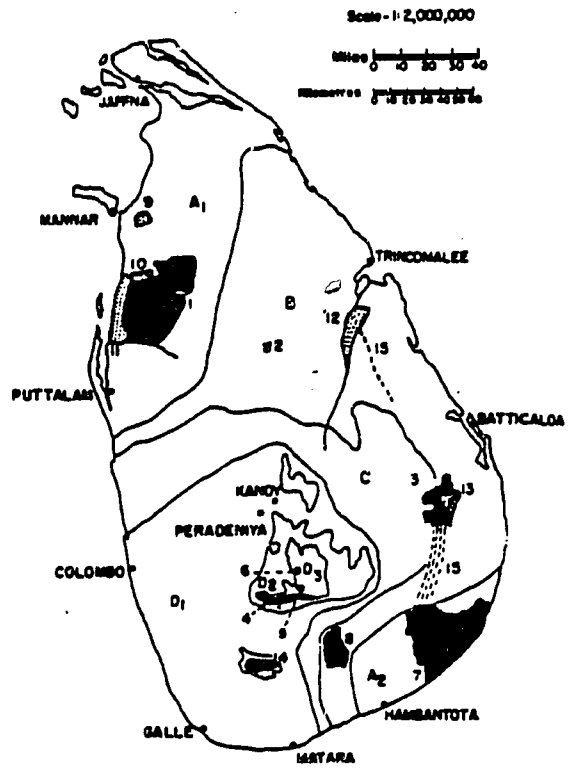


Fig. 3. Sketch-map of Sri Lanka (Ceylon) showing vegetational zones, national wildlife reserves, major sanctuaries, and other areas.

Vegetational Zones

A_1 & A_2 Monsoon Scrub Jungle (extreme N, NW and SE)
B Monsoon Forest and Grassland
C Intermonsoon Forest
D_1 Rain-forest and Grassland—below 914 m (3,000 ft)
D_2 Rain-forest and Grassland—914 to 1,524 m
D_3 Rain-forest and Grassland—above 1,524 m (5,000 ft)

National Wildlife Reserves (blackened areas)

1. Wilpattu National Park—1,095 km² (423 sq miles)
2. Ritigala Strict Natural Reserve
3. Gal-Oya National Park—259 km² (100 sq miles)
4. Peak Wilderness
5. Horton Plains
6. Hakgala Strict Natural Reserve
7. Yala National Park and Strict Natural Reserve —1,090 km² (421 sq miles)
8. Uda Walawe National Park—308 km² (119 sq miles). This Park, especially its northern half, extends even further westwards into the intermonsoon forest region (zone C).

Major Sanctuaries (stippled areas)

9. Giant's Tank
10. Wilpattu North Sanctuary
11. Wilpattu West Sanctuary
12. Somawathi-Tamankaduwa
13. Gal-Oya

Other areas

14. Sinharaja Forest—233 km² (90 sq miles) (hatched area)
15. Elephant corridors (broken lines)

SOURCE: Crusz, 1973.

percent occur only in the upper-montane areas. Most of the remaining animals originate from peninsular India.

Among the more "prominent" animals are the Asiatic elephant, leopards, buffalo and monitor (US AID, 1978).

The continuation of hunting activities and the loss of habitat due to land clearing pose a continued threat to the remaining wildlife resources.

Eight animals occurring in Sri Lanka are considered to be threatened or endangered by IUCN/FWS throughout their world distributions (Table 1).

Approximately 6,570 km^2 or approximately 10 percent of the country is designated as a reserve or santuary to protect wildlife and forestry resources (Figure 3; US AID, 1978).

E. Coastal and Marine Resources

Sri Lanka's coastline extends approximately 1800 km. with a straight-baseline length of 1250 km. Major physiographic features include long expanses of sand beaches and fresh and salt water lagoons which characterize both the eastern and western coastal areas. Brackish water marshes and mangrove areas cover an estimated 4300 km^2 of the island. Of this area, mangroves are thought to compose only 250 to 375 ha., a decline of 75 percent or more from the cover of 15 years ago (TAMS, 1980).

Off shore, the island shares a common continental shelf with the Indian mainland in the north and northwest. However, to the south and east, the shelf ranges between 8 and 40 km. offshore before reaching the break off (Farmer, 1967). The total area of the shelf is estimated to be 35,000 km^2 (Fernando et al., 1982).

TABLE 1

ENDANGERED AND THREATENED SPECIES*
FOUND WITHIN THE ACCELERATED MAHAWELI PROJECT AREA

Scientific Name	Common Name	Status
Elephas maximus	Elephant	E
Panthera pardus	Leopard	E
Presbytis senex	Purple-Faced Langur	T
Macaca sinica	Toque Macaque	T
Phaenicophaeus pyrrocephalus	Red-Faced Malkoha	E
Crocodylus palustris	Mugger Crocodile	E
Varanus benghalensis	Bengal Monitor	E
Python molurus	Python	E

KEY

*Listed in the U.S. Federal Register, Vol 44, No. 12, 1979.
E - Endangered
T - Threatened

SOURCE: TAMS, 1980

Living coral reefs are found off most of the island's coasts most notably on the north, southeast and southwest coasts. Coral mining for the production of lime is still prevalent most widely documented from the reefs adjacent to Hikkaduma on the island's southwest coast.

Major coastal uses of the coastal and nearshore areas of the country include urban settlements, paddy and coconut production, fisheries, salt production, mining and tourism. In addition, the establishment of a 200-mile exclusive economic zone in 1976, gave the country exploitative rights over an additional area totaling 250,000 km^2 (Figure 4; Shane, 1978).

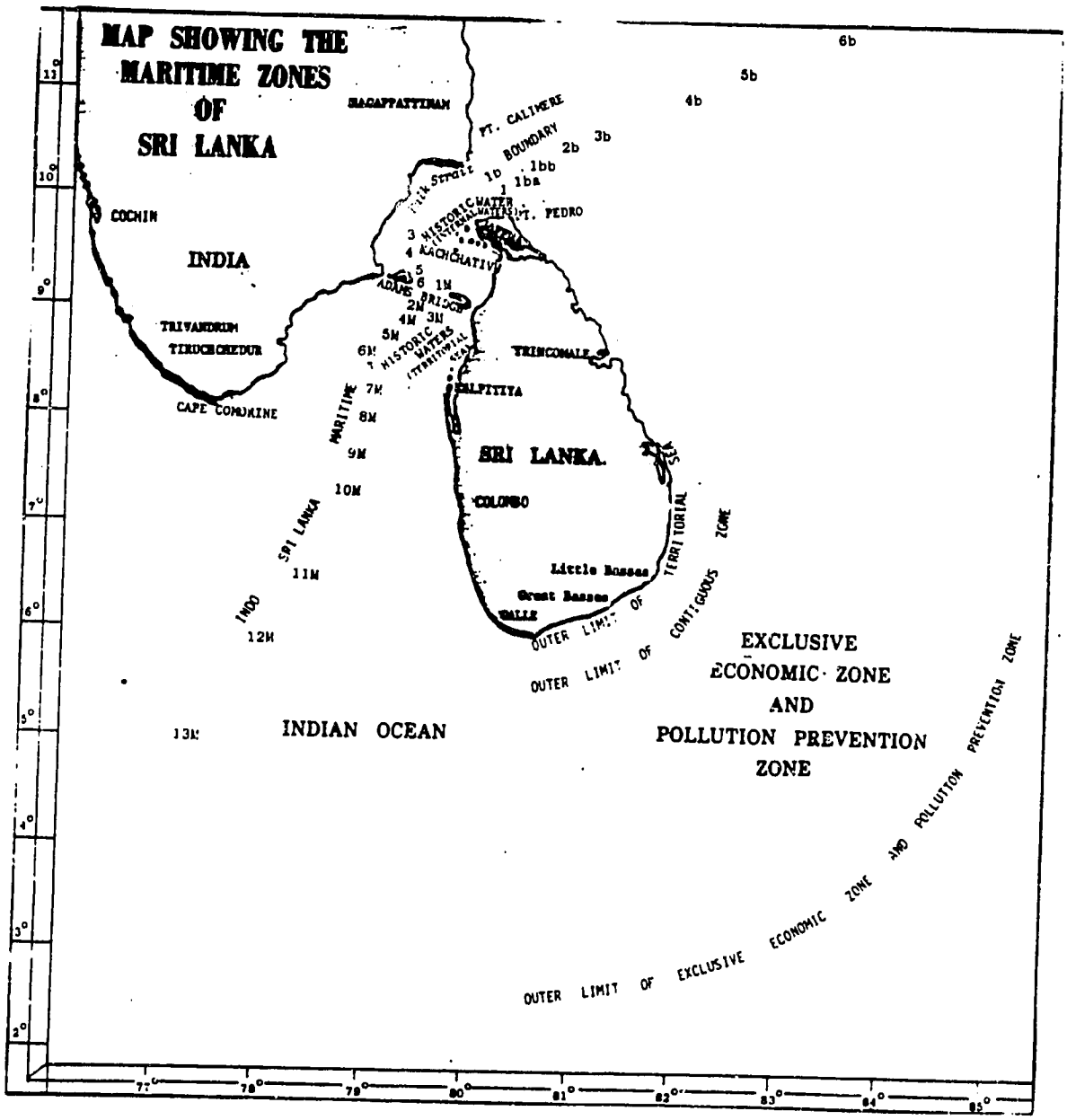
The key issues described in the literature appears to be coastal flooding, coastal erosion (some of which has been influenced by coral and marine sand mining), mangrove exploitation and industrial pollution.

4. POPULATION

By most accounts Sri Lanka's demographic features can be characterized by its high rate of growth, diversity, clustered distribution and segregated pattern of settlement.

Based on decennial censuses extending back to 1871, the total population of the country has increased from 2.4 to 14.6 million between the period 1871 and 1981 (Table 2; Johnson and Scrivenor, 1983). The natural rate of increase reached a peak of 2.7 percent in 1963 before declining somewhat to 2.5 percent in 1971. Johnson and Scrivenor (1983) have described Sri Lanka as a country in "demographic transition" following the post-WW II introduction of modern medical technology. This new technology was largely responsible for malarial eradication and increased

FIGURE 4



SOURCE: Sri Lanka Economic Atlas, 1980

Table 2 Population of Sri Lanka

Census year	*Population (millions)*	*Average annual growth rate (per cent)*	*Inter-censal increase/ decrease due to migration (per cent)*	*Annual birth rate (per thousand)*	*Annual death rate (per thousand)*	*Natural increase (per cent per annum)*
1871	2.4	–	–	–	–	–
1881	2.8	1.4	67	27	23	0.5
1891	3.0	0.9	42	29	24	0.5
1901	3.6	1.7	60	34	28	0.7
1911	4.1	1.4	34	38	29	0.9
1921	4.5	0.9	18	38	30	0.7
1931	5.3	1.7	19	40	27	1.3
1946	6.7	1.5	5	37	23	1.4
1953	8.1	2.8	5	38	17	2.1
1963	10.6	2.7	−1	37	10	2.7
1971	12.7	2.2	−5	33	8	2.5

Source: Department of Census and Statistics, *The Population of Sri Lanka*, Colombo, 1974.

(from Johnson and Scrivenor, 1983)

health care outreach efforts resulting in rapid declines in the death rate.

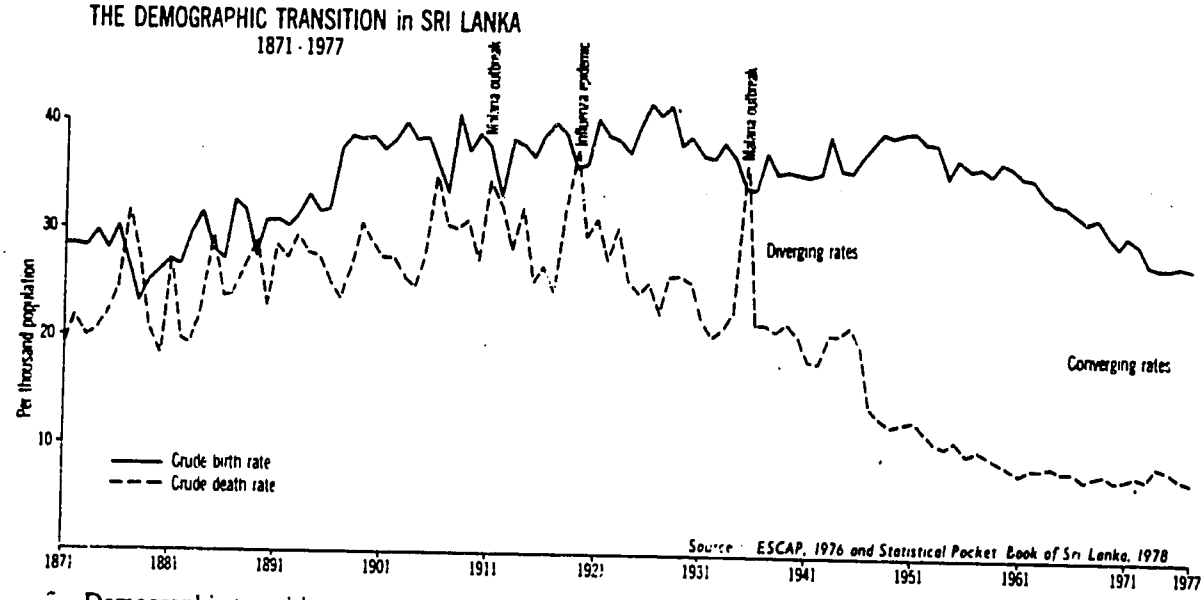
This reduction in death rate has in part contributed to the burgeoning population and pyramid-shaped age-sex profile. Presently, children under 15 years of age constitute 35 percent of the country's population and are projected to increase to 6 million by 1987 (National Plan-Division, 1983). Family planning, a national policy first declared in 1977, has yet to affect birth rates to a degree comparable to the previously achieved declines in mortality (Figure 5).

Results from the 1971 census indicate that the high and low country Sinhalese represent approximately 72 percent of the population concentrated mostly in the western dry, wet and south central regions of the country. The Sri Lankan Tamils constitute some 11 percent of the total population found principally in Jaffna and along a strip running down the eastern coast of the island, while Indian Tamils, representing 9.3 percent of the population, are highly concentrated in the central highlands. The Moors, which constitute 6.5 percent of the population, have settled mostly along the eastern and south central coasts of the island.

Small groups (1%) of Burghers, Eurasians and Malays are principally found in or near Colombo.

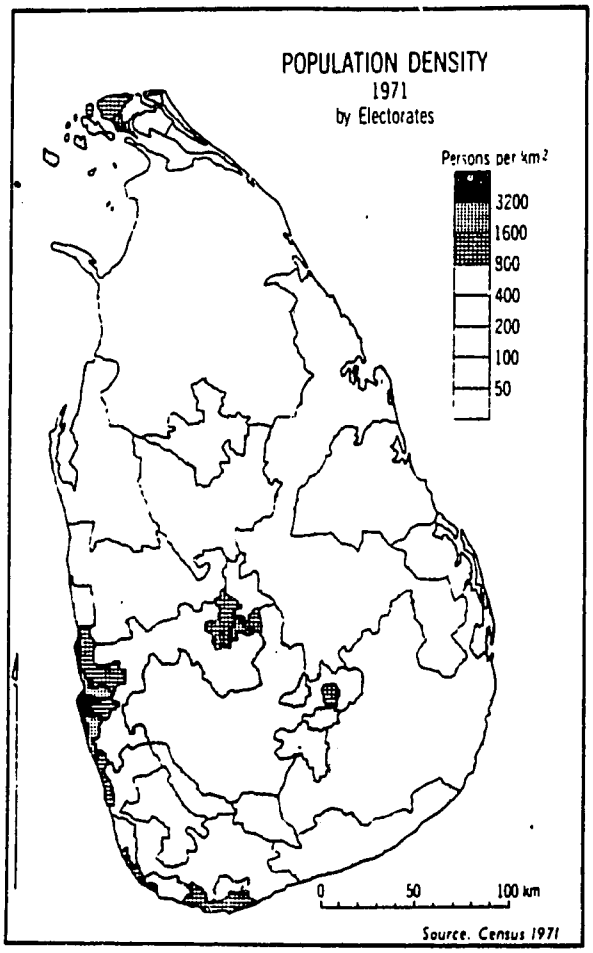
Nationally, the population distribution is remarkably skewed. Some 65 percent of the population is settled in the Wet Zone on 25 percent of the land (Figure 6). The two notable exceptions to this are the concentration centers of Jaffna and Batticaloa.

FIGURE 5



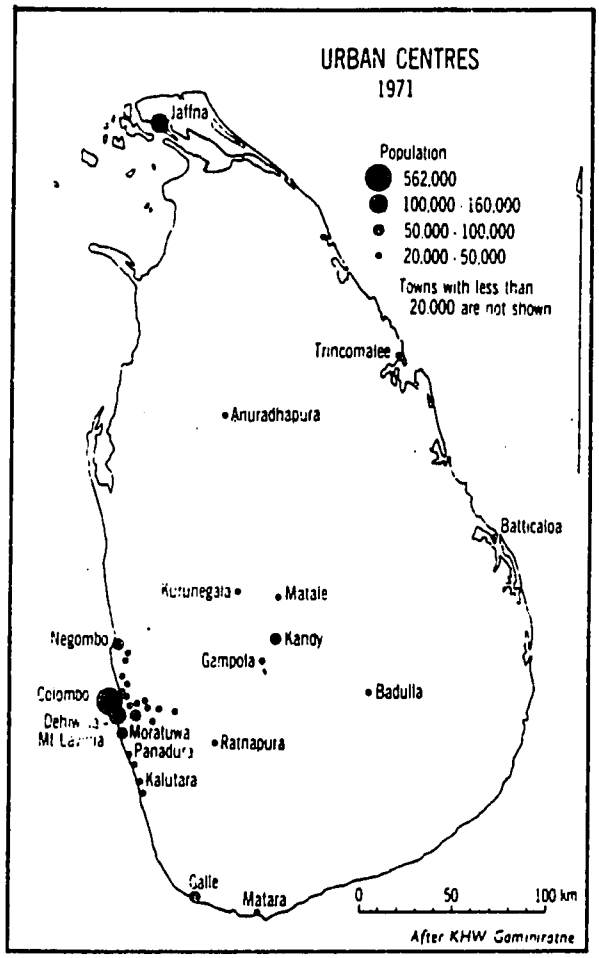
Demographic transition

From Johnson and Scrivenor, 1983.



Population density

FIGURE 6a



Urban centres

FIGURE 6b

Note: Both figures are from Johnson and Scrivenor, 1983.

This population distribution is reflected in the density figures as well. While the national average population density is approximately 200/km^2 it ranges from 20-50/km^2 in the Dry Zone to over 400/km^2 in the Wet Zone. Colombo, the country's largest urban center, maintains an average density of 3200/km^2.

The population is still largely a rural one as only 16 percent of the total live in urban centers (20,000 or greater). Most of these centers are situated on or adjacent to the coast (Figure 6b).

5. ECONOMIC BASE

Until very recently, the underpinnings of Sri Lanka's economy have changed little since the country became independent. The Gross National Product remains dominated by the primary sector (Table 3) and export composition (by value) consists largely of agricultural products. Tea, rubber and coconut products accounting for 95.7 percent of total export revenues in 1950 still contributed 73.3 percent to export-generated revenues in 1978 (Johnson and Scrivenor, 1981; Table 4).

Since 1978, however, the three major exports have declined in their importance to a combined share of little over 50 percent of total value of exports as industrial exports, such as refined oil products, steel and textiles, have grown in importance (Economic Intelligence Unit, 1982).

Other significant but relatively small-value exports contributing to national revenues include minor crops (cinnamon, cocoa, etc.), gemstones and tourism.

A brief analysis of composition of imports clearly demonstrates the country's continued dependence on basic foodstuffs. Even though

TABLE 3

GROSS NATIONAL PRODUCT (percentage)

Sector	1953[1]	1959[2]	1970[2]	1978[3]	1981[4]
Agriculture, forestry, hunting, fishing	49.9	39.1	34.2	31.8	29.2
Mining and quarrying	0.1	0.5	0.7	1.8	1.9
Manufacturing	4.7	11.6	12.3	20.7	17.8
Construction	8.6	4.8	6.4	4.9	9.1
Electricity, gas, water, sanitation	0.5	0.2	0.2	0.6	NA
Transport, storage, communications	4.9	9.2	10.0	8.1	8.4
Wholesale, retail trade	8.8	13.6	15.5	17.4	16.9
Banking, insurance, real estate	0.4	0.9	1.3	2.1	3.2
Ownership of dwellings	7.0	3.4	3.5	1.3	2.3
Services	10.2	12.3	12.6	8.1	10.0

NOTE: That totals exceed 100 percent is due to the exclusion from the tables of an adjusting net factor for income from abroad which in the years concerned was a negative quantity.

FROM: Johnson and Scrivenor, 1981

[1]Data from Balakrishnan, N. and Gunasekera, H. M. Statistical Appendix in de Silva, K. M., p. 258.

[2]Data from Central Bank of Ceylon, Review of the Economy, Colombo, 1976.

[3]Data from Central Bank of Ceylon, Annual Report for the Year, Colombo, 1979.

[4]Data from Economic Intelligence Unit, 1982.

Table 4 Composition of exports, selected years (by percentage of total value of all exports)

Product	*1950*	*1960*	*1970*	*1978*
Vegetable products				
tea	50.3	61.8	56.0	48.5
rubber	27.1	21.3	21.9	15.3
coconut products	18.3	13.3	14.2	9.5
cinnamon	0.5	0.8	1.5	1.3
cardamoms	0.2	0.2	0.6	0.3
cocoa	0.05	0.4	0.4	0.4
citronella	0.6	0.2	0.1	0.03
Fish products	–	0.02	0.3	1.8
Mineral products				
graphite	0.4	0.3	0.4	0.4
gemstones	–	0.2	0.2	4.0
Textiles and clothing	–	0.05	0.4	3.6
Total of items listed	97.45	98.57	96.0	85.13

Source: Sri Lanka/Ceylon Yearbook, Colombo, various years, and Central Bank of Ceylon, *Review of the Economy 1978*, Colombo, 1978.

FROM: Johnson and Scrivenor. 1981

dependence has been reduced by more than 50 percent since 1948, the importation of rice, what and other grains still represents 13.9% of total value of imports (Table 5).

Perhaps more troubling, however, is the trend in increased local rice and wheat production which appears to have been largely offset by the increased consumption associated with a growing national population (Figure 7).

Other notable trends associated with imports include declines in textiles while chemicals, machinery and petroleum products have increased significantly. (It must be noted, however, that these trends also reflect the effects of inflation and particularly the increased price of oil, and other petroleum products.)

Despite an average growth rate in GNP of 5.6 percent between the years 1977 through 1981, the country runs a chronic budget deficit which has only been balanced through massive infusions of foreign aid. In 1982 no less than 74 percent of the central government capital budget was estimated to be financed by foreign aid (de Samarasinghe, 1983).

The other major weakness in the economy is the country's vulnerability to shifts in exported-generated revenues due to commodity price changes in the international markets.

A. Agricultural Sector

In the plantation subsector the continuing emphasis on diversifying the national economy has signified a decline in the percentage of export revenues contributed by the big three agricultural export crops. Between the years 1971 and 1982, percentage of export revenues dropped

TABLE 5

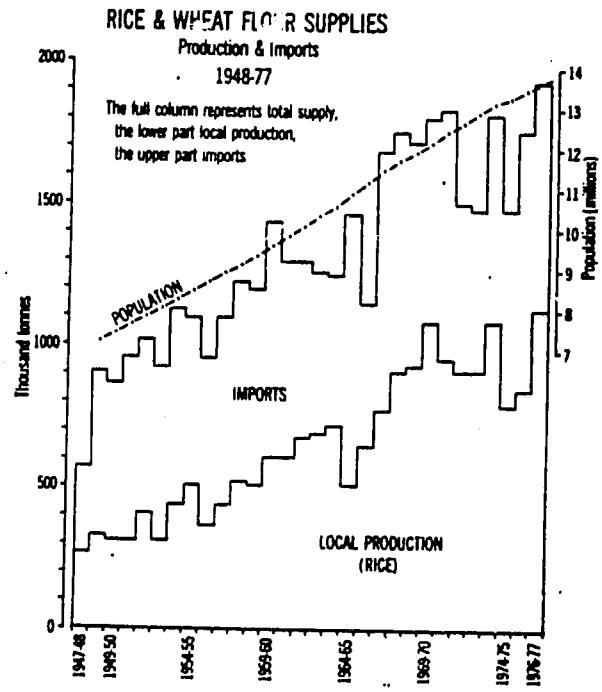
COMPOSITION OF IMPORTS, SELECTED YEARS (by percentage of total value)

	1950	1960	1970	1978	1981
Foodgrains	30.6	15.7	24.1	19.1	13.9
rice	23.8	12.4	13.0	4.7	2.8
flour and wheat	6.8	3.3	11.1	14.4	11.0
Petroleum and products	2.3	7.4	8.4	17.2	24.5
Chemicals etc.	1.6	6.6	7.0	8.9	5.3
Paper and products	1.3	2.0	2.0	2.0	NA
Textiles, yarn, clothing	14.3	11.9	8.6	8.4	6.6
Metals and articles	3.8	6.2	6.4	6.4	11.0
Machinery	3.1	7.0	11.0	12.4	6.3
Transport equipment	2.8	7.9	5.7	11.6	
Total	59.8	64.7	73.2	86.0	67.6

SOURCE: Central Bank of Ceylon, Bulletin, Colombo, February 1979.

From: Johnson and Scrivenor, 1981 and the Economist Intelligence Unit, 1980.

FIGURE 7



Rice and wheat flour supplies, 1948–77

SOURCE: Johnson and Scrivenor, 1983.

from 94 to less than 50 percent (albeit part of this decline can be attributed to reduced volume of exports).

Another factor which has affected volume of exports has been the decreasing area of land suitable for plantation crops (Figure 8). By 1974 Dromos had observed that most of the cultivable land in the country's Wet Zone was already fully utilized limiting future expansion of perennial crop production to restructuring of marginal plantation fields and increasing production efficiencies.

In contrast, he noted the low proportion of the Dry Zone which was presently under cultivation (less than 10 percent) and the critical role of irrigation in the future expansion in the Dry Zone.

Since the period of Dromos' observations many of the government agricultural policies have more or less been based on similar lines of reasoning. The major development emphasis for plantation lands has been on increasing efficiency of its management and production aspects. Efforts, directed toward this end include the conversion of marginal fields to alternative crop production, replanting and increased use of fertilizers (Department of Census and Statistics, 1983).

In the subsistence subsector government priorities are to obtain national self-sufficiency in basic food commodities, improve income and generate employment opportunities. The basic approach to achieve these goals will be to expand and improve existing irrigation facilities and increase efficiencies in land and water resource management practices.

As the various irrigation scheme components of the Mahaweli Program come on stream, the area of paddy lands under cultivation is expected to increase on the average of approximately 10,000 ha./year over the next

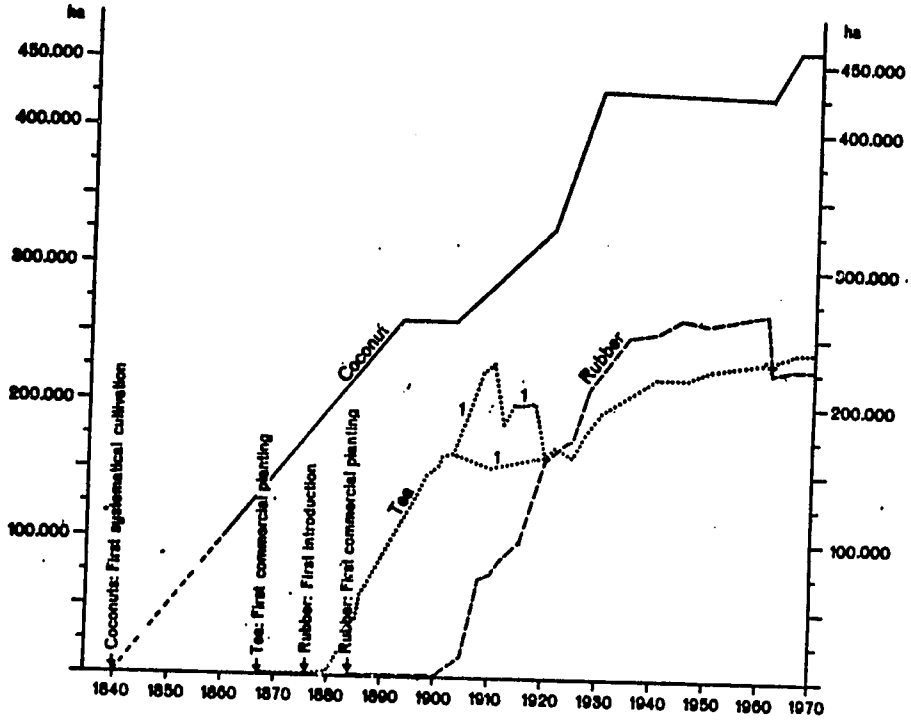


Fig. 8 : Growth of cultivated land under coconut, tea and rubber uptil 1970.
1 = Contradictory figures in the literature about the growth of the tea lands.

From: Johnson and Scrivenor, 1983.

10 years. Already there is some concern there may be an overabundance of rice production and in the future, prospective settlers in the Dry Zone may be encouraged to plant subsidary food crops or rotate them with rice.

A key area for future increases is agricultural production appears to be in the highlands characterized by a transitional climate between the Wet and Dry Zones and suitable for garden vegetables (National Planning Division, 1983).

Livestock production is a small component of the agriculture sector. The government policy priority in this subsector is to reverse recent declines in the national herd and introduce higher-yielding breeds.

B. Forestry Sector

While the contribution of the nation's forests to GDP is relatively small (2 percent), the role of the resource in supplying an estimated 60 percent of the national energy consumption underscores the significance of the sector.

Forests, as fuelwood, are the primary source of energy for Sri Lanka's rural populations and urban poor.

Presently, fuelwood demands alone are estimated to account for 4.8 million m^3/year. Coupled with land clearing for agriculture purposes, these demands are resulting in an average annual loss of forest area estimated at 50 to 60 thousand hectares/year (National Planning Division, 1983). Further, increased demand for fuelwood is expected to rise at an annual rate of two per cent into the next century. Loss of the nation's forests is further aggravated by the Mahaweli Development Program which is expected to result in an additional reduction of 100,000 ha.

These continually increasing demands on the nation's forests have extracted their toll. In 1956 an estimated 44 percent of the island was covered in forests. Since then, approximately 20 percent or more of forest cover has been removed leaving only 1.7 million hectares in forest (TAMS, 1980). Of that total some 76 percent is found in parks and wildlife and forest preserves.

The government's response to the pressures on the nation's forests has been to adopt a series of measures including: re-forestation schemes, protection of upper catchments, and increased enforcement of eviction laws protecting national lands.

Other related responses include the development of a Forestry Master Plan aimed at meeting future fuelwood demands in the Dry Zone and improving degraded catchments.

As has been previously noted much of the commercially exploitable forest in the Wet Zone has been cleared for plantation use (ECAFE, 1955). Commercial importance of Dry Zone forest is also limited due to the prolonged and widespread practice of chena resulting in poorly-developed evergreens and deciduous timber. These conditions dictated that commercial exploitation of such high-value species as mahagony, satinwood and ebony will continue to be confined to the "transition areas" located between the two zones.

C. Fishery Sector

The contribution from the fisheries sector to the 1982 agricultural sector and GDP was 10 and 3 percent, respectively (National Planning Division, 1983). Of that, coastal and marine fisheries constituted

approximately 80 to 85 percent of the island's total 1982 production (174,000 tons).

The sector, primarily composed of some 60,000 subsistence fishermen, is concentrated on the country's west coast. Four major production centers, Negombo, Jaffna, Puttalam, and Mannar account for approximately 50 percent of all landings (Department of Census and Statistics, 1983). However, the recently completed maritime boundary negotiations with India which ceeded the rich fishing grounds of Wadge Bank and a portion of Pedro Bank in the north together with increased mechanization of the country's fishing fleet, should cause a shift in traditional fishing patterns (Johnson and Scrivenor, 1981).

Fish is considered an important source of protein in the national diet. Sri Lanka has yet to obtain self-sufficiency in meeting demand. As a part of the government's general policy toward achieving self-sufficiency in staples, it has embarked on a course to expand fish production. The priority areas are: the development of fresh water resources focusing on utilization of the country's many tanks and reservoirs for fish farming. This will be pursued through the improvement of stocking and management strategies and increasing the number of breeding stations; encouragement of the ongoing mechanization program; and the development of the offshore resources which at present, only account for 2,000 tons in landings or less than 10 percent of their estimated potential yield (National Planning Division, 1983).

Besides providing a source of protein for local consumption, the fishing industry also accounts for a small but lucrative export market in prawns, shrimp and lobster which generated 19 million SDR in revenues in 1982.

D. Energy Sector

There are no known deposits of coal or petroleum in the country though exploitation activities are currently underway on the northern shelf area shared with India. As a result of the country's dependence on foreign sources of energy (32 percent of total energy consumption, Table 6a), it has been a long standing priority of GOSL to exploit the island's hydrological resources.

The first hydroelectric scheme was the Laksapana (1950) followed by the Gal Oya (1952).

At present there are seven hydroelectric power stations which account for a power potential of 329 MW (Table 6b). Hydroelectric capacity has remained the same since 1977 and increases in energy supply are due to growth in thermal-energy generation. There is an estimated technically attainable and economically feasible national hydroelectric potential of 1,592 MW in the country which could be generated from various proposed sites mostly in the Wet Zone (Table 6c).

However, for the present, the gap between locally produced energy supply and demand is expected to continue to grow at an annual rate of 8 to 9 percent at least through 1986 (scheduled completion of the Accelerated Mahaweli Development Program).

To meet the projected energy demands based on these projected growth rates, an installed capacity of 1800 MW will be needed by 1995 (National Science Council, 1973).

The government options appear to be limited to managing energy demand in the short term through an energy conservation program while providing increased energy supply in the mid to long term (National

TABLE 6a

Pattern of Energy Consumption in 1000 toe (1980)a

	Direct Petroleum	Electricity	Sub-Total Commercial Energy	Fuelwood	Total
Industry/Commercial	315 5	303.7	619 2	520.0	1139 2
Transport	607 3	—	607 3	—	607 3
Households	221 0	70.9	291 9	1520 0	1811 9
Others	40 5	131.6	172 1	—	172 1
Total	1184 3	506 2	1690 5	2040 0	3730.5
Percentage	32%	13%	45%	55%	100%

a/ toe – ton of oil equivalent.

TABLE 6b

- GENERATING PLANT POWER AND ENERGY POTENTIAL

Power Station	*Power Potential (MW)*	*Annual Energy Supply (GWh)*
Old Laxapana	50	270
Inginiyagala	10	43
Udawalawe	06	22
Wimala Surendra	50	123
Polpitiya	75	370
New Laxapana	100	504
Ukuwela	38	168
	329	1,500

Thermal Plant	*Power Potential (MW)*	*Annual Energy Supply (GWh)*
Kelanitissa (Steam)	50	230

TABLE 6c

HYDRO-POWER POTENTIAL OF SRI LANKA (RIVER BASIN-WISE) AS PER PFIEFER REPORT 1958

Name of Basin	*Net yield in million acre feet*	*Installed capacity proposed in MW*	*Likely primary energy in GWh*	*Likely secondary energy in GWh.*
Kelani	8·640	510	1,620	710
Maha Oya	0·350	15	40	30
Mahaweli Ganga	10·880	745	2,270	970
Walawe	1·450	75	250	70
Nilwala	0·350	10	40	10
Gin Ganga	0·350	45	160	40
Kalu Ganga	1·000	120	350	—
	23·020	1,520	4,730	1,830

FROM: Department of Census and Statistics, 1983.

Planning Division, 1983). One major contributor to meeting future demands will be the Mahaweli Program which is expected to supply some 1000 MW by the end of the 1980s.

While alternative sources of energy appear limited they include importation of coal, development of local peat resources and utilization of pulp and coconut wastes (Department of Census and Statistics, 1983).

E. Industrial Sector

As a result of the government's post-independence policy to diversify the country's economic base, the contribution to the GNP by the industrial sector has risen from 4.7 percent in 1953 to 20.7 percent in 1978. This has largely been brought about through incentives to increase local substitution for imports and promote exports.

Sri Lanka's approach to increased industrialization has traditionally been a combined effort between the public and private sectors. However, in 1977, the newly-elected UNP government began promoting increased involvement of the private sector through the initiation of exchange reforms and liberalization of trade and price decontrols. One of the more important new government initiatives in this period was the development of the Free Trade Zone Program (FTZ). This will be commented on in greater detail below.

The increased emphasis on the role of the private sector has been partly responsible for the high rate of growth in the industrial sector for the period 1972-1983 averaging 5.3 percent (National Planning Division, 1983).

Output from the industrial sector is dominated by three groups: chemicals (chemical, petroleum, rubber and plastics); basic consumption

goods (food, beverages, tobacco); and textiles. These three industries are estimated to contribute 86 percent of the sector's production (National Planning Division, 1983).

The policy to continue the development and diversification of the country s base and enlarge the role of the private sector in that process is expected to continue. The government priorities are to terminate government involvement in inefficient public corporations and seek means to transfer their functions to the private sector.

It is expected that there will be a move away from exports with high import costs (such as petroleum products) to products locally produced. This signifies greater exploitation of local resources and the promotion and utilization of the country's physical attractions and geographical location (National Planning Division, 1983).

Specifically, areas identified by the National Planning Division for future development efforts include:

1) increasing efficiency in the plantation sector;

2) increased exploitation of the country's mineral resources; and 3) development of the country's marine resources (including mariculture activities).

F. Tourism Sector

There has been a phenomenal growth in tourism since the creation of the Ceylon Tourist Board in 1966. Within an 11-year span tourism has increased from 23,000 arrivals in 1967 to approximately 200,000 in 1978 (Department of Census and Statistics, 1983).

The national emphasis on tourism development will focus on developing the following three areas:

coastal and marine resources (marine recreation);

ancient cities (historical and cultural interests); and

highland areas (tea gardens, golf and scenic interests).

One project currently underway is the development of a 400 hectacre resort complex north of Trincomalee exploiting the scenic beauty of the region's bays and lagoons.

G. Mining Sector

In the period 1971-1975, export-generated revenues from the mining sector increased from .5 million SDR to 32 million SDR before reaching a plateau.

Mineral exports are dominated by graphite, gemstones and mineral sands used primarily in the production of strategic metals.

The principal sites of extraction are:

Kagalle and Kurunegala Districts (graphite);

alluvial deposits in Ratnapura District (gemstones); and

north of Trincomalee (mineral sands).

6. NATIONAL ECONOMIC DEVELOPMENT PROJECTS

There are four large-scale projects currently being administered at the national level which are particularly relevant to the management and utilization of the country's natural resources.

A. Accelerated Mahaweli Development Program

The post-independence elimination of malaria removed a major constraint to settlement in the country's Dry Zone. The first large-scale settlement scheme, the Gal Oya, entailed the construction of a dam to provide the water necessary to expand existing rice and coconut lands from 20,000 to 50 000 ha. which in turn supported the re-settlement of an additional 25,000 agricultural families (MacFadden, 1952).

Since 1952, an estimated 80 major irrigation schemes (greater than 80 ha.) have been completed accounting for 46 percent of all settlement in the Dry Zone (Amerasinghe, 1976).

By far the most ambitious of the Dry Zone development schemes is the Mahaweli Development Program. The original scheme, with roots extending back to the 1950's, called for the construction of a series of storage reservoirs throughout the Mahaweli Basin designed to provide irrigation water to 13 systems (A-M) spread over the northern part of the island (TAMS, 1980). This project was to be implemented over a 30-year time period. The first project completed under the Program was system H which brought 12,000 ha. into production (Figure 9).

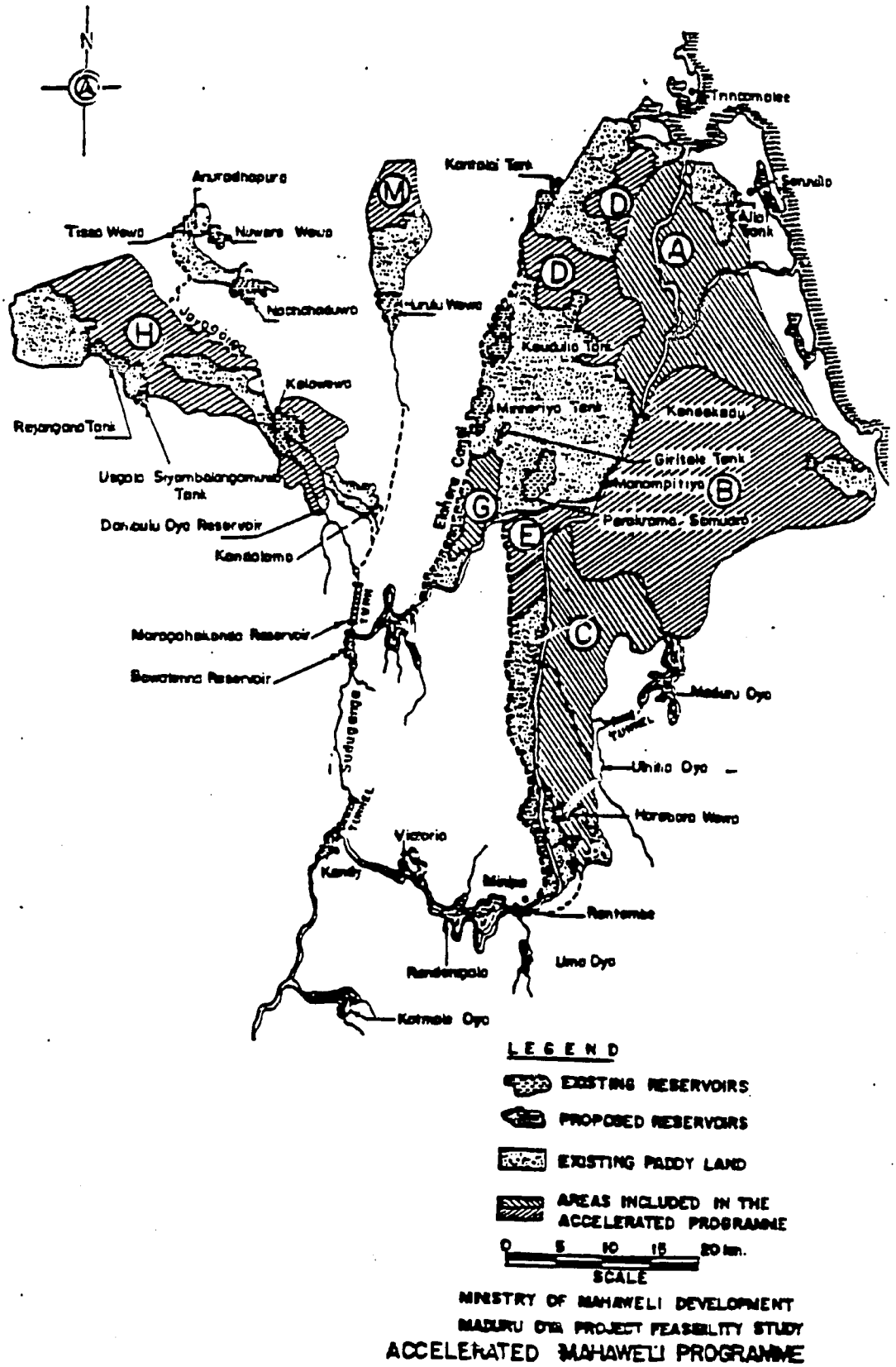


FIGURE 9

FROM: TAMS, 1980.

However, as a result of a shift in national priorities in the newly elected government in 1977, the Program was scaled-down and accelerated and scheduled to be completed in five years.

The new program would include the construction of storage and irrigation facilities designed to provide the water necessary to develop 80,800 ha. of new crop land and upgrade 14,350 ha. of existing crop lands in systems A-D (Figure 9).

The provisions of newly irrigated lands and accompanying infrastructure is expected to accomodate a population of approximately 1 million settlers (assuming an average family size of five).

The Mahaweli Program is the largest project of its kind ever attempted in Sri Lanka. Besides serving as a means to open up more of the Dry Zone, provide a source of employment and irrigate lands to produce rice to obtain national self-sufficiency in staples, all key government priorities, it will also provide a substantive source of hydropower to meet the country's future energy needs.

B. Free Trade Zones

One of the significant changes brought on by the government's shift in policy emphasizing an increased role for the private sector has been the creation of incentives to attract foreign investment capital. One such incentive has been the designation of Free Trade Zones (FTZ).

The Program, administered by the Greater Colombo Economic Commission, offers tax holidays, import duty reductions and other incentives to foreign investors needed to expand export earnings from non-traditional sectors.

Since its inception, GCEC has approved 164 projects with a recent emphasis in the basic metal and engineering industries (Table 7). Of the 164 projects contractual agreements have been completed for 84 projects (National Planning Commission, 1983).

Outside of the Colombo area the Foreign Investment Advisory Committee has a similar mandate and has approved more than 561 projects between the years 1977-1982. Similar to the shift of project emphasis by the GCEC, FIAC is beginning to focus on higher value - added investment projects such as civil engineering, construction and property development projects. Of the 203 projects currently in operation, 99 are in the manufacturing sector (Table 8).

Projects financed solely from local funds fall under the responsibility of the Local Investment Approvals Committees of the Ministries of Industries, Textiles and Rural Industrial Development. The bulk of the projects approved since 1981 constitute the manufacturing of metal products, chemical, wood products and paper-based products (National Planning Division, 1983).

C. Colombo Metropolitan Area Development Program

The third capital-intensive project is urban housing. THe priority set by government on housing was clearly stated in the 1978 Master Plan Project which stressed the rebuilding of Colombo and the development of new housing.

Under the Project, plans were formulated for the construction of 100,000 units at an estimated cost of 8 billion SDR in 1980 (Wijesinghe, 1981).

TABLE 7

Sectoral Classification of GCEC Projects in Production

Sectors	No. of Projects	Investment Committed (Rs mn) Foreign	Local	Total
1 Agriculture, Animal Husbandry and Fishing	1	1.3	3.7	5 0
2 manufacturing Industries				
(a) Textile & Readymade Garments	29	508.7	245 8	754 5
(b) Food, Beverages & Vegetable Oils	2	8.3	10 0	18 3
(c) Wood & Paper Products, Printing & Publishing	1	0.8	1 2	2 0
(d) Chemicals & Chemical, Products, Rubber and Plastic	8	132 0	75 3	207 3
(e) Non-Metal Mineral Products	1	18.3	16 5	34 8
(f) Basic Metal and Engineering Industries	4	57 8	31 6	89 4
(g) Other Industries	5	40.3	26 6	66 9
3 Civil Engineering Construction & Property Development	—	—	—	—
4 Tourist Hotels and Recreational Facilities	1	18.6	13 1	31 7
5 Specialised Services	—	—	—	—
Total	52	786.1	423 8	1209.9

From National Planning Division, 1983.

TABLE 8

Projects Approved by the FIAC
Sectorwise Classification-1979 - 1982

	No of Projects				*Envisaged Investment - Rs. Mn.*			
	1979	1980	1981	1982	1979	1980	1981	1982
1 Agriculture, Animal Husbandry and Fishing	05	13	09	08	11	107	136	46
2 Manufacturing Industries of which-	61	55	51	45	950	1408	1053	801
(a) Textile & Readymade Garments	28	08	08	12	682	27	55	162
(b) Food, Beverages & Vegetable Oil	06	05	06	05	74	499	119	258
(c) Wood & Paper Products, Printing & Publishing	03	02	04	03	12	6	150	7
(d) Chemicals & Chemical Products, Plastic and Rubber based Industries .. .	07	20	15	10	82	524	227	151
(e) Non-Metalic Mineral Products	06	06	04	03	16	268	91	70
(f) Basic Metal & Engineering Industries . ..	08	09	12	05	49	37	390	136
(g) Other Industries	03	05	02	07	35	47	21	17
3. Civil Engineering Construction & Property Development ..	26	17	17	09	282	238	2141	238
4. Tourist Hotels & Other Recreational Facilities	15	26	53	23	924	1450	3214	1915
5. Specialised Services	06	26	21	17	30	427	292	37
Total ..	113	137	151	102	2197	3630	6836	3037

From: National Planning Division, 1983.

In addition to this goal GOSL added new projects which included a model village development scheme and the construction of a new capital in Kotte.

It appears however, due to budget constrains and cost overruns, the project has been cut back significantly. This in part, reflected a change in housing policy of the government. The government's new policy will effectively take it out of housing construction and encourage an increased role for the private sector to meet the demand. This will allow GOSL to focus on providing shelter and services to the urban poor (National Planning Division, 1983).

D. District Integrated Rural Development

The District Rural Development Program was initiated in 1974 for the purpose of setting up a wide range of rural development schemes funded largely by assistance agencies in areas not directly benefiting from the previously described large national projects (Rao et al., 1983). The Program's approach is to assist in the development of decentralized planning by encouraging district level personnel to formulate and implement development activities in association with the local level organizations.

The responsibility for project development in a district rests with the Ministry of Plan Implementation and its Regional Development Division. Once project approval is obtained and funding provided, implementation is coordinated and monitored through a district project office (Rao et al., 1983).

The program now covers 9 out of the country's 26 districts. Program activities cover a range of areas from rural roads development to

health. A number of projects focus directly on development of natural resources which include forestry, fisheries and small holdings in plantation crops.

As a result of a recently completed review of the program a principal recommendation concerned the strengthening of linkages between DIRP and the national level to ensure district and local projects were consistent with the economic framework at the national level and contributed to the growth in the economy.

7. RECENT PRECEDENTS TO THE SRI LANKA NCS

Sri Lanka possesses a long history of concern for natural resources conservation and the environment (see page 1). In the modern era this concern can be traced back to the work of several mid-19th century zoologists such as Tennent and Kelaart.

More recently the first significant step towards the development of a comprehensive approach towards the management of the country's environmental and natural resources occurred in 1972. In recognition of the growing threat of pollution and degraded resources associated with the country's continuing transformation to an industrialized society, the Prime Minister directed the Secretary of the Ministry of Planning and Employment to begin efforts to address the problem. This resulted in a meeting of elected government officials which subsequently appointed several task groups to study the problems and make recommendations.

The major environmental issues identified in 1972 were:

soil and coastal erosion
need for conservation of surface runoff
need for establishment of small hydro-power plants
need for protection and management of forests
over-exploitation of medicinal plants
wildlife conservation
industrial agricultural and human pollution
landscape preservation
ineffective legislation

The task group's collective recommendations were limited largely to declarations requesting the cessation of the activities leading to the problems cited above. However, two recommendations stood out. They addressed the need for educational efforts to increase the public awareness of the nation's environmental issues and the establishment of a Central Authority for Environmental Management (National Science Council, 1973).

While it is unclear how many of those recommendations were ever acted on, the creation of the Authority was not realized.

The country's environmental issues were the topic of a second meeting in 1978 organized by the Ministry of Local Government, Housing and Construction with the assistance of UNEP.

In the keynote address, the PM stated the principal causes of environmental degradation were rapid increases in population and expanding urbanization. He also noted that the resulting demands created by these underlying causes were the justification for the country's major development projects. He concluded by stating the challenge of the seminar was to seek solutions which attempt to reconcile the demands of a healthy environment with those of the nation's development.

The primary recommendation which came out of the meeting was to create an independent Central Authority for Environment which would serve the following functions as they relate to the management of the environment:

formulate policies and legislation
prepare standards, norms and guidelines
survey natural resources
monitor environmental conditions
evaluate development plans
enforce environmental management
disseminate environmental information

The second basic recommendation consisted of a series of proposed legal reforms to enable the GOSL to more effectively manage the country's natural resources.

Since 1978, the Central Environmental Authority (CEA) was finally created and is currently the lead agency in the planning and developing of the country's NCS.

8. RECOMMENDED PRIORITIES FOR THE NCS

At this point the author must digress to include the following caveat prior to recommending priority areas on which the NCS should focus: the following recommendations have been identified and are based on most of the materials cited previously in the paper. While the preliminary review of the literature was a productive exercise it nevertheless was sadly deficient in comprehensive documentation. Most notably, the author could not obtain a copy of the IUCN Guidelines on the development of the NCS, a detailed account of the present status and evolution

of the NCS in Sri Lanka or a detailed institutional analysis of agencies responsible for one or more aspects of the country's natural resources management and conservation. In light of these deficiencies and in the absence of a country visit prior to the preparation of the document, the following recommendations should be considered as preliminary in the fullest sense.

A. National Development Projects

Mahaweli Development Program

No single past or present development activity will have a greater effect in modifying Sri Lanka's landscape than the Mahaweli Program. Among some of the environmental impacts identified by TAMS (1980) and ACRES (1980) which will result from the program's implementation include:

loss of habitat
wildlife losses
modification of hydrologic regime
salinity intrusion
modification of estuarine dynamics
increased salinization of soils
increased downstream chemical pollution

The emphasis of the NCS should be to highlight these issues, evaluate previously proposed and alternative mitigation measures, propose recommendations and initiate and monitor their subsequent implementation.

Free Trade Zones

The continuing policy for providing incentive to encourage foreign investment in Sri Lanka and the increasing emphasis on high-value industrial exports such as chemical products could imply a significant growth

in industrial pollution. The NCS should attempt to highlight existing problems and explore means by which the GCEC and FIAC and other appropriate institutions can encourage new industries to adopt pollution controls to meet nationally-set standards.

B. Present Land Use Priorities

Chena

The continuing practice of slash and burn agriculture has had a profound effect on shaping the Dry Zone landscape. The continuation of this form of land use contributes to declining soil fertility, increased erosion and loss of habitat. Approaches should be studied in conjunction with the new re-settlement schemes which attempt to phase out the practice.

Plantation

The new emphasis on increasing production efficiencies in the plantation will result in greater use of fertilizers and insecticides. The NCS should identify optimal types, concentrations and means of application of these chemicals to minimize their impact to the surrounding environment.

C. Habitat Priorities

"Intermediate Zone" Forest

Due to the nearly complete development of the Wet Zone and growing self-sufficiency in staples GOSL may begin to examine alternative land use options. One option will be the increased exploitation of the

highland areas in the region characterized as intermediate in terms of rainfall situated between the Wet and Dry Zones. This area is presently being considered for the development of subsidary food crops. The NCS should attempt to clearly define this zone, identify its significance for habitat, hydrological regulation and soil preservation and recommend a development framework consistent with NCS objectives should GOSL decide to fully exploit the region.

Coastal Ecosystems

Highlighting the continuing exploitation of mangrove and coral resources must be given renewed emphasis. Despite the widespread documentation of accelerated coastal erosion in Hikkaduwa associated with offshore coral mining the practice continues. Both ecosystems, crucial to maintaining economically-important fishery resources, are also threatened by upland water diversion. The use of alternative sources for lime production should be encouraged (back reef or coastal pleistocome reef). If practible, sustained management practices for mangrove forests should be researched and implemented. Finally, water quality and scheduling demands of coastal ecosystems must be examined in light of the country's growing demand for fresh water for agriculture production and hydropower.

Wildlife Habitat Management

The increasing development of the Dry Zone, full development of the Wet Zone and the rural practice of chena combine to pose a potentially mortal blow to Sri Lanka's remaining wildlife preserves. A major priority of the NCS should be to identify existing parks and preserves, propose

new areas and critical size limits to ensure diversity of habitat and make recommendations to further strengthen protective measures in existing sanctuaries. A key element to the success of this approach will be to encourage the development of fuelwood plantations to meet rural energy demands. Priority areas include the highland reserves (Wet and Dry), lowland villus and coastal and marine areas.

D. Geographical Priorities

Colombo

The continuing growth of this urban center will signify an increasing incidence of environmental and human health problems in the city and adjacent areas. Key issues include water quality, industrial pollution, housing and human health hazards. The thrust of the NCS should be to highlight the present situation and analyze its implications projected over time into the future. Short and long-term strategies to address urban problems need to be evaluated for their appropriateness to the country. These may include acceleration of resettlement programs, more effective birth control policy and/or educational programs.

Regional Industrial Diversification

With GOSL's increased emphasis on diversifying and locating local and foreign industry away from the Colombo area, industrial pollution, in the absence of effective controls, can be expected to grow throughout the country. Many of the measures identified for Colombo-based industry could prove applicable to regionally-located industries though the implementing and monitoring mechanisms may differ.

Dry Zone

All evidence indicates GOSL will continue its attempts to open up and develop the Dry Zone. The environmental issues will be cross-sectoral and call for increased emphasis in the identification and knowledge of the Zones' natural resources and the development of strategies to insure their suitable management and conservation.

Coastal and Marine Areas

GOSL has indicated the development of the country's coastal and marine resources is a high priority in the continuing process of national economic diversification. Specifically, the principal activities will include the mining of strategically important coastal sands, lowland rice production, tourism development, mariculture and pelagic fisheries development. Sustainable management strategies exist for each of these activities (with the exception of conversion of lands to rice production) and should be identified and fitted for the conditions in Sri Lanka.

In addition to the "thematic areas" described above which constitute the "meat" of the strategy, the NCS must follow through on the remaining key components which characterize the process.

Of these plan implementation may be the most important. While the NCS will be developed at the national level, its key to success will be its simultaneous implementation at the national, regional and local levels. One possible means to this multilevel approach is to obtain the active participation of the country's District Councils.

National coordination will depend on the institutional position and legal authority of the NEA. Every effort should be made to solicit

the active participation from other government sectors. Key players will include the country's semi-autonomous organizations such as GCEC, FIAC and the national corporations.

Besides plan implementation other important considerations to insure NCS success include: increasing public awareness of NCS's goals and objective; advising the international donor community and voluntary organizations of its purposes and solicit their assistance; and initiate long-term educational programs designed to provide a firm basis for understanding the principles of natural resources conservation in subsequent generations of Sri Lankans.

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