DRAFT ENVIRONMENTAL REPORT ON SRI LANKA

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Draft Environmental Report on SRI LANKA

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S R I L A N K A : ENVIRONMENT AND RESOURCES

0.0 INTRODUCTION AND SUMMARY

Located within the tropics and subject to monsoonal winds, the Republic of Sri Lanka has two sharply different climatic zones: the wet zone of the south-west of the island and the dry zone covering the remainder of its territory. The dry zone-wet zone distinction is essential for an understanding of Sri Lanka and its development potentialities and problems. The wet zone (about 100+ inches of rainfall per year) is the area of greatest population and industrial concentration, providing the soil and climatic conditions essential for Sri Lanka's major export crops: tea, rubber, and coconut. The wet zone is intensely utilized and apart from the possibility of land reclamation in coastal zones offers little opportunity for further agricultural expansion. The dry zone, on the other hand, until about the 13th century A.D. the center of a highly advanced civilization based on irrigated agriculture, receives less than 75 inches of rainfall per year, is relatively sparsely populated, has little industrial development, and offers the opportunity for agricultural expansion in conjunction with irrigation schemes.

With an economy based chiefly on tea, rubber and coconut, Sri Lanka, since receiving its independence from the British in 1948, has been able to raise significantly the living standard of its people, provide free education and health service, broaden the political base, and introduce land reform. Sri Lanka's economy has suffered, however, from several weaknesses: the inability to meet the food demands of its population and the rising cost of the food it must therefore import; a dependence for foreign exchange on crops which in recent years have suffered price declines on the world market; a decline in foreign investments; a high level of unemployment; inflation; and sharply rising prices for petroleum and other products essential for development. Drought through most of the first half of the 1970's aggravated Sri Lanka's weakened economic condition considerably, bringing about record low yields for rubber and other export crops.

The necessity of meeting the food requirements of its population, which has grown by about 96% since 1946, and of lowering its requirements for imported food and raw materials has resulted in several development emphases: the agricultural development of the dry zone, chiefly through the construction of major irrigation works; increased use of fertilizers, pesticides, and herbicides, with government subsidies to encourage their use; the diversification of "plantation" crops and the more efficient use of unproductive tea and rubber lands; the development of the forest industry to supply raw materials for local industry; the expansion of largely unexploited fisheries potential; and the increase of livestock numbers for meat and milk production. Mineral resources are limited but supply some foreign exchange as well as raw material for the production of cement and other construction materials such as bricks and tiles.

It is generally agreed that Sri Lanka's water, soil and forest resources offer opportunities for development, but such development must proceed rationally if environmental deterioration, already very much in evidence, is to be avoided. Although the government has established no central authority with responsibility for environmental protection, a wide range of government agencies have functions

involving the environment and natural resources (section 2), and legislation providing for protection of the environment is on the books (section 3). There are also indications that government agencies, despite some ill-advised development efforts, are willing to consider factors such as the protection of wildlife and forests in laying down development plans (section 2.2.1).

MAJOR ENVIRONMENTAL PROBLEMS

The major environmental problems of Sri Lanka, as touched on in this report, are, in descending order of importance: deforestation; problems involving water resources; soil erosion; dangers to coasts and coastal resources, especially coral reefs; wildlife protection; and industrial pollution. There are also problems involving administration and enforcement of environmental legislation.

1) DEFORESTATION:

Deforestation is identified as the chief environmental problem because it is reported to be proceeding at a rapid pace and because of its many ramifications, which include: loss of forests important for their waterholding capacity, with consequences for water flow in rivers, erosion, and local climate (section 4.2.3); increased danger of soil erosion, especially where forest land has been cleared in ares of high elevation; loss of unique rain forests (section 4.2.2.4); and loss of habitat for wild animals.

Deforestation has arisen from:

-land clearing for agricultural enterprises, either in conjunction with major development schemes or for traditional shifting agriculture (chena) which is said to account for more felled trees annually than the expansion of settled permanent agriculture (section 4.2.2.5); very frequently chena farmers encroach on land set aside as forest reserves.

-firewood collection: population growth has brought about an increased demand for this resources, leading in some cases to the looting of forest reserves(section 4.2.2.1); although most of the firewood is used domestically, tea plantations have, because of recent high costs of petroleum fuels been burning valuable forest trees for tea-drying fuel (section 4.2.2.6 and also section 4 7.3.1); no regular programs presently exist to ensure the renewal of this valuable resources.

-development of the timber industry, which has in at least one instance led to the exploitation of a unique rainforest as a source of lumber for plywood manufacture (section 4.2.2.4).

-use of timber for construction needs (4.2.2.3).

2) WATER RESOURCES

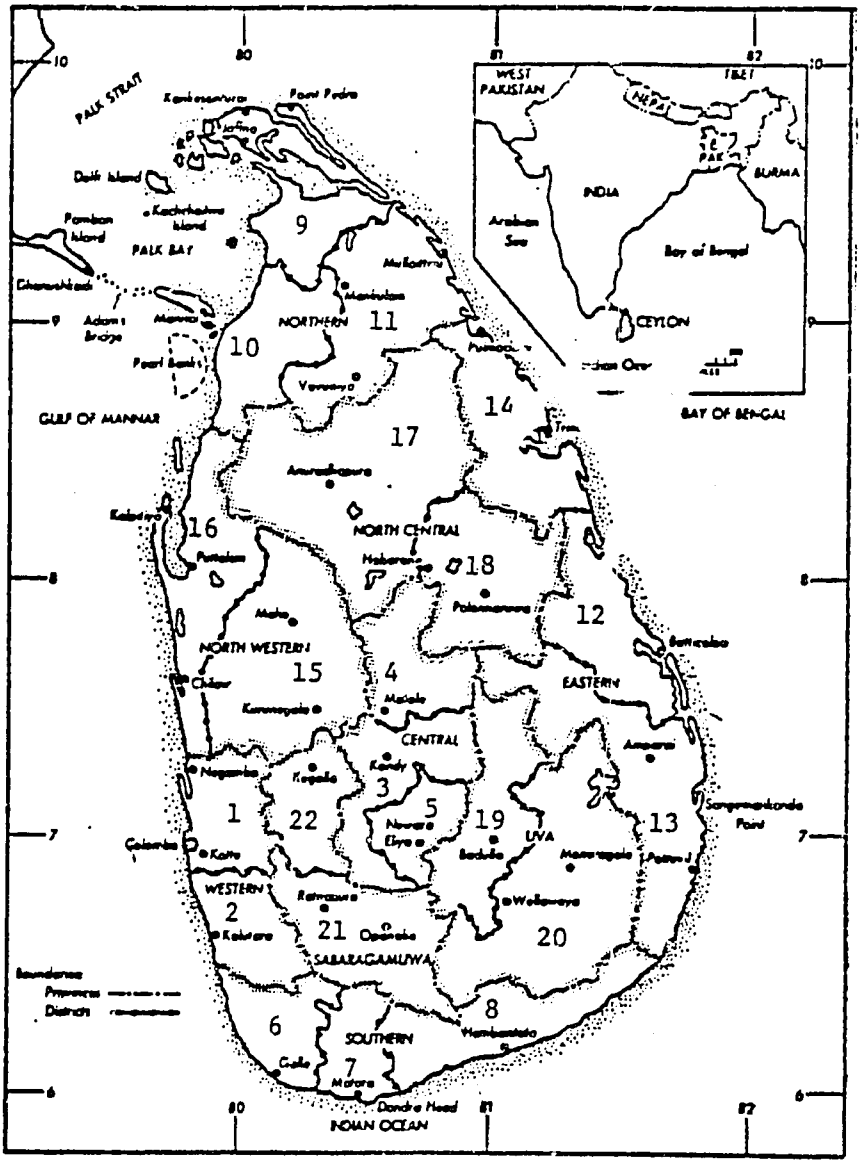
Deforestation, already considered above, is reported to have had grave consequences for water resources, leading to reduced water flow in some rivers and to localized droughts (see 4.1.1).

Other problems with water resources are:

-severe drought during the early and into the mid-70's have caused some speculation about the possible "dwindling of water resources," a development which could adversely affect development plans for agricultural expansion through irrigation;

7) ADMINISTRATION AND ENFORCEMENT

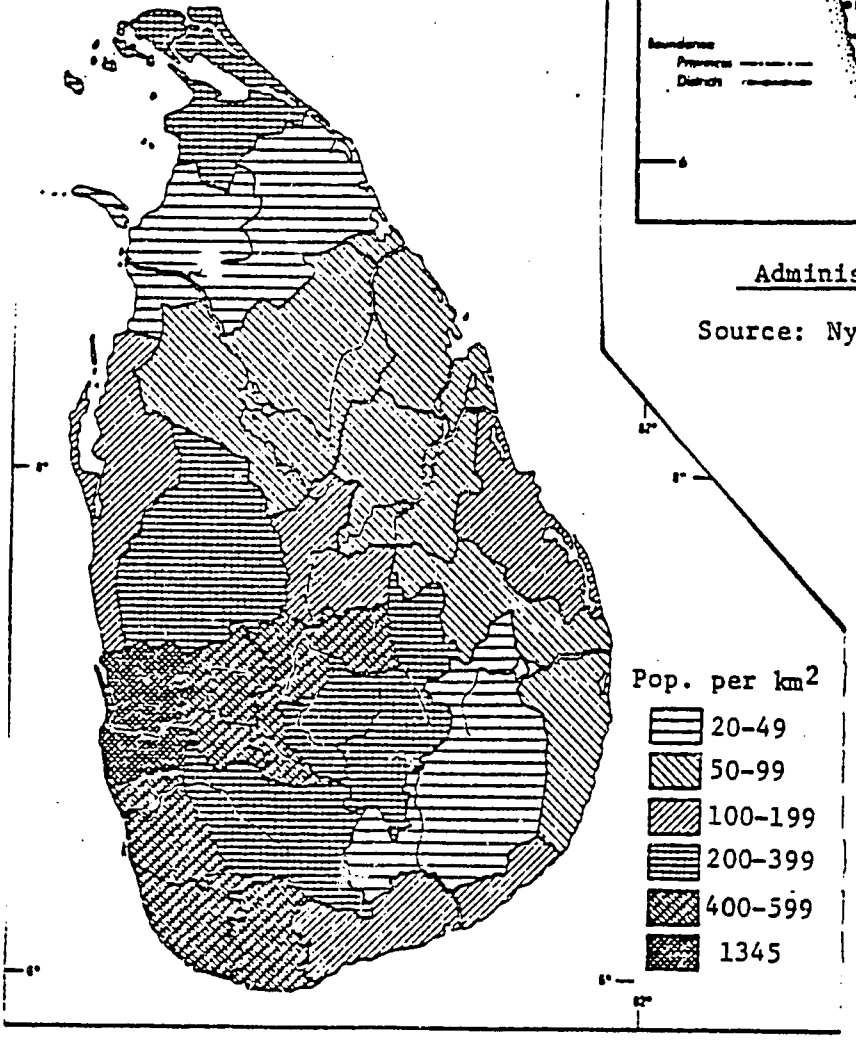
Although Sri Lanka has legislation covering environment and the development of resources, there is no central authority empowered to act in a coordinated fashion to control the many factors contributing to environmental deterioration. Furthermore, manpower shortages contribute to inadequate enforcement of laws dealing with areas such as wildlife protection and forest reserves (section 4.4.6.1).



Administrative Provinces and Districts

Source: Nyrop (1971)

POPULATION DENSITY
1974
source: Domrös(1976)



1.0 POPULATION CHARACTERISTICS

1.1 Sri Lanka is an island roughly the size of West Virginia with a population more than seven times greater. The population of Sri Lanka has experienced rapid growth since the nation received its independence from Great Britain in 1948, rising from 6,657.3 million in 1946 to 12,711.1 million in 1971 (a growth of 91.8%), the date of the last official census.

Population Growth by District: 1946-1974

	Area in sq.miles	Population (in thousands) 1946	1963	1971	1974*	1978*	Increase 1946-1974(%)	Pop. density per sq. mile 1946	1974
SRI LANKA	25,332	6,657.3	10,582	12,711.1	13,393	14,283	91.8	263	528
1. Colombo (W)	808	1,420.3	2,207	2,672.6	2,816		98.2	1,758	3,485
2. Kalutara (W)	624	456.6	631	731.8	771		68.8	732	1,235
3. Kandy (W)	914	711.4	1,044	1,187.2	1,251		75.8	779	1,368
4. Matale (W)	770	155.7	256	316.3	333		113.9	173	432
5. Nuwara Eliya (W)	474	268.1	398	453.2	478		78.3	566	1,008
6. Galle (W)	652	459.8	641	737.4	777		69.0	705	1,191
7. Matara (W)	481	351.9	542	558.2	662		88.1	732	1,288
8. Hambantota	1,013	149.7	274	341.0	359		139.8	148	354
9. Jaffna	998	424.8	613	704.3	742		74.6	425	743
10. Mannar	964	31.5	60	77.8	82		160.3	33	85
11. Vavuniya	1,467	23.2	69	95.5	101		335.3	16	68
12. Batticaloa	1,016	203.2	196	258.1	272		175.1	73	267
13. Amparai	1,048	—	212	272.8	287				273
14. Trincomalee	1,177	75.9	139	191.9	202		166.1	64	171
15. Kurunegala	1,844	485.0	853	1,028.1	1,083		123.3	263	587
16. Puttalam Chilaw	1,172	43.1 139.8	303	379.8	400		118.7	46 533	341
17. Anuradhapura	2,808	139.5	280	389.2	401		311.5	35	146
18. Polonnaruwa	1,331	—	114	163.8	173				129
19. Badulla (W)	1,089	372.2	522	616.3	649		228.5	114	595
20. Moneragala	2,785	—	132	191.4	202				72
21. Ratnapura (W)	1,250	343.6	546	661.7	698		103.1	275	558
22. Kegalla (W)	642	401.8	579	652.1	687		80.0	626	1,090

*mid-year estimates; (W)=wet zone.
Note: in 1946 and 1963 Badulla included Moneragala and Batticaloa included Amparai; in 1963 and 1971 Puttalam included Chilaw.

Present population growth rate: 1.7.

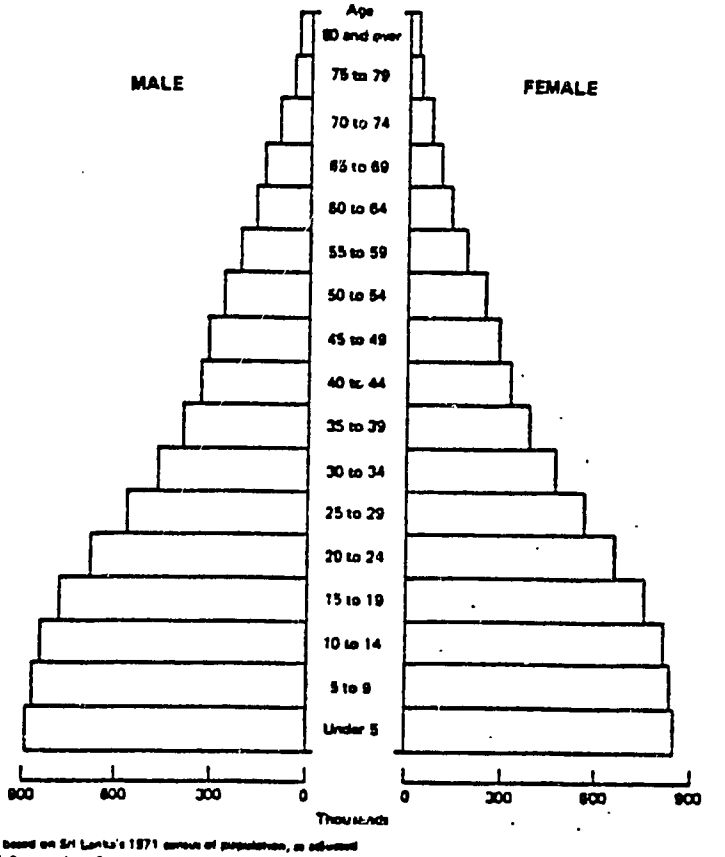
Years to double population: 41.

Percentage of population under 15: 39%.

Percentage of population over 64: 4%.

Projected population for year 2000: 20.4 million

Population of Sri Lanka, by age and sex: July 1, 1978



Projection based on Sri Lanka's 1971 census of population, as adjusted by the U.S. Bureau of the Census.

1.2 Population by ethnic membership:

Major ethnic groups of Sri Lanka

GROUP	% of pop.	language	religion	geographic distribution
Sinhalese	71%	Sinhala (Indo-European	Buddhist	most heavily concentrated in the southern half of Sri Lanka, particularly in the southwest
Tamils	22%	Tamil (Dravidian)	Hindu	eastern and northern districts, especially in Jaffna, where they comprise 90% of the population, and in Mannar and Vavuniya
Moors	6%	Tamil	Islam	throughout Sri Lanka; largest concentrations on eastern coast, in Amparia, Batticoloa and Trincomalee
Others: Burghers (racial mixture); Malays	1%	English, Sinhala, Malay	Islam, Christianity	throughout the country

An important Tamil subgroup (about 45% of the total Tamil population in 1971) is formed by the "Indian" Tamils, descendants of workers brought in by the British to work the tea plantations. Since 1970, under an agreement with the Indian government, Sri Lanka has been implementing a program to repatriate 600,000 of these Tamils, most of whom live in the estate areas of the Central Highlands, to India. Relationships between the Sinhalese majority and the substantial Tamil majority, already somewhat on the sensitive side, have been considerably exacerabated by this program.

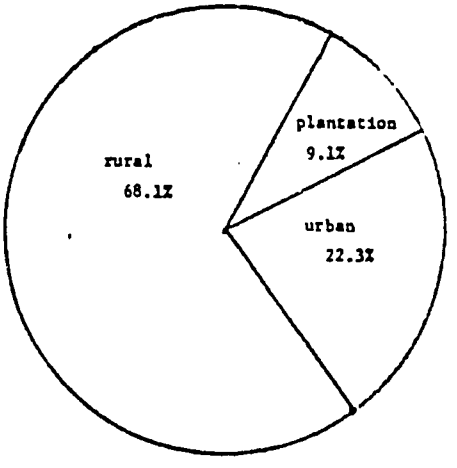
1.3 Rural-urban distribution of population

Population of major urban concentrations(in thousands)

City	District	Zone	1963	1971	1974
Colombo	Colombo	wet	512	562	592
Dehivale-Mt. Lavinia	Colombo	wet	111	155	162
Jaffna	Jaffna	dry	95	108	114
Moratuwa	Colombo	wet	78	96	100
Kotte	Colombo	wet	73	92	98
Kandy	Kandy	wet	68	94	98
Galle	Galle	wet	65	73	76
Negombo	Negombo	wet	47	57	60
Trincomalee	Trincomalee	dry	35	32	44
Matara	Matara	wet	33	37	37
Batticaloa	Batticaloa	wet	23	37	37
Badulla	Badulla	dry	27	35	36
Anuradhapura	Anuradhapura	dry	29	35	36
Matale	Matale	wet	26	31	32

Urban growth in relation to overall population growth has not been large. Between 1946 and 1971 urban population, counting all concentrations of 2,000 and above, grew from 20.3 to 22.1% of the population; growth for urban centers of over 20,000 population, went from 11.5 to 15.8% of population during the same period.

RURAL-PLANTATION-URBAN POPULATION (1976)



1.4 Wet zone-dry zone population distribution (see 4.1.1)

In 1946 only 12% of the population lived in the dry zone of Sri Lanka, the remainder being concentrated in the agriculturally more productive wet zone of the southwest of the island. Since that time, under government schemes to open up (colonize) the dry zone for extensive agricultural development, something of a shift of population has occurred: in 1977 the dry zone was estimated to contain about 20% of the population.

1.5 Educational characteristics of population:

Literacy:* 1963: 75.1%
1970: 82.6%

	1963		
illiterates:	total: 24.9%;	men: 14.6%;	women : 36.3%

	1970		
	total: 17.4%;	men: 10.3%;	women : 24.9%

School enrollments:

	1973
Primary schools:	2,117,700
Middle and Sec.:	480,300
Teacher's schools:	9,300
University of S.L.:	
Peradeniya	4,578
Colombo	3,336
Vidyalankara	1,710
Katubedde	2,134
Jaffna (1974)	114

Expenditures for education:

	1973
Public expenditures:	Rs. 614.9 million
Share of gross domestic product:	4.1%

Education is free and compulsory for all children between the ages of six and eleven. Secondary, college and university education are also free.

*Literacy is defined as the ability to read and write, with understanding, a simple paragraph pertaining to everyday life in Sri Lanka.

1.6 Health characteristics of the population:

1.6.1 Average annual birth rate: 26 per 1,000 population

Infant mortality rate: 47 per 1,000 live births (1975-76)

Crude death rate: 9 per 1,000 population

Expectation of life at birth: 68 years

Beginning in the late colonial era and continuing through the years since independence, Sri Lanka has provided its population with a level of health care far superior to that available in most lesser developed countries. Triggered by a severe malaria epidemic in the mid-1930's, health services were improved enormously: new hospitals were built in rural areas and there was an increased emphasis on preventive medical facilities throughout the country. At the same time a strong anti-malaria program involving massive spraying with DDT was responsible for a dramatic drop in the incidence of that disease.

Expanded and improved health care, which not only reduced the infant mortality rate but also led to a greater life expectancy for Sri Lankans, is the chief explanation for the rapid growth of population in Sri Lanka since the mid-1940's. It is only within the last few years that family planning programs have been successful in reducing the crude birth rate to a level which has been significant slowing population growth.

1.6.2 Medical facilities and health personnel

Hospitals and dispensaries are located throughout the country, and both outpatient and inpatient treatment is provided free in all these institutions. School children are monitored for both medical and dental problems; programs of vaccinations for paratyphoid, diphtheria and typhoid are carried out among school age and pre-school age children.

Medical facilities (1974):

Hospitals: 345/one for every 38,320 persons; this includes 30 hospitals specializing in diseases such as tuberculosis, mental illness and leprosy;
Hospital beds: 38,767/one per every 345 persons;
Central dispensaries: 356.

Medical personnel:

Doctors: 2,185/one per every 6,130 persons;
Pharmacists: 1,123/one per every 11,925 persons;
Trained nurses. 5,288/one per every 2,532 persons;
Midwives: 3,586 (1972).

Traditional "Ayurveda" Medicine:

Traditional Ayurveda medicine is still widely practiced in Sri Lanka. Ayurveda hospitals are located in Colombo, Anuradhapura, Ratnapura, Kurunegala, Beliatta and Jaffna; there are also an Ayurveda Research Institute and an Ayurvedic Medical College. The Ayurvedic Medical Council holds inquiries for the purpose of registering Ayurvedic physicians, and the Ayurvedic Pharmacopeia Board handles matters concerning traditional medicines.

Cases handled in Ayurvedic facilities include skin diseases, arthritis, asthma, wounds, snake bites, fractures, rickets, diarrhoeal diseases, gynaecological diseas respiratory ailments, diabetic mellitus and hemorrhoids.

1.6.3 Health problems:

Despite improved medical care, severe health problems persist. Malnutrition is a widespread condition which was considerably aggravated in the mid-1970's when a combination of drought and economic difficulties reduced food supplies and pushed large numbers of the population to the edge of starvation.

Disease:

Medical statistics for 1974 list cases of: Typhoid and paratyphoid (8,014); baccillary dysentary (1,808); amoebic dysentary (1,808); tuberculosis (1,472); leprosy (418); whooping cough (525); acute polio (821); hepatitis (9,707); syphillis (1,421), and gonorhhea (7,852). In addition, 1973-74 saw an outbreak of cholera in the Jaffna district in the northern part of the island; 4,405 cases of cholera were reported in 1974. Malaria, only twenty cases of which were reported in 1964, has experienced a resurgence within the past several years and is now prevalent throughout the island, particularly in the dry zone, where it is said to have reached epidemic proportions; over 500,000 cases are reported each year. Filariasis, an infestation of the lymph nodes by worms transmitted by mosquitoes, has been especially common along the coastal belt, but its incidence has been decreasing in recent years. Infestations with hook worms and whip worms are also common. Schistosomiasis, one of the most common tropical diseases, is presently not found in Sri Lanka; the snail which serves as the intermediate host for the disease is not present.

1.6.4 Sanitation and Water Supply:

Public health personnel, working with local authorities, are responsible for the provision of safe water supplies, disposal of human waste and refuse disposal. The National Water Supply and Drainage Board has major responsibilities in the treatment and supply of water.

Bacteriological examination of water supplies is carried out regularly for some urban water supplies, while some urban water supplies and some rural water supplies are monitored only occasionally. Sri Lanka's goal as reported by the World Health Organization in 1973 was to make safe water available to 6.85 million persons throughout the country by 1980. Examination of water supplies is undertaken by the National Water Supply and Drainage Board; water supplies to cities such as Colombo, which draws its water from several reservoirs, and Kandy, whose source of supply is the Mahaweli Ganga, is subjected to filtration and chemical treatment.

Domestic water supply: % of housing units supplied (total units: 2,217,478)[1971]

Source	Sri Lanka	Urban	Rural	Estate
Piped water on tap				
Inside unit	4.4%	16.3%	1.1%	5.2%
Outside unit but within premises	7.9%	10.2%	1.0%	48.0%
Outside premises	7.8%	18.8%	2.7%	21.6%
Water from well:	68.8%	50.5%	81.9%	15.4%
Other sources (stream, river, tanks)	8.9%	2.0%	11.0%	7.3%
Unspecified	2.3%	2.1%	2.3%	2.5%

1.6.4 (cont)

Bathing facilities: % of housing units (total units:2,217,478)[1971]

Facility	Sri Lanka	Urban	Rural	Estate
Bathroom				
inside	4.0%	15.8%	.8%	3.7%
outside	2.9%	11.7%	.3%	5.8%
Well water	53.3%	52.6%	59.8%	11.8%
Other(river,stream, tank)	34.8%	14.4%	34.4%	74.1%
Unspecified	4.9%	5.6%	4.6%	5.7%

Toilet facilities :

There are government programs to improve facilities for the disposal of human waste in those parts of the island where they continue to be inadequate. Under the "aided scheme of latrine construction" financial assistance is provided for poor and needy households in rural areas to construct sanitary latrines. In 1973 Rs. 400,000 was allocated for this program and Rs. 224,345 actually expended. In the filaria endemic belt assistance is given to convert bucket systems to water seal latrines. Faecal pollution of streams continues to be a problem; in 1973 an outbreak of typhoid in the Badulla district was traced to faecal pollution of the stream used as a source of water supply for the affected area.

Latrine facilities: % of housing units (total units: 2,217,478) [1971]

Facility	Sri Lanka	Urban	Rural	Estate
Flush toilet				
inside unit	3.7	12.9	1.2	3.7
outside unit	3.1	9.8	1.0	4.5
Water seal	14.3	19.2	9.9	33.9
Bucket type	4.8	19.4	1.9	4.1
Pit	38.8	18.3	44.4	38.2
None	34.3	19.1	41.5	13.4
Unspecified	1.2	1.3	1.0	2.2

Sewage treatment:

Information on sewage treatment was not available. It has been reported, however, that untreated sewage, including faecal matter, enters the canal system of Colombo, the nation's largest city, which, as a consequence has a high level of organic pollution. BOD (biochemical oxygen demand) levels of 80--296 p.p.m.*have been found (1971) in some parts of the system (the British Royal Commission for Sewage Disposal recommends a level of 4 p.p.m. for rivers capable of self-purification). BOD levels are especially high during drier weather. The canal system also receives untreated wastes from industrial plants.

*parts per million

1.7 Family planning and birth control

At least some degree of government support for family planning has been manifest since the 1950's, beginning with grants to the Family Planning Association, founded in 1953. Although the government later made its medical facilities and personnel available for family planning work, it was not until 1965 that such programs were incorporated into the agenda of the Ministry of Health. Under political fire, this National Family Planning Programme, which embraced child and maternal health care as well as birth control, was considerably subdued in 1969, but it received fresh impetus with the accession to power in 1970 of the United Front government, whose five year plan 1972-1976 stated that without a high priority for family planning programs, the strain on resources imposed by the high rate of population growth would be almost intolerable.

Family planning is said to be favored particularly by the middle classes, but birth control programs are politically unpopular among some groups, especially among certain Sinhalese, who fear a possible disruption of the present racial balance.

Statistics indicate that an increasing number of women are adopting some form of birth control each year; as of December 1973 an estimated 10% (or about 190,000) of married women were practicing birth control.

2.0 ORGANIZATIONS WITH INTEREST IN ENVIRONMENT AND NATURAL RESOURCES

2.1 GOVERNMENT AGENCIES

NOTE: The top level of the administrative structure of Sri Lanka is presently formed by 31 ministries, a large number of which have responsibilities impinging on environment and natural resources. It has been typical of Sri Lanka for government departments dealing with related and connected subjects to come under the aegis of different ministries and, conversely, for a ministry to be comprised of departments whose concerns may be difficult to coordinate or reconcile. In practice, departments tend to be the major units of administration, and because departments are organized in a self-contained fashion, inclining in many cases to act virtuously autonomously, strong ministerial direction is usually necessary to coordinate even the activities of departments within a single ministry. The strength of the department unit has frequently allowed departments to function in an almost unchanged manner even when, as frequently occurs in Sri Lanka, they are shifted from one ministry to another.

Departments whose functions reach down to the local level (agricultural irrigation, health, etc.) have regional headquarters at the administrative capitals of the districts into which Sri Lanka is organized. These officials and their subordinates interact, often in a very complex fashion, with local government authorities in the performance of their duties.

2.1.1 Department of Environment

Despite the entreaties of conservationists that a department concerned specifically with environmental management be established, no such agency has yet been established. The Ministry of Planning and Economic Affairs, which disappeared in a recent cabinet shuffle, had shown a marked interest in the inclusion of environmental concerns in economic planning. The Ministry worked in collaboration with former Australian cabinet minister Jack Beal on a report on measures for preventing further deterioration of the Sri Lankan environment. This report, begun in 1977 is to enumerate initiatives to be "considered by the Government to strengthen its efforts to prevent further environmental degradation, to control pollution and to manage the natural resources of the country."*

2.1.2 Ministry of Land and Land Development:

Established in mid-1978, this Ministry brings together under one ministerial cover departments earlier under other ministries, in an apparent effort to better coordinate development activities affecting water resources, forests, and land ownership.

2.1.2.1. Forest Department, Conservator of Forests
Kew Road, Slave Island
Colombo 2

The Department is headed by the Conservator of Forests; there are Assistant Conservators for the various sections of the country.

*It is not clear to which Ministry this report is now to be submitted: the new Ministry of Finance and Planning or the Ministry of Plan Implementation.

2.1.2.1. (cont).

Its functions include: the management and protection of all natural forests of Sri Lanka; the demarcation and preservation of the Man and the Biosphere Plot; responsibility for the reforestation of degraded forests.

The Conservator chairs the State Timber Corporation, which is responsible for harvesting and sale of timber.

The Department administers the Forest Ordinance
Felling of Trees (Control) Act.

Estimated expenditures (1975):Rs. 14,678,386/ 0.19% of total budget.

2.1.2.2 Water Resources Board
P.O. Box 34
Colombo
Established: May 1966 under the Water Resources Board Act, no. 29, of 1964.

The Board is basically responsible for the formulation of national policy on control and use of water resources.
The Board's mission specifically covers: the control, regulation, development, conservation and utilization of water resources; hydropower; irrigation; forestry; pollution; soil erosion; sewage; industrial waste; salinity ; and the coordination of related projects.

Examples of the subjects on which reports and advice were provided during 1973 are:

1. The impact on farmers under the Chandrikawewa Scheme of the drawing of water from the Chandrikawewa Reservoir for the Paper Factory at Embilipitiya; the undesirability of discharging untreated factory into the Walawa Ganga;
2. Adverse effects on water resources resulting from the clearing of 300 acres of montane forest land over 5,000 feet in elevation by an apple growing association in Mahacoodugala Forest Reserve, Nuwara Eliya;
3. The inadequacy of existing controls to combat illicit felling of forest reserves and the need for adopting strong measures with deterrent penalties to prevent devastation of forests , especially those reserved for catchment basins of reservoirs.

Budget: not available.

2.1.2.3. Irrigation Department
Baudhaloka Mawatha, Colombo

The Department implements plans calling for the provision of irrigation to lands for cultivation; performs feasibility studies dealing with hydropower projects and works out details of their designs; provides irrigation facilities.

Implements the Irrigation Ordinance.'

Estimated expenditures (1975): Rs. 55,486,290/ 0.75% of total budget.

2.1.2.4 Mahaweli Development Board

Responsible for the implementation of the Mahaweli Development Project, the Board consists of four members appointed by the minister responsible for irrigation and representatives of other pertinent ministries. The Mahaweli Development Scheme is the largest combination of water and land resources development ever undertaken in Sri Lanka.

Functions: promoting, operating and coordinating irrigation, drainage and water supply schemes in the Mahaweli development area, as well as the agricultural and economic development of "special areas" designated under the scheme.

2.1.2.5 Rivers Development Board

Functions: land preparation, provision of irrigation facilities, settlement and agriculture in connection with, among other things, the Uda Walawe Multi-purpose Project.

2.1.2.6 Land Commissioner's Department

Functions: the protection and administration of State Lands and the disposition and agricultural development of State Lands to peasants and others in settlement projects; instrumental in the promotion of schemes to "colonize" the dry zone of Sri Lanka.

Estimated expenditures(1975): Rs. 30,427,650/ 0.4% of total budget.

2.1.2.7 Land Settlement Department:

Functions: administers the Land Settlement Ordinance, under which claims to state lands are settled and investigated. This function is important in the light of the trend toward encroachment on State Land, since official certification as State Land is a pre-requisite for the eviction of encroachers.

Estimated expenditures (1975): Rs. 768,933/ 0.01% of total budget.

2.1.2.8 Land Reform Commission

Administers the Land Reform Act.

2.1.2.9 Survey Department

Functions: The department conducts: topographical surveys; engineering surveys; block topographical and demarcation surveys related to settlement of land disputes; air surveys for the crops diversification project; and various development projects; town surveys relative to assessment planning and town development, including water supply and drainage schemes; land development surveys; resources surveys designating "land capability"; and land reform surveys for the Land Reform Commission.

No land can be distributed in land reform schemes or otherwise dealt with by the Government unless first surveyed and demarcated by this Department.

Estimated expenditures(1975): Rs. 41,100,985/ 0.55% of total budget.

2.1.3 Ministry of Agricultural Development and Research

This Ministry was established in mid-1978. It contains the remnants of the previous Minister of Agriculture and Lands.

2.1.3.1 Department of Agriculture , Director of Agriculture
Colombo

Functions: research; agricultural education and training; animal production and health; farms; agricultural economics; farm management; collection of farm statistics.

The Department operates several agricultural research organizations, including the Central Agricultural Research Institute at Peradeniya and agricultural research stations at several locations including Mahailluppallama and Nuwara Eliya.

The Department publishes Tropical Agriculturist, a journal of agricultural research.

Estimated expenditures(1975): Rs. 77,483,535/ .1% of total budget

2.1.3.2 Department of Agrarian Services:

The department is basically concerned with efficient use of agricultural land to promote increased production of agricultural products.

The Department administers the Agricultural Productivity Act and oversees the Agricultural Production Committees formed under this act to ensure maximal use of agricultural land; Agricultural Lands Act of 1973 and works with the Cultivation Committees formed under the Paddy Lands Act 1958, which this act superseded.

The Agrarian Research and Training Institute, Peradeniya, assists the land reform program with research on land settlement and farm planning.

2.1.4 Ministry of Fisheries
Mawatha, Galle Face,
Colombo
Established: June 1970

2.1.4.1 Department of Fisheries

Functions: administration of the Fisheries Ordinances and related Ordinances (pearl fishing, whaling and chanks ordinances); provision of welfare services to fishermen; development of fishery cooperatives; training and extension work; development of inland and brackish-water fisheries; provision of credit facilities to fishermen; fisheries research; head of Fisheries Inspectors.

Fisheries research carried out by the Fisheries Research Station, Colombo, and the Fisheries Research Station at Negombo.

Estimated expenditures for Ministry (1975): 76,013,119/ 1% of total budget

2.1.5 Minister of State [for Tourism, etc.]

This position was established in mid-1978 and very little information is available about it. Both the Department of Wildlife Conservation, which now comes under this Minister, and the Ceylon Tourist Board were previously under the now defunct Ministry of Shipping, Aviation and Tourism.

2.1.5.1 Department of Wildlife Conservation
29 Gregory's Road
Colombo 7
Established: October 1, 1949

Functions: principal agency for implementation of matters relating to the wild fauna and flora of Sri Lanka; maintenance of national parks, nature reserves and sanctuaries; protection of wild animals both in nature reserves and on the island as a whole; issuance of licenses for hunting of certain animals; responsibility for the slaughter of unwanted game. The Department is a member of the IUCN.
Implements the Fauna and Flora Protection Ordinance.

Estimated expenditures (1975): Rs. 2,403,932/ 0.03 % of total budget.

2.1.5.2 Ceylon Tourist Board

Functions: promotion of tourism; maintenance of the National Zoological Gardens of Sri Lanka at Dehiwala, about six miles from Colombo (the zoological gardens features a world-wide selection of animals; its estimated expenditures for 1975 were Rs. 2,212,350 or about 0.029% of total budget).

2.1.6 Ministry of Industries and Scientific Affairs

2.1.6.1 Geological Survey Department
48 Sri Jinaratana Road, Colombo 2

Functions: systematic geological mapping of the country and preparation of geological maps; prospecting, exploration and appraisal of mineral resources; engineering geology and groundwater investigations; administration of mining enactments; supervision of mining and collection of mining statistics; fundamental research in earth sciences and applied research on mineral raw materials for industrial purposes. Administers the Mines and Mineral Development Act 1973. The Department's activities for 1973 included water supply investigations in various parts of the country.

Publications of the Department deal, among other things, with industrial clays, gems and semi-precious stones, and groundwater.

Estimated expenditures(1975): Rs. 2,080,575/ 0.02% of total budget.

2.1.6.2 Ceylon Institute of Scientific and Industrial Research (CISIR):
362 Baudhaloka Mawata, P.O. Box 787
Colombo 7
Established: 1955 Status: state-funded but autonomous non-profit industrial research institute.

Functions: scientific and industrial research with particular respect to utilization of Sri Lanka's raw materials. The industrial microbiology section has been studying the treatment of industrial effluents.

Note: In mid-1978, the Acting Director of the CISIR denounced state-owned institutions as being the chief polluters of the environment of Sri Lanka.

2.1.6.3 National Science Council
Established: 1968

Functions: the Council was established as an executive body to co-ordinate scientific activity in Sri Lanka; to advise the Minister responsible for science on matters pertaining to the application of science and technology; and to formulate a policy for science and technology.

The research priorities of the Council are: natural resources, health, agriculture, industry and social overheads.

The Council, in collaboration with the Planning Ministry, has produced a report on environmental management in Sri Lanka, published in the Bulletin of the National Science Council of Sri Lanka in December 1976 as Environmental Problems in Sri Lanka.*

*This report could not be obtained for use in the preparation of the present report.

2.1.6.4 Atomic Energy Authority

Functions: the Authority has a wide range of functions touching most par- on atomic energy but also on energy resources in general. It has developed Atomic Energy Regulations covering the import, storage, use and handling of radioactive materials and all forms of ionizing radiation including X-rays, as well as the use of irradiating apparatus.

The Hydrology Committee has formulated an Isotope Hydrology Programme, which includes studies on groundwater estimation and sediment transport.

The Committee on Energy, has representatives from the Ceylon Electricity Board, the Faculties of Engineering, University of Sri Lanka (Peradeniya and Katubedde Campuses); the Ministry of Plan Implementation; the Department of Irrigation; and the Radioisotope Center, Colombo Campus, University of Sri Lanka. The Committee is preparing a report covering: present and future demand for power in S.L.; a comprehensive survey of the hydropower potential; suggestions for bridging possible energy gaps; and alternative sources of energy to back up hydroelectric power, including the feasibility of using nuclear power.

2.1.6.5 State Corporations: most heavy industry in Sri Lanka, some of which is reported to be among the heaviest polluters of Sri Lanka's environment, comes under the control of the Ministry of Industry and Scientific Affairs:

-National Textile Corporation
-Ceylon Oils and Fats Corporation
-Ceylon Ceramics Corporation
-Paranthan Chemicals Corporation
-Jute Industries Corporation
-National Salt Corporation
-Ceylon Mineral Sands Corporation
-National Paper Corporation
-Ceylon Cement Corporation
-Ceylon Plywood Corporation
-Ceylon Leather Products Corporation
-Ceylon Tyre Corporation
-Ceylon State Hardware Corporation
-Sri Lanka State Flour Milling Corporation
-State Fertilizer Manufacturing Corporation
-Ceylon Petroleum Corporation.

2.1.6.6 Department of Meterology
383 Bullers Rd., Colombo 7

Estimated expenditures (1975): Rs. 3,027,545/ 0.04% of total budget.

2.1.6.7 Bureau of Ceylon Standards

Established in 1966, the Bureau prepares standard specifications and codes of practice, administers compulsory standards, and works on the adoption of the metric system. There is no indication that it has worked on environmental standards for industrial operations.

2.1.7 Ministry of Plantation Industries

This ministry deals with matters pertaining to conduct and development of Sri Lanka's plantation industries: tea, rubber, coconut and minor export crops such as cinnamon, cashew, mulberry and silk. Since the government takeover of large tea and rubber estates, completed in 1975, this ministry has become responsible for their administration as well as for the agricultural diversification of tea and rubber lands.

Several of the departments or organizations subordinate to the Minsitry are concerned with research which has implications for the more rational exploitation of natural resources. The Tea Research Institute, for example, was reported in 1977 to have established the possibility of usefully recycling waste tea leaves from instant tea factories for use in cattle fodder and for extracting the high protein content of these leaves for possible use as a protein supplement.

The organizations subordinate to the Ministry are:

-Tea Research Institute of Ceylon
-Rubber Research Institute of Ceylon
-Coconut Research Institute of Ceylon
-Sri Lanka Tea Board
-Rubber Control Department
-Coconut Cultivation Board
-Coconut Marketing Board
-Sri Lanka State Plantations Corporation.

Estimated expenditures (1975): Rs. 191,451,100/ 2.6% of total budget.

2.1.8 Ministry of Local Government, Housing and Construction

This Ministry has general supervision of the some 600 local authorities on the village, town, urban and municipal level; these authorities, whose activities are regulated by a group of central government local-authority ordinances and who are empowered to issue local bylaws, are responsible for matters such as water supply, sewerage, public health and the control of nuisances.

2.1.8.1 National Water Supply and Drainage Board
P.O. Box 14, Mt. Lavinia
Established:1974
Functions: the development, provision, operation and control of efficient, and coordinated water supply and sewerage systems; the Board is authorized to assume the water supply and sewerage functions of local authorities, either on their own request or by a compulsory transfer order.
The Board is empowered to purchase and sell water and has exclusive control of water supply in the areas of its authority.
The daily business of the Board is under a General Manager.

2.1.8.2 Department of Town and Country Planning

2.1.8.3 Department of Local Government

2.1.9. Ministry of Health
Box 500, Secretariat Bldg.
Galle Face, Colombo 1

The Ministry of Health has control over the planning and financing of Public Health and Medical Services in Sri Lanka. It works in close cooperation with local authorities.

2.1.9.1 Department of Health

Functions: Administers the national health services; conducts a program of family health services and education, including birth control clinics; public health division is responsible, in active cooperation with local authorities and voluntary organizations, for environmental sanitation, including measures taken for disposal of human waste, provision of safe water supplies, refuse disposal, housing, food and food sanitation.

The Department conducts specialized campaigns for the control of: tuberculosis, malaria, filariasis, leprosy and venereal diseases.

Estimated expenditures (1975): Rs. 331,171,487/ 4.5% of total budget.

2.1.9.2 Department of Ayurveda

Functions: Administers hospitals and programs utilizing traditional Sri Lankan medical practices.

Estimated expenditures (1975): Rs. 11,306,655/0.14% of total budget.

2.2 NON-GOVERNMENT ORGANIZATIONS INVOLVED IN ENVIRONMENT AND NATURAL RESOURCES

2.2.1 Wildlife and Nature Protection Society

Chaitiya Road, Marine Drive, Fort, Colombo 1
Established: 1894
Membership: about 3,000 members

Purpose: to assist in protection of nature in all its forms: landscape, soil, water, flora, fauna, marine habitats, and to conserve it for future generations.

Activities: The Wildlife and Nature Protection Society has been the most active force in Sri Lanka for the development of programs aimed at wildlife conservation and the creations of a favorable public opinion for wildlife conservation. A former Director has said that "practically all major and minor conservation achievements in this area during the current century have their origin in our Society."

In promoting its aims, the Society works closely with not only the Department of Wildlife Conservation, the existence of which may be largely attributed to pressure by the Society for the creation of such a government department, but also with other ministries dealing with natural resources development. The advice of the Society was solicited by the Ministry of Irrigation, Power and Highways regarding the consequence for wildlife and forest reserves of the Heda Oya Development Scheme; comments and suggestions of the Society were subsequently incorporated into revisions of the plans.

The Society publishes Loris, a journal covering not only developments affecting the wildlife resources of Sri Lanka but also environmental deterioration and the development and enforcement of legislation dealing with widlife and natural resources.

2.2.2 The Soil Association of Ceylon

Activities: The Association has assisted the government of Sri Lanka in developing more environmentally-sound agriculture by improving traditional practices abandoned after the adoption of important pesticides and fertilizers.

2.2.3 The Soil Conservation Society of Ceylon

47/1 Flower Road, Colombo 7

Activities: Among other things, the Society presents the Samaraweera Conservation Award of the year for soil conservation. In 1971 this award went to the Wildlife and Nature Protection Society.

2.2.4 Ceylon Bird Club and Ceylon Section, International Council for Bird Preservation

P.O. Box 11, Colombo

Activities: Publishes Bird Notes, a monthly.

2.2.5 Sri Lankan Environmental Federation

Established: 1977

Co-sponsored by the All Ceylon Public Transport Travellers' Federation and the Sri Lankan Consumers Users' Federation, the organization's goals are:

1) to acquire a knowledge of the psychological and environmental factors influencing the family and community;
2) to identify significant environmental pollution directly affecting the health of the nation and visitors to Sri Lanka.

2.2.6 Ceylon Environmental Society
7-13th Lane, Colombo 3

[no details available]

2.2.7 Institute of Social Research
Colombo

The Institute, about which no further details were available, sent a representative as consultant to the SCOPE/UNEP Symposium on Environmental Sciences in Developing Countries, held in Nairobi in 1974.

2.2.8 Sri Lankan National Committee for the Man and Biosphere (MAB) Programme.

(See Annex 1)

2.3. ENVIRONMENTAL RESEARCH AND EDUCATION

2.3.1 Education

Courses in biology at general degree levels are given at four campuses of the University of Sri Lanka, and special courses in botany and zoology, with ecology, are offered at two campuses. As of 1975, no integrated courses in environmental studies were available, but it was proposed to start such a course in the near future. *

2.3.2 Research

2.3.2.1 University of Sri Lanka--Vidyalankara Campus
Kelaniya, Sri Lanka

Department of Zoology: studies on the effects of pollutants on the behavior of fish and other invertebrates; the distribution of fauna in polluted environments.

2.3.2.2 Research Institutes under Government Agencies

-Agrarian Research and Training Institute (see 2.1.3.2)

-Central Agricultural Research Institute (see 2.2.3.1)

-Ceylon Institute of Scientific and Industrial Research (see 2.1.6.2)

-Coconut Research Institute, Bandirippuwa Estate, Lunuwila (see 5.2.1.2)

-Fisheries Research Station (see 2.1.4)

-Geological Survey Department (see 2.1.6.1)

-National Science Council of Sri Lanka (see 2.1.6.3)

-Rubber Research Institute, Agalawatta and Colombo (see 5.2.1.2)

-Tea Research Institute, St. Coombs, Talawakelle (see 5.2.1.2)

-Veterinary Research Institute, Gannoruwa, Peradeniya:
  -concerned with research and investigations into health and production problems of livestock and poultry.

* The undergraduate course in Architecture at the University of Sri Lanka is reported to offer a B.S. in Built Environment, a curriculum which includes a very strong element of training in environmental studies. A post-graduate training curriculum in Town & Country Planning was scheduled to commence at the Katubedde Campus of the University in 1974. The overall training thus provided is designed to make the graduate suited for responsibilities involving the management and control of environmental issues in the context of overall development plans.

3. OVERVIEW OF MAJOR ENVIRONMENTAL AND RESOURCES LEGISLATION AND MAJOR AGENCIES RESPONSIBLE FOR ITS IMPLEMENTATION

Coverage: P=protection; R=establishment of reserves; O=ownership; U=utilization; C=control; M=Marketing

RESOURCE/AREA OF CONCERN	Legislation	Coverage	Implementing Agency: Department, Authority, etc.	Ministry	sub. section of report
Renewable Resources					
WATER					
resources	Water Resources Board Act, no. 29, 1964	P/U	Water Resources Board	Ministry of Land and Land Development	3.1.1.1
supply	National Water Supply & Drainage Board Law, no. 2 of 1974	U/P	National Water Supply and Drainage Board	Ministry of Local Government, Housing, and Construction	3.1.1.3
	Colombo Municipal Council Waterworks Ord., Chapter 208	U/P	Colombo Municipal Council		3.1.1.4
	Local government laws	U/P	Municipal, Urban, Town and Village Councils		3.1.1.5
irrigation	Irrigation Ordinance, Chapter 453	U/P	Irrigation Department	Ministry of Land and Land Development	3.1.1.2
pollution	Nuisances Ordinance, Chapter 230	P	Boards of Health, local councils	Ministry of Health	
FORESTS	Forest Ordinance, Chapter 451	P/U/O/R	Forest Department	Ministry of Land and Land Development	3.1.2.1
	Felling of Trees(Control)Act, Chapt. 452	P/U			3.1.2.1
WILDLIFE	Fauna and Flora Protection Ordinance, Chapter 469	P/R/U	Department of Wildlife Conservation	Minister of State	3.1.3.1
FISH AND MARINE LIFE	Fisheries Ordinance Chapter 212	U/P	Fisheries Division	Ministry of Fisheries	3.1.4.1
	Pearl Fisheries Ordinance, Chapter 214	U/P			3.1.4.2
	Whaling Ordinance, Chapter 215	U/P			3.1.4.3
	Chank Fisheries Ordinance, Chapter 213	U/P			3.1.4.4
AIR	Nuisances Ordinance (offensive smells) Chapter 230	P	Boards of Health, local councils	Ministry of Health	3.1.5.1
Non-Renewable Resources					
MINERALS	Mines and Minerals Development Act, 1973	U/O	Geological Survey Department	Ministry of Industries and Scientific Affairs	3.2.1.1
SOIL	Soil Conservation Act, Chapter 450	P	Department of Agriculture	Ministry of Agricultural Development and Research	3.2.2.1
COASTS AND BEACHES	Crown Lands Ordinance, Chapter 254	P/O/U	Land Commissioner's Dept.	Ministry of Land and Land Development	3.3.1
Land Use and Agriculture	Crown Lands Ordinance Chapt.454	P/U/O/R	Land Commissioner's Dept.	Ministry of Land and Land Development	3.3.1.
AG. LAND	Land Reform Law, no.1 of 1972	O	Land Reform Commission		3.3.2.1
	Agricultural Productivity Law, no. 2 of 1972	U/O	Agrarian Services Dept.	Ministry of Agricultural Development and Research	3.3.2.2
	Land Development Ordinance, Chapter 464	O/U	Land Commissioner's Dept.	Ministry of Land and Land Development	3.3.2.3
	Agricultural Lands Law, no. 42 of 1973	O/U	Agrarian Services Department	Ministry of Agricultural Development and Research	3.3.2.4
PESTICIDES	Plant Protection Ordinance, Chapt. 447	U	Director of Agriculture	Ministry of Agricultural Development and Research	3.3.3.1
FERTILIZERS	Fertilizers Ordinance, Chapter 445	P/M	Director of Agriculture	Ministry of Agricultural Development and Research	3.3.4.1

3.0 LEGISLATION DEALING WITH ENVIRONMENT AND NATURAL RESOURCES

3.1 Renewable Resources

3.1.1 Water Resources (see also 3.3.1.1)

3.1.1.1. Water Resources Board Act, no. 29, of 1964

Provisions: provides for a central organization, the Water Resources Board, to advise the Minister [of Land and Land Development] on all matters relating to water resources of the island and utilization of such resources to provide for the proper distribution of water resources to meet the claims of agriculture, domestic consumption, hydropower, etc.

Areas for which the Board's advise may be required by the Minister include:
- -promotion, construction, operation and maintenance of schemes of irrigation, drainage, flood control and hydraulic power;
- --the promotion of afforestation;
- -the control of soil erosion;
- -the prevention of the pollution of rivers, streams, and other water courses.

Areas for which the Board may be asked to formulate national policy include:
- -the multi-purpose development and use of water resources;
- -the short-term and long-term provision fo water resources for domestic supplies, industrial supplies, hydraulic power, hydro-electric power, irrigation, reclamation of land, flood control, navigation, development of fisheries, protection of wild life, and control of soil erosion;
- -the disposal of sewage and industrial wastes;
- -afforestation;
- -the control of salinity.

The law in effect provides the mechanism for the establishment of an integrated national water policy and for the protection of water resources without, however, giving that policy the force of law. The Minister is under no obligation to solicit the advice of the Board on matters within its purview. Article 16 provides, however, that: "The Board may make rules for the purpose of carrying out and giving effect to the principles and provisions of this Act and for all matters connected with the functions and duties of the Board."

Implementation: By the Water Resources Board, which is now under the aegis of the Minister of Land and Land Development.

3.1.1.2 Irrigation Ordinance , Chapter 453 of Statutes [November 1, 1946]

Provisions: provides for the establishment of rates for irrigation water supplied from major irrigation works; provides for the issuance of regulations pertaining to the protection of irrigation works and the conservation of irrigation water.

Implementation: The Irrigation Department of the Ministry of Land and Land Development.

3.1.1.3 National Water Supply and Drainage Board Law, no. 2, of 1974

Provisions: Establishes the National Water Supply and Drainage Board, with powers to develop, provide, operate and control an efficient and coordinated water supply and to distribute water for public, domestic or industrial purposes; and to develop and control an efficient and coordinated sewerage system.
The Board is authorized to assume the water supply and sewerage functions of local authorities either at the request of those authorities or by a compulsory order.
Provides for the protection of waters belonging to the Board:
- -penalties for the fouling of water, throwing objects into water, allowing drains or sewers to flow into water belonging to the Board;
- -penalties for wasting water;
- -penalties for discharging, without the sanction in writing of the Board, "any sullage, foul liquids or faecal matter into any drain or other place which is not suitable or intended to receive such discharge or into any land or place in such manner as to cause a nuisance or willfully discharge ...any rain water into any sewer which is intended to carry foul water."

Implementation: The National Water Supply and Drainage Board under the aegis of the Ministry of Local Government, Housing and Construction.

3.1.1.4 Colombo Municipal Council Waterworks Ordinance, Chapter 208 [January 2, 1908]

Provisions: provides for water supply for Colombo and, in a manner similar to the National Water Supply and Drainage Board Law, provides for penalties for pollution of water intended for public water supply.

Implementation: Colombo Municipal Council under the ultimate aegis of the Ministry of Local Government, Housing and Construction.

3.1.1.5 Local government laws and ordinances : Laws establishing and stating the functions of municipal, urban, town and village councils are found in Chapters 252, 255, 256 and 257, respectively, of the Legislative Enactments of Ceylon.

Provisions: Local authorities laws assign to local authorities responsibilities in the area of water supply, public health, the control of nuisances, etc. With regard to water supply, such authorities are empowered to prevent "pollution of streams which flow into reservoirs or waterworks."

Implementation: Local authorities under the ultimate aegis of the Ministry of Local Government, Housing and Construction.

3.1.2. Forests

3.1.2.1 Forest Ordinance: An Ordinance to Consolidate and Amend the Law Relating to Forests and the Felling and Transport of Timber. Chapter 451. [January 2, 1908]

Provisions:-provides for the establishment of forest reserves on which certain activities, such as felling of trees, clearing of land, stripping of bark from trees, etc. may be carried out only with a permit;
-provides for the establishment of village forests for the benefit of a village community or a group of village communities;
-provides for the restriction of activities on other forest lands without permit or except under rules made by the Minister;
-certain trees are listed as reserved trees and land on which they stand may not be exploited in certain ways except under regulations;
-government land (definition): all forest, waste, land used for shifting agriculture, uncultivated or unoccupied land unless proof of ownership can be produced;
-penalties detailed.

Implementation: Forest Department of the Ministry of Land and Land Development. The Forest Conservator (head of the Forest Department) is the head of a hierarchy of implementing officers which include Assistant Forest Conservators and Forest Wardens on the lower levels. Police officers are responsible for apprehending violators.

3.1.2.2 Felling of Trees (Control) Act, Chapter 452 [March 15, 1951]

Provisions: Empowers the Minister [of Land and Land Development] to issue Orders providing for the prohibition, regulation or control of the felling of specific varieties of trees.

Implementation: same as for Forest Ordinance (3.1.2.1)

3.1.2.3 Enforcement of forest legislation:

Forest legislation has been difficult to enforce because of the lack of personnel necessary to prevent the damage inflicted by squatters, encroachers and illegal woodcutters. Furthermore, it is reported that the Forest Department itself has indulged in the felling of trees in restricted areas.

3.1.3. Wildlife

3.1.3.1 Fauna and Flora Protection Ordinance, Chapter 469 [March 1, 1938]

Provisions:-provides for the establishment of national reserves and sanctuaries (with protection generally more stringent in reserves), boundaries of which may not be changed without parliamentary consent;
-reserves: hunting, killing and wounding of wild animals prohibited as well as acts tending to destroy or damage their habitats such as clearing of land or destruction of vegetation; no destruction of reptile of bird eggs; no removal or plants;
-sanctuaries: no hunting or carrying of firearms without a permit;

-protection outside of reserves and sanctuaries: absolute for elephants except for certain stated exceptions (all elephants killed become the property of the government);
-close season: no hunting, killing or taking or deer or fowl;
-open season: license required for capturing buffalo or hunting, killing or taking of deer or fowl;
-protected species (see Appendix A for a complete listing)
-birds: except for 40 listed species, all are protected (about 340 species);
-mammals and reptiles:-27 species absolutely protected during both closed and open season;
-4 species may not be shot without a special license at any time of the year;
-plants:-8 absolutely protected species of herbacious plants;
-4 protected trees.

-export of animals: prohibits export of wild birds, beast and reptiles without a permit;

-marketing:prohibits sale or purchase of animals or parts thereof;

-special penalties listed for offences against elephants in nature reserves or sanctuaries: Rs. 3,000 and/or up to 3 years in prison;

-prescribed animals cannot be killed to protect crops.

Implementation: Department of Wildlife Conservation, now under a Minister of State. The Director of Wildlife Conservation heads the Department. Police and other local authorities are responsible for the apprehension of violators.

3.1.4 Fisheries

3.1.4.1. Fisheries Ordinance , Chapter 212 [June 1, 1941]

Provisions:-covers both inland fisheries and coastal fisheries;
-licensing required for fishing for profit by non-Ceylonese or Ceylonese employed by foreign interests;
-prohibits the use of poisonous, explosive or stupefying substances for the purposes of catching fish;
-provides for seasonal fishing restrictions;
-provides for the inspection of fishing boats by Inspectors;
-provides for the protection of certain fish, which may not, without a permit, be exported as live fish, egg, roe or spawn.

Implementation: Director of Fisheries of the Fisheries Division of the Ministry of Fisheries.

3.1.4.2 Pearl Fisheries Ordinance , Chapter 214 [February 12, 1925]

Provisions:-vests the exclusive right of fishing and taking pearl oysters in Sri Lankan waters in the State;
-requires a license for pearl fishing;
-the Ministry of Fisheries declares dates for pearl fishing.

Implementation: Director of Fisheries of the Fisheries Division of the Ministry of Fisheries, supported by customs officers, police officers and peace officers acting as pearl fishery guards and by the Inspector of Pearl Banks.

3.1.4.3 Whaling Ordinance, Chapter 215 [July 4, 1936]

Provisions: -requires licensing for whaling operations;
-provides protection for certain categories of whales (right whales, immature whales, females accompanied by a calf).

Implementation: Director of Fisheries of the Fisheries Division of the Ministry of Fisheries; the Marine Biologist; the Whale Fishery Inspector.

3.1.4.4 Chank Fishery Ordinance , Chapter 213 [March 14, 1953]

Provisions:-requires licenses for chank fishing, both for vessels and divers;
-limits licenses to Sri Lankan citizens or those holding valid residency permits.
-Article 10 states: "Regulations may be made for the prohibition or the regulation, supervision and control, of the export and taking of beche-de-mer, coral or shells, whether generally or in any specified area."

Implementation:Director of Fisheries under the Ministry of Fisheries.

3.1.5 Air and the Atmosphere

Note: No legislation clearly provides for the limitation of air pollution, although it is possible that the Nuisances Ordinance could provide the legal basis for restriction of polluting installations.

3.1.5.1 Nuisances Ordinance, Chapter 230 [January 1, 1863]

Provisions: Article 5 requires a license for "any manufactory or place of business from which offensive or unwholesome smells arise; Article 2(10) provides for fines for persons operating such businesses without a license.

Implementation: Boards of Health, Urban or Town Councils, under the ultimate aegis of the Ministry of Health.

3.2 NON-RENEWABLE RESOURCES

3.2.1 Mineral Resources

3.2.1.1 Mines and Minerals Law, no. 4, 1973

Provisions: A law to provide for the vesting of the absolute ownership of certain minerals in the Republic, to regulate the mining of, prospecting for, collection, processing, sale and export of minerals; to provide for the health, safety and welfare of workers in mines; to enable the compulsory acquisition or requisition of immovable or movable property for any Corporation established to develop the mineral industry; and to make provision for other matters connected with or incidental to the matters aforesaid. [This description is simply the full title of the law; no further details were available.]

Implementation: Geological Survey Department of the Ministry of Industries and Scientific Affairs.

3.2.2 Soil

3.2.2.1 Soil Conservation Act, Chapter 450 [August 13, 1951]

Provisions: -provides for surveys and investigations as to the extent of soil erosion;
-provides for the issuance of regulations covering land use in erodible areas, including restriction of the use of land for agricultural or pastoral purposes;
-provides for the prohibition or control of the exploitation of forest and grassland resources in the interests of soil conservation;
-provides for regulations controlling grazing or agricultural practices conducive to soil erosion;
-permits the Director of Agriculture to step in and take action if a landowner fails to do so.

Implementation: The Director of Agriculture under the Ministry of Agricultural Development and Research.

Note: As of 1976, no regulations of implementing legislation had been issued under this Act, which in effect means that the law has never been enforced.

3.2.3 Coasts and Beaches (see 3.3.1.1-Crown Lands Ordinance)

3.2.3.1 Proposed law: Bill to consolidate the law relating to coast conservation and the administration, control and management of the coastal zone.

Provisions: Proposes the establishment of the position of Director of Coast Conservation with the power, among other things, to implement measures for coastal conservation and the control of sea erosion in terms of national policies; provides for prohibitions on the excavation or removal of sand, stone, coral, etc. from the coastal zone.

Implementation: A proposed Director of Coast Conservation; not certain under which ministry.

3.3 Land Use and Agriculture

3.3.1 State Lands

3.3.1.1 Crown Lands Ordinance, Chapter 254 (Sept. 1, 1949)

Provisions:-deals with state lands, prescribing how they may be sold, granted, and occupied or exploited for mineral or other wealth;
-state lands may be declared as reservations, among other things, for:
  -the protection of the source, course or bed of any public stream;
  -the protection of springs, tanks or reservoirs;
  -the protection of the foreshore;
  -the prevention of soil erosion;
  -the preservation of water supplies;

-foreshores:-the control, custody and management of foreshores is vested in the state (foreshore is defined as the shore of the island between the high and low water marks);
-regulations may be issued to limit public use of the foreshore;
-any part of the foreshore may be declared as an area from which no sand, stone, coral or other substance is to be removed without a permit;
-the Government Agent may prohibit the removal of sand, stone or coral, etc. from any part of the foreshore if such removal is judged detrimental;

-waters of public lakes and streams (including public irrigation tanks and reservoirs):
-vests the right for the use of such water in the state and enables the state and its officers to take measures to provide for the conservation and supply of such waters, to provide for its more equal distribution and beneficial use, to protect it from pollution, and to prevent the unauthorized obstruction of public streams;
-public waters may not be diverted without a permit.

Implementation: Land Commissioner's Department of the Ministry of Land and Land Development.

3.3.2 Agricultural Land

3.3.2.1 Land Reform Law, no. 1 of 1972

Provisions:-creates the Land Reform Commission;
-imposes a ceiling on agricultural land owned by individuals* and vests the excess land in the Land Reform Commission for redistribution to peasant farmers or state corporations;
-this is the legislation under which the large tea and rubber estates have been taken over by government of Sri Lanka.

Implementation: Land Reform Commission under the Ministry of Land and Land Development.

3.3.2.2 Agricultural Productivity Act, no. 2, of 1972

Provisions: -defines the objectives and duties incumbent on owners of agricultural land;
-gives the State considerable power to confiscate land which failes to conform to government production norms;
-defines the powers of Agricultural Productivity Councils as a means of achieving production regarding land which comes into the hands of the State.

3.3.2.3 Land Development Ordinance , Chapter 464 [October 15, 1935]

Provisions: under this and under the subsequent Land Development (Amendment Act) 16 of 1969 and the Sale of State Lands (Special Provisions) Law No. 43 of 1973 provision is made for the alienation of State Lands to peasants and middle class allottees in Settlement Projects and for agricultural development of these projects. This is the legislation under which much of the effort to "colonize" the agriculturally underdeveloped dry zone of Sri Lanka has taken place.

Implementation:Land Commissioner's Department of the Ministry of Land and Land Development.

3.3.2.4 Agricultural Lands Law no. 42 of 1973

Provisions: concerned chiefly with the development of rice (paddy) lands, this law is designed to provide for the security of tenant cultivators of paddy lands; to specify the rent payable by tenant cultivators to landlords; and to make provisions for the establishment of Cultivation Committees, which are concerned, among other things, with the supply of agricultural equipment, implements and machinery for paddy cultivation.

Implementation : Agrarian Services Department of the Ministry of Agricultural Development and Research.

*25 acres for paddy (rice) lands, 50 acres for plantation crops.

3.3.3 Plant Protection and Pesticide Use

3.3.3.1 Plant Protection Ordinance, Chapter 447 [June 27, 1924]

Provisions:-provides for the issuance of Ministerial regulations for prohibiting the importation of certain plants, for quarantining other plants, and for the spraying or other treatment or any plants within Sri Lanka affected with any pest or disease;
-empowers the Director of Agriculture to prescribe the manner in which weeds or plants attacked by a declared pest or disease are to be treated; owner or occupier of land is obliged to conform;

Note: There are no provisions which directly apply to the control of pesticides or their use; as of March 1976 none of the implementing legislation under this Ordinance had contained such regulations.

Implementation: The Director of Agriculture under the Ministry of Agricultural Development and Research.

3.3.4 Fertilizers

3.3.4.1 Fertilizers Ordinance, Chapter 445 [January 1, 1902]

Provisions: regulates the sale of fertilizers and provides against the adulteration of fertilizers.

Implementation: Director of Agriculture under the Ministry of Agricultural Development and Research.

4.0 RESOURCES

4.1 WATER RESOURCES

4.1.1 RAINFALL AND CLIMATE

Sri Lanka has a relatively uniform tropical climate with generally high temperature and humidity levels. Mean temperatures range from 80 to 82°F with little seasonal variation in lower lying areas, gradually decreasing in higher elevations in the central highlands; in Nuwara Eliya (6,200 ft.), where the mean average temperature is 60° F, ground frost occurs on a few days of the year in January and February.

Relative humidity is generally high throughout the country, varying generally from about 70-75% during the day to about 90-95% at night; in the driest areas, however, daytime humidity may drop as low as about 60%.

The pattern of rainfall is generally determined by Sri Lanka's tropical location and by the monsoon winds to which it is exposed, while the central highland region (see relief map) is the principal factor in influencing rainfall variations within the country, dividing Sri Lanka into the wet zone of the southwest and the dry zone of the eastern and northern parts of the country.* The monsoon winds, blowing from the southwest from late May to late September and from the northeast from December to February bring the heaviest periods of rainfall to the southwest and northeast areas of Sri Lanka respectively. Two fairly distinct intermonsoonal periods occur: the first (April-May) is characterized by almost daily thunderstorms, especially in the southwest, the second (October-November) by tropical cyclones, which bring heavy, often extremely intense rains to most parts of the island.

The wet zone is favored by rainfall well distributed through the year, seldom falling below 5 inches per month; here rainfall is reliable in its occurrence and is generally effective in maintaining the moisture level of the surface soil above the wilting point. This zone covers about 25% of the land mass of Sri Lanka.

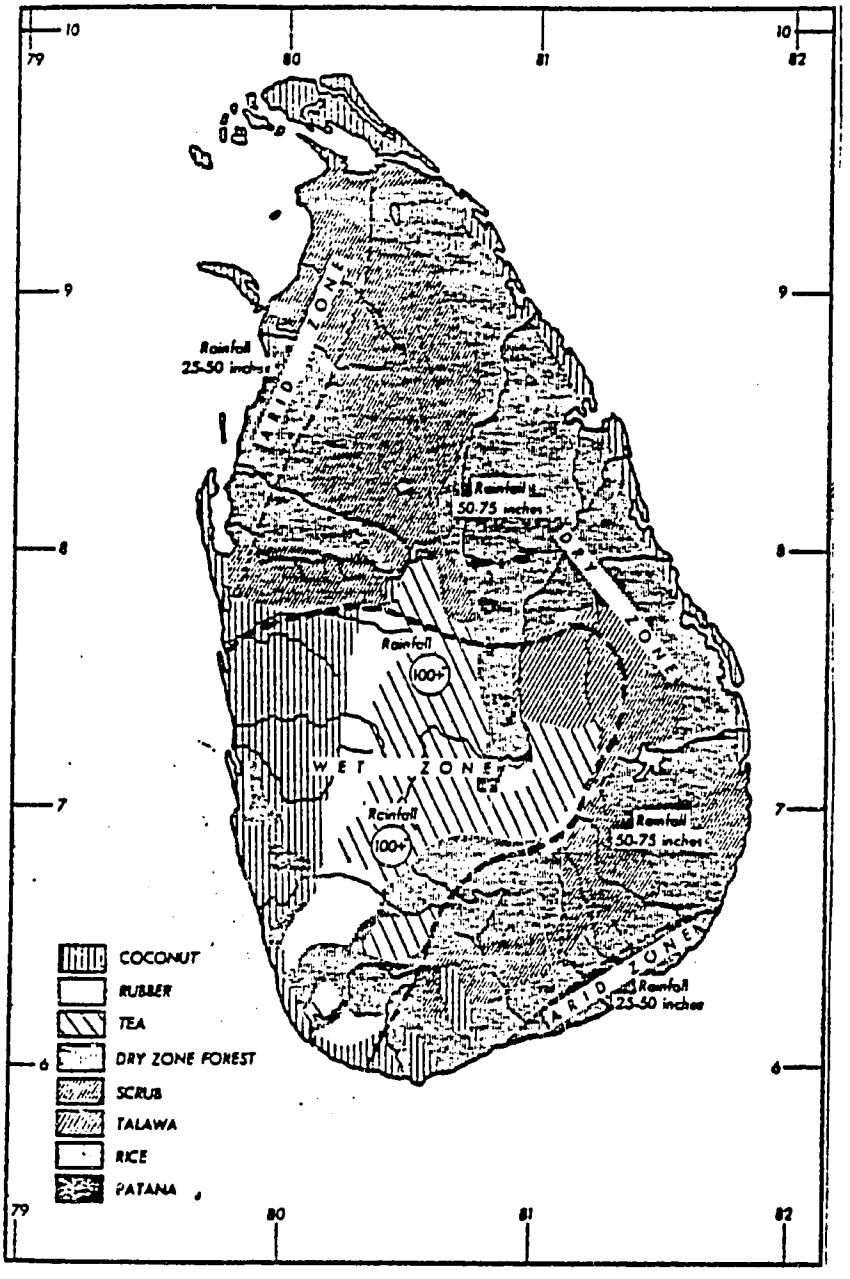
The dry zone experiences a wet season, generally running from October to January, and a dry season covering the rest of the year. This zone generally receives less than 75 inches of rain per year, although in the areas of lowest rainfall (the southeastern and norwestern parts of the coastal plains—sometimes identified as the "Arid Zone"), mean annual rainfall is below 50 inches, and drought prevails during most of the year. The dry zone covers about 75% of the land mass of Sri Lanka.

In the wet zone and are bordering it, the frequency and intensity of heavy storms varies with altitude, higher elevations (those of 3,000 feet or more) tend to have longer and gentler rains, while lower and intermediate elevations are exposed to intense rainstorms with a high erosion potential.

RECENT RAINFALL PATTERNS:

Severe droughts have occurred in recent years with the failure of the monsoon rains. This has caused lowered agricultural production and necessitated water rationing in urban areas such as Colombo. Localized droughts occurring during the intermonsoonal periods have been attributed, among other things, to deforestation.

*Without questioning the validity of the basic wet zone-dry zone classification, some sources also identify an intermediate zone (between the wet and dry zones) and an arid zone.



Rainfall and Vegetation Zones Source; Nyrop (1971)

RAINFALL: Averages from 1931-1960 (in inches)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
WET ZONE													
Colombo	3.5	3.8	4.7	10.4	14.1	8.5	5.6	4.9	6.1	14.1	12.9	7.0	95.8
Watawala	4.5	4.4	7.9	11.8	28.1	36.4	28.5	26.2	20.6	25.8	14.6	8.7	218.0
Ratnapura	6.0	7.2	9.8	13.6	19.8	18.5	12.3	13.1	12.6	19.9	14.2	8.6	155.5
DRY ZONE													
Badulla	9.2	4.8	4.4	7.9	4.6	1.0	2.0	3.8	3.7	8.6	10.7	11.0	71.6
Hambantota	4.0	2.3	2.6	4.4	4.8	2.2	1.7	1.7	1.8	5.0	7.5	4.8	43.0
Mannar	3.5	1.4	1.8	3.5	2.0	.2	.3	.6	1.0	6.7	9.7	9.8	38.7
Trincomalee	8.4	3.8	1.9	3.1	2.7	.8	2.2	4.1	3.6	9.4	14.2	15.0	69.1

4.1.1.2 Rainwater utilization

In the wet zone, where rainfall is plentiful and regular, in some areas in fact in excess of actual needs, cultivation of tea, rubber and coconuts, as well as of other minor crops, takes place under rainfall conditions.

In the dry zone shifting agriculture (chena), including some rice production, takes place strictly with reliance on the rains, but most agriculture relies on tanks (reservoirs) of various sizes, which accumulate runoff from small streams and depend only to a small extent on direct collection of rainwater.

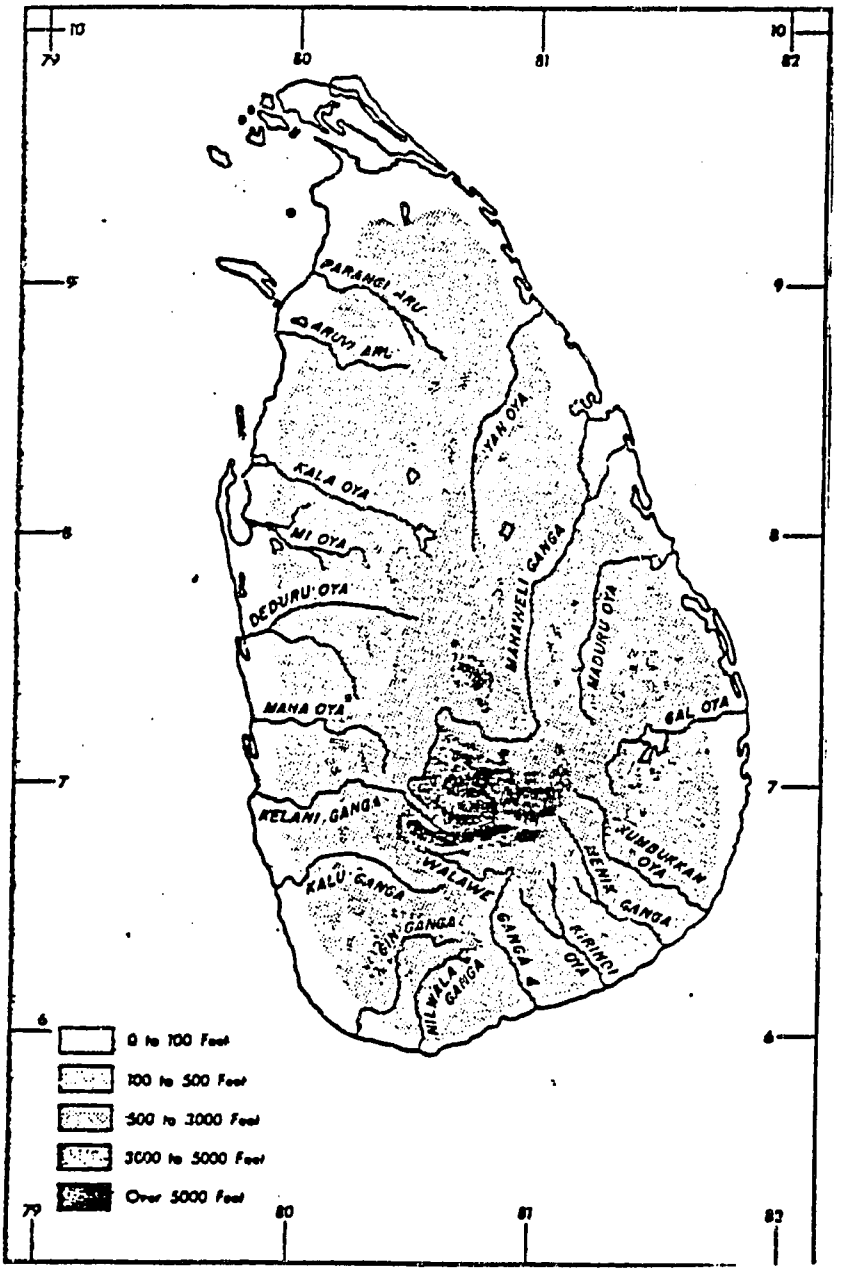
4.1.2 SURFACE WATERS

4.1.2.1 Rivers

Although there are over a hundred rivers in Sri Lanka, many of these are only small or seasonal streams. Twelve rivers account for over 75% of the total river discharge, and about 50% of these flow through the approximately one-fourth of the country which is the wet zone. Of about 89 million acre feet of rainfall per year, the average annual run-off in rivers, according to a 1969 estimate, was about 41.6 million acre feet.

All of Sri Lanka's rivers originate in the central highlands (see map), and with the exception of the Mahaweli Ganga flow directly to the Indian Ocean, often forming spectacular waterfalls as the drop to lower elevations. Most rivers have short courses: the Mahaweli Ganga, with a length of 206 miles, is the longest; the remaining major rivers are no more than 62-97 miles long. These rivers effectively drain the highlands of the country, but in the lowlands they tend to spread out on the plains, often blocking land development and communications.

Major Rivers of Sri Lanka Source: Nyrop (1971)



4.1.2.2 River utilization

Irrigation and hydropower are the two chief uses of rivers in Sri Lanka. Most of the rivers are too wild in the highlands and too shallow in the lowlands for effective navigation; only about 249 miles or river are navigable. A canal system, now largely in disrepair, has provided a water route to the interior of the country.

4.1.2.2.1 Hydroelectric power

The overall hydro-power potential of Sri Lanka, taking account of projected hydropower schemes, is estimated to be around 700-800 megawatts. The actual capacity of hydropower plants in 1975 was about 192 megawatts, with 100 megawatts expected to be added with the completion of the Laksapana hydro-power plant. In 1975, hydropower accounted for about 73% of electric power produced.

Problems: The major difficulty with hydroelectric schemes is the wide fluctuation in the flow of local rivers, which creates problems in equalizing power outputs. This necessitates large-storage reservoirs demanding large capital outlays to harness rivers for power generation.

4.1.2.2.2 Irrigation (see 5.?.2.1.2)

4.1.2.2.3 Other uses of river water:

Rivers, streams and tanks all serve as fishing grounds.

Rivers, streams and tanks continue to serve as a source of water for domestic uses and for bathing, principally in the rural and estate sector.

4.1.2.2 Lakes

There are few natural lakes; there are, however, a large number of man-made reservoirs, called tanks, formed mainly by damming rivers and streams. Many of these are as large as a mile across.

4.1.3. GROUNDWATER

Most of Sri Lanka is underlain by crystalline rocks which, because they are practically impermeable, cannot serve as groundwater aquifers. In those areas of the wet zone where the crystalline rocks are overlain by thick lateritic soils, these soils act as a sponge to hold water, while in the valley tracts and deltaic lowlands, alluvial deposits store considerable quantities of groundwater. While deep groundwater is in rare supply throughout the dry zone, it has been argued that considerable supplies of shallow groundwater are present, especially in lowland areas; such groundwater presently supplies wells, sometimes on a year-round basis, throughout much of the dry zone.

In the north of Sri Lanka, particularly in the Jaffna area, considerable groundwater is held in limestone sedimentary rock. Here, 3-6 feet of freshwater is present about 30-35 feet below ground; this aquifer, which is underlain by brackish water, has been estimated to yield from 15,000 to 100,000 gallons of freshwater per day.

Along the coastal tracts of the rest of the island, where sands and sandstone gravels have been deposited, fresh water occurs in convex formations resting on salty seawater. Supplies ranging from 20,000 to 200,000 gallons per day have been drawn from groups of wells in these formation, while the towns of Batticaloa, Mannar, and Hambantota have obtained their water supplies from such deposits underlying sand dunes.

4.1.3.2 Groundwater utilization

Wells tapping shallow groundwater supplies serve as the major source of domestic water supply throughout the country, particularly in rural areas.

Groundwater has traditionally not been used for irrigation purposes; the major exception
irrigation taps groundwater for extensive agricultural endeavors. Increasing interest is being shown in the possible use of both deeper groundwater and shallow groundwater for irrigation in the dry zone.

4.2 FORESTS

4.2.1 The Resource

Estimates of the extent of forest land in Sri Lanka vary considerably. Ceylon Forest Department estimates for 1972 place it a 53.1% of total land area, while the FAO's 1975 estimate show 2,899,000 acres of forest land, or about 44% of the area of Sri Lanka. About 2.3 million acres of this is forest reserves or proposed forest reserve under the control of the Forest Department; about 150,000 acres are planted or enriched forests.

Because of the intensive use of land in Sri Lanka, little of the forest area is primary forest.

dry zone forests

Most of the dry zone is covered by secondary vegetation that has developed after many centuries of repeated clearing for both sedentary and shifting cultivation.

In the most arid sections along the coast in the extreme northwestern and southeast tropical thorn forests with varieties of acacias and euphorbia predominate, while in the tropical dry mixed evergreen (monsoon) forest that covers most of the zone, trees seldom exceed 65 feet in height, do not form a canopy; these include, in scattered occurrence, such valuable trees as satinwood (Chloroxylon swietenia), ebony (Diospyros ebenum), mahogany (Swietenia mycrophyla) and halmilla (Berrya cordifolia).

wet zone forests

In this zone great quantities of land have been cleared and planted with commercial trees such as coconut and rubber. There also occur, mostly in forest reserves, such evergreen forest species as Doona congestiflora (local name: tiniya), Dipterocarpus zeylanicus (hora), Cullenia ceylonica and Cullenia rosayroana (kataboda) and Cyathocalyx zeylonicus (kekila), native species all in quantities suitable for large scale commercial extraction. A few valuable hardwoods such as Periscopis mooniana (nedun) are also found.

rain forest

The wet zone was once covered by rain forests. Today only about 20,000 acres of such forest remain, most of it spread out over the two Sinharaja Reserves; smaller remnants are found in the Peak Wilderness. These forests are prized by Sri Lankan conservationists as "richer in plant and animal species than all other forests of the island."

coastal zone forests

In the swampy areas of the coastal plains, mangroves and the animal life associated with them occur.

4.2.2 Utilization of forest resource

Roundwood removals (1,000's cubic meters: all non coniferous)

	1969	1973	1975*
Sawlogs, veneer logs, logs for railway ties	345	504	375
Other industrial wood	370	400	426
Fuel wood	3,880	4,150	4,225

*FAO estimates

4.2.2.1 Firewood

Firewood remains the principal use of wood in Sri Lanka; Dypetes separia, the trees which accounts for about 25% of forest growth in the dry zone, is said to be unsuitable for any other purpose.

Population pressures have brought increasing demands for firewood, and the looting of forest reserves for this ever scarcer resource has increased during recent years. This problems has been aggravated by the rise in the cost of other forms of energy, and recently even tea plantations, faced with rising energy costs, are reported to be stripping the forests of such valuable trees as satinwood in order to provide energy for tea drying.

Whereas in the past a large percentage of the nation's firewood needs was provided by wood which became available because of the replanting of old seedling rubber trees with new varieties, a recent decrease in the area of rubber replanted annually has led to a reduction in this source of firewood, putting increasing pressure on natural forests.

4.2.2.2 Industrial uses:

Because valuable commercial trees occur only in scattered stands in Sri Lankan forests and because many forests have been too dense for extensive logging, commercial exploitation of this resource has been slow in developing. In recent years, however, the government has made an effort to increase production in this sector of the economy; this has involve growing use of modern machinery and techniques.

In 1973, timber produced by the State Timber Coporation, apart from firewood, consisted of: softwood and non-softwood logs; ebony logs; railway ties; telegraph and transmission poles; and sawn timber. Some of this wood was exported: ebony, teak, satin and flowered satin wood, palu, vellam, neralu, panakka, halmilla and cyprus logs. Much wood was also supplied to local industry, particularly the State-run Ceylon Plywoods Corporation, which produces plywood for tea chests and furniture. Conservations have complained that valuable woods such ebony are being used for cheap furniture.

4.2.2.3 Construction

Sri Lanka dwellings are for the most part mud and plaster in construction with wood used for wall support, doors and windows. A recent article estimates that the wood needed for these purposes as well as for such implements as spoons and furniture in the form of benches and tables would possibly require one tree of 3-4 foot in girth. At the present rate of 53,000 new housing units per year, an equal number of trees are required to meet construction needs.

4.2.2.4 Negative effects of the development of the forest industry: the case of Sinharaja

The development of the forest industry has been accompanied, according to conservationists, by unforgiveable and nearly irremediable encroachments on unique primary forest land. The most notorious example has been the selective logging of Sri Lanka's last extensive tract of tropical rain forest, the Sinharaja, to provide input for the production of furniture at a branch installation of the Ceylon Plywood Corporation. Removal of wood, begun in 1972 and originally planned to extend to the entire forest, was later, in response to increasing protest by conservationists, restricted somewhat and a small tract (4,200 acres) was set aside for scientific purposes. Shortly after the change of governments in 1977, it was announced that exploitation of the forest would cease completely. Although logging has been halted, a great deal of harm has been done to the natural ecology of the area, not only by the removal of trees but also by the cutting of roads through the forest, the encroachment of alien weeds, and the reafforestation of certain cleared areas with mahagony, a tree alien to the habitat of the Sinharaja.

4.2.2.5 Clearing of land for agricultural development

Clearing of land to provide the acreage so desperately needed to meet the food needs of Sri Lanka's population is responsible for the loss of a good deal of forest land. As a part of the Mahaweli Ganga Project, the second phase of which entails the irrigation and agricultural development of approximately 106,000 acres, most of the scrub jungle now covering this area will be removed. Also responsible for the clearing of forest land is the traditional practice of chena (shifting) agriculture, which has become more widespread as population increases. Chena is said to account for more felled trees than the expansion of settled permanent agriculture.

4.2.2.6 Encroachment on forest reserves

Despite legal restrictions and the presence of enforcement authorities in the form of police and wardens, forest reserves are subject to the encroachments of squatters, poachers and illegal woodcutters. Such practices seem to be prevalent throughout the country, but a particularly egregious case is that of the Forest Reserve at Udawattekelle in the Kandy District, where as of 1975 squatters and illegal timber fellers had reduced this reserve from 256 to about 100 acres. Similar cases are reported in Loris, the publication of the Nature and Wildlife Conservation Society of Ceylon.

4.2.3. Forests as hydrological reserves and as influences on climate

Apart from their economic value as sources of timber and firewood, certain forests play an important role in influencing the water resources and climate of the island. Forests, most notably in the higher altitudes of the wet zone, perform the vital function of soaking up and holding rain water, which is then slowly released into catchment areas; in the absence of this important water-holding function, rainwater is more likely to be immediately lost to rivers as runoff, causing flooding and soil loss as it flows to the sea. Conservationists consequently argue that loss of forest cover through overdevelopment in the Horton Plains and Peak Wilderness areas of the Central Highlands could result in the drying up of the main sources of supply of major rivers such as the Mahaweli, Kelani, and Walawe Gangas, reducing them to streams and drastically damaging the agricultural development dependent on their waters.
It has also been maintained that hot air rising from deforested areas in higher areas has been responsible for local droughts during intermonsoonal periods.

4.2.4 Forests as animal habitat

The forests and grasslands of Sri Lanka serve as the habitat for a wide range of wildlife.

4.2.5 Reforestation

Reforestation in Sri Lanka, conducted by the Forest Department, has entailed chiefly the planting of species of trees suitable for commercial exploitation. In 1973, for example, under the long-term Forest Development Plan of 1970, there were plantings of extents of teak (10,902 acres), eucalyptus (1,107 acres), bamboo (480 acres), various pines (2,234 acres) and albizzia (504 acres). In addition mahagony "enriching" was carried out in 2,235 acres of natural forest. Other types of reforestation involve intercultivation with food crops (teak, eucalyptus and bamboo) and reforestation of unproductive tea and rubber lands, principally with Albizzia species.

4.2.6 Emergency measures for the protection of forests

Under the constant pressure exerted by conservationists, the government of Sri Lanka is becoming increasingly aware of the actual and potential consequences of deforestation on water supply, soils, wildlife, climate and the general ecology of the island.

Measures recently undertaken by the government to retard deforestation include:

- -a total ban on the felling of forests over 5,000 feet;
- -a national tree planting campaign under the personal direction of the former Prime Minister;
- -a complete ban on the export of timber (1977);
- -the halting of logging of the Sinharaja rain forest (1977).

4.3 SOILS

4.3.1 Major Soil Types*

Soil types in Sri Lanka coincide with the major climatic zones: the soils of the wet zone are generally lateritic, while red earths are the predominant soil type of the dry zone. Soil types do not occur uniformly throughout these zones, however, but rather interspersed with minor soil types, dependent on factors such as local rainfall and proximity to rivers and coastlines.

4.3.1. Lateritic soils

The soils of the wet zone are lateritic: generally mottled-red in color; clayey in texture; rich in iron and aluminum oxides; poor in silica and nutrients; low in pH; deep; and with a humus content of about 3%. These features are intensified as one moves from the weakly lateritic highlands above 3,000 feet through the strongly lateritic upland areas below 3,000 feet to the very strong lateritic soils of the wet lowland savannas.

vegetation

The natural vegetation of these soils ranges from the massive trees of the lowland rain forests to the stunted forests (about 20 feet) of the evergreen montane rain forests above 5,000 feet; this vegetation is replaced by lowland wet savanna and montane savanna respectively as areas are burned and cleared.

utilization

The lateritic soils of the wet zone have been intensely utilized and little of the natural vegetation remains. Coconut is grown in the lowlands, rubber in the lowlands and intermediate elevations and tea in the hilly regions. In the semi-dry uplands of Uva, much of the land has been terraced and brought under highly productive market crops.

The very strongly lateritic soils of the southwest lowlands, which have a very high iron content, are, in some area cut out in blocks, dried and used a construction materials (cabook).

Lateritic soils have demonstrated greatly increased production when fertilizer is used. Tea production, for example, increased by 35% over a ten-year period in response to correctly used fertilizers.

problems

These soils are subject to erosion, especially on the steep slopes which are now coming under cultivation.

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*The soil classification followed here is that of Fernando (1969) as followed in Domros (1976); another frequently cited classification is that of Moorman (1961).

4.3.1.2 Red earths

The red earths, the predominant soils of the dry zone, occur at varying levels of elevation but especially in the better drained upper slopes. They are characterized by: a generally loamy texture; a humus content of 2% or less; only partial leaching; a pH of 7-8; a good depth; and a low silica and high iron oxide content. They have a low waterholding capacity and tend to dry up soon after the rains cease. The red earths are relatively fertile as tropical soils go.

An important subgroup of these soils, the chalky red earths, occur in northern and northwest Sri Lanka

natural vegetation

The natural growth of these soils in the wetter parts of the dry zone is mixed evergreen forest, characterized by an admixture of deciduous species; this"monsoon"forest is replaced by dry grassland when areas have been cleared by burning. The drier areas bear a natural growth of thorn forest, which is replaced by arid grasslands after extensive burning and clearning.

utilization:

The red earths have been exploited chiefly for shifting cultivation, although some rubber and coconut are grown in areas closer to the wet zone. With irrigation these soils, which once supported an extensive irrigated agriculture, are being increasingly brought under rice cultivation.

The chalky red earths of the Jaffna peninsula of the north are intensely cultivated with the help of bulky organic fertilizer and lift irrigation.

4.3.2. Minor soil groupings

4.3.2.1 Alluvial soils are found on the flood plains, in the deltas and on the banks of rivers throughout Sri Lanka. These soils, which are generally crumbly, loamy and very deep, have a high level of fertility, consisting as they do or eroded topsoils of higher elevations that have been washed downstream.

The natural vegetation of such soils consists of lofty riverine forests, bamboo and tall grasses; however, little natural vegetation remains because of intensive agricultural utilization.

utilization :

Alluvial soils are the main rice-producing soils of Sri Lanka. Coconut has also been grown on them. In the area of river estuaries such soils are usually too brackish to support agriculture.

4.3.2.2 Saline soils occur in the most arid sections of the extreme northwest and southeast of the island, where the dry season is prolonged and very heavy evaporation brings salts to the soil surface. These soils are shallow, light in color, low in humus content and high in salts, especially sodium chloride and sodium sulphate.

The natural vegetation of these soils is monsoon scrub jungle, dominated by stunted acacias, euphorbias, and tamarinds. In areas where this growth has been subjected to prolonged drought or burning, short annual grasses occur.

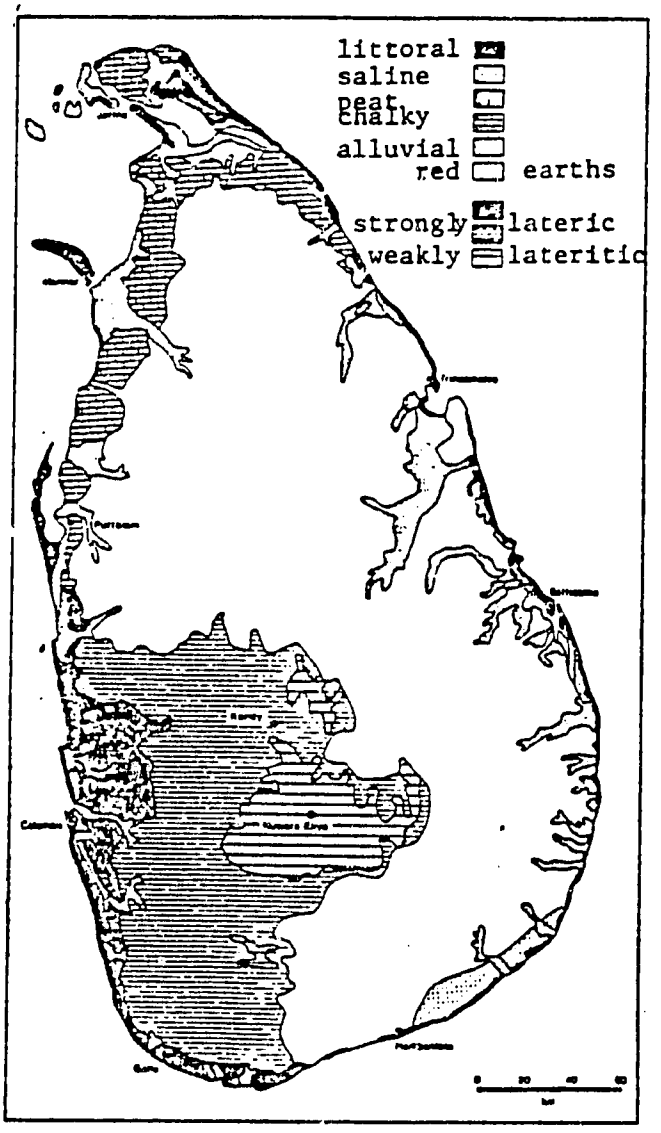
Utilization: Saline soils are poor for agriculture, except where irrigation can be used to lower their salt content. The Ruhunu National Park occupies an extensive area of saline soils in the southwest.

4.3.2.3 Bog soils (peats) occur throughout the country with greatest concentration in the Colombo area. These soils are waterlogged and contain large quantities of organic matter (humus).

Swamp vegetation occurs naturally on peat soils in the lowlands; in the highlands they support wet grassland.

Most of these soils are now economically unproductive, but boggy areas can be reclaimed through draining; gardens on such drained soils near Colombo demonstrate that they could be used for truck-farming crops.

4.3.2.4 Littoral soils are the beach sands, dunes and other materials deposited by the sea; they contain very little humus, are very infertile, bear only creeping beach vegetation, and are subject to almost no agricultural utilization.



GENERALIZED SOIL MAP

Source: Domros (1976)

4.4 WILDLIFE

4.4.1 The resource

Sri Lanka has a rich variety of wildlife. Birds include cuckoos, owls, hawks, eagles, kingfishers, peacocks, hummingbirds, flamingoes, and many unusual species, including the seven sisters bird, which is said always to flock in groups of seven. Smaller mammals include grey flying squirrels, five varieties of monkeys, and the "flying fox" bat. Among the larger mammals are the asiatic elephant, leopards, jungle bears, jackals, wild swine, buffaloes, and several varieties of wild deer. In the great rivers of the lowlands and in the brackish waters of the lagoons are reptiles such as the crocodile species known as the Ceylon mugger; the monitor lizard inhabits the banks of swampy rivers, and chameleons live in the crowns of rain forest trees. There are many varieites of insects, including spectacularly large and colorful butterflies. The rain forests abound in rare and unusual species of plants, and rivers, reservoirs, and coastal water contain a rich variety of fish and marine life.

4.4.2 Exploitation

Both elephants and buffaloes have traditionally been captured and tamed for use as farm and draught animals, a practice which still continues, although the capture of elephants has been restricted in recent years; in 1973 conservationists urged that permits to capture buffaloes as agricultural animals be issued to cover the Yala complex of parks, where large numbers of buffalo were threatening the habitat of other park animals. Animals continue to be hunted for meat, ivory, and skins.

4.4.3 Protection of wildlife

Unrestrained hunting and trapping of wildlife have led to the extinction of many species of Sri Lankan wildlife and threatened the continued existence of many others, while the increasing growth of human population and the consequent extension of land devoted to agriculture and settlement have led to a severe limitation of the areas available for wildlife habitat. Growing realization of the danger to wildlife led, beginning in 1937, to the establishment of a series of national parks and sanctuaries, which today cover 2,366.14 square miles, about ten percent of the total area of Sri Lanka.

Protected areas, almost all of which are in the dry zone, fall into three basic groups:

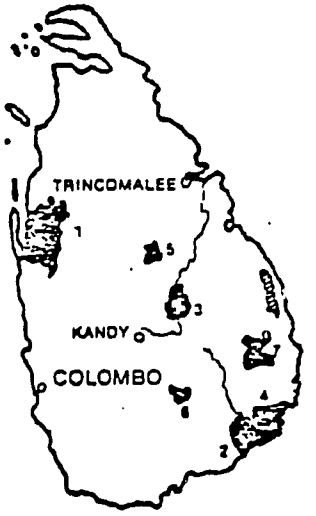
1) strict natural reserves (four with a total area of 234.40 sq. miles): entry permitted only for scientific purposes;
2) national parks and intermediate zones (four: total of 1,172,68 square miles): absolute protection provided for plant and animal life; felling of trees, clearing of land and construction of roads prohibited; entry permit required; borders may not be changed without parliamentary approval;
3) sanctuaries (40 covering a total of 767 square miles): hunting and firing of weapons prohibited; borders may not be changed without parliamentary approval; freely accessible to public; persons exercising rights such as cultivation of land before the sanctuary was declared may continue that practice; sanctuaries frequently serve as buffers to national parks and strict natural reserves.

4.4.3 (cont)

The Fauna and Flora Protection Ordinance (see 3.1.3.1), under which these areas were established also provides absolute protection outside such areas to a large number of animals of all varieties (see appendix 1) and provides for hunting or capturing of others only with a license. Orders issued under this law in recent years have considerably strengthened legal protection for wildlife by suspending the issuance of all game licenses, and prohibiting both the capture of elephants and the export of wild animals or parts thereof in commercial quantities. At the present time, therefore, only the following animals can be hunted: wild boar, hare, porcupine, jackal, takgoya, some squirrels and monkeys, civet cats, and game birds during the open season, which runs from November 1 to April 30.

Despite apparent official concern with wildlife and its protection, Sri Lanka had, as of mid-1977, not yet signed the Convention on International Trade in Endangered Species, which came into force on July 1, 1975.

4.4.4 National parks**



4.4.4.1 Wilpattu National Park (no. 1 on map)
date established: 1938
area: 508.5square miles
terrain: sandy region with a string of natural lakes on the west surrounded by sand dunes, thickets and forest patches; in the eastern and central sectors traces of old fields gradually invaded by thicket and dry secondary forest.
animals: asian elephant (Elephas maximus)*; axis deer; sambhar; buffalo; sloth bear; leopard (Panthera pardus)*; hornbills; bee-eaters, flycatchers, ibises, pelicans, eagles.

4.4.4.2 Ruhunu (Yala) National Park (no. 2 on map)
date established: 1958
area: 447.57 square miles
landscape: a coastal zone with lagoons and dunes, rocks scrub and thorn jungle; traces of ancient civilization on the plain;
animals: elephant (Elephas maximus)*; sambhar and other deer; leopard(Panthera pardus)*; crocodile; birds: peafowl, cormorants, plovers, grey heron, imperial pigeon.

4.4.4.3 Gala Oya National Park (no. 7 on map)
date established: 1954
area: 100 square miles
landscape: reservoir lake situated in flat country but dominated by gneissic hills 150 m high; dry everygreen forest occupies about a quarter of the area; the remainder is scattered tree-grassland savannah;
wildlife: elephant (Elephas maximus)*; buffalo; muntjac; axis deer; leopard (Panthera pardus)*; jackal; python (P. molurus)*; cobra; many birds

4.4.4.4 Uda Walawe National Park
date established: 1972
area: 119 square miles
animals: elephant (Elephas maximus)*; leopard(Panthera pardus)*; golden palm civet; mouse deer; jackals; grey langurs.
note: little attention has been paid to the development of this park.

4.4.5 Strict natural reserves

4.4.5.1 Yala Strict Natural Reserve (no. 4 on map)
date established: 1937
area: 116.6 square miles
landscape: flat, sandy, some sand dunes; jungle is low and thicker inland
animals: sloth bear, buffalo, deer, sambhar, elephant (Elephas maximus)*; monkeys, leopard (Panthera pardus)*; many birds.

*Animals on the U.S. Fish and Wildlife Service List of Endangered and Threatened Species (1977).
**The administration of all national parks(except Gala Oya), strict natural reserves and sanctuaries is the responsibility of the Wildlife Conservation Department (see 2.1.5.1).

4.4.5.2 Wasgomuwa Strict Natural Reserve (no. 3 on map)
established: 1937
area: 112.56 square miles
landscape: the central part is a narrow valley between two steep ridges of the Sudukanda hills; vegetation varies from thick forests at lower levels to open forests and scrub.
animals: elephant (Elephas maximus)*; sambhar; buffalo; axis deer; sloth bear; leopard (Panthera pardus)*

4.4.5.3 Other strict natural reserves are the Hakgala Strict Natural Reserve (no. 6 on map) and the Ritigala Strict Natural Reserve (no. 5 on map), both of which are rich in flora, and the Horton Plains Natural Reserve.

4.4.6 Continuing danger to wildlife:

4.4.6.1 Inadequate enforcement of nature protection laws

Personnel and equipment are in insufficient supply to enforce effectively the laws prohibiting the hunting of wildlife. In national parks, for example, there are inadequate numbers of vehicles for anti-poaching patrols, and poaching is therefore rampant. There is said to be an active illicit trade in leopard skins, and despite strictures against the killing of deer, venison is said to appear on hotel menus. Slaughter of protected species of crocodiles continues, and this, in combination with loss of crocodile habitat due to human pressure, has drastically reduced their numbers and bringing about their complete disappearance from areas in which they formerly thrived.**

It is also reported that penalties for the illegal slaughter of animals are to small to provide sufficient discouragement for poachers. In 1977, for example, a penalty imposed for the illegal possession of a leopard skin was only Rs. 15 (about $.93), and other penalties were equally as low.

4.4.6.2 The tourist trade

The influx of tourists into Sri Lanka's national parks has been increasing recently , and it is feared that the consequent expansion of roads in parks and the construction of tourist facilities may have a negative effect on animal habitats. Furthermore, tourists have supplied a ready market for illegally obtained items derived from wildlife such as ivory, leopard skins and claws, bear's teeth, feathers, fur, skin and shell.

4.4.6.3 Agricultural encroachment on wildlife protection areas and habitat

4.4.6.3.1 Shifting cultivation

Encroachments on wildlife reserves by peasant chena farmers are very common; cultivation has been reported, for example, on the edge of the Yala (Ruhunu) National Park as well as in other parks and sanctuaries.

4.4.6.3.2 Major agricultural development schemes

The head of the Wildlife and Nature Protection Society of Ceylon has noted that "technocrats and administrators" tend to ignore legislation providing for the inviolability of national parks in the preparation of extensive agricultural development schemes. Plans for the development of

4.4.6.3.2(cont)

the Heda Oya basin in the southeastern part of the island, as originally proposed by the Department of Irrigation, took no account of the effect of the project on important elephant reserves and also called for the complete elimination of a forest reserve. These plans were altered somewhat under pressure from conservationists, but other development projects, such as the Kumbukkan Oya basin development scheme are expected to result in the loss of large areas of the Yala complex of national reserves. Furthermore, it is expected that the gigantic Mahaweli Ganga Development Project, the second stage of which will open up land on the edge of Wilpattu National Park, apart from bringing into its immediate area large human populations likely to encroach on the park for firewood, will also eliminate from the surrounding area much of the scrub jungle which park animals have depended on for food in times of stress, such as prolonged drought.

4.5.2.1.2 Coastal fisheries

Coastal fisheries are by far the more productive at this time. Fishing is conducted in most coastal areas but most profitably in the Jaffna Peninsula, the Isle of Mannar, the Palk Straits, the bays of Galle, Batticaloa, and Trincolamee, and large lagoons such as Negombo and Puttalam.

Most coastal fishing is carried out on a very primitive level, usually involving the use of nets and rods or outrigger boats. Government programs under the Ceylo. Fisheries Corporation are therefore attempting to make motorized boats available and to instruct fishermen in their use, to promote deep sea fishing, now only in the beginning states, and to develop fishing harbors.

The development of coastal and deep sea fishing is currently deterred by several factors: poorly developed fishing methods; a lack of capital; and the monsoon winds, which during substantial parts of the year produce surfs that bring a halt to fishing activities (some fishermen actually migrate with the monsoons). Social and religious practices also have an important effect: most Sinhalese and Tamils are traditionally farmers, and fishing is a practice traditionally relegated to the lower castes. Furthermore, the low count of microorganisms and the low level of plankton in the Indian Ocean indicate that Sri Lanka's fishing waters may not be able to support the numbers of fish necessary for the development of a large-scale fishing industry.

4.5.2.1.3 Fish processing industry

The fish processing industry is quite small. Fish processing on a limited scale in practiced by the Ceylon Fisheries Corporation, which produced over 181,000 cans of fish in 1973 in its plant at Pesalai. This plant and another at Mutwal also produce fish meal.

4.5.2.1.4 Exports of fish

Exports of fish included in 1973: tuna (190,802 tons), skip-jack (88,807 tons), lobster (56,044 tons), prawns (82,516 tons), dried shark fins (1,535 tons), and conch shells (101,415 pieces).

4.5 Fish and Marine Life

4.5.1. Fish resource

The inland and coastal waters of Sri Lanka abound in fish, an estimated 856 varieties, about half of which are percoids (perches). The most-valued commercial marine fish are mackerel, mullet, indian salmon, and bonito, followed by perch, brace, cod and snappers, while sharks and skates are among the least valued.

Important shellfish include crabs, crawfish, shrimps, lobsters, and pearl oysters.

4.5.2 Utilization

Fish forms an important part of the diet of Sri Lankans; in rural areas it is the most important source of protein. Because the country is presently able to meet only about 70% of its needs for fish and must import the remainder, the government has been attempting to expand and modernize the fishing industry. Extreme food shortages in recent years have made this an increasingly more important goal.

Sri Lanka has declared a 200 mile limit for fishing in its waters.

4.5.2.1 Fishing Industry

	1973	1975
Total catch	98,686 tons	126,420 tons
Inland fisheries	6,860 tons	13,034 tons
Coastal fisheries	92,000 tons	113,386 tons
Tuna	18,620 tons	29,694 tons
Crustaceans	2,940 tons	6,076 tons
Mollusks	49 tons	58 tons

An estimated 40,000 persons were engaged in fishing in 1974.

4.5.2.1.1 Inland fisheries

Inland fishing is conducted in rivers, irrigation tanks, and large reservoirs. The fish production of reservoirs and large tanks has been increased greatly by the recent introduction of species adapted to such a habitat: most productive have been varous species of Tilapia. There is now a move to develop fisheries in smaller community and village tanks; in those tanks that dry up in the dry season, yearly stocking of fish measures to enhance the food supply for fish must be employed. With the aid of such fisheries development programs, which also include supplying of fishing equipment, the Department of Fisheries has estimated a yield of 20,265 metric tons for 1977 and predicts that with the successful continuation of the programs, yields will be as high as 47,075 metric tons by 1982.

The success of tank fisheries development is highly dependent on the maintenance of both good water quality and a proper level of nutrients in tanks. It is not known to what extent the increased use of fertilizers and pesticides, residues of which enter tanks in runoff waters, will effect fish production.

4.6.1 MINERAL RESOURCES

Sri Lanka's mineral resources are limited and cannot serve as the base for extensive industrial development. Nevertheless there are important mineral exports, including graphite, of which Sri Lanka is the world's largest producer, and a variety of gemstones. Deposits of limestone and silica sand serve as raw materials for the manufacture of cement, ceramics and glass.

After years of explorations petroleum desposits have been found on the northwest coast in a quantity estimated at 200 million tons. The first successful drilling operation is reported to have been conducted by an American firm in Palk Bay in mid-1976.

4.6.2 MINERAL WEALTH OF SRI LANKA

MINERAL	OCCURRENCE	MINING/EXTRACTION METHOD	PRODUCTION	UTILIZATION
GEMSTONES: cordnudum (sapphires and ruby) chrysoberyl (alexandrite and cat's eye), beryl (acquaramine), topaz, spinel, garnet, zircon, tourmaline, moonstone	-traditional gemming area in the southwest, within the upper catchment of the Kalu Ganga; new areas in Polonnaruwa District	sinking of pits and panning of gem-bearing gravels extracted from them	476,000 carats of precious and semi-precious gems in 1973	export
GRAPHITE	vein deposits in the southwest of the island — deposits said to be most productive in the world	mechanized deep mines of from 500 to 2,000 feet below surface	10,413 tons	exported after dressing and grading, chiefly to Japan and the U.S.A.
MINERAL SANDS Ilmenite Rutile Zircon	black sand deposits at Pulmoddai, north of Trincomalee (east coast) worked for ilmenite, rutile and zircon -ilmenite deposits in black sands estimated at over 5 million tons	surface mining	export(1973): 85,638 long tons of ilmenite; 2,801 tons rutile; 100 tons zircon	exported
Monazite	seasonal concentrates along the west coast especially at Beruwela and Induruwa	extraction discontinued because of poor deposits	10 long tons (1973)	
QUARTZ: pure white silica sand	the area of Marawila-Nattandiya-Madampe (between Negombo and Chilaw on the west coast)	surface mining		used in production of glass by the Ceylon Glass Company
vein quartz			427 long tons (1973)	used in glass production by Lanka Glass Factory near Trincomalee
LIMESTONE	Jaffna Peninsula; Arukalu, north of Puttalam	surface extraction	686,183 tons (1973)	cement manufacture at Puttalam Cement Works and Kankesanturai; purer crystalline deposits for lime manufacture dolomitic limestone: fertilizer and ceramics industries
FELDSPAR			615 long tons (1973)	manufacture of glass and ceramics by Ceylon Ceramics Corp. and private firms; 27 tons exported (1973).
INDUSTRIAL CLAYS alluvial clays	occur in the flood plains of all major rivers, most extensive deposits in valleys of the Maha Oya, Kalani Ganga and Kalu Ganga	surface removal	estimated at several thousand tons per year	processed in local kilns for the manufacture of bricks and tiles, esp. in valleys of Maha Oya, Kelani Ganga and Kalu G.
kaolin	at Boralesgamuwa near Colombo (deposits of over 30 million tons); Meeriyagoda in Galle District	surface removal	4,791 tons of refined kaolin produced in 1973	manufacture of toilets, etc. by Ceylon Ceramics Corporation
clay for cement	large deposits at Murunkan and Ralmadu (north of Puttalam)	surface removal	46,668 tons (Murunkan-1973) 21,8000 tons (Ralmadu-1973)	used for manufacture of cement at Kankesanturai and Puttalam
SALT	driest regions: Elephant Pass (Jaffna); Hambantota; Puttalam; Palavi	evaporation of salt water in drying beds	quite varied: between 30,000 and 80,000 tons per year; 1974: 120,000 t	used locally
IRON ORE	about 2 million tons of easily accessible ore (from 30 to 54% metallic content) mainly in southwest region—these are superficial limonitic ores; northwestern region: banded iron ore deposits: about 5 million tons with 65% iron	NOT YET EXPLOITED potential surface mining potential deep mining		
PEAT	nearly 40 million tons immediately northwest of Colombo; poorly drained	NOT EXPLOITED		
APATITE	promising deposit near Eppawela in North-Central Province; possibly 20 million tons	NOT EXPLOITED		would be used as raw material for manufacture of phosphate fertilizer and chemicals

4.7 COASTS AND BEACHES

4.7.1 The resource

Sri Lanka is an island with nearly 1,100 miles of coastline, much of which is characterized by shifting sandbars and lagoons of varying extents, the most prominent of which are at Puttalam and Negombo on the west coast and Batticoloa on the east coast. Parts of the southwest coast are marked by drowned rivers, and cliffs front the sea north of Trincomalee on the east coast. Much of the coastline is fringed by coral reefs which, in conjunction with coastal vegetation, help to prevent coastal erosion. There are few good natural harbors, with the notable exceptions of Galle in the southwest and Trincomalee in the east, which is reputed to be one of the best natural harbors in the world. Colombo, the major port has an artificial harbor.

4.7.2 utilization

Fishing thrives along many areas of the coast (see 4.5.2.1.2); salt is produced by the evaporation of sea water (see 4.6.2); beach sands are important sources of minerals such as ilmenite, rutile and monazite (see 4.6.2); pearl fishing takes place along the Gulf of Mannar; tourist complexes are common along both the west and east coasts; colorful tropical fish are collected in the waters of coral reefs; old coral is dug up for processing into cement and lime; and in many areas coral reefs are blasted and coral extracted for the manufacture of lime.

4.7.3 dangers to coral reefs

4.7.3.1 Special attention must be given to the extraction of coral, a process which has had its most devastating effects along the east coast in the Batticoloa district, where it has been estimated that over half a million cubic feet of coral are removed annually, brought to kilns in a local village, and burnt into lime, which is then loaded into trucks and delivered to locations throughout the island for use as fertilizer in vegetable gardens. This operation, which in 1977 was still reported to be flourishing, despite a 1973 prohibition order under the Crown Lands Ordinance, and involves the collusion of enforcement officials such as the local police, has been called the most egregious example of the destruction of multiple national resources known anywhere in Sri Lanka.

The consequences of this activity on the local area are manifold and include:

- sea erosion resulting in: the disappearance of mangrove communities because of loss of their soil;
  - the disappearance of small lagoons;
  - the erosion of cultivated coconut land;
- the virtual cessation of fishing activity because of the reduction of the quantity of fish which can be caught by traditional methods;
- the disappearance of useful plants within a half a mile of the coast because of increasing salinity of the soil;
- a high level of salinity in local wells.

In addition, trees throughout the area of these operations have been felled to supply firewood for the kilns; this includes both mangroves and coconut trees.

4.7.3.2 The crown of thorns starfish, which is destructive of coral reefs, has been found in large numbers off the east coast of the island, especially in the reefs extending from Trincomalee to Pulmoddai. It has been suggested that the proliferation of these starfish could be attributed to pollution or to the reduction by intensive fishing of the fish predators on star fish eggs.

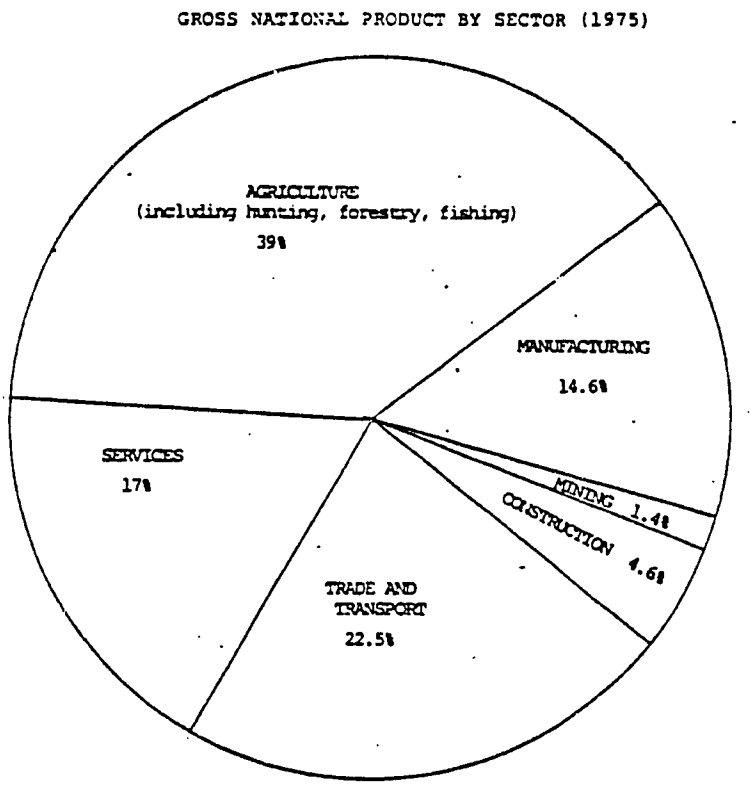
5.0 THE ECONOMY OF SRI LANKA

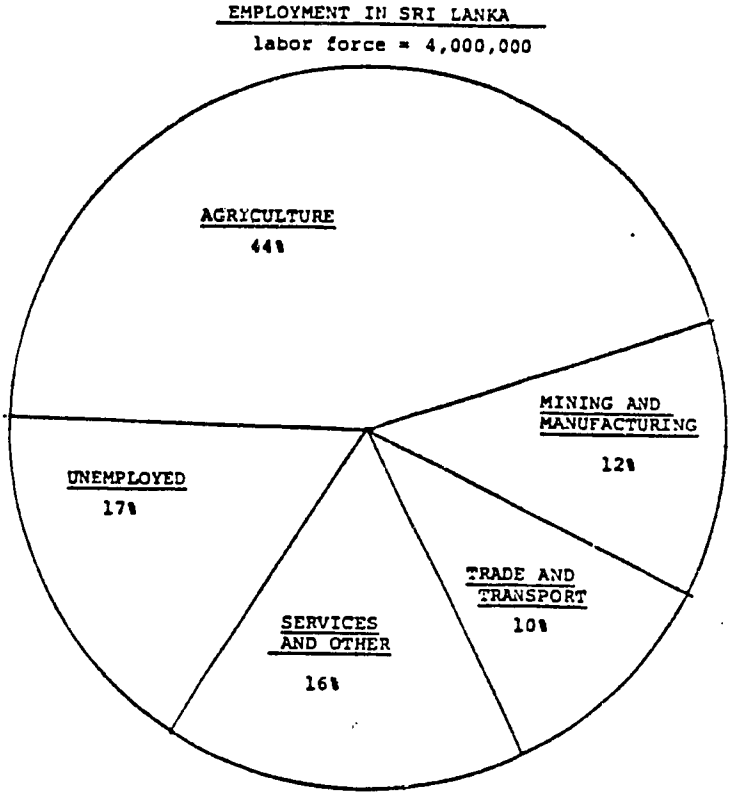
5.1 GENERAL ECONOMIC PICTURE

GNP: $3.1 billion in 1976 (1976 prices) Per capita share of GNP: $200

Real Growth Rate: 4.4% (1977); 3.0% (1976)

Monetary Conversion Rate: 16 rupees (Rs.16)=US$1 (November 1977)





Sri Lanka's economy is basically agricultural; despite increases in industrial production in recent years, the country lacks the resource base necessary for large-scale industrial development. Through foreign exchange earned from its major crops (tea, rubber and coconut) Sri Lanka has been able to import a considerable percentage of its food needs (principally rice, wheat, and sugar); raise the standard of living for its people; improve social services; broaden the political base; and initiate land reform. Recent developments, coupled with Sri Lanka's continuing inability to meet its food needs, have put a serious strain on the Sri Lankan economy: a general decline (beginning in the 1950's) in world prices for its major crops; a rise in the prices of imported manufactured products and of the raw materials used in doemstic industries; soaring petroleum prices; a decline in foreign investments following nationalization of the major estate holdings in the mid-1970's; a high level of unemployment; and inflation. These problems were severely aggravated when drought in the early and and mid-1970's lowered the production of Sri Lanka's major export crops at the same time that foreign exchange was desperately needed to supplement domestic food production, also seriously reduced by drought conditions.

Government programs to improve the economic outlook include: creation of attractive conditions for foreign investment; expansion of local industry based on Sri Lankan raw materials; diversification of export crops; and major irrigation projects designed to bring more land under cultivation with the ultimate goal of meeting the country's food needs.

5.2 Agriculture

Agriculture is the dominant sector in the economic life of Sri Lanka. Agricultural activities are fairly sharply divided between "plantation" agriculture (the usual designation for land under permanent crops such as rubber, tea, and coconut--the major crops--and such minor crops as cocoa, cardamon, pepper and cinammon) and peasant agriculture which, above all, means rice production. Animal husbandry is not highly developed.

Agricultural Land Use in Sri Lanka (FAO-1975)

	thousands of acres
Arable land	895
Permanent crops (plantation):	1,804
Grasslands	439

5.2.1 Plantation Agriculture

Plantation agriculture occupies about 54% of agricultural land or about 16% of the total land area of the island; it accounts, however, for the overwhelming bulk of Sri Lanka's exports. Because of the considerable processing undergone by tea, rubber, coconut and other plantation crops before export, plantation operations are often referred to as plantation industries; their activities come under the aegis of the Ministry of Plantation Industries.

Since 1971 most of the large plantations have become nationalized under the Ceylon State Plantations Corporation. The state now owns 63% of tea plantations, 33% of rubber plantations, and 10% of coconut plantations.

World market prices for Sri Lanka's major plantation crops have declined in the recent past, causing a serious drop in the country's intake of foreign exchange.

5.2.1.1 Plantation crops (see tables)

5.2.1.2 Measures to increase production in the plantation sector

fertilizers

Fertilizers are employed extensively in the productive of tea, rubber and coconut; for all three crops schemes are in effect to subsidize the use of fertilizers by farmers.

pesticides

Pesticides are employed to combat the various pests and fungi which attack all three major crops. The Tea Research Institute, the Rubber Research Institute and the Coconut Research Institute all participate in the development and testing of control chemicals.

5.2.1.2 (cont.)

biological control

Biological control of the coconut caterpillar is carried out through the breeding and release of pest parasites; the Tea Research Institute is reported to be working on such methods for the control of tea plant pests such as live-wood termites.

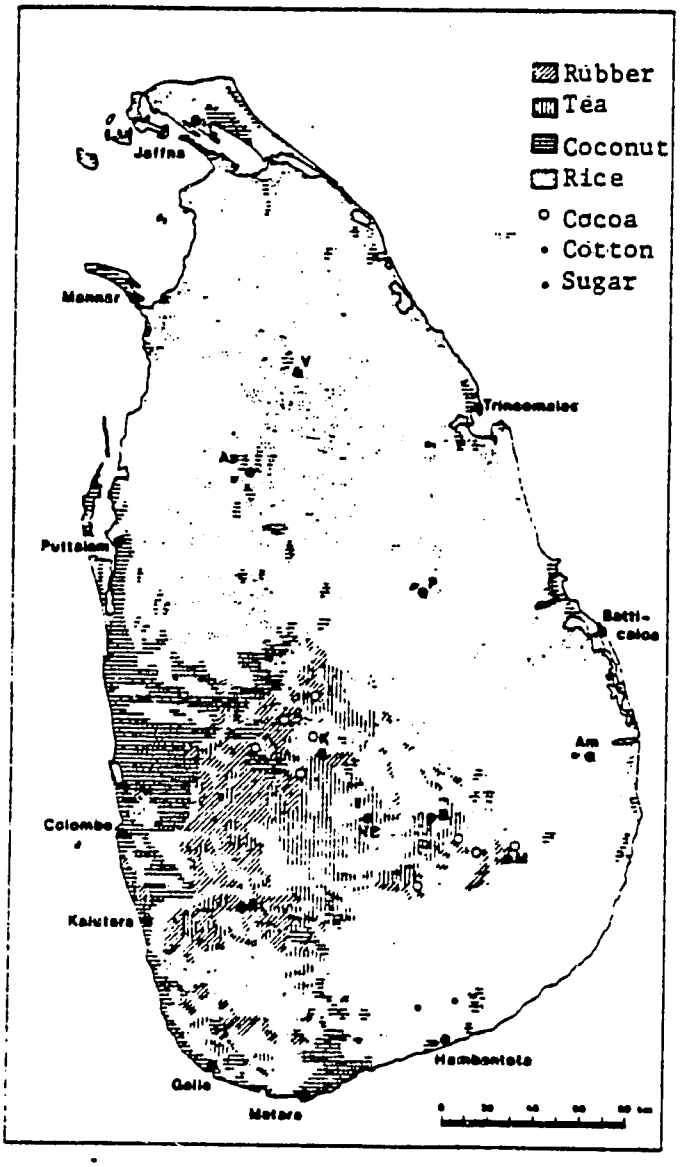
intercropping and replanting of unproductive lands

The planting of unproductive plantation land with alternative crops is also being encouraged. The Crops Diversification Subsidy Scheme, begun in 1970 on an experimental basis, is aimed as the replanting of uneconomic tea lands with coconut, cocoa, cardamon, mulberry (for silk production), lemon grass, cloves, nutmeg, pepper, pineapple, passion fruit, pasture, timber, rubber, and sugar cane; as of 1974 about 10,286 acres had been authorized for replanting, of which 3,176 had actually been replanted, chiefly with coconut, rubber, pepper, timber and cardamon.

Some coconut plantations are being intercropped with grasses suitable as cattle forage.

PLANTATION CROPS OF SRI LANKA

CROP	Area of cultivation	acreage	% of ag. land	annual yield	types of holdings	ownership	processing	consumption
Major crops								
TEA	wet zone, in areas of evenly distributed rainfall; elevations of up to 6,000 feet	598,466 (1974)	12%	465.9 mil.lbs. (1973); 470.6 mil.lbs. (1972)	small(under 10 acres): 18.5% of holdings; estates(10-500 acres): 36% of holdings); estates(500 acres+): 45.6% of holdings	private public (Tea Control Dept.) (about 63%)	extracting of juices, drying, etc. carried out on estates	about 95% exported
RUBBER	wet zone: lower slopes to the west and southwest of the central highlands; areas of evenly distributed rainfall and good drainage	563,406 (1974)	11.5%	129,993 tons (1974); 152,232 tons (1973);	small(under 10 acres) 33% of holdings; estates(10-100 acres) 23% of holdings; estates(100acres+): 23% of holdings	private public (Rubber Control Dept) (about 33%)	processed principally into ribbed smoked sheet(60%; also:latex crepe,block rubber; processing carried out on estates	about 96% exported, chiefly to People's Rep. of China; in 1974, 6.141 tons consumed locally for the production of tires for both and bicycles, toys, mats, etc.
COCONUT	lowland areas of the wet zone, especially concentrated in the Coconut Triangle: Negombo, Kalutara, Kurunegala	1,151951 (1972)	23.5%	2,500 to 3,000 nuts per acre, depending on type of holding;estimated 2,300,000 in 1976	small holdings and gardens: 75%; estates: 25%	private public (about 10%)	processed on estates and in plants to produce: dessicated coconut, coconut oil; copra; also: coir(fiber), yard, rope and matting); liqueur and fermented drinks; vinegar	about 50% exported as fresh and dessicated coconut; remainder consumed domestically
Minor crops								
CINAMMON	principally along the southwest coast; concentrated in Galle and Matara	48,678 acres	1%	50-160 lbs per acre	small holdings; few estates; usually grown in mixed coconut and cinammon estates	private	-fermentation, skinning, refermentation, drying, rolling; little technical expense involved; some oil produced from chips and leaves	export
CARDAMON	wet zone; grows best in wet mountain forests at between 3000 and 5000 ft.	11,000 acres	.2%	40-360 lbs per acre	grown most often as supplemental crop on tea estates	private/ state	green-curing; drying by hot air or over a charcoal fire; also some chemical bleaching by sulfur-drying	90-95% consumed domestically as curry spice
PEPPERS	wet zone; altitude of from 1200 to 1400 ft	14,500 acres (1972)	.2%	not known	cultivated exclusively as intercrop in gardens or on tea estates	private/ state	not known	domestic consumption
COCOA	wet zone; good conditions in the lower areas of the central highlands where rubber is grown	24,215 acres (1972)	.5%	2,204.6 tons (1974-1976)	cultivated as intercrop in gardens as well as in small rubber and coconut holdings	private	not known	export(about 0.5% of total); some consumed by small domestic chocolate industry
COFFEE	wet zone(in Kandy and Matale)--the major export crop in the 19th century	11,600	.2%	9,207 tons (1974-1976)	a garden crop	private	not known	domestic consumption covers about 1/3 of domestic demand



Areas of most important crops

Source: Domrös (1976)

5.2.2 Peasant Agriculture

5.2.2.1. Rice production (paddy cultivation)

Rice is the chief crop of the peasant sector of the Sri Lankan agricultural economy. In 1976, approximately 1,568.1 million acres were estimated to be under rice cultivation, most of these consisting of small holdings of two acres or less. The major rice growing areas are in the dry zone.

dry zone

Dry zone agriculture is dependent on irrigation as well as on rainfall. In the maha season (between October and February/March), when rainfall is greatest, the major period of cultivation occurs, and although by far the greatest portion of rice is grown under irrigation, rainfed production is also possible. In the yala season (April to August), when rainfall is low, cultivation is dependent almost entirely on irrigation.

Rice acreage in the dry zone 1973/74	maha	yala	total acreage in course of year
Major irrigation (large schemes,etc.)	392,000	285,000	650,000
Minor irrigation (village tanks,etc.)	227,000	82,000	309,000
Rainfed	285,000	43,000	28,000
	904,000	382,000	1,287,000

wet zone

In the wet zone, where too much rainfall is more often a problem than too little, paddy cultivation takes places during both the maha and yala seasons, mostly under rainfall, although in drier areas this is supplemented by minor irrigation works. However, the wet zone offers only limited land for paddy cultivation, since most of the land is utilized for plantation crops or urban settlements.

5.2.2.1.1 increasing rice production

Since independence, Sri Lanka has succeeded in increasing its food production considerably; whereas land under rice had stood at about 914,000 acres in 1946, it had increased to about 1,568,100 in 1976, mostly in small holdings of two acres or less. Rice production was adversely affected by drought in the early and into the mid-1970's, and Sri Lanka has, therefore, remained heavily dependent on rice imports to meet its rice needs (about 30% or 377,000 tons in 1973). For the 1977-78 maha season, however, the government has reported a bumper crop of 61,626,000 bushels (as compared with 54 million in 1976), an average of 53 bushels per acre for the country as a whole, and running as high as 84.6 bushels per acre in some areas.

So confident has the government become in the continued success of its efforts to increase rice production, that it recently announced that rice imports would be discontinued after 1979. Furthermore, it has announced that in November 1978 about 8,700 long tons of rice would be exported to Indonesia—the first Sri Lanka rice export in 232 years.

5.2.2.1.1 (cont.)

Increased rice production has been attributed to several factors:

-the use of fertilizers;
-the use of weedicides and pesticides;
-use of modern machinery to plough and clear lands;
-irrigation, which has permitted:
  -double cropping in areas of the dry zone where previously only single-cropping had been possible;
  -the opening up for rice cultivation of previously uncultivated land.

5.2.2.1.2 Irrigation schemes and their environmental effects

Irrigation has been practiced in the dry zone of Sri Lanka in varying degrees since the third century B.C. Irrigation schemes involve the damming of streams and rivers to form reservoirs (tanks), the diversion of rivers into reservoirs, or the diversion of rivers for continuous-flow irrigation. Recent development of the dry zone has involved the reopening of irrigation works which had fallen into disrepair, but for the extensive agricultural land development which figures so prominently in Sri Lanka's plans to achieve food self-sufficiency, major multi-purpose scheme involving not only irrigation water but also hydroelectric power production and flood control are of overwhelming importance.

Important irrigation schemes involve the Gal Oya River, the Uda Walawe River, and the Kelani Ganga, among others, but by far the most ambitious project is the Mahaweli Ganga Project, which involves the diversion of water from Sri Lanka's largest River in order by the year 2000 to provide water for 900,000 acres of land, 650,000 of which are presently undeveloped. Stage I, which supplies water to about 130,000 acres of existing irrigated land, is complete, while Stage II, which will involve the irrigation of some 60,000 acres of already irrigated land and provide water for about 40,300 new acres, is well underway. This phase of the project, which calls for the transbasin diversion of water into the Kala Oya basin, also entails the settlement of 14,000 new families into the project area, already occupied by about 25,000 families.

The impacts of the project, here taken to be indicative of the environmental effects of other dry zone major irrigation schemes, are expected to be on: public health; soils and agricultural practices; water and its quality; the flow of the Mahaweli Ganga; and flora and fauna both within and outside of the project area.*

public health

The project is expected to increase the incidence of malaria by providing new breeding grounds for mosquitoes. The incidence of waterborne diseases is also expected to increase, especially if proper sanitation is not practiced by the increased population in the area. Although measures can be taken against these potential effects, precautionary measures such as the boiling of water for domestic use may become increasingly difficult

*See Weatherly and Arnold (1977) for a detailed assessment.

5.2.2.1.2 (cont.)

because of the shortage of firewood. Unless they are applied properly, pesticides used in the project, are expected to lead to a certain amount of pesticide poisoning.

water and its quality

The quality of water is expected to be affected by the increased used of both pesticides and fertilizers; this will have its impact not only on human health but also on the fish in irrigation tanks and on wildlife not only within the project area but also in nature reserves on its fringes.
Increased use of irrigation water is also expected to lead to a rise in the water table with possible waterlogging and increase in soil salinity. However, seasonal rainfall is expected to flush excess salts from the soil, and it is felt that waterlogging can be controlled through well-managed use of irrigation water. It is also felt that the heightened water table and the consequent increase in underground water even on the higher slopes will permit a certain supply of water to the relatively shallow wells used to supply domestic water for the project.

soil

The agricultural presently practiced in the targeted area (see 5.2.2.3 in this connected) for development under the Mahaweli Project, Phase II, permits only a minimal amount of soil erosion. The clearing of land for development and the more intense working of upland areas that are particularly susceptible to soil erosion are expected to increase soil erosion in the area considerably.

deforestation

Clearing of land for development will mean the removal of large forested areas presently used for firewood supplies.

the effects on the flow of the Mahaweli Ganga and the Kala Oya

The diversion of water from the Mahaweli Ganga will cause a decrease in the flow of that river and a concomitant increase in the flow of the Kala Oya, the catchment area receiving the diversion waters. With the decrease in flow of the Mahaweli Ganga, salt water will penetrate further up the estuary at the river's mouth, causing changes in vegetation; there may also be detrimental effects on endemic fish in lowland pools normally recharged by the river during flood. In the Kala Oya, on the other hand, freshwater will penetrate further down the estuary, expanding the territory of animals and plants dependent on freshwater riverine habitats and reducing the territory available for salt tolerant species such as mangroves and animal life associated with them.

effects on wildlife (see 4.4.6.3.2)

5.2.2.1.3 possible problems with irrigation efforts

Rapid siltation of river beds and irrigation reservoirs is a problem in areas of the country where the surface flow of rivers is rapid and substantial and where indiscriminate clearing of land has led to soil erosion.

Drought and the felling of forests with large waterholding capacities could lead to a serious reduction of the water available for irrigation schemes. There is some evidence that of forest land has already has adverse effects on river flow (see 4.2.3).

5.2.2.1.4 water wastage and the need for efficient water management

It has been pointed out (see Chambers[1975]) that in Sri Lanka the limiting factor in agricultural development is not the unavailability of land so much as the availability of water. Robert Chambers has argued that present methods of water distribution in major irrigation schemes (those which come under bureaucratic control) encourage the wastage of valuable irrigation water and that better water management, in conjunction with other administrative policies, could lead to increased production, possibly even help to close the gap between food needs and food production, without the investment in expensive new irrigation schemes.

5.2.2.2. Gardens

Gardens of various sorts are cultivated throughout Sri Lanka, distributed over about 9% of the total land area of the country. In the wet zone, the gardens growing among the houses and huts of towns and villages produce a great abundance of fruits such as bananas, papayas, bread fruit, and mangoes and vegetables such as taro, cassava, tomatoes, as well as onions cucumbers, squash and beans. Gardens in the dry zone are less luxuriant in their growth, producing bananas, papayas, and citrus fruit and limited in their vegetable yield chiefly to cassava.

In addition to these more typical gardens, which are intended chiefly for consumption by their owners, are those vegetable gardens whose produce is intended for the market. In the lowlands these yield cassava, sweet potatoes, chillies, onions, and beans, while in the central highlands there grow potatoes, cabbage, red beets, carrots, leeks, tomatoes and onions.

Emphasis on the produce from such gardens was especially strong during the worst period of food shortages in the early 1970's. Plantings and yields, especially of cassava, were increased considerably during that time.

5.2.2.3 Chena (see map, page 63)

In chena, or shifting cultivation, land is cleared, worked for a few years until it loses its fertility, and then allow to lie fallow for a long period of time. In 1961 is was estimated that about 1.6 million acres of land were used for this type of cultivation, predominantly in the dry zone, although a limited amount of chena is practiced in a small and geographically concentrated area of the wet zone as well.

Traditionally chena has been practiced by peasants to supply their own food needs and to supplement rice agriculture. Land is cleared and burned at the end of the rainy season, plantings follow in September and November, and the harvest follows in January and February. During such maha (rainy season) chena, crops are not tended, and yields usually depend on the strength of the rains. Little chena is practiced during yala, except in areas of heavy rainfall. Crops grown on chena lands are: dry or mountain rice; corn; sorghum; kurakkan and cucumbers; squashes; herbs; legumes; and cassava.

Chena has traditionally been practiced on state-owned (Crown) lands, where farmers, for a minimal fee, are given permits to work from about one to two acres per applicant. A signicant number of such chenas are worked without such permission, however.

Some recent developments in chena agriculture have been the use of fertilizers and even agrochemicals in order to extend the life of the chena and the keeping of chenas primarily for the production of cash crops such as chillies. Traditionally chena lands were utilized for about one to two years and allowed to lie fallow for about 20. This period is becoming increasingly shorter due to population pressure and the consequent shortage of suitable land.

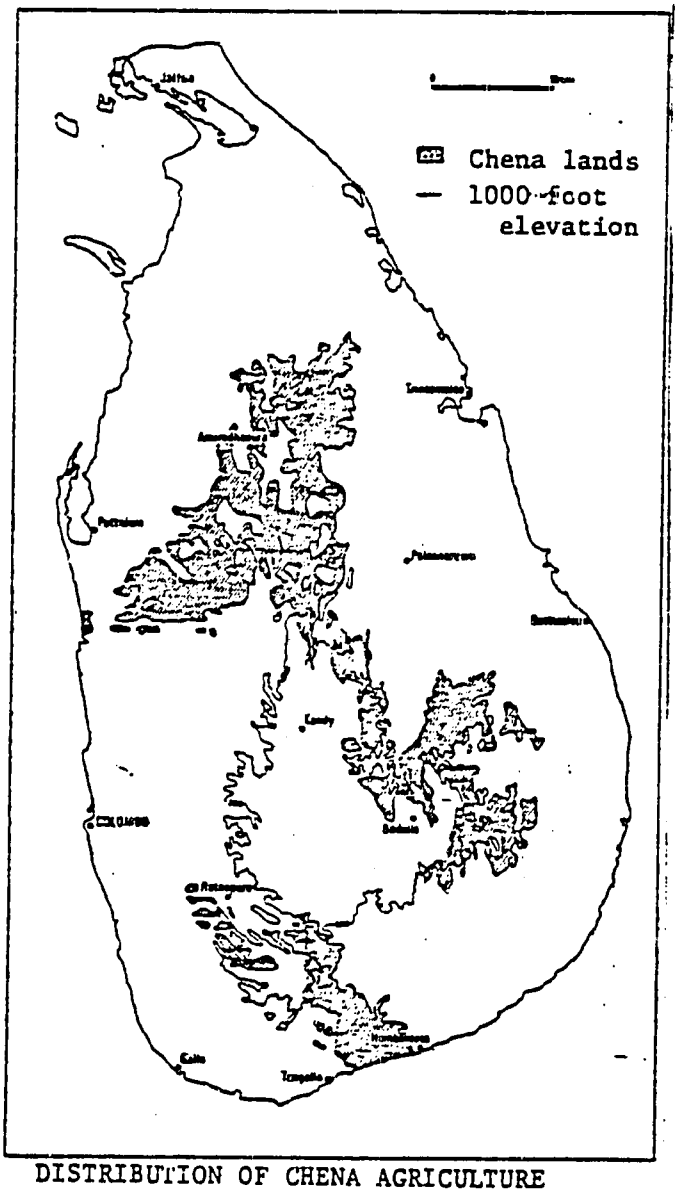
soil erosion and chena agriculture

Certain features of traditional chena agriculture, including a minimal amount of land prepration by ploughing and turning of soil and only a limited amount of weeding, have meant that soils under chena agriculture have been only minimally subject to the erosive effects of heavy rainfall. However, certain changes in practices could lead to erosion problems. For example, in areas where population pressures have caused the fallow period to drop from twenty to twelve or even ten years the threat of decreased productivity resulting from over-utilization could lead chena cultivators to the use of more modern agricultural practices, including the use of agrochemicals. The increased intensity and duration of cropping thus permitted is expected to lead to greater erosion problems in chena areas.

Special pressures on chena land are expected to occur on the scrubland fringes of large irrigation project, where project settlers, wishing to follow the traditional paddy-chena agricultural combination, are likely to compete with existing chena farmers, thus causing over-utilization of the scrub jungle adjoining the project area and resulting in land degradation.

negative effects of chena agriculture

Chena agriculture has distinct environmental disadvantages, specifically the exploitation and deforestation of woodlands and the resulting degradation of woodlands to secondary forests and eventually to savannas.



DISTRIBUTION OF CHENA AGRICULTURE

Source: Domrös (1976)

5.2.3 Animal Husbandry

5.2.3.1 Present situation

Animal production has played an unimportant economic role in Sri Lanka. Cattle and water buffalo have functioned above all as draft animals, and en elephants are occasionally used as work animals (about 1,200 to 1,500 working elephants in 1976).

Livestock [1962 and 1976] and food and skins production [1976]

Livestock (in thousands)

	1962	1976 (t=metric tons)					
		nos.	slaughtered	meat	milk	eggs	skins
Buffalo	597,481	854,000	40,000	6 t	45 t		5,940 t
Cattle	1,363,785	1,744,000*	240,000	137 t	147 t		
Goats	309,906	562,000	137,000	1 t	5 t		205 t
Sheep		30,000	7,000	n/a			14 t
Pigs	56,184	36,000	20,000	1 t			
Chickens	n/a	5,700,000	n/a	10 t		16 t	
Ducks	n/a	14,000	n/a				

*includes 350,000 milk cows

The general increase in the numbers of livestock shows the effect of a government program, initiated in 1962, to expand government livestock farms, thereby increasing the availability of upgraded breeding stock, particularly of cattle and buffalo for draft and milk purposes, but also of poultry, pigs, goats and sheep. Incentives for milk producers have been offered in the form of higher prices for milk delivered to government sterilizing, processing and packaging plants. The opening of the first condensed milk factory in Polonnaruwa in April 1968 gave a considerable boost to milk production.

Reasons for the low production of animals relate particularly to religious objections by various groups: Buddhists are opposed to animal slaughter; Moslems reject pork; and Hindus consider cattle to be sacred animals. Furthermore, the natural grasses of Sri Lanka's grasslands and savannas are not of high value for grazing purposes, the best natural grazing lands reputed to be on the lower course of the Mahaweli Ganga. The FAO estimate for 1975 is about 1,100,000 acres of grazing land.

5.2.3.2 Programs for increasing livestock production

Government programs have identified grasses suitable for animal forage in Sri Lanka both in the dry regions and in cooler mountain areas. Furthermore, because native cattle are not suitable for large-scale milke production, Jersey cattle and breeding bulls have been imported and to some extent interbred with native cattle. Government farms and project promote milk production. In addition, Brachiaria miliformis has been

5.2.3.2 (cont)

identified as suitable for intercropping with coconuts, and planting is underway.

5.2.3.3 MAB Program

Under the Man and the Biosphere (MAB) project "Impact of human activities and land use practices on grazing lands," Sri Lanka is also experimenting on using the natural grasses of the dry hilly areas of the country for grazing. About 160,615 acres are available at altitudes between 2,500 and 5,000 feet; this is land which is not suitable for agriculture because of the amount and distribution of rainfall and because of the pattern of evapotranspiration in relation to soil moisture. The focus of the program is on the establishment and proper management of permanent pastures based on adapted, drought-resistant herbage. The study, concentrated on a project area in the Bandarawela district, will examine the productivity of native grasses, evaluate the productivity and feeding value of selected species, and analyze the effects of pasture management on system stability, with particular attention to nutrient losses, soil organic matter status, erosion control, and water holding capacity. Cattle and sheep grazed on this land will be examined as to their weight gains and their economic profitability for beef and mutton production.

5.3 INDUSTRIAL PRODUDCTION

Systematic industrial development in Sri Lanka did not begin until after independence in 1948 and has been concentrated chiefly on the production of consumer goods

The chief groups of manufactured products are:

food, beverages, tobacco:	35% of total
textiles, wearing apparel, leather products:	20% of total
rubber and plastic products:	25% of total

Other areas are the production of appliances and various metal products.

Most industrial employment is provided by the private sector, which still dominates production (about 75-80%) with a relatively small number of large-scale and well-organized factories and industries and a large number of smaller-scale industries such as workshops, cottage industries and handicraft operations. Small scale industries in the private sector employ about 65% of the industrial work force.

Heavy industry is limited to a few large state-owned firms producing cement, chemicals, steel and petroleum products. The public sector represents from 17-20% of industrial production and employs about 10% of the industrial workforce.

Sri Lanka has made an effort to develop industries based on locally available raw materials, but the bulk of industry, especially in the private sector, remains highly dependent on imported raw materials for its products.

Geographically, industry has tended to be concentrated in the southwest province in the area of Colombo, but the government has recently attempted to spread industrial development to other regions of the country.

5.3.1 Industry and pollution (see table, page 67)

The table indicates state-owned firms recently reported as major polluters of the Sri Lankan environment. No data on pollution from the private sector was found, but it is to be expected that private sector operations such as chemical production, textile production, food processing, and the manufacture of paper could lead to pollution, while these and other activities demand large quantities of water for their manufacturing processes.

The potential indiscrimate use of natural resources to increase industrial production is also a threat; the operations of the Ceylon Plywood Corporation in the Sinharaja tropical rain forest have been considered above (see 4.2.2.4).

INDUSTRIAL OPERATIONS AND POLLUTION IN SRI LANKA

Industry	Location	Ownership	Production/Output	Source of Raw Materials	Pollution	Controls
Ceylon Cement Corporation	Kankesanturai, Puttalam, Galle	state	Combined production of 417,815 tons in 1973; 474,000 tons in 1974; meets S.L. demands for concrete; 5,000 tons exported in 1973	Sri Lankan limestone: Jaffna Peninsula and Aruwakulu	Plants at Kankesanturai and Puttalam reported to be polluting with kiln dust	plants have been ordered to install electrostatic precipitators
Sri Lanka Tire Corporation	Kelani	state	truck tires, agricultural tires, car and jeep tires, tubes	Sri Lankan rubber; oil based raw materials (important)	not known	not known
Paranthan Chemical Corporation	Paranthan	state	manufacture and sale of caustic soda, chlorine, hydrochloric acid, table salt; byproducts such as ferric chloride, zinc	Sri Lankan salt, imported materials	has emitted into the environment, chlorine originally intended for DDT manufacture	not known
Ceylon Petroleum Corporation	Colombo	state	produces fuel oil, naphtha, bunker fuels, marine diesel, marine lubricants, aviation gasoline and turbine fuel; refinery produced 1,672,000 tons of refined products in 1973	imported crude oil	sulfur dioxide emissions	not known
National Textile Corporation	Veyangoda, Thulhiriya, Pugoda	state	mills perform spinning, weaving, finishing; production of yarn and cloth	imported raw cotton from Egypt (14,043,336 lbs. in 1973)	untreated alkali and sizing effluents	not known
Spray Dried Milk Factory	Ambewela	state	powdered milk	National Milk Board dairies	alkali and milk washings enter water supply of neighboring villages	not known
Eastern Paper Mills Corporation	Valaichenai	state	production capacity of 22,500 tons per year; 19,338 tons of paper products in 1973	straw(major raw material): S.L. sources; waste paper	alkali and particulate wastes from the plant said to be destroying the acquatic environment along the eastern coast in the vicinity of the plant	not known

5.4 DOMESTIC ENERGY USE

FUELS FOR DOMESTIC USE

	utilization	source of supplies	consumption levels	costs involved
FIREWOOD	cooking and boiling of water are major uses	local forests; scavenging; market sales in Colombo, Jaffna, and Kandy; little being done in the way of reforestation programs for firewood, but some development schemes include village forests	no exact figures, but an estimated 4-5 million tons burned in 1975; in 1970 over 94% of the population relied on firewood, burning an estimated 1/3 to 2/5 tons per capita per year	in rural areas cheaper than kerosene and LPG; costs of transport involved for other areas; no capital investment involved for cooker
KEROSENE	cooking and lighting; also used for small industrial boilers, glass manufacturing, tea drying, etc.	produced by Ceylon Petroleum Corp. from imported petroleum; about 57 millions gallons per year produced	90% of population uses it for lighting; less than 9% of total rural population use it for cooking; about 3.3 gallons per capita per year	presently sold at prices below cost of production; price of cooker, lamp
ELECTRICITY	cooking, lighting, motors, radios, etc.	mostly hydroelectric power (see 4.2.2.1)	under 10% of household have access, with an average use of about 30 kilowatt hours per year per connected family; in 1975 an estimated 1050 kilowatt hours were generated	because of large amount of hydroelectric power, electricity is cheaper than kerosene, but costs of hookups, etc., especially in rural areas is high, and investment in cookers, etc. is also costly
PADDY HUSK	provide fuel suitable for cooking or boiling water; presently used in rice milling	byproduct of rice production	not known; stoves have been developed, but too large for home use	negligible for husk but high for adequate stove
SAWDUST	cooking, boiling water	byproduct of timber operations; available mostly in timber areas	not known ; but cookers are available and in fairly wide use	sawdust is cheap; low price cookers available
DUNG	cooking, boiling water	animal manure	not known for Sri Lanka; from one to one and one half water buffalo needed to provide fuel of family of six for cooking for one year	cheap
LPG (liquid petroleum gas)	cooking, boiling water	produced by Ceylon Petroleum Corporation	not known; average family would consume a 18 kg cylinder in 2.5 to 3 weeks	more expensive than kerosene; higher initial investment in stove

OTHER POSSIBILITIES: BIOGASIFICATION: experiments with biogasification, which involves the generation of methane from an input of human and animal wastes as well as kitchen refuse and dry leaves, is taking place under the Industrial Development Board. Fuel production would be relatively inexpensive but initial investment in facilities would be high. No practical results of present investigations expected until the 1980's.

SOLAR ENERGY: could be used for distillation of water and cooking; best possibilities in certain dry zone areas; a demonstration project on the use of solar energy in Sri Lanka is planned under the United Nations Environment Program.

WIND (AEOLIAN) ENERGY: experimentation on the use of windmills for power production is being carried out under the auspices of the United Nations Environment Program.

WORKS OF SPECIAL USEFULNESS IN THE PREPARATION OF THIS REPORT

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Contains extensive data on government programs and economic activities, mostly for 1973 and 1974.

Sri Lanka [Country Demographic Profile]. 1977. ISP-DP-8. U.S. Department of Commerce, Bureau of the Census.

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The best source for information on conservation and environmental degradation, especially as it related to animal and plant life.

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APPENDIX A: Animals protected under the Fauna and Flora Protection Ordinance

TABLE I

List of Animals Absolutely Protected During Both the Close and the Open Seasons

Class	Order	Scientific name	English name
Mammalia	Insectivora	Feroculus feroculus	Long-clawed shrew
		Suncus etruscus fellowes-gordoni	Ceylon Pigmy Shrew
		Suncus murinus zeylanicus	Ceylon Jungle Shrew
		Crocidura miya	Long-tailed Shrew
		Crocidura horsfieldi	Horsfield's Shrew
		Solisorex pearsoni	Pearson's Shrew
	Chiroptera	Rousettus seminudus	Ceylon Fruit-bat
		Murina cyclotis eileenae	Ceylon Tube-nosed Bat
		Kerivoula hardewickei malpasi	Malpas' Bat
	Primates	Loris tardigradus	Slender Loris
		Presbytis senex monticola	* Bear Monkey/Hill Wanderoo
	Pholidota	Manis crassicaudata	Indian Pangolin
	Rodentia	Petaurista petaurista lanka	Grey Flying-squirrel
		Petinomys fuscocapillus layardi	Small Ceylon Flying-squirrel
		Ratufa macroura macroura	Highland Giant Squirrel
		Tatera indica ceylonica	Ceylon Gerbil/ Antelope Rat
		Bandicota bengalensis gracilis	Lesser Bandicoot Rat/ Mole Rat
		Mus fernandoni	Ceylon Spiny Mouse
		Mus mayori mayori	Highland Spiny Rat
		Mus mayori pococki	Bicoloured Spiny Rat
		Rattus montanus	Nillu Rat
	Carnivora	Paradoxurus zeylonensis	Golden Palm Civet
		Felis rubiginosa	Rusty-spotted Cat
		Felis viverrina	Fishing Cat
	Sirenia	Dugong dugon	* Dugong
	Artiodactyla	Axis porcinus porcinus	Hog Deer
	Perissodactyla	Equus caballus	Delft Island Pony
Reptilia	Testudinata	Dermochelys coriacea	* Leathery Turtle
		Lepidochelys olivacea olivacea	Olive-back Loggerhead
		Caretta caretta gigas	Giant Brown-red Loggerhead
		Eretmochelys imbricata	* Hawksbill Turtle
		Chelonia mydas	Green Turtle
		Testudo(Geochelone)elegans	Starred Tortoise
	Squamata	Varanus monitor	* Water Lizard/ Water Monitor

NOTE I: * indicates animals on the list of "Endangered and Threatened Wildlife and Plants" published by the Fish and Wildlife Service of the U.S. Department of the Interior

NOTE II: the Asian Elephant (Elephas maximus) is absolutely protected under Article 12 of the Fauna and Flora Protection Ordinance, as are all deer and fowl during the close season.

NOTE III: the following animals appear on the list of "Endangered and Threatened Wildlife and Plants" of the Fish and Wildlife Service of the U.S. Department of the Interior as endangered or threatened in Sri Lanka but do not appear on the Sri Lankan lists of protected species:

English name	Sci. name
Langur, entellus	Presbytis entellus
Toque macaque	Macaca sinica
Indian python	Python molurus molurus
Bengal monitor	Varanus bengalensis

TABLE II

List of birds not protected during the open season (all others are absolutely protected) **

English name	Scientific name
Ceylon Spotted Dove	Streptopelia chinensis ceylonensis
Indian Ring Dove	Streptopelia decaocto decaocto
Ceylon Wood Pigeon	Columba torringtoni
Blue Rock-Pigeon	Columba livia intermedia
Bronze-Winged or Emerald Dove	Chalcophaps indica robinsoni
Green Imperial Pigeon	Ducula aenea pusilla
Ceylon Orange-Breasted Green Pigeon	Treron bicincta leggei
Pompadour Green Pigeon	Treron pompadora pompadora
Ceylon Southern Green Pigeon	Treron phoenicoptera phillipsi
Common/Fantail-Snipe	Capella gallinago gallinago
Pintail Snipe	Capella stenura
Wood Cock	Scolopax rusticola
Jack Snipe	Lymnocryptes minimus
Wood Sandpiper	Tringa glareola
Black-Tailed Godwit	Limosa limosa limosa
Curlew	Numenius arquata orientalis
Whimbrel	Numenius phaeopus phaeopus
Eastern Golden Plover	Pluvialis dominica fulva
Grey Plover	Squatarole squatarola
Painted Snipe	Rostratula benghalensis benghalensis
Watercock	Gallicrex cinerea
Ceylon Bustard-Quail	Turnix suscitator leggei
Blue-Breasted Quail	Excalfactoria chinensis chinensis
Cotton Teal	Nettapus coromandelianus coromandelianus
Shoveller	Spatula clypeata
Pintail	Anas acuta acuta
Garganey	Anas querquedula
European Teal	Anas crecca crecca
Whistling Teal	Dendrocygna javanica

** includes the Red-faced Malkoha (Phaenicophaeus pyrrhocephalus)*

TABLE III

List of animals not to be shot except on a special license at any time of the year

English name	Scientific name
Leopard	* Panthera pardus fusca
Ceylon Bear	Melursus Ursinus
Ceylon Swamp-Crocodile	* Crocodylus palustris kimbula
Marsh-Crocodile or Estuarine or Sea-Crocodile	Crocodylus porosus Schneider

TABLE IV

List of plants absolutely protected by law in Sri Lanka

English name	Scientific name
Primrose Orchid	Dendrobium heterocarpum
Wesak or May Orchid	Dendrobium macscarthiae
Daffodil Orchid	Ipsea speciosa
Foxtail Orchid	Rhynchostylis retusa
[orchid family--no Eng. name]	Vanda spathulata
Anuradhapura Orchid	Vanda tessellata
Madara Tree	Cleistanthus collinus
Baobab Tree	Adansonia digitata
Sphagnum moss	Sphagnum zeylanicum

SRI LANKA

Official language: English

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