

PLANNED LANDUSE FOR THE TEA COUNTRY

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Since the introduction of 'Export Agriculture' to Sri Lanka vast tracts of land originally under forest or natural grass were opened up for plantation crops. Very little or no attention was paid to prevent soil erosion and other adverse effects of land development in establishing these plantations. As a consequence of such unplanned land utilization the soil has degraded to a very serious extent. Stability and productivity of land can only be achieved by a well planned landuse system which ensures sustained use of the land resources.

History of Plantation Industry

Long before "export agriculture" was introduced, rice was the main crop planted on a large scale in Sri Lanka generally as a lowland crop, under submerged conditions. Shifting cultivation, known as the "Chena" system, was also common mainly in the dry zone of the island. In these "Chenas" a mixed cropping system was practiced where a variety of cereals and vegetables were produced for home needs. Even in the homesteads, mixed planting of various tree species to meet home needs was cultivated. In such holdings, indiscriminate and unscientific planting has resulted in overcrowded stands as seen in the wet zone, mainly in the mid country of Sri Lanka where they are commonly known as "forest gardens". In these gardens, various kinds of vegetables and yams were grown along with fruit trees and spices like cardamom, clove, pepper and cinnamon (Bavappa and Jacob, 1981). Export agriculture was started by the Dutch, who took over the island from the Portugese in 1658. Cinnamon and pepper which were growing successfully in home gardens were promoted as plantation crops. After that sugar cane was introduced to be planted with coffee. However, cinnamon was the main export crop during the Dutch period but it failed to be established mainly due to competition from India and Java.

In 1790, when Britain acquired parts of the island which were under the control of the Dutch, coffee became the basis of the plantation industry. The Kandian Kingdom in the highlands of Sri Lanka was acquired by the British in 1825, and the military roads constructed in order to complete this conquest, helped to open up the hill country for coffee plantations. Initially, coffee was confined to small gardens surrounding peasant homes. Subsequently, with the equalization of duties in Sri Lanka and West Indian Coffee and the sharp increase in the West Indian cost of production due to the abolition of slavery, put Sri Lanka in a favourable position. European investment was attracted and planting pro-

gressed rapidly. Exports of about 450,000 kg (1 M lb) in 1827 increased to 2.7 million kg (6 M lb) in 1837. Capital poured into the industry with £ 3 M being invested between 1837 and 1845 alone. By 1884, 24,000 ha (60,000 ac) were under cultivation, on 367 plantations mainly owned by civil servants and absentee proprietors.

Even though coffee plantations were a great success in Sri Lanka, much of it suffered from lack of experience and the plantations were severely affected by the depression which hit the industry in 1847, mainly due to the lower efficiency of Sri Lankan estates where much planting had been speculative and ill financed ; as a result many estates were sold at a loss or abandoned. Those that survived paid close attention to sounder finance and more careful management, concentrating on the best fields and employing better methods.

The crisis of 1847 was followed by about twenty years of prosperity for coffee. Prices were generally high and wages were low; by 1857, 404 European plantations occupied over 32,000 ha (80,000 ac), whilst 19,000 ha (48,000 ac) of native coffee also gave a good income. Government also aided the industry by the construction of a network of roads to help planters to transport their produce to Kandy, the capital city of the hill country by building the Colombo-Kandy railway and the harbour in Colombo. By 1860, there were more than 5,000 km of roads in Sri Lanka, mainly serving the plantation areas. In 1870, coffee exports reached a maximum of 53.6 M kg (118 M lb).

After this period, the industry suffered a rapid decline due to the coffee leaf rust disease (*Hemilia vastatrix*) which spread through hundreds of fields. Yields that once averaged 880 kg. per ha. fell to 284 kg. by 1876 and were no longer profitable. The output in 1886 was only one sixth of that of 1870, and by 1895 was only 2.7 M kg. Although the disease was the main cause for the downfall of the industry, the speculative and ill managed nature of many of the plantations which could not withstand the crisis and the abandoned areas certainly helped the spread of the leaf rust. Competition from the massive Brazilian Coffee industry further aggravated the downfall (Courtney, 1980).

The failure of the Coffee industry in Sri Lanka led to its replacement by other crops which were envisaged to be more profitable. Cinchona was a disappointment due to a general over production in the world market and thus tea found its way into the island's economy.

Development of the Tea Industry

Planting of tea in Sri Lanka has been carried out since 1860, and there is a record of a plantation of four hectares of tea in 1867. In 1887 there were 63,500 ha (157,000 ac) of tea in Sri Lanka, which increased to 164,000 ha (405,000 ac) by 1990. With the well organized trade facilities and the constantly growing British Tea Market, the growth of the tea industry was very rapid and has since become the mainstay of the island's economy.

The major problems of the tea plantations in Sri Lanka were the limited area of suitable terrain, which kept land prices high and the average estate size small and the labour shortage. The demand for labour first created by the coffee and then by the tea industry, was not met by the local peasantry despite landlessness. The landless class arose because most of the forest land cultivated by the traditional "Chena" system in the mid country area by the peasants were taken over by the British Crown under the "Waste Lands Ordinance" and subsequently leased to British interests for opening up plantations. Generally the peasant was devoted to his village and to the land, if he owned it, and refused to seek employment for a money wage. Thus the tea planters had to turn to South India for labour. The annual rate of entry of the South Indian Tamils varied from about 30,000 in the 1840's to about 100,000 in the 1880's. While some of this labour returned home, most of them eventually settled in Sri Lanka.

The plantations were largely owned and developed by individual planters who were mainly British, using their experience from Indian Tea plantations. The formation of plantation companies came into operation a few years before the second world war. After the formation of the companies, most of the proprietary planters became the shareholders of these companies. Along with the development of the plantations there was also widespread development of the small holdings owned by the natives. In Sri Lanka the hectareage of tea small holdings expanded very greatly during the 20th century with their produce being processed in plantation factories. Even though there were considerable number of small holdings, the monopoly of the export crop production was maintained by the plantations.

Present Position

All Tea, Rubber and Coconut plantations over 20.0 ha (50 ac) owned by individuals and plantation companies were nationalized during the 1973/75 period under the Land Reform Act. Most of these plantations are now managed by two state corporations, State Plantations Corporation and Janatha Estates Development Board, under the Ministry of Plantation Industries.

The area under tea in 1985 is recorded as 231,650 ha. When one considers the recorded areas from 1971 (Table I), one can see a fluctuation in extent which is a highly unlikely feature for a perennial crop such as tea. The figures in Table I were computed from various plantation registers and replanting records in the Tea Commissioner's Division. These figures are apparently not accurate. An aerial survey done by the Survey Department of Sri Lanka with the assistance of the Hunting's Survey Limited using the aerial photographs obtained in 1956 indicated the tea area in Sri Lanka as 259, 473 ha. Since then no proper landuse survey was done until the recent Landuse Mapping Project carried out using the aerial photographs obtained in 1981-1984 which recorded the tea area in Sri Lanka as 201,630 ha. The downward trend in production could be mainly due to this considerable reduction of the tea area during the past two decades.

TABLE I — Extent, production and cost of production of tea in Sri Lanka

Year	Area (Ha)	Production (×1000 kg)	Cost (Rs/kg)
1971	241,667	217,773	3.53
1972	241,858	213,475	3.75
1973	242,302	211,271	4.47
1974	242,191	204,038	5.55
1975	241,877	213,679	6.70
1976	240,578	196,606	7.42
1977	242,012	208,572	8.19
1978	242,903	198,981	11.89
1979	244,099	206,417	13.43
1980	244,715	191,375	18.71
1981	244,819	210,148	18.79
1982	242,141	187,816	21.97
1983	210,064	179,287	25.16
1984	227,874	208,058	35.56
1985	231,650	214,084	36.67

Source : Central Bank of Sri Lanka, Annual Report, 1987.
Statistical Handbook of Sri Lanka, 1986.

In addition, the cost of tea manufacture also increased rapidly during the past two decades, causing more pressure on the economy. As shown in Table I, the cost of production has increased more than ten times since 1971. The high cost of fuel increased labour charges and the high cost of almost all items required for manufacture caused the sharp rise in the cost of production.

Present Landuse Problems

Soil erosion

The physical relief of the main tea growing area is dominated by a mountain range rising to about 2,400 m (7,800 ft). These mountains consists mainly of steep land with slopes exceeding 25 per cent. The natural vegetation of the area had been thick evergreen rain forests and open grasslands known as "Patana" lands. Very little of this natural vegetation is still preserved. Vast areas of virgin rain forest in the central hills were cleared rapidly by the planters under the British regime to cope with the immense demand for land for coffee and then tea plantations. In developing these plantations, insufficient or no attention was given to prevent the adverse effects of land development, particularly soil erosion.

However, where new tea is planted on the contour with appropriate soil conservation practices, soil erosion is checked to a great extent. But in the recent past, more virgin jungle and uneconomic old tea areas have been cleared in order to grow food crops under various agricultural development schemes. Unlike the new tea plantations, there is very little soil conservation undertaken in these lands, and they are more exposed to the hazards of erosion. Because of intensive cultivation practices followed in seasonal agricultural crops, soil erosion takes place much more rapidly. Within a short period of time, land formerly productive, becomes riddled with rills and gullies through soil erosion. Furthermore, opening of new settlement schemes, highway construction and forest logging also contribute to erosion.

The central hill country, where tea is grown extensively, also plays an important role as the major catchment area for the water supplies of the island. The influence of various activities in the hill country, which increase soil erosion, increase the amount of suspended sediments carried by the major rivers of the country.

Besides causing sedimentation of the natural waterways, soil erosion has more recently brought about the deposition of enormous amounts of silt in the country's major hydro-electric reservoirs causing problems in generating power during the dry season.

Soil erosion from the hill country contributes to the general desiccation of the whole country by greatly accelerating free movement of water and lowering the water table. Countless springs and streams that once flowed strongly all the year round have now ceased to flow, or at best flow only sporadically. The rivers where clean water once flowed perennially with moderate seasonal rise and fall are now characterized by violent fluctuations in volume over shorter periods of time. Various types of activity in the hill country have therefore led to a marked decrease in the general water supply of the country. The drought periods experienced in Sri Lanka in the recent past emphasize this point. The supply of electricity has been reduced throughout the country due to the lack of water in the hydro-electric reservoirs, and the rationing of drinking water has been made necessary in most urban areas including Colombo.

Similarly sudden rise of the river waters due to heavy rains have made the low-lying areas to be affected by floods and the hilly areas by landslides causing extensive damages to people and property.

The ultimate consequence of unchecked soil erosion will be the exhaustion of valuable natural resources. This will cause serious damage to the national economy, resulting in depletion of national wealth and lowering of living standards.

Unplanned Settlements

After the nationalization of the plantations in 1975, some of the old uneconomic tea areas were abandoned and used as new settlements under the village extension schemes. Under these programmes many old tea areas, some on very steep land and eroded were cleared, new houses built and land given to new settlers. These lands were not suitable for settlements. Attempts to grow vegetables and other home needs by the new settlers increased erosion and further degraded the lands. Selection of sites for settlements were usually done in a hurry with very little attention being given to the dangers and the effects of factors of land degradation. Thus, within a few years the new settlement schemes become unproductive, leaving the settlers in a hopeless position.

Land Selection for Replanting

Yield of a commercial tree crop begins to decline after a period of time. The majority of tea plantations in Sri Lanka are older than 80 years and may have long entered the uneconomical phase of the crop. Although the need to undertake replanting with newly improved high yielding clones is well recognized, there are considerable problems of implementation. The replanting process is a very expensive item in the plantation budget. Every existing old tea plantation cannot be replanted as the conditions of some of the lands are no longer suitable for tea and need improvement adding to the already expensive operation of replanting. In respect to land selection only a few land factors are considered at present. These include slope and the amount of rock outcrops of the land. No proper land suitability survey has been done to identify the most suitable land for tea growing upon which a systematic replanting programme could

be developed. Because of the lack of this correct identification of suitable land, unsuitable land is being replanted at great cost, and as a consequence good crop establishment is not achieved. On the other hand, some land best suited for tea has been put to other uses like village expansion projects and agricultural diversification schemes excluding tea.

Importance of Landuse Planning

Planned Landuse

When considering the problems which exist in the tea growing areas, minimising soil erosion is of paramount importance in order to conserve the limited land resources. This objective can be achieved by selecting the best suited land use and practicing proper conservation methods.

Stability in land management can only be achieved by a thorough appreciation of the natural factors governing the productivity and by the application of a well planned landuse system which ensures sustained productivity. It is only through a planned landuse system that it is possible to reduce soil loss to a minimum in the cultivated tea area while maintaining the plantation in their correct ecological balance.

The first approach of systematic landuse planning for a tea area is to identify and classify the lands according to their suitability for tea. This will serve many purposes. Firstly, it may be used to determine if a particular tea land is uneconomical because of its inherent unsuitability of the soil, land, poor management, bad genetic material or of some other reason. Lands can then be earmarked for diversification into other uses on the basis of such evaluation.

Secondly, decisions regarding the desirability of replanting land with clonal tea and the order in which lands should be replanted can also be made from the information gathered from the classification. Naturally, lands which show greater return on investment should be replanted first. Programmes of infilling could be worked out in a similar manner.

Thirdly, it can be used to measure management performance. Once the yield potential for each land class under standard management is known, the yield, to which the management should aim, could be fixed for any tract of land or estate. The extent to which management realises these goals can then be easily assessed.

More than 50 years of intensive research done in all aspects of the tea industry has yielded some specific cultural and cultivation practices to increase production quantitatively as well as qualitatively. The application of a correct landuse classification system, integrating research findings into the classification system, is now a great need. It should be based on the critical examination of all the natural factors governing the crop productivity, with the application of research findings, to ensure stability in production.

Past Work on Landuse Planning

The first attempt to identify and classify regions according to their suitability for tea, based on selected land characteristics, was made by Panabokke (1970), who identified the main agro-ecological regions of the tea and rubber growing areas. While this gave a general assessment of the suitability of these regions for tea, no criteria of suitability is given.

Smith (1971), working under the aegis of the FAO-supported agricultural diversification project, formulated specifications for a "Land capability" classification of the "wet zone" as a basis of diversifying uneconomic tea and rubber land into other crops. He worked out a set of criteria based on limitations of climate, topography, soils and drainage by which lands could be classified according to their general capability for agriculture, including arable annual crops, pasture, plantation crops and forestry. Unfortunately as with all capability classifications, this was too general and failed to take into account the unique requirements and characteristics of tea as a crop. It, therefore, did not lend itself to very precise or useful interpretation.

Desaunettes *et al.* (1974), produced a methodology for land evaluation in the "wet zone" of Sri Lanka based on a division of the area into pragmatically defined "major land systems", i.e. major physiographic regions. These regions were further sub-divided into physiographic units corresponding more or less to the classification of Smith (1971). The actual method of mapping was to study the distribution of land classes in each physiographic unit and to extrapolate this distribution to cover each physiographic region. Unfortunately, this method was too complex to be applied by those not directly involved in the mapping itself, and also the sample areas needed to represent the different physiographic regions kept increasing as the mapping progressed and new physiographic regions were "discovered".

De Silva (1979), outlined a system of land classification within tea plantations designed to suit development needs based on a simple division of the well drained land according to topography, availability of land and location. Recommendations regarding the diversification of units not suited for tea into other crops and uses were also made.

The principles of a system of land suitability classification for Sri Lanka was proposed by De Alwis (1976), and have been adopted as the basis of a land suitability classification for different uses by the Landuse Division of the Irrigation Department. This system is in accord with the FAO framework for land evaluation (1976). It emphasises the two-step approach in which the physical suitability classification precedes the final economic land evaluation.

De Alwis *et al.* (1980), presented a simplified version of the suitability classification systems used by the Landuse Division. The simplifications that

have been introduced reduced the number of classes and sub-classes and eliminated the suitability unit. They were intended to facilitate rapid mapping by quickly trained personnel.

A Systematic Method for Tea Land Planning

Planning for any project is basically a clear and logical process of assembling all available factors, assessing the requirements and objectives of the project in hand and finally planning the development of the project to achieve the objectives. Landuse planning requires the planning of each unit of land in the project within its capabilities and its treatment in accordance with the needs it has for protection and improvement to achieve maximum sustained production. It is aimed at helping the planter to produce more crop and more money from his land while at the same time, maintaining or improving the fertility of the land. The ultimate goal of landuse planning is, therefore, conservation of natural resources while achieving high productivity and profit.

In order to achieve the above objectives, a systematic landuse planning programme for tea lands could be outlined with three main levels of approach involved:

- (a) Reconnaissance Landuse Plan
- (b) Regional Landuse Plan
- (c) Landuse Plan for Individual Units

(a) Reconnaissance Landuse Plan

This level of planning will deal with very large areas of land and would involve the entire tea growing area in Sri Lanka. The objective would be to establish a general pattern of potential landuse within the area. While using the past work done on suitability classifications, this may be carried out from an examination and interpretation of aerial photographs with a minimum amount of field work. The field work will involve basic checking of problem areas, limited soil pit sampling and some topographical survey.

(b) Regional Landuse Plan

Regional planning is the second stage of approach. Having done a broad landuse plan for the entire tea growing area, more specific natural regions, such as individual agro-ecological regions or even smaller units or tracts of land, could be identified. At this level it is aimed to produce a landuse planning programme on a regional basis for more specific aspects of landuse, including the identification of suitable land for replanting of tea, area for re-forestation and for pasture land, areas suitable for village expansion and crop diversification schemes and areas where other land re-organisation is required. When identifi-

cation of suitable land for tea is carried out the criteria outlined by De Alwis et al. (1980) may be used as a simplified land suitability classification for tea. Various kinds and degrees of limitations identified in this classification are illustrated in Tables 2a and 2b.

A detailed analysis of aerial photographs combined with a more intensive field work programme to carry out a systematic detailed soil and topographical survey is required at this stage. After a detailed soil survey it is possible to refine the "soil type" criteria given in Tables 2a and 2b. When the soil is classified into various series it is possible to study the suitability and limitations of each series for the growth of tea and their potential for other landuse practices. It is necessary to identify not only the kinds of limitations in each for different landuse but also their degree of hazard for erosion. Therefore it could also be used to plan conservation measures required to maintain the existing land suitability class or to improve it. The use of land as a renewable resource, which could be managed for sustained production indefinitely, becomes easier to achieve when the conservation needs can be identified this way. After such a survey it is possible to produce suitability maps for various landuses which could then be used for planning and management purposes.

(c) Landuse plan for Individual Units

Under the proposed "Cluster System" of estates where a cluster of estates is to form a more intensive management unit a practical landuse programme could be drawn-up, to be implemented in each "Cluster". Small holdings and villages within the estate cluster could be incorporated into one land unit for the purpose of the landuse programme. Such a practical landuse programme can serve a more important role to develop the whole unit to its maximum potential and at the same time ensuring the conservation of the natural resources to their optimum levels. Classification of land into various suitability units within a cluster should be based on the integrated information and data obtained under regional landuse plans.

After the preparation of unit landuse plan for each unit or cluster all future developments such as soil and water conservation work, replanting and infilling of tea, timber plantations, establishment of pasture for dairy development work, allocation of land for workers and villages for vegetable cultivations and for other needs, new buildings and road works could be planned accordingly to its best suitability for each use.

TABLE 2a—Criteria for placing lands in classes according to their suitability for tea—single limitations

Kind of Limitation Degree of Limitation	Climate (agro-ecol. region)	Slope (%)	Soil depth (cm)	Soil type (great soil group)	Rockiness (%)	Gravel (Vol. % in top 90 cm.)
Up-Country						
None	WU2-3, IU2.3	0-25	> 90	RYP	0-10	0-10
Moderate	IUI	25-70	50-90	Eelworm infested RYP	10-20	10-50
Severe	All other up-country regions	> 70	<50	Hydromorphic clayey and eroded soils	> 20	> 50
Mid-Country						
None	WM3	0-25	> 90	RYP	0-10	0-10
Moderate	WM2, IM2	25-55	50-90	RBL & IBL	10-20	10-50
Severe	All other mid-country regions	> 55	<50	Hydromorphic clayey and eroded soils	> 20	> 50
Low-Country						
None	WLI	0-25	> 90	RYP	0-10	0-10
Moderate	WL2	25-75	50-90	RBL	10-20	10-50
Severe	All other low-country regions	> 70	<50	Hydromorphic clayey and eroded soils	> 20	> 50

NOTE : RYP=Red-Yellow Podzolic soils; RBL=Reddish Brown Latosolic soils; IBL=Immature Brown Loam soils; Wu1, WM1, etc., refer to Agro-ecological regions as defined by Panabokke (1970).

TABLE 2b—Criteria for placing lands in classes according to their suitability for Tea—dual moderate limitations

Moderate limitations	Climate	Slope	Soil Depth	Soil Type	Rockiness	Gravel
Climate	Class 2	Class 3	Class 4	Class 3	Class 3	Class 3
Slope	Class 3	Class 2	Class 4	Class 3	Class 3	Class 3
Soil depth	Class 4	Class 4	Class 2	Class 3	Class 3	Class 4
Soil type	Class 3	Class 3	Class 3	Class 2	Class 3	Class 3
Rockiness	Class 3	Class 3	Class 3	Class 3	Class 2	Class 3
Gravel	Class 3	Class 3	Class 4	Class 3	Class 3	Class 2

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