AN ENVIRONMENTAL PROFILE OF THE NUWARA ELIYA DISTRICT

MINISTRY OF HOUSING CONSTRUCTION &
URBAN DEVELOPMENT
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ENVIRONMENTAL PROFILE

NUWARA ELIYA DISTRICT

ENVIRONMENTAL DIVISION
NATIONAL BUILDING RESEARCH ORGANISATION
99/1, JAWATTA ROAD
COLOMBO - 5.

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CONTENTS

ABBREVIATIONS

A.R.T.I	- Acute Respiratory Tract Infections
C.E.A	- Central Environmental Authority
C.E.C.B	- Central Engineering Consultancy Bureau
D.D.E	- Deputy Director of Education
D.E.O	- District Education Office
D.S.D	- Divisional Secretary's Division
G.S.D	- Grama Sevaka Division
G.S.N	- Grama Sevaka Niladhari
I.D.B	- Industrial Development Board
I.E.C	- Information, Education and Communication
i.R.D.P	- Integrated Rural Development Programme
L.M.R.F	- Lower Montane Rain Forest
MCH/ FP	- Maternal & Child Health/ Family Planning
M.O.H	- Medical Officer of Health
M.O	- Medical Officer
S.A.L.T	- Sloping Agricultural Land Technique
N.A.R.A	- National Aquatic Resources Agency
N.G.O	- Non Governmental Organisation
P.H.I	- Public Health Inspector
P S.E.D.P	- Primary Schools Development Programme
P.S.D.P	- Primary Schools Development Programme
R.D.A	- Road Development Authority
R.D.H S	- Regional Director of Health Services
S.I.D.A	- Swedish International Development Agency
S.L.L.R & D.C	- Sri Lanka Land Reclamation & Development Corporation
U.D.A	- Urban Development Authority
Z.D	- Zonal Director

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Chapter One

Executive Summary

1.0 Introduction

Sri Lanka's focus on Environmental Conservation without any prejudice to social and economic development as stated in National Environmental Action Plan (NEAP) is most gratifying. Our people have high expectations of economic advancement and poverty eradication. If we are to survive, a high economic advancement is needed and to achieve this goal our development must be rapid but sustainable. The agenda 21 formulated at Rio de Janeiro in 1992 goes on to state "An effective strategy for tackling the problems of poverty, development and environment simultaneously should begin by focusing on resources, production and people and should cover demographic issues, enhanced health care and education, the rights of women, the role of youth and of indigenous people and local communities and a democratic participation process in association with improved governance".In complying with Agenda-21 our attention will be focused on resources and environment of Nuwara Eliya district.

Nuwara Eliya District has its own unique geographical, historical and cultural features. Whether these features are still preserved in its pristine form is worth considering. Today, Nuwara Eliya District is an environmentally critical area. Over the past decade society has felt the impact of environmental degradation resulting from intense and relentless human activities understood at various levels of the society. There is a message of urgency that must reach all levels of people for environmentally friendly living.

The analysis of secondary data shows that all five Divisional Secretaries Divisions of this district are faced with certain common environmental problems viz deforestation, soil erosion, pressure on marginal lands, extinction of fauna and flora, siltation, pollution of water courses, human settlements and sanitation. It has also been reflected that poverty underlines most of these environmental problems. Hence policy planners should give priority to poverty alleviation in all their development programmes. While on going programmes in the district towards amelioration and preservation of environment are given thought, recommendations and short comings spotlighted in the profile where appropriate should be taken note of and remedial measures taken.

2.0 Environmental Setting

2.1 Physical Characteristics

Nuwara Eliya District lies in the Central Province of Sri Lanka, between longitudes 80°24'5" and 80°57'8" East and latitudes 7°16B'5" and 6°45'02" North. It is land locked by 4 districts ; Kandy District to the North,Kegalle District to the North-West, Ratnapura District to the South-West and Badulla District to the East.

The land elevation varies from 3000' to about 8000' and has variety and complex of landform features like mountain ranges, mountain summits, denuded plateaus, plains, parallel ranges, valleys and slopes. There are gorges, cataraches and river meanders.

2.2 Climate

The significant feature being that the highest rainfall and the lowest temperature are recorded from this district. Watawala receives the highest annual rainfall exceeding 5588 mm. Nuwara Eliya experiences the lowest temperature of about 7.2°c (Feb) and it may occasionally fall below freezing point. However in the district the temperatures are relatively low varying from 60° to 80°F for the most of the year.

The districts annual mean daily maximum and minimum temperatures are 20.2° and 11.6° centigrade respectively. The relative humidity ranges between 65% and 87% during the day and 69% and 93% during the night. During the south-west monsoon the wind speed exceeds 12 km per hour. The fohn winds are as strong as 50 km per hour.

2.3 Natural Surface Drainage

The district of Nuwara Eliya is drained by head-streams of Mahaweli, Kelani and Walawe river systems, that follow the South East, North-West trend of the bedrock in parallel valleys. The cross faults resulting in steep escarpments have allowed the streams to descend steeply from one level to another forming cascade of waterfalls.

2.4 Human Resources

1981 census gives the population of the district as 603,577. Fifty percent of this population comprised of estate Indian Tamils. In 1971-1981 the population growth was -0.29%. This decrease was due to repatriation of "stateless" persons. The average population density was 354 persons per sq.km. The population at the end of 1990 was 623,112 with 56% of the population concentrated in the Nuwara Eliya and Ambagamuwa Divisional Secretaries' Divisions. The estimated population for 1992 was 712,638.

2.5 Employment Profile

The district is considered to be a high employment region. The proportion of the employed population amounted to about 91% to 96% in 1981. The highest employment recorded is in the agricultural sector. Of the overall labour population of this district women form the highest percentage.

The manufacturing sector comparatively has the lowest employment cadre. The labour force engaged in other employment activities viz. carpentry, construction, minor industries and trade is also low. The percentage of employees in the government sector especially in the professional field is poor. The district not being conducive as a residential area does not attract the public sector from more popular areas in the island.

2.6 Administrative set-up

The District Secretary is the head of the administrative set up of the Nuwara Eliya district which is divided into 05 (five) administrative divisions, each headed by a Divisional Secretary on whom devolves almost all the work hitherto done by the former government agent who co-ordinates and supervises the work which has not been transferred to Divisional Secretaries.

There are 517 Gramaseveka Divisions each administered by a Grama Seveka Niladhari.

The main resources of the district namely land, water, fauna and flora and minerals come within the purview of the respective local heads, who have been delegated with authority by their heads of departments in Colombo.

2.7 Education

There are 456 government schools, 2 private schools and 5 pirivena schools for a school going population of 160,693.

This district lacks educational facilities especially for higher education. In 1991 the advanced level student population was only 2.1% of the total student population.The cut-off point for selection on a district basis to universities was lower than for other areas.

The educational set up has been geared to suit the school population. Thus there are Tamil medium primary schools for estate children and both primary and secondary schools exclusively for Sinhala rural and urban children. A few schools cater to both Sinhala and Tamil students. Higher education facilities are provided by a few Central Schools or Madhya Maha Vidyalayas.

There is not much scope for technical education except in the Nuwara Eliya Divisional Secretary's Division. At present facilities for vocational education are available only to a limited number of school leavers and drop-outs.

2.8 Health

The health services come under the Regional Director of Health Services of the relevant Ministry of the Central Provincial Council. The base hospital of the district is in Nuwara Eliya town. There are 02 peripheral units, 11 central dispensaries, 12 district hospitals and 2 rural hospitals in the district.

2.9 Infrastructure

A net work of roads interconnect estates, villages and towns through a common transport system originating in the main towns of the district.

The up-country railway line from Colombo to Badulla runs through Ambagamuwa and Nuwara Eliya Divisional Secretaries' Divisions. The most convenient mode of transport is obviously by road as the railway route is far remote from many areas of the district. Two of the main highways passing through Nuwara Eliya district are Kandy-Badulla and Colombo-Badulla roads.
Apart from a few scattered villages, the main towns and suburbs are supplied with electricity. Telecommunication services are available mainly in the towns while limited facilities may be found in the minor towns. The direct dialing telephone system in Nuwara Eliya and Hatton links these towns with all parts of the island.In the estate sector,electricity and telecommunication facilities are limited to the factories and officers' bungalows.

3.0 Resources

Soil, forest, fauna and flora, rivers, water falls, inland waters are the main resources of the district.
The dominant types of soil includes red-yellow podsolic, reddish brown latosolic, immature brown loams and regosois. The red yellow podsolic soils are widely distributed throughout

the district. The reddish-brown latosolic and immature brown loams are found in mid-country wet zone and intermediate zone of the district. The regosols are shallow stony or gravelly soils present on rock crops.

The forests belong to the montane and sub montane types. The forests in the past were degraded due to logging for fuelwood supply. Presently the forests are being encroached upon by villagers for permanent vegetable cultivation.
The wide variety of montane fauna and flora exhibits genetic diversity, especially bio-diversity and endemicity.

The rivers that originate in the district form the headwaters of important rivers like Mahaweli, Kelani and Walawe which are the life line of Sri Lanka. Maskeli ganga, Kehelgama, Kothmale and Kurundu oya have been dammed for the production of hydro-electricity. Of the many beautiful waterfalls the gigantic power of Laxapana falls serve the country in generating power at the hydroelectricity plant.

3.1 Trend in Land Use

The total land area is 1720.5 sq.km. In 1979/ 1981 the total land under agriculture was 58% of which 37% was tea land.The built up land accounted to 0.5% with 0.3% as barren land and 38.6% was under forest cover.

3.2 Power & Energy Sources

Fuelwood, kerosene, gas and electricity are the main energy sources. Fuelwood is used mostly for cooking, while the tobacco industry accounts for a small percentage of the total national consumption.

The estate lines and the rural areas that lack power services depend mainly on kerosene for lamp lighting. The demand for gas is among the affluent in the urban sector.

3.3 Use of Agro-chemicals

Nuwara Eliya district depends heavily on agro-chemicals for increased productivity in agriculture. Thus the intensive cultivation of vegetables including potatoes makes use of large inputs of chemical fertilizers and pesticides. The large scale use of pesticides to achieve crop protection has led to chemical pollution of water courses and ground water.

4.0 Environmental Problems

4.1 Human Activities

The regression of forest in the district is a spin off effect of human pressure on land. The montane and sub montane forests are being subjected to illicit encroachments. The direct demand has been for the substitution of agriculture for forest either under extensive permanent vegetable or chena cultivation. This situation is further compounded by illicit felling, forest fires and illicit mining for precious stones in forest reserves and along stream banks.

Another cause of great concern is the excess use of and over reliance on agro chemicals by farmers. It has been reported that the farmers are using more than the recommended

regulations. Other strategies will have to be adopted within a framework of a comprehensive environmental policy for run-off from cultivated or cleared land and urban streets.

5.5 Population

The need for smaller family units is urgent in order to cope with the carrying capacity of the district. Population programmes need solid community support and should be treated as peoples' movements and even incorporated into the school curriculum. The family planning programmes and other population activities must be directed to meet the policy of the government that aims at reaching replacement level fertility at least by the year 2000.

5.6 Environmental Education

The message for the care of natural resources and environment and the repercussions of slicing away at the natural resource base should reach all levels of the society.
Since it is universally recognised that children are a very effective channel of communication, Government Organisations and NGO'S should work through them to reach the rest of society.Programmes should be geared to educate the child, adolescents and the old to help create a friendly and sustainable environment conducive to both present and future generations.

6.0 Potential Resources for Sustainable Development

6.1 Potential Resources

6.1.1 The open economic policies of the government provide an impetus for the development of potential resources that could draw foreign exchange earnings to the district. There are a number of potential resources including investment in human resources especially in women that augur well for sustainable economic growth of the district.

6.1.2 There are vast possibilities for the expansion of vegetables, fruits and flower production and processing industries given the understanding of ecologically sound agricultural practices and practical experiences in quality control and packing to farmers and others engaged in these activities. Horticulture is not only a vital sector in the export arena it will also result in increased income, employment opportunities, human nutrition and local industries.

6.1.3 The district has a bountiful resource in water. Hence the maximum benefits could be achieved by impiementing a well planned programm for utilizing of water resources.The potential for the development of medium to small size hydro-power units will be economically attractive but their long term success will depend on sound watershed management. These units cause less disturbance to the flow of the stream and environment. In the British era as many as 450 tea estates ran on hydro-power generated locally. With new concept of Village Hydro, the promoting of hydro projects in tea estates and villages are timely. In this venture it is important to train people in maintenance and operations, in local manufacture of equipment like turbines and electronic gadgets. The export of bottled table water that could also cater to the local market,especially to hotels and guest houses,is also recommended.

6.1.4 The potential for inland fisheries is evident in an interiorly situated district having many inland waterways both natural and man-made. The development and expansion of the fresh water fishery industry already carried out in Kothmale and Ambegammuwa DS Divisions will provide job opportunities as well as fish for consumption particularly to the rural sector.
Aquatic polyculture should be experimented to increase productivity of fish ponds. The production of harvestable fish in floating cages are other possible methods that could be adopted.

6.1.5 As Nuwara Eliya is well known for its tourist attractions there is a great potential for an expanded tourist industry that would contribute much to the growth of the economy. The tourist board expects annual tourist arrivals to increase two to three fold between 1990-1995 and to top the one million mark before the year 2000, thus the inputs for the industry will be considerably increased. To cater to special interest groups a variety of recreational facilities like boating, fishing, bird watching, hiking, scenic walks, sports etc could be provided to attract the adventurous and nature and fun loving visitors.

Haycarb has already identified few sites for resort development. This would bring a wide range of infrastructural improvements and job opportunities. But the most important aspect to be considered in these ventures is the most rational and planned approach towards its development to avoid costly environmental mistakes. The natural resources of tourist attraction must be immediately protected by strong enforcement as nature based tourism is a source of foreign exchange in addition to stimulating local economics and creating employment. A quick travel service to Nuwara Eliya would help to attract more tourists. Hence the suggestion to set up a helipad cum air strip for small planes at the center of the Race course as suggested in the Report Development of the city of Nuwara Eliya is worth considering in order to set up an air service to Nuwara Eliya from Colombo.

6.1.6 Another important dimension is gender. It depends very much on how women feel themselves to be part of the society.One of the levers to make the future livable, is to invest in women-the rural women, particularly,in their education, health and employment.

6.1.7 Investment is at present limited to a few medium to small scale industries except in the tea industry. There is a great potential for the development of steel agricultural appliances manufactured in homes in the Kothmale area. Those engaged in these activities given the proper guidance and provision of incentives, would contribute to the share of engineering -based industries.

6.1.8 There is a great potential for the establishing of medicinal gardens especially in the Kothmale project area. It can meet the domestic needs in addition to being a commercially viable venture. The Ministry of Indigenous Medicine can be instrumental in providing extension services , incentives and subsidies to schools, societies and individuals interested in establishing medicinal gardens. Most of these medicinal plants have an export potential as they are needed for the preparation of Western drugs. This reveals the economic viability of growing them on a medium to large scale.

6.2 Environmental Management & Planning

The government has given great priority to environmental management and planning which forms an integral component of all development programmes. At district level, Divisional Secretary as chairman of the Environmental Advisory Committee co-ordinates issues on environment.

6.2.1 This profile indicates the environmental stress that should be mitigated or eliminated for sustainable development. By applying practical environmental management and establishing priorities, the on-going damages to the environment could be curtailed.

6.2.2 The practical priorities should immediately focus on environmental conditions that are most likely to have adverse effects. As long as preventive and corrective environmental attitudes are overlooked by man and his insatiable demand for land go unheeded, there is no hopeful sign that the future could be managed. A fact so evident in the district where the steep slopes are cleared for vegetable cultivation. The lenient attitude towards encroaches has undoubtedly induced more encroachments into forest, water course reservations etc.

6.2.3 This is a clear indication as to the need for community participation, that should be actively promoted in environmental management and planning in the district. The improper alienation of land in certain areas has caused dissatisfaction among NGOs, environmentalist and concerned citizens. The cutting of the new Pidurutalagala Road is a stark example of one of the worst man-made environmental disasters where protests from environmentalist and concerned citizens were of no avail.

6.2.4 Thus this profile recommends that educating, creating understanding and convincing top decision makers are important instruments for promoting environmental planning and management. There is a need to strengthen environmental agencies, develop appropriate policies, institutional arrangements and man-power resources and also to educate the public.

Chapter Two

Main Recommendations

1.0 Sri Lanka's scenario towards a newly industrial country status will have an impact on the environment. Internalization of environmental concerns in sectorial policies and programmes, and their co- ordination are therefore essential to achieve sustainable development.

The right to development is a fundamental human right but the unsustainable pattern of production and use of resource base can no longer be afforded or supported. In view of this, recommendations are made for environmental management in keeping with development policies of the government.

2.0 **The recommendations will cover the following sectors**

2.1 **Population**
The natural increase of population must be managed at any cost to mitigate the considerable impact it would have on the fragile environment.

In view of this,family planning programmes already in operation in the district must be able to effectively convince and motivate the client population on birth control measures.

2.1.1 During 1980's the family planning programmes have significantly contributed towards reducing marital fertility especially among higher age groups, after having the required number of children. Yet it is important to dispel rumours and misconceptions about contraception mainly among the rural and the estate sectors.

2.1.2. The family planning acceptor rates of temporary modern methods by MOH areas in 1990 showed an acceptor rate less than 31 per 1000 married women in the reproductive age (MWRA) for Nuwara Eliya, Watawala and Rikillagaskada which was well below the national average of 45.6 per 1000 MWRA for 1990. It is necessary to undertake operational research studies to identify the specific service delivery needs in these areas.
It is also important that women start to use contraception early - preferably within four months after child birth. The health managers/ workers must ensure that mothers/ clients are motivated early for family planning within their areas.

2.1.4 As knowledge levels in contraception for specific methods are lacking in the younger groups (age 15 -24) and those with little or no education the family planning IEC efforts should also take note of the literacy and educational background of the client population.

2.1.5 An ideal child bearing pattern must emerge where pregnancies do not occur before age 18 or after age 35 and where they are not too close or too frequent.

2.1.6 Population issues should be treated as an integral part of school education. The retention of girls in school has a bearing on the eventual size of their families after marriage. When students are exposed to population education their knowledge, attitudes and decisions regarding other population issues can be influenced as well.

Teachers in rural areas often recognized as community leaders with their own orientation towards population issues and fertility behavior could add another dimension to the effects of population education in schools.

Non-formal educational channels are needed, to reach inter alia, the many school drop-outs and unschooled youth particularly girls and women who seek early entry into the labour force, marry early and start child bearing shortly thereafter.

3.0 Environmental Education

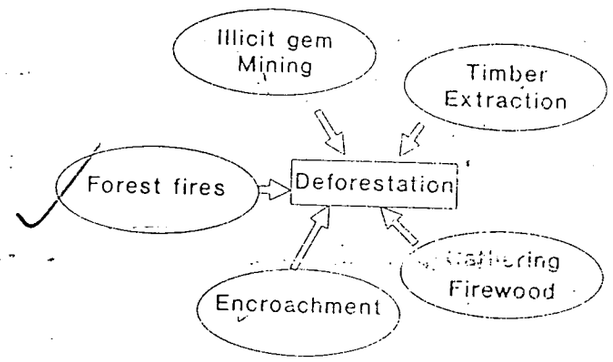
3.1 Environmental education has been a part of the process aimed at solving environmental problems and preventing the development of new ones. It should be viewed as fundamental to solving environmental degradation and creating a sustainable society.

3.1.1 The environmental education in the district could be more fruitful if special focus on the social and behaviour dimensions of environmental problems are carefully analysed and understood.

3.1.2 A feedback on environmental programmes is crucial for identifying areas that need to be given more attention on environmental values and conservation.

4.0 Forest Resources

Extensive deforestation is a well known fact and it is attributed to the following:-



A firm and clear forest policy to mobilize public support and strict enforcement of forest laws are necessary to overcome these problems.

4.1 Catchment Areas

In the montane forests, maintaining original tree cover is likely to be the cheapest and most effective way of protecting catchment areas.

It is vital that catchment areas like Horton plains be left undisturbed.

4.2 Soil

The podozols and all soils on steep slopes should be maintained under perennial tree cover. The development of soil and vegetation are interdependent in that the improvement of one leads to improvement of the other until they reach dynamic equilibrium in the natural forests.

4.3 The Air Around

Forests are important in maintaining the purity and invigorating nature of the air.

They also impart a certain degree of humidity to the atmosphere that is essential to bring about local precipitation during inter monsoonal periods.

4.4 Natural Buffers in Disease Outbreaks

Forest blocks alternating with agricultural land would prevent spread of disease outbreaks, while providing the natural control of pests in agriculture. This would be an incentive to farmers to adopt integrated pest control methods.

4.5 Conservation of Genetic Resources

The presence of biologically rich areas like Horton Plains should be subjected to intensive studies. The data should provide guidelines for computation of how people benefit from conserving biological resources.

4.6 The report of the committee for the formulation of a national policy for the preservation of flora and fauna made to the Minister of State in February 1986 strongly recommended that "the wet and montane zone forests should be completely protected and not be further decimated for any reasons". The following recommendations are given with this objective in mind in respect of areas where development and human pressure had an impact on environment.

4.6.1 The areas that call for catchment protection and for their biological diversity must be strictly conserved and managed. The remaining forests could be considered for any other use,provided it is sustainable.

4.6.2 The felling of costly timbre ,clearing of forests for planting tea and for other purposes,by plantation managements,have been reported from catchment areas, the worst affected area being Horton Plains. A most welcome step by the government was a cabinet decision taken on 4th August 1993 to appoint a committee of officials to monitor forest lands coming within plantations managed by private agencies and state corporations in order to keep a constant tab on damages caused to these forests. Such timely and corrective measures are needed to avert major environmental impacts.

4.6.3 Plantations managed by private agencies and state corporations should emulate the genuine efforts of a private individual who maintained full protection of a forest Rogersongama in Kothmale, while under cropping it with cardamom.

4.6.4 Fuelwood could be provided by block fuelwood plantation and farmers wood lots as recommended in the forestry master plan. This would ease the pressure on forests like Pidurutalagala and Kikiliyamana and those in Kalapuraya, Shanthipura, Top Pass, Under bank etc, where encroachers have pushed the forest boundaries. The lover's Leap area and the three major foot-paths to the summit of Adams Peak should be banned for firewood seekers during the pilgrim season.Forest management plans that provide buffer zones to supply the needs of the people are recommended. Fuelwood supplies particularly to the estate households should be provided from fuelwood plantations. Biomass fuel like uprooted tea bushes and other fuelwood from wasteland and scrubland outside the forest proper could be used.

4.6.5 The upper montane rain forests (UMRF) subjected to human pressure in the higher elevations of the Kothmale sub catchment should be given maximum legal protection. The vegetable cultivation around Nuwara Eliya, Ohiyo and Hakgala on highly erodible mountain slopes should be discouraged. The land over 5000 ft elevation should be strictly kept under natural forest. The villagers cultivating cash crops in these areas should be resettled elsewhere.If land has to be used for seed production necessary conservation methods must be applied like retention walls, alternating contour forest strips, terracing etc.

4.6.6 The LMRF that occur in patches in the Kothmale subcatchment are the refuges for specialized fauna and flora. Whether these isolated refuges are adequate to sustain these species is not certain . The preservation of these habitats is urgent as the critical situation is most discernible.

4.6.7 A more diverse forest cover with potential for self perpetuation and less susceptible to perturbation could be established by the introduction of indigenous and other broad leaf species to heavily eroded and infertile steep slopes covered with exotic genera.

4.6.8 We stress the importance of the complete protection of natural forests, while timber and fuelwood should be established in plantations on degraded lands suitable for the purpose- as forests cleared in Dunsinane and Kikiliyamana reserves for plantations in 1973 clearly indicate that environmentally they did not reach the standard of the former trees of this area.

4.6.9 Tobacco cultivation on slopes greater than 40% should be banned while chena and vegetable cultivation should be stopped forthwith on such altitudes especially in the tobacco growing areas of Hanguranketha DSD. These areas should have a permanent forest cover. The Ceylon Tobacco Company who has the monopoly of the tobacco cultivation has expressed their concern for protection of environment. This attitude should be further strengthened and the knowledge of technological improvements with regard to reduced consumption of fuelwood should be effectively applied in use of tobacco dryers.

4.7.0 The primitive three stone fire place a very wasteful method of fire wood utilisation should be replaced by stoves with a single aperture. The use of fuel efficient and smoke free stoves should be promoted.

4.7.1 Forest plantations will supply the industrial wood supply and fuelwood. Careful forest designs should be adopted in the opening up of plantations. Vantage points along roads and crests of some ridges should be left unplanted.

4.7.2 Plantations that have largely failed under reforestation programmes in wet patanas should be totally abandoned. The degraded patanas near Pattipola are more suited for tea or vegetable cultivation or for agroforestry. The plantations should be sited in areas not justified to the public so that they would avoid them.

4.7.3 As thirty percent of the islands endemic plants are exclusive to the montane zone the conservation of all natural forests are vital. Agro forestry and homegardens that emulate natural forests are recommended for utilisation by man.

4.7.4 Encroachment into forests, steep slopes, water courses and reservations must be controlled once the encroachers have been relocated.Production forests are recommended on less steep slopes. Protection planting must be established along streams and reservoir banks. The land to be reclaimed and re-vegetated along waterways should be in accordance with regulation (11) under section 50 of Crown Land Ordinance No.8 of 1947.

5.0 Water Resources

The district is endowed with a bountiful supply of the resource that needs careful management to reap the maximum benefits.
At present the Ministry of Lands, Irrigation and Mahaweli Development covers Land, Irrigation and Forestry, the major sectors that are associated with water development.

In view of the rapid rate of water resource utilization during the past few decades, a strategy for development and conservation is a vital factor that calls for urgent consideration.
Government policies are now focused towards augmentation, rehabilitation and improved water management, within the DSDs that need such development programes.

5.1 The establishment of community water committees similar to those that are being formulated by the Hanguranketha Pradeshiya Sabha is recommended.

5.1.1 Water management projects for irrigation schemes are recommended,with proper guidance and education on water management,as farmers being the direct users will be the best managers of the resource.

These projects should help sustain a perennial water supply in the many tanks and channels in the area. Afforestation of areas near tanks and channels to prevent soil erosion is also essential.

5.1.2 The Janasaviya Trust Fund was mainly responsible for the restoration of Bodi Ela in Hanguranketha with the co-operation of the villagers. Further,the Govi Sanvidhanaya has planned for the future maintenance of the ela with profits drawn from a shop that provides the needs of an agricultural community. Thus community participation would help the villager to develop a sense of self worth and self-consequence.

5.1.3 The supply of potable water must be given high priority to prevent water-borne diseases in Haguranketha as most wells and some pipe borne waterways are unsuitable for drinking purposes.

5.1.4 The efficient functioning of the proposed irrigation systems in Kothmale DSD depends on the reforestation of the steep slopes and community participation is recommended for this exercise.

5.1.5 A canal conservation system must be implemented along with the renovations of the defunct irrigation systems in Kothmale DSD. Under the government participatory irrigation management policy farmer organisations could be encouraged to reforest irrigation channel networks and catchments. The knowledge gathered from similar programmes carried out by IRDP Nuwara Eliya are vital in effecting future programmes. It is important to train and educate the farmers in the techniques of planting and managing of trees, and to entrust them with the planning and management of reforestation programmes.

5.1.6 The proper maintenance of some of the largest irrigation schemes in Kotmale is essential while implementation of educational and awareness programmes for rural level officials and farmers is recommended.Rural water schemes provided by the Sarvodaya can be effectively maintained if the rural population especially the woman are given water-user education.

5.1.7 In Ambagamuwa DSD construction of mini dams in paddy growing areas of Horagoda, Polpitiya and Nawala villages need to be considered.

5.1.8 Planners should select suitable waterways and available ground water sources in Ambagamuwa DSD to initiate a programme to provide a continuous supply of water throughout the year.

5.1.9 The augmentation of the existing water supply scheme in Nuwara Eliya is recommended especially during the tourist season, to overcome the water shortage.The land in Unique View in the upper and lower area around Glenfall, must be reforested.The soil erosion on the banks of the Pidurutalagala road could be averted by paving,constructing drains and turfing the lower side of the slopes,and reforestation of the damaged area with native trees of the reserve itself.

If major scarcity of water is to be avoided, low water consuming technologies, efficient water metering systems and economic disincentives for wastage will have to be tried out and introduced. To achieve this the institutional capabilities of the municipality and other local bodies must be strengthened.

5.2.0 The water supply schemes of Nuwara Eliya DSD have to be augmented while Nanu Oya, Watagoda,Samanpura and Meepilimana schemes need to be renovated.

5.2.1 As sites for major hydropower projects are utilized what remains is largely the potential for mini and micro projects for which watershed management is of considerable importance.

5.2.2 The many lakes, streams and waterways must be protected from varying states of pollutants viz excess pesticides and fertilizers, silt etc. brought by run off from cultivated lands and/or domestic waste, human and animal excreta and other solid waste from urban, rural and estate settlements.

The up keep and protection of Lake Gregory is important. A proper land use management of the lake environ should be adopted. The rehabilitation and conservation of catchment areas with construction and maintenance of proper silt traps is essential. The lake could be turned once more to a center of recreational attraction to locals and tourists. The introduction of boating and fishing on a commercial scale is recommended.

5.2.3 The Boralanda (Barracks Plains Reservoir) and Katumana lakes should be rehabilitated and used as water sources. The encroachers on the tank bed must be found alternate land for cultivation.

5.2.4 The Nanu Oya stream, Thalagala Oya and Lovers Leap stream should be rehabilitated. This could be done by the Land Reclamation Board.

5.2.5 The National Environment Act reflects the view that water is a resource to be protected and managed for the use of future generations. In this respect the key issues will be the management of domestic, agricultural and industrial wastes and the detection of their water pollution potential in order to establish bases for future strategic planning. A surface water monitoring net work is essential to ensure basic human health standards and to maintain ecological processes.

5.2.6 As the hydro geological balance of the island depends on the Horton plains serious thought must be given to it and necessary action taken. The wild life Conservation Department should increase the man-power to monitor the 8,000 acre park and prevent encroachment, for which a firm and coherent state policy with strong government support in collaboration with non-governmental organizations and local people is needed.

5.2.7 Maximum benefits could be achieved from the improperly utilised ponds and reservoirs of Castlegreigh Moussakelle & Kotmale by the implementation of a well planned programme to develop the fresh water fishery industry to produce fish for local consumption.

6.0 Land Use Planning

6.1 Urban Lands

The total land area of the district is 1741.2 sq.Km. The largest urban land area is in Nuwara Eliya DSD and is 820 hectares in exent. The town in the district occupies 1.8% of the total land area.

There are eight local authorities;

1.	Nuwara Eliya	-	Municipal Council.
2.	Hatton Dickoya	-	Urban Council.
3.	Thalawakelle-Lindula	-	Urban Council.
4.	Nuwara Eliya	-	Pradeshiya Sabha.
5.	Ambagamuwa	-	" "
6.	Kothmale	-	" "
7.	Hanguranketha	-	" "
8.	Walapane	-	" "

6.2 Agriculture Land

Tea is the main crop covering approximately 36% of the land cultivated on state owned land by private companies. 31,384 hectares of the district is under rural agriculture (18%).

One-fifth of the land is under paddy cultivation, rainfed annual crops, perennial crops in mixed gardens,and tea.

6.3 **Forest Land**

Twenty eight percent is under forest cover. However only a mere 29,000 ha is considered dense forest,the remaining 20,000 ha. being degraded forest.

6.4. **Range land**

The natural grasslands in Nuwara Eliya DSD consists of 8,373.3 acres (7.08%), a part of this has been allocated for Government Animal Husbandry Farms.

The cultivation of potato in the Ambewela and New Zealand farm pastures found on steep gradients have resulted in soil erosion and contamination of the Kande Ela and Ambewela reservoirs which are the only trout habitats other than those of the Horton Plain streams.
In Ambagamuwa DSD grasslands spread into 11,890 hectares of land.

In Kothmale 560 hect. are patana lands, the grasslands cover 200 hect.

In Hanguranketha though rearing of milk cows is widespread pasture lands are inadequate.

In Walapane, animal husbandry is concentrated around Ragala, Udapussellawa and Bogawanthalawa.

The following recommendations are given with reference to land use planning.

6.5 The urban areas should be given high priority in the development process. The carrying capacity of each urban area must be taken into consideration in all development projects. The government actions can reverse a city's deterioration if sufficient resources can be mobilised.

6.5.1 The city of Nuwara Eliya has exceeded its carrying capacity as is evident in the steady increase of encroachments on to steep slopes,both for settlement and cultivation.

6.5.2 A satellite town on Moon plains as suggested in the repon "Development of the city of Nuwara Eliya' is recommended, to ease the situation.

6.5.3 It is recommended that the proper use of land having the following slopes should be as follows:

-0-40 percent slope for agriculture and housing

- 40-60 percent slope for plantation agriculture agroforestry or forestry

- >60 percent under protective cover

6.5.4 A rational land use policy must be adopted for which a great deal of scientific data is needed. This can be obtained by scientific research. It is essential to identify the areas for which data is lacking. Scientific research alone will not answer these problems, as the land use planning handbook for Sri Lanka (FAO sponsored for the division of land use policy planning 1988) states. Land use planning means making use of all available technical information,as well as the experience of the local farmers, and involving local people and planning staff in the preparation, implementation and review of development plans.

6.5.5 Consultation with the land users should begin at a very early stage i.e. from the time the problem was first identified,and must continue through survey and design phases, so that the improved land use can be put into effect in partnership with the farmers.

6.5.6 An Educational campaign must be mounted at 4 different levels, on land use planning.

- that of the politicians, administrators and policy makers to create an awareness of the extremely serious situation and the availability of logical solutions that could be carried out immediately and effectively in the best interest of the district.

- that of the farmer or the land user and his family, to demonstrate to them that the proposed improvement is in their best interests, and teach them how to apply it.

- that of the community as a whole on the danger inherent in the degradation of land and the advantage of conservation and prevention of pollution

- that of the technical level, to train an adequate number of technicians to a sufficiently high standard,that would enable them to tackle the problems.

6.5.7 Agricultural products of export value such as products of kitul, fruits, flowers, pepper, cardamom, coffee etc. must be given special attention.

Youths of kitul growing areas viz Kotmale, Pitakande, Minuwandeniya, Hangarapitiya, Polpitiya and Hitiyagama of Ambagamuwa DSD should be encouraged to take on to kitul agro industries for local and export markets.They could be trained by the IDB as tappers and on kitul agro industries.
The kitul collecting centers for mira and centers for its products like treacle/ jaggery must be established. The marketing of kitul products should be efficiently carried out with private sector participation.
It is important that farmers be informed of the current trends for agricultural products in the export market. The farmers should be provided with high yielding, disease resisting varieties of pepper, cardamom and coffee, through the Department of Export Agriculture. Cultivators should be encouraged and motivated to grow flowers as cottage level, revenue generating projects which could be expanded to supply the export market.

In fruit production emphasis should be placed on methods of utilizing the seasonal overproduction by preserving. The wastage due to poor post-harvest handling, collecting, storing, transporting, and marketing have to be studied and rectified. As the quality and quantity of fruits will determine the demand from foreign markets, it is essential to generate and disseminate fruit production technology to all interested commercial or small scale growers. Hence the five year research plan (1993-1997) of the Department

of Agriculture could be made use of to achieve these goals.

6.5.8 In the forestry sector forest management, forest protection and forest research need to be strengthened.

6.5.9 There is plenty of scope for expansion in the animal husbandry sub-sector, especially in milk production.

7.0 Soil Conservation

7.1 The highest soil erosion rates are recorded in tobacco, vegetable, chena and poorly managed tea land. A part from these, erosion from house and road construction sites are extremely high in localized watersheds near urban areas and in civil engineering sites as in Kotmale new road development areas.

As channelised and non channelised erosion of various types occur, soil conservation practices must be given high priority in land management. The following recommendations are given with respect to this situation.

7.1.1 As degraded tea land records the highest soil erosion rates for any crop such uneconomical tea lands should be rehabilitated excluding those tea lands that have to be converted to other land uses.

7.1.2 The continued cultivation of erosion crops like tobacco and potato goes unheeded on steep slopes. As many families depend on these profitable cash crops for their livelihood there is no alternative but to encourage the farmers to adopt effective soil conservation methods.

7.1.3 There are several methods of controlling soil erosion particularly in the sloping agricultural areas. The most highly recommended of these are:

i. overcropping - growing plants to cover the soil

ii. contour buffer cropping - planting cover crops in strips between regular crops

iii. crop rotation - planting different crops in succession

iv. reforestation - planting trees in denuded areas

v. sloping agricultural land technology (SALT) - integrates several soil conservation methods in just one setting

A study has revealed that a farm tilled in the traditional way erodes at the rate of 1,163.4 metric tons per hectare per year over six years. A SALT farm erodes at the rate of only 20.2 metric tons per hectare per year in the same period. The rate of soil loss in a SALT farm is 3.4 metric tons per hectare per year which is within the tolerable range. Most soil scientists place acceptable soil limits for tropical countries within the range of 10 to 12 metric tons per hectare per year.

The land use upgrading programme conducted by IRDP of Nuwara Eliya,and the Tobacco Company programmes of soil conservation in the Intermediate zone (Walapane

and Hanguranketha) follow The Sloping Agricultural land Technology (SALT). This may prove a more sustainable option and should be supported.

7.1.4 Many encroached lands are in ecologically fragile areas.A definite programme of action should be taken to restore these areas.

7.1.5 Chena farming should be restricted to degraded forest lands. A development programme which allows for the re-adoption of certain traditional chena practices which are less harmful to the environment along with modern methods of conservation farming, could be introduced.

8.0 Agriculture

Agricultural practices have led to rapid land degradation resulting in high rates of soil erosion and siltation, flash floods, occurrence of landslides, and loss of productive capacity of land.

Another prevalent environmental issue is the indiscriminate use of agro chemicals and pesticides in the high value vegetable gardens. The following recommendations are made in respect of agricultural activities in the district.

8.1 Land use improvement is considered very urgent especially in tea small holdings, market gardens and chena cultivation.

Diversifying crops in poorly managed homegardens, chena and poorly managed tea holdings in Kotmale and Ambagamuwa should be done to upgrade these degraded lands.

8.1.1 The erosion control effected by live barriers along the contour lines as against physical barriers which are adopted by IRDP in all DSDS except Nuwara Eliya are recommended. Live barriers would be more economical and efficient than the physical barriers like stone walls, lock and spill, drains and terraces. The various bio-barrier crops-(Annexure 1) serve a multipurpose function to the farmers by providing mulch, compost, fodder, fuel wood and food in addition to preserving the soil. The greenery will also help to ameliorate the environment.

8.1.2 Annexure-2 gives the recommended agro-chemicals used by the farmers. The chances of residues of currently used biodegradable insecticides remaining on crops at harvest time are remote if spraying and harvesting practices are properly adhered to. Most chemicals have less toxic effects except civaterr; The farmers must be warned particularly against the excessive use of these chemicals.

The greater use of bio-fertilizers like compost, farm yard manure and green manures as substitutes for chemical fertilizers must be encouraged among farmers. Research has shown that the use of rice straw at 3t/ ha of paddy land could provide all the potassium and part of the nitrogen required by the crop.

Sustainable and high quality agricultural productivity can be achieved through adoption of high quality crops without costly reliance on pesticides and other inputs. The development of traditional agricultural management methods along with integrated pest

management will no doubt help to protect not only the health of the consumers and farmers but also the environment.

9.0 **Human Settlements**

The central role of human settlements would be to strike a balanced development with the environment as the development process has its inevitable impact on them. This was evident especially during the construction of the Kotmale reservoir that necessitated the resettlement of 3000 families. The resettlement on lands above the reservoir has given rise to new environmental and land use problems. Certain settlements in the district are found located in areas least suitable for residential use as in landslide-prone areas on slopes > 40 percent. Thus to prevent worsening conditions in urban,rural and estate settlements,the following recommendation are made:

9.1.1 The encroachment on state lands unsuitable for settlements in urban areas must be banned, by strict enforcement of laws.

9.1.2 The extension of the electricity grid to established colonies in Nuwara Eliya DSD,and the many needy villages in Hanguranketha, and estate labour lines, should be given high priority, while providing government introduced incentive packages for service connections and internal wiring to the very poor.

An alternative assured source of energy as stipulated in the Rural Electrification Programme should be considered for remote areas in Walapane.
Thus action to extend the electricity grid to rural settlements of the district that lack the facility, should be carried out as far as possible, while providing packages of incentives introduced by the government to the villagers who are too poor to pay for service connections and internal wiring.

9.1.3 The problems of health, sanitation, potable water supplies and drainage are felt in certain village and estate settlements no less than in towns.Environmental sanitation and primary health care programmes conducted at village levels must be strengthened.

9.1.4 Use of sanitary latrines must be encouraged in the many settlements that lack this facility.

9.1.5 Drainage systems in all settlements specially those on sloping terrains must be well planned.A good surface drainage system in Nuwara Eliya town will help to prevent the frequent occurrence of flash floods and silting of water bodies like Lake Gregory.

9.1.6 In Irrigation settlements primary environmental care which empowers communities for self development must be encouraged.

Remedial action plans for areas of concern in the district must specifically

- Define the environmental problem,including the geographic extent of the affected area using maps and surveillance information;
- Identify the beneficial issues impaired;
- Describe the causes of the problems and identify any sources of pollutants;
- Identify remedial measures proposed to restore beneficial uses;
- Identify a schedule for implementing remedial actions;

- Identify jurisdictions and agencies responsible for implementing and regulating remedial actions;
- Describe the process for evaluating remedial program implementation and regulating remedial measures;and
- Describe the surveillance and monitoring activities used to track program effectiveness and eventual confirmation that uses have been restored.

The ecosystem approach depicted as a circle with three equal segments representing social, economic, and environmental interests.
Operating principle: no part of the ecosystem can be sacrificed without detriment to human interest.

Source: AMBIO - A journal of the human environment, Vol. XVIII No. 8, 1989 Pg.424

An ecosystem approach is recommended to carry out the above action plan where it relates people to ecosystems that contain them rather than to environments with which they interact. Under ecosystem approach all organizations, agencies, and people affected by or affecting an area of concern come together as "stakeholders" to work cooperatively.

Chapter 3

Physical Characteristics

1.0 Tenitory

The census prior to and in 1971 recorded a total land area of 1247.70 sq.km. while 1971-1981 census, recorded a total land area of 1720.5 sq.km.following district boundary changes that included Ambagamuwa, formerly of Kandy district.

	By Road	Aerial (km)
1. To the North up to Randenigala	72	31.2
2. To the South upto Petresso estate (Bogawanthalawa)	60.8	25.6
3. To the East to Kirkil estate (Udapussellawa)	48	20
4. To the West Kalugala (Ginigathena)	75.2	36.8
5.To the North East up to Bolagandawela	54.4	24.8
6.To the South East upto Haggala	9.6	8
7.To the North West upto Balapokuna (Pundalu-Oya)	28.8	16
8.To the South West upto Sri Pada	78.4	36.8

2.0 Physiography

The district belongs to the highest peneplain in the island.The Southern margin of this peneplain, stretches for more than 50 miles from Adam's Peak (7,360') on the west and rising from around 1000' to more than 5000' as at World's End. Running Northwards from the center to the Southern margin are the highest plateau regions and the high plains stretching from Kirigalpotha (7,859') to Pidurutalagala (8292'). This bare, gently undulating, grassland includes the picturesque Horton plains, Elk plains, Moon plains and Kandepola - Sita Eliya plains all at an average elevation of 6000' - 7000'. On the East of these high plains is Hakgala (7127') and Totupola (7,741'). On the West is the Hatton plateau, a deeply dissected area with strong relief having an average level of erosion between 3500' and 4500'.The remarkable appearance of 'flatness' in the Hatton plateau is largely due to the nearly horizontal attitude of the rocks comprising much of the area. Long escarpments some rising thousands of feet in sheer rock walls are also common particularly in the Hatton area.
Extremely steep slopes can be seen in the upper mountain regions that descend down through various slope categories to the lower parts of the mountain ranges.

3.0 Geology

The Nuwara Eliya District belongs to the Highland series of the Precambrian Complex of Sri Lanka.The major rock types found being chanockites, quartzites, marble, granites,granulitic quartzites and quartz-feldspar-hornblende-gneisses, charnockitic gneisses, augen gneisses and unclassified rock types(Map 1). The quartizites and marble give rise to frequent landslides, other rocks are liable to slide to a degree depending on the existing fractures, joints,faults and weathered zones.

NUWARA ELIYA DISTRICT – Geology

LEGEND

- Alluvium
- Cryslalline Limestone
- Charnockites
- Quartzites
- Undifferentiated Metasediments

Source: GEOLOGICAL MAP – Nuwara Eliya District, Geological Survey Dept. and National Atlas of Sri Lanka, Survey Dept

4.0 Lithology

Charnockites , the predominant rock type are generally confined to the mountains with the less resistant rocks at the valley bottoms. Quartzites found around Nuwara-Eliya, Hatton, Norton Bridge and Maskeliya form parallel bands that can be sometimes traced for miles along the strike.The quartzites form prominent escarpments and ridges.The dark grey charnockitic gneiss occur in great quantities. Most of the Dimbulla valley (as area around Talawakelle is known) is made of chanockitic gneiss and this is clearly noticed on the road from Dimbulla to Nanuoya.

A specific garnet sillimanite schist with large garnets can be seen in many parts. Corundum and spinel at the contact of marble and syenite have been recorded from Non Pariel Estate, Ohiya.

Calcium carbonate that form solution caves are found at Ella (Ravana's cave) and two other caves in the Norton Bridge area. One of them named ' Cave of the Seven Virgins' seen from the road to Maskeliya occupies a small cliff face overlooking the valley of Maskeliya Oya. The other at the foot of Laxapana Falls is inaccessible. Dolomite is present in the Northern region of Hanguranketha Divisional Secretary's Division. The deposits at Bengamuwa Labuhena, Galauda have been utilized while those at Okandagala, Idampitiya, Adhikarigama are unutilized.

5.0 Topography

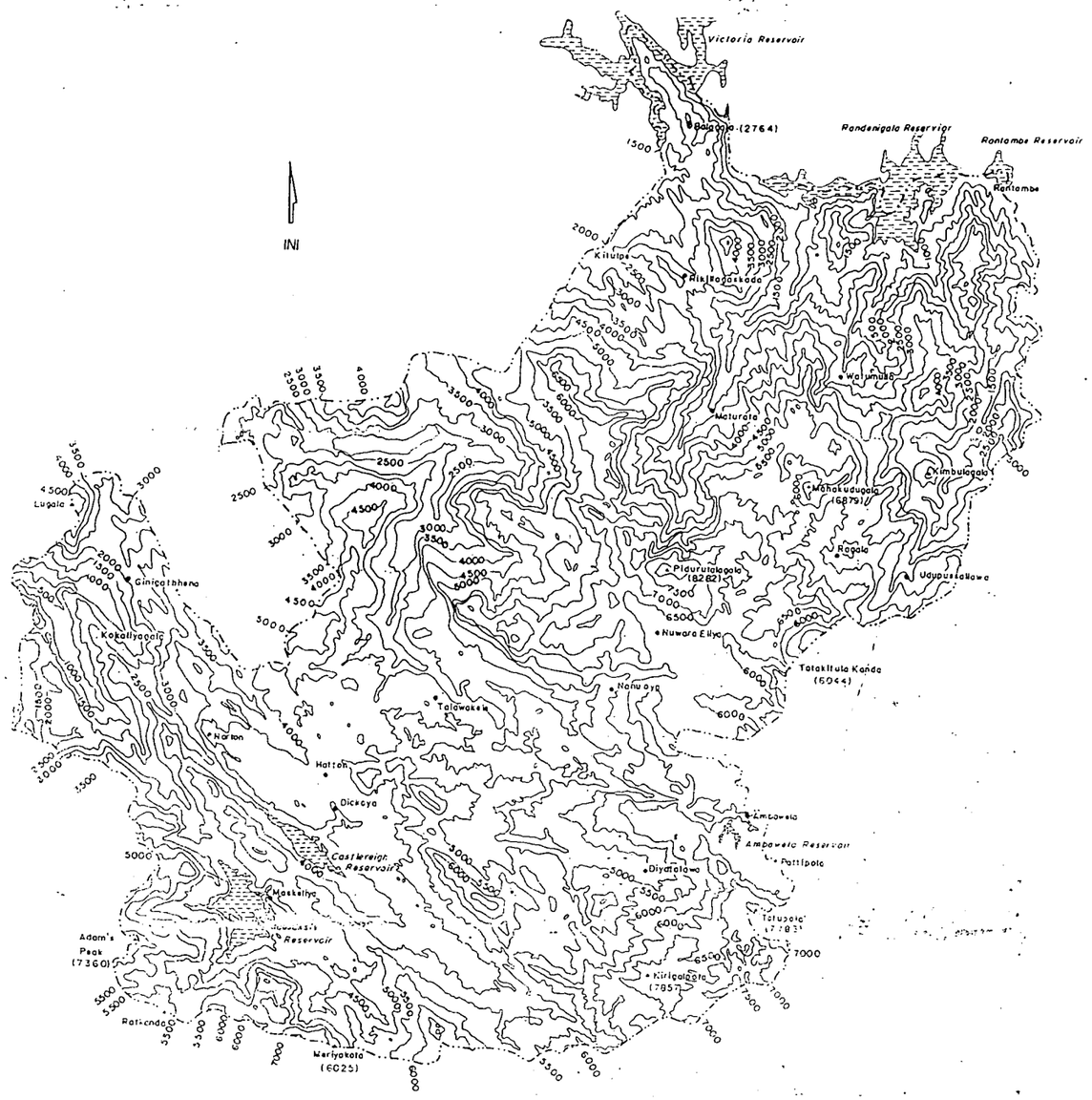
The district has a plethora of peaks, plateaus, basins, ridges valleys and escarpments. The part of the district included in the central massif has a central back bone of high plains and peaks. The high plains are Bopatalawa (Horton Plains), Hawa Eliya (Moon Plains), Mipilimana (Elk Plains), Sita Eliya (Kandapola Plains) and Ambewela plains. The peaks are Pidurutalagala Totapolakanda and Kirigalpotta. The high plains along with its peak can be visualized as a vertical axis of an anchor shaped area of summits, the base being represented by a chain of mountains, the "Southern Mountain Wall". The Hatton plateau, to the West of the Central back-bone tilts to the North and has series of well marked South East - North West trend of the anticlines and synclines namely Ramboda and Wanaraja anticline, Pundalu oya, Norwood and Hatton syncline.
The rivers flow radially in gorges from the district except the head streams of Mahavali that cut across the grain of the central mountains to form an annular pattern of flow. The long profiles of these streams have sharp discontinuities that often correspond to the main topographical discontinuities within the highlands. Thus the borders of the anchor shaped areas of summits as well as the margins between the elevated plateaus and its peripheral plateaus of intermediate elevation abound with picturesque waterfalls like Laxapana, St. Clairs, Devon, Aberdeen, Nanu Oya, Lover's leap etc.

6.0 Climate

6.1 According to Koelmeyer (1957), rainfall is the most striking climatic feature in the island due to its seasonal variability.The climatological data indicates that Nuwara Eliya at an elevation of 1800m receives low intensity rainfall while the intensity increases around lower elevations towards Nawalapitiya that lies on the windward slopes of the Central mountains.

6.2 The meteorological data prepared by the Department of Meteorology gives mean values obtained from day to day observations of weather elements for a period of 30 years viz :

NUWARA ELIYA DISTRICT – Relief



6.2.1 Rainfall

Unlike the wet zone of the district that receives rainfall during the main four seasons, the intermediate zone receives rainfall only during the North-East monsoon and the two intermonsoonal months. Unreliable rainfall and frequent dry spells are a common feature in the intermediate zone.

The rainfall in the four main seasons calculated for Nuwara Eliya station are as follows:-

March-April	Convectional	12%
May-September	South West Monsoonal	45%
October-November	Convectional, Cyclonic Depressional	23%
December-February	North East Monsoonal	20%

30 YEARS AVERAGE OF MONTHLY MEANS FOR RAINFALL (1961 – 1990)

STATION NUWARA ELIYA

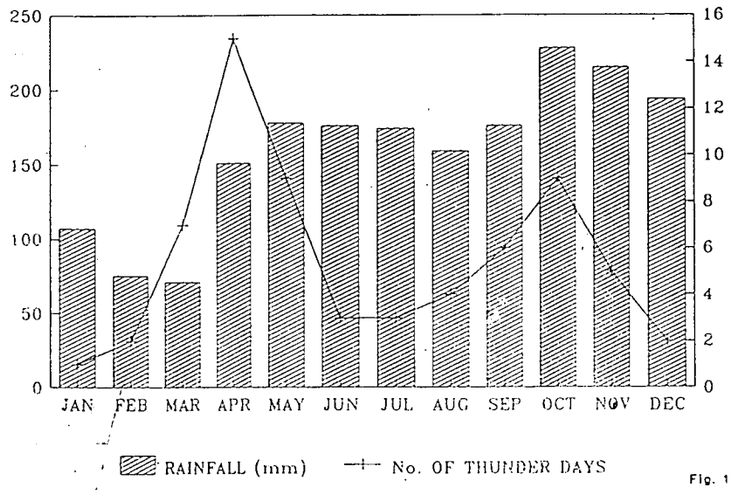


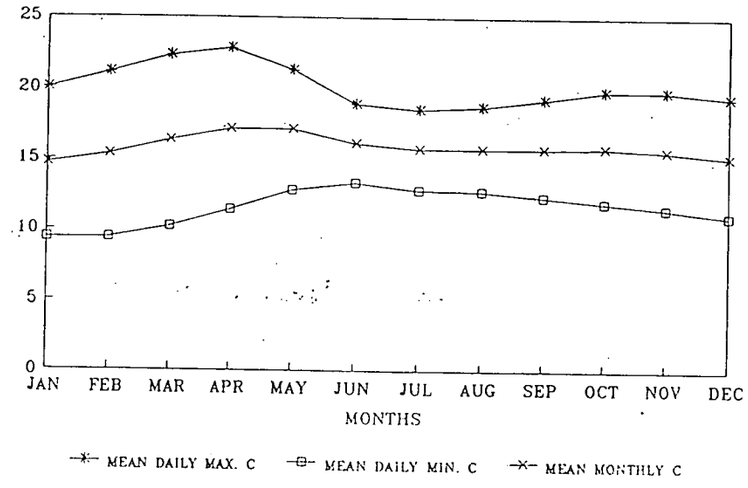
Fig. 1

The number of thunder days is highest for the month of April with 15 thunder days, characteristic of convectional activity during this period.

Nuwara Eliya has experienced a significant decline in annual rainfall during the last 100 years. The decline coincide with deforestation of the hill country for tea plantations, but this fact alone cannot explain the decrease of nearly 20 percent in a hundred years. Some unknown meteorological change may be responsible for this rainfall decline.

The average of the mean daily maximum and the mean daily minimum temperature of each month gives the mean monthly temperature for each month.

MEAN DAILY MAXIMUM, MINIMUM MEAN MONTHLY TEMPERATURE



STATION NUWARA ELIYA

Fig. 2

6.2.3 Relative Humidity

MEAN DAY AND NIGHT RELATIVE HUMIDITY FOR 30 YRS(1961-1990)

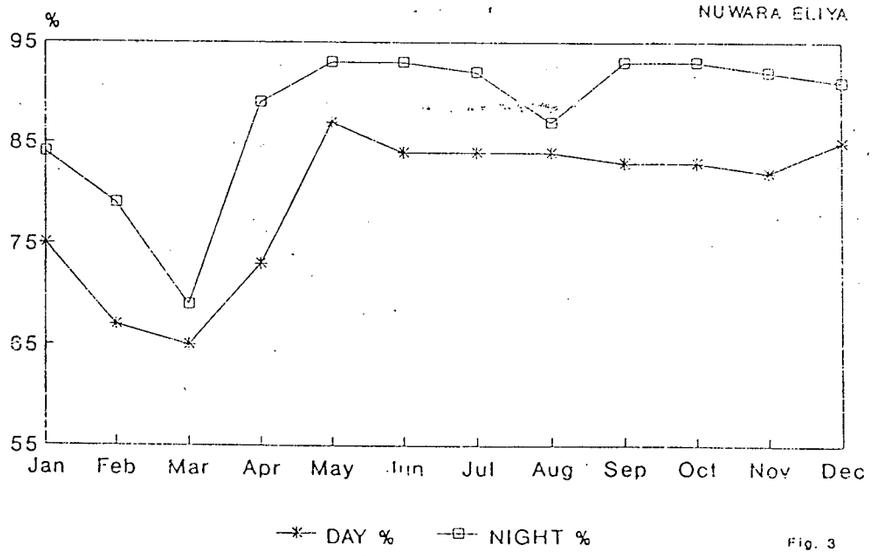


Fig. 3

Fig. 3 indicates that the

* Day humidities are lower than the night humidities.
* The mean day relative humidity for 30 years (1961 - 1990)was minimum in March and maximum in May.
* Both mean day and night relative humidities dropped during the months of January to February and started to rise from March to May.

There is a definite correlation between the relative humidity and the rainfall pattern in the district. High rainfall is connected with high humidity and low rainfall with low humidity (Domros 1974)

6.2.4 **Winds**

The terrain of the district determines the movement of wind over the area.

RESULTANT WIND DIRECTION AND WIND SPEED
FOR 30 YEAR AVERAGES OF MONTHLY MEANS
(1961 - 1990) NUWARA ELIYA.

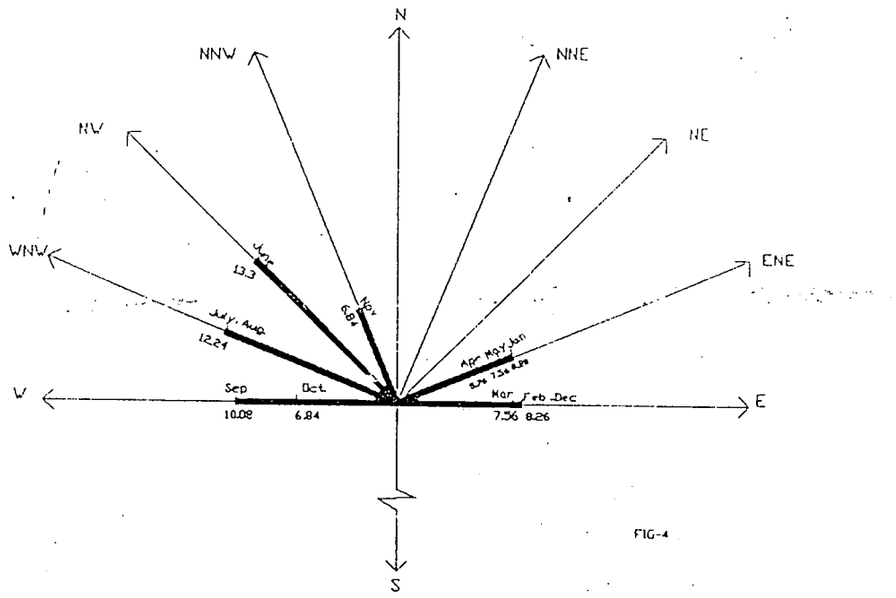


FIG-4

The wind speed ranges from 5.76 - 13.3 km/ hour (fig.4).The resultant wind directions for 30 years (1961-1990) were E, ENE, NW, WNW, W.
Strong winds prevail during the South West monsoonal period and blows in a zonal area to the North of Central hill country.

Table 1 - Duration of Wind Speed Per Day in Hours

JANUARY		APRIL		JULY		OCTOBER	
Speed km/h	Hours	Speed km/h	Hours	Speed km/h	Hours	Speed km/h	Hours
≤10	21	≤10	23	≤10	0	≤10	24
11-15	03	11-15	01	11-15	12	11-15	0
16-20	0	16-20	0	16-20	12	16-20	0

* source : The National Atlas of Sri Lanka, Survey Department

In Nuwara Eliya the wind speed per day for months January, April and October prevail mostly in the range < 10km/ h. In July during the South West monsoon the wind speed varies within the ranges of 11-15 km/ h to 16-20 km/ h for each 12 hrs of the day.(Table-1)

Table-11 Pressure in Hectopascals(1960-1990)-Station:Nuwara Eliya

J	F	M	A	M	J	J	A	S	O	N	D
813.6	813. 5	813.7	813.1	812.3	812.0	811.9	812.1	812.6	813.1	813.2	814.4

* source : Dept. of Meteorology.

The pressure changes fall within a narrow range of 814 to 812 hectopascals.
In January the pressure gradient is moderate and Northerly. In April and October the pressure distribution is fairly even and South Westerly. In July the pressure gradient is fairly steep though South Westerly.

7.0 Natural Surface Drainage Patterns

7.1 Rivers and Streams

The Kotmale oya, one of the seven major tributaries of Mahaweli formed by its several head streams arise in the core of the central highlands.
The Dambagastalawa oya originating in Ambewela hills flows into Agra oya(from Horton Plains) and joins Nanu oya (from Pidurutalagala) to meet Kotmale oya.Pundalu oya has its source in Great Western and Bamboda mountain and Punna oya in Kikiliyamana mountain. The many other tributaries of the Kotmale oya are Ganthera oya, Devathuru oya, Himal oya, Nidahaskotuwa oya and Niyangandara oya.

The catchment of Kotmale includes:

(i) a high level surface at an altitude approx 2200 - 2300 m and consists of low undulating hills covered by dense montane forests

(ii) a low level surface at an altitude of approx. 400 m. This area of low undulating hills is exclusively used for tea cultivation

(iii) a gorge region of steep slopes in an area of high relief. The three main tributaries Kotmale,Pundalu and Punna Oya flow at the bottom of this gorge.

Maha oya, one of the smaller tributaries of Mahaweli drains Hanguranketha.A net work of minor elas feed Maha oya and the Ela mal wewa,Watuketiyawa wewa, Ambaliyadda, Warang and Huvan Arawa empty direct into Maha oya.

Walapane is drained mainly by the Belihul oya, Kurundu oya, and the Uma oya. Several tributaries like Halgran oya, Madulla oya and the Kuda oya feeds the Uma oya.

Kelani ganga is formed by the confluence of the Maskeli oya and the Kehelgama ganga that originates in the mountain range of Kirigalpotha.Other tributaries of We oya, Gurugoda oya, Sitawaka ganga join up bringing abundance of drainage. The characteristic feature of all these tributaries is their slope gradient dropping to about 200 ft per mile.

7.2 The district is basically suited for the development of water power, the only source of indigenous energy in Sri Lanka. The harnessing of the flow in the upper reaches of the Kelani ganga and Mahaweli ganga for the generation of electric power have been already carried out.

The tributary of Maskeliya Oya with a catchment of 129.5 sq.km was dammed at Mousakelle to detain 123 million cubic meters to generate hydro-power at Polpitiya.

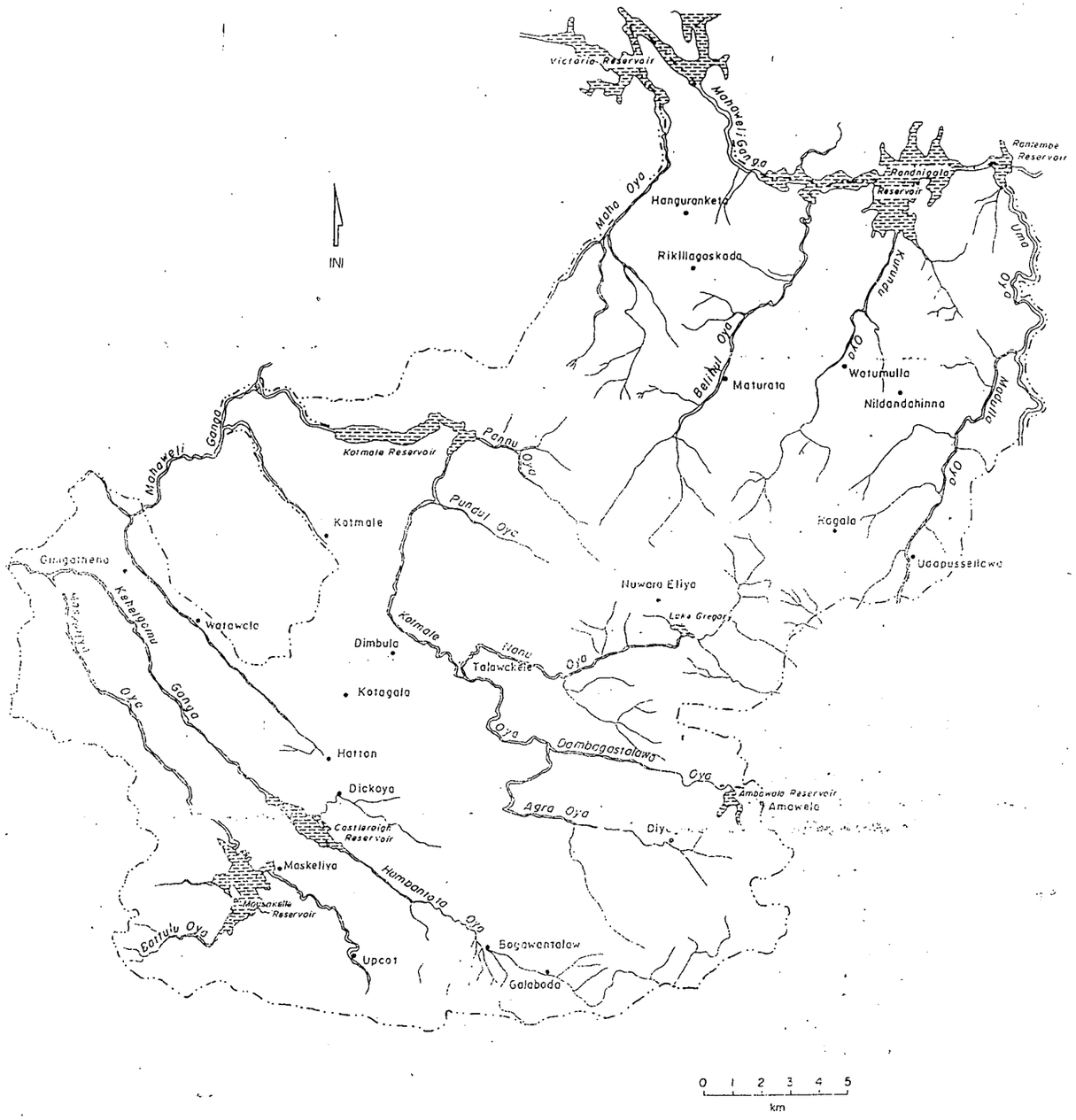
The tributary of Kehelgama has been fully tapped with a 48 million cubic meter reservoir at Castlereagh and a small reservoir at Norton Bridge. The first supplies water for hydrogeneration to a plant at Norton and the second to another plant at Laxapana.

At approx 4 km upstream from the confluence of the Kotmale oya and Mahaweli ganga, the latter has been impounded forming the Kothmale reservoir of capacity 172 million cubic meters. This has a catchment of approx. 554 km2 upstream from the dam site.

7.3 The minor irrigation works in Hanguranketha and Walapane DSDs are small water conservation storage tanks or stream diversion anicuts looked after by the beneficiaries, under the care of Farmer Committees.

The water from the Belihul Oya is tapped by an anicut to feed the Bodi Ela and Lamasuriya Ela. The historic Bodi Ela is the focus and nerve-knot of the surrounding farming area bordered by the Okandagala range and by the Belihul Oya. Today, Udapadiyapalella, Bodimalkada and Welapahala depend almost exclusively on the waters of the Bodi Ela to irrigate their paddy and vegetable crops. Ma-Ela an anicut for part diversion of flow in Mul-Oya ,is another irrigation course in Hanguranketha. Apart from many irrigation channels there are tanks in areas such as Walugama,Gala Uda, Moragolla, Wilpana and Malulla.

NUWARA ELIYA DISTRICT - Surface Water



Status Of Human Resources

1.0 Demographic Features

1.1 Population Size

Table 111 - Population National and District

Year	1971	1981	1991*	2001*
Sri Lanka	12,689,900	14,846,800	17,247,000	21,309,100
N'Eliya District	450,278	603,577	541,000	749,000
%District	3.5	4.1	3.1	3.5

source : Dept. of Census & Statistics
*Estimated values

About 93.8 percent of the population comprise of the rural sector. Walapane and Hanguranketha DSDS being essentially rural. The tea plantations carry comparatively a thinner population.

1.2 Distribution and Density

DISTRIBUTION AND DENSITY OF POPULATION
1981 NUWARA ELIYA DISTRICT

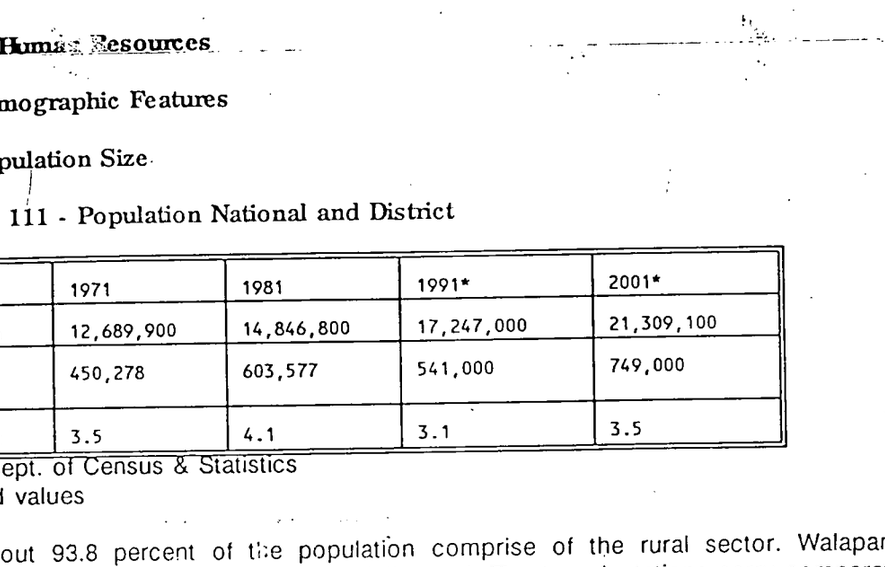
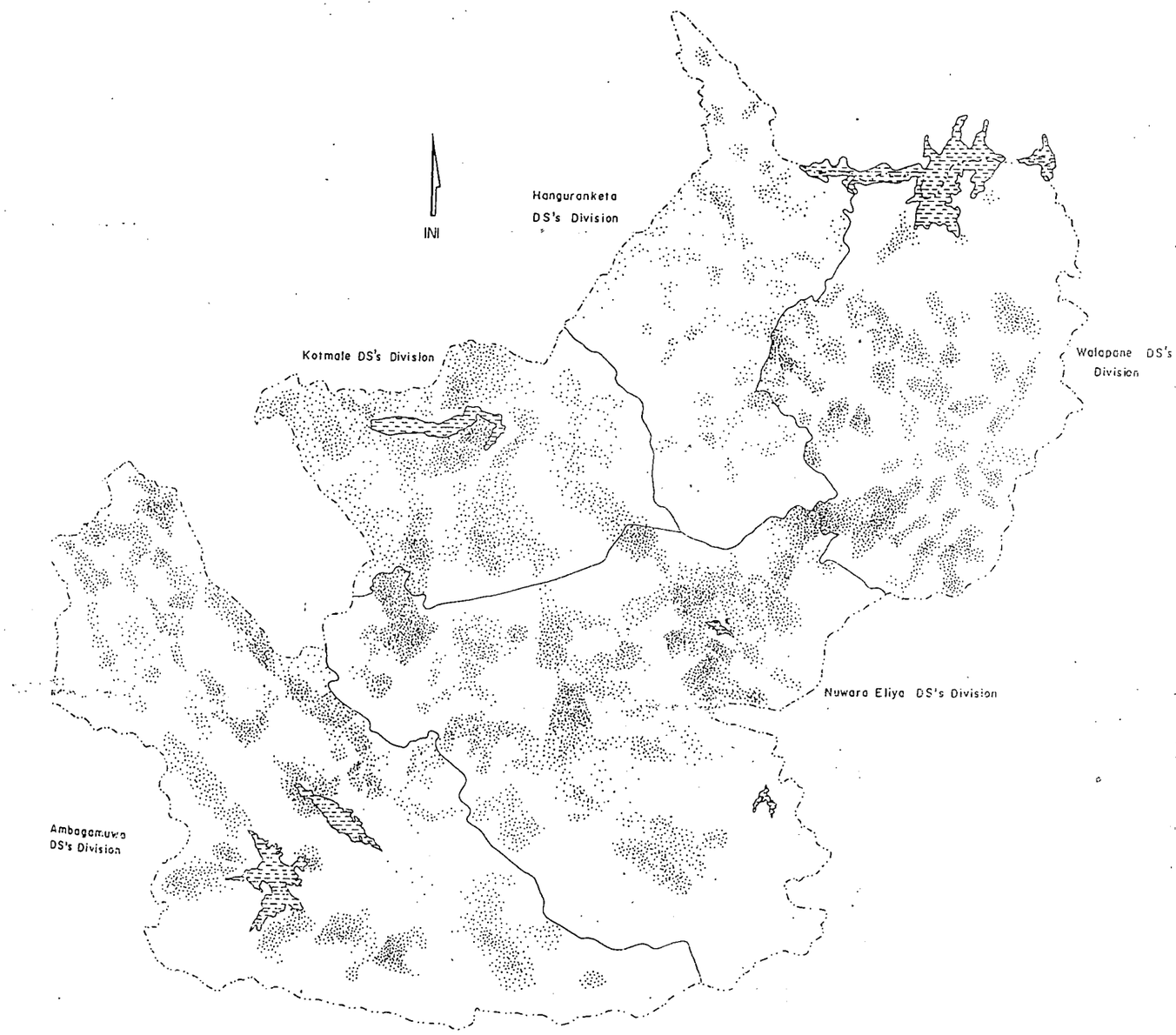


FIG. 5

NUWARA ELIYA DISTRICT — Distribution of Population



LEGEND

- Distribution of Population (1 Dot Represents 50 Persons)
- Reservoir / Tank
- District Boundary
- DS's Division Boundary

Source. IRDP Nuwara Eliya

DENSITY OF POPULATION
SRI LANKA & NUWARA ELIYA DISTRICT

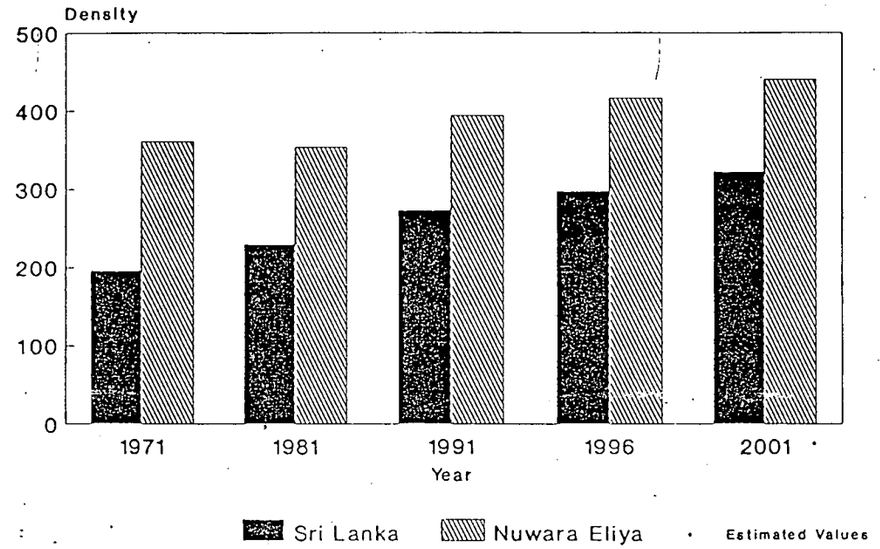


Fig. 6

The towns however as in any district, are far more densely populated. It is found that the highest concentration of over 5000 persons per sq.km. is in Hatton-Dick Oya UC rather than in Nuwara Eliya MC where the density is 1,365 persons per sq.km.Walapane DSD,an isolated area in the district has a population density less than that of the average density of the district with sparsely populated areas like Bolgandewela, Yatimadura and Arikwatte.

1.3 Composition of Population

1.3.1 Sex Ratio

A gradual decline in the sex ratio from 104-101.5 has been observed for the district during 1971-1981.

With respect to the composition of urban and rural population, in the urban sector the males out number females by a sex ratio of 123. The rural population shows no disparity but comprise of equal numbers of both males and females.

1.3.2 Age Composition

Relative to the country it has a high proportion of 35.5 percent children below 15 years of age and a low proportion of 2.9 percent of old folk of 65 years or more.(see Annexure 3 - composition sex ratio - 1981).

1.3.3 Dependency Ratio

The dependency group under 14 years is expected to drop from 35.5% to 27% during the period 1981-2001 as a trend towards smaller families gets established.

The age groups 65 and over are expected to increase from 2.8% to 5.7% during this period. The differential growth of the various age groups where the older age group grow faster than the younger ages, would result in the age composition moving towards an older configuration. In 1981 the age composition was a broad based gradually tapering pyramid typical of a young population.In 2001 it is likely to be a dagada with a reduced base, a slightly bulging middle and a tapering but broader apex.

1.4 Birth Rate

In 1980 Nuwara Eliya district recorded a high crude birth rate of 27.8. By 1985 the rate dropped to 23.7 per 1000. As a result the rate of natural increase itself declined from 2.13% to 1.7%.

Table IV - Age Specific Total Fertility Ratios (1962-64:1970-72:1980-82)

Age Group	15-19	20-24	25-29	30-34	35-39	40-44	45-49	Total fertility ratio
1962-64	51.2	237.1	276.6	221.0	144.1	41.0	5.9	4.9
1970-72	27.1	167.5	215.0	171.5	125.7	32.3	6.7	3.7
1980-82	16.0	141.3	134.4	84.4	51.7	17.5	2.5	2.2

source : Soma de Silva, Fertility Levels & Trends in Sri Lanka

The rise in age at marriage has been responsible for over half of the fertility decline. Further decline in fertility has resulted from a reductions in marital fertility which has been attributed to an increase in contraceptive use.

1.5 Average Age at Marriage

The average age at marriage of women has increased from 23.4 years in 1971 to 24.3 years in 1981. During the same period the average age of marriage for men changed marginally from its 1971 level of 27.7 years.

1.6 Mortality Trends

The crude death rate in Nuwara Eliya district has been high mainly due to it being a plantation district.

In 1989 the maternal deaths in Nuwara Eliya district was the highest for the country. The rate being 2.3 as against the national rate of 0.6. The still births recorded for the same year was 35.9 which again was the highest for districts.

Table V - Birth Rate and Death Rate _ Nuwara Eliya District

Year	1978	1980	1982	1984	1985	*1990
Birth rate per 1000	29.7	27.8	14.6	21.8	23.7	22.9
Death rate per 1000	9.1	6.5	4.3	6.6	6.7	8.3

source : Dept. of Registrar General *Not confirmed

1.7 Maternal Mortality Rate

Nuwara Eliya district had a maternal mortality rate of 1.7 in 1979, one of the highest in Sri Lanka. Geographically a high mortality zone exists with a core in Nuwara Eliya district followed by the surrounding full circle of districts Kegalle, Kandy, Badulla and Ratnapura with a stretch extending westward to Colombo. 60-70 percent of the causes of maternal morbidity and mortality continue to be preventable connected with haemorrhage, anaemia, sepsis, obstructed labour and toxemia. In the estate sectors poverty has contributed to worsening maternal morbidity and mortility due to poor sanitation, lack of access to nutritious food and safe drinking water and a healthy environment.

1.8 Infant Mortality Rate

Table VI - Infant Mortality Rate Sri Lanka and Nuwara Eliya District

Year	1974	1975	1976	1977	1978	1979	1980	1981
Sri Lanka	51	45	44	42	37	38	34	30
Nuwara Eliya	119	79	100	76	75	79	74	53

source : Dept. of Registrar General

In the 70s the infant mortality rate was high.A decline was evident in 80s and by 1985 the rate was 46 as against the rate of 79 in 1975. A 58 percent decline was thus observed. Yet Nuwara Eliya stands out as the district of highest mortality in Sri Lanka. Both infant and child mortality are highest in the estates, being closely associated with the low level of education and place of residence. Food stamp beneficiaries are the most affected by poverty and problems of child survival and development exists to a greater extent here than elsewhere. Infant mortality due to acute Respiratory Tract Infections are common. Thus a high ARI mortality rate is recorded for Nuwara Eliya district where the socio-economic status of the population, mostly estate labour is relatively low.

1.9 Migration

There was an increase in the outmigrants in the inter censal period 1971-1981 which was little more than three times the migration during 1953-1971. Most internal migration in recent years has been short term over small distances. In 1981 only 3.6% of the population lived in a district other than the one in which they had been born. The main currents of migration have been international. The increase in the outflow migration was due to two factors : repatriation of Indian estate labour to India and the locals to Gulf states for employment.

2.0 Employment

2.1 The economic activities of the people in the district depend mainly on area of domicile and tradition. The Government Development Policies and other attractive economic ventures have paved new avenues of employment to the people of Nuwara Eliya district. During 1981 the participation rate in economic activity was 68.5 percent among men. The age group 35-39 years had the highest participation rate of 95.3 percent. The female participation rate was 50.8 percent with a peak rate of 71.0 percent in age groups 30-34 years and 35-39 years.

2.1.1 Agriculture

Agriculture plays a dominant role in the economy of the district. A high percentage of 77.6 percent of the employed are engaged in agricultural occupations.
In Hanguranketha, Walapane and Kothmale DSDs 17%, 12% and 6% respectively of the cultivated land are under paddy. Paddy is cultivated in the comparatively flatter lands at the bottom of the valleys adjoining streams etc, and on sloping lands where terracing is done. In Hanguranketha and Walapane DSDs paddy cultivation is done mainly by minor or major irrigation systems.

Vegetable cultivation is carried out extensively by encroaching on to crown land especially reservations as there is a scarcity of arable land in the district. Potato cultivation is the most lucrative agricultural activity of recent times.

The principal form of land use in the past has been chena cultivation mostly confined to the undulating lands at the bottom of the valley generally above settlements. With population increase the chena land too has extended to sloping lands. Three-four decades ago tobacco was introduced to these areas especially in Hanguranketha and Walapane DSDs. As income generated from tobacco has been significantly higher more and more chena farmers have taken to tobacco cultivation.

2.1.2 Plantation Industry

Tea is the main plantation crop covering a land area of 39,947 hectares. The total estate labour population is 128,737.

Table VII - Estate Labour Force Employed According to Sex

DSD	NUWARA ELIYA	KOTMALE	AMBEGAMUWA	HANGURANKETHA	WALAPANE
MALES	26690	10547	15045	3497	-
FEMALES	27439	10416	16674	3428	-
TOTAL	54129	20963	30719	6925	-

source : Dept. of Census & Statistics

Coconut and rubber are cultivated on a small scale in the wet and the intermediate zones. Coconut cultivation is carried out in Hanguranketha and Ambagamuwa. In Hanguranketha 1.5 percent of the total land area is under coconut cultivation.In 1989 there was 833 hectares of land under coconut in the district.

The rubber lands are exclusively confined to Ambagamuwa DSD that had 300 hectares of cultivated rubber land in 1979/ 81.

2.1.3 Animal Husbandry

Cattle farming is a well established economic activity in the DSDs' due to the favourable climatic conditions and availability of large extents of grazing lands. The government sector animal farms in Nuwara Eliya associated with natural patana grasslands are maintained mainly for milk production.At present less than half the produce from GSD in Nuwara Eliya is supplied to milk powder production factory at Ambewela.

In Hanguranketha rearing of milch cows is widespread. Hatton and Maskeliya are two animal husbandry zones that produce the bulk of the island's requirements.

In Kotmale and Walapane DSD's rearing of milch cows are done at home garden level.

Kotmale is the only division where poultry farming is done on a fairly large scale. The rearing of goats, sheep, pigs and rabbits are also done in this district though to a lesser extent for local consumption.

2.1.4 Small Industries

The percentage of employment in this field is comparatively less.There are few small industries, found confined to certain divisions only.

The most common small industries of the district are :

- Carpentry
- Handloom Textile Weaving
- Masonry
- Production of Beedi
- Quarrying
- Black smithy
- Polythene Industry (In Hatton)
- Food Processing
- Agro - based Industry
- Pottery
- Paint Industry

There are many other small industrial ventures that could be developed to create more job opportunities especially in the production of building materials using local raw materials like clay sand granite etc.

2.1.5 Trade

The retail and wholesale dealers are the key personal engaged in the trading industry. The export of products and import of local needs are handled by both wholesale dealers and importers. There are small trade outlets that caters to the lower and middle class population managed by medium scale businessmen. The outstation businessmen have direct contacts with the producers of locally grown agricultural products.

2.2. Classification by Industry

-Medium Industry
-Minor Industry
-Self Industry

According to Central Environmental Authority's classification on the basis of pollution level there are three high polluting and 29 of each medium and low polluting industries in Nuwara Eliya district.

The list of above mentioned industries are given in Annexure 4.

2.3 Classification by Occupation

The following are the figures of the employed population by industry and sex (1981).

0	Agriculture, Hunting, Forestry, Fishing	104,537	91,798	196,335
1	Mining & Quarrying	86	8	94
2	Manufacturing Industry	3,904	703	4,607
3	Electricity, Plumbing, Gas Industry	1,117	21	1,198
4	Construction	4,133	191	4324
5	Wholesale & Retail Trade & Restaurants and Hotel Services	10,572	528	11,100
6	Transport, Stores & Communication	3,725	148	3873
7	Finance Insurance, Real Estate	768	101	869
8	Community, Social & Private Estate	9,218	4,283	13,501
9	Activities not adequately defined	6,411	2760	9,170
		144,531	100,541	245,072

Source : Regional Development Division-Ministry of Policy Planning & Implementation

C. General Administrative Set Up

Due to the reorganisation in 1990 the number of GSN divisions in Hanguranketha and Nuwara Eliya DSD'S were increased.As a result of these changes there were GSN who had only few families under their purview. The Grama Sevaka Niladhari is the secretary to Gramodaya Mandalaya which comprises of elected members from the village. The district Divisional Secretary function as the Secretary of Pradeshiya Committee, formed by the Gramodaya Mandalaya.The institutions serving the division are given in Annexure- 5.

DSD'S & GS DIVISIONS

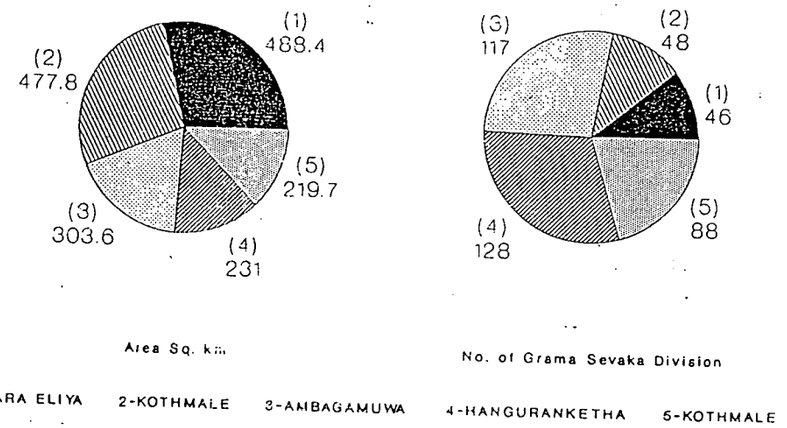


Fig. 7

D. Services

1.0 Education

1.1 The Central Province has four educational zones of which Nuwara Eliya district is one such zone. Each zone has a zonal director who has no administrative powers but solely supervisory powers. Each division has a Divisional Education Officer coterminous with the Divisional Secretariat. A Deputy Director of Education (SLEAS II) function at divisional level with Provincial Director of Education in Kandy, who is the representative of the line ministry.(See Annexure-6)

Table VIII-Pupil Population and Schools by Status 1991

	1AB	1C	Type2	Type 3	Private Schools	Pirivena	Total
Male	7626	18179	31030	25890	633	428	83786
Female	7652	18383	27774	22999	527	-	77335
No Sch	12	42	123	279	02	05	463

* source

* source : Educational statistics of Sri Lanka 1992 (A Publication of the Ministry of Education & Higher Education).

1.2 Only 2.6 percent of the schools are grade 1 AB. Although there are twelve 1AB schools, not a single National School has been established.

The student strength in private schools is quite negligible.i.e. 0.7 percent when compared to the total student population in the district.

In Type 2 schools gender disparity has widened and is significant at the post primary level.The gender disparity tends to be wide in planttion labour families of South Indian origin.However, it is declining with the implementation of specific educational programmes as in the SIDA (PSEDP) supported programmes in plantations in the Nuwara Eliya district while SIDA (PSDP) stresses more on the educational level of primary Sinhala medium schools in the district.

1.3 The uneven allocation of resources to the district and schools reinforced the relationship between the socio-economic background of the schools, the school facilities provided and the performance of the students.

[1] Definitions of schools-annexure-7

Table IX- One Teacher and Two Teacher Govt. Schools

Govt. Schools	1985	1986	1987	1988	1989	1990	1991
One teacher	84	89	85	107	53	34	32
Two teacher	89	81	86	73	86	57	47

* source

In 1981 the one teacher or two teacher schools in Nuwara Eliya District was 29.65. But there has been a marked decline of the number of schools with one teacher and two teachers during 1985 to 1991.

Table X-Schools,Teachers and Pupil Teacher Ratiosin Government Schools-1991

Category of teachers	No. of teachers	Pupil teacher Ratio
Graduates	918	174
Trained	1906	84
Untrained	2980	54

* source

The above data shows that the quality of teaching staff should be strengthened to meet the educational requirements. The district is educationally disadvantaged with a marked shortage of teachers in all divisions, and specially trained teachers and graduates. The least ratio is pupil untrained teacher ratio that brings down the quality of education in the schools.

1.4 In educational performance overall repetition rate in 1991 was 12.66. Performance at secondary school public examinations reflects disparities in school facilities and in the learning - teaching environment. (Dept. of Examinations)

Males dominate in number as repeaters till year 9. In year 11 females dominate. Male domination is obvious in the grand total of repeaters. This may be mainly due to the curriculum being less attractive to the males.

* source : Educational statistics of Sri Lanka 1992 (A Publication of the Ministry of Education & Higher Education).

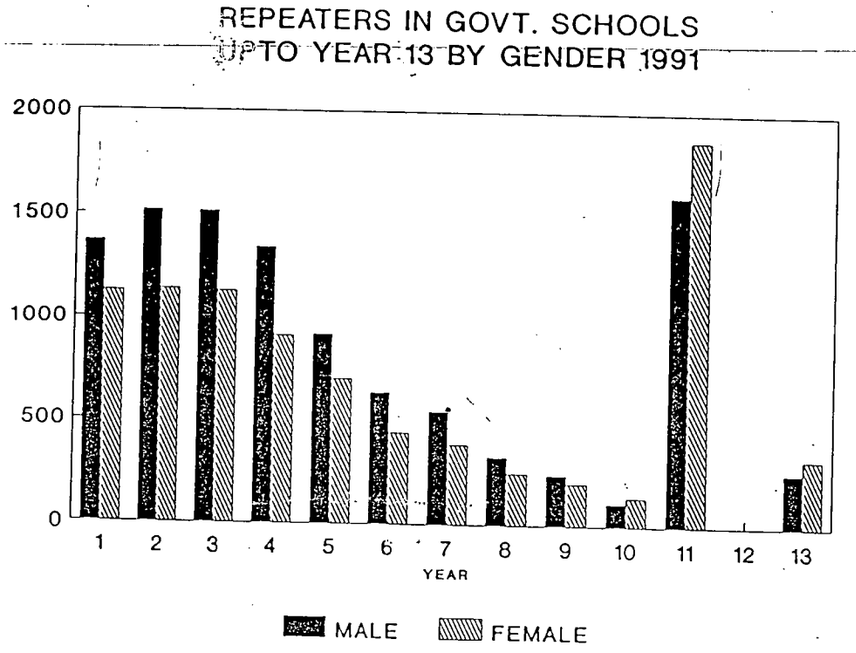


FIG. 8

Table XI - Repetition Rate up to year 13 in Govt.Schools by Gender 1991.

Male No.	Rate	Female No.	Rate	Total No.	Rate
10414.0	13.3	8650.0	12.0	19064.0	12.66

* source

1.5 The Provincial level decentralisation has to improve the quality of education in individual schools. The cluster school system is dormant and it is neither encouraged nor discouraged by the Ministry.

But this system is still operative at the Divisional Level. Much of the organisational work required by the DEOs is done through the cluster system.

The literacy rates among estate population are far below those of the rest of the population. Female literacy is particularly low. The educational facilities at post primarylevel are still poor on the plantation. Few of the estate schools provide secondary and vocational educational facilities. The estate schools lack educational resource materials while the school supervision is also poor. The shortage of teachers is worst in estate schools when compared to other schools in the district.

* source : Educational statistics of Sri Lanka 1992 (A Publication of the Ministry of Education & Higher Education).

1.6 The school drop-outs of years 5 to 9 are greater in number. The vocational education opportunities are meager to meet the needs of annual school drop - outs and school leavers

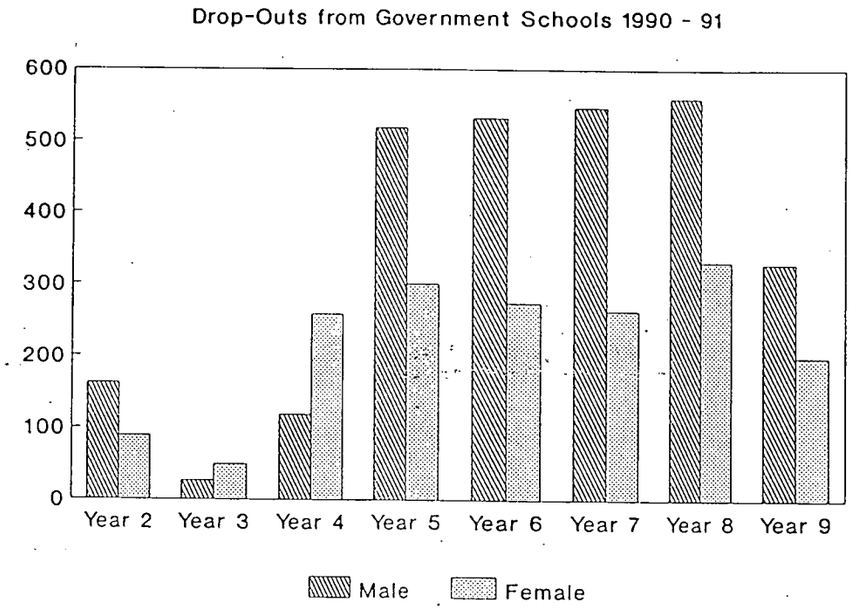


Fig.9

The drop outs generally belong to families of landless labourers, small scale cultivators and the unemployed in which the costs and opportunity costs of education are a major barrier to the utilisation of existing educational opportunities.

Female drop out rates are higher than the male drop out rates in the Nuwara Eliya district where nearly half the population are plantation families. Gender disparity in participation rates of the 5-14 age group is found in the plantations.

Male domination as drop-outs is more marked as the curriculum and school set up de-motivate them in staying in the school.

The newly appointed Tertiary and Vocational Education Commission is expected to re-organize the system of vocational education for the school drop-outs to provide better co-ordination, diversification and follow-up of the output of programmes.

1.7 **Technical Education**

Nuwara Eliya Higher Technical College conducts a number of training courses in both Sinhala & Tamil media. Some of the courses were not popular among students due to its long duration and the quality of training received gave no job opportunities. Recently short term courses have been conducted for training carpenters, masons and bar benders with much success. Nevertheless this college has not attracted sufficient students from the area. The students from outstations too are inconvenienced as residential facilities are lacking.

The other training centers in the Nuwara Eliya DSD are :

1. Forest college
2. Agricultural Training Center, Galpalama
3. Technical College, Kotagala
4. Waterfield Computer Faculty Teacher Education

Teacher Education

The Sri Pada College of Education, Kotagala is completed to meet the teacher requirements in schools. A pre service training is given to those who qualify at the GCE O/ L and A/ L, in the Tamil and the Sinhala media respectively.The recruitment is done in the ratio 3:1 (Tamil : Sinhala). There is also a teacher college at Talawakele to train teachers for the Tamil medium schools.

2.0 Health

2.1 The health unit areas of the Nuwara Eliya RDHS division provides health facilities through a net-work of institutions. A MOH is responsible for all promotional and preventive health within a defined health unit area.PHM is the front line health worker providing domicilary MCH/ FP services to mothers and children within the area.

The plantations have their own health scheme which include estate hospitals, maternity homes and dispensaries manned by estate health staff. The government hospital in the plantation region serve as the referral hospital.

2.2 Patient Care Services

The Base hospital and the primary health care centers are responsible for curative, rehabilitative, preventive and primary health care.Higher levels of care are afforded through the base hospital in Nuwara Eliya.

Table - XII The distribution of Government Medical Institutions and Beds 1991

Instutions	Base Hospital	District Hospital	Peripheral Units	Rural hospital	Maternity Homes& Central Dispenseries
No.of Institutions	1	12	3	1	3
No. of. Beds	197	1004	108	14	39

* source

Beds for 1000 population - 2.5
In addition there are 18 central dispensaries.
The average duration of stay is longer in the base hospital. The reduction in the stay in other institutions is due to the higher pressure for admission and consequently a quicker turn over of patients and on the type and severity of diseases. In 1991 47,170 in-patients received treatment in district hospitals while at the base hospital the in-patients treated were 13,827.

The Leading Causes of Hospital Deaths & Rank Order (Nuwara Eliya)-1991.

Diseases	Rank
•Pesticide poisoning	01
•Slow fetal,growth Total malnutrition &Immaturity	02
•Malignant neoplasms	03
•Ischaemic heart disease	04
•Cerebrovascular disease	05
•Diseases of the respiratory tract pneumonia,broncho pneumonia & influenza	06
•Pneumonia and broncho pneumonia	07
•Diseases of the nervous system	08
•Intestinal Infectious diseases	09
•Burns	10

Pesticide poisoning remained as the 6th leading cause of death in Sri Lanka during the period 1986-1990 and in 1991 it ranked fourth.
These deaths were reported mainly from agricultural areas like Nuwara Eliya that ranked first in 1991.

2.4 The district lack specialised medical officers in Cardiology, ENT,Paediatric,Neuro and Thoracic surgery and orthopaedic. In all there are 9 specialists for the district and includes :

Table XIII - Distribution of Medical Officers(Specialists)

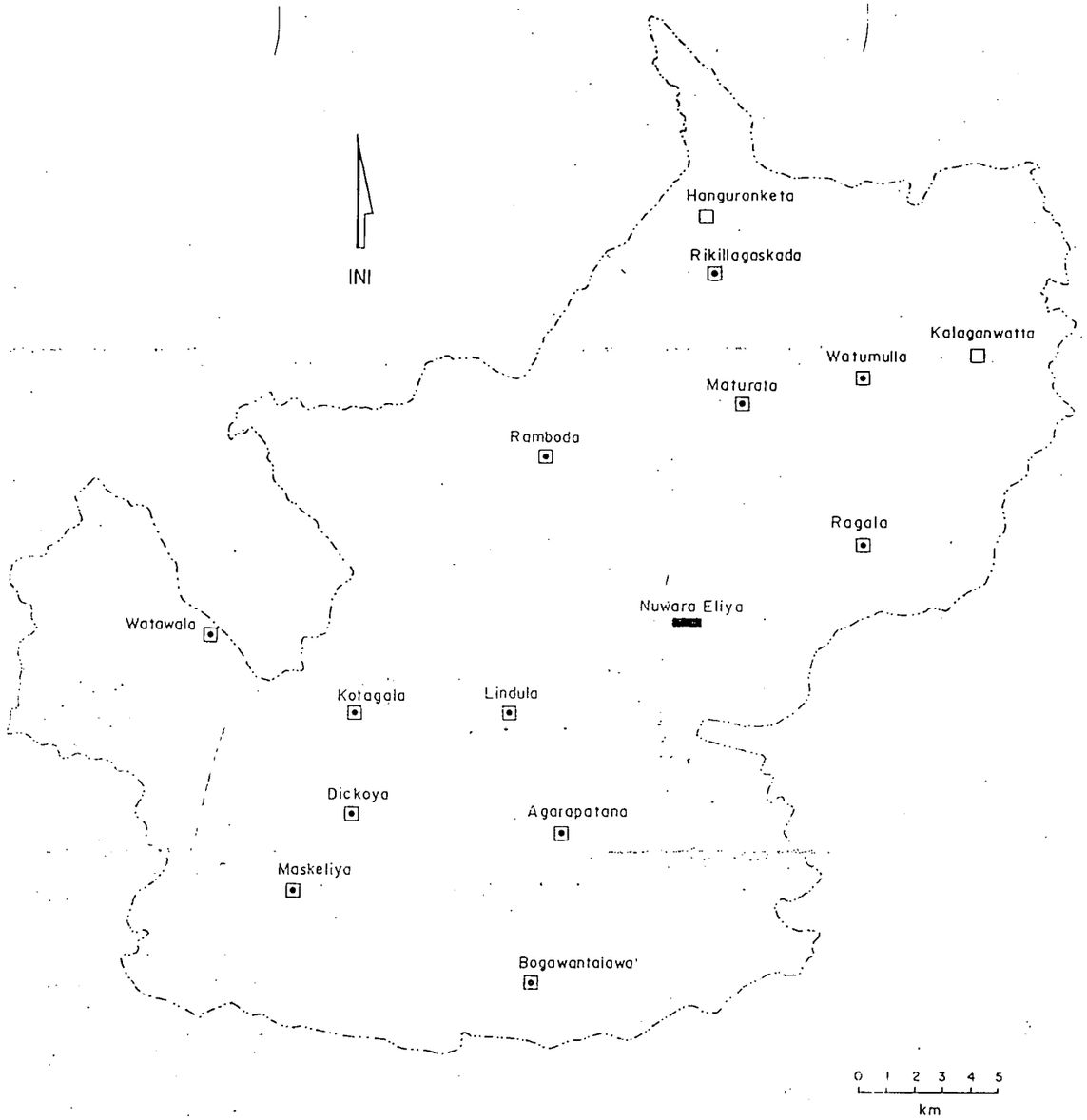
General Physicians	01
General Surgeons	01
Obstetricians & Gynecologists	01
Pediatricians	01
Eye Surgeons	01
Anesthetists	04

*source

Under the specialised services, Respiratory Disease Control Programme trained various categories of staff that included the estate Medical Assistants, MOs, MOH, PHIs, Public Health Midwives etc. The rabies control activities were operated by the Provincial Director of Health Services. The decentralization resulted in the dispersion of limited resources of the rabies campaign. Therefore the provincial rabies unit was established with totally inadequate facilities.The vaccination of 25 ,423 dogs and elimination of 4,825 dogs was recorded by the public health veterinary unit during 1991 for the RDH division of Nuwara Eliya.

*source: Annual Health Bulletin Sri Lanka-Ministry of Health 1991

NUWARA ELIYA DISTRICT - Hospitals



TYPE OF HOSPITAL

- Base Hospital
- District Hospital
- Rural Hospital

2.6 The key health personnel by district 1st September 1991

Medical Officers-i.Curative services include specialists	42
ii.Administrative preventive services	01
Dental Surgeons(includes regional dental surgeons)	08
Registerd/ Assistant Medical Officers	51
Nurses	177
M.O.H	03
Public Health — Nursing Sisters	01
Public Health — Inspectors	15
Public Health — Midwives	87

2.7 **Community Health Care Services**

Community Health Care Services comes under the Medical Officers of Health.They are assisted by Public Health Nursing Sisters,Supervising Midwives, Midwives,Public Health Inspectors and School Dental Therapists.

2.8 **Alternate Medicine - Ayurveda**

There are 03 Ayurvedic dispensaries.23, 431 out patients were treated in these dispensaries in 1991. There is a medicinal herbal nursery in Pattipola administered by the Central Goverment that supply plant and seeds to medical plant cultivators.

D. **Infrastructure Facilities**

1.0 **Markets**

The central markets established by the Municipal Council are located at Nuwara Eliya,Thalawakele and Kotagala.
There are weekly fairs conducted at Nuwara Eliya and Kandapola for estate employees.A special incentive based weekly Pola has been organised in Nuwara Eliya town for sale of the vegetables grown by compost fertilizer user farmers.
The villagers depend mostly on weekly Polas for their daily needs and textiles.
The Hatton Dick Oya Urban Council maintains the public market in Hatton and Maskeliya.There are number of vegetable sales outlets including one at Ginigathena.
The main marketing center at Rikillagaskada town purchase products of the region for local sales and the surplus is sent outstations. There are 29 retail stores in Rikillagaskada and 17 in Hanguranketha.The villagers depend mostly on weekly Polas for their needs.
The consumer outlets of the co-operative societies in Kotmale lack basic facilities,trained staff and a good transport service.An efficient consumer service could be operated if these impediments are ovrercome.

Table XIV - Marketing outlets of the Goverment and Corporation sectors

Co-operatives Development Dept.	Co-operative wholesale establishment	Fisheries Corporation	Markfed	St. Trading Corporation	Milco Ltd.	Building Materials Corporation
237	01	03	01	02	08	01

source: Agricultural Statistics of Sri Lanka 1992 Dept.of Census &Statistics Ministry of Policy Planning & Implementation

2.0 Road Net-work

Nuwara Eliya district has a good net-work of roads making it possible to approach almost every part of the district. It is a district that could be proud of its road system that was constructed during the colonial British period under the tea plantation industry.
Since of late the roads in certain areas of the district have not been maintained properly by the respective local authorities and some of these roads are in a state of disrepair.

The main highways through, to and from Nuwara Eliya:

1.Kandy→Nuwara Eliya→Badulla
2.Colombo→Nuwara Eliya→Badulla
3.Nuwara Eliya→Hatton →Avissawella→Colombo
4.Kandy →through Raja Mawatha→Nuwara Eliya

Table XV The Details of the road net-work in Nuwara Eliya District (in Km.)

DSDS	Highway Category				
	A	B	C	D	E
Nuwara Eliya	78.08	99.04	128	46.72	54.9
Ambegamuwa	38.4	121.6	22.4	-	-
Hanguranketha	-	36.85	105.4	61.23	-
Walapane	-	62	126.4	32.61	81.6
Kotmale	N/A	N/A	N/A	N/A	N/A

* source : Resources Profile of Nuwara Eliya District.

Table - XVI Distribution of Road kilo meterage by District 1991

A	B	C	D	E	Total
129.16	383.65	506.48	80.44	262.24	1,361.9

Nuwara Eliya :

The roads in Nuwara Eliya DSD connect all estates and colonies to the Nuwara Eliya town.
There are four main approaches:
The North-West approach by the spectacular Ramboda pass
The South East approach from the Uva district passing the botanical gardens at Hakgala
The Western approach from Dimbulla
The North - Eastern approach from Kandy via Kandapola.

The road system within the city of Nuwara Eliya is over 100 years old.
A major over hauling of the road system to cope with the heavy traffic and frequent usage of roads need to be considered.
The lapses in maintenance of the new roads opened during the last few decades have caused great inconveniences to the road users.

Ambegamuwa :

The roads are maintained by 3 organisations namely RDA located in Norwood,Kandy PC and Ginigathena Pradeshiya Saba. The estate roads are motorable and well maintained. 40 km long road from Ginigathena to Bogawanthalawa and 40-50 km long road from Maskeliya a to Upcot interconnect the estates of the area.

Walapane :

The highways extend to 302.4 Km. The roads running through Walapane are :

1. Nuwara Eliya— Ragala— Wathumulla— Kandy
2. Nuwara Eliya— Ragala— Udapussellawa — Welimada

The Northern sector of Walapane that stands isolated could be reached by constructing roads covering up to 480 Km. The majority of roads, about 80 percent belong to categories C,D and E.

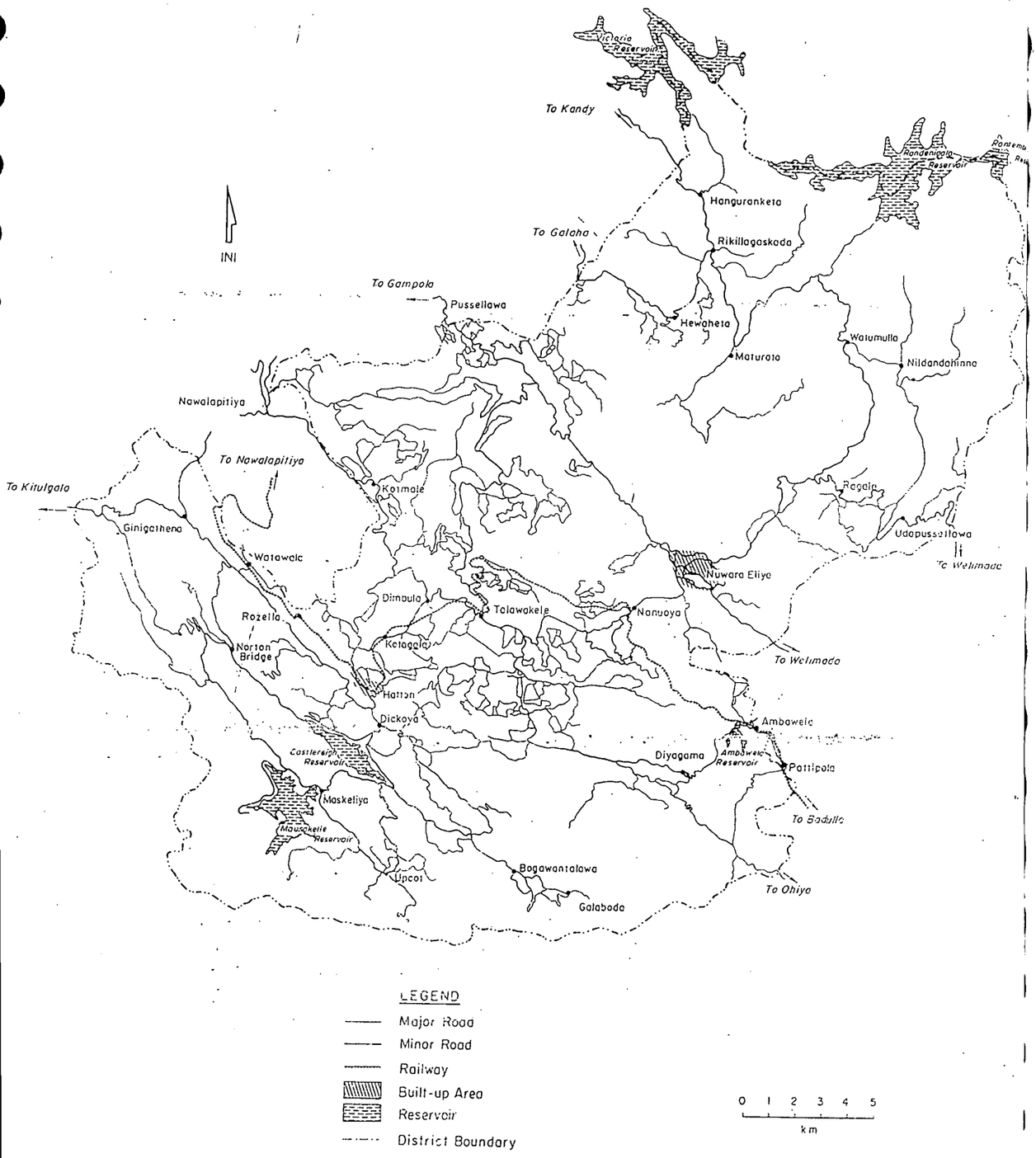
Hanguranketha:

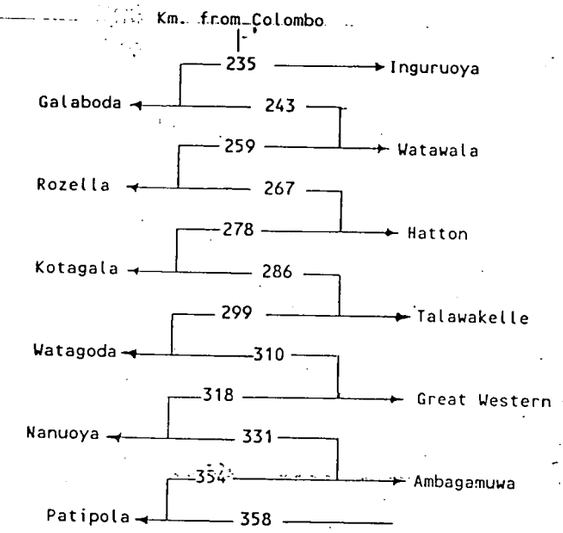
The highways are subjected to much erosion due to the prevalence of rainfall during greater part of the year. The roads in Mandaramnuwara and Lemasuriya are subjected to earthslips and erosion. In considering the terrain and the heavy rainfall of the area the road system has to be visualized as an integral part of the environment along with the engineering aspects of road construction.

3.0 Railway

Nuwara Eliya district is served by a main railway line running from Colombo to Badulla. There are three daily services from Colombo to Badulla through Nuwara Eliya that includes two day trains and the night mail. Their departure times from Fort station being 5.55 a.m., 9.45 a.m. and 8.15 p.m. respectively. The Watawala railway line situated on a landslide prone area has posed a great threat in recent years to the train services in the hill country. Presently Sri Lanka railways are following the guidelines provided to them for vigilant action in order to permit careful running of trains both at day time and night.
Following are the 12 stations located within the district:

NUWARA ELIYA DISTRICT — Transport





4.0 Bus Service

All bus depots were privatized by distributing 50% of shares to depot workers as of December 1992.

The depot at Nuwara Eliya town provide daily bus services on 34 routes. The Hatton depot operates buses to 50 villages but the village roads on high elevations are not suitable for passenger transport.

In Kotmale, a number of short distance services are provided to the neighboring small towns.A better transport service could be provided by consolidating the number of buses as per commuter requirements and by improving the neglected bus routes especially the routes mentioned herein:

1. Nuwara Eliya → Pundaluoya route (via Dunsinane)

2. Bogahawatta → Rawanagoda route

3. Pundalu oya → Thalawakelle route

In Walapane and Hanguranketha the transport facilities are poor. Wathumulla depot provides bus services to both divisions while the Kandy, Nuwara Eliya and Hanguranketha depots provide transport services to Walapane. The national transport commission has undertaken to improve the system of subsidised bus transport for students. The government has entrusted the peoplised companies to continue with the concessionary scheme where the student is given the option to travel in any bus irrespective of the company from which the student has purchased the ticket..

The National Transport Commission will also take a decision on uneconomical routes avoided by the bus companies.

5.0 **Communication**

5.1 **Post Offices**

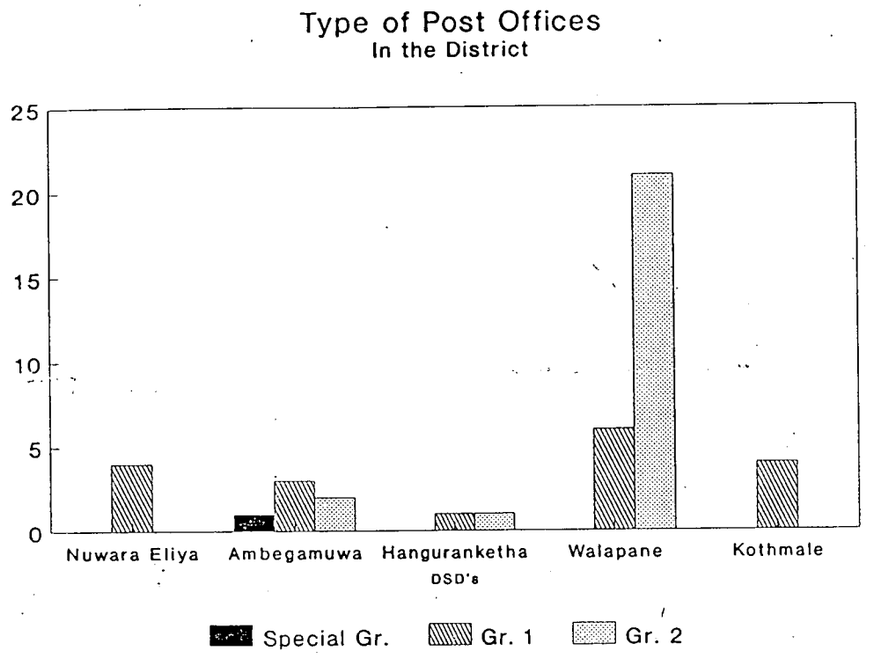


Fig. 10

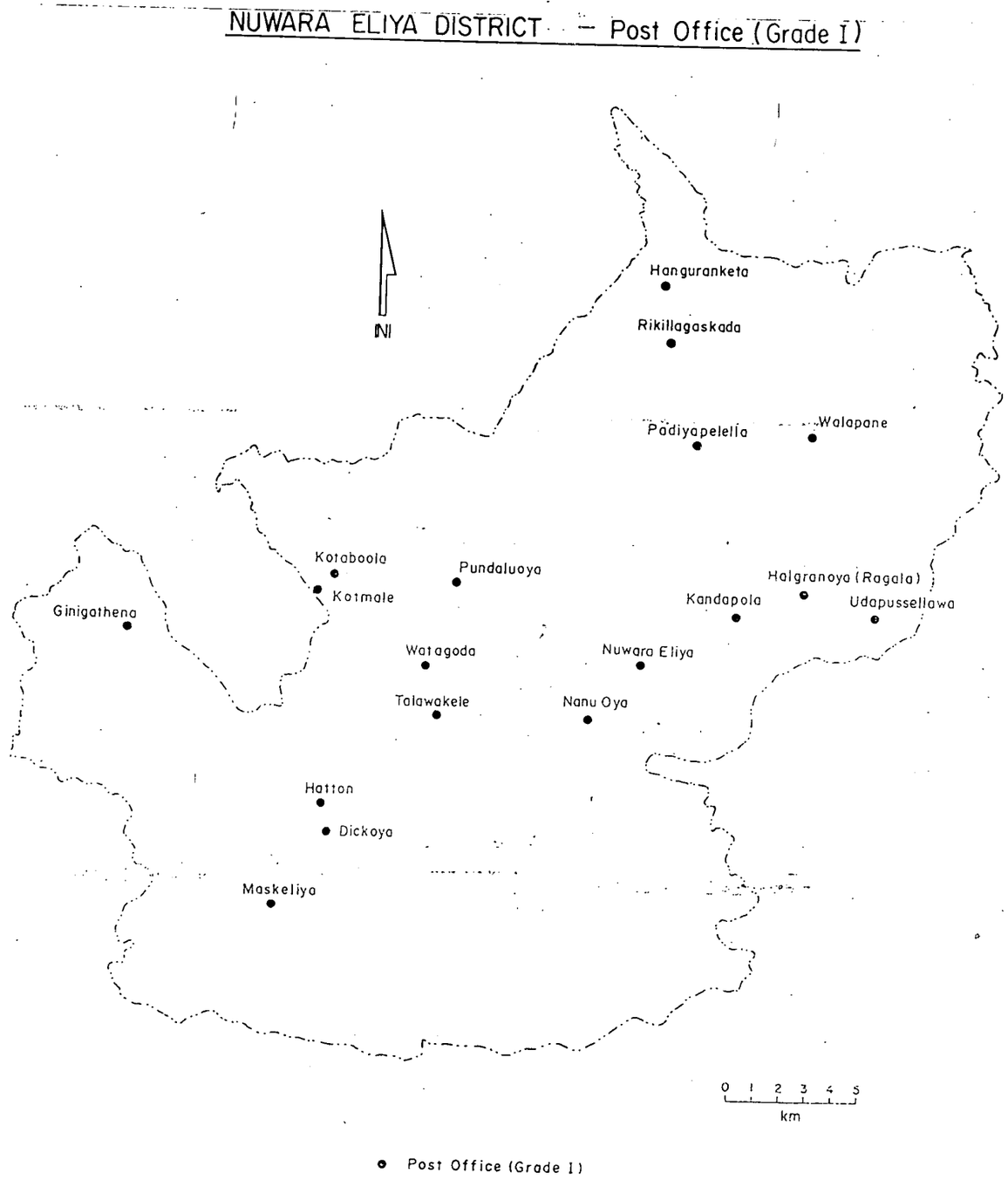
The Sub- Post offices lack certain facilities such as telephones, adequate staff, delivery vehicles etc.The Sub Post- Offices with and without Telephones

With telephones-*

10 *	Nuwara Eliya
08 °	
02 *	Walapane
16 °	

Without telephones-°

10 *	Ambagamuwa
10 °	
08 *	Haguranketha
11 °	



Telephone Facilities

The main exchange in Nuwara Eliya town has 1042 lines. The telephone lines available in the rural switching units are as follows:

1. Maskeliya	- 123 units.	2. Talawakelle	- 106 units.
3. Maturata	- 52 ,,	4. Watumulla	- 48 ,,
5. Rambada	- 42 ,,	6. Udu Pussellawa	- 41 ,,

The non-functioning of telephone lines at Agrapathana extends to well over 15 years and theft of telephone copper wires is very common in the area.

6.0 Drainage Facilities

The surface drainage system in Nuwara Eliya is outdated. A well planned drainage system should be established for the inner city of Nuwara Eliya and lake Gregory. A preliminary survey on catchment areas,outfalls and rainfall data are essential to design an effective drainage system.

Most of the townships in the district have no proper drainage systems. During heavy rains most areas go under water.

A district having a high terrain and a high rainfall regime should provide an efficient system for storm water runoff to curtail flash floods, erosion and earth slips.

Chapter 4
Resources and Human Activities

A. Renewable and Non-renewable Resources

1.0 Soil

The geochemistry of the soils influences their fertility. The soil fertility can be improved by the addition of fertilizers to get better yields especially of food crops.Presently there is an ever increasing demand for fertilizers in the district where vegetable cultivation is carried out on a massive scale.

The preservation and protection from erosion is as important as the geochemistry of soils in this district where vegetation cover has been cleared on hill slopes mainly for cultivation of vegetables.

Classification of Soils in Agroecological Regions of the District

Zone	Agro Ecological	Major Soil Groups	Terrain
Upcountry wet zone	WU1	Red yellow podzolic soils & mountain regosols	Mountainous, steeply dissected hilly & rolling
	WU2	Red yellow podzolic soils & mountain regosols	-do-
	WU3	Red yellow podzolic with dark B horizon & red yellow podzolic with prominent A, horizon	rolling
Mid country wet zone	WM1	Red yellow podzolic soils & red yellow podzolic soils with semi prominent A. horizon	steeply dissected hilly & rolling
	WM2	Reddish Brown latosolic soils immature brown loams & red yellow podzolic soils	Steeply dissected hilly & rolling
Upcountry intermediate zone	IU2	Red yellow podzolic soils & mountain regosols	Mountainous steeply dissected, hilly & rolling
Midcountry intermediate zone	IM1	Reddish brown earths & immature brown loams	Rolling, hilly & steep
	IM3	Immature brown loans reddish brown latosolic soils & Reddish brown earths	Steeply dissected hilly & rolling

Major Soil Group	Relative Structural Stability
1. Reddish brown latosolic soils	very good
2. Red-yellow podzolic soils	good
3. Reddish brown earths	medium

The soils of the district are mainly of the red yellow podzolic type. The structural stability and consistence of the soil have an important bearing on some aspects of soil management. These soils have a desirable consistence and can therefore be worked under a wide range of moisture conditions.

1.3 **Physical & Chemical Properties**

Major Soil Group	Physical	Chemical
A. Red yellow Podzolic soils	reddish to yellowish well drained, fine textured with good filteration & permiability	strongly acid soils with low pH good cation exchange capacity
B. Reddish Brown latosolic	reddish Brown, well to moderately well drained fine textured	medium acid soils,good cation exchange capacity
C. Regosols	relatively young, thin stony & gravelly, on steep slopes. regosols have a higher run-off rate	neutral to acid
D. Reddish Brown earth	water capacity is around1.7 inches of water per foot depth of soil, shallow as well as eroded phases occur on the sharply rolling and the hilly landscape in the intermediate zone	neutral with a tendency toward slightly acid very good cation exchange capacity
E.Immature Brown	has a satisfactory depth, texture & drainage	Slightly acid has a good cation exchange capacity

Agricultural Potential

Sub-soil groups

A -The modal group is extremely good for common plantation crops as well as certain orchard crops. However anti-erosion measures are necessary on the steeper slopes. Prospects for plantation foresty are extremely good.

B.- Perrenent agricultural crops, orchard crops could conveniently replace some of the uneconomic tea in the mid-country.

D - By tropical standards, the agricultural potential of these soils could be rated as very high.A wide range of tropical cereals, pulses, oil seed, fibre and subsidiary food crops as well as pastures can be grown either under rainfed or irrigated conditions. The deeper soils in which quartz - gravel layer is absent orchard crops could be introduced.

The imperfectly drained and poorly drained associates of these soils like low humic gley soils are the most productive rice growing soils.The gravely and eroded phases of these soils have very poor agricultural potential and are therefore best allocated for nature reserves and the shallow phases are ideal for forest plantations.

E - Topographic conditions are satisfactory for extensive pasture development. The imperfectly and poorly drained associates are best for either rainfed or irrigated rice. Rice yields will be lower than in the corresponding drainage members of the reddish brown earths.

2.0 **Water**

2.1 **Surface Water**

These include the following
- rivers and streams
- lakes
- other water bodies

2.2 **Ground Water**

The district has hard fractured rock with local and limited ground water resources. Most of these areas consists of crystalline rocks traversed by discontinuites,such as plains of bedding,joints and foliations along which water circulates,a feature leading to many springs. There is no continuous body of ground water with a single water-table in crystalline rocks but rather separate pockets of ground water each having a distinct water table.The utilisation of such water pockets depends on their exact location and this is often indicated by heavy fissuring and jointing.Thus haphazard well sinking in areas of crystalline rocks often lead to failure. There is heavy concentration of springs in Hanguranketha where the ground water yield is fairly reliable.

3.0 **Atmosphere - Air Quality**

The topography of the district indicates that it could act as the ultimate sink for gaseous pollutants in the island.But at present there are no major polluting industries of such magnitude in Sri Lanka to cause such impacts.

Transient pockects of air pollution occur from time to time due to forest fires.

The volatile pesticides used in agriculture easily escape into the air but,as many areas of the district receives heavy rainfall the accumulation of these in the atmosphere for longer periods is quite unlikely.

Air pollution by vehicular emission is not significant in the district.

The haphazard dumping of garbage and industrial solid wastes in certain areas cause pollution of the vicinity due to emissions of noxious gases.

The district suffers no serious air quality degradation so as to interefere with the visual intergrity of the district's landscape.

4.0 Flora

The dense forest cover of the district includes the montane temperate forests and the sub-montane evergreen forests which reflect climatic, topographic and other variations.
The montane temperate forest confined to hills above 1500m. has low canopy reaches,about 13m in better sites. In exposed areas the canopy height is low and the trees have a twisted, gnarled appearnce. Stunted or "elfinwoodlands" are found in the highest reaches. The effect of the wind on these montane ecosystems are pronounced in places where wind channels are developed.

The main tree species are Elaecocarpus glandulifer (Thiththa weralu), E serratus (Honda weralu), Michelia nilgirica (Sapu), Semecarpus coreacea (Badulla). The dense undergrowth has shrubs such as the small hill bamboos, strobilanthus spp. In the upper montane forest the flora abounds with lichens, mosses,liverworts and ferns besides the variety of angiosperms.

The sub-montane evergreen forests are found on the Adam's Peak range around Hatton in hills between 900m to 1350m. The species which are frequent and characteristic of these forests are Calophylum calaba (keena) Doona gardneri (Dun) Diospyros sylvatica (Sudu kadumberiya). Terminalia parviflora (Hampalanda) and Carallia calyana (ubberiya).

There are 413 endemic plant species in the montane zone of which 62 species are considered very rare. The presence of 3 endemic genera alone Stemenonoporus, Leucocodon and Hortonia indicates the importance of the natural flora in the montone zone.

Fauna

There is a unique array of fauna and most of the endemic vertebrate of the island are found in the district. The endemic species, by virtue of their long evolutionary history show very low adaptability range and the reduction of natural forest would greatly affect their existance.

Of the four sub species of monkeys found in the island two types are found in Horton plains. They are the highland purple faced leaf monkey (Pithecus vetulas monticola) and the dusky torque monkey (Macaca sinica aurifons),the former is an endemic species.

The sambhur (Ruse unicolor) barking deer (Muntiacus malabaricus) and the mouse deer (Moschiola meminna) are the three members of the deer types also seen at Horton plains. Of the reptiles there are few confined to this district.

There are number of endemic bird species. The Sri Lankas-largest birds of prey the majestic mountain hawk eagle is also found here.

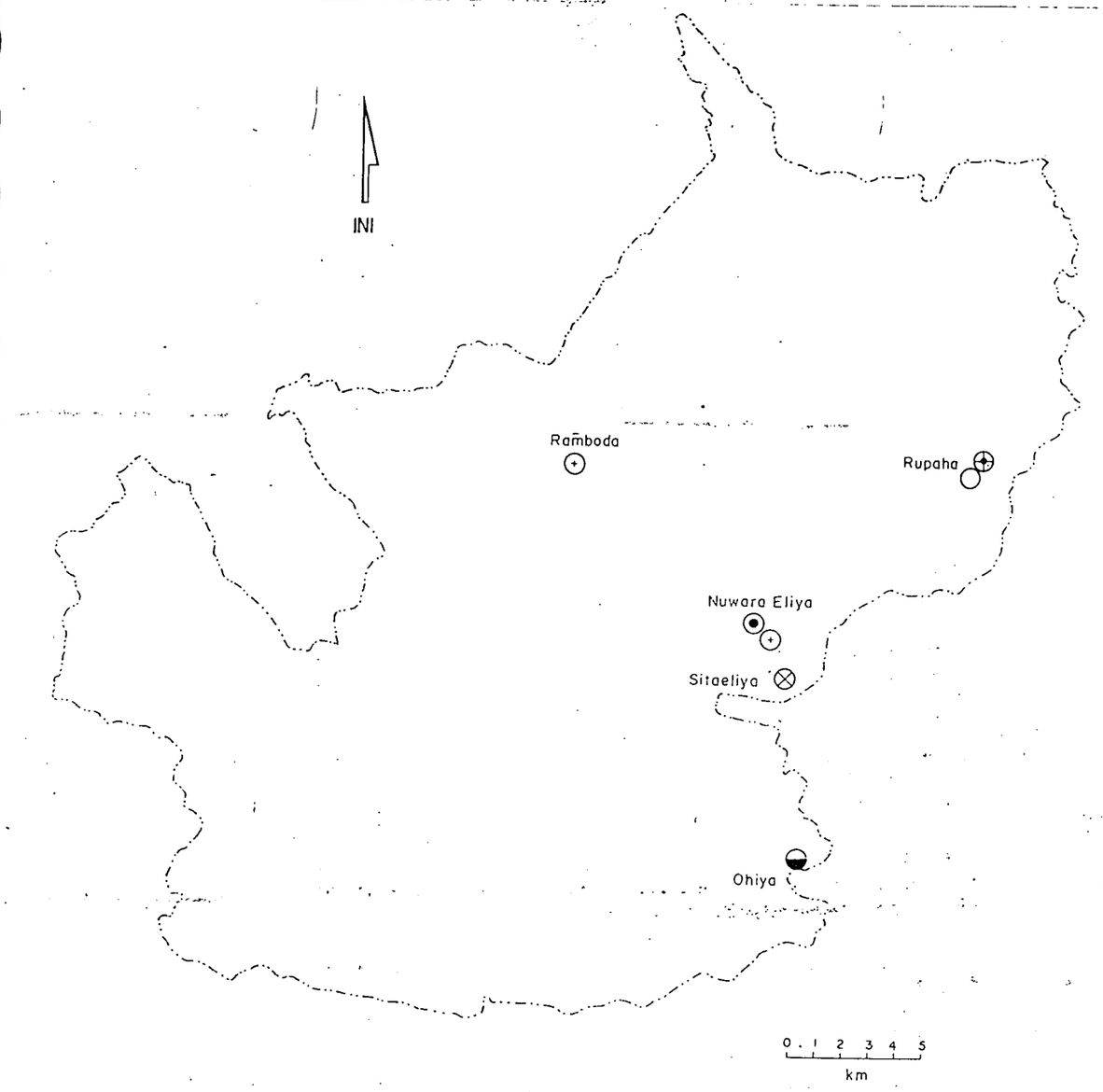
6.0 Mineral Resources

A number of mineral surveys have been conducted in Nuwara Eliya district since 1903.

Mica- Some varieties have been discovered at Moon Plains and at 4/5th culvert on the road to Sita Eliya from Nuwara Eliya (map6)

Green Marble - A deposit is found at Rupaha area. Its economic viability has not been investigated yet.

NUWARA ELIYA DISTRICT - Minerals



LEGEND

- Clay
- Mica
- Corundum
- Green marble
- Iron ore
- Gold

Source: Mineral Map - Nuwara Eliya District
Geological Survey Dept.

Clays - Multi-coloured small clay deposits are found in different parts of the district. A deposit occurs as a thin layer of white clay at Lake Gregory.

Corundum and Other Gem Minerals - Gems of economic value have been discovered in Moon Plains, Horton Plains, Elk Plains and around Lake Gregory. Some of the gems are Cat's Eye, corundum, Zircon and Tourmaline. Corundum is known to occur in rocks around Sita Eliya and Rupaha.

Iron Ore - The few minor occurances of iron ore around Nuwara Eliya town are proved to be economically exploitable.

Gold - Traces of gold are known to occur in Nuwara Eliya district since 1854. The investigations carried out at Ramboda area by the Geological Surveyor Department and by a Chinese Team showed that there no economic quantities of gold. The area such as Moon Plains, Baker's Farm and Mahagastota should be investigated further for any possible deposits.

Building Stones - Hard rocks suitable for use as building stones and road metal are available in the district. Charnokites granulites and some gneissic rocks shown in the geology map are more suitable for these purposes.

B. Trend in Land Use

In respect of land use the district could be classified as follows (1979/ 81)

	Total area ha.	% Total area
Built up Urban Land	800	0.5
Agriculture	99059	58.6
Forest	65510	38.5
Barren	510	0.3
Water bodies	3580	2.1

1.0 Urban Land Use

The unplanned urban land use practices especially in Nuwara Eliya have posed many environmental problems. Hence all on-going haphazard development activities must be stopped by strict enforcement of laws.

2.0 Agriculture Land

Agriculture land can be classified into 7 categories.

Land Use	Extent Ha	% of the District
1.Homestead	11400	6.5
2.Tea	66234	38.0
3.Paddy	5350	3.0
4.Coconut	310	0.2
5.Rubber	300	0.17
6.Mixed	49	0.03
7.Additional cropland	8630	0.05
8.Other crops	10440	5.98
Total	36479	53.93

The agricultural production levels are low not only on sloping land but is also seen in the homestead gardens and in the paddy lands.

2.1 Homestead

Some homesteads provide variety of food, fuel, fodder, wood and medicinal crops. These gardens vary in species composition according to elevation and climate. The management practices in these gardens vary widely from farmer to farmer.The knowledge of plant species growth habits and requirements among farmers are of low standard.

2.2 Tea

Tea is the main agricultural crop cultivated in the district.In the Land Suitability Evaluation and Land Use Survey, tea cultivation comes under 4 land use catergories: 'Well Managed Seedling Tea', 'Poorly Managed Seedling Tea' and 'Clonal Tea'(VP-tea) in the estate plantations and 'Small holder Tea' in the village agricultural sector.
Basically management patterns vary from that of the big tea estates to the small holding sector estates. The more reputed estates are under the supervision of well experienced planters and supporting staff while small holders manage their blocks of land through mostly their own experience and are family oriented.
From the point of view of the environmentalist soil erosion from tea plantations has been a subject of much concern. It is found that even well managed seedling tea with a 70% to 90% canopy cover are subjected to moderate erosion.In certain estates unsuitable extents of land have been identified, these extend up to steep slopes.In Nuwara Eliya DS division Cristles farm state and Dimbulawatta estate have released 3 hectares each of steep unsuitable land to Janasaviya recepients.Only one third of the estate lands released for Janasaviya in Nuwara Eliya DS division are found to be suitable.The allocation of unsuitable steep land should not be the practice as these lands have to be left under nothing but forest cover.
The marginal and non suitable tea lands should be found alternative land uses. Ambagamuwa has relatively more marginal lands than the other DS divisions and includes 18% of the total area under tea as compared to 13% in th entire district.

If poorly managed seedling tea lands are to be still preserved for tea cultivation urgent measures are necessary to rehabilitate them. These lands will be lost for any agricultural use if the present programmes on rehabilitation are not accelerated manyfold to avert the massive erosion process.

The tea small holding sector faces many development constraints. Among them land is a limited resource where most tea holdings are 1 acre or less than 2 acres. The productivity in this sector is low. The development of tea small holdings especially in Kotmale DS division would help promote the economy of the peasantry. The upgrading of these lands would be essentially similar to poorly managed seedling tea lands.
Sri Lanka needs to search for counter measures to increase productivity and efficiency in the tea industry to face the increasing competition from the emerging East African tea producers of Kenya, Tanzaniya, Malawi etc. Thus it is hoped with the reprivatization of state enterprises such as JEDB and SLSPC these objectives would be fulfilled. Presently 74 estates in the district have been privatised.

Some recommendations that should be carried out immediately are:

• The quality of superintendence and superintendents that has eroded during the last 10 to 20 years has to be corrected effectively and expeditiously.

•• All land that donot contribute to the yield should be isolated.

This would bring large savings on weeding,plucking,fertilizers etc. and ultimately influence the final cost of production figure where a yield increase of 15% -20% could be expected.The end result would be higher yield per hectare and low cost of production.

2.3 Paddy

During 1990/1991 cultivation year the district had 9,315 hectares under paddy. In the intermediate zone a household manages from 0.25 to 0.75 acres of paddy. Almost fifty percent of villagers do not own any paddy lands. As a result share-cropping of paddy is common in the intermediate zone. An average paddy share cropper may have around 0.25 to 0.5 acres of land, the take home yield being far below the subsistance requirement.
The gross extent sown under rainfed is comparatively very much less being 124 hectares in 1991/92 Maha season as against 5099 hectares under minor irrigation schemes and 923 hectares under Major irrigation schemes during the same year. District wise the lowest total production is recorded for Nuwara Eliya.

The paddy yields in Hanguranketha is poor due to lack of proper maintenance of irrigation works and unsatisfactory water management systems. Improved seed varieties,transplanting in rows and soil conservation methods would help increase the yields.

In Walapane the yields are generally low as inputs used are very low.

Although in Kothmale a very small number of hectares are cultivated by rain water this extent is much more than in the other divisions. The minor irrigation systems in this divisions are in four areas of authority coming under Agrarian Services Committees. They are Maldeniya, Pundalu Oya, Helboda and Harangala.

In Ambegammuwa, Ginigathena and Vidulipura Agrarian Services Centres maintain the small scale irrigation works of the division. 80% of the area under paddy cultivation is situated in Walapane and Hanguranketha DS divisions. The rainfed paddy is cultivated both in Maha and Yala seasons in the wet zone and only in Maha in the intermediate zone where usually old improved varieties are grown. Paddy grown on bench terraces on hill slopes are supplied with irrigated water via canals. Both old improved and new high yielding varieties are grown on hill slopes.

The extensive use of agro-chemicals and pesticides and weedicides are associated with paddy cultivation.

The percentage of fungicide used in Nuwara Eliya district in 1988/89 Maha and 1989 Yala were 26.54 and 39.51 percent respectively.

2.4 Coconut

Presently 754 hectares are under coconut cultivation. This excludes the number of coconut trees found scattered in the coconut growing divisions. The largest extent of coconut land is found in Hanguranketha DS Division. The following data gives the land areas under coconut in the DS divisions.

	Hectares	No. of Scattered Coconut Trees
Ambagamuwa Korale	132	5132
Kotmale	16	4146
Nuwara Eliya	-	11
Hanguranketha	331	24974
Walapane	276	8137
District	754	42400

The coconut small holdings according to land use classes come under moderate erodibility. Most coconut lands are not well maintained and as such strengthening of extension services and encouraging coconut small holders is important as the production of coconut has not shown much progress.

2.5 Perennial Crops

Unlike seasonal crops, the perennial crops do not subject the soil to frequent disturbances and crops could be used to stabilize the soils.

Table XVII - Area (Hectares) under Perennial Crops in Nuwara Eliya District By DS Division.

	Plantain	Papaw	Orangers	Mangoes	Butterfruit	Lime	Pears
Ambagamuwa	199	3	17	54	78	1	-
Kotmale	185	8	21	102	41	-	-
Nuwara Eliya	11	-	1	6	9	-	-
Hanguranketha	186	3	3	59	20	4	2
Walapane	281	4	63	108	110	22	16
Total	862	18	105	403	266	27	18

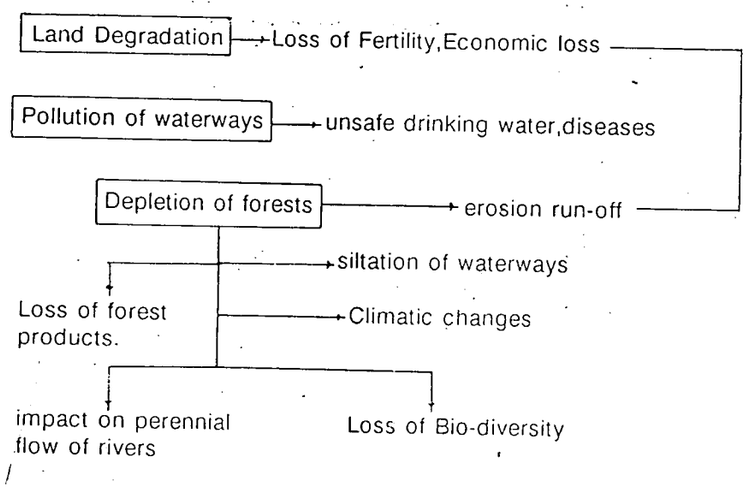
2.6 Vegetables

This district is best known for its English style vegetables that have flourished since its introduction to Nuwara Eliya by the Britisher Sir Samuel Baker.

Area (hectares) under vegetable cultivation in Nuwara Eliya district by DS divisions.

DS Division	Up Country Vegetables	Low Country Vegetables
Ambagamuwa	294	3
Kothmale	288	25
Nuwara Eliya	1170	26
Hanguranketha	1854	156
Walapane	1142	154
District	4748	364

Vegetables grown on small holdings (1/4 to 2 ha) for commercial production are grown on raised beds in valleys or bench terraces on moderately sloping lands. High year round, family or hired labour is required for planting to harvesting operations.
Pesticides and chemical fertilizers are used extensively by farmers at most times along with extensive cultivation of vegetables that has led to-



Carrots, lettuce, raddish, beet, cabbage, knol-khol, beans, leeks and cauliflower could be recommended for land above 1000m elevation while raddish, beans, winged beans, cabbage. brinjals, cucumber for lands below 1000m.

2.7 Subsidiary Food Crops

Potato is the main subsidiary food crop ofthe district and is grown extensively in Nuwara Eliya DSD.The area under subsidiary crops in 92/93 is given in Annexure-8

3.0 Forest Cover

The Survey Department has estimated a total forest cover of 58,450 hec. The present dense forest includes 30,410 hec. and this includes the natural montane forests. The other forest lands are

Open forest - 10,570 ha. Scrubland - 9,880 ha.
Forest plantation - 7,590 ha.

The following are the three forest reserves managed by the Forest Department that come under Nuwara Eliya and Halgran oya ranges.

Range	Name of Area	Extent in Acres	Rood	Perches
Nuwara Eliya	Kandapola-Sita Eliya FR	6724	10	2
Nuwara Eliya	Meepilimana FR	2146	1	10
Halgran oya	Dambakelle FR	176	0	0

There are number of proposed reserves, the extents of which are given below along with Hakgala Strict Nature Reserve.

Ranges	Name of Area	Extent in Acres	Rood	Perches
Nuwara Eliya	Agra Bopots PR	22500	0	00
Nuwara Eliya	Galpalama PR	181	3	30
Nuwara Eliya	GalwaysLand PR	140	-	-
Nuwara Eliya	Kandapola Sita-Eliya PR	276	3	24
Nuwara Eliya	Kikilimana PR	12030	-	-
Nuwara Eliya	Nanu oya PR	1039	3	17
Nuwara Eliya	Ottery-Queenswood PR	130	-	-
Nuwara Eliya	Pattipola Ambewela PR	3701	2	21
Nuwara Eliya	Hakgala strict nature reserve	1045	3	5.4
Nuwara Eliya	Preston Elsmere PR	150	-	-
"	Conical hill PR	3878	1	26
Halgran oya	Ambaliyadda PR	152	2	08
"	Harasbedda PR	900	0	00
"	Ragalla PR	662	2	-
"	Pannala PR	2900	1	23
Halgran oya-Mahakudugala	Mahakudugala PR	4355	1	07
Kandy,Halgran oya,Nuwara Eliya	Pedru PR	1700	-	07
Hatton	Rilagala PR	1400	-	-

According to Forest Dept. sources, there are no encroachments into the forest reserves except by villagers who collect fuelwood, which is said to be a seldom practice of theirs. It is also said that marginal encroachments do take place. A vital factor to be considered is to declare all identified proposed reserves to the highest possible legal status under the Fauna and Flora Protection Ordinance. The total protection of these areas are urgent and as such adequate financial and man power resources should be provided to these areas.

3.1 Forest Plantation

26,555.9 ha of land in the district were under forest plantation by year 1991 as stated by the Forest Department. The main species cultivated were Pinus caribaea and Eucalyptus grandis. The plantations under P caribaea are 1,504.3hec in extent. These plantations have a good ground cover of fallen needles as a result these plantations in the steep slopes are subjected to minimal soil erosion. In

Eucalyptus plantations the forest cover is poor and serious erosion is evident. Forest fires are common in these plantations and occur annually especially in the drier intermediate zone. These fires are mostly intentional but accidental fires too occur.Annexure-9 gives the extent of forest plantations in Hatton, Nuwara Eliya and Halgran Oya ranges carried out by the Forest Dept.

3.2 Scrubland

16.9% of forest cover is scrubland of which 3.72% is in Nuwara Eliya DS division. Some of these have been distributed for cultivation of vegetables.

3.3 Grasslands

The wet montane grasslands or wet patnas are found dispersed among the upper montane rain forests. They occur above 1500m, under high cloud cover, low insolation, water logged soils, high wind and low temperature. The dominant species of tussock grass are Chrysopogon zeylanicus and Cymbopogon confertiflonis associated with a rich herb flora. Rhododendron with its leathery leaves and sprays of blood red blooms are the only trees in these grasslands found in Horton Plains, Moon Plains, Elk plains etc. a patna area of 2000 has been preserved on Horton plains.

The dry montane grasslands or dry patnas are found in lower altitudes between 1000m and 1500m and Cymbopogon confertiflorus and Imperata arundinella are the predominating species of wiry grasses that grow here.

These grasslands are frequently burnt thereby leaving the soil exposed during certain periods. It is important that these are protected from fires to prevent erosion that leads to significant sedimentation of nearby waterbodies.

4.0 Chena or shifting cultivation has been one of the causes in the degradation of the forest cover in the drier parts of the intermediate zone. All chena lands are state lands which have been encroached by villagers, either on a temporary permit or illegally. The highest and steepest slopes are subjected to shifting cultivation during the rainy season. Low yields in the chena plots are due to low fertility of the soil that has been subjected to continuous cultivation. Some chena plots have almost assumed the status of permanent cultivation although no inputs are used. The area under chena cultivation includes 11,049 hectares that amounts to 6.3% of the total land use categories within the Nuwara Eliya district.

5.0 Pasture Land

In Ambagamuwa DS division 1,890 hec of pasture land are available to feed 57,600 livestock. 1944 hec of grassland are available in Nuwara Eliya DS division in the farms at Ambewela, Bopathalawa Dayagama and Rosita and New Zealand farms. The Ambewela and New Zealand farm pastures on steep gradients have been cleared for potato cultivation leading to soil erosion and contamination of the Kanda ela and Ambewela reservoirs. In the other DS divisions lack of sufficient fodder has been one of the constraints in animal husbandary.

7.0 Human Settlements

By the year 2001 the district will have a population density of 440 persons per sq km as against 322 persons per sq km for the whole island.

An overview of the settlements in Nuwara Eliya Municipal limits shows that some settlements have spread to fragile environments and poses severe environmental problems. The improper land alienation and encroachments have resulted in the present state of land degradation. The beauty of the city has been badly marred by the improper on-going development activities that are in progress, where extensive land alienation on high elevations have taken place regardless of any land use planning. In 1990, about 2000 allotments were identified to determine their suitability for occupation 103 such allotments were cancelled as unsuitable. About 500 permit holders and encroachers had to be evacuated from environmentally critical sites for relocation.

Shanthipura, is unique in being the country's settlement to be located at the highest elevation of 6400 ft. The settlers 50 owners in all should be relocated and the 25 acre land conserved under forest cover.

The Unique View lower slopes are prone to landslides where 30 owners occupy 15 acres. These lands are highly unsuitable for any type of landuse and should be conserved and settlers relocated elsewhere to avoid disaster to their life and property.

20 acres in Kalukela is steepland showing instability and is subjected to landslides. The owners 25 in number should be relocated and the land should be conserved and all human activities banned.

The other locations in the city of Nuwara Eliya where human settlements have posed much environmental problems are given in Annexure 10.

There are about 30 new Janawasa set up in close proximity to Kotmale reservoir for those evacuated due to innundation of the reservoir or earthslips. The lands allocated for this purpose were from tea estates. The Mahaweli Economic Agency has taken measures to upgrade the economy in these Janawasamas. The agency has provided the tea small holders bank loans, VP tea seedlings for infilling of old tea holdings and training programmes that included soil conservation methods.

In the plantation settlements the estate bungalows, quarters of other officers and labour lines form the main units. Almost 60 percent of the total population in the district live in the estate and the bulk are the estate labourers. The sub standard labour lines are an unsightly view against the beautiful estate bunglows built mostly durig the British era. The labour lines that lack basic amenities such as toilet facilities have caused organic pollution of water ways.The village settlements compromise 33 percent of the total population in the district and associated with the dwellings are the homestead gardens.

6.1 Housing

The vast majority of houses nearly 85 percent were built before 1971. These are classified as permanent, semipermanent and temporary. During 1981 census 28.9 percent of houses were identified as permanent structures.

The supply of electricity to houses in the urban sector was 52.6% in 1981. Only 11.6 percent of the houses in the rural sector were provided with electricity. Since then rural electrification was intensified.
Villagers who live on slopes and tracts of land that should be reserved as protected conservation forestry does much damage to the environment.

In Ambagamuwa landslides occur in many villages. Pariyagala, Polpitiya, Laxapana, Pitawala, Deniyagala and Peragolla are areas prone to landslides. The villagers whose lands were damaged have not yet received alternate lands. In such occasions villagers are compelled to settledown in nearby areas and cultivate the landslide prone areas again. Villagers participate in shramadana in their own villagers as well as in neighbouring villages.

In certain adjoining hamlets disputes arise due to unwillingness in sharing the supply of water to their cultivated lands. Such grievances go unsettled for years.

In Hanguranketha, associated with the major and minor irrigation schemes are settlements engaged actively in the cultivation of paddy and other crops. The irrigation settlements are constantly subjected to many hardships as most of these irrigation works have to be rehabilitated along with the minor catchment areas needing soil conservation measures. Under development schemes many minor catchments like Madaran Nuwara, Watawala, Dehipe, Ranmetiya, Ketahiragama were carried out by the Dept. of Agriculture during 1988/ 89.
In most of these settlements the main health problem is malnutrition among children and mothers. The highest malnutrition is recorded in the Nuwara Eliya district especially in the estates and villages.

6.1.1 Toilet Facilities

It is found that this district still lack this basic facility in urban and rural areas to varying degress. The available toilet facilities range from water sealed to pit lavatories to temporary lavatories. As lack of toilet facilities poses a grave environmental problem provision of such facilities must be given high priority especially in Grama Sevaka Niladhari Divisions like Udawela where 147 out 197 families lack toilet facilities and in Wewatenna where out of 442 families 335 are without toilets. These are few instances cited to point how important it is to educate the people on sanitation to be aware of its ill effects leading to diseases and pollution of the environment.

6.1.2 Housing Schemes

The district with the available land resource suitable for building and population pressure is undoubtedly faced with many problems in housing viz inproviding houses for the houseless, relocation of citizens living in unsuitable lands. restriction of unauthorised buildings, proper landscaping etc.

The National Housing Authority has built 2320 houses in Hanguranketha during 1979-89. The details of which are as follows.

	No of Houses
1. 100,000 houses programme	151
2. One million houses programme	1949
3. Sevana fund	205
4. By IRDP	15

Under the 1.5 million house programme 1431 houses would be constructed. Loans will be provided to 600 families and assistance given to 512 families who are recipients of foodstamps.

6.1.3 Estate Housing Schemes

The survey of worker house requirements has revealed the total requirement of new units in estates. The existing worker houses that need upgrading were also identified for re-roofing, extension of kitchens, provision of sufficient ventilation and repairs to ramps and drains.

In the JEDB estates, the Hatton and Nuwara Eliya regions had 14,981 and 23,987 worker houses respectively of which certain units required upgrading.

Worker houses.

Region	Units				
	Existing Stock	Potential	Good New	Require Upgrade	Require
Hatton	14981	13732	6802	1213	6770
Nuwara Eliya	23987	22881	9917	1188	12513

Special attention should be paid for upgrading of line rooms as further delay of the upgrading results in poor living condition of workers. This would also result in further deterioration of the line rooms eventually requiring much higher funds for new constructions.

7.0 Industrial Sites/ Uses

Nuwara Eliya district is the centre of the great Sri Lankan Tea Industry. Tea processing factories have been put up associated with tea estates in this district. Nuwara Eliya DS division has about 63 tea factories which have been modernised recently to increase production capacity. The location of these factories are indicated in Map A.

Kothmale DS division has 32 tea factories. Map B shows their location and distribution in the division. Ambagamuwa DS division has 52 tea factories. Most of the tea estates are found clustered in areas like Laxapana, Maskeliya, Bogawantalawa, Norwood etc.

In Hanguranketha DS division there are only 9 tea factories apart from them there are no other factories. Some of the factories are located in Mul Oya, Wewatenna, Deegalahinna, Ratyaya GS wasams.

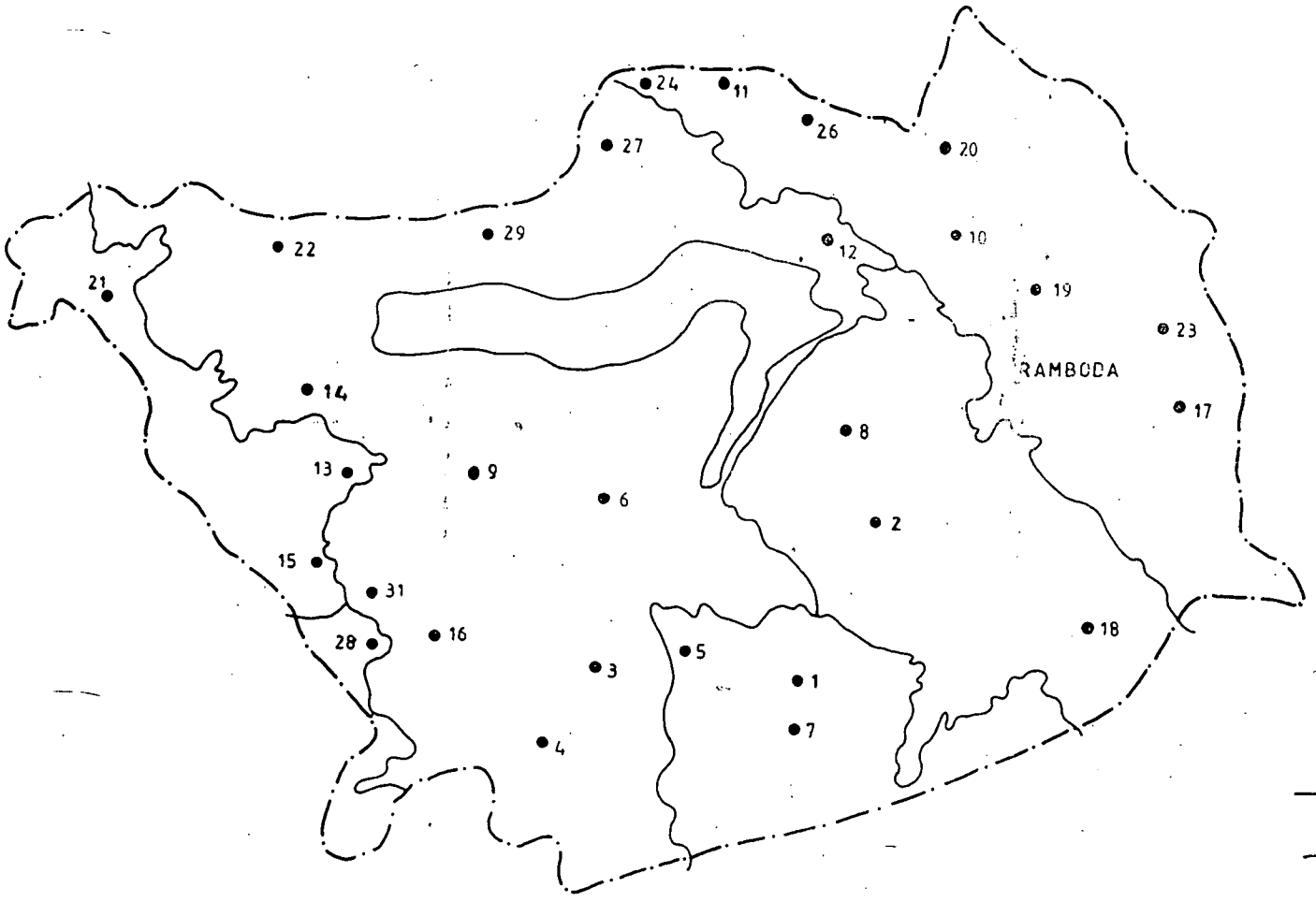
The oldest factory in the district belongs to the Ceylon Brewary Ltd. founded in 1884. The factory has been modernised and as a result calls for less labour force. It is located at Hospital Rd, Hawa Eliya, Nuwara Eliya.

Inter Fashion Apparel Factory is also located at Hawa Eliya in close proximity to the Base Hospital. This factory has about 1,300 employees who are engaged in the production of warm apparel for the export market.

The Artificial Eye Brow Poduction Factory was started in 1985 and has sub centres at Mahagasthota and Kalukele. This factory has employed 275 females.

The Ambewela Powdered Milk Production Factory is situated about 12 km from Nuwara Eliya towards World's End. The production capacity of the factory is 101,000 litres per day. The average milk powder

Kotmale DSD Location of Estates



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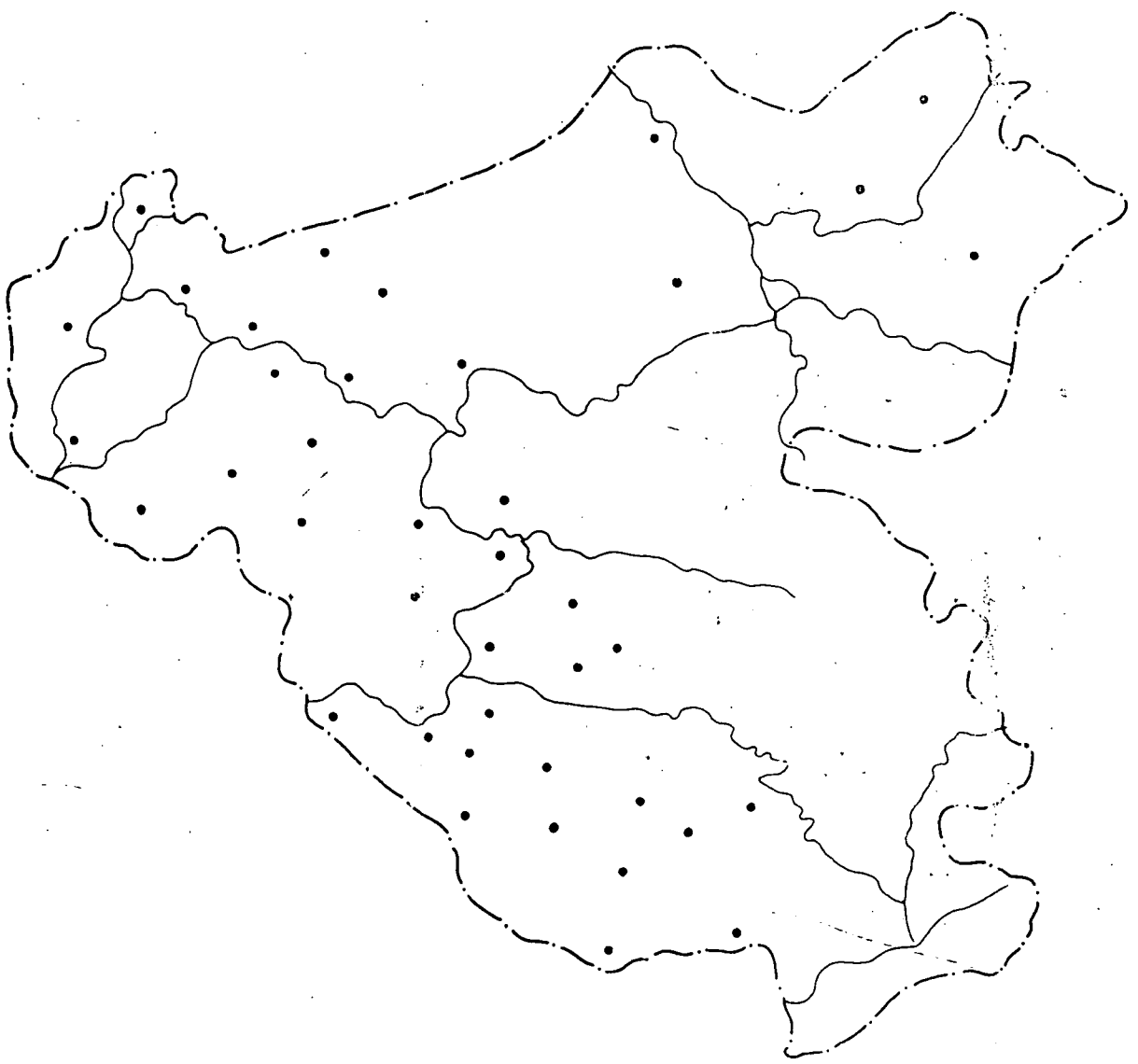
Location of Tea Factories in the Nuwara Eliya DS Division *(MAP A)*



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production (SDMR) is 10 metric tons. On an average 25 metric tons of butter is produced per month. While ghee is produced as a by product. The employees' work in two shifts and the permanent employee cadre is 150.

The Redco Ready made garment factory is located at Dick oya. The products are mainly for export. This factory provides employment to 650 girls.

The German Lanka Textile Industry at Ginigathena produces mainly white polyester. There are about 100 girls and 15 others employed in the industry. The polythene factory in Hatton employs about 100 males and females, where polythene sacks and photo copy papers are manufactured.

Under the 200 garment factory programme several private enterprenuers have opened garment factories in the district thus providing employment to many young females of this area. The approved list of enterprises for the establishmet of garment/ Apparel products manufacturing project under 200 garment factory programme is given in Annexure 11.

8.0 Cultural Sites

The sites of cultural importance are concentrated mostly to Hanguranketha, Kothmale and Walapane DS divisions. Most of the cultural sites are found to be associated with ancient places of worship and the Sinhala kings who lived here in seclusion. Cited below are few cultural places in the district.

Many ancient cave temples have been recorded from Hanguranketha. The ancient paintings, carvings moonstones and Makara at the entrance to the cave temples are the many common identifiable features. "Pothgul" vehera is characterised by a roof top made of copper sheets having a lining of stoneslates below it. The paintings and carvings date back to the later part of the kandyan era. The wood carvings in Arathana Raja Maha Vihara are some of the fine creations of the kandyan era. Some of these carvings include swans,lions,Horses and lotuses. The ruins of a palace including religious ole books are some of the cultural valuables that remain today.

The impoundment of Randenigala caused the loss of important cultural sites like Saresunthane, Ekesse Devale and Isthripura.

The wall paintings in the Liniyagala Maha Vihare in Walapane dates back to 3rd centuary BC. There is a strong belief that Udamadura, Yatimadura and Arukwatta are places where ancient palaces were built although there are no clues for their existence.

There are many prominent peaks in the Hakgala strict nature reserve which are sites of Hindu worship. The nearby Sita Eliya, a Hindu temple on the main Nuwara Eliya - Welimada Road,recognised as a cultural heritage that goes back to the legend of Rama and Sita. There is a well maintained trail to the summit but with no other facilities.

9.0 Historical Sites

A number of inscriptions of historical interest were found from Nuwara Eliya district. The records of fifteen such inscriptions, 8 from Hanguranketha 3 from Walapane and one each from Nuwara Eliya, Ambegamuwa and Kothmale have been inventorized in the Archeological Department.

Of these,three inscriptions are cited below :
Rakitipe is a village in Unantanna-vasam, Diyatilaka korale in the Nuwara Eliya district.An inscribed stone was found in the village between years 1906 and 1912. The abrupt ending of the inscription, the

sun and moon emblem carved above it shows that the stone is the top fragment of a pillar about 13 1/2 inches square. The inscription records the gift of land or some other benefaction in the reign of Lila vati, the Queen dowager of Parakrama Bahu 1 as evident from the first clause. The date of record is guessed as 1211 AD.

Pannala (Lihiniyagala) in Walapane is a cave 155 ft long and about 12 ft broad. The cave is constructed 14 ft above ground level. The Bratmi inscription on the cave consists of six Brahmi letters. It denotes the name of the cave - Manapadasane of agreeable sight.

There is no possible doubt of the existence of a vihare during the period from AD 900 to AD 1000. 'Proof Positive is afforded by the broken half of the inscribed pillar slab
(kept at Nuwara Eliya kachcheri against further distruction) and refers to the early 10th centuary.

11.0 Animal Husbandary

The Ministry of Rural Industrial Development controls animal husbandary enterprises. The primary departments are Department of Animal Production and Health responsible for research, extension and verterinary services and the Livestock Development Board which handles a number of Livestock farms and promotes livestock development by individual farmers.

The Table XVIII - Distribution of cattle and buffaloes in the divisions 1992

DSD	Neat Cattle		Others	Buffaloes		Others
	Milch Cows			Milch Cows		
	Milking at present	Not Milking at present		Milking at present	Not Milking at present	
Ambagamuwa	4146	2023	4643	0	31	220
Kotmale	1848	909	2062	78	301	717
Nuwara Eliya	4252	2768	4674	60	33	66
Hanguranketha	2982	3131	3645	173	816	923
Walapane	2582	3815	3572	85	736	1112
District	15811	12646	18596	396	1917	3038

The cultivated grasslands include 72 hectares, of which 71 hectares are found in Nuwara Eliya DS division.The small farmers engage in Animal husbandry as a secondary activity along with crop cultivation. The highest expenditure incurred for livestock is on animal feeds both in the urban and rural sector. Though the Government has recognised the need in promoting diary industry and many policies have been introduced,yet there are lapses that have to be looked into especially,with regard to collection of milk storage facilities and transport.

Poultry farming is not so widespread although common among estate labourers. In Nuwara Eliya DS Division poultry products are supplemented from other divisions. Hence steps should be taken to encourage more people in colonies and settlements to take up to poultry keeping,a profitable industry that could provide a supplementary source of income especially to the rural poor.

C Power and Energy Sources

1.0 The majority of the people especially the villagers and the estate labourers depend on fuelwood and kerosene for their requirements. The tea and tobacco industry in the district consumes a certain percentage of firewood of which a greater portion of consumption is by the Tea Industry. However the largest consumer is the domestic sector. The ever increasing cost of fossil fuel would restrict the bulk of energy requirements of the people to firewood in the future as well.

1.1 Electricity is available in all tea plantations and supplies are restricted to factories and bungalows. All roads within the municipal limits of Nuwara Eliya and the urban council limits of Ambagamuwa have been provided with street lamps. Most of the rural areas under the rural electrification scheme have been supplied with electricity while it is expected to complete its target of providing electricity to all by the year 2000. A small percentage use electricity for cooking due to high cost of consumption.

In Nuwara Eliya electric heating systems are installed in hotels, guest houses and in many bungalows and cottages of the effluent where the traditional English fireplace is still in use.

1.2 Although use of gas is more expensive it is considered more convenient and time consuming by the housewives in urban areas. With the scarcity of firewood this source of energy has become the next best for many.

D Use of Agro Chemicals

The use of agro chemicals is widespread in the tea industry, paddy and in the cultivation of cash crops.

In the tea industry fungicide use is inevitable if the industry is to be made viable economically. It is said that for efficient crop protection and production tea industry has to solely depend on fungicide till such time that they are successful in obtaining genetically resistant or tolerent plant materials. The widely used fungicides in tea are copper based products. Investigations carried out for copper levels in tea soils due to continuous use of the fungicides show no indication of build up in the environment. It is also unlikely that abnormally high levels reach streams and waterways. The residue limit of fungicides in tea in Sri Lanka do not even reach the low level of 40 ppm, the residue limit in Germany. Methyl bormide a fumigant applied long before planting of tea does not pose any residue problems. As for insecticides there is complete ban on organochlorine use in tea. Since tea is a beverage consumed for its flavour insecticidal application will have its effect on the finish product. It is important that the final product is free of any residue, as such recommendation for spraying is said to be done after thorough testing. Herbicides used are mostly non persistent and breakdown in the soil within a few weeks. MCPA and 2-4 are harmless herbicides even at high doses. Karmex and Simazine too, do not have any harmful effects on soil micro organisms. The herbicides used in tea industry are not mutagenic or teratogenic and there is no risk of leaching into groundwater either. Thus it could be concluded that at the current level of use herbicides recommended for tea pose no enviornmental hazard.

It is found that 5 estates in Nuwara Eliya district use organic fertilizers. Other estates need to emulate

as chemical fertilizers applied very often find its way to water causes along with the run off from tea lands located at high elevations.The presence of excess nitrate in ground water has been documented for the district indicating the heavy use of fertilizers.

The worst environmental problem is the over use of pesticides by farmers in the vegetable cultivation. During rainy seasons application is intense. The farmer uses more and more of the pesticides on the cultivation as rain washes away the already sprayed pesticides. Thus unknowingly copious amounts of the pesticide find its way to the environment. It is found that most farmers apply pesticides before the appearance of any pest even though it should be done only if the pest damage exceeds the eocnomic threshold value. Most pesticides are bought by the farmers directly from the market on their own accord while just a few consult the views of extension officers before purchasing.

Chapter V

Environmental Problems and Existing Management Measures

Nuwara Eliya district poses significant environmental risks and changes resulting from the growing intensity of human activities. Traditionally Sri Lankans are conservationists but necessity has driven them to over exploit natural resources. Hence Environmental Protection and Management has a major role to play in maintaining a harmonious balance between development to meet human needs and the fragile environment.

There is often heavy pressure on the politicians as well as on policy makers to satisfy the needs of people. The policy makers are forced to look at the immediate short term gains of development projects. The cumulative effect of this has led to grave environmental consequences.

Poverty, on the other hand is a great threat to the environment. The poor in order to survive often destroy their immediate environment. This has led to deforestation, encroachment on marginal lands, allowing livestock to overgraze grasslands etc.

Hence one of the major challenges facing the district is how it could manage the finite resource base of land, water and air in order to ensure sustainable development.

The Brundtland Commission on Environment and Development spoke about "our common future" with this in mind, the district has to involve young and old, men and women at all levels in a multitude of activities in order to move towards sustainable development.

An agenda of action is needed to solve the most urgent environmental problems for most of which the technological know how is available. What is needed is political will and commitment to make the future safe for the people of the district.

A Problems Arising Out of Human Activities

Nuwara Eliya district well known in the past for its unique climate and environment is fading away from her glory at the mercy of man's unplanned land use resulting from an uncontrolled scramble for land for housing and agriculture. The Nuwara Eliya city alone speaks for the present environmental degradation that has reached great diamensions, where a city of beautiful flower gardens in the past has turned to a city of agricultural plots that sprawl far on to the steep slopes replacing the forest cover.

Some of the environmental problems prevalent in the district due to human activities are documented herewith along with the existing management procedures.

1.0 Siltation of Lake Gregory - Nuwara Eliya

it is a man made lake that covers an area of 96 hec. which has been in existence for nearly hundred years. In the recent past much concern was expressed over the filling up of this lake which was attributed to the massive erosion of top soil in surrounding hills. It was stated that the lake has become no man's land as its management has not been entrusted to any particular authority in the past. The lake has got filled up in huge patches inspite of regular dredging costing millions of rupees. Studies carried by NARA indicated that there is a high concentration of nutrients both nitrogen and phosphorus from inflow of pollutants due to human activity around its basin. The surface run-off carried excess fertilizers from catchment areas while Nanu oya and the drains from Army Camp brought high organic loads to the lake. The load of pollution during its course through the marshy areas get reduced to some extent before reaching the lake. There was further reduction of nutrients and pollutants in the lake due to growth of aquatic weeds. The

resulting explosive growth of aquatic plants and weeds often obliterate the lake surface. These studies however concluded that the water quality of the lake is yet suitable for recreational activities as it is below the maximum level set by the CEA (5000 MN/ 100 ml) for raw water for public water supply bathing and recreation.

Currently UDA has prepared a Preliminary Plan for the development of the surrounding areas of the lake. This includes areas in between the Badulla Road and the Lake Bund and upper lake Road and the Lake Bund.

The restoration of Gregory Lake has been phased out for a period of three years from 1991 and UDA has engaged SLLR & DC who has been awarded the contract for the project with CECB as consultant for the project. This project consists of 3 contracts namely

Contract 01 - Surface Clearing and Dredging
Contract 02 - Construction and Improvement of silt traps
Contract 03 - Improvements to the Nanu Oya

Surface clearing has been completed. Dredging of 150,000 sq m has been already done as outlined in the original contract. UDA is awaiting for cabinet approval to award the additional 50,000 sqm of dredging area. SLLR & DC has programmed to complete this extra work by March 1994. Under contract 02-13 silt traps have been constructed around the lake while contract 03 too has been completed providing improvements to Nanu Oya, which has been widened and cleared. The embankment have been stabilised and gabion boxes have been introduced at bends. The maintenance work for 1993 is also carried by SLLR & DC and this includes clearing of water surface and removing silt from silt traps.

While these measures are taken it is extremely important to control the causative factors leading to siltation of the lake. Hence desilting becomes a wasteful exercise unless the catchment areas of the lake are rehabilitated and conserved. The rehabilitation of Thalagala and Lovers Leap Stream too should be considered.

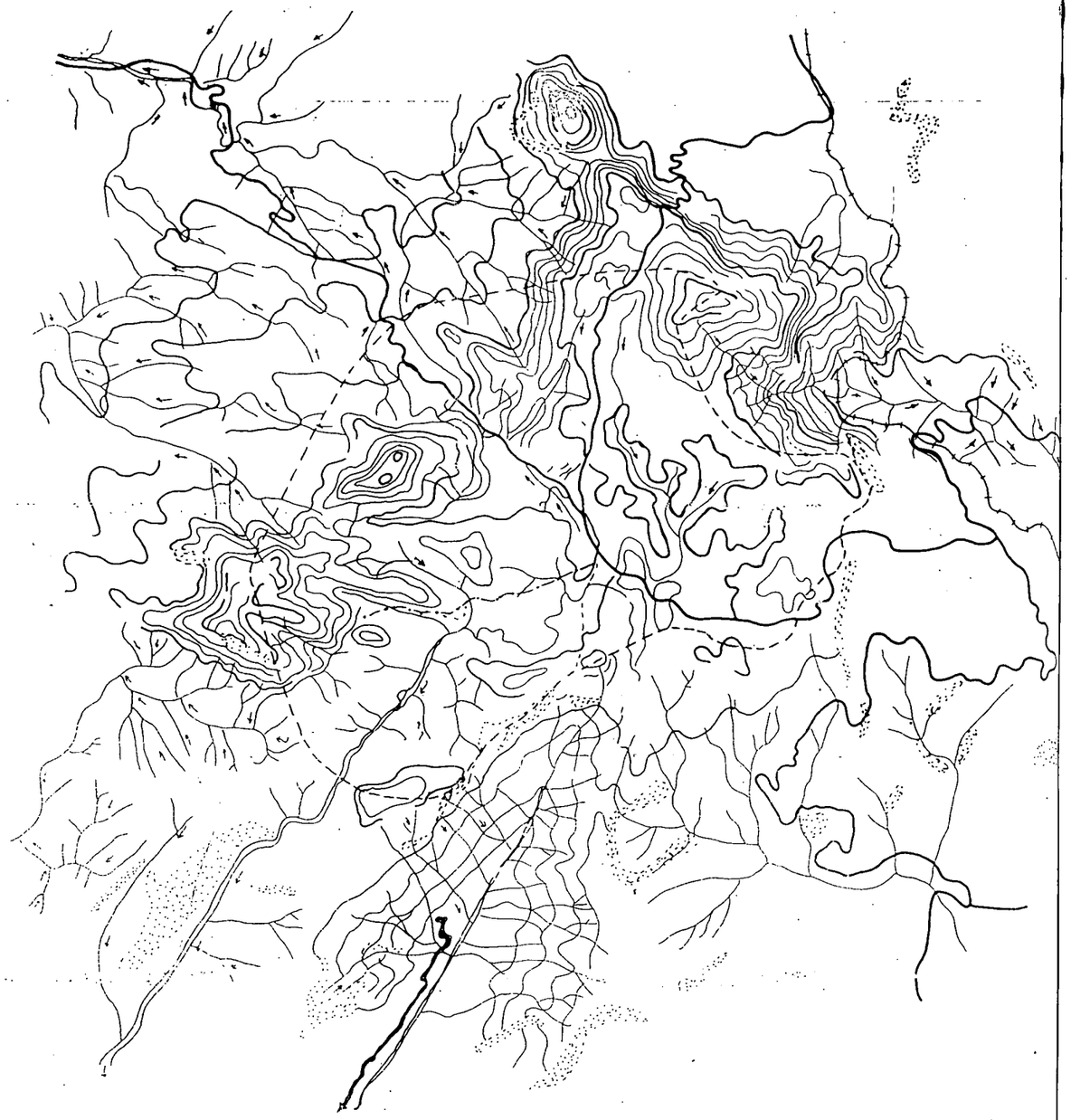
2.0 The New Pidurutalagala Road

This road reaches top of Pidurutalagala where large office buildings have been constructed disregarding of the fact that these fragile environments at high elevations shoult be left practically undisturbed. The present activities would definetly increase the strain on the ecosystem as there is the danger that the large numbers of staff who may be accomadated in the offices may tamper with the environment for cultivation of potatoes, flowers etc. ignoring the consequences. During the two years of road cutting the wash away of all earth was the main contributing factor for the silting of Gregory lake as waterways got constantly blocked. This damage could have been controlled with foresight if simultaneous paving and drain construction, compacting and turfing the low side slopes were done.

As stated in the report "Development of the city of Nuwara Eliya" it is one of the worst man-made environmental disasters of Sri Lanka. Much could be done to remedy most of the destructions especially the replanting of vast areas cleared unnecessarily during the construction of the road. The restriction of visitors and prohibiting firewood collectors should be strictly adhered to in the Pidurutalagala forest.

3.0 Horton Plains - Poaching & Gem Mining

Poaching and illicit gem mining are known to take place in Horton Plains despite its remoteness and solitude.The private lands and the Goverment Potato Farm co-exist with the Nature Reserve which threatens its safety. This co-existence appears to be impracticable as the Wildlif Department no doubt is finding it difficult to prevent poaching with the development of private lands. The



MAP OF HORTON PLAINS

labourers on the Potato Farm set fire to the vegetation around the farm.The deers are attracted thereafter to the new shoots that spring up and fall easy victims to the poacher's guns.

The complexity and diversity of animals and plants impart a dynamic equillibrium to the fragile ecosystem of Horton Plains. These systems are relatively stable provided they are not subject to man's influence. Illicit practice of gem mining has spread to this environmentally sensitive area. Gem mining had been observed towards the south west border of the park, along the foothills of kirigalpoththa and Agarbopath thalawa. Mining is intense around the tributaries of Belihul Oya and Agra oya which has caused the erosion of stream banks. It is said that at least two or three cases of culprits are brought to the notice of the warden at the park each month and produced before the Nuwara Eliya courts.

4.0 Kotmale Catchment Erosion Hazards

The settlement of people in the Kothmale reservoir and landslide prone areas were done mostly on state lands having slopes greater than fifty percent. The development of Infra-structural facilities in settlements have led to extensive erosion where road constructions led to cutting, filling and crossing of drainage lines.

Erosion was more extensive around Kothmale reservoir where roads were cut through steep landslide hazard slopes. It is important that environmental aspects are not overlooked in such instances. Almost 50% of the tea lands in the area are poorly managed and are subjected to moderate to severe slope erosion.

The forest cover is mostly degraded or under forest plantations. The degradation of forest cover has been very rapid and cleared for village expansion and opening of market gardens. The forest plantations are on steep slopes and have a high erosion hazard. The market gardens have spread on to steeper areas with the increase production of temperate vegetables in recent years. These lands which are cleared forest lands have very poor conservation methods where beds and drains are cut across the slopes.

5.0 The Likely Dangers in Kotmale and Randenigala Reservoirs

These reservoirs were constructed in 1980's. The geological surveys during the construction of these reservoirs indicated unfavourable geological and tectonic conditions with deep fractures running along Kotmale dam and through high dam of Randenigala - Rantambe as well as through the reservoirs.

These reservoirs gave rise to earthquakes 6 on Richter scale claiming many human lives and causing much property damage during the impounding period as a result of reservoir induced earthquakes.

It is observed that the geological environment of these large engineering projects was as unfavourable as the conditions around the large reservoirs in India, Koyna, Kariba in Rhodesia, Africa and at Kremasta in Greece constructed in the 1960's.

Since 1982 for a lengthy period of nine years microseismic activities in the three reservoir projects were monitored. The many records, as much as thousands recorded 4 on Richter scale. With the impounding of Randenigala - Rantambe area seismicity has increased. A tremor of magnitude M6 (Richter scale),12 km distance from Randenigala dam along the Mahaweli shear zone poses a grave danger when considering the damage caused to Koyna concrete dam south of Bombay by a earth tremor of magnitude 6.6.
The deep fractures with significant relative movements of over 20-30 ft running through the dams and reservoirs may induce earth quakes resulting in damage to the structures.

As 53 earthquakes 3 on Richter scale had occurred between 1823 and 1979 the low magnitude seismic records cannot be overlooked.
The fact that the island which is moving 2mm a year along thousands of fractures should be kept in mind. There is good testimony to these movements in Kothmale where 45 sq miles of land creeping hover around the area in addition to the cracking of the tunnel and flooding of the Kotmale condign power.

6.0 Deforestation

This is a common phenomenon prevalent in the district. The major contributing factors to the increasing strain on the forest vegetation has been "Population" and "Development" Human numbers and human needs are interacting on the forest system in a way that threatens both nature and man.

Vegetable cultivation is practised in every possible extent of land in this district thus reaching contours of even 5000 feet elevation. The cultivation of highly protected areas of virgin forest in the Hakgala, SeethaEliya and Pidurutalagala have caused much damage to the environment.

Hakgala 1,142 ha contiguous to Hakgala Botanical Gardens was designated as a strict natural reserve on 25th February 1938. The large scale encorachment by vegetable farmers threatnes the existence of this small reserve famous for its endemic archiac Monimiaceae **Hortonia floribunda** and abundance of orchids.

The distribution of land at Pedro hill and the road cut to the summit has removed much of the virgin forest. There is cultivation taking place in this area by encroaches. The reason adduced for the encroachment is the acute land problem. There were instances when state authorities have deployed teams to evict encroaches or to keep them away. But there were also instances,where they have been the worst offenders in parcelling land to peasants in keeping with their own system of priorities. Single Tree Hill and land at Toppass have been cleared for vegetable cultivation. The destruction of forest land for cultivation by those occupying the Pedro scout camp at Bomburella has also caused a severe threat leading to erosion.

The Hawa Eliya timber depot is the only firewood distributing centre for many far away villages like Shanthipura, Pattipola, Meepilimana and Toppass. The villagers who have an easy access to forests nearby get their supply of firewood by destroying these forests rather than making a long way to town for their firewood supplies.
Land alienation in Mihindupura and Meepilimana has resulted in vast areas of forest cover being removed.

The forest cover in catchment areas of the district have dwindled in the past years. Horton Plains being the source of major rivers like Kelani, Walawe and Mahaweli was an issue much debated and discussed in the last few decades. Its protection so as to maintain the flow of these major rivers was of paramount importance. There are many instances of man's intervention into the plains even in recent times inspite of it being declared a strict nature reserve with strict ban on mining, poaching and fuelwood collection.

In Kothmale most of the natural forests are reduced to isolated patches in the midst of tea land grassland or homegardens.

In Hanguranketha and Walapane most of the forest clearings are for chena and tobacco cultivation.

In Ambegamuwa cutting down of trees in the reserved forests have become a severe threat to change in weather patterns. 1st class and 2nd class timber species grow in most of these

reserved forests located in Bogawanthalawa, Singimale, Norton Bridge, Morahenagama, Kalugala and Maskeliya.

In the district reforestation and afforestation programmes have been implemented through state agencies such as Forest Department, The Mahaweli Environment Authority and IRDP Nuwara Eliya. Many forest plantations have been established. The tobacco company under the direction of Dept. of Agriculture has set up its own fuel plantations to minimise destruction of forest and the ensuring environmental catastrophies. Agro forestry is gaining popularity in the district as an alternate system of cultivation to chena cultivation which would relieve the pressure on the dwindling natural forests by providing food, timber, fuelwood, to the rural population and fodder for livestock. The environmental laws have help curb deforestation to some degree.

The environmental offences during 1992- August 1993 are as follows:

	1992	1993
01 Offences involving forest fire	09	03
02 Offences involving transport of timber	03	-
03 Offences involving in unauthorised clearing of forests	13	19
04 Offences involving in encroachments etc	07	04

(Source - SSP office Nuwara Eliya)

7.0 Chena & Tobacco Cultivation in the Intermediate Dry Zone Walapane & Hanguranketha

Chena cultivation in Walapane is done on land for which annual permits have been issued or on encroached lands. In Hanguranketha chena cultivation is carried on a similar basis. These lands have been subjected to high or very high erosion hazard as soil conservation is not existent in this type of cultivation.

Chena or shifting cultivation as practised today in these region is very wasteful and destructive as entire trees are cut down without leaving stumps for regeneration, fallow time is extreamly short or non existent with continous cultivation. The chena lands are abandoned once they become badly infertile due to complete loss of top soil. Thus erosion control on these soils go beyond physical or temporary measures. Chena cultivation on slopes of more than 15% has caused "high" erosion hazard. "Very high" erosion hazard is experienced over the 15% erosion hazard. Chena cultivation is done mostly on marginal and non-suitable land, while tillage is done just before the rains so that the bare soils are extreamly liable to soil erosion.

Tobacco cultivation is done in Walapane Hanguranketha, Hali ela and Nildhandahenna officialy, it is allowed only on slopes up to 40% but it is found that these restrictions go unheeded as strict regulations are not enforced. This has been a lucrative crop in the intermediate dry zone for the past 25 years. Many farmers are attracted by the good returns and prefer to engage themselves in the cultivation of tobacco rather than seasonal crops which helped the farming community to remain at subsistence level. As tobacco requires optimal solar radiation it has to be grown as a monocrop. It is found through field observations that the soil of tobacco lands can erode completely within a period of 10 to 20 years. Hence soil erosion and consumption of wood fuel for curing of tobacco are the two main concerns of the environmentalist as regards tobacco industry. Along with chena land tobacco land are classed under "high" to "very high" erosion hazard according to P.J. Zijlstra in his work on erosion hazard and land suitability in the Nuwara Eliya district.

Ceylon Tobacco Company Limited points out that although the area under tobacco in this region is smaller compared to the total extent under other seasonal crops, tobacco catches the eye of the conservationists as the crop is supported by an organised institution, while the other crops cultivated by private farmers are ignored.

The company from early seventies with the assistance of the Dept. of Agriculture has launched a programme of soil conservation. In the late seventies much emphasis was given to permanent methods of conservation viz stone and bench terraces. Anyhow the erosion process in these lands continued as the measures taken were insufficient and maintenance was poor.

The Soil conservation programme implemented by the company restricted the cultivation of tobacco to gradients below 40% conforming to the Agrarian Services Act. An attractive subsidery of Rs. 1875/- per acre was paid on both stone and bench terraces with the approval of the Dept. of Agriculture. The tobacco company is of the view that fair amount of dissatisfaction prevailed among the farmers as there was no restriction enforced on the cultivation of other crops. Besides there was no government support for the conservation of their lands by way of a scheme of subsidary. The company towards the latter part of 1989 suspended mechanical methods of conservation giving way to SALT a popular method practised now in the district for crops grown on sloping lands.

The tobacco company has a success story from Dadayampola where an extent of 115 acres have been developed with 91 farmers using the SALT technique. 83 out of 91 are Janasaviya recipients. For curing of tobacco, the company has started on its own fuel-wood plantations. In Nuwara Eliya district, it has a 120 acres of Eucalyptus grandis plantation in Malapattawa. The possibilities of using alternate fuels have been explored. Paddy husk can be used as a substitute in areas like Walapane and Hanguranketha, which is being already used in a paddy growing area like Polonnaruwa.

The fuel saving devices like warm air furnaces introduced by the company would reduce the fuel usage by 30%. The conversion of furnaces into venturi systems minimising the heat losses are expected to save nearly 20% and it is envisaged that when these systems are finally installed in the barns a total reduction of 50% of the wood fuel usage from the conventional system could be achieved. The group agri environmental manager of Ceylon Tobacco Company Ltd states that this is a significant achievement of the company research.

8.0 Tourism

Tourism is mainly confined to Nuwara Eliya and its environs.

With the increase in the tourist arrivals to the country many hotels are to be constructed in Nuwara Eliya as indicated below:

Hotel approvals granted since 1992 (Nov) within Nuwara Eliya District up to date.

District	under construction	final approval granted	Pending approval
Nuwara Eliya	10	144	870

(Source- Tourist Board- 1993)

The refurbishmeent of existing hotels instead of construction of new hotels are recommanded by the master plan. Anyhow final approval have been granted to 144 hotels. As suitable land is scarce a haphazard development of hotels should be avoided.

Already Grand Hotel at Nuwara Eliya is demolshing its old Golf Wing and the construction work on the new 64-room building designed to blend with the present architecture of the hotel is due to begin soon. This type of projects should be encouraged more than granting approval for setting up of new hotels.

9. Use of Chemical Fertilizers

The excessive use of chemical fertilizer is well documented for the district. The intensive agricultural patterns in Nuwara Eliya district has caused pollution of ground and surface water by nitrates.

Paddy is the highest consumer of pesticides. The near by wells in paddy fields are subjected to pesticide pollution.

The farmers are well aware of the consequences of pesticide use as they grow separate plots of vegetables for their own consumption without the use of pesticides. This selfish attitude of the farmers should change. Yet there are few farmers about 8% who spray water 2-3 times to their crops before harvesting, to remove any pesticides deposited on the surface of crops.

10. Pollution Caused by Industries

The Ceylon Brewary Ltd discharges its untreated effluents to a nearby stream while its solid waste is being sold as animal feed. The final effluent that is discharged to the stream was tested in the environment laboratory of NBRO which recorded a very high COD value of 4320 mg/ l. The COD value of bottle washings was found to be 1469 mg/ l.

The height of the factory stack is rather low as plumes of smoke lingers at a lower elevation causing air pollution.

The disposal of solid waste from many industries is done on a haphazard way. In most instances the waste is dumped in places of closest reach without much consideration of the suitability of the site. These dumped waste exposed to rain, wind and other agencies poses environmental problems.

In the textile industry the non degradable waste comprises of packing materials like polythene. Thus using sites for disposal of such solid waste on adhoc selection should not be allowed.

11. Disposal of Solid Waste in Nuwara Eliya

The solid waste generated in Nuwara Eliya town is mainly from residential premises, tourist hotels and guest houses and commercial centres. In addition there is the agricultural waste from the many vegetable gardens and from horticulture activities carried out in the town.

The crude open dumping of solid waste on a site which is on a mountain slope situated approx 7 km from the city poses many undesirable affects on the environment thus causing air pollution, health hazards while marring the visual beauty of the environment. The wastes dumped on the sloping land ultimately gets pushed down and finally reach the stream located in the valley below thus causing pollution of the stream and the Bomurella reservoir located about 2.5 km down stream of site.

The solid waste from two industries located within the MC area produce about 1.19 m ton per day. Of these two the garment factory carry its waste using its own tractor to the municipal dumping site while the waste from the eye lash factory is carried by the municipal tractor.

In the hospital premises waste is collected using 21 plastic bins. The waste is collected by the municipality except the theatre and labour room wastes which are buried in the cemetry.

The other hospital waste is emptied into an open masonary bin located at one of the entrances to the hospital.

During rainy seasons water gets collected in the bin and get mixed up with the surgical waste and flows through its outlet pipe into the nearby stream, thus polluting it. This stream is being used by people for washing harvested vegetables, watering of vegetable gardens and various other household activities. The careful handling of hospital wastes are therefore very essential.

Natural Disasters in Nuwara Eliya

The major types of disasters in Nuwara Eliya are landslides and forest fires.

The occurance of landslides and earthslips are frequent in the Nuwara Eliya district as the area is subject to monsoonal changes.However in the recent past there has been unprecedented increase in the occurance of landslides mainly due to unplanned landuse.This is due to people having had to exploit hazardous areas which are only partially or not at all suitable for uses to which they have been put.

Hence it is important to create an awareness among those living in hilly areas on the consequence of unsuitable land uses,such as bad cultivation practices,diversion of natural water courses, impoundment of water,removal of vegetative cover and indiscriminate slope cutting for construction work etc.

The most hazardous areas should be banned from all human activities to avoid the occurrance of devastating landslides that lead to tremendous inconveniences, damages and losses.

Pre-landslide actions are needed in landslide prone areas that include prevention mitigation and preparedness.

Prevention-Requires recognising the causes of the disaster and elimination or drastically reducing the effects.

Mitigation-Attempts to minimise the destructive effects of the hazard and the magnitude of the disaster.

Prepardness-Actions attempting to limit the impact of the disaster by structuring the response and instituting a quick and orderly reaction.

The rehabilitation activities must be carried out as quickly as possible to help the community back to normal life after the occurance of a landslide so that physical reordering ofthe community and the physical environment and the return of the community to pre disaster or better levels of building replacement and infrastructure are attained.

A large number of landslides in the Nuwara Eliya district have been documented by NBRO,(Annexure-11). In some cases fairly detailed geological and geotechnical investigations were done. The causative factors were determined in order to design remedial measures.

In a few cases inclinometers were erected for measurement of slope surface movements, slope indicator tubings were installed for subslope movements and piezometers were used for measurement of hydrostatic pressure.

C. **Existing Methods of Environmental Protection and Management**

1.0 **Existing Methods**

The institutional arrangements for the decentralisation of administraion resulted with the development of Divisional Secretariat.

1.1 At district level the district co-ordinating committee has the Senior Minister as chairman co-chaired by Chief Minister, MPs and other government officials. The main responsibility being to co-ordinate the activities of the district with respect to the natural resources of the district that includes land, water, fauna, flora and Man.

1.2 The District Development Committee also chaired by the Senior Minister is responsible for the allocation of decentralised budget funds for environmental protection and management.

1.3 The district agricultural committee is headed by the District Secretary. He is responsible for the co-ordination of all agricultural activities of the district along with the Divisional Secretaries at divisional level. The committee is responsible in executing environmental protection and management practices in all agro-based development programmes.

1.4 The Divisional Secretaries co-ordinate and control environmental activities in their divisions. As pivotal points of development and administration relationships with government institutions, non government organisations and with general public have been strengthened.

2.0 **Short Comings in Existing Methods**

The environmental damage in particular areas of the district is pretty obvious and there for all to see. The glaring environmental damages in the district have gone out of hand due to many reasons as stated below.

2.1 The lapses in the effective implementation of environmental protection and management issues by respective officers.

2.2 Lack of co-ordination among various agencies of the government charged with environmental protection.

2.3 Pressure from influential persons.

2.4 Lack of officers and personnel with adequate training on conservation and environmental issues.

2.5 Lack of adequate facilities and incentives to officers engaged in enforcement of laws in illicit gem mining. illicit extraction of timbre and encroachments.

2.6 The non adherence of agricultural practices on slopes greater than 40;

2.7 Inadequate financial allocation that constraint the implementation of environmental protection in forest and watershed management.

2.8 It is essential to spotlight the following environmental problems in the district

2.8.1 The highland farmers in the district have caused major impacts on the environment resulting in pesticide pollution, soil erosion and misuse of water resources.

2.8.2 Many unauthorised buildings have come up in Nuwara Eliya ignoring the unique architectural traditions. Landscaping is completely overlooked by both private and public sector residents.

2.8.3 Many forest boundaries are pushed further in by encroaches to get more open land for vegetable/ potato cultivation in certain areas, like Hakgala strict nature reserve.

2.8.4 The vegetables that are sent out of the district are packed in sacks after being washed in waterways that are very often polluted and muddy. Certain farmers in Nuwara Eliya has got into the practice of leaving bags of vegetables soaked in Thalagala Oya till the lorries come for loading.

2.8.5 The forest cover in many catchment areas are subjected to much destruction posing a great threat to the regular water supply in streams and rivers as seen in Pidurutalagala and Horton Plain Strict Nature Reserve.

3.0 **Views of the Public**

The public are of the opinion that along with development, environmental degradation has taken place in the district.

It is evident from interviews conducted that there have been public protest on various environmental issues such as those stated below :

3.1 The new Pidurutalagala road was cut despite much protest from environmentalists and concerned citizens.

3.2 The extensive improper land alienation within the city of Nuwara Eliya for development purposes.

3.3 The frequent silting of lake Gregory has caused much concern to environmentalists who have highlighted the issue on many occasions through mass media.

3.4 Illicit gem mining and poaching in Horton plains has caused much concern. The public blame the authority for being often non chalant and indifferent.

3.5 Deforestation for timbre extraction, cultivation etc is allowed in certain areas irrespective of the consequences and the public have no say as their protests are not given any consideration.

4.0 It is essential to identify such areas where necessary steps should be taken to minimise and mitigate the environmental hazards that prevail in the district. It is essential to monitor activities in areas such as degraded watershed and denuded catchment areas, and conserve existing forests in the catchment areas of all reservoirs including rivers and feeder streams. It is also important to have extensive educational programmes on optimum use of pesticides.

The Department of Wild Life Conservation should increase its cadre and greater training opportunities provided in order to implement The National Wild Life Policy. The staff of the Forest Department should be increased and have trained personnel especially to combact encroachment and illicit felling.

All officers from field officers to Grama Seva Niladharis should be appraised on environmental issues especially in agro-forestry, soil conservation, water management, disaster preparedness and protection of fauna and flora.

Chapter 6

Potential Resources for sustainable development and environmental Management and Planning.

A Potential Resources

1.0 The sustainable development of the district has to be visualised within the context of conserving its unique environment. Hence an assessment of the potential resources available is an essential prerequisite towards a realistic development concept :

Land area	- 1718.26 sq.km
Water bodies	- 3434 hec.
Forest cover	- 58,450 hec.
Soil	- mainly red yellow podzolic, reddish brown earths, reddish brown latasolic
Population	- 705,280 (1992 estimate)
Density of population	- 319Sq.Km.
Rate of increase	- 1.9%

-58 % of the area of the district is already under agriculture

- the forest cover has been reduced to a critical minimum. Encroachments, extraction of timber, forest fires are still common occurrences.

- the fragile environments are being constantly tampered for vegetable/ potato cultivation

- chena cultivation has led to much soil erosion and land degradation in the intermediate zone.

- still the Nuwara Eliya municipality has no proper garbage dump. Presently garbage is dumped in a vicinity of a water source and is damaging the Bomburella Reservoir below.

- the industries in the district have not taken proper measures for disposal of factory discharges eg. solid wastes, effluents etc. The Ceylon Brewery Ltd has yet to go for an effluent treatment plant.
  (The final effluent has a COD mg/l - 4320 & Washings 1469)

- landslides, rockfalls are a common phenomenon in the district. The potential areas have been identified by the landslide hazard mapping unit of NBRO.

- the indiscriminate use of pesticides, fertilizers by farmers.

2.0 Forest

Forests could be identified as dense forests and degraded forests. The remaining dense forest should be left untouched and protected. More than 81% of the area under degraded forest can be upgraded to dense forest of which certain extent is suitable for economic forestry.

As for dense forest no land improvement is needed but with the on going rapid deforestation steps for improved protection is considered very urgent. Thus in the case of 'protection forest' prevention of further degradation by extraction of trees, forest fires and encroachment should be compeltly restricted allowing for a permanent recovery of the forest. The upgrading of degraded forests to 'economic forest'or protection forest will be through infilling or replanting. The rehabilitation of the degraded catchment areas of the Mahaweli needs high priority to maintain the dry flow of the river and the life span of the reservoirs.
The Forestry Extension Division of the Forest Department is involved in an extensive participatory forestry project which is funded by the Asian Development Bank that involves community participation.

3.0 Reforestation of Scrubland

Most of the scrublands have been cleared for shifting cultivation or some other land use and ultimately abandoned resulting in a secondary growth of scrub. 80% of this land is considered suitable for reforestation under protection forestry.

4.0 Animal Husbandry

There is a great potential for increasing milk yield of cows and poultry yield by magnetised water. It is found that magnetic treatment of water increases weight and milk yield of cows and also increases egg production and growth of chicken. It has been proved that cows which drank the treated water for three years produced one litre of milk more,and had fewer milkless days and enhanced the conception rate. Calves fed with the same weighed 350 kg as opposed to 300 kg in the control group. Chicken and turkey have put three percent excess body weight and the eggers laid six percent more ie an extra of 18 eggs with the treatment. There was also a lower mortality level and the feed consumption was reduced by about 6 percent. M. Babu and K. Mani of Tanuvas, Pudukottai states that tests showed the treated group produced nine percent less fat. In this tests treatment administered to water provided to animals or birds is treated magnetically before.

5.0 Water Supply

There is a shortage of water supply in the district especially during March-April periods. The existing environmental problems and increase of city population in Nuwara Eliya has resulted in a short supply of water mainly during the April season.
This problem has been aggravated followed by the influx of holiday makers during the season. Another environmental constraint is the water pollution in the streams due to lack of toilet facilities in low income group houses and line rooms in the estates and to over-use of agro-chemicals by farmers. Portable water is hard to obtain in Nanu-Oya, Thalawakale and Agra Oya.
The other DS divisions too faces similar problems.The shortage of water in the dry season disrupt the agricultural activities.The farmers suffer great losses due to the lack of maintenance of a

perennial supply of water throughout the year.
In view of the current problems augmentation of many of the existing water supply schemes in the district is essential.The rehabilitation and maintenance of the existing irrigation systems to provide the maximum requirements is an urgent need.The introduction of a better system of water management with farmer participation would help tide over unfavourable periods.The field training classes in handling and use of agro-chemicals should be systematically carried out so that excessive use of it will be brought under control to prevent the pollution of surface and groundwater.Organic pollution on the other hand could be arrested by encouraging the use of toilet facilities and providing these facilities to the needy sectors in the settlements,estates,etc

6.0 Small Industries

With the available resources many small industries could be established.This would diversify job-opportunities available in a district that is predominantly agricultural and where most fragile environments are being tapped for cultivation.Thus the identification and investigation of the suitable physical resources available in the district for the establishment of small industries that will utilize them and there by create employment,are the vital aspects to be considered.
It is reported that graphite is found in Adhikarigama and Hapuwala in Hangurankетha DS division.Static granite is found in Hatton,Norton Bridge and Maskeliya areas.There are sizeable deposits of mica,limestone clay and sand available in the district.There is unutilized dolomite at Adhikarigama,Okadagala,Idampitiya,Ekiriya and Diyatilakagama.The possibility of manufacturing colour pencils by using the soils in Kotmale area need to be considered as suggested by Sarvodaya Movement.

There is also plenty of scope for small scale industries based on surplus agricultural products.At district level food processing and canning industries could be started with state aid.

6.1 Silk Industry

The Development Finance Corporation of Sri Lanka has taken steps to cultivate mulberry in 300 acres of land in Hangurankетha. A co-operative society is to be established whcih would undertake cocoon drying, thread spinning, thread preparation, textile printing and marketing. This would help create many job opportunities and would improve the economic level of the rural people. There is great scope for initiating such projects in Kotmale.

6.2 Bamboo Products

A dual purpose would be served by planting bamboo along river banks and reservations. The primary aim would be for the conservation of soil erosion in addition to help meet the demand for making handicraft and for construction purposes etc.

7.0 Use of Animal Manure & Green Manure Crops

Using animal manure is a low cost way to improve the soil. Using it as a fertiliser is very easy because livestock is a major part of the farming system in the district. Animal manure should be properly used to obtain its maximum benefits as it not only provides nutrients but also improves the soil for a long time. Green manure crops can be used as they are easily obtainable in the

district and could be put to maximum use by farmers. They should be encouraged on their use instead of relying on more expensive chemical fertilizers. In shifting agriculture green manures can be planted on land first year it is to go fallow. Thus, the period of fallow can be cut to one year instead of 3 or more years. In chena cultivation this aspect should be considered to upgrade such lands.

Composting is a technology that is often recommended but it might be useful to compare it with the use of green manure crops.

- Compost decomposes the organic matter that is already there whereas green manure crop can often add over 40 tons of traditional matter per hectare. This is an important factor to be considered as village farms are often in short supply of organic matter.
- Compost will return to one's field about 98% of the nitrogen one started out with. A green manure crop however will add considerable amount of new nitrogen to the system.
- Making compost takes tremendous amount of work unlike for green manure crop.
- Compost cannot be used as a food source
- Compost heap requires water and needs to be near a water supply and this could be at fair distance from where it is to be applied. Green manure crops take available rain water and is planted right where they will be used. Leguminous green manure crops that can make nitrogen fertilizers from atmospheric nitrogen could offer small scale farmers a tremendous number of advantages such as:
- They add organic matter to the soil in addition to the large quantities of nitrogen, thereby improving top soil depth, water holding capacity, nutrient content, friability and texture.
- They require no capital outlay after the initial purchase of a handful of seeds. No chemical inputs are needed, dependency on outside sources of fertilizer and pesticide is reduced.
- The cover they provide for the soil protects the soil from wind and water erosion.
- They provide generous amounts of high-protein fodder for animals, which is especially valuable during the dry season.
- Some green manure crops provide human food like edible beans, peas and pods.
- They can provide cash income (from sale of firewood, food or feed).
- Some green manures when intercropped with basic grains, can control most weeds thereby eliminating costly weeding operations.

Conclusion

A coherent environmental program with on-going research towards a "new harmony" for the better care of the resources and environment of the district need to be implemented. This would lead to respecting the inherent nature of plants, animals and the landscape and thus optimize quality in all these interdependant factors.

Presently, high tech industry is turning animals into flocks of homogenous meat and milk suppliers and plants to fit farmer's image of what a plant should and even be. The throwing of odd chemicals to speed up the process and keep off the "enemy" is the most popular and common practice of most farmers. This may seem the only solution in reality but it is more like twisting nature's arm and taking her treasures at gun-point. Indeed the potatoes, the cabbages may look big and nice in the market. But at what cost? Does the cascade of technologies really do a worthwhile job. In their hearts they know it doesn't.

Thus "Harmony" that would create a durable system in which people could work together with nature as a whole instead of manipulating some at the expense of others is a scientifically accepted fully integrated 21st centuary concept.

In view of this, various agencies of government charged with environmental protection should be enjoined to co-ordinate their activities while they synchronize and harmonize rules and regulations so as to implement a successful cohorent environmental program for the district.

Project Team

Name	Designation
Mrs. R.Balasuriya (Leader)	Consultant Environmental Division

Other Contributors

Mr. K.M.Manickavasagar	Head Environmental Division

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List of Persons Interviewed

01.	Dr. Dudley Dissanayake	Former G.A. Nuwara Eliya District.
02.	Mrs. N.T. Herath	Mayor of Nuwara Eliya.
03.	Mr. N. Mediwake	Senior Superintendent of Police, Nuwara Eliya Division.
04.	Mr. P.R. Keerthiratne	I.R.D.P. Office, Nuwara Eliya.
05.	Mr. A. Palihawadana	Ecologist, I.R.D.P. Office, Nuwara Eliya.
06.	Mr. Sarath Gamage	Quality Controller, Ceylon Brewery, Nuwara Eliya.
07.	Mr. H.M. Bandaratilake	Conservator of Forests, Forest Dept. Batharamulla.
08.	Mr. A. Senaratna	Mahaweli Engineering & Construction Agency, Land Use Division, Colombo-5.
09.	Dr. Azeez Mubarak	Head, C.I.S.I.R, Bauddhaloka Mw., Colombo-7.
10.	Mr. B.M. Ratnapala	Director - Informal Education Ministry, Isurupaya, Battaramulla.
11.	Ms. Champika De Silva	Architect, Design & Project Management, Division, Urban Development Authority.
12.	Mrs. Janaka Hettiarachchi	Deputy Director, (Planning Central Province), UDA, Sub Office, Janasavigama, Pallekelle.
13.	Mr. W.N. Wilson	Senior Lecturer, Dept. of Geography, University of Colombo.

14.	Mr. S.B. Rajakaruna	Group Agri. Environmental Manager, C.T.C. Ltd.
15.	Mr. P.N.S. Wijeratna	Assistant Director, Sri Lanka Export Development Board.
16.	Mr. L. Rupesinghe	Assistant Manager Quality Assurance Ambewela Farm.
17.	Mr. R. Gunawardena	Tech. General Manager, Ceylon Brewery Ltd, Nuwara Eliya.
18.	Mr. W.R.M.S. Wickramasinghe	Deputy Conservator of Forests, Forest Dept. Battaramulla.
19.	Mr. A.W.D. Bandula Senaviratna	M.M.C. Nuwara Eliya.

In addition to the above several publications, reports, papers, and ancient manuscripts were studied for collection of data in the preperation of this profile.

Annexure 1

Selected hedgerow/boundary row species used in SALT.

Tephrosia vogelii
Crotalaria angyoroides
C. useramensis
Flemingia congesta
Caliendra calothyrsus
Leucaena leucocephala
Sesbania grandiflora
Acacia auriculiformis
A. decurrens
Cassia spectabilis
C. auriculeta
Albizzia moluccana
A sumatrana
Gliricidia sepium
Moringa oleivera
Sambacus nigra (Elderberry)
Thithonia diversifolia
Erythrina lithosperma
Eupatorium inuliformis
Tecoma stans

Grasses

Savandra
Hammil grass
NB-21 grass

Annexure 2

Agrochemicals Used in Nuwara Eliya District

Common Name	Trade Name	Concentration of Formulation	Use
1. Methamidophos (I)	Aloran	600g/l	I
2. Pirimiphos	Actellic 50EC	500g/l	I
3. Pormothion	Anthio 33	330g/l	I
4. Propineb	Anthracol	70%	F
5. Captain class IV	Captan 50%WP	50%	F
6. Mancozeb classIV	Dithane	80%	F
7. Quinalphos	Ekalux 25EC	250g/l	I/AC
8. Maneb	Polyram MWP	80%	F
9. Chlorpyrifos	Pyrinex 20EC	200g/l	I
10. ,,	Lorsban	400g/l	I
11. Methamidophos	Tamaran LC60	600g/l	I
12. Carbosulfan	Marshal	200g/l	I
13. Dimethoate	Macklhoate		
14. Mancozeb + metallix copper	Trimiltox	20%+21%	F
15. Mancozeb	Vondozeb WP	80%	F
16. ,,	Manzate (200)	80%	F
17. Thiram	Pormasol forteWP	80%	F
18. Maneb	polyram maneb WP	80%	F

I: Insecticides, F : Fungicides, AC : Acricides

Annexture 3

Table IV - Age Composition Sex Ratio - 1981

Age	Population	%	Sex Ratio
<1	17976	2.98	304
1-4	64550	10.70	102
5-9	68319	11.30	101
10-14	63289	10.50	103
15-19	61656	10.20	94
20-24	61762	10.20	92
25-29	52698	8.73	91
30-34	50612	8.40	96
35-39	40676	6.73	99
40-44	31198	5.20	113
45-49	25939	4.30	108
50-54	20128	3.33	125
55-59	15743	2.61	112
60-64	11721	1.94	118
65-69	8296	1.40	118
70-74	4758	0.78	140
75->	4246	0.70	124
	603577	100	

Annexture 4

High Polluting Industries

Name	Location
Gerlanka Textiles Mills Ltd	82/1, Hatton Rd Ginigathena.
Ceylon Brewary Ltd	Hospital Rd, Hawa Eliya Nuwara Eliya.
Ceytea, Premium Exports Ceylon Ltd	Agarapathana

Medium Polluting Industries

Name	Location
Venture State Plantation	Venture State Plantation, Norwood
Kurkusworld Estate	Kurkusworld Estate, Bagawanthalawa.
Paddy Mill - A M I Kumarasinghe	Ambagamuwa Udabalangama
Abbotsleigh Estate	Hatton
Branswick Estate	Maskeliya
Sri Lanka State Plantation	Norwood
Brownlow State Plantation	Maskeliya
Lime Kiln A W M Ranbanda	Ambaliyadde Hanguranketha.
Mooloya Estate	Hewaheta
Hope Estate	Hewaheta
Loolecondera Group	Deltota
Lime Kiln N Kuruppiah	6/9, Aluth Veediya Ginigathena.
New Welding Works	Norwood
Alton Estate (SLSPC)	Upcot
Metal Quarry - G R Somapala	58, Koladeni Rd Ambagamuwa Udabulathgama.
Ginigathena Multipurpose Co-op Society (Iron Store)	Ginigathena.
Kew State Plantation (SLSPC)	Bogawanthalawa
Gwinlow Engineering Enterprises	Nuwara Eliya Rd Thalawekelle.
M Y Hemachandra & Co	Kotmale Rd Thalawekelle.
Namal Garage	B Devasiripura Thalawekelle.

Tilak Motors	213 Middleton Thalawekelle
Talawekelle Iron Works	Hatton Rd, Talawekelle
D K W Plastic Industry	187H Dimbula Rd Hatton
Polykar Pvc Industries	18, Dumburugiri Rd Hatton
Ratna Saw Mill	Badupola Ginigathena
Southern Lanka Service Station	19, Sanatha Lenerd St Halgaran oya
Hatton Wood Works Complex	199/1, Dumuburugiri Rd Hatton
Swiss Chees Co Pvt Ltd	Bogahawatte, Patna
Saman Saw Mill	45/10 Thala Veediya Pundalu oya

Low Polluting Industries

Name	Location
Bakery G Sunil Shanta	Kuburahena, Lakshapana
Bakery (Coorporative)	Abatalawa Rd Ginigathena
Ginigathena Co-operative	Hatton Rd, Ginigathena
New Bakery E G Piyasena	Norton Bridge
Bakery H M Heenbanda	29, Lawson Rd Nuwara Eliya
Golden Bake House	2/1 Kandy Rd Nuwara Eliya
New City Bake House	Hawa Eliya Nuwara Eliya
Inatub Garments Pvt Ltd	10, Haddon Hill Rd Nuwara Eliya
Inter Fashion Co Ltd	Udapussellawa Rd Hawa Eliya
Niluka Timber Store	Nuwara Eliya Rd Talawekele
Jayanthi Wood Works	1/14 Jayanthi Mw Talawekele
Walker Sons & Co Ltd	Talawekele
S S International Pvt Ltd	P O box 16, Hawa Eliya Nuwara Eliya
Ananda Grinding Mill	52, Hatton Rd Talawekele
Samanala Saw Mill	9 Circular Rd Hatton

Siripura Grinding Mill	53, Kotmale Rd Talawekele
Chandiran Grinding Mill	222, Nuwara Eliya Rd Talawekele
Universal Printers & Publishers	1 Upper Dumburugiri Rd Hatton
Puneeda Lime Kiln	51, Hatton Rd Watawela
Prabath Cement Block Industry	217 Nuwara Eliya Rd Talawekele
Saw Mill W Ranasinghe	Kumudu Ambatalawa Rd Ginigathena
Nishantha Furniture	Kandy Rd, Walapane
Saw Mill K G Gunasinghe	Millapitiya, Watumulla
Wood Works	B/6, Hapugastalawa
Sarath Furniture	Ranpurawa, Colombo Rd Ginigathena
Sarawana Timber Depot	187 wooton Bażzaar Kotagala
Wood Works A A Hasan	8/15 Hapugastalawa Nawalapitiya
Saw Mill	Perawanguwa Hanguranketha
Saw Mill	Lakmali Medapitithenna Hanguranketha

Annexure 5- Institutions serving Nuwara Eliya DSD

5A

Office/Institute	Nuwara Eliya
Police Station	Nuwara Eliya
Post Office	Nuwara Eliya
Hospital	Nuwara Eliya
Pradeshiya Sabba	Kotagala
Urban Council	Nuwara Eliya
Divisional Education Office	Edanhill Rd, Nuwara Eliya
Divisional Health Services Office	Hawa Eliya, Nuwara Eliya
Agriculture Development Authority	Udapusselava Rd, Kandapola
Agrarian Services Centre	Jayatilake Mw, Nuwara
Range Forest Office	Udapussellawa Rd, Nuwara
Bank of Ceylon	Lawson Rd, Nuwara Eliya
People's Bank	Nuwara Eliya
National Savings Bank	Nuwara Eliya
Regional Rural Development Bank	Unicview, Nuwara Eliya
MPCSU	Nuwara Eliya

5B

Office/Institute	Walapane
Police Station	Ragala, Udapussellawa
Post Office	Walapane, Nildandahinna
Hospital	Udapussellawa, Walapane
Pradeshiya Sabba	Walapane
Urban Council	
Divisional Education Office	Walapane
Divisional Health Services Office	District hospital
Agriculture Development Authority	Walapane
Agrarian Services Centre	Nildandahinna, Walapane Theripehe Rupha
Range Forest Office	Randenigala
Bank of Ceylon	Walapane
People's Bank	Nildandahinna
National Savings Bank	
Regional Rural Development Bank	Nildandahinna
MPCSU	Egodakanda, Walapane

5C

Office/Institute	Hanguranketha
Police Station	Hanguranketha, Maturata
Post Office	Hanguranketha, Rikillagaskada
Hospital	Maturata, Rikillagaskade
Pradeshiya Sabba	Rikillagaskade
Urban Council	
Divisional Education Office	Karandagolla
Divisional Health Services Office	Rikillagaskada
Agriculture Development Authority	Hanguranketha
Agrarian Services Centre	Getambe, Peradeniya
Range Forest Office	Nuwara Eliya
Bank of Ceylon	Rikillagaskada
People's Bank	Hanguranketha
National Savings Bank	
Regional Rural Development Bank	
MPCSU	

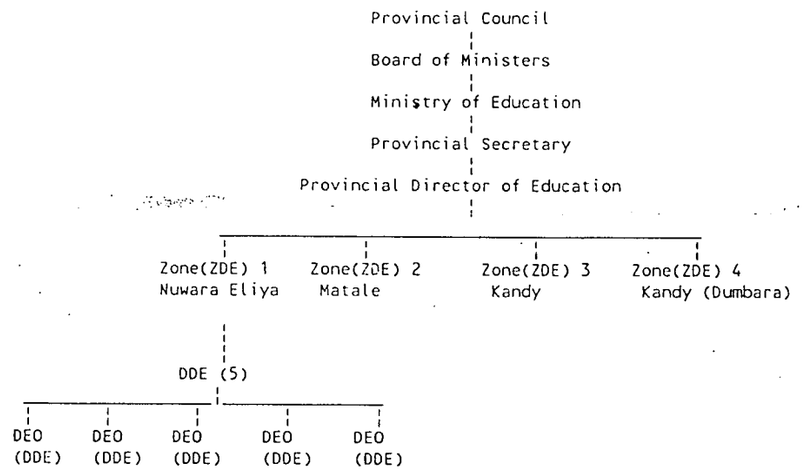
Annexure 5D

Office/Institute	Kothmale
Police Station	Kothmale
Post Office	Kothmale
Hospital	Sangillpalama
Pradeshiya Sabba	Kothmale
Divisional Education Office	Newtown, Kothmale
Divisional Health Services Office	Nuwara Eliya
Agriculture Development Authority	Helboda, Katukithula Pundalu oya
Agrarian Services Centre	Maldeniya, Harangala, Nawalapitiya
Range Forest Office	Ramboda
Bank of Ceylon	Pundalu oya
People's Bank	Pundalu oya
Regional Rural Development Bank	Pundalu oya
MPCSU	Thawalam thenna, Kothmale

5E

Office/Institute	Ambegamuwa
Police Station	Ginigathena
Post Office	Ginigathena
Hospital	Ginigathena
Pradeshiya Sabha	Dambagamuwa
Urban Council	Hatton- Dick oya
Divisional Education Office	Hatton
Divisional Health Services Office	Nawalapitiya
Agriculture Development Authority	Widulipura Ginigathena
Agrarian Service Centre	Widulipura Ginigathena
Range Forest Office	Hatton
Bank of Ceylon	Hatton Ginigathena Maskeliya
Regional Rural Development Bank	Ginigathena
MPCSU	Hatton Ginigathena

Annexure 6



Annexure 7 - Definitions of Schools

1 AB - School which have GCE (A/L) Science classes and those with/without hostels.

1 C - Schools with GCE (A/L) Arts & Commerce streams.

Type 2 - Schools from year 1 - year 11.

Type 3 - Primary schools (year 1 - 5).

Annexture 8A - 92/93 Area (Hectares) under Subsidiary Crops

DS Division	Potatoes	Red Onions	Big Onions	Other Yams
Ambegamuwa	62	-	-	-
Kothmale	129	-	-	-
Nuwara Eliya	732	-	-	-
Hanguranketha	55	69	-	04
Walapane	162	02	01	-

8B

	Cardamoms	Cloves	Nutmeg	Cinnamon	Pepper	Coffee
Ambagamuwa	4	194	1	-	79	410
Kothmale	86	124	-	2	63	252
Nuwara Eliya	-	-	-	-	-	2
Hanguranketha	184	10	2	-	166	171
Walapane	-	4	-	-	77	188
Total	274	332	3	2	385	1023

Annexure 9

Range		Species	Pre	60-4	65-9	70-4	75-9	80-4	85-9	90-94	TOTAL
Hatton	1	Cypress & Pinus mixture	0	0	0	0	18	0	0	0	18
	2	Eucalyptus grandis	68	73	10	60	72	59	0	5	347
	3	E. robusta	0	14	0	31	19	20	20	0	104
	4	P. caribaea	0	0	0	16	251	569	121	0	957
	5	P. patula	0	0	0	0	0	0	5	0	5
	6	P. (mixed)	0	0	18	0	0	0	0	0	18
	7	E. microcorys	8	0	0	0	0	0	0	0	8
Nuwara Eliya	1	Accacid	71	5	0	20	0	0	0	0	96
	2	Cupressus spp	35	20	0	6	17	0	0	0	78
	3	E. mixed	99	72	62	0	0	0	0	0	233
	4	E. globulus	0	0	12	0	0	0	0	0	12
	5	E. grandis	144	182	193	158	188	364	229	39	1497
	6	E. microcorys	90	40	29	0	2	0	0	0	161
	7	E. pilularis	41	5	0	9	0	0	0	0	55
	8	E. robusta	53	121	299	51	167	102	0	0	793
	9	P. caribaea	0	0	0	3	48	23	0	16	90
		P. patula	2	2	91	246	316	26	0	0	683
		P. mixed	0	0	31	3	16	5	0	0	55
Halgaran oya	1	E. mixed	111	0	3	10	0	5	0	0	129
	2	E. globulas	0	27	0	4	19	0	0	0	50
	3	E. grandis	362	167	36	9	22	29	208	184	1017
	4	E. microcorys	112	4	14	0	0	0	0	0	130
	5	E. robusta	0	7	21	0	0	0	0	0	28
	6	P. caribaea	0	0	0	7	271	547	26	0	851
	7	P. patula	0	5	0	12	16	0	0	0	33
	8	P. mixed	0	0	0	0	10	0	40	0	50
	9	Swietenia macrophylla	0	0	0	0	1	0	0	0	1
	10	Tectona	0	0	0	0	0	3	0	0	3
	11	Terminalia arjuna	0	0	0	0	0	0	0	5	5
	12	Unspecified indegenous	0	0	0	0	0	0	32	8	40

Annexure 10

Problamatic Human Settlements Within the City of Nuwara Eliya

SETTLEMENT	NO. OF HOUSES	LAND EXTENT	CONDITION	SUGGESTIONS
01 Lover's Leap, Lady Mc. Call Drive(LMD)	7	3 Ac	very steep slope	relocate families & conserve land
02 LMD Upper section near spout	8	4 Ac	,,	,,
03 Galways Land Natural Reserve	11	6 Ac	reservation	,,
04 Thalagala Stream Reservation	8	3 Ac	stream reservation	,,
05 Moon Plains	64	76 Ac	water sources gullies, lake catchment	relocate on more suitable sections of the same land
06 Underbank forest plantation	12	2 Ac	forest encroachment at high elevation	relocate
07 Race Course	20	2 Ac	insanitary	relocate families in the edge of the race course
08 Police Station MC line	50	2 Ac	,,	improve existing settlements
09 Area between Rahula MW & LMD	02	1 Ac	landslides road reservation	relocate & conserve

Source : Development of the City of Nuwara Eliya

Annexure 11

Name of Company	Identified Areas & Divisions
Haskell Garments Lanka Pvt Ltd	Nuwara Eliya, Amgamuwa
Trend Settings Apparels Pvt Ltd	Dick oya (UC), Ambagamuwa Korale
Sapphire Garments Pvt Ltd	Dick oya (UC), Ambagamuwa Korale
Giorio Morandi Pvt Ltd	Nuwara Eliya, Hanguranketha, UDA Hewaheta
Genesis Fashions Co Pvt Ltd	Nuwara Eliya, Kothmale
Nuwara Eliya Garment Pvt Ltd	Nuwara Eliya
Bibile Garment Pvt Ltd	Nuwara Eliya
Garment Services Pvt Ltd	Nuwara Eliya
Uni Lanka Garments Pvt Ltd	Nuwara Eliya, Walapane
Asian Apparels Pvt Ltd	-do-
Intercraft Gar. Exports Pvt Ltd	-do-
Star Asia Garment Pvt Ltd	-do-
Kings International Gar. Pvt Ltd	Nuwara Eliya, Ambagamuwa
De Livera Industries Ltd	Nuwara Eliya, Thalawekele
505 Apparels Pvt Ltd	Nuwara Eliya
Kotagala Garments Pvt Ltd	Nuwara Eliya
Regent Fashions Pvt Ltd	Nuwara Eliya, Ambagamuwa
Sendils Apparels Pvt ltd	Nuwara Eliya, Ambagamuwa
Minra Garments Pvt Ltd	Nuwara Eliya, Hanguranketha
Senev Fashions Pvt Ltd	Pollonnaruwa, Meirigiriya
Aruni's Designs Pvt ltd	-do-

Annexure 12 - Some slides documented by NBRO along Estates & Main roads

Map No	No	Type	Description
62/12	1	Landslide (the path of which had been over 600 m along the stream) occurred in 1986	Damaged the culvert and the Ambaliyedda Rupaha road
	2	Landslide/debris flow (06 Jan. 1986)	Road length, of about 30m completely destroyed
	3	A crack has formed in 1986	The road (Udapussellawa, Ambaliyedda) at 3rd mile post subsided
	16	Cutting failures	
	17	Old slide	
	18	Cutting failures	
	19	Old slide	
	20	Old slide	
	21		Several old slides, Inferred area
	22		Old slide below and an inferred area above road
	23	Rockfalls	
	24	Potential slide	
	25	Potential slide	
	26	Old slide	
	27	Old slide	
	28	Old slide	
62/07	01	Cutting failure	
62/17	01	Potential slide	
	02	Potential slide	
	03	Oldslides	
	04	Oldslides	
	05	Potential slide	
	06	Oldslides	
	07		Several oldslides and inferred areas
	08	Rockfalls	
	09	Oldslides	
	10	Oldslides	
	11	Oldslides	

Map No.	No	Type	Description
62/12	1	Landslide (the path of which had been over 600 m along the stream) occurred in 1986	Damaged the culvert and the Ambaliyedda Rupaha road
	12	Rockfalls	
	25	Oldslides	Several slides in close vicinity
	26	Oldslides	
	27	Potential slide	
	28	Potential slide	Slide above road
	29	Potential slide	
	30	Potential slide	
	31	Potential slide	
	32	Potential slide	Several slides
61/10	01	Oldslide	Occurred in Dec. 1991
62/12	01	Oldslide	
	02	Oldslide	
	03	Potential slide	
	04	Inferred area	Houses at risk
	05	Oldslide	
	06	Oldslide	
	07	Oldslide	
	08	Oldslide	
	09	Oldslide	
	10	Oldslide	
	11	Rockfalls	
	12	Rockfalls	
	13	-	Cutting failures, inferred area
	14	Oldslide	Several old slides
	15	Inferred area	
61/15	01	Cutting failures	Several slides in close vicinity
	02	Old slide	
	03	Old slide	
	04	Rockfalls	Slide above road
	05		
62/11	01	Rockfalls	

Map No	No	Type	Description
62/12	1	Landslide (the path of which had been over 600 m along the stream) occurred in 1986	Damaged the culvert and the Ambaliyedda Rupaha road
	02	Rockfalls	
	03	Inferred	Several slides
	04	Rockfalls	
	05	Rockfalls	Several failures in close vicinity
	06	Pot.slide	
	07	Inferred area	
	08	Pot.slide	
	09	Old slide	
	10	Pot. slide	
	11	Rockfalls	
	12	,,	
	13	,,	
	14	Pot. slide	
	15	-	Inferred area with oldslide
	16	Inferred area	
	17	,,	
	18	Oldslide	
	19	Pot. slide	Several failures in close vicinity
	20	,,	Several slides with houses below them
	21	,,	Houses below the pot. slide
	22	,,	Pot slide below road
	23	,,	Rockfalls, pot. slide with houses at risk
	24	-	
62/16	01	Cutting failure	
	02	Rockfalls	
	03	Inferred area	
	04	Rockfalls	
	05	Inferred area	
	06	Rockfalls	
	07	Rockfalls	

Map No	No	Type	Description
62/12	1	Landslide (the path of which had been over 600 m along the stream) occurred in 1986	Damaged the culvert and the Ambaliyedda Rupaha road
	08	Inferred area	
	09	Rockfalls	
	10	Rockfalls	
	11	Rockfalls	
	12	Rockfalls	
62/06	01	Rockfalls	
	02	Rockfalls	
	03	Oldslide	
	04	Rockfalls	
	05	Rockfalls	
68/02	01	Old landslide	-
	02	Old landslide	-
	03	Slope inferred area	Can be affected to railway line
	04	Earth slide	Watawala - damaged to the railway line
	05	Old landslide	Occurred in 1952 - Railway line was damaged
68/07	01	Old landslide	Occurred in 1979, damaged to the railway line
	02	Old landslide	This occurred below the railway line
	03	Old landslide	Occurred in upper part of the main road but it is very close to the road No damages reported
	04	Series of landslide	Series of landslides occurred along the estate road in different years
	05	Potential rockfall area	Can affect main road
	06	Potential rockfall area	Can affect main road
	07	Potential rockfall area	Can affect main road
	08	Old landslides	Two landslides. One below the road in 1989 & the other on upper part of old road.

Map No	No	Type	Description
62/12	1	Landslide (the path of which had been over 600 m along the stream) occurred in 1986	Damaged the culvert and the Ambaliyedda Rupaha road
	09	Old landslides	Several cutting failures between locations 8 & 9 in 1989.
	10	Old landslides cum potential sliding area	Slide occurred in 1992
	11	Cutting failures	Several cutting failures between locations 11 & 12 damaging the main road.
	12	Cutting failures	Several cutting failures between locations 11 & 12 damaging the main road.
	13	Rock slide	Occurred in 1989 June damaging the main road.
	14	Old landslide	Occurred in June 1989 damaging road. Tension cracks are visible on the road
	15	Old landslide	Occurred in 1989 - damaged the main road
	16	Potential rock fall area	Can be affected to main road
68/08	01	Old and potential landslide area	Area is between railway line and a stream. It can be activated again damaging the railway line
	02	Old landslide	Occurred in 1993, just below the railway line
	03	Potential sliding area	Can affect the main road
	04	-do-	Can affect the main road
	05	Cutting failure	-
	06	Small old landslides	-
	07	Series of cutting failures	Along the main road.
	08	Potential sliding area	Can affect the main road
	09	Series of cutting failures	Can affect the main road
	10	Old landslide	Damaged the railway line in 1990.
	11	Potential sliding area	-

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Map No	No	Type	Description
62/12	1	Landslide (the path of which had been over 600 m along the stream) occurred in 1986	Damaged the culvert and the Ambaliyedda Rupaha road
68/13	01	Potential landslides	Can affect the main road
	02	Potential rock fall area	Can affect the estate roads
	03	Potential sliding area	Can affect the main road
	04	-do-	Can affect the main road
	05	-do-	Can affect the main road
	06	Cutting failure	Along the main road
	07	-do-	-do-
	08	Potential sliding area	Very close to castlereagh reservoir, affecting the main road
	09	Cutting failures	Along the main road
	10	-do-	-do-
	11	-do-	-do-
61/18	01	Potential landslide area	Can affect the main road
	02	Potential rockfall area	-do-
61/19	01	Potential rockfall area	Can affect the railway line
	02	Old landslide	
61/22	01	Cutting failure	Can affect the railway line
61/24	01	Potential landslide and old landslide	No details about the slide

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* Land Classification Map of Nuwara Eliya District.