Preface

The Fragile Area, including as it does a complex of ecological regions with much bio-diversity, extensive forest land, areas of great natural beauty and water sources for several of the country's river systems has incontrovertible claims to protection. At the same time the imperatives of development – in the context of widespread poverty and scarce natural resources- pose a constant challenge to the claims of protection.

The strategy for the development of the fragile area, set out in the following pages, represents a compromise between the conflicting claims of protection and development.

In a situation where some pressure is already being felt on land, earmarking land for protection- disallowing or restricting its use- is not a decision to be lightly taken. Thus it is that in formulating this strategy and, even more, in operationalzing it spatially over the Fragile Area, the assistance of those most closely concerned with and knowledgeable about the issues affecting the Fragile Area and how they could be best resolved was earnestly sought.

The cooperation expected was ungrudgingly extended in abundant measure and we would like to acknowledge, with great appreciation, the outstanding contributions made towards this effort by the Urban Development Authority, the Land Use Policy Planning Division, the National Building Research Organization and the National Resources Management Centre. We wish to thank in particular the members of the core group Mrs.Janaki Hettiarachchi (U.D.A), Mr.B.A.Jayananda (LUPPD), Mr.R.M.S.Bandara (N.B.R.O) and Mr.R.S.K.Keerthisena (N.R.M.C) for the contributions they made.

In a global context when there was a tendency to take irreplaceable natural resources for granted and to exploit them recklessly for short term gain, it is not surprising that sustainable development is emerging as a pervasive theme in harnessing the resource endowments of a country. The strategy for the development of the Fragile Area, conceived in the same spirit, should fit in admirably in the pursuit of the universally accepted goal of sustainable development.

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January 2005

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1.0 INTRODUCTION

The National Physical Planning Department (NPPD) has designated an area in the Central Highlands as an Environmentally Fragile Area (Fig:I). The area which represents a special resources complex with a distinctive topography, soils, climate and vegetation. It not only sustains most of the country's major rivers but also contributes to replenish and sustain the water table of the country.

In many parts of the area the present land uses are not sustainable. This mismatch between land uses and land sustainability has not only led to accelerated land degradation but also to property damage and loss of life. Further degradation and threats to human life have to be prevented by rationalizing land use and allocating land to the most appropriate categories.

All lands within the area cannot be used for production purposes; some lands have to be protected in order to preserve and manage the natural and cultural resources on a sustainable basis. These lands have to be identified and steps taken to ensure that they will not be adversely affected by expanding human requirements and economics activities. In other words there is a need to strike a balance between production and protection. The purpose of the proposed strategy in to achieve this objective.

Protection will be promoted by integrating into a Protected Area Network, areas currently protected and other areas that should be protected. The latter will include environmentally sensitive areas; aesthetic and recreational areas and agricultural lands that are not suitable for agriculture and settlement. Production will be enhanced by developing the key economic sectors; expanding the urban services; and providing the necessary infrastructure.

2.0 DEMARCATION OF THE FRAGILE AREA

The Soil Conservation Act No. 25 of 1951, as amended by Act No.24 of 1996 empowers the Minister in charge of the subject of soil conservation to declare any area as a conservation area. Accordingly the following areas within the Central Highlands have been declared as conservation areas.

1. Nuwara Eliya District
2. Kandy District
3. Three Divisional Secretariat Divisions in the Ratnapura District ie. Eheliyagoda, Kuruwita and Ratnapura
4. Three Divisional Secretariat Divisions in the Matale District ie. Wilgamuwa, Laggala, Rattota

Although several Conservation Areas have been demarcated this has apparently been done mostly on the basis of expert judgments and not on any comprehensive study[1]. This deficiency has now been rectified by demarcating Conservation Areas based on soil erosion potential[2]. The proposed boundary of the "Conservation Areas" coincides with the 300m contour line with a few exceptions.

The NPPD accepted this boundary and modified it slightly to include, for statistical purposes a few Divisional Secretariat Divisions of which only parts had fallen within the "Conservation Area" demarcated on the basis of the soil erosion potential. The Fragile Area defined by the NPPD covers an extent of 11,100sq km which represents approximately17% of the total land area of the country. It includes 2 Districts (Kandy and Nuwaraeliya) and parts of 8 Districts (Matale, Kegalle, Monaragala, Badulla, Kalutara, Ratnapura, Galle and Matara). A total of 79 Divisional Secretariat Divisions fall within the Fragile Area. (Fig:II)

1. Munasinhe M.A.R. and S.M. Vipula Pushpakumara- "Re-Demarcation of Conservation Areas in SriLanka based on Soil Erosion Potential" Journal of the Soil Science Society, Sri Lanka, Vol 14,2002
2. Ibid

3.0 JUSTFICATION FOR THE DELIMITATION OF A FRAGILE AREA

The area demarcated is considered environmentally fragile for several reasons.

3.1 Vulnerability to Landslides

The National Building Research Organization has delineated areas in some of the hilly districts in relation to the degree of the potential risk for development activities. The landslide hazard in 4 of the districts is given below.

Table I - KEGALLE, RATNAPURA, KANDY, NUWARA ELIYA DISTRICTS VULNERABILITY TO LANDSLIDES

District	Total Area (sq km)	Landslide Hazards		
		Landslides are to be expected Area %	Level of landslides high Area %	Total %
Kegalle	1687	9.3	27.1	36.4
Ratnapura	3302	9.3	24.1	33.6
Kandy	1938	9.4	17.0	26.4
Nuwaraeliya	1895	5.0	15.0	20.0

SOURCE : National Building Research Organization

The figures show that in the areas within the fragile area covered by the NBRO studies, 11.2% of the land faces a serious level of landslide hazard while another 35.0% faces a modest level of landslide hazard (Fig:III)

It is noteworthy that the occurrence of landslides has been increasing over the years and this is in turn has resulted in increased property damage. This can be seen from the table below.

Table II - SRI LANKA-LOSSES DUE TO LANDSLIDES

Period	No. of Years	Number of Landslides	Houses Damaged
1969-1989	20	33	23
1990-2002	12	38	52

SOURCE : National Building Research Organization

3.2 Vulnerability to Soil Erosion

Information on Soil Erosion is not available for the entirerity of the Fragile Area. However a study done within the Central Province, (a large part of which falls within the Fragile Area) serves to indicate the seriousness of the problem[3].

The specific objectives of the study were to assess the relative potential and the hazard of soil erosion within the Central Province and to prioritize the areas for soil conservation planning. The variables considered in the study included the slope percentage of the terrain, erodibility of the soils, erositivity of the rainfall and the present land use.

Initially, five potential soil erosion categories were recognized viz low, moderate, high, very high and extremely high. The extents under each category in the three administrative districts are given in the table below.

Table III: CENTRAL PROVINCE - EXTENT UNDER EACH POTENTIAL SOIL EROSION CLASS FOR EACH DISTRICT

Potential Soil Erosion	Nuwara Eliya		Kandy		Matale		Total	
	Extent (ha)	%	Extent (ha)	%	Extent (ha)	%	Extent (ha)	%
Low	20443	12	29968	16	53148	26	103559	18.4
Moderate	35638	21	19127	10	77567	38	132332	23.6
High	50513	30	69036	37	57761	29	177300	31.6
Very High	45470	26	58932	31	13472	7	117874	21.0
Extremely High	18511	11	12097	6	0	0	30608	5.4
Total	170575	100	189160	100	201938	100	561673	100

SOURCE: Munasinhe M.A.R., S.M. Vipula Pushpakumara, T.M.J.Bandara and H.M. Bandara Herath- "Use of Geographical Information Systems for Soil Erosion Hazards Assessment of the Central Province of Sri Lanka" Annals of the Sri Lanka Department of Agriculture 2001-Vol 3.

3. Munasinhe M.A.R., S.M. Vipula Pushpakumara, T.M.J.Bandara and H.M. Bandara Herath- "Use of Geographical Information Systems for Soil Erosion Hazards Assessment of the Central Province of Sri Lanka" Annals of the Sri Lanka Department of Agriculture 2001-Vol 3.

In the case of approximately 60% of the land in the Central Province the soil erosion potential ranges from high to extremely high. It is note worthy that the proportion of land falling within these 3 categories amounts to nearly 75% in the Kandy district and the 70% in the Nuwara Eliya district. The extents under each potential soil erosion class in each of the districts are shown in Fig: IV.

The soil erosion potential indicates the risk of erosion or the potential irrespective of the land use. However it has been noted that the soil erosion potential of a particular area can be changed considerably by changing the land use[4]. Hence the soil erosion potential map is of limited value as it does not indicate the areas where the land uses have to be changed. A more useful soil erosion hazard map has been prepared by studying the erosion potential in relation to the present land use[5]. Five erosion hazard classes have been recognized and the extents under each hazard classes in the three administrative districts are given below.

Table IV: CENTRAL PROVINCE - EXTENT UNDER EACH SOIL EROSION HAZARD CLASS FOR EACH DISTRICT[6]

Potential Soil Erosion	Nuwara Eliya		Kandy		Matale		Total	
	Extent (ha)	%	Extent (ha)	%	Extent (ha)	%	Extent (ha)	%
Low	49610	29.0	46792	25	94500	47.0	190902	34.0
Moderate	53635	31.0	54618	29	75929	37.4	184181	32.8
High	28185	17.0	36171	19	12450	6.2	76806	13.7
Very High	32890	19.0	47790	25	18900	9.3	99580	17.8
Extremely High	6255	4.0	3790	2	160	0.1	10205	1.7
Total	70575	100	189161	100	201939	100	561674	100

SOURCE: Munasinhe M.A.R., S.M. Vipula Pushpakumara, T.M.J.Bandara and H.M. Bandara Herath- "Use of Geographical Information Systems for Soil Erosion Hazards Assessment of the Central Province of Sri Lanka" Annals of the Sri Lanka Department of Agriculture 2001-Vol 3.

4. Munasinhe M.A.R., S.M. Vipula Pushpakumara, T.M.J.Bandara and H.M. Bandara Herath- "Use of Geographical Information Systems for Soil Erosion Hazards Assessment of the Central Province of Sri Lanka" Annals of the Sri Lanka Department of Agriculture 2001-Vol 3.
5. Ibid
6. Ibid

For the province as a whole the proportion of the land with a soil erosion hazard ranging from high to extremely high amounts to nearly 35%. The proportion in the three categories is approximately 46% in the Kandy District,40% in the Nuwara Eliya District and 16% in the Matale District. The extent under each hazard class in each of the districts is shown in Fig:V.

3.3 Presence forests rich in biodiversity and invaluable for watershed protection.

The Forest Department has assessed the importance of units of contiguous forest in the country for watershed protection and species conservation. The forests have been divided into 3 categories. i.e. Highest Importance, Important and Lowest importance.

Of the 104 forests classified as being of Highest Importance 70 have been identified as Top Priority. Of these Top Priority forests approximately 1/3 fall within the Fragile Area. The distribution of these forests according to administrative units is given in the Table below.

Table V - FRAGILE AREA – DISTRIBUTION OF TOP PRIORITY FORESTS

District	Top Priority Forests	Top Priority Forests Located within the Fragile Area *
Nuwara Eliya	7	6
Kandy	2	2
Matale	2	0
Kegalle	4	2
Moneragala	3	1
Badulla	5	5
Kalutara	6	0
Galle	9	1
Matara	10	2
Ratnapura	15	8

* Some of the forests fall within two or three administrative units.

SOURCE: Forest Department

The Forests in the area provide habitats for many of the country's woody endemic plants and endemic animals (Fig:VI). The most important of these forests in terms of bio diversity are:

1. Peak Wilderness Sanctuary. This is considered to be unique among Sri Lanka's forests in having a range of altitudinally graded, structurally and physiognomically distinct and biologically diverse forest formations that include tropical lowland, sub-montane and upper-montane rain forests, and natural grasslands[7]. This forest is also floristically important in terms of the large number of rare endemics it contains.
2. Sinharaja forest. This is considered to be a treasure-trove of endemic species, including trees, insects, amphibians, reptiles, birds and mammals.
3. Knuckles Range of forests. These are important in terms of rare species of woody plants and animals, some of which are unique to this site. In addition, these forests contain 14 of the 23 species of endemic birds; more than 50 percent of the endemic fish, of which nine are threatened and three are restricted to the forest; and a large number of butterflies and reptiles[8].
4. Horton Plains Natural Park. This constitutes a rare subtropical eco-system. Which is well recognized for its rich biodiversity. Its flora is given to a high level of endemism. Horton plains harbours 52 species of endemic birds and 11 species of migrants.

3.4 Contains the Upper Water Sheds of the Major Rivers in the Country

The Fragile Area sustains most of the island's major rivers and contributes to replenish and sustain the water table of the country. Of the 103 rivers in the island approximately 30 originate in the area lying over 100 meters. Of these the following 15 rivers have their source region within the fragile area.

1. Mahaweli Ganga
2. Kala Oya
3. Deduru Oya
4. Maha Oya
5. Kelani Ganga

7. Ministry of Forestry and Environment, "Biodiversity Conservation in Sri Lanka". August 1998

8. Ibid

6. Kalu Ganga
7. Gin Ganga
8. Nilwala Ganga
9. Walawe Ganga
10. Uruboka Oya
11. Malala Oya
12. Kirindi Oya
13. Menik Ganga
14. Kumbukkan Oya
15. Gal Oya

The source regions of the above rivers are shown in (Fig:VII)

3.5 Presence of Lands with Steep Slopes

A significant proportion of the Fragile Area is mountainous and steeply dissected. As a result a fair amount of land has slopes of over 60%. Although these lands are generally considered to be unsuitable for agricultural proposes, a large extent exceeding this limit has been utilized by people for cultivation crops such as tea, vegetables and potato leading to severe land degradation. The extent of land with slopes of over 60% in the areas coming under the Fragile Area within the Nuwara Eliya, Kandy, Kegalle and Ratnapura Districts is given below.

Table VI - FRAGILE AREA - LANDS WITH SLOPES OF OVER 60%

District	Extent falling within the fragile Area	Extent with Slopes of over 60% (ha)	Proportion of land with Slopes of over 60%
Nuwara Eliya	174210.3	15870	9.14
Kandy	192203.7	32080	16.7
Kegalle	82293.2	18890	23.0
Ratnapura	268333.8	66780	24.9

SOURCE : National Building Research Organization

The distribution of lands with slopes of over 60% in the Nuwara Eliya, Kandy, Kegalle and Ratnapura district is shown in Fig:VIII.

4.0 PROFILE OF THE FRAGILE AREA.

The Fragile Area demarcated on the basis of criteria elaborated above has an extent of 1,107,849 hectares. As shown in Fig. II the area covers the entirerity of the districts of Nuwara Eliya and Kandy and parts of the districts of Matale, Badulla, Ratnapura, Kegalle, Monaragala, Matara and Galle.

4.1 Topography

The distinctive feature of the fragile area is that it covers in full, the area of the highest elevation in the country. While the fragile area spreads out from the central hills towards the plains, the plains proper are outside the fragile area. (Fig.IX.) The resulting picture is that the fragile area has, on the whole, a hilly terrain with pockets of flat land especially towards its perimeter. The type of terrain classified according to the Agro Ecological Regions is given in Table VII.

4.2 Climate

The fragile area being almost entirely in the wet zone of the country, climatic conditions are marked by a high rainfall and a low to moderate temperature regime. Some parts of the area receive the highest rainfall in the in the country. The distribution of average annual rainfall within the area in showing (Fig.X). The temperature within the area varies between 25 ºC and below 17.5 ºC. At Nuwara Eliya which is located at 1800m above mean sea level the average annual temperature is 15 ºC. The spatial variations in the average annual temperature are shown in (Fig. XI).

4.3 Natural Vegetation

The major types of natural vegetation are forests and grasslands. Forests which cover approximately 19.0% of the area include Lowland Rainforests, Sub Montane Forests and Montane, Dwarf Forests. The grasslands which account for less than 1% of the land area include both wet patanas and dry patanas. The major types of vegetation in the area are shown in (Fig.XII).

4.4 Soils

The area has a variety of soil types. The major soil types are the Red-Yellow Podsolic soils which cover approximately 70% of the area and the Reddish Brown Earths which cover another 17%. The distribution of the major soil types are shown in (Fig.XIII).

4.5 Land Uses

The major land uses in the area are croplands, forests, scrubland and chena which together account for nearly 75% of the land area. Of the crops grown Tea is the most important and is followed by Rubber, Paddy, Other Plantation crops and Coconut. The extents under major land uses within the area are given below.

Table VIII - FRAGILE AREA – LAND USES

Category	km^2	%	
Cropland			
Tea	1886.28	17.02	
Rubber	984.00	8.88	
Paddy	684.41	6.18	
Other Plantation	328.98	2.97	
Coconut	53.74	0.49	
			35.53
Forest Areas	2097.73	18.94	18.94
Scrubland	1294.70	11.69	11.69
Chena	919.91	8.30	8.30
Grassland	64.11	0.58	0.58
Total	**8313.86**		**75.04**

SOURCE: GIS Division, Urban Development Authority

The spatial distribution of the major crops is shown in (Fig.XIV).

4.6 Population

The Fragile area accommodates approximately 25% of the country's population although it covers only 17% of the land area. The fact that the economy of the area is almost exclusively agricultural is reflected in the high proportion of rural population (76%). When combined with the estate population the non-urban population reaches 93%.The average density of population varies from less than 10 persons per hectare to 500 persons per hectare. As is to be expected the highest densities are to be found in the urban areas (Fig.XV).

The urban population is distributed amongst towns of varying size. The largest town is Kandy M.C. with a population of approximately 110049 and is followed by Badulla M.C.(40920); Nuwara Eliya M.C. (25049); Gampaha U.C.(24283); The distribution of towns in the area is shown in (Fig.XVI).

5.0 CURRENT PROBLEMS IN THE FRAGILE AREA

The fragile Area faces a number of environmental problems arising out of the pressures placed on the natural resources by a rapidly expanding population. The more important of these are outlined below.

5.1 Loss of Biodiversity

Pressures are being placed on the Fragile Area which is rich biodiversity by the increasing demand for land for settlement and agricultural development. There are many biodiversity rich forests in the area and these are being threatened particularly by communities living in the peripheral areas. Forests are being cleared for settlements and the expansion of plantations crops such as tea, illicit mining and mini hydro development. These processes inevitably lead to a significant loss of forest cover and biodiversity over time[9].

Between 1992 and 1999 the extents under montane and submontaine forests, nearly all of which fall within the Fragile Area have apparently declined by approximately 3000 hectares.

Information on the loss of biodiversity in the Fragile Area is not available. However it has been observed that within the country over 30 species of fauna and over 50 species of flowering plants, including 13 species of Orchids are suspected of being extent. Approximately another 480 flowering plant species and 90 fauna species have been assigned threatened status[10].

5.2 Increasing Land Degradation

Land degradation has emerged as a serious problem within the Fragile Area because of the pressures being exerted on the land due to the demands from various various events. Although the nature of the problem is known the magnitude of the problem in the area has not been assessed.

9. Ministry of Environmental and Natural Resources – National Action Programme for Combating Land Degradation in Sri Lanka,2002.
10. Ministry of Environmental and Natural Resources – National Action Programme for Combating Land Degradation in Sri Lanka,2002.

However some idea of the seriousness of the problem can be had from a study undertaken in the upper Mahaweli Catchments Area (which falls within the fragile area) a few years ago[11](FigXVII). The different land use classes already degraded and being threatened with degradation are given below.

Table IX - UPPER MAHAWELI CATCNMENT – DEGRADED LANDS

Degraded Lands			Degrading Lands		
Classes	**Extent (ha)**	**%**	**Classes**	**Extent (ha)**	**%**
60% Tea Cover	25906	8.33	Slope>60% Land Cover Except Natural Forest	6278.20	2.02
Grasslands	21304.09	6.85	Slope>30%-60% Annual Crops Except Paddy	11729.91	3.77
Forest Plantation	21302.15	6.85	Slope>30%-60% Scrublands	1672.60	0.54
Rocks	1808.35	0.58	Slope>30%-60% Urban & Settlement Areas	7345.00	2.36
Total	70320.59	22.61		27025.71	8.69

SOURCE: Environmental and Forest Conservation Division, Mahaweli Authority, Polgolla, Kandy

The figures show that nearly 23% of the lands in the Upper Mahaweli Catchment are degraded and another 9% is being degraded. This implies that only about 67% of the land in the area is of a good quality.

5.3 Settlements in Hazardous Areas

Some people within the Fragile Area have constructed homes and other buildings in areas prone to landslides. Settlements in such areas not only lead to the damage of property but also to a loss of life.

11. Chandrasekara C.M.M.M.K. and H.Manthrethilake "Degree of land Degradation in the Upper Mahaweli Catchments Area (An Indicative Map Prepared Using Geographical Information Systems). Environment and Forest Conservation Division, Mahaweli Authority, Polgolla, Kandy, 1999.

Information on the number of houses damaged and the number of deaths due to landslides within the Fragile Area are not available. However according to the National Building Research Organization approximately 40 houses have been damaged and 120 persons have lost their lives due to landslides within the past two decades or so.

The seriousness of the problem within the Fragile Area has been brought out in the investigations carried out in 2003 by the National Building Research Organization in the Ratnapura, Matara and Kalutara Districts. Of the 398 sites investigated in the three districts 50% were high risk areas, where residents had to be evacuated; 16% were moderately risk areas where the residents had to be warned; and 34% low risk areas where the residents had to be made aware of the risks they were facing. The district level distribution of the sites investigated is given below.

Table X - LANDSLIDE HAZARD INVESTIGATION-2003

District	No of Sites Investigated	Level of Risk					
		High (to be evacuated)		Moderate (to be warned)		Low (made aware)	
		No.	%	No.	%	No.	%
Ratnapura	329	164	49.85	47	14.29	118	35.87
Matara	45	31	68.89	8	17.78	6	13.33
Kalutara	24	5	20.83	7	29.17	12	50.00
Total	398	200	50.00	62	16.00	136	34.0

SOURCE : National Building Research Organization

5.4 Slow Ground Water Recharge

The Fragile Area forms a major part of the main hub of the water buffer in the country[12].Conditions in the Fragile Area therefore not only determine the water flow in the 103 watersheds but also the use of ground water for domestic and/or other purposes, the sustenance of agro- wells and the rehabilitation of small tanks in the lower parts of the country[13].

1. Senanayake Nanda - "Sustaining the Small Tanks Rehabilitation Programme" Ceylon Daily News, September 7th 2004.
2. Ibid

Today the water holding capacity of the Fragile Area is being reduced because of the increased run off due to human activities such as the clearing of forests, the cultivation of annual crops on steep slopes and the neglect of reservation areas of streams. Unless steps are taken to improve infiltration to recharge the ground water the water holding capacity of the Fragile Area is likely to be reduced further.

5.5 Sedimentation of Reservoirs.

There are a number of reservoirs within the Fragile Area. ie Kotmale, Polgolla, Victoria, Randenigala, Rantembe, Castlereagh, Norton, Maussakele, Canyon, Laxapana, and Samanalawewa (FigXVIII). Certain land uses in nearly all of the catchments of these reservoirs generate soil losses.

Different land uses associated with high rates of soil erosion include upland annual rain fed crops, vegetable and tobacco cultivation, poorly managed tea lands and home gardens, and scrubland[14]. The percentage of land under erosive land use in the different reservoir catchments is given below.

Table XI - RESERVOIRS – PERCENTAGE AREAS UNDER EROSIVE LAND USE IN THE CATCHMENTS

Reservoir	Percentage Under Erosive Land Uses
Kotmale	15
Polgolla	-
Victoria	21
Randenigala	31
Rantembe	29
Castlereagh	21
Norton	24
Maussakele	9
Canyon	12
Laxapana	22
Samanalawewa	23

SOURCE: Mahaweli Authority of Sri Lanka

3. Mahaweli Authority of Sri Lanka, Draft Reservoir Management Plan, Dam Safety and Reservoir Conservation Programme, August 2003.

A part of the eroded soil finds its way into the reservoirs leading to sedimentation and a consequent reduction in the storage capacity. Approximate estimates of the storage lost annually and the percentage of volume of storage lost up to the present for some of the reservoirs are given below.

Table XII - RESERVOIRS – STORAGE LOST EACH YEAR AND PERCENTAGE OF VOLUME OF STORAGE LOST UP TO THE PRESENT

Reservoir	% of Storage Lost Each Year	% of Volume of Storage Lost of the Present
Rantembe	3.8	46
Polgolla	2.7	71
Laxapana	1.32	43
Randenigala	0.69	11
Norton	0.58	19
Canyon	0.35	11
Kotmale	0.21	-

SOURCE: Mahaweli Authority of Sri Lanka

5.6 Threats to Archaeological Reserves and Places of Scenic Beauty

Archaeological Reserves include those declared by the Archaeological Department under the Antiquities Ordinance and Archaeological monument or place and their immediate surroundings which come under controlled development, subject to the approval of the Archaeological Department. All of these areas are be threatened by Encroachments by poor landless people for residential purposes, Road widening projects that eat into reserves, creative visual incongruities and Development activities that are not in harmony with this surrounding environment.

Kandy City has been declared as a World Heritage City by the UNESCO and is subject to certain restrictions of development. The incongruous structures just out side the border of the Heritage City limits may also be considered as threats.

The Sri Lanka Tourist Board has declared some highways within the area as Protected Highways. This has been done on the merits of the many places of scenic beauty that are to be found along their lengths. The major threat to these places stem from the limitations of the concept itself. The Tourist Board can control any structure including

hoardings along the road but not any destructive activity that would harm the scene itself. As such the declaration of a highway per se does not guarantee the protection of places of scenic beauty. Such places are often threatened by development activities carried out without sensitivity to the delicacy of the place.

5.7 Cultivation of Lands with Slope of over 60%

Lands with slope of over 60% are generally considered unsuitable for agricultural purposes. Nevertheless a significant proportion of such lands within the Fragile Area are being utilized for cultivation.

Information on the precise extent of lands with slopes of over 60% given over to agriculture within the Fragile Area is not available. However in order to obtain some idea of the seriousness of the problem an attempt was made to estimate the extent of such lands in the area coming under the Fragile Area within the Ratnapura, Nuwara Eliya, Kandy and Keglle Districts by taking the areas mapped by the National Building Research Organization and superimposing on these areas the land uses mapped by the Urban Development Authority. The results are presented in the Table below.

Table XIII - FRAGILE AREA – AREAS WITH SLOPES OF OVER 60% SLOPE - CULTIVATED EXTENT (HA)

	District			
	Ratnapura	**Nuwara Eliya**	**Kandy**	**Kegalle**
Tea	3695.18	2943.34	8003.87	683.69
Rubber	11082.81	62.54	1365.38	5182.88
Coconut	1450.25			54.19
Other Plantation	752.51	778.44	1.00	378.48
Paddy	7885.68	647.14	577.83	155.88
Total	**36418.82**	**4431.46**	**9948.08**	**6446.12**
Total Area with slopes over 60%	**66780.00**	**15870.00**	**32080.00**	**18890.00**
Proportion Cultivated	**54.54**	**27.92**	**31.01**	**34.12**

The figures show that within the 4 Districts approximately 45% of the lands with slopes of over 60% are given over to agriculture. Soil erosion on these slopes is very high particularly in areas with fragile soils and high rainfall erosivity. Such lands should therefore be left for forestry and recreation.

5.8 Encroachments on Agriculturally Unsuitable Lands and Reservations

Encroachments on state lands within the Fragile Area have been going on for quite some time. Some of the encroached lands prior to June 15th 1995 and suitable for alienation are being regulated subject to several conditions. The regulation programme undertaken in the Central Province between 1990 and 2003 serves to indicate the seriousness of the problem. The number of lots and the extent regularized are given in the table below.

Table XIV - CENTRAL PROVINCE – LAND REGULARIZATION PROGRAME 1990 – 2003

District	No. of Lots Regularized	Extent Regularized (Ha)
Matale	5780	2563.97
Kandy	4094	277.33
Nuwara Eliya	2458	163.16
Total	12332	3004.46

SOURCE: Provincial Land Commissioner – Central Province

The magnitude of the problem in brought out further in the table below which gives the figures for a few selected Divisional secretaries Divisions,

Table XV - ENCROACHMENTS – JANUARY TO SEPTEMBER 2004

D.S. Division	No. of Parcels
Welimada	652
Uwa Paranagama	631
Haldummulla	231
Ella	23
Total	1537

SOURCE: Land Use Policy Planning Division

The figures show that a little over 1500 parcels have been encroached upon during nine month period. Encroachments pose a problem because a substantial number takes place on lands that should not be opened up for settlement or agriculture. An encroachment survey carried out in the country in 1979 indicated that approximately 55,000 hectares of land found under encroachments were on state reservations. A survey carried out by the National Land Commissioner six years later revealed that the highest incidence of environment was on stream and road reservations and that encroachments are often found on ecological marginal lands. That process has continued and more lands unsustainable for alienation are being encroached. According to the land use policy planning division 1761 parcels were encroached in the Welimada D.S. Division in 2003 and of these only 880 parcels were considered As being suitable for alienation this indicate that approximately 50% of the encroachments were on lands that were not suitable for settlement or agriculture.

Encroachments are also taking place in state forests. The extents being encroached are not available for the Fragile Area. However some idea of the seriousness of the problem can be had from the figures given in Table XVI. The figures clearly indicate that illicit encroachments and clearings are on the increase.

6.0 THE NEED TO STRIKE A BALANCE BETWEEN PROTECTION AND PRODUCTION IN THE FRAGILE AREA.

In the past when allocating and utilizing lands for development the policy has been to meet the development needs first and the protection needs later. This attitude has been changing in recent years and more attention is now being paid to environmental conservation. This is clearly reflected in the formulation in recent years of several policies such as the National Environment Policy (2202); the Land Use Policy (2002); the Watershed Management Policy (2002); and the National Wetlands Policy (2004). The policies are expected to provide direction and guidance for environmental and natural resource management in the country. These initiatives underpin the need to take a fresh and more enlightened look at resource management in the Fragile Area.

As mentioned earlier the Fragile Area represents a special resource complex with a distinctive topography, climate, vegetation and soils. It is also the source region for most of the islands major rivers an contributes to replenish and sustain the water table of the country.

All lands in the area cannot be put into economic use because of their vulnerability to land slides, the hazard of soil erosion and the presence of bio-diversity rich forests. The utilization of these areas for agriculture and settlement has led to heavy degradation, the accelerating degradation manifesting itself in heavy soil losses, increase in landslides and the clearing of forests. Further degradation resulting from improper human intervention therefore has to be prevented by rationalizing land use in the area and allocating land to most appropriate categories. This can only be done by striking a balance between protection and production. The strategies proposed to achieve this objective are outlined below.

7.0 PROPOSED CONSERVATION STRATEGY

Many efforts have been made by successive governments to promote the sustainable use of land resources in the country in general and the Fragile Area in particular. However the current problems in the Fragile Area outlined in section 5.0 seem to indicate that these efforts have not been entirely successful.

The efficient and sustainable management of the land and water resources in the Fragile Area in vital not only for the further development of the area but also for the development of the country. The need for the integrated planning of the land resources in the country has been affirmed in the thirteenth amendment of the constitution but the available evidence does not seen to indicate that this approach has been widely accepted. On the whole little attention has been paid to the management of land and water resources on a holistic and comprehensive basis that. The problems in the Fragile Area clearly indicates that fragmented approach to land resource management has only had a limited impact. These problems have to be addressed early in order to ensure a sustainable future for the area; if not these could be serious ecological and socio-economic consequences. The following strategies are being proposed in the hope that their implementation will help to solve these problems and bring about the much needed balance between protection and production.

7.1 Identification and Demarcation Areas that will be strictly Protected and where Development activities should not be allowed

As mentioned earlier all lands within the Fragile Area cannot be put in to economic use; some lands have to be protected in order to manage the natural and cultural resources on a sustainable basis. The protected areas should include both areas that are presently protected and all of the other areas that need to be protected. The latter should include unutilized lands with slopes of over 60%; unutilized lands lying over 1500m; degraded lands with slopes of over 60%; lands where landslides are to be expected; areas of natural beauty and natural features of exceptional value;

environmentally and hydrological important wetlands; all natural and man made water courses and water bodies and their reservations and catchment areas and archeologically important sites. These areas need to be identified and demarcated. The areas to be protected and the institutions that should be entrusted with the responsibility of identifying, demarcating and protecting these areas are indicated in Table XVII.

Once the identification and demarcation is completed, both categories i.e. areas presently protected and few areas that need to be protected should be integrated into a Protected Area network. The establishment of such a Network will not only help to eliminate the current bias towards production in the Fragile Area but also contribute towards the sustainable management of its limited land and water resources.

7.2 Development of an Appropriative Urban Pattern

Nearly all of the towns in the Fragile Area date back to the historical past. From very small beginnings these towns have grown in size and today they contain nearly 10% of the total population in the area.

In the early stages the horizontal expansion of these towns was not constrained by physical limitations. On the one hand there were very few threats of natural hazards because of the limited pressures exerted on the utilized land by a relatively small population and on the other there was enough land to meet the demands of a slowly expanding population. The current situation is quite different. The demands from a rapidly expanding population have not only set up severe pressures on the land making. many towns more vulnerable to natural hazards but have also reduced the extent of land available for expansion. Today these and other physical limitations are threatening the very existence of some towns and constraining the spatial expansion of many others. It is therefore important that in the case of each town the potential for expansion be assessed in relation to the physical limitations being faced.

The major physical limitations to urban expansion in the Fragile Area are (a) vulnerability to natural hazards, particularly landslides. (b) limited availability of lands for expansion and (c) threats to natural and cultural resources. Based on these limitations, the towns in the area have been classified into 4 categories as follows.

Category	Recommendations	No of Towns
I	Towns that should be move because of their high vulnerable to natural disasters particular landslides.	3
2	Towns where future spatial expansion be prevented because of their moderate vulnerability to natural disasters limited availability of land for expansion and threats to natural and cultural resources.	12
3	Towns where limited spatial expansion be permitted because of their low vulnerability to natural disasters.	38
4	Towns where spatial expansion need not be restricted as they do not face any physical limitations.	8

The distribution of these towns is shown in Fig XIX. It in imperative that plans for the future growth of these towns be prepared taking into coordination the above classification.

7.3 Identification and demarcation of lands from which settlements should be withdrawn

Some people within the Fragile Area reside on lands that are highly vulnerable to landslides. Continued residence in these areas will inevitably lead not only to property damage but also to a considerable loss of life. It is therefore imperative that such areas be clearly identified and demarcated and subsequently arrangements made to evacuate people from these areas.

Criteria for identifying lands from which people should be evacuated have been developed by the National Building Research Organization (N.B.R.O.). These include (a) physical criteria such as the presence of tension cracks, unstable slopes, unsuitable geological structures and drainage patterns and (b) socio-economic criteria such as the density of housing and the costs of adopting mitigatory measures.

Based on these criteria, some sites have already been identified and demarcated in selected areas within the Ratnapura, Kalutara and Matara district. It is strongly recommended that the exercise be extended to all the areas that have been zoned by the N.B.R.O. as areas where landslides are to be expected.

Some of the persons who reside in hazardous areas may not be aware of the dangers they face. Such persons should be made aware of the risks that are been taken as a matter of priority. Others may be aware of the potential dangers but unable to move to safer areas on their own initiative either because of the non-availability of alternative lands and employment opportunities or because of limited financial resources. By remaining in these areas both groups of people run the risk of losing not only their residences but also their lives. Hence they should be encouraged to leave and steps taken to assist them in the evacuation process. An important step in this process is the identification and prioritization of lands for re-settlement.

7.4 Identification and Prioritization of Lands for Re-Settlement

Persons who need to be evacuated from areas vulnerable to landslides will have to be resettled in other areas. Ideally the new areas selected for resettlement should be in close proximity to areas from which people are evacuated in order to minimize social and economic dislocation. However if such areas cannot be found in close proximity to the evacuated sites people will have to be inevitably settled in more distant locations. When selecting such locations attention should be paid not only to the suitability of the site for settlement but also to the availability of alternative income earning opportunities in the vicinity either in agriculture or other occupations acceptable to the evacuees. It is also important that the costs of relocation be borne by the relevant government institutions.

Since the cost of acquiring privately owned lands for re-settlement will be both costly and time consuming re-settlement should take place as far as possible on state owned lands. Privately owned lands should be acquired only if sufficient state owned lands are not available.

There are two possible sources of land that could be utilized for resettlement purposes (a) Unutilized State Owned Lands and (b) Uncultivated lands belonging to Regional Plantation Companies (RPC), The Sri Lanka State Plantations Corporation (SLSPC) and the Janatha Estates Development Board (JEDB).

(a) Unutilized State Owned Lands

The Land Use Policy Planning Division has made an inventory of all the available unutilized state owned lands in the country. Each parcel of land has been identified and details pertaining to each parcel eg. the Plan No, name of the land , terrain conditions tenure, distances to towns and access to different services such as water, electricity and roads have been indicated. Furthermore the lands have been classified according to potential uses, including agriculture and housing. The criteria used for classifying lands as being suitable for housing include

1. Slope of the Land
2. Drainage
3. Presence of Rocky Land
4. Distance to a Motorable Road
5. Distance to a Main Road
6. Distance to the Closest Road Junction
7. Distance to a Large Town
8. Availability of Electricity
9. Availability of Telecommunication Facilities
10. Source of Water
11. Distance to Source of Water
12. Distance to Social Infrastructure Facilities.

The extents available in the different Divisional Secretaries Divisions falling within the Fragile Area and the lands recommended for agricultural land use and housing are given in the Table XVIII below;

Table XVIII : Fragile Area – Extents of Available Unutilized State Owned Lands

District	Extent Avai.(ha)	Recommended for Agri. (ha)	Recommended for Hous. (ha)
Badulla	11873.70	1297.40	119.80
Ratnapura	2190.18	914.48	101.08
Matale	1563.11	377.85	198.66
Monaragal	1350.62	1148.42	202.20
Kegalle	500.85	330.52	199.78
Kalutara	430.19	72.01	5.06
Kandy	276.66	55.88	157.90
Nuwara Eliya	32.78	20.98	0.00
Matara	10.20	9.10	9.60
Galle	0.00	0.00	0.00
Total	**18228.29**	**4230.64**	**994.08**

Source : Land Use Policy Planning Division

(b) Uncultivated lands belonging to Regional Plantation Companies, the SLSP and the JEDB

Information on uncultivated lands belonging to RPC, SLSPC and JEDB are available with the Plantation Management Monitoring Division of the Ministry of Plantation Industries. Some of these lands apparently remain unutilized became of their physical unsuitability for cultivation eg. rocky, steep and waterlogged lands. Some of the lands have already been earmarked for various development purposes, such as planting of tea, rubber and oil palm; forestry; village expansion; housing schemes and dendro- power projects. The remaining lands should be evaluated for their suitability for settlement. At the same time, lands that have been earmarked for development purposes could be looked into to find out whether some of them could be released for resettlement purposes. The extents of uncultivated lands belonging to RPS's, SLSPC and JEDB within the Fragile Area are given in table below.

Table XIX : Fragile Area – Uncultivated Lands Belonging to Regional Plantation Companies and Sri Lanka State Plantation Corporation and Janatha Estate Development Board *

District	Extent (ha)
Kandy	5790.40
Badulla	3004.60
Ratnapura	2915.10
Matale	2343.81
Nuwara Eliya	2333.00
Kegalle	653.80
Matara	589.57
Kalutara	88.29
Colombo	54.22
Monaragal	11.61
Galle	11.12
Total	**17795.10**

Source: Plantation Management Monitoring Division, Ministry of Plantation Industries.

* The data were available on an electorate basis. Data for electorates and parts of electorates falling within the Fragile Area have been included.

7.5 Classify Lands for Agricultural Production

All of the lands given over to agriculture within the Fragile Area are not suitable for cultivation. Nonetheless a high proportion of these lands have been brought under agricultural production. Evidence of misuse can be found in the heavy soil losses that are taking place and the presence of abandoned and heavily degraded land. Further misuse has to be prevented by classifying both the lands presently being utilized for agriculture and lands remaining unutilized according to their suitability for agricultural production.

The lands within the Fragile Area could be broadly divided into two categories according to elevation.(a) lands situated 1500 meters above mean sea level and (b) lands situated below 1500 meters mean sea level.

(a) Lands situated 1500 meters above Mean Sea Level

The need for protecting lands above 1500 meters due to their environmental sensitivity was recognized over a century ago in the different pieces of legislation that were enacted. The efforts at protection however have not been entirely successful and today a substantial proportion of these lands have been

brought under production. The only areas that remain protected are the Forests and Wild life Reserves.

The lands outside the forest and wildlife reserves comprise lands that have already been utilized for production and settlement and lands that remain unutilized. The utilized lands in turn can be subdivided into two categories. (1) lands given over to the cultivation perennial crops and (2) lands given over the cultivation of temporary crops.

(1) Lands given over to the Cultivation of Perennial crops

Perennial crops may be allowed to remain on the land provided appropriate conservation measures are adopted. An authorized officer from the Department of Agriculture should inspect such land and satisfy himself that adequate soil conservation measures have been adopted. If the measures adopted are considered to be inadequate the land user should be requested to adopt adequate soil conservation measures within a specified period of time.

(2) Lands given over the Cultivation of Temporary Crops.

Cultivation of annual crops should be prevented on lands presently being utilized. Persons cultivating annual crops should be directed to cease cultivation of such crops and to maintain a protective surface vegetation by establishing either forest tree species or perennial fruit trees.

Unutilized lands belong to state and private institutions and private land owners such lands should not be utilized for production; they should be disposed of only for conservation purposes.

(b) Lands situated below 1500 meters Mean Sea Level

Cultivated lands below 1500 meters should be divided into two categories – lands with slopes of over 60% and lands with slopes below 60%. Users of state and private lands with slopes of over 60% should be encouraged to convert such lands if not already under forest vegetation to agro-forestry systems. In areas with slopes below 60% effective and suitable conservation

measures should be made a non-negotiable pre-requite for agricultural land use.

It is likely that there are some lands below 1500 meters remaining unutilized. Unutilized lands with slopes of over 60% should be disposed of only for conservation purposes. Other lands could be utilized for agricultural purposes provided adequate conservation measures are adopted wherever necessary.

Within the Fragile Area, there are some lands that are heavily degraded. These lands have to be clearly identified and divided in to two categories.
(a) lands with slopes of over 60%. These lands should be rehabilitated through forest vegetation or agro-forestry systems (b) lands with slopes of less than 60%. These lands should be rehabilitated through farmer motivation and mobilization and by encouraging the adoption of low cost conservation technology.

The classification of agricultural land represents a necessary step in preventing the misuse of land. An equally important step is the encouragement of land uses to sustainably manage the land that they operate.
Encouraging farmers particularly small holders to manage their land sustainably by adopting recommended conservation strategies where appropriate is not an easy task. It is significant that 99% of the holdings within the Fragile Area are small holdings and such holdings account for 60% of the land under production. The attitudes and goals of these persons have generally been motivated by rational self-interest, and what they are doing with the land is what they think is best for them and their immediate family members. They feel confident that they are making use of the resources available to them i.e. land, labour, capital etc. efficiently in order it achieve their goals.
The land degradation taking place within the Fragile Area clearly indicates that the decisions taken by many of the land users have impacted adversely on the land resources. Consequently their attitudes and actions need to be modified if the sustainable management of land resources is to be promoted. They should be motivated to take an active part in managing the land that they operate by making them aware of the benefits of conservation i.e. either

through enhanced yields or an increase in the value of land and by developing simple and uses friendly interventions.

7.6 Promotion of Appropriate Agricultural Crops and Practices

7.6.1 The predominant crops grown in the Fragile Area are annual crops such as paddy, vegetables, potatoes and tobacco; and perennial crops such as tea, rubber, coconut, coffee, cocoa, cloves and cardamoms. These crops have been grown over a long period of time but not always in relation to the physical suitability of the land for a particular use. As a result there are many areas within the Fragile Area where crops are grown on lands that are not ideally suited for their cultivation. Evidence of such a mismatch between land use and land types can be seen in eroded uplands, marginal tea lands, decline in soil fertility and a reduction in crop yields

A major reason for the decline in yield of plantation crops and food crops over the past several decades has been the loss of voluble top soil due to erosion. Studies have shown that in the case of tea the loss of 1 cm of soil cover is associated with a 44 Kg/ha reduction in made tea yields[1] while in the case of rubber the output could be expected to decline by nearly 174 Kg/ha/Yr for a loss of each one centimeter of top soil.[2]

Agriculture on sloping lands in many areas is generally maintained by the artificial replacement of nutrients removed by erosion. Available evidence suggests thst vegetables growers in the upcountry use large amounts of fertilizer to make up for the increasing poverty of soil. A survey done in two small catchments in the hill country indicated that the proportion of fertilizer used by vegetable farmers was higher than what was recommended[3]. In the case of tomatoes and beans there was an over use of

[1] Coomarassawamy Ananda, Anura Ekanayake, A.H. Chistolm and S.jatasooriya(1997), " Effects of Land Degradation on Tea Productivity" in Economic policy Reforms and the Environment: Land Degradation in Sri Lanka, Proceeding of a workshop, Colombo, December 1997.

[2] Samarappuli I.N, A. Ekanayaka, I.Samarappuliand N. Yogarathnam(1997), "Modelling the Effect of land Degradation on yield of Rubber" in Economic policy Reforms and the Environment: Land Degradation in Sri Lanka, Proceeding of a workshop, Colombo, December 1997.

[3] Ministry of Forestry and Environment, Environment Action 1 Project(1998)- " Study on Economic – Environment Linkages of Fertilizer Use Among Small Scale Farmers in Selected Watershed" (Draft)

mixtures by 67.0% and 220.0% respectively and urea by 103.0% and 130.0% respectively. It has also been noted that vegetable and tobacco growers in the hill country commonly applier Metric ton of fertilizer per hector which can be seen as consistent with depleted natural nutrients.[4]

Further evidence of declining crop yields due to soil erosion has been provided by a study of the economics of the soil erosion in a village in the hill country where the cultivation of potatoes of sloping lands represents the predominant form of land use.[5] The results have shown that within the next few decades there will be a significant fall in the yield of potatoes on such lands due to the effects of erosion. The decline may occur to such extent that potato cultivation may no longer become viable.

Areas unsuited for the production of any crop should be withdrawn form that use. This can be done either by selecting a crop and determining the areas best suited for its cultivation, or by selecting an area and determining the kinds of uses that are best suited for the area. Either approach will ensure that the utilization of land for agricultural purposes in the future, will be determined primarily on the basis of the suitability of the land for the identified use. The concentration of production on the lands best suited for a particular use will not only lead to higher levels of productivity, but also to lower costs of production and enhanced agricultural incomes.

Areas withdrawn from a particular crop. need to be evaluated to determine their suitability for conversion into other agricultural uses. The recommended uses however should not only be physically suitable **but** also economically viable and socially acceptable. If conversion to agricultural uses is not possible, alternative non-agricultural uses for these lands will have to be found.

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[4] Gamage, Dhanawardana and Mohamed Aheeya (1998), "Economic and Social Factors Affecting Land Degradation in the Upper Mahawali Catchment- Sri Lanka", Environment Action 1 Project – Ministry of Forestry and Environment.

[5] Clark R(1994), " Economic valuation of Soil Erosion Conservation measures-A case study of Perawella Area in the Upper Mahawali Catchment", Environment and Forest Conservation Division, Mahawali Authority of Sri Lanka.

7.6.2 Some specific recommendations to achieve expected production targets for some of the land uses are given below:

7.6.2.1 Erosive Land Uses

a. Upland annual (rainfed) crops; vegetable cultivation on slopes without conservation and Tobacco. These crops are highly erosive. They have been given a high Erosion Hazard Rating of 40[6] and the rate of erosion has been assessed at approximately 180 tons, per hectare per year[7]. Cultivation of these crops should not be allowed on slopes of over 60% and in areas where the erosion hazard is either extremely high or very high. In other areas the land uses should be encouraged to adopt appropriate technologies both traditional and new to control land degradation. The new technologies should indicate mechanical measures, biological measures and agronomic measures.

b. Lands that are marginal for tea cultivation eg. poorly managed tea lands with a erosion hazard rating of 32 should be identified and withdrawn from cultivation and turned over to alternative uses, and production should be consolidated by concentrating on the most productive areas. Within these areas land use should be optimized through inter cropping and crop diversification particularly in the mid and low country areas. Expansion in the small holdings sector should be encouraged but steps should be taken to ensure that the new areas being added particularly in the low country areas are located in the most suitable lands for production.

[6] Michael Stocking presented Erosion Hazard Ratings (EHR) for the major land use types in the Upper Mahaweli Watershed. EHR is a dimensionless value that indicates the relative erosion hazard of different land uses. The reference land use, allocated an EHR of 1 is well managed tea grown on slopes of 30 – 60% with an 80% cover. The maximum hazard rating value is 40.
Stocking M. 1992, Soil Erosion in the Upper Mahaweli Catchment, Technical Report No.14, Forest/ Land Use Mapping Project, Mahaweli Authority of Sri Lanka.

[7] Upper Watershed Management Project – Final Report, Appendices 1,2 and 3, Ministry of Agriculture, lands and Forestry 1997.

7.6.2.2 Other land Uses

a. Rubber

Lands marginal for rubber e.g. Lands over 45% slopes, lands with a high water table and lands prone to flooding should be identified and put to alternative uses. In the other areas high yielding clones should be planted and correct agronomic practices adopted to increase the present productivity to about 2880 Kg/ha/year. At the same time, small holders should be encouraged to grow other crops with rubber and steps taken to expand production outside the traditional areas.

b. Minor Export Crops

Minor export crops are defined as perennial crops other than tea rubber and coconut where over 80% of the production is exported. These include beverage crops such as coffee and cocoa, spices such as pepper, cloves, condiments and nutmeg and a number of other crops such as lemon gran and vanilla. The export potential of minor export crops is quite high but despite this both the production and productivity remain low. Production should be increased by (1) improving the productivity of existing lands by increasing plant density and introducing high yielding varieties (2) encouraging home garden production and (3) encouraging tea and rubber estates to undertake crop diversification programmes and encouraging inter-cropping with minor export crops in forestry models.

c. Coconut

The production of coconut should be expanded by (1) promoting cultivation on home gardens (2) replacing tall varieties with improved varieties that can give more than 100 nuts per acre and (3) encouraging inter-cropping and animal husbandry.

d. Livestock Sector

Expand the forage area by incorporating quality lands. Such lands could include areas being withdrawn from tea and rubber but suitable for pasture / fodder cultivation for high producing dairy

cattle in the high and mid grown areas; patana lands; homestead, gardens and areas within plantations suitable for pasture / fodder.

7.7 Identification of an Appropriate Transport Infrastructure

An appropriate transport infrastructure in the fragile area needs to optimize on the available road and rail infrastructure initially, and then look at other means of transport as alternative modes, in order to promote the needed balanced development of the area. The strategies proposed are as follows:

7.7.1 Internal (within the area)

(a) The existing Networks of National Highways and the Railway are indicated in figure XX

They link urban centers of the area and perform an important socio- economic function. Hence they need to be well maintained. Any improvements to these networks have to be carefully studied, bearing in mind that some pass through landslide prone areas. Over the years several places along them have been subjected to major landslides.

(b) New Road Linkages

In addition to the above, there will be the need to find new road linkages to the proposed settlements. Through several studies that have been carried out by institutions such as the NBRO and land slide prone areas have been identified. These findings should be given due consideration in carrying out EIR studies for new highways, new railway lines or in finding new road links for the proposed settlements in the area.

(c) City centered light rail systems.

This could be a viable proposition in the first instance for Kandy, for the use of commuters as well as the tourists and other visitors. Such systems could also be viable for Nuwara –Eliya and Badulla.

7.7.2 External (from outside the area)

There are several tourist attractions within this area, particularly in the districts of Kandy and Nuwara – Eliya. In order to market such areas, efficient transport systems, particularly from Colombo, have to be established. They could be (a) more efficient road and rail based systems and (b) specially designed air travel systems.

(a) More efficient road and rail based systems

New additions to the networks of National Highways and Railway, as indicated in Fig. XXI needs to be considered.

The new proposals include those that have been proposed by the RDA, by the Railway Department and also the NPPD.

In this regard the Expressway from Colombo to Kandy, proposed by the RDA, needs special consideration. Special Consideration also needs to be given to the proposals of the Railway Department, particularly that from Avissawella via the vicinities of Ratnapura, Balangoda and Wellawaya to the Eastern Province. The NPPD proposals need consideration from the point of view of equitable development of the Country.

(b) Specially designed air travel systems

The viability of air travel derives from the limitations placed on the development of road and rail transport as an effective means of promoting tourism.

Domestic air travel could be promoted at three distinctly different levels:

- through a suitable system of small planes for which a domestic airport needs to be considered , preferably close to Kandy and also Badulla. The Civil Aviation Authorities have been entertaining such thoughts over the years.

- through the use of Helicopters for which ideally a network of heliports should be established after a careful study around Kandy, Nuwara Eliya, Badulla and also places of tourist attraction.

- through the use of amphibious small planes which could land on water bodies as well. There are a number of strategically placed water bodies ,such as the Nuwara-Eliya lake, Victoria Reservoir, Randenigala Reservoir in the area that could be considered with advantage for this purpose. There are several other water bodies too that could be studied for this purpose. These are indicated in Fig. XXII

7.8 Achieve a Rational Distribution of Population

The population of the fragile area at the beginning of the projection period, in 2001 amounted to approximately 4.5 million persons and was distributed within the area as follows:

District	2001
Kandy	1210823
NuwaraEliya	700083
Ratnapura	1008164
Badulla	707517
Matara	169452
Kalutara	103784
Kegalle	386384
Galle	27553
Moneragala	35435
Matale	235831

Source: Department of Census & Statistics

The density patterns for that year are shown in Fig. XXIII

Population Projections.

During the twenty year inter census period between 1981 and 2001 the total population grew at a very low rate of 1.2 per cent per annum. Only the growth rate of Moneragala District amounting to 1.8 per annum exceeded the national rate. The growth rates of all the other districts constituting the fragile area were below the national level. The population projection of the fragile area took into consideration all these differential growth patterns of the districts during the entire period under consideration. Thus the cumulative growth patterns show that the fragile area population will grow at a rate of 0.86 per annum during 2001-2005 period; at a rate of 1.04 during the 2006-2011 period and at a rate of 0.955 during the 2012-2016 period. The population projections for the Fragile Area for the years 2006, 2011 and 2016 are given below:

Table XX : Population Projections for the Fragile Area

	2001	%	2006	%	2011	%	2016	%
District	Observed							
Kandy	1210823	26.4	1270922	26.5	1334003	26.5	1400216	26.5
Ratnapura	1008164	22.0	1069147	22.3	1133819	22.5	1202404	22.7
Badulla	707517	15.4	741812	15.5	777769	15.4	815468	15.4
Nuwara Eliya	700083	15.3	705294	15.0	753977	15.0	782460	14.8
Kegalle	386384	8.4	399115	8.3	412264	8.2	425848	8.0
Matale	235831	5.1	248764	5.2	262405	5.2	276795	5.2
Matara	169452	3.7	176702	3.7	184262	3.7	192146	3.6
Kalutara	103784	2.3	107647	2.2	111748	2.2	116101	2.2
Monaragala	35435	0.8	38872	0.8	42642	0.8	46781	0.9
Galle	27553	0.6	28936	0.6	30388	0.6	31913	0.6
Total	**4585026**	**100.0**	**4787211**	**100.0**	**5043277**	**100.0**	**5290132**	**100.0**

Source: Computed and Estimate: Department of Census and Statistics 2001: for the base year:

Note: The fragile Area population is estimated based on the population of the relevant DS Division of the district constituting the fragile areas of each district.

The expected distribution of population in the year 2016 according to the Divisional Secretaries Divisions can be seen from Fig. XXIV

The density pattern for the years 1981, 2001,2006, 2011 and 2016 for the districts of Kandy and Nuwara Eliya and the parts of the other 8 districts included within the Fragile Area are given below;

Table XXI : District Densities - Fragile Area

District	1981	2001	2006	2011	2016
Galle	487	613	787	826	868
Kalutara	516	673	715	760	809
Kandy	554	664	696	731	769
Matara	516	599	636	663	691
Kegalle	412	43	485	500	517
Nuwara Eliya	354	410	413	441	458
Ratnapura	246	312	330	350	371
Badulla	227	274	285	295	304
Matale	180	227	235	248	261
Monaragala	49	72	77	85	93
Total					

Source : Estimated based on Department of Census and Statistics, 2003

The detailed density pattern for the year 2016 for the Divisional Secretaries Divisions falling within the Fragile Area are given in Fig. XXV

Accommodating the Future Increase in Population

According to the projections the population is the Fragile Area would increase up to 5.2 million persons by the year 2016. This implies that the area will have to accommodate another 700,000 persons in approximately ten years time.

Ideally all of these persons should accommodated within the Fragile Area. Some can be absorbed in the rural sector but the potential in limited partly due to Fragile Ecology and partly becomes of the limited employment opportunities in agriculture. Furthermore if the majority of the people were to

remain in the rural areas, pressures will be exerted on the existing land by an increase in the number of landless persons.

Hence much of the increase will have to be accommodated in the urban areas especially in those towns where spatial expansion need not be restricted as they do not face any physical limitations. Some can also be accommodated in towns where limited spatial expansion can be permitted because of their low vulnerability to natural disasters and the minimum threats to natural and cultural resources. The secondary and tertiary sectors in these towns will have to be strengthened in order to provide the necessary employment opportunities.

The question that has to be answered however is whether the majority of the presently unemployed persons and the new entrants to the labour force in the area can be absorbed both physically and economically by these towns. The labour force of the fragile area was estimated taking in to consideration the differential numbers of the working age population of the constituent districts of the fragile area. The estimated labour force as at 2001 amounted to approximately 2 million and would increase up to 2.5 million persons by the end of the projection period. During this period the labour force will grow at an average annual rate of 1.5 percent. The sex ratio of the labour force shows that more males are in the labour force because of the higher labour force participation of the males when compared to females. The answer to the question whether the presently unemployed persons and the new entrants to the labour force in the area can be absorbed both physically and economically can only be obtained through detailed studies. If at the end of the studies, the answer that is provided is in the negative then suitable settlement and employment opportunities for the surplus persons will have to be found elsewhere in the country. Since such opportunities will be limited in other parts of the Wet zone new settlement and employment opportunities will have to be found in the dry and intermediate zones.

The Dry and Intermediate zones have the potential to accommodate more people and provide them with the necessary employment opportunities because of the availability of unutilized lands and the presence of a rich resource base. The latter includes fertile agricultural land, economically

important minerals, large and medium scale reservoirs, a variety of tourist attractions such as beaches, fauna and flora, world heritage sites and distinctive developed attractions such as irrigation works. The region also has a long coastline that provides access to both living and non-living natural resources within the Exclusive Economic Zone and non-living resources in the Extended Continental Shelf which has to be claimed by the year 2009. All of these resources open up several possible developments which will have to explored and exploited.

8.0 PROPOSED DEVELOPMENT STRATEGY

8.1 Develop the key economic sectors. The following major policies will be adopted to develop these sectors.

Agriculture

- Consolidate production in the permanent crop sector by concentrating on the most productive areas; promoting planting material with quality characteristics; and optimizing land use through inter- cropping and crop - diversification.

- Promote conservation farming in areas given over to the production of annual crops.

- Develop the dairy farming sector by expanding the forage area by utilizing some of the areas being withdrawn from tea and rubber but suitable for pasture/ fodder; patana lands; and areas within plantations suitable for fodder.

Manufacturing

- Strengthen existing industrial estates to attract both local and foreign investors.

- Develop new industrial sites in suitable areas for the location of environment friendly industries such as electric, electronic and information technology, and agro-based.

Mining

- Encourage mineral processing prior to export in order to increase the value add components.

- Establish industries based on known mineral occurrences to tap dormant mineral resources.

Tourism

- Identify potential eco-tourism sites and develop them to derive economic benefits by earning foreign exchange, spreading development and generating employment benefits.

- Develop economic linkages with other economic activities such as agriculture and rural industry.

8.2 Expand the Urban Services.

The urban services will be expanded

- By developing the urban centres in the region in a hierarchically structured manner. The hierarchy will consist of 4 levels as follows:

  Regional Centres
  Major urban Centres
  Secondary Urban Centres
  Divisional Urban Centres

- At each level the necessary services will be provided in relation to the hinterland population and the required thresholds for the services.

- Conservation areas, and cultural and recreational activities will be treated as important land uses and integrated into urban physical planning.

- Provision of social infrastructure will be accorded high priority within urban areas.

- High and medium density, concentrated, residential development will be promoted (both vertical and horizontal) in the core areas of towns to optimize land use.

- Steps will be taken to reduce the vulnerability of buildings and infrastructure in settlements within natural disaster prone areas by adopting guidelines for construction in Disaster Prone Areas.

- Land use restructuring / planning and land use zoning will be based on hazard zonation maps - at macro and micro scale depending on the level and scale of planning.

8.3 Provide the necessary infrastructure.

The infrastructure needs of the Central Region will be provided on a planned basis particularly to cater to the expansion of the urban services and other economic activities.

(i) Special emphasis will be given to road and rail linkages within the area and with the rest of the country. The area is expected to benefit from;

- the new highway and railway proposals to link Colombo to the East via Ratnapura and Wellawaya, and
- from the proposed railway links from Avissawella to Nawalapitiya and from Badulla to Ella.

(ii) Use of Aircraft that could land on man made water bodies such as the Victoria Reservoir will be encouraged to further improve the accessibility of the area.

(iii) Agricultural production, manufacturing, dairy farming, mining industry, and tourism will be assisted with the necessary access roads, power and energy and water.

(iv) IT education and the propagation of knowledge based development will be intensified as a part of an island wide programme.

9.0 LINKS WITH NATIONAL AND REGIONAL POLICIES AND PLANS.

The preparation of a plan for the environmentally fragile area finds full endorsement in the national physical planning policy as elaborated in the National Physical Plan of 2002.

The National Physical Plan specifically states that all land in the country cannot be used for the promotion of economic activities. Some lands have to be left unused and protected in order to manage the country's natural resource base on a sustainable basis.

The philosophy underlying the fragile area plan, that areas to be protected should be identified as a first priority and that development should be confined to areas outside these, derives from the national physical plan.

The broad fragile area identified includes the Nuwra Eliya and Kandy district and parts of the Matale, Badulla, Moneragala,Ratnapura, Kegalle ,Galle and Matara Districts. All these districts have come under several regional development plans and projects, the most common being the Integrated Regional Development Projects. In these projects, especially in the later years environmental protection received much emphasis. Looked at in this light the fragile area plan can be taken as promoting a major policy element in the governments approach to regional development.

For some time now the commitment of the government to a policy of protection of the natural environment in the context of disaster management has been made clear. This policy received further emphasis as a result of the widespread damage suffered in some areas of the country in 2003.

Government has accepted the protection of the environment as an important dimension of economic development. In pursuit of this policy the government department entrusted with the mandate for the approval of major development projects, viz the Department of National Planning, insists on project proposals being cleared on environmental grounds before they are approved or forwarded to the Cabinet of Ministers for consideration and approval.

The policy of ear-marking a fragile area for varying degrees of environment protection can be regarded both as a further stage in the governments commitment to environmental protection and as facilitating the environmental controls already in place such as the procedures referred to above.

Growth with equity is a major plank of the government's policy on economic development. Equity is a broad concept which covers groups in society based on different socio-economic levels as well as regions. The unequal development of regions, attract criticism on grounds of equity, in addition to criticisms leveled against it on strictly economics grounds. Harmful exploitation of the resources of one region to serve the interests of others also offends consideration of equity.

The reckless exploitation of natural resources for private gain while enriching a few would greatly jeopardize the economic interest of the majority. Equity demands that scope for this type of exploitation be minimized. The fragile area policy is designed to achieve this objective.

Equity also has a temporal aspect which is particularly relevant for sustainable development. In the use of resources, the interest of future generations too should be taken into consideration. This concern too is answered by the fragile area policy which seeks to safeguard a vulnerable region so that the interest of both the present and future generation would be best served.