Updated Baseline and Landscape Strategies of Knuckles & its Buffer Zone

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A PROJECT CARRIED OUT BY THE ECOLOGICAL ASSOCIATION OF SRI LANKA (EASL)

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Preface

This document is an updated version of the Landscape Strategy Document prepared for the GEF OP 6 phase. A rapid survey was conducted covering all nine Divisional Secretariats in which the Knuckles Conservation Forest (KCF) and its buffer zone are located. During this exercise, all key government sector stakeholders and the selected members of communities and community organizations we had access to were consulted to get an idea about the state of the environment in the Knuckles Conservation Forest (KCF) and its buffer zone. The main focus of this update is to determine the critical areas of interventions under the banner of "Local Action for Global Impact."

1. BACKGROUND

During the UNDP-GEF_SGP Op 6, the baseline status of the Knuckles landscape was prepared to implement the projects aimed at finding solutions to global environmental problems by implementing local actions. Of the three landscapes selected by the UNDP/GEF/SGP for funding under the OP 6, Knuckles is one of the globally important biodiversity hotspots in Sri Lanka. Under GEF OP 6, 14 projects were implemented in this landscape

1.1 GEF SGP 7 Operational Phase

The Ecological Association of Sri Lanka (EASL) was provided a grant to update the landscape strategy for Knuckles which was prepared under the GEF OP 6 with the tools adopted from the COMDEKS (Community Development and Management for the Satoyama Initiative) programme. A rapid field assessment was carried out for one month from mid-February to mid-March, 2023. This update is based on field observations, existing knowledge of the area, published literature, stakeholder consultations at District and Divisional Secretary Division (DSD) levels and Community level meetings.

1.2 The Priority Area for Baseline Assessment

The Knuckles Landscape is one of the three landscapes selected by the National Steering Committee (NSC) of UNDP-GEF-SGP of Sri Lanka, Op 6, for intervention to protect its natural environment. Under the GEF OP 6, 14 grantees implemented projects in 21 Grama Niladhari Divisions (GNDs) of 6 Divisional Secretariats (Table 1.1 & Figure 1.1) of Matale and Kandy Districts.

Figure 1. 1: Geographic Distribution of the GEF OP 6 Projects

A total of 14 projects were conducted in the Knuckles landscape. These projects can be categorized into landscape wide projects (2) and small area focussed projects. Of nine (09) DS Divisions, only in six small area projects were implemented; no such projects were implemented in Panwila and Ukuwela DS Divisions which include land

located within the KFC. The three divisions, Kundasale, Ambangangakorale and Naula, which include areas from the buffer zone only are also not covered during OP 6 project cycle. However, there was one landscape-wide project which focussed on the conservation of the Herpetofauna in the Knuckles landscape. In addition, the Knowledge Management Project assisted the grantees with technical knowledge to carry out their planned activities.

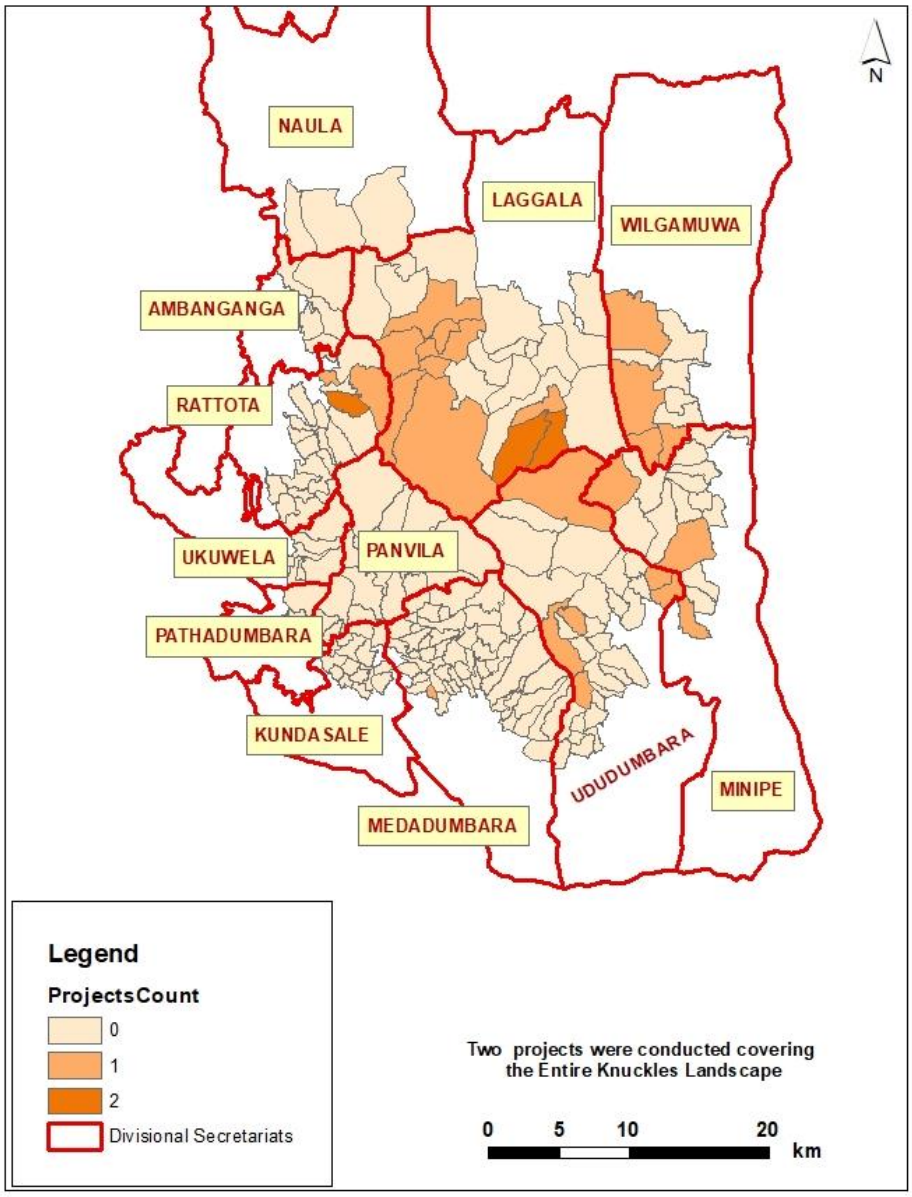

Figure 1.1: The Geographic Distribution of GEF OP 6 Projects

Table 1. 1: Location of GEF 6 Projects

District Name	DSD Name	GND/village Name
Matale	Laggala	Meda Ele Etanwala Rathninda Ilukkumbura Mahalakutuwa Kahagala Lakegala Narangamuwa Ranamuregama
	Rattota	Madawatta Dankanda kumbua
	Wilgamuwa	Sulugune Uduwelwala Moragaha Ulpota Hettipola
Kandy	Medadumbara	Kandegama 1
	Minipe	Udattawa Galamuduna
	Ududumbara	Nawanagala Kandagama 2 Kobonilla Udakumbura Padupola Meemure Rathnaella

This baseline assessment of Knuckles landscape includes both the KCF and its buffer zone (as in UNESCO map). The former has only a few settlements remaining, while the latter is mostly an anthropogenic landscape with some natural and seminatural forest areas.

1.2.1 The Knuckles Conservation Forest (KCF)

The montane forests of the Knuckles area are left intact by planters during the colonial period thanks to a ban in 1873 on the sale of land above 5000 foot (1500m) contour. However, the same protection was not accorded to the sub montane forests (1000m to

1500m). In the Knuckles area this order had a very limited effect for a number of reasons. One reason is that the total land above 5000 foot contour is only about 2000 ha. of which the area under montane forests is limited by the presence of rock outcrops and thin soil layers. The ban also came just before the collapse of the coffee industry by then a large track of forest land had been converted to coffee plantations. The land already sold was also not included in this order. As a result, most of the knuckles mountainous area was stripped of the natural vegetation.

Even after independence, things did not improve significantly towards the protection of the natural heritage of the Island in this area. Most of the abandoned coffee estates were under poorly managed tea. Some of these tea plantations were abandoned exposing the soil to erosion in the absence of proper land management practices. Even the currently utilized tea plantations in this area can be described as poorly managed tea with wide open spaces between tea bushes allowing rain splash erosion. Low income from these plantations means no soil conservation is practiced.

In 2000, the Government of Sri Lanka gazetted (No. 1130/22) the Knuckles Conservation Forest (KCF) covering an area of about 17,500 ha of state lands. There are also patches of private lands or encroached lands inside the KCF boundary. After acquiring the private lands located within the conservation area (3167 ha) by the government gazette notification number 1507/9 of 2007, the extent of the KCF was further increased (Fernando, 2010). The current extent of the KCF is given as 31,305ha (GDSRSL,2008). The Knuckles landscape as whole has unique characteristics consisting of a number of sensitive ecosystems and natural sceneries, (Forest Department, 2009). Since the KCF and adjoining forested areas provide habitats for an exceptional number of endemic species of flora and fauna, the area is known as a 'super biodiversity hotspot' (UNESCO World Heritage Centre, 2014). This area is home to species that are still not even identified. The location is also an important hydro catchment area of a number of tributaries of the Mahaweli Ganga. According to Badenoch (2009), Knuckles area accounts for 30 percent of watershed of the Mahaweli Basin.

The Department of Forest Conservation is giving a high priority to completely free the KCF of human settlements and other activities. Cultivation of cardamom has been stopped completely eliminating one of the threats to the montane and sub-montane forests of the area. However, still there are a few villages which have their dwellings and/or cultivation areas within the KCF boundary. At a recent discussion at DSD office

at Minipe, those who came from one such GND (Udagaldebokka) expressed their willingness to move to a place outside the park if their needs are met by the Government. However, it is not clear to what extent their views represent those of the other members of the village. A solution to this problem is urgently needed, otherwise the status of the KFC as a World Heritage Site may be adversely affected. It is also essential for the preservation of the natural environment of the KFC for the benefit of the future generations.

1.2.2 KCF Buffer Zone

The protected areas declared under the National Heritage Wilderness Areas Act (NHWA) No. 3 of 1988 have a 100m buffer zone around them where human activities are restricted. This is not sufficient for the KCF which is under threat of encroachment from the villagers of the border areas. However, other than the 100m belt, no other legally enforceable buffer zone exists for the KCF. The application submitted to UNESCO for inscribing the property in the World Heritage list, a broader buffer zone has been suggested for management purposes (Figure 1.3). "The area surrounding the KCF has been considered as the buffer zone" (GDSRSL, 2008). It further states that the buffer zone has no legal basis and consists of private as well as government land.

The KCF and two other properties in the central highlands of Sri Lanka, Horton Plains National Park and Peakwilderness were inscribed in the UNESCO Natural World Heritage Sites List. The UNESCO World Heritage site of KCF includes a buffer zone with an extent of 35,304ha around the KCF. The buffer zone around KCF needs some form of legal status.

Despite the fact that the ecological richness of the area was partially wiped out by the Colonial planters who introduced coffee to the area in the 19th century (Figure 1.2), the area remained a globally important biodiversity hotspot. Some pockets of montane cloud forest was saved thanks to the 1873 ban. The maximum spread of coffee plantations up to 1880 is shown in Figure 1. 2. A significant portion of the sub-montane forest (1000 – 1500m) was covered with coffee plantations. This shows the devastation caused to the sub-montane forests in this area by the coffee planters. These coffee plantations were converted to tea after the collapse of coffee and what remains of the original tea plantations are still operational. The photo taken during the recent field survey shows one plantation (Hare Park) has started replanting in a section of the property (Plate 1.1).

PLATE 1.1: Replanting Tea in Hare Park Estate

Note: Poorly managed tea is visible in the foreground

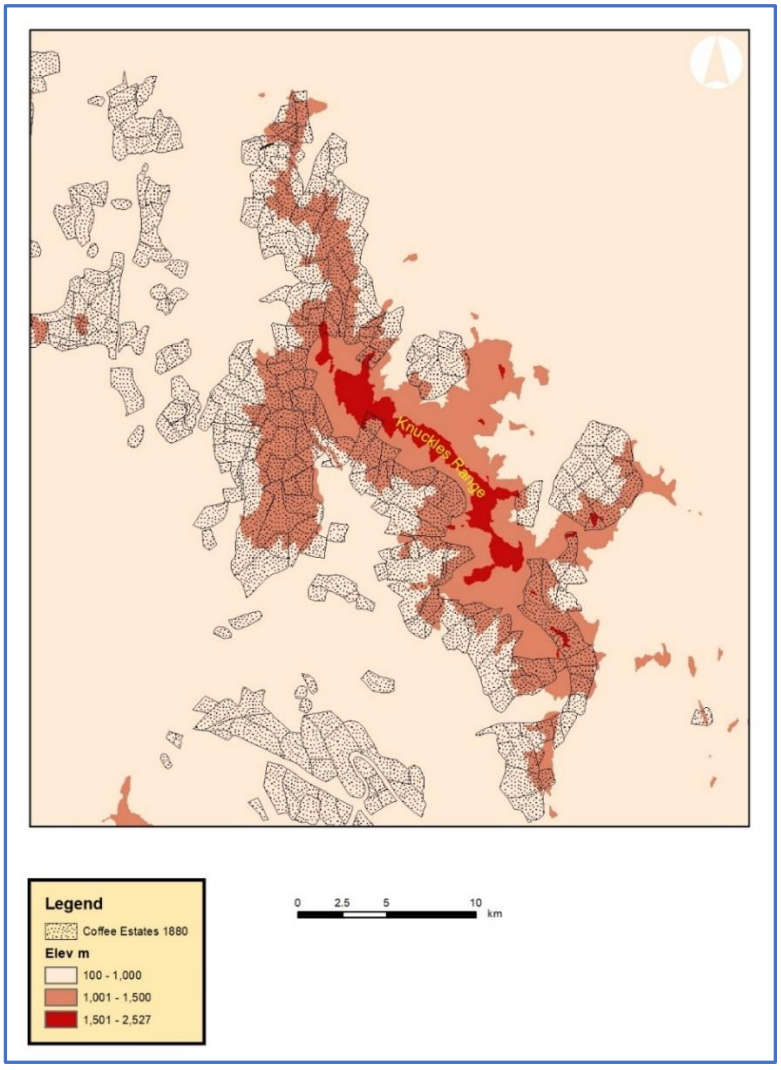

Figure 1. 2: Coffee Estates in 1883 (Source: Fergusson, London)

1.2.3 Geographic Area

The KCF falls within twelve DS Divisions of the Kandy and Matale Districts of the Central Province (Table 1.2). The proposed buffer zone (UNESCO, 2008) includes additional three DS Divisions (Kundasale, Ambangangakorale and Naula). Both the KCF and the buffer zone lie in 12 DS Divisions. Of these 12 Divisions, only 9 includes parts of KCF. The GN Divisions in the KCF and the Buffer Zone are listed in Table 1.2 and depicted in Figure 1.3.

The KCF is mostly an uninhabited area except for a few families living in several isolated villages. Most of the GN Divisions which are intersecting the KCF have the settled areas outside the KCF. The exact number of families living inside the KCF is not known at this stage.

Table 1. 2: Location within DS Divisions

	Divisional Secretariat	KCF	Buffer
Kandy	Pathadumbara	✓	✓
	Panvila	✓	✓
	Medadumbara	✓	✓
	Ududumbara	✓	✓
	Minipe	✓	✓
	Kundasale	--	✓
Matale	Laggala	✓	✓
	Wilgamuwa	✓	✓
	Rattota	✓	✓
	Ukuwela	✓	✓
	Ambanganga Korale	--	✓
	Naula	--	✓

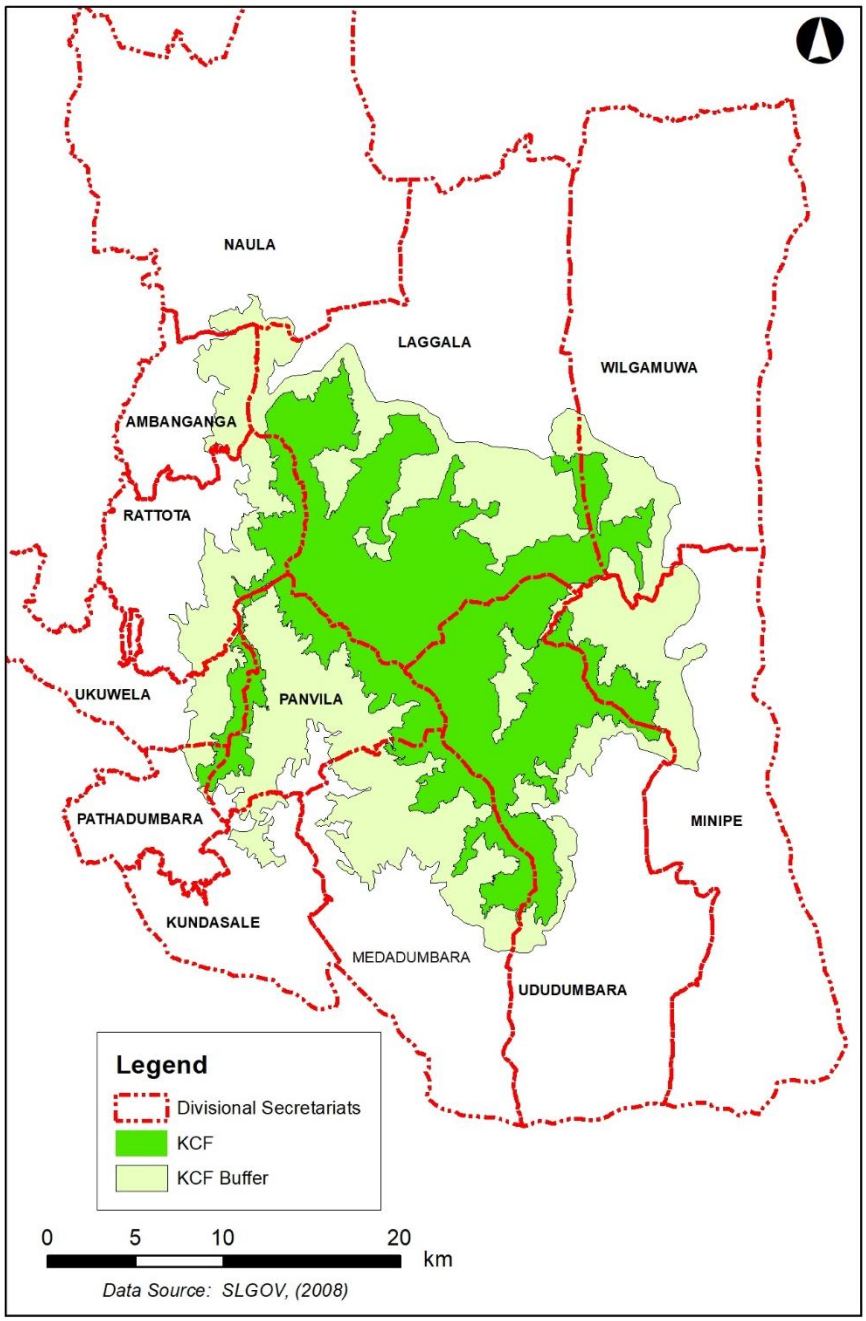

Figure 1. 3: Geographical Location of KCF and Buffer Zone

1.2.4. Distribution of Buildings

Some of the buildings that could be seen on the satellite images can be considered as dwellings, while many of them are various other buildings (Figure 1.4). Where dwellings are found, there are croplands within the KCF and are privately owned or encroached land. Many of the GN Divisions adjoining the KCF have dwellings outside the KCF boundary but some of the chena and paddy lands are located inside. On the whole, the dwellings are small in number due to the difficulty of the terrain.

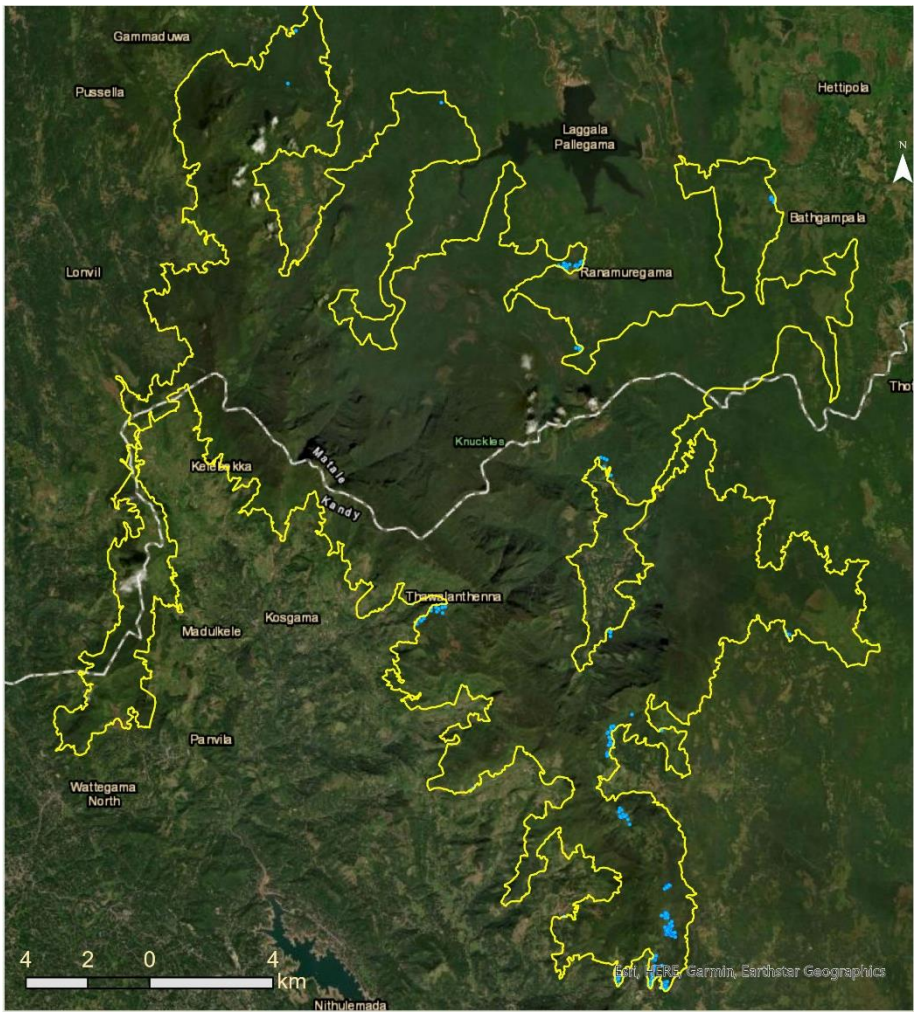

Figure 1. 4: Buildings Located within the KCF

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1.2.5. Land Use

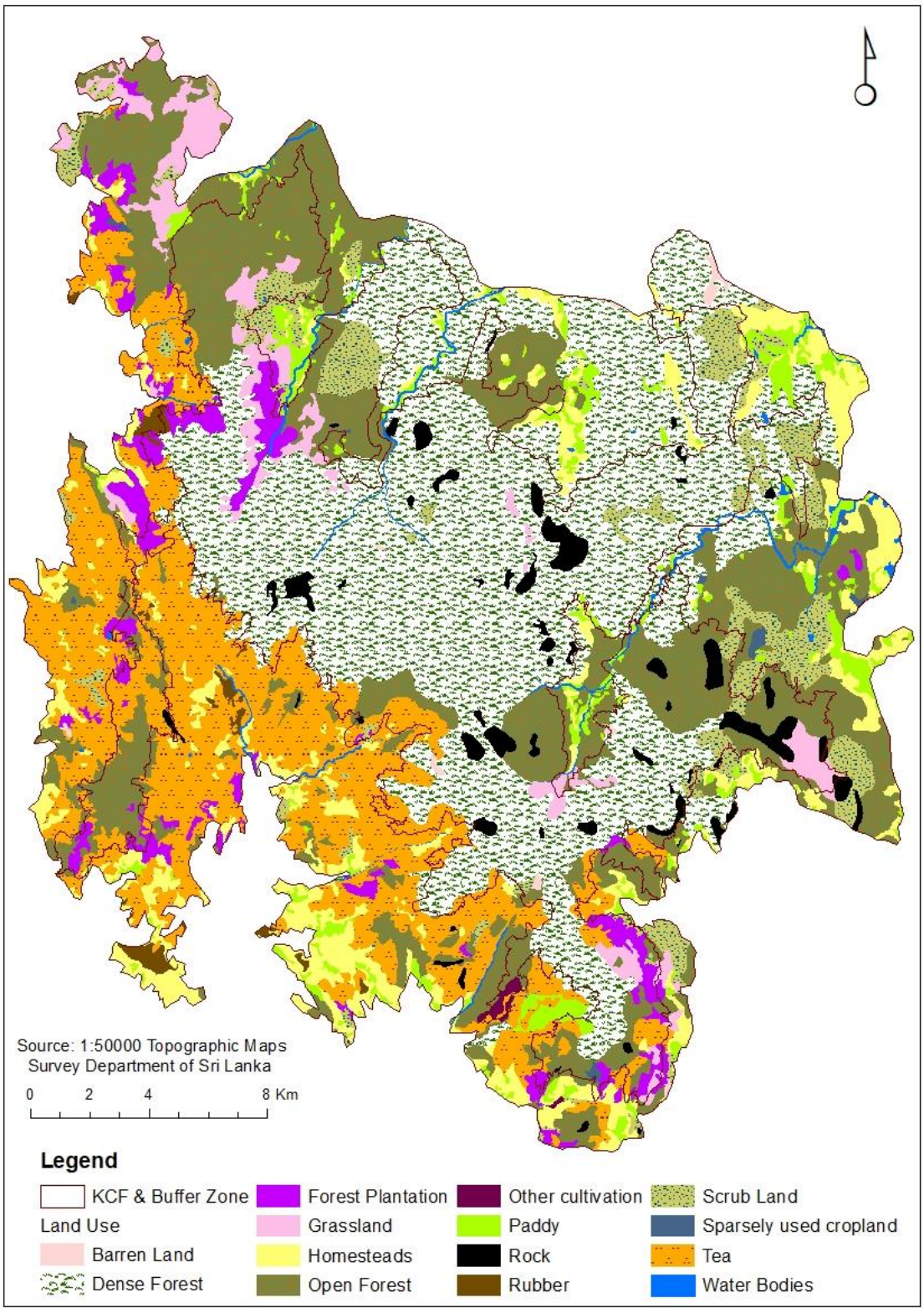

Figure 1. 5: Land Use in the Knuckles Conservation Forest Area and the Buffer Zone as in UNESCO Map

As can be seen from Figure 1.5 and Table 1.3, most of the human occupation is confined to the KCF buffer zone. But still there is some human activity either by the remnants of the small hamlets or the plantation companies. All existing plantations which account for 6.2% of the KCF area is owned by the government but now managed by plantation companies. The total area cultivated by people of remaining hamlets is only 1.2% or about 4 ha. Thus a 93% of the KCF is currently unused land. The forest plantations are Pinus and Eucalyptus which are alien to this environment. It has been proposed by the Forest Department to allow cardamom cultivation under their strict control in the pinus forests to prevent soil erosion and to promote some local tree cover.

Table 1.3: Land Use within the KCF

Land Use	Extent (ha)	Extent (Km^2)	Percentage
A. Vegetation			
Barren Land	40	0.4	0.13
Dense Forest	17760	177.6	56.67
Open Forest	6290	62.9	20.07
Scrub Land	1600	16.0	5.11
Grassland	1080	10.8	3.44
Forest Plantation	1000	10.0	3.19
Rock	1170	11.7	3.74
Water Bodies	80	0.8	0.25
Total Extent	**29020**	**290.2**	**92.6**
B. Cultivations			
Tea	1930	19.3	6.16
Homesteads	120	1.2	0.40
Paddy	160	1.6	0.50
Rubber	30	0.3	0.10
Sparsely used cropland	20	0.2	0.07
Other cultivation	60	0.6	0.18
Total Extent	**2320**	**23.2**	**7.4**

1.2.6. Biodiversity and Ecological Value including Watershed Services

Flora

Floristic diversity in the Knuckles area is found to be very high. Knuckles region harbours 1033 species of flowering plants of which 160 are endemic (Ekanayake, *et al.*, 1994). Eleven species of plants have been listed as nationally threatened and 25 species considered as globally threatened (Ekanayake, 1994).

The wide range of climatic and landscape features in the Knuckles region has resulted in a variety of natural vegetation types (Bambaradeniya and Ekanayaka, 2003). de Rosayro (1958) recognized three major forest formations in the Knuckles region. They are (a) Lowland tropical moist semi-evergreen forests (*Intermediate zone forests*), (b) Sub-montane tropical wet semi-evergreen forests (S*ub montane forests*), and (c) Montane tropical wet evergreen forests (*Montane forests*).

Lowland tropical moist semi-evergreen forests (Intermediate zone forests)

Tropical moist semi-evergreen forests are found within a relatively small area in the Knuckles region (Mimure, Pallegama and Illukkumbura). This forest differs from the true dry zone forests by having a number of facultatively deciduous species characteristic of this climatic zone (Ekanayake, 1994). The characteristic tree species in the lowland semi evergreen forests are *Felicium decipiens* (Sapindaceae), *Melia azedarach* (Meliaceae), *Semicarpus nigro-viridis* (Anacardiaceae), *Dimocarpus longan* (Sapindaceae), *Vitex altissima* (Verbenaceae), *Mangifera zeylanica (*Anacardiaceae) *Calophyllum tomentosum* (Clusiaceae) and *Nothopegia beddomi* (Anacardiaceae). Trees of this forest formation reach a height of 30 m. A canopy layer and a sub canopy layer could be recognized. The shrub layer has species that are also found in the dry mixed deciduous forests or Monsoon forests of the dry zone. *Memecylon umbellatum* (Melastomataceae), *Glycosmis mauritiana* (Rutaceae) and *Ardisia missionis* (Myrsinaceae) are characteristic shrub species of the understory (Balasubrmanium, 1988).

Sub montane forests

Wet submontane forests

Major portion of the wet sub montane forests have been cleared during the colonial period to establish tea plantations (Balasubrmanium, 1988) and hence very little wet

sub-montane forests remain in Knuckles region. They are mainly confined to Kelebokka area.

The dominant tree species of this forest community are *Cryptocarya wightiana* (Lauraceae), *Myristica dactyloides* (Myristicaceae), *Aglaia congylos* (Meliaceae), *Elocarpus glandulifer* (Elaeocarpaceae), *Litsea gardneri* (Lauraceae) in the canopy layer. *Hortonia floribunda* (Monimiaceae) is a common understory species in this forest. *Diplazium* spp (fern) and *Chloranthus glaber* are herb species in undisturbed submontane forests.

Dry submontane forests

Vitex altissima (Verbenaceae) is a constituent of this forest and it behaves as a deciduous species. The other species recorded from this forest formation are *Callophyllum lankiness* (Guttiferae), *Mangifers zeylanica* (Anacardiaceae), *Myristica dactyloides* (Myristicaceae), *Nothopegia beddomi* (Anacardiaceae), *Syzygium zeylanicum* (Myrtaceae) and *S. spathathulatum* (Myrtaceae). *Euonymus* sp (Celastraceae), and *Gnidia eriocephala* (Thymelafaceae) are shrubs occurring in this forest formation (Balasubrmanium, 1988). These forests are found in Udadumbara area

Montane forests

The structure of this forest is simple and is characterized by a single storied canopy layer and an undergrowth of *Strobilanthes* spp (Acanthaceae), *Indocalamus walkeri* (Poaceae), *Impatians* spp (Balsaminaceae), *Hedyotis* spp (Rubiaceae) and *Gaertnera* spp (loganiaceae). *Strobilanthes* spp. (Acanthaceae) is dominant at midlands. *Calophyllum walkeri* (Guttiferae), *Calophyllum trapzeifolium* (Guttiferae) and *Garcenia echinocarpa* (Clusiaceae) are the dominant tree species in the montane forests of the Knuckles region. Montane forests are manly found in Thangappuwa, Kalupahana, Selvakanda, Gombaniya areas. In sheltered sites the canopy layer may reach a height of 15-20m. They have an umbrella-shaped crown.

The other major vegetation types in the region are patanna grasslands and cardamom plantations. Most of patanna grasslands have originated on abandoned coffee and tea cultivation lands as plagioclimaxes which are maintained by frequent burning. These grasslands are mainly covered with *Cymbopogon nardus* (Holmes, 1951, Gunatillake *et al*., 2008). Patanna grasslands occur in areas such as Deinstone, Kumbukgolla and

Hunnasgiriya while abandoned cardamom plantations are found in Thangappuwa, Rangala, Kalupahana, and Corbat's gap areas. Although the high altitude areas in the Knuckles range remain as uninhabited wilderness, traditional human settlements occur along the narrow river valleys. The villagers are involved in the cultivation of paddy in terraced fields, supplemented with seasonal cropping. Commercial plantations of tea and cardamom are also located within the Knuckles forest range. Patches of plantation forest, dominated by pine (*Pinus caribaea*) are located in areas bordering the Knuckles region such as Hunnasgiriya, Loolwatta, Deinstone (Bambaradeniya and Ekanayaka, 2003)

Cardamom cultivation in this area dates back over 100 years (Sri Bharathi, 1988). Cardamom (*Ellettaria cardamomum*, Family: Zingiberaceae) was cultivated under the shade of canopy trees on sub montane and montane forests (900 m above msl) in the Knuckles region (Bambaradeniya and Ekanayaka, 2003).

Native to South Asia the perennial cardamom plant produces an aromatic berry that is widely used as an ingredient in cooking, confectionary and traditional medicine. The primary region for commercial cultivation of cardamom in Sri Lanka was in the Knuckles Mountain range, where 55% of the country's crop is harvested. About 2,721 ha of land in the Knuckles area was under cardamom plantation (Gunawardana, 2003) by the time it was banned in the year 2000 (Jayasinghe & Rambodagedara, 2016).

Fauna

Comparatively, little work has been carried out on the fauna of the Knuckles region. Invertebrate fauna in the Knuckles region is poorly documented. A survey concluded in 2004 has yielded in the recognition of 37 species of land snails (Table 1), of which 28 are endemic to the country (Ranawana, 2014). Butterfly fauna recorded in the Knuckles region amount to 118 species (Perera, *et al*., 2018).

Thirty two species of amphibians have been recorded from the Knuckles region, of which 25 are endemic to Sri Lanka and 19 are nationally threatened while eight are confined to the Knuckles region (Perera, *et al*., 2018). The critically endangered amphibian *Nannophrys marmorata* (Kirtisinghe's Rock Frog) which inhabits the rivulets that drip over rocky surfaces is found only in the Knuckles Region

Knuckles range harbours a rich diversity of reptiles. Of the 88 species recorded from the area, 44 are endemic; while 30 are nationally threatened (Perera, *et al*., 2018). Leaf-nosed lizard – *Ceratophora tennentii,* Knuckles Pigmy Lizard (*Cophotis dumbara*) Manamendra-Arachchi's Whistling Lizard (*Calotes manamendrai*) and Pethiyagoda's Crestless Lizard (*Calotes pethiyagodai*) are among the 13 endemic reptile species to the Knuckles range (Perera, *et al*., 2018). Of the 175 bird species recorded in the Knuckles region, 23 are endemic to the country and 17 are nationally threatened (Perera, *et al*., 2018). Sixty one mammal species have been recorded in the Knuckles region. Of these 12 are endemic and 24 are nationally threatened (Perera, *et al*., 2018). Although the large vertebrates such as the elephant (*Elephas maximus*), sambar (*Cervus unicolor*) and leopard (*Panthera pardus*) are not common in the region, other mammal taxa are found in considerable numbers.

The stream network of the Knuckles range (which flows to the Mahaweli River) harbours 35 fish species including 17 endemic species and eight Nationally Threatened species. Four species namely Phillip's Garra (*Garra phillipssi*), Blotched Filamented barb (*Dawkinsia srilankensis*), Martenstyn's Barb (*Systomus martenstyni*) and Knuckles Labuca (*Labuca insilaris*) are endemic to the Knuckles region (Perera, *et al*., 2018).

Table 1.4. Species richness, number of endemic and threatened animal species recorded from the Knuckles region

Category	Species	Endemic	Nationally threatened
Butterflies[1]	118	9	-
Molluscs[2]	37	28	-
Freshwater fish[1]	35	17	8
Amphibians[1]	32	25	19
Reptiles[1]	88	44	30
Birds[1]	175	23	17
Mammals1	61	12	24
Total	546	158	98

(Source documents: [1] Perera, *et al*., 2018; [2] Ranawana, 2014)

2. Situation Analysis

2.1 Methodology

Information gathering was done using field observations, stakeholder consultations, community meetings, consultation of Divisional Secretaries and their staff and the review of the available Resource Profiles (2021). We also conducted meetings with the community leaders. The details of these meetings are given in Tables 2.1 and 2.2.

Table 2. 1: Details of Participants to Stakeholder Meetings

SH Meetings	Date	Venue	Participants		Total
			Female	Male	
1. State officers	26.01.2023	District Secretaries Office, Matale	04	16	20
2. Community Leaders	09.02.2023	Community Hall, Narangamuwa	07	21	28
4. State Officers & Com. leaders	22.02.2023	Conference Hall, Ududumbara	23	23	46
5. State Officers & Com. leaders	29.02.2023	Tamil School, Kalabokka, panwila	9	18	27

Table 2. 2: Details of Key Informant Interviews

Meeting	Date
Meeting of Kandy DFO	23.01.2023
Meeting of RFO, Hunnasgiriya	23.01.2023
Meeting of Rattota DS	02.02.2023
Meeting with Rattota Land Use Officer	02.02.2023
Meeting with Laggala AD, Planning	02.02.2023
Meeting with administrative GN	02.02.2023
Meeting of Farmer association Secretary, Narangamuwa	03.02.2023
Meeting of DS, Minipe	03.02.2023
Meeting of Madadumbara DS	10.03.2023
Meeting of community leaders in Kalugala oya and Kalugala GN divisions	10.03.2023

The Resource Profiles for the year 2021 are the latest available data source which contains a wealth of information about the area by GN Divisions. Although this data has some errors, it is still the best available source of detailed statistical data about the

area. To supplement this data rapid surveys were conducted in all nine DS Divisions within which the KCF and the buffer zone are located (Tables 2.1 and 2.2). The stakeholder meetings with the Government officers were quite illuminating and helpful in grasping the actual ground situation. Informal discussions we had with the people were more productive than the public meeting.

Other than the first workshop held in Medadumbara which had the participation of only 22% female participants, all the other workshops had a well balanced participation of both genders enabling a discussion of concerns both genders. However, the main themes came up for discussion are not gender specific but more about the economic situation, particularly the livelihoods of the people. This was expected in a climate of economic down turn experienced during the post-covid period.

Some of the participants indicated they are now attempting to cultivate cardamom in private lands (i.e. home gardens) outside the KCF. Some have already started cultivation of cardamom in their home gardens. The cultivations we observed in Narangamuwa and Kalugala appear to show the potential but they have not reached the harvesting levels yet. The farmers were keen to obtain expert advise on this. Since the people are used to cultivate cardamom for a long time they have the knowhow but they are not sure about the suitability of the climate in the low-lying areas.

Our observations during interactions with the people also indicated that some of the information they provided is unreliable. This is because they have assumed that there is an opportunity to receive financial support. Various aid programmes have left the people to develop an increasingly dependency mentality. There is a need to break this trend so that they will work towards a degree of independence and self-reliance. The dependency mentality is a barrier to any realistic development of the area. The people of some GN divisions are locally known to be totally dependent on the handouts from various donors and the Government. Some of the Samurdhi recipients are not entitled to receive Samurdhi benefits as far as the eligibility criteria are concerned. Only the segment of population which is really poor are the estate workers of the area. They do not have their own land, proper housing and sanitary facilities. Their nutrition intake is also low.

2.2 Key Findings from baseline Study

2.2.1 Environmental Issues

- **Illegal activities related to livelihood activities:** Several common livelihood activities of the people in this area were identified. Clearing of land for cultivation is prominent among them; *chena* cultivation inside KCF by the people either living inside the KCF or in adjoining areas. This practice prevalent despite the law enforcement efforts by the officers of the Department of Forest Conservation. Another highly destructive practice is setting fire to grasslands for collecting firewood, hunting animals or protecting crops from wild animals, such as porcupine (*Hystrix indica*) and wild bores (*Sus scrofa*). Extraction of forest products such as wines for preparation of ladders to climb kithul trees (*Caryota urens*) is a serious problem in some villages where kithul tapping is prominent. However, it is noted that such activities are confined to a few geographical areas in the Knuckles landscape.

- **Decline of species diversity:** Kithul, Nelli (Phyllanthus emblica), madu (*Cycas* spp.) and veralu (*Elaeocarpus serratus*) are some important varieties of trees which support the livelihood of people around Knuckles landscape. But these resources that are used to be widespread in the forest periphery and home gardens are disappearing fast. Kithul trees have become a target of elephants and even humans for the production of furniture and used as materials for construction of houses. Decline of Nelli and Madu are said to be related to human activity near the forest periphery. Populations of honey bees (mainly *Apis cerana*) have also gone down according to the villagers.

  The crop diversity of this landscape has also gone down leading to widespread mono-culture based commercial farming. Cultivation of local varieties has been almost completely disappeared with the introduction and popularization of hybrid crop varieties. However, there are a few well to do entrepreneurs from outside cultivation local varieties for a niech market in the country and abroad. The ordinary farmers do not have the necessary infrastructure to produce/market should produce at present. As a result, more popular monoculture is practiced with the aid of agrochemicals for the mass market.
  This is commercially more attractive but in some seasons marketing of the products appear to be difficult due to the over production. Marketing problem affects all farmers in general but there seems to be some developments that can be described as positive developments. It was revealed at the meeting with the farmers of Narangamuwa village that the farmers are provided inputs for cultivation of certain crops and with the assurance of purchasing the harvest. A trader in Dambulla Economic Centre distributes necessary inputs at the beginning of the season and purchased the produce from the contracted farmers. Even though the cost of inputs is deducted from the final payment, the farmers say it is more profitable that system they had earlier. This solves one of the

biggest problems in rural agriculture and can be considered a sustainable practice because most farmers did not get a good income either due to lack of marketing facilities in the area earlier.

Market for Kitul products has also improved in the recent past, but the lack of Kitul trees is the major problem in the area. Cultivation of Kitul should follow hand in hand with the development of small-scale industrial facilities in the local area to process Kithul sap to achieve high standards required for the export market. Most villagers who engage in this industry do not maintain production standards and tend to get better price by means of cost reduction through adulteration of the product. These practices could kill the appeal for these products in the long run.

- **Land degradation:** Soil erosion, declining water holding capacity of soil, declining soil fertility are the prominent components of land degradation in this area, particularly under seasonal crops. It is also widespread in poorly managed tea estates. The tea estates were observed are mostly old plantations where soil conservation is not practiced despite the fact that they are deemed uneconomical. Only a couple of plantations have started replanting, while others are totally abandoned. Soil erosion studies done in the past show that the poorly management tea plantations in the upcountry areas are experiencing high rates of soil erosion, while erosion under well management tea is minimal.
- The Knuckles landscape is spread in two climatic zones, Intermediate and Wet Zones with the largest area in the former. Though the areas in the intermediate zone receive moderate rainfall, its intensity is said to have increased in the recent period. The wet zone areas receive high rainfall. Mountainous nature of the terrain and lack of proper land management practices are the causes of accelerated soil erosion. In addition to that, plantations of *Pinus* in some lands in the forest periphery, and the citronella first introduced as a soil restoration measure has increased soil erosion and landslides due the frequent forest fires in those areas. Burning of litter layer during the dry season, exposes soil to erosion.

- **Waste management problems:** Two types of waste are discharged into the environment, sanitary waste disposal mainly in estate worker settlements polluting the water sources of the area and haphazard waste disposal mostly by local tourists. Most estate worker settlements are of poor quality, confined to small area and lacking in sanitary facilities. Both domestic waste and sanitary waste are disposed into the land around the settlements. Estate management or the government pays little attention to this problem. The quality of the water in the downstream areas needs to be tested for to determine the suitability of the water for human consumption.

The local tourists arrive in the area in large numbers. However, there is no proper waste management plan in operation and cooperation from the tourists, particularly the Sri Lankans is also very poor. At present waste is collected and disposed by the personnel of the Forest Department who have volunteered to do this. This is not a sustainable practice.

- ***Forest Diebacks and Spread of Invasive Species***

1. Spread of invasive species: Several invasive plant species were identified during the rapid field survey in the KCF. These species are given below with their specific habitats.

    - *Ageratina riparia* (=*Eupatorium riparium*) (road sides; forest/road side borders)
    - *Austroeupatorium inulaefolium* (degraded grasslands)
    - *Miconia crenata* (= *Clidemia hirta*) (Road sides/ forest ecotone)

PLATE 3.1: A Forest Dieback (View from the Main Road to the west of Riverston

Forest diebacks were observed in the Denaston and Riverston areas. The dieback areas have now been taken over by invasive plants mentioned above.

2.2.2 Socio-economic issues

- **Crop damage by wild animals:** Villages along more than half of the Knuckles perimeter encounter human-wildlife conflict (HWC) leading to a damage to crops and other assets. Elephants (*Elephas maximus maximus*) are the most destructive animals in this regard. In addition to it, Toque Macaques (*Macaca sinica*), wild boars, deer species such as barking deer (*Muntiacus muntjak*) , porcupines, peacock (*Pavo cristatus*) and white-spotted chevrotain/meminna (*Moschiola* spp.) cause severe damage to crops. Crop damages done by toque monkeys are wide-spread in the entire Knuckles landscape. Although killing of some animals who damage crops is legal, the scarcity of firearms means it cannot be implemented. Exact percentage of crop damage by wild animals is not known but it appears to be substantial.

- **Land Hunger:** Local people living around the forest hold the view that they do not have enough land to cultivate and also for their children and grand children. Villagers expect the government to provide land to the future generations despite the fact that all of them do not intend to remain in the village and practice agriculture. There should be a change of attitude of the villagers. Because of the traditional practices, continuous fragmentation of agricultural lands is a growing problem.

- **Poor state of infrastructure:** Roads near the forest areas are in a poor state. Owing to this travelling by vehicles has become tiresome and costly as a result. On certain days the existing roads are blocked by large tour busses according to the information provided by the local officials. We also observed deteriorating state of the roads of the area. These roads are narrow and not suitable for long passenger transport vehicles. There is a need for a solution to this problem.

- **Poverty:** Poverty is not visible in most rural areas. But a high percentage of villagers receive assistance from social safety net- Samurdhi. Most poverty assessments use the number of Samurdhi recipients as a measure of poverty in an area According to Resource Profiles, more than half of the population in the villages receive Samurdhi. It is even 100% in some villages. During the discussions we had with the villagers, it was revealed that they do not need it but since it is given they take it. That shows that the Samurdhi system is not performing what it intended to do. However, poverty is quite visible among the estate workers.

- **Drop out from schools:** This problem is found mainly in the areas where estate people are living. Children appear to abandon school education before completing the mandatory period due to poverty. Inability to provide sufficient

food, unaffordability of expenses and using children to earn an income have led to this situation. Though using child labour is illegal, it is widespread in the area.

- **Low contribution of tourism to local economy:** During the recent past, tourism has generally declined in the Knuckles periphery owing to travel restrictions during the Covid pandemic, and economic downturn that followed. Even during the times of tourism boom, its contribution to the local economy was low. The habit of local tourists of bringing food and many other things they need contributes little to the local economy. The small-scale tourism business activities of the local people also cannot compete with more established operators in the area who have better facilities for the foreign tourists. There are no sales outlets strategically located which stock good quality local products for both local and foreign tourists The practice of adulteration of local products to make a quick profit is a major barrier to sustainability of local industries.

- **Disappearing of traditional knowledge:** Most of the traditional seed varieties together with their cultivation methods and skills are disappearing. The rural farmers switching from traditional crops to cash crop cultivation in home gardens is clearly visible. The dominant crops cultivated are pepper (*Piper nigrum*), cardamom (*Elettaria cardamomum*), tea and vegetables in addition to paddy. Skills in traditional crafts, such as reed basket weaving, weaving mats, etc. are also disappearing. However, traditional products may not bring enough income to the people and better income generating activities are preferable. But a selected few with the necessary skill may be able to engage in producing and marketing such products.

- **Lack of an overall policy to manage the buffer zone:** The Knuckles management plan prepared in 1994 recognized the 3,500 ft (1067 m) contour as the KCF boundary and the area between 2,500 ft (757 m) and 3500ft the 'buffer zone' and made recommendations to implement development activities. However, when the KCF was declared in 2000 a legally designated buffer zone was not included. Later when the application to UNESCO to inscribe the KCF in the World Heritage Sites List, was submitted a buffer zone was given around the KCF. However, the 35,074 ha buffer zone still does not have a legal status, which is a policy gap to implement a landscape management plan.

2.2.3 Findings of Stakeholder Discussions

The following section analyzes and describes briefly the data generated through takeholder meetings under five themetic areas. In contrast to the SGP Op 6 baseline study, this study did not focuss on the four zones seperatly, but focuss is on the entire Knuckles landscape. However, it is interesting to note that some information re-confirms the GEF 6 baseline study findings and their continued existence though the time gap between two studies is about five years.

In GEF Op 6 study for two Zones the highest values were recorded for governance and other two zones for landscape diversity. In this study, the highet values were recorded for the livelihood, landscape diversity, agro-biodiversity and governance and social equity respectively. Covid 19 and economic crisis happened after 2018 (after GEF 6 study) might be the main reason for this change. All the meetings highlighed livellihood issues the people have while landscape diversity was religated to the second place. This change however, does not indicate that the landscape diversity issues are not important.

Figures 2.1 and 2.2 show that the average values received for Livelihood and socio-economic conditions range from 0.47-4.76 showing the overall average of 3. This indicates that socio-economic conditions in the area should attract the attention of planners and development workers. It is more than the 2018 situation reported by GEF 06 study. Lack of employment, crop damage by wild animals, weak road network are linked to the economic crisis directly or indirectly. Lack of emloyment opportunities in construction and related industries in urban areas could be the main reason. This could be on par with the national conditions.

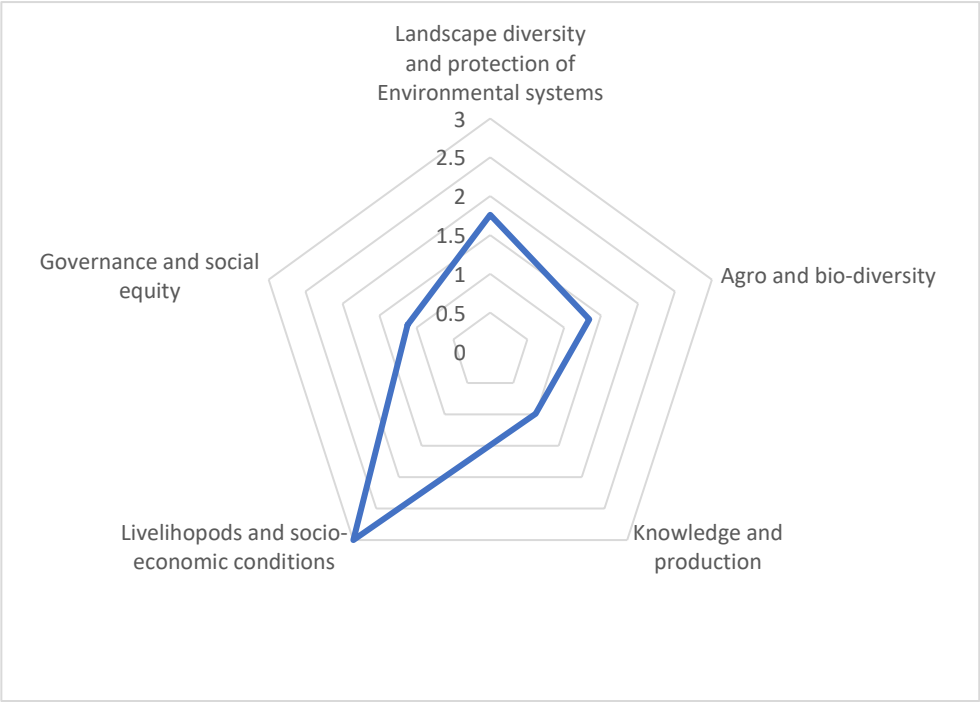

Figure 2. 1: Radar Diagram under Five Thematic Areas

Landscape diversity received the second highest score ranging from 0.41 to 2.35 with an average of 1.7. It appears to be still important as much as what it was in 2018 but its relative place has gone down compared to the socio-economic condition. Damages caused on some environmental systems, soil erosion, decline of soil fertility are main reasons.

Third position reported by the agricultural diversity including the bio-diversity. Its lowest value exits at 1.65 and the highest value 3.35. The lowest value here is higher than other areas of concern which indicates that nobody has replied to that question as considering that it is not relevant. That means the people of the area view that there is no issue of declining bio-diversity. It may also have been that the people did not comprehend these technical questions in order provide an answer.

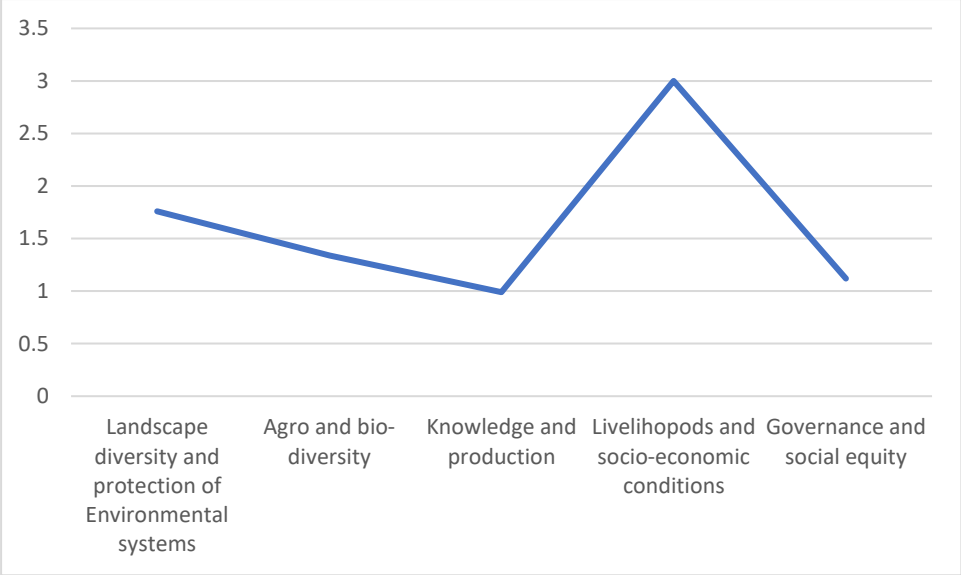

Figure 2. 2: Mean Score Received for each Thematic Area

Governance and social equity received the third place ranging its value from 0.65 to 1.71 with an average of 1.12. People claimed that there is preferential treatment to some persons. It shows that equal opportunities are not available all sections of the people in the society.

Knowledge and innovations received the last place. The values ranged from 0.6 to 1.76. Knowledge on management activities in Knuckles and the use of fertilizer received relatively a higher score inviting some interventions. Even passing of traditional knowledge to the younger generation was not considered a high priority.

2.2.4 Summary of Overall findings from the workshop scores, post workshop discussions, and individual and group discussions

- **Understanding Landscape Diversity:**

Understanding and appreciating landscape diversity varies considerably, with scores varying from very low to very high even within the same area. Consultations with private sector landowners and preliminary interviews with key informants in the area revealed that local knowledge of biodiversity is considerably diminishing due to outmigration, and disengagement from traditional livelihoods typical to the area, especially among young people. The importance of fostering localised knowledge, that is to say, greater understanding of unique local features was highlighted as a necessity. This also links to the declining traditional knowledge of biodiversity and the absence of concerted efforts to document and transmit this knowledge.

2.2.4 Summary of the Current Status of the Issues Identified in the GEF OP 6 Landscape Strategy Baseline

This summary is the current state of the baseline situation in comparison to the baseline set at the beginning of the GEF OP 6 baseline. As can be seen from Table 2.3, some issues seem to have diminished in their severity. The magnitude of the issues in terms of their severity is categorized into Low (l), medium (M) and high (h). At the same time we identified new issues which may have been missed in the previous baseline. The comparison was done on the basis of expert opinion after reviewing the information provided by the participants of the meetings conducted with the community and the other stakeholders including the government officers.

Table GEF 6 LS STRAEGY: Issues Identified in GEF OP 6 and Current State

Key-Issue	Sub-Issues	Magnitude	Remarks
1. **Productivity fluctuations**	1.1. Landscape degradation	H	Abandoned tea lands in estates, pine plantations without undergrowth and Citranella grasslands with evidence of rill and gulley erosion. Both Pinus plantations and citronella grasslands are subject to annual fires.
	1.2 Climatic variations,	H	Seasonal differences, increased rainfall condition
	1.3 Lack of appropriate planting material,	M	This does not seem to be a grave problem
	1.4 Inadequate knowledge,	H	Lack of knowledge to continue traditional employments and crop cultivation and also poor knowledge in modern agricultural technology
	1.5 Lack of advanced technological intervention,	H	Advanced technological interventions are not embraced by local people. There are no agro-based industries in the area.
	1.6 Price fluctuations	M	This is a common pattern during harvesting season.
	1.7 Lack of proper marketing avenues	H	Remoteness and transportation difficulties have created this situation, for example throwing away of milk in some days since milk collection is irregular. The worst is with goat milk for which no demand exists there.
	1.8 Encroachment of forest lands including clearing for agriculture, Cardamom cultivation	L	Severe in some geographical areas such as Udagaldebokka. This is no longer relevant inside the forest, the recent trend is to cultivate them in home gardens
2. Illegal activities related to income and livelihoods	2.1 Gem mining	L	Not observed during the field survey
	2.2 Unsustainable exploitation of non-timber forest products	H	This we observed in several villages.
	2.3 Deliberate setting of forest fire	H	There is no change during the last few years.
	2.4 Cutting saplings for stakes for bean and tomato cultivation	M	

Key-Issue	Sub-Issue	Magnitude	Remarks
3 **Soil and water pollution**	3.1. Excessive use of agrochemicals	L	Increase in the prices has led to low use
	3.2 bad agricultural practices that causes soil erosion,	M	Cultivation of short-term crops, cultivation of cardamom at Home Gardens with removing undergrowth
	3.3 Improper waste management, especially from unregulated tourism activities and lack of sanitation at estate worker settlements.	H	Waste collection in some of the tourist areas
4 **Inaccessibility to farming lands inside the forest boundary**	4.1 Traditionally cultivated by local communities (paddy in particular) before the KCF was declared	H	This issue regarding paddy cultivation seems fading away. Only a few people are still practicing this unsustainable cultivation method.
	4.2 increasing preference for short-term yield varieties	L	This can be a solution to water shortage. Analysis of rainfall data has to be done to assess the rainfall trends.
5 **Degradation and loss of wildlife Habitats**	5.1 Expansion of human habitations and agriculture	M	Paddy is still cultivated but chena cultivation is not allowed.
	5.2 Waste disposal	H	Lack of facilities at tourist areas and lack of systematic waste collection system Lack of sanitation facilities in estate worker settlements
	5.3 Human-wildlife conflict	H	Crop damage is a major problem Elephants coming to villages is another problem despite erection of electric fences

	Key-Issue	Sub-Issue	Magnitude	Remarks
6	**Spread of invasive plant species**	6.2 Habitat degradation and change	H	Common along road sides and in areas of forest dieback
7	**Expansion of cardamom cultivation**	7.1. Removal of understory	L	Since cardamom cultivation is no longer practiced
		7.2 Preventing forest regeneration	L	This was not observed
		7.3 Cutting trees for timber and poles & firewood	M	There is a reduction in this practice but not totally stopped
		7.4 Loss of forest structural complexity	L	
8	**Different forms of land ownership and fragmentation of landholdings**	8.1 Numerous types of unsustainable ad-hoc development	H	Construction of Tourist buildings not compatible with the landscape
		8.2 Encroachment	M	There is a reduction
		8.3 Intentional forest fires	H	There is no change
9	**Unsustainable land management**	9.1 Land use practices and land degradation	H	Unproductive and abandoned tea plantations and pine plantations
		9.2 Drying up water sources,	L	Not evident at present
		9.3 Increasing vulnerability to climate change impacts	M	An increase in rainfall is reported. This affects the pepper harvest negatively.
10	**Unsustainable extraction of forest product**	10.1 Forest Degradation	M	This has become a minor issue now
		10.2 Exposing slopes and leaving them vulnerable to erosion and drying,	H	Cleared *chena* land, pine forests and Citronella covered areas are prone soil erosion
		10.3 Impacting habitat for ecologically sensitive endemic species,	M	KFC is a supper biodiversity hotspot. Most of the threats described and illegal entry into the KFC are problems.
		10.4 Drying up water sources, and increasing vulnerability to climate change impacts.	M	This is contrary to the impression we got. Need to examine long-term rainfall data.

Key-Issue	Sub-Issue	Magnitude	Remarks
11 Over use and commercial-scale extraction of water	12.1 Increased demand for water	L	Also there is increased supply of water in the low-lying areas after the completion of Kaluganga and Moragahakanda reservoirs.
12 Large-scale gem mining	12.2 Degrading streams	L	Not observed in this area
	12.3 Loss of aquatic biodiversity	L	Need to study this. People did not report this.
	12.4 Blocking natural elephant corridors	M	The electric fences & deforestation in the area outside KFC restrict elephant movement
13 **Abandoned tea plantations**	13.2 Soil erosion	H	As described above
	13.3 Declining productivity	M	A successful partnership of a trader and farmers was found in Narangamuwa. The farmers received agricultural inputs and the harvest bought at an assured price after deducting the cost of inputs. This model seem to be workable.
14 **Lack of proper waste disposal measures**	14.1 Degrading streams and rivers and the biodiversity	H	Households (without sanitary facilities living adjoining line settlements of estates) cause water pollution in streams
15 **A large influx of tourists**	15.1 Pollution	H	Due to the disposal of sanitary and other waste into the environment
	15.2 Ecosystem degradation.	M	Addressed this issue earlier
16 **Lack of demand and market value**	16.1 small scale and niche crops are lowering economic benefits	M	This cannot be confirmed

NEW ISSUES

Key-Issue	Sub-Issue	Magnitude	Remarks
1. Forest Dieback	1.1 Loss of biodiversity	H	Newly observed problem. It is not widespread at present. But with time it could become a major issue.
	1.2 Spread of invasive species	M	This confined to road side areas and forest dieback areas
	1.3 Habitat Change	M	Deforestation in the nominal buffer zone
	1.3 Change in faunal composition	M	
2. *Pinus* plantations	2.2 Forest Fire		Need to promote undergrowth
	2.3 Absence of an undergrowth		
	2.4 Has become an invasive plant		
	2.5 Fire during dry season		
3 Citronella (*Cymbopogon nardus***) Spread**	3.1. No ecological or economic value at present	H	Economic utilization will help control fire
	3.2 Supress forest regeneration	H	Main reason is fire
	Colonize the open up areas (forest gaps) in the forests	H	Has become an invasive species and it was introduced to the area by planters.

3. Landscape-scale Approach to Conservation of the KCF

3.1 Justification for landscape-scale conservation in the Knuckles Conservation Forest

The Knuckles area represents one of the major sub-watersheds of the Mahaweli Ganga. It is an important source of water for the Dry Zone development. The recipients of this water includes a range of stakeholders, including local and national interests. Within

the KCF and its buffer zone, the people who live there and earn a living depend on the availability of water in the upper catchments for domestic use and irrigation, and other daily needs. There are also several national level companies which collect and bottle mineral water for sale across the country. Thus the lowland dry zone as well as the national economy depends on the Knuckles landscape for its water resources. From this perspective the community of stakeholders become much greater and diverse.

The Knuckles is the source of water for the human habitations, agricultural fields, reservoirs, and national parks such as Wasgamuwa that surround the mountains (Figure 3.1). Loss and degradation of the forests in the Knuckles mountains will, therefore, will impact a wide range of stakeholders. Furthermore, some of the ongoing nationally important projects such as the Moragahakanda, Kalu Ganga, Victoria, Randenigala and Rantambe reservoirs depend on the watershed services of the Knuckles range.

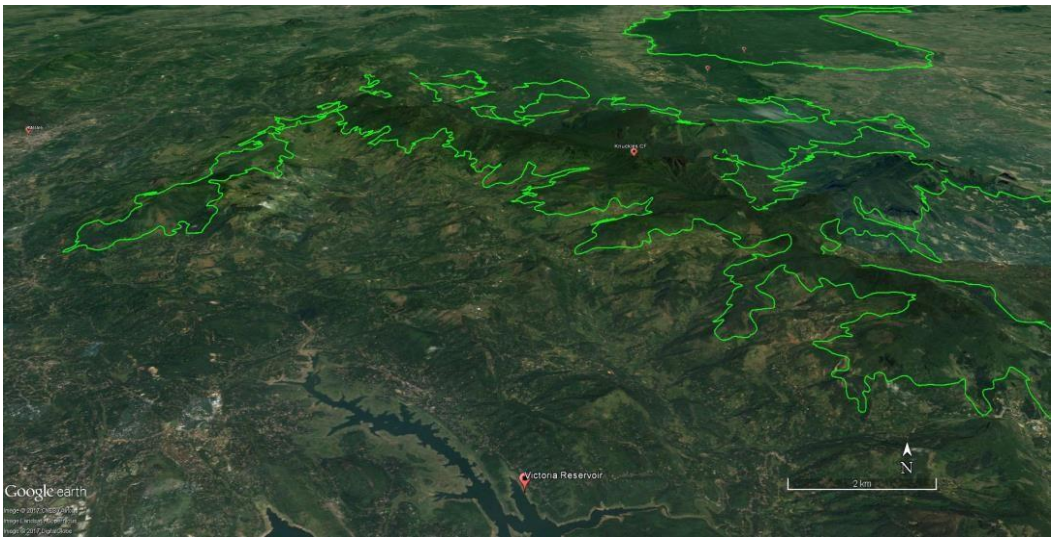

Figure 3. 1: Google Earth image to show relative ecological links *between the Knuckles Conservation Forest area and the surrounding human habitation, agricultural areas, and protected areas. The Knuckles mountain range is the water tower for these surrounding areas, and supply the necessary water to suppose ecological and human communities. Without a landscape-scale analysis these ecological links that should be conservative imperatives will not be considered for lack of perspective.*

Consultations with the people and the Divisional Secretaries and other government officers indicated that forest fires, mostly caused intentionally, are still a problem and have destroyed forests in the Meda Dumbara, Uda Dumbara, Minipe, Wilgamuwa and Laggala Pallegama Divisional Secretariats. Degradation of the watershed areas in the Meda Dumbara and Uda Dumbara areas due to these fires can affect the viability and longevity of the Victoria-Randenigala-Rantambe reservoirs, if environmental flows in the rivers that supply the reservoirs are lost.

At the institutional level, the major water users are the Ceylon Electricity Board for power generation, the Irrigation Department and Mahaweli Authority for irrigation. The beneficiaries are not confined to the local people but the national economy as a whole. As a result, the major interests at the institutional level should also play a part as the stake holders in the protection of the Knuckles landscape.

The forests in the Knucles area connect Wasgamuwa National Park and Victoria, Randenigala and Rantambe (VRR) Sanctuary (Figure 3.2). Elephants frequent the northern sections of the KCF, especially in the Laggala-Pallegama and Wilgamuwa areas, which have forest connectivity with Wasgamuwa, known for its elephant populations. The general belief is that the elephant move from Wasgamuwa National Park and move up to the VRR Sanctuary and back using the Knuckles forests as a corridor. While research is needed to confirm these observations, the forest connectivity should be maintained as a 'no regrets' strategy. Loss of this forest corridor due to agriculture or settlement could result in a greater human-elephant conflict. Furthermore, it is important to conserve the ecological gradient from montane to lowland, especially since strategies to build climate resilience in ecological communities recommend maintaining such 'climate corridors'.

Conservation strategies within the KCF should also, include ensuring 'landscape connectivity' within the upper elevation zones. Forest fragmentation within the Knuckles is isolating populations of larger species, including leopards, sambar, barking deer, and forest birds, lizards, and butterflies. Forest conversion and degradation affects endemic species, restricting them to small habitat patches that are susceptible to 'edge effects' that cause environmental changes inside the core areas, and thereby the species. Thus, a forest conservation plan for the KCF has reduced most human activities to a few isolated locations. These are traditional villages which have become untenable because the facilities, such as education, transport, health, employment opportunities, utilities, such as electricity and water cannot be provided to

these communities. The remaining few should be encouraged to leave for a better area and facilitate their transition to a new livelihood. Such a move will prevent further damage to the forest.

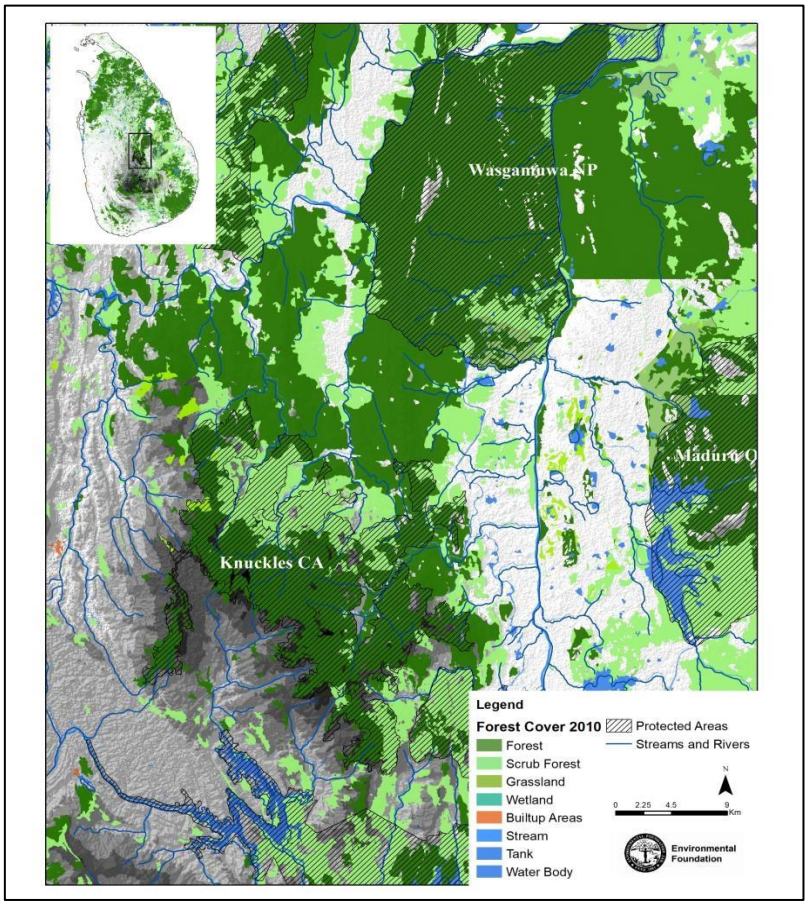

Figure 3. 2: Map showing forest connectivity between Knuckles Conservation Forest and Wasgamuwa National Park, and river connectivity with the reservoirs. The green areas indicate forests and scrub.

The degraded lands that can contribute to connectivity through restoration should be identified using spatial planning. Community-centred conservation efforts aligned with extant local livelihoods must be actively mobilised towards this effect, enhancing awareness on the importance of interlinked ecosystem services.

Thus, overall, a landscape-scale approach to ensure effective conservation of the Knuckles landscape should include the following:

- A spatial analysis to identify the ecosystem services accrued by the communities and their livelihood activities within the KCF and in the surrounding area of influence, including in the lowlands. It is important that all

efforts should be made to encourage those still living in within the KCF to move to areas with more facilities and employment opportunities.

- A spatial analysis to identify the ecosystem processes that maintain the natural communities and focal species (e.g.the endemic species, habitat specialists, threatened and endangered species) in the Knuckles area, and the habitat requirements to maintain these communities and species populations.
- A spatial analysis to identify the ecological linkages between the Knuckles and the ecosystems in the lowlands.
- A conservation strategic plan and landscape and site-scale interventions through a science-based analysis with stakeholder consultation.
- A baseline survey towards obtaining spatial data on livelihoods (particularly the informal sector), community-environment relationships, natural resource use and mapping extant community-driven conservation efforts.
- Reforestation of the land acquired around the Kalu Ganga Reservoir and the strict management of the watershed areas of the these two reservoirs for their sustainability.

3.2 Strategies, Outcomes and Impact Indicators for landscape-scale conservation in the Knuckles Landscape

The strategies and interventions will have both, top-down and bottom-up elements in the planning and implementation process. Thus, while the landscape-scale approach will seek to streamline large scale processes in an integrated, interdisciplinary manner combining natural resource management with environmental and livelihood considerations, the challenges within the KCF and buffer zone areas lie in reconciling the optimal nexus of cultivation, the burgeoning tourism sector, and conservation of some of Sri Lanka's irreplaceable biodiversity and critically important ecosystem services—sustainable water, pollination and slope stabilization to prevent natural hazards and disasters—for communities, including those located far beyond the boundaries of the Knuckles landscape. These interactive dynamics relating to land and natural resource use must be addressed in a way that fosters greater local awareness, community stewardship, and does not alienate local residents, which was raised as a concern during stakeholder consultations.

The landscape-scale approach and the recommendations for community projects have been identified within the context of: existing policy and laws; important biodiversity and ecological conservation needs, especially in terms of providing ecosystem services to the communities; and enhancing local participation in the development of community-centred and driven conservation initiatives, mindful of ensuring gender equality whereby women's participation is encouraged at all levels from inception to implementation, and generating sustainable localised opportunities for securing livelihoods and enhancing economic benefits for communities while preserving the ecological value of the area.

The present attempts at conservation in the KCF and buffer zone have been topdown to a certain extent but a movement towards bottom up approaches, with the involvement or engagement of the local communities. Willingness to further seek collaboration and community level management should be explored. There are many economic activities that can enhance the current livelihood activities of the people through collaborative programmes. In this regard the willingness on the part of the Forest Department to allow pilot projects to cultivate cardamom in Pine plantations can be considered a radical departure from the old policies. This will help control fire in pine plantations and allow other forest species getting established.

3.3.Typology of Community Projects

3.3.1 Recommendations for Project Interventions

Recommendations for a landscape-scale conservation management strategy and approach of the KCF and buffer zone to address these key issues are discussed in this Section.

1 Increased forest protection, and restoration in key areas that increase ecological connectivity, restore ecological integrity of forests and soils, and ensure sustainable provision of ecosystem services in line with existing community knowledge and traditional initiatives pertaining to conservation and landscape restoration;

2 Conserve representative biodiversity with a focus on the irreplaceable endemic and endangered species and control the spread of invasive species;

3 Improve and enhance livelihoods and localised income generation opportunities centred on the pillars, environmental, social and economic sustainability through sustainable agricultural systems and alternative livelihoods informed by traditional

knowledge and methods, and environmentally-sound innovations that rely on sustainable forest resource uses and natural resource conservation;

4 Strengthen institutional structures and governance mechanisms for better, responsible natural resources management and greater community participation in the development and implementation of local conservation plans and initiatives;

5 Regulations to govern and determine exploitation of natural resources and ecotourism activities which seek to empower, and not marginalise local communities;

6 Build climate resilience and reduce vulnerabilities from natural disasters through better, community-driven ecosystem conservation and resilience building; and increased environmental awareness among local communities and other stakeholders through knowledge transfer and exposure and documentation of extant traditional knowledge.

7 Geared to ensuring gender equality and emphasising the participation of women and youth at all stages, in relation to the documentation and adaptation of traditional knowledge, development and implementation of localised conservation plans and initiatives, and within the scope of livelihood efforts.

8 Allowing communities in the area to use the pine plantations for cardamom cultivation for a limited period until the other forest species take over.

9 Harvesting of citronella for the production of citronella oil. This will reduce the occurrence of fires in these areas by reducing combustible material. At present citronella is spreading like an invasive species.

10 Prevention of water and soil pollution in the forest areas near the estate worker settlements by improving sanitary facilities and through education. A sanitary domestic water disposal system should be developed with the participation of the community. The stream water in the area is considered to be polluted by faecal matter because these settlements are located on the high elevations and the waste is disposed in a haphazard manner.

11 National level tourism industry should make an effort to develop ecotourism in the area with the participation of the community. For this local infrastructure development should be done preserving the traditional landscape. Currently the local youth who received training as guides do not have the necessary language skills. What is practical is to have national level guides to accompany tourists to

the local area and work with the local guides. A partnership should be developed between the two parties so that one party does not exploit the other.

While many interventions will be implemented at local scales with community engagement, the following outcomes and types of project interventions are proposed as complementary and synergistic contributions to achieve the landscape-scale targets. It is essential that the community is consulted from inception in order to assure a defined role for the community in carrying these actions forward in line with the pillars of economic, social and environmental sustainability. While the following table summarises the type of interventions, the **Annex 2** will provide more details along with maps for particular intervention.

3.4. Outcomes and Impact Indicators

Project typology and interventions needed	**Impact Indicators**
Outcome 1 : Manage the Knuckles landscape through a "public–private partnership" *Key Stakeholders: Forest Department, Divisional Secretariat representatives, other government stakeholders, private sector and local community representatives* Target area: Entire landscape of Knuckles KCF and the boundary	
1. Support at least 2 consultative workshops (Kandy and Matale Districts) and preliminary meeting to form the management committee, draft the terms of reference according special attention to community role and its economic, social and environmental sustainability, code of conduct, and enter into a formal Memorandum of Understanding among stakeholders for sustainable management of the KCF and buffer zone through a PPP. Community stakeholders will be selected paying special attention to gender, age and ethnicity. 2. Support strategic management plan for the landscape (i.e., the KCF and buffer zone). 3. Address community role, sustainability, management	• Formal agreement to manage a landscape through a PPP • A PPP multi-stakeholder management committee adequately representation of community demographics in terms of gender, age and ethnicity formed. • Climate change-integrated, landscape conservation management strategic plan developed and approved by the management committee. • Framework for an enabling policy to manage the conservation area according to the strategic plan developed and approved through government gazette.

responsibilities, project implementation targets assigned to respective DSs (but within context of landscape strategy). 4. Support process to formulate and approve a policy framework for enabling conditions to manage the KCF and the buffer zone as a contiguous landscape through PPP. Necessary to empower management committee, including to acquire and amalgamate abandoned and unoccupied private lands, regulate/ prevent destructive practices such as mining, tourism and other impacts (e.g., solid waste, behavior etc.).	It is essential that a mechanism to finance these activities must be established. Both Kalu Ganga and Moragahakanda projects have been completed, the GEF 7 should seek financial support from other collaborating agencies for these activities.
Outcome 2: Support conservation interventions to protect and restore sensitive ecosystems, habitats, and species, and prevent further degradation of the natural resources in the core area, especially in headwaters of the streams.	
• Support development and implementation of in-situ conservation action plans for endemic species. • Support habitat restoration and management for endemic/habitat specialist species. • Maintain ecological connectivity; Elephant corridors. Prioritize KCA core, where illegal logging, chena, and fires have degraded or converted forests. Most affected by illegal logging and chena (Panwila, and Wilgamuwa DSs) fire (Meda Dumbara, Uda Dumbara, Minipe, Wilgamuwa and Laggala-Pallegama DSs). Mobilize and train citizen scientists from the KCF and buffer zone communities in priority DS's to	At least 1,300 ha of forests with abandoned cardamom plantations under reforestation and sustainable management by community forest management groups. 320 ha of chena in the KCF and buffer zone under restoration and reforestation projects. The ~ 900 ha of tea lands inside the KCF core area (in Rattota, Ukuwela, Panwila, Meda Dumbara, and Uda Dumbera) are acquired and being reforested through a gradual process of thinning and planting with indigenous trees. At least 500 ha under forest restoration and management are made eligible for carbon funds as a pilot UNREDD+ project. At least 25 citizen scientist groups formed (gender disaggregated), trained and are actively engaged in biodiversity conservation

manage and monitor sensitive habitats and species. 4. Mobilize and train citizen groups in priority DSs to create awareness of environmental best practices to control and prevent pollution and forest fires. 5. Restore disused tea plantations in core area Rattota, Ukuwela, Panwila, Meda Dumbara and Uda Dumbara DSs. Develop pilot reforestation projects for eligibility for carbon credits under UNREDD+.	and enhancing ecosystem services. At least 20 members of the local community actively involved in the development and implementation of the conservation plans with equitable representation in terms of gender.
Outcome 3: Conserve and increase forest cover in the buffer zone of the KCF by restoring lands that are degraded or mismanaged through community - based restoration interventions	
1. Explore the feasibility of acquiring degraded and/or unmanaged tea estate land in the buffer zone from the SLPCA for reforestation through community forestry programs. The priority should be given to tea estates in the Medadumbara, Pathadumbara, Panwila, Ukuwela and Rattota DSs. 2. Restore the abandoned cardamom plantations. Laggala Divisional Secretariat (Ranamure, Narangamuwa, Attanwala, and Rambukoluwa grama Niladari Divisions), of Matale and Divisional Secretariats (Meemure and Ranagala Grama Niladari Divisions) 3. Establish community forest management groups (disaggregated by gender) to manage acquired tea estates. Meda dumbara, Patha Dumbara, Panwila, Ukuwela, and Rattota DSs. CUG formation and transparent governance governance structures, with equitable ethnic and gender representation.	At least 1,000 ha of abandoned tea in critical water source areas of the buffer zone under community forestry using analog forestry.

• Establish community - based natural resource committees (disaggregated by gender) within the Moragahakanda resettlement communities. • Guide sustainable land, water, and forest management plan for the immediate areas of resettlements and areas of impact, through inclusive and • consultative processes • Introduce and support crop - depredation and human – wildlife conflict mitigation measures. ○ • Mobilize and train community - based fire prevention and control units with rapid response capability • Meda Dumbara, Uda Dumbara, Minipe, • Wilgamuwa and Laggala - Pallegama DSs	
Outcome 4: Support sustainable agricultural practices that preserve and enhance agricultural biodiversity and productivity.	
1. Introduce and promote organic agriculture, and innovative agricultural techniques that promote soil conservation and enrichment, and low water use and dependency. Laggala - Pallegama and Uda Dumbara DSs, where erosion and soil degradation is high. 2. Develop direct market linkages between the farmers and national and international commercial enterprises for assured market and price points. Laggala- Pallegama and Uda Dumbara DSs, where innovative agricultural technologies will be promoted. Support and promote innovative and novel agricultural strategies. e. g., cardamom cultivation in Pinus plantations; process produce (e. g., tomatoes, pepper) using solar dryers and add value; promote SALT technologies; plant Gliricidia sepium along hedgerows for biomass energy.	• At least 5,000 ha of tea estates available for divestment in the buffer zone brought under alternative, sustainable land uses, including farming using methods that promote soil conservation and alternative livelihoods (e. g., horticulture) that encourage ground cover to stabilize slopes and conserves soils. • At least 2, 000 ha of land cultivated using traditional crop varieties. • At least 2 farmer - group enterprises equitably engaging both men and women linked with corporate sector for better market access and price guarantees.

Outcome 5: Ecologically sustainable, community - owned revenue generating schemes to improve livelihoods of people

1. Support pilot projects to develop alternative livelihood opportunities to reduce pressure on the natural ecosystems e. g., fruit and vegetable processing, mushroom cultivation, greenhouse horticulture and nurseries in home gardens, bee- keeping, organic composting, etc. Prioritize remote, isolated villages where livelihood options are low, and people rely heavily on forest resources, and Moragahakanda resettlement communities. 2. Form local entrepreneur groups and develop partnerships with corporate sector for market access with guaranteed price points. 3. Develop a "Knuckles or "Dumbara" brand and create awareness to access niche markets and for value addition. Designation of Origin (PDO) in line with the European Union mechanism to protect the names, methods and quality of agricultural produce and speciality products and create awareness nationally and internationally to access niche markets and for value addition. PDO Schemes are geared towards no only promoting products of specific geographic origin, especially those from underserved rural areas, improve the income of local farmers in line with a commitment to maintaining quality, create localised	• A landscape- scale "ecotourism" program developed and implemented with benefits to community- based enterprises • Branded local produce marketed in niche markets through corporate partnerships • A community- based waste disposal and recycling enterprise. • Number members in the community (gender • disaggregated) receiving direct benefit from these schemes.

opportunities in local areas, and the provision of clear information on origin to consumers. 4. Develop and support implementation of a strategic, landscape - scale tourism program. Establish committee to manage and monitor operations with transparent governance systems. 5. Mobilize, train, and establish community-based (gender-disaggregated) naturalist groups with an accreditation system and a web-based system to engage their professional services. 6. Establish a community- based and operated solid waste disposal, recycling, and anti- litter program. Priority is main Naula road, and at specific spots such as Riverston and Mini World's End (Uda Dumbara, Raththota)	
Outcome 6: Increase knowledge and capacity of the local communities and institutions to increase resilience of the overall landscape, communities and livelihoods	
1. Create awareness programs on the unique features and ecological importance of KCF; landscape and national- scale socio - ecological and economic contributions. Watershed/ecosystem values; sustainable commercial activities. All of the KCF and buffer zone, including the most remote villages. 2 Develop and support a knowledge sharing platform for local community groups in the KCF and buffer zone for landscape- scale planning and strategizing. Support technical and expert inputs to advice on climate smarting livelihood options, agriculture and infrastructure.	• Publications documenting lessons learned from SGP- supported projects produced and distributed • Internet and social media- based knowledge platforms developed for use by communities, national development and conservation agencies and external expert groups • Number of community groups or collectives for knowledge-sharing and transmission established

3.5 Criteria for Project Selection

Project selection must take place in line with the following subsequent to undertaking a survey of active community-based groups and initiatives undertaken locally:

- Aligned with national policies, the KCF/buffer zone strategic plan, and national and local legislature.
- Must be in compliance with principles of ecosystem and biodiversity conservation and sustainability of using natural resources.
- Must increases ecosystem and social resilience and sustainability, and promote social capital.
- Must bring direct or indirect economic benefits to communities and the local economy.
- Must benefit a wider group rather than a few individuals; in the case of the latter, must not cause negative impacts and harm on the larger community.
- Must be geared to actively solicit local/traditional knowledge, community participation, engage women and youth.
- Must be aimed at raising awareness among the wider community members about the importance of conservation and other interlinked concerns, challenges and opportunities.
- Should seek to document, utilize, adapt, disseminate and elevate traditional knowledge and practices specific to the region.

3.6 Criteria for CBO selection

- Capacity to implement and previous experience in community mobilisation with a social and/or environmental focus
- Diverse membership reflecting the socio-economic and cultural diversity of the local area, alongside age and gender.
- Capacity to co-finance initiatives, or possess the capacity to mobilise human, material and/or financial capital towards implementation.
- Capacity to handle finances or proof of having sound financial management system
- Registration at relevant government institutions
- Objects of incorporation are in line with UNDP SGP programme objectives
- Willingness to adopt a sound and regular reporting mechanism.

4. Monitoring and Evaluation Plan

- Projects must be initiated on the basis of undertaking a comprehensive baseline assessment in order to determine indicators at a localised level, given the diversity of issues and context in the Knuckles Conservation Forest region.
- The indicators for monitoring will necessarily be at different scales. The indicators also have to be practical and 'do-able', with the least number of indicators that will provide the most information with the least effort and cost.
    - Species indicators:
        - Distribution of endemic species. The distribution of endemic species will provide information on the status of the irreplaceable species in the KCF. Indicators can be monitored through field surveys.
    - Composition of forest ecosystem.
        - This indicator will provide information about the integrity of the forests in the KCF. Permanent vegetation monitoring plots will be established in the KCF. Plots will be surveyed for the species compositions every two years. Monitoring should focus on regenerating species, presence of invasive species, and status of species sensitive to environmental change, such as ferns, mosses, lichens, etc. consolidated .
    - Forest change indicators.
        - Change in forest and other land cover. Use remote-sensing data (e.g., Global Forest Watch) to track forest loss and gain (e.g., reforestation and restoration areas).
    - Environmental flow indicators
        - Rainfall -runoff in the area and changes in the hydrological regime.
            - Socio-economic indicators
        - Number of new alternative livelihood activities, which are sustainable, implemented
        - Change in the crop yield with the increased use of organic agricultural techniques
        - Inclusivity of local community and authorities in conservation and development within the target landscape

- Establishment of a regular reporting mechanism with at least two M&E sessions held at the landscape level, with one conducted during the implementation and the other at the end of the project.
- Each project will have a robust M&E framework that will monitor the project level indicators and assess the progress of activities against the expected outcomes. Beneficiary organizations will submit quarterly physical and financial progress reports, which will also include case studies presenting the success of the projects and the lessons learned.
- At least two field monitoring visits need to be conducted to evaluate the ground level activities and the overall project progress.
- Setting up of a multi-stakeholder (community members, private and public sector representatives, development partners, technical specialists) steering committee to periodically review progress, and adapt project scope and activities as required.
- Encouraging the setting up of a local newsletter with the support of local schools or youth organisations to update community on progress and raise awareness on relevant issues

5. Knowledge Management Plan at the Landscape Level

- Knowledge management will be a main component of the program strategy and the best practices, lessons learned and case studies will be used to generate knowledge sharing material.
- Different multimedia tools including, newsletters, policy briefs, brochures, short-films and video clips will be used to disseminate information. A photo documentary or a video clip to depict key case studies will be recommended.
- As with the M&E framework, grantees will be requested to allocate and develop a knowledge management plan by identifying the type of knowledge management products that will be produced during the course of the project.
- The participants will be encouraged to share their experiences through regular workshops on thematic issues organized with the involvement of various stakeholders (CBOs, NGOs, government bodies, academia). They will be encouraged to participate in nationally and internationally important events and

knowledge fairs such as World Environment Day. Platforms such as these will be used as an opportunity to inform and influence policy at the local, regional and national levels. Further, these can be also focused on strengthening local institution and enhancing skills at the local level to monitor and manage activities in a sustainable manner.

6. Major Areas of Interventions

Potential Areas for Outside Intervention

1. **Fire Control in Pine forests and grasslands (citronella)**

Fire is a recurrent issue around the in the area with pinus plantations and patanna grasslands. Areas around Rattota, fires are associated mostly with *Pinus* plantations; whereas Ududumbara, Minipe and Wilgamuwa in the areas with patanna/citronella grasslands. Using the local community organizations, a pilot project can be implemented in the pine plantations to cultivate cardamom with necessary controls. Similarly, the fire hazard in the citronella dominant patanna grasslands can be reduced by a similar pilot project to extract citronella oil again with the community participation.

2. **Resettling of remaining families in small isolated villages in the KCF**

This will not only reduce unsustainable activities in the KCF, but also improve living standards of the people who cannot be provided at present with the same public utilities other citizens take for granted due to the difficult terrain and high per capita cost.

Udagaldebokka, is an isolated village located KCF on private/state land. The people of the village are reported to have caused considerable damage to forests by clearing forest lands for chena cultivation. Some villagers are willing to resettle in a more hospitable place with access to public utilities. The Forest Department has some lands for this purpose but needs outside help to provide other facilities.

3. **Development of eco/culture-based tourism**

A form of ecotourism is already in place; however, it lacks community participation. Therefore, community-based ecotourism could be integrated to enrich present situation to increase the benefits to local people.

4. **Control of wildlife damage to crops**

This is inherent to all the areas around Knuckles with slight variations with animals involved.

5. **Management of Elephant migratory routes (forest connectivity)**

This is connected with the problem of animal crop damages. Elephants raiding croplands/villages is partly due to the blocking of their migratory routes by the expansion of settlements and agricultural lands. It is necessary to identify elephant migratory routes and leave forest corridors for this purpose. Protection barriers such as electric fences as well as biological control measures should be introduced. Current practice is erecting electric fences. They are costly and difficult to maintain. Vegetation barriers which elephants are reluctant to cross may be a more sustainable solution.

6. **Sanitation and nutrition problems in Estate Sector**

Ududumbara, Madadumbara, Panwila and Rattota, Bambarella, and Kelebokke are examples for estate sector worker settlements where sanitation facilities are not available and people also do not have good hygienic habits. Improvement of these conditions may require providing physical facilities and education.

7. **Maintenance of soil productivity on sloping lands**

Sloping Land Agriculture Technology (SALT) can be a potential area of intervention to protect the agricultural soil in many places around Knuckles. A major part of the Knuckles buffer zone consists of sloping lands. Current state of soil conservation practices is not adequate. The agricultural lands as a whole needs a soil nutrient management strategy. This can be done quite easily by improving awareness among the farmers. High prices of agricultural inputs might find impetus to launch such low cost solutions.

8. **Organic Agriculture**

The misuse of agrochemicals is a major economic problem and health hazard in Sri Lanka. Fertilizer applications are not based on a proper assessment of soil in the farmlands. Providing subsidies for fertilizer has become a major economic as well as environmental problem. It is necessary to find ways for targeted fertilizer application

methods to be introduced. Farmers can be trained to assess their own soil using low cost methods with the help of the Department of Agriculture. It is also important to educate government agencies responsible share the soil data they collect with public money with the local farmers.

There is also high potential for organic farming for a niche market in Sri Lanka and abroad. At present, a higher price can be charged for organic products to compensate for higher cost of production. Therefore, making aware of the importance of organic farming and introducing of marketing avenues for such products could be introduced.

9. Improvement of local ecological resources (Kithul, Rattan, Garcinia (Goraka), etc.)

Marketable products from Kithul, rattan and several other plants and herbs can be promoted in this area. This sector is currently under-utilized for various reasons. What is lacking in the area is the people with entrepreneurship skills to take this industry to a higher level. Providing these skills to the local people will help them develop their economic conditions. Forest boundary areas could be a source area for this intervention. There is a shortage of Kithul trees in most villages. Kithul is a major food source for elephants and they are responsible for the destruction of Kithul trees in the area according to the villagers. A suitable method should be found to create Kithul plantations, possibly with private electric fences or biological barriers around such plantations. In order to enhance this capacity the suitable people in the villages should be identified and organized. Kithul planting can also be done in areas which do not have threat of elephants.

10. Development of sales centres to sell local products

Local products are not widely available for visitors to buy and they are collected by outside traders. Also, what is available are not value-added products. Therefore, opening of sales centers can contribute to local economy by increasing employments and increasing the income of local people. Such sales centres can be established close to major tourism attractions as well as near entry/exit points.

11. Quality enhancement of local products:

Value addition, maintenance of standards, incorporation of local brand names could be a few areas to be developed. There is a large price difference for good quality products at super markets and the prices charged in the Knuckles area. Branding of products and strict quality control will ensure sustainability and income levels of the local people. Similarly, the visitors will also benefit from cheaper good quality products that they can purchase when they visit the area. There should be a mechanism to verify quality of these products by an independent organization.

12. Developing Better Marketing Strategies

Marketing of the local products is still a major problem. There are no sales centres in the areas

13. Providing technical support of cardamom cultivation

This practice is being developing in Laggala area utilizing the conventional knowledge. This could be further developed by external interventions. The farmers also seem to be keen to acquire knowledge in better cultivation methods, processing of products and marketing. The few cardamom plantation we observed appear to show the potential in the home-gardens. As a part of home garden enrichment program cardamom cultivation can be popularized. No additional lands is required for this task.

14. Forest dieback control

This problem is recently observed in the KCF which can cause serious damage to some species in the future. Therefore, studies have to be conducted to find the causes and remedial measures. The problem is not widespread at present, but it could spread if no timely action is taken.

15. **Gradual introduction of local species to planted forests:** Planted forests, particularly with *Pinus* is responsible for increasing the occurrence of wild fires. Therefore, introduction of local species which are more useful for local communities could be attempted.

16. **Training volunteers to help chase elephants from villages with Wild Life Officers**

This is relevant for North east to North West areas of Knuckles. The shortage of manpower is one of the major problems the Wildlife Department is facing in addition to the lack of resources and the difficulty of the terrain. The local communities are well placed for this task and the volunteers can, not only chase out elephants, but also improve defenses around the villages and croplands.

17. **Introduction of fish varieties to existing/newly built ponds in the plantations**

There are ponds in the areas of Panwila, Ududumbara and Madadumbara area mostly in estate ands. Introduction of fish varieties to them will decrease the poverty and increase the protein intake of the poor families. This should be developed into a self-sustaining system in cooperation with the State Agencies responsible for inland aquaculture.

Citronella oil extraction

Citronella oil is made by steam distillation of leaves of *Cymbopogon nardus* (Pangiri mana). The process is expensive. Since there are several citronella oil distillation plants in Sri Lanka, villagers could be encouraged to harvest citronella leaves and sell them to the distilling factories. This intervention needs Forest Department approval as citronella is growing in the grasslands within KCF. The extent of citronella in the Knuckles landscape is not known at this stage. The potential of using citronella plant for citronella oil extraction was provided by the Divisional Forest Officer of Matale. This can be a small activity in a larger activity aimed at controlling wild fires.

18. **Introduction of fish varieties to existing/newly built ponds in the plantation**

There are natural, small-scale ponds in the tea estates of Panwila, Ududumbara and Madadumbara. Introduction of suitable exotic food fish varieties to them will increase the protein intake of poor families. Ornamental fish breeding as a livelihood is another option. This could be a good intervention which could benefit school drop-outs above the 14 yeas of age. Training on breeding, connecting trainees to market appears to be important.

Annex 1

1.0 Overview of the Landscape

The communities in Matale and Kandy districts across which the Knuckles Conservation Forest and the buffer zone area are largely reliant on agriculture and other types of cultivation for income generation. Preliminary meetings with stakeholders revealed that there exists some tension in relation to the stringent demarcation of forest boundaries. While there is no uniformity or consensus on the demarcation of boundaries and their enforcement, residents appear to have a good understanding of what the official boundary lines are. Generally, while the importance of conservation was understood, formal efforts at conservation were viewed as detrimental to the community, notably due to the interlinked restrictions on livelihood, be it subsistence cultivation, commercial agricultural practices or tourism-related ventures. Gripes were also expressed in relation to local communities no longer being able to enjoy the local landscape due to restricted access to certain sites of significance such as Lakegala off Meemure. Past practices associated with dependence on forest products for medicinal purposes or to supplement diet were noted to be declining if not absent due to restrictions in accessing the forest area. This was noted in relation to the lack of viable alternative opportunities for income generation, highlighting that top-down efforts at conservation were viewed as alienating local communities and poorly aligned with local development efforts as made evident by the politicisation of, and various failed attempts at completing local infrastructure projects. These sentiments are inevitably associated not only with residents being compelled to seek work elsewhere in order to supplement their earnings, but also the lack of scope and opportunities for young people in particular.

Moreover, what is of particular significance is that tourism is a burgeoning sector in both districts. The Knuckles area is popular with a growing number of domestic tourists, which in turn has led to a rapid incline in the sharing economy through conversion of dwellings into homestays and the construction of small-scale tourist accommodation. These ad hoc constructions coupled with largely unregulated interlinked entrepreneurial activities are a source of considerable concern locally, not only due to fears of both internal and external competition, but the lack of adequate provisions for visitor safety,

waste management and other social issues associated with provision of home-stay tourist accommodation.

Tensions persist in relation to access to scenic protected areas, and given the informality with which these ventures take place (and typically, as a means of diversifying or supplementing one's income) entails that very little information is available on the type, scope or scale of these activities. As of 2016, the percentage distribution of informal sector employment in the non-agricultural sector by district, stands at 54.1% in Kandy and 54.3% in Matale highlighting that over half the population in the informal sector are engaged in nonagricultural activities.

1.1 Socio-Economic and Demographic Context

1.1.1 Matale

The Matale District covers an area of 1,993km^2 and is made up of 11 Divisional Secretariats and 545 Grama Niladhari Divisions. As of 2015, the district's total population is 502,000 (242,081 Male, 259,919 Female), with a labour force of 199,142 (2015). 188,518 are listed as employed, while 10,624 (5.3% of labour force) are listed as unemployed. The district's poverty headcount index is 7.8%, with 37,000 persons classified at poor or living below the Official Poverty Line of LKR 3,624 per month (2012/13). The mean household income for the Matale District is LKR 35,004 per month (and LKR 9,392 mean per capita income), which is below the national average of LKR 45,878 (and LKR 11,819 per mean capita income). Percentage of average monthly household income is derived as follows: 29.0% from wages, 12.9% from agricultural activities, 12.6% from non-agricultural activities, 13.0% from other sources of cash income, 15.3% from ad hoc gains, 17.1 non-monetary gains, and 7.3% income in kind. Mean household expenditure is LKR 39,222, which considerably exceeds the mean household income indicating likely debt concerns, and possible economic hardship. The poorest 20% of the population account for 5.4% of the district's income share, compared to 47.6% of the middle 60% and 47%of the richest 20% indicating a considerable level of inequality. However, these figures are more or less on par with the national averages of 4.5%, 42.6% and 52.9% for poorest 20%, middle 60% and richest 20% respectively.

14.8% of the Matale District's population are listed as suffering from a chronic illness or disability, slightly higher than the national average of 14.2%.

1.1.2 Kandy

The Kandy District covers an area of 1,906.3 km^2 and is made up of 20 Divisional Secretariats and 1,188 Grama Niladhari Divisions. As of 2012, the district's total population is 1,340,000 (610,000 Male, 720,000 Female), with a labour force of 508,591 (2015). 481,373 are listed as employed, while 27,217 (5.4% of labour force) are listed as unemployed. The district's poverty headcount index is 6.2%, with 83,000 persons classified at poor or living below the Official Poverty Line of LKR 3,624 per month (2012/13). The mean household income for the Kandy District is 43,138 per month (mean per capita income LKR 10,899), which is below the national average of LKR 45,878 (and LKR 11,819 per mean capita income). Percentage of average monthly household income is derived as follows: 33.9% from wages, 15.5% from agricultural activities, 11.2% from non-agricultural activities, 14.8% from other sources of cash income, 8.3% from ad hoc gains, 16.3 non-monetary gains, and 5.1% income in kind. This indicates a considerable diversity in terms of income generation, but may also suggest a degree of income instability. Mean household expenditure is LKR 41,442, which lies below the average monthly income, indicating then a higher degree of income stability in comparison to Matale. The poorest 20% of the population account for 4.9% of the district's income share, compared to 44.3% of the middle 60% and 50.8% of the richest 20% indicating a considerable level of income inequality. However, these figures are more or less on par with the national averages of 4.5%, 42.6% and 52.9% for poorest 20%, middle 60% and richest 20% respectively.

13.8% of the Kandy District's population are listed as suffering from a chronic illness or disability in comparison to the national average of 14.2%.

The Divisional Secretariat and Grama Niladhari Divisions within the Kandy and Matale Districts that belong to the Knuckles Conservation Forest Area and Buffer Zones are in Table 1.

Table 1 Administrative divisions within the Knuckles Conservation Forest and its Buffer Zone

DS division	No. of GN divisions- Knuckles Conservation Forest*	No. of GN divisions- Buffer Zone+	Total No. of GN divisions from each DS division
Kandy			
Meda Dumbara	14	39	53
Minipe	06	07	13
Panwila	11	03	14
Patha Dumbara	02	02	04
Uda Dumbara	23	06	29
Kundasale	N/A	14	14
Matale			
Laggala-Pallegama	21	05	26
Rattota	08	13	21
Ukuwela	03	03	06
Wilgamuwa	08	01	09
Ambanganga Koralaya	N/A	06	06
Naula	N/A	02	02

*- Number of GN divisions on the Knuckles Conservation Forest boundary

+- Number of GN divisions outside the Knuckles Conservation Forest boundary but within the buffer zone boundary

The population data pertaining to the aforementioned administrative areas are in Table 2.

Table 2 Population densities in KCF and buffer zone with respect to DS division

DS division	Knuckles Conservation Forest			Buffer Zone		
	Area (ha)	**Population**	**Population Density (per ha)**	**Area (ha)**	**Population**	**Population Density (per ha)**
KANDY						
Kundasale	N/A	N/A	N/A	620.06	15349	24.75
Meda Dumbara	2089.04	10237	4.9	5934.5	25557	4.31
Minipe	1305.22	2548	1.952	3876.1	10993	2.84
Panwila	3084	28639	9.286	5300.74	3546	0.67
Patha Dumbara	142.26	4728	33.235	292.22	3671	12.56
Uda Dumbara	9163.86	8883	0.969	2784.49	2143	0.77
Total per district	**15784.38**	**55035**	**N/A**	**18808.1**	**61259**	**N/A**
MATALE						
Ambanganga Koralaya	N/A	N/A	N/A	1558.51	7801	5.01
Laggala-Pallegama	12899.66	5419	0.42	8068.15	1413	0.18
Naula	N/A	N/A	N/A	452.46	873	1.93
Rattota	1244.73	9857	7.919	2942.23	15584	5.3
Ukuwela	318.27	2285	7.179	1553.33	1697	1.09
Wilgamuwa	1004.9	9137	9.092	1806.35	249	0.14
Total per district	**15467.56**	**26698**	**24.61**	**16381**	**27617**	**13.65**

TOTAL	**88876**	**81733**	**N/A**	**88876**	**88876**	**N/A**

The total population of this area is 170, 609. It is essential to note that the figures reflect the number of people living in the adjacent GN Divisions, rather than those living specifically within the Knuckles Conservation Forest and Buffer Zone areas.

Table 3 Population by Sector

DS division	**Population by Sector**			
	Urban	**Rural**	**Estate**	**Total**
KANDY				
Kundasale	**Data is not available at present.**			
Meda Dumbara				
Minipe				
Panwila				
Patha Dumbara				
Uda Dumbara				
Total per district				
MATALE				
Ambanganga Koralaya	--	13518	2689	16207
Laggala-Pallegama	--	12395	152	12547
Naula	--	31998	--	31998
Rattota	--	45585	7620	53205
Ukuwela	1013	63219	6248	70480
Wilgamuwa	--	30557	--	30557
Total per district	**1013**	**197272**	**16709**	**214994**

As illustrated in Table 3, the majority of the population are rural, followed by those resident in the Estate Sector indicating inevitable differences in socio-economic and environmental factors including livelihood, cultivation practices, land use and inheritance, and traditional knowledge pertaining to the environment. In the Matale

District, only a very small portion of the population living in Divisional Secretariats adjacent to the Knuckles Conservation Area are considered Urban, and they are concentrated in the Ukuwela Division.

The population in and around the KCF depends mainly on agriculture, primarily paddy and chena (slash and burn) cultivation. In addition to these, the surrounding communities engage in tea, rubber, coconut cultivation and small-scale export crop production (Figure 1). Land use patterns in the Kandy and Matale Districts are in Table 4 and 5, respectively.

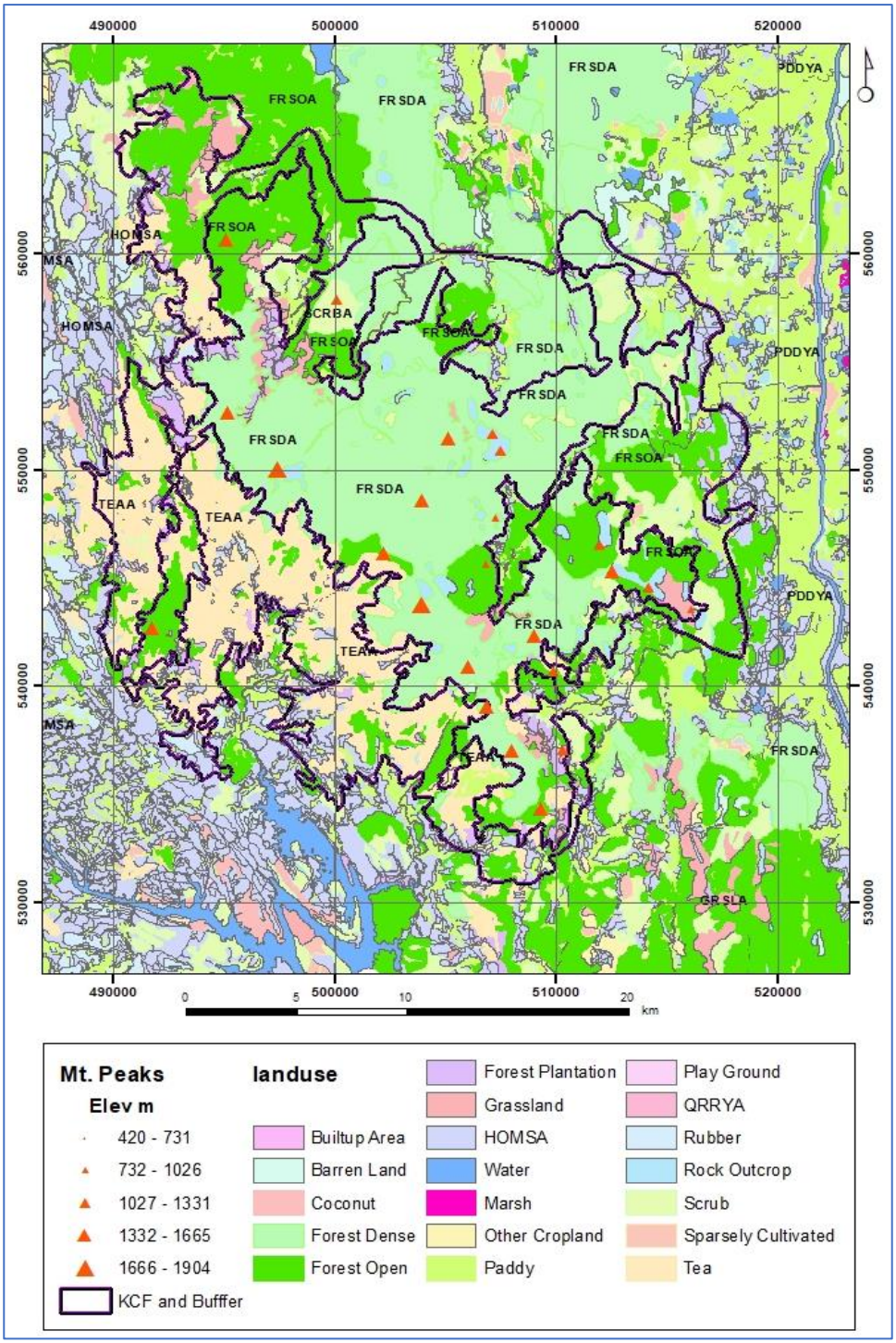

Figure 1 Land use map for KCF and its buffer zone (Data Source: SD 2018)

1.2 Policy and legal Context

Presently the KCF receives state protection under two Gazettes. In 2000, in accordance with the Forest Conservation Ordinance 1907 (No. 16 of 1907) as amended (hereafter referred to as the Forest Ordinance) Section 3 A (1), an area of 31,305 ha was declared a Conservation Forest (Gazette No. 1130/ 22 dated 2000-05-05). This category receives the highest level of protection under the Forest Ordinance, and the KCF is the first

Conservation Forest to be declared in Sri Lanka. Areas protected under the Forest Ordinance are managed by the Forest Department (FD) of Sri Lanka.

The KCF includes other lands that are not owned by the state within its boundary. As the 'Conservation Forest' status is only applicable to state owned land (Forest Ordinance Section 3 A (2)), the protection provided by the new status of the forest was unable to give legal protection against any harmful activities taking place in these private lands.

However, according to the section 3 A (6), of the Forest Ordinance, any immovable property not being state land, which possesses of any features referred to in the section 3 A (1), that is required for the existence and preservation of the Conservation Forest, may be acquired under the provisions of the Land Acquisition Act on the recommendation of the Minister.

To protect these lands till such acquisitions are complete, an Environmental Protection Area (EPA) was declared along the same boundary as the KCF by a second Gazette issued in 2007 (Gazette No. 1507/ 9 dated 2007-07-23) (Annex 2) under the National Environment Act No. 47 of 1980 (hereafter referred to as the National Environment Act). This gazette pertains to all non-state-owned land within the prescribed boundary. EPAs under the National Environment Act are managed by the Central Environment Authority (CEA) of Sri Lanka.

Currently, the Forest Department (FD) has completed most of the land acquisition process regarding the above private lands within and bordering the KCF. According to the officials at the FD the next step is to re-gazette the Conservation Area including these changes.

Thus, the current status is that all lands within the KCF are protected, either as Conservation Forest under the Forest Ordinance or as an EPA under the National Environment Act. The ownership of the land in the buffer zone varies as large private plots of land, small private plots of land (village level) and state.

1.3 Biodiversity and Ecological Value including Watershed Services

Overall, the KCF has been included as a conservation priority in several global analyses, including Endemic Bird Areas, Centres of Plant Diversity, Global 200 ecoregions, Key Biodiversity Areas, and Alliance for Zero Extinction Sites for its biodiversity values

and contributions to a global biological repository. Its inclusion as a Global Biodiversity Hotspot flags it as a high biodiversity area that is also under high threat from anthropogenic drivers.

1.3.1 Biodiversity Values

The KCF and its surrounding area, including the buffer zone, harbours 31% of higher plants (Angiosperms and Gymnosperms) and ferns (Pteridophytes), and 32% of the species from several faunal groups (Birds, Butterflies, Dragonflies, Mammals, Reptiles, Amphibians, Freshwater Fishes, Land Snails, Tarantula Spiders and Freshwater Crabs) known from Sri Lanka. For example, of the 3,492 plant species (including 943 endemics) known from the country, 1,068 (including 318 endemics) are found in the KCF and its surrounding area. Also, of the 1,615 species (including 658 endemics) of mammals, birds, reptiles, amphibians, freshwater fishes, land snails, butterflies, dragonflies, freshwater crabs and spiders, recorded from Sri Lanka, 520 (including 195 or 30% endemics) are known to occur in the KCF and buffer zone.

But the Knuckles is also known for endemic species that are restricted to this mountain range. The Knuckles have thus been identified as a site of global importance in an analysis conducted by the Alliance of Zero Extinction.[1] Some of the species that qualify the Knuckles as an AZE site are seven species of frogs (*Nannophrys marmorata*, *Philautus fulvus*, *Philautus hoffmanni*, *Philautus macropus*, *Philautus mooreorum*, *Philautus steineri*, *Philautus stuarti*) that are restricted to these mountains, and are conservation imperatives because of their irreplaceability.

The Knuckles range is one of the 70 International Bird Area (IBA) sites in Sri Lanka listed by Bird Life International (Table 6). Three (A1, A2, A3) of four criteria are fulfilled by the Knuckles range as an IBA.

A1. Globally Threatened Species (47 sites in Sri Lanka),

A2. Restricted-Range Species (54 sites in Sri Lanka),

A3. Biome-Restricted Species (45 sites in Sri Lanka),

A4. Congregations (26 sites in Sri Lanka)

Table 6: Summary of the Knuckles IBA

Site ID	National Name	International Name	Final Code	Area (ha)	Criteria
15240	Knuckles Range	Knuckles Range (Knuckles IBA)	LK026	30000	A1, A2, A3

The Knuckles is also a Key Biodiversity Area[1], a site deemed to be of global importance for biodiversity based on presence of threatened biodiversity, geographically restricted species, ecological integrity, and irreplaceable species and biological processes.

The Knuckles have also been recognized as a Centre for Plant Diversity[2] because of its plant richness and endemism.

[1] http://www.keybiodiversityareas.org/what-are-kbas

[2] UNEP-WCMC 2013. Centres of Plant Diversity. Version 1.0 (digital reproduction of Centres of Plant Diversity, eds S.D. Davies, V.H. Heywood, WWF and IUCN, Gland, Switzerland, 1994-7

1.3.2 Watershed values and services

The KCF and its buffer zone are entirely within the Mahaweli river basin and provide 30% of water to the major reservoirs in the Mahaweli system: Victoria, Randenigala and Rantembe reservoirs. If the watershed's forested slopes are degraded and the soil is exposed, the topsoil will be washed downslope, and into the reservoirs, decreasing their storage capacities. The silt and other particulate matter will abrade and damage the turbines. Furthermore, given the local communities' reliance of natural water sources for consumption, the role of these forests in water purification must be accorded particular attention. Forest cover on the slopes also plays a crucial role in regulating water quality and flow rate, buffering against floods. Loss of forest cover will greatly reduce the potential for retaining water within the upper slopes by allowing rainfall to percolate into the ground, rather than be lost as surface run-off, and replenish groundwater. Bare slopes without forest and ground cover also leaves the soil exposed to the impacts of rain drops, loosening the topsoil and exacerbating erosion. Erosion also has considerable implications for cultivation and agricultural productivity, which in turn may affect not only livelihoods, but food security for local communities

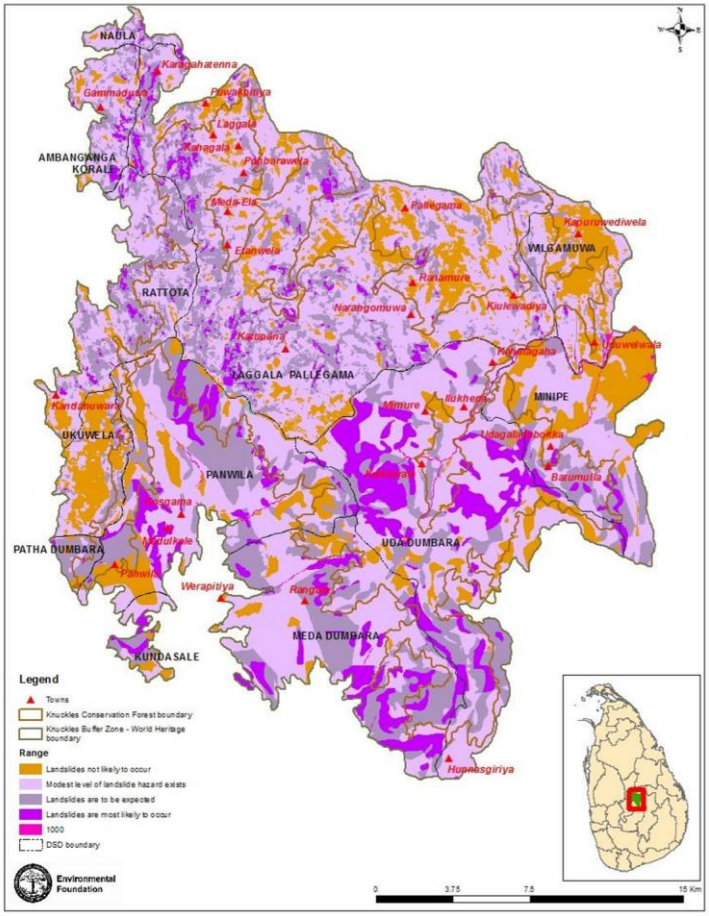

Figure 2. Landslideprone areas of the KCF. Map from EFL. 2017. Towards the sustainability of the knuckles conservation forest and its buffer zone. An insight into the present status and recommendations to address issues faced. Environmental Foundation (Guarantee) Limited. August 2017

that rely on subsistence. Water shortages have been noted in several areas in the region, and its exacerbation could have serious repercussions.

Analyses have shown that many areas in the KCF are prone to landslides (Figure 2). Thus, forest cover on the slopes in the KCF also acts as a buffer against natural disasters within the mountain range, and far downstream because the forests will stabilize the slopes. Thus, exposed and degraded slopes should be reforested, and existing forest cover should be conserved. Given the inclining incidence of inclement weather in Sri Lanka, the consequences for the physical safety of local communities could be significant. Landslide related deaths and displacement have increased in the past few years, and the pressure to provide suitable alternatives for relocation have resulted in the clearing of state-owned lands with little attention paid to environmental impact that occurs as a result of resettlement and interlinked infrastructure development. These relocations have also been viewed as disruptive to livelihoods, especially where community livelihoods rely on local environmental resources, be it in the form of foraging, agriculture, or other forms of cottage industry.

Thus, an ecologically intact KCF is necessary for sustained provision of water to a large part of the country. Degradation of the watersheds from removal of forest cover would result in loss of sustained water, increased surface erosion, landslides, loss of soil fertility, and will have severe impacts on agricultural productivity and power generation that will affect the national economy and governance.

1.3.3 Climatic context

Rainfall and temperature are the main controlling climatic factors in this region. Most parts of the KCF and its buffer zone are within the wet zone and receive heavy, intense rainfall, mostly during the months of November to February. The average annual rainfall varies from 2500 to 5000 mm. There are no distinct dry months in the wet zone areas. Small parts of the KCF and its buffer zone are within the intermediate zone, where average annual rainfall ranges from about 1900 to 2500 mm. There are less than three dry months in the intermediate zone areas.

The mean annual temperature of the KCF and its buffer zone at the elevation of 915 m above msl ranges from 13 to 18.5 ºC, and drops further with an increase in elevation. In the lower elevation areas the temperature ranges from 20 to 25 ºC.

Climate change projections for Sri Lanka show different results in the spatial distribution of the extent and trends in change, depending on the models and projections used, and are ambiguous.[3] However, all models indicate that Sri Lanka's climate is changing, especially the patterns of precipitation that include more extreme events, and there is a gradual, overall increase in atmospheric temperature.[4] There is more annual variability in rainfall, which is also more unpredictable. The national policy on climate change articulates broad statements to guide decisions at national and sub-national levels against the threats from climate change, with connectivity to other policies and plans, especially the National Action Programme for Combating the Degradation of Lands in Sri Lanka (NAP-CDL), which recognizes that climate change can intensify land degradation, resulting in soil erosion and landslides in the montane watersheds that require urgent attention. The National Physical Plan (NPP) also recognizes that development of infrastructure should be cognizant of the environmental fragility of the central montane areas, and the need for conservation of these ecosystems. Thus, although climate projections cannot accurately predict the trends in rainfall and temperature within the Knuckles mountains maintaining forest cover will be important as an adaptation strategy against too much or too little water.

1.4 Current issues

The major issues facing the KCF and buffer zone area including threats to the ecological integrity, livelihoods, and human wellbeing in the KCF and buffer zone are as follows:

1. A considerable part of tea crop in Sri Lanka is mature and old. For instance, 40 per cent of the tea extent is under seedling tea and about 90 per cent of the seedling teas are over 60 years old and need to be replanted. Similarly, around 30 per cent of the VP tea are more than 30 years old and need replantation (Weeraratna 2017).

   There are 30 tea estates that cover over 10,000 ha of tea estates in the KCF and the buffer zone (Figure 3). Most are owned by the state, but managed by private companies and only a few are owned by individual farmers (Bandaratillake 2005). The government owned estates were acquired in the 1970s under the Land Reform Act, to be operated as state enterprises by the Sri Lanka State Plantations Corporation (SLSPC). However, over the years these enterprises have failed; the estates have been badly managed, with loss of productivity. Many have been

[3] https://www.researchgate.net/publication/267368588_HOW_PREPARED_ARE_WATER_AND_AGRICULTURAL_SECTORS_IN_SRI_LANKA_FOR_CLIMATE_CHANGE_A_REVIEW

[4] National Adaptation Plan for Climate Change Impacts in Sri Lanka 2016 to 2025 Climate Change Secretariat Ministry of Mahaweli Development and Environment 2015

abandoned. Historically, the living conditions of those resident within these estates have also been notoriously poor, with little effort made to improve housing, infrastructure, essential services and welfare, which has resulted in pervasive poverty and poor quality of life as there are few livelihood options available outside wage labour, upon which housing is contingent. Livelihood and conservation oriented strategies must consider scope for facilitating estate residents to diversify opportunities for income generation. This may also permit for improved retention of labour locally, given inclining outmigration in search of better and more stable employment opportunities.

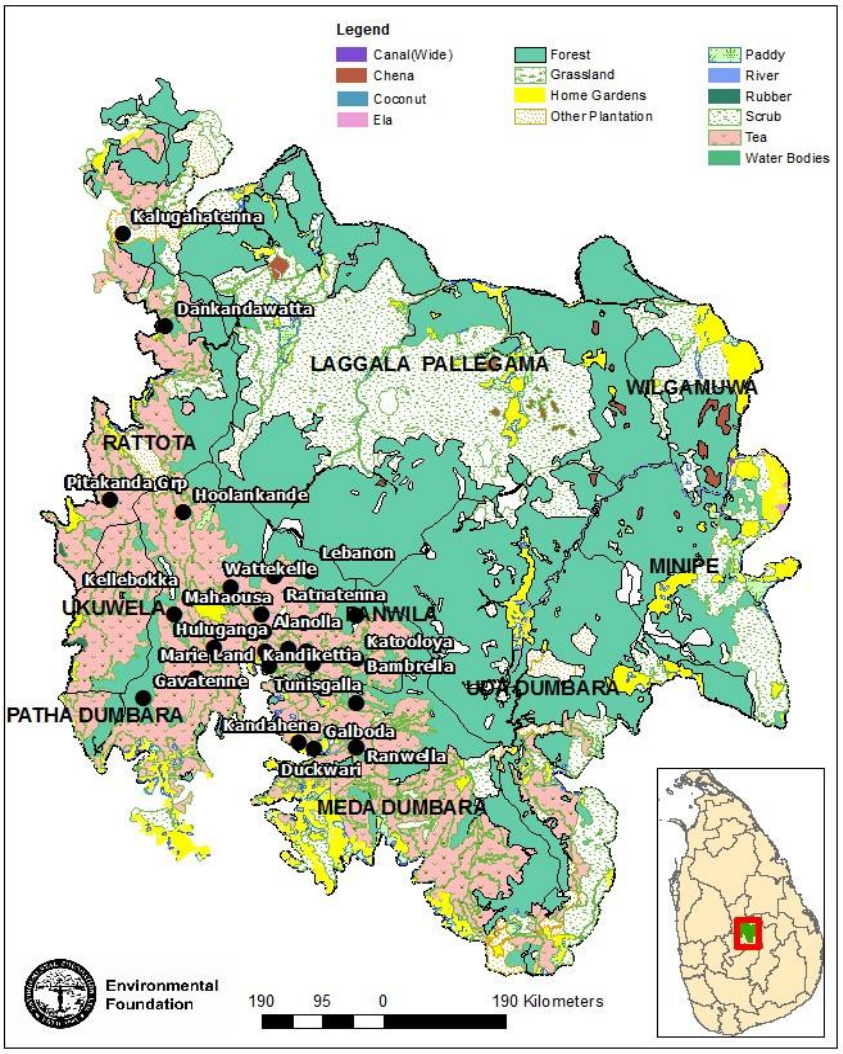

Figure 3: Tea estates within the KCF and within its buffer Zone

The state-owned estates are now in the process of being divested for other uses. The Ministry of Public Enterprise Development has, by way of Government gazette, proposed management of these estates through new management arrangements, including publicprivate partnerships and 30-year lease agreements with small- and medium scale investors that can demonstrate sustainable and financially viable plans to improve productivity of the lands and improve livelihoods. As part of the conservation management strategy of the KCF buffer zone, these estates can be acquired, especially to increase forest and ground cover while providing local communities with alternative livelihood opportunities. Community forestry, horticulture, woodlots that can be sustainably used are some strategies that can reforest these estates and also take pressure away from forests in the core area.

Through contact details provided by the SLSPC, an Estate Manager, Mr. Lakshvijaya Perera (Rangala Estate), was contacted to acquire more information on the status of the tea estates in the Knuckles area. Mr. Perera mentioned that the productivity in the area has decreased due to shortage of labour and rainfall variability. However, he believes that with adequate field work and better cultivation techniques which include infilling, use of high quality tea cultivars and effective fertilizer and pest management practices, would lead to increased tea productivity over the coming years. It was further mentioned that there was a government initiative to use degraded or abandoned tea estates for other economic ventures and estates have been called upon to submit proposals for their respective areas. Proposals for degraded tea estates include eco-tourism activities, cattle farming and crop diversification such as spice crops, energy yielding crops such as *Gliricidia* and fruit crops which could be cultivated on unproductive lands. SLSPC provides applications for leasing out unproductive lands following a site visit and more information can be gained from their Head Office in Colombo and they will facilitate filtering of related information as per requirement.

2. The Soil infertility caused by slash and burn cultivation and cash-crop cultivation, including small-holder tea are contributing to soil infertility. Excessive use of NitrogenPhosphorus-Potassium fertilizers in tea plantations over the years degrading the soils and the waterways. Additional factors such as higher levels of soil acidity, leaf and root diseases, pest infestations have led to soil degradation, infertility and thus, productivity. For instance, Duckwari Group initially (prior to

1898) had a total tea plantation cover of 655 ha, which decreased to 481 ha by 1967, with 125 ha being abandoned and the rest of the land being utilized for paddy (1 ha) and cardamom cultivation (48 ha) (Weerawardhena and Russell 2012). Given the elevation and steep slopes of the area, these lands are also vulnerable for soil erosion, which further contributes to the loss of topsoil and nutrients. Studies have shown that in the case of tea, the loss of 1 cm of topsoil cover is associated with a decline in yield of 44 kg/ha/yr. It is also worth noting the reported incidences of CKDus in adjacent area, the careless and excessive use of chemical fertilizer coupled with soil erosion may also exacerbate issues pertaining to community health.

3. Some areas of the KCF experience forest fires during the dry months. Most fires are anthropogenic; people set fires to clear forests for chena and to create grazing areas for livestock. Fires are also set by hunters to encourage new growth that attracts grazing wildlife that are then hunted. Fires spread rapidly, especially in grasslands with the exotic *Panicum maximum*, and through Acacia and pine plantations, facilitated by the accumulated leaf litter and pine needles. The forest department lacks the resources to prevent and extinguish fires. The areas most frequently affected by fires are Meda Dumbara, Uda Dumbara, Minipe, Wilgamuwa and Laggala-Pallegama Divisional
   Secretariats.

4. Unregulated and organic growth and expansion of tourism is becoming a significant threat to the KCF. Tourist resorts are being constructed on private forest lands, forest lands on long-term leases, land owned by the Land Reform Commission, and even on forest lands under statutory grants with no proper planning and environmental safeguards. Several hotels are being built, or are already built in forest areas in the
   Kandy District. Four hotels have been constructed in Riverston and Gonamada Watte in the Matale District. Furthermore, the unregulated conversions and additions to private households as a means of providing budget accommodation for tourists is common. The occupants and management of these hotels encourage illegal and unregulated activities, including bush meat trade, disposal of effluents and waste into the waterways, clearing the vegetation around the properties, and

providing guests with non-biodegradable containers that are then strewn through the landscape as guests visit or travel through the KCF. Damage and degradation of the environment also occurs during the construction phases.

5. Visitors driving and picnicking along the main roads leave behind non-biodegradable waste; the main roadsides and the streams are littered with Styrofoam lunch containers, plastic bags, glass bottles, aluminium cans, and other solid waste. Currently, there is no established waste management system in any part of the conservation area. The largest group responsible for solid waste generation and littering are local tourists that carelessly dispose of garbage along the roads. Such accumulation of garbage not only disrupts the ecology of the conservation area but also degrades the habitat, clogs the waterways, poses a threat to wildlife that attempt to eat this garbage, and creates an unpleasant environment that can become a disincentive for other visitors. It can also spread diseases; for instance, water collecting in these containers can be breeding habitat for dengue mosquitoes. Use of soap and other detergents used by visitors bathing in streams and waterfalls pollute the waterways, affecting aquatic biodiversity that are adapted to clean water and cannot tolerate changes to water quality.

6. Collection of firewood is a major issue, especially in areas with estates along the KCF boundary and buffer zone. Usually, estate workers are settled in close proximity to the estate, thus close to the conservation area. The main source of energy used by these inhabitants is firewood, which is generally sourced (or supplemented) from the forest.

7. Illegal logging and forest clearing is another major threat. People cut down trees and clear forests for various reasons, especially to obtain timber and for chena cultivation. The scale of forest clearing ranges from small, to meet domestic needs, and large, for commercial purposes. Patha Dumbara, Panwila and Wilgamuwa are the most affected Divisional Secretariats. But it is notable that in Meda Dumbara the rate of deforestation is now under control.

8. Forest encroachment for livelihood-related activities also contributes to degradation. Some of these are illegal. For instance, although cardamom cultivation in the core area is now prohibited, banned after the after the government decision in 1994 to discontinue cardamom cultivation in forest lands. However, some cultivation continues, which prevents forest regeneration. According to the Department of Agriculture statistics, about 2,700 ha of cardamom had been planted in and around the Knuckles forest.[5] Over 60% of cardamom cultivation in the Knuckles range is estimated to be in environmentally sensitive areas, above 1,200m in elevation and on steep slopes. Because farmers clear the understory to plant cardamom, these slopes are susceptible to soil erosion and drying, that degrades the soil and causes siltation downriver, including in the hydropower reservoirs. Clearing the undergrowth also prevents forest regeneration and reduces structural complexity, which is essential to provide suitable habitat for many of the endemic species.[6] Trees are also cut for firewood to construct barns for drying cardamom.

   However, because of fluctuating cardamom prices people have been abandoning cardamom cultivation. By 2009, the Forest Department estimated that the area under cardamom cultivation had reduced to about 400 ha. Legal action against the remaining cultivators is in progress; at present there is some small-scale cardamom cultivation in Panwila, Hagala and Kalupahana. Thus, there is, potentially over 1,300 ha of forests where cardamom has been abandoned that can, and should, be restored and reforested. These are mostly in Ranamure, Narangamuwa, Attanwala, and Rambukoluwa, in the Laggala Divisional Secretariat, and Meemure in the Kandy Divisional Secretariat, all of which are in the core area of KCA. [8] Ranagala in the Kandy Divisional Secretariat is another area with extensive areas of abandoned cardamom in the buffer zone of KCA.

9. Loss of agricultural productivity is being reported by farmers. Forest clearing and historically bad agricultural practices has resulted in erosion and loss of topsoil.

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[5] H.M. Bandaratillake. 2005. The Knuckles Range: protecting livelihoods, protecting forests. In: Durst, P.B., Brown, C., Tacio, H.D. and Ishikawa, M. (eds). In search of excellence: exemplary forest management in Asia and the Pacific. Food and Agriculture

[6] Somaweera, R., Wijayathilaka, N., Bowatte, G. and Meegaskumbura, M., 2015. Conservation in a changing landscape: habitat occupancy of the critically endangered Tennent's leaf-nosed lizard (Ceratophora tennentii) in Sri Lanka. Journal of natural history, 49(31-32), pp.1961-1985. [8] Table 3, Project Document.

Climatic fluctuations and water shortages are also contributing to low yields. Lack of knowledge to predict and assess current and future market demands based on trends, lack of advanced technological innovations in farming practices, and poor access to markets make the farmers vulnerable and marginalized.

10. Crop depredations by wildlife also cause economic losses, and lead to human wildlife conflicts. Loss of natural habitats and food for wildlife forces them to enter human settlements and raid agricultural areas, increasing the level of conflict. Spread of invasive plant species—many of which are weeds—also require additional management of agricultural fields, including the use of stronger chemical controls that in turn affect biodiversity and health of people, from farmers to consumers.

11. Fragmentation of land ownership is also creating a fine-grained land-use matrix that becomes a constraint to developing a landscape-scale conservation management plan. It also fragments and severs ecological connectivity, affecting persistence of species populations, survival of biodiversity, and sustainability of ecosystem processes and services.

12. Other issues that have to be considered and addressed include: lack of boundary demarcation; land issues related to land acquisition for resettlements; water extraction for commercial bottling; free-grazing livestock in forests; various ad hoc development projects; illegal gem mining that causes erosion and siltation of the waterways; and treasure hunting.

13. Resettlement activities taking place in the Moragakakanda-Kalu Ganga Multi-purpose hydro project and opportunities created for collaboration with. The section below discusses more on the Moragahakanda Project and its impacts, other ongoing and related projects pertaining to this landscape and possibilities for collaboration.

1.5. **Moragahakanda-Kalu Ganga Multi-purpose Hydro Project**

This section contains information gathered from the Mahaweli Authority of Sri Lanka, their report on Restoration Implementation Programme (RIP), and direct information received from the Moragahakanda Project Office.

This megaproject on the northeastern foothills of the Knuckles has important implications and consequences on the KCF and its buffer zone. Under this project, a dam will be constructed across the Amban Ganga, one of the main tributaries of the Mahaweli river, to create a large reservoir. The multi-purpose irrigation and hydropower project is aimed at generating and providing 25MW of electricity to the national grid, while providing water to irrigate and cultivate 5,154 ha of existing land during Maha and 21,208 ha during the Yala seasons in the North-Central Province, increasing the cropping intensity from 1.55 to 1.85.

The project is being implemented by the Mahaweli Authority of Sri Lanka which was established under the Mahaweli Authority Act of Sri Lanka No.23 of 1979. This is a project identified under the survey of Irrigation and Hydro Power Potentials of the Mahaweli Ganga and the Adjoining River Basins during the four year period from 1965 to 1968 by a UNDP/FAO team with Sri Lankan counterparts. Implementation was commenced in 2007 .

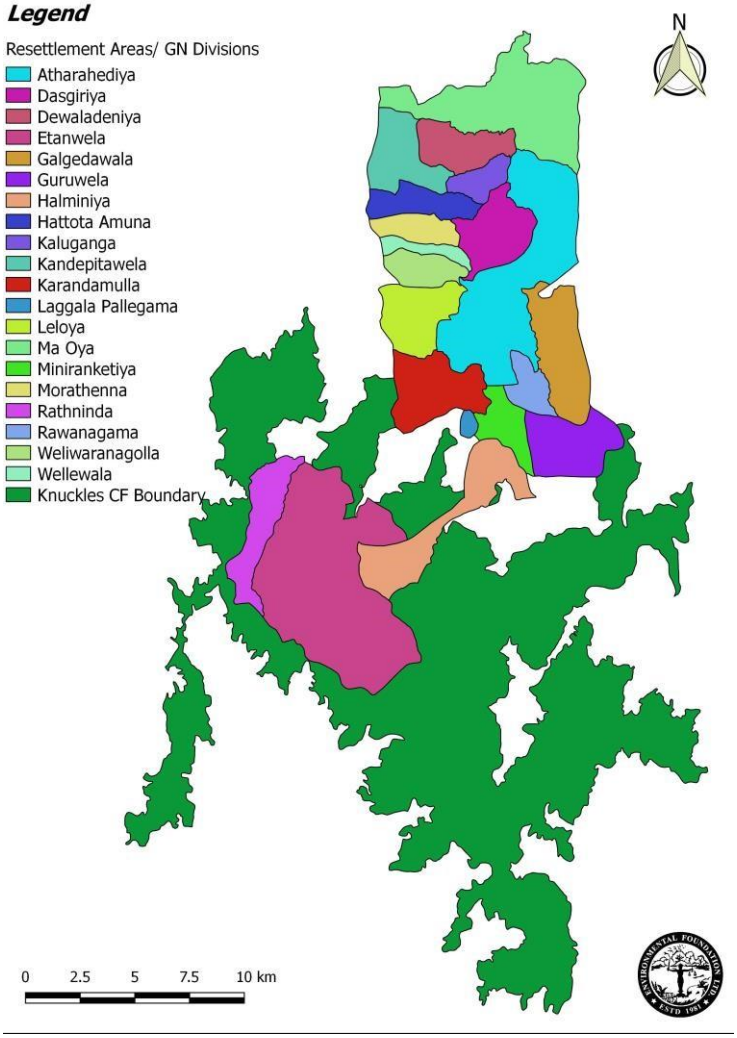

Figure 4: Grama Niladari Divisions of the resettled area in - Laggala Pallegama Divisional Secretariat

The project activities affect the KCF and buffer zone since people from some of the settlements that were inundated by the reservoir have been resettled in the Knuckles, specifically in the Laggala-Pallegama Divisional Secretariat (Figure 4). The Restoration Implementation Plan (RIP) of this project deals with acquisition and compensation, relocation/resettlements and economic rehabilitation processes of the affected persons (APS) of the Moragahakanda Project, inclusive of other entitlements. The policy framework of the RIP is based on the National Involuntary Resettlement Policy (NIRP) and related enactments on land acquisition and land alienation. The data contained in the RIP are based on the findings of the socio-economic surveys carried out by MASL in 2006 and 2008 and from the Acquisition Surveys (under Section 2 of Land Acquisition Act) done by the Survey Department in 2009.

The extent of the affected area under this project is 4153 ha, that includes the tank bed, road deviation, an elephant corridor between the Giritale-Minneriya protected areas and Wasgamuwa National Park, the trace for the electricity transmission line and the branch channel trace of Medirigiriya. However, the area of the KCF and buffer zone affected is restricted to Laggala-Pallegama, where the land use and land cover was changed from shrub forests and forests to human settlements and related infrastructure.

Based on the guidelines of Mahaweli Authority of Sri Lanka and prevailing policies pertaining to resettlements, the following assistance schemes are being introduced to provide incomes and livelihood improvements for the affected persons.

- Training and employment opportunities to vulnerable families
- Job restoration grants
- Business grants to owners of business establishments
- Ex-gratia payment for households opted for System 'D'

As per the MASL RIP, the following new ventures have been identified for the long-term sustainability and economic rehabilitation of the affected people.

- Off-farm activities, like fish farming, gem mining
- Establishment of small scale agro based industries.
- Market oriented crop diversification.
- Hi-tech agriculture.
- Involvement in other income generating activities during off seasons
- Establishment of service provider entities.

Furthermore, it has been decided to allocate land for infrastructure including common areas for schools, temples/religious places, business establishments, play grounds, banks, welfare societies, etc. Thus, the resettlements and activities of these people will create a larger area of impact due to livelihood and other related activities, than the actual resettlement footprint. Therefore, interventions to control the area of impact will be necessary.

1.5.1. Status of the Laggala- Pallegama Resettlement

The System 'F' which is being developed under the Kalu Ganga Reservoir Project lies in the Laggala-Pallegama Divisional Secretariat. The gross area of System "F" is 139 km^2 of which 78 Km^2 have been already developed. At present, a population of 6573

persons live in this area, with a Male: Female ration of 51% to 49%. Most of these people are dependent on rain-fed agriculture and chena cultivation. In the new Laggala resettled area, 911 ha has been used for homesteads, 2113 ha for farmsteads, and about 157 ha for commercial establishments.

1.5.2. The environmental restoration programme for the resettlement and the buffer areas

An impact assessment has determined that the resettlement programme will result in some soil erosion, destruction of water resources, and disturbance to wildlife. In order to mitigate these impacts, the recommendations of the EIA are being carried out as part of the project implementation. In addition, community forests will have to be established and the reserved land will have to be protected against encroachment and degradation by unsustainable uses. Fences and other physical demarcations may be necessary to prevent encroachment and expansion of the settlements into the forest areas.

The hydro project has also allocated funds for environmental restoration, including in the Knuckles, which creates opportunities for community based organisations (CBOs) become engaged as community conservation stewards.

1.6. Other relevant projects/ opportunities for synergy.

- The GEF project, **Enhancing Biodiversity Conservation and Sustenance of Ecosystem Services in Environmentally Sensitive Areas** will assist the Government of Sri Lanka to safeguard biodiversity in ecologically sensitive areas with multiple land uses by operationalizing a new land use governance framework called Environmentally Sensitive Areas, which will be primarily outside protected areas. One of the main outcomes of this project is biodiversity-friendly management at two sites (at least 200,000 ha). The project will also develop a framework for landscape-scale planning in these areas.
- The **Sri Lanka Community Forestry Programme** (with financing from the Government of Australia) is a four-year program that is expected to result in a substantial increase in the number of community forestry sites, and the area of forest within these sites. This is expected to enhance the livelihoods and reduce the incidence of poverty in those communities participating in the program. It is

expected to improve the quality of 23,000 ha of forests under the community forestry approach in 18 districts. The proposed SGP project will cooperate with SLCFP in its activities in particular in improving the livelihood options available for the households and to build the capacity of communities to participate in sustainable community forestry management activities. This project could potentially contribute towards establishing community forestry programmes in the KCF buffer zone.

- The **United Nations Readiness Programme for Reducing Emissions through Deforestation and Forest Degradation** (UNREDD) seeks to establish an appropriate management structure for REDD+ Readiness and Implementation at national and subnational levels and ensure their effective operation. Placing particular emphasis on the involvement of forest-dependent local communities, the Programme is developing and implementing a comprehensive system of stakeholder consultation, awareness and capacity building for the forest and land-use activities to be covered as part of the REDD+ Programme. A Community-based REDD+ programme will pilot ground level initiatives that feed into the UNREDD process as a demonstration of best practices, sharing experiences and lessons. Through this effective engagement, and consequent discussions, a national strategy will be developed and a framework for activity implementation. Some of these pilots could potentially be implemented in the KCF and its buffer zone, where degraded lands are slated to be restored through forestry practices.

- The GEF financed **Rehabilitation of Degraded Agricultural Lands in Kandy, Badulla and Nuwara Eliya Districts in the Central Highlands** project aims to demonstrate feasible projects and best practices, arrest erosion and fertility degradation, and provide livelihoods for communities with enhanced incomes. Lessons learned from this project can be applied in the KCF and buffer zone.

- The goal of the World Bank **Ecosystem Conservation and Management** project is to improve the management of ecosystems in two landscapes in Sri Lanka to achieve conservation and community benefits (Government of Sri Lanka, 2006). The project consists of four components: 1) pilot landscape planning and management; 2) sustainable use of natural resources and human-elephant co-existence; 3) protected area management and institutional capacity; and 4) project

management. Under Component 2 communities living adjacent to protected areas and other sensitive ecosystems will receive support to plan natural resource use and develop livelihoods. Participatory Community Action Plans will be used. The two landscapes will include a biodiversity rich wet zone and a dry and arid zone forest landscape both of which face different types of development pressures. The KCF could become one of the sites.

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