Ooty: Understanding Urbanisation in an Ecologically Sensitive Area

Case Study, Environment Cluster, Rockefeller Project

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SECTION I: INTRODUCTORY NOTE

Ooty: Understanding Urbanisation in an Ecologically Sensitive Area

As part of a Rockefeller- IIHS partnership, IIHS is producing a series of working papers, policy briefs, digital interviews, and a range of teaching-learning material that are directed towards addressing various kinds of urbanisation challenges faced by Indian cities. Each of the knowledge outputs is targeted at national, state and city policymakers, practitioners, entrepreneurs, civil society leaders, and communities and local stakeholders. There are ten thematic clusters, and each cluster comprises a working paper, policy brief, a case, and two short films. As part of the environment cluster, a case was developed on Ooty, to understand the implications of urbanisation in ecologically sensitive areas.

Brief Case Description

Western Ghats is an ecologically sensitive zone, and one's of world's biodiversity hotspots. Spread across multiple sub-ecological zones, and several states, conservation of Western Ghats poses a whole range of challenges. In recent times, there have been two reports by different government committees which tried to lay out a blueprint for conservation and development in this region. However, these reports have been largely silent about both the impacts and role of urban areas.

Yet, urban areas and their particular challenge cannot be ignored. According to Census 2011, nearly 48% of the population in Western Ghats reside in urban areas. Thus, it becomes imperative to understand how urban areas can develop with minimal environmental impacts. Through understanding one particular city, the case hopes to grapple with the possible impacts of urban areas on the Western Ghats. The case will assess the possible impacts of Ooty on its environment: specifically it will seek to understand whether and how impacts of cities located in ecologically sensitive zone differs from other cities. Furthermore, it seeks to unravel how its location in the Western Ghats has affected its growth, and pushed it along a certain trajectory. The case would also examine the governance and institutional structures for Ooty and its wider region, and explore the consequences of disjuncts between administrative and planning boundaries on both urban and environmental governance. While it would not be the primary focus, the case would also examine what urban concerns need to be integrated in the larger blueprint/ action plan for the Western Ghats which different reports have tried to develop.

SECTION II: TEACHING NOTE

Target Audience

MUP Learners (Concentration in Sustainability), UPP learners (Course on Environmental Management)

Proposed Learning Outcomes

The proposed learning outcomes of the case are:

1. The learners should be able to assess environmental impacts of cities located in ecologically sensitive areas, and understand how and whether these impacts are different for cities in different ecological zones

2. The learners should be able to understand the different pathways through which location of a city within a particular ecosystem affects its growth and development trajectory

3. The learners should begin to understand the complex "ecological" and "development" dynamics

4. To learners should be able to critically engage with 'boundaries' (administrative and natural), and grapple with 'scale' in context of environmental governance

Learning Environments

The case can be taught in a classroom in any module related to Environment, Sustainable Cities, or Sustainable Development. A practica could also designed later using this case as existing material.

Questions for Discussion and Exercises

1. What are environmental impacts of Ooty? How are these different from other cities e.g. Bangalore/ Mysore?
2. How has location of Ooty within Western Ghats impacted its development trajectory?
3. Get learners to prepare institutional mapping for different urban systems, and key natural resources/ elements e.g. land, biodiversity. Lead discussion to bring out the disjuncture between different boundaries.

SECTION III: MAIN CASE

I. Context

Western Ghats

A consensus about the exact nature, origin and extent of the Western Ghats has not been arrived at, despite several studies on these characteristics. The most widely accepted theory describes the Western Ghats as a "passive margin great escarpment[1]". This means that the Western Ghats are not true mountains in the geological sense, but rather the raised faulted edge of the Deccan Plateau. Older than the Himalayas, it is estimated that the Ghats were formed during the Late Cretaceous Era (Kale in Migon, 2010).

The Western Ghats runs uninterrupted in the north-south direction, parallel to the western coast, for a length of about 1500 kilometres with the exception of the Palghat Gap. It arises below the river Tapi in Gujarat, traverses six states – Gujarat, Maharashtra, Goa, Karnataka, Tamil Nadu and Kerala- and ends near Kanyakumari, the southernmost point of the sub-continent. The Palghat Gap is used to separate the Ghats into two sections, the Northern and the Southern Block. The areal extent of the Western Ghats has been estimated by different entities to range between 120,000 sq. km. and 160,000 sq. km.

Significance of the Western Ghats

Despite the lack of consensus over the geological features, the significance of the Western Ghats remains undisputable. Due to their elevation & location, the Western Ghats acts as a barrier to the south-west monsoon winds, bringing in heavy rainfall to the windward regions located on the western side of the Ghats. While the rain shadow regions receive much less rainfall, they derive their sustenance from the impressive river system that arises from the Western Ghats.

Most of the rivers that drain peninsular India, therefore, have their headwaters in the Western Ghats. These include the shorter, swifter westward flowing rivers such as the Periyar, Mandovi, Netravati & Sharavati among others. These rivers drain the coastal plains of states such as Kerala, Maharashtra & Karnataka & are instrumental in the creation of coastal backwaters and in irrigating and supplying drinking water to the Western Coast.

The Western Ghats also gives rise to longer and slower rivers such as Godavari, Krishna and the Cauvery. Along with their several tributaries, these river systems drain most of peninsular India. Thus, more than 360 million of the peninsular Indian population directly or indirectly depend on the Western Ghats for their survival and livelihoods. The topology and river network of the Western Ghats have also been used for other purposes such as generation of hydroelectric power.

The climate and the topography of the Western Ghats have created a unique network of ecosystems, which has been claimed as one of the world's eight hottest hotspots (Myers et al, 2000). It has been estimated that the Western Ghats harbours over 325 species listed in the IUCN Red Data Book; it is also estimated that over 2000 endemic plant species and 300 endemic vertebrates are present in the Western Ghats. The attribution of the 'hotspot' tag

[1]Escarpments are described as precipitous hill slopes of considerable length, formed by faulting and usually separating two areas of different elevations.

also points towards the increasing environmental threat that the Western Ghats has been facing.

Besides the natural landscapes, the Western Ghats also has a significant impact on the cultural landscapes of the sub-continent. Sacred groves form a sizeable section of the land area of the Ghats, and have been traditionally used as a method of conservation of biodiversity. Natural features of the Ghats, such as mountains and rivers have been accorded religious significance, and temples and temple towns have been present in the Western Ghats. Several tribal communities also inhabit the Western Ghats, and have moulded their livelihoods around the areas they inhabit. These cultural and religious features have also helped in maintaining the biodiversity levels in the Western Ghats. From the colonial era onwards, tourism has also been a major activity in the Western Ghats.

Current Challenges

Despite the importance of the Western Ghats in multiple aspects to peninsular India, there has been a significant incursion of anthropic activity since colonial times, including the establishment of large settlements and industries. The scale of human interference has increased manifold over the recent decades, leading to increased environmental degradation and loss of biodiversity across the Western Ghats. The need for increased measures for conservation and economic development of the region had led the Government of India to institute a Western Ghats Development Programme through its Five Year Plans. In 2010, "*In view of the environmental sensitivity and ecological significance of the Western Ghats region and the complex interstate nature of its geography, as well as possible impacts of climate change on this region, the Ministry of Environment and Forests, Government of India, constituted, […] a Western Ghats Ecology Expert Panel.*"

However, the release of the Western Ghats Ecology Expert Panel (WGEEP) report was met with protests and violence across the region. It was felt that the Panel prioritized ecological conservation without giving adequate importance to the economic development of the region and its inhabitants. In the light of these events, the GoI constituted a High Level Working Group (HLWG) to review the workings of the WGEEP and suggest measures to promote the simultaneous economic growth and environmental conservation in ecologically sensitive areas of the Western Ghats.

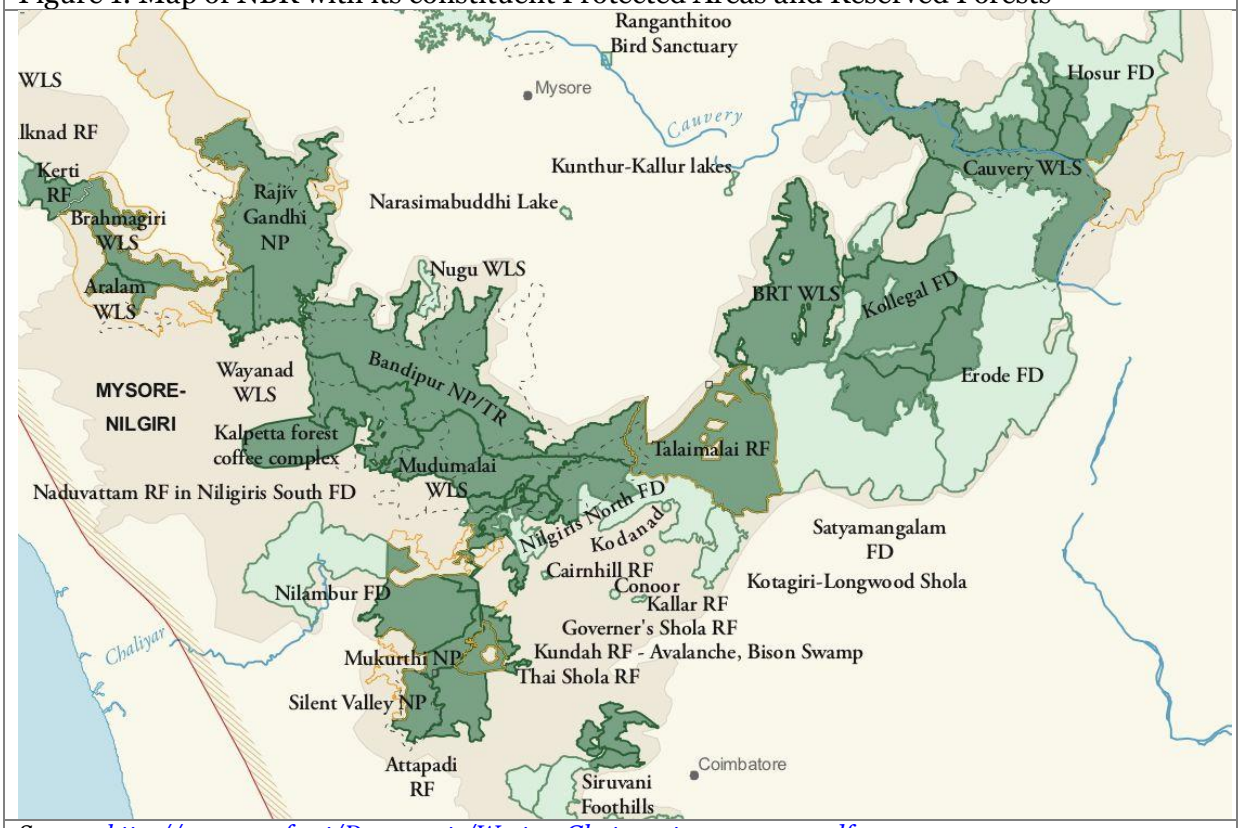
Nilgiri Biosphere Reserve

Within the Western Ghats, the Nilgiris lies at the intersection of the three southern states of Karnataka, Kerala and Tamil Nadu. It constitutes an ecologically sensitive region of immense significance within the Western Ghats. As part of the UNESCO's 'Man and Biosphere Program' in 1973-74, the Nilgiris were chosen as being representative of the Western Ghats. Subsequently, the Nilgiri Biosphere Reserve was established in 1986, to fulfil the following objectives:

- To conserve in situ genetic diversity of species
- To restore degraded ecosystems to their natural conditions
- To provide baseline data for ecological and environmental research and education
- To function as an alternate model for sustainable development

The Nilgiri Biosphere Reserve (NBR) is India's first designated biosphere reserve. It is a complex of Protected Areas (PA) and reserved forests that stretch across 5520 sq. km at the intersection of Kerala, Karnataka and Tamil Nadu.

Figure 1: Map of NBR with its constituent Protected Areas and Reserved Forests



Source: http://www.cepf.net/Documents/WesternGhats_outcomes_map.pdf

Box 1: Biosphere Reserves

Biosphere reserves are areas of terrestrial and coastal ecosystems that promote solutions to reconcile the conservation of biodiversity with its sustainable use. They consist of ***a core zone(s) of strictly protected ecosystem, a buffer zone where limited human activity is permitted, and a transition zone where greater activity is allowed****. Biosphere reserves have three main aims: conservation, economic development, and research and education. Thus, biosphere reserves serve as "living laboratories" for testing and demonstrating integrated management of land, water and biodiversity.*

Source: UNESCO (http://www.unesco.org/new/en/hanoi/natural-sciences/biosphere-reserves/)

Of the total area, the NBR further is divided into a core zone (1240 km²) and a buffer zone (4280 km²). The buffer zone is futher divided into Manipulation (Forestry) Zone (3239 km²), Manipulation (Tourism) Zone (335 km²) and Restoration Zone (706 km²) (Daniels, 1996). The terminology not being standardized, the buffer zones play partially the role of the transition zones of the NBR. However, they are not always defined and their management is not centralized. Other reserves, such as the reserved forests, do not have buffer zones (Puyravaud & Davidar, 2013). There was and still is no transition zone. The NBR only

includes the constituent protected areas in the region. These constituent reserves are as poorly connected to each other as before the creation of the NBR.

The NBR unifies a number of protected areas (PAs) such as the Rajiv Gandhi National Park and Bandipur in Karnataka; Wayanad Wildlife Sanctuary, Nilambur, Silent Valley National Park, Attapadi Reserve Forest in Kerala; Siruvani Hills, Mudumalai Wildlife Sanctuary, North and South Divisions of the Nilgiris, and Mukurthi National Park in Tamil Nadu. There are varying levels of protection accorded to PAs, such as the Silent Valley National Park which doesn't allow for any human activity within it, as opposed to the Mukurthi National Park, which is a growing tourist destination.

Table 1: Area under various zones of the Nilgiri Biosphere Reserve

State	Core area	Buffer area				**NBR**
		Manipulation (Forestry) zone	Manipulation (Tourism) zone	Restoration zone	Total	
Karnataka	701.8	212.2	945	2081.5	3238.7	**3940.5**
Kerala	264.5	269.2	0	65.8	335	**599.5**
Tamil Nadu	274	344.2	245.9	116.3	706.4	**980.4**
Total	**1240.3**	**825.6**	**1190.9**	**2263.6**	**4280.1**	**5520.4**

Source: Daniels, 1996

Ecological Significance

The diversity of the Nilgiri landscape is characterized by scrub forests, evergreen forests, *sholas* (montane forests), grasslands and vast stretches of lowland rainforest. NBR has been identified as one of the ten bio-geographical zones of India, which houses over 3700 plant species, more than 1000 species of mammals, 550 of birds and 30 of reptiles and amphibians (Daniels, 1996).

Settlements and People

Apart from the diverse flora and fauna, the NBR is home to several indigenous populations such as Cholanaickas, Todas, Badagas, Paniyans, Kurichiyans, Kurumbas, Chettis, Irulas, Sholagas, Kotas, Adiyans, Kattunayakans, Mudugas, Alars, Pathiyans and more (Biswal, 2009). Several of these communities are largely hunter-gatherers who are dependent on the forests and its produce.

Issues/Concerns

While the NBR has been declared as a Biosphere Reserve, there is little or no follow up to this in terms of policies or programmes. NBR per se is not a Protected Area. In fact the Biosphere Reserve is not recognised as an administrative unit by MoEF. There are many PAs in it, but the rest of the area is not a PA. Not being an administrative unit, the NBR is governed and managed as any other area. The different states have different policies and programmes for development and conservation. The districts within the NBR are not grouped together either at the state level or in the NBR as a whole. Thus the ecological and cultural significance of the region is not reflected in the way it is being managed.

However, communities in the NBR practice diverse livelihood strategies including agriculture, Non-Timber Forest Produce (NTFP) collection and wage work.

Nilgiri Plateau

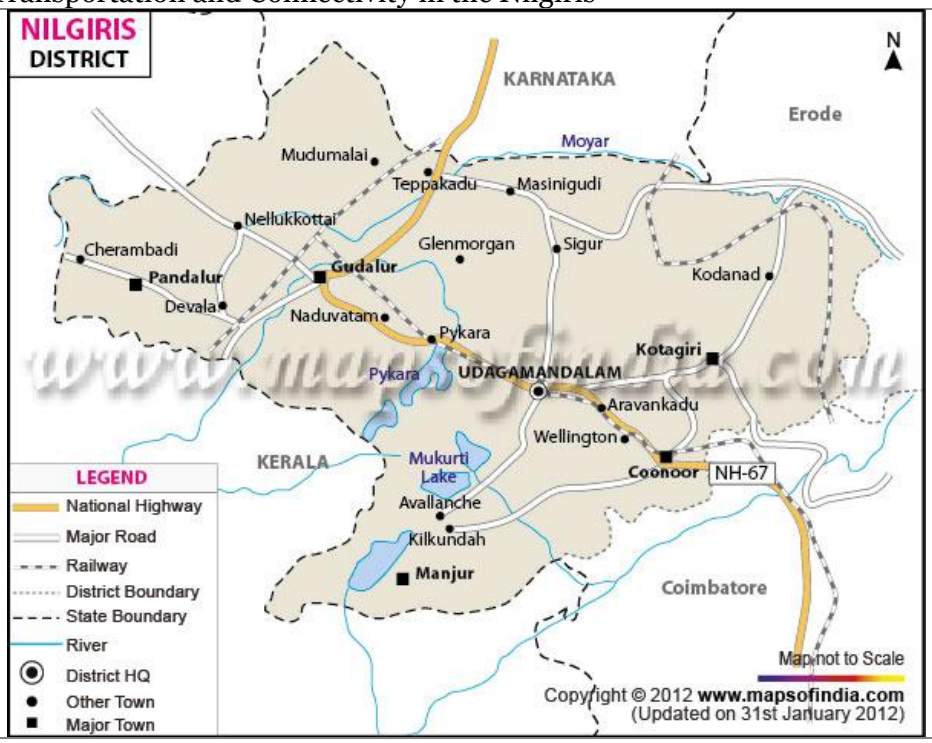
Location and Access

The district has come a long way from its initial pre-colonial and colonial days when there were hardly any means of access. The importance of a strong road network was understood well by the British who set about improving the existing routes and building additional routes. Building roads was labor-intensive in the early days, with labour being brought from the plains, including convicts. However, the outcomes of building the major roads opened up the district to flows of commerce and migration.

The major roads in the early days were four: the Kotagiri and Coonoor ghat roads connecting Mettupalayam to the district, the Gudalur ghat road connecting Mysore and Wayanad to the Nilgiris and the Sigur ghat road connecting Mysore with the Nilgiris. These ensured that there was a constant linkage of the Nilgiris with its various neighbours.

The importance of these roads to the district can be gauged from the fact that they still continue to be the default routes for access to the Nilgiris. The Kotagiri Ghat currently is part of State Highway 15 and runs from Erode to Ooty; the Coonoor Ghat is part of National Highway 67 and runs from Coimbatore to Pykara (beyond Ooty); the Gudalur Ghat is part of National Highway 212 extending from Gundlupet to Nagapattinam while the Sigur Ghat is State Highway 67 running from Mudumalai to Ooty.

Figure 2: Transportation and Connectivity in the Nilgiris



Source: http://www.mapsofindia.com/maps/tamilnadu/districts/nilgiri.htm

Currently, the total extent of the road network in the district is around 2600 kilometres. The distribution of the road network according to the hierarchy as well as the material of construction is listed below.

Table 2: Length of roads in the Nilgiris district (in km)	
National Highways	109.2
State Highways	114.6
Major District Roads	141.97
Other District Roads	714.6
Municipalities	210.73
Panchayats	670.88
Town Panchayats & Townships	532.02
Forest roads	184
Total length	**2678**
Source: District Statistical Handbook, 2008-09	

Table 3: Length of network by road surfaces (in km)		
Surfaced Roads	Cement Concrete	829.7
	Bituminous	632
	Water Bound Macadam	432.5
	Total Surfaced	1894.3
Unsurfaced Roads		326
Total		**2220.3**
Source: District Statistical Handbook, 2008-09		

The introduction of the Mountain Railway system eased access to the plateau from the Coimbatore side a great deal and proved to be the shortest route, given that carts were the major mode of transport in the early parts of the 20th century. However, it did not seem to have the impact that it was thought to, in many ways reflecting the case of the Kalka-Shimla Railway network ***(Kennedy, 1996).*** However, it has gained popularity in recent times as a major component of the tourist circuit, due to it being awarded the status of an UNESCO World Heritage Site, and as reflected in the increasing ridership numbers below.

Table 4: Ridership figures for the Nilgiri Mountain Railway				
Year	Domestic	Foreign	Total	Growth Rate (%)
2008	177,080	7,460	184,540	-
2009	205,630	7,114	212,744	15.3
2010	211,646	16,166	227,812	7.1
2011	242,566	12,859	255,425	12.1
2012	374,972	25,390	400,362	56.7
2013	365,196	23,500	388,696	-2.9
Source: Tourist Office, Ooty				

Topography and Climate

The NBR has a diverse topography with altitude ranging from 80m (Nilambur Plains) to above 2600m (Nilgiri Plateau) above MSL. As a result of this topographic complexity and spread, the NBR encompasses a wide range of rainfall zones which receive between 500 mm to 7000 mm of precipitation annually. The western side has heavier rainfall averaging about 5000 mm. Jun-September is the main monsoon season, although there are summer and occasional winter rains locally within the NBR. April and May are the hottest months. In the higher elevations in the Nilgiris, temperature drops below zero degrees centigrade during December-January. The combination of topography and climate has resulted in the diversity of vegetation types in the region. (Daniels, 1996)

The geographical area of the Nilgiris district is 2452.5 sq. km. It is approximately 130 km wide by 185 km. The topography is rolling & steep with 60% of cultivable land having slope

of 16-35°C[2]. The elevation ranges from 900 m to 2636 m AMSL. During summer the minimum temperature varies from 10-12° C and the maximum temperature from 21-25° C, and in winter the minimum temperature dips to 2° C & the maximum varies from 16-21° C[3].

The district benefits from both the South West and North East Monsoons. While the South West Monsoon brings rains to the whole of Gudalur, Pandalur and Kunda taluks and parts of Udagamandalam taluk, the North East Monsoon is the mainstay for the Coonoor and Kotagiri taluks. The average annual rainfall is 1921 mm[4]. About 63% of the annual rainfall is received during SW monsoon and 22% during NE monsoon[5]. In 2013, the total rainfall in Ooty was about 1289 mm.

Land Use and Land Cover

The land use profile of the district is given in the table below.

Table 5: Land Utilization (2008-09) (Area in sq. km.)

Classification	Taluk						District Total	% of total
	Kundah	Ooty	Coonoor	Kotagiri	Gudalur	Pandalur		
Forest	194.7	611.6	41.1	202.0	325.6	50.7	1425.8	**56.0%**
Barren & Uncultivable uses	9.7	7.9	5.6	7.0	0.9	2.7	33.8	1.3%
Land put to Non-Agricultural uses	3.8	32.6	27.6	11.7	12.1	12.0	99.8	3.9%
Cultivable Waste	2.1	10.5	0.3	5.0	0.2	2.1	20.2	0.8%
Permanent Pastures & other Grazing Land	12.2	9.1	9.2	16.6	0.7	3.0	50.8	2.0%
Land under Misc. Tree Crops & Groves	4.8	17.9	6.1	3.3	2.9	2.8	37.8	1.5%
Current Fallows	11.1	31.1	10.2	21.0	3.6	6.0	83.0	3.3%
Other Fallow Land	3.8	12.5	0.4		0.2	1.7	18.6	0.7%
Net Area Sown	75.2	146.9	128.3	130.1	160.3	134.4	775.2	**30.5%**
Geographical Area	317.6	880.0	228.8	396.7	506.4	215.3	2544.9	100.0%

Source: The Nilgiris District Statistical Handbook, 2008-09

It can be seen from the above table that forests and agricultural land together occupy 86% of the district's land area. Non-agricultural land accounts for 4% of the land area. The larger question that this table poses is the availability of land for the further expansion of human settlements in the district. The question is particularly pertinent for the cities of Ooty and Gudalur, where the presence of forest land in their immediate vicinity compounds the problem. At present there is widespread conversion of cultivable land into human settlements due to increasing land prices and the Nilgiris being an attractive destination for holiday homes.

[2] District Administration, The Nilgiris (http://nilgiris.nic.in/profile.html).
[3] The Nilgiris District Statistical Handbook, 2008-09
[4] https://en.wikipedia.org/wiki/Nilgiris_district
[5] Tamil Nadu Economic Appraisal (2005-06), Evaluation and Applied Research Department, Government of Tamil Nadu, Chennai

In their 1995 paper 'Maps as markers of ecological change', Gadgil and Prabhakar, conflating historical records and (then) current satellite imagery, builds a picture of the ecological changes that have occurred in the district following large scale human intervention over the last two centuries. Annex XX, reproduced from this work, showcases the major changes in the Nilgiri plateau since 1847.

Ecological Significance

The NBR is a high biodiversity region with 3238 species of angiosperms, 71 species of gymnosperms, 134 species of pteridophytes, 300 species of butterflies and 684 species of vertebrates (Daniels 1996). More than half the endemic vertebrates of Western Ghats occur in the NBR (Daniels, 1996). Of the flowering plants, 135 are endemic to the region and of the 175 species of orchids found in the region, 8 are endemic. Many more species remain to be identified. Loss of habitat and changing land use are major threats to the biodiversity of the NBR (Keystone, 2012[6]). Among the lower vertebrates a number of little known amphibians, reptiles and fish still exist in the NBR. 39 species of fish, 31 species of amphibians and 60 species of reptiles endemic to the Western Ghats also occur within the NBR. Of these 24 were known only from the NBR. Twelve species of mammals endemic to the Western Ghats are also found in the NBR (Daniels, 1996).

Botanical evidence pertaining to the maintenance of grassland cover in the upper Nilgiris are said to indicate human interventions in the eco-history of the region going back 3000 years. During the period 1800-1860s, the British regime introduced plantations of tea and coffee and many exotic commercial tree species, like Eucalyptus, wattle and cinchona. Teak, sandalwood and rosewood were also extracted from natural forests for revenue (Keystone, 2007[7]). Rules and policies, such as the Kerala Private Forest Act 1971, which allowed the state to take over private plantations without compensation, led to large scale deforestation (Prabhakar, 1994).

Forests and Plantations

The region consists of Evergreen, Semi Evergreen, Moist, Dry and Montane (Shola) tropical forests.

Demographic and Socio-Economic Profile

The population of the Nilgiris district is 735,394 (Census, 2011). The sex ratio is 1042 for the entire district, while it is 1054 in rural areas and 1034 in urban areas. In the age category of 0-6 years, which constitutes about 9% of the population, the sex ratio is 985 for the entire district and 990 and 982 respectively for the rural and urban areas. This trends merits closer examination as it may point to sex selection and/or other practices that do not favour the girl child. In terms of literacy the district is ranked 4th in the state with 85.2% population of seven years or older being literate. However there is a distinct gender divide with the female literacy being only 79.0% compared to male literacy of 91.7%. This disparity is seen in both urban and rural areas. Interestingly, the district is ranked 3rd in the state in male literacy but only 5th in female literacy.

[6] Keystone, 2012. Where the Kurinji Blooms – A Biodiversity Learning Module. Keystone Foundation, Kotagiri
[7] Keystone, 2007. Honey Trails in the Blue Mountains. Keystone Foundation, Kotagiri.

Scheduled Castes constitute 32.1% of the population and Scheduled Tribes 4.5%. This skewed demography against the indigenous communities is one of the factors for their marginalization historically.

Till the arrival of the British, the indigenous population of the Nilgiris consisted of tribal groups such as the Todas, Kotas, Kurumbas, Irulas amongst others. The arrival of the British also led to a large influx of Indians from the plains, who soon after, became the largest demographic group pushing the indigenous communities to the periphery. However the Badaga community continued to flourish, having adapted to the change in lifestyle that the British bought in. Over time, the Badaga community continued to grow, joining in on the tea revolution from the 1920s onwards (Folke, 1966) and eventually owning most of the small scale tea plantations in the district.

The repatriated Sri Lankan Tamil population was the cause of the next major demographic shift in the district. While estimates of their population vary, it is estimated that they constitute a significant part of the population. The migration tables from Census 2001 suggest that there were more than 47,00 repatriates living in the district, forming 15% of the total migrant population of the district and 6% of the total population. However, this is suspected to be underreported as some of the more credible estimates put them close to 25% of the district population.

Demographic changes occurring throughout the district are inherently linked to the land ownership patterns in the district, as well as employment figures. This also points to the possibility of a continuing marginalization of the scheduled tribes in the growth of the district.

Some of the demographic indicators of the district and the constituent taluks, as obtained from the 2011 Census, are given in the table below.

Table 6: Key demographic features of the Nilgiris district and constituent taluks									
	Nilgiris	Nilgiris Urban	Nilgiris Rural	Panthalur	Gudalur	Ooty	Kotagiri	Coonoor	Kundah
Population	735,394	435,655	299,739	125,931	104,768	191,960	108,684	157,744	46,307
Urbanization	**59.2%**	-	-	**35.4%**	**92.0%**	**55.6%**	**39.2%**	**82.8%**	**31.9%**
Household Size	3.7	3.8	3.6	4.1	4.2	3.6	3.5	3.6	3.3
Sex Ratio	1042	1034	1054	1043	1034	1050	1064	1014	1073
Child Sex Ratio	985	982	990	986	972	1015	956	975	1006
Scheduled Castes (% of population)	32.1%	34.2%	28.9%	39.1%	26.5%	30.4%	27.4%	34.1%	36.3%
Scheduled Tribes (% of population)	4.5%	2.3%	7.6%	8.7%	6.3%	3.2%	5.8%	1.5%	1.1%
Literacy Rate	85.2%	88.0%	81.2%	86.7%	86.7%	82.5%	83.0%	88.3%	83.5%
Male Literacy	91.7%	93.4%	89.3%	92.1%	91.4%	89.9%	91.6%	94.1%	91.3%
Female Literacy	79.0%	82.8%	73.5%	81.6%	82.3%	75.5%	75.1%	82.6%	76.2%
Total workers (% of population)	52.3%	48.0%	58.6%	49.2%	46.0%	53.5%	57.8%	50.6%	62.3%
Source: Primary Census Abstract, Census of India, 2011									

Education

One of the positive effects of the colonial occupation of the Nilgiris was increased attention to education, resulting in the establishment of several schools over time8. Indeed, some of the schools established during the colonial era are still operational. The attention given to education by the State government - even through agencies such as TANTEA which have established primary schools within their estates - also helped it to have a substantially literate population. However, this has not especially translated into opportunities for higher education within the district, with the number of colleges and higher education institutions being very few in numbers. This has also led to the younger population of the district – those who can afford it- moving to larger cities such as Coimbatore and Bangalore for higher education and further opportunities that it provides. Compounded with a lack of employment opportunities in the tertiary sector –apart from tourism, this has also been put forward as one of the reasons for outmigration from the district.

Economy

The gross district domestic product of the Nilgiris was ₹3253 crores in 2008-09 (in 2004-05 prices). The corresponding figure for the year 2004-05 was ₹2513 crores, showing a Compound Annual Growth Rate of 6.4% over the period.

However, these figures need to be compared with those for the State to get a better picture. The district contributes to just 1% of the State's GDP, with only two other districts in Tamil Nadu contributing lesser.

Table 7: Sectoral Economic Contribution of Tamil Nadu & the Nilgiris

	2004-05			**2008-09**		
	Primary	**Secondary**	**Tertiary**	**Primary**	**Secondary**	**Tertiary**
	24.3%	21.5%	54.2%	20.1%	14.4%	65.6%
The Nilgiris	611.8	539.26	1362.45	653.29	466.96	2132.96
	11.9%	30.9%	57.2%	9.6%	28.0%	62.4%
Tamil Nadu	25995.08	67679.31	125328.83	30794.11	89629.75	199660.86

Source: Tamil Nadu Statistical Department,2010

It is also interesting to note the sectoral distribution of the district domestic product with similar figures at the State level. The primary sector contributes to a fifth of the DDP, more than double the proportion at the State level. The decline in the secondary sector is also noteworthy, especially since the sector has shown a decline in absolute value over the period.

Tourism

While tourism has always been the mainstay of economic growth in the Nilgiris, the rate of growth of the sector increased tremendously in the post-liberalization period. The increased size of socio-economic classes with disposable income was central to this phenomenon. The relative proximity of the Nilgiris to affluent urban centres such as Bangalore, Chennai and

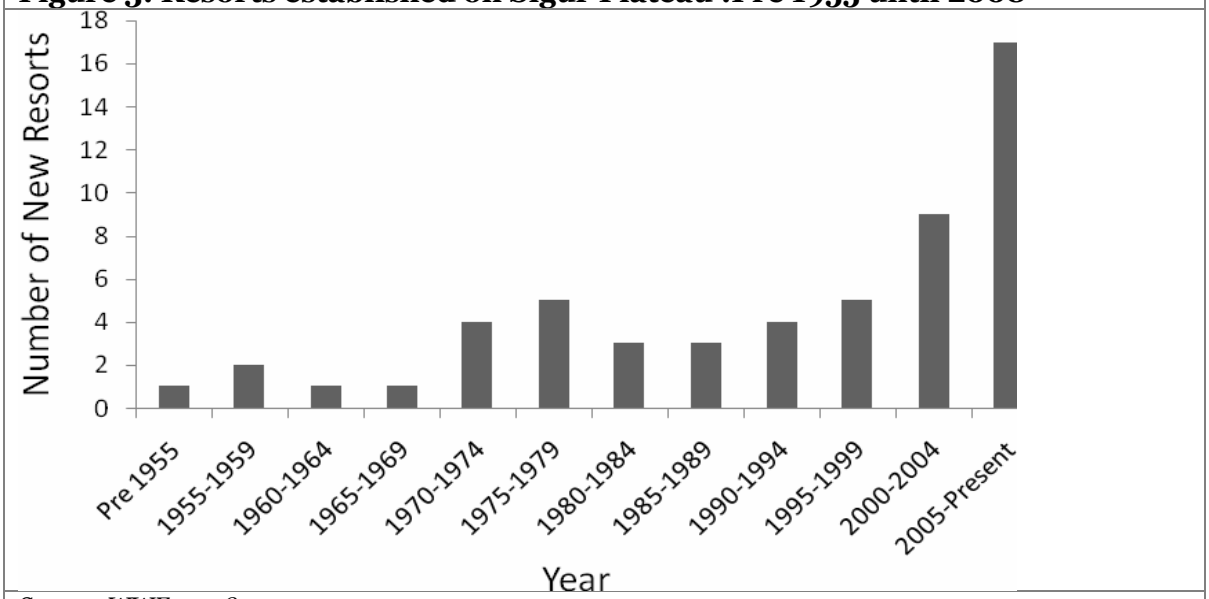
[8] It must be noted here that even to this day, Ooty continues to be a popular as a destination for elite elementary education due to the location of several residential schools. The story of the same dates back to the colonial era, when some of the best schools in the country were established in hill stations for the upper class British wards.

even burgeoning cities such as Mysore, Coimbatore and Kochi was also a significant factor in the increase in tourist numbers.

Interestingly, this period also reflected the growth of the conservationist movement in the Nilgiris, which was supported to an extent by the district administration and to a larger degree, by the State government. Following a period of severe environmental degradation in the district, these changes were instrumental in revitalizing the fortunes of the district.

Realizing the large potential of tourism in the district and the lack of capacity of the tourist and forest departments of the state to cater to this demand, private players have increasingly become involved. The extent of their involvement varies across a spectrum ranging from luxury resorts and adventure resorts to homestays and economical lodging options. They are also spatially distributed across the district, within the cities and even within protected areas. As such, concerns on the suitability, necessity and the impact of such tourism have been voiced by multiple actors over time. A study by WWF on the Sigur Plateau (the north-eastern extent of the Nilgiris district) shows the number of resorts that have come up in the region, with a significant spike in recent times.

Figure 3: Resorts established on Sigur Plateau :Pre 1955 until 2008



Source: WWF, 2008

The expansion of the tourist infrastructure has occurred with little planning or regulation and therefore has brought with it, several new own pressures. Whilst tourism has brought new livelihood opportunities as older systems have declined in the region, it has been pointed out that these jobs are seasonal and are often taken up by those from other parts of the country.

At the same time, the provision of other governance and infrastructure arrangements has not been in alignment with the requirements of the large increase in tourism. This starts at the policy level and goes down to implementation (or lack of it).

Box 2: The WGEEP on Tourism

The Panel noted that tourist activities inside the Western Ghats had been increasing steadily over the years, and with little to no planning or regulation. More importantly, it noted that tourist visits to Protected Areas (PAs) had also increased significantly. It criticized the promotion of tourism by the State without adequate mechanisms such as EIAs and Cumulative Impact Assessments.

It listed an increasing number of resorts and the like, especially within fragile and sensitive zones as a major factor in habitat fragmentation of wildlife leading to increased incidences of man-animal conflicts. Similarly, it noted that tourism also led to increased risks of forest fires, withdrawal of water resources, contamination of water sources – ground and surface -and a proliferation of solid waste in ecologically sensitive areas.

Eco-tourism, the Panel noted, had been bandied about by authorities without undertaking the requisite measures needed to qualify the term.

The Panel's concerns with tourism however, also extend to the socio-economic-cultural front. It recognizes that tourism had led to changes in livelihood options for local communities, forced or otherwise.

The Panel also suggests that tourist sites in the Western Ghats needs to be viewed as production-consumption systems (PCS). It uses Lebel and Lorek's (2010) definition of the same as "systems in which environmental goods and services, individuals, households, firms and states are linked by flows of materials, energy and relationships in which transactions of money and information or negotiation of power and influence take place". A sustainable PCS would integrate notions of carrying capacity, prevention of pollution and the polluter pays principle in its functioning. The notion of carrying capacity especially becomes important in the light of increasing tourist numbers to the Western Ghats.

Tea and other farm-based livelihoods

As per the census 2011, 52.3% of the population are workers, with the corresponding figure being 48% in the urban areas and 58.6% in the rural areas. Wage labour in plantations is an important source of employment for most communities in the district. While some of the plantations have wage workers on long term basis providing them with housing and other facilities, majority of them are casual labourers. The booming construction industry in the district is also providing a source of wage work, although there is an increasing trend of importing labourers from the plains areas due their lower wage demands. The local wages are higher compared to the plains mainly due to the plantation industry.

Being mainly a horticulture region, cultivation of tea, coffee, spices and vegetables is an important source of livelihood. Paddy is grown to a lesser extent and Eucalyptus oil is another important produce. The vegetable production typically of potatoes, cabbage and other so called 'English vegetables' which are supplied to Mettupalayam and markets in other parts of the state as well as neighbouring states.

With 43,000 ha under tea in the Nilgiris[9], the district plays an important role in the tea industry in the South. Small growers account for 70% of tea production in the Nilgiris, with landholdings of less than 1 ha each. Most of the small tea growers belong to the Badaga community. Conversion of irrigated land from tea to vegetables is a common sight in the Nilgiris. In lower elevations, plantations also support spice crops such as pepper, cardamom

[9] http://www.upasitearesearch.org/coonoor/

and cloves. Animal husbandry is another important occupation. Todas have traditionally been rearing buffaloes in the region, but with the increasing demand for milk and milk products in the district, other communities undertake animal husbandry as well. Aavin, the state cooperative milk marketer, has a district level procurement setup, the Nilgiris District Co-Operative Milk Producers' Union Limited. In 2008-09, the milk production was 6.6 million liters in the flush season and 2.6 million litres in the lean season.

I. Urbanisation in **the** Nilgiris

Even though Nilgiris is a hilly and forested district, most of the habitations are well connected by roads. Only tribal habitations that are located in remote locations remain unconnected. The proximity to Mettupalayam and Coimbatore on one side and the plains towns in Kerala and Karnataka has meant a constant flow of people and goods through the district. With 59.2% of its population in urban areas, the district is reflecting the larger trend in the state, wherein Tamil Nadu ranks first in the country on share of urban population (48.45%)10. However the urbanization is possibly more due to in-situ urbanization rather than through migration11, which results in the urban population being spread out over a large area rather than being concentrated near towns. This may also result in a portion of the urban population not having access to urban amenities and services.In this context, this case study focuses on Ooty (Udhagamandalam), the district headquarters and the most popular hill station in South India. The Ooty town is a unique case of urbanization and development in a biodiversity rich zone.

Historical Trajectory of Settlements and Urbanization in the Nilgiris

Ooty

Urbanization in the Nilgiris started with Ooty which was recommended by the then Collector of Coimbatore, John Sullivan, to be the site of a sanatorium for sick and invalid European soldiers, due to its location and climate. It is interesting to note that unlike Kotagiri or Coonoor, which had developed from existing villages, Ooty was a completely 'Greenfield' development. However, the pattern of the development of the hill station differed greatly from the usual gridded urban frame that the British relied on in the plains and was more on the lines of an English village. The first developments in Ooty consisted of a few European residences. As the number of settlements grew, Sullivan also realized the necessity of a source for water and built the lake by damming up nearby streams. By 1828, the sanatorium in Ooty was in operation. Soon, it developed into a town with the sanatorium, public bazaars and several government offices, primarily due to its temperate climate and environment. It was however, designated as a military bazaar, equivalent to a cantonment.

Coonoor and Wellington

The increasing influx to Ooty necessitated the development of alternative routes into the district. This led to the construction of the Coonoor ghat roads, providing an alternative route of entry to the Nilgiris from Coimbatore from the existing Kotagiri ghat road. This turned out to have a profound impact on the pattern of urbanization in the district, with Coonoor becoming the secondary urban hub for the region. Coonoor gained prominence as an alternative residential destination for Europeans, owing to its moister and warmer climate compared to Ooty. The establishment of the military cantonment at Wellington in Jagathala in 1854 proved to be an additional driver of growth for Coonoor. Additionally, the establishment of Coonoor as a centre for plantations and trade led to further economic and demographic growth in Coonoor.

[10] http://www.spc.tn.gov.in/12plan_english/7%20Urbanisation.pdf
[11] http://f.hypotheses.org/wp-content/blogs.dir/489/files/2012/08/Unacknowledged-Urbanisation_CPR-Working-Paper_KCPradhan.pdf

The growth of Ooty, therefore, indirectly led to the growth of Coonoor. In 1866, both towns were constituted as municipalities under the provisions of the then municipal Act, the Towns Improvement Act of 1865. Incidentally, the population of Coonoor was just 1400 at the time. In 1870, Ooty received a further boost in status, when it became the summer seat of the Madras Presidency.

Kotagiri

Concurrently, Kotagiri's growth had very much to do with its location. The initial roads to the Nilgiris from Mettupalayam were through Kotagiri, and led to its growth in the early exploration of the district. Kotagiri was also one of the early centres for the coffee and tea industry (which did not pick up in the earlier years and hence, declined.) However, following the construction of the shorter, easier and therefore, more popular Coonoor ghat in 1832, its growth declined. Even though the climate of Kotagiri was in the Goldilocks zone as compared to Ooty and Coonoor, the comparative inaccessibility compared to Coonoor led to its decline, aided by the decline of the coffee industry in the latter half of the 19th century.

Gudalur

The history of Gudalur lies slightly separate from the trajectories taken by urban settlements in the Nilgiri plateau. Being a part of the region of Nilgiri-Wayanad and under the control of the Nilambur Kovilakam, it was equally closely linked to Kerala and Karnataka[12]. Gudalur was also a key point on the Gudalur ghat, connecting Wayanad and Mysore to the Nilgiris and therefore also served as a trading hub. However, despite its connectivity to a larger region, the threat of malaria was instrumental in reducing the growth of the Gudalur ghat road and by extension, Gudalur for a significant period of time. Gudalur, unlike its counterparts in the Nilgiri plateau was also severely affected by the gold rush in the 1880s, with the aftermath of the rush leaving large portions of coffee estates in the Gudalur region abandoned. It was only after Independence, and the subsequent influx of a large migrant population from Wayanad that Gudalur started experiencing rapid growth once again.

Development of Ooty

The increasing populations in both towns were not supported by a subsequent increase in infrastructure in the cities. With increasing congestion, increasing pollution and decreasing hygiene was fast becoming a serious issue. Diseases such as enteric fever and cholera, previously unknown in the Nilgiris, began to be widespread. In Ooty, the Lake was used extensively as the cesspool for the town, resulting in severe insanitary conditions, especially in the crowded Indian settlements next to the banks of the lake. This, however, had a positive impact on the future of the cities as plans for rehabilitating and constructing water supply and sewerage systems were made.

The first systematic water supply network in Ooty was constructed by 1865, drawing water from the Doddabetta reservoir; and was extended in 1874 to include the Marlimund reservoir. Several additions were made and included the Snowdon reservoir and Tiger Hill stream. By 1887, Ooty had the startings of a sewerage system in place, covering mostly the central bazaar areas. While initial plans for the same had meant to divert sewage and storm water in to the lake, the final plan took it to the lake's outfall. In1903, a comprehensive

[12] Francis (1908) says that in 1908, the population of Gudalur was comprised of 33% Tamils, 20% Malayalis and 20% Kannadigas amongst other groups.

closed sewerage network which would let out the waste into a sewage farm was proposed; it was soon operational and it continues to be the backbone of the existing sewerage system in the city. The plans for having a drainage system in Coonoor was started in 1885 using both open sewers and closed sewers ending with discharging the waste into the Coonoor River. The system was in operation by 1892. Water supply was initially through open streams flowing through the settlements, but these were greatly polluted so that it was decided to have a separate water supply system. By 1905, a system was in place, drawing water from the Coonoor River.

A key development from the legislative side around this time was the passage of the Hill Sanitaria Municipal Act in 1907, which authorized hill municipalities to raise taxes and control land-uses to ensure a more sanitized atmosphere in the towns (Kenny, 1995). This was precipitated by the outbreak of plague in 1903 in Ooty, killing 262 Indians. This hit the district very heavily, with the number of visitors to Ooty and Coonoor during summer falling drastically (Kennedy, 1996).

Even as late as the early 1900's, the major towns in the district continued to be Ooty and Coonoor. In his Gazetteer, Francis (1908) does mention Kotagiri, the Wellington Cantonment and Gudalur as the only other "*places of any size in the district*". However, newer developments such as the Nilgiri Railway (and the labour required for the same) and the Cordite factory with its large employment potentials proved to be boosters for growth. It is interesting to note that, as the numbers of Indians visiting or residing in the Nilgiris increased from the end of the 19th century to the first decades of the 20th, the numbers of the British visiting the district reduced, significantly due to the increasing ease of travelling to England. The increased pressures on the British Raj as the Independence Movement picked up steam in the 20th century, as well as the impact of the World Wars, influenced the cities greatly. World War I had a positive impact on Ooty, as families of Army officers in the plains moved in large numbers to the Nilgiris and bringing in precious economic resources. It was however, a short term impact, with these families moving back to England at the end of the War. The Independence Movement too, had its impact on Ooty and other hill stations. Incensed by the Madras government's residence in Ooty for 8 months in a year, nationalists called for the same to be abolished, which was gradually done over the 1930s. The assuredness of India's independence and World War II dealt the final blow in the colonial history of urbanization in the Nilgiris.

II. City Profile for Ooty

Linkages and Connectivity

Road: Ooty and other major towns in The Nilgiris district - Conoor (18 kilometers away), Kotagiri (31 kilometers away) and Gudalur (50 kilometers away) - are primarily connected to the surrounding region by road, including both National and State Highways. The NH 67 which starts from Nagapattinam in coastal Tamil Nadu and ends at Gundlupet in Karnataka is the only National Highway passing through Ooty town. It is the primary access road to the Nilgiris from Coimbatore and therefore, the most heavily used. Apart from the NH 67, there are several State Highways and major district roads passing through the Nilgiris district such as the SH 11, 12, 15 and 98. Of these, SH 15, the Kotagiri Ghat Road connecting Ooty with Erode, and Gudalur Ghat Road, which connects Ooty with Mysore and Wayanad are especially important in regional connectivity.

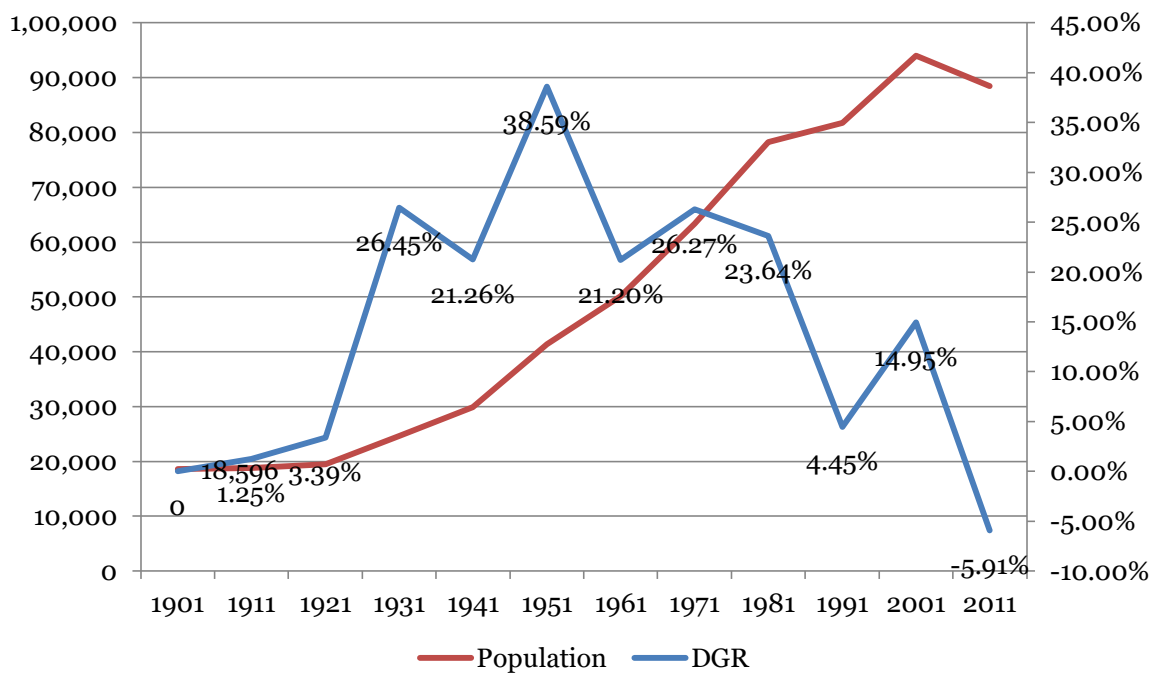
Railways: The 46 kilometre Nilgiri Mountain Railway connects Ooty, Coonoor and Wellington with Mettupalayam, located at the foot of the Nilgiris, through a metre-gauge line and through Mettupalayam to the railway grid. The rail network itself was proposed in 1871 as an alternative convenient option for accessing the mountains from bullock carts and ponies in the then-existing ghat roads. It has been certified as a UNESCO World Heritage Site (as part of Mountain Railways of India Network) and continues to be a major tourist attraction, with the annual ridership figures for 2013 reaching close to 400,000.

Demographics and Socio-Economic Profile

Ooty is located centrally in The Nilgiris district and is the district headquarters. It is currently a special grade municipality[13] covering an area of 30.67 sq. km. With the current population being recorded as 88,430 in the Census of 2011, Ooty is categorized as a Class –II town. The town has witnessed uneven growth over the past century, with sharp peaks during the 1950's and 1960's and an absolute decline over the 2001-2011 decade. The growth of population over the last century in Ooty is shown in the table and the graph below.
The question of falling population is however, not limited to the city. Other urban areas – with Gudalur as the significant exception- within the District too, have recorded the same, leading to questions of economic growth and its equitable distribution within the region. Other key demographic details of Ooty town and the (urban part of the) Ooty taluk is listed in the table below.

[13] Special Grade Municipality : As per sub-section (6) of section 4 of the Tamil Nadu District Municipalities Act, 1920 (Tamil Nadu Act V of 1920), the State Government may, by Notification, classify municipalities into Special Grade, Selection Grade, First Grade and Second Grade, for the purpose of effective administration of the Municipalities. Special grade municipality is the one whose average annual income is above ₹ ten crore.

Figure 4: Population growth in Ooty 1901-2011



Source: Town Directory, Census 2001; Primary Census Abstract, Census 2011

Table 8: Key demographic features of Ooty

	2001		2011	
	Taluk	Municipality	Taluk	Municipality
Population	205633	93987	191960	88430
Household Size	4.2	4.4	3.6	3.8
Sex Ratio	1005	1000	1049	1053
Child Sex Ratio	986	995	1015	987
Scheduled Castes (as % of population)	29.6	28.5	30.4	29.0
Scheduled Tribes (as % of population)	2.4	0.4	3.2	0.3
Literacy Rate	77.1	86.8	82.5	90.1
Male Literacy Rate	86.0	92.1	89.9	94.5
Female Literacy Rate	68.2	81.4	75.6	85.9
Total workers (as % of population)	44.1	35.8	48.9	40.7
Male working population (%)	55.5	53.8	60.9	58.5

Female working population (%)	32.6	17.9	37.6	23.8
Main workers (as % of total workers)	91.4	96.7	92.0	90.4
Cultivators (as % of Main workers)	6.4	2.0	6.6	2.0
Agricultural labourers (as % of Main workers)	**24.3**	15.3	**39.1**	16.0
Other workers (as % of Main workers)	68.7	82.0	53.5	81.2
Source: Primary Census Abstract, Census 2011				

The table puts forward some interesting observations. The increasing share of agricultural labourers over the last decade in the taluk raises questions to the changing share of the services sector- particularly tourism- in employment.

Economy

The economy of the city is heavily dependent on tourism. A sizeable number of tourist attractions lies within the city – such as the Botanical Garden, the Ooty lake, the Lake Garden etc. – while other tourist attractions in the district such as waterfalls, lakes and wildlife are easily accessible from the city. Thus, ancillary support for tourism – such as hotels and homestays, restaurants, tourist taxis and other services have a strong base in the city, generating significant employment in the city[14]. In addition, handicraft and non-timber forest products manufactured or harvested in the district also utilize the tourism potential of Ooty as a strong market[15].

However, looking back at the data from Census 2011 listed in the table above, it can be seen that agricultural labourers form close to a sixth of the work force in the city. More interestingly, it can be seen that the percentage of agricultural labour in the workforce has also increased over the past decade, while the proportion of other workers have decreased slightly. This data should also be read in the light of the demographic changes that have been occurring in the district and the city.

Apart from tourism, there are a few industries operating in and near the city. Tea processing units constitute a large portion of the workforce employed in the sector, while the Government also has a significant presence in the city by virtue of its position as the district headquarters.

Land Use and Built Form

The first Master Planning exercise for Ooty was carried out in the 1980's with the Master Plan being released in 1986. However, the document was seen as being inadequate, which further compounded the issues in the city during implementation (or the lack thereof). This led to a revised Master Plan being made in 1997, which also raised similar questions from

[14]The district statistical handbook lists 103 of 139 hotels, resorts and tourist homes in the district as being located in and around Ooty city. Interestingly, Gudalur ranks second with 22 such facilities with a majority of them being resorts situated in rural areas such as Masinagudi and Theppakkadu.
[15]As a proxy, the Nilgiris district statistical handbook states that khadi artifacts in the Nilgiris generated ₹ 11.94 lakhs in sales in Ooty, while the other 3 major cities of Coonoor, Kotagiri and Gudalur had sales of ₹6.84, 4.75 and 3.46 lakhs respectively in 2008-09.

detractors as its predecessor. In 2010, a revised Master Plan was approved and is currently in enforcement.

The 1997 Master Plan acknowledges the need to guide development in hill towns in such a fashion that primarily takes into account aspects of conservation, such as the carrying capacity of the hills. Keeping in line with this approach, it also goes on to suggest that EIAs be done for every upcoming development in the town.

The Master Plan lists 75% of the total land in the city as being privately owned, with the municipal authority owning 20% and other Government lands constituting the remainder of 5%. The land use pattern in 2004 and the revisions required for 2011 as listed in the Business Plan are tabulated below as follows:

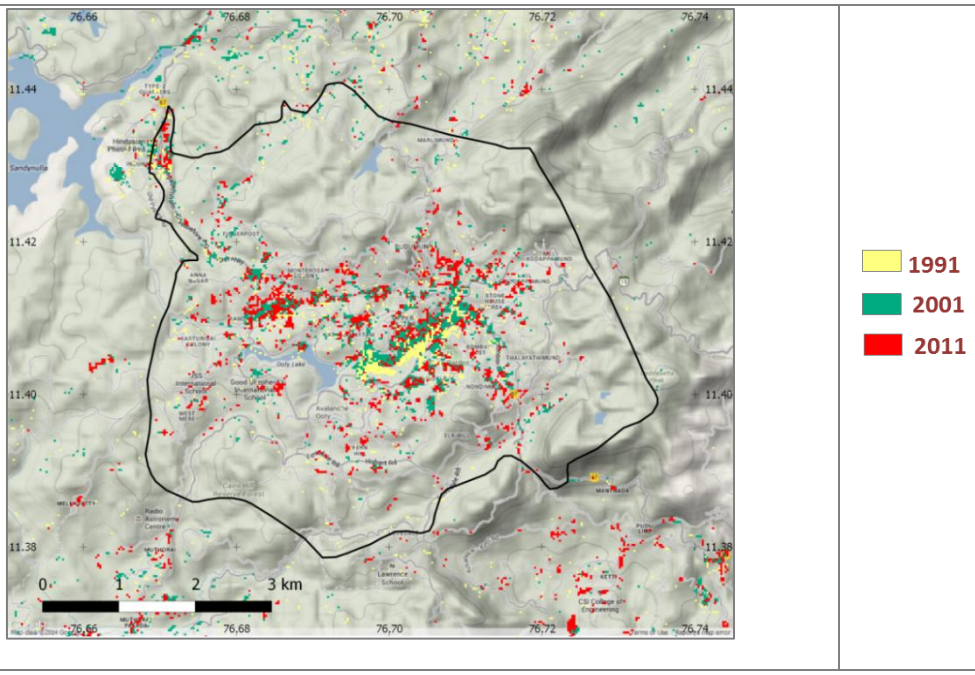
Table 9: Land use in Ooty: 2004 and 2011

Type of Land use	**Land use 2004**		**Proposed Land use 2011**	
	Area	**% to total land use**	**Area**	**% to total land use**
	Sq.Km	*%*	*Sq.Km*	*%*
Residential	4.96	16.19	5.67	18.49
Commercial	0.54	1.77	3.68	12
Industrial	0.06	0.18	0.05	0.16
Educational	0.72	2.36	0.72	2.35
Transportation & Communication	1.73	5.64	1.73	5.64
Public & Semi-public	0.62	2.01	3.17	10.34
Circulation	0.12	0.39	-	-
Urbanized land	**8.75**	**28.55**	**15.02**	**48.97**
Agricultural	-	-	7.85	25.6
Water Bodies	0.36	1.17	0.36	1.17
Open spaces	1.23	4	0.22	0.72
Undeveloped Land	20.33	66.29	7.22	23.54
Non Urbanized land	**21.91**	**71.45**	**15.65**	**51.03**
Total	**30.67**	**100**	**30.67**	**100**

Source: 'Master Plan for Udhagamandalam Planning Area' in Business Plan for Udhagamandalam, 2007

Land-use land-cover analysis of the region around the city of Ooty shows that the Built-up area has increased from 1 sq.km. to 2.96 sq.km. in the period between 1992 and 2011. The land-use maps for Ooty for the years 1992, 2001 and 2011 are given below.

Figure 5: Change Map for Ooty Built-up – 1992, 2001 and 2011



Source: IIHS Analysis, 2014

Density

With an area of 30.67 sq. km. and a population of 88,430, the population density of Ooty city is 2883 persons per sq.km. The City Development Plan has assessed the population density at the ward level and found that the distribution of the population across the city is highly unequal. The table from the report is reproduced below.

Table 10: Ward Density of Ooty town

Range	Density	No of wards
0-3062	Very Low	13
3062 - 10000	Low	14
10000-15000	Medium	1
15000-25000	High	5
25000-45000	Very high	
>45000	Saturated	1

Source: Business Plan for Ooty, 2010

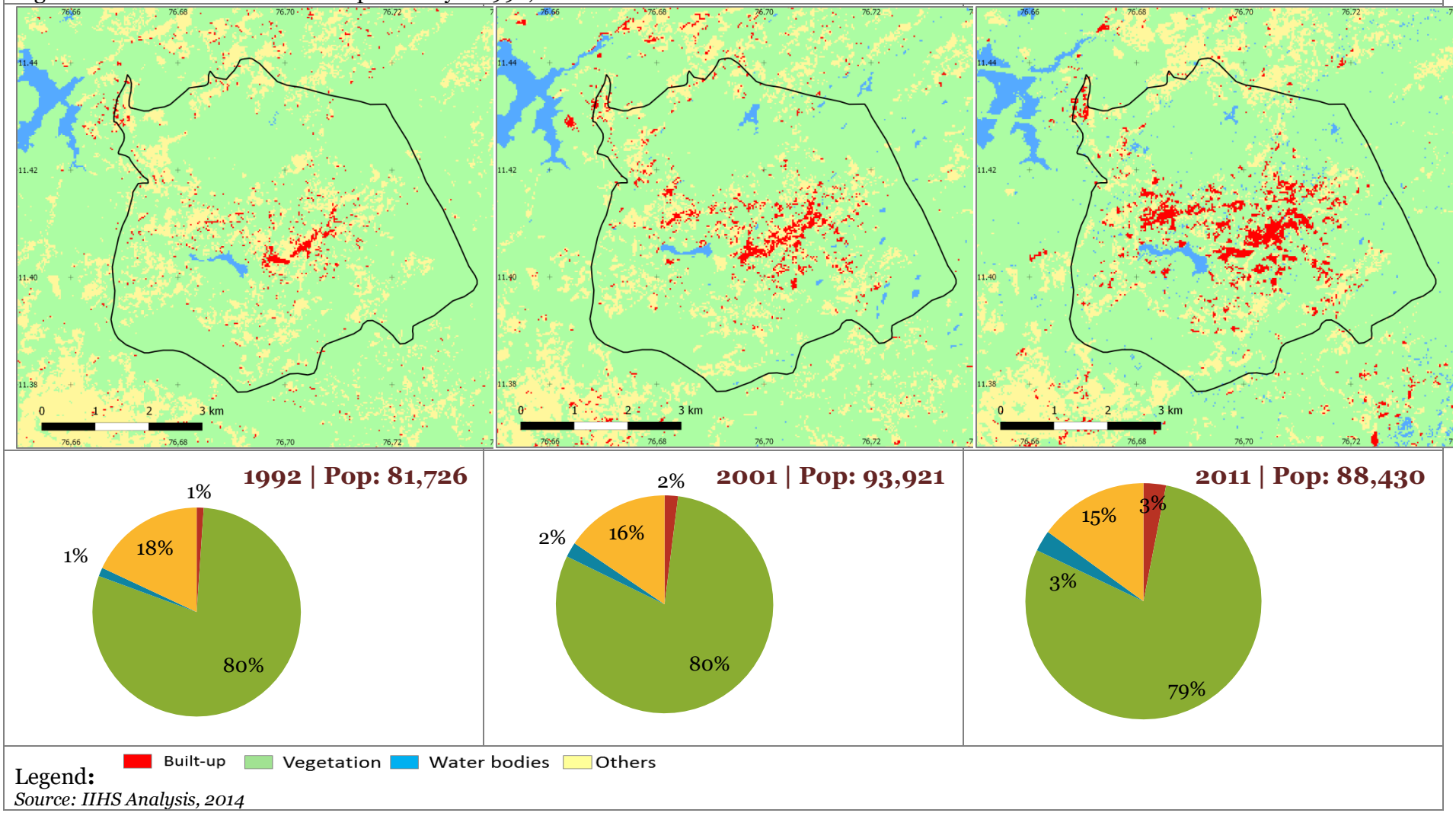
The Business Plan also looks at the population density of the city in recent years using Census data. It shows that the city reached its peak in 2001 when the population density rose above 3,000 people per sq. km, with the outmigration from the city reducing the density. However, as the change map for built-up area in the city shows, the extent of built environment in the city has almost tripled between 1991 and 2001.

Table 11: Population Density in Ooty: 1981-2011

Year	Population Density (people/sq. km.)
1981	2,553
1991	2,665
2001	3,062
2011	2883

Source: Business Plan for Ooty, 2010, IIHS Analysis

Figure 6: Land-use Land-cover Map for Ooty – 1992, 2001 and 2011



Legend:

Source: IIHS Analysis, 2014

Infrastructure and Services

Water Supply

Household Level: According to Census 2011, 92% of households in the city use tap water as their primary source of drinking water; of these 87% receive water from a treated source. The figures for slum households in the city are also quite similar; 94% of households use tap water. The distribution of households and slum households in the city and Ooty taluk according to their primary source of drinking water is depicted in the table below.

Table 12: Primary Sources of drinking water for households			
	Taluk – Urban	Municipality	Slum Households
Treated tap water	81.2%	87.0%	83.3%
Un-treated tap water	8.3%	4.7%	10.7%
Well	3.7%	3.5%	2.7%
Handpump/Tube well	1.1%	1.2%	0.1%
Spring	4.4%	2.7%	3.1%
Other sources	1.2%	0.9%	0.1%
Source: Housing and House listing Tables, Census of India 2011			

However, the high usage of tap water amongst the residents of the city does not translate directly into individual household connections. This becomes explicit looking at the location of the primary source, as seen in Census 2011. Only 50% of all households and 18% of slum households in the city have the location of the primary source within their premise.

Table 13:Location of primary sources of drinking water		
	All households	Slum households
Within the premises	50.2%	18.6%
Near the premises	**43.6%**	**72.4%**
Away from the premises	6.2%	9.0%
Source: Housing and House listing Tables, Census of India 2011		

City Level: The primary source of water for the municipality – as well as the Wellington Cantonment – is the Parsons Valley Reservoir, located 22 kilometres away from the city.The source was first tapped in 1975, with a withdrawal of 4.5 MLD water. Increasing population – both fixed and floating – forced the city to introduce an additional scheme to withdraw 9.1 MLD from 2000 onwards, from the same source. However, apparently only 9.5 MLD is withdrawn currently, with an additional 2 MLD sent to the Cantonment Board.

This scheme would be able to provide close to 120 lpcd to the populace; however the much larger size of the floating population, especially during the tourist season of summer is not

accounted for in this calculation. The CDP says that 0.5 MLD is procured privately from tankers and other local sources. However, newspaper reportage seems to contradict this; a PIL filed in the Madras HC in October last year suggested that 1.2 MLD of groundwater was being drawn by around 300 hotels and resorts in and around the city. The increasing use of groundwater in the city is also reflected through the falling water level in water bodies in and around the city.

In addition, earlier reportage suggests that the current withdrawal has also become insufficient, requiring a third phase to the Parsons Valley water supply project. However, due to the involvement of the Tamil Nadu State Energy Department in power generation activities in the Parsons Valley reservoir, this could complicate the endeavour.Water treatment, currently, is done by the TWAD Board and involves filtration and chlorination.

The CDP pegs NRW at about 15%, but this could very well be an underestimate, given the age and the condition of the network. It acknowledges the inadequacy of the current system and the need to provide more connections. It also lists that water is pumped currently on alternate days. However, it doesn't indicate the adequacy of the current source for the future- immediate or long term.

Sanitation

Household Level: As is the case with most Indian cities, the lack of a comprehensive sanitation system at the city level shows that multiple sanitation options are in use by household around the city. Census 2011 figures for the all households in the city as well as slum households are listed below.

Table 14:Household Sanitation Arrangements in Ooty			
		All households	Slum households
HH with latrine within the premises		65.5%	29.6%
	Connected to sewer network	44.8%	14.1%
	Septic tank	9.5%	6.4%
	Pit latrine	8.6%	8.2%
	Others	2.6%	1.0%
HH with no latrine within the premises		**34.5%**	**70.4%**
	Public latrine	**22.7%**	**43.0%**
	Open Defecation	**11.9%**	**27.4%**
Source: Housing and House listing Tables, Census of India 2011			

City Level: The history of the sanitation arrangements from the colonial times have been described in earlier parts of this case. The sewerage system that was in existence since the late 1800's was augmented in 2000, but still covers only a limited portion of the city.

The sewers cover a length of 50 km, and using gravity and pumping stations pump the sewage to a STP located close to the Ooty Lake. While the STP has a treatment capacity of 5 MLD, the CDP states that only 2.5 MLD of it is utilized. The STP uses Activated Sludge Treatment System and releases the treated waste water is sent along to sewage farms nearby and then on to the Sandynulla reservoir nearby.

Apart from the sewerage network, the CDP also states that other sanitation options are provided by the municipality, such as septage management facilities through periodic collection by honey suckers which then *"[….] disposes them off in low lying areas outside the municipal limits"*. Additionally, it mentions that 78 public toilets and 11 ISP complexes are provided by the municipality.

Questions of appropriate and adequate waste water collection, treatment and reuse would gather further steam as the city grows further. Wastewater pollution of Ooty's lakes has already been recognized as a core issue –both in terms of attracting/sustaining tourism and also in pollution of water sources.

Storm water drainage

The length of the SWD network as of 2002-03 was reported as 54 kms in the CDP. All the drains are open pucca and drain into the Ooty Lake. As with other Indian cities, solid waste disposal, encroachments, waste water disposal and siltation has reduced the carrying capacity of the SWD network and the natural drainage channels as well as the lake, while adding to environmental pollution and contamination of surface water sources.

Meanwhile, Census 2011 reports that 22% of households in the city do not have drainage connectivity to dispose of their waste water.

Table 15:Drainage Connectivity for households – Census 2011

	The Nilgiris - Urban	Ooty Taluk – Urban	Ooty Municipality	Ooty Slums
Closed drainage	32.1%	47.3%	57.3%	20.9%
Open drainage	43.9%	27.0%	20.7%	40.0%
No drainage	**24.0%**	**25.7%**	**22.0%**	**39.2%**

Source: Housing and House listing Tables, Census of India 2011

Solid Waste Management

Solid Waste Management in the city is carried out by the Public Health department of the Municipality. The Business Plan states that the daily generation of solid waste in the Municipality is around 38 tonnes; of this, around 35 tonnes is collected by the Municipality. This would put the solid waste generation rate at around 200 grams per capita daily. In response to an RTI, the Municipality had responded that of the 13,800 tonnes of solid waste generated annually, 5500 tonnes or 40% was non-biodegradable waste. There is currently no system of waste segregation or management at any level, which coupled with the susceptible environment, could have severe repercussions for the region. The lack of efficient solid waste management in the city also impacts on other aspects of the environment such as clogged streams and nullahs across the city.

The official dumpsite for Ooty town is in Theetukal, which is located four kilometers away from the city. It falls under the Nilgiris South Forest Division and is reserve forest land adjoining shola forests. The Municipality has been using the site as a landfill since 1972, with

an (semi-legal?) agreement between the Municipality and the Agriculture Department. This agreement existed till 1992, but the dumping continued following the end of the agreement with the area of the landfill increasing to 12 acres from the 5 acres as mentioned in the agreement. In 1994, when the issue was publicized (Details are slightly sketchy in the document), a new agreement between the Nilgiris South Division and the Municipality was drawn up for a period of 20 years (post-dated from 1992-2012), which also increased the extent of the landfill to 15 acres. As the agreement has come to an end, currently the landfill is in violation of the Forest (Conservation) Act.

The impacts of the absence of a sustainable solid waste management system would have multiple impacts on the nearby residents – human, animal and plant. The obvious impacts would be air pollution from burning the waste and soil and groundwater contamination from the leachates. Anecdotal reports from residents have mentioned a significant loss of biodiversity, with both flora and fauna being affected severely by the landfill. This however, still does not account for the solid waste that tourist activities generate around the city and nearby tourist impacts which have a larger impact on the ecosystem of the Nilgiris.

Box 3: Governance and the case of Ooty Lake

Created to augment the drinking water requirements in Ooty, the Ooty Lake was from its initial days used to release waste water from surrounding settlements. Some of the impacts of this pollution have been noted earlier in the case.

Additionally, the topography of Ooty is such that storm water from the surrounding higher elevations ends up in the lake. This was utilized to design the storm water drain network for the city. However, waste water outlets from unconnected drains and dumping of solid waste among other polluting factors has led to siltation of the lake bed and eutrophication.

At the same time, the lake has been an important tourist attraction in the city. Tourism Department data indicates that more than 1.9 million tourists visited the lake in 2013.

Within this context, we look at the way Ooty Lake is being governed and managed.
As mentioned above, the Ooty Municipality is a key stakeholder, using the lake to channel storm water. However, not being a key custodian of the resource, it does not look at curbing the pollution levels as a key task.
The tourism department provides boating facilities and manages other tourism-related aspects, but does little to manage the pollution of the lake despite tourists adding significantly to the solid waste in the lake area.
The Water Resources Organization (WRO), a subdivision of the PWD is in charge of maintaining the lake. Their conservation effort is limited to removal of solid waste and weeds, and does not even include desilting. Being under the district administration, projects for maintenance or rejuvenation needs to be approved by the State government.
The Tamil Nadu Pollution Control Board monitors the quality of water regularly under a national monitoring programme run by the CPCB. Strangely, the results do not even reach the district and are sent directly to Chennai. In the CPCB reports, we do find that the BOD levels for Ooty have gone up to 20.6 mg/l in 2011 from 15 in mg/l in 2010[16]. Apart from these organizations and their interventions (or lack of it), external agencies have also been brought in to improve the condition of the lake. The HADP has also invested in projects to clean up the lake; however it was restricted to clearing water hyacinths and other weeds from the surface, and as was the case with the WRO, did not involve desilting of the lake.

[16]Source: Status of Water Quality in India 2011, CPCB

The number of initiatives and programmes that have gone into cleaning the lake shows that financial constraints are less of an impediment than the lack of a clear, integrated vision, co-ordination, mandate and capacity amongst the various agencies involved. It also begs the question: Are so many agencies and institutions required to manage a lake located inside the municipality without devolution of adequate powers and responsibilities to the municipality first?

III. Key Trends in the Nilgiris

Land Use

Land use change is one of the most significant drivers in the Nilgiris ecosystem. From the historic changes introduced by the British to the more recent trend of increasing built up area, the changes in land use have had a deep impact on the ecology of the region. The table below shows the land use/cover changes over a period of over 36 years.

Table 16: Land use changes in the Nilgiris district

S No.	Land use class	Area (sq. km.)			Percentage (%)		
		1973	1991	2009	1973	1991	2009
1	Dense forest	656.91	826.59	993.34	25.75	32.4	38.93
2	Open forest	67.33	8.27	116.03	2.64	0.32	4.55
3	Forest plantation	469.20	290.36	305.41	18.39	11.38	11.97
4	Settlement	7.49	29.11	44.29	0.29	1.14	1.74
5	Waterbody/Lake/Reservoir	32.87	39.51	29.26	1.29	1.55	1.15
6	Tea plantation	483.45	471.23	437.55	18.95	18.47	17.15
7	Forest blank	82.59	9.84	24.43	3.24	0.39	0.96
8	Mixed forest	248.31	328.75	239.65	9.73	12.88	9.39
9	Land with scrub	40.19	23.83	47.65	1.58	0.93	1.87
10	Barren rock/stony waste	34.31	29.02	3.52	1.34	1.14	0.14
11	Industrial/Mining area	2.92	6.71	1.48	0.11	0.26	0.06
12	Agro-Horticulture plantation	400.69	477.51	288.63	15.7	18.71	11.31
13	Land without scrub	25.32	10.84	20.36	0.99	0.42	0.8

Source: Lakshumanan et al, 2012

The area under settlements has increased nearly six fold, waterbodies have reduced by nearly 10% and forested areas have increased by close to 50%. The reduction in the area under water bodies suggests possible conversion of small wetlands into other land use. The area under tea plantation has also come down, possibly due to conversion to settlements and horticulture. The forest area has increased with a simultaneous reduction in area under forest plantations.

The process of rapid land transformation has not only brought about an ecological crisis in the region but has also threatened the agricultural economy of the watershed through accelerated soil erosion, deforestation and reduction in ground water recharge17.

[17]Lakshumanan et al, 2012

Demographic Changes

The Nilgiris is the only district in the country to have registered a decline in population in 2001-2011. The population has come down from 762,141 in 2001 to 735,394 in 2011. While the population growth in the previous decade was 7.31%, it was -3.51% for 2001-2011. Correspondingly, the population density also came down from 299 to 287. The share of district's population in the state population also declined significantly from 1.22% to 1.02%.

Sex Ratio has shown a healthy increase from 1014 to 1042. Literacy too has made a significant improvement from 80.01% to 85.20%, with female literacy registering a greater increase from 71.64% to 78.98% than male literacy which only grew from 88.54%91.72%. This has reduced the gap between male and female literacy somewhat although there is still a long way to go.

Over the years there has been a shortage of labour in the district. This is caused by the changing profile of communities who had migrated here to work in the tea industry. Second and third generation members of these families are educated and do not want to work as labourers in the tea industry. To meet the shortage large tea factories have used labour contractors and got workers from other parts of India, including Odisha, Jharkhand, and Chhattisgarh etc.

This trend was also found in the Sri Lankan Tamil repatriates who had earlier contributed to the largest demographic change in the district. Education and related subsidies has increased mobility, social standing and increased the options available for the younger generation.

The impact of immigrants from other parts of the country on the urban areas could be high, despite their residence in the estates. They access urban areas for their various needs and demands. The peculiar situation of tea plantations and their requirement for manual labour for picking tea was shown as the reason for the lack of mechanization of the sector. In the future, it may be necessary to conduct research on this aspect of migration, as current data is not available with the Census.

Tourism

The government has focused on promoting tourism in a big way with Ooty and Coonoor being the primary tourist destinations. There is an annual tea and tourism festival held in Ooty which is the focal point of the government's efforts. In Ooty the flower show is the high point and similar shows are organized in Coonoor, Kotagiri and Gudalur. With weekend getaways from cities like Bangalore and Chennai becoming more popular over the last few years, the inflow of tourists is being seen throughout the year, rather than strictly during the summer and winter seasons. The table below shows the number of tourists visiting the Botanical Garden, Ooty as per the government records.

Table 17: Tourist Arrivals at the Botanical Gardens, Ooty

Year	Domestic	Foreign	Total
2008	2,328,614	33,564	2,362,178
2009	2,225,214	29,632	2,254,846
2010	2,135,220	24,574	2,159,794

2011	2,428,860	32,438	2,461,298
2012	2,537,348	33,997	2,571,345
2013	2,371,093	35,075	2,406,168
Source: Tourism Office, Ooty			

Over the last three years, at least 2.4 million tourists visit Ooty annually. Given that the population of Ooty town is just 90,000 this is a huge addition. A look at the seasonal average over this six year period in the table below, shows that nearly half of the tourists visit Ooty in April-May, which is also when water scarcity is at its peak.

Table 18: Monthly Tourist Arrivals to Ooty

Month	Domestic tourists	Foreign tourists	Total	% of annual total in the month
January	143,941	3,839	147,781	6.2
February	103,780	3,755	107,535	4.5
March	114,646	3,399	118,045	5.0
April	257,686	2,548	260,234	**11.0**
May	819,358	1,794	821,152	**34.7**
June	154,125	1,675	155,800	6.6
July	84,906	2,013	86,919	3.7
August	119,384	1,597	120,981	5.1
September	130,557	1,716	132,273	5.6
October	160,375	2,725	163,099	6.9
November	120,084	3,122	123,206	5.2
December	128,884	3,365	132,249	5.6
Total	2,337,725	31,547	2,369,272	100.0
Source: Tourism Office, Ooty				

According to District Sources, an estimated 2.4 million tourists visit the city annually, including 35,000 foreign tourists. Currently with rising awareness of biodiversity, wildlife tourism and eco-tourism, the tourists' inflow occurs all throughout the year. However, this is not in a planned well by the authorities. The standoff between hoteliers and homestay owners were also pointed out in regard to tourism. While hoteliers have to pay more taxes due to the current policy, they have also been raising their voice against the fact that they receive lesser number of guests in recent times due to homestays.

Tourists do not get a flavour of the biodiversity of the area nor are able to understand the ecological aspects in simple terms. Besides, the infrastructure available for the sudden surge of tourists in the summer is under stress. Special problems are faced with water resources, the treatment of waste and sewage. This leads to unhygienic measures which could be a health risk.

Development of the city is restricted by poor rate of infrastructure growth which is under stress by seasonal peaks of floating population. Air and water pollution are serious sources of concern for sustainable growth. A century-old waste disposal system is unable to cope with growing load of sewage, resulting in the pollution of the Ooty Lake, a main tourist attraction. Traffic in mountain roads, scarce hotel accommodation, growing water demand, food,

entertainment and health facilities, growing solid waste that decomposes slowly in cold temperature - all are in a state of stress.

Infrastructure and Access

Over the years there has been an increase in the coverage of essential infrastructure such as roads, water supply, electricity etc. The status of roads is lopsided with the Kotagiri-Ooty road being maintained very well whereas the main Mettupalayam-Coonoor-Ooty-Gudalur National Highway is in a neglected state. In terms of telecommunications, there is an extensive cell phone network that makes up for the patchy coverage of landlines. This is particularly important for maintaining communications in case of landslides and cyclonic winds which disrupt the road and landline networks. Ooty, Coonoor and Gudalur towns have 3G network connectivity.

Health infrastructure is one area where the district is severely lacking. Although emergency ambulance services are covering the district over the last few years, the absence of treatment facilities in the district leads to undue delay in accessing health care at the time of need. People continue to depend on government and private hospitals in Mettupalayam and Coimbatore for their health care needs.

Water / Hydrology

As seen from the land use/land cover study quoted earlier, the area under waterbodies has declined by about 10%. Keystone's studies on wetlands in the Nilgiris reveals that they have no legal protection and are easy targets for 'development' into other land uses and in many cases are already irreparably damaged. Since there is no separate category in land administration called wetlands, it is difficult to trigger government action for conservation of these small wetlands. Historically, most wetland losses were due to agriculture. Today, the most common threat to Nilgiris wetlands is development because of fertile soil and location, many wetland areas have been put up under farming, business and housing developments and form localized high population zones within the area[18].

A large number of small dams have historically been built in the upper areas of the district for power generation. There are also systems of large tunnels that are used for power generation.

In terms of groundwater, the district is in a safe zone. However locally groundwater levels are falling all over the district, with the number of open wells and bore wells being dug each year going up. However in the absence of any legislation in the state to regulate groundwater extraction, it is difficult to accurately estimate the number of wells at present.

Table 19: Average depth of ground water in meters for 2013-14

Month-year	Previous Year	Current year	Rise/fall in water level
Jun-13	2.95	2.89	0.06
Jul-13	2.84	2.3	0.54

[18] Keystone Foundation, 2006
http://www.indiawaterportal.org/sites/indiawaterportal.org/files/Wetlands%20_conservation_and_sustainable_management_in_the_Nilgiris_Keystone_Foundation_2006.pdf

Aug-13	3.55	2.2	1.35
Sep-13	2.35	2.92	-0.57
Oct-13	2.45	1.63	0.82
Nov-13	1.73	1.98	-0.25
Dec-13	8.15	4.93	3.22
Jan-14	2.69	2.23	0.46
Feb-14	3.13	2.56	0.57
Mar-14	13.4	13.04	0.36
Apr-14	3.18	2.48	0.7
May-14	3.28	2.29	0.99
Source: TN Public Works Department			

As can be seen above, the only ground water level data available in the public domain is one number for the entire district, which serves little practical purpose. Groundwater level is a location specific phenomenon. Given that a sizable number of habitations and private houses depend on wells for their water needs, the groundwater withdrawal is significant. However since regulations regarding construction of new wells are non-existent, there is no way to quantify the groundwater status without a significant effort at collecting primary data.

There is also a popular perception that habitations that depend on springs are safer, as the source of spring water is not connected to the ground water that wells tap into. However this is a misconception. Water from springs as well as wetlands are part of the same aquifer. They are merely different discharge points for the same body of water. Thus, while springs are being tapped by Panchayats and TWAD Board for water supply, there is no attempt to conserve the sources of water for these springs.

Changing Occupational Profile

Overall Economy

The primary sector, which is largely unorganized, contributed to 20% of the Net District Domestic Product (NDDP), whereas for the state it was only 14% of the Net State Domestic Product. This is attributed to the contribution of tea in the economy of the district. However the annual growth rates of the primary sector had shown a declining trend, mainly due to the sluggishness in tea production and tea yield[19].

The contribution of the secondary sector was lower in the district (21.15%) in 2006-07 compared to the state (27.08%). In this registered manufacturing sector's (13.82%) contribution was more in the district NDDP than in the state (11.39%). This could be attributed to the tea factories operating in the district. On the other hand, unregistered manufacturing sector contributed poorly (0.25%) to the NDDP as compared to the SDP (6%). While the construction sector only contributed 6.86% to the NDDP against a contribution of 10% to the SDP, there was an increasing trend since 2002-03.

The tertiary sector contributed 58.95% to the NDDP, which is at par with the state as a whole. Since 2003-04, the tertiary sector's contribution has been growing owing mainly to growth in tourism.

[19] DHAN Foundation, 2011. District Human Development Report – The Nilgiris. State Planning Commission, Chennai.

The contribution of agriculture and manufacturing sectors is similar at the district level. This could be due to the influence of tea in both sectors.

Employment[20]

The overall work participation rate (WPR) for the district was 45.06% in 2001 and it has grown to 52.3% in 2011. As before the rate is higher in the rural areas than in the urban areas. The overall WPR was also lower in the taluks with municipalities (Ooty, Coonoor and Gudalur). The female WPR was higher in the district (35.39%) than in the state (31.54%). The gender disparity in WPR was also lower in the district (19.47%) than in the state (26.10%) and the country (26.05%). Here again, the gender disparity in WPR was higher in the taluks with municipalities.

Main workers formed 90.30 % of the total workers in the district as per the 2001 census, which was higher than the state level (85.25%) and the country as a whole (77.81%). The share of main workers among total workers was lower among women than among men. This higher share of main workers does not translate into contribution to NDDP, implying lower productivity of workers in the district.

Among main workers, cultivators and agricultural labourers constitute only 16.19%, which is much less than that for the state. Percentage of female cultivators was lower than male cultivators.

The employment exchange in Ooty has facilitated only a few hundred (varying from 158 to 807) job placements per year between 1999-2000 and 2007-08. It is unclear as to how effective these placements are.

As of 2005, a total of 230,572 tea workers were on the roll in the district. Of these 56.45% were residents of the district, which is lower than the corresponding figures for the state, South India, North India and for the country as a whole. However this proportion has seen an increasing trend during the period 2002-2005.

According to the district statistical handbook 2008-09, a total of 12,308 people were employed by 282 working factories in the district. Of these 4512 were employed by tea factories, 3200 by the Cordite Factory, 1200 by Needle Industries and 1095 by Hindustan Photo Films, among others. Village, Cottage, handicraft and small scale industries did not contribute significantly to the employment in the district.

The prevalence of child labour was much lesser in the district (1 per 1000 children) as compared to the State (6 per 1000 children).

[20] DHAN Foundation, 2011. District Human Development Report – The Nilgiris. State Planning Commission, Chennai.

IV. Environmental Impacts

While most of the above mentioned issues are spread throughout the district, the urban areas of the district face their own set of issues. Problems such as traffic congestion, air pollution, ineffectual solid waste management, rise of a speculative housing market, proliferation of informal settlements amongst a host of others have long been viewed as characteristic of Indian cities; but it was imagined that urban areas in hilly regions were largely shielded from these. Increasingly however, hill towns have become vulnerable to these pressures, which are exacerbated by the governance regime and institutional bottlenecks, risks and vulnerabilities to natural disasters and the imposition of an external social and economic order.

This state of affairs has led to increasing environmental degradation of the region. The most visible aspect of the same – extensively part of the newspaper reportage on Ooty- is an omnipresence of solid waste. However, the impact of tourism also extends to decreasing water availability – with hotels and large resorts accounting for a large share of the same-, rapid pollution of surface water resources and increasing air pollution and traffic congestion, especially within urban areas. This has led to fears among the local populace that the future growth of the region and the urban areas within it could be seriously constrained as the landscapes which brings in tourism would have disappeared.

Ecologically Sensitive Area – A consideration for regional planning

The overall land use classification does not take into consideration ecological aspects, rather focusing on classification based on human needs. Around 65% of land in the city was classified as unutilized by the CDP. But this points to several questions: Does this take into account wetlands and their ecological significance? Is the wasteland harbouring rare and endangered plants? What would future Plans do with this 'unutilized' land? Would the land use for these areas be changed? How have past land use changes happened? In Ecologically Sensitive Areas it is important to analyse these classifications to see if they are sources of springs, peat bogs or grasslands that are an essential part of the shola ecosystem of these hills.

The recent mushrooming of the 'Second home syndrome' is a growing phenomenon, found commonly outside the city limits rather than in the already densely developed core city. These were more in line with a 'ribbon development' frame alongside the major roads connecting cities such as Coonoor, Kotagiri and Ooty, and have started only over the past 5-6 years. This development also moved along two trends: On the one hand, individual buyers buy large plots of land in the order of 50-100 acres where they build a house in a small fraction of the plot, leaving the rest of the land with tea or natural vegetation. Secondly, tea estates, which have become financially unviable, divide their land into smaller plots and sell them to individual buyers.

Nilgiris also has a large number of small growers. It is seen that recently, Badaga small tea growers have begun to sell off their smaller plots of land to those seeking to build vacation residences. It was pointed out that this was a reflection of the larger process of outmigration happening in the district, where Badagas were selling off land which they had held for generations and had cultivated. The IT boom and the presence of several higher education

institutions in Coimbatore have led young Badagas to lose their interest in the traditional sectors of agriculture and cultivation.

Spring, Wetland, Water Regime

Large scale destruction of forests and marshes in the middle and lower zones for tea and vegetables respectively, seems to have reduced rainfall dramatically in the district[21]. The change in land use form rain-fed agricultural crops to plantation crops requiring irrigation has also increased demand for irrigation, placing a widespread pressure on natural water sources[22]. The increased use of pesticides, weedicides and fertilisers has resulted in groundwater pollution. Along with the biological pollution caused due to improper disposal of solid waste this has increased incidence of skin and water borne diseases among indigenous people.

Most of the water supply schemes have traditionally tapped springs and water is channelled to the habitations through gravity or pumping and storage. However with conversion of tea plantations to built-up areas without the support of a proper sewerage system, instances of sewage contaminating water sources have increased. Wetlands on the other hand, despite being important ecosystems and performing natural water filtration services, have been the target of land 'development', involving filling them up with soil and building over them. The lack of recognition or protection to wetlands in the land administration system has made them an easy target.

The increasing exploitation of groundwater through open wells and bore wells to meet the growing water demand is also resulting in lowering groundwater table. This is particularly visible in low rainfall years. The lack of groundwater regulation in the state coupled with the Nilgiris being classified as a safe zone for 'groundwater development' by the CGWB has resulted in the growth in number of wells not raising any alarms. If this trend continues, there is risk of water scarcity in many habitations and parts of towns as private irrigation wells would compete with water supply wells in the same aquifers.

Air Pollution

Tourism in Ooty and its intensity during the summer season results in excessive air pollution. The number and kind of vehicles which come to the hills need to be monitored for emissions. In a study, an analysis was done of all vehicles in the city and their emission details compiled. The study concluded that old models of vehicles were higher polluters. Though there is an emission checking centre in Ooty – it is only for locally registered vehicles. The number of tourist vehicles entering the city is not taken into account. This increases air pollution in the district, not only impacting the city but also the regions all along the road. In the future, primary data collection will be necessary to get clear figures on this aspect.

[21] Project Appraisal Report of the Kundah and Lower Bhavani River Valley Project, 1996-97 by Agricultural Engineering Department, Chennai
[22] Keystone Foundation, 2002. Hill Waters and Livelihoods Report. Keystone, Kotagiri.

Solid Waste

As a result of high tourism the city also has pollution impact due to solid waste disposal. Both sewerage and dry waste become difficult to manage during the peak season of tourism. Most of the waste goes into the Ooty Lake, which is a major tourist attraction. Many unsuccessful attempts have been made to divert sewers going into the lake and garbage stopped from being dumped in it. The Udhgamandalam municipality has also taken steps to spate solid waste from the household level. Of late a bio-remediation has been approved to clean all lakes in urban areas of Tamil Nadu.

Human-Wildlife Conflict

The Nilgiris district is a part of the Nilgiri Biosphere Reserve with more than 40% of the land area under the forest cover. The forest spread across three divisions has a tiger reserve, national park and numerous forests under the reserved forest category. These forests are a part of the wildlife corridor that connects the Western and Eastern Ghats. These forests harbour a wide range of wildlife including the mega-fauna such as the Asian Elephant, Indian Gaur and carnivores such as the tiger, leopards and dholes. Earlier studies conducted in the region reveal that the district has a good populace of wildlife when compared to nearby districts and regions.

On the other hand, the biodiversity-rich landscape of the district has high human densities comprising of indigenous and settler communities. Over the years the landscape has undergone massive changes in the form of plantations and urbanisation. These changes have had a direct impact on the forests and subsequently the wildlife corridors. Over the years the incidents of interactions between humans and wildlife have increased causing irreversible damages to both humans and wildlife. This would include communities living within forest areas and those on the fringe. The reports of such interactions are a regular feature in the local media and on certain occasions capture the attention of the national press as well. While elephants, tigers and wild boar are the most commonly cited 'conflict animals', there is a high possibility that, these are only a few select instances being reported, possibly because of the extent of the damage, or the importance of the animals involved in the conflict.

Studies undertaken by organisations in the region indicate that the issue of conflicts is not uniform across all three divisions in the district. For example, quoting the records maintained at the Forest Department most incidents of crop damages were caused by elephants and gaur; whereas the incidents of livestock depredation were by leopards and tigers. The Gudalur division reports as most incidents of conflict are caused by elephants. However, a large portion of incidents remain unreported, due to numerous reasons. The lacuna of concrete information on the incidents of conflict is a hindrance towards understanding and mitigating the issue.

On the other hand certain administrative and legislative decisions, have also contributed towards the increase in conflict. The Nilgiri Biosphere Reserve was formed across three administrative state boundaries; each of which implements independent rules and legislative mechanisms regarding the governance of the landscape awarded to them. Approaching governance of a biosphere through a fragmented approach as used by individual state administrations might have furthered the existing problem.

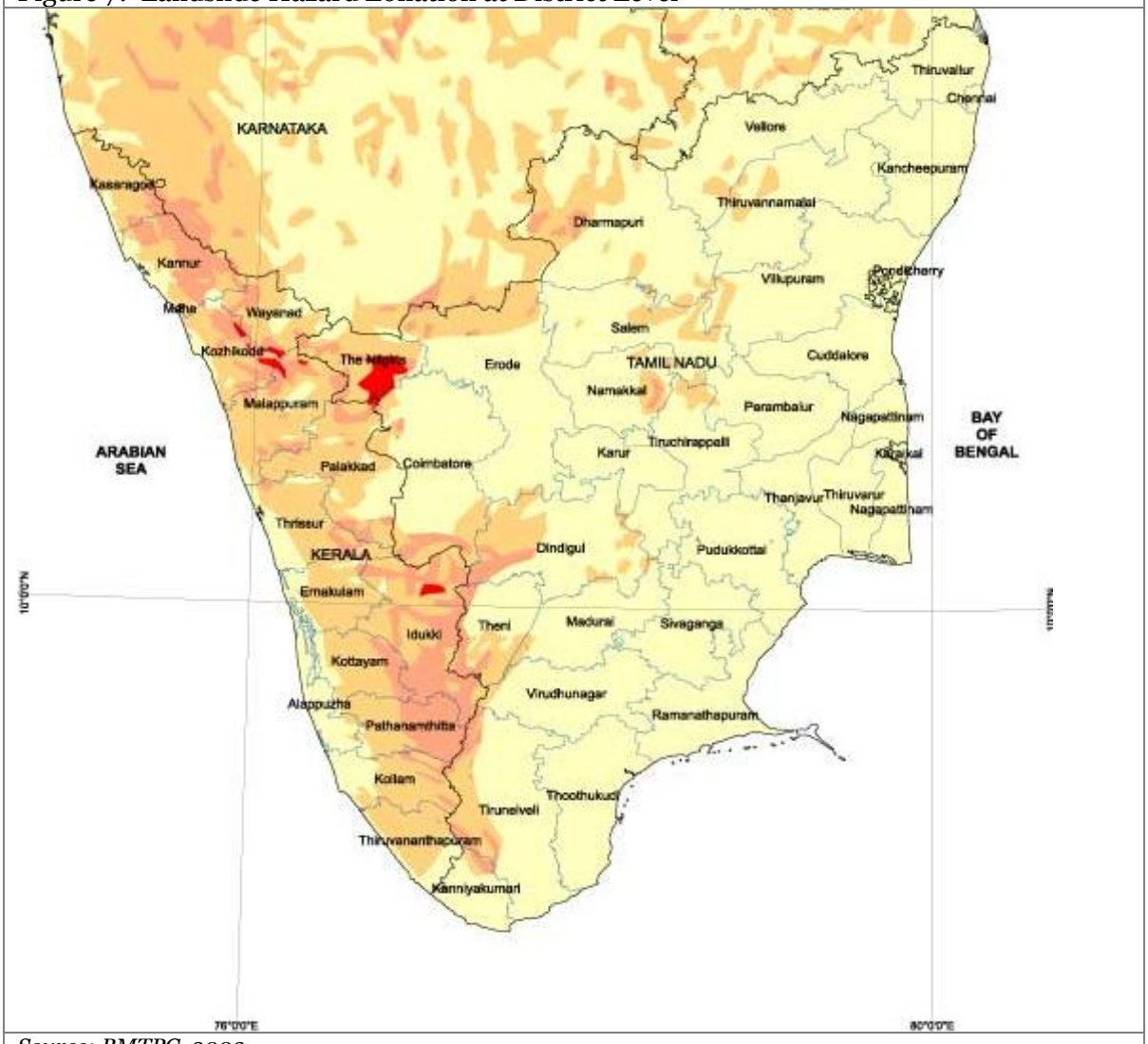
While, the administration and forest department officials have undertaken various measures such as providing wildlife proof barricades and paying compensation for damages suffered as a result of wildlife, the local populace is still sympathetic towards wildlife in most cases. The locals would also describe a slightly different narrative, where conflict is an ongoing and almost daily process, but not necessarily with the most popular species mentioned above, but with smaller and possibly more elusive animals like mongoose, hare, porcupine etc.

Landslides

Landslides are positioned on the other extremity of externalities from adverse rainfall conditions in the district. Although landslides were common in the district, it has been noted that the intensity and frequency of these events have been increasing in recent times. The BMTPC (Building Materials and Technology Promotion Council under MHUPA) in its vulnerability atlas of India has described parts of the Nilgiris as

[…] well known for the danger of landslides, and the perennial threat to life and poverty. Restriction on all new constructions and adoption of improved land use and management practices deserve to be encouraged. Investments on landslide remediation measures, on public education and an early warning system are strongly indicated.

Figure 7: Landslide Hazard Zonation at District Level



Source: BMTPC, 2003

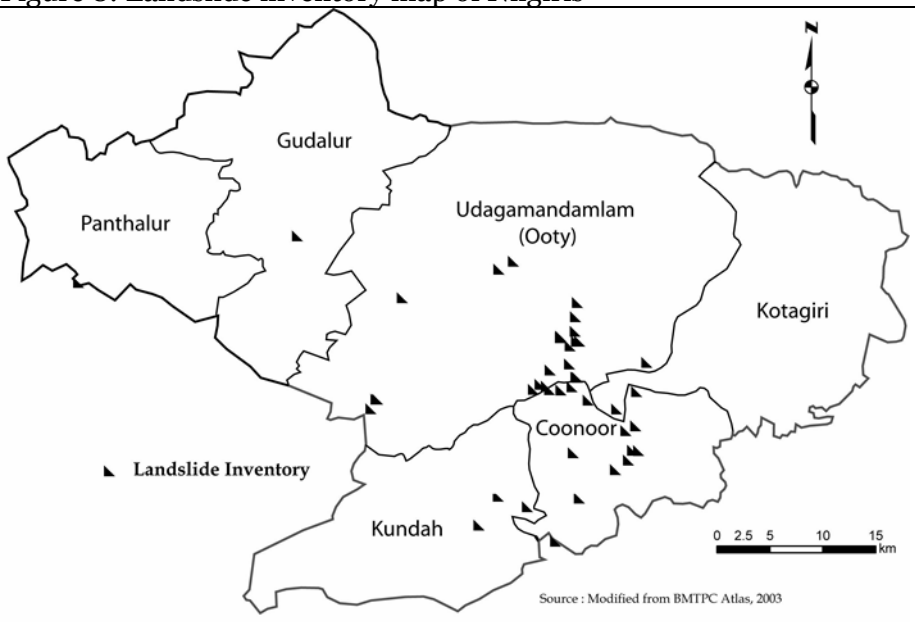
Ganapathy et al (2010) have listed and described some of the major landslide events that have occurred in the district in the past. The same study also creates a landslide inventory map of the district. The same is reproduced below.

Table 20: Major landslides in the Nilgiris

Year	Locations	Casualties
1865	Ooty, Coonoor	No
1891	Coonoor Ghat	No
1902	Coonoor, Kotagiri	No
1905	Coonoor	No
1978	Ooty, several parts of Ooty & Coonoor taluks	Yes
1979	Kodanad, Coonoor, Kotagiri, Kundah	Yes
1990	Kundah	Yes
1993	Coonoor	Yes
1998	Coonoor Ghat	No
2001	Coonoor Ghat	No
2006	Coonoor – Mettupalayam stretch	Yes
2009	Ooty, Coonoor, Mettupalayam	Yes

Source: Ganapathy et al, 2010

Figure 8: Landslide inventory map of Nilgiris



Source: Ganapathy et al, 2010

As is evident from the representations above, Coonoor and the surrounding regions are at highest risk from landslide events. The growth in population and settlements has also led to casualties as compared to earlier times. The vulnerabilities of poorer households having to reside in more landslide prone areas also contribute to the same.

Land Fragmentation & Biodiversity

Land use change and the conversion of small holdings into housing plots is a growing trend in the Nilgiris. This is leading to fragmentation of land by building fences, more roads, accessing water and electricity and construction of buildings. Largely urban in nature, these structures disturb large extents of land use, mainly tea. Over the years, constant pressure on land has resulted in ecological damage in the Nilgiris – initially conversion from Shola and Grasslands to tea & commercial plantations and now conversion of tea to urban forms. Every land use change results in fragmentation and causes ecological disturbances. Water flows, wildlife corridors/movements are good examples of disturbances caused with land use change.

Overall urbanisation reduces tree cover and wilderness areas on which several fauna depend. Several rare, endangered and threatened species can get destroyed due to changes made on land. There is already much research done on the loss of biodiversity in the Nilgiris historically. However, current losses are not being monitored or recorded. In the future, this aspect will have to be studied using primary data in select sites.