



## URBANISATION v/s ENVIRONMENTAL THREATS IN DARJEELING HILLY AREAS: ITS IMPACT AND MANAGEMENT

### GEOGRAPHY

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### ABSTRACT

Environment where we live and thrive is the source of life on earth, where every action, growth and development of mankind takes place. As society expand, shrinkage of environmental arena takes place in an unplanned way. Demographical interference viz. population growth, rapid unplanned urbanisation, development projects etc. leads to degradation of mountain ecosystem of Darjeeling, and its adjacent areas. The methodology adopted during this study is based on various primary and secondary data collected from trusted sources (Government & NGO's), along with some statistical measures were included for quantitative analysis of the final result. The changing nature of human habitation and its impact on that area were analysed based on the data between 1999 and 2012. Both qualitative and quantitative analysis was given importance in this research. This paper mainly attempts to identify how changing demography and dynamic expansion of society causes environmental threats and what will be its impact in future. It reveals from the study that how man-environment relationship is changing and development and destruction taking place silently. At the end of this paper some management approaches on various issues were discussed which will be helpful to researchers for further analysis.

### KEYWORDS:

- Population growth, Urbanisation, Solid waste, Black carbon concentration, Deforestation.

### INTRODUCTION

"Homo sapiens are undergoing a radical transformation in its environment" the growth and development of Darjeeling town and cities were somehow different than the pattern of growth in the plain area. Urbanisation was first introduced by the Britishers (150 years back) for their comfort and utilisation of hill resource; this was the first initiative of well attentive habitation. Later on urbanisation or in other words spontaneous growth of settlement and population growth have taken place with the introduction of Tea industry in that area. With this influential activity introduce a drastic change by the middle of 19th century which generates a huge mass of population and various developments in Darjeeling. At present Darjeeling holds a huge mass of population including Urbanisation and urban growth, education, employment, good social wellbeing between different groups of people and a diversified socio-economic and cultural understanding between the habitants.

Historically speaking, when the population was thin a state of equilibrium was there between man and environment, but situation changes gradually with the change of time. Progress in urbanization and population growth exerts direct impact on land use and enhances environmental degradation in Darjeeling town and it adjoining hilly areas. Hence increase in urbanisation affecting both macro and micro environment of Darjeeling town tremendously.

**1. AIM OF THE STUDY-** The aim of the study is to get information with a view of finding causes of the environmental degradation of the Darjeeling town and its adjacent areas and suggest menace for its management.

**2. METHODOLOGY-** The author at first obtained the basic areal data from the Census of India 1901, 2001 and 2011. Most of the data's were collected from Secondary data and information's gathered from Municipal offices and NGO's. A basic field survey was organised during the month of July 28<sup>th</sup> 2016 by using the questionnaire method applied through the areas of *Lepchajagat* (a tribal area of Darjeeling) and *Jalapahar* to know the past scenario of the hilly areas from the senior citizens.

**3. STUDY AREA-** Darjeeling district lies between 26o 31' N and 27o 13' N latitude and between 87o 59' E to 88o 53' E longitude, the total area is about 3,149 km<sup>2</sup> and 1/5th cover of the total geographical area of Darjeeling district is hilly (shivalik). On the north it is bounded by Sikkim, in the south by Bangladesh, in the west by Nepal and Bihar and on the east by Bhutan and Jalpaiguri district.

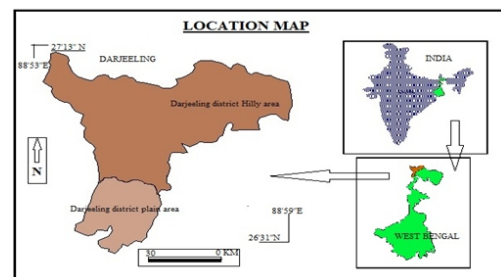


Fig-1: Location Map of the study Area

### 4. ANALYSIS BETWEEN URBANISATION, POPULATION GROWTH AND ENVIRONMENTAL DEGRADATION OF DARJEELING TOWN AND ITS SURROUNDING AREAS (BASED ON 1991, 2001 AND 2011) :-

While coating the statement i.e environmental threats it is necessary to look forward and examine all the data's collected and by applying suitable statistical measures to find out the complex interrelationship between urbanisation, population growth along with environmental degradation. The sub-division wise distribution of urban local bodies are as follows :-

- Darjeeling Sadar sub-division.
- Kalimpong Sub-division.
- Kurseong Sub-division.
- Siliguri Sub-division.

**(4.1) Change in Urbanization and Population** - Economic growth have stimulated rapid urbanisation and population growth in Darjeeling town. The first regular Census under British regime was conducted in Darjeeling in the year 1871-72 showing a population figure of 94,712 which increased manifold to 1,55,179 by the next Census in 1881 and within Census 1901 the population of Darjeeling grew to as much as 2,49,117. The population of the district continued to increase at a steady pace during next decades and by 1941 it almost touched the four lakhs mark at 3,90,899. As per the first Census after independence of 1951, the population of Darjeeling district was 4,59,617, an increase of almost 73% during 50 years from 1901. After independence, the growth rate of population gradually decreased (with an exception in the decade 1971-81) adding lesser people to the bounty. As per Census 2011, the population of Darjeeling stands at 18, 46,823 with 9, 37,259 males and 9, 09,564 females.

**Reasons for the growth of urban population in Darjeeling town and its surrounding areas are:-**

- 1. Urban pull factors** – viz. Better employment, educational opportunity, high standard of living, better health facility, better transportation etc.
- 2. Rural push factors** – viz. Unemployment, poor education, haphazard living condition, poor health facility etc.

**Table-1: Growth of urban population in municipal towns (1981-2011)**

year	Darjeeling	Kalimpong	Kurseong	Mirik	Total
1981	57603	28885	18008	-	104496
1991	73062	38832	26758	7022	145674
2001	107197	42998	40019	9141	199355
2011	118805	49403	42446	11513	222167

Source: Census of India (1981, 91...2011)

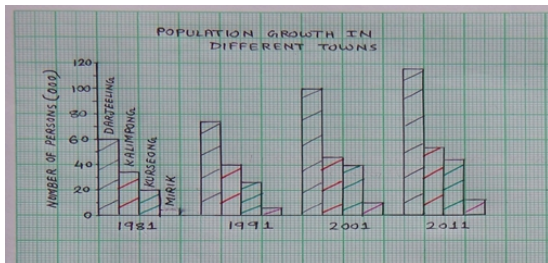


FIG- 2: Population growth in different towns (1981-2011)

It is observed from the (table-1) that almost 55% of population of Darjeeling hilly areas lives in Darjeeling towns where as 27% in kalimpong and 17% in kerseong (data 1981). But the scenario changed in 2011 with huge influx of population, expansion of urbaniastion took place Darjeeling town records about 53.5% of urban population followed by Kalimpong with 22.2% and Kurseong with 19.1%. Mirik Town during the same census period barely records only 5.1% which is the smallest town of the region.

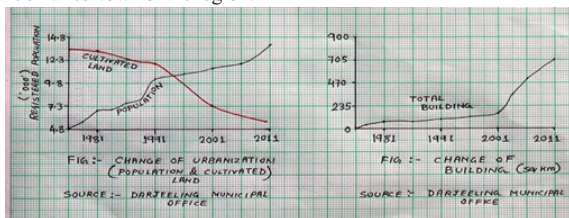


FIG- 3: Data collected and computed by author itself (based on 1981-2011), showing change of urbanisation & construction of buildings.

**(4.2) Change in land use and land cover-** During the research work to find out the parameters that how environmental degradation taking place in the town area and its surrounding, the data based on land use helps a lot. The land resources are confronted with more space shrinkage enhancing environmental pressure with city expansion, urbanisation and population growth of Darjeeling. Due to rapid economic development change in land use has taken place after 1995 onwards, cultivated and forested lands have decreases to a large extent. From the data source of Darjeeling Municipal office Data from Ministry of Forest and West Bengal state forest report (secondary source); based on 1999-2007) a gradual depletion of forested area had taken place with due progress of human settlement in Darjeeling and its adjacent areas, 321.2 km2 forested area was recorded during 1931-41 survey and the situation remains same till 1960's.

**General charecterestic's of Land use and land cover area of Darjeeling and its surrounding**

Darjeeling (including four sub-division)	Total forested area- 554 km2(2006-7 data)
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Fallow land	Shrinkage of fallow land have taken place after 2001 with influx of population and ever increasing price of land for habitation. Area under fallow is about – 19.25%.
Cultivated land	Decrease in cultivated land have taken place after 1999 by 7.1%.

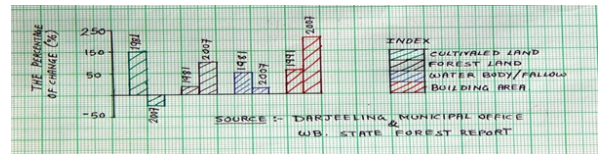


Fig- 4: Change in Land use, (Data collected and computed by the author itself)

Various changes have taken place with the change of space and time, tremendously dynamism of changing population and urbanisation exerts the wealthy qualities of Himalayan ecology and human pressure ultimately degrading the environment through their unscientific use and improper management.

**5. GROWING URBAN ENVIRONMENTAL THREATS IN DARJEELING HILLY AREA: ITS IMPACT & MANAGEMENT**

– After analysis and proper study of all the data's collected, no doubt it is a matter of concern that with the proper growth and development of population along with urbanisation, silently depletion of environment have taken place due to various reasons. Some notable environmental threats usually noticed in Darjeeling hilly areas are:-

**(5.1) Impact of Urbanisation on Atmospheric Enviroment** – With progressive growth in urbanization resulted excessive growth of urban air pollution become more prominent environmental issue. At present, Darjeeling town and its surrounding area's urban ambient air quality is high and on its peak of overall pollution level. After 1990's, the number of motor vehicles increasing at a rate faster than the population, the data obtained from the State pollution board (W.B.) automobiles plying through the Hill cart (NH 55) and Leborg cart Road crossing Darjeeling and spreading towards other areas was about 230 apprx , per hr (data 2009) and there is weakly adding of vehicle's more than 20 (both two & four wheelers). According to many Environmentalist, Ecologist and Sociologist this large scale influx of vehicles in Darjeeling causes massive air pollution. Later on, various studies and research revealed that; vehicles contribution regarding to air pollution are estimted to account 40% of CO, 20% of HC, 20-25% of NOx, 30% of SPM and 10% of So2.

**Vehicle population (in %) in an around Darjeeling town area.**

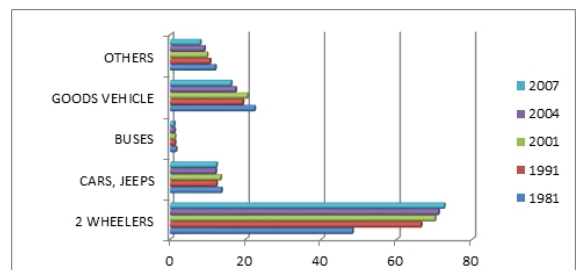


FIG- 5: Source; - West Bengal pollution control Board annual report & data's

This cause the problem of air pollution in Darjeeling, some of the exhaust gas like CO2 is a major greenhouse gas while carbon monoxide, NOx and Hydrocarbons are major health hazard for the people as emission takes place within the breathing zone. Nowadays the mild and pleasant weather scenario degrading day by day, raise of temperature takes place due to urbanisation indirect phenomena of Urban Heat Island in near future.

**5.1 (a) Air pollution along with "Black Carbon Concentration"-**

Recent research points out some peculiar phenomena, scientist have point out that polluted air generated in the industries of north India travel over 2000 km to reach the hilly areas of Darjeeling and Sundarbans areas of West Bengal. A huge thick mass of air carrying Particulate matter of less than 2 micrometres travel under the influence of strong north-westerly winds (Mr. A Chatterjee; an Environmental scientist at Bose Institute). According to his research; in Darjeeling the average BCC is 3.5 micro grams per cubic metre which is comparatively high, beside that the Researchers in Darjeeling analysed the origin and found that 43% did not originate locally. Being very fine, less than 1 micro metre it is respirable and can directly affects human lungs and cause several cardiovascular disorders. Black carbon also hastens the process of climate change as it leads to the melting of snow when it gets deposited on glaciers.

**• Some Management approaches –**

(i) Specifications of 2T oil for two stroke engine with respect to smoke reduction must introduce (EPA instruction September 1998). Pre-mix 2T oil will use less excess oil by the vehicles, which will be helpful further as pollution reduction.

- (ii) Battery driven two wheelers must be introduced.
- (iii) Commercial or Goods vehicles more than 20 years must be prohibited from plying.
- (iv) Traffic congestion must be avoided and maintained systematically.
- (v) Catalytic converter for new petrol vehicle (specially 4 wheelers) must be made compulsory.
- (vi) Industry must be set up only after the completion of EIA and EMP procedures along with rules and regulation.

**(5.2) Urbanisation along with sanitation and Sewerage problems –** Darjeeling town probably generates more than 6.60 mld of sewerage (data 2001). Comparatively the sewerage system was very old which was laid down in 1935 and covers only 35% of towns at present. Due to improper management the system is decaying and day by day it is breaking down. The system collects the domestic waste of more than 2800 households and more than 50 community toilets, and finally which is attached to 6 central septic tanks and ultimately disposed into the jhoras (i.e., waterfalls). Sometime CST's don't work properly and hence, the system needs upgradation. Many residences although do not have a proper sanitation channelization, in most old buildings sanitation system fully deprived and out-dated. By applying a formula to calculate the total sewerage from the water supply to each municipal corporation (including four sub-divisions):-

$$T_s = T_w * S_w / 100$$

Whereas, Ts = total sewage, Tw = total water supply, Sw = proportion of sewage. After calculation, more than 17% of sewage is untreated.

**Some management approaches – (i)** Municipal survey team must try to go through a survey for checking the faulty sanitation service in residential areas annually.

- (ii) Checking of the central sewerage system must be conducted to avoid future problems.
- (iii) Unmanaged waste water causes diseases, hence proper treatment is necessary.

**(5.3) Impact of Urbanization on Solid Waste –** Darjeeling town and its surrounding areas (including; Kurseong, Kalimpong and Mirik) produces more than 250 metric tonne of solid waste per day. Darjeeling town alone produce more than 50 metric tonne of waste per day (Darjeeling municipal office; 2002 report). Solid wastes consist of the discards of households, dead animals, industrial and agricultural wastes and other large wastes like debris from construction site, automobiles, furniture etc.

**Types of solid waste usually found in an around Darjeeling hilly areas are;-**

Decomposable waste from food slaughter house and market refuse

non-decomposable waste like cloth, rubber, leather. It also includes non-combustible i.e. ceramics, metals, glass etc. Hospital refuses; like needles, cotton, plasters and operation waste. Waste like debris from constructional site and landslide etc. Dead animals, households, veterinary hospitals and zoo waste. Others include ashes, agricultural waste and mining waste etc.

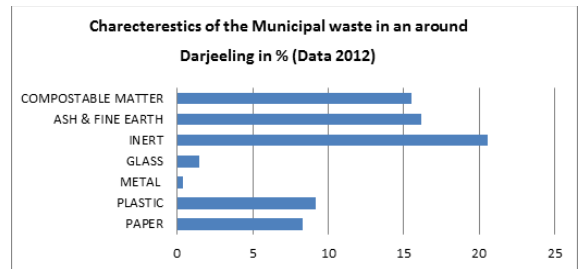


FIG- 6: Source; - Municipal office of Darjeeling & Siliguri municipal office (data collected and computed by author itself, 2012 data source).

The present trend indicates that the paper and plastic continue to some extent, the proportion of inert, combustible matter, ash and fine earth is comparatively high. The garbage collection vehicle collects all the waste from different parts of the town and ultimately deposited above Hindu burial ground.

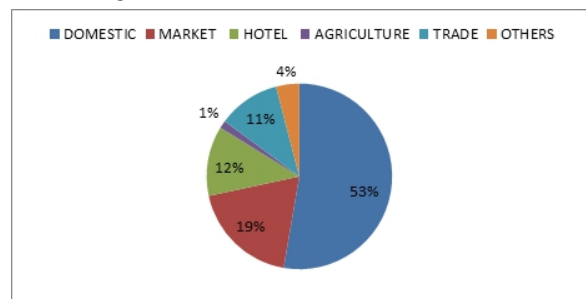


FIG- 7: Source; - Darjeeling Municipality.

Domestication practise discharge huge untreated solid waste, sometime this are responsible for spreading deadly diseases like plague, cholera etc. the flies which carry pathogenic organism cause disease such as dysentery, diarrhoea etc. With increase in urbanisation and population the ratio of increase in solid waste will take place.

**Some management approaches –**

(i) From the views of Central Pollution Control Board (CPCB) and NEERI provided some guide lines after extensive studies which must be applied for profound management purpose.

(ii) Every house hold must provide separate containers for the collection and segregation of inorganic recyclable materials like plastic, glass, metals, papers etc.

(iii) Unscientific disposal of solid waste must be checked by the authorities, along with the treatment of sanitary landfills be the main option for disposal of urban solid waste.

(iv) Disposal of solid waste as well as sewage over the natural stream must be prohibited.

(v) Mountain slopes must not allow to be used as dumping ground.

(vi) Application of technologies like Incineration, Palletisation and Pyrolysis-gasification should be introduced (if applicable).

(vi) A reputed firm named Consulting Engineering Service pvt. Ltd (1984) to prepare a project on total up gradation of sewerage system of Darjeeling but it is not working till date. Hence governmental involvement is needed.



**(5.4) Urbanisation along with Traffic congestion and Noise pollution** – One of the most notable problems of Darjeeling town and its surrounding regions is the lack of space. Shrinkage of space taking place with increase in population and urbanisation, which hinders roads width and promotes traffic congestion. In Darjeeling and in its sub-division the road system is only one way direction; within the time interval between 10.00 am to 1.00 pm (exceeds 75 decibel) heavy traffic congestion took place and which remains for more than 1 and ½ hour of traffic jam. The road density usually ranges to about 9 km<sup>2</sup> and most of the roads of Darjeeling Municipal Area are not built for heavy vehicles beside that most of the roads are in pathetic state.

**Some management approaches** – Highly induced Proton horns and heavy sounded silencers must be prohibited in an around Darjeeling hilly area. Enforcing on the reduction of speed limit will be helpful further and machine along the construction sites must be checked oiled and maintained regularly for good result.

**(5.6) Urbanisation along with Deforestation and loss of Biodiversity** - Biodiversity is a combination of two words 'biological' and 'diversity' and it refers to the variety of life on earth, and its biological diversity. Darjeeling hilly area having rich biological diversity, but the rate decreasing with progress in urbanisation and influx of people. At least 10 per cent of its recorded flora, and possibly a large fraction of its wild fauna, is threatened and many may be on the verge of extinction.

Deforestation was introduced in Darjeeling hilly region with the hands of British colonial settlement. Later on, Tea industry attracts a huge number of population which directly influence the growth of urbanisation and economy. The total area under forest of Darjeeling district is 1,204 km<sup>2</sup> (data 2006-7, State forest report) of which 1,115 km<sup>2</sup> is Reserved forest and 89 km<sup>2</sup> is unclassified state forest. Darjeeling Town and its adjoining sub-division shares only 554 km<sup>2</sup> (2006-7 data) of forest area which is less. For a hilly region, about 60% of forest cover is mandatory but Darjeeling covers only 38.23% (2006-7 data). Darjeeling district alone having 44.6% of Degraded notified forest in west bengal(2006-7 data) of which Darjeeling hilly area having 27.25%.

**Some management approaches** –

- (i) Encouragement of Social forestry will be helpful.
- (ii) Afforestation must be conducted with the co-operation of both Govt. organizations and NGO's in degraded forest areas.
- (iii) Illegal felling of trees must be prohibited,
- (iv) Introduction of plantation along with forestry will be helpful.
- (v) Afforestation will increase soil strength.
- (vi) Plantation of tree along the road side must introduced.
- (vii) social and public awareness along with participation for saving the forest resource.

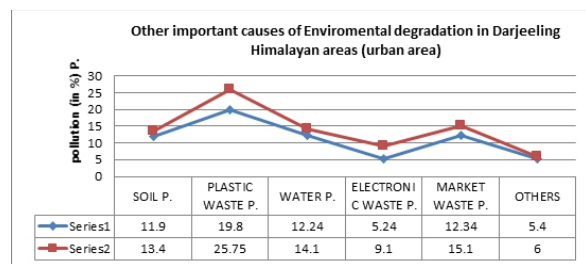


FIG- 9: Source;- Data collected and computed by author itself (series-1 = 2001, series2=2011)

Some of the other urban environmental threats which are commonly found in this areas are soil pollution (due to unscientific disposal of garbage and solid waste etc.), Water pollution (leakage in underground sewage pipes, waste disposal along jhora's side), Plastic waste (throwing of plastic bags, bottles and burning of plastic amenities etc.), Electrical waste (disposal of useless wires, cut off nails, batteries etc.), Market waste (disposal of vegetables remains, throwing of animal remains and waste from the meat shop and fish market etc.) and others,

degrading the environmental quality of Darjeeling town and its surrounding areas.

**(6) THE NEED FOR AN INTEGRATED ENVIRONMENTAL MANAGEMENT APPROACH** – Progress in development is the nature of every humans life, hence process of urbanization and regional development cannot be stopped. But, we have to manage our environment, we have to make progress along with scientific management as our clear cut aim only then, we can achieve sustainable development.

**(i) Waste reduction** – This will be the one of the preventive action which will help to reduce waste and waste generated problem in urban environment, our main aim will be on more goods and service with less utilization and hampering the natural resource.

**(ii) Recycling** – After using the materials and products the concept of recycling comes in the arena of environmental management. Recycling can be done with large amount of materials such as, paper, metal, plastic, card board, rubber, glasses etc. it can be also an economically beneficial activity.

**(iii) Composting** – Compost is one type of bio fertilizer, formed with the combined action of aerobic and anaerobic environment. The compost made out of urban heterogeneous waste is found to be of higher nutrient value as compared to the compost made out of cow dung and agro-waste. It will be very useful for Tea gardens and floricultural activity.

**(iv) Others** – Sanitary Land filling and Incineration will also be helpful.

**CONCLUSION** – Darjeeling town and its surrounding areas experience rapid population growth and urbanisation after 1950's. But the region suffers with unplanned settlement, increase in population, over exploitation of natural resource etc. This changes in the region along with development brings various environmental threats which has to be overcome. Planned and scientific management approaches some how will be helpful further to maintain a sustainable man-environment relationship in Darjeeling Himalayan areas in present and future.

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