

# Recent Trends on Development and Sustainability of Darjeeling District, West Bengal

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**Abstract:** *Socio-economic Development is a continuous and dynamic process which tends to facilitate a better life for us but in real when it crosses the level of carrying capacity of environment and breaks the environmental ethics then environmental degradation starts and loss its sustainability. In Darjeeling district, the socio-economic development is mainly dependent on three basic activities as tea production, forestry and tourism industry which now affect environment and get negative feedback. In this paper, the impacts of the development of these three activities and inter-relationships will be discussed through data analysis about changing pattern of Landuse / Landcover maps, decreasing yield rate of tea due to degrading agro-climatic situation, development of tourism industry through using application Remote Sensing data by using Geographical Information System and descriptive statistic.*

**Key Words:** *Carrying Capacity, Environmental Ethics, Geographical Information System, Remote Sensing, Yield Rate.*

## 1. INTRODUCTION:

Generally, the socio-economic development is the ultimate target of any modern civilisations but it becomes a common human nature which always tends to exploit and consume the natural resources beneficially both directly and indirectly. For this, we get feedback which may always not good as we think. So, we should understand the threshold limit of nature and its carrying capacity. Generally, sustainable development indicates a progressive condition where present needs get its importance as well as future also. In other words, it is a balance in between development and basic philosophy to maintain the environment. According to R. Paul (2015), Darjeeling district is such a geographical area where environment creates suitable conditions for tea which is one of the most popular assets of India for its great aromatic flavour. But recent various reports and articles indicate environmental degradation of this region mainly due to over exploitation through deforestation and tourism industry. In this case, a huge population migrated in this area and population growth is also responsible for major landuse/ landcover changes. Thus, deforestation for settlement, packaging and other purposes, is occurred which breaks the environmental ethics.

## 2. LITERATURE REVIEW:

Various research articles, reports, maps have been reviewed and the most relevant literatures have been mentioned below According to Misra (1987), the quality of Indian tea is gradually decreased which is reflected on the price of Indian tea in international market. This research articles also highlighted the glorious past of Indian tea, especially Darjeeling tea which is relevant with this topic.

According to Mann (1939), the position of India in respect to other best quality tea producing countries is described as very significant and in India Darjiling is one where the geographical factors have a great impact on tea cultivation.

A research work of Mitra (1991), entitled as “Indian Tea Industry: Problems and Prospects”, a study of Indian tea production and its demand in domestic and international markets comparatively with other countries, argued that the low productivity and its high demand of Indian tea production. In the research work of Dr. Sherpa Bhutia about “The Sustainable Tourism Development in Darjeeling Hills of West Bengal, India: Issues and Challenges” we can find the present condition of tourism industry and major impacts on tea cultivation. Vimal Khawas focused on mainly issues about environmental and rural development of Darjeeling district which reveals the present conditions of various socio-economic aspects and their problems in light of tea cultivation.

A discussion about the vegetation cover of Darjeeling district and related issues of Debabrata Das reveals the information about forest resource of that area. Also several studies focussing on this topic reveal the either individual or including few factors. As deforestation and others anthropogenic activities play a major role in this case, so changing pattern of Landuse/ Landcover maps will be another supportive reference to represent the present conditions. In this context Tourism industry is also responsible matter. So, it will be analysed emphasizing on year-wise tourist arrival growth. The complexity of several factors should be discussed in holistic manner with focussing recent trend of development and sustainability in this paper.



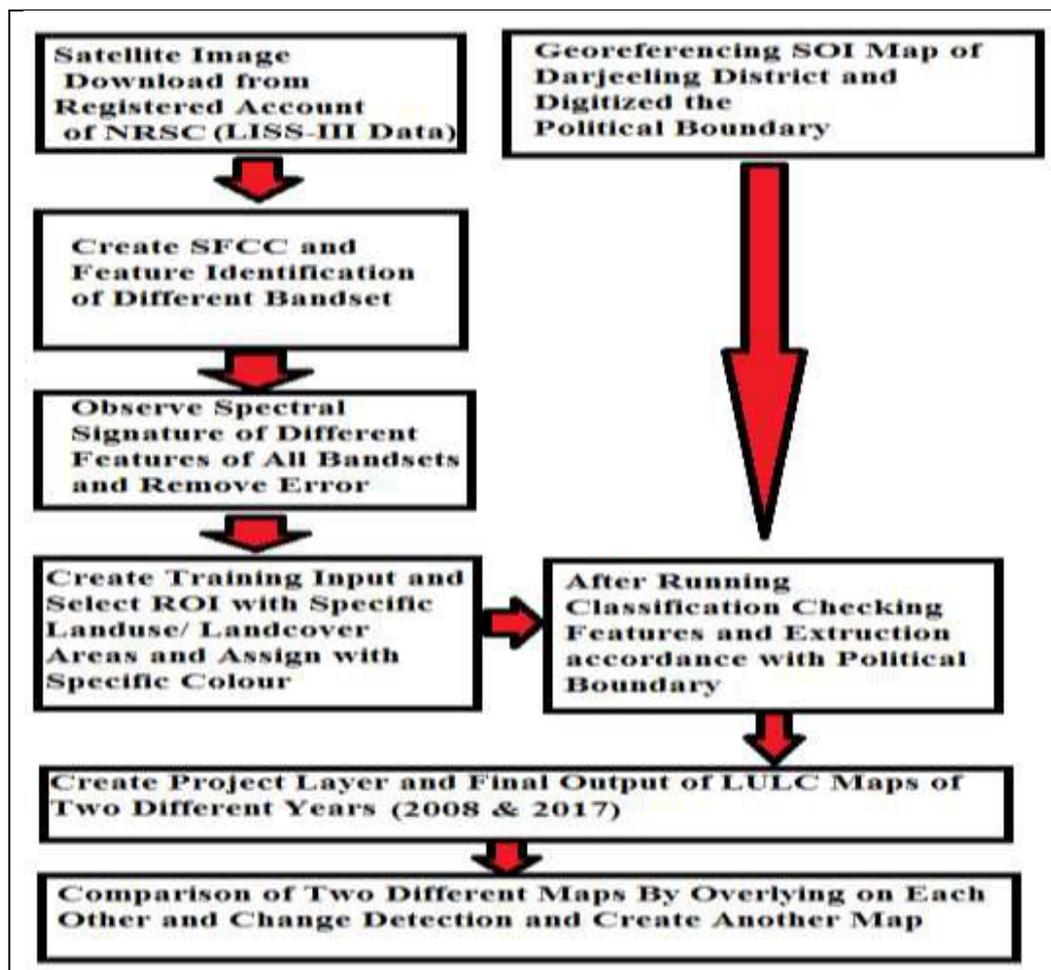


Figure 2: Methodology of GIS Application for Analysis of LULC Maps

## 5. RESULTS AND DISCUSSION:

### 5.1. Changing Pattern of Landuse/ Landcover:

In 1835, Darjeeling was most popular as a hill station but since 1839, it appeared as a centre of tea distribution with only 20 families. From Kumeon, seeds of *Camellia sinensis* var. *Sinensis* were brought and tea cultivation was started and nurseries were established by the British Government in 1847. The development and growth of tea estates gradually increased over the years (R. Paul, 2015).

From this beginning, a huge population attracted to work from neighbouring countries, states and districts. Thus needs for land in the purpose of settlement, agriculture and associated lumbering became the major causes for deforestation. With this continuous process another activities started to play a major role, i.e., Tourism industry for beautiful natural environment. Thus over exploitation starts to grow up day by day with changing Landuse pattern. On the basis of available satellite images, the LULC maps are prepared which is showing a huge deforestation and transformation of vegetation covers into Settlement and agricultural cropped land (Figure 3.).

On the basis of the changes in LULC maps from 2008 to 2017, the major changing areas is located (Figure 4.). Now, the maximum transformation of vegetation covers into cropped land is occurred in northern parts while the most transformation into settlement areas is occurred in southern parts. Thus, a huge reduction of vegetated area for not only lumbering but also for settlement for increasing population is located especially (surrounding the Siliguri town) southern parts of this area. Though, many fallow lands also transformed into settlement areas but it indicates environmental vulnerability like Landslide due to loss of vegetation covers triggered with Earthquake and Rainfall.

Several studies (Bairagya & Jha, 2015; Nad, 2015; Tirkey & Nepal, 2012) reveals that landslide is one of the most disastrous natural hazard affecting on crop cultivation especially tea gardens of Darjeeling hill area which belong steep slope during earthquake and heavy rainfall. Though Darjeeling hill area belongs to the part of the eastern Himalaya and Himalayan Frontal Thrust, Darjeeling has Tista Lineament trending NW-SE and Kanchenjunga lineament trending NE-SW reveals earthquake prone area of this region but earthquake and landslide are very correlated to each other and it is seen that the seismic prone areas especially which are submerged along with tea garden the effects of landslide is more clear of that areas (Bairagya & Jha, 2015).

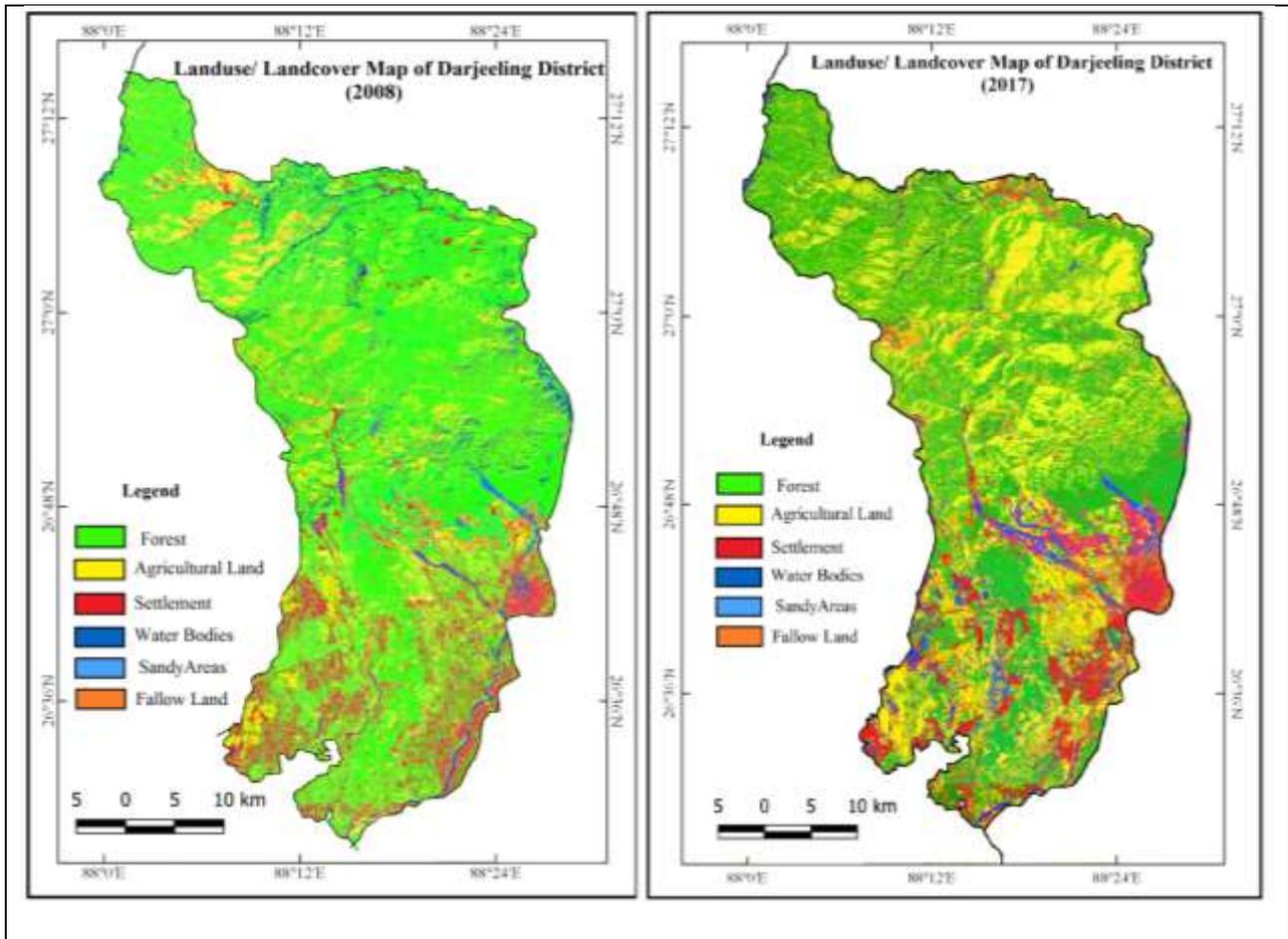


Figure 3: Landuse/ Landcover Maps of the Study Area of the 2008 and 2017

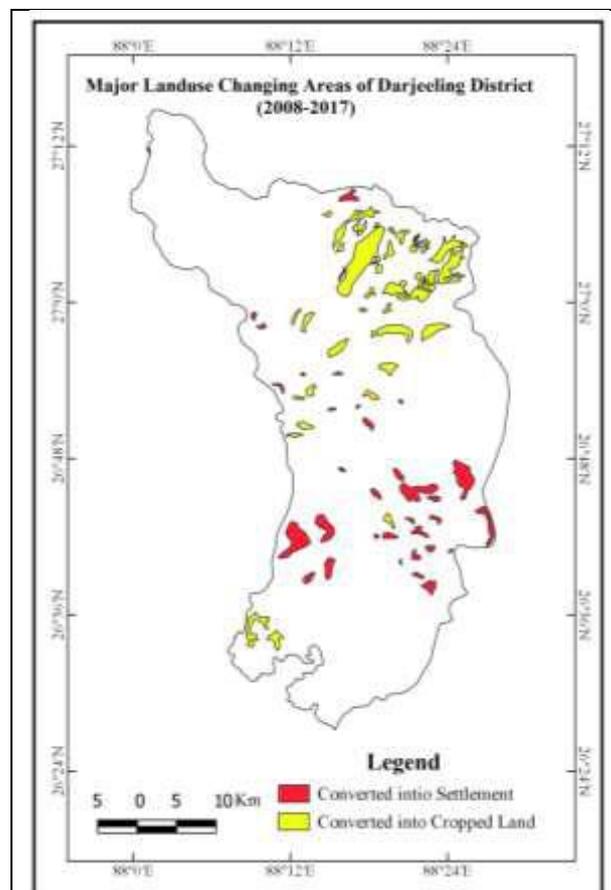


Figure 4: Major Converted Areas from 2008 to 2017

According to C. Nad (2015), the main causes of land slide may group into two e.g., increase driving force due to seismic events, ill drainage system, heavy rainfall, increase slope (physical factors); deforestation, unscientific mining, heavy vehicular movement, building construction in hill area etc (manmade factors) and decrease in share resistance due to pedological and hydrological factors (physical); heave land degradation, road ways, population, plastic pollution (manmade) etc.

## 5.2. Overall Impacts:

As agricultural land coverage increased, the area under tea cultivation was also increased from 2008 to 2017. According to the annual report of Tea Board of India, in the year of 2004-05, the planted area was 17.539 Hectares which increased to 17.82 Hectares in 2014-15 (It is mentioned earlier that the Kalimpong district was merged with Darjeeling district before 2017. So, the tea plantation areas under Darjeeling district, which is above mentioned, was also included a small area of Kalimpong). So, it may be expected that one of the most valuable cash crops for India, Tea Production will be increased but reality is not as such. Yield rate (thousand Kg./ Ha.) of tea leaf production decreased about 12.82% from 2004-05 to 2014-15 (Figure 5.).

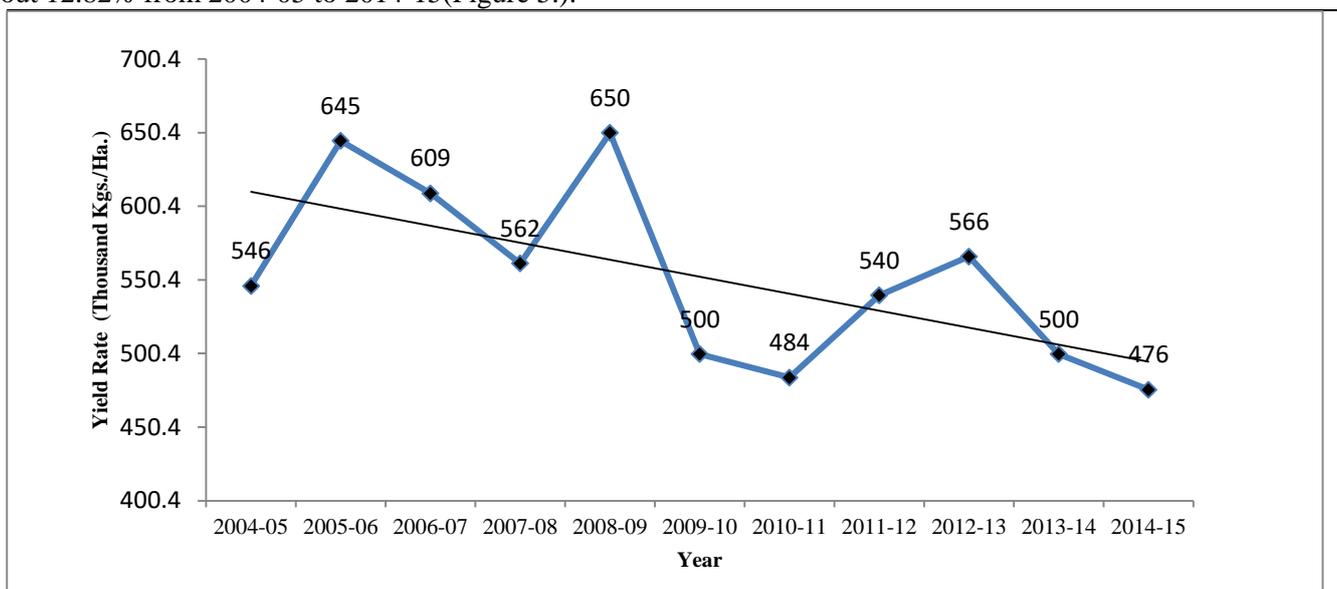


Figure 5: Year-wise Variation of Yield Rate of Tea

The decreasing trend of yield rate is due to mainly two factors, i.e., degradation of agro-climatic conditions and others factors regarding garden management.

Factors which are responsible for such yield rate as follow:

## 5.3. Lack of Proper Management of Tea Estates:

### a. Replacing Tea bushes scientifically:

It is an important factor that tea bushes are not replaced in proper way. Khawas (2006) reveals the information about the age of maximum tea bushes as “About 66 percent of the shrubs are over 50 years out of which more that 50 percent have been there for over 100 years. Further, there are bushes that are over 140 years old!” (p.15). One of the causes of such situation is fear for risk of loss in production because it needs about five years for providing tea leaves for business. In reality old bushes are not replaced for benefit and they try to accelerate the area coverage under tea cultivation. For this, Malathine, Aldrine, Sulphur, Lindane, blitox etc are used in this cultivation for better yield (Bhutia, 2014). But it leads to soil pollution and other health hazard. Though it leads to support for increasing tea production but it is not sustainable for environment.

**b. Shade of Trees in Tea Garden:** Beside this, it is known that tree for shade of tea bushes play an important role of which life cycle, density of canopy etc should be considered properly for maintain tea garden and its quality (Chowdhury, A., et al., 2015). In this view, tea plantation covers one side of ecological balance through with forest and makes this economic activity as an ecosystem in another side.

## 5.4. Adverse Impacts of Tourism Industry:

Though the income from tourism industry is one of the major sources of income but it may discourage the major and exclusive cash crop, tea plantation. Because the agro-climatic conditions may be affected in various ways like:

**a. Hotels and Resorts:** Adverse impacts of tourism industry influences the infrastructural development of hotel resorts on hill slope especially which are in the area of where landslide and other extreme events are occurred. Not only that but also the huge deforestation for hotels and resorts and other uses in tourism purposes led to soil erosion and landslide. Thus the degradation of soil influences the low productivity of tea production (Bhutia, 2015).

**b. Pollution:** In the time of March, April, May and October months, the arrival of maximum tourists in Darjeeling district is the one of the causes of congestions and air pollution due to several movements of motor vehicles and other pollution. Waste materials (both solid and liquid) pollute the local environment which produced by tourists. For this environmental degradation led to adverse impacts on tea production (Bhutia, 2015).

**c. Scarcity of fresh water and electricity:** Scarcity of fresh water and electricity cut off occur in those times when the arrival of tourists is so much especially in March to June. The consumption of electricity and water by local people and tourists hamper the electric supply for tea factories and other works (Bhutia, 2015).

### 5.3. Climate Change:

Climate change is one of the most important issues related to Darjeeling tea production. As the local climate is favourable, tea cultivation was started commercially from about 1860. But the climatic condition of that time is not as same as present condition. According to P. S. Patra, J. S. Bisen, R. Kumar et al. (2013), the minimum temperature of Darjeeling is about 7.91-14.93°C and maximum temperature varies between 18.10-20.50°C. Total annual rainfall in one year ranges between 226.64 to 558.03 cm and maximum of rainfall occurred during May to September (about 80%) and a little part of the precipitation is in form of snow or drizzle in mainly winter. As the yearly average maximum and minimum temperature increase from 19.99°C (1993) to 20.50°C (2012) and 13.33°C (1993) to 14.93°C, the amount of total rainfall is also sharply decline from 439.25 cm (1993) to 286.75 cm (2012). For this, the decreasing trend in yield rate of tea production is also the result of such climatic change and subsequent impacts on tea clones like, carbohydrate assimilation, respiration, evapo-transpiration, pest and disease infestation etc (Patra, et al., 2013).

R. Kumar, J. S. Bisen, M. Choubey, M. Singh and B. Bera (2015) found that there is a close relationship in between such atmospheric variables and net photosynthetic rate ( $P_n$ ) of clone (both positive and negative) and for this climate change can control the yield rate of Darjeeling tea. Not only in terms of quantity, quality also diminished sharply as per my father and few tea garden owners' view and experience.

### 5.4. Others:

There are also so many challenging issues related tea cultivation like labourers problem, high cost of production etc. S. K. Saha and V. A. Patel (2016) found that a huge number of labour employments are now a challenging issue. The number of labourers, who are directly engaged with this industry, is increased 0.95 million to 1.2 million from 1950 to 2015 and about 10 million people are engaged indirectly. Amongst these labourers are migrated from outside and generally they are very poor. So, tea estates face a lot of expenditure for providing their services which share about 60% of the cost of production (Saha & Patel, 2016).

In present situation, the age of inflation leads to motivate to the labourers for increasing their wage and in many cases tea estates fail to meet their demand and close their garden. Few planters delay uprooting and replanting old bushes, modernisation becomes slow and to reduce the cost of production planters choose longer picking cycle (15 to 18 days) which are reveal the poor condition of tea industry (Saha & Patel, 2016).

So, tea estates face a two-sword danger. Not only that but also the condition of tea labourers is so poor that not good for tea cultivation. As we know that tea cultivation is mainly dependent on labourers, so their condition should be considered for continuing grow-up worldwide reputation of Darjeeling tea.

So, from the above discussions, we can relate the all above mentioned factors related to each other which may create probable threats on Biodiversity loss, ecological imbalances etc.

## 6. SUGGESTIONS:

So, following suggestions are important regarding this issue:

At first the human behaviour should be considered. The all demands of individual and local communities are not same. As the population increasing day by day, the life style of the people also changed but this change is not equally. So, these adverse impacts influence deforestation, urbanisation, unemployment etc. The environmental pollution also occurs simultaneously. So, the population should be checked and their habitation also should be scientifically built up at perfect site. Especially, the agricultural labourers who are involved in tea cultivation and their employment should take care. Besides this immigration, income level, conflicts between labourers and management committee of tea estates with political touch should be handled through special care of agricultural labourers. If population grow up uncertainly then it may create pressure on tea cultivation and simultaneously other sources of income which are directly or indirectly hamper surrounding environment like tourism industry (with very minimum share in others professions). So, not only tea cultivated area but also the surrounding environment should be unpolluted because well environment is one of the

important factors which play a major role for quality (smell) of Darjeeling tea. It is for make growing up the export of such quality.

A part of profit from tea export should be utilized in local development through government incentives. The adverse impacts of tourism industry on environment should be filtered. The uncertain resorts and hotels building should be stop besides tea gardens and removed far away from tea estates (especially lower Darjeeling where tea cultivation does not occurred or minimum). The movement of motor vehicles should be controlled from November to March especially in those areas where agro-tourism makes flourish around tea estates. Especially in this season, the chance of environmental pollution is more than other seasons. So, the tourists' behaviour should be restricted because the fine quality tea production is occurred in this time. Tea estates should be proper managed in scientific way that the soil fertility or soil health may develop as agricultural hub. Not only that but also tea bushes should be replaced scientifically. In this case the farming system should be changed in which organic inputs may deserve more importance than chemical ones. This not only for environment but also it is highlighting mainly to local people who are directly or indirectly involved with tea cultivation. Besides this the forest department should be take special care for forest which should be maintained in such way that it will be effective positively for such functions like biodiversity in flora and fauna, ecological balance, wood collection with reforestation (with maintaining forest area eco-friendly) etc. In other words, tea cultivation should be developed in sustainable manner that it may be effective for both poor or the local tribal people and rich or the industrialists and businessmen who are involved with tea industry directly and indirectly.

## 7. CONCLUSION:

Human behaviour is an important factor which regulates the friendship between environment and human beings. But, the behaviour in particular time period, is also the result of evolution of interaction between environment and human beings which change through time. The recent scenario of Darjeeling is not expectable as it is ignored the basic environmental ethics in various ways. Here anthropogenic activities is the main part of opening all such type of dimensions of Darjeeling which is changed as one of the main reasonable cause to damage the man-environment relationship and it should be changed into the only one remedy to remove and mitigate all such problems with due respect to nature.

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