Chapter 2

Physical Geography, Economy and Land Use Changes in Sikkim

2.1 Physical Geography of Sikkim

The physiographical characteristics, particularly the topography, drainage system and climate shape the livelihood, economy and land use patterns of a region. The topographical features, particularly altitude and aspect in relation to sun and wind decide the habitability of a region. Along with topography, the drainage system too plays an important role in ascertaining the suitability of a place for human habitation. However, climate is the most important and decisive physical element that governs most of human activities. Livelihood and land use patterns of a place bear the distinctive stamp of the climate and the resultant natural setting of the region. The natural environment in the Himalayas still acts as a determinant of livelihood. Moreover, the options of livelihood are limited in land-locked mountain regions. The economy and land use in Sikkim are therefore primarily determined by the physical geographical attributes in the state.

The Physiography of Sikkim

The physiography of Sikkim is characterized by great variation in elevation. The land elevation in Sikkim ranges from 250m to 8500m. The state is separated from Tibetan highland by the convex arc of the Greater Himalaya. In the eastern side the Chola Range separates it from Tibet and in the west the Singalila Range, another offshoot of the Himalayan arc, separates it from Nepal. There are many peaks and passes on the three sides of Sikkim. In the Northern side the important peaks are Lhonak, Sentinel, Khora Khang etc., and important passes are Kongra La, Say Say La etc. In the Eastern sector the high altitude passes are Nathu La and Jelep La. In the Western sector there is the great Kanchenjunga (8595m.). The upper part of Tista basin includes the whole of Sikkim and virtually marks its boundary. All the major rivers of the state flow from north to south following the slope of the land. There are many glacial lakes, which

freeze during winter. The state also has some hot mineral springs, e.g. Ralong in West Sikkim and Phur Cha Chu in the South Sikkim.[1] The topography of the state does not allow human habitation beyond 4000m. The human settlement in Sikkim is generally concentrated below 3000m.

The River System of Sikkim

Tista is the only major river system in Sikkim. The drainage system of the state has a very dense network of streams contributing to the Tista. Its tributaries and sub-tributaries drain the entire state and dissect the land in such a manner that hardly any sizeable piece of level land can be found. So the entire state is divided into various parts. The Tista originates from Chho Lhamo glacial lake. The Rangit is the main tributary of Tista. The important tributaries on the right bank are the Zemu (Lachen) Chhu, Rangyong Chhu, Rangphap Chhu. On the left bank of Tista, the Lachung Chhu is the main tributary. The other tributaries on the left bank are Dik Chhu, Chhombo Chhu, Kalep Chhu, Gey Chhu, Rangpo Chhu, Rongni Chhu etc.[2]

The Climate of Sikkim

The climate of Sikkim changes within very short distances. As Sikkim is a mountainous state, the climatic contrasts can be felt very frequently. The altitudinal differences play the most important role in determining the weather and climate in Sikkim. The climate prevailing in the state can be classified into six types -

1. *Sub-tropical Humid*: This type of climate prevails in those areas, which are lying below 1500m amsl. In this area, the day temperature is much higher (almost 35 degree C) and the rainfall too is high. The humid period is very long from April to September. In summer months, the nights are cool because of night-shower. The winter season is cold and dry. At Namchi of South Sikkim the summer temperature is as high as 35 degree C but in winter it is as low as 6 degree C.

2. *Semi Temperate*: This type of climate can be found in the range of 1500m to 2000m amsl. The annual mean temperature in summer is 26 degree C and in winter it is 8 degree C. The mean annual rainfall is 2400mm. At Gangtok, the temperature hovers between 2 to 26 degree C and mean annual rainfall is 3500 mm.

3. *Temperate*: This climate is experienced between 2000m to 3000m amsl. Here the temperature ranges between 0 and 15 degree C. Rainfall and snowfall is medium and high. This area is cool in summer but very cold in the winter.

4. *Alpine Snow Forest*: The climate prevails in areas lying between 3000m to 4000m amsl. From November to March, the temperature is extremely low. The harsh climate renders the major part uninhabited. Rainfall occurs between May and September. At Thangu (3812m.) in North Sikkim the average annual the rainfall is only 800mm.

5. *Alpine Meadow or Tundra*: This type of climate prevails in the extreme northern, eastern and western section of Sikkim, where elevation is more than 4000m. amsl. Temperature almost all the time is close to freezing point. Atmospheric pressure is low. The summer is very short. The ground remains snow-covered for several months.

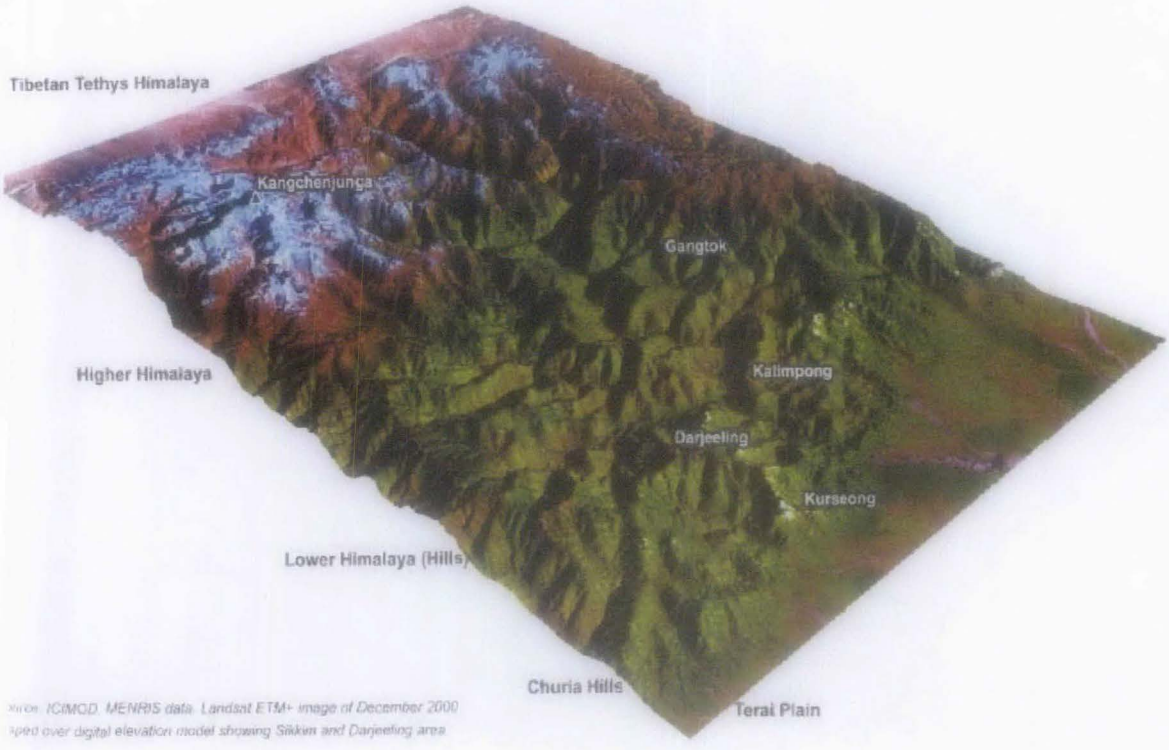
6. *Arctic*: This is experienced in the extreme northwestern part of Sikkim where elevation is more than 6000m amsl. The snow peaks like Kanchenjunga, Kabru, Talung, Pyramid etc. are located within this climatic area. No vegetation and animal life can be seen in this zone.[3]

The climate of Sikkim in general is cold and humid throughout the year as rainfall occurs almost every month. The state receives an average annual rainfall of 500cm, which is highest in the Eastern Himalayas. This high rainfall causes extensive soil erosion and frequent landslides in some places of Sikkim. Monsoon rain starts normally from June and continues up to early October, with pre-monsoon rains in April-May. The temperature varies with the slopes and altitudes. Maximum temperature is recorded normally in July and August and minimum temperature in December and January. During the monsoon period, the fog is a common feature of the hill weather in Sikkim. In high altitudes, the temperature goes down to freezing point several times in a year. Snowfall is quite common in high altitudes and not a rare phenomenon in the middle altitudes in the Sikkim Himalayas. As per the available data, mean rainfall is lowest in Thangu (820mm) and highest in Gangtok (3494mm). It is revealed from the iso-hyetal analysis of data that there are two maximum rainfall areas in Sikkim:1) South-East quadrant, including Mangan, Singhik, Dikchu, Gangtok, Rongli etc and 2) South-West quadrant including Hilley. Namchi is located in between these two points, which is

low rainfall area. The North-West snow-covered area receives the least rainfall (4.9mm) but experiences regular snowfall. The rainfall during the monsoon season is heavy and well distributed. The wettest month is July in almost all places in Sikkim. The distribution of post-monsoon rainfall decreases from North to South, and the distribution is just opposite, i.e., from South to North during the Monsoon period. The average number of rainy-days (days with rain of 2.5mm or more) ranges from 100 at Thangu to 184 at Gangtok and the highest annual rainfall for the individual station exceeds 5000mm.

The soil of Sikkim contains medium nutrient and moisture. Soil moisture has an overt impact on forest type and coverage in area. The state primarily consists of gneissose rocks and half-schistose rocks. The first type of rock is brown clay and generally shallow and poor. These groups of rocks are typically crude with high ferric concentration and neutral to acidic and poor organic/mineral nutrients. Most of the evergreen and deciduous forests are carried by this rock.

Figure 2.1: Satellite Image of Sikkim Himalaya



Source: ICIMOD, Digital Elevation Model showing Sikkim and Darjeeling, 2000, www.icimod.org

2.2 Demographic Aspects of Sikkim:

The demographic parameters taken into consideration for the present discussion are the total population, population density, FMR (Female Male Ratio), IMR (Infant Mortality Rate), Birth Rate, Death Rate etc., which reflect the health of the human resources of an area. FMR means number of women per thousand men. IMR means the number of deceased infants per thousand children. Birth rate means the number of people born per thousand people. Death Rate means the number of deceased persons per thousand people.

The state of Sikkim experienced enormous demographic changes in the last hundred years or so. Though the density of population always remained low in the state due to its mountainous territory and poor accessibility, some major changes occurred in the

demographic map of the state after its merger with Indian union in 1975. The following table shows the changes in Sikkim's population, sex ratio and density over time since 1891.

Table 2.1: Temporal Changes in Population, Sikkim, 1891-2001

Year	Total Population	FMR	Population Density/ Sq. km.
1891	22152	912	-
1901	59014	709	8
1911	87920	951	12
1921	81721	970	12
1931	109808	967	15
1941	121520	935	17
1951	137725	907	19
1961	162189	904	23
1971	209843	863	30
1981	316385	835	45
1991	406457	878	57
2001	540493	875	76

Source: Census of India, 1981, 1991, 2001

As seen from the Census records, in the first Census i.e., in 1891, the population of Sikkim was only 22152 and then the FMR was 912. After 10 years, i.e. in the 2nd Census, the number of population increased almost 2.8 times but the FMR decreased to 709. The population density was lowest ever with 8 persons living in a sq. km of area in 1901. In 1921, the population decreased by almost 6000 than in 1911 but with the same population density (12 persons/sq. km.) and highest ever FMR at 970. Since then to 1971, i.e. at the time of the last pre-merger census, the population as well as density increased but there was a fall in FMR. The post merger census of 1981 showed lower

FMR at 835. But during this period, the population increased largely with the addition of more than one lakh people. The population density was 1.5 times more than the previous census. In 1991, the decennial rise in population was slower than the previous increase but the rise in FMR was quite remarkable. The last census in 2001 has shown that the population in the state has increased sharply with the addition of 1.3 lakh more people than the 1991 population total and taking the total population of the state to 540,493. The population density too rose to 76 persons per sq. km. But the increase in population was not reflected in the FMR as it lowered to 875 compared to the 1991 FMR 878.

Table 2.2: Decennial Population Growth Rate of Sikkim vis a vis India

Census Year	*India*	*Sikkim*
1901	NA	NA
1911	5.75	48.98
1921	(-)0.31	(-)7.05
1931	11	34.37
1941	14.22	10.67
1951	13.31	13.34
1961	21.51	17.76
1971	24.8	29.38
1981	24.66	50.77
1991	23.85	28.47
2001	21.51	33.06

Source: Census of India, 1951, 1961, 1971,1981,1991,2001

The decennial growth rates of the population of Sikkim as well as India are given in the above table. In 1921, the decennial growth rate was negative for Sikkim as well as for India. It happened presumably due to the epidemic of influenza that gripped the country in the previous decade. But in 1911, the growth rate was second highest in case of Sikkim. The highest growth rate was in 1981 due to the merger of Sikkim with India in 1975. The highest growth rate in India was in 1971 which happened due to the creation of Bangladesh. In this period, there was a huge influx of refugees to India from Bangladesh. The decennial growth rate became slower after 1981. In 1991, it was 28.47% and in the last census i.e., 2001, it was 33.06%.

Table 2.3: Comparative Table of Birth Rate, Death Rate & IMR

	Birth Rate		Death Rate		IMR	
Year	***India***	***Sikkim***	***India***	***Sikkim***	***India***	***Sikkim***
1997	27.2	19.8	8.9	6.5	71	51
1998	26.5	20.9	9	6.1	72	52
1999	26.1	8.7	8.7	5.8	70	49
2000	25.8	21.8	8.5	5.7	68	49
2001	25.4	21.6	8.9	5.1	66	42
2002	25	21.9	8.1	4.9	64	39
2003	24.8	21.9	8	5	60	33

Source: Sample Registration System, GOI

In the above table, the comparative figure of birth rate shows that the national average is always much higher than the Sikkim average. But it is to be noted that the national average decreased every year, whereas the figure for Sikkim increased and stabled at around 21 since 2000. The death rate is also much lower in case of Sikkim than the national average. In the above table it is found that the national highest was 9 in 1998, whereas in Sikkim, the highest was at 6.5. In case of Infant Mortality Rate (IMR), the figure is much lower than the national average. During the period from 1997 to 2003, the highest IMR in India was 71 in 1997, and in case of Sikkim the highest was 51 in 1997. In 2003, the IMR was 60 in case of India, but in case of Sikkim, it was 33. Thus it can be concluded from the comparative table that the health condition in the state is better than the national standard.

2.3 Economic Aspects of Sikkim

Sikkim is not known to have a robust economy. In the early nineties the per capita gross domestic product in the state was marginally below the all India average. But, since 1999-2000, the state performed better than the all India average. It indicates that

the state economy is growing rapidly since early nineties. It might have happened due to high income from the cash-crops and horticultural crops. The fact is also true for per capita net state domestic product. The following table shows the per capita gross state domestic product in rupees.

Table 2.4: Per Capita Gross State Domestic Product (GSDP) at Constant Prices

(in Rupees)

Year	India	Sikkim
1993-1994	8759	8457
1994-1995	9209	8045
1995-1996	9693	8592
1996-1997	10253	9200
1997-1998	10541	10099
1998-1999	11018	10866
1999-2000	11471	11592
2000-2001	11757	12070
2001-2002	12215	12615

Source: CSO, GOI & ESSME, GOS

Table 2.5: Net State Domestic Product and Per Capita Income at Constant Prices(1980-81) in Sikkim

Year	Domestic product (in thousand Rs.)	Annual Growth Rate	Per capita income (Rs.)	Annual Growth Rate (%)
1980-81	489800		1571.00	
1981-82	521900	6.55	1611.00	2.55
1982-83	588200	12.7	1750.00	8.63
1983-84	614200	4.42	1758.00	0.46
1984-85	694600	13.09	1919.00	9.16
1985-86	755900	8.82	2017.00	5.11
1986-87	891700	17.96	2297.00	13.88
1987-88	1075500	20.61	2678.00	16.59
1988-89	1149000	6.83	2924.00	9.19
1989-90	1228900	5.51	3118.00	6.63
1990-91	1353200	10.11	3369.00	8.05
1991-92	1442900	6.63	3492.00	3.65

Source: Sikkim Human Development Report, 2001

It can be seen from the above table that the annual growth rate of net state domestic product was positive, sometimes with double digits. The highest growth was during 1987-88. The per capita income was also higher since that time and it became highest (Rs.3492/-) in 1991-92. There was a continuous growth from 1986-87 to 1987-88, as a corollary to the growth in per capita income. It appears that there was an increase in

agricultural production including cash crops like large cardamom during that time, which boosted up the hill economy.

To discuss the economic aspects in detail, it is necessary to know the current position of the state in terms of poverty. Generally, the people of mountain area are at comparative disadvantage as far as the sources of income are concerned. There are a variety of reasons that might be responsible for poverty, e.g, limited livelihood opportunity due to marginality, fragility and niche. The low productivity of crops due to absence of irrigation, less fertile soils, less opportunity to use fertilizer etc. make the life of an average farmer in a hilly terrain difficult. Further, the inaccessibility or lack of communication aggravates the problem. So, there is a direct relation between poverty and mountain around the globe. Sikkim is no exception and here too, the common people face a myriad problem due to inhospitable terrain and climate. More than 60% of the total geographical area of the state is not suitable for human habitation. A major part of the state is either inaccessible or has very poor connectivity. Although there is a decline in the percentage of people living below poverty line (BPL), the reality is, the total number of BPL people in the state is alarming. The table below shows the percentage of BPL people in the state in the year 1999-2000 at 36.55, which makes it clear that more than a third of the state's population lives miserably.

Table 2.6: People Below Poverty Line (in %):

Years	*All India*	*Sikkim*	*Ranking*
1973-74	54.88	50.86	16th
1977-78	51.32	55.89	9th
1983	44.48	39.71	15th
1987-88	38.86	36.06	14th
1993-94	35.97	41.43	5th
1999-2000	26.1	36.55	4th

Source: ***Sample Registration system, GOI***

The above table shows the percentage of people living below poverty line. In 1973-74, the position of Sikkim was slightly better than the all India figure. Then Sikkim was an independent state. After the merger of Sikkim with India in 1975, the condition of Sikkim worsened. But, later in1980s, the number of BPL people decreased in Sikkim.1990 onwards, the all India figure fell rapidly, but in Sikkim, it increased in 1993-94 and decreased subsequently. But the fall is not satisfactory at all in respect of all India figure.

The economic activities in Sikkim are mainly centered on agriculture and allied activities. Agriculture has the highest contribution to the economic well-being of the state. But, the industry and service sectors also have some contribution. The table below shows the structural change in the Sikkimese economy.

Table 2.7: Structural Shift in the Sikkimese Economy

Sectors	1980-81	1985-86	1990-91	1995-96
Primary	51.59	50.96	46.49	52.03
Secondary	18.10	16.45	12.97	13.65
Tertiary	30.30	32.58	40.53	34.31

Source: Govt. of Sikkim (1998), Sikkim Five Year Plan 1997-2002, Volume-1 and Sikkim in Brief 1998, Bureau of Economics and Statistics, Planning and Development Department, Gangtok

In the above table it is clear that the contribution of primary sector has increased marginally since the merger of Sikkim with India. But, during mid-eighties to early nineties, the contribution decreased marginally. The contribution of secondary sector is decreasing every year. In case of tertiary sector, the contribution increased substantially in 1990-91, and in this period, the role of primary and secondary sector slowed down. Since mid-eighties, the economy of Sikkim followed the same path of dominant primary sector. The service sector is growing every year since the merger of Sikkim with India.

The following table is important to understand the current position of the state in terms of food security.

Table 2.8: Per Capita Availability of Food Grains in Sikkim from 2002-03 to 2003-04

Particulars	*Unit*	*2002-03*	*2003-2004*
Total food production in state	000 Tonnes	97.07	99.34
Food grain for other purpose			
a) Post harvest milling and shortage@15%	000 Tonnes	14.4	14.9
b) Use as beverage@25%	000 Tonnes	24.08	24.84
c) Use as animal feed @23.5%	000 Tonnes	23.64	23.34
d) Use as material for seed, ritual, sale, industries etc@2.5%	000 Tonnes	2.41	2.48
e) Total food grain available for other purpose	000 Tonnes	63.53(66%)	65.56(66%)
Food grain available	000 Tonnes	32.80(34%)	33.78(34%)
State population	Lakhs	5.58	5.77
Floating and migrant population	Lakhs	1.18	1.23
Per capita availability of food grains per day	Grams	153	158
Food grain requirement @ 500gms per day			
a) For state population	000 Tonnes	101.84	105.3
b) For floating and migrant population(92days)	000 Tonnes	5.43	5.66
c) For overall population	000 Tonnes	107.26	110.96
Deficit food grain	000 Tonnes	74.76	77.18

Source: Area and Food Production Statistics of Sikkim 2003-04, GoS, Gangtok

In India, 417gm of food grain per head per day was required during 2001-02 according to the data available in agricultural dept. But, per capita food grain available per day in Sikkim was 153gm in 2002-03 and 158gm in 2003-04. This marginal increase happened due to increase in production from 97.07 thousand tonnes to 99.34 thousand tonnes. As population increases every year and huge number of tourists visit Sikkim, the food requirement for consumption increases every year. The deficit in food grain has increased from 2002-03 to 2003-04. The shortfall in food

grain is substantial and necessitates food grain import from other states to meet up the local demands.

Table 2.9: Comparative Figure of Industries in Sikkim from 2000-2004

Particulars	No. (2000)	No. (2004)
Provisionally Registered	386	320
Small Scale Units	367	367
Permanently Regd. SSU	Na	363
Cottage Industries	36	36
Medium Scale Industries	3	3
PSUs	3	3
Joint Sector Undertaking	Na	Na
Non-functioning Units	87	87

Source: ***Sikkim: A Statistical Profile 2002, 2004-05, DESME, GoS,***

The growth of industrial sector in Sikkim is not good. It is found from the above table that there was a decrease in the provisionally registered industries from 386 to 320. The number of SSU, Cottage Industries, PSUs and Small Scale Units remained unchanged. Thus, it is clear from the above table, that, the industrial growth was stagnant since 2000.

2.4 Land use pattern - Determining livelihood options

Land is the habitat of man and its wide use is crucial for the economic, social, and environmental advancement of mankind. Although it is part of man's natural heritage, access to land is controlled by ownership patterns. Land is partitioned for administrative and economic purposes, and it is used and transformed in a myriad ways. Population growth, technological and social hazards, and environmental degradation are all to be taken into greater account today by policy makers, resource

planners, and administrators who make decisions about the land. They need more detailed land information than has been traditionally available.[4]

Land use of an area is a reflection of the importance of its physiographic conditions, socio-cultural characteristics and politico-historical background because land use characteristics are the results of and land use practices are directly influenced by these attributes of land. The available land resources and their utilisation that show an interactive nature of man with the nature is, therefore, related to the physical and socio-economic conditions of land. [Vink 1972, Singh 1995] Thus, a systematic and regional description of land use patterns has a great significance and the changing nature of land use practices is able to explain the causes of increasing intensity of resource use and changing relationship of man's activities with nature. According to various classical as well as neo-classical theories of land use, the land use practices are influenced by the socio-economic factors like locational factors of land use (economic rent, market access, availability of modern agricultural inputs and transport costs) and social customs and traditions of landholders, tenancy status and the consumption patterns of the farming communities, at micro-aerial scale, but at macro-level the land operations and land use intensifications accelerated by physical factors of land, namely, the relief features, geological structure, soil characteristics and climatic conditions. [McCarty & Lindbarg 1967]

As Sikkim is an agricultural region, the economic wellbeing of its population has a close relation with the current state of agriculture in the state. With considerable variation in physiographic and agro-climatic conditions in the four districts, crop yield and cropping intensity vary considerably from district to district. In Sikkim, the state of regional agriculture depends primarily on the availability of arable lands and the productivity.

Table 2.10: Per Capita Land Availability in Sikkim

Particulars	**1971**	**1981**	**1991**
Net Cultivable Land	0.31	0.31	0.24
Operational Area for Agricultural Use	0.8	0.34	0.27
Land for Non-Agricultural Use	0.33	0.27	0.21
Pastures and Cultural waste	0.4	0.23	0.18
Forest	1.26	0.83	0.65

Source: Bureau of Economics and Statistics, GoS, Sharma and Sharma, 1997

The above table shows the per capita land availability in Sikkim since 1971. It is a matter of great concern that the per capita forest land has decreased substantially form 1.26 ha in 1971 to 0.65 ha in 1991. The operational area for agricultural use too has decreased almost one-fourth from 1971 to 1991. The net cultivable land has decreased marginally compared to others. The same is true for land in non-agricultural use and pastures and cultural waste. It happened because the increase in population necessitated transformation of land from agricultural use to other uses.

Table 2.11: Changes in Land Utilisation Pattern, 1976-77 to 1990-91(Ha)

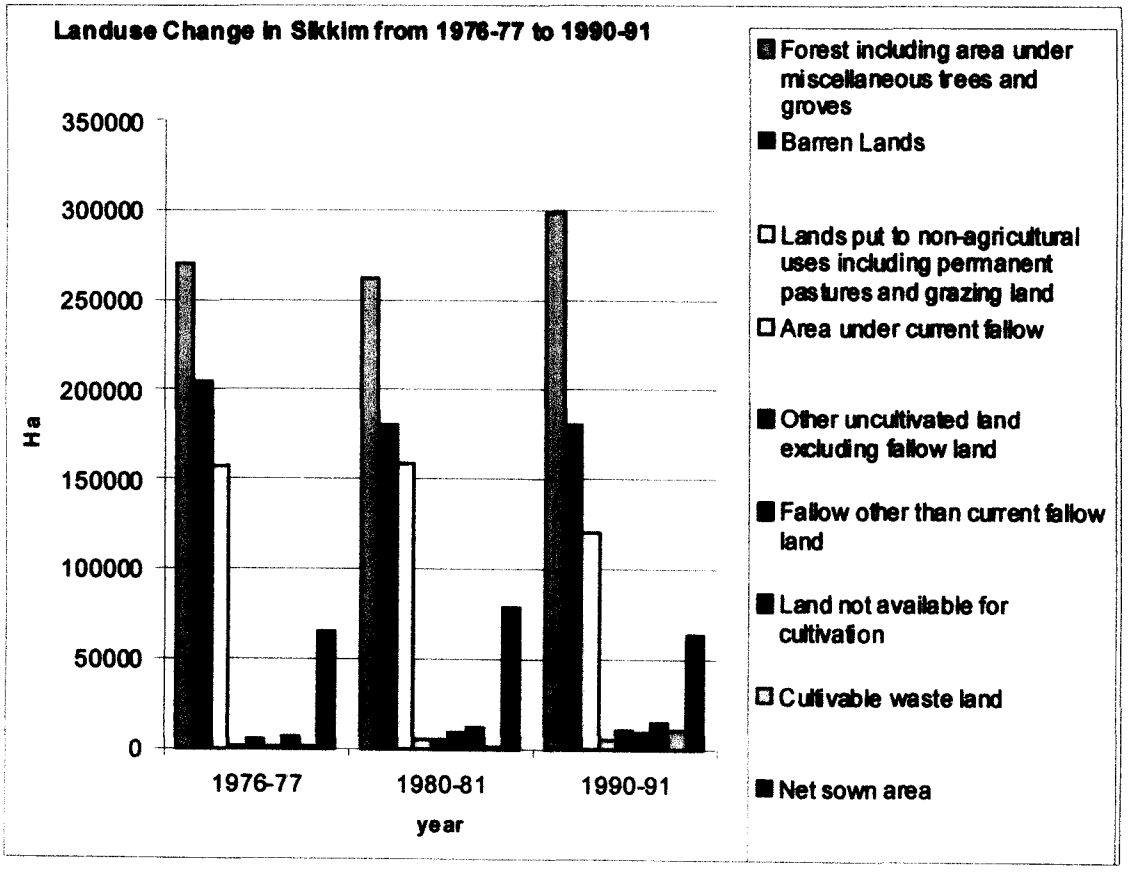
Particular	*1976-77*	*1980-81*	*1990-91*
Total Geographical Area	709600(100.00)	709600(100.00)	709600(100.00)
Forest including area under miscellaneous trees and groves	269380(37.96)	261983(36.92)	298000(42.00)
Barren Lands	204010(28.75)	180250(25.40)	180000(25.37)
Lands put to non-agricultural uses including permanent pastures and grazing land	157148(22.15)	158299(22.31)	120299(16.95)
Area under current fallow	501(0.07)	4428(0.62)	3906(0.55)
Other uncultivated land excluding fallow land	4925(0.69)	4560(0.64)	10830(1.53)
Fallow other than current fallow land	944(0.13)	9474(1.34)	9204(1.30)
Land not available for cultivation	6613(0.93)	11604(1.64)	14300(2.01)
Cultivable waste land	1153(0.16)	681(0.09)	9807(1.38)
Net sown area	64926(9.15)	78321(11.04)	63254(8.91)

Source: Sikkim State Annual Plan, 1996-97, Vol.I, Planning and Development Department, GoS, Gangtok

There are nine different categories of land use in the state of Sikkim, these are – a) Forest, b) Barren Land, c) Pasture and Grazing Land, d) Current Fallow land, e) Uncultivated Land excluding Fallow, f) Fallow other than Current Fallow, g) Land not available for Cultivation, h) Cultivable Waste Land and i) Net Sown Area.[5] It is found from the above table that the net area sown has increased in 1980-81 by almost 2% but decreased subsequently by almost 2.5%. The cultivable wasteland has decreased greatly in 1980-81 but increased after that. The fallow land other than current fallow has increased enormously from 944 ha to 9204ha and also the area under current fallow has increased enormously. Thus, the total land that could be

brought under use increased during this period but it was not utilized for production. The problem of proper land use management system was persisting in Sikkim during that period. The land under forest cover was almost 38% in 1976-77. It tended to decrease just after merger with India. Subsequently, the area again increased to 42% in 2001 as a consequence of the measures taken by the govt.

Figure 2.2: Landuse Changes in Sikkim from 1976-77 to 1990-91



Source: Sikkim State Annual Plan, 1996-97, Vol.I, Planning and Development Department, GoS, Gangtok

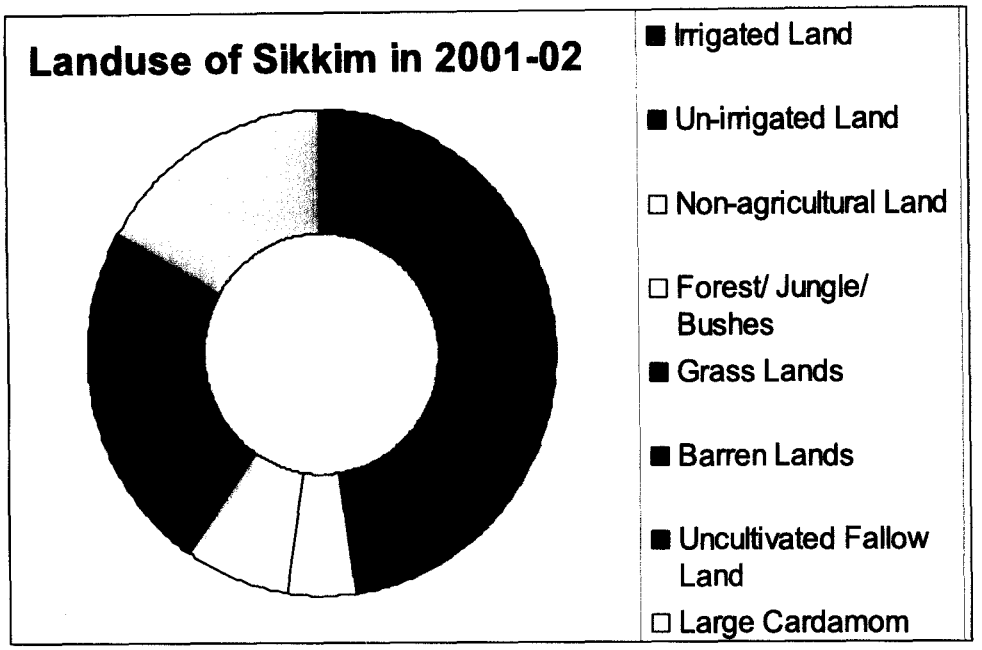
Table 2.12: Land-use Data of Sikkim in 2001-2002

Land-use Types	*Lands in 000Ha*	**Percentile**
Irrigated Land	11.31	*9*
Un-irrigated Land	49.31	*38*
Non-agricultural Land	6.22	*5*
Forest/ Jungle/ Bushes	8.98	*7*
Grass Lands	17.34	*14*
Barren Lands	4.12	*3*
Uncultivated Fallow Land	8.54	*7*
Large Cardamom Plantations	21.22	*17*
Total	**127.04**	**100.0**

Source: Sikkim: A Statistical Profile 2004-05, DESME, Govt. of Sikkim

The land use pattern of Sikkim during 2001-02 shows that more than $1/3^{rd}$ of the total land (49331.04 ha.) remained un-irrigated. Almost $1/5^{th}$ of the total land was under large cardamom cultivation, the main agroforestry product, followed by the forest/jungle/bushes (14403.5 ha). The combined figure of Barren Lands and Uncultivated Fallow Land was quite high. The land suitable for irrigation was almost $1/11^{th}$ (9%) of the total land. So, the pressure on agricultural land was increasing day by day as population increased. The unirrigated land (38%) and forest land (7%) both were under forest cover in previous years' land use category.

Figure 2.3: Landuse of Sikkim 2001-02



Source: Sikkim: A Statistical Profile 2004-05, DESME, Govt. of Sikkim

Table 2.13: District-wise Land-use pattern of Sikkim, 2001-02

Particulars	State Total (ha)	North(%)	South(%)	East(%)	West(%)
Irrigated land	11309.6	12.3	19.2	48.2	20.4
Un-irrigated land	49308.6	7.6	33.2	23.5	35.8
Non-agricultural Use	6224.3	30.5	25.9	30.0	13.6
Forest/Jungle/Bushes	14403.5	6.6	10.1	68.5	14.8
Grass Land	4118.3	1.7	31.2	35.4	31.7
Barren Land	8981.0	11.5	26.6	28.3	33.6
Uncultivated fallow land	8543.2	12.1	7.5	11.7	68.7
Cardamom field	24161.3	37.1	18.2	27.1	17.5

Source: Adapted from Sikkim: A Statistical Profile 2004-05, DESME, GoS, Gangtok

The percentage share of irrigated land (48.2%) is highest in the East district, followed by West district (20.4) but with huge difference. North district has smallest share of cultivable land but with highest share of cardamom field (37.1%). The East district has highest share of forest area with 68.5% followed by the West District. The West district has highest barren and uncultivated fallow land which amounted to 33.6% and 68.7% respectively. This district also has highest percentage of un-irrigated land (35.8%). As the major part of the North district remains under snow cover for months, the land under non-agricultural use is highest in this district (30.5%).

It has been reported in the state of forests in the Survey of Environment 2001, published by The Hindu "It is only the 'Culturable Wastelands', covering 13.94 million hectares and part of the 'Fallow land other than current fallow', covering 9.89 million hectares, which seem to be potential areas on which forest cover can be expanded through afforestation. In addition, efforts will have to be made to raise trees outside conventional forest areas through innovative Agroforestry programmes."[6]

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