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## **Impact of Population Growth on Forest Cover: A Case Study of Tawang District of Arunachal Pradesh**

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### **Abstract**

*The role of population growth on the forest degradation has been much debated worldwide. There is a reciprocal relationship between population growth and forest cover in large. In other words, population growth turns out to be the main cause of deforestation. Deforestation threatens the well-being and livelihoods of millions of people who largely depends on forest resources. Today deforestation is occurring at alarmingly rates, especially in the regions that are experiencing rapid population growth. Tawang district of Arunachal Pradesh has a population density of 22 persons per square kilometres which is higher than the state. The district is inhabited by the Monpa tribes who are living in close association to their forest resources and derive their daily requirements like fire woods, timber, medicinal plants, food and fodder for their animal. The fire wood extraction appears to be causing maximum impact on forest degradation as firewood forms the basic source of heating the houses in an area which is characterized by longer winter months. Every year each household burns at least two fully matured trees to keep their houses warm. But there is no denying the fact that the other form of extractions are also contributing in the deforestation. Earlier, man-nature interaction*

*was quite sustainable when population was very low. But today due to rapid population growth the interaction with forest is becoming more and more intense leading to loss of many important resources. Consequently, many important plant species like rhododendron, oak, juniper pines, etc. are largely threatened. The paper attempts to examine the population growth trend in the Tawang district and its impact on the forest cover of the district. Both the primary and secondary data sources have been used to analyse the relationship between population growth and forest cover change in the district.*

**Keywords : *Population Growth, Forest Cover, Deforestation, Degradation.***

## **Introduction**

The contribution of population growth in altering the face of the earth has a long history. The relation between population dynamics and landscape change was first developed by Thomas Malthus. Malthus (1873) predicted that population growth would lead to famine and an eventual population crash since, he noted, food production tends to increase only arithmetically whereas human populations tend to grow geometrically. The concept of population change or growth is often used to connote the change in the number of inhabitants of the territory during a specific period of time, irrespective of fact whether change is negative or positive. The role of population change in deforestation and forest degradation has been much debated. There is a reciprocal relationship between the population growth and forest cover in large. It may make more sense to say that deforestation is a principal ingredient of population growth. Far from being costly deforestation often pays for itself in fuel, construction material, and timber sales besides providing new land for agriculture (Hartwick, 2005). While population growth and density are unquestionably related to the forest cover trends, there is no simple way to describe or predict that association. The pressure of Population growth on the carrying capacity of the environment is also viewed as a major cause of air, water, and solid-waste pollution. The equality of environment is constantly losing its status due to increase in population growth in most countries of world (John, 1984).

Deforestation is one of the major environmental issues from the global perspective. Deforestation may have destructive or constructive consequences depending upon ecological conditions, extent of economic development, and many other factors (Allen, 1983). The degree of international attention to deforestation is commensurate with the role of forest in the global, national and local ecosystems. Awareness of the deforestation problem in developing countries emerged in the early 1970s when several studies illustrated the severity of environmental damage and wood shortages attributable to deforestation. These first studies on the subject included graphic descriptions of erosion in mountainous regions and first-hand accounts of desertification in the semi-arid tropics (Daniel and Kulasingan, 1974; Eckholm, 1975, 1976). Today deforestation is occurring at alarmingly rates, especially in the regions that are experiencing rapid population growth. Population pressures are frequently cited as a cause of deforestation.

### **Study Area**

Tawang district of Arunachal Pradesh lies approximately between 91° 30' to 92° 45' East longitudes and 27° 22' to 27° 50' North latitudes. The districts share international boundary with Tibet in the North and Bhutan in the West and South. The topography of the region is mostly characterized by mountainous and its greater part falls within the higher mountain zone, consisting of snow-clad peaks and valets. *Tawang Chu* and *Nyamjang Chu* are the main rivers flowing through the district which flows towards the Bhutan and joins one of the major tributaries of Brahmaputra River Manas in Assam.

Tawang district is a part of Eastern Himalayas Biodiversity Hotspot. The region is very rich in both floral and faunal diversity. On the basis of structural and compositional characteristics, the vegetation of the district is broadly classified into temperate forest and sub-alpine and alpine forest. The temperate forests are further classified into broad leaved forest (2750 – 3000m) and Temperate coniferous and broad-leaved forest (3000 – 3500 m) while the sub-alpine and alpine forests includes Rhododendron scrub lands (4000 – 4300 m), Dwarf Rhododendron meadows (4200 – 4600 m) and High-altitude grassy meadows (4350 – 5250 m).

A wide variety of animal species, high mountain birds, mammals, reptiles, snow leopard, Musk deer, barking deer, bear and other animals live freely without fear as the Monpa people do not practice hunting and trapping. On an average the areas receive 1653 mm annual rainfall and mean maximum and minimum monthly temperature of 21.66° C and -0.65° C. The average annual relative humidity ranges from 66.21% to 79.35%. Tawang district is inhabited Monpa tribes with a total population of 49,977. The density of population is 23 persons per Sq. km which is higher than the state (census 2011). The district is spread over a total area of 2172 square kilometres.

### **Methodology**

The study is based on both the primary and secondary data sources. The primary data are collected through personal interviews and field observations. About 10 villages from Thingbu, Jang, Mukto, Lhou, Kitpi and Dudungkhar circles were selected randomly for the present study. The Gaon Burahs (GB), Village elder, Brokpas, both the men and women were taken interviews from the selected villages. The Focus Group Discussion (FGD) was adopted to discuss the present condition of forest cover and deforestation rate in the district. Government publication i.e. district statistical hand book of Tawang district (1991-2001 and 2001-2011), Statistical Abstract of Arunachal Pradesh (1991-2001 and 2001-2011) and other published data sources were used.

Land use land cover maps were prepared from the Satellite Imagery of Indian Remote sensing (IRS) Linear Image Scanning Sensor (LISS) III of two different years i.e. 2002 and 2011 to show the change detection by using Integrated Land and Water Information System (ILWIS).

### **Impact of Population Growth on Forest Cover**

The total population of Tawang district was 38,929 as per 2001 census which increased and became 49,977 during the 2011 census. The district experienced a decadal growth of population with 28.37% during the last one decade i.e. from 2001 to 2011 which is higher than the states decadal growth of population 5.92 %. As per the 2011 census the density of population in the district has also increased by 23 persons per

square kilometres from 18 persons per square kilometres in 2001 census. This trend of population growth increases demand for wood, both timber and fuel. People derive their daily requirements like firewood, timber, medicinal plants, food for their animals since many years. But, the increase in population demands more resources from the forest leading to increase pressure on available resources. The depletion of forests has several adverse effects to the region with varying intensity from place to place. When forests are destroyed on hillsides, rates of soil erosion typically increase, sometimes dramatically: Faster rates of evaporation in deforested areas can lead to desiccation of soils and potential climatic change: Forests, especially tropical forests, are the home to millions of species whose disappearance depletes the genetic stock available to humans and raises profound ethical concerns (Preston, 1996).

Forest provides a variety of high valuable ecological, economic and social services, including; the conservation of biological diversity; carbon storage; soil and water conservation: provision of employment and enhancement of agricultural production system: improvement of urban and peri-urban living conditions (FAO, 1999). More than half of the global fresh water have their source at mountains, supplying all the major rivers as well as many smaller ones and providing critical storage in lakes, glaciers and other places. But the critical role of mountain catchment areas is threatened by the major land cover and land use changes that take place in mountains and highlands throughout the world. Deforestation and forest degradation are rapid in the mountain areas of developing countries, which often are characterized by rapid population growth and resulting land scarcity and poverty. Rapid population growth, expansion of cropland, and intensive harvesting of forests for fuelwood and wood exports contribute to deforestation in different areas of the world although the time lags between causes and effects vary dramatically (Allen and Barnes, 1985). Impact of Population growth on forest cover in Tawang district has discussed under the following livelihood activities of people in Tawang Area.

### **Fuelwood**

Since maximum population belongs to the rural area about 36291 which is 73

percent (2011) who turns to agriculture, grazing, lumbering as a livelihood. Therefore, one would expect deforestation to increase with rural population density. Population growth also increases the demand for wood, both for timber and fuelwood. The Monpas of Tawang district who are living in close association to their forest resources and derive their daily requirements fire woods, timber, medicinal plants, food and fodder for their animal. Fuelwood gathered from the forested commons is the most important source of domestic energy in the rural areas of many developing countries (Cecelski, Dunkerley, and Ramsey, 1979). The fire wood extraction in the district appears to be causing maximum impact on forest degradation as firewood forms the basic source of heating the houses in an area which is characterized by longer winter months. About half the world's population cook with biomass fuels, which provide around 35% of energy supplies in the developing countries (World Bank, 1992). But there is no denying the fact that the other form of extractions is also contributing in the deforestation. Earlier, man-nature interaction was quite sustainable when population was very low. But today due to rapid population growth the interaction with forest is becoming more and more intense leading to loss of many important resources. Consequently, many important plant species like rhododendron, oak, juniper pines, etc. are largely threatened.





*Fig. 1: (a) Destruction of Forest for Firewood (b) Firewood (c) & (d) Firewood for Sale.*

### **Logging**

Destructive felling and Log extractions are one of other means of earning livelihood of the people of rural areas of Tawang district which is another factor responsible for depletion of forest at large. The most of the people who are engage in logging are uneducated and they are destroying the forest resources in a very unsustainable way. The intensive cultivation is not possible due to less arable land and the people are compelled for logging and timbering to support their family. Earlier, this logging practice was minimum when the population was low but with the increasing number of populations the intensity of man-environment interaction is also getting higher.





(a)



(b)



(c)



(d)

*Fig. 2: (a): log, (b) & (c): Planks, (d) Truck Carrying Planks to the Market*

## **Grazing**

Animal herding and grazing is one of the important occupations to earn livelihood among the Monpas of Tawang. Animals are considered to be as the symbol of wealth in the Monpa society. The Brokpas and Yengtepas are the people who are engage in animal rearing. These people migrate from one place to other with their herds in search of pastureland and fodder for their herds. While doing that they set fires on the forest and convert them into grazing land which is one of the most destructive human activity to the environment. With the growing human population their numbers are also

growing which ultimately leads to the more forest destruction. Desertification has been widely identified as a major human-induced global change associated with excessive pressure on grasslands (Meyer and Turner, 1992).



**Fig. 3: (a) Forest Converted into Grazing Land, (b)Grazing land. Once it was covered by forest.**

### **Agriculture**

Farming is by far the most important human activity that has transformed the land, and continues to be the principal route by which humans affect the environment. Eleven percent of the earth's land surface is now cultivated, although less than one percent is in permanent crop (Waggoner, 1994). Introduction of new agricultural practices i.e. apple, kiwi and orange cultivation in some part of Tawang district where climatic condition is suitable for these crops are coming up. Though economic necessity is the driving force behind this change but the role population growth in creating the demand for this kind of products cannot be undermined. Therefore, this simple fact shows the effect of growing population on the natural resources of a region thereby affecting the natural environment of a region.

### **Developmental Activities**

In the recent times numbers of unplanned developmental activities are coming up in the district like mini hydroelectricity projects and dams. In the district there

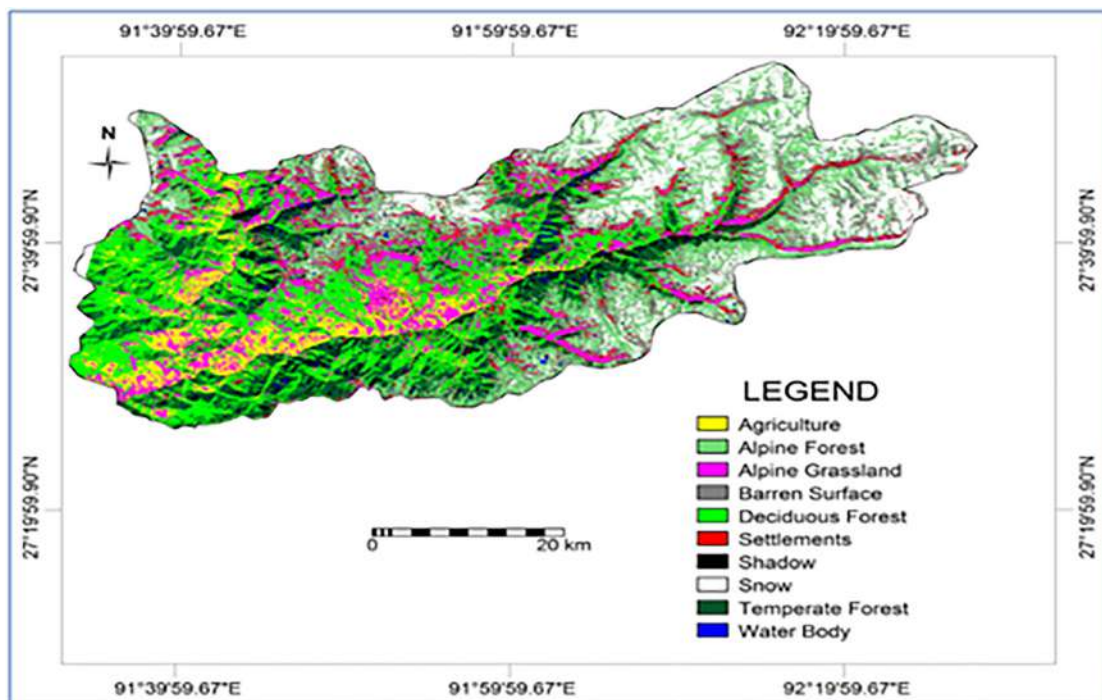
is hardly any small stream is left without a Mini Hydroelectricity project is going on. At present there are more than 87 mini hydro projects and three micro hydro projects which destroyed huge area of forest in the district. At the same time in the name of development all the water sources of the district are getting polluted. The remaining forest which were not reachable for the rural people are getting clear today. These unplanned projects have led to the destruction of whatever forest is left. It won't be wrong to say that these unplanned developmental projects are not for the development rather destruction.

### **Land Use Land Cover from 2002–2011**

The Tawang district had 47.71% of area under forest coverage from the total geographical area during year 2002, however, this percentage came down to 29.08% during the year 2012, which is a change of 18.63 % (Table 1) The change may be attributed to the rapid deforestation for the purpose of fire wood extraction, logging, grazing, agriculture, developmental activities etc. The percentage of agriculture has been reduced from 6.30% during 2002 to 5.32% during the year 2012 this may be because of the peoples shift from the agricultural activities towards the other activities like government services and logging which gives higher return. In case of settlement it has become more than doubled during last 10 years. It was concentrated on only 4.09 % from the total geographical area during 2002 which became 9.49 % in 2012. It clearly shows the raising pressure of population on land with the growth of population. There is a decrease of 13.26 % in case of deciduous forest in the district. It was 19.34 % in the year 2002 which became 9.49 % in the year 2012. This category of forest is mainly known for fire woods among the Monpas of Tawang district because some of the best quality of fire wood i.e. Oaks are found in this category. The trends of temperate and alpine forest are also declined by 11.10 % in 2002 to 9.00% in 2012 and 17.27 % during 2002 to 14.00 % during 2012 respectively. The reason for the downward trend of this forest type could be attributed logging practices and increasing family size of the Brokpas which is followed by clearing vast forested area and convert it into grazing lands.

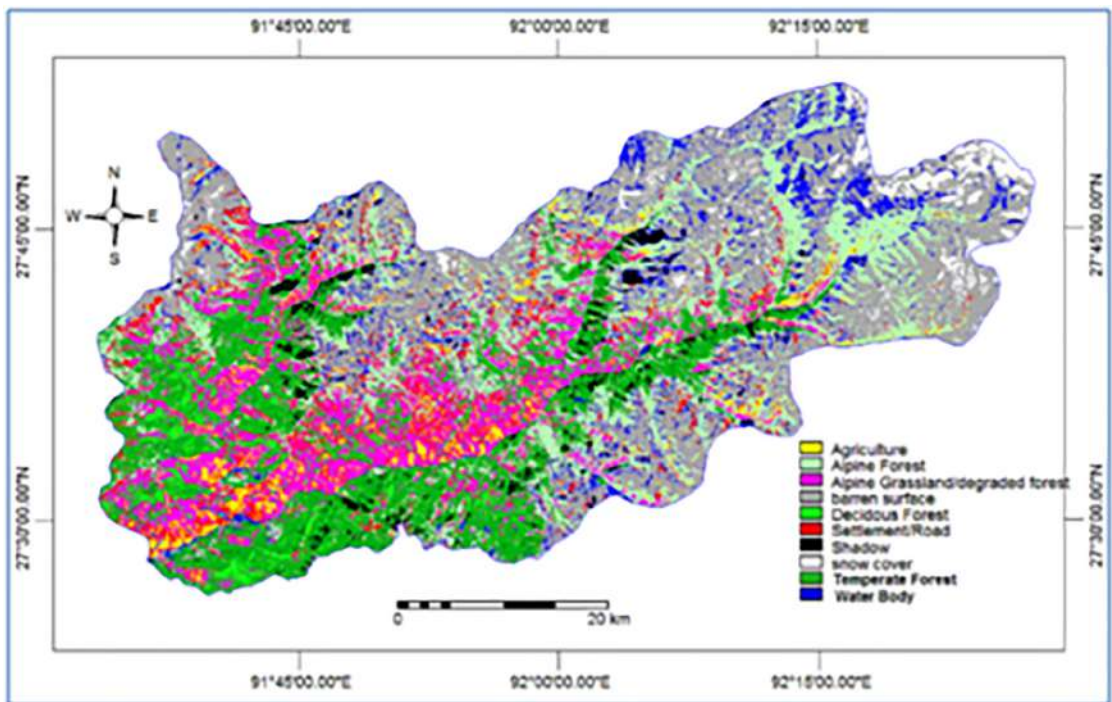
**Table 1:** Area Under Forest Coverage in Tawang District.

	Category	Area in %	
		2002	2012
Land Use Land Cover	Agriculture	6.30	5.32
	Settlement	4.09	9.49
	Deciduous Forest	19.34	6.08
	Temperate forest	11.10	9.00
	Alpine Forest	17.27	14.00
	Alpine Grass land/Degraded Forest	8.15	18.71
	Barren surface	13.75	22.11
	Snow Cover	14.73	4.45
	Water body	0.42	7.68
	Shadow	4.84	2.86
	<b>Total</b>	<b>100</b>	<b>100</b>



**Fig. 4:** Land Use Land Cover Map of Tawang District - 2002.

Degraded forest has increased it was 8.15 % in the year 2002 which has increased and became 18.71 % in 2012. During 2002 percentage of barren surface was 13.75 % which became almost doubled 22.11% in 2012. The growth of population also impacts the glaciers in the region. In the year 2002 there were 14.73 % of the land was covered by snow but in the year 2012 it was only 4.45 % of land was under snow cover. As the snow recedes the percentage of water bodies increased by 0.42 % in 2002 to 7.68 % during the 2012. Percentage of shadow is also decreased it was 4.84 % during 2002 which became 2.86 % in 2012.



*Fig. 5: Land Use Land Cover Map of Tawang District (2012)*

## **Conclusion**

Today the district has a population density of 23 persons per sq. km with a decadal growth rate of 25.92 % which is not a good indication for future as the resources are limited. Firewood seems to be one of the important factors behind the rapid defor-

estation, because it is the only cheap and easily available energy sources to keep their houses warm as other forms of energy are not easily available like LPG. Intensive cultivation is not possible due to less arable land and people are compelled for livestock rearing and grazing is a treat to the forest cover as people convert forest areas into grazing land. Some section of the society are engaged in logging practice as they have no other options to earn their livelihood which also contributes in loss of forest cover. Also, the impact of growing demands for plantation agriculture such as Apple, kiwi and orange in the region cannot be ruled out in the forest cover loss. Awareness through community participation by Government policies and programs and NGOs could play significant role in conservation of forest. Alternative energy sources like use of renewable energy sources i.e. hydroelectricity as substitute for firewood in cooking and heating purpose can reduce pressure on forest resources. Government assistances in form of financial, fodder, medication etc. to the Brokpa (semi-nomadic people) community may reduce the conversion of forest land into grazing land. Awareness on Family planning in the rural areas.

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