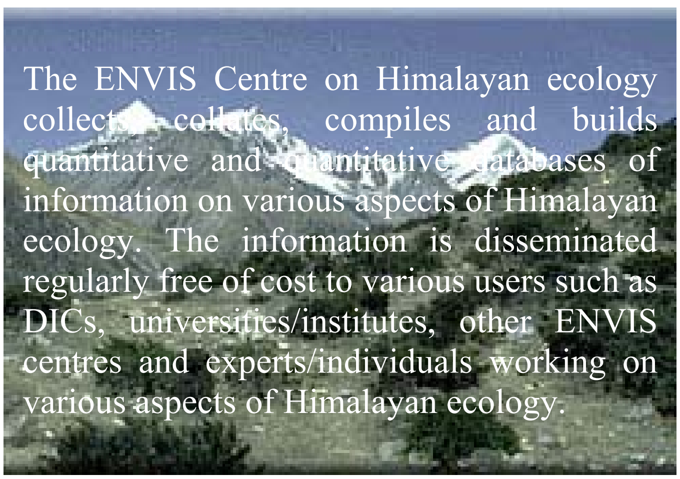
# ENVIS Newsletter

## on Himalayan Ecology

Volume 3, 2006

### In this issue






### Editorial

ENVIS Newsletter on Himalayan ecology is an annual non-priced publication of the ENVIS Centre, which was established at the headquarters of the G.B. Pant Institute of Himalayan Environment and Development (GBPIHED) in the financial year 1992-93 with the fiscal support from the Ministry of Environment and Forests, Government of India, New Delhi.

The third volume of this Newsletter contains four articles received from the researchers of this Institute. The opinions expressed in these articles of the Newsletter do not necessarily reflect the official views of the GBPIHED or the editors. The content of the Newsletter may be quoted or reproduced for non-commercial use provided the source is duly acknowledged. Contributions to the next volume of the Newsletter in the form of research/popular article(s) and news item(s), etc., related to various aspects of Himalayan ecology, are welcome. The matter supplied by the individual/organization may be edited for length and clarity. Request for subscription of the Newsletter may be sent to the Executive Editor of the Newsletter. The comments/suggestions for the improvement of the Newsletter are also welcome.

**P.P. Dhyani**
Executive Editor

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# Multiple node cuttings: An alternate method for clonal propagation of "maggar" bamboo

Bamboo is the most diverse group of plants in the grass family, and the most primitive sub-family. They are distinguished by having woody culms and complex branching, a complex and generally robust rhizome system, and infrequent flowering. Bamboo has a cosmopolitan distribution, ranging from 46° N to 47° S latitude, reaching elevations as high as 4000 m in the Himalayas and in parts of China. These are highly adaptable, with some species being deciduous and others evergreen; at least some species seem to be able to change this habit when necessary.

One of the most important contributions of bamboo is the production of paper. Its use as a long fiber raw material in the pulp and paper industry is well known and it is one of the most sought after raw materials in the tropics. Although once called poor man's timber, it is no longer cheap. Apart from industrial use, bamboos are utilized in making rayon, mat boards, roofing, construction, furniture, agricultural implements, baskets and numerous traditional uses.


Fig. 1. Propagation of *D. hamiltonii* through multiple node cutting

There is high demand of bamboo for commercial purposes. However, productivity of bamboo forest in India is far below compared to China; this is mainly attributed to over exploitation, lack of scientific management, recurrent fire, poor natural regeneration and damage by cattle. Cultivation of bamboo in India is still at infancy stage. Almost 99% of annual bamboo production in the country comes from the natural stands in the forests and only 1% is derived from plantations. Nevertheless, increased productivity can be achieved following selection of the right species, elite clones, genotype match with site characteristics and proper management practices. In Uttaranchal state, bamboo forests are very much limited and only few stands can be seen here and there. In view of the importance, the need for bamboo multiplication and cultivation has been realized in this region; this paper reports clonal propagation of 'maggar' bamboo (*Dendrocalamus hamiltonii* Nees et Arn. Ex Munro) using multiple node culm cuttings for mass propagation.

Culm cuttings (about 2.0 m in length containing 4-5 nodes) from about 15 years old plants of *D. hamiltonii* were used for chemical induction of roots. The effect of auxins (IBA and NAA) and a systemic fungicide (Bavistin) on adventitious root formation was examined. The culm cuttings (10 culms per treatment) were planted horizontally with the bud facing upwards (Fig. 1A). It was observed that the buds started to sprout following 2 weeks of planting and among these treatments slightly higher concentration of NAA performed better than IBA and Bavistin (Table 1 & Fig 1B). Except NAA none of these growth regulators could enhance rooting and subsequent survival rate. Each individual culm containing nearly 4-5 rooted plantlets were separated (Fig. 1C & D) and placed in the polybags for field plantation.

The outcome of the work would result in development of a simple method for large scale multiplication of quality planting material (true-to-type) and subsequently can be used for development of technology packages for cultivation of the bamboo species for the restoration of degraded lands and also for deriving economic benefits to the local communities.

**Table 1.** Effect of some growth regulators on root induction in multiple node culm cuttings of *D. hamiltonii*

| Treatment | % rooting | Avg. no. of roots | Avg. no. of shoots |
|---|---|---|---|
| Control | 0.0 | 0.00 | 0.00 |
| IBA (250 µM) | 22.0 | 5.3 | 2.3 |
| NAA (250 µM) | 50.00 | 25.8 | 3.5 |
| Bavistin (5 %), w/v | 5.0 | 3.9 | 1.0 |

Treatment consists of 10 culm cuttings; data were taken six months following planting

***- R.K. Agnihotri and S.K. Nandi***

## Climate change in the higher Himalaya – A case study in Lahaul valley

Since the Earth was formed more than four billion years ago, its climate has periodically shifted from warm to cool and back again - some times dramatically. The earth's climate changed substantially over a period of two millions of years. A very small quantity of change in the climatic conditions is a regular feature; however, the changes those occurred within the last 150 years are rapid. Temperature is rising both at global as well as at local level due to global warming. Impact of the climatic changes is also being felt in the Kullu and adjoining cold desert areas of the Lahaul valley. It is being felt by the people of the Lahaul valley that the valley is continuously receiving lesser snowfall and getting warmer. During peak irrigation months of June to August snowmelt is decreasing in the traditional water channels locally called *kuhl.* Natural springs, the only source of drinking water in the valley, are drying. Local farmers believe that poor yield of apple crop in the Kullu valley is due to rise in temperature and lesser snowfall in the valley. The areas, which were famous for its apple production hardly 25 years ago, do not produce substantially today due to climatic changes in the Kullu valley. To examine the peoples' perception about the climatic changes in the Lahaul and adjoining Kullu valleys, the present assessment was carried out from the data collected from three meteorological stations, viz. Koksar (3212m), Tandi (2958m) and Udaipur (2650m) during January 2001 to July 2005.

During 2001 to 2005, maximum temperature was recorded in 2004 ($32^0$C), followed by 2003 ($30^0$C) at Tandi. However, Koksar station of the valley showed a minimum temperature of $-19^0$C during 2004, followed by 2002 ($-18^0$C). A comparison of temperature from 2001 to 2005 revealed a considerable reduction of $8^0$C found at Udaipur. However, there was a slight change in temperature of Tandi and Koksar during the initial and final year of recording. Monthly basis calculation of data showed that in all three stations, a rapid increment in temperature was recorded from May to July, which declined considerably from November to February. The temperature was recorded maximum in July and minimum in February.

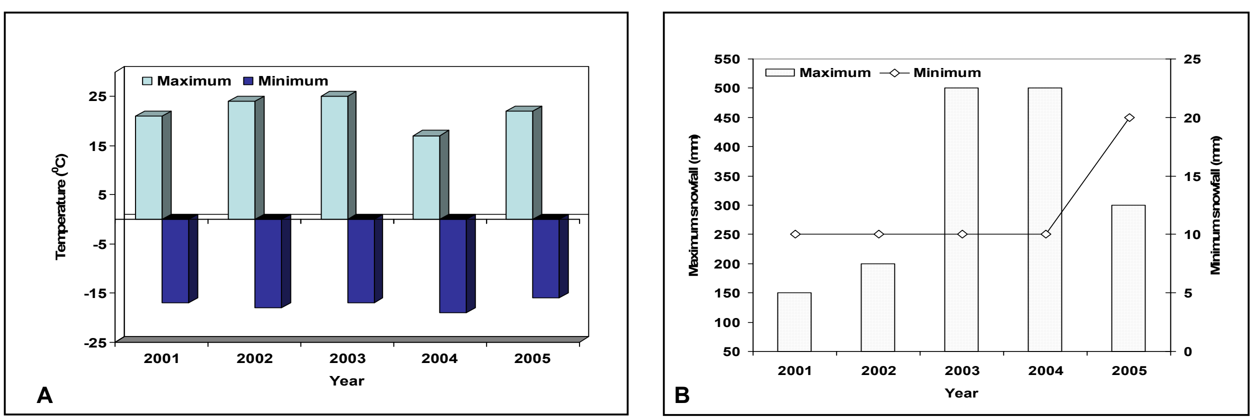



Figure 1. (A) Temperature and (B) Snowfall of Koksar in Lahaul valley

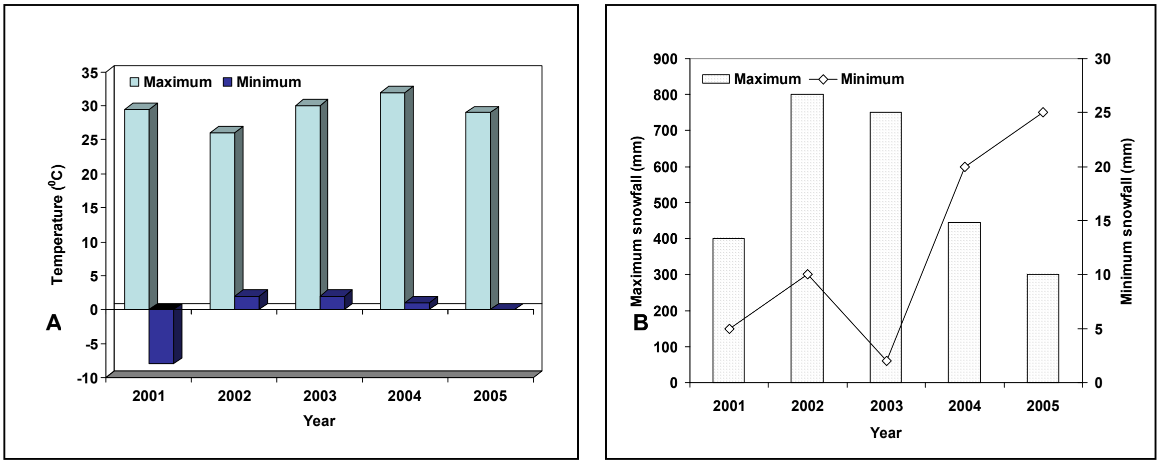



Figure 2. (A) Temperature and (B) Snowfall of Tandi in Lahaul valley

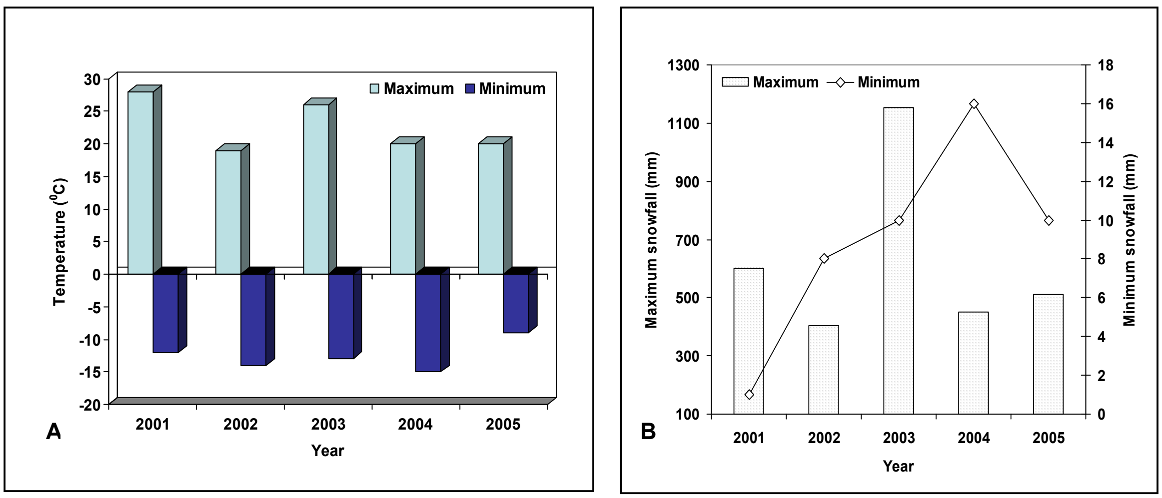



Figure 3. (A) Temperature and (B) Snowfall of Udaipur in Lahaul valley

During 2001 to 2005, an increment in rainfall was recorded in all three stations; Koksar had the maximum rainfall during 2005 (274mm), which was found very high compared to 2001 (35mm). Further, minimum rainfall was observed in the lowest altitudinal station, i.e., Udaipur (0.01mm) during 2004. In general, in all three stations, rainfall was found to be started from May and continued till September, where maximum rainfall was recorded during July. There was no rainfall observed between November and February.

During 2003 in Udaipur and Koksar and 2002 in Tandi, maximum snowfall was recorded, i.e., 1154mm, 500mm and 800mm, respectively. However, minimum snowfall was observed in the lowest altitudinal station, i.e., Udaipur (1mm) during 2001. Snowfall was found to be started from October and was continued till April; where, maximum snowfall was recorded in February.

The data on discharge pattern of Chandrabhaga river was recorded from two stations, i.e., Tandi and Udaipur. Tandi is the first location where the daily discharge pattern of the river is recorded. Here maximum discharge was 516.1$m^3$/sec during 2005; it increased up to 1130.63$m^3$/sec on reaching at Udaipur by the association of other perennial streams in the way. As far as year is concerned, maximum discharge was 1387.8$m^3$/sec in 2003 at Udaipur. The discharge pattern was highly influenced by the annual increment in temperature in the valley. In general, discharge of the above river during the study period was found to be rapidly increased from April to July and then declined in the subsequent months.

***- S.K. Sinha and S.S. Samant***

# Erosion problem in the lesser Himalaya: A case study in Chalthi, Kumaun Himalaya

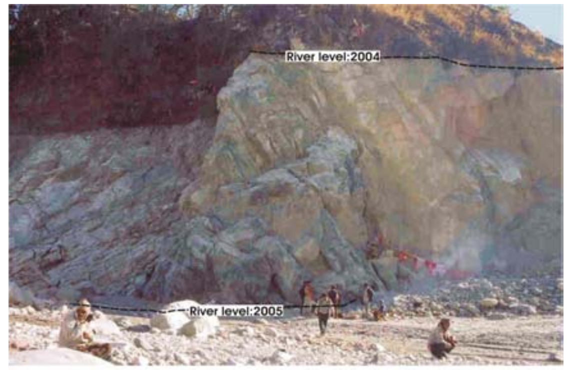



Fig.1:Showing river level in year 2004(marked by cotton flag) and in year 2005 :

The geo-environmental status of the Himalaya is basically reflection of the control exerted by major and minor geofractures evolved in consequence to the mountain building process. These thrusts/faults have rendered the present fragile setup of the Himalaya. The Himalayan rivers are marked by steepened gradients in the higher reaches, which gradually decreases in the frontal and Bhabar region. It is due to this setup several environmental problems have arisen in the mountain region and the inhabitants are compelled to sustain under continuous threat from the landslides, earthquakes, cloud-burst and land erosion. One of the inevitable problems of concern in the mountainous region is the erosion. The higher gradients of the river channels in the higher Himalaya cause exceeding erosion of the terrain, the ultimate effect of which is faced in the low altitude zone, i.e., the lesser Himalayan and Bhabar region. In these lowlands, greater discharge received from the higher reaches causes either rapid erosion of the topography or instantaneous deposition of voluminous sediment load. A case example of the erosion problem in the lesser Himalayan region of approximately 1km$^2$ area in the Chalti (Champawat –Tanakpur road section) is discussed here.

Geologically the Chalthi and nearby area is a critical place falling in a zone of intense shearing and shattering where two major thrust, viz. Ramgarh Thrust (Ladhia Thrust) and Main Boundary Thrust traverse adjacent to each other. Geologically, Chalthi is situated between the Siwaliks (sandstone) in the south and Nagthat quartzite towards north. Due to closeness of these two major thrust systems, tectonically the area is unstable and also prone to landslide and subsequent erosion. As the rocks are disturbed and fragile, voluminous amounts of consolidated and unconsolidated rock material are being transported downstream in the form of debris flow. Flooding of the river channel with gravels is very common scenario in the Bisoria gad (a tributary of Ladhiya river). During the rainy season increased discharge causes huge amount of unconsolidated to consolidated material transport in the form of mud/debris flow and many a times impounds the river channel modifying landforms.

Terraces are the dominant geomorphic features existing in most of the Himalayan terrain. These represent the past fluvial or colluvial deposits and are witness to the falling water levels or uplifting terrain. In the Chalti area such terraces have been deposited over the Siwalik and Lesser Himalayan basement. Since, the region has a low altitude, it serves either as a depositional basin or susceptible erosional surface for the fluvial tracts emerging from the higher reaches. During monsoon the erosion process increases in response to increased discharge.

Terrace erosion is an immediate and aggravated scenario in the mountain region. An example of this is cited here. During the 2005 monsoon terrace outcrop at Chalti was eroded by 20mt (photo: flags at the top of hillock marks the position of river level during 2004 and flag river level at present - 2005) causing loss of agricultural and forest land and human casualty. With fragile rock fragments and unconsolidated terrace material, the whole mass moved downstream along the channel of Ladhiya river. It cannot be said that erosion may be around 20mt/year since the materials comprising the terraces are of unconsolidated nature, hence can be washed out by smaller discharge. But considering the 20m erosion during a single monsoon the problem becomes critical. The region is severally affected by landslide hazard, which is dominant phenomenon during the monsoons. In 2006 a huge landslide arising from the hinterland impounded the Ladhiya river thereby forming landslide induced lake. The lake formation due to material derived from the mass movements is a common phenomenon in this region. Such lakes remain for couple of years and thereby burst resulting in increased discharge downstream. The increased discharge becomes acute in view of increased erosion and dumping in the downstream. At Chalti most of the human occupation and farming practices are confined to terraces, conservation of terraces from erosion is the need of hour. The area is waiting for the scientific approach for the mitigation of landslide hazard and to save life and property of people.

***- Suman Joshi, R.K.Dumka and K. Kumar***

# Arunachal Pradesh – A transition profile

*Arunachal Pradesh*, the land of rising sun in India, is located in the extreme north-eastern frontier area of the country. Geographically, it is situated near the tropic of cancer, lying between 26°28' and 29°30' N latitudes and between 91°30' and 97°30' E longitudes. The state occupies a strategic position and is bounded by international boundaries with Bhutan in the west, China (Tibet) on its north and north-eastern sides, Myanmar (Burma) on the south-eastern side, while the state boundaries of Assam and Nagaland are part of its southern border. The area falls in the climatic transition between torrid and temperate zones of the northern hemisphere. Physiographically, it includes a longitudinal belt of the Assam plains of above 150m altitude in the southern border, the foot hills, the ranges of lesser sub-Himalayas (*Sivalik*) and greater Himalaya (*Himadri*) lying parallel from south to north with altitudes varying between 150m to 7090m amsl.; a beautiful mountainous area with high hills and valleys. The heights of mountain peaks show a greater variation ranging from 1829 to 7090m; the highest one is Kangte in the Tawang district. The main ridges and spurs of the sub-Himalaya fan out to the plains mostly in transverse direction except in some places where the prominent ridges run more or less parallel to each other from west to east. The high mountains in the northern ridge remain snowclad almost throughout the year.

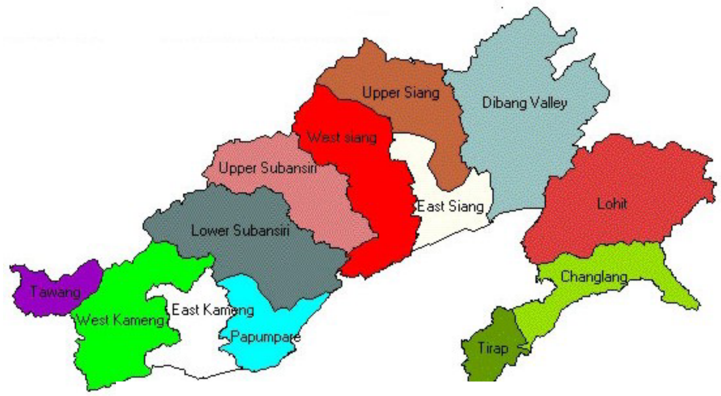



**Figure 1**: Districts of Arunachal Pradesh

Arunachal Pradesh is the largest state in the north-east India covering an area of 83,743km$^2$ with a small population of 1,091,117 persons and lowest density of about 13 persons/km$^2$ in the country. The state has diverse physiographic and socio-economic characteristics. A distinct economic diversity can be observed in the state. The tribes of the plains in the south are engaged in agricultural activities as their traditional mode of economy, while lumbering and fishery being the main economic activities of the hills and river valleys. Most of the states' area is under hills and mountains of the eastern Himalaya, which are characterized by weak socio-economic organization, traditional social order, limited use of modern technology, shortage of skilled labour, thinly dispersed population with difficulty in flow of materials, surplus labour and weak infrastructure development.

### *Population variation*

**Table 1**: Decadel growth rate of human population (1961-2001): Districts are ranked according to decadal growth pattern (for the decade 1991-2001)

| District | Decadel growth rate (%) | | | | Rank |
|---|---|---|---|---|---|
| | 1961-71 | 1971-81 | 1981-91 | 1991-2001 | |
| Tawang | 26.66 | 15.90 | 30.14 | 22.69 | 4 |
| West Kameng | 19.50 | 29.44 | 35.74 | 32.21 | 6 |
| East Kameng | 24.44 | 21.64 | 17.92 | 13.24 | 1 |
| Lower Subansiri[a] | 30.32 | 39.22 | 38.46 | 40.64 | 8 |
| Upper Subansiri | 30.77 | 23.10 | 27.09 | 9.80 | 3 |
| West Siang | 12.05 | 27.04 | 31.64 | 15.17 | 2 |
| East Siang[b] | 49.48 | 40.07 | 30.60 | 21.01 | 7 |
| Dibang Valley | 48.59 | 103.37 | 39.03 | 33.61 | 10 |
| Lohit | 84.63 | 45.90 | 57.85 | 30.78 | 9 |
| Changlang | 151.12 | 35.92 | 53.56 | 30.84 | 11 |
| Tirap | 24.99 | 28.51 | 28.70 | 17.21 | 5 |
| Arunachal Pradesh | 38.91 | 35.15 | 36.83 | 26.21 | |

[a, b] include Papumpare and Upper Siang, respectively

East Kameng, West Siang, Upper Subansiri, and Tawang district recorded lower growth rate, while Lohit, Dibang Valley, and Changlang recorded a very high growth rate in the state in the last four decades. Among these districts the growth rate of Lohit and Changlang is a major threat to the state not only because of their high growth rate but also due to their population size. East Kameng and East Siang districts show a gradual decrease of population growth rate in consecutive four decades.

Note: The state has now 16 districts. The data is given for the 13 districts that existed in 2001.

***Man - Land distribution***

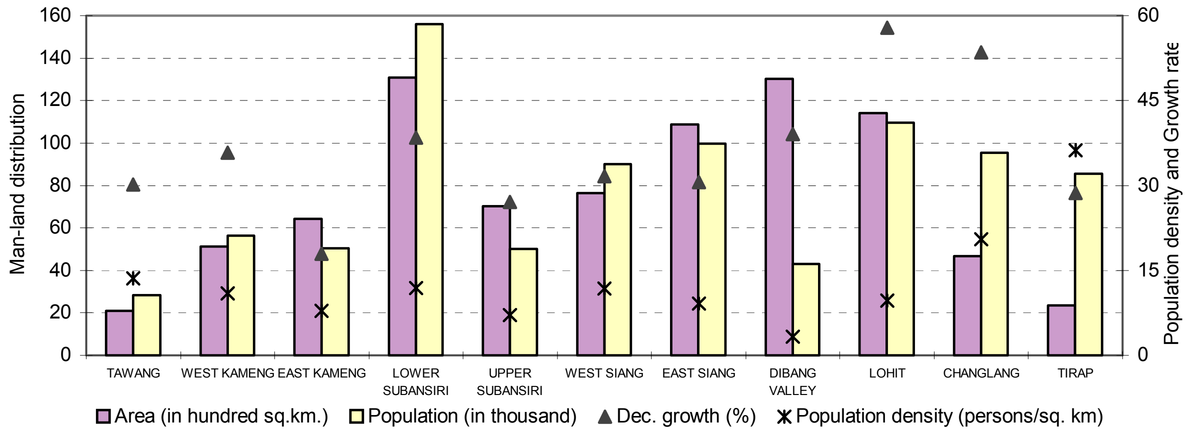



**Figure 2**: Geographical area and population distribution

The man-land ratio of the state is best in the country mainly due to its small population spread in a large territory. But the distribution is extremely uneven. The districts having moderate to low population growth such as Dibang Valley, Siang (West & East), Kameng (West & East) and Upper Subansiri exhibit no threat to man land ratio. Lohit, Changlang, and Lower Subansiri (recorded high to moderate population growth, respectively) will threaten the ratio of the state in next decades because of its population, both in terms of size and the rate of change. The below average population growing district of Tirap and Tawang may threat the man-land ratio in the next few decades because of their small area. While the high growth of population in Lower Subansiri is attributed to migration of population to Itanagar and sorrounding areas from all over the state and outside, the districts Lohit, Changlang, and Tirap are probably influenced by continued migrations from the neighboring countries.

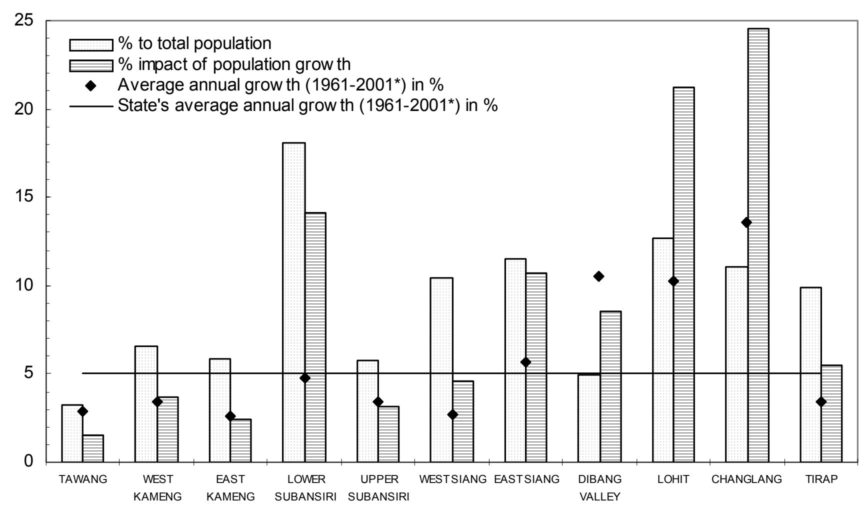



**Figure 3**: Population size, trend of population growth and its impact (*worked out from the decadal figures)

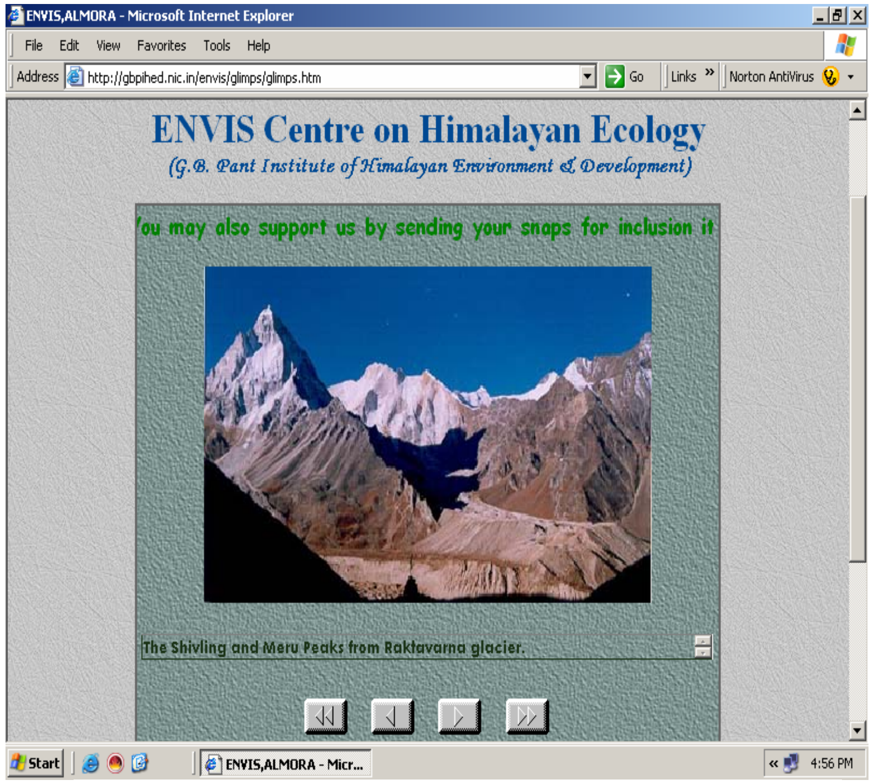
Though the state contributes a negligible share to the nation's total population (about 0.1%), the annual average population growth rate of the state is much higher (above 5) than the national average (about 3.35). Further the annual average growth rate of human population is alarmingly high (above 10 during 1961-2001) for the districts Changlang, Dibang Valley and Lohit. The effect of population growth has been derived quantitatively using two factors, *viz.* the population size and the trend of population growth of individual district. The state as a whole account for 100%, and the percentage share of this effect by the individual district along with population size and growth rate has been shown comparatively in the figure 3. Changlang, Lohit, and Lower Subansiri are the adversely affected districts in the sate, while Tawang has the least threat because of its small population and marginal growth rate.

[**Source**: Census 2001; Resource Atlas of Arunachal Pradesh, 1999]

***– S.N. Nandy***

**Recent Events @ GBPIHED**

- Training on Environmental and Social Management Framework for Uttaranchal Decentralized Watershed Development Project, 20-22 February 2006
- Brain Storming Session on Ecosystem Services and Ecological Economics: Himalayan Mountain Context, 24-25 February 2006
- Workshop on Intellectual Property Rights : Himalayan Context, 26-27 February, 2006
- Annual Day Celebration of the Institute at Himachal Unit (Mohal-Kullu) on 10 September 2006 commemorating the 119th Birth anniversary of *Bharat Ratna* Pandit Govind Ballabh Pant Ji. On this event XIth Pt. G.B. Pant Memorial Lecture was delivered by *Professor S.S. Handa* on Medicinal Plants for Health Care.
- Workshop on Shifting Agriculture: Issues and options, September 10, 2006, Itanagar
- Wildlife week celebrated on 7th October 2006

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