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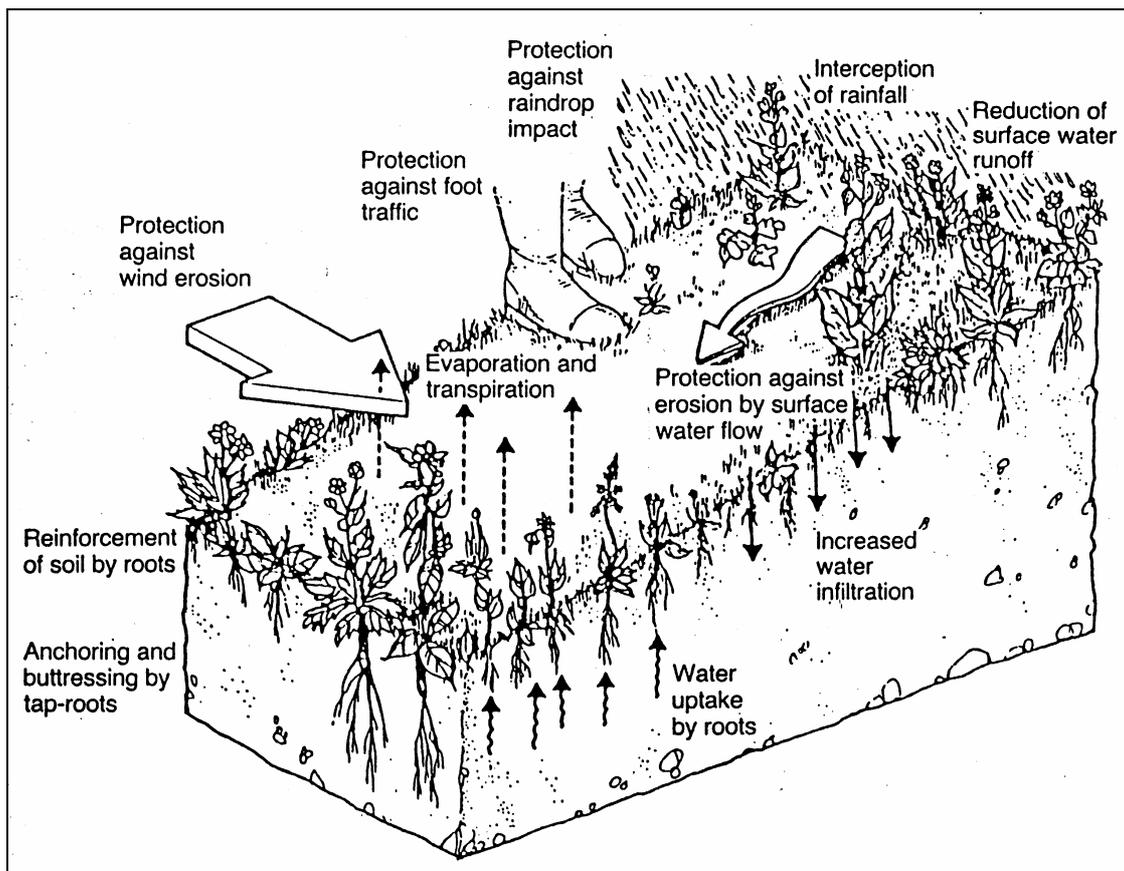
*Compiled by S.N. Nandy*

## HILL SLOPE INSTABILITIES AND ROLE OF MOUNTAIN RISK ENGINEERING

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### Hill Slope Instabilities

The constraints of difficult terrain, physiographic features, climatic variability in addition to natural calamities in the form of landslides, earthquakes, cloud bursts, *etc.*, pose threats to the Indian Himalayan region. On the other side the complex web of ever increasing population and its developmental needs of construction, mining, food, fuel, fodder, tourist/pilgrims inflow, *etc.*, have already disturbed the region considerably. The faulted belts and the areas suffering from environmental degradation in the IHR are known to be facing problems of accelerated soil erosion rates and mass wasting processes. Construction of buildings, roads and geo-technical projects have caused immense destruction of forests and have triggered intense erosion in the vulnerable areas. The recurrence of mass wasting at the developmental project sites has aggravated the deterioration of the mountain ecology. The sheet and gully erosion, the preliminary part of mass wasting processes are the prime cause for accelerated soil losses. Apart from this, ever increasing growing needs of food, fuel and fodder for the growing population have increased the pressure on forests; an important aspect for ecological and environmental balance and thus the processes of mass wasting.



**Figure 1:** Engineering functions of vegetation.

### **Mountain Risk Engineering (MRE)**

In view of the accelerated soil erosion rates and mass wasting processes and the growing concern for effective mitigation of hill slope instability, a consensus is developing regarding the urgent need for co-ordinated efforts not only from civil engineering and geological sciences but also from the relevant disciplines of soil and water conservation, plant and social sciences. The mitigation of risk arising from hazardous mass wasting processes is advanced in mountainous areas of Europe, Japan and parts of North America. Careful and systematic approach to site selection, process identification, hazard mapping and representation of mass wasting processes is needed to define the level of risk and its possible mode of mitigation. This has helped in the development of the concept of MRE. The subject is considered as the science and art of engineering/mountain infrastructure giving due consideration to natural and human processes, and the tolerable risks to and from infrastructures. Thus, this is an integrated approach to solving the infrastructural engineering problems of hilly and mountainous area. Its aim is to evolve cost-effective and site-specific design, as well as environmentally conscious construction and maintenance practices.

### **Principles and Practices of MRE**

Hill slope instabilities resulting from erosion and mass movements of soil due to varying natural and man induced factors is a major environmental hazard. Vegetation, the key factor that maintains equilibrium between the stability or instability of a slope is believed to increase the risk of hill slope failure when the vegetal cover is removed. The issue generated interest among researchers and the outcome is seen in the form of BIO-ENGINEERING. This refers to the use of any form of vegetation, either alone or in conjunction with other physical measures, as an engineering material (*i.e.*, one that has quantifiable characteristics and behaviour). The engineering functions of vegetation are shown in Figure 1.

The following section briefly gives the steps involved in implementation of MRE treatments.

#### **Site Assessment**

- Geologic
- Land use (Practices and Management)
- Climate
- Physiography
- Soil Survey
- Socio-economic issues

Once the causes and mechanism of hill slope instability is known along with other inputs, the treatments are decided. In MRE, stress is given to low cost BIOLOGICAL and PHYSICAL structures for stabilising hill slope instabilities. The design principles for Physical structures are quite advanced, however, for Biological structures, relatively a new development, following guidelines are adopted (Fig. 2).

### **MRE Applications**

Detailed investigations on land slope instabilities at village Joshiyana (J) and Khoont (K) of Almora District, UP were carried out under MRE : India Project. For making the detailed site assessment, basic data were compiled from a. Topographical map of the area (1:50,000 scale), b. Cadestral map of the area (1:1,000 scale), c. Topographical survey of the area, d. Survey on Geologic formations, lithological & structural features, and e. Survey on Climate and Vegetation.

Each of these locations have more than one site, and hereafter for ease of reference they are referred to as J1, J2,... or K1, K2... respectively as per the location and the number of the site. The following section presents the salient features of the site and the treatments carried out.

**Site J1 :** The site is located on the left flank of Kutmaria stream, a tributary of the river Kosi. This slip is part of the abandoned land which had experienced a major landslide in ancient time. The bed of the stream at this location remains damp throughout the year due to presence of a spring source located further 100m up on the left flank. The exposed scar zone, however, remains totally dry because of low water holding capacity of the soil, high slope (steepness) and abandoned terraces in the vicinity.

At this site main treatments were brush layering at relatively less gradient zone and diagonal rows of

grass plantation on steep slope. The objectives for selecting these treatments were to check the rate of soil erosion during rains and provide reinforcement to overburden. To provide additional strength, shrubs plantation was done in the grass plantation zone. For reducing the effects of toe cutting in future, Bamboo plantation was done in the damp stream bed. Tree plantation in the nearby abandoned terraces was carried to achieve long term goal of overall hill slope stability.

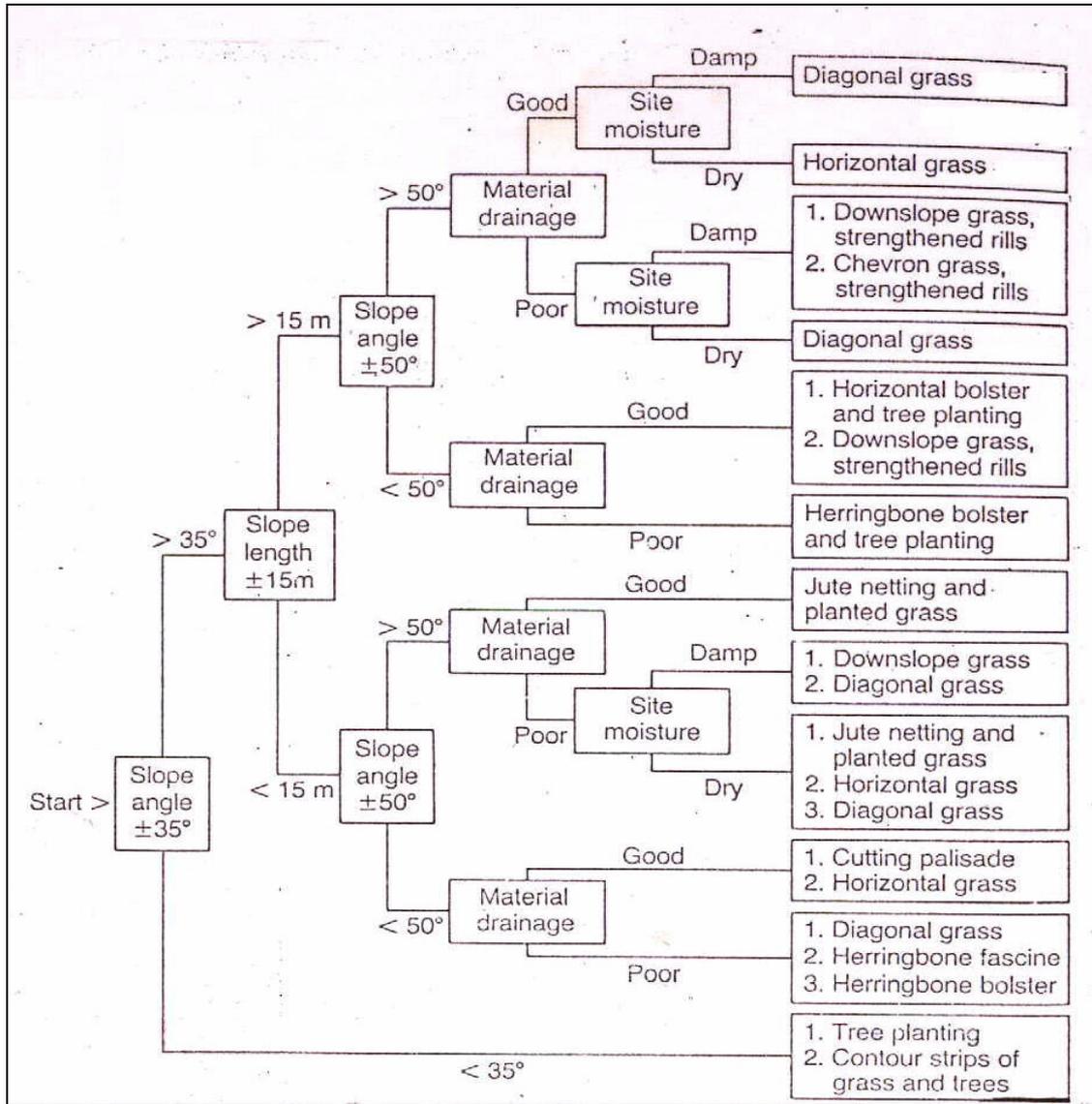


Figure 2 : Selection criterion for Bio-engineering treatments

**Site J2 :** The right flank of the Kutmaria stream at this location suffered from a landslide around 2 years back. The average slope is more than 30 degrees and has good drainage due to slope steepness, low water holding capacity of the soil and absence of vegetal cover. In addition, tension cracks were noticed above the crown and on both sides of the landslide.

At this site, it was felt that it required a). to protect the almost barren crown section from rain water impact, b). to support the toe portion with shrub plantation and c). to stabilise the toe by protecting it from toe

cutting. Thus, from the crown section to almost mid section of the slide, where slope was more than  $30^{\circ}$ , Jute netting with grass plantation was carried out after trimming of slope. In the remaining area, brush layering was carried out. To provide support to the slide mass at the toe section, options of constructing toe wall and stone masonry check dam were considered. The low gradient of the stream in the section (around 10 degrees) favoured construction of a stone masonry check dam (2.5m wide and 1.5m high) across the stream as compared to a toe wall of 20m length and 1m height. After back filling of the check dam, Bamboo plantation was done in the stream bed where as, shrubs plantation was done in the toe section of landslip in order to provide cover against excess runoff.

**Site J3 :** The site situated about 100m upstream of site J2 had lines of permanent under ground water sources and had several active points of water emergence. The entire area, though originally terraced, however, at present abandoned, was very wet and was creeping down the slope at a very slow rate as indicated by the bulging soil mass and presence of resulting small landslip on the flank of the stream. The initial discharge measurements indicated that about 2.5cum per day of flow can be tapped continuously. The overall situation suggested need for adoption of suitable technology for draining the entire area and henceforth, a French drain system was designed. However, considering the fact that the nearby terraces are since not under cultivation and severe scarcity of drinking water in the adjoining area, together with the discussions with villagers, it was perceived that instead of constructing a water harvesting tank for collection of drained discharge, a small chamber with overflow section be constructed so that the water stored could be used for drinking purpose. In future, if required, the size of chamber could be increased.

The toe cutting at this site, and the gradient of the stream, in general drew the attention towards the need for constructing suitable structures to protect the banks. It was decided to put Gabion check dams at appropriate locations. After careful consideration of the stream profile, cross sections and stream-bed material, it was decided to construct Gabion check dams (CD1, CD2 and CD3) of dimensions as per site requirements.

**Site K1 :** This slide mainly occurred due to water emergence at 2-3 spots within the slide and got triggered by excess rainfall generated runoff water spread over the slide mass at the crown section coupled with toe cutting at the toe by the high discharge in the Khulgad stream. This process has been supported by rock bed dipping steeply in the general slope direction. Based on the investigations, it was perceived that major requirements of the site are safe disposal of spring discharge and support to the sliding mass at the toe section. The proposed measures at this site consisted of rip-rap drain (about 215m long) aligned to properly drain out the spring discharge together with drainage of excess water from the soil mass and a stepped Gabion toe wall (length - 12m, Height - 3m, bottom width - 2m). The toe wall was constructed at a location where the length requirement was minimal and firm underground rocks were present to provide foundation. The sides of toe wall were anchored sideways also. In the slide zone at certain locations, rocks are exposed whereas in the remaining area still good soil cover is present, however it remained wet due to spring water. To drain water from such areas and thereby provide stability, diagonal rows of grass plantation was carried out. In relatively drier patches, shrubs plantation was done. At few patches, good canopy cover of *Alnus* was present. In such areas Large Cardamom plantation was done to provide incentive to the land owners. Additionally, it was noticed that, at the crown section, runoff water could enter the main slide. To protect it from damage, small stone rip-rap was constructed to divert the surface runoff to the main rip-rap drain. To strengthen the section i.e. the inlet point of surface runoff, 3 live check dams were made. The slide portion below the stepped Gabion toe wall, was treated with live stakes and diagonal grass plantations to provide strength and protect it from further severe erosion.

**Site K2 :** At this site, the well terraced land had been mostly abandoned by the villagers due to its remoteness from the main village. The entire area is well protected from animal grazing and sufficient water is present in the form of three spring sources. However, with fields not being under cultivation, the spring water was getting spread all over the area resulting into almost marshy land. As a result, certain amount of lateral creep was present in the area. At this site, the major treatment was safe disposal of spring discharge, which was accomplished by constructing stone rip-rap drain. With the support from villagers, the entire area has been

brought under horticultural plantation of Walnut and large Cardamom such that the area is ecologically restored and put under productive use apart from providing financial benefits to the owners.

#### **Demonstration Sites**

A few demonstration sites in and around GBPIHED campus at Katarmal have also been developed to provide greater awareness and exposure to a large number of visitors to the Institute which include villagers, general public, NGO's, researchers, administrators and planners. Due to relative inaccessibility of Joshiyana and Khoont sites, it was found necessary to set-up these demonstrations with a good mix of all possible technologies. Keeping in mind the need for future continuous monitoring and research on these MRE measures for further improvement, these sites have advantage in this regard.

A total of 4 sites, named hereafter D1, D2, D3 and D4 respectively, were identified on or near to road head where it has been tried to demonstrate the various combinations of practices of MRE. At almost all of these sites, one can find typical example of underestimating the potential damages that can be caused by surface runoff especially on disturbed topography in hilly terrain.

**D1 :** At this location, one chute drain of dimensions 1mx1m was draining surface runoff of more than 1ha area, however, the road side drain for disposal of all the incoming water was made only 0.3mx0.3m. Thus all the excess water was crossing over the outward sloping road and damaging the lowest elevation point. It is important to point out that in this road section, on the valley side, loose debris in huge quantities was dumped during the construction. Thus additional signs of creep movement were noticed at few other spots. Looking to the overall situation, the remedial measures at this site included one culvert with hume pipes followed by stone rip-rap to the main stream, gabion wall at the washed off section with cut-off drain at top and Jute netting in the central zone and Jute netting with grass plantation at the subsidence areas.

**D2 :** The site is located near to the International Guest House of the Institute. It is important to highlight that for construction of this building, the hill slope was levelled and to support the fill material, retaining wall (3 to 5 m high) on three sides was constructed. This was also required since a road is passing all along this retaining wall. This retaining wall has foundation on underneath mica-schist rocks with very thin soil cover. However, with time good plant cover has come up. With heavy rainfall of this year, small land slips occurred at this place and almost exposed the foundation of the retaining wall. To protect the foundation, it was decided to provide cement concrete sloping cover in the form of drain all along the retaining wall. It is perceived that this would essentially protect water from entering the foundation and underneath firm rocks so that the stability of wall is not reduced. All the water collected in this drain is then safely discharged to the nearby drain.

**D3 :** The excess flow from the Library block, Administrative block and surrounding areas is drained out by two culverts located on to the right side of the Administrative block. These outlets had been left untreated where the land slope below the outlets is around 45 degrees. This had resulted in severe soil erosion and gully formation at these locations. To stabilise these sites alternate structures have been used. At first site, a series of bamboo check dams have been constructed and in the central zone stone pitching has been done to form a wide rip rap drain. At the outflow section of the culvert, gabion mattress has been provided such that the vertical fall energy of the flow is dissipated. On the flanks of gully, Jute geo-grid has been laid for grass plantation. At the lower end, a collection chamber is made which drains the flow safely to the main drain below.

At the second location, at first gabion mattress is provided, as in the earlier case. Further below this, cement concrete blocks (0.5m deep and 0.3 m wide) were laid of dimensions 1.5 m x 1.5 m. The blocks were laid such that they coincided with the natural shape of the gully. These blocks were than pitched with river stone in zig-zag pattern such that the impact of flow could be partly absorbed by the obstructions, i.e., river stones. The side flanks of the gully were covered with Jute for grass plantation.

**D4 :** At the main entrance of the campus of GBPIHED at Katarmal, although road side soccer drain had been provided, it was not of sufficient dimensions to discharge all the incoming surface runoff safely. As a result,

the excess flow crossed the main road and was cutting the road at the lowest elevation point thereby causing danger to the main road itself first and the slope stability in long run. Considering the overall need, it was decided to strengthen the drainage network with required deepening and lining with cement concrete. For the collection of flow on the road, a drain covered with iron grill has been constructed.

### **Conclusions and Future Prospects**

Several small to medium sized hill slope instabilities in two villages (Joshiyana and Khoont) of Kumaun Himalaya have been stabilised adopting principles and practices of MRE, for the first time in Indian Himalayan Region (IHR).

The concept of MRE has been well adopted not only by the Institute but also by the villagers, apart from Planners and Administrators. Moreover, there is considerable scope and need to provide practical training to the persons engaged in control of land slope instabilities. Also, the concept of MRE needs to be propagated throughout the IHR through extensive dissemination of experiences gained and through extension of similar activities in other parts of IHR.

One of the major achievements of this work has been successful peoples' participation in the various activities. It also provided insight to appropriate approaches, to be adopted for taking up location specific problems of hill slope instabilities. The rate analysis norms developed and experienced could be of great help in similar future activities. Another important outcome of the work is identification of suitable bio-engineering treatments for the region along with suitable plants species and their functions in slope stabilisation.

In this series on *Hill Slope Instabilities and Role of Mountain Risk Engineering*, it is intended to provide details of implementing various treatments especially low cost, to create general awareness about the techniques and serve as guidelines for practising professionals engaged in stabilisation of hill slope instabilities.

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## NOTES ON THE VARIATION OF SCLEROTIAL STRUCTURE OF *SCLEROTINIA SCLEROTIUM* (LIB) DE BARY, INCITANT OF CABBAGE HEAD ROT

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*Sclerotinis sclerotiorum* is an ubiquitous organism infecting large number of crop plants in field and transit (3). The fungus produces profuse sclerotia in nature in the infected plant parts as well as on PDA *in vitro*. The sclerotia have a vital role in perpetuation of the fungus and in building up of inoculum potential at the time of infection in nature. Survey of literatures revealed that sclerotia of *S. sclerotiorum* varied from 2-11mm in various hosts (1, 2). However, morphometric variation of sclerotia of the fungus specifically of the cabbage isolate is lacking. In the present study, observation was made on characteristics of sclerotial structure of *S. sclerotiorum* causing head rot of cabbage.

Sclerotia were randomly collected from the damaged parts of infected cabbage plants grown in the commercial plots of the research farm, Gori, ICAR Research Complex for NEH region, Arunachal Pradesh centre, Basar. The fungus was isolated, purified and grown on PDA at  $20 \pm 1$  °C for 15 days to produce sclerotia. Data on sclerotial morphometric characters (both *in vivo* and *in vitro*) were recorded.

Observations on sclerotial morphology (Table 1) revealed that in nature on cabbage host the fungus produced mostly irregular, flat rectangular or short to long cylindrical sclerotia. Size of sclerotia varied from 4x2 mm - 25x10 mm with an average size of 9.6x3.7mm. Weight of sclerotia ranged the fungus produced mostly regular cylindrical sclerotia of 3.2x1.0 - 4.2x2.4mm size with an average of 3.64x1.2mm whose weight varied from 83 - 158 mg (average 85.3 mg). Population of sclerotia varied from 10-105 per plant in nature whereas 6-53 per inoculated petriplate *in vitro*. In both the cases sclerotia were black in colour at full mature stage.

**Table 1.** Characteristics of sclerotia of *S. sclerotiorum*.

Sl. No.	Character	On cabbage host in nature	On artificial culture at $20 \pm 1$ °C
1.	Sclerotial morphology	Irregular flat rectangular, short to long	Mostly regular short cylindrical
2.	Size	4x2mm - 25x10mm	3.2x1.0 - 4.2x2.4mm
3.	Average size	9.6 x 3.7mm	3.6 x 1.2mm
4.	Weight	26 - 255 mg	83 - 158 mg
5.	Average weight	89.6 mg	85.3 mg
6.	Sclerotial population	10 -105 per plant	6 - 53 per inoculated petridish of 10cm diameter
7.	Colour at maturity	Black	Black

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## ROLE OF CULTURE IN SUSTAINABLE LIVING AND FACTORS FOR ITS DISINTEGRATION

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### Abstract

This article discusses about influences of culture on resource use and management for sustainable living with the help of polyandry, a unique cultural practice found among the Jaunsaries, a tribal community in Central Himalayan region of India. The Jaunsaries, a scheduled tribe, inhabit in Jaunsar Bawar region of Dehradun district of state of Uttar Pradesh. The Jaunsaries, once famous for its polyandrous culture, now is monogamous and the practice of polyandry is fast disappearing. Through an empirical study, an attempt is made to find out the various characteristics of this practice, *i.e.*, polyandry. Why the people of Jaunsar Bawar practise this unique practice and why they have now. Started abandoning are some of the key issues that are dealt in this article. The article also discusses how developmental activities play a key role in changing the traditional cultural practices with the help of education, economic and infrastructure developmental activities.

### Introduction

Development is a continuous process. The economic growth is the prime attribute of development. However, the concerted confirmation to the monolithic economic growth has resulted in disparities and distorted progress. The search on indigenous development advocates the value added growth with a holistic approach integrating ecology, culture and integrative qualities of the society. In indigenous development, the society decides its own goal according to its condition and ensure sustained improvement for the well being or the quality of the life of its members.

In 1967 Lynn quoted that the more science and more technology are not going to help us out of the present ecological crises, until we find a new religion and respect our tradition. Culture stands for a total way of life which secures for an individual the satisfaction of his bio-psychic drives and fulfillment to other wants, ultimately endowing satisfaction. It is a framework for generating new ideas and changes to save a society from stagnation. This organic, practical and pragmatic nature of culture otherwise called the social engineering, is responsible for bringing civilization or development. Culture molds itself to significant external conditions to maximize the possibility of betterment of life.

The social economy of the Himalayan societies is manifestation of man's cultural interactions through various institutions with nature (Das, 1990; Samal *et al.*, 1993). These cultural institutions evolve strategies which make effective use of the resources through adaptation. In certain parts of the Himalaya, the practice of polyandry is the singular manifestation of value-attitude system inherent in the culture as a most suitable adaptation to sustain the community through checks and controls (Samal *et al.*, 1994). Polyandry, as a cultural institution is still found in various pockets in Indian Himalayas *i.e.*, Ladakh, Lahaul & Spiti, Kangra, Sirmour in Western Himalaya, Jaunsar Bawar in Central Himalaya and Siyang district in Eastern Himalaya.

Polyandry is a custom by which a woman is socially permitted to have more than one husband at the same time (Needham, 1971).

The Encyclopedia Britanica (1972) has put forth convincing criteria in identifying a polyandry society.

1. Children recognize more than one man as having the status of father,
2. A woman bears legitimate children to several different fathers in succession,
3. A legitimately married woman regularly cohabits with several man, none of whom rate as father to her children and
4. A single legitimate husband allows other man for sexual access to his wife

All the above definitions have generally focused on male perspectives ignoring how do females themselves perceive polyandry. In addition to this difficulty of a sound definition, the people particularly elite from cross cultural communities view polyandry as an ignominious practice, ignoring its characteristic as a marker of sustainability that enforces community stability and cohesiveness.

### The Study Area

The Jaunsar Bawar is situated in Chakrata tehsil of Dehradun district, which lies between 77°45' and 78°7'20" East to 30°31' and 31°3'3" North. The whole region consists of entirely of mountain tracts. It is most rugged hill tract with gorges. The region is encircled by the Tonns river on the west and Yamuna on the east and south. Geologically the Jaunsar Bawar region comes under two divisions, *i.e.*, Siwalik in the south and Lesser Himalaya (Outer and Inner) on the north (Valdiya,1980).

The altitude ranges lowest from 405 to 3071m. where temperate climate is found in higher elevations while lower river valleys of Tonns and Yamuna are quite hot. The average rainfall is about 175 cm. Coniferous forests are in the higher elevations and broad leave forests in the lower parts is common in the region

The total geographical area of region is 1002.07 km<sup>2</sup> constituting nearly 32.5 per cent of Dehradun district.

### Research Design

The study was carried out from the mid of 1994 to mid of 1996, stretching over a period of two years. Initially five villages from each block (Kalsi and Chakrata) were selected based on secondary information. Out of these ten villages, Matiyawa village was selected for detailed study which was near representative of all the villages.

Matiyawa village is one of the remote villages of Kalsi block. Primary survey was conducted through the help of a schedule and information were collected from every household. The head of the household and his absence, the senior most member of the household was interviewed. Preference was accorded to interview female respondents also. Observation was another tool used in primary survey. Secondary data was collected from Census of India, District Statistical Abstracts, office of Block Development and Revenue office.

The main objectives of this study is to find out how far the developmental activities are influencing the traditional cultural practices and the impact of development interventions on polyandry culture in different time period.

### Polyandry and Sustainable Development

The inhospitable geo-climate specificities like isolation in Jaunsar Bawar have apparently evolved polyandry as a suitable cultural institution to maximize the scarce resources available at their disposal for sustenance. An appropriate adaptation that kept up economic conditions in conformity with the prevailing ecological factors, it was made a cultural complex though sanctions of social codes and conducts (Samal, 1997). Through this cultural complex, division of labour is being channelized, social security to woman and children is being systematized and the unity of people and property of a family also remained secured. The positive aspects of Jaunsari polyandry are as following;

1. Polyandry culture always supports to low population growth.
2. Joint family could be sustained in limited resources because the family economy is controlled by the head the family. The distribution of money being equal results the less disputes within the family.
3. Old age security is accorded through prevalence of joint family structure.
4. Among Jaunsaries a woman does not become widow until the youngest brother is alive. To be more specific, the word widow does not exist for the Jaunsaries.
5. A Jaunsari women has equal right with her husband in policy and decision making system of the family, may it be big or trivial.
6. A girl has the right to select/chose her prospective husband and decide that should she marry him alone or remain his exclusive wife or be wife to his brothers also. In other words practice of polyandry depends on the willingness of women. Here, to find out the status of the polyandry practice at present, village Matiyawa has been selected for the study. Significant physio-cultural characteristic of the village is given in Table 1.

**Table 1.** Socio- Economic Status of Matiyawa Village

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<i>Physical Features</i>	
longitude/latitude	77°53'12"E/30°39'48"N

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Altitude (msl)	1000-1400
<b>Cultural Features (1991)</b>	
Number of Households	26.0
Total population	256.0
Population growth (1981-91)	4.9
Density of Population (per hectare)	1.1
Literacy rate(%)	25.4
Sex ratio [/1000 male]	741.0
Percentage of workers	47.3

Source, (i) Field Survey, (ii) N.I.C., Dehradun, UP, 1991.

### Factors for its Disintegration

Ecology, economy and culture are inseparable and rather supplement each other in sustainable living, particularly in traditional communities (Samal,1997). Undoubtedly, culture is always affected by the surrounding environment, to be specific, by infrastructure, economy, education, etc. The combination of these elements with physical environment makes a society or a region different from others. Through acculturation and being influenced by infrastructure, education and economic needs, the practice of polyandry has been fast disintegrating / disappearing among the Jaunsaries.

### Case Study

#### (I) Infrastructure Development

Infrastructure is one of the most important factor which has direct or indirect impacts on traditions, belief and customs. All the basic infrastructure facilities, *i.e.*, roads, educational institutions, communication, medical and health, etc. play an important role on changing the age old cultural practices of the area. It is clear from the study that when the infrastructure facilities were almost absent from the village in early fifties (Table 2), the polyandry system was found predominant( 63.6 per cent of the total married population). At that time, more than 94 per cent of the population was engaged in agricultural activities (Table 3).

**Table 2.** Temporal Development of Facilities

Available facilities	Before 1950	1995-96
Distance from the road	20 Km.	8 Km.
Primary School	Nil	1 (1960)
Junior Basic School	"	1 (1978)
Adult Education Centre	"	1 (1995)
Post Office	"	1 (1975)
Medical Facilities(Ayurvedic)	"	6 Km.
Electricity	"	-
P.D.S.	"	1 (1993)
Drinking Water Source	Natural	Tap water[1980]
Total literacy(1951-1991)(%)	5.6	25.4
Male literacy(%)	9.4	37.4
Female literacy(%)	Nil	9.2

Source, (i) Field Survey (ii) District Census Handbook, Dehradun,U.P.1951 & N.I.C. Dehradun.

#### (II) Educational Development

In early fifties the literacy was only 5.6 per cent. Due to lack of educational facilities, even to get primary education, the students had to cover 20 km. from the village. It seems that till 1960, this culture was preserved due to remoteness. The year 1960 established and gave a new avenues for this village, as the first primary school was opened and gave a new light to the villagers. After 1960 the area was connected with road and the walking distance was reduced from 20 km. to 8 km. from the road head (Makti pokhari). It is also observed that after the educational facility was available within the approachable distance not only the

males but also females started to educate.

**Table 3.** Changes in Culture and Economy

Time Span	Marriage Types			Occupation			
	Polyandry	Monogamy	Polygamy	Agriculture	Business	Professional	Service
Before 1945	63.6	36.4	-	94.9	-	5.1	-
1945 - 65	41.5	53.7	4.8	78.1	2.4	-	19.5
After 1965	-	100.0	-	13.3	-	-	86.7

Source : Primary Survey, 1996

### (III) Economic Development

Occupational positions are sometimes inherited through ascription in Indian perspective. But in recent past there has been some changes in these norms. Occupational structure and mobility are other indicators of changing values of the society. The socio-economic reforms are silently coming at village level. Education and migration played an important role for this transformation. Before 1945 as much as 94.9 per cent workers were engaged in primary activities, whereas the rest 5.1 per cent were engaged in other works. Due to education, employment in service sector increased to 19.5 per cent. After 1965 the maximum workers moved towards government services (defense, banks, post office, etc.) with 86.7 percent of total working population. The major change was mainly due to the declaration of the region as Scheduled Tribe area in 1967. Thus it is clear that both education and occupation directly affected their traditional cultural practice, *i.e.*, polyandry which is continuously changing. Polyandrous marriages are replaced by the monogamous marriages. It is due to the new linkages and interactions of villagers with outer world. It is striking to note that during last 30 years there is not a single person who adopted the traditional marriage system *i.e.*, polyandry in this village. It seems that this marriage system is almost disappearing from the village.

### Conclusion

The socio-economic advantages of polyandry among Jaunsaries can not be ignored. Until early sixties, when the area was not subject to development interventions, the system was totally satisfying. The system is disintegrating with changing thought patterns of people under development interventions. Developmental activities had played an important role to going away from the traditional cultural practices. Continuous population growth and their increasing demands compelled them to migrate outside. Thus, the migration have played a vital role for losing the traditional cultural practices. Education is an important means for human thinking.

### Acknowledgment

The authors are indebted to Dr L.M.S. Palni, Director, G.B. Pant Institute of Himalayan Environment and Development, Kosi, Almora, for providing basic facilities and thankful to Shastri Indo-Canadian Institute for financial help.

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### **Seminar on 50 Years of Himachal Horticulture**

*November 16-17, 1998*

The seminar on '50 year of Himachal Horticulture' has been jointly organised by the Department of Horticulture, Himachal Pradesh, Shimla and the Himalayan Agro Systems, Shimla with partial financial assistance from the National Horticulture Board, Government of India, to highlight where we were, where we are and where we intend to go.

It is hoped that the deliberations and interactions among scientists, horticultural officers, agricultural officers, growers, economists, planners and others will pave a way for evolving guidelines for boosting the production of quality horticultural produce in the State.

The seminar has been grouped into 6 technical sessions: Production Technology, Nursery Technology, Protection Technology, Processing Technology, Post-harvest Technology, and Futuristic Technology to discuss various activities of the horticulture industry of Himachal Pradesh. Apart from these, plenary session has also been included to chalk out guidelines for future planning of this industry.

### **Symposium on Plant Tissue Culture**

*June 7-9, 1999*

*National Symposium on Role of Plant Tissue Culture in Biodiversity Conservation and Economic Development* held at the head quarters of *G.B. Pant Institute of Himalayan Environment and Development, Almora*. The three days symposium was attended by large number of tissue culturists throughout the country and emphasised on 6 major themes:

1. Micropropagation and somatic embryogenesis
2. Growth, differentiation and production of secondary metabolites (including medicinal plants)
3. Tissue culture studies in medicinal plants
4. Genetic transformation & transgenics (including medicinal plants)
5. Cryopreservation, conservation strategies & crop improvement (including medicinal plants)
6. Synthetic seeds, hardening, acclimatisation and miscellaneous.

### *Summary of completed/ongoing projects*

## **AN APPROACH TO REJUVENATE THE WASTELANDS OF NORTH-WEST HIMALAYAS THROUGH DUALY (*RHIZOBIUM* + VAM) INOCULATED SEEDLINGS OF *ROBINIA PSEUDOACACIA***

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During the present investigation, soil from various wasteland sites of different districts of Himachal Pradesh were sampled and their chemical properties such as pH, EC, organic carbon, available N and P were studied in addition to VA-mycorrhizal spores population. In these soils, the growth performance of *Robinia* was also evaluated. Total of nineteen rhizobial isolates were developed from the nodules of *Robinia* raised in different wasteland soils and were screened alongwith the four isolates from nursery soils for *Robinia*. Further, impact of different VAM-fungi at varying levels of phosphorus were also evaluated on the growth of *Robinia*. The interaction effect between efficient rhizobial isolates and VAM-fungi was studied as a part of development of technology for manufacturing dually inoculated *i.e.* profusely nodulated and VAM colonized saplings of *Robinia*.

The wasteland soils of various districts of H.P. varied in their chemical characteristics. The pH of such soils was found acidic to alkaline in nature and electrical conductivity varied between 0.036 to 1.614 dsm<sup>-1</sup>. In majority of the wasteland soils sampled the organic carbon, available nitrogen and available phosphorus status was poor. In general, the wasteland sites studied were steep slopes, having eroded, shallow soils. The stoniness was prevalent in most of the soils. In majority of the soils the population of VA-mycorrhizal spores was higher than that of generally found in cultivated soils.

The performance of *Robinia* in these wasteland soils under glass-house conditions, was poor except in few soils. Overall the nodulation status was very poor suggesting the lack of sufficient population of specific rhizobia to form the nodules in the *Robinia*. For normal growth of *Robinia* or other species in these soils, it is necessary to modify the site in some way.

In contrast to chemical fertilizers, VA-mycorrhizal fungi and N<sub>2</sub>-fixing symbionts is a long term proposition for increasing/changing soil fertility as once it is introduced into the soil it will be self sustaining. Although, VAM-fungi and rhizobia are widely distributed, the adverse conditions prevailing at wasteland sites can adversely affect the population either reducing their number or eliminating the efficient strain altogether in which only the unproductive strains survive. Therefore, it is imperative to either conserve the indigenous VAM-population in degraded soils or develop the efficient, competitive inoculum of VAM and rhizobia to ensure the availability of adequate inoculum of the appropriate strain for supporting the growth of tree species. Effectiveness, competitiveness and persistence of introduced *Rhizobium* in soil is prerequisite for the success of any inoculation programme, especially in degraded/eroded soils.

During the present investigation, total 19 rhizobial isolates from wasteland soils and four efficient isolates from nursery soils were screened for *Robinia*. Majority of the rhizobial isolates significantly improved the plant growth in terms of nodulation status, biomass production and total nitrogen. Various rhizobial isolates varied in their efficacies in synthesizing the shoot and root biomass. From this it could be inferred that the selection of *Rhizobium* isolates for leguminous NFTs shall be made depending upon the situation and objective, whether more root/shoot biomass is required. The isolates efficient in synthesizing more root biomass could be exploited for the rejuvenation of wastelands.

Plants inoculated with mycorrhizal fungi produced higher root colonization at all levels of phosphorus than the uninoculated plants.

## **DEGRADED SOIL AND PLANT RESTORATION IN JHALUKBARI HILL SLOPES USING SWEET**

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*Department of Botany, Gauhati University, Guwahati (Assam)*

The present project site which is a hill slope was once covered by lush green forest cover. But due to over use and also abuse the soil now turn unproductive and fallen barren for the last many decades. The hill slope

of the site was covered by some very pernicious weed species only. The site therefore was first made suitable for tree sapling plantations. In the approsimatey two hectares of land 101 tree saplings were planted. The tree saplings belong to fuel wood, medicinal, oil, timber, rubber, fodder yielding plants and also plants of micellaneous uses. Various herbaceous plants were selected and allowed to grow on the soil surface to check soil erosion. The soil nutrients were studied before and at regular intervals of every four months after plantation. Within the three year period of the project the tree saplings grow to a maximum height of 8 meters (*Cassia siamea*, *Leucena leucocephala*). Other species also show very encouraging growth. The survival percentage of saplings were more than 95%. The growth (IVI) of associated herbaceous species in the planted as well as adjacent areas were also studied at regular intervals. People of the nearby localities visited the project site and were encouraged to start the same type of works in their localities. The porject works beyond doubt proved that the hill slopes of Jhalukbari hitherto left barran and unproductive can be turned into productive ones. The people of the near by areas already started collecting fodder and thatch grass from the project site.

*Selected Abstracts*

*Compiled by D.S. Negi, S.N. Nandy and S.K. Sinha*

*G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263 643, India*

**Ahmad, Farooq and Khajawall, M.H.** 1999. **Effects of harvest dates and post-harvest calcium chloride treatments on physico-chemical characteristics of pear CV. bartlett.** *Applied Biological Research*, 1(1): 43-46. Division of Pomology, S.K. University of Agricultural Sciences & Technology, Shalimar, Srinagar 191 121 (J&K); Department of Horticulture, Jammu & Kashmir Government, Lalmandi, Srinagar (J&K). [CALCIUM CHLORIDE; HARVEST DATES; PEAR; PHYSICO-CHEMICAL CHARACTERISTICS; POST-HARVEST TREATMENT]

A study was conducted to assess the effects of harvest dates and post-harvest CaCl<sub>2</sub> treatment on physico-chemical characteristics of pear cv. Bartlett. Rapid colour development, decline in firmness, less physiological loss in weight, higher organoleptic rating and more fruit spoilage were observed with delay in harvesting, especially 113 and 115 days after full bloom (DAFB). Comparatively, low acid content, higher TSS, total and reducing sugars and more calcium contents were observed in late-harvested fruits. The calcium chloride treatment delayed colouration, improved fruit firmness, organoleptic rating, TSS, sugar content and peel and flesh calcium content and reduced physiological weight loss, spoilage and acidity in fruits. Harvesting the pear fruits 105 or 107 DAFB and dipping them in 8-12% CaCl<sub>2</sub> proved most appropriate pre- and post-harvest treatment, respectively, to enhance the keeping quality of the fruit.

**Ahmed, N. and Tanki, M.I.** 1999. **Exploitation of residual heterosis for improvement of root yield in turnip (*Brassica rapa* L.).** *Applied Biological Research*, 1(1): 71-74. Division of Olericulture, S.K. University of Agricultural Sciences and Technology, Shalimar, Srinagar 191 121 (J&K). [BRASSICA RAPA L.; HETEROSIS; ROOT YIELD; TURNIP]

Heterosis over better parent for root yield was studied in F<sub>1</sub>, F<sub>2</sub> and F<sub>3</sub> generations. The crosses were developed involving nine diverse cultivars of turnip following diallel system without reciprocals. The results indicated presence of substantial amount of heterosis not only in F<sub>1</sub> (69.29%) but also in subsequent F<sub>2</sub> and F<sub>3</sub> generations, which was to an extent of 31.91 and 24.70%, respectively, suggesting that crosses (Pusa Chandrima x White Flat Round, Pusa Snow Ball x White Flat Round, Purple Top White Globe x Pusa Snow Ball and Pusa Chandrima x Pusa Swati) with significant residual heterosis could be utilized either in the synthesis of composites or directly as advance generations of single crosses. A method consisting of random selection of root in F<sub>2</sub> followed by their mating at random was also suggested to restore hybrid vigour in the later generations.

**Ahmed, N.; Tanki, M.I. and Nayeema, Jabeen** 1999. **Heterosis and combining ability studies in hot pepper (*Capsicum annum* L.).** *Applied Biological Research*, 1(1): 11-14. Division of Olericulture, S.K. University of Agricultural Sciences and Technology, Shalimar, Srinagar 191 121 (J&K). [CAPSICUM ANNUM L.; COMBINING ABILITY; DIALLEAL ANALYSIS; HETEROSIS; HOT PEPPER]

Six hot pepper cultivars namely Elephant Trunk, Pusa Jwala, Shalimar Long, SPE-1, Punjab Lal and G-4 were crossed in all possible combinations without reciprocals to study heterosis and combining ability. The highest heterosis over better parent for yield and earliness was observed in Shalimar Long x Punjab Lal, Elephant Trunk x Shalimar Long and Shalimar Long x SPE-1. Variances due to general combining ability (gca) and specific combining ability (sca) were significant indicating involvement of both additive and non-additive gene effects in the expression of all the characters. Shalimar Long and Elephant Trunk recorded high gca effects for most of the characters, while Punjab Lal, G-4 and Pusa Jwala exhibited high gca effects for fruit number. Estimates of sca effects showed Shalimar Long x Punjab Lal, Elephant Trunk x Shalimar Long, Elephant Trunk x Pusa Jwala and Shalimar Long x SPE-1 to be best cross combinations for yield as well as for earliness.

**Banerjee, Paramesh and Satyaprakash** 1999. **Using global positioning system for orthometric height**

**determination for gravity surveys in Ladakh Himalaya.** *Current Science*, 76(2): 243-246. Wadia Institute of Himalayan Geology, 33 Gen. Mahadeo Singh Road, Dehradun 248 001, India. [GPS; GRAVITY; LADAKH HIMALAYA; ORTHOMETRIC]

Though GPS can be used for precise 3-D positioning, the height thus measured in spheroidal which needs to be converted to the orthometric height for any practical use. This requires knowledge of the geoid undulation that can either be measured using GPS/levelling technique, or can be modelled from gravity data. We carried out extensive field measurements along a 100 km long transect in Ladakh Himalaya to study the viability of using the GPS for orthometric height determinations required for gravity surveys. Geoid of the study area was also predicted using global gravity models, e.g. OSU91 and EGM96. It is seen that even on high and difficult terrain like that of the Himalaya, GPS can be used for orthometric height determination with an absolute accuracy of 1-2 m.

**Chachra, Sushmita Paul and Bhasin, M.K.** 1998. **Anthropo-Demographic study among the caste and tribal groups of central Himalayas: 1. Population structure.** *J. Hum. Ecol.*, 9(5): 405-416. Department of Anthropology, University of Delhi, Delhi 110 007, India. [AGE COMPOSITION; BHOTIAS; CASTE GROUPS; DEPENDENCY RATIOS; INDEX OF AGING; POPULATION COMPOSITION; SEX RATIO]

This study presents the population structure of the caste groups of Kumaun and Bhotia tribal groups of Kumaun-Garhwal Himalayas or the central Himalayas. The three districts covered are Almora, Pithoragarh and Chamoli. The Bhotias traditionally have been transhumants migrating to lower altitudes in the winter and to high altitudes in the summer, though they are gradually settling down. The sex ratio, age composition of these populations give a picture of the structure/demographic pattern prevalent in the hill region of Uttar Pradesh.

**Chalapathy, M.V.; Bidyapati, L.; Singh, N.Ibohal and Prasad, B.** 1998. **New records of two *Brachymeria* species (Hymenoptera: Chalcididae) Hyperparasitizing tachinid parasitoids of *Antheraea proylei* Jolly (Lepidoptera: Saturniidae) from north-eastern parts of India.** *J. ent. Res.*, 22(3): 291-292. Regional Tasar Research Station, Imphal 795 002, Manipur, India. [ANTHERAEA PROYLEI; BLEPHARIPA ZEBINA; HYPERPARASITIZING; SILKWORM]

*Antheraea proylei* Jolly is an endemic species of oak tasar silkworm. It is parasitized by two species of tachinid flies, *Exorista sorbillans* and *Blepharipa zebina*, causing heavy crop loss every season. Two species of hyperparasitoides, viz., *Brachymeria lugibris* and *B. alternipes* were recorded to hyperparasitize these uziflies from the north-eastern parts of India. They seem to be potential agents in the biocontrol of uziflies.

**Chalapathy, M.V.; Singh, N. Ibohal and Prasad, B.** 1998. **New record of pupal parasitoid *Perilampus nesioties* Crawford from a tachinid parasite of *Antheraea proylei* (Jolly) (Lepidoptera: Saturniidae) from Manipur.** *Entomon*, 23(4): 339-339. Regional Tasar Research Station, Mantripukhri, Imphal 795002, India; Department of Life Science, Manipur University, Imphal 795003, India. [ANTHERAEA PROYLEI; BLEPHARIPA ZEBINA; PERILAMPUS NESIOTES; PUPAL PARASITOID]

*Perilampus nesioties* Crawford, a pupal parasitoid on *Blepharipa zebina* (Walker), a tachinid fly infesting oak tasar silkworm, *Antheraea proylei* in Manipur is reported for the first time.

**Dar, G.M.** 1999. **Carbon and nitrogen nutrition of *Cladobotryum dendroides*, the causal fungus of cobweb disease of cultivated mushroom (*Agaricus bisporus*).** *Applied Biological Research*, 1(1): 57-61. Dept. of Plant Pathology, Himachal Pradesh Krishi Vishwa Vidyalya, Nouni-Solan (H.P.); Present address: Division of Plant Pathology, S.K. University of Agricultural Sciences and Technology, Shalimar, Srinagar 191 121 (J&K). [AGARICUS BISPORUS; CARBON AND NITROGEN NUTRITION; CLADOBOTRYUM DENDROIDES; COBWEB DISEASE; CULTIVATED MUSHROOM]

The fungus *Cladobotryum dendroides* (Bull. per Merat) W. Gamz and Hoozem, incitant of cobweb disease, was isolated from the naturally infected carpophores of *Agaricus bisporus* (Lange) Singh. mushroom. Among different sources of carbon, maltose followed by glucose proved best for growth and sporulation of the isolate. Among nitrogen sources, peptone followed by asparagine proved significantly

superior to other sources. When different concentration combinations of glucose and asparagine were tested, the fungus recorded maximum growth and sporulation in the medium containing 50g glucose L<sup>-1</sup> and 4g asparagine L<sup>-1</sup>. C:N ratio of 50:1 proved optimum for better growth and excellent sporulation. Fungal growth in most of the treatments resulted in a remarkable change in pH of the medium at the end of incubation period.

**Devi, Nirmala; Sengupta, Sarthak and Ghosh, A.K.** 1998. **Opportunity of selection in the Kheza of Phek district, Nagaland.** *J. Hum. Ecol.*, 9(5): 515-516. Department of Anthropology, North Eastern Hill University, Shillong 793 014, Meghalaya, India. [FERTILITY; FOETAL LOSS; KHEZA; MORTALITY; NAGALAND; SELECTION INTENSITY]

The index of total opportunity for selection with its components, fertility and mortality, has been reported for the Kheza of Phek district, Nagaland. The present data have also been compared with other populations of North East India.

**Dhakal, Amod Sagar; Amada, Takaaki and Aniya, Masamu** 1999. **Landslide hazard mapping and the application of GIS in the Kulekhani watershed, Nepal.** *Mountain Research and Development*, 19(1): 3-16. Graduate School of Agricultural Sciences, University of Tsukuba, Tennodai 1-1-1, Tsukuba, Ibaraki 305-8572, Japan; Institute of Agricultural Forest Engineering, University of Tsukuba, Tennodai 1-1-1, Tsukuba, Ibaraki, 305-8572, Japan; Institute of Geoscience, University of Tsukuba, Tennodai 1-1-1, Tsukuba, Ibaraki 305-8571, Japan. [DRAINAGE; LANDSLIDE HAZARD; WATERSHED]

A study is presented of the application of GIS of landslide hazard mapping. Two methods of statistical analysis are employed: the failure rate (FR) and quantification scaling type II (Q-S II). The study area is the Kulekhani watershed (124 km<sup>2</sup>), located in central Nepal. A map showing the distribution of landslides was produced from air photograph interpretation and field checking. This was used to analyze the important terrain factors influencing landslide initiation. The factors employed were slope gradient, slope aspect, elevation, geology, land-use/cover, proximity to fault lines, and drainage density. Each factor was divided into several classes. The influencing factors were first determined from the FR analysis and were then considered for the Q-S II analysis. Also, two of the influencing factors were overlaid in turn to produce combined factor layers (consisting of combined classes). This was used as the basis for another FR analysis. Geology was found to be the most important factor influencing landslide activity. Other important factors were elevation and land use/cover. Based on the results of the three analyses, three hazard maps were produced each with four levels of hazard classes: high; moderate; less; and least. The area occupied by the different hazard classes do not show substantial variation from map to map. In general, about four percent of the study area fell into the "high hazard class." The "moderate", "less", and "least" hazard classes occupied about a quarter, a half, and a fifth of the total study area, respectively.

**Dhar, U. and Upreti, J.** 1999. ***In vitro* regeneration of a mature leguminous liana (*Bauhinia vahlii* Wight & Arnott).** *Plant Cell Reports*, 18: 664-669. G.B. Pant Institute of Himalayan Environment & Development, Kosi-Katarmal, Almora 263 643, U.P., India. [BAUHINIA VALII; BROWNING; MATURE EXPLANT; MICROPROPAGATION; MULTIPURPOSE]

An *in vitro* propagation protocol has been developed from mature lianas of *Bauhinia vahlii*. Browning was the major obstacle in the establishment of cultures. Explants collected during the growing season (April-June) showed maximum browning; however, browning was minimal during the dormant phase. This problem was circumvented by soaking the sterilized explants in a solution of antioxidant (50 mg l<sup>-1</sup> ascorbic acid+75 mg l<sup>-1</sup> citric acid). The explants were thereafter transferred to culture room conditions after an initial incubation in the dark at 4 °C for 48 h. Shoot proliferation (58%), shoot number (4.5) and shoot length (35 mm) was best in Murashige and Skoog (MS) medium supplemented with 2.5 µM kinetin + 100 mg l<sup>-1</sup> adenine sulfate. Seasonal fluctuations significantly affected the proliferation potential of the explants. March-April was found to be the best season for shoot initiation. Microshoots were rooted on a half-strength, growth regulator-free, agar-gelled Murashige and Skoog medium after a dip in half-strength MS liquid medium containing 1-naphthaleneacetic acid+Indole-3-butyric acid (10 µM). Rooted plantlets were potted and acclimatized under culture room conditions for 4 weeks before transfer to a polyhouse.

**Dhar, Uppendra; Rawal, R.S.; Samant, S.S.; Airi, S. and Upreti, J.** 1999. **People's participation in Himalayan biodiversity conservation: A practical approach.** *Current Science*, 76(1): 36-40. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263 643, India. [BIODIVERSITY; CONSERVATION]

In the Himalaya, the existing attempts to conserve biodiversity are inadequate and therefore innovative changes in policies and programmes are called for so as to focus greater attention on people's participation. Harnessing people's creativity and energies through participatory programmes will go a long way in furthering the cause of conservation. Recognizing the importance of this approach, G.B. Pant Institute of Himalayan Environment and Development (Conservation of Biological Diversity Core Group) initiated a programme in 1995 focusing on school/college students and teachers. The programme envisages to involve and seek public support at different levels starting from the identification of area-specific issues to development and dissemination of conservation packages. The concept and achievements of the programme are detailed in the paper.

**Farooq, S. and Pathak, G.K.** 1998. **A Comparative study of Asava/Aarishta and total solvent extract of some medicinal plants.** *Journal of Non-Timber Forest Products*, 5(1/2): 47-49. Chemistry Department, D.A.V. (P.G.) College, Dehradun, U.P., India. [BACTERIA; BIOMASS; MEDICINAL PLANT]

The present studies reveal that in the old conventional methods of Asava and Aarishta, the poor extractability of plant material manifest due to diverse factors and their non-sterility results in the curtailment of their therapeutic effects. The use of appropriate organic solvents ensure antimicrobial activity and complete sterility.

**Ganai, M.R.; Mir, G.A.; Talib, A.R. and Bhat, A.R.** 1999. **Depth-wise distribution of available micronutrients in soils growing almonds in Kashmir Valley.** *Applied Biological Research*, 1(1): 19-23. Division of Soil Sciences, S.K. University of Agricultural Sciences and Technology, Shalimar, Srinagar 191 121 (J&K); Department of Horticulture, J&K Government, Srinagar, Kashmir; Division of Pomology, SKUAST, Shalimar, Srinagar Kashmir 191 121. [MICRONUTRIENTS; ORCHARD SOIL; PHYSICO-CHEMICAL PROPERTIES; SOIL PROFILE]

Depth-wise distribution of DTPA-extractable micronutrients viz. Zn, Cu, Mn and Fe was studied in almond growing soils of Kashmir valley. The texture of these soils ranged between clay-loam to silty clay-loam. The DTPA-extractable Zn was low to medium whereas Cu, Mn and Fe were adequate. The available Zn, Cu, Mn and Fe contents decreased with increase in soil depth. In surface soils, the available Zn, Cu, Mn and Fe were negatively correlated with soil pH and CaCO<sub>3</sub> content and positively correlated with organic carbon and clay. In sub-surface soils, available Zn, Mn and Fe were negatively correlated with soil pH and CaCO<sub>3</sub> content and positively correlated with organic carbon.

**Ghosh, M.K.; Srivastava, R.C. and Prasad, B.** 1998. **Impact of protein and fibre constituents of food leaves on larval weight of oak tasar silkworm *Antheraea proylei* J. (Saturniidae: Lepidoptera).** *Uttar Pradesh J. Zool.*, 18(1): 5-8. Regional Tasar Research Station, Imphal 795 002, India; Life Science Department, Tripura University, Agartala 795 004, India; Life Science Department, Manipur University, Imphal 895 003, India. [ANTHERAEA PROYLEI; CRUDE FIBRE; QUERCUS SERRATA; SILKWORM]

The multiple correlation and Beta coefficient of fifth instar larval dry weight of *Antheraea proylei* with crude protein and crude fibre constituents of *Quercus serrata* leaves have been studied. Positive and significant impact of protein and significantly negative effect of crude fibre components have been found on the larval body weight of this silkworm.

**Goel, C.L.** 1998. **Characteristics and fatty acid composition of *Taxus baccata* linn. seed oil.** *Journal of Non-Timber Forest Products*, 5(1/2): 70-72. Indian Council of Forestry Research & Education, (Forest Research Institute), New Forest, Dehradun 248 006. [CANCER; FATTY ACID; OILSEEDS; TAXOL]

Seeds of *Taxus baccata* are fairly good in kernel percentage and the oil content is quite high (69.93%). This species, therefore holds tremendous scope for commercial exploitation and to increase the production of

oil from tree borne oilseeds. The oil is found to be quite rich in oleic, linoleic and linolenic acids. Linoleic and linolenic acids are nutritionally essential fatty acids. Therefore, the oil may be a potential source for edible uses, provided toxicological investigations also support it. However, detailed pharmacological investigations are desirable. The species is well known all the world for its 'taxol' contents which is used for the cure of cancer. However, the seeds of this species are not being used at the present for any specific purpose and hence hold good future prospects for multipurpose utilization.

**Gulam-ud-din; Arunachilla, A.S. and Tanki, M.I.** 1999. **Diallel analysis of some economic traits in egg plant.** *Applied Biological Research*, 1(1): 83-84. Division of Olericulture, S.K. University of Agricultural Sciences and Technology, Shalimar, Srinagar 191 121 (J&K). [DIALLEL ANALYSIS; EGG PLANT; GENE ACTION; *SOLANUM MELONGENA* L.]

Eight inbred lines of egg plant viz. IIHR-54, CO-2, Dilruba, Jamuni Gola, Arka Shirish, Pusa Purple Long, Pusa Purple Cluster and IIHR-12 were crossed in a diallel mating system without reciprocals. The over-dominance was observed for days to 50% flowering, number of fruits plant<sup>-1</sup>, total fruit yield plant<sup>-1</sup> and dry matter content and partial dominance was observed only for average fruit weight. The spreading pattern of array points along and around regression line suggested large genetic variability among the parents for almost all the traits.

**Gupta, Radhna and Kalia, Manoranjan** 1998. **Food habits and dietary pattern of expectant mothers in the Palampur sub-division of Himachal Pradesh.** *J. Hum. Ecol.*, 9(2): 163-170. Department of Food Science and Nutrition, Himachal Pradesh Agricultural University, Palampur, 176 062, H.P., India. [EXPECTANT MOTHERS; FOOD HABITS; FOOD INTAKE; NUTRIENT INTAKE]

The experimental subjects formed thirty healthy pregnant women (20-30 year age) from each trimester of pregnancy (total 90). The data were collected through a pre-structured respondent questionnaire. Information regarding general information, food habits, food consumption pattern, mean daily food intake, and mean daily nutrient intake was gathered. Majority of expectant mothers were housewives belonging to rural areas and having low socio-economic status. The findings of the study revealed that there was not much a difference in the food and nutrient intake from the normal routine. The mothers nourished their babies on their own body stores only without much input from outside. Considering the fact that most pregnant mothers are not aware of the nutritional needs, nutrition education during antenatal visits should be considered as an important activity in providing antenatal care.

**Hemam, Natabar Shyam and Reddy, B. Mohan** 1998. **The changing forest management and utilisation patterns in Manipur: A historical analysis.** *J. Hum. Ecol.*, 9(6): 529-544. Anthropology and Human Genetics Unit, Indian Statistical Institute, Calcutta 700 035, West Bengal, India. [FOREST MANAGEMENT; KUKIS; MANIPUR; MEITEIS; NAGAS; RESOURCE]

The problem of rapidly dwindling forest resources is one of the most contentious issues of recent times. The negative effect of deforestation is well perceived, but there is little convergence of opinions on the possible causes that varies in time and space. Although there have been studies on the historical process of deforestation in India, little information is available from the North-eastern states of India. The present paper examines the historical process of changes in forest management and utilisation patterns *vis-a-vis* changes in socio-political, population, subsistence system, infrastructure, *etc.* in Manipur, one of the North-eastern states of India.

**Jabeen, Nayeema; Ahmad, N. and Tanki, M.I.** 1999. **Genetic variability in hot pepper (*Capsicum annum* L.).** *Applied Biological Research*, 1(1): 87-89. Division of Olericulture, S.K. University of Agricultural Sciences and Technology, Shalimar, Srinagar 191 121 (J&K). [*CAPSICUM ANNUM* L.; GENETIC ADVANCE; HERITABILITY; HOT PEPPER; VARIABILITY]

Genetic variability, heritability and genetic advance were studied in 71 hot pepper lines during *Kharif*, 1993. Significant differences were observed for all the characters studied. Both phenotypic and genotypic coefficients of variation, in general, were high for fruit yield plant<sup>-1</sup>, fruit number plant<sup>-1</sup>, seed number fruit<sup>-1</sup>, pericarp thickness and average fruit weight. Heritability in broad sense was high for all the characters. High

heritability associated with greater genetic advance was observed for fruit yield plant<sup>-1</sup>, fruit number plant<sup>-1</sup>, seed number fruit<sup>-1</sup>, pericarp thickness and average fruit weight. The study revealed that these characters have fixable additive gene effects and, therefore, are more reliable for making effective selection.

**Jana, S.K. and Chauhan, A.S.** 1998. **Wild edible plants of Sikkim Himalaya.** *Journal of Non-Timber Forest Products*, 5(1/2): 20-28. Botanical Survey of India, Sikkim Himalayan Circle, Gangtok 737 103, India. [GERMPLASM; HIMALAYAS; WILD EDIBLE PLANT]

In the present communication, the information on 45 less known edible plants of Sikkim Himalaya used by the different local tribal inhabitants has been provided.

**Jhon, A.Q. and Paul, T.M.** 1999. **Response of *Chrysanthemum morifolium* ramat to different levels of nitrogen and phosphorus.** *Applied Biological Research*, 1(1): 35-38. Division of Floriculture, Medicinal and Aromatic Plants, S.K. University of Agricultural Sciences & Technology, Shalimar, Srinagar 191 121 (J&K). [CHRYSANTHEMUM; FLORAL CHARACTERS; NUTRITION; VEGETATIVE GROWTH]

A 3 year field study with five levels of nitrogen (0, 10, 20, 30 and 40 g m<sup>-2</sup>) and four levels of phosphorus (0, 10, 20, and 30 g m<sup>-2</sup>) on a silty loam soil was conducted in chrysanthemum cv. Flirt at SKUAST, Shalimar campus from 1991 to 1993. The pooled results indicated that the application of N and P<sub>2</sub>O<sub>5</sub> significantly improved the vegetative growth and influenced floral characters as compared to control. At 10 g level of both elements the results were statistically at par with higher levels, hence 10 g dose each of N and P<sub>2</sub>O<sub>5</sub> m<sup>-2</sup> is recommended for optimum production during planting year of crop under Kashmir condition.

**Kamili, Afifa S.; Masoodi, M.Amin and Zargar, G.H.** 1999. **Genetic analysis of some quantitative traits in bivoltine silkworm (*Bombyx mori* L.) population: detection of components of inter-allelic gene action.** *Applied Biological Research*, 1(1): 79-82. Division of Sericulture, S.K. University of Agricultural Sciences and Technology, Mirgund, Baramulla (J&K); Directorate of Research, S.K.U.A.S.T., Shalimar, Srinagar 191 121 (J&K); Division of Plant Breeding and Genetics, S.K.U.A.S.T., Shalimar, Srinagar 191 121 (J&K). [BOMBYX MORI; EPISTASIS; TRIPLE TEST CROSS]

In a triple test cross of bivoltine silkworm (*Bombyx mori* L.) the inter-allelic gene action was found important for most of the economic attributes under study. Partitioning of total inter-allelic interaction revealed that most of the economic traits exhibited additive x additive type gene action in both (temperate and sub-tropical) environments. The traits showing high additive gene action together with *i*-type epistasis are expected to have high fitness during aggregation and provide ample chances of getting elite new races.

**Khongsdier, R. and Basu, D.** 1998. **A study of food and nutrient intakes among the dimasa of north Cachar hills.** *J. Hum. Ecol.*, 9(6): 603-607. Department of Anthropology, North-Eastern Hill University, Mayurbhanj Complex, Nongthymmai, Shillong 793 014, Meghalaya, India; Anthropological Survey of India, North East Regional Centre, Upper Lachumiere, Shillong 793 001, Meghalaya, India. [DIMASA; HOMEOSTASIS; NUTRITIONAL STATUS]

This paper attempts to describe the food and nutrient intakes among the Dimasa of North Cachar hills in Assam. The findings indicate that the over-all dietary intake among the Dimasa is more or less according to the recommended allowances given by the Indian council of medical research, though the consumption of nutrients like iron, carotene and vitamin B<sub>2</sub> is far below the recommended requirement. The problems concerning the practical method for measuring under nutrition in a population were pointed out, taking into consideration the use of recommended allowance, for any given nutrient, as a cut-off point and the hypothesis of homeostatic variation in dietary requirements.

**Kotal, Murali** 1998. **PTC taste sensitivity and colour blindness in Banai of Garo hills, Meghalaya.** *J. Hum. Ecol.*, 9(3): 291-291. Anthropological Survey of India, North East Regional Centre, Shillong 793 001, Meghalaya, India. [BANAI; DEFECTIVE COLOUR VISION; MEGHALAYA; TASTE SENSITIVITY; VARIATION]

Data are presented on the PTC taste sensitivity and colour blindness in Banai a small endogamous population of Meghalaya. The results indicate significant variation in the distribution of these genetic markers

when compared with the neighbouring population groups.

**Kumar, Dinesh; Khattri, K.N.; Teotia, S.S. and Rai, S.S.** 1999. **Modelling of accelerograms of two Himalayan earthquakes using a novel semi-empirical method and estimation of accelerogram for a hypothetical great earthquake in the Himalaya.** *Current Science*, 76(6): 819-830. Department of Earth Sciences, Kurukshetra University, Kurukshetra 136 119, India; 100 Rajindra Nagar, Kaulagarh Road, Dehradun, 248 001, U.P., India; National Geophysical Research Institute, Uppal Road, Hyderabad 500 007, India. [ACCELEROGRAMS; EARTHQUAKE; HIMALAYAS; HYPOTHETICAL; SEMI-EMPIRICAL]

This paper presents a fast semi-empirical method for calculating synthetic accelerograms for a wide range of earthquake magnitudes. The fidelity of this method is demonstrated by successful modelling of the observed accelerograms of the 1986 Dharmasala ( $M_s$ 5.3) and the 1991 Uttarkashi ( $M_s$ 7) earthquakes at relatively shorter distances. At larger distances, the synthetic accelerograms tend to over-estimate the ground motions. The method has also been tested for a hypothetical great earthquake ( $M_w$  8.5) by comparing the synthetic accelerogram with that obtained using the more sophisticated composite source model. The method has applications where seismic hazard needs to be estimated and empirical data sets including accelerograms, velocity- $Q$  models and earthquake focal mechanisms are sparse or not available at all. It will also be useful in obtaining uniform probability response spectra for such regions.

**Laha, Rama Chandra** 1998. **Edible forest vegetables of Kolasib forest division in Mizoram.** *Journal of Non-Timber Forest Products*, 5(3/4): 173-175. Lecturer & Head, Department of Botany, Govt. Kolasib College, Kolasib, Mizoram 796 081, India. [EDIBLE FOREST; MIZORAM; VEGETABLE]

The present study elucidates the knowledge of the local ethnic groups of Mizoram on wild forest plants and their contribution to the local diet. These are 27 such species which are consumed by these ethnic groups in various forms.

**Manibabu, Mayanglambam** 1998. **Colour blindness among the Maring Nagas of Manipur.** *J. Hum. Ecol.*, 9(2): 199-200. Department of Anthropology, Oriental College, Imphal 795 001, Manipur, India. [COLOUR BLINDNESS; HILL REGION; MARING TRIBE; NORTH-EAST]

Data on the sex-linked colour vision deficiency are presented for 202 Maring males of Manipur and the results of the region show a total number of defective colour vision persons of 1.98%.

**Marston, R.A.; Miller, M.M. and Devkota, L.P.** 1998. **Geocology and mass movement in the Manaslu-Ganesh and Langtang-Jugal Himals, Nepal.** *Geomorphology*, 26(1-3): 139-150. University of Wyoming, Laramie, WY 82071, USA; Foundation for Glacier and Environmental Research and University of Idaho, Moscow, ID 83843, USA; Central Department of Meteorology, P.O. Box 127, Lalitpur, Nepal. [GEOECOLOGY; MAIN CENTRAL THRUST; MASS MOVEMENT; NEPAL]

This study describes and explains the spatial distribution of mass movement in the central Nepal Himalaya. Judgments were formulated on the origin and rates of mass movement using field evidence, topographic maps, geologic maps, and SPOT imagery. Mass movement scars were mapped in the field during a 240-km traverse of the Langtang-Jugal Himal and a 300-km traverse of the Manaslu-Ganesh Himal. Chi-square analyses revealed that the frequency of slope failures varies with slope aspect, and position above/below the Main Central Thrust (MCT). Human disturbance did not account for a statistically significant increase in mass movement, except in sites occupied by mid-slope roads and where excessively steep slopes, marginal for agriculture or grazing, have been deforested.

**Masoodi, N.A.** 1999. **Influence of altitude, aspect and growth season on leaf traits of *Coriaria nepalensis*.** *Applied Biological Research*, 1(1): 53-56. Section of Forestry, Faculty of Agriculture, S.K. University of Agricultural Sciences and Technology, Wadoora, Sopore 193 201 (J&K). [ALTITUDE; CORARIA NEPALENSIS; GROWTH SEASON; LEAF LIFE SPAN; NUTRIENT CONTENT; SPECIFIC LEAF AREA]

Leaf traits of *Coriaria nepalensis* were compared at three elevations viz. 1200, 1600 and 2000 m asl on two aspects, north and south, of Massourie hills. Site at higher elevation and in northern aspects had restricted

length of growth season, shorter leaf life span and higher leaf nutrient contents than those at lower elevations or on southern aspect. Specific leaf area and nutrient contents decreased significantly among the sites. Production of short-lived leaves with high nutrient contents was considered adaptive under the conditions of short growing season. As the leaves matured, the concentration of N, P and K in leaves decreased in June in comparison to March. The leaf nutrients showed increase in September and finally declined markedly during leaf senescence (i.e. December). The Ca and Mg contents showed progressive increase with increase in life span of leaves.

**Mir, M.A.; Mir, N.M.; Bhat, A.R. and Naik, H.R.** 1999. **Effects of harvest dates and canopy location on the quality of sweet cherries CV misri (Bigarreau noir grossa).** *Applied Biological Research*, 1(1): 39-41. Division of Post Harvest Technology, S.K.U.A.S.T., Shalimar, Srinagar 191 121 (J&K); Division of Pomology, SKUAST, Shalimar, Srinagar, Kashmir 191 121. [CANOPY LOCATION; FRUIT CHARACTERISTICS; MATURITY INDICIES; QUALITY; SWEET CHERRIES]

A study on the effects of harvest dates and canopy location on the physico-chemical quality attributes of sweet cherry cv. Misri revealed that the fruit position influenced the dates of maturation as indicated by size, weight, TSS and TSS:acid ratio. Fruits from interior of the tree were found to be less mature than from exterior or top. For better organoleptic traits, it is desirable to harvest Misri cherries from 72 to 75 days after full bloom.

**Negi, K.S.; Muneem, K.C. and Pant, V.K.** 1998. **Status of medicinal and aromatic plants in Ex-situ field gene bank of U.P. Himalaya.** *Journal of Non-Timber Forest Products*, 5(3/4): 85-95. National Bureau of Plant Genetic Resources, Regional Station-Bhowali 263 132, Niglat, District Nainital, U.P. [FARM YARD MANURE; HERBAL PLANT; SEED GERMINATION]

This report enumerates in brief the status of medicinal and aromatic plant genetic resources introduced, established and maintained in the field gene bank of Regional Station, Bhowali since 1986. A total number of 239 accessions comprising of 190 species belonging to 105 genera in 36 families has been conserved *ex-situ*. The dominant genera of medicinal and aromatic plant wealth are *Achillea* (11), *Calendula* (05), *Datura* (06), *Hypericum* (05), *Matricaria* (03), *Mentha* (04), *Papaver* (04), *Pelargonium* (05), *Plantago* (12), *Salvia* (11), *Solanum* (05). This paper also highlights the importance come promising and potential medicinal and aromatic plants and efforts made to popularize them.

**Owen, Lewis A. and England, John** 1998. **Observations on rock glaciers in the Himalayas and Karakoram mountains of northern Pakistan and India.** *Geomorphology*, 26(1-3): 199-213. Department of Earth sciences, University of California, Riverside, CA 92521-0423, USA; Department of Earth and Atmospheric Sciences, 126 Earth Sciences Building, University of Alberta, Edmonton, Canada T6G 2E3. [HIMALAYAS; KARAKORAM MOUNTAINS; ROCK GLACIERS]

Rock glaciers are abundant in the Lahul and Garhwal Himalayas of northern India and the Karakoram mountains of northern Pakistan. They exhibit morainic and protalus forms and are restricted altitudinally and climatically to sites above approximately 4000 m asl. and regions where annual precipitation is less than 1000 mm. In these areas, morainic rock glaciers are large, usually >1 km long, >100m wide and >15m thick. They are advancing over recent fluvial terraces and modern floodplains. The morainic rock glaciers record the advance of ice-cored moraines following retreat of glaciers, likely since the Little Ice Age. These rock glaciers form a major component of the landscape and are important conveyors of debris down valley under the influence of gravity.

**Owen, Lewis A. and Sharma, Milap C.** 1998. **Rates and magnitudes of paraglacial fan formation in the Garhwal Himalaya: implications for landscape evolution.** *Geomorphology*, 26(1-3): 171-184. Department of Earth Sciences, University of California, Riverside, CA 92521 0423, USA; Department of Geography, Government College, Kullu, Himachal Pradesh, 175101, India. [DEBRIS FLOWS; GARHWAL HIMALAYA; GLACIATION; PARAGLACIAL FAN; QUATERNARY; RESEDIMENTATION]

The development of paraglacial fans, studied in the upper Bhagirathi valley, Garhwal Himalaya, northern India, relates to the retreat of the Gangotri Glacier over the last 200 years. These fans demonstrate the speed by which mass movement and fluvial processes may lead to the modification and readjustment of the

Himalayan landscapes during deglaciation. The paraglacial fans in this region grew within approximately 100 year of deglaciation, and there after were modified by small debris flows and entrenched by fluvial incision. On the basis of the preservation of moraines which were deposited during the Last Glacial, total re sedimentation of glacial sediments by mass movement and fluvial processes is estimated to occur over approximately 100,000 years in this region. A knowledge of the magnitude and frequency of development of paraglacial fans is essential for hazard mitigation and management in Himalayan environments where glaciers are presently retreating and are likely to retreat in the near future if global warming occurs.

**Parhar, Keerti and Biswas, Sas** 1998. **Medicinal plant resources of Doon Valley and adjacent Siwaliks - I.** *Journal of Non-Timber Forest Products*, 5(1/2): 29-33. JRF, University Grant Commission; Scientist - SE, Botany Division, Forest Research Institute, Dehradun 248 006, India. [AGRO-CLIMATIC; MEDICINAL PLANT; OVER-EXPLOITATION]

The present paper records 50 plants of medicinal value from Doon Valley and adjacent Siwaliks. They have been arranged alphabetically with their vernacular names if any, places of occurrence, flowering and fruiting period, uses. Several of the plant species are likely to go under the category of threatened plants due to over-exploitation and habitat destruction if timely measures are not taken to conserve them.

**Pavate, P.P.** 1999. **Tangsa - A hill dwelling people of Arunachal Pradesh.** *J. Hum. Ecol.*, 10(2): 157-158. Department of Anthropology, Karnatak University, Dharwad 580 003, Karnataka, India. [APONG; DONY-POLO; KACHCHU; TANGSA]

This paper is the result of my stay with the Tangsa of Arunachal Pradesh. This 'land of sunrise' is located in North Eastern India. Arunachal Pradesh is predominantly inhabited by twenty six major groups belonging to the Indo-Mangoloid stock. Etymologically Tangsa means the 'people living on hills'. They inhabit mainly six villages of Changlang district namely, Kharsang, Miao, Chingsa, Lonkey and Kultom. 'Tangsa' have settled in the forest land around the Kharsang and established their Basties (Settlements). They construct their houses on a raised platform. Their economy is of subsistence type. They practice 'jhum' cultivation. They grow rice, mustard, potato, cauliflower, cabbage, kachchu, pumpkin and fruits like pineapple, papaya and banana. Rice is the staple food of these people. They drink rice beer. Tangsa worship nature (Dony-Polo). Statues and Photographs of deities are not worshiped. These people are largely animistic, having belief in multitude of supernatural beings.

**Peet, N.B.; Watkinson, A.R.; Bell, D.J. and Kattel, B.J.** 1999. **Plant diversity in the threatened subtropical grasslands of Nepal.** *Biological Conservation*, 88(2): 193-206. School of Biological Sciences, University of East Anglia, Norwich, Norfolk NR4 7TJ, UK; School of Environmental and Biological Sciences, University of East Anglia, Norwich, Norfolk NR4 7TJ, UK; Department of National Parks and Wildlife Conservation, P.O. Box 860, Kathmandu, Nepal. [CLASSIFICATION; GRASSLAND; NEPAL; PROTECTED AREA; TERAJ]

Previously extensive tall grasslands, and their associated fauna, are now restricted to small fragments in protected areas in low-land Nepal and northern India. Conservation management of the remaining grasslands has been hindered by the lack of a grassland classification. A classification of the grasslands in four protected areas in Nepal is presented. Two hundred and forty six plant species were recorded and nine species assemblages, with eight phases, were identified. Royal Chitwan National Park contained the greatest diversity of assemblages, whilst Royal Bardia National Park and Royal Suklaphanta Wildlife Reserve, were of conservation significance for the occurrence of an *Imperata cylindrica* assemblage and its associated fauna. Early successional assemblages dominated by *Saccharum spontaneum* and *Phragmites karka* predominated in Koshi Tappu Wildlife Reserve. The spatial and temporal distribution of grassland assemblages is primarily influenced by fluvial processes but also by fire, cutting and grazing. Changes in the impact of these disturbances, for example as a result of dam building or a change in the fire regime, will alter the diversity and distribution of the plant assemblages together with their associated fauna. Immediate conservation action should involve controlling grazing in Koshi Tappu, removing invading woody species from *Imperata cylindrica* grassland and mapping the distribution of assemblages in all protected areas.

**Pradhan, N.R.** 1998. **Important minor forest produce of Mizoram (A status paper).** *Journal of Non-Timber Forest Products*, 5(3/4): 102-106. Asstt. Conservator of Forests, Office of the Chief Wildlife Warden, Tuikhuahtlang; E & F. Office Complex, Aizwal, Mizoram. [BAMBOO; BIODIVERSITY; MINOR FOREST; SUB-TROPICAL PINE FORESTS]

The paper presents the important Minor Forest Produce (MFP) of Mizoram with emphasis on Bamboos, Canes, Medicinal plants and Orchids resources. It also highlights their conservation, management, preservation and exploitation on sustainable basis.

**Rishi, A.K.; Bhan, M.K.; Dhar, P.L. and Ali, Nasir** 1998. **Correlation studies in *Dioscorea deltoidea*.** *Journal of Non-Timber Forest Products*, 5(1/2): 44-46. Regional Research Laboratory (Branch), Sanat Nagar, Srinagar 190005, Kashmir, India. [DIOSCOREA DELTOIDEA; LEAF AREA; PLANT]

Simple, partial and multiple correlation studies were conducted on the yield and its components in 19 diverse genotypes of *Dioscorea deltoidea* Hook. In simple correlation tuber yield was significantly correlated with leaf area/plant, tuber girth/plant, number of vines/plant and weight of vine/plant, while partial correlation co-efficients indicated positive relationship with number of vines/plant, leaf area/plant and tuber girth/plant. Multiple correlation co-efficients revealed that leaf area, number of vines and weight of vine were better combinations than others for enhancing the tuber yield.

**Rowbotham, David N. and Dudycha, Douglas** 1998. **GIS modelling of slope stability in Phewa Tal watershed, Nepal.** , 26(1-3): 151-170. Department of Geography, Nipissing University, North Bay, Ontario, Canada P1B 8L7; Department of Geography, University of Waterloo, Waterloo, Ontario, Canada N2L 3G1. [DEM; LOGISTIC REGRESSION; TERRAIN]

Hazards are an inherent but dangerous and costly element of mountainous environments. Conventional maps of mountain hazards provide useful inventories of hazardous sites but provide little insight into the operation of the hazards. Furthermore, this approach tends to rely heavily on subjective interpretation of the landscape, which means that the results can not be replicated or transferred to other areas. Thus, alternative approaches employing the quantitative capabilities of geographic information system (GIS) to model and predict slope stability are receiving increasing attention. This paper reports on the use of a diverse GIS database, compiled primarily from existing maps and aerial photographs, to construct a regional model of slope stability in Phewa Tal watershed, Nepal. An integral part of the research was to explore an alternative approach to the commonly used grid cell approach by employing geomorphometrically significant terrain units. The terrain units employed were created by generating line network representing local maxima and minima extracted from elevation and curvature surfaces. One of the chief benefits of applying GIS technology in this research was the ability to georeference all of the attribute data to these terrain units. In doing so, it allowed the database to be exported into an external statistical package, where the terrain units could be statistically explored as the basic analytical unit. The application of a variety of statistical techniques resulted in logistic regression being selected as the most useful. Logistic regression successfully predicted terrain units as being either stable or unstable at a rate of approximately 90% concordance with a conventionally produced map of slope stability. The statistical probabilities of terrain unit stability were imported back into the GIS to produce a map of predicted slope stability that compared well with the conventional map of slope stability. The findings of this research suggest that the use of geomorphometrically significant terrain units extracted from a digital elevation model (DEM) are an efficient alternative to approaches using regular grid cells. In particular, the terrain units facilitated the use of logistic regression, and significantly decreased the amount of computing costs. Finally, this research also suggests that important information can be gathered from existing information sources, such as maps, aerial photographs, and written documents, thereby limiting the need for costly and time consuming field work at the reconnaissance level. Based on this latter finding, other information sources, such as satellite imagery, should be examined.

**Sah, M.P. and Mazari, R.K.** 1998. **Anthropogenically accelerated mass movement, Kullu valley, Himachal Pradesh, India.** *Geomorphology*, 26(1-3): 123-138. Wadia Institute of Himalayan Geology, 33, Gen. Mahadeo Singh Road, Dehradun 248001, India. [CAUSES OF MASS MOVEMENT; HIMACHAL PRADESH; KULLU; LANDSLIDE]

A devastating landslide occurred on 12 September 1995 near Luggar Bhatti, Kullu, Himachal Pradesh, and killed 65 people. An estimated  $0.96 \times 10^6 \text{ m}^3$  of unconsolidated mass slid SSE down the terminal part of a thick alluvial fan of Quaternary age on the left bank of the Beas River. About  $0.03 \times 10^6 \text{ m}^3$  of dislodged material formed a 15-m high and 150-m long hump at the bottom of the failed slope; a shallow sag pond developed in the rear. The slide occurred after heavy rains on 3-6 September in the region when the Beas rose to a bankfull position. Factors involved in this toppling-cum-debris slide include steep slope, continuous seepage with high pore water pressure in unconsolidated material, a road-cut obliterating the foot of the fan slope, and impinging by the Beas River during the flood. A survey in the area showed that a variety of mass movement processes were triggered by the heavy rains in September; the most predominant being a series of slope failures on the outside of meander loops and bank erosion caused by turbulence of the overflowing Beas River. Extensive damage was sustained by National Highway-21 (NH-21), a bridge ramp near Bhuntar, a suspension bridge at Kullu and two other bridges upstream. Most damage occurred in the Manali area where massive buildings were washed away by the flash flood. This paper examines the factors and processes responsible for triggering widespread mass movement and related damages in the Kullu valley. Whereas some smaller events occurred in the early and middle part of this century, the recurrence and intensity of mass movements are recent phenomena attributed mainly to escalating socio-economic development, growth of tourism and population pressure. Some long term policy is suggested for mitigation of landslides and other denudational processes in relation to impelling human factors.

**Shroder Jr., John F.** 1998. **Slope failure and denudation in the western Himalaya.** *Geomorphology*, 26(1-3): 81-105. Department of Geography and Geology, University of Nebraska at Omaha, Omaha, NE 68182, USA. [DENUDATION; SLOPE FAILURE; WESTERN HIMALAYA]

Slope failures, glaciers, and rivers constitute the three main agents of denudation in the Himalaya. Failure of slopes is strongly controlled by bedrock geology, especially at plate terrane boundaries, although climatic and seismic controls of failure also occur. Slope-failure complexes in the western Himalaya studied for this report include the Pakhar, Kaghan, Nanga Parbat, and Atabad Hunza areas, with 23 different slope failures reported within all the complexes. Quantification of denudation by mass movement requires measurement of volumes and determination of timing of sediment emplacement and removal where possible, to obtain better data on recurrence intervals and total geomorphic work performed in formation of the landscape. The relation of mass movement to overall denudation by glaciers and rivers, and its role in catastrophic floods and debris entrainment is assessed.

**Shroder Jr., John F. and Bishop, Michael P.** 1998. **Mass movement in the Himalaya: new insights and research directions.** *Geomorphology*, 26(1-3): 13-35. Department of Geography and Geology, University of Nebraska at Omaha, Omaha, NE 68182, USA. [HIMALAYA; MASS MOVEMENT; TECTONICS]

Ongoing studies that relate tectonics to the processes at the surface of Earth show that many more source of information about agents of shallow denudation, such as mass movement, are required to comprehend the long term erosion that leads to deep denudation over geologic time. Mass movement in the Himalaya is scale-dependent, from the massive extension of whole mountain ranges (gravity tectonics), through the sacking failure of single peaks, to the smallest slope failures. Generally, denudation of the Himalayan orogen begins with slope failure into glaciers and into river valleys and continues by glacial and fluvial transport. The maximum size of stable slopes and mean angles of slope that are produced by these failure are complex and controlled by a variety of factors, including mass strength of the rocks, stress fields, angles of internal friction controlled by rock type, cohesion that includes the control of rock temperature, bulk unit weight of rock, and discontinuities. The process of mass movement in the Himalaya have been described many times for the past two centuries. Recently, developments in a variety of fields have been introduced to assess the character of mass movement. Geomorphometry, remote sensing, digital elevation models, and geographic information system technology are revolutionizing the study of mass movement in the Himalaya.

**Singh, P.K.; Singh, P.N. and Prasad, B.** 1997. **Biochemical changes in the haemolymph of healthy and uzifly infested larvae of *Antheraea proylei jolly* (Lepidoptera: Saturniidae).** *Sericologia*, 37(3): 465-472. Department of Life Sciences Department, Manipur University, Imphal 795003, Manipur, India. [AMINO

ACID; COCOON; HAEMOLYMPH; SILKWORM]

Quantitative estimation of the total amino acids (TAA), folin proteins (FP), total proteins (TP), total solids (TS) in the haemolymph of healthy and Uzifly, *Parasarcophaga knabi* (Parkar) infested fifth instar, oak tasar silkworm larvae *Antheraea proylei* jolly indicated marked differences. TAA decreased from  $11.26 \pm 0.12$  to  $7.05 \pm 0.75$  g/100 ml; FP decreased from  $5.75 \pm 0.19$  to  $0.61 \pm 0.43$  g/100 ml; TP decreased from  $11.32 \pm 0.12$  to  $1.21 \pm 0.79$ g/100 ml; and TS decreased from  $11.14 \pm 0.19$  to  $1.16 \pm 0.17$  g/100 ml. Absorption spectra of the haemolymph of healthy and Uzifly-infested silkworms showed 3 and 9 maxima, respectively. The consequences of these findings are discussed in relation to cocoon and non-cocoon formation.

**Sriram, V. and Khattri, K.N.** 1999. **Modelling of strong ground motions from Dharmsala earthquake of 1986 (mb 5.7).** *Current Science*, 76(3): 429-438. Wadia Institute of Himalayan Geology, 33 General Mahadev Singh Road, Dehradun 248 001, India. [EARTHQUAKE; HAZARD; HYPOTHETICAL; SEDIMENTATION RATE]

We have modelled a suite of accelerograms recorded at nine stations during the 26 April 1986 Dharmsala earthquake using the composite source model. The synthetic accelerograms were generated by convolving a source pulse radiated from the composite source with the synthetic Green's function that was computed for a layered velocity structure representing the site and an appropriate fault plane solution. The velocity-*Q* structure was obtained on the basis of oil exploration information on velocities, using the model obtained for the 1991 Uttarkashi earthquake and its trial and error modification to match the observed and the synthetic accelerograms in terms of peak ground acceleration, duration of strong shaking and frequency content. The match is found to be satisfactory for stations having smaller epicentral distances. The observed and the synthetic accelerograms for the station at Dharmsala, Kangra, Shahpur and Nagrota Bagwan show a satisfactory match in terms of appearance and in their spectrum. The information developed in the above analysis was used to estimate earthquake hazard at Dharmsala and Kangra for an earthquake of body wave magnitude 6.2 and having a similar focal mechanism as the Dharmsala event by simulating the ground motions. The expected peak ground accelerations for Dharmsala and Kangra for this hypothetical event are 0.7 g and 0.5 g respectively compared to 0.2 g and 0.15 g recorded for the mb 5.7 Dharmsala earthquake.

**Thapa, Ranjana; Sengupta, Sarthak and Ghosh, A.K.** 1998. **Dermatoglyphics of the lyngam of Meghalaya, India.** *J. Hum. Ecol.*, 9(6): 629-631. Dept. of Anthropology, North Eastern Hill University, Shillong 793 014, Meghalaya, India; Dept. of Anthropology, Dibrugarh University, Dibrugarh 786 004, Assam, India. [INDICES; LYNGAM; MEGHALAYA; PALMAR MAIN LINES; PAPILLARY PATTERNS; TRIBE]

The note describes the results of finger and palmar dermatoglyphics of the lyngam tribe of Meghalaya, India.

**Uppal, Rajesh and Khosla, P.K.** 1998. **Auxins and seasonal interactions in promoting the rooting of cuttings of some shrubs of western Himalaya under field and mist conditions.** *Journal of Non-Timber Forest Products*, 5(1/2): 50-53. Department of Agroforestry and Environment, H.P.K.V. Palampur 176062, Himachal Pradesh; Director, Extension Education, Dr. Y.S. Parmar U.H.F., Solan, Himachal Pradesh. [AGROFORESTRY; HIMALAYAS; SHRUBS]

Effective rooting failed to take place under normal circumstances. However the exogenous application of growth hormones, viz., IAA, IBA and NAA had a pronounced impact on rooting percentage in *Plectranthus rugosus*, *Lonicera quinquelocularis* and *Coriaria nepalensis* with the application of growth hormones. Of all the auxins under study IBA had shown maximum per cent success in rooting while IAA and NAA were significantly superior over control.

**Valdiya, K.S.** 1999. **Rising Himalaya: Advent and intensification of monsoon.** *Current Science*, 76(4): 514-524. Geodynamics Unit, Jawaharlal Nehru Centre for Advanced Scientific Research, Jakkur, Bangalore 560 064, India. [GRASSLAND; GREAT HIMALAYA; RAINFALL; SEDIMENTATION RATE]

Even though the Himalaya had emerged as a high-land by middle Miocene, it was not until the late

Miocene (11 to 7.5 m.y. ago) that it became a mountain barrier high enough to disrupt west-to-east flow of winds and push low-pressure area over northern India, which attracted moist summer winds from the Indian Ocean. Abrupt increase in the delivery of detritus to foreland Siwalik basin around 11 to 10 m.y. and to Bay of Bengal in the interval 10.9 to 7.2 m.y. and the first appearance of diagnostic minerals of the Great Himalayan complex in Siwalik sediments at 9.2 m.y. and in Bengal Fan between 10.9 and 7.2 m.y. implies that the Himalaya was exhumed and suffered accelerated erosion in the late Miocene, although brisk denudation had begun in mid-Miocene. Apatite fission-track dates and muscovite-cooling ages confirm strong movements on the boundary thrusts in the interval 8 to 6 m.y. The change of palaeoflora in the Siwalik domain from evergreen tall tropical to tall grasses 10 to 7.5 m.y. ago imply sudden change to dry climate characterized by seasonal heavy rains. The sudden appearance of endemic upwelling species at 8.5 to 7.4 m.y. in the Indian Ocean indicate activation of upwelling currents, which were set in motion at about 8 m.y. by southwesterly monsoon winds. Strong tectonic movements at the beginning of the Quaternary and at 0.8 m.y., as manifest in influence of enormous volumes of sediments in the Siwalik and in the Bay of Bengal, must have lifted up the Himalaya to still greater elevation, and caused diversion of the even flow of moist winds and created large cool areas conducive to precipitation of snow. Cold climatic conditions, which had started 2.5 to 3.0 m.y. ago in the northern hemisphere, culminated in the glaciation of the higher mountains in the Pleistocene. It remains to be seen whether the oscillation of humid and dry phases in the Holocene is in any way related to spurts of tectonic movements on the terrane-bounding active faults of the Himalaya.

**Varte, R.Th** 1998. **Opportunity for natural selection: The Hmar of Manipur, India.** *J. Hum. Ecol.*, 9(5): 513-514. Anthropological Survey of India, North East Regional Centre, Upper Lachumeire, Shillong, Meghalaya 793 001, India. [HMAR; INDEX OPPORTUNITY FOR SELECTION; MANIPUR]

In the present study an attempt has been made to deal with the opportunity for natural selection among the Hmars (the lesser known tribe of India) of Churachandpur (Manipur) based on the differential fertility and mortality from 35 ever-pregnant women aged of 45 + years. The value of  $I_m$ ,  $I_f$  are 0.072 and 0.250. Observed that the  $I$  value is 0.379 indicates the selection is operating or reported moderate in the population.

**Watanabe, Teiji; Dali, Liu and Shiraiwa, Takayuki** 1998. **Slope denudation and the supply of debris to cones in Langtang Himal, Central Nepal Himalaya.** *Geomorphology*, 26(1-3): 185-197. Graduate School of Environmental Earth Science, Hokkaido University, Sapporo, Hokkaido 060-0810, Japan; Institute of Low Temperature Science, Hokkaido University, Sapporo, Hokkaido 060-0819, Japan. [CONE VOLUME; DEBRIS FLOW CONE; DENUDATION RATE; LANGTANG HIMAL; SEDIMENTATION RATE; TOE INCISION]

The onset and termination of the formation of debris cones and the rate of denudation of source areas were studied in the Langtang Valley, central Nepal Himalaya. A stereo photogrammetric analysis was employed to map a detailed topography of debris cones, through which the volume of 19 cones was calculated. Debris cones were classified into four types (types 1-4) based on the criteria, such as incision of a toe, sizes of a cone and surface boulders, altitudinal distributions and vegetation cover. Cones of types 1-3 had been formed after deglaciation following the Langtang stage (3310 years BP). Type 1 cones are characterized by incision of toes by glaciers of the Lirung and Yala stages. The formation of the type 1 cones terminated well before 2000 year BP. Radiocarbon dates of charcoal fragments and buried soils show the major period of formation of the type 2 cones from 3300 to 2000 year BP. The rate of sedimentation calculated near the toe of cone 3 has been reduced in the last 5 centuries from 30.0 cm/ 100 years to 5.5 cm/ 100 years. The large amount of denudation of source area (116.9-132.5 m) indicates that slope failures initiated the formation of type 3 cones. The development of type 4 cones made less of a contribution to landscape evolution in the valley. The rates of denudation for source areas were calculated except for those above type 3 cones. The average rates are 15.6-6.2 mm/ year (above type 1 cones), 3.2 mm/ year (type 2 cones) and 3.4 mm/year (type 4 cones). Debris cones of types 2 and 3 are located on the valley floors which are completely deglaciated. Those of types 1 and 4, on the other hand, are located by the large valley glaciers with debris cover. The formation of type 1 cones is important especially in terms of debris supply to moraines and supra-glacial debris in the upper valley.

**Zaki, F.A.** 1999. **Incidence and biology of codling moth, *Cydia pomonella* L., in Ladakh (Jammu & Kashmir).** *Applied Biological Research*, 1(1): 75-78. Division of Entomology, S.K. University of Agricultural Sciences and Technology, Shalimar, Srinagar 191 121 (J&K). [APPLE; CODLING MOTH; INCIDENCE; LADAKH HIMALAYA; LIFE CYCLE]

Studies on codling moth, *Cydia pomonella*, indicated that the pest is widely distributed in all the fruit growing villages of Ladakh (J&K). The mean infestation of the pest on apple was 49.7 and 42.5% for Kargil and Leh districts, respectively. The infestation of the pest on fallen fruit was more severe (69.9%) than its infestation on the fruits still on trees (27.5%). All the indigenous and introduced cultivars of apple were found infested by this insect with varying degrees of susceptibility. Among local varieties of apple Thakushu was comparatively least infested. Life cycle of the pest on apple in Ladakh was studied. It completed 1 to 2 generations in one season. At cooler places only one generation was completed. The insect hibernated as larva in the silken cocoon. The pupation took place in the month of May of the next season.

**Zaz, G.M.** 1999. **Incidence and biology of black cutworm *Agrotis ipsilon* (Hfn).** *Applied Biological Research*, 1(1): 67-70. Division of Entomology, S.K. University of Agricultural Sciences & Technology, Shalimar, Srinagar 191 121 (J&K). [BIOLOGY; CUTWORM; INCIDENCE; SURVIVAL POTENTIAL]

The incidence of black cutworm, *Agrotis ipsilon* in field/vegetable crops at Shalimar, Srinagar, Kashmir was monitored by using light traps. The emergence of moths was recorded from third week of March and continued till first week of May. Minimum catch (4) was in third week of March and maximum (9) in first week of May. The life span of moths varied from generation to generation. Females lived longer (12.0 days) than males (10.3 days). The sex ratio of male to female was approximately 1.0 : 0.9. Under laboratory conditions, pest completed two generations and hibernated third generation in pupal stage during the last week of September. Observations of the survival potential of caterpillars showed maximum mortality (75%) in second generation and minimum (40%) in first generation. Larvae passed through six instars before undergoing pupation. High temperature (24.8 °C) reduced the duration of instars while low temperature (17.7 °C) increased it.

*News & Views*

*Compiled by S.N. Nandy, D.S. Negi and S.K. Sinha*

*G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263 643, India*

**Freak weather in hills might wreak ecological havoc**

The snowfall has been unexpectedly less in higher reaches of Garhwal and Kumaon during the spell. With neither enough snow nor a drop of rain the forest fires raging in some pine and mixed forests have been felt uncontrolled. Forest fires in the post-fall months are more damaging for the flora than in summer. The lack of snow and rain is a cause of concern not only for botanist and conservationists but also for hydrologists. It could lead to a further shrinking of glaciers, thus endangering the perennial sources of water for the entire plains of northern India.

THE STATESMAN: January 2, 1999

**Jhelum touches record low water level**

Due to the long dry spell and freezing temperature in the Kashmir valley over past few weeks, water in the Jhelum has touched a record low in past 54 years. The valley is already reeling under shortage of power supply and, is further possess to heavy decline in power production from various hydel projects due to decline in the water level in all water bodies.

THE TRIBUNE: January 2, 1999

**Kashmir forests ravaged by fires**

Mysterious forest fires are ravaging conifer forests throughout the Kashmir valley threatening the loss of some rare plant species and animal in the region forever. The locals admit that timber smugglers, in tandem with forest officials, are setting the fires to destroy traces of mass deforestation, however, according to official sources, the fires occurring are the result of an exceptionally dry spell hitting the Valley. Though the Centre had launched its 'Forest Fire control Methods' under the Eighth Plan, they are yet to be implemented in the Valley, which has the biggest forest cover.

THE TELEGRAPH: January 5, 1999

**Rs 450 crore tech mission plan for NE horticulture**

The Centre proposes to set up a technology mission for integrated development of horticulture in the north-eastern states comprising Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and Sikkim. The proposed technology mission will aim at improving production and productivity of horticultural crops and ensure sustained growth through effective linkages between production, research, extension, post-harvest management and marketing.

THE BUSINESS STANDARD: January 15, 1999

**Illegal mining on the rise**

The large-scale illegal mining and quarrying under political protection in Kangra district of Himachal Pradesh creating environmental imbalances. During last five years the water level of a number of *khads*, which are major source of over 200 water supply schemes has gone down and a number of water sources has already dried up due to reckless and unscientific mining. It is estimated that the state government is losing a revenue of Rs. 35 crore every year from the district alone.

THE TRIBUNE: January 19, 1999

**Project eating up forests**

Insecurity haunts wildlife in Himachal Pradesh with new cement plants and hydroelectric projects eating up the forest area in the state. Wildlife sanctuaries are one by one falling prey to such development projects which are being constructed by influential business houses. About 52% of the forest area in the state is undermarked and the authorities have no assessment of encroachments. It is estimated that forest area of

over 25,000 hectares was under encroachments.

THE TRIBUNE: January 20, 1999

### **SC order upsets Himachal's green felling plan**

The Himachal Pradesh Forest Corporation had floated bonds to raise financial resources for which the government had approved a proposal for carrying out green felling. The Supreme Court's decision making the Centre's approval of forest working plans mandatory, has upset the State's plan of carrying out green felling.

THE TRIBUNE: January 25, 1999

### **Sinking villages of Chamba**

Twenty villages in the Bakan, Bassu and Samra areas of interior Chamba district in Himachal Pradesh have started sinking because of illegal state mining effecting about 18,000 population in the region. As the only source of earning, the local resident were forced to engaged in quarrying, while the authorities were hesitant to take action against the culprits because of their political patronage. 'Save Himalaya', a social organisation set up by Mr. Rattan Chand is fighting the lone battle by educating and campaigning the local about the disaster, that the mining would bring for them.

THE TRIBUNE: January 28, 1999

### **Tehri dam safe, not prone to quakes: Govt**

The Centre has informed the Supreme Court that the Tehri dam was safe and did not need 3-D non-linear seismic tests. The government said the National Committee on Seismic Design Parameters (NCSDP) had termed the recommendation for such test as conservative and concluded that the dam was safe enough to withstand the maximum credible earthquake (MCE).

THE INDIAN EXPRESS: February 3, 1999

### **Promoting Eco-friendly Tourism**

The 100-years-old picturesque hill station of Darjeeling in the sub-Himalayan West Bengal stands out as a mute witness to the havoc wrought in by an increasing tourist flow. Over last five years, more than 300 hotels have sprung up in and around Darjeeling. The reckless construction activities have lead to drying up water springs, disappearing forest stretches besides massive soil erosion and landslides. Promotion of the concept of eco-tourism in the Himalayan region is considered significant in that it would go a long way in preserving the natural beauty of this mountain region.

*Radhakrishna Rao* for THE SENTINEL: February 6, 1999

### **Himalayan yew drying up**

The Himachal Pradesh Government's decision to allow the collection and export of leaves of Himalayan yew, which is being exploited by pharmaceutical companies to manufacture medicines for treating cancer, has proved fatal for endangered species. Over the past three years, thousands of yew trees have dried up in various parts of the state and the natural regeneration of this slow-growing species is poor. While scientists at G.B. Pant Institute of Himalayan Environment and Development have used tissue culture methods to produce saplings, replenishing the depleted reserves in the high altitude areas is difficult.

THE TRIBUNE: February 7, 1999

### **Threat to Nepal's forests may affect India's borders**

Environmentalists warned that the Nepali Government's proposal to allow a state-run body to fell trees in the Terai belt would deplete the Himalayan Kingdom's forest cover and spell doom for the bordering Indian states. Due to dwindling forest cover in the Terai, two Indian states Uttar Pradesh and Bihar have experienced devastation floods and silting problems over the past few years.

THE STATESMAN: February 9, 1999

### **Fungi eat into Himachal's sheesham**

According to a survey conducted by Dr Y.S. Parmar University of Horticulture and Forestry, about 30% of the sheesham plantation have been completely damaged in the state. The study has suggested that to prevent the fungi from spreading, healthy trees should be isolated and affected ones uprooted.

THE INDIAN EXPRESS: February 11, 1999

#### **Co-op effort to grow tea on wasteland**

The Sang Martam Tea Growers's Co-operative Society has earmarked about 1000 acres of wasteland for growing 'Rumtek tea' with an estimated production of two lakh kilos per year. To augment tea cultivation in Sikkim, a cooperative society has produced 700 acres of land in the East Sikkim district. The memorandum of understanding signed with Makalbair Tea Estate, has agreed to set up a tea processing plant at Sang Martam by investing over Rs. 2.17 crores with 50% equity.

THE BUSINESS LINE: February 15, 1999

#### **Disaster struck Chamoli in middle of the night**

A massive earthquake of 6.8 on the Richter scale struck Chamoli causing at least 100 casualties and about collapsing 170 houses, according to the initial report. It was the second time in eight years the Himalayan region of northern Uttar Pradesh had been hit by a severe earthquakes. At least 1600 people were killed in Uttarkashi, 1991 when an earthquake measuring 6.6 on the Richter scale hit the hilly.

THE ASIAN AGE: March 3, 1999

#### **Tea production severely affected by drought in Tripura**

Tea was the most important agro-based industry in the State with a production of six million kg per annum and about 6000 hectare of land were under tea cultivation. The production was severely hamstrung in Tripura this year following unprecedented drought. According to Tea Association of India, the drought would push the production of annual crop by 20-25%.

THE ASSAM TRIBUNE: March 17, 1999

#### **600MW Kameng hydel project with NEEPCO coming up**

The government of Arunachal Pradesh has decided to work out an agreement with the North East Electric Power Corporation (NEEPCO) to construct the 600 megawatt Kameng hydel power project. Participating in the discussion on 1999-2000 fiscal budget, the Chief Minister said reports on many other hydel projects would be prepared, which provide ample opportunities for the people to improve their standard of living.

THE ASSAM TRIBUNE: March 28, 1999

#### **Tehri dam safe from quake impact**

The 6.8 magnitude earthquake that rocked a wide sweep of area across the northern part of the India claimed over 100 lives in Chamoli, left the controversial Tehri dam structure unaffected. Conflicting views on the structural safety of the Tehri dam and hydro power project to high magnitude earthquakes have been expressed by scientists. Seismologists at the Indian Meteorological Department said the damage was low perhaps because the foci of the earthquake was 30 km deep inside the earth, in contrast, the Uttarkashi one occurred in 1991, around 12 km deep.

THE BUSINESS LINE: March 30, 1999

#### **Frequency of earthquakes has increased in the Himalayan region**

The seismicity in the Himalayan region has increased, as in the past eight years the region has experienced two earthquakes with a magnitude over 6.5 on the Richter scale. In seismically active areas, a quaked measuring more than 6.5 may occur once in 20 years, according to the scientist of Indian Meteorological Department(IMD). The IMD admits that the north and north-eastern movement of the Indian plate at the rate of about 5 cm per year and its collision with the Eurasian plate, which is relatively stationary, makes the Himalayan region quake-prone.

THE TIMES OF INDIA: March 31, 1999

### **Rubber stretching Tripura ecology: Report**

Despite its new-found tag of 'the second rubber capital of India', a recent study into the impact of rubber plantation reveals its telling effect on the state's fragile ecology. The report says the plantation may lead to an ecological and socio-economic disaster in the tiny state by destroying the top soils and causing deforestation that may end up causing desertification. However, the Tripura government pins a lot of hope on the state's rubber cultivation, the World Bank also supports projects to raise new plantations.

THE STATESMAN: April 4, 1999

### **Hot summers spark forest fires in HP**

With the mercury shooting up abnormally in the first half of April, conditions have become similar to the one prevalent in June when summer is at its peak. The pine forest, prone to fires because of highly combustible nature along with the failure of the forest department to take necessary preventive measures has aggravated the problem. Though the department has released Rs. 1 crore for marking fire lines, controlled burning and other preventive measures, these are not carried out by the field staff in the right earnest.

THE PIONEER: April 18, 1999

### **Dehra Dun institute to make coal from leaves**

The Garhwal Mandal Vikas Nigam (GMVN) in Dehradun has developed a technology to make coal out of 'chir' leaves which cover the floor of forest in the Garhwal hills. According the chairman of GMVN, the technology would not only prevent forest fires by removing these leaves from the forests but would also create employment opportunities and resolve the problem of non-availability of fuel for villagers.

THE ASIAN AGE: May 1, 1999

### **Air of Chamoli hills today is more poisonous than Delhi's**

The Ganga is running black in the hills and its discharge has unseasonably increased. The fumes opened by the earthquake are pouring out dark soil into streams that flow into it. The sky too is black with forest fire smoke and ash filament floating in the air. The Alaknanda and Bhagirathi, blistering hot winds howl throughout the day, even at heights over 6,000 feet, noon-temperature crosses 35 degree Celsius. All vegetation has turned into tinder, as it has not rained for more than six months. Because of the thick acrid smoke filling the air, the respiratory diseases, eye, and stomach ailments had increased tremendously.

THE HINDUSTAN TIMES : May 1, 1999

### **Rare cranes found in Arunachal**

A wintering site of the black necked crane, a globally endangered species has been found in the Zemingthang valley of Tawang district in Arunachal Pradesh. Earlier the cranes also wintered in Apatani valley of Subansiri district of the state, but they vanished in 1960s due to the development of large townships. The environmentalist pointed out an interesting observation, that all the wintering and breeding sites of these cranes happened to be located in few localities of Tibet and Ladakh, where Buddhism is the practicing religion. This probably indicates that religion can play an important role in wildlife conservation.

THE NORTH EAST TIMES: May 1, 1999

### **Forest fires in HP threaten erosion of land, flora, fauna**

Inadequate rainfall during last winter and early onset of summer this year have resulted in about 200 forest fires in Himachal Pradesh. According to State's forest minister, out of 35,407 km<sup>2</sup> forest area in the state, 8,267 km<sup>2</sup> were prone to fire incidents. A six-year project called 'modern forest control methods' under a Centrally sponsored schemes is yet to be implemented due to insufficient grant from the ministry.

THE TIMES OF INDIA: May 1, 1999

### **Officials lock horns with 'van gujjars' at national park**

Faced with the task of evacuation for the proposed Rajaji National Park near Dehradun, the park authorities are in confrontation with the 'van gujjars'. Gujjars, the nomadic tribes inhabited in the area are not agreed to shift to the rehabilitation sites at Pathri and Gandhikhata in the neighboring Hardwar district. After

having failed to force the dwellers to leave the forests, the authorities are believed to project them as poachers and timber smugglers.

THE STATESMAN: May 3, 1999

#### **DGHC flouts SC order, fells trees**

In a blatant violation of the Supreme Court order, banning felling of trees, the Darjeeling Gorkha Hill Council (DGHC) felled silver firs in the heart of Singalia National Park, which was discovered and seized by the forest department in a raid. The park which is the highest in the state, is habitat of the endangered red panda and also the home of the 'daphne-munal' - a rare breed of pheasant. This is not the first time that the DGHC has shown scant disregard for natural environment.

*Niraj Lama* for THE STATESMAN: May 4, 1999

#### **Nagaland losing its forest cover**

The eastern districts of Nagaland are facing environmental degradation as 'miscreants' join hands with *jhum* cultivators spelling doom for the lush green forests area. According to official sources, the green almost destroyed in adjoining districts of Mon, Tuensang, and Meluri subdivision of Phek district. The rivers and streams had dried up this year causing acute drinking water shortage in various parts of Mon and Tuensang. The Supreme Court's ban on timber felling has not helped the situation as commercial exploitation during the past few years have adversely affected the tropical and sub-tropical rain forests in the foothills.

THE SENTINEL: May 10, 1999

#### **1,700 trees axed, Nainital bleeds**

In spite of several protest marches demanding expeditious action against the Maharishi Mahesh Yogi Sanstha for felling 1,700 teak and sal trees on the land recently purchased by it, the guilty are yet to be punished. Though the forest department had lodged an FIR a month ago and claimed to be carrying out an investigation under the Tree Protection Act, no arrests have been made so far.

THE INDIAN EXPRESS: May 17, 1999

#### **Jhum cultivation a threat to environment**

The sifting cultivation by slash and burning of forests in hills, popularly known as *jhumming*, is being practiced by the tribals of North Cachar Hills in Assam. With the fast increasing population in hills, more and more new villages are coming up by clearing and destroying forest cover, thereby *jhum* area getting extended. This age-old system of cultivation not only causes soil erosion and landslides, but also deforestation threatening the environment, flora and fauna - even the very base of the hills. Until now, crores of rupees had already been spent in the name of integrated *jhum* control and development programme but the practice of *jhum* cultivation has not yet been controlled.

THE ASSAM TRIBUNE: May 25, 1999

#### **Wedding 'belles' green Garhwal**

Every monsoon, young girls plant seedlings in a fallow area with the consent of the village head and the *Mahila Mangal Dal*, a women's welfare organisation. The planting is very organised, run by a group christened 'Maitee' (girl's parents home), when the saplings become full-grown trees, they are named after the girl who planted them. The Maitee's unique tree-planting custom finds mention even in most wedding cards. The unique social custom, started as late as 1994 at Gwaldam, is now spreading to other villages, raising hopes of a greener Garhwal.

THE TELEGRAPH: May 25, 1999

## DISTRICT PROFILE: Hamirpur

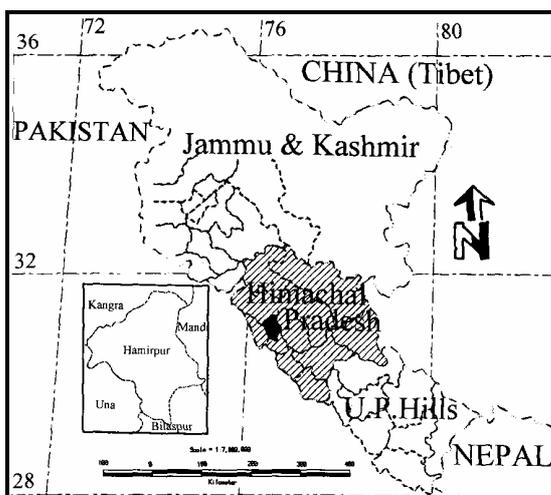
Compiled by S.N. Nandy

G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263 643, India

Hamirpur district is situated between 76°18' to 76°44' E longitude and 31° 52'30" N latitudes. The district in the north is bounded by the river Beas, which separates it from Kangra. In the west lies the Una district and in the south Bilaspur district. In the east Sir Khad separates it from Mandi district. The total area of the district is 1,118 km<sup>2</sup>. The tract is hilly, covered by lesser Himalaya (Shivalik range). The elevation varies from 400 to 1100m, having almost flat and precipitous slopes of hills. Three principal ranges run south east. The Beas is the main river of the district which form the boundary of the district with Kangra. The main streams of the district are Bekar Khad, Pung Khad, Kunah Khad and Man Khad drain in the river Beas, while Suker Khad and Mundkhar Khad drain into Sir Khad, which ends up into the river Satluj.

Sub-divisions	3
Tehsils	5
Sub-tehsils	1
Community development blocks	5
Urban area	4
Residential villages	1617
Non-residential villages	33

**Demography:** According to 1991 census about 7.14% of total Himachal population is residing in Hamirpur while the district contribute only 2.01% of geographical area of the state. The literacy rate, sex ratio and population density of the district are highest in the state. However, the decadal growth rate is declining from 19.91% in 1971-81 to 16.17% in 1981-91. The number of females per 1000 males (sex ratio) is not only the highest one in the state but it is highest among 78 districts of 12 Himalayan states. In contrast, the sex ratio of children (0-7 year age group) of the district is 938, indicating a significant decline of sex ratio in next few decades. Another important feature of the district's sex ratio is, it is very high in rural area (1123), whereas in urban area it is only 870, though only 6.15% of the total population is residing in urban area.

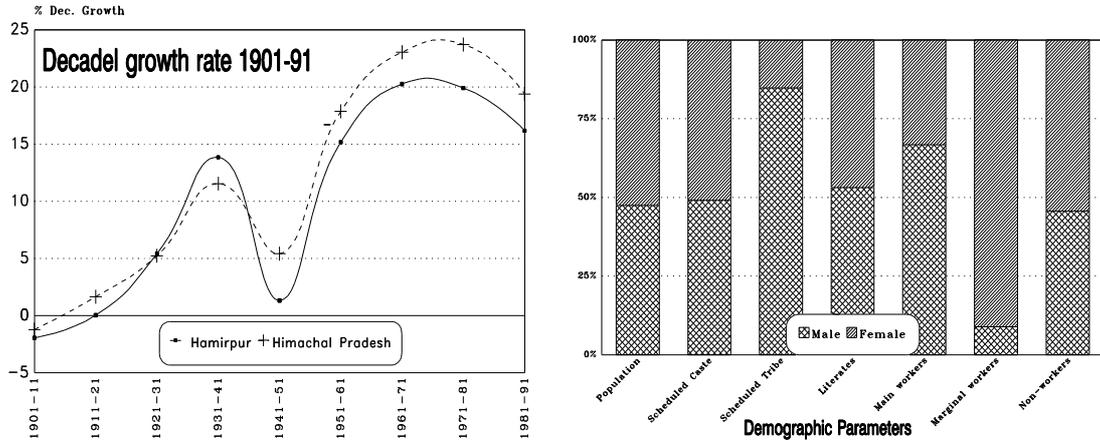


Location map: Hamirpur

**Administrative setup:** As a result of reorganisation in 1972, Hamirpur was created as a separate district comprising 2 tehsils; Hamirpur and Barsar with district head quarters at Hamirpur. In 1980 there was further reorganisation of tehsils, as a result of which 3 more sub-tehsils of Tira Sujampur, Nadaun and Bhorang were created. Hamirpur, Nadaun, Tira Sujampur and Bhota are four towns and urban agglomerations of the district having population less than one lakh each. The number of administrative units of the district in 1997-98 are as follows:

Demographic parameter (1991 Census)	Hamirpur	Himachal Pradesh
Population	369128	5170877
Decadal growth (1981-91)	16.17	20.79
Density	330	93
Sex ratio	1105	976
Rural population	93.85	91.31
SC	23.68	25.34
ST	0.06	4.22
Crude literacy *	63.32	53.48
Main worker	29.87	34.41
Marginal	12.00	8.42
Non-worker	58.13	57.18
Economic density	783	825

\*Literacy rate including population age below 7 years.



The main languages spoken in the district are Hindi and Pahari. The district is mainly inhabited by Hindus (99.16%), followed by Muslims (0.64%) while Sikhs, Buddhists, Jains and Christians comprises only 0.2% population.

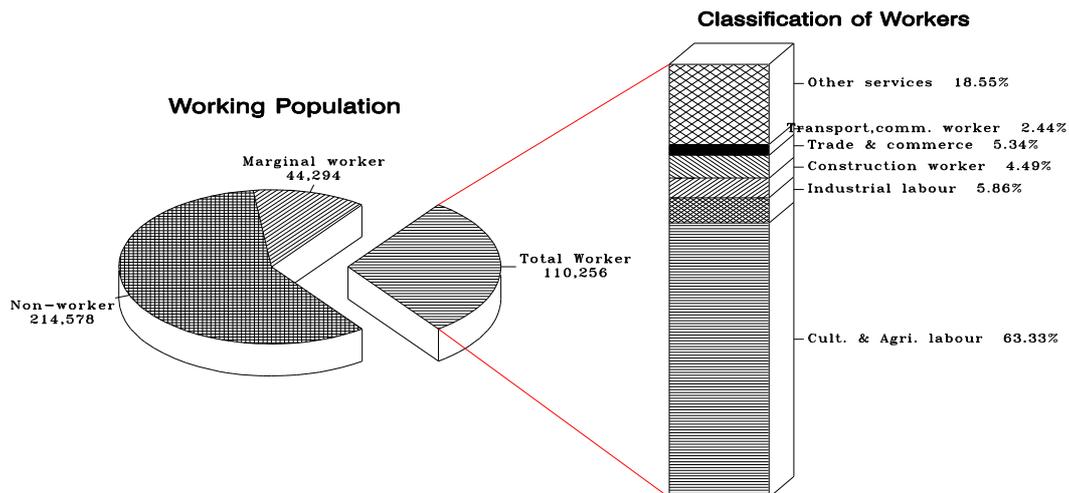
**SC & ST population**

SC			ST		
Rural	Urban	Total	Rural	Urban	Total
24.1(26.0)	17.4(18.5)	23.7(25.3)	0.1(4.5)	0.3(1.2)	0.1(4.2)

**Work participation rate of male and female in rural and urban areas**

Rural						Urban					
Main		Marginal		Non-worker		Main		Marginal		Non-worker	
M	F	M	F	M	F	M	F	M	F	M	F
41.7	19.4	2.4	21.9	55.9	58.7	45.0	11.2	0.5	2.9	54.5	85.9
(48.8)	(20.1)	(1.7)	(16.5)	(49.5)	(63.4)	(51.9)	(11.1)	(0.4)	(3.0)	(47.7)	(85.9)

The figure within the bracket indicate the respective data of the state of Himachal Pradesh.



Industrial labour comprises workers engaged in mining, quarrying, manufacturing, production in house-hold and non-house-hold industries including livestock and forestry operation.

### Educational status

Literacy rate (%) of 7 years and above

Rural			Urban		
Male	Female	All	Male	Female	All
84.6(73.9)	65.1(49.8)	74.1(61.9)	91.8(89.0)	80.5(78.3)	86.6(84.2)

The figure within the bracket indicate the respective data of the state of Himachal Pradesh.

No. of schools	1972-73	1997-98	% change
Primary school	164 (1: 142)	485 (1:81)	+195.73 (+75.31)
Middle school	55 (1:404)	63 (1:78)	+14.55 (+417.95)
High school	38 (1:821)	72 (1:309)	+89.47 (+165.70)
Senior Secondary	-	32 (1:740)	-

The figures within the bracket indicate the ratio of schools to the number of students in the respective schools.

The total number of schools increased 153.7%, whereas the enrollment of student increased only 17.73% during the period 1972-73 to 1997-98, resulting significant decrease in number of students per school. Other than these schools 2 Industrial Training Institutes (ITIs), 1 Polytechnic & Government College and a Regional Engineering College is also operating in the district. Though the employment opportunity of the district did not increased in due course, the number of candidates registered with the employment exchanges of the district was 51,471 (in 1997), which has increased 17 times in the past 25 years.

### Agriculture & irrigation

Area (in ha) under main crops

	1972-73	1997-98	% change
Paddy	5637	2813	-50.10
Wheat	19703	34795	+76.60
Barley	214	161	-24.77
Maize	25424	32608	+28.26
Other grains	12767	13	-99.90
Total crops	63745	70390	+10.42

Fruit production

	1972-73	1997-98	% change
Area under fruits (ha)	472	5765	+1121.40
Production (tones)	70	2047	+2824.29

Inspite of increased fruit production, the horticulture in the district is at infant stage and its production is not to the level of commercial scale.

Irrigated area under crops

Area (ha) under crops	1972-73	1997-98	% change
Paddy	1089	970	-10.93
Wheat	965	1633	+69.22
Barley	1	26	+2500.00
Maize	181	706	+290.06
Other grains	131	-	-100.00
Pulses	3	14	+366.67
Potato	-	3	+300.00
Sugarcane	-	3	+300.00
Vegetables	-	74	+7400.00
Other food crops	121	-	-100.00
Spices	-	13	+1300.00
Oil seeds	1	9	+800.00
Total irrigated area	2492	3451	+38.43

Irrigation

	1968-69 to 1970-71	1988-89 to 1990-91	% change
Net area irrigated (ha)	1,481 (89,951)	1,766 (99,456)	+19.24 (+10.57)
Intensity of irrigation (%)	182.2 (172.1)	180.4 (172.2)	-0.99 (+0.058)

The figure within the bracket indicate the respective data of the state of Himachal Pradesh

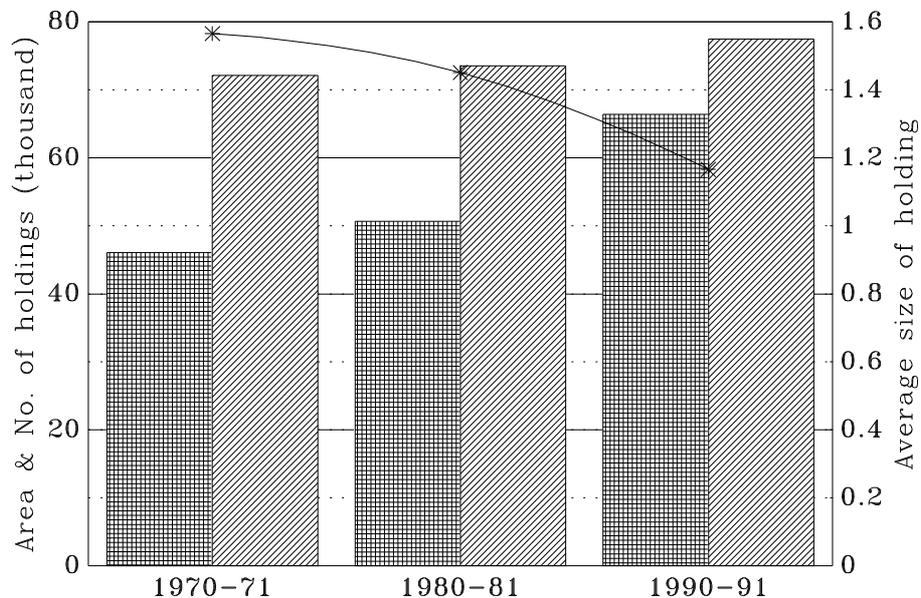
**Land Utilisation**

Landuse pattern

Total geographical area (ha)	Reported area (ha)	Percentage of landuse with respect to total geographical area					
		Forests	Not available for cultivation	Other than cultivated land excluding fallows	Fallow land	Net sown area	Cropping intensity
1,11,800	1,09,973	18.2	28.5	10.2	7.8	35.3	189.8
(55,67,300)	(33,61,521)	(29.8)	(11.4)	(39.6)	(1.9)	(17.3)	(167.5)

The figure within the bracket indicate the respective data of the state of Himachal Pradesh.

The current fallows contribute 96.1% to the total fallow lands (8,527 ha) of the district, the barren and uncultivated land contribute 45.7% to the total land available for not cultivation (31,312 ha), culturable waste and permanent pastures contributes 96.8 and 3.2% respectively to the total other uncultivated land excluding fallows (11,208 ha). The cropping intensity has increased marginally from 180.5 in 1968-69 to 189.8 in 1990-91.



■ No. of holdings ■ Area of holdings \* Holding size (average)

The area of land holding increased 0.37% per annum, while the number of holdings increased at the rate of 2.21% per annum during the period of 1971-91, resulting in decline of the average holdings 1.25% per annum during the period.

**Human pressure on land resources**

Reporting area	Area (ha) per 1000 persons			
	Forests	Net area cultivated	Net sown area	Gross cropped area
298 (650)	54 (194)	127 (121)	105 (113)	200 (189)

The figure within the bracket indicate the respective data of the state of Himachal Pradesh.

### Livestock

The total livestock in Hamirpur according to Livestock Census, 1988 is 2,32,828 (about 4.36% of total Himachal livestock) which comprises of bovine (66.49%), ovine (32.78%), equine (0.69%), and others (0.04%).

#### Production from livestock

Product	1988-89	1992-93	% change
Milk (tonnes)	38,454 (499,747)	52,684 (610,084)	+37.01 (+22.08)
Meat (tonnes)	170 (3670)	175 (4163)	+2.94 (+13.43)
Egg (thousand)	2,764 (48,464)	3,838 (69,720)	+38.86 (+43.86)
Wool (tonnes)	59 (1,351)	59 (1,511)	0.0 (+11.84)

The figure within bracket indicate the data of the state of Himachal Pradesh for the respective products.

### Transport

Road Network	1990-91 (in km)	Road per km <sup>2</sup> area (in 1991)	1997-98 (in km)	% increase (1991-98)
Matalled	353 (6,542)	0.32 (0.12)	527	49.29
Unmatalled	598 (10,748)	0.53 (0.19)	630	5.35
Total	951 (17,290)	0.85 (0.31)	1157	21.66

The figure within bracket indicate the data of the state of Himachal Pradesh for the respective roads.

In 1972-73 the total length of road network in the district 454 km. The conversion of unmatalled to matalled road contributes the significant increase (49.29%) of matalled road in the district during the period 1991 to 1998

### Other Infrastructural facilities

Number of amenities	1972-73	1997-98
Post office	179	221
Bank	4	54
Industries		
Registered factories	-	64
Employees in registered factories	-	173
Electricity		
Electrified villages	239	1717
Percentage of inhabiting electrified villages	14.74%	100%
Health services		
Hospital	-	1
Primary Health Centre	6	19
Community Health Centre	-	4
Dispensary	10	6
Health sub-centre	34	155
Ayurvedic Hospital	-	2
Ayurvedic Dispensary	13	53

[Sources: Census of India 1991; District Hamirpur at a glance 1998, District Statistical Office, Hamirpur; Agricultural Census Report; Livestock Census, Himachal Pradesh; Directorate of Land Records, Shimla, Himachal Pradesh; Department of Animal Husbandry H.P., Shimla and The Encyclopedic District Gazetteers of India (Ed. S.C. Bhat)]