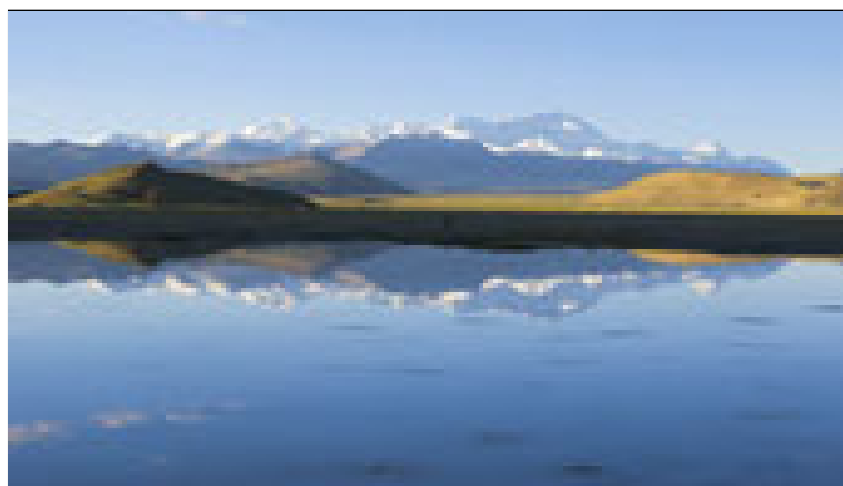


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GRASSLAND MANAGEMENT IN HIMALAYAS - NEW OPPORTUNITIES AND CHALLENGES

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The Himalayan Eco-system is one of the most important and threatened life support systems on the earth. In the shadows of Himalayas, live more than 250 million people in India. The rivers which rise in the Himalayas and down into wide Indo-Gangetic plains support the native flora and fauna which besides these people also sustain over 100 million people in this sub-continent. The population pressure on land, its mounting demand for fuel and fodder have greatly denuded the Himalayan Range the life line of India in particular and Indian subcontinent general. These Himalayas are long stretch of various hill ranges, 2500 Km long and 250-400 Km wide and are seismically and tectonically sensitive. Small disturbances their in precipitates changes that rapidly assume alarming proportion. The hill slopes are being fast denuded of soil cover and the rate of erosion and sediment load in lakes, rivers, reservoirs, streams *etc.* has increased significantly. The paramount importance of reversing this trend is recognized not only because the Himalayas are a source of water but also because of its crucial importance for the very survival and growth of people living in the Himalayan region. This mighty Himalayan chain is experiencing the worst ever environmental crisis. It faces a state for rapidly depleting resources as a result of modern developmental activities most of them completely unwanted. The dominant tree species alongwith several associated plants, trees, shrubs, bushes, creepers and grasses has evolved at the last stage of natural succession and so are called climax species which in ecological terminology is the permanent vegetation that would ultimately come to cover the land area that is cleared of all vegetation and then left undisturbed. It is a final, natural, stable, self maintaining and self reproducing stage of vegetational development and is crucial for the eco-conservation of any region. The indigenous vegetation is vanishing not only because of over exploiting but also because no chance is being given for its regeneration and in the plantation programme emphasis always laid on commercial exotic species. In recent years their has been lot of public resentment against the large scale introduction of exotic plants in the Himalayan mountains and number of ecologists and social workers have also stood against this anti ecological approach of reforestation. There are some exotic plants which are not introduced by man and invade the area accidentally. Parthenium, lantana, Eupatorium are examples of such exotics. Having turned thousands of hectares of land in the Himalayan hills into green desert. These problematic exotics are proving extremely dangerous. Wherever they invade the land, the natural succession ceasesto occur *i.e.* regeneration of indigenous plants. Parthenium which has become a great menace in several parts of India, is a stark example of such aggressive behaviors. It was introduced during the Shipment of wheat grain form the U.S.A. in 1950's under PL-480 project. I am quoting the view expressed in meeting of International Union of Conservation of Nature (IUCN).

The destruction of forests by invasive herbaceous and shrubby species is one the most serious environmental problem. Montana and temperate ever green rain forests are among the most threatened vegetation type would over.

The Himalayan land degradation can be easily glanced through the following figures:

Total geographical area	- 328m ha.
Land affected by soil erosion and degradation	- 175m ha.
Areas facing varying degree of droughts	- 260m ha.
Annual average loss of soil nutrients	- 8.4mt.
Annual loss of production for not developing ravines	- 3.0mt.

In the recent years visible changes have appeared in the physical and biological components of these Himalayas that is catching the attention and concern. These changes include fast receding tree line, recurring floods and periodic droughts, moisture regime, eutrophicating and sedimenting water bodies, deteriorating land-scape, landslides, great ornithological changes, variations in the periodicity and cyclic patterns of microclimate of the country as a whole.

Out of the total geographical area of 328m. ha in the country, pastures are spread over 12m. ha (3.9% of the geographical area) and sustain a livestock population of 406 million (1982) of which buffaloes constitute 16.3% and sheep and goats 35%, respectively. The condition of this enormous livestock population in the country in general is very poor because of inadequate availability of feed and fodder and latest for 1991

reports, the demand of 662 to 770 mt while production remains around 503mt from all sources (green fodder from arable area, forest and wastelands, top feeds and agro-waste) leaving a gap of 159 to 267 mt (NWDB, 1991). In spite of large cattle population per cow, average milk production in India is 20 times less than the average production in developing countries and same holds true for other livestock products. These natural pastures in the sub-continent in general and J&K State in particular have depleted and deteriorated due to continued misuse, indiscriminate cutting and grazing, overstocking, noxious and obnoxious weed proliferation, premature grazing, trampling, selective feeding, bad distribution of cattle, shifting cultivation, lack of grazing policy *etc.* are all contributory factors resulting in large scale destruction of this vital Himalayan land resources.

Research observations have interestingly revealed insignificant correlation with the carrying capacity of land, based on area and number of cattle/live-stock. However, productivity correlated analysis of pastures gives clear cut idea of "Pasture Utilization Capacity" and which should be applied for the prescription of all types of Judicious and sustained Grass Land Management/Studies on "Pasture Utilization Capacity" will clearly bring out effect of over grazing on the alpine pastures which have otherwise tremendous potential of improvement in biomass production which can be ensured on sustained basis by rotational grazing.

But also these alpine and sub-alpine pastures have been subjected to over all crowding-which the government should try to reduce.

In the call for the action there is an urgent need to put a halt to the Himalayan and resource degradation which has been a matter of considerable concern and problems of such areas are diverse and need multi pronged strategy to combat various processes of denudation to arrest, the further, process of desertification and improve the site for optimum biomass production and conservation.

REGENERATION DYNAMICS OF MID HILL GRASSLANDS OF KANGRA VALLEY - I. PRE-MONSOON PERIOD

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Grasslands and other grazing resources occupy a very important position in the hill agriculture and the grassland utilization is an important component of the hill farming system. The herbage utilized during grazing is the largest fodder resource followed by crop residues, tree leaves, concentrates and cultivated fodder. The land constraint has always guided the farmers to utilize most of the cultivated land for food production. Fodder cultivation is the last priority in the hills. This fact, further strengthens the importance of grasslands for the sustenance of huge population of livestock.

Besides grazing, these grasslands are also used for harvesting hay which is essential for maintaining the livestock during lean periods. The privately owned grasslands known as *Ghasnis* or *Khadetar* in Kangra Valley are enclosed during monsoons to achieve higher hay production. The standing biomass which comprise of grasses like *Chrysopogon gryllus*, *Arundinella nepalensis*, *Imperata cylindrica*, *Paspalum notatum*, *Heteropogon contortus* etc. is harvested during October-November and is conserved for use during winter. Some of the farmers let the biomass stand in their grasslands and harvested it on day-to-day requirement basis. By this time (October-November) the biomass is only dry and fibrous grass which has lost most of its nutritive value. The standing biomass production declined from 12.03 t/ha harvested on 25th September to 9.97 t/ha harvested on 5th November. Similarly a decline in crude protein percentage and increase in crude fiber percentage takes place with the delay in harvesting time. The crude protein percentage of 6.90 recorded on 5th September declined to 5.14% till 5th November. The crude fibre percentage of 31.05 recorded on 5th September increased to 35.60 till 5th November (Majid, 1983).

The farmers have shown their inability to harvest the herbage at earlier dates because of their occupation with the other agricultural pursuits. It is only after October when they are free from the *Kharif* crop harvest and post harvest engagements, that they can spare time for grass harvest. A suitable alternative time frame needs to be determined for the farmers so that they achieve maximum qualitative and quantitative production from their grasslands. A year round distribution of rainfall (Table 1) further strengthen the prospects of herbage availability at alternate dates.

Table 1. Climatic parameters of the study site

Month	Temperature (°C)		Rainfall (mm)	RH (%)	Evaporation (mm)
	Max.	Min.			
July	26.5	20.4	525.9	79	14
August	26.0	19.9	683.6	84	12
September	26.5	17.7	301.0	71	21
October	25.2	14.6	16.8	49	28
November	20.9	7.5	11.6	38	23
December	16.8	6.9	2.9	50	15
January 96	15.4	5.1	40.7	48	16
February	17.5	7.3	74.8	52	20
March	21.1	10.9	64.7	59	26
April	21.6	14.4	24.0	44	50
May	28.4	17.6	31.6	40	67
June	29.2	19.9	259.8	63	42

This communication aims to present the findings of an investigation carried out on a protected grassland at Palampur (Kangra Valley) to determine its biomass regeneration potential. The spectrum of biomass availability at different periods of a year could help in determining alternative dates for farmers to harvest their grasslands for making hay.

Material and Methods

A well protected grassland representing typical grassland situation of Kangra Valley was identified in the Himachal Pradesh Krishi Vishvavidyalaya campus near Seed Production Department. The flat portions of the grassland support white clover (*Trifolium repens* L.) dominated vegetation while the slopes support grass dominated vegetation. The grasslands have never been fertilized and are rainfed. Ten permanent quadrates each of 1 x 1 m size were laid out in both the legume and grass dominated grasslands. The vegetation from these quadrates was manually clipped on 8th day of every month. The fresh weight of the herbage was recorded in the field only. 500 gms of green herbage from each sample was oven dried at 60° C for determining the dry weight. Average of biomass production recorded from ten quadrates was taken as the representative figure. In case of legume dominated grasslands biomass was partitioned into grasses and legumes and their weights were recorded separately. The weed/forb biomass was negligible.

The grasslands of Kangra Valley record maximum biomass production during monsoon and remain dormant during winter (October-February). In order to determine the regeneration of vegetation during different seasons which coincide with the native agricultural practices, the year was classified under three seasonal categories viz., Pre-monsoon (March-June), Monsoon (July-September) and Winter (Oct.-Feb.). The regeneration potential during pre-monsoon period is presented in this paper.

Observations

Observations recorded on green and dry herbage yield and its increase and decrease are presented in Tables 2 and 3. In case of the legume dominated grasslands maximum green herbage yield of 6.62 t/ha and 1.2 t (dry)/ha was recorded in the month of May. The grasses contributed 0.83 t/ha (fresh) and 0.19 t/ha (dry) while the white clover contributed 5.79 t/ha (fresh) and 1.01 t/ha (DM). This was the maximum grass biomass recorded during pre-monsoon period. The minimum production of grass (0.19 t/ha) and white clover (0.89 t/ha) was recorded during March and June respectively. The moisture content in both grasses and legume was highly variable. In case of grasses maximum and minimum dry matter percentages of 75.0 and 22.9 were recorded in April and May respectively. In case of legume the variation was not so well pronounced. Maximum and minimum dry matter percentages of 25.74 and 18.13 were recorded during June and May respectively.

Table 2. Herbage recovery from legume dominated pasture

Month	Herbage recovery (t/ha)							
	Grasses		Legume		Total		Change (%)	
	F.W.	D.W.	F.W.	D.W.	F.W.	D.W.	F.W.	D.W.
March	0.19	0.06	1.4	0.24	1.59	0.3	-	-
April	0.04	0.03	3.04	0.44	3.08	0.47	43.38	36.17
May	0.83	0.19	5.79	1.01	6.62	7.20	53.47	60.83
June	0.47	0.11	0.89	0.24	1.36	0.35	-386.8	-242.86

In case of grass dominated grasslands the biomass recorded during pre-monsoon period was significantly lesser than the legume dominated grasslands. A maximum herbage yield of 0.39 t/ha (fresh) and 0.16 t/ha (dry) was recorded during June. The dry matter percentage ranged between 40 and 50 being recorded during April and May respectively.

Table 3. Herbage recovery from grass dominated pasture

Month	Herbage recovery (t/ha)		Increase/decrease (%)	
	F.W.	D.W.	F.W.	D.W.
March	0.30	0.14	-	-
April	0.30	0.12	-	-16.67
May	0.22	0.11	-36.36	-9.09
June	0.39	0.16	43.59	31.25

As far as the increase in the regenerated biomass is concerned, in legume dominated grasslands an increment of 48.38% and 53.47% was recorded during April and May respectively in case of green herbage yield. The dry matter production recorded an increment of 36.17 and 60.83% during April and May respectively. During June, the biomass production declined by 386.8 and 242.9% in case of fresh and dry matter respectively.

The grass dominated pastures exhibited a slow and insignificant progression in biomass production while the fresh herbage production remained static during March and April, a decrease of 16.67% was recorded in dry matter production during April. During May, the fresh and dry matter yields declined by 36.36% and 9.08% respectively. It was only during June that an increment of 43.6 and 31.25% was recorded in fresh and dry matter production respectively.

Discussion

The observations recorded (Tables 1 and 2) have revealed that the regeneration in the grasslands is a continuous process which may add to or reduce the biomass production according to the availability of growth controlling factors like moisture, temperature *etc.* The gradual and progressive increase of biomass production in legume dominated grasslands may be correlated to a corresponding increase in the temperature. During March when thawing takes place in the plants after a dormant winter, the maximum day temperature is 21.1°C which increases to 28.4°C during May when maximum herbage is available from legume dominated pastures.

The poor growth of grasses may be attributed to the fact that most of the grasses growing in the grasslands are warm season grasses and require higher temperature and moisture for their optimum growth. The growth of grasses picks up during monsoon (July onwards) and it remains active even after the end of rainy season.

This differential growth pattern during pre-monsoon period offers a productive cut of leguminous herbage to the farmers. The green herbage yield of 6.62 t/ha can further be enhanced by various managerial intervention. April and May offer many sunny days to the farmers when the herbage can be dried into hay which is very difficult to make during the following monsoon.

Reference

- Majid, M.A. (1983) Effect of cutting dates, nitrogen rates and curing techniques on production and quality of hay from natural grasslands. M.Sc. Thesis, Deptt. of Agronomy and Agrometeorology, HPKV, Palampur.

SURVEY ON ANIMAL HUSBANDRY PRACTICES, BOTTLENECKS IN ANIMAL PRODUCTION AND STRATEGIES FOR IMPROVEMENT: A PROFILE OF SELECTED VILLAGES IN HIMACHAL PRADESH

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INTRODUCTION

The state of Himachal Pradesh is located between latitude 30°22'40"N to 33°12'40"N and longitude 75°45'55"E to 79°04'20"E and altitude range from 350 to 6,975 m above msl. About 92% population in Himachal Pradesh is rural and depends directly on agriculture, horticulture and animal husbandry (Anonymous, 1994). The rearing of livestock is an integral component of the economy of the state and inseparable from the agricultural component of almost every household in rural areas of the state due to small size of the holdings. A survey was conducted to study the animal husbandry practice and problems in selected 300 households.

STUDY AREA AND METHODOLOGY

Kangra district of Himachal Pradesh was selected for the study. Twelve villages (Bandla, Suggar, Guggar, Khilroo, Sidhpur, Banuri, Rajpur, Patti, Barol, Gadhara and Deogran) were identified as target area belonging to Palampur block (latitude, 32.6°N; longitude, 76.3°E; altitude, 1,290.8 m) in Kangra District (H.P.). The area is characterised by mild summer and moderate to severe winter having the mean monthly minimum and maximum temperature (°C) varying from 5±0.9 in January to 20.4±1.2 in June and 14.7±1.8 in January to 29.6±3.4 in June, respectively. The average monthly rainfall ranged from a minimum of 26.5±29.4 mm in October to a maximum 655.2±175.8 mm in August and the relative humidity from 35.8% in April to 77.6% in August months. Linkages between the institute and the state departments and other voluntary agencies were established to collect the demographic information particularly with reference to human population, livestock population, animal husbandry practices, veterinary inputs *etc.* The survey was conducted on the basis of households, which represents the smallest unit of a village. 300 households from these 12 villages were selected by random sampling technique and the farmers inquired through personnel interview by door to door survey based on a questionnaire mainly on rural animal husbandry practices and problems faced by the farmers. Meteorological data were collected from the Department of Agronomy and Agrometeorology of H.P.K.V., Palampur (H.P.).

Table 1. Demographic information of the study area

Name of village	Human	Cattle	Buffalo	Sheep	Goat	Equine	Poultry	Rabbit	Pigs
1. Bandla	3500	957	225	3500*		-	800	19	-
2. Sugar	1500	200	60	15	10	-	70	30	-
3. Ghuggar	3975	363	54	65	14	18	40	8	8
4. Khilroo	1500	120	30	25	12	45	-	-	-
5. Sidhpur	1400	350	225	180	20	30	480	2	-
6. Tanda	1815	420	15	15	-	50	-	-	-
7. Rajpur	1800	300	30	35	-	-	-	-	-
8. Patti	3110	600	50	350	-	10	325	-	-
9. Barol	1765	250	25	25	5	4	-	-	-
10. Gadhara	1400	268	45	67	16	8	420	18	-
11. Deogran	1150	300	30	15	-	7	-	-	-
12. Banuri	1200	340	40	28	22	14	400	-	-
Total	24,115	4468	829	4419*		186	2535	77	8

*Total number of sheep and goats

RESULTS

Demographic information

General profile of the farmers: Table 1 shows the demographic information of the selected villages. About 40% heads of the households were illiterate. The general profile of the households, family size and main occupation of heads of the family is shown in Table 2.

Table 2. General profile of farmers

I	Type of farmers	No of households	% of households
	Nuclear	133	44.33
	Joint	167	55.77
II	Family members/household		
	1-5	141	47.0
	6-10	129	43.0
	11-15	22	7.33
	16-20	7	2.33
	20-25	1	0.33
III	Main occupation of the heads of the family		
	Farming	200	66.66
	Business	15	5.0
	Service	65	21.6
	Daily wages	20	6.66

Type of land holding and farming: The Table 3 shows the land resources of the farmers. Majority of the farmers were landholders and the percentage of landless, small, marginal and big farmers were 7.6, 40.7, 43.7 and 8%, respectively. 89.7% farmers had mixed farming (agriculture and livestock production), while 9% had livestock and remaining 1.3% owned agricultural activity alone.

Table 3. Type of land holdings

Type of land holdings	No of farmers	Percentage
Big	24	8.0
Small	122	40.7
Marginal	131	43.7
Land less	23	7.6

Animal resources

94.3% farmers had cattle and 23% had buffaloes either singly or in combination with other livestock. The average livestock to human population was found to be 84.7% : 100.56% of the livestock owner were having crossbred animals and 44% had local breeds. Majority of the farmers (88.66%) had cattle of small herd size (1-5) while the rest (5.33%) had a medium herd size (6-10). No farmer was having large herd size except a couple of owners possessing migratory flocks of sheep and goats only in one of the villages. The estimated population of cross bred and local breed per household was 1.14 and 1.69, respectively. All the farmers were having veterinary and animal health services either at home or at veterinary dispensaries located between 2-12 km from the household. The distance between the veterinary hospital/dispensaries and the household had a direct impact on utilisation of the facility by the farmers. Agricultural operations were mainly by utilisation of draught animal power in these villages located in hilly terrain. The dung was mainly used as manure but is also used as fuel by some animal owners.

Feeding and nutritional status of the livestock

There was great irrationality in the feeding practices. In general the nutritional status of the livestock was far from satisfactory. Economic status of the farmers, most of whom in the study area are small and marginal (84.4%) was found to be the major impediment in providing recommended plane of nutrition to the

livestock. Similarly, land holdings being very small in relation to the family size, the farmers preferred to grow only cash crops and no fodder at all. Thus, in spite of the implementation of cross breeding programmes during the last couple of decades, there was no corresponding increase in livestock products. Data based on the "on-the-farm research" for comparative returns from utilisation of the land for fodder cultivation and growing cash crops are not available for these areas.

Mineral mixture was offered to animals only by a limited number of farmers. Most of the farmers were not aware of the need for providing salt routinely in the feed and did so only once in a week. The animal rearing was mostly based on grazing in the pastures, and feeding systems utilising the tree forages. The pastures are undeveloped, overgrazed, contain poor quality grasses and are infested with poisonous plants like *Lantana*, *Eupatorium* and *Ageratum*. Stall feeding is on paddy straw, maize stover, local grasses, rice bran and oil cakes. 90% households were utilising the tap water for drinking purpose for human consumption and 20% used tap water for livestock as well while the remaining 80% households allowed their livestock to drink water from ponds, streams and ditches. This could be a reason for the high parasitic infections reported by the farmers.

The maintenance diet for local cattle comprises of fodder trees, grasses cut from forests, grazing in nearby forests and hay stored for lean seasons. Obviously, many farmers prefer indigenous cattle because they are 'less demanding' and 'less prone to the problems' usually associated with crossbred animals. Moreover, the native animals are more sustainable in the prevailing circumstances. Nutritional deficiencies in crossbreeds, in general, cause serious problems leading to poor productivity, infertility, abortion and high morbidity & mortality.

Breeding

Cross breeding programmes had their impact in these representative villages since it yielded desirable results in terms of germplasm. While artificial insemination (AI) facilities are available for cows, buffalo owners have difficulty in arranging breeding of buffaloes. 64.7% farmers adopted AI practices for cattle breeding, while 22.3% were adopting natural services and 7% adopted both the practices (Figure 1). 6% farmers are neither adopting AI nor natural services for breeding of their animals, but kept animals for draught purpose only. Repeat breeding was found to be a major problem in these villages. The percentage of conception was low which may be due to silent heat or failure to take the animal at proper time for AI or insemination failure. The problem of repeat breeding (4-6 times) was reported by 16.7% farmers in about 76 cattle. The problem of infertility was also emphasised by the farmers but the exact cause (s) are yet to be elucidated.

Production and utilisation of milk

The milk yield of livestock in these villages ranges from 1.28 to 10.5 kg/day/household and the average was 2.9 ± 2.4 kg/day/household (Table 4 & 5). The milk yield was lowest in Patti village and highest in Tanda which may be due to its location near the city area and the farmers getting all possible help from the experts of various agencies besides better transport, communication and marketing facilities. The higher ranges in milk production signified the higher production potential of the animals and the lower ranges indicated poor feeding and management practices.

Immunisation practice

57% of the farmers were aware about the schedule of vaccination against infectious diseases, especially foot and mouth disease (FMD), of which only 52% farmers adopted the vaccination either fully (45%) or partially (7%). The farmers also expressed their difficulties due to the non availability of veterinary aid in time in the nearby areas, medicines/vaccines from state animal husbandry department.

Diseases

Heavy parasitism was one of the major problems of this region in livestock. The relationship between worm infection, animal hygiene and housing is obvious. Fasciolosis was identified as one of the most important parasitic diseases of the livestock in the area with 62% infected cattle and buffaloes out of 227 animals examined by a spot study with an eggs per gram of faeces (EPG) ranging from 30 to 400. Most

of the deaths were reported to be due to various diseases followed by accidental poisonings by ingestion of toxic plants or accidents. Amongst poultry and wool rabbits, coccidiosis has been found to be the major cause of morbidity and mortality. Seasonal outbreaks of diseases like FMD, rinderpest (RP) has been reported by the farmers. Problems associated with migratory animals were mainly the lack of pasture land, abortions, infectious diseases and lack of veterinary inputs at higher reaches.

Table 4. Milk production in the target area

Name of village	Total milk	No of households	Average milk yield production kg/day
1. Bandla	74.0	32	2.31
2. Suggar	55.5	25	2.22
3. Ghuggar	80.5	25	3.22
4. Khilroo	32.5	23	1.41
5. Sidhpur	44.0	21	2.09
6. Banuri	43.5	25	1.75
7. Tanda	222.0	21	10.5
8. Rajpur	65.5	21	3.1
9. Patti	47.5	37	1.28
10. Barol	52.0	25	2.08
11. Gadhiara	43.0	20	2.15
12. Deogran	65.5	24	2.73

Table 5. Production and utilisation of milk

	Milk yield in kg/day/household	No. of farmers	percentage
Production	Nil	91	30.33
	Up to 5 Kg	169	56.33
	Above 6 Kg	40	13.52
Disposal	Nil	91	30.33
	Home use (HU)	177	59.04
	Sale & Home use	32	10.86

DISCUSSION

Bovines account for 56% of livestock wealth in Himachal Pradesh against the national figure of 63% during 1987. The growth rate of buffalo population (2.03% per annum) increased at a faster rate than cattle (0.5% per annum) during 1966-92 (Chauhan, 1995a). The average daily milk yield of crossbred cow (3.24 kg) was more than double that of the indigenous cow (1.45 kg), however, the average daily milk yield of buffalo (2.86 kg) was not only higher than the indigenous cow but is quite close to that of crossbred cow. Over a period of 13 years (1977-1990), the cattle and buffalo milk production increased by 163.7 and 52.3%, respectively. Buffalo milk constitutes 52.7% of the total milk production. The per capita daily milk availability increased from 191 gm in 1977-78 to 288 gm in 1989-90, an increase of 50.8%. This was higher than the national level of 174 gm, world level of 275 gm and the minimum recommended level of 250 gm by Nutritional Expert Committee of the ICMR (Chauhan, 1995b). However, these figures are far below those of the developed countries. So, there is no reason for being complacent and strategies must be developed for optimum output from the livestock keeping in view their genetic potential. The major problems on animal husbandry practices as perceived by the farmers of these villages are shown in Table 6.

Table 6. Major problems on animal husbandry practices as perceived by the farmers

Problems	Suggestions
A: Animal Production	
Economic constraints	Increasing the overall productivity from agricultural operations, efficient utilisation of resources, co-operative efforts.
Non availability of fodder	Fodder cultivation, improvement in local pastures/common grazing lands, popularisation of fodder legumes, and trees. Introduction of silvi-pasture systems.
Lack of marketing and transport	Development of co-operative systems/ facilities societies for marketing and transport of livestock products.
Poor extension facilities	Establishment of mobile veterinary clinics, involvement of voluntary organisation in the transfer of technology.
Lack of technical know-how	Organising health camps, farmer's training on more <i>pragmatic</i> basis.
Socio-economic status	Improvement in basic civic amenities at village level.
Low genetic potential of the native cattle	Further fillip to cross breeding programmes.
Small land holdings	--
B: Animal Health*	
Bacterial diseases	Brucellosis, rinderpest, mastitis haemorrhagic septicaemia
Viral diseases	FMD, rabies
Parasitic diseases	Liver flukes, amphistomosis, parasitic enteritis, blood protozoan diseases, mange
Miscellaneous	Mastitis, accidents, wild animal injury, pasture poisoning, reproductive disorders like sterility, anoestrus, repeat breeding, abortions, obstetrics, retention of placenta <i>etc.</i>
Non availability of veterinary inputs	Non availability of veterinary aid at home/nearby areas, non availability of medicines, vaccines <i>etc.</i>

*Preparation of epidemiological data on the disease profile and development of longterm planning on disease prevention and control measures.

Sustainability is a key word in science and development policy over the last one decade. Keeping in view the mountainous agro-ecosystem and the multipurpose nature of the animal resources, the farmers in the study area adopted technology within the inherent limitations leading to the success of cross breeding programme in the region. The animal resources, milk production and per capita milk availability of milk seems to be consonant with the inputs but there is vast scope for improving the productivity. In a similar survey earlier, Lall *et al.* (1979) reported average daily milk yield of 1.9 kg/cow and 3.4 kg/buffalo. Indigenous cattle breeds are commonly raised by small holder farmers for multipurpose agricultural operations while exotic breeds mainly by progressive farmers, more so by ex-service men in the study area.

Indigenous livestock provide practical means of using natural grasslands where crop production is not possible but the exotic animals cannot perform well because of higher susceptibility to environment, disease and nutritional stresses. Improved livestock management by small holders would contribute to farm income, household nutrition and sustainability of livestock production. Mixed farming will be the choice of farmers in the mountainous agroecosystem since livestock constitutes an inseparable component of hill area agriculture (Chander and Mukherjee, 1995). The prospects for improvement feed resources depend largely on better utilisation of crop residues and pasture improvement. There is a need to demonstrate some promising technologies currently available for crop residue improvement and efficient utilisation of tree forages which are sample, low cost, and easy to adopt by the rural farmers.

Diseases are still a bottleneck in profitability of livestock sector in the region. Chauhan *et al.*(1994) reported that maximum loss to the dairy animals was due to bacterial diseases followed by parasitic diseases. The extent of mortality was higher (2.03%) on small farms with larger dairy herd size and lower (1.30%) on

farms with smaller dairy herd size. Further the extent of morbidity did not vary significantly among various categories of farms.

A study conducted during the last one decade indicates that gastrointestinal parasitism along with bacterial and viral diseases are responsible for heavy economic loss to the farmers. Feeding of cut and carry grass from waterlogged areas and allowing livestock to drink water from ponds, streams, ditches *etc.* could be the reasons for the high parasitic infections, especially flukes and nematodes in livestock to these villages. Flukes (*Fasciola*, amphistomes and *Dicrocoelium*) and strongyle were found to be the important parasitic infections throughout the year. *Fasciola* was found to be endemic throughout the year with a high percentage infection in buffaloes than cattle. In general, other fluke infections and strongyle showed a regular seasonal pattern with high prevalence with a small peak in March-April followed by a high peak in the month of July-September. Faecal egg counts of flukes (*Fasciola*/amphistomes) ranged from 50 to 300 in cattle and 50 to 400 in buffaloes with high load during rainy and post rainy seasons. The strongyle egg counts also revealed a similar trend with an overall mean monthly EPG ranged from 85-1,720 in cattle and 90-1,625 in buffaloes, with a high peak during the months of July-September. The important nematodes observed in study include, *Strongyloides*, *Trichostrongylus*, *Haemonchus*, *Oesophagostomum*, *Bunostomum* and *Mecistocirrus* in the decreasing order of prevalence. Broad spectrum anthelmintic treatment of dairy animals at least twice in year, once in March-April and second in July-September would reduce the parasitism and increase productivity of animals in the region (Jithendran *et al.*, 1998).

Role of NGOs

The non-government-organizations (NGOs) can play a very important role in the hill areas. The hill states of India have a difficult terrain which makes the approach and access of Government agencies very difficult and some times even impossible. There are a number of voluntary organisations which operate in rural sector, have "firsthand" experience of the rural potentials and problems and can play a pivotal role in transfer of technology. It is important that Government extension agencies involve NGOs in all transfer of technology programmes. The activities centered around the following aspects are expected to boost the dairy development in the region (Kaushal, 1996).

- * Awareness amongst both the local people and the Govt. about the importance of livestock sector in hill farming.
- * Programmes involving selection of indigenous breeds to get higher outputs without losing their natural adaptability.
- * Providing veterinary facilities like vaccination, therapeutic and prophylactic veterinary *etc.*
- * Improving the quality of locally available fodder in the hills in order to meet the nutritional inputs for the livestock.
- * Supporting local hill communities in marketing of animal produce through the creation of self help groups, group marketing entrepreneurship, co-operative societies.
- * Demonstration of model dairies, fodder cultivation, nurseries, creation of voluntary groups to seek technology.

CONCLUSIONS

Keeping in view of the mountainous agro-ecosystem and the multipurpose nature of the animal resources, the farmers in the study area adopted technology within the inherent limitations leading to the success of cross breeding programme in the region. The animal resources, milk production and per capita milk availability has increased remarkably although, there is a vast scope for improving the productivity and sustainability of these animals. Education of the farmers on balanced and improved feeding of the animals, better management practices and disease prevention and control strategies would go a long way in improving the livestock productivity in the region. Sustainable development in hills can only be achieved through optimum utilisation of its natural resources. Veterinary service needs to be strengthened and improved. The potential of indigenous cattle breeds needs to be tapped by improving nutrient availability from locally available feed resources. Involvement of NGOs to educate the farmers on available technology and to motivate the farmers to seek technology would be a step forward in this direction. If the efforts of farmers,

research institutions, extension agencies, Government and NGOs are integrated for promotion of hill area agriculture, the bright future is not far away for the hill farmers.

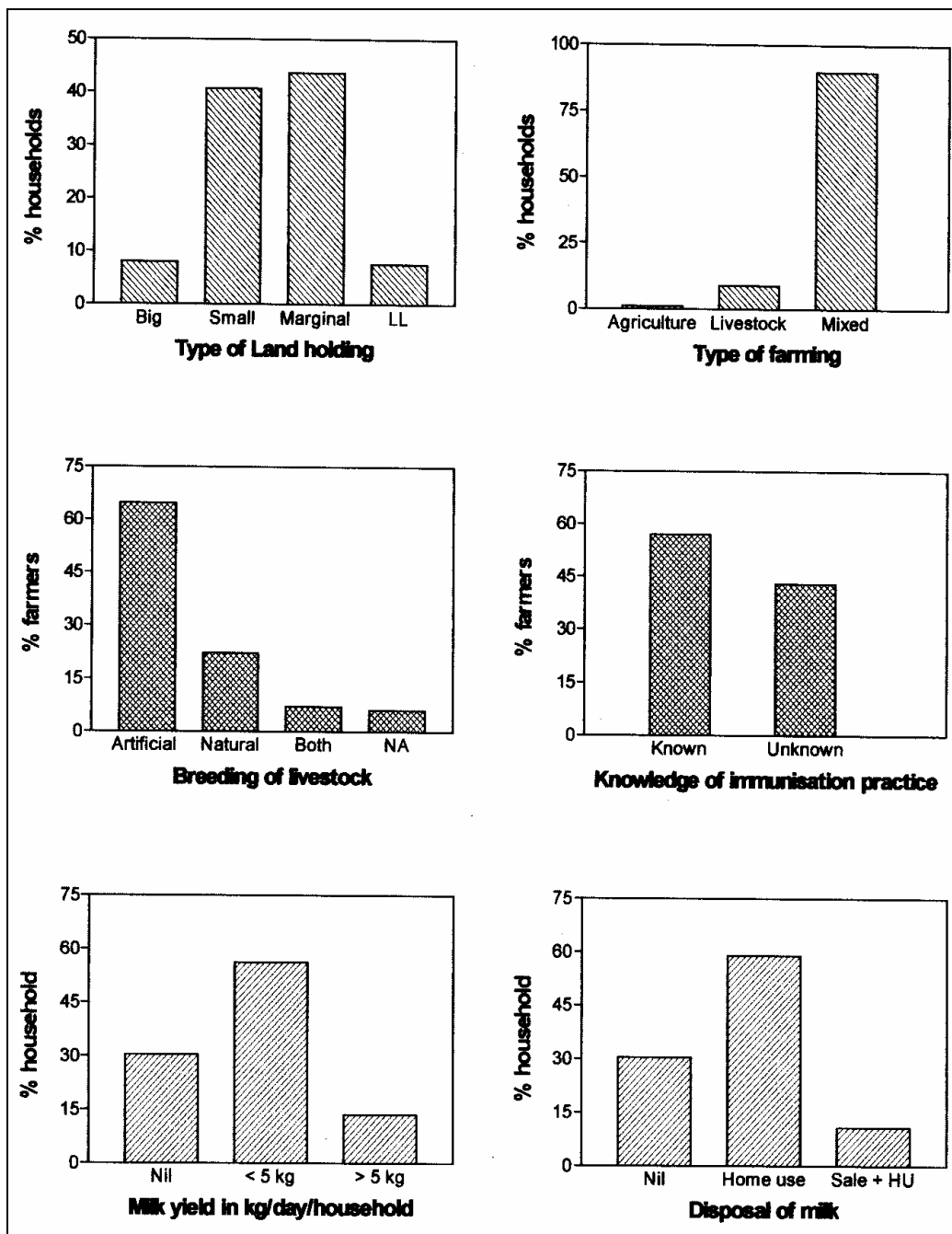


Figure 1. Profile of land holdings, type of farming, breeding, knowledge on immunisation, milk yield and milk disposal in the study area

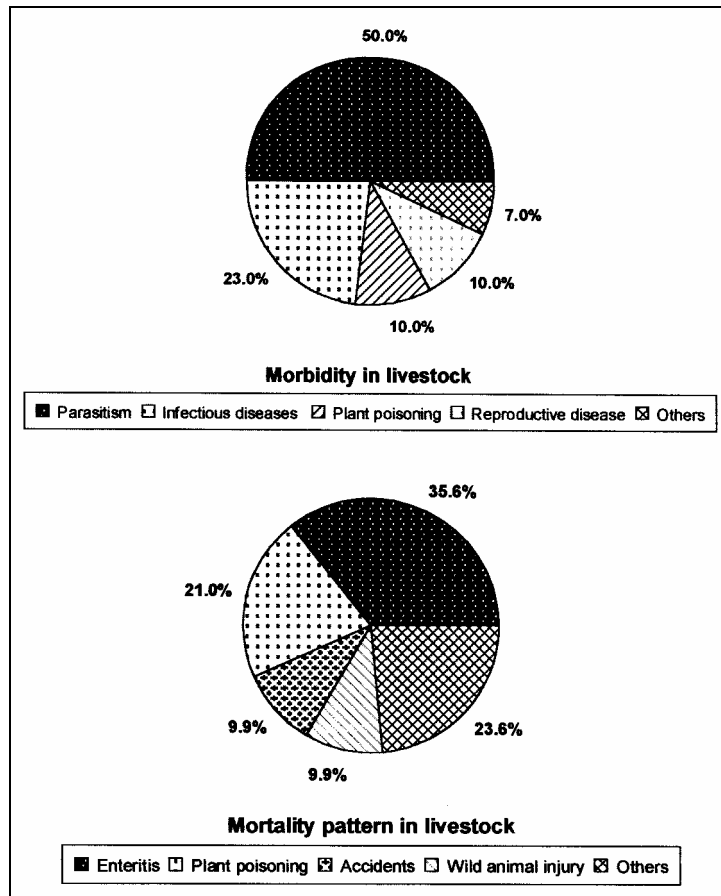


Figure 2. Morbidity and mortality pattern in livestock in the study area

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LIMNOLOGICAL STUDIES OF A FRESHWATER RIVER (GOMOTI) IN TRIPURA WITH REFERENCE TO PERIPHYTON

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To know the nature of species composition of periphyton and their degree of significance with water quality of lotic ecosystem as well as freshwater pisciculture, the present observations were made during 1993 to 1996 in Gomoti river, which is located at south district of Tripura. The upper stretch of the river (Lat 23°28'00" N and Long 91°50'00" E) is 55-70 m wide, the depth of which varied between 1 m in the summer to 2.5 m in the monsoon. Horizontal wave current was found throughout the river. The water flow ranged from 30 cm. s⁻¹ to 80 cm. s⁻¹. The middle stretch (Lat 23°28.5'15" N and Long 91°30'00" E) is 65-90 m wide. The lower stretch, however, is more wide (80-110 m) with a depth of 1.8-3.5 m.

The littoral vegetation available in the upper and lower reaches are *Ipomaea aquatica*, *Coix* sp., *Oryza rufipogon*, *Polygonium* sp. etc. However, in the lower reach the most common occurrence of vegetation is *Eichhornia crassipes*.

The periphyton consists of 24 genera and 9 species of filamentous algae, 19 general and 10 species of diatoms, 20 genera and 5 species of sessile protozoa and 8 genera and 17 species of sessile rotifera. The faunal composition of periphyton from the lotic ecosystem is known for the first time in the world.

Of the periphytic biota, sessile rotifers were recorded in the lower reach only, where their preferred substrata *Eichhornia crassipes* was noted. The surroundings of this plant showed a number of planktonic rotifers such as *Brachionus plicatilis*, *B. calyciflorus*, *B. sp.*, *E. locustris*, *K. earlinae*, *K. cochlearis*, *Colurella obtusa*, *Cephalodella auriculata*, *C. gibba*, *C. forlucula*, *Lecane aspasia*, *Trichotria tetractis*, *Eospora* sp., *Euchlanis dilatata*, *Lophocharis salpina*, *Monommata grandis* which serve as excellent live food during the larval stages of the fish. The heterogeneous species composition of periphyton is an index of occurrence of different fish species in the river (table 1).

Table 1. Periphytic biota (unit/cm²) of Gomoti River.

Filamentous algae	<i>Mougeotia</i> sp.	<i>Gyrosigma attenuatum</i>	<i>Pyxidium</i> sp.
<i>Spirogyra adnata</i>	<i>Penium</i> sp.	<i>Synedra ulna</i>	<i>Vaginicola</i> sp.
<i>S. fluviatilis</i>	<i>Nematochrysis</i> sp.	<i>Grammatophora</i>	<i>Cothurnia</i> sp.
<i>Spirogyra</i> sp.	<i>Characium</i> sp.	<i>serpentina</i>	<i>Epistylis</i>
<i>Ulothrix zonata</i>	<i>Oedogonium</i> sp.	<i>Pinnularia viridis</i>	<i>Squalorophrya</i> sp.
<i>Ulothrix</i> sp.	<i>Anabaena</i> sp.	<i>Melosira</i> sp.	<i>Rhabdostyla</i> sp.
<i>Rizoclonium</i> sp.	<i>Pseudoanabaena</i> sp.	<i>Amphipleura pellucida</i>	<i>Stentor roeseli</i>
<i>Schizogonium</i> sp.		<i>Denticula</i> sp.	<i>Acineta limnetis</i>
<i>Hormidium subtile</i>		<i>Acanthes linearis</i>	<i>Metacineta</i> sp.
<i>Dinobryon sertularia</i>	Sessile Rotifera	<i>Licmophora</i> sp.	<i>Paracineta</i> sp.
<i>Oscillatoria</i> sp.	<i>Beauchampia crucigera</i>	<i>Cymbella cistula</i>	<i>Tokophrya</i> sp.
<i>Gonatozygen</i> sp.	<i>Collotheca</i> sp.	<i>Fragilaria</i> sp.	<i>Podophrya</i> sp.
<i>Hyalotheca</i> sp.	<i>Ptygura</i> sp.	<i>Gomphonema</i> sp.	<i>Caulicola valvata</i>
<i>Zygnema</i> sp.	<i>Limnias</i> sp.	<i>Navicula</i> sp.	<i>Campanella</i> sp.
<i>Oedocladium</i> sp.	<i>Floscularia</i> sp.	<i>Eonotia pectinalsi</i>	<i>Discophrya</i> sp.
<i>Cladophora</i> sp.	<i>Octotrocha</i> sp.	<i>Nitzschia</i> sp.	<i>Platycola</i> sp.
<i>Draparnaldia</i> sp.	<i>Carchesium</i> sp.	<i>Frustulia</i> sp.	
<i>Spirotaenia</i> sp.		<i>Amphora</i> sp.	
<i>Sphaeroplea</i> sp.		<i>Pleurosigma</i> sp.	
<i>Closterium</i> sp.		Protozoans	
<i>Spirogonium</i> sp.	Diatoms	<i>Pyxicola</i> sp.	
	<i>Bacillaria paradoxa</i>	<i>Vorticella microdtoma</i>	

Higher species diversity of periphyton is an indication of non-stressed water quality of the river. Furthermore, the sessile rotifers, which are unable to tolerate stressed water (Datta and Banik 1987; Banik and Kar 1995; Banik 1996), showed higher species diversity, which also suggest non-stressed nature of the Gomoti river water.

The biomass (ash-free dry weight of periphyton) depicted a progressive productive nature of the river (table 2). Interestingly, a positive correlation ($P < 0.01$) was found between the rate of production of algal periphyton and of the faunal periphyton. Of the faunal group, rotifera is a major component in energy transfer and nutrient cycling.

Table 2. Biomass of periphyton ($\text{mg AFDW.m}^{-2} .\text{d}^{-1}$).

Reach	Zone I	Zone II	Zone III	Zone IV
Upper	345.30	352.25	363.93	358.76
Middle	376.22	382.61	405.04	399.96
Lower	434.36	436.24	421.03	458.98

For the growth of periphyton, the submersed macrophyte *Eichhornia crassipes* is most helpful. The leaves of this plant utilize the reduced available light, increase the ratio of surface area to volume and hence, increase the efficiency of gaseous exchange and nutrient absorption in water medium. So, occurrence of such kind of macrophyte in a considerable quantity permits greater productivity.

The temperature exhibited an increasing trend from the upper to lower reach (table 3). pH of the water is acidic. The silicate, phosphate and nitrate concentrations were found to be conducive for the growth of algae and indirectly for the growth of fauna ($P < 0.01$).

Table 3. Physico-chemical conditions of Gomoti River.

Parameters	Range
Water temperature ($^{\circ}\text{C}$)	4.00 - 31.00
Transparency (cm)	4.00 - 38.93
pH	6.4 - 6.9
Dissolved oxygen (ppm)	4.1 - 15.36
Free Carbon dioxide (ppm)	2.0 - 12.00
Bicarbonate (ppm)	56.0 - 110.0
Dissolved Organic matter (ppm)	3.2 - 13.97
Salinity (ppt)	0.05 - 0.09
Silicate (ppm)	2.6 - 16.00
Phosphate-P (ppm)	0.02 - 4.60
Nitrate-N (ppm)	0.10 - 3.8
Calcium (ppm)	1.30 - 10.01
Magnesium (ppm)	0.30 - 2.61

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Summary of Completed/Ongoing Projects

AN APPROACH TOWARDS EQUITABLE DEVELOPMENT FOR BIODIVERSITY CONSERVATION AND SUSTAINABLE GROWTH IN GOVIND PASHU VIHAR SANCTUARY, UTTARKASHI, GARHWAL HIMALAYA

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To conserve the shrinking biomass resource is the need of the hour. There is no exaggeration to say that human survival itself is imperiled due to biodiversity loss. Keeping this view in mind several FFT's (Fact Finding Tours) programme were organised by SHER (Society for Himalayan Environmental Research) within Govind Pashu Vihar Sanctuary and National Park in which various factors responsible for the loss of phyto-diversity of the region were investigated thoroughly. Letters were written to concerned authorities acquainting them with deteriorating biological diversity and giving suggestion for both *in-situ* and *ex-situ* conservation measures that could be undertaken to protect endangered medicinal and aromatic plants. But nothing was done in this context during the span of more than eight months. Therefore this project proposal was submitted to G.B. Pant Institute of Himalayan Environment and Development, with the main motive of development of demonstration site of *ex-situ* conservation of rare and threatened taxa.

Results of random sample plot survey revealed that *Aconitum heterophyllum* is most vulnerable to illegal exploitation practices followed by *Aconitum atrox*, *Dactylorhiza hatagirea* and *Jurenia macrocephala*. Species like *Polygonatum verticillatum* seems to be out of commercial exploitation. In order to collect the germplasm of some species of commercial importance several tours were organised at different pockets of Garhwal Himalaya. Efforts were made to plant living germplasm as well as seeds collected from different localities separately in nursery site. Some seeds were taken to Vikasnagar in order to work out their germination potential, and growth of seedlings during the winter season.

In totality 1,25,000 seedlings of most economically viable plant species were raised in nursery beds at Majhota Tok in Dhatmir village. All the experiments pertaining to the multiplication of these species which comprises methods of vegetative propagation and seed germination under different concentration of hormone, soil texture and sowing depth were conducted in nursery site, and were observed for sprouting of leafy shoot and survival percentage. After identifying the best results these experiments were replicated for respective species in larger scale. Finally the replicated experiments were observed for the production of usable plant part.

The effect of NIAGARA on tuber cuttings of *Aconitum atrox* at 100 ppm concentration enhances the percentage of sprouting in middle and lower segments in comparison to control within the nursery site. The fresh weight of tubers at the end of first year enhanced under NIAGARA treatment. But no effect was observed in case of number of sprout particularly in lower and middle segments. Similar studies when conducted under demonstration site exhibited a great decrease in sprouting percentage under control as well as hormonal treatment.

The response of basal part of stems of *Aconitum atrox*, *Aconitum heterophyllum* and *Dactylorhiza hatagirea* under 100 ppm concentration of NIAGARA showed a considerable increase in sprouting percentage in comparison to control. 12% of *Aconitum heterophyllum* plants reached to flowering stage within one year. Not only this but the percentage of flowering almost doubled on NIAGARA treatment. NIAGARA at 50 ppm concentration enhances the sprouting percentage in *podophyllum hexandrum*, *Paris polyphylla* and *Polygonatum verticillatum*. The fresh weight of rhizome also increased with hormone treatment in comparison to control.

Application of STIK and GA3 on cut parts of dormant shoot buds of *Dactylorhiza hatagirea* showed that the length and gross weight of roots increased significantly but the natural shape of tuber (paw shape) was distorted completely. GA3 at 100 ppm concentration significantly enhanced the germination percentage in *Aconitum atrox*, *Aconitum heterophyllum*, *Saussurea lappa* and *Selinum wallichianum*. However, in *Rheum australe* GA3 treatment does not show any positive correlation. GA3 treatment reduces the germination percentage in *Valerina jatamansi*.

Germination of *Aconitum atrox* and *Aconitum heterophyllum* observed under three textural groups of soil exhibited a very significant correlation. Sandy loam is found most conducive as far as growth and development of seedling is concerned, however germination percentage is observed highest in silty loam type of soil. In silty clay loam type of soil germination percentage was found very low almost half to that of silty loam. The fresh weight of roots also reduces gradually from sandy loam to silty clay loam.

Seed of *Aconitum heterophyllum* sown at the depth 0.5cm exhibit a very high germination percentage in comparison to seed sown at the depth of 0.1 and 0.3cm. The percentage of emergence of true leaf as well as fresh weight of roots also increased with increasing depth 0.1 to 0.5cm.

The work for the transplantation of seedling and plantlets in demonstration site started during the month of October and November. One year old seedlings/plantlets of *Aconitum atrox*, *Aconitum heterophyllum*, *Paris polyphylla*, *Polygonatum verticillatum*, *Saussurea lappa* and *Selinum wallichianum* were transplanted in well prepared terraced field during the October month of 1995 and 1996. Adequate care of plantlets in demonstration site was taken during the winter season and dry summer months. For the restoration of degraded land more than 15,000 plantlets of *Hippophae rhamnoides* were planted with the help of local people.

Various Eco and TRUGA (Training for Rural Gainful Activities) campus were organised at Dhatmir village in order to raise awareness amongst the local populace regarding the biological diversity of the region and to motivate them for cultivation of these herbs in their private land. 10 progressive farmers were selected from Dhatmir village and were trained in various aspects of agrotechniques pertaining to the cultivation of medicinal herbs. With the completion of project duration (3 years) in December 1996, the land owners of demonstration site were involved directly in ongoing project activities under supervision of SHER. In addition to this three trained farmers were also provided with the seedlings of *Aconitum atrox* and *Aconitum heterophyllum* which they planted in their private land. Today many farmers are willing to cultivate these medicinal herbs, but the main hurdle is non-availability of Germplasm. In order to meet out the demand of villagers and to conserve the genetic resources SHER is engaged in establishing a Germplasm and Technical Resource Centre (GTRC) within the Govind Pashu Vihar Sanctuary and National Park.

ASSESSMENT OF BIODIVERSITY AND INFRASPECIFIC VARIATION AMONG TWO REPUTED MEDICINAL PLANT GENERA *ACONITUM* L. (RANUCULACEAE) AND *PODOPHYLLUM* L. (PODOPHYLLACEAE) IN THE HIMALAYA

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Aconitum in North West Himalaya is represented by 10 species and 2 varieties and *Podophyllum* by one species. A detailed studies on biodiversity assessment and infraspecific variations of *Podophyllum hexandrum*, *Aconitum balfourii*, *A. falconeri*, *A. heterophyllum*, *A. laeve*, *A. violaceum* was carried out based on field studies as well as earlier collections in herbaria. Although most species of these genera exhibit remarkable morphological variations, no infraspecific taxa have been recognised (except under *A. heterophyllum*) as these variations are observed to be continuous. A new variety *A. heterophyllum* var. *roylei* has been described. *A. heterophyllum* and *A. violaceum* are shown to be morphologically highly diverse. Genetic diversity in this group is least studied. The taxonomic treatment of the genus includes a key to all species, correct nomenclature, distribution and useful taxonomic notes, where possible. In the present study *A. ovatum* and *A. cordatum* have been shifted back under *A. heterophyllum*. *A. kashmiricum* is also treated here as a morphological variant of *A. kashmiricum*. *A. balfourii* var. *rhombilobum*, *A. falconeri* var. *latilobum*, *A. heterophyllum* spp. *parciflorum*, *A. laeve* var. *curvipilosum*, *A. violaceum* var. *robustum* and *A. violaceum* var. *weileri* have been reduced as synonyms under their typical varieties. *A. falconeri* has been reported for the first time from Kumaon Himalaya. Lectotypification has also been done for a few species.

A critical observation was also made on the nature of micromorphological characters (hairs) of 4 species of *Aconitum* and one species of *Podophyllum*. All the species (*A. balfourii*, *A. heterophyllum*, *A. laeve* and *A. violaceum*) studies for hairs can be easily differentiated based on hair characters. The hairs varied mainly in density, type, orientation and its presence and absence on different parts of plants.

Extensive field survey was undertaken to Valley of Flowers, Hemkund, Sunderdonga, Pindari, Har Ki Dun, Milam, Shujua bugyal glaciers and collected all available species of *Aconitum* (*A. balfourii*, *A. laeve*, *A. heterophyllum* and *A. violaceum*) and *Podophyllum hexandrum*. The population of these plants throughout its range was observed to be very sparse and decreasing day by day and receding towards higher and higher elevation as also observed by Shah (1985).

Discussing the current status of the species, it is said that owing to the medicinal virtues, most species of the genus have become critically endangered in their type localities. Both *in-situ* and *ex-situ* efforts are recommended to conserve the genetic diversity in these species.

LANDUSE AND LAND CAPABILITY MAPPING IN PART OF KUMAON LESSER HIMALAYA

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The main objective of the study is to evolve an optimum landuse framework based on scientific and pragmatic land capability classification, for the sustainable development of rural ecosystems in the Lesser Himalayan watersheds of Kumaon. The research problem was approached by catering the analytical components of Landuse survey and mapping, geomorphological mapping, soil survey and analysis, environmental hazard zone mapping, land capability classification, landuse planning and delineation of viable agro-ecological units. Sim Gad Watershed encompassing a geographical land surface of about 53.90 km² in the Lesser Himalayan ranges of district Almora, in Kumaon region of Uttar Pradesh has been selected as the study area for the present investigation.

The landuse survey and geomorphological mapping were carried out using Survey of India topographical sheets at scale 1:50000, cadastral maps, and field survey and mapping. The physio-chemical analysis of soils was done using standard soil survey techniques including intensive and extensive sampling and laboratory and field experiments. Landslides and erosion were considered as principal environmental hazards, and delineated and mapped using field survey, remote sensing and GIS techniques.

The land capability classification is based on the scientific parameters of surface slope, soil depth, soil texture and erosion status. The entire land surface of the watershed except, forests, portions of uncultivable wasteland and areas under other uses, were surveyed for land capability analysis, and classified into three categories of land - (a) good quality land, (b) medium quality land, and (c) poor quality land. Out of these three classes of land identified in the region, the first two were found suitable for the purpose of crop farming.

An optimum landuse framework was evolved for the watershed based on the land capability classification, environmental hazard status and through community participation. Drastic changes have been suggested in the traditional landuse pattern through increasing the forest cover from 52.13 percent to as much as 63.14 percent by bringing and a considerable proportion of wasteland under community forest. The area under cultivation has been reduced by 1.10 percent while the land of the watershed under horticulture has been proposed to be increased from existing merely 2.60 percent to 9.54 percent of the total geographical land surface of the basin.

Finally, taking into consideration the, the proposed land use pattern, the availability and productive potential of natural resources, and people's needs, problems and development options, the entire watershed was divided into three viable and coherent agro-ecological units - (a) Fodder-horticulture unit, (b) Fodder-agriculture unit, and (c) Fodder - vegetable unit.

ESTABLISHMENT OF MODELS FOR REHABILITATION OF REGRADED 'JHUM' LAND IN A WATERSHED USING 'SWEET' IN MIZORAM'

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Mizoram which lies between 21°35'-24°39'N latitude and 92°16'-93°39'E longitude is basically a rugged mountainous terrain state in North East India where about 2/3 of the population depend on agriculture for their livelihood. Owing to the fact that the state hardly has flat land, it favours slash-and-burn or 'jhum' or shifting agriculture. Shifting cultivation has been practiced by the farmers from time immemorial and is the major source of livelihood of the people. Due to high population pressure, highest proportion of land of the state are now found under shifting cultivation and also, the 'jhum' cycle in recent years has been reduced to 2-3 years. This reduction in jhum cycle results in excessive deforestation, increased soil erosion, loss of soil fertility, depletion of soil nutrient contents, destruction of microbiological activities in the soil, increased weed pressure and unsustainability of, and unsuitability for crop production.

Therefore, shifting cultivation has always been a subject of disapproval by foresters, conservationalists through academic dismissal by economists, ecologists and to the reluctant tolerance by administrators. Heavy and prolonged monsoon in the state further aggravate the danger of soil erosion inevitably linked with the shifting cultivation. Despite all these detrimental effects, shifting cultivation has not been possible to be eradicated. Under the New Land Use Policy (NLUP), the Government of Mizoram identified the poor 'jhumias' and provided them some incentive to take up multipurpose fast growing tree species in their land and to wean away from shifting cultivation, however, it hardly yield any fruitful result. The farmers were not ready to change their traditional practices. In order to overcome the above problems, the needs and desires of local people and their interactions with the local resources have been taken into care while devising various models using 'SWEET' (Sloping Watershed Engineering Technology) for rehabilitation of degraded jhum land in Mizoram Himalayas.

बांस

बांस घास परिवार का सबसे लम्बा व मजबूत पौधा है। यह समस्त भारत में पाया जाता है उत्तराखण्ड में यह रिंगाल के नाम से जाना जाता है। उत्तराखण्ड में बांस की तीन प्रजातियाँ हैं। एरूनडिनेरिया फैल्काटा, डैन्ड्रो कैलमस हिमल्टोनाइ, डैन्ड्रो कैलमस स्ट्रिक्टस।

रोग व उपाय: बांस में कई फांलिएज रोग पनप जाते हैं। इसके पत्तों में चकते लग जाते हैं और फांलिएज रस्ट, हाट स्पॉट, सूटी मोल्ड भी बीमारी के रूप में लगते हैं। इनके इलाज के लिए, फैनितोथियान का घोल पानी के साथ या मैलेथियोन का २% घोल छिड़क दीजिए।

पौध रोपण की नयी तकनीक: बीज को क्यारियां बनाकर, लाइन में माह जुलाई में बो दीजिए। यह अगस्त में उगकर छोटा पौधा हो जायेगा, फिर इसे क्यारी से उखाड़ कर छोटे पॉलीबैग में लगा दीजिए। पॉलीबैग में मिट्टी, रेत और गोबर हो, व एक खुराक एन०पी०के० की डाल दें। अगस्त से मार्च तक इसकी गुड़ाई, सिंचाई आदि करते रहना चाहिए। अप्रैल के प्रथम सप्ताह में इसके छोटे पौधों को पॉलीबैग से सावधानी पूर्वक निकालकर, प्रत्येक पौध की जड़ व राइजोम को अलग कर सावधानी से इसे काट लें; दूसरे चरण में की गयी प्रक्रिया को दोहरा कर नये पौधों को भी पॉलीबैग में रोपित कर दें, एक पौध से आपको ४ से ८ नये बच्चे पौधे मिलेंगे, उनमें से एक पौधा आप नर्सरी में रखें व शेष को माह जुलाई में जहां रोपण करना है, रोपित कर दें। जो भविष्य की उपज बन जायेंगे, इसकी फसल तैयार होने में तीन से पांच वर्षों का समय लग जाता है।

सहयोग से
भारतीय वानिकी अनुसंधान एवं शिक्षा परिषद
पोस्ट: न्यू फारेस्ट
देहरादून, उ० प्र०

अर्पण

एसोसिएशन फॉर रूरल प्लानिंग एण्ड एक्शन
ग्राम: हेल्लिया, पोस्ट: अस्कोट
जला: पिथौरागढ़ २६२५०१, उ०प्र०

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 263643, India

Agnihotri, Y.; Agarwal, M.C. and Kumar, Nirmal 1998. **Relative efficiency of Latin Square Design with *Eucalyptus* in Shivalik hills.** *Indian Forester*, 124(4):231-239. Central Soil & Water Conservation Research and Training Institute, Research Centre, Chandigarh, India. [EUCALYPTUS; GRASSLAND; SHIWALIK]

The efficiency of various Latin Square Designs (LSD) relative to the Complete Randomised Designs (CRD) and Randomised Complete Block Design (RCBD) for various sizes and shapes of plots with height and diameter at breast height (D.B.H.) of *Eucalyptus* in Shivalik hills were worked out. The relative efficiency (percentage) of 3x3, 4x4, 5x5 and 6x6 LSD for different plot sizes and shapes compared with CRD and RCBD when rows are treated as blocks (ignoring columns) and when columns are treated as blocks (ignoring rows) have been computed. The number of units required in CRD and RCBD taking rows as blocks or columns as blocks for obtaining the relative efficiency equivalent to that of 3x3 to 6x6 LSD were also evaluated and it was found that LSD was more efficient than CRD and RCBD for experimentation with *Eucalyptus* trees height and D.B.H. in Shivalik hills.

Airi, Subodh; Rawal, R.S.; Samant, S.S. and Dhar, U. 1998. **Treatments to improve germination of four multipurpose trees of central sub Himalaya.** *Seed Science & Technology*, 26(2):347-354. G.B. Pant Institute of Himalayan Environment and Development, Kosi, Almora 263 643, U.P., India. [GERMINATION; LIVESTOCK; SEEDLING]

The germination of four multipurpose species *Semecarpus anacardium*, *Olea glandulifera*, *Ehretia laevis* and *Pittosporum floribundum* after presowing treatments was studied. Acid scarification (50% sulphuric acid) for 5 and 10 min significantly increased the percentage germination and reduced mean germination time (MGT) in *O. glandulifera* and *S. anacardium*. Increased germination was achieved in *P. floribundum* by treatment with GA₃ (100 ppm) for 24 h. In *E. laevis* increased germination was achieved when mechanically scarified seeds were soaked for 24 h in water.

Aivalli, Veeranna 1998. **Single-line administration - An administrative experiment in Jammu & Kashmir.** *The Indian Journal of Public Administration*, XLIV(3):604-608. [ACCOUNTABILITY; ADMINISTRATION; DECENTRALISATION; DEMOCRACY]

Presenting case of Ladakh, where single-line administration operates, the author discusses its background, features and advantages that have flowed from it in terms of better coordination among development departments at district level, qualitative change in working of government departments, democratic decentralisation and better administrative accountability. He also briefly discusses the drawbacks of the system before commending the success of the system.

Ao Wati, A.R. 1998. **Status of forests and conservation approaches of *Tragopan blythii* in Nagaland.** *Indian Forester*, 124(6):449-452. Additional Chief Conservator of Forests, Nagaland, Kohima. [BAMBOO; BIODIVERSITY; TIMBER; WILDLIFE]

Nagaland is known for its richness in biodiversity. The State also harbours as many as 200 species of epiphytic and terrestrial orchids, many of which are rare and endangered. Under Wildlife Programmes, the conservation of *Tragopan blythii*, a rare and endangered species found in the Nagaland has been initiated to save this bird from extinction.

Arora, Manoj and Sharma, M.L. 1998. **Seismic hazard analysis: An artificial neural network approach.** *Current Science*, 75(1):54-59. Department of Civil Engineering and Earthquakes Engineering, University of Roorkee, Roorkee 247 667, U.P., India. [ANN; EARTHQUAKES; MAGNITUDE; SEISMIC HAZARD]

An artificial neural network (ANN) approach is applied for the estimation of seismic hazard in a region. The seismicity rhythm is recognized by means of an ANN approach. The seismicity cycle may be divided into four stages, viz. energy accumulation, increasing release in energy, intense release and the remnant release of seismic energy. The seismicity data from the earthquakes catalogue (1790-1990) for the Arakan Yoma and Naga Thrust belt in NE India have been used. Future seismicity for the region is predicted up to the year 2040. The results show that the intense energy release cycle will start somewhere in the year 2030 and will continue up to 2040. The successful operation of ANN and its application to predict seismicity cycle in the selected region shows that the approach may be applied to other areas also for the seismic hazard evaluation.

Banerjee, U.K. 1998. **Germination of *Melia azedarach* seeds with IAA, IBA and GA₃.** *Indian Forester*, 124(3):220-223. Department of Silviculture and Agroforestry, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, H.P., India. [GERMINATION; MELIA AZEDARACH; SEEDLING]

Seed of *Melia azedarach* when soaked in 200 ppm of IAA for 24 hours have been found to give better germination percentage as compared to other concentrations of IBA and GA₃.

Bargali, Kiran; Singh, S.P. and Singh, R.P. 1998. **Seed characteristics and germination behavior of some early and late successional tree species on a nutrient gradient.** *Indian Forester*, 124(3):247-251. Department of Forestry, Kumaun University, Nainital. [GERMINATION; NUTRIENT GRADIENT; SEEDLING; TREE SPECIES]

Seed characteristics germination behavior on nutrient gradient was studied in three early and three late successional tree species. It was found that early successional species have lower seed dry weight (835 to 1110 mg seed⁻¹). Seed moisture content was also greater for late successional species (52.58%) than for early successional species (19.97%). However, per cent germination was lower for late successional species (65%) in comparison to early successional species (78%). All species showed broad germination responses on the nutrient gradient.

Bhardwaj, D.R. and Mishra, V.K. 1998. **Rooting response of stem cuttings of maple (*Acer oblongum* Wall.) to IBA and cutting position.** *Indian Journal of Forestry*, 21(1):16-18. Department of Silviculture & Agroforestry, University of Horticulture & Forestry, P.O. Nauni 173 230, Solan, H.P., India. [GERMINATION; SEEDLING; SILVICULTURE; STEM CUTTING]

The study was carried out to examine the influence of IBA and cutting position of shoot on the rooting of stem cutting of *Acer oblongum*. Root regeneration in cuttings untreated with IBA was extremely low. The application of IBA (1000, 3000, 5000 ppm) exercised significant improvement in rooting per cent, primary root number, root length and root dry matter over control. The cuttings emanating from lower portion of shoot gave better rooting response as compared to upper ones.

Bhardwaj, L.N. and Gupta, V.K. 1998. **Studies on Mycoflora affecting *Pinus gerardiana* (chilgoza) seeds and their management.** *Indian Forester*, 124(4):252-255. Department of Plant Pathology, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, H.P., India. [FUNGICIDE; PINUS GERARDIANA; SEED-BORNE FUNGI]

Ten fungi were found deteriorating the edible nuts of *Pinus gerardiana* (Chilgoza) of which *Penicillium citrinum* and *Trichothecium roscum* were the most predominant. Maximum spoilage (12 to 114%) in storage was however recorded on seeds stored in polythene bags, plastic containers and glass bottles, whereas seed stored in cloth bags, gunny bags, wooden boxes and cardboard boxes remained free from visible moldy growth even after nine months of storage where only 2 to 5% seed showed moldy growth. Out of seven fungicides tested, seeds treated with carbendazim (Bavistin, 0.05%), thiophenate methyl (Topsin, 0.05%) and benomyl (Benlate, 0.05%) provided significantly better control of *P. citrinum* when stored in cloth bags for nine months, however, insignificant results were obtained when seeds after fungicide treatment were stored in polythene bags.

Bhatnagar, P.R.; Chauhan, H.S. and Srivastava, V.K. 1997. **Unsteady unsaturated flow from a surface disc source.** *Journal of Hydrology*, 203(1-4):154-161. Crop Production Division, V.P.K.A.S., Almora 263 601, U.P., India; Dept. of Irrigation. & Drain. Engg., and Dept. of Math. & Stat., G.B. Pant Univ. of Agric. and Tech., Pantnagar 263145, U.P., India. [DISC SOURCE; OBLATE SPHEROIDAL COORDINATES; SOIL WATER MOVEMENT; TRICKLE IRRIGATION; UNSATURATED FLOW]

A mathematical model in an oblate spheroidal coordinate system is presented to describe the unsteady wetting pattern emerging from a disc source of constant radius. Two types of source boundary conditions were considered with the model, inflow through a saturated disc, and constant inflow through a disc. Numerical solutions of the problem are obtained using an alternating direction implicit finite difference method. The model is validated with the analytical model of Warrick and Lomen (1976), and through comparison with the observed wetting fronts for the experiment conducted by Clothier and Scotter (1982). Effect of the two conditions used for source boundary are discussed.

Bhatt, B.P.; Chauhan, D.S. and Todaria, N.P. 1998. **Growth performance and biomass yield of some leguminous taxa in Garhwal Himalaya.** *Indian Journal of Forestry*, 21(2):171-173. Department of Forestry, Post Box - 59, H.N.B. Garhwal University, Srinagar-Garhwal 246 174, U.P., India. [BIOMASS; FAUNA; FODDER; GARHWAL HIMALAYA; NITROGEN FIXING]

Seeds of various leguminous spp. (*Acacia auriculiformis*, *A. melanoxylon*, *Albizia lebbek*, *Chamaecystis palmensis*, *Dalbergia sissoo*, *Flemingia macrophylla*) were tested for their germination, growth and biomass production. *A. lebbek* showed maximum (57.5%) and *A. auriculiformis*. Growth attributes of rest of the species ranged in between these two extremes.

Bhau, Brijmohan Singh and Koul, Veenu 1998. **Switching on *Bacillus thuringiensis* to reduce selection for resistance.** *Current Science*, 75(8):771-777. The authors are in the Department of Botany, University of Jammu, Jammu 180 006, India. [ANTI-FEEDANT; BACTERIA; ENVIRONMENT-FRIENDLINESS; INSECT-RESISTANCE PLANTS]

The scope of plant genetic engineering in allowing genes from *Bacillus thuringiensis* encoding natural endotoxin is well illustrated by the production of insect-resistance plants. There is great concern over increasing evidence of field resistance of insect pests to this endotoxin. Efforts are on for prevention of the spread of this resistance and identification of strategies which give the best protection for the lowest cost in terms of increased resistance in the pests as well as environment-friendliness.

Bhola, N. and Mishra, V.K. 1998. **Influence of Nitrogen Fixing Trees on the status of some soil micronutrients.** *Indian Journal of Forestry*, 21(2):103-107. Department of Silviculture and Agroforestry, Dr. Y.S. Parmar University of Horticulture and Forestry, Solan, H.P., India. [DALBERGIA SISSOO; MICRONUTRIENTS; NITROGEN FIXING; SEEDLING]

The soils under 6-year old plantations of seven Nitrogen Fixing Trees (NFTs) viz., *Acacia nilotica*, *Acacia auriculiformis*, *Bauhinia variegata*, *Leucaena leucocephala*, *Albizia lebbek*, *Acacia catechu* and *Dalbergia sissoo* were studied to know the micronutrient (Zn, Cu, Fe and Mn) build up in soil at four different peripheral distances (30, 60, 90 and 120 cm from tree trunk) and two soil depths (0-15 and 15-30 cm). The concentration of these micronutrients were also estimated in leaves of the NFTs. *Acacia nilotica* leaves registered maximum concentration of Zn, Cu, Fe and a comparable content of Mn. In soils, available Zn, Cu, Fe and Mn were significantly higher under the NFTs at all peripheral distances as well as soil depths than controls (open plots adjacent to plantation plots). A declining trend in amount of available nutrients was observed towards greater peripheral distance and soil depth. Maximum build up of available Cu, Fe and Mn was noticed under *Acacia nilotica*, maximum Zn was observed under *Albizia lebbek*.

Bohle, Hans-Georg and Adhikari, Jagannath 1998. **Rural livelihoods at risk how Nepalese farmers cope with food insecurity.** *Mountain Research and Development*, 18(4):321-332. South Asia Institute, Heidelberg, Germany and Pokhara, Nepal. [DYNAMIC PRESSURE; HOUSEHOLD; LIVESTOCK; SUSTAINABLE LIVELIHOOD SECURITY]

Since the early 1990s, Nepal has changed from a net exporter to a net importer of food. Nearly half of Nepal's districts have become deficient in food. The situation is most serious for peripheral mountain regions of the Middle Hills. The paper concentrates on food deficient village communities in fragile mountain tracts of Nepal. It is based on household surveys in six peripheral mountain villages. More than fifty percent of all households are not even self-sufficient in food for six months in a year. The project then focuses on the coping strategies of the mountain farmers which aim at bridging this gap in food supply. The analysis reveals highly diverse, complex, and innovative strategies which require high degrees of mobility and activity. There is a general tendency that these strategies are increasingly oriented towards markets. It becomes clear that the growing tendency towards external linkages offers new potentialities, but, at the same time, new risks for the mountain population. The project therefore examines the major determinants which make specific coping strategies more or less successful. In addition to caste and ethnicity, household structures (including work participation patterns, gender composition, age structure, and health status) emerge as most decisive factors. Despite all efforts, the majority of the mountain population, nevertheless, is severely undernourished. For an increasing proportion of the village people, survival has become a permanent crisis.

Chandra, J.P.; Yadava, M.P.S. and Gandhi, J.N. 1998. Performance of *Eucalyptus* species in Nainital Tarai of Uttar Pradesh. *Indian Forester*, 124(3):232-235. WIMCO Seedling Limited, R & D Centre, Rudrapur, Distt. U.S. Nagar, U.P. [CHARCOAL; EUCALYPTUS; FIBREWOOD; PLYWOOD; SEEDLING]

Performance trial of 25 provenances of six species of eucalyptus was conducted at R&D Station of M/s WIMCO Seedlings Limited located at Rudrapur, Nainital District in U.P. Out of 25 provenances tried, 10 were of *E. camaldulensis*, 5 were of *E. grandis*, 4 were of *saligna*, 3 were of *E.brassiana*, 2 were of *E. urophylla* and 1 was of Mysore gum. Observations of height, DBH, basal area, volume/ha were recorded. It was observed that provenance 13022 NW of Caboolture, 112970 SRF 194 Herberton Range, Qld. of *E.grandis* and 13026 South of Calliope, Qld. of *E. saligna* yielded higher wood per unit area than rest of the provenances under study and were significantly better than control *i.e.* Mysore gum CBJ-38. Provenance 13395 of *E. brassiana* yielded poorest.

Chatterjee, Anupam and Chattopadhyay, Anshuman 1998. Influence of buthionine sulfoximine mediated glutathione depletion on clastogenic activity of bleomycin and γ -rays. *Current Science*, 75(6):604-608. Genetics Laboratory, Department of Zoology, North-Eastern Hill University, Shillong 793 022, India. [BLEOMYCIN; BUTHIONINE SULFOXIMINE; CHROMOSOME ABERRATIONS; RADIOMIMETIC]

The extent of induction of chromosome aberrations (CAs) by bleomycin (BLM) and γ -rays has been compared in buthionine sulfoximine (BSO)-mediated reduced glutathione GSH-depleted human peripheral blood lymphocytes. The rationale for BSO treatment is based on the premise that GSH serves as a major endogenous cellular defense against various exnobiotics and GSH depletion itself may lead to significant sensitization. Radiation and BLM-induced CAs were scored from 1st cycle metaphases in samples with or without BSO. BSO-treated samples showed higher sensitivity to radiation than the BSO-untreated one, whereas reduction in clastogenic action of BLM was observed in the BSO-treated sample. The frequency of all types of radiation-induced CAs was increased except exchanges. The reduced effect of BLM in GSH-depleted cells could be explained on the basis of failure of reactivation of the oxidized BLM by endogenous GSM whereas increased effect of radiation in GSH-depleted cells could be due to more free-radical induced DNA lesions, less DNA-shielding effect and low efficient repair.

Datta, S.K. and Virgo, K.J. 1998. Towards sustainable watershed development through people's participation: Lessons from the lesser Himalaya, Uttar Pradesh, India. *Mountain Research and Development*, 18(3):213-233. Former Project Director, Watershed Management Directorate, P.O. New Forest, Dehradun 248 006, U.P., India; Technical Assistance Team Leader, WS Atkins, Cambridge CB3 0NA, U.K. [BIODIVERSITY; ECO-REGENERATION; FIREWOOD; FODDER; SOCIO-ECONOMY]

The paper reviews experiences of the Doon Valley Integrated Watershed Management Project, with emphasis on the evolution of a participatory "process orientated" approach aimed at developing community

capabilities to sustain the increased natural resource production systems introduced by Project activities. The focus is on promoting convergent planning and strengthening the skill and institutional capacities of the rural communities, as well as of the government agency responsible for implementation. The major conclusions are: (1) that human resource development should precede external technical watershed management activities; (2) that under the participatory approach, external implementors need to be encouraged to merge their technical skills with the indigenous skills of villagers in order to achieve a convergent approach. The initial focus of watershed management projects should be on communities and the adjacent areas under their influence, rather than on the physical aspects of watersheds. Women proved to be most receptive and capable of forming cohesive groups to manage natural resources, with livelihood-generation as the primary trigger. Actual priorities perceived by villagers through participatory (PRA-based) planning frequently differ from "targets" and priorities defined by outside planners. Conventional watershed management activities are rarely perceived by villagers as priorities, creating frustration for the external implementors and demanding flexibility in inputs, budgets, and phasing. The project produced initial improvements in living conditions and in local involvement by people in managing natural resources. This was supplemented by physical soil and water conservation measures and community-managed grass and fodder tree plantations. The consequent reduction in pressure on intervening forest areas should favor natural eco-regeneration. Moreover, the increased environmental awareness and involvement of the villagers is expected to facilitate protection of afforestation programs beyond the village limits.

Dhar, T.N. and Barthwal, C.P. 1998. **Administrative in mountain regions: challenges and paradigms (case of Uttarakhand).** *The Indian Journal of Public Administration*, XLIV(3):584-595. [ADMINISTRATION; FOREST AREA; GRASSLAND; LANDUSE PATTERN; POLICY-MAKING]

Apparently pursuing the objective of providing good governance to people inhabiting difficult mountain area, whose needs and problems dilator substantially from those of the plans areas, the authors, present the case of proposed Uttarakhand State. Besides discussing the proposed state's features-demographic geophysical, economic, *etc.*-they present details on its existing administrative system and proposed structural and institutional changes required to address its specific administrative and developmental problems.

Dobhal, Rakshima and Tayal, H.D. 1998. **Physico-chemical studies on the quality of some samples of ground-water of Doon Valley (U.P.).** *Indian Journal of Forestry*, 21(1):51-55. Department of Chemistry, DAV (P.G.) College, Dehradun 248 001, U.P., India. [CHEMICAL ANALYSIS; CORRELATION COEFFICIENT; DOON VALLEY; GROUND-WATER]

Water samples of ground water from 10 tube-wells were collected for physico-chemical characteristics as per standard methods of analysis. Most of the parameters are correlated with one another. The data obtained are summarized in table-1 which depicts the suitability of ground water of this area for drinking and domestic purposes. The studies also reveal (i) Ca-SO₄, (ii) Mg-SO₄, (iii) Ca-Mg-HCO₃, (iv) Ca-Mg-SO₄ and (v) Ca-Mg-Cl-SO₄ types of combinations of ground waters. It is, therefore, suggested that precautionary measures have to be taken to avoid further deterioration in the quality of ground water.

Gupta, A.K. 1998. **Status and management of wildlife in Tripura.** *Indian Forester*, 124(10):787-793. Conservator of Forests, Southern Circle, Udaipur, Tripura, India. [BIODIVERSITY; CONSERVATION; FLORA; WILDLIFE]

Tripura is smallest of the seven North-Eastern States, but because of her unique Bio-geographical and Zoo-geographical position, is very rich in bio-diversity and biological resources. Over the past few decades, however, various factors have adversely contributed towards wildlife conservation and management in the State. The paper records some of the unique faunal components of wildlife in the State and discusses about likely steps for sustainable wildlife conservation vis-a-vis meeting varied needs from diverse user groups.

Gupta, L.M. and Raina, R. 1998. **Side effects of some medicinal plants.** *Current Science*, 75(9):897-900. Department of Forestry Products, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan 173 230, H.P., India. [HERBAL DRUG; MEDICINAL PLANT; TOXICITY]

Herbal drugs are playing an important role in health care programmes worldwide, especially in developing countries. This is primarily due to the general belief that herbal drugs are without any side effects besides being cheap and locally available. The article gives an account of 21 medicinal plant species which are being used, on large scale, for treatment of particular diseases, reported to be having serious side effects. Medicinal plants, before being allowed to be used as drugs, should also be tested for side effects, in any.

K.C., Himmat Singh and Pokhriyal, T.C. 1998. Distribution of leguminous and non-leguminous nitrogen fixing plants in relation to altitudinal variations in eastern part of Nepal. *Indian Forester*, 124(7):544-555. Eastern Regional Forestry Office, Biratnagar, Morang, Nepal; Plant Physiology Section, Forest Research Institute, Dehradun, U.P., India. [FERTILIZER; NITROGEN FIXING; SOIL EROSION; TIMBER-LINE]

A chronological survey was conducted to study the identification and distribution of some nodulating and non-nodulating leguminous and actinorrhizal herb, shrub, climber and tree species in Eastern part of Nepal from Tarai (60 m) to timber-line (above 3000 m). Amongst 186 species and 79 genus explored in this study, 172 and 14 species, 70 and 9 genera were recorded in leguminous and actinorrhizal groups. Total 144 and 7 species, 59 and 5 nodulating genera were recorded in leguminous and non-leguminous species. In the three sub-families of Leguminosae, Papilionoideae was recorded to offer highest number of nodulating species and Caesalpinioideae non-nodulating. However, maximum numbers of nodulating herbs, shrubs, and climbers were recorded in Papilionoideae and trees in Mimosoideae. The distribution of nodulating leguminous species were observed to be dominated in the tropical and sub-tropical areas with a sharp decline from 1800 m onwards. The maximum 92 species were observed to be occurred between 0-600 m altitudinal range, followed by 84 species between 600-1200 m, 80 species between 1200-1800 m, 48 species between 1800-2400 m, 17 species between 2400-3000 m and the minimum 5 species in and above 3000 m. These nodulating species distributed in different altitudinal ranges can be further screened for the various afforestation and soil-improvement programmes in the region.

Kikim, A. and Yadava, P.S. 1998. Impact of fire on regeneration of dominant tree species in a secondary subtropical forest of North-Eastern India. *International Journal of Ecology and Environmental Sciences*, 24(1):81-93. Department of Life Sciences, Manipur University, Imphal 795 003, India. [CASTANOPSIS TRIBULOIDES; DISTURBANCE; QUERCUS FENESTRATA; SAPLINGS; SEEDLING; SPECIES DIVERSITY]

The effect of fire was analysed on four different sites in a secondary sub-tropical forest of Manipur, North-Eastern India. The study was undertaken over a two-year period from April 1993 to April 1995. *Quercus fenestrata*, *Quercus dealbata*, *Castanopsis tribuloides* and *Machilus bombycina* were dominant tree species in these forests. The maximum number of seedlings and saplings was recorded for *Quercus fenestrata* on sites I and II whereas on sites III and IV, the highest number of seedlings and saplings was exhibited by *Castanopsis tribuloides*. The density of seedlings increased in the first year after fire but subsequently decreased in the second year on all the sites except I. The number of saplings decreased after fire in the initial year but thereafter it increased in the second year. Most species regenerated by coppice rather than by seeds. As many as 85.29% of the young plants were sprouts from rootstock or tree stumps.

Kirn, H.S.; Kapahi, B.K. and Srivastava, T.N. 1998. *Iris atchinsonii* (Baker) Boiss. A new record for India from Jammu and Kashmir State. *Indian Journal of Forestry*, 21(2):164-166. Department of Botany, Govt. Gandhi Memorial Science College, Jammu Tawi 180 001, India; Regional Research Laboratory (CSIR), Canal Road, Jammu Tawi 180 001, India. [FLOWERING PLANTS; HERBARIUM; TAXON]

Iris atchinsonii (Baker) Boiss, has been reported for the first time from Rajouri district of Jammu & Kashmir State and forms a new record for India. Detailed description with an illustration of the taxon has been provided for easy identification.

Krishna, Gopal; Dwivedi, Madhu; Nautiyal, M.C. and Sah, V.K. 1998. Land degradation: Assessment of soil sensitivity, sediment and nutrient losses from watershed in Central Himalaya. *International Journal of Ecology and Environmental Sciences*, 24(1):37-47. Hill Campus, G.B. Pant University of

Agriculture and Technology, Ranichauri, Tehri Garhwal 249 199, U.P., India. [ERODIBILITY INDICES; LAND CAPABILITY CLASSIFICATION; LAND DEGRADATION; SOIL SENSITIVITY; SUSPENDED SOIL LOAD; WATERSHED]

In order to study the land degradation problem in a watershed on Henwal river, erodibility indices under different land use practices as well as soil suspended sediment and nutrient losses from the watershed were assessed. Watershed comprising of 547.23 ha of land of which 34.8% area is under forest, 3.0% under grazing and 62.3% under cultivated lands. Lands under capability classes of IIIs, IVse, Vse, VIes, VIIes and VIIIes with erosion(e), soil and root zone limitations (s) were identified. The results revealed that erodibility indices viz. clay moisture equivalent ratio (CMER), clay ratio (CR), percolation ratio (PR), surface aggregation ratio (SAR) and water stable aggregate (WSA) were lowest while erosion and dispersion ratios (ER and DR) were highest in the cultivated and horticultural lands whereas the opposite trend was noticed in the forest and grazing lands indicating their sensitivity to degradation and being prone to erosion. Land degradation was also estimated in terms of sediment and nutrients load in river water. Sediment and concentration of nutrients were highly variable in different weeks and months depending on rainfall. Highest sediment load of 148 mg L⁻¹ was recorded during 8th week (3rd week of July). pH of the water was slightly alkaline (7.4) with EC of 122 µs m⁻¹. Total soluble salts (TSS) varied from 110 to 180 mg L⁻¹ with an average of 135 mg L⁻¹. The bicarbonate (HCO₃⁻) and carbonates (CO₃²⁻) constituted > 50%, calcium (Ca²⁺) and magnesium (Mg²⁺) >25%, chlorides (Cl⁻) 10% and the sulphates (SO₄²⁻), nitrates (NO₃⁻), phosphates (PO₄³⁻), sodium (Na⁺) and potassium (K⁺) together only 15% of the total ion concentration in the runoff. The possible causes for land degradation were identified as (i) ineffective soil and water conservation measures, (ii) lack of maintenance of soil organic matter, (iii) unbalanced use of fertilizer, (iv) selection of crops not suited to particular soil type and faulty crop rotation.

Kumar, M. Ravi; Rao, N. Purnachandra and Bhatia, S.C. 1998. **Analysis of Harvard centroid moment tensor solutions and computation of strain rates in the Himalaya and Tibetan plateau regions.** *Current Science*, 75(3):311-316. National Geophysical Research Institute, Hyderabad 500 007, India. [EARTHQUAKES; SEISMOGENIC; TENSOR; TIBETAN PLATEAU]

Deformation tectonics of the Himalaya and Tibetan plateau regions has been analysed using the Harvard centroid moment tensor data from 1977 to 1996. The slip vectors of the thrust earthquakes in the Himalaya and the *P*-axis azimuths of the strike-slip earthquakes in the Tibetan plateau region are found to trend NNE on an average. This is in agreement with the directions of maximum compression and extension derived from the eigen vectors of the summed moment tensor. For the Himalayan and Tibetan plateau regions, the directions of principal compression are N22°E and N20°E respectively, while the directions of extension are N59°W and N72°W. This indicates that a similar compressive regime prevails in both the regions, under the influence of the Indian plate motion with respect to the Eurasian plate. The computed strain rates indicate a crustal thickening in the Himalayan region, with the ratio of N-S convergence, E-W extension and crustal thickening being about 5:2:3; and a crustal thinning in the Tibetan plateau region, with the ratio of N-S convergence, E-W extension and crustal thinning being about 4:9:5.

Kuniyal, J.C.; Jain, A.P. and Shannigrahi, A.S. 1998. **Public involvement in solid waste management in Himalayan trails in and around the Valley of Flowers, India.** *Resources, Conservation and Recycling*, 24(3&4):299-322. G.B. Pant Institute of Himalayan Environment and Development, Himachal Unit, Shamshi, Kullu 175 126, H.P., India. [HIMALAYAN TRAILS; PERCEPTION; PUBLIC INVOLVEMENT; REUSE; SOLID WASTE MANAGEMENT; VALLEY OF FLOWERS; WASTE GENERATION]

The Himalayas have always been tranquil, religious and enchanting for meditation, worship and recreation for saints, pilgrims and tourists respectively. But today there is no significant difference between metropolitan towns on the plains to tiny tourist religious spots in the hills of the Himalayas owing to a high influx of more than 1.16 lakh visitors within a 4-month season in a year. The beautiful treks from Govind Ghat (1928 m) to Hemkund Sahib (4329 m) and the Valley of Flowers National Park have suffered from litter and foul smells due to unattended solid waste. In the first part of the study, the perceptions of participatory groups such as visitors, stall keepers, the host community, the Gurudwara management

committee (GMC) and district administration (DA) regarding environmental assessment of solid waste management (SWM) have been taken into account. Since visitors and stall keepers are the major contributory participatory groups in generating and causing primarily solid waste problems, they were studied in detail. The local villagers as a host community by means of participatory interactions and meetings were assessed as an important participatory group along with assessments of their other problems. In addition, the GMC and DA have been assessed as regulatory participatory bodies at local and government levels for ongoing tourism activities and the resultant solid waste problem. Three hundred and fifty one visitors and 40% of the stall keepers were thoroughly interviewed. The second part of the study highlights the estimation of solid waste generation from the essential commodities supplying visitors at halting areas (e.g. Ghangariya) and Hemkund Sikh shrine.

Lee, S.W.; Choi, W.Y.; Norbu, L. and Pradhan, R. 1998. Genetic diversity and structure of blue pine (*Pinus wallichiana* Jackson) in Bhutan. *Forest Ecology and Management*, 105(1-3):45-53. Forest Genetics Research Institute, P.O. Box 24, Suwon 441-350, South Korea; Forest Research Centre, P.O. Box 673, Thimphu, Bhutan. [DIFFERENTIATION; GENETIC DIVERSITY; ISOZYME; PINUS WALLICHIANA]

Blue pine (*Pinus wallichiana* Jackson) is a member of subsection *Strobi* that is an important component of middle and high-elevation Himalayan forests. Five natural populations of *P. wallichiana* in Bhutan were investigated by starch-gel electrophoresis in an effort to determine the extent and distribution of genetic diversity. The level of genetic diversity was relatively high ($A = 1.8$; $P_{95} = 54.0\%$; $H_o = 0.163$; $H_e = 0.168$) and the degree of genetic differentiation ($G_{ST} = 0.027$) was low compared with those of other pines. The mean value of unbiased genetic distance, as proposed by Nei [Nei, M., 1978. Estimation of average heterozygosity and genetic distance from a small number of individuals. *Genetic* 89, 583-590.] ($D = 0.003$), confirmed that there is a very low differentiation and a close genetic relationship in blue pine populations of Bhutan. The estimates of the number of migrants per generation (N_m) of Wright [Wright, S., 1951. The genetical structure of populations. *Ann. Eugen.* 15, 323-354.] and Slatkin [Slatkin, M., 1985. Rare alleles as indicators of gene flow. *Evolution* 39, 53-65.] were 8.87 and 9.01, respectively. Five natural blue pine populations in Bhutan seemed to be in equilibrium with the expectations of Hardy-Weinberg.

Mahanta, A. and Gupta, B.B.P. 1998. *In vitro* effect of adrenergic agonists and antagonists on tissue respiration in *Rana limnocharis* and *Rana cyanophlyctis*. *Current Science*, 75(9):958-960. Environmental Endocrinology Lab., Department of Zoology, North-Eastern Hill University, Shillong 793 022, India. [METABOLIC; PHENYLEPHRINE; RINGER-PHOSPHATE; TISSUE RESPIRATION]

In vitro effects of $\alpha 1$ - and $\beta 1$ -adrenergic agonists, phenylephrine (PHE) and isoproterenol (ISO), on the rate of tissue respiration of *Rana limnocharis* and *Rana cyanophlyctis* were studied in the presence and absence of $\alpha 1$ - and $\beta 1$ -adrenergic antagonists, prazosin (PRAZ) and propranolol (PROP), during the month of April (summer/rainy season). PHE and ISO, when administered separately, induced significant increase in the rate of liver and muscle tissue respiration. ISO and PHE, when administered together, potentiated the calorogenic action of each other. PHE-induced increase in the respiratory rate was blocked significantly by PRAZ only in muscles of both the species. PROP blocked ISO-stimulated respiratory rate of liver tissue of *Rana limnocharis* and of skeletal muscle of *Rana cyanophlyctis*. However, PRAZ and PROP when administered together, completely blocked the ISO- or PHE-induced increase in the rate of tissue respiration in both the species. These findings seem to confirm that both $\alpha 1$ - and $\beta 1$ - adrenergic receptors are actively involved in the adrenergic stimulation of the metabolic rate of amphibian tissues. The degree of involvement of the adrenergic receptors in calorigenesis seems to vary with the tissues and the species.

Mahanta, J.; Chetia, M.; Hazarika, N.C.; Narain, K. and Sharma, S.K. 1998. Toxicity of *tuibur*, a unique form of tobacco smoke extract used in Mizoram, India. *Current Science*, 75(4):381-384. Regional Medical Research Centre (North Eastern region), Indian Council of Medical Research, Post Box 105, Dibrugarh 786 001, India. [N-NITROSAMINES; TOBACCO; TUIBUR]

A unique form of water extract of tobacco smoke called *tuibur* is used by some people in Mizoram. The toxicity of *tuibur* was studied using modified version of *Allium* test. Even dilute solutions of *tuibur* exhibited significant toxicity by reducing the root growth of *Allium* bulbs and inducing tumour formation in

the roots. Microscopical features revealed reduction of mitotic index, formation of micronuclei, lagging chromosome and c-mitosis in the root tip cells treated with different concentrations of *tuibur*. EC₅₀ value of *tuibur* for root growth was also estimated.

Maikhuri, R.K.; Nautiyal, S.; Rao, K.S. and Saxena, K.G. 1998. **Role of medicinal plants in the traditional health care system: A case study from Nanda Devi Biosphere Reserve.** *Current Science*, 75(2):152-157. G.B. Pant Institute of Himalayan Environment and Development, Garhwal Unit, P.O. Box No. 92, Srinagar (Garhwal) 246 174, U.P., India; GBPIHED, Kosi-Katarmal, Almora 263 643, U.P., India; School of Environmental Sciences, Jawaharlal Nehru University, New Delhi 110 067, India. [BUFFER ZONE; HERBAL TREATMENT; MEDICINAL PLANT; TAXUS BACCATA]

Tolchha-Bhotiya sub-community, inhabiting the buffer zone villages of Nanda Devi Biosphere Reserve, has strong faith and belief in traditional health care system, viz. herbal treatment. Twenty-five plant species are generally being used along with other materials and plant products in different combinations to cure fifteen major diseases. About eight and nine plant species are used for curing more than one disease. However, for some rare and serious diseases like tuberculosis, rheumatism, internal wounds and fractures, a few people, particularly those belonging to higher income group, prefer allopathic treatment. Since the knowledge of various medicinal plants being used in herbal treatment and their method of use is confined to local practitioner - *vaidhya* - it is of utmost importance to record this knowledge for future generations, otherwise it will be lost forever in the process of acculturation, which is taking place in the community at an alarming rate.

Maithani, Kusum; Arunachalam, A.; Tripathi, R.S. and Pandey, H.N. 1998. **Nitrogen mineralization as influenced by climate, soil and vegetation in a subtropical humid forest in northeast India.** *Forest Ecology and Management*, 109(1-3):91-101. Department of Forestry, Restoration Ecology Laboratory, North Eastern Regional Institute of Science and Technology, Nirjuli, Arunachal Pradesh 791 109, India; Department of Botany, Plant Ecology Laboratory, North-Eastern Hill University, Shillong, Meghalaya 793 022, India. [MINERALIZATION; NITROGEN FIXING; SUBTROPICAL HUMID FOREST]

Nitrogen mineralization was studied in 7-, 13- and 16-year old regrowing forest stands by determining ammonium-N, nitrate-N, ammonification and nitrification rates during different seasons for two annual cycles. Mean concentration of ammonium and nitrate-N were highest in the 16-year old stand, and lowest in the 7-year old stand. Inorganic-N (ammonium+nitrate) was highest during winter and lowest during rainy season in the three stands, whereas net ammonification, nitrification and N mineralization rates showed reverse seasonal trend. The net ammonification and mineralization rates were significantly higher ($P < 0.01$) in the 16-year old stand than in the 7- and 13-year old stands, but nitrification rate followed a reverse trend. Inorganic-N and net N mineralization rates were significantly higher ($P < 0.01$) in the surface soil layer (0-10 cm) than the subsurface layer (10-20 cm). Ammonium was the dominant form of inorganic-N. Nitrogen mineralization rate was positively correlated with the density and basal area of the woody vegetation, whereas nitrification rate was negatively correlated. Further, net N mineralization was heavily governed by rainfall, soil moisture, temperature and microbial population.

Mehrotra, M.D. 1998. ***Rhizoctonia* aerial blight - A destructive nursery disease and its management.** *Indian Forester*, 124(8):637-645. Forest Pathology Division, Forest Research Institute, Dehradun, U.P., India. [AGRO-FORESTRY; BIOTYPE; MICRO-SCLEROTIA; NURSERY; SEEDLING]

The paper records for the first time the occurrence of leaf blight, a new disease of *Cassia fistula* Linn., *Bauhinia variegata* Linn., *Dalbergia sissoo* Roxb. and *Populus deltoides* Marsh caused by *Rhizoetonia solani* Khun anamorph of *Thanatephorus cucumeris* (Frank) Donk in the nurseries in Western Uttar Pradesh. Of the three morphologically different biotypes of the fungus found on diseased plants, one formed typical dark brown sclerotia, the other produced micro-sclerotia, while the third did not produce sclerotia. The disease caused blighting and webbing of leaves by the fungal hyphae running over the infected aerial parts and forming cobweb like structure. Stromatoid aggregates developed on the surface of infected leaves and clusters of hyphae formed at the base of the petiole or petiolule. The disease caused premature defoliation and group infection of seedlings due to lateral spread of the disease through contact of the

overlapping foliage of the adjoining seedlings. Epidemiology of the disease, mode of infection and extent of damage to the seedling crop are described and measures for management of the disease outlined.

Mehrotra, Poonam; Mehrotra, Pawan and Rawat, Y.S. 1998. **Canopy effect on the dry matter allocation in different components of evergreen and non-evergreen forb species of Kumaun Himalaya.** *Current Science*, 75(12):1399-1402. Ecology Laboratory, Department of Botany, Kumaun University, Nainital 263 002, U.P., India; Department of Forestry, Kumaun University, Nainital 263 002, U.P., India. [BIOMASS; CANOPY; CHIR-PINE FOREST; GRASSLAND]

Two forb species, *Artemisia vulgaris* and *Arisaema concinuum* occurring in both open and closed canopy forests have been selected for the study of resource allocation pattern under different light, moisture content and pH conditions to individuals of both species were randomly selected and harvested at peak of their growth. The distribution of dry mass in the underground, stem, leaves and in reproductive components were determined. In open canopy, both forb species had relatively greater dry mass invested in their reproductive activity than that of individuals occurring at the closed canopy site. However, the allocation of dry mass to supporting and assimilatory system of plants were adversely affected by direct sunlight, low moisture content, pH of soil and less fertile soil character of open canopy site than at close-canopy site. Regression analysis showed strong correlation between reproductive organ biomass and total biomass in individuals at the open canopy site.

Mondal, Tapan Kumar; Bhattacharya, Amita; Sood, Anil and Ahuja, Paramvir Singh 1998. **Micropropagation of tea (*Camellia sinensis* (L.) O. Kuntze) using Thidiazuron.** *Plant Groth Regulation*, 26(1):57-61. Division of Biotechnology, Institute of Himalayan Bioresource Technology, Palampur 176 061, H.P., India. [AXILLARY SHOOT MULTIPLICATION; CAMELLIA SINENSIS (L.) O. KUNTZE; NODAL SEGMENTS; THIDIAZURON; WOODY PLANT]

The effect of thidiazuron (TDZ) on the micropropagation of *Camellia sinensis* (China hybrid) was compared with that of benzylaminopurine (BAP) using nodal segments from *in vitro* raised seedlings. Extremely low concentrations of TDZ (1pM-100nM) alone were effective in inducing shoot bud proliferation and maintaining high rates of shoot multiplication on hormone-free media. On the other hand, higher concentrations of BAP (1-10 μ M) and its continued presence were required to initiate and sustain shoot proliferation. While wider ranges of BAP combined favourably with auxins like NAA or IBA, only specific combinations of TDZ and NAA were effective for shoot proliferation. TDZ treated explants yielded healthy shoots, with sturdy leaves, even during the initial stages of growth, whereas, the effect of BAP was cumulative over subcultures in attaining a high proliferative rate.

Nath, S. 1998. **Mycoplasma-like organisms as the causative agent of witches' broom of *Cedrela* (*Cedrela toona* Roxb.) in Himachal Pradesh, India.** *Current Science*, 75(10):1058-1061. Department of Bio-Sciences, M.L.S.M. College, Sunder Nagar, District Mandi 174 401, H.P., India. [HONEY-SCENTED; SYMPTOMS; TETRACYCLINE; TIMBER]

Cedrela toona is an important timber plant growing extensively in Himachal Pradesh. Unfortunately, a large number of trees exhibit witches' broom-like disease symptoms in the crown region. The infected plant/branch displays stunted growth, excessive bud sprouting, reduced leaf size and inhibition of flowering. All these symptoms suggest the involvement of mycoplasma-like organisms (MLOs). Histochemical examination of thin stem sections revealed strong positive reaction with Dienes' stain and fluorescent dye, aniline blue in the phloem elements of infected plants *vis-a-vis* healthy ones. Moreover, application of tetracycline to diseased plants causes remission of disease symptoms. These experiments establish the association of MLOs with this disease. Tetracycline treatment of infected plants was found to be an effective remedy.

Pandey, Rajiv; Dhall, S.P.; Kanwar, B.S. and Bhardwaj, S.D. 1998. **Some models for predicting volume of *Populus deltoides*.** *Indian Forester*, 124(8):629-632. Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, H.P., India. [BIOMASS; DIAMETER; MID-HILLS; SILVICULTURE]

Cross-validation technique is discussed for the validation purpose of models with brief review of the technique in forestry literature. Results of two volume estimation models have been analysed with definition of few terms *viz.*, apparent error, true error and excess error.

Pandit, M.K. and Babu, C.R. 1998. **Biology and conservation of *Coptis teeta* Wall. - an endemic and endangered medicinal herb of Eastern Himalaya.** *Environmental Conservation*, 25(3):262-272. Centre for Inter-disciplinary Studies of Mountain & Environment, Univ. of Delhi, South Campus, New Delhi 110 021; Department of Botany Univ. of Delhi, Delhi 110 007, India. [CONSERVATION BIOLOGY; EASTERN HIMALAYA; ECOLOGY; ENDANGERED SPECIES; MEDICINAL PLANT]

Medicinal plants are a valuable resource for regional economic development in the tropics, and the Eastern Himalaya in particular harbours many such species. Extensive deforestation and over-exploitation in this region have brought several species to the brink of extinction, and *Coptis teeta* is such an endangered species; yet scientific information for its conservation is lacking. Investigations on the distribution range, demography, ecology, cytology, reproductive biology and population genetic structure of *C. teeta* were carried out; it was found to be endemic to a small area, to occupy a very narrow habitat and to be highly dispersed with very small population sizes. Edaphic factors were found to have played a vital role in ecological preference, natural distribution and evolutionary divergence of the species. The species exhibits a 'K' strategy, high male sterility, low reproductive success and efficiency, inadequate seed dispersal, and little genetic variability. A combination of these genetic hurdles and external threats in the form of habitat disturbance and over-exploitation for commercial purposes could result in its extinction. The species was found to have highly specific microsite requirements that cannot be met in other habitats. It is argued that *in situ* conservation measures would be the best strategy for the continued survival of this species. For effective management of the species it is recommended that its habitat be declared a protected area with the active cooperation of local inhabitants including the sharing of benefits of conservation.

Pant, C.K.; Pant, Charu C.; Kalra, S. and Pathak, H.D. 1998. **Occurrence of amino acids in Middle-Krol stromatolites from Nainital, Kumaun Lesser Himalaya.** *Current Science*, 75(4):393-395. Department of Chemistry and Department of Geology, Kumaun University, Nainital 263 002, U.P., India. [AMINO ACID; CHEMICAL FOSSIL; MIDDLE-KROL]

Geochemical studies on Middle-Krol stromatolite sample from Nainital area of Kumaun Himalayas revealed the presence of amino acids, *viz.* cysteine, lysine, aspartic acid, serine, glycine, threonine, α - alanine, proline, valine and phenylalanine with varying amounts of protein bound (55%) and free amino acids (45%) of the total. Absence of non-protein amino acids points to the marked biochemical relationship between Precambrian and extant organisms and their involvement in stromatolite formation.

Pant, R.K.; Juyal, N.; Rautela, Piyoosh; Yadav, M.G. and Sangode, S.J. 1998. **Climate instability during last glacial stage: Evidence from varve deposits at Goting, district Chamoli, Garhwal Himalaya, India.** *Current Science*, 75(8):850-855. Wadia Institute of Himalayan Geology, 33 Gen. Mahadeo Singh Road, Dehradun 248 001, U.P., India; Physical Research Laboratory, Ahmedabad 380 009, India. [GARHWAL HIMALAYA; HIGH DENSITY; LGS; PALEOSEISMIC]

The varve deposits at Goting, district Chamoli, Garhwal Himalaya have recorded climate history of the Last Glacial Stage (LGS). ¹⁴C chronology indicates that the deposition commenced around 40 ka BP and continued till the glacial maxima (about 20 ka). The magnetic susceptibility of the varve succession matches well with the lithological climate record. The varves are alternating dark and light gray bands of sub-millimeter scale separated by limonitic (pale yellow) bands and ice rafted dropstone debris. The mineral magnetic measurements show susceptibility enhancement corresponding to the limonitic beds. The enhancement of susceptibility has been attributed to accelerated weathering in the source area resulting from the temporary climatic shift from intense glacial cold to short-lived cool and wet periods. Such episodes were frequent during the LGS.

Philip, G. and Ravindran, K.V. 1998. **Glacial mapping using landsat thematic mapper data: A case study in parts of Gangotri glacier, NW Himalaya.** *Journal of the Indian Society of Remote Sensing*, 26(1&2):29-34. Wadia Institute of Himalayan Geology, P.B. No. 74, Dehradun 248001, U.P., India; ISRO/NNRMS, RRSSC, HRS Campus, P.B. No. 135, Dehradun 248001, U.P., India. [ELECTROMAGNETIC; GLACIER; LANDSAT; SATELLITE]

Glacial mapping is difficult and hazardous because of the remoteness and inaccessibility of the terrain. In this context, remotely-sensed data from satellites provide valuable information on glaciers and the associated landforms. It is important to note that judicious selection of spectral bands is critical in mapping the glacial features. Glacial landforms in parts of Gangotri glacier, NW Himalaya, have been delineated using selected bands of Landsat Thematic Mapper Data. Digital image processing of Landsat data has helped in identifying the major features of the Gangotri glacier such as accumulation and ablation zones, and glacial moraines. The study shows that Thematic Mapper bands 4, 5 and 7 are more useful in snow mapping because of their distinct spectral discriminability in identifying the glacial features.

Pokhriyal, B.P.; Mahesh, R.K. and Jauhari, R.K. 1998. **Studies on the molluscan diversity of asan river system in Doon Valley with special reference to vectors of trematode parasites.** *Indian Journal of Forestry*, 21(2):167-170. Parasitology Laboratory, Department of Zoology, D.A.V. (P.G.) College, Dehradun 248 001, U.P., India. [FAUNA; MOLLUSCAN DIVERSITY]

The present investigation reveals monthly collection of molluscs in Asan river system from Sahaspur to Herbertpur between April 1994 to March 1996. As many as 18 species of molluscs comprising 13 species of gastropods and 5 that of bivalves were collected. The gastropods were found under 5 different families (Viviparidae, Bymnaerdae, Thiaridae, Planorbidae and Pilidae). While the bivalves belonged to 2 different families (Unionidae and Corbiculidae). Among the gastropods, the Thiarids were common and their number constituted about 42% of the total collection of the snails. Further, the following species of snails, viz., *Lymnaea auricularia*, *L. acuminata* and *Thiara (Melanoides) tuberculata* have been found to carry larvae of trematode parasites.

Raina, A.K.; Jha, M.N. and Pharsi, S.C. 1998. **Fine sand mineralogy of some selected soils of Mussoorie forest division of Uttar Pradesh.** *Indian Forester*, 124(11):925-930. Division of Forest Soil and Land Reclamation, Forest Research Institute, Dehradun, U.P., India. [MINERAL; NUTRIENT POOL; SOIL FERTILITY]

Fine sand mineralogy of some selected horizons of the soils of Raipur range of Mussoorie Forest Division (Uttar Pradesh) were investigated. Light minerals constituted bulk of fine sand fractions and consisted of quartz, feldspar and mica (muscovite) in order of their abundance. Heavy minerals occurred in minute amounts and were dominated by opaque minerals, biotite, calcite, chloritised, mica, zircon, garnet, hornblende, tourmaline and rutile. Differences in mineralogical make up were mostly associated with nature and composition of parent material and degree of weathering. The soils, in general, contained low to moderate amount of weatherable minerals indicating their podzolic nature and much less contribution of nutrients from minerals to the soil labile nutrient pool.

Rao, A.N.; Haridasan, K. and Bisht, N.S. 1998. **Vegetative propagation of *Panax* species (Ginseng) in Arunachal Pradesh.** *Indian Forester*, 124(9):702-704. State Forest Research Institute, Itanagar, Arunachal Pradesh, India. [GERMINATION; GINSENG; SEED; SEROOTEX]

This paper deals with the cultivation technique of two species of Ginseng viz. *Panax sikkimensis* and *P. bipinnatifida*. Result of the experiments conducted on the growth and multiplication of rhizomes by treating them with different hormones such as Serootex 03, IAA, IBA and NAA have also been discussed.

Rawat, Laxmi and Rawat, Vijay 1998. **Rainfall patterns in Doon Valley, India.** *Indian Forester*, 124(9):714-724. Ecology and Environment Division, Forest Research Institute, Dehradun, U.P., India. [CLIMATE; RAINFALL INTENSITY; TEMPORAL VARIATION]

The course of annual, monthly and seasonal rainfall of New Forest has been discussed along with its variability, frequency, intensity over a period of 60 years (1931-1990). Annual rainfall at decadal intervals

and 2 blocs of 30 years, extremes of rainfall recorded, variability of rainfall monthly and seasonal; rainfall frequency-monthly and seasonal, rainfall intensity-annual, monthly and seasonal; temporal variations of frequency of rainy days have been analysed and discussed.

Ray, P.N. 1998. **Fifty years of forestry in Tripura - Achievements in retrospect, macro futuristic perspectives and imperatives.** *Indian Forester*, 124(6):397-412. Principal Chief Conservator of Forests, Tripura. [FUELWOOD; INFRASTRUCTURE; NON-TIMBER FOREST; SOCIAL FORESTRY]

Achievements during last 50 years of forestry in Tripura have been documented, highlighting notable developments in forest resources base, afforestation, infrastructure, control of shifting cultivation, conservation efforts, enabling mechanisms, capacity building and institutional strengthening. A critical appreciation reveals that gains accrued but disappointments were also many. It evaluates the efficacies of implementation of National Forest Policies, management planning process, conservation, social forestry, commercial function, protection, regulation and enforcement works pointing out the issues where forestry organisation could not achieve certain cherished goals and why; several institutional shortcoming, external constraints and organisational weakness are identified. Within the general framework of managerial cybernetics, strategic planning of forestry in the State is devised on the basis of a SWOT analysis spelling out the ways and means of capitalising the latent strengths and neutralising the threats in the external environment, and coping up micro environmental complexity. The imperatives of a mission-driven forest management in the State facing the emerging challenges, have been suggested.

Roy, Debesh 1998. **Educational situation in a hill village of West Bengal: A case study.** *Man in India*, 78(3&4):305-315. Assistant Director, Directorate of Census Operations (Ministry of Home Affairs), 20/B, Abdul Hamid Street, Calcutta 700 069, W.B., India. [EDUCATIONAL DEVELOPMENT; LITERACY RATE; SELF EMPLOYMENT]

Overall educational background in India is not so satisfactory even after the four decades of independence. If the overall literacy rate of 1981 is compared with the literacy rate of 1971 it is evident that the rates have increased in all the States and Union Territories and in some cases enhancement is rather significant. It is also a fact that some areas are still lacking behind in spite of various strategies of the government to uplift the education and literacy rate in India. Present paper, based on some empirical data, tries to find out the reasons behind the higher literacy rate and poor educational standards in a hill village of West Bengal and also to find out the various constraints on education that prevails in the village in general.

Sahai, Kanak 1998. **An observation on reproductive performance of *Pinus echinata* Mill. introduced in Kumaun Himalayan region of India.** *Indian Journal of Forestry*, 21(1):19-22. National Botanical Research Institute, Lucknow 226 001, U.P., India. [GERMINATION; PINUS ECHINATA; SEED FERTILITY]

From six best growing exotic pine species *P. echinata* Mill. was studied in detail continuously for 9 years for its reproductive performance in relation to male and female cone-set, seed-set and seed qualities. The species has apparently well to the Himalayan climate in Kumaun. Fluctuations in reproductive performance over the years is probably due to the climate.

Savant, P.V. 1998. **Status of tigers within protected areas (other than tigers reserves) in Mizoram.** *Indian Forester*, 124(10):783-786. Chief Wildlife Warden, Mizoram, Aizawl. [CONSERVATION; PROTECTED AREA; WILDLIFE]

Meeting the challenge for protection of threatened tiger population in Mizoram, some management prescriptions have been suggested with effective conservation measures.

Savant, P.V. and Patnaik, S.S. 1998. **Forests and forestry in Mizoram - A profile.** *Indian Forester*, 124(6):433-439. Chief Conservator of Forests, Mizoram, Aizawl; Principal Chief Conservator of Forests, Mizoram. [BIODIVERSITY; FODDER; FUELWOOD; SUB-TROPICAL FOREST]

The Mizoram is primarily a Tribal State. Agriculture is the mainstay of the people. Traditional 'Jhum' is practiced. The forests of the State broadly classified into (1) Tropical Wet Evergreen, (2) Tropical Semi-Evergreen and (3) Montane Sub-Tropical Pine forests. Past and present Forest Management System,

Afforestation Programme, Farm Forestry, Wildlife Management, Biodiversity Conservation, Forest Research and Training, Joint Forest Management have been discussed.

Sen, Sunita 1998. **Seed mycoflora of *Robinia pseudoacacia* Linn. and its control.** *Indian Forester*, 124(5):347-350. Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, H.P., India. [AGRO-FORESTRY; GERMINATION; MYCOFLORA; SEEDLING]

Eight fungal species *Alternaria alternata*, *Cladosporium* sp., *Fusarium equiseti*, *F. oxysporum*, *F. semitectum*, *Penicillium chrysogenum*, *Rhizopus* spp. and *Ulocladium consortiale* were found associated with seeds of *Robinia pseudoacacia* (Linn.). However, species of *Fusarium* were found the most predominant ones, and were invariably isolated from seeds samples collected from Bajaura, Manali and Sharbo area of H.P. Amongst the various fungi, *Fusarium* species and *Alternaria alternata* were found pathogenic and caused significant reduction in seedling stand. Mercuric chloride (0.1), Baycor (0.25%) and Blitox 50 (0.3%) provided best control of associated mycoflora.

Shankar, Uma; Lama, S.D. and Bawa, K.S. 1998. **Ecosystem reconstruction through 'taungya' plantations following commercial logging of a dry, mixed deciduous forest in Darjeeling Himalaya.** *Forest Ecology and Management*, 102(2-3):131-142. Tata Energy Research Institute, TERI House, Hakimpura, Siliguri, West Bengal 734 401, India; Department of Biology, University of Massachusetts, 100 Morrissey Boulevard, Boston, MA 02125, USA. [DECIDUOUS FOREST; REGENERATION; SPECIES LOSS; TAUNGYA]

In Darjeeling Himalaya, after commercial logging, natural forest is converted into 'taungya' plantations. Under the 'taungya' system, choice species of high timber value are planted following slash-burning on clear-cut forest lands. Agricultural crops are raised in the interplanting space for the first two consecutive years. Regeneration is allowed along with the growth of planted species after abandoning the crop cultivation. This study examines ecosystem recovery 35 years after the conversion of a dry, mixed deciduous forest into 'taungya' plantation. Only 28 out of 87 species in natural forest regenerated in the 10-cm cbh class of individuals. The loss of species was independent of abundance in the community; not only rare, but also common, species of natural forest were lost in 'taungya' plantation. Mature forest specialists suffered the greatest loss, and open-habitat specialists increased. An introduced species, *Tectona grandis*, dominated in terms of abundance, use of vertical space, and total ground coverage. *Shorea robusta* was codominant due to its coppicing ability. Prospects for recovery of the lost species are bleak because juvenile populations in the regeneration layer (comprising individuals < 10-cm cbh and > 30-cm height) are either absent or very small. The study concludes that conversion of natural forest into 'taungya' plantations dramatically alters the landscape, interrupts recovering ecosystem structure and causes considerable loss of species.

Sharma, K.K.; Sharma, O.P. and Tripathi, N.K. 1998. **Female heterogamety in *Danio rerio* (Cypriniformes : Cyprinidae).** *Proc.Nat.Acad.Sci. India*, 68(B-II):123-126. Department of Biosciences, University of Jammu, Jammu 180 004, India. [DANIO RERIO; FEMALE HETEROGAMETY; G-BANDS; NORS]

A diploid count of 50 chromosomes (2n=50) has been recorded in both male and female *Danio rerio*. In female, the diploid complement comprised 7 meta-, 7 submeta- and 36 subtelocentric chromosomes (NF=100); the sex chromosome pair being heteromorphic (a submetacentric Z and a metacentric W). Whereas, in male the diploid complement comprised 6 meta-, 8 submeta- and 36 subtelocentric chromosomes (NF=100); the sex chromosome pair being homomorphic (largest submetacentrics) designated as ZZ. A pair of NORs have been observed on the largest subtelocentric pair.

Sharma, Vinita and Thakur, M.L. 1998. **Some aspects of foraging behaviour of *Apis florea* Fabr. on *Ammi majus* Linn. in Doon Valley (Uttar Pradesh).** *Indian Journal of Forestry*, 21(2):115-118. Division of Forest Entomology, Forest Research Institute, Dehradun. [HONEYBEE; NON-WOOD FOREST; NURSERY]

Apis flora Fabr. has been recorded the most important visitor of *Ammi majus* Linn. The bee population and the time spent per flower were highest at 1100 hrs. while the number of flowers visited per minute was highest in the afternoon at 1500 hrs. The hour of the day influences the foraging behaviour of *Apis florea* Fabr. and the foraging bees while collecting pollen from the flowers also bring about pollination in the plant.

Singh, Arun P. and Singh, Raka 1998. **Butterflies of *Quercus leucotrichophora* - *Cedrus deodara* forest.** *Indian Forester*, 124(8):646-657. Conifers Research Centre, Shimla, H.P., India; Division of Forest Ecology, F.R.I., Dehradun, U.P., India. [BUTTERFLY; DEODARA; FOREST ECOSYSTEM; NECTAR PLANT]

A study was carried out in a *Quercus leucotrichophora* - *Cedrus deodara* forest to find out its butterfly species composition, their status, habits, nectar plants, larval food plants and seasonal occurrence. The dominant flora of the study area was also recorded. A total 35 butterfly species were recorded. Field observation showed that all the species of butterflies are dependent for food and nectar on plants that are typical of *Quercus leucotrichophora* - *Cedrus deodara* forest ecosystem.

Singh, Charan; Agarwal, M.C.; Kumar, Nirmal and Puri, D.N. 1998. **Biomass production of *Morus alba* under different management practices on degraded bouldery riverbed lands of Doon Valley.** *Indian Forester*, 124(3):252-260. Central Soil and Water Conservation Research and Training Institute, Dehradun, U.P., India. [BIOMASS; GREEN LEAVES; SILKWORM; WOOD YIELD]

The leaf production from *Morus alba* L. tree is fully appreciated in the hill region for rearing silkworm. The leaf can be obtained through various management practice. Since sporadic information is available on the production of leaves under various management practices which is required for optimum sustainable production without damaging the growth of the trees, studies on *Morus alba* were conducted to establish a suitable prediction model of leaf and total branch wood yield under three different management practices *i.e.* coppicing, pollarding and lopping on bouldery riverbed soils of Doon Valley. The studies showed that the third degree polynomial was found to be most suitable prediction for leaf and total branch wood in all the three management practices. The leaf production was maximum under pollarding management practice while total branch wood yield was maximum under coppicing.

Singh, Charan; Vishwanatham, M.K.; Kumar, Nirmal and Agarwal, M.C. 1998. **Growth, survival and mean annual increment of *Quercus leucotrichophora* (Ban Oak) on degraded lands of Doon Valley.** *Indian Forester*, 123(9):732-738. Central Soil and Water Conservation Research and Training Institute, Dehradun, U.P., India. [COLLAR DIAMETER; DEGRADED LANDS; WATER CONSERVATION]

Quercus leucotrichophora (Ban Oak), is a most suitable tree species for protective and productive purpose in the degraded lands of higher altitude of North-West Himalayan region. An attempt has been made to explore the possibility of its growing in the lower altitude *i.e.* in the degraded lands of Doon Valley so that its large scale plantation can be taken up where soil and water conservation measures are to be carried out on priority basis. On the basis of survival, height, collar diameter and diameter at breast height performance from 1986 to 1994, it is possible to grow it on degraded lands of Doon Valley. Moreover, its growth performance in degraded lands are quite encouraging. The regression equations between plant age with individual growth character (*i.e.* height or collar diameter or diameter at breast height) were also estimated.

Singh, Ombir 1998. **Effect of seed weight on germination, survival and initial growth of *Quercus dilatata* in the nursery.** *Indian Forester*, 124(11):959-961. Conifers Research Centre, Shimla, H.P., India. [CHARCOAL; FUELWOOD; GERMINATION; SEEDLING]

The effect of seed weight on germination, survival and initial growth of *Quercus dilatata* was studied and the results showed that seed weights classes of 1.0 gm to 2.5 gm and above gave significantly better germination and survival percentage, seedling growths as well as seedling dry weights than the seed weight class of upto 1.0 gm. It is, therefore, recommended that *Quercus dilatata* seeds below 1.0 gm in weight should not be used for nursery sowings.

Singh, Ombir 1998. **Seed maturity indices in silver fir (*Abies pindrow spach*).** *Indian Forester*, 124(3):243-245. Conifers Research Centre, Shimla, H.P., India. [GERMINATION; SILVER FIR; SPECIFIC GRAVITY]

This study deals with seed maturity of Silver fir in relation to specific gravity of cones and seed moisture content. The specific gravity of mature cones varied from 0.97 to 0.98 and germination percentage of the seed collected from such cones was about 32%. The moisture content of the seed decreased as the seed matured and the same of the mature seed varied from 15.82 to 16.60 per cent.

Singh, R.P.; Rawat, D. and Jishtu, Vaneet 1998. **Agroforestry in cold desert areas of Himachal Pradesh, India.** *Indian Forester*, 124(5):321-330. Conifers Research Centre, Shimla, H.P., India. [AGRO-FORESTRY; COLD DESERT; FODDER; FUELWOOD; LIVESTOCK]

Agroforestry plays an important role in the development and improvement of an area. The existing agroforestry practices in different parts of India and their potential contribution to sustainable development in cold desert region of Himachal Pradesh, India, as well as the potential for developing and improving agroforestry with rural people participation has been recommended. Different agroforestry systems have been suggested for improving the productivity of land in cold desert region.

Singh, Rajpal and Verma, T.D. 1998. **Incidence and control of poplar stem borer, *Apriona cinerea*, Chevrollet (cerambycidae: coleoptera) in Paonta valley of Himachal Pradesh.** *Indian Forester*, ():556-560. Horticultural Research Station, Dr. Y.S. Parmar University of Horticulture and Forestry, Dhaulakuan, Distt. Sirmour, H.P., India. [AGRO-FORESTRY; MID-HILLS; POPLAR]

Incidence of Poplar stem borer, *Apriona cinerea*, *Chevrollet* on plants of 4 age groups viz. 6 months, 1-2, 2-3 and 5-6 years was recorded at village Jagatpur, Paonta Valley, Sirmour, Himachal Pradesh during 1994. No attack of the pest was recorded on 6 months old plants but 2-3 year aged plants were heavily infested (88%) by the pest as compared to other age groups where infestation ranged between 2-27%. Maximum mean number of holes bored per plant in the most susceptible age groups was 7.6 and 23.0 respectively. Out of the five insecticides viz. methyl parathion, dichlorvos, cypermethrin, phorate and furadan and three modes of insecticidal application spot treatment, spraying and soil treatment were tested against this borer in summer of 1994. Spot and spray applications of methylparathion, dichlorvos and cypermethrin each at 0.01% cone. were found to give 7.80 per cent kill of the pest. Soil application of phorate and furadan @25 gm/plant was found ineffective.

Singh, Ramesh; Th., Singh Raghmani and Kumar, Anil 1998. **Studies on growth performance of local tree species after coppicing.** *Indian Forester*, 124(2):158-162. ICAR Research Complex of N.E.H. Region, Manipur Centre, Lamphelpat, Imphal; Conservator of Forests, Western Circle, Imphal, Manipur, India. [AGRO-FORESTRY; FODDER; FUELWOOD; TIMBER]

A study was conducted during 1988 to 1991 with 15 (fifteen) local multipurpose tree species for identifying maximum yield of fuelwood, fodder, pole, timber etc. about 15 years old tree species coppiced at 15 cm above the ground level at Krishnagiri Farm., Langol Hills, ICAR Research Complex for NEH Region, Manipur Centre, Imphal. The maximum height (9.46 m), girth (89.67 cm) and number of branches (19 nos.) was recorded in *Grewia optiva* followed by *Ficus hispida*, *Celtis australis* and *Aillanthus excelsa*. The maximum canopy was recorded in *Ficus hispida* (42.44 m²) followed by *Grewia optiva* and *Ficus cunia*. Maximum crown height was in *Grewia optiva* (6.69m) followed by *Ficus hispida* and *Aillanthus excelsa*. The maximum fodder (green) yield was recorded in *Grewia optiva* (95.5 kg/plant) followed by *Ficus hispida* and *Bauhinia purpurea*. The maximum dry matter (%) was recorded in *Quercus pachyphylla* (50.3%) followed by *Quercus dealbata* and *Schima wallichii*.

Singh, Th. Binoy and Yadava, P.S. 1998. **Seasonal fluctuations of oribatid mites in a subtropical forest ecosystem of Manipur, North Eastern India.** *International Journal of Ecology and Environmental Sciences*, 24(1):123-129. Department of Life Sciences, Manipur University, Imphal 795 003, India. [CRYPTOSTIGMATA; POPULATION DENSITY; SEASONAL FLUCTUATIONS; SOIL LAYERS; TULLGREN FUNNEL]

Oribatid mites (Acari: Cryptostigmata), an important group of soil micro-arthropods, play an important role either directly or indirectly in maintaining structure and fertility of soil. An investigation has been carried out in two forest sites in a sub-tropical forest ecosystem at Shiroy Hills, Ukhrul district of Manipur, located at 25°13' N Latitude and 94°25' E Longitude and at an altitude ranging from 1885-2555 m above MSL. The soil animals were extracted from three different soil depths. 0-10, 10-20 and 20-30 cm, by using modified Tullgren funnels. Maximum population density of Oribatid mites was concentrated in the 0-10 cm soil layer, and it decreased with increase in the soil depth in both the forest sites. Maximum total population density of mites was recorded during summer, in August ($654 \times 10^2 \text{ m}^{-2}$) and July ($554 \times 10^2 \text{ m}^{-2}$) in the forest sites I and II, respectively. The population declined in December with the onset of winter season. Microclimatic conditions in different layers of soil, primarily soil temperature and humidity exhibited a significant positive relationship ($P < 0.001$) with the changes in the population density of mites.

Thoudam, N.S. and Yadava, P.S. 1998. **Emission of carbon dioxide and carbon balance in an agro-ecosystem at Imphal, Manipur.** *International Journal of Ecology and Environmental Sciences*, 24(1):95-102. Department of Life Sciences, Manipur University, Imphal 795 003, India. [ALKALI ABSORPTION METHOD; MICROBIAL RESPIRATION; PADDY FIELD; PLANT BIOMASS; PRIMARY PRODUCTIVITY; ROOT RESPIRATION]

The rate of carbon dioxide emission was estimated by an alkali absorption method during growing (June-November) and post-harvest (December-May) periods in an agro-ecosystem (*Oryza sativa* L.) at Imphal, Manipur. The rate of root respiration (RR) increased from March onward attaining highest value in October ($53.84 \pm 2.10 \text{ mg CO}_2 \text{ m}^{-2} \text{ hr}^{-1}$) and decreased there after until February ($11.09 \pm 2.11 \text{ mg CO}_2 \text{ m}^{-2} \text{ hr}^{-1}$). The rate of microbial respiration (MR) and total soil respiration (TSR) was maximum in September and decreased considerably to a minimum in March. Out of the TSR, RR contributed 24.47% and 30.84% and MR 75.53% and 69.16% during growing and post-harvest periods, respectively. The RR, MR and TSR are positively correlated with relative humidity of air, soil temperature and soil moisture. The annual carbon budget was calculated from the annual carbon input ($251.67 \text{ kg ha}^{-1} \text{ yr}^{-1}$) and output ($60.55 \text{ kg ha}^{-1} \text{ yr}^{-1}$). The net carbon accumulation was estimated to be $191.12 \text{ kg ha}^{-1} \text{ yr}^{-1}$ which would partly be carried over to next year in the system.

Topal, Y.S.; Samal, P.K.; Pant, Pushpa and Rawat, D.S. 1998. **Socio-economic and culture adaptations in the sustainable use and management of resources in high altitude village in Central Himalaya.** *Man in India*, 78(1&2):9-25. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263 643, U.P., India. [CULTURAL ADAPTATIONS; HIGH ALTITUDE; LANDUSE PATTERN; LIVESTOCK; SOCIO-ECONOMY]

The article is based on the findings of a study on the functioning of the village Khatuwa, located in the Jaunsar-Bawar region of Central Himalayan region of India. The village is inhabited by the Jaunsaries, a scheduled tribe and have been so since 1967, when the area Jaunsar-Bawar, where they reside, was declared scheduled area. They are polyandrous, though the system is fast disappearing. The difficult and harsh eco-climate has directed the people to develop socio-economic and cultural adaptations in consonance with the demands of the ecology for their very survival. The present article discusses some of these socio-economic and cultural adaptations, which, otherwise, are markers of sustainability for the continued functioning of the village, through an indepth and empirical study. As found, economic practices, *i.e.*, landholding, agriculture, cropping pattern, *etc.* and social behaviours, *i.e.*, social hierarchy and intercaste interactions, forms of family, marriage types, *etc.* are tuned and adopted to ecological demands.

Uniyal, V.P. and Mathur, P.K. 1998. **Diversity of Butterflies in the great Himalayan national park, western Himalaya.** *Indian Journal of Forestry*, 21(2):150-155. Wildlife Institute of India, Post Box 18, Chandrabani, Dehradun, India. [BUTTERFLIES; CONIFER; DIVERSITY; GRASSLAND]

About 50 species of butterflies belonging to 5 families and 13 subfamilies were recorded in this study. Habitat preference of various families were also studied in different forest types, *viz.*, broad leaved, conifer, mixed conifer and alpine area of Sainj sub-watershed of the Great Himalayan National Park.

Upadhyay, Rajeev and Sinha, Anshu K. 1998. **Tectonic evolution of Himalayan tethys and subsequent Indian plate subduction along indus suture zone.** *PINSA*, 64, A(5):659-683. Wadia Institute of Himalayan Geology, Dehradun 248 001, U.P., India; Birbal Sahni Institute of Palaeobotany, 53 University Road, Lucknow 226 007, U.P., India. [ACCRETION; OPHIOLITES; RIFT; SUBDUCTION; TURBIDITES]

Three distinct tectonostratigraphic units in the Indus Suture Zone have been recognised. These are: The Lamayuru Complex; Ophiolitic Melange; and Nindam Formation. The tectonostratigraphic disposition of these three units have been assessed in the light of subduction related non-collision tectono-sedimentary processes during Triassic to Eocene period. This time span is consistent with the opening and closing of the Neo-Tethys ocean. Sediments of the Lamayuru Complex were deposited on the leading passive edge of the Indian subcontinent, the Ophiolitic Melange on the other-hand started forming along the trench passive and active interaction zone. Sediments of the Nindam Formation were deposited in a trench-slope.

Varatharajan, R.; Sudhakar, S.; Reeta, L.; Singh, N. Ibohal and Mathavan, S. 1998. **Occurrence of reovirus in oak tasar silkworm *Antheraea proylei*.** *Current Science*, 75(7):724-726. Department of Life Science, Manipur University, Imphal, Manipur 795 003, India; Department of Genetics, School of Biological Sciences, Madurai Kamaraj University, Madurai 625 021, India; Regional Tasar Research Institute, Imphal, Manipur 795 002, India. [CPV; MEAN DIAMETER; SEGMENT; SILKWORM]

Infection of cytoplasmic polyhedrosis virus (CPV, Reoviridae) in the oak tasar silkworm *Antheraea proylei* (Saturniidae) has been recorded, CPV forms hexahedral shaped polyhedra with a mean diameter of $10.75 \pm 1.2 \mu\text{m}$. The viral genome is fragmented and has eleven segments of double-stranded RNA in equimolar concentrations. The size of the dsRNA fragments ranged from 4.0 to 0.56 kbp; the total genome size is 24.21 kbp. This is the first report on the occurrence of reovirus in the wild silk moth *A. proylei*.

News & Views

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

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Cry of the Himalayas

'Save humankind by saving trees', nowhere is this message more relevant than in the holy Himalaya, the author recall the famous Chipko movement of Seventies in Uttarakhand. The movement has attempted to stimulate awareness in people about the nature of the exploitation to which their forests and therefore, their lives are exposed. He claims that the sheer amount we waste each year in tackling floods and droughts should be proof enough of this. The exploitation of our forest wealth is tantamount to the annihilation of our cultures. The industrial revolution was the start of this terrible trend. The industries have little connection with forests and soils and thus millions who once protected and nourished these gifts of nature are themselves caught in a web of destruction. Quite apart from this, they are forced to live subhuman existence on streets and slums where they quickly lose even the dignity that was their birthright. Only 31% of forest area remaining in the Uttarakhand according to satellite imagery. The author appeal for join us in convincing our government that any further commercial exploitation of the Himalaya through the clear-felling of its forests or the building of destructive projects such as the Tehri Dam can only result in weakening the foundation of our security for tomorrow.

Sunderlal Bahuguna for THE HINDUSTAN TIMES: June 5, 1998

Foresters fiddle as Kumaon burns

Forest fire in Bageswar and Pithoragarh districts in Uttarakhand have caught forest officers napping. Gearing up for World Environment Day celebrations, to officers ignored the fire for over 12 hours in Bageswar, Kausani and Pithoragarh of Kumaon hills. However, the Nainital forest division has reported loss of trees in 213 hectares and the forest department has recorded 57 cases of forest fires in the past week. The funds of UNDP, who had collaborated with the state in a fire control project, have been irregular and the state government too had not provided the required manpower. Further, the crackdown on the forest mafia was largely on paper.

Tapas Chakraborty for THE TELEGRAPH: June 6, 1998

BHEL plan to ensure clean water for hills

To ensure clean potable water in the upper reaches of the Ganga and its tributaries, Bharat Heavy Electricals Limited (BHEL) has undertaken a scientific monitoring and analysis programme. As per the contract awarded under the Ganga Action Plan, BHEL's Pollution Control Research Institute at Hardwar will conduct monthly studies, analyse and scientifically assess the water quality of river streams from Badrinath to Anoopshehar, on continuous basis. The results of this programme will determine the need of setting up sewage treatment plants for cities like Srinagar, Joshimath and Uttarkashi.

THE STATESMAN: June 6, 1998

Japanese-aided sericulture project launched in Imphal

The Japanese Ambassador to India formally inaugurated the first phase of the Japanese Government funded multi-crore-repees Manipur sericulture project in Imphal. He admits the project focus on the involvement of women and had advantages for a State like Manipur where there were no big industries. According to the Manipur State Sericulture Directorate, each unit will produce silk yarn worth Rs. 1.5 lakhs and the entire project will provide employment for 34,800 people.

THE BUSINESS LINE: June 23, 1998

Villagers oppose airport project

The proposal for an airport in the tourist area of Banikhet in Chamba district of Himachal Pradesh has not materialised due to procedural wrangles. Over 1000 residents of Pukhri and Kanda villages are opposed to the idea, as at least 150 families will be dislocated and thousands of pine trees axed. The residents point out that during the past 10 years a number of surveys have been conducted, but nobody has bothered to find any alternate site for their habitation and suggest adequate compensation for them. However, the Director of Civil Aviation said that the people would be given 'good' compensation and efforts would be made to get them jobs. The government claims that the airport will go a long way in promoting tourism in Chamba.

Pratibha Chauhan for THE TRIBUNE: June 25, 1998

316 sq km forests lost NE in 2 years

The North-Eastern states have lost over 300 sq. km forest cover since 1995 even as a Supreme Court order banning felling of trees is in vogue in the region. A report compiled by Forest Survey of India revealed that Assam recorded maximum forest loss followed by Manipur while Mizoram recorded an increase in forest coverage during 1995-97. The states Arunachal Pradesh, Meghalaya and Nagaland still have more than two-third of their total area under forest cover. The Ministry of Environment & Forests declared Dibru-Saikhowa sanctuary (Assam) as a new biosphere reserve, while Nokrek sanctuary (Meghalaya) and Manas Tiger Reserve (Assam) had already been identified as such reserves considering their rich biodiversity and unique ecosystems. The Ministry also sanctioned various projects to Botanical Survey of India, Zoological Survey of India, Regional Research Laboratory and Manipur University during these years.

THE ASSAM TRIBUNE: June 25, 1998

Tripura to have solar electricity

The Tripura Government has initiated steps to implement the Centre-sponsored programme to bringing solar-power electricity to 10 police stations in remote Indo-Bangla international border areas. The scheme was being implemented under the border area development programme, the first in the north eastern region, wireless sets of these ten police stations would also be operated through solar electricity.

THE ASIAN AGE: July 4, 1998

Action plan to combat poaching in the Northeast

Alarmed by the destruction of forests and depletion of rare wild animals in the Northeast, environmentalists here are working on an action plan to combat widespread smuggling and poaching. Experts from the Kaziranga, Manas and Pabitora reserves have stepped up security arrangements in the area to combat illegal poaching.

Sukhendu Bhattacharya for THE ASIAN AGE: July 7, 1998

Horticulture can transform rural economy in North East

A horticulture revolution in the north eastern region is possible through an integrated development programme to bring about a transformation on the rural economy in the North East, according to Dr H.P. Singh, Horticulture Commissioner of India. The meeting held at Shillong, on the proposed Technology Mission for the Integrated Development of Horticulture, took stock of the horticulture potential in the region. However, he lamented that the various schemes and programmes for horticultural development launched by the Centre have not reached the farmers.

THE ASSAM TRIBUNE: July 9, 1998

Uncontrolled limestone mining causing environmental hazards

Despite mounting pressure by environmentalists to close down limestone mining causing environmental hazards in the Sirmaur district of Himachal Pradesh, the same is continuing. There are around 50 major mines under the Sirmaur district mining officer. Illegal mining is estimated at over a third of the entire mining work being carried out in the belt. The limestone mining has been banned in the

bordering Doon valley of Uttar Pradesh due to serious environmental hazards, but the Himachal Pradesh Government has given a free hand to carry out mining activity on the pretext that is lucrative for the locals as well as the state government.

Baldev Chauhan for THE STATESMAN: July 12, 1998

Himachal lake facing environmental damage

Renuka lake, one of Himachal Pradesh's most picturesque and largest lakes in the Sirmour district is suffering from serious natural hazards, such as heavy silting, growth of dense weeds and pollution by the residents and visitors and neglect by the authorities. Although slow paced desilting is currently going on in the adjoining Parshuram lake, but it was found that there is in fact a need for voluntary organisations who can involve pilgrims, locals and the government to carry out the longterm operations.

Baldev S Chauhan for THE STATESMAN: July 13, 1998

Haphazard constructions make HP quake-prone

The forest cover in Himachal Pradesh is gradually decreasing with concrete building and orchards coming up in place of green trees. Mult-storey concrete buildings are coming up throughout the state despite the fact that the state has been placed in seismic zones IV and V, which are the two highest earthquake-prone zones in the country. Unfortunately, the successive governments in the state have not taken any measures to enforce the building laws or prepare a plan to allow only such structures which fit in the hill environment.

S.P. Sharma for THE TRIBUNE: July 18, 1998

Rohtang Pass faces pollution threat

Rohtang pass (13,050ft altitude), the famous tourist destination, 51 km from Manali in Himachal Pradesh is facing a serious pollution threat. During May-June and September-October, thousands of tourists visit the Pass daily, but the lack of tourist amenities and ever-accumulating layers of non-degradable materials polluting the entire terrain from Manali to the Pass. If the menace of pollution caused by non-degradable material is not controlled soon, tourism, will face severe problem. But, unfortunately the government is yet to take any remedial steps.

M.C. Thakur for THE TRIBUNE: August 12, 1998

Govt set to approve Rs 370 cr hydel project for N-E

The Vajpayee government is all set to push through a Rs 370 crore hydro-electric project in the Aizwal district of Mizoram under its new initiatives plan for the north-eastern region. Design of the various components of the Tuirial Hydro-electric project was made in consultation with Central Water Commission and Central Electricity Authority. After the agreement with Mizoram government the North Eastern Electric Power Corporation Limited (NEEPCO) executing the project, aims at generating 240 million units of hydro power.

Devsagar Singh for THE FINANCIAL EXPRESS: August 17, 1998

Illegal mining, quarrying on the rise

Large-scale illegal and unscientific mining and quarrying combined with public utility like construction of roads and buildings have further contributed to the fragility for ecology creating an environmental imbalances in Himachal Pradesh. The forest destruction by illegal and legal mining have resulted in floods and land erosion of the state. A survey reveals is that most of the person who are engaged in this business enjoy protection of ministers and MLAs and on their recommendations the officials of the state mining department have been issuing casual permits by charging nominal royalty from these persons. The mining and quarrying in the state has put a question mark on the lives of Bhakra and Pong dams built at a high cost. The capacity to hold water by these dams has been reducing year after year because of heavy siltation caused by destruction of forests and mining in the catchment areas of these

dams. Besides these natural lakes in Dharamsala and Chamba have been diminished because of soil erosion and existence of Rewalsar lake is under threat.

Ravinder Sood for THE TRIBUNE: August 19, 1998

New forest policy in Nagaland

The Nagaland government has formulated a policy for protection of forest, environment and ecology with adoption of the national forest policy 1988. The Wildlife Protection Act, 1972 had also been adopted in the State for management of wildlife in the national parks and sanctuaries and also for conservation of biosphere invoking all sections of the people.

THE ASSAM TRIBUNE: August 20, 1998

वनों के अवैज्ञानिक दोहन से उत्तराखण्ड भूस्खलनों की चपेट में

आजादी के बाद से उत्तराखण्ड में हुए वनों के अवैज्ञानिक दोहन से अब हिमालयी क्षेत्र का पर्यावरणीय सन्तुलन बिगड़ गया है। इस कारण ही वर्षा ऋतु में प्रकृति की मार उत्तराखण्डवासी झेल रहे हैं और पूरा उत्तराखण्ड भंयकर भूस्खलनों की चपेट में हैं। इसी कारण मालिपा व उंखीमठ दुर्घटनाएं आज विश्व पटल पर है। आजादी के बाद से अब तक उत्तराखण्ड में २५.३५ हजार हैक्टेयर वन क्षेत्र नष्ट हुआ है। निर्माण कार्यों के लिए कराए गए वनों के कटान की जगह नया वृक्षारोपण अधिकतर कागजों में ही होता रहा। वन विभाग के ही आकड़ों के अनुसार प्रदेश के कुल वन राजस्व १.०७ अरब रूपयों में से केवल पर्वतीय क्षेत्र के वनों से ४६.०५ करोड़ का राजस्व सरकार प्राप्त करती है। यदि इस वन राजस्व का दस प्रतिशत भी हरवर्ष वह पहाड़ में पर्यावरण संवर्द्धन व संरक्षण के उपायों पर खर्च करती तो आज पहाड़ को भारी भूस्खलनों की इन विभिन्निकाओं का शिकार नहीं होना पड़ता।

दिवाकर भट, अमर उजाला, अगस्त २५, १९९८

UP plan to prevent hill disasters

The state government has decided to commission two projects to help prevent natural calamities in the Uttar Pradesh hills in the wake of the landslides which claimed several lives in Malpa and led to widespread devastation. An ambitious 2,100 crore project to be executed with the help of the World Bank is eco-restoration and development in hill areas will be implemented in phases. The other project, Integrated Watershed Development Plan, will include water management and eco-friendly programmes.

THE TIMES OF INDIA: August 25, 1998

Denuded, eroded and killed

Man-induced soil erosion today poses the single largest threat to the stability of the Himalayan ecology. Due to incessant depletion of forests, about 600 million tonnes of top, fertile soil, is washed annually into streams and rivers from the hills of Himachal Pradesh. Forestry experts are of the view that the growing biotic pressures on the forests, the prime cause of soil erosion. Over grazing, excessive extraction of fuelwood and herbs, unscientific lopping of trees for fodder, and forest fires are some of the factors contributing of the shrinking forest cover of the state. The author presents a detailed study on decreasing forest cover and various effective measures to check soil erosion by afforestation.

Romesh Dutt for THE TRIBUNE: September 12, 1998

Digging up an eco disaster in Kullu

The Kullu valley in Himachal Pradesh faces serious ecological degradation because of large-scale unscientific and illegal mining and quarrying. Despite the deployment of field guards to check this by the Department of Industries, illegal quarrying is on the rise. Geo-scientists say that a ban on mining in river beds should be strictly implemented in order to save the valley from flash floods.

THE PIONEER: September 13, 1998

Towards eco-friendly tourism in Himalayas

Eco-tourism is slowly but surely catching up in the Himalayas with benefits accruing from it slow in coming and few takers among the entrepreneurs. According to Wildrift Adventures, an environment friendly adventure tourism in the Himalayan region, the eco-tourism should attempt to link tourism promotion to regional development and environmental concerns to optimise the benefits from the tourism industry for the Himalayas on a sustaining basis. However, there are only a few NGOs who are trying to do their part for the cause of the environment, notable are Society for Nature, Environment and Humanity (SNEH), Central Himalayan Rural Action People (CHIRAG) and an women's organisation 'Arohi' operating in the Uttarakhand region. Their activities are varied like involvement in various social forestry schemes, nurseries, developing rain water harvesting system, preservation of lakes, building stone cottages using local architecture and materials, afforestation and tree planting with the help of local and outside school children according to the needs of the area.

THE HINDU: September 20, 1998

Quake likely in Himalayas: Expert

A major earthquake, with a magnitude of above 8 on Richter scale, is likely to hit the Himalayan region, anytime in the next 10 years, as the seismologically vulnerable mountain ranges are undergoing dynamic geomorphologic changes, according to eminent geologist Dr J.G. Negi of National Geophysical Research Institute. The Himalaya, the youngest mountain ranges in the world stretching over 2,000 kms, is a very dynamic zone caught up in a plate tectonic activity involving Eurasia and Indian plate. Because of this activity, the 'folds' in Himalayas are undergoing continuous adjustments, Dr Negi said. He stressed to be cautious and chalk out advance measures to identify precursors and put in place the disaster management system.

THE TIMES OF INDIA: September 21, 1998

Mystery fires of Himachal

Investigations into the mysterious drying up of over two thousand full grown trees in Kheer Ganga forest under Parbati division three years ago have led to the uncovering of a major scandal and revealed the modus operandi of how officials have been plundering the state's precious forest reserves in the grab of 'salvage marking'. There have been numerous instances in which green trees had been felled. However, the department despite the total ban on felling of oak, took no action against the errant officers.

Rakesh Lohumi for THE TRIBUNE: September 28, 1998

Inside the garden

Several hundred of Bhotiya tribals of Nanda Devi Biosphere Reserve living in the village of Lata, Tolma, Peng and Rini which lie on the periphery of the park, went on a hunger strike and forcibly entered the park's core zone to claim their traditional rights of gathering forest produce and grazing their cattle. With the closure of the park in 1982 and the banning of human activity within it, most of the tribals who had earned their livelihood by rearing goats and sheep and by collecting medicinal herbs from the forests, found themselves difficult to survive. The study conducted between 1994 to 1997, revealed the population declined 15% over the decade. The villagers also found that the medicinal herb base, which they had been harvesting in a sustainable manner over centuries, had also been recklessly plundered. The Valley of Flower, declared a protected area, is an example of the tragedy since grazing has been banned there. The study suggested that promotion of ecotourism in the buffer zones of the reserve and the setting up of employment generating schemes in the area to help ease the problems of the people. It also recommended that the forest department be better equipped to deal with the task of protecting the local ecology and maintaining the biodiversity in the biosphere. Hence policing such extensive areas is impossible without the active support of the very people who have a personal stake in the survival of these fragile forests.

S.M.A. Kazmi for THE INDIAN EXPRESS: October 4, 1998

Major dive to restore glory of Dal lake

The Dal lake spanning over 75 km² in the 13th century, covers only 24 km² now according to Urban Development Department. Alarmed by scientific findings that the world famous Dal, the post-glacial lake may cease to exist in 100 years from now, the government and other agencies have launched a major drive to distill and dewed the lake, and free from encroachments. A project of Rs. 300 crore was formulated by the National Lake Conservation Programme of the Union Environment and Forest ministry after a pre-feasibility report for the conservation of Dal and Nageen lakes was submitted. The lake conservation programme includes afforestation and soil conservation in lower Dachigam area and Dara Danihama catchment areas and tapping of debris and sediments from the catchment area by constructing settling basin at Teilbal.

THE HINDU: October 5, 1998

Timber smuggling depletes J&K forests

An estimated 3 lakh conifer, deodar and kail trees have been smuggled from the forests in Jammu and Kashmir during the years of high-pitched militancy, according to the Forest Minister of the state. The area of degraded forests in the State has swelled to 5 lakh hectares. The wildlife, social forestry, fisheries, environment and pollution departments have become non-functional with infrastructure suffering colossal damages, the Minister said. The Government had launched a drive against smugglers and encroachers and had reactivated forest agencies, paving the way for better forest management. To meet the challenge posed by smugglers and encroachers, the Government has decided to raise a forest protection force at a cost of Rs 105 crore. However, the critics have constantly alleged that funds which come from the Union Government and foreign agencies like the World Bank are not properly utilised for promotion, protection and conservation of forests and other related sectors. They claim that the continuing misuse of funds would have disastrous results, leading to soil erosion and heavy flooding in the valley.

THE PIONEER: October 7, 1998

मध्य हिमालय में यूरोपियन सब्जियां उगाने में सफलता

राजकीय फल अनुसंधान केन्द्र, पिथौरागढ़, उत्तर प्रदेश ने मध्य हिमालय की जलवायु में २८ प्रकार की यूरोपियन सब्जियों को उगाने में सफलता हासिल कर ली है। अनुसंधान केन्द्र के वैज्ञानिकों का दावा है कि प्रस्तावित उत्तराखण्ड राज्य में यदि सब्जी और फल उत्पादन को प्राथमिकता दी जाए तो वह विदेशी सब्जियों के पर्याप्त जर्म प्लाज्म काश्तकारों को आसानी से उपलब्ध करा देगे। मध्य हिमालय में ३५०० से ६५०० फीट की उंचाई पर यूरोपियन सब्जियां उगाने की अनुकूल परिस्थितियां हैं। इस अनुसंधान केन्द्र में जो २८ किस्म की सब्जियां उगाई गई हैं, ये सभी अच्छा उत्पादन दे रही हैं।

डा० दीपक उप्रेती, अमर उजाला, अक्टूबर १४, १९९८

Mafia encroaches on Himachal forest land

Large-scale encroachment of forest land is going on unchecked in the apple belt of Himachal Pradesh. The highest number of such incidents is being reported from Rohru, Jubbal, Kotkhai and Chopal. While the encroachment of land adjoining apple orchards has been going on for decades, but of late there is a growing trend of adopting far more aggressive and menacing methods such as penetrating the virgin pine forests and occupying land there, before the neighbour does the same. What has angered environmentalists most is that despite adequate powers with the forest and revenue department to eject these illegal encroachers, virtually nothing has been done by successive governments to deal with them effectively.

THE STATESMAN: October 16, 1998

Afforestation plan by forest dept

The forest department of Nagaland has decided to take up afforestation programme for regeneration of degraded forests with the objective of converting such areas to productive forests. The consequence of uncontrolled tree felling and shifting cultivation leading to serious ecological problem, whereas the active participation of the land owners was needed for successful implementation of the afforestation programme thereby establishing a resource based economy.

THE SENTINEL: October 18, 1998

Himachal Pradesh apples hit by pests

According to the scientist of Dr Y.S. Parmar University of Horticulture and Forestry, Solan, about 69% of apple crop in Kullu, Shimla, and Mandi had been adversely affected because of red mites. Apple production generate a revenue of about Rs. 300 crore, which is the backbone of the economy of Himachal Pradesh and the peculiar topography and agro-climatic conditions prevailing in the state are ideally suited for the production of different type of apple crops. According to experts, use of highly concentrated Nephthaline and presence of red mites have dashed hopes of a bumper apple crop in this season.

Charanjit Ahuja for THE FINANCIAL EXPRESS: October 19, 1998

Civilisation takes its toll of Naini Tal

Before the first British description of Naini Tal appeared in the *Calcutta Englishman* in 1842, the lake in the vicinity of Almora was frequented by the local people on certain occasions. There was certainly no habitation and mountain tourism was virtually unknown then. Unplanned growth of the lake city, legal and illegal constructions without any regard for the hill geography, increase in population and traffic congestion have all whittled the charm of the Kumaun hills, which inspired hundreds of sages to retire to the mountains to worship and meditate. Today lakhs of tourists visit Naini Tal and its surrounding Bhim Tal and Naukachia Tal every year, adversely effecting the environment of the town and the water quality of the lake. The three lake are a study in contrast, Naini Tal is dying and cries out for resuscitation. Bhim Tal has already started unfolding its bounties before tourists, while the Naukachia Tal is still innocent.

K. Kannan for THE HINDU: October 19, 1998

Rafting on Alaknanda upsets greens

With ever increasing water sport activity along the Alaknanda river upstream of Rishikesh has upset environmentalists. Over the last few years, there has been a sudden spurt in the rafting activity in the area. Though the official of Garhwal Mandal Vikash Nigam said that they are very careful about the environment dimensions of the sport which involve large groups, further the increase emphasis on eco-tourism came the latent danger to the fragile eco-system on the region.

THE TIMES OF INDIA: October 19, 1998

Tehri Dam at the root of landslides

The author presents a detailed study after the August 1998 landslides in the region, which ended the Kailash-Mansarovar *Yatra* at Malpa village. The Himalayas, being the tallest as well as the most fragile mountain system in the world, are organically very active. Thousands of landslides of medium to large dimensions occur seasonally. According to geologists the seismic movements are perennial in the young Himalayas. On an average, nearly 200 earthquakes of varying degrees occur yearly in the Uttarakhand region itself. The Bahuguna activists blame the building and construction of Tehri for disturbance of the existing eco-system and for the catastrophic landslides that devastated the Uttarakhand area. The August 98 landslides made the *Chipko* followers vocal on the related issues. The author views that the effect of human disaster would be worse than that of a nuclear bomb and the construction of Tehri Dam could hasten such a possibility.

Ashok Mahajan for THE BUSINESS AND POLITICAL OBSERVER: October 27, 1998

Forest protection force will clear encroachments in J&K

The Forest Protection Force (FPF) being set up in Jammu and Kashmir will justify its existence more by removing encroachments on forest land than by counter-smuggling operation. The loss due to encroachments was much bigger than that caused by illegal felling of trees, according to the chief conservator of forests, Kashmir division. The setting up of FPF involved an expenditure of Rs 105 crore, equipped with modern communications network to facilitate rapid action, is expected to curb forest smugglers. However, the environmentalists disagree with it, saying the money being spent on the FPF could be better utilised by undertaking rehabilitation work in the degraded forests.

THE TIMES OF INDIA: October 27, 1998

Watershed shifting cultivation gaining impetus in Tawang

Watershed shifting cultivation is gaining impetus among the people of the snow clad Tawang district of the backward Himalayan state of Arunachal Pradesh over the last few years. The National Watershed Development Project in shifting cultivation area, Mukto, under Tawang district which was approved by the state government has been functioning since 1996. The beneficiaries were imparted training on the work with the help of local expert and have also been provided with project incentives for purchase of cloth nets, locally available raw materials from the project fund and successfully produced local paper to a total quantity of 30,000 sheets this year.

T.T. Tara for THE ASSAM TRIBUNE: October 31, 1998

Nomadic tribe opposes eviction move

A large number of Van Gujjars expressed deep anguish over the move to evict them from the forests. These nomadic tribes are also sore at the authorities trying to prevent them from lopping leaves for feeding their livestock. The Rural Litigation and Entitlement Kendra has mooted Community Forest Management Plan, advocating that forests could be better managed by indigenous people living in or depending on the forests. Several environmentalists admit the Van Gujjars, being strict vegetarians and having vast knowledge of silviculture and wildlife are a fit case to manage the proposed Rajaji National Park.

THE HINDU: October 31, 1998

Himachal bans use of recycled polybags

In a major step forward to deal with polythene menace, the Himachal Pradesh government has proposed a ban on the use of recycled, coloured polythene bags for carrying food items. The notification is being issued under the State's Non-Biodegradable Garbage (control) Act, 1995, however there is no ban on the manufacturing units or even sale of recycled polythene bags.

THE INDIAN EXPRESS: November 10, 1998

Beas plan delay: SC rebukes HP govt

The Supreme Court today pulled up the Himachal Pradesh government for not submitting a composite action plan to restore the ecology and environment of river Beas as directed by the court to submit a composite action plan to restore its ecology in the Kullu-Manali region. Counsel for the state government said the irrigation and other department had already started afforestation activity in the catchment areas of the river and other preliminary plans were being worked out.

THE INDIAN EXPRESS: November 12, 1998

टेहरी बांध बनने के बाद गंगा जल्दी प्रदूषित होगी

टेहरी बांध बनने के बाद गंगा के प्रदूषण नाशक गुण नष्ट होने की सम्भावना है। पी० ए० सी० स्वर्ण जयंती गंगा अभियान दल के स्वागत समारोह को संबोधित करते हुए उत्तर प्रदेश के पर्यटन व लोक कल्याण मंत्री कलराज मिश्र ने कहा कि इस प्रकार टेहरी बांध बन जाने के बाद गंगा और भी जल्दी

प्रदूषित होगी। श्री मिश्र ने कहा कि उत्तरकाशी व टेहरी के बीच गंगा के प्रवाह मार्ग में ऐसी जड़ी बूटियां हैं, जिनके प्रभाव व गंगा में समिश्रण से टेहरी के आगे भी गंगा जल कहीं प्रदूषित नहीं होता है। पर्यावरणविदों की टेहरी बांध निर्माण से सम्बन्धित चिंता इसी बात को लेकर है कि बांध बन जाने के बाद यह जड़ी बूटियां नष्ट हो जाएंगी।

दैनिक जागरण, नवम्बर १३, १९९८

Sandal wood plants in Himachal

Contrary to the popular belief that sandal was the exclusive preserve of the southern states, scientists of Silviculture and Agroforestry department of Dr Y.S. Parmar University of Horticulture and Forestry, Nauni have successfully developed nursery and plantation technologies for large-scale establishment of sandal (*Chandan*) in the lower areas of the Himalayas. Sandal trees had been recorded growing in the Jawalaji area of Kangra district and in Bilaspur. In view of the economic importance of the sandalwood, the department prepared a plan for starting a project for adapting the sandal trees on a commercial scale in Himachal Pradesh. The main constraints of spreading of plantation of sandal outside its limited habitat are heavy biotic pressure, particularly grazing, browsing and trampling of young trees by cattle, lack of nursery and field plantation technologies, poor and slow rate of seed germination under Himalayan conditions.

THE TRIBUNE: November 24, 1998

Beauty and the beast

Shahtoosh, the most elegant wispy shawl of soft texture can be folded into the pocket has perpetrated years of merciless killing. The source material of shahtoosh is the skin of the chiru antelope, mainly inhabiting in the Tibetan plateau of China, a few of them seasonally troop into the Ladakhi regions of India. The dwindling numbers of chiru due to constant hunting, the total population came down to 200 to 220 only in northwestern Ladakh. The slaughterer Tibetan antelopes are the source of shahtoosh and this precious raw wool is the main barter item for tiger bones from India. The smuggled wool is bundled into Kashmir through western Nepal to be woven into shawls and scarves. In the last few years, the trade in shahtoosh has boomed, as it is prized as a fashion accessory in America, Europe and Japan. Though shahtoosh is still carried over remote Himalayan passes by Tibetan nomads and their yaks, a large bulk of the trade is now handled by more sophisticated traders. In the international market the shahtooshes are now fashioned for extinction of chirus, the most unusual creatures.

Rajlakshmi Bhattacharyya for THE TELEGRAPH: November 28, 1998

Chilgoza pines face extinction

Man's greed and apathy, hostile soil conditions and insect attacks have over the years, been slowly but inexorably pushing *pinus gerardiana*, commonly called chilgoza or neoza pine, towards extinction in India. It is the only available species which can withstand the harsh climatic and geo-physical conditions of the dry temperature zones. This particular pine species was found only in the western Himalayas, Kinnaur and Pangi valley of Chamba district of Himachal Pradesh and a small pocket (bordering Tibet) of Kashmir in India. The scientist of Dr Y.S. Parmar University of Horticulture and Forestry says the preservation steps of chilgoza pine forests have assumed importance not only because the trees have come to face extinction, but also in the context of the paramount need of arresting the heavy soil erosion in the Sutlej valley, particularly in Kinnaur.

Romesh Dutt for THE TRIBUNE: November 28, 1998

Another forest disease in HP

Scientists of the Himalayan Research Group, a non-government organisation had identified the fungal disease responsible for the drying up of deodar trees. *Fusarium oxysporum* and *Ganoderma lucidum*, two dreaded fungi, are responsible for the mysterious forest disease which caused large-scale mortality of shisham (*dalebergia sissoo*) trees in the mid-hill areas of the state over the past two years. This is the second forest disease detected in Himachal Pradesh over the past six months. Earlier, it was the *Phytophthora cinnamomi* fungus which dried up over 800 deodar trees in the Chail area. The twin attack

of the deadly fungi had infected thousands of shisham trees in Bilaspur, Una, Hamirpur, Kangra and parts of Mandi district. The mid-hill belt starting from Ghaghes and extending right upto Nurpur has been the worst hit. In Kangra, Dehra and Nadaun subdivision alone more than 2,000 trees have dried up.

THE TRIBUNE: November 30, 1998

Ladakh threatened

The pristine beauty of the mountainous Ladakh is in danger of being spoilt forever by increasing pollution and ecological and ecological damage due to increased tourist traffic. Hotels and guest houses are coming up in agricultural areas. Inadequate electricity has forced hotel and guest house owners to use diesel-run generators, disposed of plastic bags causing the mystical place is threatened to end up as yet another unplanned touristy ghetto.

RASHTRIYA SAHARA: December 1998

Umiam Lake choked by Shillong garbage

The breathtaking Umiam Lake, 15 km away from capital Shillong, a major tourist attraction in the North-East, is slowly turning poisonous with toxic wastes polluting the lake's tranquil water. Solid wastes, sewage water and other pollutants from the Shillong city are draining into the lake threatening its very existence. The Umkrah and Umshyrpi, the two major streams, have been virtually turned into mere sewage carriers. The expert called for immediately setting of a sewage treatment plant and total ban on dumping of garbage and other solid waste into the waterbodies as urgent remedial steps.

THE ASSAM TRIBUNE: December 1, 1998

Carpet industry in Kashmir grows as child labour suffers

While the economy of Jammu and Kashmir has been hit hard during militancy, the state's carpet weaving industry actually grew during this period with both production and profit going up. As men fell to bullets, their children had no choice but to fend for themselves and earn a livelihood. Many of these destitute children thus found jobs in the carpet weaving industry. A study sponsored by UNICEF recommended health service, non-formal education and higher wages, since poverty and ignorance were the main reasons for child labour.

Sant Kumar Sharma for THE TIMES OF INDIA: December 7, 1998

Tribals oppose laying of railway line

The laying of the foundation stone of the Diphu-Karong railway line through Assam-Nagaland-Manipur by the Railway Minister Mr Nitish Kumar, has failed to enthuse many sections of the people in this region. The Autonomous State Demand Committee of the Karbi Along in Assam protesting against the construction of the rail line, which will pass through the proposed district of the tribals. They feel that, if the rail line becomes operational, the Kuki tribals and others will have free access to their state and that their demand for a separate State will be eclipsed.

THE HINDU: December 11, 1998

J&K seeks army's help to control forest fires

The official sources said thousands of trees were lost in the northern areas of Kashmir valley due to accidental fire and anti-insurgency operations by security forces in the forest during the past few months. The Jammu and Kashmir government has sought the army's help to control the forest fires caused by mortar and artillery shelling by Pakistani troops from across the line of actual control.

THE TIMES OF INDIA: December 12, 1998

Scheme for conservation, use of herbs

Since herbal medicines have gained wide acceptance, the demand for these medicines has increased tremendously in the past few years, thus putting great pressure on natural sources. More than 40 species of medicinal plants in Himachal Pradesh have been declared endangered due to continuous extraction to meet the growing demand of the pharmaceutical industry. *Vanaspati Van*, an ambitious scheme for development and conservation of medicinal plants recently operating in Chamba district. It would conserve, enrich the depleting natural herbal resources and to develop the agro-techniques of the medicinal plants cultivation besides providing nature care by setting up nature care units in the region.

THE TRIBUNE: December 22, 1998

NEW ADDITIONS IN BIBLIOGRAPHICAL DATABASE ON HIMALAYA

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Information embodied in documents is a great national and international resources. Scientific and technological knowledge has been expanding at a terrific speed. With the result, especially the scientists have been facing problems to cope with the relevant literature. It is becoming more and more difficult for them to keep themselves up-to-date and well informed in the field of their specializations. In the changed context nobody could afford to neglect information already available in some form. Not only that the available information had also to be collected and passed on to the persons who could use them profitably with in the shortest possible time. Now the modern library, with a few exceptions is regarded as a service institution and its aim is to enable the users to make the most effective use of resources and services of the library. This type of library acquires material, processes it, and makes it available for use rather than preservation. In order to facilitate the use of a library, Librarians provide tools like library catalogues, shelflist and subject bibliographies, etc.

Literature on area of studies like Himalaya is vast, multilingual and expensive. It becomes a matter of concern to any serious research worker. There is a definite need at local, regional, national and international levels at least to reduce the gravity of the problems if not to solve this fully. Bibliography is a technique of systematically producing descriptive lists of written or published records. Due to literature explosion, it is very difficult for any library to procure all the materials on any subject, even if it is too narrow. The concept of resource sharing become most popular in the field of research. By resource sharing, more and more research materials are used and it will definitely help research and development activities. Bibliographical services are most powerful tool for resource sharing. No modern library can function without bibliographical tool. Bibliography contributes towards the use of books and other materials and promotes useful applications of knowledge. The basic aim of bibliography is to assist the users in locating the existence of or identifying a book or other material of their interests.

In this current subject bibliography, an attempt has been made to categorize the books available on Himalaya in the Library and Information Centre of G.B. Pant Institute of Himalayan Environment and Development, under major subject headings. Books in English, Hindi and Chinese languages have been included in this bibliography. Entries are arranged using combination of Author, Title and Publisher Indexes, under various major subject headings. The present bibliography is the result of the extracts from the database of library, which is being maintained by the software package "PALMS (Prasad Automated Library Management System) developed by the first author himself. In displaying data and entry format Indian Standards have been followed which reads - Author. Title : Subtitle. Place of Publication, Publisher, Year of Publication. Pages.

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