

Changing Land use Pattern in Uttarakhand

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Abstract

An attempt has been made here to highlight the in land use change, existing land use pattern, operational holdings pattern, and area under irrigation of Uttarakhand. In the state of Uttarakhand, 90 percent areas are hilly and 80 percent agriculture depends in the rain. The holding size is very tiny. Out of the total net sown area about 30 % area is availing irrigational facility. It is find out that the area under forest and agricultural is decreased and waste and uncultivable area is increased during the specified periods. It is generally practiced on the terraces carved out on the hill slopes and is still based on traditional methods and could not overcome the restrictions imposed by the mountainous environment.

Introduction

Agriculture plays a vital role not only in the economy of Uttarakhand but also in India's Economy. Over 70 percent of the rural people depend on agriculture as their principle means of livelihood. Though agriculture is the main stay of the population, but it is practiced at subsistence level and in the absence of any other allied economic activity. The varying environmental conditions are indeed responsible for variation in land use pattern, agriculture, cropping patterns and its allied sections.

In the state of Uttarakhand, 90 percent area is mountainous part and 70 percent agriculture depends in the rain. It is generally practiced on the terraces carved out on the hill slopes and is still based on traditional methods and could not overcome the restrictions imposed by the mountainous environment. Physically the difficult terrain, the infertile soil, cold climate and other adverse natural circumstances combined with the misfortunes caused by the degradations and underdeveloped economy, of the people impose many limitations upon the inhabitants which lead the cultivators to adopt peculiar agricultural practices (Pargai, 2010), the hill farmer characterized by much input of labour and little output from the farm. However the parts of Tarai-Bhabar have marked by different type of agriculture which is highly developed.

Objectives of the Study

Keeping in mind the vital significance of land use and agriculture in the region the main objective is to study the patterns of changing land use, existing land use, land holding etc. in the region. The present study is based on the secondary source which has been collected from the district statistical handbooks and revenue record offices. To examine the spatial patterns figures for various years have been computed from statistical diaries.

Methodology and Source of Data

The present study is based on secondary sources, which have been collected from the district statistical handbooks and revenue record offices. To examine the changes in spatial land use patterns figures for various years have been gathered and computed from statistical diaries.

Review of Literature

A number of micro and macro level surveys have been conducted in these aspects, which are directly and indirectly related to land use. However few studies are being mentioned here. Among the British geographers Prof. L D Stamp (1960) was the pioneer worker in this field in early 1930. It is followed up, by the geographer of the A.M.U. Aligarh, Prof M. Shafi who produced a Ph.D. thesis (1956 and 1960) on Land Utilization in Eastern Uttar Pradesh under the supervision of Prof Stamp. The first credit goes to Shafi for intensive land use study on large scale. He has selected twelve villages for detailed study from varied environmental conditions. He also corrected the field produce and nutritional level of the village people and considered per capita of daily intake of energy 200 kcal as the minimum requirement for taking into account a loss of ten per cent in the process of post harvest. He also published a number of papers of this credit (1964, 1965, and 1974) and edited several books. The work in this field has also been done by Enyedi (1964), Bhatia (1967 a & b), Dillon (1973), Dikshit (1973), Hussain (1976), Khusro (1965), Singh and Dillon (1984), Singh (1972), Vasanti Devi (1964) etc. in particular.

Negligible surveys conducted on the Himalayan region are related to land use and agricultural development. Among them Jalal (1970 and 1976), Akhtar (1974 and 1980), Bisht (1982), Pant (1988 and 1992,) Pant et al 1988, 1990, 1991, and 1992), Pant and Jalal (1991) Jalal et al (2001)) are important ones.

About Study Area

The state of Uttarakhand extends between 28°43'N to 31°27'N latitude to 77°34'E to 81°02'E longitude. Encompassing an area of 53483 km² with 1,00,86,292 population. The population of Uttarakhand is spread over in about 16,000 villages and 115 urban centers and it is divided into 2 divisions – Garhwal and Kumaun with 95 community development blocks (Figure 1).

Land Use Pattern of Uttarakhand

The land utilization of any geographical area is greatly influenced by the socio-economic level and cultural attitudes of its inhabitants. The land use planning must take into consideration the settlement and population characteristics of an area, and the changes therein; as they reflect the mode of land utilization. Thus any study of land use also involves the cultural factors, i.e., agriculture, settlement, population and infrastructural developments.

Land use in any area depends upon the objectives of the life of the people living therein. It represents the interaction of the physical and the economic factors (Stamp, 1960). The term land use not only implies the use of the land for cultivation, pastoral, forestry etc. but it also includes the various related aspects and factors survey is significant for both the process of such utilization in a region. Land use survey is significant for both the aspects i.e. better understanding of the process and more rational land use investigation is helpful in understanding the resource use pattern of region. Land becomes a scarce resource warranting the promotion of technical changes for intensive uses of land and for the use of land augmenting inputs, which incorporates various objectives viz. geographical area classified into various types which has been described here as a broad land use categorization.

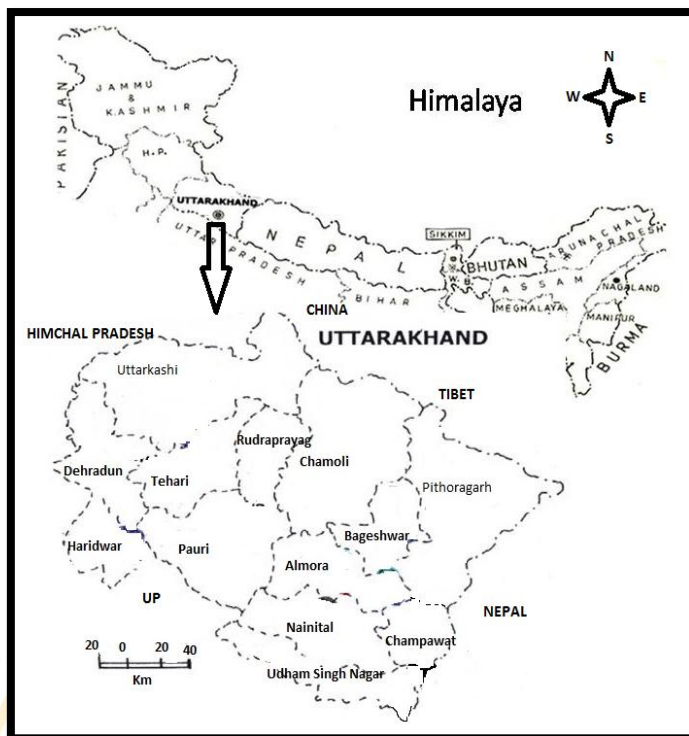


Figure – 1- Location Map of Uttarakhand

Uttarakhand illustrates a complicated land utilization pattern varying with altitude, slope aspects and other mountainous land forms. The land utilization, so far is rather traditional than scientific one. However, the Tarai- Bhabar region may be seen with the scientific use of land. On the contrary, all the classes of land use are under deterioration in the hilly region. Decreasing fertility of the agricultural land, denuded pastures and wastelands are some of the alarming problems.

Forest land

Man has been closely associated with the forests from very beginning of his appearance on the planet. It constitutes area of the most precious natural resources available to mankind which enter into almost every aspects of economic change. Man has been exploiting forest resources for various purposes since time immemorial. Uttarakhand, area under forest as given in table 1 is 61.44 per cent in 2002-2003, 61.12 per cent in 2003-2004 and 61.11 per cent in 2004-2005 of total reported area. It is decreased about 0.33 percent during 2003 to 2004. It is considered to be in keeping with the forest policy laid down by the government of India in 1988 in which 66.7 percent of the total geographical area is recommended to be under forests in the region. However, in this area besides reserve forests, civil/soyam forests, panchayat forests and private forests are also included.

Table 1: Land use pattern in different years of Uttarakhand (ha.)

Categories	2002.2003		2003-2004		2003-2004	
	Ha.	Per cent	Ha.	Per cent	Ha.	Per cent
Reported area	5671704	100	5668443	100	5670110	100
Forest land	3467918	61.44	3465057	61.12	3465057	61.11
W. & uncultivable land	312470	5.5	311256	5.49	311817	5.49
O. than agriculture land	152145	2.68	151702	2.67	152180	2.68

Cultivable waste land	386456	6.81	385991	6.8	386288	6.81
Permanent pasture	229322	4.04	228934	4.03	228944	4.03
Tree, bushes etc. land	252189	4.44	251007	4.42	248979	4.39
Current fellow	41048	0.72	43090	0.76	41683	0.73
Other fellow	71367	1.26	70680	1.24	68432	1.2
Net sown area	758789	13.37	760726	13.42	766730	13.52
More than one time Sown area	452843	7.98	460784	8.12	467809	8.25

Source: Statistical hand book, Uttarakhand, 2008-2007

The maximum forest cover is accounted 88.39 per cent in Uttarkashi followed by 76.41 per cent in Rudraprayag, 73.42 per cent in Nainital, 66.29 per cent in Tehri, 60.42 per cent in Chamoli, 58.21 per cent in Champawat, 57.31 per cent in Pauri, 55.51 per cent in Bageshwar, 54.7 per cent in Dehradun, 50.7 percent in Almora, 49.98 per cent in Pithoragarh, 33.35 per cent in U S Nagar and 31.33 per cent in Haridwar in the year 2004-2005 (Table 2).

Cultivable Waste land

Cultivable waste land provides an index of the availability of land real extension of agriculture. Extension of Agriculture through reclamation of waste land is important for developing the agriculture in the area where the possibilities of introducing scientific method are very limited. The cultivable waste in this accounted for 6.81 per cent being 386456 ha in 2002-2003 and 6.8 per cent being 385991 ha in 2003-2004 and 6.81 per cent in 386288 ha .in 2004-2005 (Table 1). So far the proportion of cultivable waste land in different districts is concerned; it ranges from 0.28 per cent in lowest in Uttarkashi district and highest 10.08 in Tehri (Table 2).

Waste and uncultivable land

Waste and uncultivable waste land including higher gradient area and walls are considered as unused land. This category is most commonly referred as the wastelands in revenue records. These areas put under the use of seasonal grass fields and open grazing. A third major category of waste land and uncultivable land is unused land including rocky waste and erosion-prone wasteland. Waste land and uncultivable land are totally unproductive or useless and remain unused largely owing to not producing food for human consumption. The waste land and uncultivable land in the accounted for 5.5 per cent being 3,12,470 ha in 2002-2003 and 5.49 per cent being 3,11,256 ha in 2003-2004 and 5.49 per cent in 311817 ha in 2004-2005 (Table 1). So far the proportion of waste land and uncultivable waste land in different district is concerned; it ranges from 0.06 per cent in lowest in Nainital district and highest 18.93 in Chamoli district (Table 2)

Net sown area or agriculture land use

The term net sown area is used to include the land which is actually cropped during the current agriculture year that is the net cropped area. Obviously, the distribution of net sown area is profoundly influenced by physical factors, especially isohyetal, edaphic and terrain conditions. However, the socio-economic factors also exert significant influence it. Net sown area occupies only about 13.52 per cent of the total reported area in Uttarakhand. It has come in for lot of criticisms for causing soil erosion and landslides. Initially the rain fed lands were well terraced and had inward slopes. The terraces were well repaired after the rainy season. Rainfall was copious. Irrigated lands were scanty but irrigation was also done by gravitational channels fed by bush and boulder dams constructed at village sites on the rivers. The restoring of water and its distribution

was done by the farmers themselves. The livestock were maintained by crop residues and fodder grass and leaves obtained from forests which were well stocked and highly productive. The system depended on locally available renewable resources.

Districts	Reported area (Ha.)	Land use Categories (area in %)								
		Forest land	Uncultivable & Waste land	Other than agriculture	Cultivable waste land	Pasture land	Tree, bushes, etc.	Current fellow	Other fellow	Net Sown Area
Uttarkashi	812415	88.39	4.63	0.64	0.28	1.01	0.53	0.47	0.69	3.36
Chamoli	837580	60.42	18.93	0.95	5.74	4.75	4.83	0.11	0.11	4.16
Tehri	485766	66.29	1.12	1.09	10.08	0.12	0.06	7.45	1.18	12.61
Dehradun	368993	54.7	0.99	5.91	7.35	0	14.1	2.09	2.07	12.79
Pauri	671852	57.31	5.33	2.3	5.57	5.23	8.34	1.16	2.71	12.05
Rudraprayag	235421	76.41	3.08	1.27	3.4	1.82	4.92	0.29	0	8.81
Haridwar	231116	31.33	1.07	11.53	0.89	0.16	0.23	1.12	1.68	51.99
Pithoragarh	410692	49.98	5.07	2.45	9.48	12.98	6.94	0.33	1.06	11.71
Almora	465858	50.7	5.51	2.17	9.1	6.33	5.84	0.94	1.67	17.74
Nainital	406333	73.42	0.06	2.28	6.57	0.11	4.38	0.98	0.74	11.46
U S Nagar	281070	33.35	0.35	8.99	1.16	0.08	0.44	0.89	1.02	53.72
Bageshwar	238378	55.51	2.27	1.97	6.39	8.02	11.13	1.22	2.84	10.65
Champawat	227311	58.21	3.54	2.07	7.42	8.39	0.09	10	1.23	9.05
Uttarakhand	5672785	61.47	5.5	2.68	6.79	3.73	4.38	0.73	1.2	13.52

Table 2. Districts wise land use pattern of Uttarakhand

Source: Statistical hand book, Uttarakhand, 2008-2007 and Pargain, 2010

The maximum area under agriculture of total reported area of Uttarakhand is 53.72 per cent in U S Nagar, followed by 51.99 per cent in Haridwar, 17.74 per cent in Almora, 12.79 per cent in Dehradun, 12.61 per cent in Tehri, 12.05 per cent in Pauri, 11.71 per cent in Pithoragarh, 11.46 percent in Nainital, 10.65 per cent in Bageshwar, 9.05 per cent in Champawat 8.81 per cent in Rudraprayag, 4.16 per cent in Chamoli and 3.36 per cent in Uttarkashi district in 2004.2005 (Table 2). District Udham Singh Nagar and Haridwar represent the Tarai and Bhabar region and district Nainital and Dehradun represent the Tarai region and Dun valley. Remaining nine districts represent actual hill area concept or hill state.

Fallow land

The cultivated land which has not been cropped in the recent past is termed as fallow land. This would include all land which had been taken up for cultivation but is temporarily out of cultivation for a period of not less than one year and not more than five year for any one or more reasons, such as, poverty of cultivators inadequacy of water, un-remunerative nature of farming etc. The total fallow land in the Uttarakhand is 110115 ha (1.93%) of which 68432 ha can be classified old fallow and 41683 ha as current fallow. The maximum area under fallow including current and old fellows accounted for 11.23 per cent in Champawat and followed by 8.63 per cent in Tehri, 4.16 per cent in Dehradun, 4.06 per cent in Bageshwar, 3.87 per cent in Pauri, 2.80 per cent in Haridwar, 2.61 per cent in Almora, 1.91 per cent in Udham Singh Nagar, 1.72 per cent in Nainital, 1.39 per cent in Pithoragarh, 1.16 per cent in Uttarkashi, 0.29 per cent in Rudraprayag and 0.22 per cent in Chamoli of the year of 2004-2005.

Other than agriculture

The area used other than agriculture in settlements, roads, water bodies etc. this is also called unproductive land. The total land under this category is 152145 ha in 2002-2003, 151702 ha in 2003-2004 and 152180 ha in 2004-2005.

It represents total reported area of 2.68 per cent, 2.67 per cent and 2.68 per cent in the year of 2002-2003, 2003-2004 and 2004-2005 respectively (Table1). The other than agriculture used land is maximum represents in 11.53 per cent in Haridwar, 8.99 per cent in Udham Singh Nagar 5.91 per cent in Dehradun, 2.45 per cent in Pithoragarh, 2.3 per cent in Nainital, 2.28 per cent in Pauri, 2.17 per cent in Almora, 2.07 per cent in Champawat, 1.97 per cent in Bageshwar, 1.27 per cent in Rudraprayag, 1.09 per cent in Tehri, 0.95 per cent in Tehri, 0.95 per cent in Chamoli and 0.64 per cent in Uttarkashi (Table 2, Figure 2 and 3).

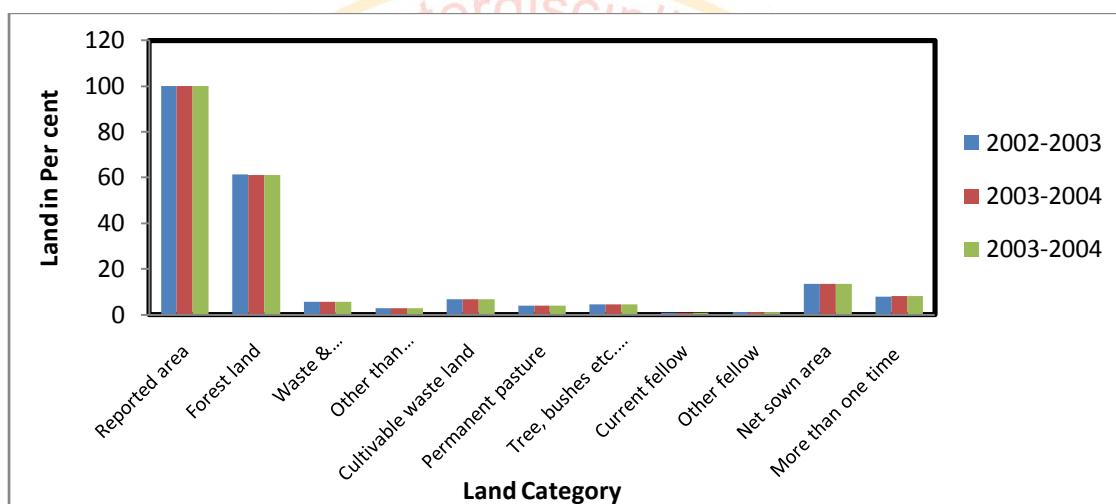


Figure 2 Land use Category in Uttarakhand (2002-2003,2003-2004 and 2004-2005).

Pasture land

The area under pasture land in the Uttarakhand recorded 229322 ha in 2002-2003, 228934 ha in 2003-2004 and 228944 ha in 2004-2005 (Table 1). In terms of percent the pasture land, 4.04 per cent in 2002-2003, 4.03 per cent in 2004-2005 of the total reported area (Table 1). The District wise pasture land are maximum 12.98 per cent in Pithoragarh followed by 8.39 per cent in Champawat, 8.02 per cent in Bageshwar, 6.33 per cent in Almora, 5.23 per cent in Pauri, 4.75 per cent in Chamoli, 1.82 cent in Rudraprayag, 1.01 per cent in Uttarkashi, 0.16 per cent in Haridwar, 0.12 per cent in Tehri, 0.11 per cent in Nainital, 0.08 per cent in Udham Singh Nagar and 0.03 per cent in Dehradun (Table 2)

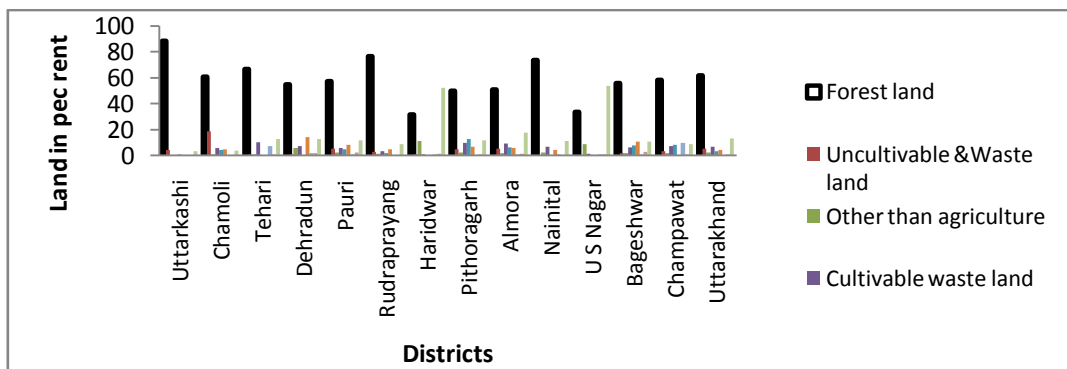


Figure 3: District wise Land use Pattern in Uttarakhand

Irrigated Area

Irrigation is age old practice since the development of civilization in Uttarakhand. Irrigation development in most parts of the Himalaya is very difficult task due to its rugged topography. Irrigation is the most significant constraint to determine the use of land and cropping choice. Table indicates the district-wise extent of irrigation in Uttarakhand. It shows that 30.89 percent of net area sown is irrigated in the region. The extent of irrigated area is 69.06 percent of the total area in Nainital district as against 75 percent irrigated area in the district of plains - Tarai and Bhabar.

Table 3: District wise Irrigated area in Uttarakhand

Districts	Net Irrigated area (ha)	Irrigated area as percentage of net area sown	Percentage of the total irrigated area
Nainital	1,49,982	73.17	69.06
Almora	11,828	11.02	5.45
Pithoragarh	6,678	7.52	3.07
Chamoli	2,758	6.46	1.27
Uttarkashi	4,328	13.68	1.99
Tehri	11,068	15.02	5.10
Pauri	8,780	8.88	4.04
Dehradun	21,753	39.51	10.02
Uttarakhand	2,17,175	30.89	100.00

Source: Pargain, 2010

It is followed by Dehradun district (10.02%). There are numerous streams 'gad' 'gadhera' in the region, but very little use of them is made for irrigation because of diverse topographic features and high costs of lift irrigation schemes on the one hand, silting and sliding of the gules constructed by villagers on the other (Pant et al., 1989).

Operational Holding

The Size of the holding or operational unit of cultivation is one of the most important factors influencing agricultural production and productivity of land and economic status of the land holders. The distribution of operational holdings in Uttarakhand reveals acute imbalances and disparities. The major percentage of land holdings falls under small farm which is on account of continuous process of fragmentation of holdings into small sizes. The pattern of distribution of landholdings in various groups is presented in table It is seen that more than 70 per cent holdings have size below 1 ha and

nearly 18 per cent of the holdings are 1 to 2 ha in size. In all, 97.1 per cent holdings are below 4 ha in size. The pressure on land is therefore, excessive. The per capita availability of land is observed as low as 0.057 ha in the Uttarakhand region (Pant et al. 1990).

The extent of profitability of agricultural operations and its efficiency depends largely upon the size of the unit of cultivation (Pargain, 2010). As elsewhere in the country, the agriculture in the area is dominated by small and marginal holding. There are about 23000 operational holding in the area (Agricultural Census, 2005-2006). It is noted repeatedly that the Himalayan region, except the tracts of Tarai and Bhabar, have very fragmented and tiny holdings. It is due to the fact that arable land is not available at one location in plenty specially in raised ground. The arable land is ranging between 12 and 18 per cent of the total area in different districts of the Uttarakhand.

The paucity of arable land on the one hand and growing rural population without alternate rural occupations on the other, leads to smaller holding. In fact, there are solemn topographical constraints of hill area wherein, the holding has to bear plots in different sunny and shady upland and low lying areas. If a big tract of holding say 10-25 is given to a farmer in uplands areas, it extends over a long ridge having more than 5000 terraces, each bearing very small pace for the bullocks to turn, such a big area cannot be effectively supervised for crops as the wild animals birds and peats destroy the crops.

Table 4 : Distribution of operational holding in Uttarakhand

Size group (ha)	Operational holdings			
	Number	Percent	Area (ha)	Percent
Below 1.0	628267	70.5	242511	28.7
1.0-2.0	158402	17.8	220726	26.2
2.0-4.0	78414	8.8	212384	25.2
4.0-10.0	241613	2.7	132200	15.7
Above 10.0	1421	0.2	35629	4.2
Total	890667	100	843450	100

Source: Pant et al. 1990.

Thus, very big operational holding are not possible in steep hill area. The size of holding has a bearing on the costs of operation. To the valley-opening, the size may mean the area as it connotes plains but on the uphill side, the bigger holding raises the costs in terms of labour supervision, cultivation, weeding and watch and guard so high that bigger holding becomes unviable in the upland areas.

Conclusion

More than half of the population of Uttarakhand directly depends on agriculture for their livelihood. There is an increasing pressure of growing population on the available agriculture resources in the Uttarakhand state as in the whole country. Over 80 percent of the total Geographical area of the region is covered with hills, rivers and Valley where irrigational as well as other technological measures cannot be implemented properly. The mountainous region of the state has small size of land holding and there is less than 5 percent agriculture/cultivated area in that region and that too mainly depends on rainfall. The agriculture production fulfills the food requirements of the people for less than six months only. Maximum area of the state has much less food production than actual requirement. The situation demands immediate attention towards the conservation of our land, particularly the agricultural land.

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References

- i. Anonymous, 2007-2008, Statistical Diary of Uttarakhand, Arth evam sankya vibhag Uttarakhand.
- ii. Akhtar, R., (1974) Agricultural Land use and Nutrition in the Great Himalaya: A Case Study, *The Geographer*, 21 (2):37-51.
- iii. Akhtar, R., (1980) Environment, Agriculture and Nutrition in Kumaun Region, Marwa Publications, New Delhi.
- iv. Bhatia, S.S., (1967a) Spatial Variations, Changes and Trend in Agricultural Efficiency in Uttar Pradesh, 1953-1963; *Indian Journal of Agricultural Economics*, 22(1) 66-80.
- v. Bhatia, S.S., (1967b) A New Measure of Agricultural Efficiency in Uttar Pradesh, India, *Economic Geography*, 43: 232- 237.
- vi. Bisht, G.S., (1982) Land Utilisation and its Impact on Nutrition and Health in Kosi Basin of Kumaun Hill. Ph.D. Thesis, Kumaun University, Nainital.
- vii. Dhillon, S.S., (1973) Changing Pattern in Agricultural Land Use in Mahasu District (Himachal Pradesh), 1951- 1966, Unpublished Ph.D. Thesis, Kurushetra University.
- viii. Dhillon, S.S., (1975) Altitudinal Agro-climatic Zones and their Rhythm in Mahasu District (H.P.), *Geographical Review of India*, 37, 300- 304.
- ix. Dikshit, K.R., (1973) Agricultural Regions of Maharashtra. *Geographical Review of India*, Vol.35, 384-386.
- x. Enyedi, G.Y., (1964) Geographical Types of Agricultural Budapest, *Applied Geography in Hungary*.
- xi. Hussain, M., (1976) A New Approach to the Agricultural Productivity Regions of the Sutlej- Ganga Plains of India, *Geographical Review of India*, 36, pp. 230-236.
- xii. Jalal, D.S. (1970). Land Utilization in Baman Gaon (Kotadun). *National Geographical Journal of India*, 16: 127-149.
- xiii. Jalal, D.S., (1976) Land Utilization in the District of Pithoragarh, Chaitanya Publications, Allahabad: 228p.
- xiv. Jalal D.S., B. R. Pant and R. C. Joshi (2001). Environmental Study in Himalayan Region, Anmol Publication, New Delhi.
- xv. Khusro, A.M., (1965) Measurement of Productivity at Macro and Micro Level, *Journal of the Indian Society of Agricultural Statistics*, 17(2), pp.278-283,
- xvi. Pant, B.R., (1988) Land Utilization in Kotadun, Kumaun Himalaya Ph D. Thesis, Kumaun University, Nainital: 270.
- xvii. Pant, B. R., (1992). Agrarian Environment of Kotadun, Kumaun Himalaya. In: B.P. Chaurasia (ed.) Environmental Pollution-Consequences and Measures, Chugh Publications, Allahabad: 306-329.
- xviii. Pant, B.R. and D.S. Jalal, (1991) Nutrition Deficiency Diseases in Indian Central Himalaya, *The Geographer*, 38(1)30-41.
- xix. Pant, B.R., Joshi, R.C. and Jalal, D.S., (1988). Land Capability Classification Model for Kotadun , Kumaun Himalaya. *Geographical Review of India*, 50(1): 47-52.
- xx. Pant, B.R., Joshi, R.C. and Jalal, D.S., (1989), Water Management in Kotadun Kumaun Himalaya, In R. D. Khulbe (ed.) *Perspectives in Aquatic Biology*, Paprus Publishing House, New Delhi: 509-514.
- xxi. Pant, B.R., Joshi, R.C. and Jalal, D.S., (1990) Cropping Pattern and its Impact on Nutrition and Health in Kumaun Himalaya with Special Reference to Kotadun. In: M.P. Joshi, A.C. Fanger and C.W. Brown (eds.) *Himalaya: Past and Present*, Vol. I. Shree Almora Book Depot, Almora : 365-385.
- xxii. Pant, B.R., R.C. Joshi and D.S. Jalal, (1991) Agricultural Land use and Nutrition in Kotadun, Kumaun Himalaya. *Geographical Review of India*. 53(4): 8-18.
- xxiii. Pant, B.R., R.C. Joshi and D.S. Jalal, (1992) Agricultural Panorama of Uttarakhand. In N. Mohammad (ed.) *New Dimensions in Agricultural Geography*, Volume V Spatial Dimensions of Agriculture, Concept Publishing Company New Delhi: 81-94.

- xxiv. Pargain R. (2010) Agricultural Development in Uttarakhand, Ph. D thesis submitted to Kumaun University Nainital
- xxv. Shafi, M., (1956) Land Utilization in Eastern U.P. Ph. D Thesis London School of Economics.
- xxvi. Shafi, M., (1960) Land Utilization in Eastern U.P. Aligarh Muslim University, Aligarh.
- xxvii. Shafi, M., (1964) Land Use Planning, Land Classification and Land Capability; Methods and Techniques, The Geographer, Vol. XVI.
- xxviii. Shafi, M., (1965) Approaches to the Measurement of Agricultural Efficiency, Proceedings of the Summer School in Geography (Mimeo), Nainital, pp. 1-5.
- xxix. Shafi, M., (1974) Perspectives on the Measurement of Agricultural Productivity, The Geographer, No. 1, Vol. XXI.
- xxx. Singh, Jasbir, (1972) A New Technique for Measuring Agricultural Efficiency in Haryana (India), The Geographer, 19(1), pp. 15-33.
- xxxi. Singh, Jasbir and S.S. Dhillon, (1984) Agricultural Geography, Tata Mc-Graw Hill Publishing Co. Ltd., New Delhi.
- xxxii. Stamp, L.D., 1964. Applied Geography, London: 37-64.
- xxxiii. Vasanti Devi, M.N., 1964. Some Aspects of the Agricultural Geography of South India, Indian Geographical Journal: 29(1 &4)

