



## **Identification of Environmental Sensitive Zones in Pauri Garhwal District, Uttarakhand**

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**Abstract** Pauri Garhwal district of Uttaranchal Himalayas is considered one of the developed districts after Dehradun in the region. A greater part of the district is under severe stress (ecologically) as varied and uncoordinated human activities like deforestation, agriculture on steep slopes, over grazing, mining and quarrying and road building is increasing day by day. As a result, not only the culturable land is rapidly getting degraded and depleted, but also the ecology of the entire region is being severely affected. There is, therefore, the obvious conflict between the developmental activities being undertaken in the region on one hand, and the need to maintain a desirable level of ecological balance on the other. An attempt has been made in the present study to assess the development and demarcate the environmentally sensitive areas in the district Pauri Garhwal.

**Keywords** sensitive zones; altitudinal variations; drainage density; destruction; slope

### **Justification**

The topography, altitude and location altogether decide the prospects of development and state of environment in Pauri Garhwal district. The topography of this region is highly rugged and difficult with precipitous slopes. Though Deep canyons, roaring streams, huge boulders and dense forests present a beautiful scenery, the pressure of population, tourism, developmental activities and natural hazards reveals the other side of the coin reflecting the vulnerable Himalayan sub ecosystem. The terrain and topography amidst in the district, the splendor of which nestle a host of small and medium sized hill towns and village settlements, many of which are attractions and pilgrimage centers. At the micro level the problem tend to maximize in its horizontal extent and volume. Various developmental activities are being carried on in the region, as a result of which destruction of the environ-

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ment have become side effects. Such developmental activities like development of transport and communication, infrastructure, generation of hydro-power and agriculture have had their spread effects, and many parts of Himalayas are gradually experiencing a process of development oriented environmental change. From the human standpoint, we can find out various models of development and environmental change. But in Himalayan context it's difficult to evolve a specific strategy for the development considering the complex nature of physical and human interaction. To survive and support the growing number of people and their activities, and its impact have greatly increased the number of Earth's natural systems by the means of modification, cultivation, built on and degradation. We need not and indeed cannot stop growing food or building cities, but we must recognize that all changes in our environment have far-reaching and unpredictable consequences.

The state of environment on the whole is considered to be upper side of the positive negative scale. But by keeping in mind the very vulnerability, fragility and sensitivity it has been experienced that this hill district of Uttaranchal is under severe environmental stress. As the area is not rich in terms of natural resources of present day economic value, the micro level changes in the agricultural practices, housing, surface water and socio-economic set up have brought up many marks of destruction on the face of natural landscape. The degree and form of environmental destruction varies from urban to rural ecosystems. Rural areas generally found to be in good state of environment till they are isolated from the modern day developmental strategies. But as the system has altered, the environmental impacts have experienced a profound negative change. As a consequence of this we face a number of interconnected environmental and resource problem. Virtually all the rural areas seek economic development: as increase in their capacity to provide goods and services for the peoples final use. But man nature relationship in these areas is confined to the rational use of resource. As we try to follow the pace and types of development of plains or urban areas in these hilly tracts a problem of land life support system arises. The rural as well as the urban environmental conditions in the Pauri Garhwal district are undergoing radical changes. Rural settlements are the emblem of human's ingenuity in transforming physical landscapes into cultural ones. Obviously, they provide important clues on the lifestyles, level of awareness and socio-economic order of inmates, as well as, the prevailing environmental conditions at various point of time. Variable character of geographical conditions is very well reflected in the location, size, spacing and anatomy of settlements. Mountainous region, on account of their complicated relief and extremely uneven distribution of resources represents wide variety of settlements. Human habitations in the Himalayas are basically rural and characteristically unique, emanated from fragile environment.

Vertical and angularity of relief in association with small population size of settlements are the prime conditioning factors of settlement shape in the mountainous terrain of Garhwal. A flat land is very scarce in this region, most of settlements are sited on the sloping terrain. Linearity resulting from lineo-fugal or lineo-petal

forces is one of basic component of settlement shape in this region. Settlement shape generally developed as the result of various combinations of lineation in response to the landforms. Rivulets, streams, stream bank, terrace-scarps, river terrace, scarp-edge, radiating spurs, fan, cones, break of slopes and road tracks are the elements of lineo-fugal forces. In mountainous terrain land use is and has to be closely associated with landforms types. The low lying areas in the valleys are dominated by irrigated or wet cultivation and have compact settlements, the mid slopes spur are moderately cultivated for dry course crops, and the surrounding low hills of the valley are occupied by reserved forest with scattered settlements. While high mountains, normally under the conical forests, alpine pastures and perpetual snow do not witness any cultivation of permanent settlement. As such, atypical valley section in Garhwal comprises five distinct categories of land, which exhibit their own characteristic types of land use. The spatial distribution of land use in the district is mainly controlled by physiographic conditions.

### **The Study Area**

District Pauri Garhwal is a part of Garhwal Himalayas-Siwalik and Doons as per regional divisions' scheme of census of India. It is bounded by the Chamoli district on the north-east, Bijnor on the south, Almora and Nainital on the east while its northwestern boundary is formed by the river Ganga, which separates it from district Dehradun. River Alaknanda separates it from district Tehri Garhwal. Pauri Garhwal district lies in south-eastern part of the Garhwal Himalayas. It extends between 78° 13' East to 79° 14' East longitudes and 29° 15' North to 30° 15' North latitudes. The highest range of Dhanpur and Dudhatoli separates it from Chamoli Garhwal. Ganga plain bound the southern part of the district, while the Bhabar separates it from Bijnor district. Tehri Garhwal and Dehradun districts bound the Western part of the district.

The western boundary from north to south follows the river Alaknanda upto Devprayag and along Ganga upto Rishikesh. In the extreme southeast, the Patli-doon and Ramganga separate it from Almora and Nainital districts of Kumaun. Excepting a narrow belt of 'plain' in south known as 'Bhabar' and 'doons', the whole of district consists of successive gorges and steep hillsides. There is a general rise of slope from southwest (350 meters) to northeast (3100 meters).

The district covers a total area of 5312 square kms, which is nearly 10 percent of the total geographical area of the Uttaranchal. It supports a population of more than 700000 persons with a population density of 130 persons per square kms. It is divided into five tehsils namely Pauri, Lansedowne, Kotdwara, Thalishain, and Nainidanda. It is further divided into 15 developmental block i. e. Pauri, Kot, Nainidanda, Dhangu, Jahrikhal (Lansedowne), Ekeshwar (Chondkot), Pokhra, Rikhnikhal, Beeronkhal, Khirsu, Paabo, Kaljikhhal, Thalishain, Duggadda and Yamkeshwar.



**Figure 1** Location of the Study Area

## Research Methodology

A research programme is always based on certain technical procedures. In the beginning of the research data - primary as well as secondary, are collected which are further analysed to get the meaningful results. As such, research methodology forms a vital link between the crude data and the final analysis. The present study is an attempt to analyse the block level situation regarding environmental status in Pauri Garhwal district. Secondary data has been used for the detail analysis of Land use, altitude, magnitude of slope, transport facilities, Health centers and hospital and levels of development. Secondary data are collected from the government and quasi-government departments' sources in whatever form - 'published'

or 'unpublished' they were available. For the present study, secondary data were collected at basin and block levels. They have been taken from various sources.

## **Ecological Niches and Adaptation**

Environmental crisis resulting from rapid economic development and attendant consumerist culture on the one hand and equally rapid increase in the population has now put a question mark on the very survival and development. The technological advancement that man has acquired to transform nature is unparalleled in the human history. Man can use his power to create a heaven on the earth; he can also use it to dig his own grave. Despite the growing importance of the environmental issues within the international and national scenario, we still do not agree on the basic concepts and approaches dealing our common global future. Though each country at different stages of development and various regional level is struggling to fight against the natural resource scarcity, which is different from earlier stage of development process. In the past twenty years there have been a marked changes in the methods and aims of academic disciplines.

Resource degradation is a severe problem in the third world countries and has a profound effect on the sustainability and development. An institutional approach with consideration of the rights involved is an essential part of solution to these problems. Increasing exploitation of local commons like land, forests and water to satisfy myopic needs of the people have a deleterious impact on the welfare of these economies. Many of these countries are now more prone to unprecedented droughts, famines, desertification and rapid depletion of ground water resources.

Degradation of local commons like forests cover, wildlife, natural habitat of flora and fauna and land and water quality is on the rise. Deforestation and lack of conservation has resulted in higher deposition of chemicals and sediments into water bodies, which alter the ecosystems. Recently a number of studies focusing on the human induced transformation of the natural environment and development and management of environment and physical resource base have emerged, in India as well as abroad. Most of the Literature available on the problem is mainly focused on human impact on the nature and watershed management. A good deal of research on natural resource management has been done by a number of scholars on analysis, management and development of natural resources in a long term ecological perspective. Valuable contributions in the field of land use planning were initiated by the International Geographical Congress of International Geographical union in Lisbon, under the chairmanship of L. D. Stamp of Britain. The commission outlined a project for World Land Use Survey and Planning and the complexities of Population, Resources and environmental management along with agriculture development and ecology. There are two streams of thoughts related with population and related aspects as the main cause of environmental degradation - some blamed rapid population growth, while other group of thought does not rec-

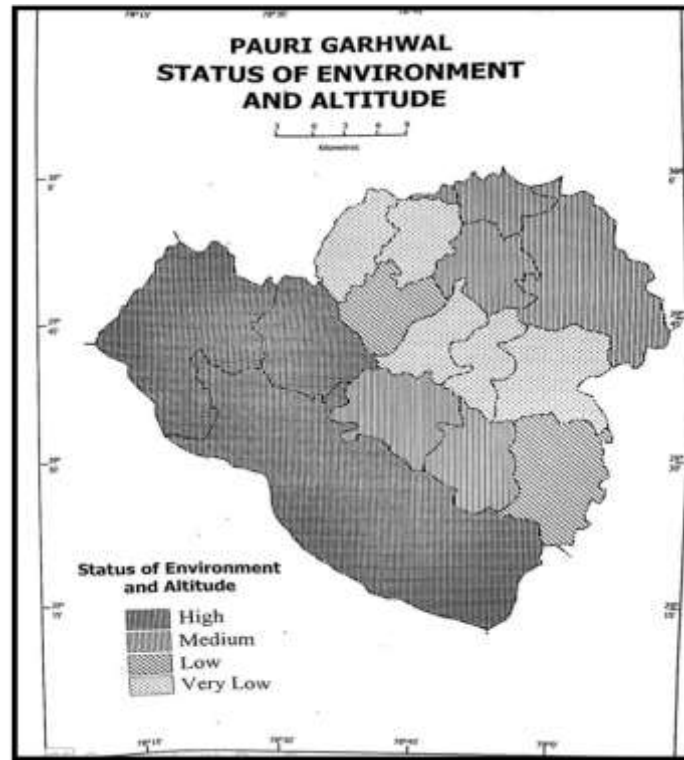
ognize it as a main factor. But, conventionally, many scholars have shown that environmental degradation in developing countries is one of the outcomes of the relationship between population growth and the environment. Population growth contributes to deforestation both directly by encroaching on land and indirectly by increasing the demand for wood products in a country (Rudel 1995).

Where earlier people had limited ability to alter their surroundings, we now have power to extract and consume resources, produce wastes, and modify our environment in the way that can threaten both our continued existence and that of many components with which we share the environment. To ensure a sustainable future for ourselves, future generations, and the natural environment we need to understand the natural environment we live in. The perception of environment has evolved and is intrinsically linked with the development process. Earlier expression of interest in the future of the natural environment was anti urban and anti industrial. Much of the environmental philosophy is now increasingly concerned with finding new forms of development co-existing with the nature. Many of the negative aspects of development have so compressed themselves on the minds of masses concerned to the environment, that the question is often asked “why development?” It is true that in the past industrial and agricultural developments have created many environmental problems ranging from pollution of water, soil and air to degradation of land deforestation. This is happening due to the mismanagement and improper use of the technology by man. But environmental problems are caused also by a lack of adequate infra structural development.

Environmental issues, which emerge due to various factors, vary widely from space to space. Such environment is directly related to the living environment of the people though forced by the natural environment. Thus this study deals with the existing environmental status of the hill district Pauri Garhwal. This part of the Study attempts to probe into the various factors, attributes and characteristics of physical environment. Following are the indicators to be taken in order to assess the environmental status: altitude, slope, drainage density, and land use.

### **Physical Environment and Altitude**

The term Altitude is generally used as synonym to elevation means the height of the land surface above the sea level. When taken in topographic terms it indicates the variation in the nature of the land surface or in other words the lie of the land. Thus it shows the broad features and relative heights of highlands and lowlands under the term relief, which are portrayed by the name of various landforms. When it comes to the factors affecting the weather, climate and atmosphere of a particular place the altitude plays an important role in determining the state of environment. So the altitude has been taken as the indicator for assessing the state of environment in Pauri Garhwal district in the present study.



**Figure 2** Status of Environment and Altitude

**Table 1** Altitudinal Distribution of Land in Pauri Garhwal

S.No.	Block	Upto 675	675-1350	1350- 2000	2000- 2700	Less than 2700
	( % area under the height range / in meters)					
1	Kot		46.6	53.4		
2	Kaljikkhal		58.8	41.2		
3	Pauri		18.8	74.4	6.8	
4	Paabo		9.1	50	40.9	
5	Khirsu		16.7	26.9	56.4	
6	Thalisain			10.1	79.9	10
7	Bironkahl		12.2	28.6	59.2	
8	Dhangu		61.5	38.5		

9	Dogadda	69.1	26.3	4.6	
10	Jahrikhal		48.5	51.5	
11	Ekeshwar		46.4	50	3.6
12	Rikhnikhal		48.2	50.6	1.2
13	Pokhra		14.7	63.4	21.9
14	Yamkeshwar	51	49	63	
15	Nainidanda	37			
Total	9	32.3	26.7	20.5	1.5

Source: Statistical Handbook

The table reveals that at the district level the average height varies between 500 to 2900 meters from the mean sea level. The district is entirely mountainous and only 9 percent of the total area falls under surface height below 675 meters above the sea level covering the portions of Dogadda and Yamkeshwar blocks. The one third of the land surface in the district is between the height range of 675-1350 meters and majority of the land comes in this altitudinal zone. About one fourth of the land in the district comes in the altitudinal zone ranges a height of 1300-2000 meters. Yamkeshwar block does not comprise any land in this category. About one fifth land area falls in the next category of altitude i.e. 2000-2700 meters. Only eight blocks contribute to this category of altitude. The altitude in the district increases from southwest to northeast. In the northeast the Thalishain block comprises the maximum height above the sea level in the Dudhatoli range or lesser Himalayas. In the last category of altitude i.e. above 2700 meters, only 1.5 percent of the land is covered.

A detail analysis of the table shows variation among the blocks in terms of altitude shows that in Kot, Kaljikhhal, Dhangu, Nainidanda and Jahrikhal blocks the surface height varies from 675 to 2000 meters. In Yamkeshwar the maximum area is under the 1350 metres above sea level. In the Dogadda block about 70 percent of the area is below 675 meters and rest is range up to 2000 meters. Pauri, Pabo, Khir-soo, Beeronkhal, Ekeshwar, Rikhnikhal and Pokhra blocks represents the district in a well proportionate manner as in these blocks the height ranges from 675 to 2700 meters above the sea level. Thalishain block is the area of maximum height in the district and 10.1, 79.9 and 10.0 percent of the area in the district falls under the height of 1350-2000, 2000-2700 and above 2700 meters respectively.

## Magnitude of Slope and State of Environment

Slope of land generally determines the land use. In case of Himalayas slope determines the land use as well as the degree of interaction between man and his natural environment. In case where slope categories have been determined, further



useful information can be derived by measuring the area of each category and than expressing it as a percentage of total area. This can be done for areas with physical unity, such as a river basin. With regard of this, in Pauri Garhwal district the table depicts that 67.14, 21.00, 7.21 and 4.65 percent of the land falls under the slope category of <15, 15-30, 30-50 and >50 degree of slope respectably. Block wise analysis of the slope reflects that in Dhangu and Yamkeshwar the slope is found to be very gentle as in these blocks only two categories of slope are exist i. e. <15, 15-30 degree. Variation in slope is found to be high in Kot, Khirsoo and Ekeshwar blocks as they are having slopes of all the respective categories and the significant amount of land falls in those categories in compare to other blocks. The land available in these blocks under the category of below 15 degree of slope is 48.21, 41.46 and 50 percent receptively of the total land.

While In other Blocks percentage of land in this category ranges from 60 percent in Pauri block to 93 percent of the total area in Nainidanda block. In this respect all these blocks offers great opportunity of use of land to man for various purposes. As the angle of slope increases the limitation in the use of land arises. The land become subject to more degradation and the sensitivity tend to increase. In Kot, Khirsoo, Dhangu and Dogadda blocks the more than 30 percent of land falls in the slope category of 15-30 degree of slope. The district average in this category is only 21.00 percent of the total area. These are the blocks where state of natural or physical environment is subject to consideration. In Beeronkhal, Khirsoo, Pabo, Pauri and Kaljikhhal Blocks the land under the category of 30-50 degree slope is more than 13 percent of the total land, which is again considerably above the district average i. e. 6.21 percent. Land under this category is not available in Dhangu and Yamkeshwar blocks. Beeronkhal, Jahrikhal and Nainidanda blocks there are only three categories of slope are found. And above 50 degree of slope is not available in these blocks.

**Table 2** Magnitude of Slope in Pauri Garhwal

S.No.	Block	<15	15-30	30-50	>50
	(% area under the slope category/ degree of slope)				
1	Kot	48.21	33.92	7.14	10.71
2	Kaljikhhal	72.72	5.45	14.54	7.27
3	Pauri	59.6	10.52	14.04	15.78
4	Paabo	62.6	13.51	18.91	5.4
5	Khirsu	34.46	37.71	12.19	15.64
6	Thalisain	80.12	10.67	7.63	1.53
7	Bironkahl	65.25	18.69	16.1	
8	Dhangu	67.85	32.15		
9	Dogadda	58.19	31.96	3.27	6.55

10	Jahrikhal	78.68	16.4	4.91	
11	Eleshwar	50	19.23	9.84	20.92
12	Rikhnikhal	74.35	23.1	2.56	
13	Pokhra	82.21	5.28	2.01	10.52
14	Yamkeshwar	77.46	22.54		
15	Nainidanda	93.61	5.02	1.37	
Total	67.14	21	7.21	4.65	

Source: Statistical Handbook

The district has 4.65 percent of area in the steep slope category of more than 50-degree slope. But in Eleshwar, about 26 percent land is have the slope characteristics of such kind. This type of land is hardly usable for human activities. Pokhra, Kot, pauri and Khirsu blocks are also having considerable amount of land in this category of slope. But in Nainidanda, Yamkeshwar, Rikhnikhal, Jahrikhal, Dhangu and Beeronkhal blocks area in this category of slope is not available. Hence, in these blocks more land is suitable for undertaking the human activities.

### **Drainage Density and Environmental Status**

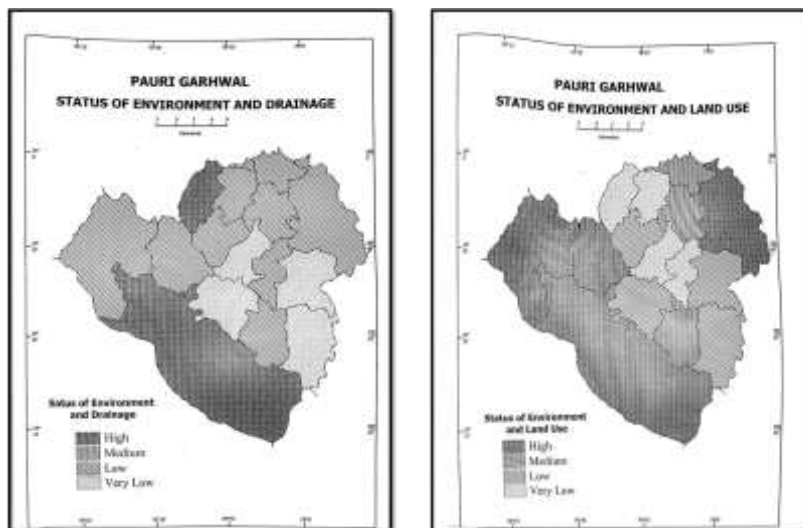
Drainage is the prime factor to describe the state of physical environment in any region. Being part of Himalayas, the district is well covered by the rivers, streams and rivulets. The main river in this region is the Bhagirathi river flowing up to Deoprayag and the river Ganga up to Rishikesh in the north. Ramganga river flows in the southern part of the district. Rivers of further lower order are the Nayar, which is formed by Eastern Nayar and western Nayar. Apart from this Hiyuhi nadi, Palin nadi, Sona nadi, Dhara nadi, Mandal nadi, Palacen nadi, Kho nadi, Khawasan nadi, Malar nadi and Malin nadi are the rivers of further lower order flowing in the southwestern part of district. A brief interpretation of drainage in the district reveals that most of the rivers in the district are nadi, Mandal nadi, Palacen nadi, Kho nadi, Khawasan nadi, Malar nadi and Malin nadi are the rivers of further lower order flowing in the southwestern part of district. A brief interpretation of drainage in the district reveals that most of the rivers in the district are

**Table 3** Drainage Density in Pauri Garhwal

	Blocks	Length of River Density (meter/km <sup>2</sup> )	Drainage
1	Kot	200	High
2	Kaljikhhal	100	Medium
3	Pauri	100	Medium
4	Paabo	50	Low
5	Khirsu	100	Medium
6	Thalisain	60	Low
7	Bironkhal	10	Very low
8	Dhangu	80	Medium
9	Dogadda	220	High
10	Jahrikhal	30	Very low
11	Ekeshwar	30	Very low
12	Rikhnikahl	80	Medium
13	Pokhra	80	Medium
14	Yamkeshwar	100	Medium
15	Nainidanda	10	Very low
	District	75	

Source: Statistical Handbook

following the dendritic patterns, which points out a well developed drainage system with many consequent, subsequent and obsequent streams. Though the small rivulets and streams are abundant in the district, but to find out the drainage density only above-mentioned rivers have been taken into consideration. Dogadda and Kot blocks are having high drainage density. Kaljikhhal, Pauri, Khirsoo Pokhra, Dhangu, Rikhnikhal, and Yamkeshwar blocks are having medium drainage density. Thalisain and Paabo blocks are having low drainage density, while Jahrikhal, Ekeshwar, Beeronkhal and Nainidanda blocks are having very low drainage density.



**Figure 3** Drainage & Environment

**Figure 4** Status of Environment and Land Use

In Yamkeshwar, Rikhnikhhal and Ekeshwar blocks the proportion of land under forest is considerably high than the district average. In Pokhra, Jahrikhal and Beeronkhal blocks the proportion of land under forest is near and about the district average. In Thalिसain, Nainidanda, Paabo, Pauri and Kaljikhhal blocks the proportion of land under forest is considerably low than the district average. In Kot, Khirsoo and Dhangu blocks the proportion of land under forest is very low and these blocks are subject to under heavy pressure of man nature interaction. Spatial pattern of forest distribution shows that land under forest is found more in southern and eastern parts of the district as compared to north and western parts of the district.

Agriculture, being the main occupation of people in the district, finds important place in the land use pattern of the district. Agriculture is the activity of man by means of which he could able to modify the natural environment. The land under agriculture is very low in the district. Evidently, the land under agriculture is found 8.19 percent of the total area in the district. Pauri (16.40 percent) and Khirsoo (12.70 percent) blocks are having the proportion of land agriculture above than the district average. Kaljikhhal and Paabo blocks are also having proportion of land under agriculture use above the district average. In Dhangu, Jahrikhal, Ekeshwar and Pokhra blocks the proportion of land under agriculture is near and about the district average.

In Thalिसain, Beeronkhal, Dogadda, Rikhnikhhal, Yamkeshwar and Nainidanda blocks the proportion of land under agriculture is very low and considerably less

than the district average. Spatial distribution of land under agricultural use shows that it is found more in the northern region which is adjacent to the Alakananda river as compared to the higher terrain in the other parts of the district. Land under pastures and grazing is another category of land use. It is evident from the table that district have 3.98 percent of land under the category of pastures and grazing land. The proportion of the pastures and grazing land is highest in Paabo (10.40percent) block followed by Kaljikhhal (9.10 percent) and Pauri (7.10 percent). In Beeronkhal, Jajrikhal, Dogadda, Pokhra and Nainidanda blocks the proportion of pastures and grazing land is considerably low than to the district average. Kot, Khirsoo, Thalissain, Dhangu, Ekeshwar and Yamkeshwar blocks are having a proportion of pastures and grazing land near and about the district average. The state of environment is vulnerable in these tracts of all the blocks.

A quite considerable proportion of land is occupied by land under horticulture and other than agricultural use. About 15.61 percent of the total land in the district come under this category of land use. It ranges 7.42 percent (Dogadda) to 22.20 percent (Kot) blocks. In Dhangu, Kaljikhhal and Nainidanda blocks the proportion of land under horticulture and other than agricultural use is above the district average. Paabo, Ekeshwar and Yamkeshwar blocks are having the proportion of land under horticulture and other than agricultural use near and about the district average. Rests of the blocks are having the proportion of land under horticulture and other than agricultural use below the district average.

About 6.14 percent of the land come under the category of culturable waste. The proportion of land under culturable waste is lowest in Pauri, Dogadda and Kaljikhhal blocks, where it is reported less than 4 percent of the total area. The proportion of land under culturable waste is found comparatively low in Yamkeshwar, Paabo, Nainidanda, Beeronkhal and Rikhnikhal blocks, where it is recorded little less than 6 percent of the total land. The proportion of land under culturable waste is recorded in a medium range i. e.6 to 9 percent of total land in the Kot, Khirsoo, Dhangu,, Jahrikhal, Pokhra and Ekeshwar blocks. The proportion of land under culturable waste is recorded highest in Thalissain Block. This type of land is generally put away from the use and occasionally it is put to use casually, hence it is prone to degradation in the hill areas depending up on the structure of land and slope. About 5.47 percent of the total land in he district is used as the land under grazing and pastureland. It is reported highest among the blocks in Kaljikhhal and Paabo, where more than 9 percent of the total land is occupied under this category. In Pauri and Khirsoo the proportion of land under grazing and pastureland is reported of medium range i.e. little less than 7 percent. The proportion of the land under grazing and pastureland is found to be low in Yamkeshwar, Pokhra, Rikhnikhal, Ekeshwar, Dhangu, Thalissain and Kot blocks, where it is reported between 4 to 6 percent of the total area. In Jahrikhal, Beeronkhal, Nainidanda and Dogadda the proportion of land under grazing and pastureland is found lowest. It can be said that there is a heavy pressure of agriculture and related activities in these blocks.

About 7.88 percent of considerable proportion of the total land use is occupied by the category of land under other uses than agriculture. The land under this category is the most prone to serious environmental consequences as this is the land where all the built up area, construction sites, mining, land under landslides and other degradation activities are generally undertaken by man. Proportion of such type of land has been reported highest in Kot, Dhangu, Nainidanda and Dogadda blocks i.e. more than 13 percent of the total land. Natural environment in these blocks may be considered as more vulnerable in these blocks due to it multiplying affects. Proportion of land under other uses than agriculture is found to be of medium range i.e. 7 to 10 percent of total land, in Beeronkhal, Khirsoo and Kaljikhhal blocks. . Proportion of land under other uses than agriculture is found to be low in Pauri, Jahrikhal, Pokhra, Paabo and Yamkeshwar blocks where it is reported as 4 to 7 percent of the total land. In Rikhnikhal, Ekeshwar and Thalissain blocks the proportion of land under other uses than agriculture is found to be the least and it can be said that there is a heavy pressure of agriculture and related activities in these blocks.

### **Environmental Sensitivity Zones**

Mountain ranges tend to run in long, linear belts along the margins of lands. Fundamental to an understanding of mountain environment are the changes that occur in the landform with increasing altitude, degree of surface water and with increasing slope and their composition with the decrease or increase of temperature, water vapour and winds. The changing climatic conditions with altitude makes the mountain environment very dynamic and vulnerable. In addition mountainous relief results from the operation of various endogenous and exogenous forces tend to be very prone to the degradation. In other words the components of mountain environment are endless in number but to study the mountain environment in relation to human interaction is subject to available of data and information about the various levels. Study of levels of environmental status of Pauri Garhwal is the study of such nature. It is based on the primary as well as secondary data hence the findings are sometimes different than the known literature and common experiences. The term 'high' in terms of environmental status refers to the environmentally most stable areas from the developmental point of view subject to other feasibility factors.

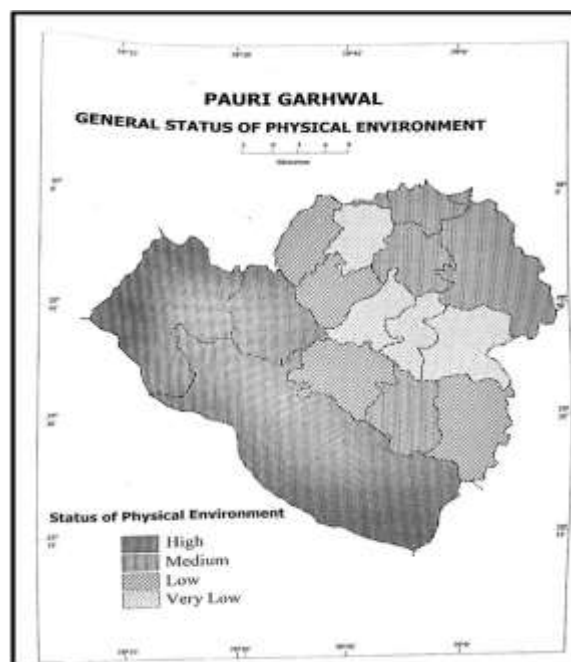
The analysis of the various components of environment and their respective indicators reveals that Dhangu, Dogadda and Yamkeshwar blocks are assessed as the rank of high environmental status among the all 15 blocks.

**Table 4** General Status of Physical Environment in Pauri Garhwal

Category	No. of Blocks	Name of Blocks
High	3	Dhangu, Dogadda, Yamkeshwar
Medium	4	Thalisain, Paabo, Khirsoo Rikhnikhal
Low	4	Kot, Kaljikhhal, Jahrikhal, Nainidanda
Very Low	4	Beeronkhal, Pauri, Ekeshwar, Pokhra

Source: Data Analysis

The reason for their ranking may be drawn as the location in lower altitudinal range, comparatively high proportion of land in flat to low gentle slope, higher proportion of land under forest and large share of land under agriculture and horticulture. The blocks under this category fall under the altitude range of 675 to 2000 meters above the sea level. Only 13 percent of the total area combine together of these three blocks fall above the 2000 meter above the sea level. In this respect these blocks have obtained high value or weights regarding the composite value. Spatial pattern of distribution of the levels of levels of environmental status shows the linear belts of high level of environmental status along the southern margins.

**Figure 5** Environmental Sensitivity

The category of levels of medium environmental status comprises of four blocks namely Thalissain Paabo, Khirsoo, and Rikhnikhal. These blocks are having near and above weightage regarding the various indicators undertaken for the analysis. It is revealed out of the analysis that the state the level of environmental status in Khirsoo and Rikhnikhal blocks is found constantly medium in regarding all the four components. So as in Paabo block where three out of four components undertaken to assess the level of environmental status were obtained as of medium category.

Thalissain block have earned the status of medium level of environmental status due to high rank in 2 out of 4 components, while in other two it has got one medium and one low level of environmental status. Interestingly the Thalissain block is found more developed environmentally during the primary field survey, but the analysis of data resulting different way. Spatial distribution of the medium level of environmental status reveals that it is found in two patches one of Paabo, Khirsoo and Thalissain in the north east and other small patch of Rikhnikhal itself in the south-central part.

In the category of low level of environmental status, table depicts that only 4 out of total 15 blocks are falling in the category. These blocks namely Kot, Kaljikhhal, Jahrikhal and Nainidanda are located in a north south pattern. The performance of Kot block is quite interesting in regards to the component wise levels of environmental status. It has been ranked as high with regards to one component i.e. drainage, whereas ranked as very low in terms of altitude, slope and land use. Kaljikhhal block has been ranked low in 3 out of 4 components undertaken to assess the levels of environmental status, whereas in terms of drainage it has avail medium rank. The block Nainidanda in the category has been ranked low in case of two out of four components. Jahrikhal block in the category of low level of environmental status is due to its low ranking in the three components of assessment. This patch on the map seems to follow the pattern of distribution of slope in the same blocks. It can be said regarding the low level of environmental status in these blocks that the state of altitude, slope drainage and land use in Kot, Kaljikhhal, Jahrikhal and Nainidanda blocks is subject to concern. Any human activity is to be undertaken without having the knowledge of all the aspects mentioned above would be more harmful the natural environment in compare to other blocks.

Pauri, Ekeshwar and Pokhra blocks are ranked very low in the categorization of the levels of environmental status. Pauri and Pokhra blocks have been ranked medium levels of environmental status in terms of drainage density. In terms of the rest of the components these two blocks have again been ranked very low and so as put into the category of very low level of environmental status. Ekeshwar block is the only block, which in respect to all the components have been ranked in the category of very low level of environmental status. This can be explained in terms of the topographical characteristics of the block in particular and the size or its geographical area that it has been assigned less value or composite weightage. Still it



can be said that the state of environment in this block seems to be critical as far as the physical environment is concerned. So Pauri, Ekeshwar and Pokhra blocks are having less potential for better utilization of the physical aspects in compare to the other blocks of the district.

## Conclusion

The general environmental status in the district reveals that area is having good and stable state except few blocks, where the agricultural land is more and the forest land is high. Area under high altitude is nearly 20 percent of the total area of the district, within that area the barren patches of land with high magnitude of slope may be considered as vulnerable. Such combinations of altitude, slope and land use are the critical areas with their profound negative spread effect degrade the environment at a faster rate. The existing environmental status highlights the quality of the environment for the further development.

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