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# Himalaya's Agricultural Capacity and Cultivation Patterns

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**ABSTRACT:** The majority of the people living in the Himalayan basins work in agriculture. Some people's whole livelihoods depend on it. Eighteen point three one-third of the population is directly involved in farming in the form of cereal crop cultivation or animal farming. Land use, output, and productivity are all about even between grain cultivation and animal husbandry. The basin has a unique agricultural system based on centuries-old methods and practised mostly on small terraced fields. The Pindar Basin has an area of 1856.56 km2 and is located between 290°59′N and 300°21′N on the latitude axis and 790°29′E and 800°5′E on the longitude axis. You may find it at a height of 782 metres and 6861 metres in the eastern Garhwal Himalaya (Uttarakhand). The Chamoli district is located on the banks of the Alaknanda River, which the Pindar River joins near Karnprayag. In this research, we examine the relationship between agricultural output and cropping intensity in the region under investigation. Many environmental and societal variables affect a region's potential for agricultural success. It is therefore a result of the interaction between physical and cultural elements, and it is expressed in terms of both per-hectare productivity and overall output. The term "cropping intensity" refers to the total number of crops harvested from a particular field in a given year. There are a few different types of crop rotations that may be used. The efficiency with which land is used may be measured by looking at how heavily it is farmed. Wherever circumstances are optimal, it is safe to assume a certain level of cropping intensity, defined as the ratio of gross cropped area to total cultivated area.

## I.INTRODUCTION

Pindar Basin is home to towering peaks and vertiginous inclines. Farmers on marginal ground have destroyed the landscape by trying to grow crops on territory that isn't suitable for agriculture. This has led to increased risk of flooding and sedimentation in the valley below, which would not otherwise be allowed. Nonetheless, the slopes do have a few positive characteristics that make them stable enough for some kind of landuse. Population density is low everywhere save places with readily tillable land. The area's limited accessibility prevents any radical technology advancements from happening very soon. Large-scale redevelopment plans may not be required if these assumptions are correct. The watershed management plan would focus mostly onenhancing methods throughout key and secondary areas. Therefore, the survey component should seek out underutilised resources. If, for instance, marginal land is used for farming, it must be ecologically handled by, for instance, lowering the strain of overgrazing on the land and establishing plantation agriculture there. Low output in the Pindar Basin is the outcome of ecological issues related to environmental deterioration. Natural disasters such as cloud bursts and soil erosion, especially during the rainy season, as well as irrational human interventions such as unscientific excavation and belting for road and dam construction, overgrazing, overloping, overfollowing, overplugging, and deforestation, all contribute to a decline in fertility and productivity. Due to geographic characteristics, historic value, and archaic ploughing and harvesting methods, yield is quite low. In order to increase production in the basin, the current research seeks to first diagnose the nature of the land resources and their linkages with the natural circumstances and scientific quarries. Pindar Valley stretches from 290° 59′ N to 300° 21′ N and from 790° 29′ E to 800° 5′ E in longitude, covering an area of 1856.56 km2, which provides sustenance for a population of 2,656,600 (in 2001) over glacial, glaciofluvial, and fluvial landforms (Sharma2011). Its elevation ranges from 800 metres to 6800 metres, making it a representation of the eastern Garhwal Himalaya. The Pindari Glacier is the source of the 124-kilometer-long Pindar River, which flows through the district of Bageshwar before joining the Alaknanda River near Karanprayag in the district of Chamoli. Its unique socio-geographical character is defined by the watersheds of the Ram Ganga in the south, the Sarju in the east, the Nandakini in the north, and the Alaknanda in the north west. Parts of the Chamoli and Bageshwar districts are included in the region under research; specifically, the blocks of Karnparyaga, Tharali, Dewal, Narayan Bagar, Kapkot, and Gairsain (Fig-1). The climate varies from warm and temperate in the lowlands to cool and temperate at higher altitudes in the mountains to cold and Alpine at the highest mountain peaks. Snow falls year-round, keeping the mountains permanently white. The majority of the valley has a mild climate, with temperatures ranging from fifty to three hundred degrees Celsius in the lower regions to fifty to two hundred degrees Celsius in the upper regions. There is a bimodal distribution of rainfall

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between 1500 and 1700 millimetres (UYRDC).

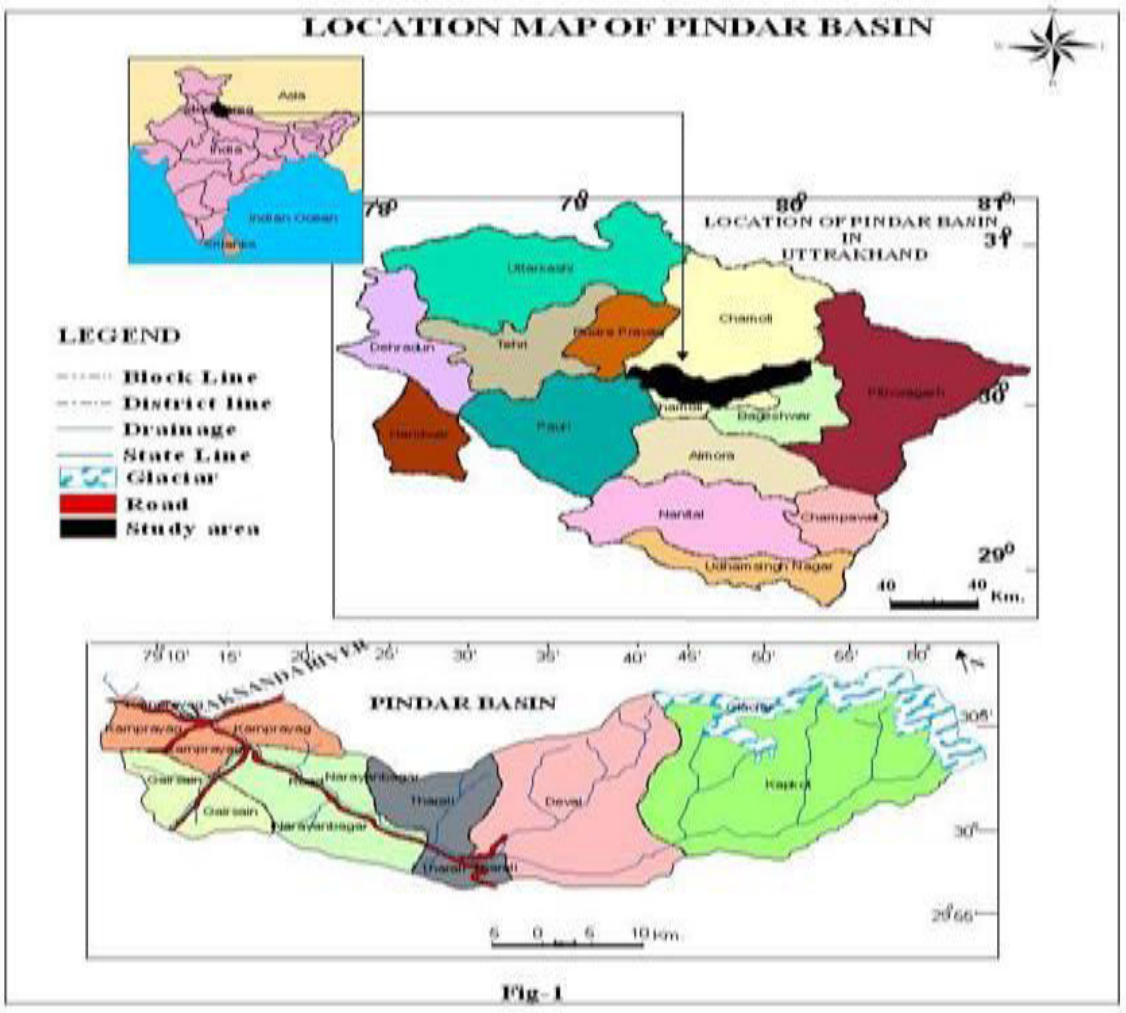


**Figure1: Location Map**

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## II.RESEARCH METHODOLOGY

Primary data on land usage, land utilisation, and relative repercussions was gathered from locals through questionnaire and in-person interviews, while secondary data was gathered via the 2011 Indian Census and other official and semi-government sources. The relevant maps were made using the Arc GIS 10.3 environment.

**Crop Pattern:**

Physical, economic, and institutional considerations often determine the cropping pattern of a region. To be most effective, a cropping system has to be fine-tuned to the specifics of the environment in which it is grown (Pal and Asthana, 1985). Five main crops (paddy, wheat, barley, mandua, and Sava) account for around 91.96 percent of the total farmed land in the research region. Vegetables, tobacco, oilseeds, and pulses are all significant crops. With a few notable exceptions, mandua is the most significant crop, the predominate crop in much of the region used as a replacement for wheat, and is cultivated on upland areas under rain-fed conditions. Jhangora, a paddy alternative, thrives in the wetter months of the year on higher ground. The region also relies heavily on the harvest of barley. Most other commercial crops and vegetables are cultivated with the use of irrigation on very small plots of land, and only in particularly rich soil. The region's most valued crops include ginger, guava, and apple, in addition to staple foods.

The agricultural practised in the basin is subsistence farming; annually, two harvests—Rabi and Kharif—are grown. It is common practise to plant rice, pulses, millets (koda, jhangora, konichinai), potatoes, and other tubers during the Kharif season, while wheat, peas, grammes, lentils (masur), and oil seeds are harvested during the Rabi season. Rabi crops, which are seeded in October and harvested in April and May, take up 16,845 Hectares (or 43.02 percent) of the total farmed land. Wheat is planted on around 34% of all farmland. This crop is often planted in places with deep soil that has a high moisture sensitivity capacity. Wheat requires more water than it gets naturally, therefore it's irrigated anywhere it can be planted. The agricultural economy of the region is mostly governed by kharif crops. Most of the rich land and agricultural space in the region's villages is devoted to growing maize, mandua, and paddy since these crops are economically significant and adaptable. While the timing of paddy harvesting varies with altitude, the ploughing season is universal. The rice harvesting season in the "Gangarh" (plain region) begins one month before the "danda" (highland) season (high altitude areas). Both the 'Gangarh' and the 'danda' have distinct planting and harvesting windows: early September for the 'Gangarh' and October for the 'danda. (Sharma, 2011) Because irrigation is crucial for rice, irrigated fields are often paddy farms. Cropping patterns in Pindar basin are shown per block (tab-1). In Karanprayag, wheat is the most important crop, and it takes up 35.74 percent of the total acreage in the city's agricultural blocks. Wheat is grown on more land in Narayan Bagar (30.62%), Tharali (18.46%), Deval (30.08%), Gairsain (42.45%), and Kapkot (33.70%), except in Tharali, where paddy is grown on more land (36.40%) and wheat (18.46%; 0.5 hectares). Crops are harvested in the months of May in the 'Gangarh' area and June in the Danda region. Kapkot has the largest concentration (6.33%) of minor crops, followed by Narayan Bagar (3.35%) and the lowest concentration (0.57%).

Tharali had 1.45%, Gairsain 2.95, Deval 2.47, and Karanprayag 2.14%. The potato is the basin's primary cash crop. Deval (19.20%) and Karanprayag (3.93%) blocks had the most potatoes. Narayan Bagar included a minimum of 1.89 percent potatoes. The remaining 3.69 percentage points may be found in the Tharali, Gairsain, and Kapkot blocks. The high altitude zone is home to a variety of crops, but ramdana, soyabean, and beans stand out. Unfortunately, the marketing of these crops is still limited owing to a lack of readily available transportation and marketing channels.

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**Table 1: Block wise Cropping Pattern**

| Crops | Karn-prayag Area (sq.km) | (%) | Narayan-bagar Area (sq.km) | (%) | Tharali Area (sq.km) | (%) | Deval Area (sq.km) | (%) | GairSainArea (sq.km) | (%) | Kapkot Area (sq.km) | (%) | Total Area (sq.km) | (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Paddy | 2033 | 27.76 | 1471 | 27.81 | 1440 | 36.41 | 517 | 21.3 | 1639 | 23.25 | 3400 | 25.53 | 10500 | 26.67 |
| Wheat | 2617 | 35.74 | 1620 | 30.62 | 730 | 18.46 | 730 | 30.08 | 2993 | 42.45 | 4488 | 33.7 | 13178 | 33.48 |
| Barley | 157 | 2.14 | 177 | 3.35 | 58 | 1.47 | 60 | 2.47 | 208 | 2.95 | 843 | 6.33 | 1503 | 3.82 |
| Pullses | 40 | 0.55 | 199 | 3.76 | 93 | 2.35 | 28 | 1.15 | 55 | 0.78 | 458 | 3.44 | 873 | 2.22 |
| Oil Seeds | 51 | 0.7 | 63 | 1.19 | 78 | 1.97 | 49 | 2.02 | 73 | 1.04 | 65 | 0.49 | 379 | 0.96 |
| Potato | 288 | 3.93 | 100 | 1.89 | 146 | 3.69 | 466 | 19.2 | 167 | 2.37 | 280 | 2.1 | 1447 | 3.68 |
| Mandua | 1794 | 24.5 | 1299 | 24.56 | 1271 | 32.14 | 455 | 18.34 | 1445 | 20.5 | 2891 | 21.71 | 9155 | 23.26 |
| Sava | 298 | 4.07 | 338 | 6.39 | 108 | 2.73 | 113 | 4.66 | 398 | 5.65 | 605 | 4.54 | 1860 | 4.73 |
| Makki | 25 | 0.34 | 17 | 0.32 | 20 | 0.51 | 8 | 0.33 | 62 | 0.88 | 260 | 1.95 | 392 | 1 |
| Soyabeen | 20 | 0.27 | 6 | 0.11 | 11 | 0.28 | 11 | 0.45 | 10 | 0.14 | 28 | 0.21 | 86 | 0.22 |
| Total crops wise Area sq.km. | 7323 | 100 | 5290 | 100 | 3955 | 100 | 2427 | 100 | 7050 | 100 | 13318 | 100 | 39363 | 100 |
| Crops wise total (%) | **18.6** | | **13.44** | | **10.05** | | **6.17** | | **17.91** | | **33.83** | | **100** | |

**Table 2: Main Cropping in Pindar Basin**

| Name of Crops | Area (hect.) | Percentage | Cumulative Percentage |
|---|---|---|---|
| Rice | 10500 | 26.71 | 26.71 |
| Wheat | 13178 | 33.52 | 60.23 |
| Barley | 1503 | 3.82 | 64.05 |
| Maize | 392 | 1.00 | 65.05 |
| Mandua | 9155 | 23.29 | 88.34 |
| Sava | 1860 | 4.73 | 93.07 |
| Urd | 378 | 0.96 | 94.03 |
| Masur | 319 | 0.81 | 94.84 |
| Pea | 7 | 0.02 | 94.86 |
| Arhar | 82 | 0.21 | 95.07 |
| Mustar | 379 | 0.96 | 96.03 |
| Soyabeen | 86 | 0.22 | 96.25 |
| Potato | 1447 | 3.68 | 99.93 |
| Til | 27 | 0.07 | 100.00 |
| Total | **39313** | **100.00** | |

## Agricultural Productivity

Several ecological and economic variables affect a region's potential for agricultural growth. Per hectare productivity and total output are therefore indicators of agricultural productivity, which is determined by the interaction of physical and cultural factors. While the two terms are sometimes used interchangeably, "productivity" refers more specifically to the capacity of a certain agricultural region to generate crop yields, regardless of whether such yields result from the natural richness of the area or from the labours of its human inhabitants. Fertility, on the other hand, refers to a soil's capacity to provide all the necessary plant nutrients for a plant to develop normally. The index of agricultural output divided by the index of agricultural input is one definition of agricultural productivity (Shafi, 1984).

Table 4 displays the total acreage, yield, and productivity of conventional crops and vegetables. The land is used for traditional crops including Manduwa, Jhangora, Wheat, and Paddy throughout all of the elevational zones, but the area

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under vegetable crops is more evenly distributed. Karnprayag block, with its large Net planted area (4811 hectares) and relatively low height (2200 metres), ranks first in production, as shown in table 4. Although Deval Block's total area of 4075 hect. is larger than that of Karnprayag, its net sown area of just 1716 hect. makes it the second most productive block after Karnprayag. Kapkot (7402 hect. taking complete block in study) has the lowest productivity, thus this is better. This is due to the fact that most of Deval consists of glaciated zones, forested areas, and alpine pastures, whereas the block net snow area is located in the valley floor and potatoes are the primary crop for settlements located at higher altitudes. In terms of yield per hectare, Narayanbagar is the most productive region, with 31.93, followed by Tharali at 25.54, and Garsain at 16.71. (Figure-2).

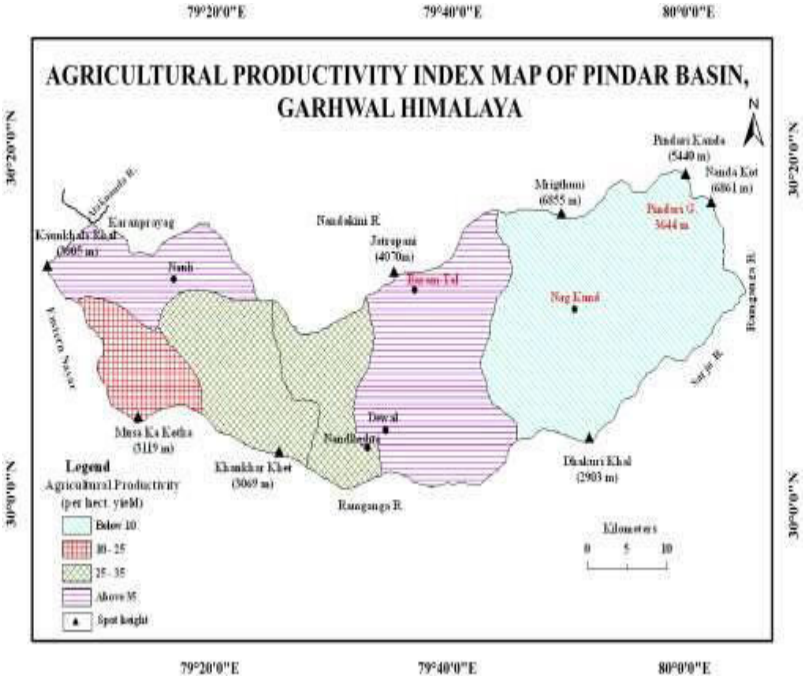


**Figure 2: Agricultural Productivity Index**

## III.CONCLUSION

Subsistence farming is the norm in the basins because of the unforgiving terrain, which results in poor crop yields and therefore low living standards for the people who rely on agriculture for their livelihood. Because of its limited yield, traditional value, and antiquated pouching and harvesting techniques, it is mostly grown in certain regions. Traditional crops including Manduwa, Jhangora, Wheat, and Paddy are cultivated on land in all six blocks, while vegetable crops are grown on land in the lowest two blocks. In all climate zones, traditional crops like manduwa, jhangora, wheat, and rice take up the lion's share of available farmland. In contrast, the area devoted to growing vegetables (onions and potatoes in particular) varies widely from one hamlet to the next, and even from one valley to the next in the highlands. This also indicates that vegetable output and productivity are higher than those of conventional crops, regardless of whether they are grown on low ground or highland. The valley's lush agricultural belt that stretches from Gwaldom to Karnprayag on both banks of the river is another positive feature. The productivity of these river terraces might be greatly improved with the addition of fertilisers and pesticides, experimentally developed seeds, and enough irrigation infrastructure.

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