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CROPPING PATTERN AND AGRICULTURAL PRODUCTIVITY OF PINDAR BASIN, GARHWAL HIMALAYA

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Abstract - Agricultural practices are main occupation of inhabitants of the Himalayan basins. It is also a main source of livelihood of majority of the people. About 18.31 percent population is engaged in the production of cereal crops and livestock farming. Along with substantial cereal farming, rearing of animals has an equal proportion in terms of land cover, production and productivity. The farming system in the basin is peculiar, which is based upon the centuries old practices and carried out mainly on narrow patches of terraced fields. The Pindar Basin which extend from 29^0 59'N to 30^0 21'N Latitude and 79^0 29'E to 80^0 5'E Longitude covering the area of 1856.56 km^2. It is present in the eastern part of the Garhwal Himalaya (Uttarakhand) with elevation ranging between 782 m to 6861 m. River Pindar originates from the 'Pindari Glacier' which confluence with Alaknanda River at Karnprayag in district Chamoli. The paper is analyzing topics agricultural productivity and cropping intensity related to study area. Agricultural productivity of an area is influenced by number of physical and socio-economic factors. Thus it is a function of interplay of physical and cultural variables and it manifests itself through per hectare productivity and total of production. Cropping intensity means the number of crop that is harvested in a year from as single field. It may be single, double or triple cropping systems. The intensity of cropping indicates the efficiency of land use. The intensity of cropping i.e. gross cropped area divided by total cultivated area may be assumed at that point where there is most advantageous conditions.

1. Introduction

The Pindar Basin consists of very High Mountain and steep precipitous slopes. Marginal land farmers have attempted to squeeze out a living from lands not suited for crop production and have not only ruined the entire land scape in the process but have created hazards for floods and sedimentation in the area down below and would not usually permit any trace of soil on these hills. However, there are a few redeeming features which make the slopes sufficiently stable to allow some kind of landuse. The pressure of the population except in area where soil is easily workable is too little. Poor accessibility of the area would not provide for major technological changes in near future. On the basis of these assumption it may not be necessary to think of major landuse changes. The strategy for watershed control would mostly confine to improving practices within major and use regions. The survey aspect should therefore aim at locating areas whose potential is not being fully utilized. For example if marginal land is agriculture, it should ecological be treated through reducing its pressure of overgrazing and developing plantation agriculture on it. Ecology problems dealing with environmental degradation consequently result in low productivity in the Pindar Basin. Natural hazards i.e., cloud bursting, soil erosion mainly on rainy season and unrationlized human interferences like unscientific quarrying and blasting for road and dam construction, over grazing, over loping, over following, over plugging and deforestation consequently give birth to low fertility rate and low production and productivity. Yield is very low due to some localized factors, traditional value and old method of ploughing and harvesting. The present study aim to diagnose the nature of land resources and their relations with the natural conditions and scientific quarry and then treat them with ecological measures for the more productivity in the basin. Extension of Pindar valley is from 29^0 59′ N to 30^0 21′ N latitude and 79^0 29′ E to 80^0 5′ E longitude, area of 1856.56 km^2 which is feeding population of 2, 65,600, (2001) residing in different landforms of glacial, glacio fluvial and fluvial (Sharma2011). It represents the eastern part of the Garhwal Himalaya with elevation ranging from 800 m to 6800 m. Pindar River originates from the Pindari Glacier, district Bageshwar 32 Km and flowing an approximate 124 km with its numerous tributaries, confluences into the Alaknanda River at Karanprayag in Chamoli district. The watershed of the Ram Ganga in the South, the Sarju in the east, the Nandakini in the North and the Alaknanda in the North West delimit it and gives it a distinct socio-geographical identity. The study area comprises a part

of Chamoli and Bageshwar Districts divided in 6 blocks namely Karnparyaga, Tharali, Dewal, Narayan Bagar, Kapkot and Gairsain (Fig-1). The climatic condition range from warm temperate at the valleys to cold temperate at the higher altitudinal of the mountain followed by cold climate and the Alpine at the high mountain ridges. The snow covered peaks are covered by perennial snowfall. The climate is predominantly temperate and temperatures range from 5^0 to 30^0C in lower parts and -5^0 to 22^0 centigrade in higher part of the valley. Rainfall varies between 1500 mm to 1700 mm in a bimodal pattern (UYRDC).

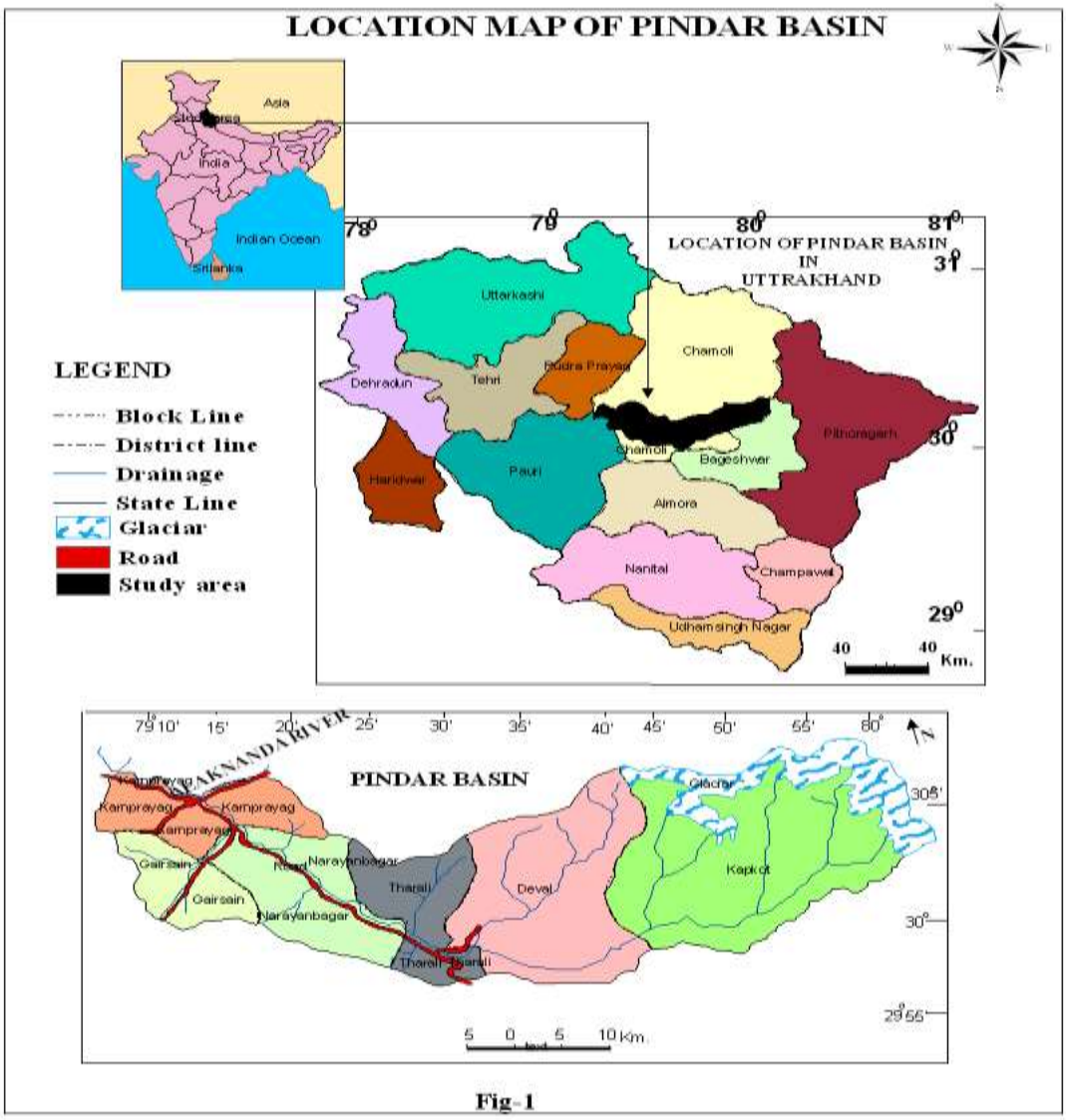

Fig-1

Figure 1: Location Map

2. Research Methodology

Methodology constrains upon the collection of primary and secondary data, where primary data regarding land use, land utilization and relative consequences were collected from local people through questionnaire and personal interviews and secondary data from the census of India, government and semi-government organizations. Related maps were generated in Arc GIS 10.3environment.

3. Result and Discussion:

3.1 Crop Pattern:

The cropping pattern of an area is mostly governed by the physical, economic and the institutional factors. In principle the actual cropping pattern should be intimately adapted to physical conditions and should evolve suitable cropping pattern (Pal and Asthana, 1985). There are five major crops paddy, wheat, barley, mandua, and Sava in the study area which occupy about 91.96 percent of the total cultivated land. Among other crops, pulses, vegetables, tobacco and oilseeds are also important. Mandua is the most important crop with a few exceptions, and is predominant crop in most of the area used as substitute for wheat and is grown on uplands under rain fed conditions. Jhangora is a substitute to paddy and grows on upland under rainy season. Barley is another important crop of the areas. Other cash crops and vegetable occupy very little areas mostly in fertile soil and are grown with help of irrigation. Besides the food grains, the region has cultivation of ginger, guava, and apple which are most valuable crops of the area.

Through the basin agriculture falls under the subsistence farming, in a year they grow two seasonal crops Rabi and Kharif. Under the Rabi crops wheat, peas, grams, lentil (masur) and oil seeds are grown, and in Kharif – paddy, pulses, millets (koda, jhangora, koni chinai) and patato etc. cultivated. The area of 16,845 Hectares i.e. 43.02% of the total cultivated land is utilized for the Rabi crops which are sown in October and harvested in April and May. Nearly 33.48% of the total cultivated land is under wheat. Generally, areas of deep soil which have high moisture sensitive capacity have been given to this crop. Rainfall in the area is not sufficient for wheat and wherever possible it is grown with the help of irrigation. Kharif crops are the main crops controlling the agro economy of the area. Maize, mandua and paddy are important crop of the area and are adoptable to a variety of environmental conditions, mostly village and areas of fertile soil have been given to these crops. The harvesting period of paddy is variable according to elevation but the ploughing period is the same everywhere. In the "Gangarh" (plain area) the paddy harvesting beings one month advance to that of 'danda' (high altitude areas). The ploughing period is March-April both in the 'Gangarh' and 'danda' and the harvesting period is the early September in the 'Gangarh' and October in the 'danda'. (Sharma 2011) Irrigated lands are paddy farms because irrigation is most import for paddy. The (tab-1) shows block wise cropping pattern in Pindar basin. Wheat is a principal crop and percentage of area under wheat leads among in the block 35.74% in Karanprayag. Narayan Bagar (30.62%) and Tharali (18.46%), Deval 30.08%, Gairsain 42.45% and Kapkot 33.70% than the paddy except Tharali where the wheat crop is bear just half land than the paddy (Paddy 36.40% and Wheat 18.46%).The harvesting of the crop is the month of May, in 'Gangarh' region and June in Danda. The other important crops are barely, the highest percentage occupy in Kapkot 6.33% followed by Narayan Bagar (3.35%), and the lowest percentage found in Tharali 1.47%,a Gairsain, Deval and Karanprayag, 2.95, 2.47 and 2.14 % respectively. Potato is main cash crop in the basin. The highest percentage of potato found in Deval (19.20%) block followed by Karanprayag (3.93%). Minimum percentage of potato found in Narayan Bagar1.89%. Other blocks Tharali, Gairsain and Kapkot contain 3.69%, 2.37% and 2.10% respectively. Ramdana, soyabean and beans are prominent among the other crops in the highly elevated zone. Unfortunately, due to inaccessibility of means of transport and the marketing of these crops is still low.

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)	(%)	GairSain Area (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**	

3.2 Area of Crop for agriculture practice:

The (tab-2a) exhibits blockwise cereals, (tab-2b) exhibits blockwise oilseed and (tab-2c) exhibits blockwise vegetable, their sown and harvesting months, area of irrigation and unirrigated land, total agricultural land with its mean altitude and other details.

Table 2 a: Block wise Cereals in Pindar river basin

Cereals								
Block	**Name of species**	**Family**	**Sown (Month)**	**Harvesting (Month)**	**Area (Irrigated)**	**Area (Unirrigated)**	**Total Area In ha**	**Mean Altitude**
Karanprayag	Wheat	Gramin	Nov.	April	464	2153	2617	1400
	Barley	Gramin	Nov.	March	-	157	157	1400
	Corn	Gramin	June	Sept.	-	25	25	1600
	Mandua	Gramin	June	Nov.	-	1794	1794	1600
	Jhangora	Gramin	June	Sept.	-	-	-	-
	Sawa	Gramin	June	Oct.	-	298	298	1600
	Rice/Paddy	Gramin	June	Oct.	486	1547	2033	1300
Total	Total Produce	Gramin			**950**	**5974**	**6924**	
Narayanbagar	Wheat	Gramin	Nov.	April	224	1396	1620	1500
	Barley	Gramin	Nov.	March	-	177	177	1500
	Corn	Gramin	June	Sept.	-	17	17	1700
	Mandua	Gramin	June	Nov.	-	1299	1299	1700
	Jhangora	Gramin	June	Sept.	-	-	-	-
	Sawa	Gramin	June	Oct.	-	338	338	1800
	Rice/Paddy	Gramin	June	Oct.	234	1237	1471	1400
Total	Total Produce				**458**	**4464**	**4922**	
Tharali	Wheat	Gramin	Nov.	April	147	583	730	1400
	Barley	Gramin	Nov.	March	1	57	58	1400
	Corn	Gramin	June	Sept.	-	20	20	1700
	Mandua	Gramin	June	Nov.	-	1271	1271	1700
	Jhangora	Gramin	June	Sept.	-	-	-	-
	Sawa	Gramin	June	Oct.	-	108	108	1700
	Rice/Paddy	Gramin	June	Oct.	189	1251	1440	1500
Total	Total Produce				**337**	**3290**	**3627**	
Dewal	Wheat	Gramin	Nov.	April	25	705	730	1400
	Barley	Gramin	Nov.	March	-	60	60	1400
	Corn	Gramin	June	Sept.	-	8	8	1500
	Mandua	Gramin	June	Nov.	-	445	445	1500
	Jhangora	Gramin	June	Sept.	-	-	-	-
	Sawa	Gramin	June	Oct.	-	113	113	1500

	Rice/Paddy	Gramin	June	Oct.	23	494	517	1400
Total	Total Produce				**48**	**1825**	**1865**	
Gairsain	Wheat	Gramin	Nov.	April	177	2816	2993	1400
	Barley	Gramin	Nov.	March	-	208	208	1400
	Corn	Gramin	June	Sept.	-	62	62	1600
	Mandua	Gramin	June	Nov.	-	1445	1445	1600
	Jhangora	Gramin	June	Sept.	-	-	-	-
	Sawa	Gramin	June	Oct.	-	398	398	1600
	Rice/Paddy	Gramin	June	Oct.	194	1445	1639	1400
Total	Total Produce	Gramin			**371**	**6374**	**6745**	
Kapkot	Wheat	Gramin	Nov.	April	1572	2916	4488	1200
	Barley	Gramin	Nov.	March	9	834	843	1200
	Corn	Gramin	June	Sept.	2	258	260	1600
	Mandua	Gramin	June	Nov.	-	2891	2891	1600
	Jhangora	Gramin	June	Sept.	-	-	-	-
	Sawa	Gramin	June	Oct.	-	605	605	1600
	Rice/Paddy	Gramin	June	Oct.	1554	1846	3400	1400
Total	Total Produce				**3137**	**9350**	**12487**	

Table 2 b: Block wise Oilseed in Pindar river basin

Oil Seeds								
Block	**Name of Spcies**	**Family**	**Sown (Month)**	**Harvesting (Month)**	**Area (Irrigated)**	**Area (Unirrigated)**	**Total Area**	**Mean Altitude**
Karanprayag	Mustard	Gramin	Nov	March	-	33	33	1400
	Til	Gramin	July	Sept	-	6	6	1400
	Soyabean	Gramin	July	Sept	-	20	20	1600
Total						**59**	**59**	
Narayanbagar	Mustard	Gramin	Nov	March	3	57	60	1400
	Til	Gramin	July	Sept	-	-	-	-
	Soyabean	Gramin	July	Sept	-	6	6	1600
Total					**3**	**63**	**66**	
Tharali	Mustard	Gramin	Nov	March	2	61	63	1500
	Til	Gramin	July	Sept	-	4	4	1600
	Soyabean	Gramin	July	Sept	-	11	11	1600
Total					**2**	**76**	**78**	
Dewal	Mustard	Gramin	Nov	March	-	24	24	1500
	Til	Gramin	July	Sept	-	3	3	1600
	Soyabean	Gramin	July	Sept	-	11	11	1800
Total						**38**	**38**	
Gairsain	Mustard	Gramin	Nov	March	-	49	49	1400
	Til	Gramin	July	Sept	-	14	14	1600

	Soyabean	Gramin	July	Sept	-	10	10	1800
Total						**73**	73	
Kapkot	Mustard	Gramin	Nov	March	-	25	25	1200
	Til	Gramin	July	Sept	-	-	-	-
	Soyabean	Gramin	July	Sept	-	28	28	1600
	Alsi	Gramin	July	Sept	-	7	7	1600
	Sunflower	Gramin	June	Oct	-	5	5	1600
Total						**65**	**65**	

Table 2 c: Blockwise Vegetable in Pindar river basin

Block	Name of Spcies	Family	Sown (Month)	Harvesting (Month)	Area (Irrigated)	Area (Unirrigated)	Total Area	Mean Altitude
Narayanbagar	Potato	Gramin	Throughout the year		-	100	100	1600
	Tobacco	Gramin	Throughout the year		-	1	1	1400
	Onion	Gramin	Nov	Jun	-	-	-	1400
	Pind Potato	Gramin	Throughout the year		-	-	-	1400
	Jakhiya	Gramin	Jun	Sept	-	-	-	1400
	Cabbage	Gramin	Dec	Feb	-	-	-	1200
	Cauliflower	Gramin	Dec	Feb	-	-	-	1200
	Brinjal	Gramin	May	Sept	-	-	-	1600
	Lady's Finger	Gramin	May	Sept	-	-	-	1400
	Pumpkin	Gramin	Jun	Oct	-	-	-	1400
	Gourd	Gramin	May	Oct	-	-	-	1400
	Bottle Gourd	Gramin	May	Oct	-	-	-	1400
	Bitter Gourd	Gramin	May	Oct	-	-	-	1400
	Cucumber	Gramin	Jun	Nov	-	-	-	1400
	Mustard	Gramin	Nov	Feb	-	-	-	1200
	Rye	Gramin	Nov	Mar	-	-	-	1200
	Spinach	Gramin	Nov	Mar	-	-	-	1200
	Methi	Gramin	Nov	Mar	-	-	-	1200
	Chaulai	Gramin	Nov	Mar	-	-	-	1800
	Bathua	Gramin	Nov	Mar	-	-	-	1200
	Ginger	Gramin	April	Nov	-	-	-	1400
	Turmeric	Gramin	April	Oct	-	-	-	1400
	Red Chilli	Gramin	Jun	Oct	-	-	-	1400
	Coriender	Gramin	Oct	April	-	-	-	1400

Total						**101**	**101**	
Tharali	Potato	Gramin	Throughout the year		-	146	146	1600
	Tobacco	Gramin	Throughout the year		-	-	-	-
	Onion	Gramin	Nov	Jun	-	-	-	1400
	Pind Potato	Gramin	Throughout the year		-	-	-	1400
	Jakhiya	Gramin	Jun	Sept	-	-	-	1400
	Cabbage	Gramin	Dec	Feb	-	-	-	1200
	Cauliflower	Gramin	Dec	Feb	-	-	-	1200
	Brinjal	Gramin	May	Sept	-	-	-	1600
	Lady's Finger	Gramin	May	Sept	-	-	-	1400
	Pumpkin	Gramin	Jun	Oct	-	-	-	1400
	Gourd	Gramin	May	Oct	-	-	-	1400
	Bottle Gourd	Gramin	May	Oct	-	-	-	1400
	Bitter Gourd	Gramin	May	Oct	-	-	-	1400
	Cucumber	Gramin	Jun	Nov	-	-	-	1400
	Mustard	Gramin	Nov	Feb	-	-	-	1200
	Rye	Gramin	Nov	Mar	-	-	-	1200
	Spinach	Gramin	Nov	Mar	-	-	-	1200
	Methi	Gramin	Nov	Mar	-	-	-	1200
	Chaulai	Gramin	Nov	Mar	-	-	-	1800
	Bathua	Gramin	Nov	Mar	-	-	-	1200
	Ginger	Gramin	April	Nov	-	-	-	1400
	Turmeric	Gramin	April	Oct	-	-	-	1400
	Red Chilli	Gramin	Jun	Oct	-	-	-	1400
	Coriender	Gramin	Oct	April	-	-	-	1400
Total						**146**	**146**	
Dewal	Potato	Gramin	Throughout the year		-	466	466	1800
	Tobacco	Gramin	Throughout the year		-	-	-	
	Onion	Gramin	Nov	Jun	-	-	-	1400
	Pind Potato	Gramin	Throughout the year		-	-	-	1400
	Jakhiya	Gramin	Jun	Sept	-	-	-	1400
	Cabbage	Gramin	Dec	Feb	-	-	-	1200
	Cauliflower	Gramin	Dec	Feb	-	-	-	1200
	Brinjal	Gramin	May	Sept	-	-	-	1600
	Lady's Finger	Gramin	May	Sept	-	-	-	1400
	Pumpkin	Gramin	Jun	Oct	-	-	-	1400
	Gourd	Gramin	May	Oct	-	-	-	1400

	Bottle Gourd	Gramin	May	Oct	-	-	-	1400
	Bitter Gourd	Gramin	May	Oct	-	-	-	1400
	Cucumber	Gramin	Jun	Nov	-	-	-	1400
	Mustard	Gramin	Nov	Feb	-	-	-	1200
	Rye	Gramin	Nov	Mar	-	-	-	1200
	Spinach	Gramin	Nov	Mar	-	-	-	1200
	Methi	Gramin	Nov	Mar	-	-	-	1200
	Chaulai	Gramin	Nov	Mar	-	-	-	1800
	Bathua	Gramin	Nov	Mar	-	-	-	1200
	Ginger	Gramin	April	Nov	-	-	-	1400
	Turmeric	Gramin	April	Oct	-	-	-	1400
	Red Chilli	Gramin	Jun	Oct	-	-	-	1400
	Coriender	Gramin	Oct	April	-	-	-	1400
Total						**466**	**466**	
Gairsain	Potato	Gramin	Throughout the year		-	167	167	1600
	Tobacco	Gramin	Throughout the year		-	-	-	
	Onion	Gramin	Nov	Jun	-	-	-	1400
	Pind Potato	Gramin	Throughout the year		-	-	-	1400
	Jakhiya	Gramin	Jun	Sept	-	-	-	1400
	Cabbage	Gramin	Dec	Feb	-	-	-	1200
	Cauliflower	Gramin	Dec	Feb	-	-	-	1200
	Brinjal	Gramin	May	Sept	-	-	-	1600
	Lady's Finger	Gramin	May	Sept	-	-	-	1400
	Pumpkin	Gramin	Jun	Oct	-	-	-	1400
	Gourd	Gramin	May	Oct	-	-	-	1400
	Bottle Gourd	Gramin	May	Oct	-	-	-	1400
	Bitter Gourd	Gramin	May	Oct	-	-	-	1400
	Cucumber	Gramin	Jun	Nov	-	-	-	1400
	Mustard	Gramin	Nov	Feb	-	-	-	1200
	Rye	Gramin	Nov	Mar	-	-	-	1200
	Spinach	Gramin	Nov	Mar	-	-	-	1200
	Methi	Gramin	Nov	Mar	-	-	-	1200
	Chaulai	Gramin	Nov	Mar	-	-	-	1800
	Bathua	Gramin	Nov	Mar	-	-	-	1200
	Ginger	Gramin	April	Nov	-	-	-	1400
	Turmeric	Gramin	April	Oct	-	-	-	1400
	Red Chilli	Gramin	Jun	Oct	-	-	-	1400
	Coriender	Gramin	Oct	April	-	-	-	1400

Total						**167**	**167**	
Kapkot	Potato	Gramin	Throughout the year		7	273	280	1800
	Tobacco	Gramin	Throughout the year		-	-	-	
	Onion	Gramin	Nov	Jun	-	-	-	1400
	Pind Potato	Gramin	Throughout the year		-	-	-	1400
	Jakhiya	Gramin	Jun	Sept	-	-	-	1400
	Cabbage	Gramin	Dec	Feb	-	-	-	1200
	Cauliflower	Gramin	Dec	Feb	-	-	-	1200
	Brinjal	Gramin	May	Sept	-	-	-	1600
	Lady's Finger	Gramin	May	Sept	-	-	-	1400
	Pumpkin	Gramin	Jun	Oct	-	-	-	1400
	Gourd	Gramin	May	Oct	-	-	-	1400
	Bottle Gourd	Gramin	May	Oct	-	-	-	1400
	Bitter Gourd	Gramin	May	Oct	-	-	-	1400
	Cucumber	Gramin	Jun	Nov	-	-	-	1400
	Mustard	Gramin	Nov	Feb	-	-	-	1200
	Rye	Gramin	Nov	Mar	-	-	-	1200
	Spinach	Gramin	Nov	Mar	-	-	-	1200
	Methi	Gramin	Nov	Mar	-	-	-	1200
	Chaulai	Gramin	Nov	Mar	-	-	-	1800
	Bathua	Gramin	Nov	Mar	-	-	-	1200
	Ginger	Gramin	April	Nov	-	-	-	1400
	Turmeric	Gramin	April	Oct	-	-	-	1400
	Red Chilli	Gramin	Jun	Oct	-	-	-	1400
	Coriender	Gramin	Oct	April	-	-	-	1400
Total					**7**	**273**	**280**	

Table-3 shows cropping pattern in the Pindar valley. It shows cropped area in hectare and percentage of cropped area. The major crops that are grown in the Pindar basin are wheat (33.52%) followed by rice (26.71%) and mandua (finger millets) i.e. 23.29%, sava occupied 4.73% of the cropped area. Other crops are barley (3.82%) and potato (3.68%), maize, urad, masur, pea, pulses, and mustered, linseed, soybean (oil seed) have less cropped area. (Tab-3) below exhibits main cropping in Pindar basin.

Table 3: 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**	

3.3 Agricultural Productivity

Agricultural productivity of an area is influenced by number of physical and socio-economic factor. Agricultural productivity is thus a function of interplay of physical and cultural variables and it manifests itself through per hectare productivity and total of production. Productivity is not a synonym of fertility, it is generally used to express the strength of agriculture in particular region to produce crops with regard to whether that is due to bounty of nature or to the efforts of man. On the other hand, fertility denotes the ability of soil to provide all the essential plant nutrients available for healthy plant growth. Agricultural productivity has also been defined as the ratio of index of total agriculture output of the index of total input used in farm production (Shafi, 1984).

Table 4, Shows area (hect.), production (quintal) and productivity (hect. /yield) of the traditional crops and vegetable combined. There are 6 blocks with different elevations, which exhibits that the land is devoted for traditional crops particularly for Manduwa, Jhangora, Wheat and Paddy in all the attitudinal zones, whereas the land under vegetable crops. According to the (tab-4) the highest productivity is observed in Karnprayag block 43.41hect./yield which is having highest Net sown area (4811 hect.) and a relative elevation 2200m which comes under lower valley zone. The second highest productivity is noticed in Deval Block 4075 hect., through the total area of this block is higher than Karnprayag by the net sown area is 1716 hect. This is less than Kapkot (7402 hect. taking whole block in study) which is having lowest productivity. This is because maximum area of Deval comes under Glaciated zone, forest cover and alpine pasture, but the block net snow area comes in lower valley zone and potato is main vegetable grown in high altitudinal villages. Narayanbagar, Tharali and Garsain are having following productivity 31.93, 25.54 and 16.71 hect. /yield respectively (Figure-2).

Table 4: Agricultural Productivity of Study Area

Blocks	Elevation(m) Relative Height	Location		Area net sown (Hect.)	Production (quintal)	Productivity (per hect yield)
		Latitude	Longitude			
Karnparyag	2200	30^{0}15'54.02" N	79^{0}12'51.62" E	4811	208845	43.41
Narayan Bagar	1082	30^{0}08'51.39" N	79^{0}22'32.00" E	4499	143640	31.93
Tharali	1300	30^{0}04'44.36" N	79^{0}29'47.00" E	3404	86940	25.54
Deval	1495	30^{0}03'20.87" N	79^{0}34'49.91" E	1716	69930	40.75
GairSain	2411	30^{0}06'21.31" N	79^{0}17'14.89" E	4636	77490	16.71
Kapkot	1195	29^{0}57'13.11" N	79^{0}55'50.55" E	7402	30240	4.08
Total				26468	617085	23.31

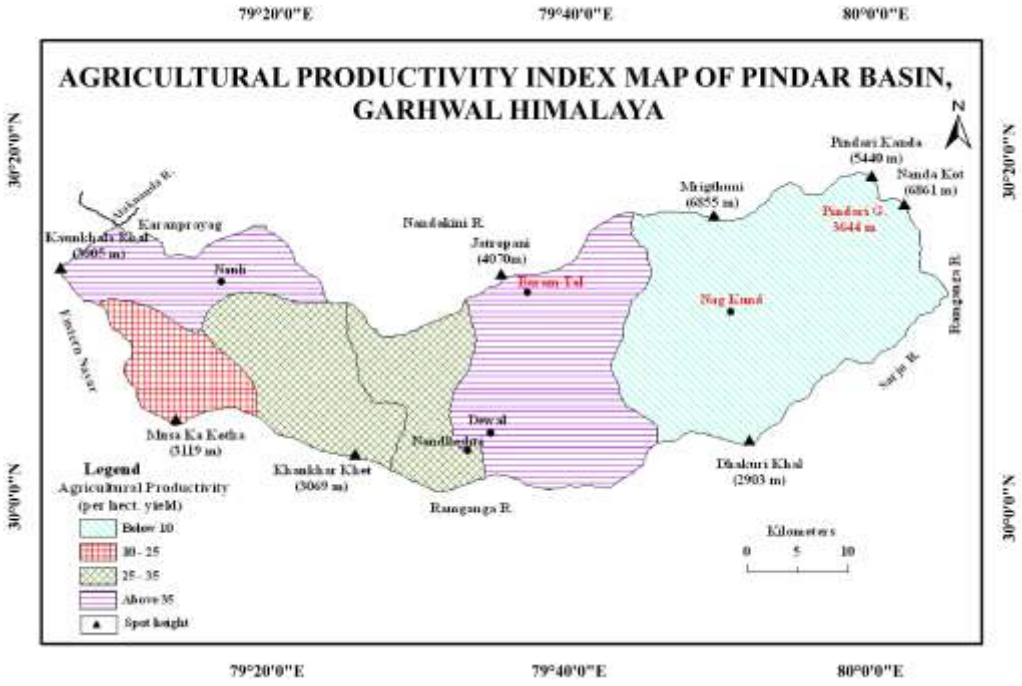

Figure 2: Agricultural Productivity Index

Table 5: Village-wise Agricultural Productivity

Valley	Watershed	Villages	Elevation	House holds	Total Population	Cultivator	Traditional Crops			Vegetables		
							Area (hect.)	Produc-tion	Product-ivity	Area (hect.)	Produc-tion	Product-ivity
Upper	Dolamgad	Ghes	2200	147	774	278	320	1600	5	60	1000	16.7
	Ghatiyagad	Badiyakot	2200	120	623	318	395	1470	3.7	55	960	17.5
	Boragad	Kuwari	1900	53	272	113	290.1	1000	3.4	26	600	23.1
Middle	Simli gad	Jakh	2140	126	618	111	405	1700	4.2	50	1220	24.4
	Ming gadhera	Khainoli	1900	112	560	80	385	970	2.5	165	1745	10.6
	Nunagad	Kulsari	1150	96	384	204	460	1800	4.7	80	500	7.1
Lower	Kewargad	Kimoli	1600	168	991	484	247.9	2200	8.9	85	1200	14.1
	Wara gad	Thapli	1400	55	222	9	120	1200	10.0	45	150	3.3
	Ata gad	Bangaon	1050	100	541	114	320.25	2700	8.4	80	267	3.3

In (tab-5) reveals that the study is carried out by dividing valley into three zones upper, middle and lower and from each zone three watershed has been selected from which one village is taken for study. In total nine villages of nine basin in three zones are analyzed. Every villages is having different attitude, watershed, location and landforms. The table also shows area (ha) production (quintal) and productivity (hect. /yield) of the traditional crops and vegetable. The highest percentage of land is devoted for traditional crops particularly for Manduwa, Jhangora, wheat and Paddy in all the attitudinal zones. Whereas the land under vegetable crops (Onions and potato is remarkably low, this also various from the villages of valley regions to the high lands villages. It further denotes that vegetables have high production and productivity both in low land and highland than to traditional crops varies from 2.5 to 2.5 hect. /yield respectively.

The highest productivity under traditions crops is observed in Kimoli (8.9 hect. /yield) which falls under Lower valley zone elevation of 600m and the lowest is registered in Khainoli (2.5 hect./yield) which falls under middle valley an elevation of 1900 followed by Badiyakot and Kuwari having production of 3.7& 3.4 hect./yield respectively. But in upper

valley Ghes is having productivity of 5 hect. /yield at the elevation 2200m. Bangaon and Thapli of lower valley are having second (8.4 hect /yield) and third (7.5 hect. /yield) highest productivity respectively. Jakh and Kulsari at the elevation of 2140m and 1150m having productivity of 4.7 to 4.2 hect. /yield respectively.

In the case of vegetables highest productivity is of Jakh (24.4 hect. /yield) which is followed by Kuwari, Badiyakot, Ghes of upper valley 23.1, 17.7 and 16.7 hect. /yield respectively. This is because of potato production and the lowest productivity of Thapli and Bangaon (3.3 hect. /yield) in low valley zone.

Conclusion

The basins agriculture falls under the subsistence farming; the area has rough, rugged and uneven landscape a sign of low fertility and low yields of crops which gives birth to a low living of standard of people who depend directly or indirectly on agriculture. Its yield is very low due to some localized factors, traditional value and old method of pouching and harvesting. There are 6 blocks with different elevations, which exhibits that the land is devoted for traditional crops particularly for Manduwa, Jhangora, Wheat and Paddy in all the attitudinal zones, whereas the land under vegetable crops. The highest percentage of land is devoted for traditional crops particularly for manduwa, jhangora, wheat and paddy in all the attitudinal zones. Whereas the land under vegetable crops (Onions and potato is remarkably low, this also various from the villages to valley regions to the high lands villages. It further denotes that vegetables have high production and productivity both in low land and highland than to traditional crops. There is another redeeming character of the valley, which is a linear rich fertile belt on both sides of the river from Gwaldom to Karnprayag. Here in these river terraces to increase the productivity there is need of fertilizers and insecticides, experimental cultivated seeds, sufficient irrigation facilities.

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