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Assessment of Rural Development and Socio-Economic Disparities Rudraprayag District Uttrakhand: A Study of Geographical Perspective

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Abstract: Rural development and Regional Disparities is a universal problem. this is a crucial aspect of Socio-Economic progress, particularly in mountainous regions like Rudraprayag district in Uttarakhand. Rudraprayag district is characterised by rugged terrain, limited arable land, and vulnerability to natural disasters and faces unique challenges in agriculture, infrastructure. and livelihoods. This phenomenon plays a crucial role in enhancing the quality of life and economic well-being of people living in remote areas. This study explores the rural development and the socio-economic disparities in the Rudraprayag district of the Garhwal Himalaya, Uttarakhand. The present study analyses the inter-block variations in the level of socio-economic development based on the main key indicators and different socio-economic parameters of Rudraprayag district, Uttarakhand. It tried to analyse the cause of the high and low levels of development of the blocks. This study explores block-wise disparities in key indicators such as infrastructure, education, healthcare, and livelihood opportunities across different communities and regions within the district. the level of socio-economic development has been measured using Composite Z-score methods.

Keywords: Rural development • Regional disparity • Socio-economic disparities • Socio-economic development level • Agriculture.

Introduction

Rural development plays a vital role in regional planning, particularly in mountainous regions like the Garhwal Himalaya, where geographical constraints and socio-economic disparities create unique challenges. Rudraprayag district in Uttarakhand, located in the central Himalayas, exemplifies these issues, with uneven development patterns due to limited infrastructure, a fragile ecosystem, and reliance on traditional agriculture. Persistent disparities in education, healthcare, employment, and connectivity continue to affect the quality of life in rural areas.

(Ray 2017)Inter-block socio-economic disparities remain prominent in many regions. Samsulijar and Syechalad (2019) studied economic disparity in Aceh, Indonesia, from 2011–2016, finding moderate inequality and recommending improved public services, stronger local revenue, and reduced dependence on national funds. P.S Kutwal (2023) examined rural development disparities in Uttarakhand (2001–2011), revealing progress above the national average but at a slower pace.

Belanche and Luis (2021) found that rural communities often exhibit stronger place identity than urban ones, underlining the importance of community environments in shaping individuals' emotional and cognitive attachment to place. Naldi and Nilsson (2015) highlighted how the European Union's smart growth strategy supports sustainable rural development by encouraging innovation and knowledge transfer.

Olmedo and Twuijver (2023) investigated rural social enterprises in Ireland, showing their critical role in addressing local needs and generating social innovation through place-based strategies and hybrid resource use. In China, Guo and Zhou (2022) demonstrated how targeted poverty alleviation—through industrial development, education, and precise identification of poor households—effectively reduced rural poverty.

Mondal (2023) explored regional disparities in rural development in West Bengal's Hugli district, Philip Kostov and Lingard (2004) advocated shifting from agriculture-centric rural policies to integrated, livelihood-focused approaches involving both public and private sectors. Scott and Rowe (2016) critiqued economic-focused cultural policies in the UK, proposing a social justice framework that emphasizes culture's intrinsic value in rural well-being.

Kumar and Kumar (2023) emphasized the importance of the Sustainable Livelihood Approach (SLA) in enhancing rural development outcomes. Sati (2022) assessed Mizoram's potential for rural prosperity through sustainable use of natural capital—like eco-tourism, agroforestry, and micro-hydro power. Finally, Nemes (2005) stressed the need for integrating top-down policy directives with local, bottom-up approaches for successful rural development in Europe.

Study Area

Rudraprayag district is a district of uttarakhand state of northern india. The district occupies an area of 2439 sq km. rudraprayag town is the administrative headquarters of the district. The district is bounded by Uttarakashi district on the north, Chamoli district on the east, Pauri district on the south, and Tehri Garhwal district on the west (Fig 1).

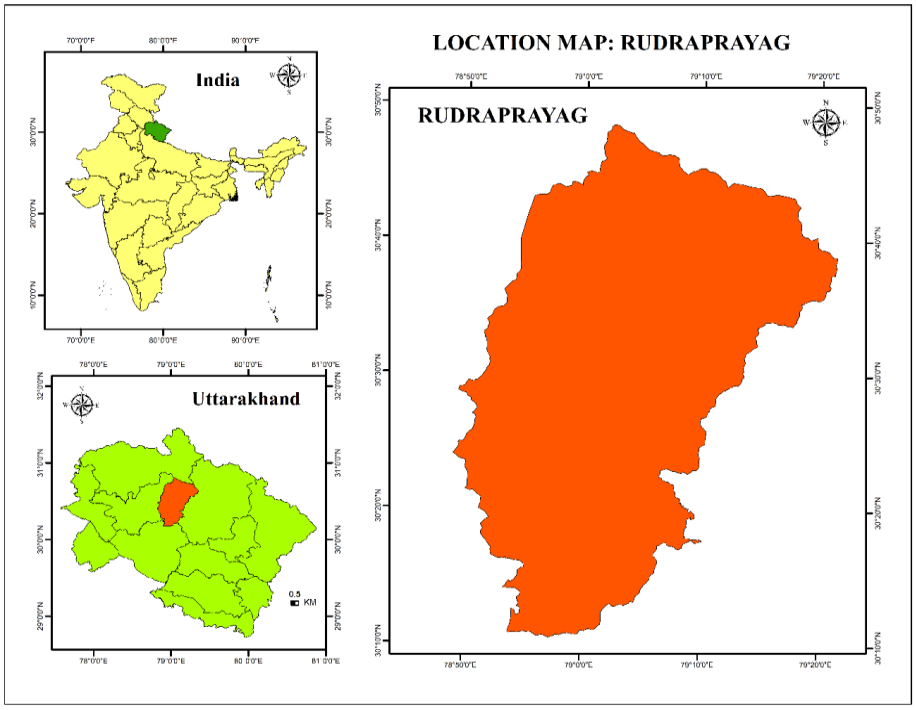

Fig 1: Location map of the study area

Data and Methodology: The district was established on 16th September 1997 when Uttarakhand was a part of Uttar Pradesh. The district consists of 4 tahsils, 3 blocks, 27 nyay panchayats, and 688 villages. The majority of the district population is rural with 95.90% of people in villages, while only 4.10% of the population resides in urban area. The population density of the district is 122 per sq km. Rudraprayag district located between

30°19'N to 30°49' latitude and 78°49'E to 79°21' longitude cover about 1982.92 sq km. Rudraprayag district located on boundaries of the Chamoli, Tehri Garhwal, Uttrakashi, and Pauri districts. There are mainly two river basins in the district, one is the Mandakini river and the second is the Alaknanda. Rudraprayag town is the administrative centre of the district.

This study is mainly based on secondary data sources relating to regional disparities, that has been obtained from different sources. Socio-economic data were put out with the help of the district statistical handbook of Rudraprayag (2018), the district census handbook (2011), and other published and unpublished data secondary sources. To assess disparities at the block level in terms of education, healthcare, transportation, communication, agriculture, etc., this data is analysed using statistical techniques for studying inter and intra-region disparity on the basis of main indicators. Mapping settlements in Arcgis and data analysis using software is MS Word and MS Excel. In this study, methods of measuring development disparities among the blocks of Rudraprayag district, such as the Z-Score test and the composite index, were used. This formula was for us to calculate.

(a) The formula for calculating the z-score method is follows :

$$zi = \frac{x-\bar{x}}{\sigma}$$

Where,

Zi = The standardized score of the variable

X = value of the individual data point

$\bar{x}$ = mean value of the variable

σ = standard deviation of the variable

(b) The formula to calculate the composite mean z-score is follows :

$$C.S = \frac{\sum Zij}{N}$$

Where,

C.S.= Composite mean z-score

Zij = Z-score of indicator j in area i

N = Total number of variables

Results and Discussion

The current study of rural development and socio-economic disparities of Rudraprayag district, Uttarakhand, reveals a complex interplay of geographical, economic and social factors that shape the region's development trajectory. The study concerns the disparities of intra-district development on the block level in Rudraprayag district. The finding key highlights rural infrastructure and socio-economic, agriculture and all over sectors. Agriculture remains the primary occupation, but most farming is subsistence-based due to small landholding and lack of irrigation facilities. Socio-economic development is a very important role in standard of living and quality of life of human status.this study to measure by socio economic aspects, which have taken 22 indicators, the indicators are grouped into three categories. First is the Agriculture sector, which we have taken 9 parameters, second is Economic development, which we have taken 8 parameters and third is Social development, which we have taken 5 parameters. The entire district has been categorised into three levels – High, Medium, and Low – based on socioeconomic development. The classification is determined by the overall ranking score derived from 22 different indicators.

Disparities in Agriculture Development

Agriculture is the backbone of the rural economy and the prime source of livelihood in the Rudraprayag district. This study access to intra district disparities at the block level, agriculture development index of the study area made by 9 variables (X1 to X9). Which are the following, X1 total area in hectares, X2 percentage of cultivated area, X3 percentage of irrigated area, X4 percentage of net sown area, X5 percentage of gross sown are under food crops, X6 percentage of gross irrigated

area, X7 percentage of net irrigated area, X8 percentage of govt. canal irrigation, X9 crops yield.

Table 1 -Agriculture Development Index

Block	Ukhimath	Agastyamuni	Jakholi
x1	-0.24	1.54	-0.04
x2	-0.06	0.7	0.96
x3	-0.64	0.07	1.59
x4	-1.2891	1.1442	0.1409
x5	-1.4142	0.7036	0.7106
x6	-0.1783	-1.1258	1.3041
x7	-1.3506	1.0385	0.3121
x8	0.2973	-1.346	1.0488
x9	-1.03	0.97	0.06
Composite z-score	**-0.6561**	**0.4105**	**0.6762**

Source: District Statistical handbook Rudraprayag 2018

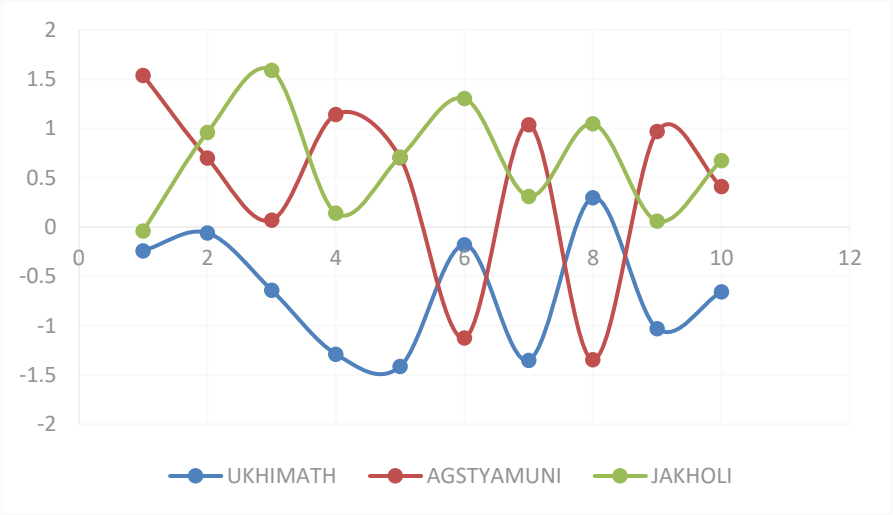

Fig. 2: Composite Score value Agriculture development

Table 1: presents details about agriculture facilities across different blocks in the Rudraprayag district. Ukhimath block has a composite z-score of -0.6561, Agstyamuni has a total score of 0.4105, and Jakholi block has a total agriculture score of 0.6762. Among these, the Jakholi block exhibits the highest agriculture development, and the Ukhimath block has the lowest agriculture performance. Ukhimath struggles significantly in agriculture performance due to poor irrigated and crop yield,a very low percentage of net sown area strengths is moderate govt. canal irrigation. Agastyamuni has a large agriculture based but faces irrigation issues, the block strengths is the largest total agriculture area and high percentage of net sown area. Jakholi is the most agriculturally developed block due to strong irrigation and crop production, weakness of the area agriculture sector in net sown area is slightly above average, the strengths of the area has a highest percentage of irrigated area and best gross irrigated area. Jakholi is the most agriculturally developed block and has better infrastructure overall compared to another block. Then followed by Agastyamuni and Ukhimath block.

Table 2:Level of Agriculture Development

Category	Range	Name of Block
Low	-1.51- -0.51	Ukhimath
Medium	-0.51 – 0.61	Agastyamuni
High	0.61 – 2.04	Jakholi

Source: Compiled by Authors

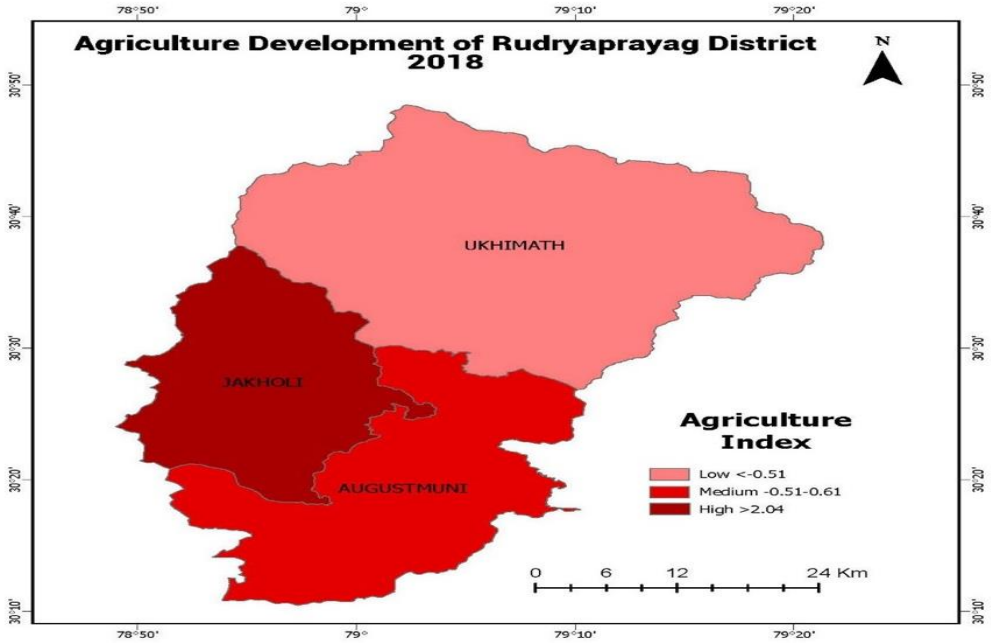

Fig. 3: Level of Agriculture Development Rudraprayag District 2018

Disparities in Social Development : Social development is the process of improving the well-being of individuals and communities by enhancing education, economic opportunities and focusing on improving livelihoods, education, and women's empowerment. In order to accentuate inter-block disparities in socio-development of the district. The social development index of the study area made by 5 variables (X10 to X15) which are following, X10 is percentage of total literacy, X11 percentage of male literacy, X12 percentage of female literacy, X13 percentage of SC ST population to total population, X14 per lakh population metal road km.

Table 3: Social Development Index

Block	Ukhimath	Agastyamuni	Jakholi
x10	-1.26	0.05	-0.35
x11	-1.1	0.69	-1.68
x12	-1.14	0.4	0.07
x13	-0.1	-0.95	1.04
x14	1.679	-0.898	0.579
Composite z-score	**-0.384**	**-0.141**	**-0.068**

Source: Statistical handbook district Rudraprayag 2018

Table 3: Details about social development across different block disparities in the district of Rudraprayag. In the order, the Ukhimath block has a composite z-score value of -0.384, the Agastyamuni block total composite score value is -0.141, and the Jakholi total z-score value is -0.068. Ukhimath -1.26 has the lowest total literacy, Agastyamuni 0.05 is near the average, and Jakholi block -0.35 is slightly below the mean. Male literacy -1.26 has the worst male literacy, ukhimath -1.1 is also low, and while agastyamuni block 0.69 performs better. Female literacy in the UKhimath block in -1.14 is the worst performing, Agastyamuni 0.4 is above average, and the block of Jakholi 0.07 is close to the mean. Metal road infrastructure as per lakh population km.In Ukhimath block 1.679 has the best road infrastructure, followed by Jakholi 0.57, Agastyamuni -0.898 is the lowest of both and the mean. Overall social development composite z-score value, Jakholi -0.068, performs the best among the three blocks, as its composite z-score is closest to zero. Ukhimath -0.384 has the lowest composite score including the worst social development performance among the three.

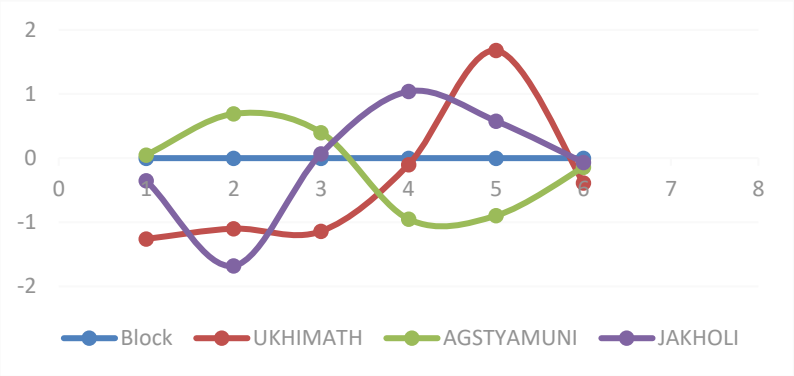

Fig. 4: Composite score value Social Development

Table 4: Level of Social Development 2018

Category	Range	Name of Block
Low	-1.51- -0.040	Ukhimath
Medium	-0.040 - 0.85	Jakholi
High	0.85 – 1.05	Agastyamuni

Source: Compiled by Authors

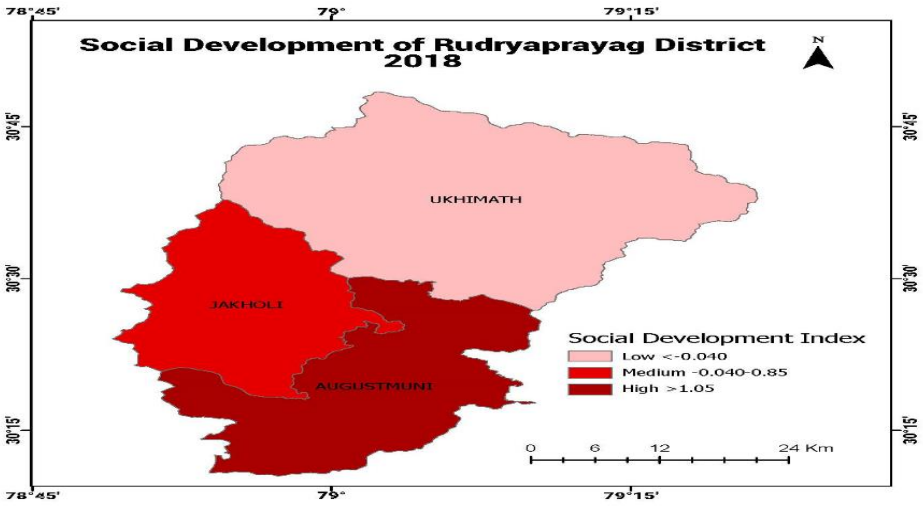

Fig. 5: Level of Social Development Rudraprayag District 2018

Disparities in Economic Development

Economic development usually refers to the method of enhancing the quality of life and improving living standards and financial well-being of its people, it includes the development of infrastructure like roads, electricity, medical facilities, drinking water and banking access to market and financial services. The goal is to reduce poverty and ensure sustainable and inclusive growth in villages.

Table 5: Economic Development Index (Source: Statistical Handbook District Rudraprayag)

BLOCK	Ukhimath	Agastyamuni	Jakholi
x15	1.05	0.2	0.39
x16	0.57	0.59	0.56
x17	0.44	0.59	0.7
x18	0.58	0.58	0.58
x19	0.89	0.5	0.31
x20	1.17	0.28	0.13
x21	1.53	-0.53	0.16
x22	0.48	0.62	0.63
Composite z-score	**0.838**	**0.352**	**0.432**

This study to measure inter disparities at the block level, the economic development index of the study area followed by 8 variables (X15 to X22), which are the following- X15percentage of medical facilities inhabited villages, X16 percentage of drinking water inhabited villages, X17 percentage of post office number of inhabited villages, X18 percentage of telephone inhabited villages, X19 percentage of transports communication inhabited villages, X20 percentage of bank inhabited villages, X21 percentage of pucca road inhabited villages, X22 percentage of power supply number of inhabited villages.

Table 5: The study details about intra-block disparities on economic development in Rudraprayag district of Uttarakhand. In this order, the Ukhimath block has a composite score value of 0.838, the Jakholi composite score is 0.432, and the Agastyamuni total economic composite score is 0.352. Ukhimath shows the highest economic development based on the composite z-score, including overall infrastructure and service. Especially in banking and transport, but slightly lower in drinking water and post offices. Agastyamuni has the lowest score in terms of relatively lower development in these dimensions. Agstyamuni is the least developed, especially due to very low access to roads and medical services and other infrastructure. This block is underdeveloped relative to the other in terms of economic development. Jakholi shows moderate development, leading in post office availability and power supply, but weak in banking access and transport facilities. Jakholi is better than Agastyamuni but still lacks in financial and transport infrastructure.

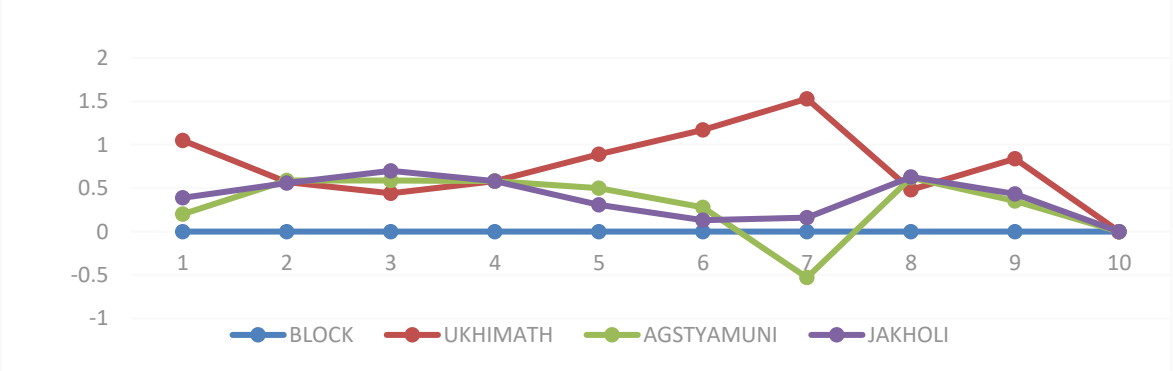

Fig. 6: Composite Score value Economic Development

Table 6: Level of Economic Development 2018

Category	Range	Name of Block
Low	-1.51 – 0.401	Agastyamuni
Medium	0.401 – 0.601	Jakholi
High	0.601 – 1.05	Ukhimath

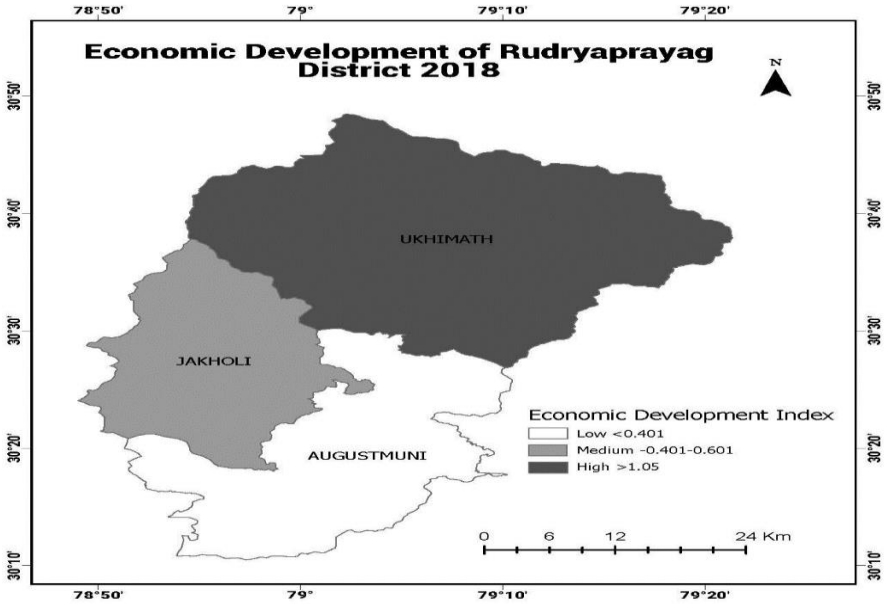

Fig. 7: Level of Economic Development Rudraprayag District 2018

Disparities Overall Development

Intra-block variation in the level of Agriculture development Social development, Economic development disparities has been analyze on the basis of overall development by combining various factors with the composite z-score method. Therefore it is to access overall development by including all the relevant variables from three dimensions in order to analyze the intra-block regional disparities of district Rudraprayag. To find out the spatial differences in the level of development, a composite z-score value has been calculated. The composite development index is derived by aggregating all individual z-scores from the entire index.

Table 7: Aggregate Composite z-score

Blocks	Agriculture composite value	Social composite value	Economic composite value	Overall composite value
Ukhimath	-0.656	-0.384	0.838	-0.202
Agastyamuni	0.41	0.141	0.352	0.903
Jakholi	0.676	-0.068	0.432	1.04

Source: Compiled by Author

Table 7: Based on the aggregate composite z-score, the highly developed area is identified. Jakholi block 1.04 has the highest overall development among the three blocks. Mainly due to strong agriculture and economic sectors, despite slightly weak social sector indicators, it needs to be improved. Agastyamuni block overall composite value is

0.903, it's close to the Jakholi block and shows moderate development, but it is showing balanced and steady development across all sectors. Ukhimath block overall composite z-score value is -0.202, which shows the lowest level of development among the three blocks. The economic sectors of UKhimath are strong and show the highest value in both blocks, but very poor agriculture and social sectors pull down overall development. The agricultural and Social sectors are slightly below the average development. Improvement efforts should focus on agriculture and social infrastructure.

Table 8 : Level of Socio-Economic and Agriculture development 2018

Category	Range	Name of Block
Low	-1.51- -0.301	Uakhimath
Medium	-0.301 – 0.951	Agastyamuni
High	0.951 – 2.01	Jakholi

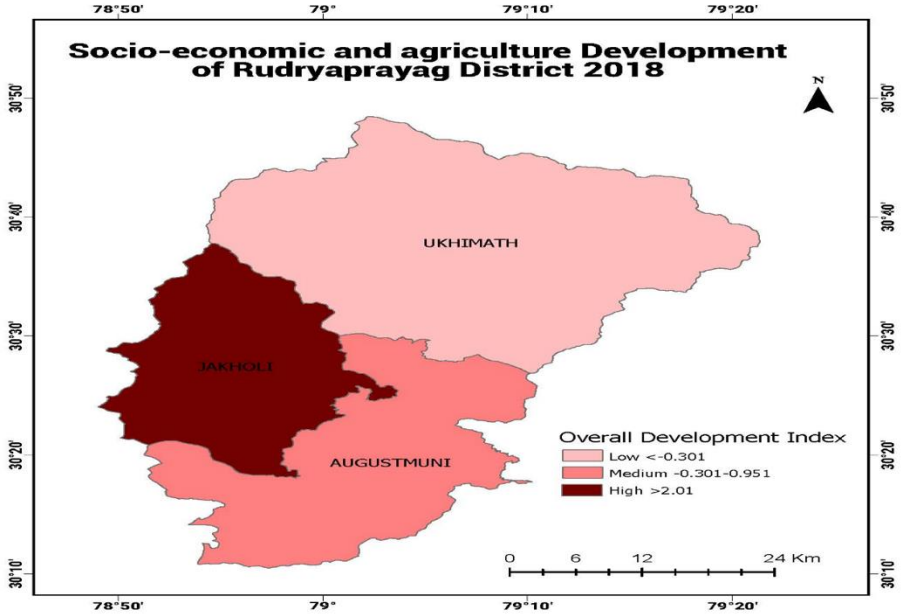

Fig.8: Socio-economic and Agriculture development Rudraprayag District 2018

Conclusion

This study examines rural development and socio-economic disparities in Rudraprayag district, highlighting notable intra-block imbalances. Among its three blocks, Jakholi shows the highest overall development, largely due to better agricultural productivity and moderate economic infrastructure, though it still lags in social indicators like literacy and healthcare. Agastyamuni reflects moderate development with balanced sectoral growth, yet faces challenges in infrastructure and healthcare services. Ukhimath, despite relatively better economic infrastructure—particularly in transport and banking—ranks lowest overall due to weak agricultural output and poor social conditions.

The findings emphasize the need for block-specific, integrated rural development strategies. Priorities include improving irrigation, boosting agricultural productivity, enhancing educational and healthcare facilities, and expanding rural infrastructure. The disparities are primarily attributed to the region's challenging geography and uneven distribution of development resources.

In the context of the hilly Garhwal Himalaya, rural development demands tailored interventions that address both sectoral weaknesses and spatial inequalities. A comprehensive policy framework should aim to strengthen underperforming sectors in each

block while promoting equitable growth. Intermediate rural areas, which are more connected to urban centers, often demonstrate better development outcomes. Leveraging this connectivity through a place-based approach can be an effective strategy for fostering regional growth.

This research offers valuable insights into micro-level challenges and opportunities related to agriculture, infrastructure, and socio-economic development. The findings are expected to aid policymakers in designing targeted interventions for reducing regional disparities, particularly in Rudraprayag, and contribute to broader rural development planning across Uttarakhand.

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