

Changing Agriculture, Land Use, and Cropping Pattern in Chamoli District, Western Himalayas

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ABSTRACT

Agriculture is the backbone of Chamoli's economy, supporting over 70% of the rural population. This study analyses changes in agriculture, land use, and cropping patterns in Chamoli District, Uttarakhand, in the Western Himalayas, from 2013 to 2023. It shows a significant decline in traditional crops such as rice (-23.7%), wheat (-20.1%), and potatoes (-45.1%), alongside an increase in pulses and oilseeds, including urad (+97.3%), mustard (+60.4%), and arhar (+38.3%). Despite a 5.4% reduction in cultivated land, total crop production rose by 28.7%, and average yields improved by 0.41 MT/ha, indicating a shift toward more intensive and resilient farming practices. Land use data reveal a decrease in net sown and fallow areas, accompanied by growth in tree cover and uncultivable land—driven by ecological changes and socio-economic factors, such as migration and shifting farmer priorities. Field surveys conducted across 108 villages highlight local perceptions of declining crop production, particularly in potatoes (-4 units), wheat (-3), and rice (-3), while ragi shows a modest increase (+2). These findings underscore the importance of adopting adaptive agricultural policies to foster sustainable development in the Himalayan region.

Keywords: Cropping pattern, Agriculture, Crop production, Land use, Himalaya region

INTRODUCTION

Agriculture is a major occupation and a prominent source of livelihood for many people living in the rural areas of developing countries. However, the output from it is not sufficient to feed the growing population. Although significant growth in global crop production has been observed over the past 50 years, this expansion has been driven largely by crop intensification- achieving higher yields per unit of land, rather than by the expansion of cultivated land (FAO, 2015). Crop growth trends vary significantly across regions due to differences in climate, soil, technology, and economic factors. Cereals such as wheat, rice, barley, maize, oats, and millet dominate global crop production but face challenges in developing countries, where yields remain low due to limited access to modern farming techniques, irrigation, and high-quality seeds. How diversification into high-value horticultural crops-especially off-season vegetables, can boost income

and employment in Himachal Pradesh's mid-hill farms. It highlights the role of infrastructure, irrigation, and market access in shaping crop choices and returns, (Chand, 1996). declining crop productivity, shrinking landholdings, and reduced farmer interest in Uttarakhand's agriculture sector. It emphasizes the need for sustainable practices, improved infrastructure, and farmer awareness to revive agricultural growth (Verma *et al.*, 2022). Earlier claims of declining agricultural engagement post-economic reforms show instead a shift toward commercial crop cultivation across India. Using NSSO data, it highlights how changing crop patterns have positively impacted productivity and farm dependency (Majhi and Kumar, 2018).

In Asia and Northern Africa, wheat and rice production have seen significant growth, driven by improved agricultural practices and increased demand. However, rising incomes and urbanization are shifting dietary preferences toward protein, fats, and sugar,

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leading to greater demand for livestock products. Livestock production is surpassing crop production, further diverting resources away from crops. This trend reflects a broader dietary transition in developing regions, affecting agricultural priorities. Agriculture remains the main occupation in Chamoli, with over 60% of households engaged in farming. Despite this, the sector contributes less than 10% to the district's GDP, highlighting a persistent disconnect between labor input and economic output. The total cropped area is 45,047 hectares, while the net sown area stays around 315.53 sq. km. Chamoli district has experienced rising temperatures and changing rainfall patterns, with slight increases in winter and pre-monsoon rains, but no clear overall trend. The shift from traditional Jhuming cultivation to settled wet rice and cash crop farming in rural Mizoram is driven by climate change, land use policies, and socio-economic shifts (Sati and Vangchhia, 2018). These climatic shifts have led to reduced yields of traditional crops, such as mandua and wheat, increased soil moisture loss, and a gradual shift toward horticulture and off-season vegetables in irrigated areas. Rainfed farming has become more vulnerable due to unpredictable weather. Wild edible plants play a significant role in enhancing the diets and livelihoods of Uttarakhand's hill communities. Their contribution to food and nutritional security is undervalued and threatened by habitat destruction and cultural changes. Sustainable use and policy support are crucial for preserving these traditional food systems (Bisht *et al.*, 2017).

The changing of land use and cropping patterns worldwide has become a topic of debate. Several studies have explored changes in agriculture and cropping patterns, along with their driving forces. However, to date, little research has been conducted on land use and cropping patterns specifically in the Chamoli District. This paper investigates the evolving agricultural and cropping patterns in Chamoli District, highlights the main driving forces behind these changes, and discusses their consequences. It also proposes various policy measures for the sustainable development of agriculture in Chamoli.

Study Area:

Chamoli district lies in the northeastern part of Uttarakhand state. It is bounded by North Latitude 29° 55' 00" and 31° 03' 45" and East Longitude 79° 02' 39" and 80° 03' 29". The geographical area of the district is 8030 km². Chamoli district, the largest district in Uttarakhand, is also important as it shares its northern

boundary with Tibet (China). It shares its north-western boundary with Uttarkashi District, its western boundary with Rudrapur, its south-western boundary with Tehri Garhwal, its southern boundary with Almora, its south-eastern boundary with Bageshwar District, and its eastern and north-eastern boundaries with Pithoragarh. It is a treasure trove of natural beauty and ecological diversity. From the vibrant Valley of Flowers to the snow-laden slopes of Auli, its geography offers breathtaking experiences year-round. The region's temperate climate adds to its charm, welcoming visitors throughout every season. Majestic peaks, sacred lakes, and cascading rivers make Chamoli a haven for both adventure and serenity. Truly, it stands as a shining jewel in Uttarakhand's mountainous. Fig. 1 shows the study area map.

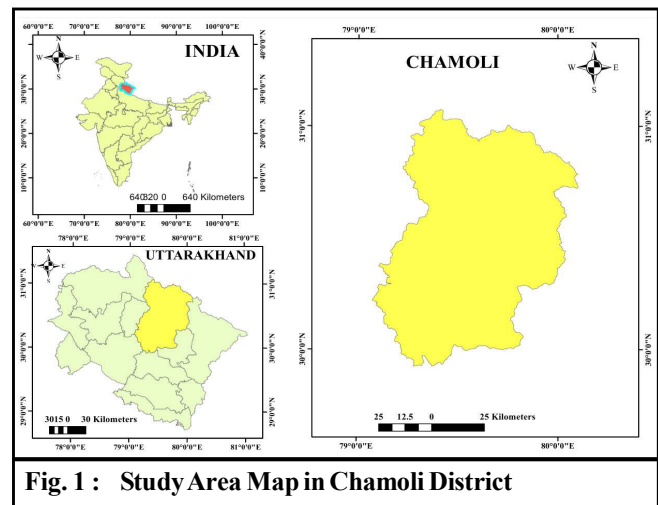


Fig. 1 : Study Area Map in Chamoli District

Objective:

1. To examine the change in agricultural land use and cropping patterns in Chamoli district from 2013 to 2023.
2. To understand and document the local farmers' perceptions of these changes.

METHODOLOGY

This study adopts an empirical approach, utilizing both qualitative and quantitative data sources to assess the changing land use and cropping patterns in Chamoli district, Uttarakhand

Primary data:

Primary data was collected through thorough field surveys using questionnaires, interviews, structured

schedules, and group discussions. Villages were selected through random sampling to ensure representation from different altitude zones within the block, capturing the region's geographical diversity. Respondents were chosen based on their active involvement and experience in agriculture; all were between 25 and 55 years old and regularly engaged in farming. Of the total participants, 42% were male and 58% were female, ensuring a balanced and inclusive view of local agricultural practices and climate-related challenges.

Secondary data:

Secondary data was collected from a diverse range of credible sources, including government reports, research papers, district statistical handbooks, academic books, journals, and newspapers. These sources provided valuable historical information about crop yields, land use changes, and farming trends in the region, enabling a better understanding of long-term changes in agriculture and the environment.

RESULTS AND DISCUSSION

Change in agriculture and cropping patterns:

Table 1, analysed the changes in area, production, and yield of major crops in Chamoli district from 2013 to 2023 (Table 1) and found a decline in the area planted with rice (-23.7%), wheat (-20.1%), peas and beans (-89.3%), masoor (-8.8%), soybeans (-7.3%), and especially potatoes (-45.1%). Conversely, urad (+97.3%),

mustard (+60.4%), and arhar (+38.3%) saw significant increases in cultivated area, supported by moderate gains in maize (+30%), horse gram (+33.3%), and small millets (+17.9%). Despite these changes, the total arable land decreased by 5.4%.

In terms of crop production, peas and beans decreased by 90.5%, masoor fell by 51.7%, and potato declined by 37.8%, while maize increased by 185.7%, showing the highest growth, followed by urad (+162.2%), arhar (+138.2%), and mustard (+136.7%). The average growth in total crop production was 28.7%. Regarding yield, most crops showed improvement, with potatoes having the highest increase (+1.27 MT/ha), followed by maize (+1.08 MT/ha), wheat (+0.37 MT/ha), arhar (+0.37 MT/ha), and small millets (+0.33 MT/ha). The average yield across all crops rose by 0.41 MT/ha over the decade, indicating a move toward more intensive and efficient farming practices in the district.

Fig. 2 illustrates the changes in total area, production, and crop yield in Chamoli district from 2013 to 2023. It was observed that the total area decreased by 5.4%, while total production increased by 28.7%, and yield rose to 0.41 MT/ha during this period.

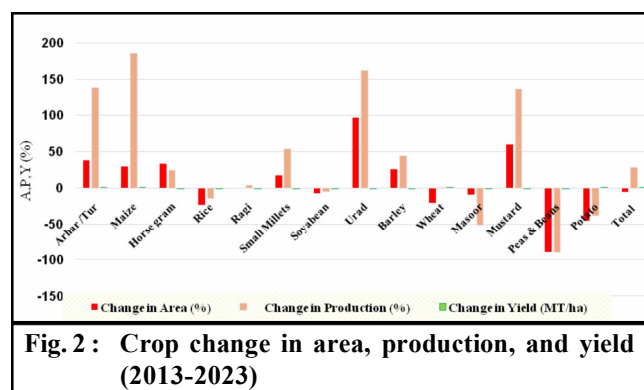


Fig. 2 : Crop change in area, production, and yield (2013-2023)

Changes the agricultural area of the crop:

Fig.3. Analysis from 2013 to 2023 shows that Chamoli district experienced a notable shift in cropping patterns: traditional staples like rice (-23.7%), wheat (-20.1%), peas and beans (-89.3%), masoor (-8.8%), soybeans (-7.3%), and especially potatoes (-45.1%) saw significant declines in cultivated area. Meanwhile, pulses and oilseeds expanded—urad (+97.3%), mustard (+60.4%), and arhar (+38.3%) led the growth—supported by moderate gains in maize (+30%), horse gram (+33.3%), and small millets (+17.9%). Despite a 5.4% decrease in total arable land, overall crop production increased by 28.7%, driven by sharp rises in maize

(+185.7%), urad (+162.2%), arhar (+138.2%), and mustard (+136.7%). Yield improvements across most crops—especially potato (+1.27 MT/ha), maize (+1.08 MT/ha), and wheat (+0.37 MT/ha)—reflect a shift toward more intensive and efficient farming practices in the district.

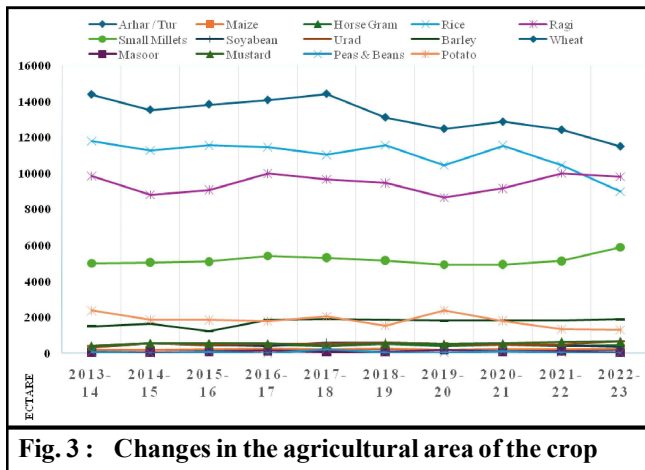


Fig. 3 : Changes in the agricultural area of the crop

Change in total area(ha), production (MT), and yield of crops (MT/ha)from 2013 to 2023:

Fig. 4: Wheat experienced the most significant growth, with area increasing by approximately 2.4 lakh hectares, production reaching 2.45 lakh metric tonnes, and yield improving to 1.8 MT/ha. Rice also expanded notably—1.8 lakh hectares in area, 2.1 lakh MT in production, and 1.6 MT/ha in yield. Urd and soybean followed with strong gains: Urd covered 1.5 lakh hectares, produced 1.7 lakh MT, and yielded 1.5 MT/ha; soybean reached 1.6 lakh hectares, 1.65 lakh MT in production, and 1.4 MT/ha in yield. Potato and maize showed moderate increases, while crops like barley, horse gram, ragi, small millets, and mustard remained largely

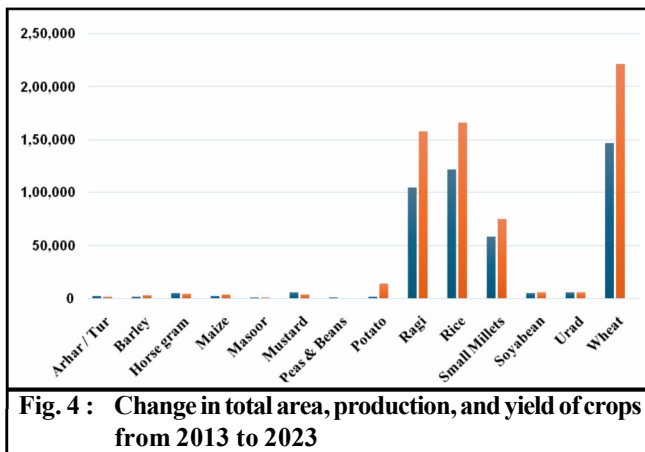


Fig. 4 : Change in total area, production, and yield of crops from 2013 to 2023

unchanged, each staying below 50,000 hectares in area and 40,000 MT in production, with little improvement in yield. Overall, the decade saw a clear shift toward high-yield crops like wheat, rice, and urd, reflecting changing priorities and improved farming practices.

Land Use Change Analysis (2013–14 to 2022–23):

The data reveal a significant shift in land use across the Chamoli district over the decade. While the total reported area stayed constant at 801,000 hectares, internal land use categories experienced notable changes, reflecting ecological transitions and socio-economic pressures. There is a sharp decline in cultivable barren land, which has decreased by 20.51%, suggesting land abandonment or reclassification. Similarly, current fallow land decreased by 26.19%, and other fallow land dropped by 30.56%, indicating a reduction in seasonal or rotational farming. The net sown area, representing the actual cropped land, contracted by 11.89%, while the gross sown area fell by 11.43%, and land sown more than once decreased by 9.52%. These declines indicate a clear contraction in agricultural activity, possibly driven by migration, aging farmers, or declining profits in traditional crops. In contrast, some land use categories showed growth. Barren and uncultivable land increased by 3.16%, signalling potential land degradation or long-term abandonment. Area under trees and bushes expanded by 16.67%, possibly reflecting a shift toward horticulture, agroforestry, or natural regeneration (Table 2).

The forest area saw a marginal increase of 0.25%, suggesting stable forest management with limited encroachment or reforestation activity. Meanwhile, other usable lands, except for agriculture, declined by 16.67%, which may be attributed to urbanization, infrastructure development, or tourism-related land conversions.

People's perception:

Analysis of Change in Major Crop Production:

The researcher conducted a study across 108 villages selected through random sampling from three key elevation zones: 500–1500/ m, 1500–2500/ m, and above 2500/ m. This study aimed to analyse changes in the production of major crops such as potato, wheat, barley, rice, mandua, mustard, urad, and maize in 2023 and 2024. The findings, summarized in Table 3, show that the data were collected through field surveys using questionnaires, schedules, and interviews.

We analysed crop production showed a

Table 2 : Land Use Change in Chamoli District from 2013–14 to 2022–23

Sr. No.	Land Use Type	2013–14 Area (ha)	2022–23 Area (ha)	% Change
1.	Total Reported Area	801000	801000	0.00%
2.	Forest Area (as per ISFR)	603000	604500	0.25%
4.	Current Fallow Land	4200	3100	-26.19%
5.	Other Fallow Land	3600	2500	-30.56%
6.	Barren and Uncultivable Land	9500	9800	3.16%
7.	Cultivated Barren Land	7800	6200	-20.51%
8.	Pastureland	1200	1200	0.00%
9.	Area under Trees and garden	1800	2100	16.67%
10.	Gross Cropped Area	41200	36500	-11.41%
11.	Net Sown Area	32800	28900	-11.89%
12.	Field Sown More Than Once	8400	7600	-9.52%
13.	Gross Sown Area	41200	36500	-11.41%

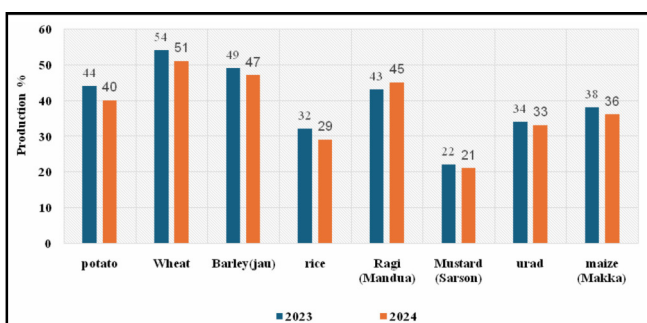
(Source: Socio-Economic Analysis and District at a Glance)

Table 3 : Production of Major Crops in % (2023-24)

Sr. No.	Crops name	2023	2024
1.	Potato	44	40
2.	Wheat	54	51
3.	Barley (jau)	49	47
4.	Rice	32	29
5.	Ragi (Mandua)	43	45
6.	Mustard (Sarson)	22	21
7.	Urad	34	33
8.	Maize (Makka)	38	36

(Source: Compiled by Researcher Based on Primary Data)

predominantly declining trend, with notable decreases in potato (-4 units), wheat (-3), rice (-3), and barley (-2), while only ragi (mandua) registered a modest increase (+2), suggesting a potential shift in cultivation preferences or agro-climatic suitability (Fig. 5).

**Fig. 5 : Production of Major Crops in % (2023-24)**

Conclusion:

This study highlights significant changes in agriculture in the Chamoli district from 2013 to 2023. While traditional crops like rice, wheat, and potatoes have decreased in both area and production, crops such as maize, urad, mustard, and arhar have grown considerably,

showing higher yields and better adaptability to changing conditions. Despite a 5.4% reduction in total cultivated land, overall crop production increased by 28.7%, and the average yield rose to 1.41 MT/ha. This suggests that farmers are adopting more efficient and resilient cropping practices. Land use data shows a decline in net sown and fallow areas, along with an increase in tree cover and uncultivable land—reflecting ecological shifts and socio-economic changes such as migration and decreased farming interest. Field surveys across 108 villages indicate that farmers are adapting to climate variability and market pressures, although challenges remain—especially regarding irrigation, profitability, and crop reliability. The future of agriculture in Chamoli district relies on smart crop choices, ecological awareness, and empowering farmers with the tools and knowledge they need to succeed.

REFERENCES

- Bisht, I. S., Mehta, P. S., Negi, K. S., Rawat, R., Singh, R., & Garkot, S. (2017). Wild plant food resources in agricultural systems of Uttarakhand Hills in India and its potential role in combating malnutrition and enhancing human health. *J. Food Sci. Toxicol*, **2**(1) : 3.
- Chand, R. (1996). Diversification through high-value crops in western Himalayan Region: Evidence from Himachal Pradesh. *Indian J. Agric. Econ.*, **41**(4) : 652-663
- FAO (2015). Statistical Pocketbook World Food and Agriculture, Food and Agriculture Organization of the United Nations, Rome.
- Majhi, B. and Kumar, A. (2018). Changing cropping patterns in Indian agriculture. *J. Economic & Social Development*,

14(1) : 37-45.

Himalayas (pp. 17-27).

Sati, V. P. and Vangchhia, L. (2018). Changing agriculture and cropping patterns in Mizoram, Northeast India. In *Proceedings of a conference on Climate change: Impact, adaptation & response in the Eastern*

Verma, A., Kumar, M. and Bisht, S. (2022). Changing patterns of agriculture in Uttarakhand state from 2010-2020. *IOSR Journal of Economics and (2018)d Finance (IOSRJEF)*, 1-10.
