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Geospatial crop concentration analysis using GIS techniques in Parbhani district

Ankush Ramrao Gaike and Dr. Vijay Baisane

Abstract
Crop concentration patterns in a given region are examined in this study, which looks at changes in crop density and distribution between 2001-02 and 2020-21 for a variety of crops, including rice, wheat, jowar, bajra, maize, pulses, sugarcane, cotton, spices, and oilseeds. Crop concentration indices were calculated using the Bhatia method, and the results showed significant variation in concentration levels across tehsils, influenced by factors like soil conditions, water availability, and climatic changes. Some crops, like rice and sugarcane, showed a marked decline in areas where water scarcity increased, while drought-resistant crops, like bajra and pulses, expanded. The study provides insights into sustainable farming practices under changing climate scenarios and emphasizes the crucial role that socioeconomic and agroclimatic factors play in determining crop concentration.

Keywords: Cropping pattern, crop concentration, quarter classifications

Introduction
An agricultural region is a continuous area with a clearly defined outside boundary and some degree of uniformity. Similar to how the northwest portion of Maharashtra's block soil may be referred to be a cotton area of Peninsular India, we may distinguish between the rice region in the country's eastern Great Plains and the wheat region in Punjab and Haryana. The notions of cropping patterns, crop concentration and diversification, crop combination, and agricultural productivity must all be explained in depth when considering the significance of agricultural terminology in agricultural regionalization.
Since 60% of the population makes their living from agriculture and related industries, it remains the most important sector of the Maharashtra state economy. The state's gross cultivated area is around 69 hectares, while its total size is 1.50 lakh square kilometers. Maharashtra has consistently performed well in terms of agricultural output, and its farmers are comparatively more adaptable to shifting market dynamics and technological advancements. Through the implementation of various development plans and the dissemination of pertinent technology to increase output, the Agriculture Department has taken on the task of achieving a greater growth rate in agriculture. Because it offers a solid foundation for agricultural regionalization, the study of cropping patterns is a crucial component of agricultural geography. It is uncommon for one crop to completely isolate other crops in a given location at a given time; instead, the crops are typically produced in combinations. Crop regions are shaped by physical forces, and their extension is determined by socioeconomic interactions. It is impossible to overstate how crucial it is for emerging nations like India to adopt appropriate cropping patterns. Agriculture cannot expand horizontally without significant financial investments.

Study Region
The selected topic for this study is Parbhani. Situated between latitudes 18° 45' N and 20° 10' N and longitudes 76° 13' E and 77° 26' E, it is located in the central area of Maharashtra. Administratively, it is bordered to the north by the Hingoli district, to the east by Nanded, to the south by Latur, and to the west by the districts of Beed and Jalna. The study region covers 6511 km^2 or 2.11 percent of the state of Maharashtra's total area. The Parbhani district is located on the Deccan Plateau; 457 meters above sea level, the majority of the area is rocky. The Purna, Dudhana, and Kapra rivers are significant waterways in the Parbhani

district. The summers in the Parbhani districts are hot, and the winters are cold. In 2011, 1836086 people were living in the study region, or 1.63 percent of Maharashtra's total population. Administratively, the research area is separated into nine tahsils: Parbhani, Pathri, Manvat, Selu, Jintur, Gangakhed, Palam, Sonpeth, and Purna.

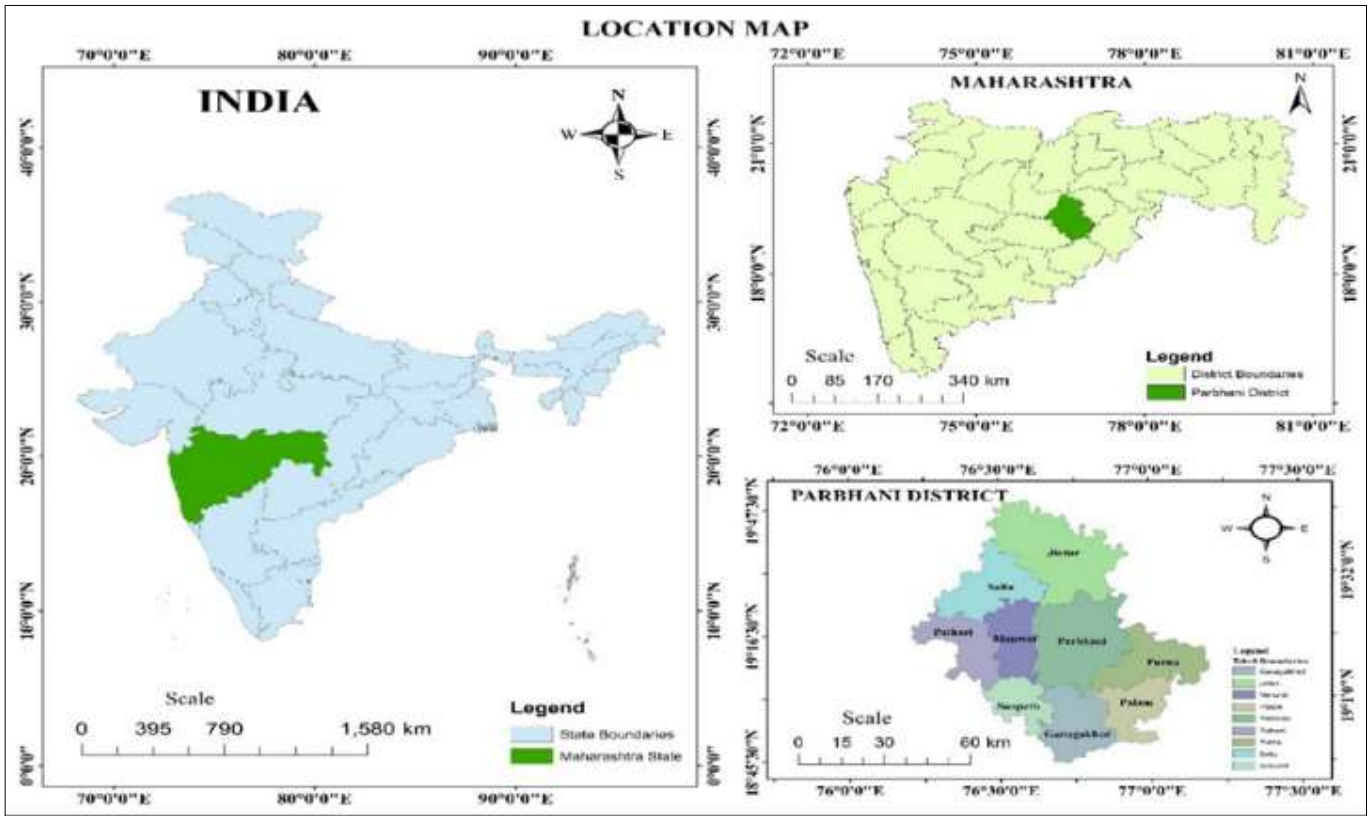

Fig 1: The figure shows the location map of Parbhani District within the state of Maharashtra, India, highlighting its boundaries within the state and its subdivisions

Objective

The following are the study objectives for this paper:

1. To examine how the cropping patterns of major crops in the study area.
2. To study the spatial distribution and concentration of crops in Parbhani district.
3. To analysis the current crop concentration scenario in study area.

Methodology

Determining the district's agricultural concentration and diversification for 2001–02 and 2021–22 is the aim of the current study. For this study, ten important crops that are cultivated in this region were carefully chosen. The data used in this study originated from secondary sources. The Department of Economics and Statistics, the Parbhani District Handbook, and the district's socioeconomic summary provide the data needed for study. Bhatia's approach was used in the study to first determine the crop concentration, which was subsequently assessed using a formula. It should be mentioned that higher index values correspond to greater concentration and vice versa. On the other hand, if the concentration value becomes close to 1, there will be more concentration. The formula of the Bhatia's crop concentration index is:

Bhatia's Crop Concentration Index (1965)

$$= \frac{\text{Area of } x \text{ crop in the component areal unit}}{\text{Area of all crops in the component areal unit}} \div \frac{\text{Area of } x \text{ crop in the entire region}}{\text{Area of all crops in the entire region}}$$

Several statistical techniques have been developed and applied to identify areas of crop concentration. Florence assessed an enterprise's proportion to the region as a whole using a location quotient. Even though it was straightforward, the findings where not ideal as socioeconomic factors were not included when evaluating the significance of an organization. By computing the difference between the regional and national proportions of the area covered by a defined enterprise and a specific enterprise, sought to quantify relative regional concentration. The location quotient method was employed by Bhatia (1965) [2] to ascertain the spatial concentration of crops.

Result and Discussion

Crop concentration patterns show how the density of any crop varies over time in a particular area. The concentration of a crop in a given region is mostly determined by its topography, temperature, soil conditions, and moisture content. There is a minimum, maximum, and optimal temperature range for each crop. It tends to accumulate in areas with ideal agroclimatic conditions and to become less dense as geographic conditions deteriorate.

Table 1: Index of Determination of Crop Concentration (2001-02 & 2020-21)

Crop	Decade	Selu	Jintur	Parbhani	Manwat	Pathari	Sonpeth	Gangakhed	Palam	Purna
Rice	2001-02	0.39	3.10	0.71	0.43	0.61	0.23	0.72	2.27	0.41
	2020-21	0	0	0	0	0	0	0	0	0
Wheat	2001-02	1.48	0.00	1.43	0.43	0.00	0.00	0.00	0.00	4.59
	2020-21	1.31	0.97	1.06	1.06	0.94	0.28	0.72	0.67	1.61
Jowar	2001-02	0.80	0.55	0.90	1.12	0.78	1.17	1.13	1.60	1.36
	2020-21	1.07	0.86	0.90	0.91	1.05	1.07	1.28	1.31	0.79
Bajara	2001-02	1.47	0.30	0.92	1.56	1.75	0.73	2.14	0.24	0.00
	2020-21	0.59	0.13	0.00	0.72	2.49	3.43	2.20	2.32	0.00
Maize	2001-02	0.84	0.66	0.70	2.86	1.31	0.99	1.13	1.07	1.29
	2020-21	0.62	0.22	0.71	1.08	1.76	1.95	1.43	1.65	1.15
Pulses	2001-02	1.07	1.36	1.47	0.76	1.40	0.43	0.53	0.76	0.12
	2020-21	1.02	1.43	1.06	0.89	0.67	0.93	0.91	0.66	0.83
Sugarcane	2001-02	2.42	0.67	1.42	1.70	0.00	0.00	0.40	0.37	0.85
	2020-21	0.04	0.01	0.53	0.93	4.48	0.80	1.03	0.31	2.51
Cotton	2001-02	0.93	1.43	0.67	0.88	1.10	1.52	1.43	0.69	0.88
	2020-21	1.49	0.76	0.90	1.35	1.09	1.35	0.96	1.17	0.41
Spices	2001-02	1.24	0.62	0.59	2.92	1.78	1.11	1.15	0.70	0.79
	2020-21	0.70	0.78	0.79	1.42	1.17	0.96	1.02	1.21	1.47
Oilseeds	2001-02	1.75	0.79	0.82	2.34	1.28	1.28	0.82	0.25	0.57
	2020-21	0.65	1.06	1.13	0.84	0.71	0.86	1.02	1.13	1.39

Source: Computed by Researcher

Table 2: Degree of Concentration based on quartile classification

Crop Index Value		Degree of Concentration			
		Very Low Concentration	Low Concentration	High Concentration	Very High Concentration
Rice	2011	< 0.39	0.40 – 0.43	0.44 – 0.72	> 0.72
	2021	0	0	0	0
Wheat	2011	< 0.43	0.44 - 1.43	1.44 - 1.48	> 1.48
	2021	< 0.67	0.68 - 0.97	0.98 - 1.06	> 1.06
Jowar	2011	< 0.78	0.79 - 0.90	0.91 - 1.17	> 1.17
	2021	< 0.86	0.87 - 0.91	0.92 – 1.07	> 1.07
Bajara	2011	< 0.30	0.31 – 0.92	0.93 - 1.47	> 1.47
	2021	< 0.13	0.14 – 0.72	0.73 – 2.32	> 2.32
Maize	2011	< 0.70	0.71 – 0.99	1 - 1.13	> 1.13
	2021	< 0. 62	0.63 - 1.08	1.09 - 1.43	> 1.43
Pulses	2011	< 0.43	0.44 – 0.76	0.77 – 1.36	> 1.36
	2021	< 0.67	0.68 – 0.89	0.90 – 0.93	>0.93
Sugarcane	2011	< 0.40	0.41 - 0.85	0.86 - 1.70	> 1.70
	2021	< 0.04	0.05 - 0.53	0.54 - 1.03	> 1.03
Cotton	2011	< 0.69	0.70 - 0.88	0.89 – 1.10	> 1.10
	2021	< 0. 76	0.77 - 0.96	0.97 – 1.17	> 1.17
Spices	2011	< 0.62	0.63 – 0.79	0.80 - 1.24	> 1.24
	2021	< 0. 79	0.80 - 1.02	1.03 – 1.21	> 1.21
Oilseeds	2011	< 0.57	0.58 – 0.82	0.83 – 1.28	> 1.28
	2021	< 0.71	0.72 - 0.86	0.87 - 1.06	> 1.06

Source: Computed by Researcher

Rice Crop Concentration Index (2001-02 & 2020-21)

The Rice crop includes a total cropped area of roughly 9600 hectares, constituting 1.27% of the total cultivated land. Jintur (3.10) and Palam (2.27) showed very high rice concentration due to favorable geographical conditions, such as ample water resources and fertile soil. Tehsils like Gangakhed (0.72), Parbhani (0.71) and Pathri (0.61) had a high concentration, reflecting moderate suitability for rice cultivation. Manwat (0.43) and Purna (0.41) with low concentration, likely had limited irrigation or less favorable soil. Very low concentrations in Sonpeth (0.39) and Selu (0.27) might be due to water scarcity or unfavorable terrain. By 2020-21, rice cultivation had completely disappeared, likely due to changing climatic conditions, reduced water availability, or a shift in agricultural focus to other crops better suited to the region's evolving conditions.

Wheat Crop Concentration Index (2001-02 & 2020-21)

The Wheat crop includes a total cropped area of roughly 32265 hectares, constituting 4.27% of the total cultivated land. In 2001-02, wheat cultivation was highly concentrated in the tehsil of Purna (4.59), likely due to favorable conditions such as well-irrigated lands, suitable winter temperatures, and fertile soils. Selu (1.48) exhibited high crop concentration, indicating moderately favorable conditions for wheat, perhaps aided by localized irrigation systems. Parbhani (1.43), with a low concentration, might have had limited water availability or a preference for other crops like cotton or pulses. Manwat (0.43) had very low concentration, suggesting geographical or climatic constraints, possibly due to less fertile land or inadequate irrigation. The remaining tehsils had no wheat cultivation, likely due to water scarcity, unsuitable soil, or preference for crops more suited to their local environment.

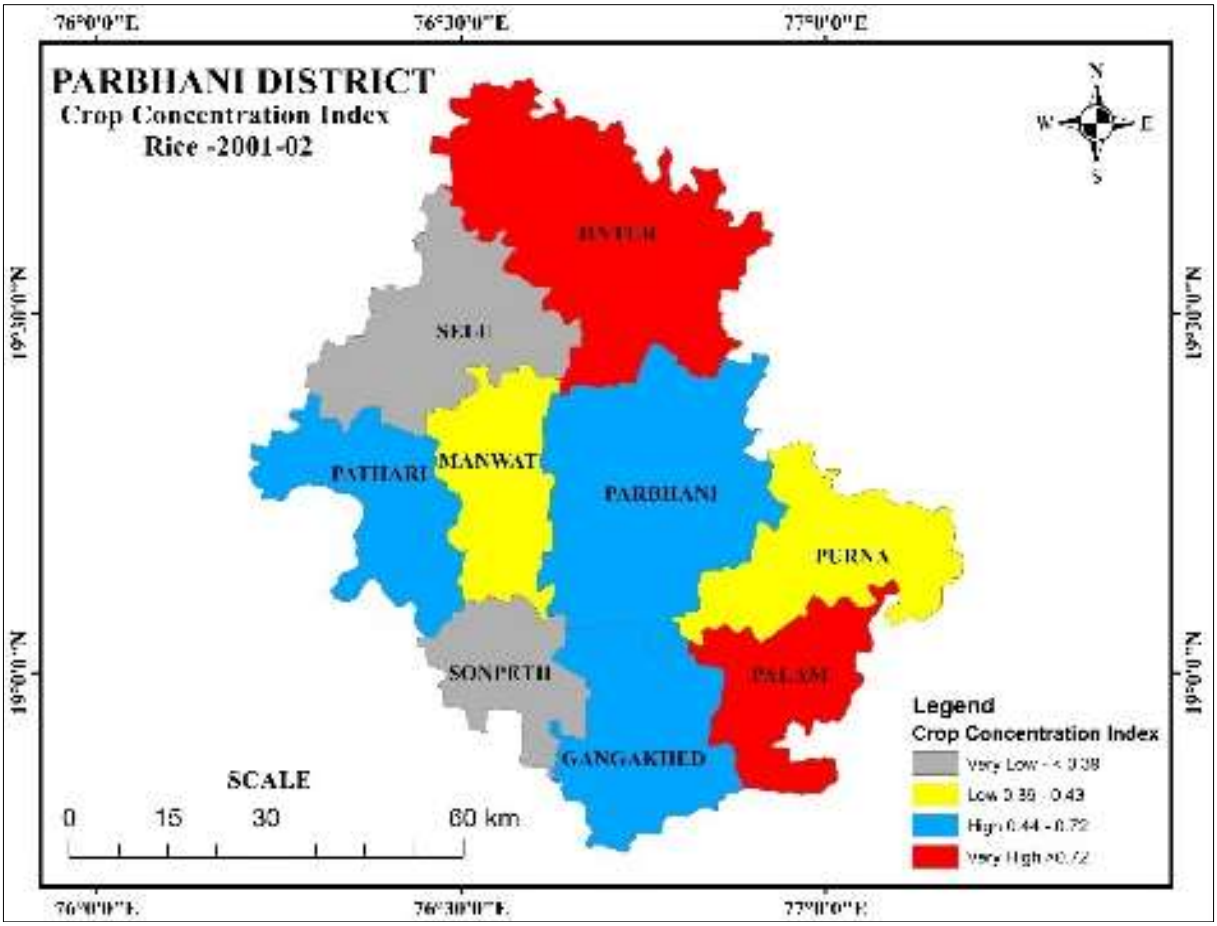

Fig 2: The figure illustrates the crop concentration index for rice in different tehsils of Parbhani District for the year 2001-02, with varying levels of concentration depicted through a color-coded legend

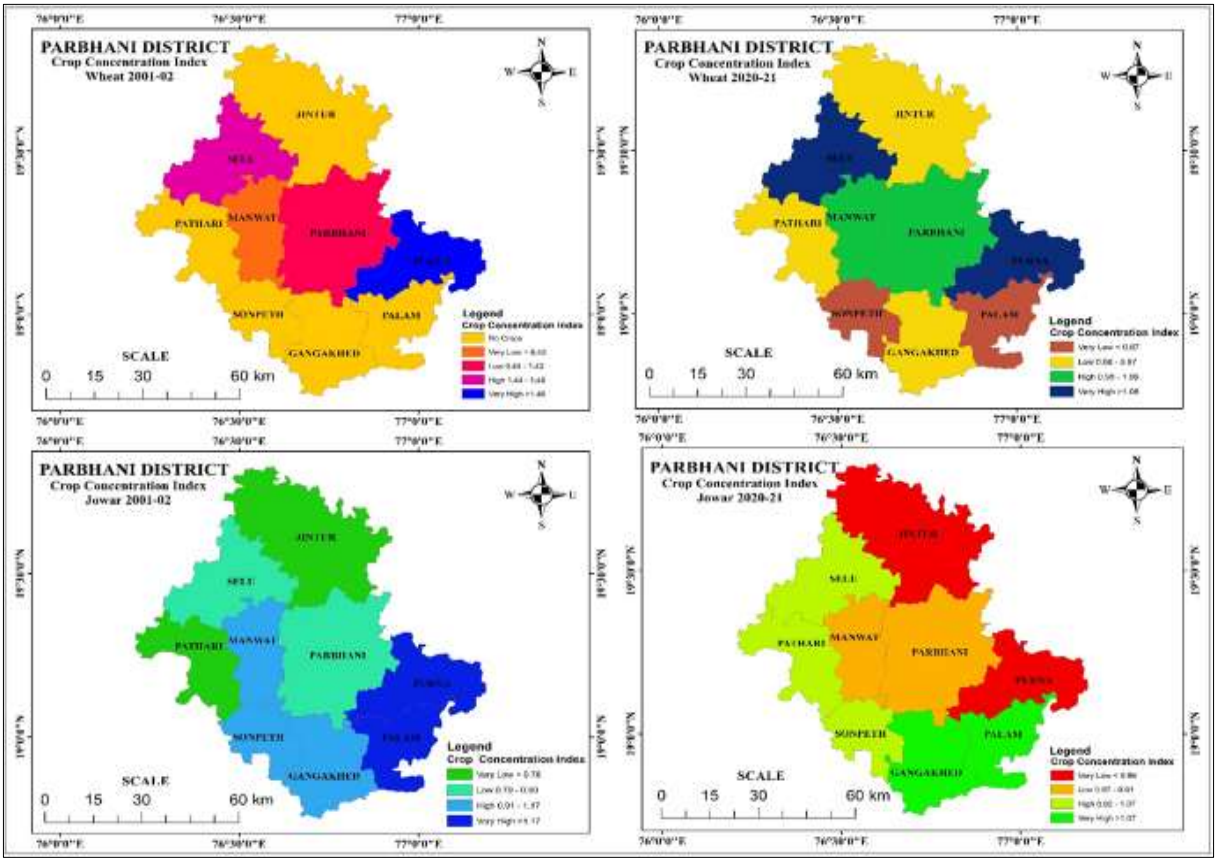

Fig 3: The figure presents the crop concentration index maps for wheat and jowar in Parbhani District for the years 2001-02 and 2020-21, using distinct color codes to show varying levels of concentration across different tehsils

The Wheat crop includes a total cropped area of roughly 39014 hectares, constituting 4.71% of the total cultivated land. By 2020-21, wheat concentration had decreased in all tehsils, with Purna (1.61) and Selu (1.31) still maintaining very high concentration, indicating that these regions remained favorable for wheat cultivation despite overall declines. Parbhani and Manwat (1.06) showed high concentration, which might suggest improved water management or an increased focus on wheat as part of crop diversification. Jintur (0.97), Pathri (0.94), and Gangakhed (0.72) had low concentration, possibly due to less favorable climatic or soil conditions. Palam (0.67) and Sonpeth (0.28), with very low concentration, likely faced water shortages or other geographical challenges, leading to a shift in focus toward crops better suited to local conditions.

Jowar Crop Concentration Index (2001-02 & 2020-21)

The Jowar crop includes a total cropped area of roughly 272442 hectares, constituting 36.06% of the total cultivated land. In 2001-02, jowar (sorghum) cultivation had very high concentration in Palam (1.60) and Purna (1.36), likely due to these areas' suitability for rain-fed crops, with moderate rainfall and soils favorable for jowar. Gangakhed (1.13) and Manwat (1.12) had high concentrations, reflecting regions with similar semi-arid conditions conducive to jowar growth. Parbhani (0.90) and Selu (0.80) showed low concentrations, possibly due to mixed cropping systems or marginally less favorable agronomic conditions. Pathri (0.78) and Jintur (0.55), with very low concentrations, likely faced geographical limitations, such as more arid conditions or less reliance on jowar as a staple crop, leading to a preference for other cereals.

The Jowar crop includes a total cropped area of roughly 103640 hectares, constituting 12.50% of the total cultivated land. By 2020-21, jowar concentration shifted slightly, with Palam (1.31) and Gangakhed (1.28) maintaining very high crop concentration, indicating their continued suitability for jowar despite overall changes in cropping patterns. Sonpeth, Selu (1.07), and Pathri (1.05) had high concentrations, which may reflect improved agronomic practices or greater focus on jowar as a resilient crop in these tehsils. Manwat (0.91) and Parbhani (0.90) continued with low concentrations, showing stability in their cropping patterns. Jintur (0.86) and Purna (0.79), with very low concentrations, likely faced decreased jowar cultivation due to changing climatic conditions, water scarcity, or a shift toward more profitable or water-efficient crops.

Bajara Crop Concentration Index (2001-02 & 2020-21)

The Bajara crop includes a total cropped area of roughly 9563 hectares, constituting 1.27% of the total cultivated land. In 2001-02, bajra (pearl millet) cultivation was highly concentrated in Gangakhed (2.14), Pathri (1.75), and Manwat (1.56), likely due to these areas' suitability for drought-tolerant crops like bajra, which thrives in semi-arid conditions withlow water requirements. Selu (1.47) also had high concentration, reflecting favorable agro-climatic conditions.

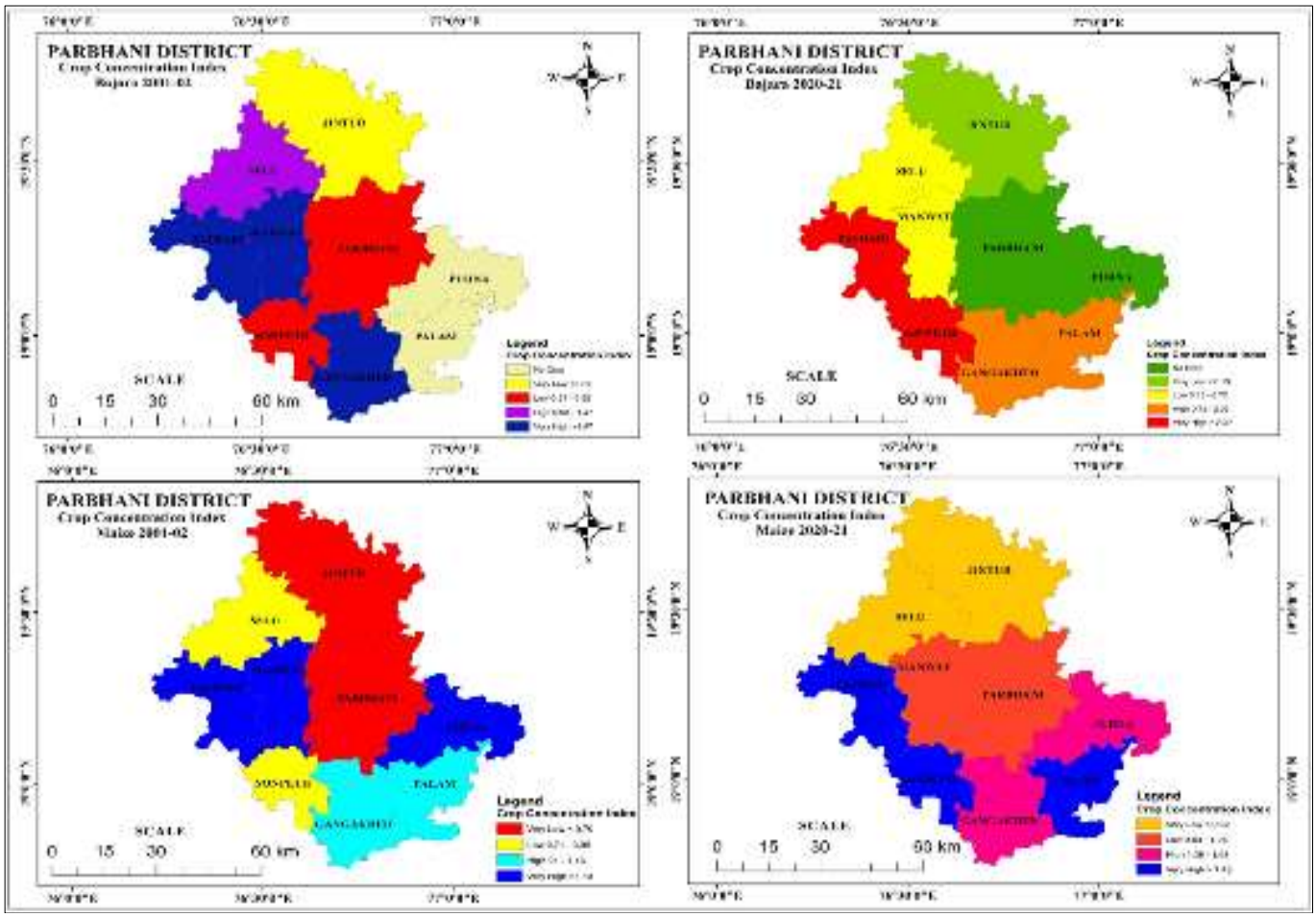

Fig 4: The figure displays crop concentration index maps for rabi jowar and maize in Parbhani District, comparing data from the years 2001-02 and 2020-21, with color coding to indicate different concentration levels across tehsils.

Parbhani (0.92) and Sonpeth (0.73) showed low concentrations, possibly due to less ideal growing conditions or crop diversification. Jintur (0.30) and Palam (0.24), with very low concentrations, likely faced more arid conditions or farmers' preference for other cereals better suited to their soils and climate.

The Jowar crop includes a total cropped area of roughly 608 hectares, constituting 0.07% of the total cultivated land. By 2020-21, bajra cultivation had significantly increased in Sonpeth (3.43) and Pathri (2.49), showing very high concentration, which may indicate a growing reliance on drought-tolerant crops as water resources declined or due to climatic changes. Palam (2.32) and Gangakhed (2.20) had high concentration, reflecting continued suitability for bajra and possible expansion in cultivation due to shifting agricultural priorities. Manwat (0.72) and Selu (0.59) saw low concentrations, likely due to competition from other crops or changing rainfall patterns. Jintur (0.13), with very low concentration, and other tehsils with zero concentration likely shifted away from bajra due to changing climatic conditions or a transition to more profitable crops.

Maize Crop Concentration Index (2001-02 & 2020-21)

The Maize crop includes a total cropped area of roughly 2136 hectares, constituting 0.28% of the total cultivated land. In 2001-02, maize cultivation had very high concentration in Manwat (2.86), Pathri (1.31), and Purna (1.29), likely due to these areas' favorable soil conditions and sufficient rainfall, making them ideal for maize production. Gangakhed (1.13) and Palam (1.07) had high concentration, reflecting moderate conditions for maize, with access to irrigation likely playing a key role. Sonpeth (0.99) and Selu (0.84) showed low concentration, indicating less favorable agronomic conditions or a preference for other staple crops. Parbhani (0.70) and Jintur (0.66), with very low concentrations, likely faced geographical limitations, such as less fertile soils or lower water availability, reducing the focus on maize cultivation.

The Maize crop includes a total cropped area of roughly 3732 hectares, constituting 0.45% of the total cultivated land. By 2020-21, maize cultivation patterns shifted slightly, with Sonpeth (1.95), Pathri (1.76), and Palam (1.65) showing very high concentration, indicating that these tehsils remained favorable for maize, possibly due to improved agricultural practices or increased focus on drought-resistant crops. Gangakhed (1.43) and Purna (1.15) maintained high concentration, reflecting steady conditions for maize cultivation. Manwat (1.08) saw a reduction to low concentration, perhaps due to changing rainfall patterns or competition from other crops. Parbhani (0.71) and Selu (0.62) remained in low and very low concentration, respectively, likely due to less suitable conditions, while Jintur (0.22) continued its very low concentration, reflecting a significant decline in maize cultivation due to geographical or environmental factors.

Pulses Crop Concentration Index (2001-02 & 2020-21)

The Pulses crop includes a total cropped area of roughly 182910 hectares, constituting 24.21% of the total cultivated land. In 2001-02, pulse cultivation had a very high concentration in Parbhani (1.47) and Pathri (1.40), likely due to favorable soil conditions and moderate rainfall suited for pulse crops. Jintur (1.36) and Selu (1.07) showed high concentrations, indicating these tehsils were also well-suited for pulses, possibly due to the adoption of rain-fed agriculture. Manwat, Palam (0.76), and Gangakhed (0.53) had low concentrations, which might reflect less favorable agro-climatic conditions or crop diversification strategies. Sonpeth (0.43) and Purna (0.12), with very low concentrations, likely faced geographical limitations like less fertile soils or water scarcity, leading to less focus on pulse crops compared to other staples.

The Pulses crop includes a total cropped area of roughly 197902 hectares, constituting 23.87% of the total cultivated land. By 2020-21, pulse cultivation shifted slightly, with Jintur (1.43), Parbhani (1.06), and Selu (1.02) maintaining very high concentrations, suggesting these regions remained favorable for pulses due to consistent rainfall and suitable soil. Sonpeth (0.93) and Gangakhed (0.91) showed high concentrations, possibly due to improved irrigation or an increased focus on pulses as a water-efficient crop. Manwat (0.89) and Purna (0.83) had low concentrations, reflecting stable but less optimal conditions for pulses. Pathri (0.67) and Palam (0.66), with very low concentrations, likely faced decreased suitability for pulses, possibly due to changes in rainfall patterns or competition from more profitable or resilient crops.

Sugarcane Crop Concentration Index (2001-02 & 2020-21)

The Sugarcane crop includes a total cropped area of roughly 14014 hectares, constituting 1.86% of the total cultivated land. In 2001-02, sugarcane cultivation had very high concentration in Selu (2.42), likely due to access to irrigation facilities, fertile soils, and suitable climatic conditions for water-intensive crops like sugarcane. Manwat (1.70) and Parbhani (1.42) showed high concentrations, reflecting moderately favorable conditions with adequate water sources. Purna (0.85) and Jintur (0.67) had low concentrations, likely due to limited irrigation and less ideal conditions for sugarcane. Gangakhed (0.40) and Palam (0.37), with very low concentrations, likely faced geographical challenges such as water scarcity, while Pathri and Sonpeth did not cultivate sugarcane, likely due to unsuitability for this crop.The Sugarcane crop includes a total cropped area of roughly 33044 hectares, constituting 3.99% of the total cultivated land. By 2020-21, the sugarcane concentration shifted significantly, with Pathri (4.48) and Purna (2.51) showing very high concentration, suggesting improved irrigation infrastructure and a focus on high-revenue crops like sugarcane. Gangakhed (1.03), Manwat (0.93), and Sonpeth (0.80) had high concentrations, indicating better water management and an increase in sugarcane cultivation. Parbhani (0.53) and Palam (0.31) showed low concentrations, likely due to reduced water availability or a shift towards less water-intensive crops. Selu (0.04) and Jintur (0.01), with very low concentrations, likely experienced a significant decline in sugarcane cultivation due to water scarcity, soil degradation, or changing crop priorities.

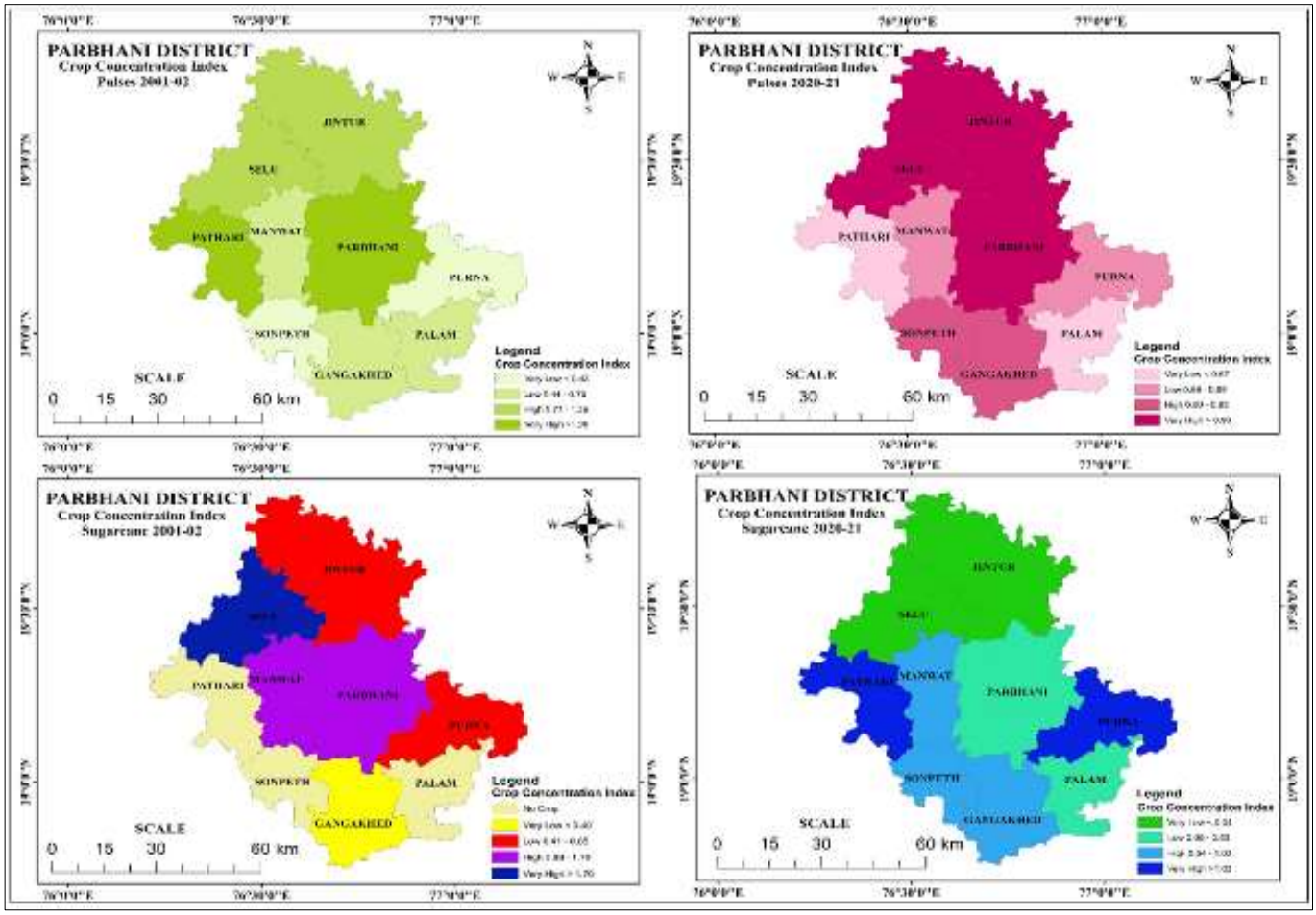

Fig 5: The figure shows the crop concentration index maps for pulses and sugarcane in Parbhani District, contrasting data from 2001-02 and 2020-21, with different concentration levels represented through color gradients across various tehsils

Cotton Crop Concentration Index (2001-02 & 2020-21)

The Cotton crop includes a total cropped area of roughly 203362 hectares, constituting 26.92% of the total cultivated land. In 2001-02, cotton cultivation had very high concentration in Sonpeth (1.52), Jintur, and Gangakhed (1.43), reflecting the suitability of these regions for cotton, likely due to their black cotton soil and moderate rainfall. Pathri (1.10) and Selu (0.93) had high concentrations, indicating favorable agronomic conditions, though perhaps with slightly less access to water or inputs than the highest-ranking tehsils. Manwat and Purna (0.88) showed low concentrations, likely due to mixed cropping patterns or marginally less suitable soils. Palam (0.69) and Parbhani (0.67), with very low concentrations, likely faced geographical or water limitations, making cotton a less dominant crop in these tehsils.

The Cotton crop includes a total cropped area of roughly 199683 hectares, constituting 24.08% of the total cultivated land. By 2020-21, cotton cultivation patterns shifted, with Selu (1.49), Manwat, and Sonpeth (1.35) showing very high concentrations, reflecting sustained or improved conditions for cotton, likely driven by favorable rainfall and perhaps better agricultural practices. Palam (1.27) and Pathri (1.09) had high concentrations, suggesting improved conditions for cotton cultivation or a shift in focus toward this high-value crop. Gangakhed (0.96) and Parbhani (0.90) had low concentrations, reflecting stable but less dominant cotton cultivation, possibly due to increased competition from other crops. Jintur (0.76) and Purna (0.41), with very low concentrations, likely faced declining cotton cultivation due to water scarcity or changing crop preferences.

Spices Crop Concentration Index (2001-02 & 2020-21)

The Spices crop includes a total cropped area of roughly 3408 hectares, constituting 0.45% of the total cultivated land. In 2001-02, spices cultivation had a very high concentration inManwat (2.92) and Pathri (1.78), likely due to favorable soil conditions and climate for spice crops, along with established cultivation practices. Selu (1.24), Gangakhed (1.15), and Sonpeth (1.11) showed high concentrations, indicating these tehsils were also well-suited for spices, potentially benefiting from good rainfall or irrigation infrastructure. Purna (0.79) and Palam (0.70) had low concentrations, likely due to less favorable conditions or competition with other crops. Jintur (0.62) and Parbhani (0.59), with very low concentrations, likely faced limitations such as soil type or water availability, making spices a less dominant crop in these regions.The Spices crop includes a total cropped area of roughly 1534 hectares, constituting 0.19% of the total cultivated land. By 2020-21, the spice cultivation pattern shifted, with Purna (1.47) and Manwat (1.42) showing very high concentrations, possibly due to improved irrigation or growing demand for spices. Palam (1.21) and Pathri (1.17) had high concentrations, reflecting favorable conditions or increased focus on spice production.

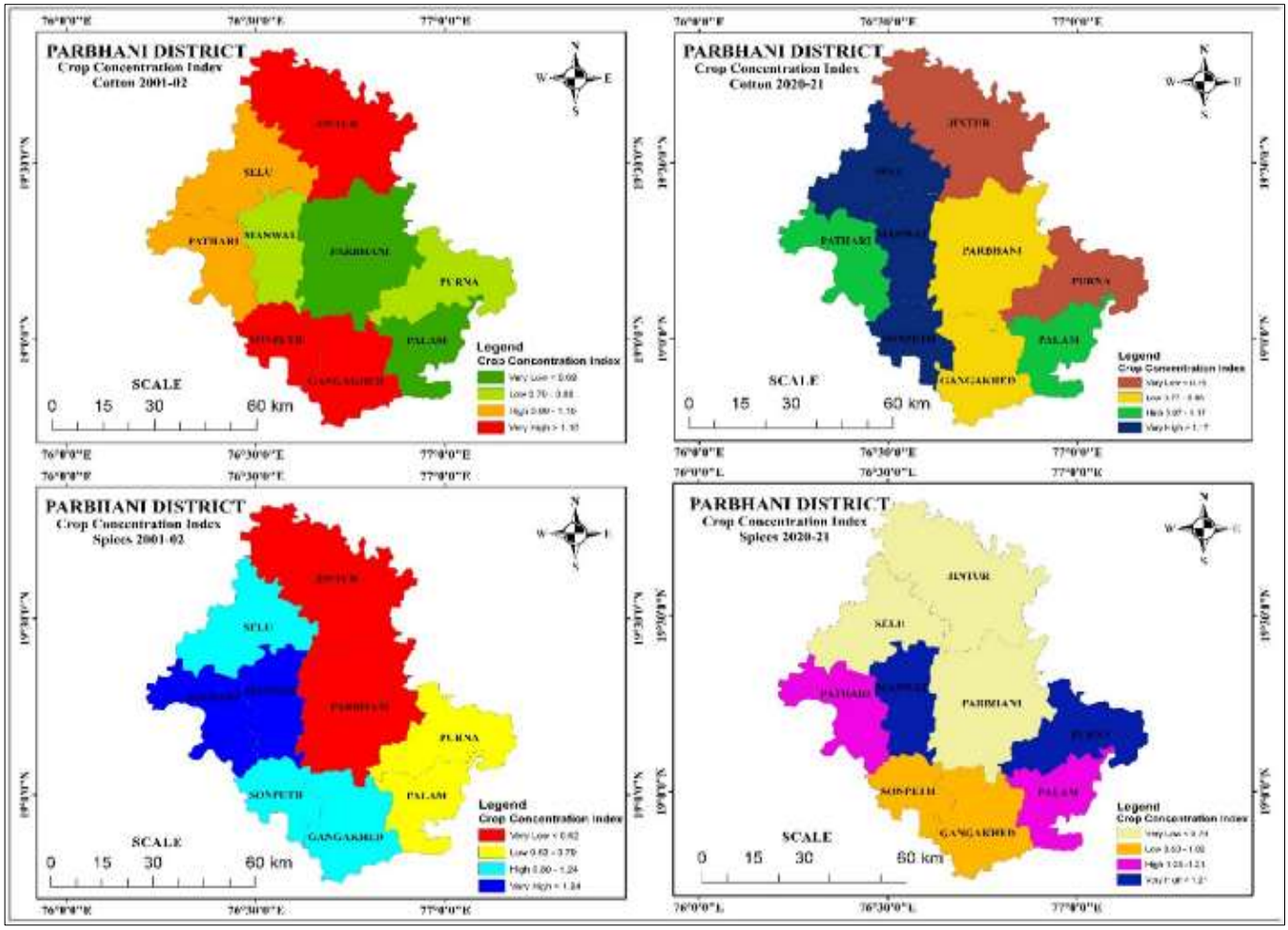

Fig 6: The figure depicts crop concentration index maps for cotton and spices in Parbhani District, comparing data from 2001-02 and 2020-21, with color-coded gradients indicating varying concentration levels across different tehsils

Gangakhed (1.02) and Sonpeth (0.96) saw low concentrations, suggesting stable but less extensive cultivation of spices. Parbhani (0.79), Jintur (0.78), and Selu (0.70), with very low concentrations, likely faced declining suitability for spice cultivation, possibly due to changing climate conditions, soil degradation, or a shift toward other crops.

Oilseeds Crop Concentration Index (2001-02 & 2020-21)

The Oil Seeds crop includes a total cropped area of roughly 25730 hectares, constituting 3.41% of the total cultivated land. In 2001-02, oilseeds cultivation had very high concentration in Manwat (2.34) and Selu (1.75), likely due to favorable soil conditions and the suitability of these areas for oilseed crops like groundnut and sunflower. Pathri and Sonpeth (1.28) showed high concentrations, indicating moderate conditions with sufficient water and soil fertility. Parbhani and Gangakhed (0.82), along with Jintur (0.79), had low concentrations, likely reflecting less favorable growing conditions or a focus on other crops. Purna (0.57) and Palam (0.25), with very low concentrations, likely had limited suitability for oilseed crops due to poor soil quality or insufficient rainfall.

The Spices crop includes a total cropped area of roughly 249920 hectares, constituting 30.14% of the total cultivated land. By 2020-21, the distribution of oilseeds cultivation shifted significantly. Purna (1.39), Palam, and Parbhani (1.13) had very high concentrations, possibly due to improved agricultural practices, better irrigation, or market demand for oilseeds. Jintur (1.06) and Gangakhed (1.02) showed high concentrations, indicating stable conditions for oilseeds. Sonpeth (0.86) and Manwat (0.84) had low concentrations, possibly due to a shift toward other crops. Pathri (0.71) and Selu (0.65), with very low concentrations, likely saw a decline in oilseed cultivation due to changing climatic conditions or a focus on more profitable crops.

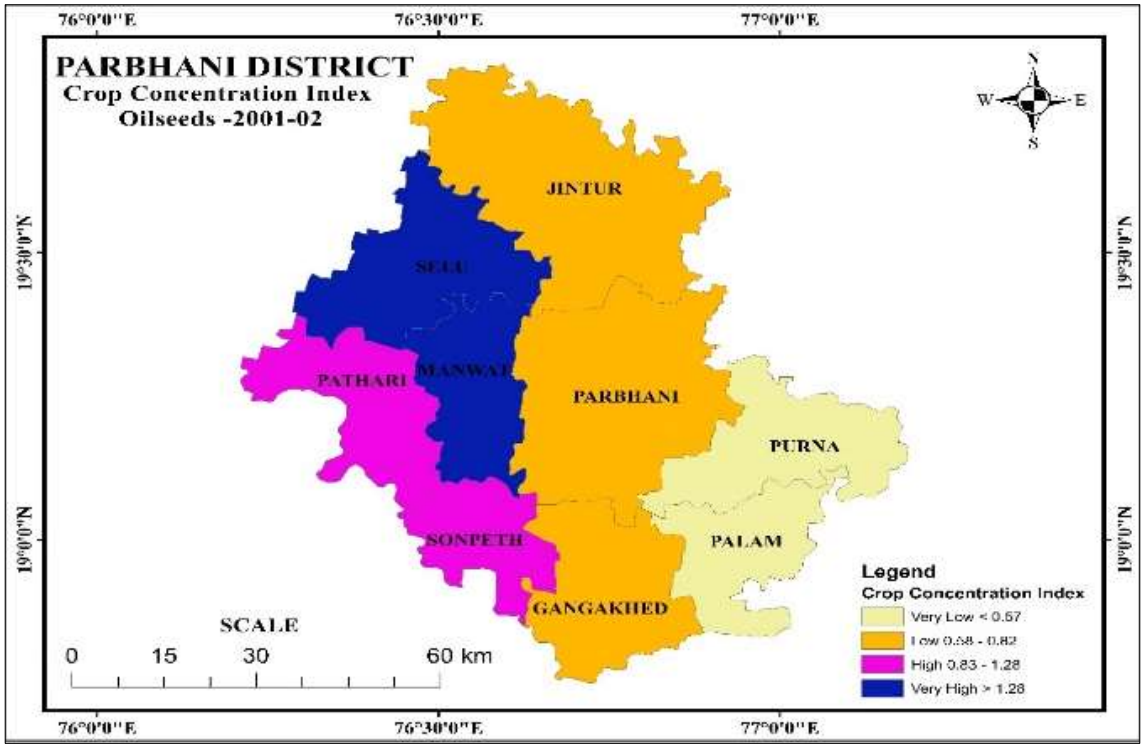

Fig 7: The figure illustrates the crop concentration index for oilseeds in Parbhani District for the year 2001-02, using different colors to represent varying levels of concentration across the tehsils

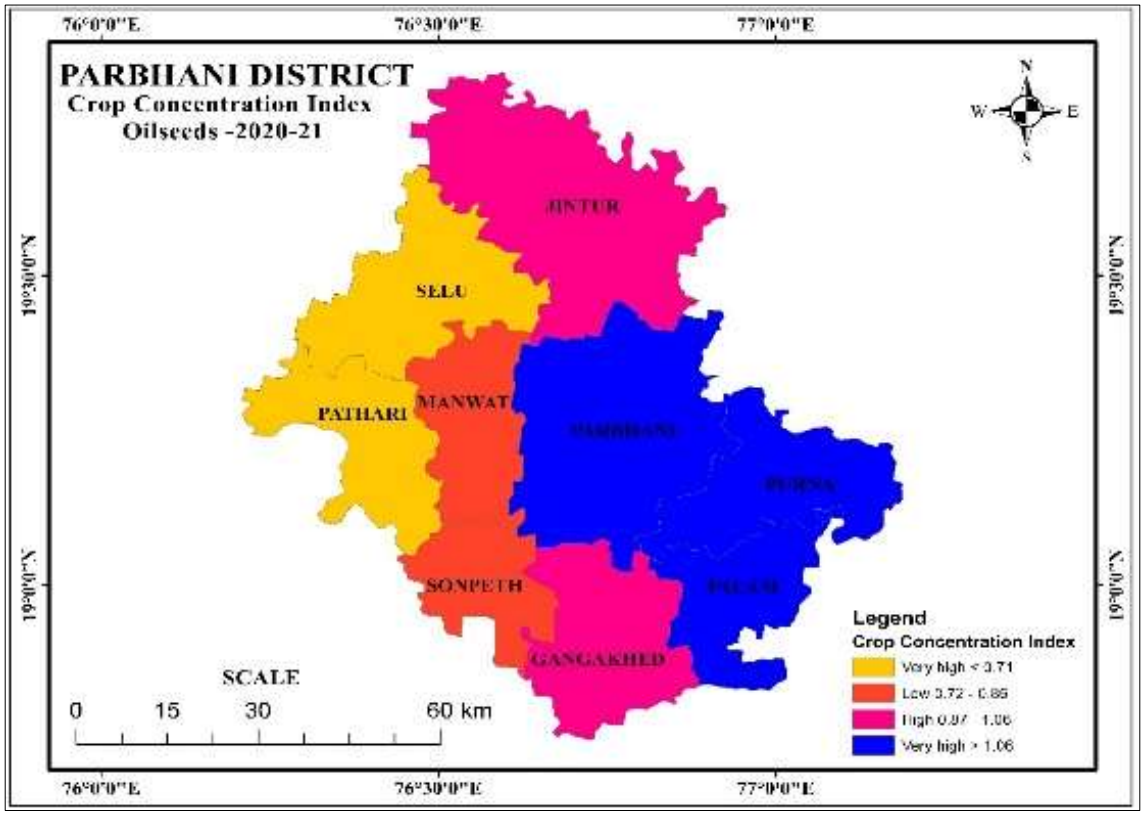

Fig 8: The figure shows the crop concentration index for oilseeds in Parbhani District for the year 2020-21, highlighting different concentration levels across the tehsils using a color-coded gradient

Conclusion

While wheat witnessed a mild decline but remained viable in some locations with improved water management, rice production had mostly vanished by 2020–21, most likely as a result of water constraint. As rainfall patterns changed and water supplies decreased, concentrations of jowar and bajra rose in some tehsils, suggesting a preference for crops that could withstand drought. Although there were still significant concentrations of maize in certain places, tehsils with limited water supplies or topographical constraints observed a decrease in the crop's production. Because of their capacity to adapt to rainy circumstances and their increasing significance as a water-efficient crop in the area, pulse crops were able to sustain steady concentrations.

While cotton and oilseeds saw regional increase as a result of better agronomic methods and consumer demand, sugarcane demonstrated a shift to locations with higher irrigation.

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