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AREA VISUALIZATION OF SOME KHARIF CROPS DIVERSIFICATION IN CHHATTISGARH STATE OF INDIA

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ABSTRACT

Approximately 80% of the population in Chhattisgarh, an Indian state, is involved in agricultural activities. For a considerable duration, it has mostly been involved in the cultivation of only paddy crops. Crop diversification, which involves shifting cultivation away from less profitable crops towards more profitable ones, is considered a method that is predicted to boost the economic growth of farmers in this state. The current study evaluates the condition of the land dedicated to several crops, including Rice, Soybean, Small Millet, and Urd, during the kharif season in Chhattisgarh. This assessment is based on secondary data spanning 19 years, specifically from 2000-01 to 2018-19. During the Kharif season from 2001 to 2019, there has been consistent growth in the cultivation of crops such as rice and soybean. However, the cultivation of tiny millets and urad has witnessed a decline over the same period.

Keywords : Area, Visualization, Chattisgarh, Kharif Crops, and Diversification.

Introduction

The present paper focused on studying the Chhattisgarh state. The state of Chhattisgarh was established on November 1, 2000, through the division of the state of Madhya Pradesh. The state of Chhattisgarh is positioned in Eastern India, with coordinates ranging from 17°46" N to 24°5" N latitudes and 84°15" E to 84°24" E longitudes. Chattisgarh is renowned as the primary region in India for cultivating and producing high-quality rice, earning it the title of the "Rice Bowl of India."

Kharif crops, also referred to as monsoon crops or autumn crops, are cultivated and harvested in India during the monsoon season, which typically spans from June to November in the Indian subcontinent. However, the exact duration may vary depending on

the specific crop and geographical location. In some cases, Malik (2002) the Kharif season may commence as early as May and conclude as late as January. The season is commonly acknowledged to commence in India in June and conclude in October. Kharif crops are typically sown at the onset of the southwest monsoon season and are reaped towards the conclusion of the monsoon season, specifically in October and November.

Haque (1985) Crop diversification was intended to provide Chhattisgarh farmers with more alternatives for raising a variety of crops, enabling them to boost production activities and lower the chance of crop failure in a given season due to drought, flood, etc. Dasgupta (2002). The general definition of agricultural diversification is the shifting of land from less lucrative crops to more profitable ones. Crop shift, or

diversification, is the consequence of government policies and thrusts on certain crops during a specific period. Additionally, a variety of interrelated factors can lead to crop diversification: (a) resource-related factors like irrigation, rainfall, and soil health; (b) household-related factors like food, fodder, some requirements for self-sufficiency, and investment constraints; (c) technology-related factors like seed, fertilizer, marketing, water use, storage, and post-harvest processing; (d) institutional and infrastructure-related factors like tenancy difficulties and land holding size; (e) price-related elements like output and input prices, as well as trade and various other economic policies that affect prices. These components are interconnected. While the size of the farm, the ability to provide food and fodder, and investment limits are important variables influencing how large and small farmers allocate their land, the latter can avoid This research study utilized four prominent Kharif crops, including Rice, Small Millet, soybean, and Urd, over various plateaus in the state of Chhattisgarh. These plateaus include the Northern Hills, Chhattisgarh Plains, and Bastar Plateau

Hazra (2003) was identified several factors that have varying degrees of influence on crop diversification. These factors include: (a) reliance on rainfall for more than 60% of the cropped area, (b) insufficient supply of improved and quality seeds and planting material, (c) sub-optimal and excessive use of resources such as water and land, (d) inadequate basic infrastructure like rural power, roads, transportation, and communications, (e) fragmentation of farmland, (f) limited agriculture mechanized limitations and size of farmland; (g) inadequate post-harvest technologies and infrastructure for post-harvest handling of perishable produce; (h) poor agro-based industry; (i) inadequately trained farmers and widespread illiteracy among farmers; (j) poor research extension-farmer connections; (k) emerging pests and diseases that affects cropplants; (l) inadequate agricultural investments; (m) dismal database for horticulture crops.

Bhalla and Tyagi (1989) had analyzed the agricultural growth pattern in multiple states of India. According to their claims, the introduction of new seed-fertilizer technology in the mid-1960s led to significant although inconsistent differences in the level of progress across different States. Nevertheless, the implementation of the new technology has encountered challenges in gaining a strong presence in the geographically elevated regions of the country, namely the mountainous, eastern, and central districts. Chand (2002). The growth was characterized by a geographical and resource-oriented bias, resulting in

the most significant benefits for well-endowed regions such as Punjab, Haryana, and Uttar Pradesh. As a consequence, there are now differences in the way agriculture has developed across different regions.

Materials and Methods

Selection of Crops

Following agronomic crop of Chhattisgarh were used for Kharif crops after the formation of the state in 2000, viz., Rice, Small millet, soybean and Urd.

Collection of data

The annual time series data on area of different crops in different districts of Chhattisgarh has been collected during 2000-01 to 2018-19 from the website of area and production statistics by Ministry of Agriculture and farmers welfare http://aps.dac.gov.in/APY/Public_Report1.aspx.

Software Used

In the present study, statistical analyses have been carried out using the powerful software “R: The project for Statistical computing”. For the help of R software we use different type of graphing plots viz., Bar Graph, line Diagram and percentage bar graph.

Results

Visulation of Trends of different Crops of Kharif Season in Chhattisgarh Region

Graphical assessment of the area of Rice

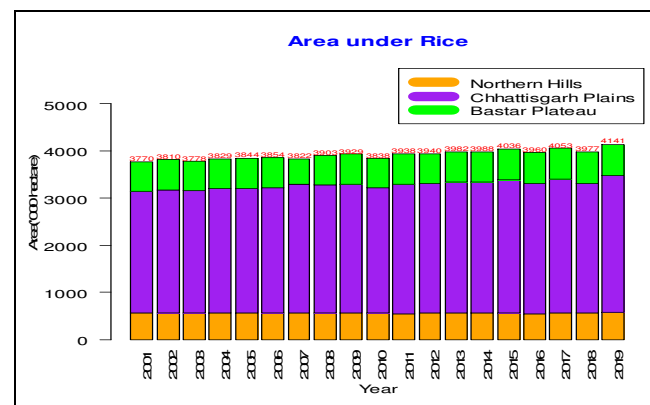


Fig. 1 : Calculation of the surface area covered by rice

Based on Figure 1, the following can be inferred:

1. The highest recorded area of Rice cultivation is 51735.33 ('000 ha) (70%) in Chhattisgarh Plains, followed by Bastar Plateau with 12025.17 ('000 ha) (16%) and Northern Hills with 10629.76 ('000 ha) (14%). In a certain year, the Chhattisgarh plains had the highest area coverage of 2906.16 ('000 ha) (70%) in 2018-19, followed by the Northern Hills with 567.15 ('000 ha) (14%) and

the Bastar plateau with 668.08 ('000 ha) (16%). (Lakra, 2014). The area under Rice in Chhattisgarh was maximum (4141 '000 ha) in 2018-19 with maximum contribution from Chhattisgarh Plains, and was minimum (3770 '000 ha) in 2000-01. (Lakra, 2014).

2. The area coverage of Northern Hills to Rice has been almost uniform to the average level of 559.16 ('000 ha). (Lakra, 2014).
3. The area coverage of Bastar Plateau to Rice has been almost uniform to the average level of 632.9 ('000 ha). (Lakra, 2014).

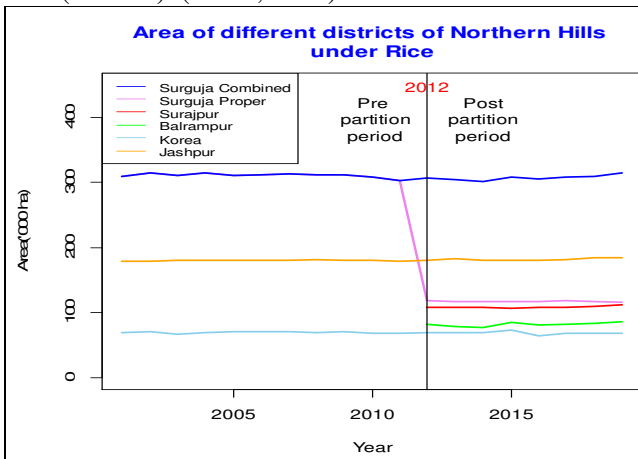


Fig. 2 : Calculation of the land area in various regions of the Northern Hills dedicated to rice cultivation.

The following conclusions are derived from the Figure 2. Regarding the area coverage of Rice in the Northern Hills, the following information is provided:

1. Before 2012, the districts under Rice cultivation had area coverage in the following decreasing order: Surguja (3420.44 thousand hectares), Jashpur (1982.38 thousand hectares), and Korea (763.54 thousand hectares). Bhalla and Tyagi (1989).
2. Since 2012, the districts with the largest area coverage of Rice in decreasing order have been Jashpur (1453.81 thousand hectares), Surguja (936.85 thousand hectares), Surajpur (866.98 thousand hectares), Balrampur (655.96 thousand hectares), and Korea (549.8 thousand hectares). Bhalla and Tyagi (1989).
3. There is no discernible pattern in the extent of Rice cultivation in Surguja, Jashpur, and Korea before and after the partition in 2011-12. Similarly, Balrampur and Surajpur did not exhibit any trend in the partition period of 2011-12. Bhalla and Tyagi (1989).

Area of different districts of Northern Chhattisgarh Plains under Rice

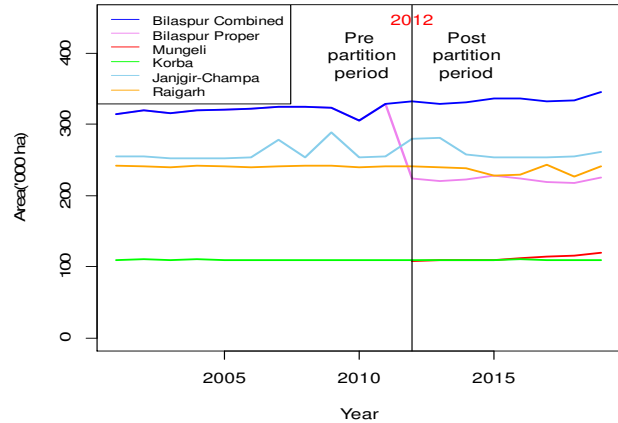


Fig. 3: Area of different districts of Northern Chhattisgarh Plains under Rice

According to Figure 3, the following can be deduced regarding the area coverage of Rice in the Northern Chhattisgarh Plains:

1. Before 2012: The districts arranged in descending order of area coverage before the partition year 2011-12 were Bilaspur (3521.88 '000 ha), Raigarh (2652.37 '000 ha), Janjgir-Champa (2853.32 '000 ha) and Korba (1205.81 '000 ha).
2. After 2012: Similarly, the districts arranged in decreasing order for the post-partition year 2011-12 were Janjgir-Champa (2096.53 '000 ha), Raigarh (1887.51 '000 ha), Bilaspur (1780.94 '000 ha), Mungeli (897.17 '000 ha) and Korba (874.32 '000 ha).
3. Mungeli has been showing an increasing trend in areas under Rice in the post-partition period.
4. There is no noticeable trend in the area coverage of Rice in Bilaspur, Korba, Raigarh, and Janjgir-Champa showed no trend in the area pre and post-partition 2011-12 periods.

Area of different districts of Southern Chhattisgarh Plains under Rice

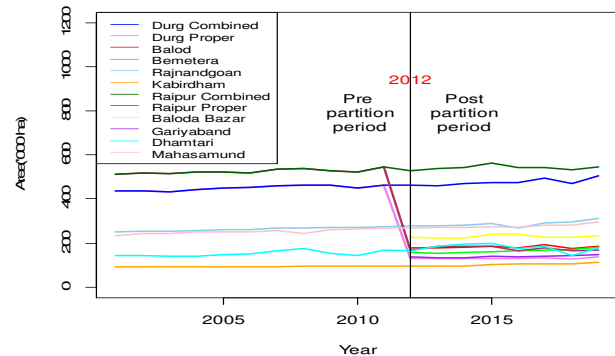


Fig. 4 : Area of different districts of Southern Chhattisgarh Plains under rice

According to Figure 4, the following can be determined about the area coverage of the Rice in the Southern Chhattisgarh Plains:

1. Before 2012: In decreasing order, the area coverage of the districts under Rice has been sequential of Raipur (5779.44 '000 ha), Durg (4955.17 '000 ha), Rajnandgoan (2887.14 '000 ha), Mahasamund (2758.08 '000 ha), Dhamtari (1665.81 '000 ha) and Kabirdham (1028.13 '000 ha). Kurosaki (2003)
2. After 2012: In descending order, the area coverage of the districts under Rice has been sequential of Rajnandgoan (2287.05 '000 ha), Mahasamund (2210.85 '000 ha), Baloda Bazar (1832.42 '000 ha), Balod (1450.32 '000 ha), Dhamtari (1420.84 '000 ha), Raipur (1400.02 '000 ha), Bemetera (1311.36 '000 ha), Gariyaband (1108.05 '000 ha), Durg (1048.5 '000 ha) and Kabirdham (822.1 '000 ha).
3. In Raipur, there was no trend in the pre and post-partition 2011-12 period in the area under Rice. It was observed that its major constituent district was Baloda Bazar, whose area under Rice was higher than Raipur itself after the 2011-12 partition period, although another constituent district of Durg, namely, Gariyaband had a lesser contribution to Rice area after the partition period in 2011-12.
4. There is no noticeable trend in the area coverage of Rice in Balod, Bemetera, Gariyaband, and Baloda Bazar in the post-2011-12 partition period, while Kabirdham, Mahasamund, Raipur, Durg, Rajnandgoan, and Dhamtari showed no trend in the area in both and pre and post-partition 2011-12 periods.

Followed by an analysis of Figure 5, the following conclusions can be drawn regarding the area coverage of Rice in the Bastar Plateau:

1. Before 2008: The districts arranged in descending order of area coverage before the partition year 2007-08 were Bastar (1799.1 '000 ha), Dantewada (1365.53 '000 ha) and Kanker (1155.39 '000 ha).
2. Between 2008-12: The districts arranged in descending order of area coverage before the partition year 2011-12 were Bastar (959.33 '000 ha), Kanker (689.21 '000 ha), Dantewada (530.09 '000 ha), Bijapur (239.26 '000 ha) and Narayanpur (102.35 '000 ha).
3. After 2012: Similarly, the districts arranged in decreasing order for post-partition year 2011-12 were Kanker (1436.96 '000 ha), Bastar (1070.02 '000 ha), Kondagoan (816.32 '000 ha), Sukma (625.31 '000 ha), Dantewada (554.99 '000 ha), Bijapur (486.16 '000 ha) and Narayanpur (194.53 '000 ha).
4. Kanker showed a slightly increasing trend in the area under Rice in both the pre and post-partition period.
5. Bastar had no trend in the area under crop but when Narayanpur and Kondagaon were separated from it in 2007-08 and 2011-12 respectively, there was a fall in the area under Rice.
6. Dantewada had no trend in the area under crop but when Bijapur and Sukma were separated from it in 2007-08 and 2011-12 respectively, there was a fall in the area under Rice.
7. There is no noticeable trend in the area coverage of in Bijapur and Narayanpur in the post-2007-08 period and Sukma and Kondagoan had the same in the post-2011-12 period.

Area of different districts of Bastar Plateau under Rice

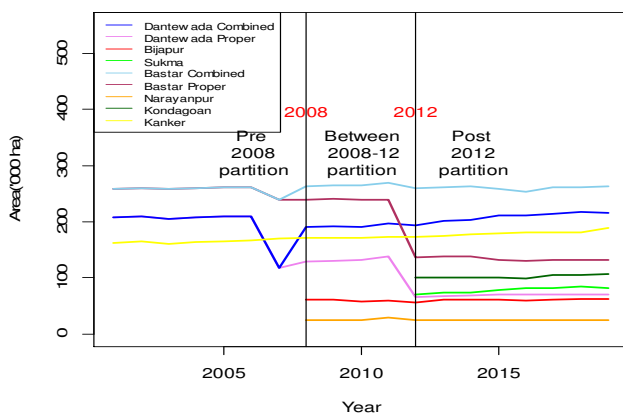


Fig. 5: Area of different districts of Bastar Plateau under Rice

Graphical assessment of the area of small millets

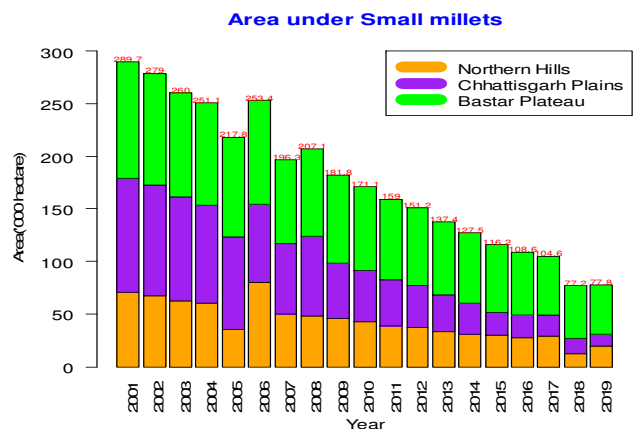


Fig. 6: Area under Small millets

On perusal of Figure 6, the following may be concluded:

1. The maximum area coverage of small millets has been observed to be 1497.64 ('000 ha) (47%) in Bastar Plateau on average followed by Chhattisgarh Plains with 1048.61 ('000 ha) (29%) on average and Northern Hills with 820.56 ('000 ha) (24%) on the average. However, for a particular year, the maximum area coverage was 108.79 ('000 ha) (38%) in 2000-01 in Chhattisgarh plains, 79.87 ('000 ha) (32%) in 2005-06 in Northern Hills, and 110.31 ('000 ha) (38%) in 2000-01 in Bastar plateau.
2. The area under small millets in Chhattisgarh was maximum (289.7 '000 ha) in 2000-01 with maximum contribution from Bastar Plateau; and was minimum (77.2 '000 ha) in 2017-18.
3. The area coverage of Bastar Plateau to Small millets has been decreasing throughout the study period from (110.37 '000 ha) in 2000-01 to (47.17 '000 ha) in 2018-19.
4. The area coverage of Chhattisgarh Plains to Small millets has been decreasing drastically throughout the study period from (108.79 '000 ha) in 2000-01 to (11.25 '000 ha) in 2018-19.

Area of different districts of Northern Hills under Small millets

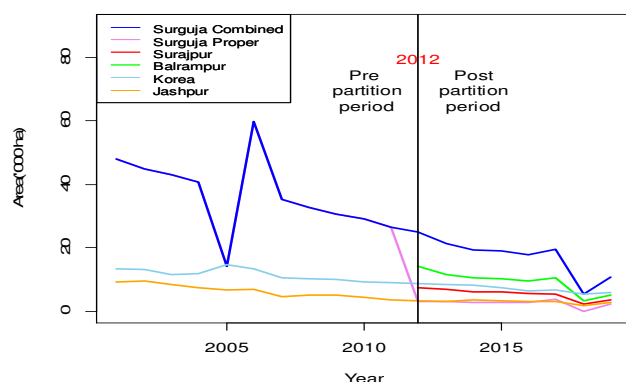


Fig. 7: Area of different districts of Northern Hills under Small millets

The following are the findings drawn from Figure 7, regarding the area coverage of small millets in Northern Hills:

1. Before 2012: In decreasing order, the area coverage of the districts under small millets has been sequentially of Surguja (404.04 '000 ha), Korea (126.93 '000 ha) and Jashpur (70.77 '000 ha).
2. After 2012: The area coverage of the districts under small millets in decreasing order has been sequentially of Balrampur (74.94 '000 ha), Korea

(56.93 '000 ha), Surajpur (42.99 '000 ha), Jashpur (23.76 '000 ha) and Surguja (20.17 '000 ha).

3. Surguja had decreasing trend in area under small millets in both pre and post 2011-12 period. However, it may be noted that prior to 2011-12, most of the area contribution in Surguja was due to Balrampur and Surajpur, however, after partition in 2011-12, the area under small millets in Surguja fell even below Balrampur and Surajpur.
4. There is decreasing trend in the area coverage of small millets in Surajpur and Balrampur in post partition 2011-12 period while Jashpur, Korea and Surguja showed same in both and pre and post partition 2011-12 periods.

Area of different districts of Northern Chhattisgarh Plains under Small millets

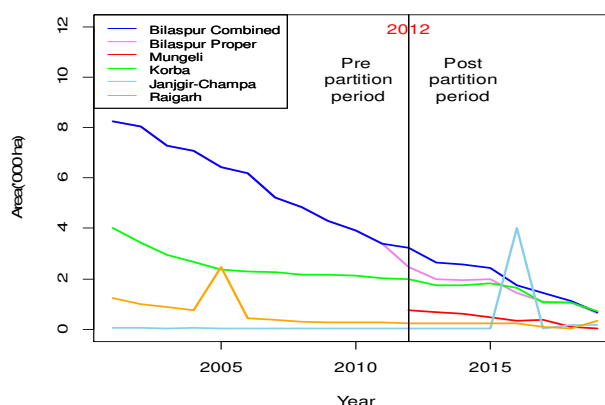


Fig. 8: Area of different districts of Northern Chhattisgarh Plains under Small millets

According to Figure 8, the following can be deduced regarding the area coverage of small millets in the Northern Chhattisgarh Plains:

1. Before 2012: The districts arranged in descending order of area coverage before the partition year 2011-12 were Bilaspur (64.93 '000 ha), Korba (28.43 '000 ha), Raigarh (8.16 '000 ha) and Janjgir-Champa (0.36 '000 ha).
2. After 2012: Similarly, the districts arranged in decreasing order for the post-partition year 2011-12 were Bilaspur (12.57 '000 ha), Korba (11.75 '000 ha), Janjgir-Champa (4.43 '000 ha), Mungeli (3.3 '000 ha) and Raigarh (1.61 '000 ha).
3. Bilaspur, Raigarh, and Korba showed a decreasing trend in area in both pre and post-partition 2011-12 periods, while Mungeli showed the same in post 2011-12 partition period.
4. There is no noticeable trend in the area coverage of small millets Janjgir-Champa in both pre and post-partition 2011-12 periods.

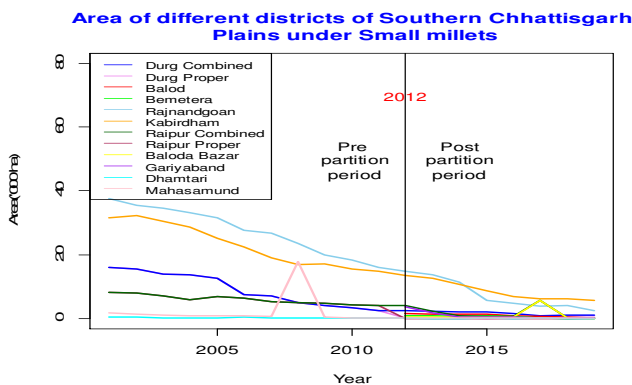


Fig. 9: Area of different districts of Southern Chhattisgarh Plains under Small millets

According to Figure 9, the following can be determined about the area coverage of the small millets in the Southern Chhattisgarh Plains:

1. Before 2012: In decreasing order, the area coverage of the districts under Small millets has been sequential of Rajnandgoan (304.73 '000 ha), Kabirdham (253.93 '000 ha), Durg (101.15 '000 ha), Raipur (65.43 '000 ha), Mahasamund (25.92 '000 ha) and Dhamtari (1.93 '000 ha).
2. After 2012: In descending order, the area coverage of the districts under Small millets has been sequentially of Kabirdham (70.5 '000 ha), Rajnandgoan (560.96 '000 ha), Baloda Bazar (7.36 '000 ha), Balod (7.29 '000 ha), Gariyaband (6.89 '000 ha), Bemetera (3.79 '000 ha), Durg (2.16 '000 ha), Mahasamund (0.96 '000 ha), Dhamtari (0.26 '000 ha) and Raipur (0.1 '000 ha).
3. Rajnandgoan and Kabirdham have been showing a decreasing trend in areas under Small millets throughout the study period.
4. In Raipur, there was a decreasing trend in both pre and post-partition 2011-12 period. It was observed that its major constituent districts were Gariyaband and Baloda Bazar, whose areas under Small millets were higher than Raipur itself after the 2011-12 partition period.
5. In Durg, there was a decreasing trend in both pre and post-partition 2011-12 period. It was observed that its major constituent districts were Balod and Bemetera, whose areas under Small millets were higher than Durg itself after the 2011-12 partition period.
6. There is no noticeable trend in the area coverage of Small millets in Balod, Baloda Bazar, Bemetera, and Gariyaband in the post-2011-12 partition period, while Dhamtari and Mahasamund showed no trend in the area in both and pre and post-partition 2011-12 periods.

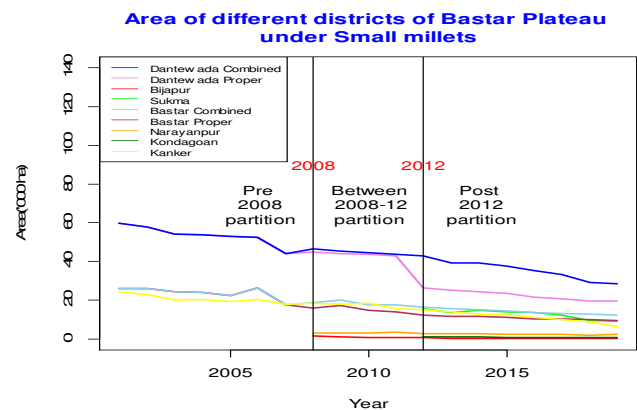


Fig. 10: Area of different districts of Bastar Plateau under Small millets

Following an analysis of Figure 10, the following conclusions can be drawn regarding the area coverage of small millets in the Bastar Plateau:

1. Before 2008: The districts arranged in descending order of area coverage before the partition year 2007-08 were Dantewada (374.52 '000 ha), Bastar (166.24 '000 ha) and Kanker (145.46 '000 ha).
2. Between 2008-12: The districts arranged in descending order of area coverage before the partition year 2011-12 were Dantewada (175.71 '000 ha), Kanker (69.86 '000 ha), Bastar (61.45 '000 ha), Narayanpur (12.52 '000 ha) and Bijapur (3.85 '000 ha).
3. After 2012: Similarly, the districts arranged in decreasing order for post-partition year 2011-12 were Dantewada (180.94 '000 ha), Sukma (101.58 '000 ha), Kanker (89.66 '000 ha), Bastar (86.94 '000 ha), Narayanpur (19.15 '000 ha), Kondagoan (7.35 '000 ha) and Bijapur (2.41 '000 ha).
4. Sukma showed a decreasing trend in the area under Small millets in post 2011-12 partition period.
5. There is a decreasing trend in the area coverage of Small millets in Bastar, Dantewada, and Kanker throughout the study period.
6. There is no noticeable trend in the area coverage of Small millets in Narayanpur and Bijapur in post 2007-08 period, the same is observed in Kondagoan in post 2011-12 partition period.

Graphical assessment of the area of Soybean

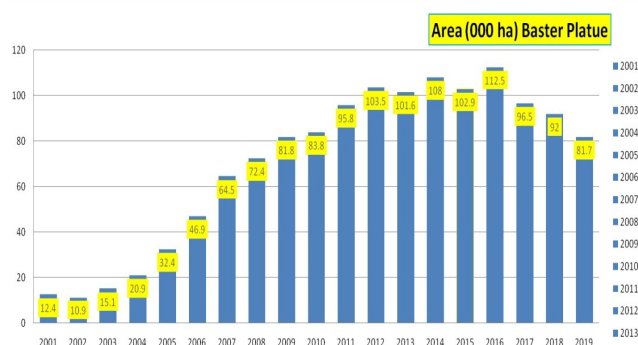


Fig. 11: Area under Soybean

On perusal of Figure 11, the following may be concluded:

1. The maximum area coverage of Soybean has been observed to be 1332.44 ('000 ha) (99.55%) in Chhattisgarh Plains on average followed by Northern Hills with 1.65 ('000 ha) (0.25%) on average and Bastar Plateau with 1.39 ('000 ha) (0.20%) on the average. However, for a particular year, the maximum area coverage was 112.28 ('000 ha) (99.8%) in 2014-15-16 in Chhattisgarh plains, 0.20 ('000 ha) (0.21%) in 2010-11 in Northern Hills and 0.17 ('000 ha) (1.65%) in 2000-01 in Bastar plateau.
2. The area under Soybean in Chhattisgarh was maximum (112.5 '000 ha) in 2014-15-16 with maximum contribution from Chhattisgarh Plains; and was minimum (10.9 '000 ha) in 2001-02.
3. Throughout the study period, the area coverage of Bastar Plateau and Northern Hills to Soybean has been 1.39 ('000 ha) and 1.67 ('000 ha) respectively.
4. The area coverage of Chhattisgarh Plains to Soybean has been increasing throughout the study period from (12.26 '000 ha) in 2000-01 to (81.57 '000 ha) in 2018-19.

Area of different districts of Northern Hills under Soybean

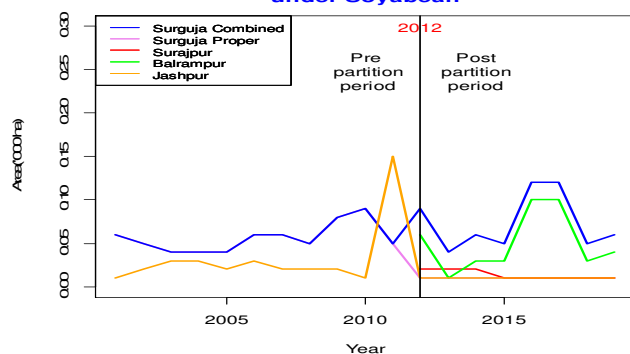


Fig. 12: Area of different districts of Northern Hills under Soybean

The following are the findings drawn from Figure 12 regarding the area coverage of Soybean in Northern Hills:

1. Before 2012: In decreasing order, the area coverage of the districts under Soybean has been sequential of Surguja (0.62 '000 ha) and Jashpur (0.36 '000 ha).
2. After 2012: The area coverage of the districts under Soybean in decreasing order has been sequential of Surajpur (0.11 '000 ha), Balrampur (0.4 '000 ha), Surguja (0.08 '000 ha) and Jashpur (0.08 '000 ha).
3. Surgujahad an increasing trend in the area under Soybean in pre 2011-12 period but after that, it showed no trend. However, it may be noted that before 2011-12, most of the area contribution in Surguja was due to Balrampur and Surajpur, however, after partition in 2011-12, the area under Soybean in Surguja fell even below Balrampur and Surajpur.
4. There is no noticeable trend in the area coverage of Soybean in Balrampur and Surajpur in post 2011-12 partition period, while Jashpur showed the same in both and pre and post-partition 2011-12 periods.

Area of different districts of Northern Chhattisgarh Plains under Soybean

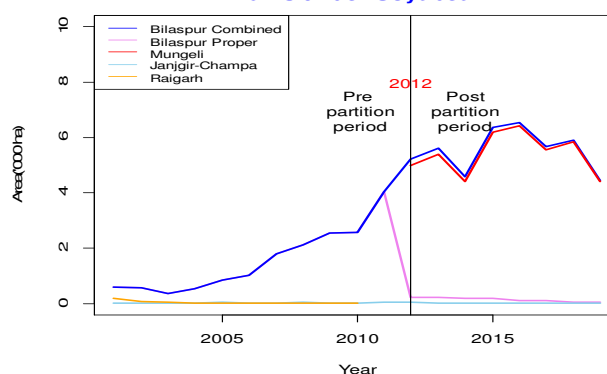


Fig. 13: Area of different districts of Northern Chhattisgarh Plains under Soybean

According to Figure 13, the following can be deduced regarding the area coverage of Soybean in the Northern Chhattisgarh Plains:

1. Before 2012: The districts arranged in descending order of area coverage before the partition year 2011-12 were Bilaspur (16.95 '000 ha), Raigarh (0.41 '000 ha) and Janjgir-Champa (0.32 '000 ha).
2. After 2012: Similarly, the districts arranged in decreasing order for post-partition year 2011-12 were Mungeli (43.2 '000 ha), Bilaspur (1.11 '000 ha) and Janjgir-Champa (0.17 '000 ha).

- In Bilaspur, there was an increasing trend in pre 2011-12 partition period while in the partition period decreasing trend was observed. It should be noted that the major area under Soybean in pre 2011-12 partition period in Bilaspur is mainly because of Mungeli.
- There is no noticeable trend in the area coverage of Soybean in Mungeli and Janjgir-Champa in pre 2011-12 partition period, while Raigarh in both pre and post-partition 2011-12 periods.

Area of different districts of Southern Chhattisgarh Plains under Soybean

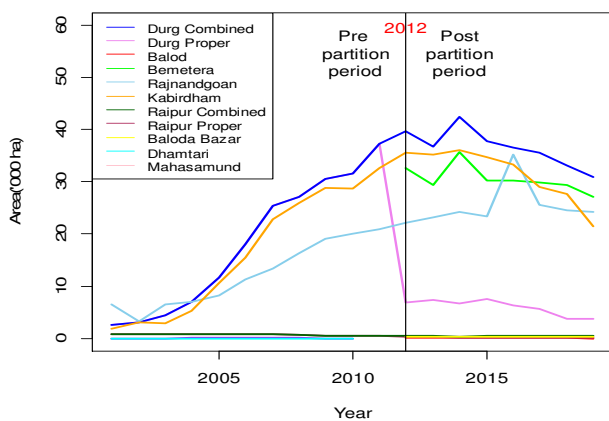


Fig. 14: Area of different districts of Southern Chhattisgarh Plains under Soybean

According to Figure 14, the following can be determined about the area coverage of the Soybean in the Southern Chhattisgarh Plains:

- Before 2012: In decreasing order, the area coverage of the districts under Soybean has been sequentially of Durg (198.97 '000 ha), Kabirdham (178.24 '000 ha), Rajnandgoan (132.25 '000 ha), Raipur (7.41 '000 ha), Dhamtari (0.23 '000 ha) and Mahasamund (0.16 '000 ha).
- After 2012: In descending order, the area coverage of the districts under Soybean has been sequential of Kabirdham (253.29 '000 ha), Bemetera (244.58 '000 ha), Rajnandgoan (202.64 '000 ha), Durg (47.73 '000 ha), Baloda Bazar (2.05 '000 ha), Raipur (1.26 '000 ha) and Balod (0.71 '000 ha).
- Kabirdham has been showing an increasing trend in the area under Soybean in pre 2011-12 partition period, while a decreasing trend in the partition 2011-12 period.
- Bemetera showed a decreasing trend in the post 2011-12 partition period.
- Rajnandgoan showed an increasing trend in the area under Soybean in both the pre and post-2011-12 partition period.

- In Raipur, there was a decreasing trend in the pre-partition 2011-12 period, while no trend was observed in the post-partition 2011-12 period.
- In Durg, there was an increasing trend in the pre-partition 2011-12 period, while a decreasing trend was observed in the post-partition 2011-12 period. It was observed that its major constituent district was Bemetera, whose area under Soybean was higher than Durg itself after the 2011-12 partition period, although another constituent district of Durg, namely, Balod had a lesser contribution to Soybean area after the partition period in 2011-12.
- There is no noticeable trend in the area coverage of Soybean in Balod and Baloda Bazar in post 2011-12 partition period, while Dhamtari and Mahasamund showed no trend in the area in both pre and post-partition 2011-12 periods.

Area of different districts of Bastar Plateau under Soybean

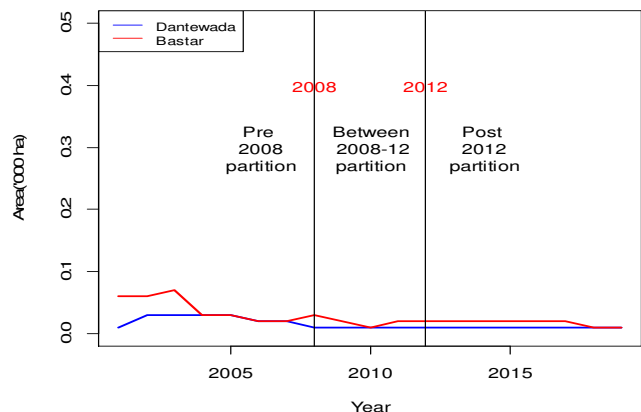


Fig. 15: Area of different districts of Bastar Plateau under Soybean

Following an analysis of Figure 15, the following conclusions can be drawn regarding the area coverage of Soybeans in the Bastar Plateau:

- Before 2008: The districts arranged in descending order of area coverage before the partition year 2007-08 were Bastar (0.29 '000 ha) and Dantewada (0.17 '000 ha). Tingre *et al.* (2009)
- Between 2008-12: The districts arranged in descending order of area coverage before the partition year 2011-12 were Bastar (0.08 '000 ha), and Dantewada (0.04 '000 ha).
- After 2012: Similarly, the districts arranged in decreasing order for the post-partition year 2011-12 were Bastar (0.14 '000 ha) and Dantewada (0.04 '000 ha). Tingre *et al.* (2009)
- Bastar showed a decreasing trend in the area under Soybean throughout the study period.

- 5 Dantewada showed a decreasing trend in the pre-2007-08 partition period while no trend was observed in post 2007-08 partition period. Tingre *et al.* (2009)

Graphical assessment of the area of Urad

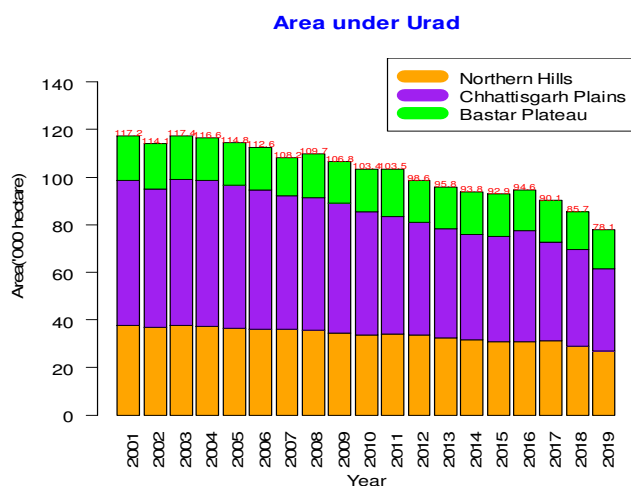


Fig. 16: Area under Urad

On perusal of Figure 16, the following may be concluded:

- 1 The maximum area coverage of Urad has been observed to be 973.41 ('000 ha) (49.55%) in Chhattisgarh Plains on average followed by Northern Hills with 643.8 ('000 ha) (33%) on average and Bastar Plateau with 336.59 ('000 ha) (17.5%) on the average. However, for a particular year, the maximum area coverage was 61.29 ('000 ha) (52%) in 2002-03 in Chhattisgarh plains, 37.72 ('000 ha) (32%) in 2002-03 in Northern Hills and 19.94 ('000 ha) (20%) in 2010-11 in Bastar plateau. Suseela (2016).
- 2 The area under Urad in Chhattisgarh was maximum (117.4 '000 ha) in 2002-03 with maximum contribution from Chhattisgarh Plains; and was minimum (78.1 '000 ha) in 2018-19.
- 3 The area coverage of Bastar Plateau to Urad has been almost constant to the average level of 17.71 ('000 ha).
- 4 Throughout the study period, the area coverage of Northern Hills to Urad has been decreasing from (37.6 '000 ha) in 2000-01 to (27.12 '000 ha) in 2018-19.
- 5 The area coverage of Chhattisgarh Plains to Urad has been decreasing throughout the study period from (60.96 '000 ha) in 2000-01 to (34.47 '000 ha) in 2018-19.

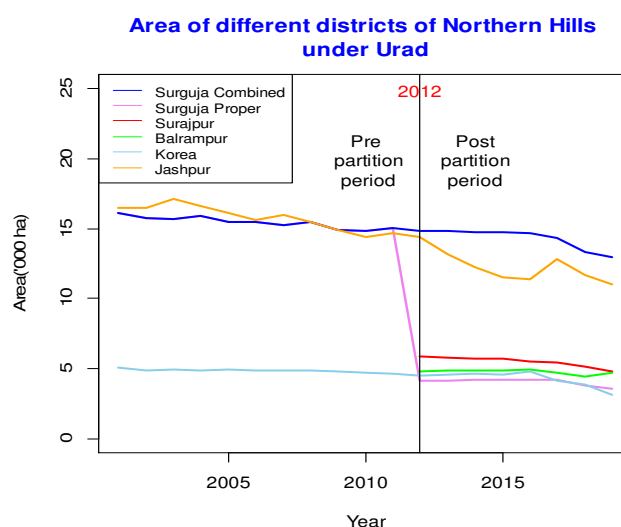


Fig. 17: Area of different districts of Northern Hills under Urad

The following are the findings drawn from Figure 17 regarding the area coverage of Urad in Northern Hills:

1. Before 2012: In decreasing order, the area coverage of the districts under Urad has been sequential of Jashpur (173.85 '000 ha), Surguja (169.81 '000 ha) and Korea (53.23 '000 ha).
2. After 2012: The area coverage of the districts under Urad in decreasing order has been sequential of Jashpur (98.21 '000 ha), Surajpur (43.89 '000 ha), Balrampur (38.13 '000 ha), Korea (34.27 '000 ha) and Surguja (32.41 '000 ha). Nayak (2016).
3. Surgujahad a slight decreasing trend in the area under Urad in pre2011-12 period but after that, it showed no trend. However, it may be noted that before 2011-12, most of the area contribution in Surguja was due to Surajpur and Balrampur, however, after partition in 2011-12, the area under Urad in Surguja fell even below Balrampur and Surajpur.
4. Jashpur showed a decreasing trend in the area under Urad throughout the study period.
5. There is no noticeable trend in the area coverage of Urad in Balrampur and Surajpur in the post-2011-12 partition period, while Korea showed the same in both and pre and post-partition 2011-12 periods.

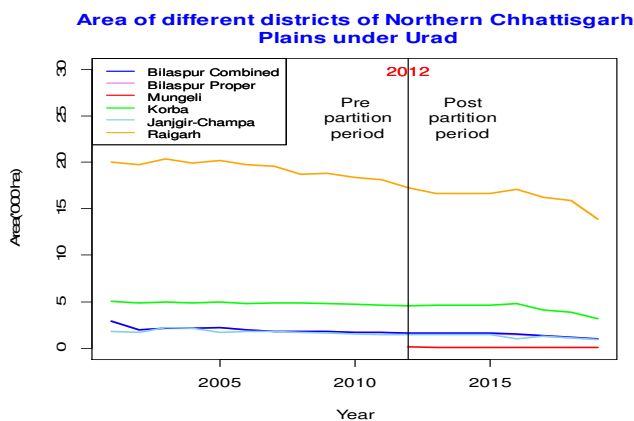


Fig. 18: Calculation of the land area in several districts of the Northern Chhattisgarh Plains dedicated to Urad cultivation

According to Figure 18, the following can be deduced regarding the area coverage of Urad in the Northern Chhattisgarh Plains:

1. Before 2012: The districts arranged in descending order of area coverage before the partition year 2011-12 were Raigarh (213.66 '000 ha), Korba (53.32 '000 ha), Bilaspur (21.91 '000 ha) and Janjgir-Champa (19.23 '000 ha). Singh (2001)
2. After 2012: Similarly, the districts arranged in decreasing order for the post-partition year 2011-12 were Raigarh (130.38 '000 ha), Korba (34.27 '000 ha), Bilaspur (10.84 '000 ha), Janjgir-Champa (9.95 '000 ha) and Mungeli (0.67 '000 ha). Singh (2001)
3. Raigarh has been showing a decreasing trend in the area under Urad throughout the study period.
4. There is no noticeable trend in the area coverage of Urad in Mungeli in the post-2011-12 partition period, while Bilaspur, Korba, and Janjgir-Champa showed no trend in the area in both pre and post-partition 2011-12 periods. Singh (2001)

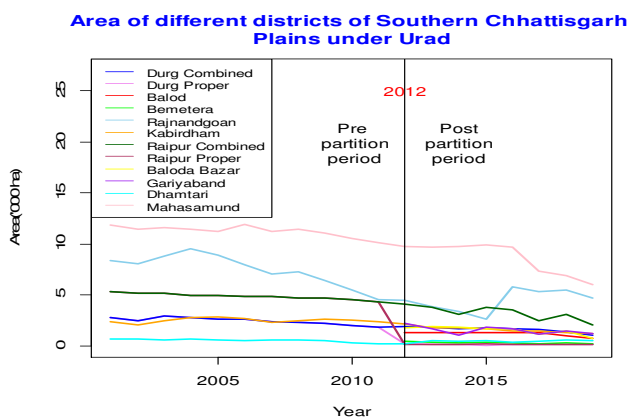


Fig. 19: Calculation of the land area in several districts of the Southern Chhattisgarh Plains dedicated to Urad cultivation.

According to Figure 19, the following can be determined about the area coverage of the Urad in the Southern Chhattisgarh Plains:

1. Before 2012: In decreasing order, the area coverage of the districts under Urad has been sequential of Mahasamund (123.64 '000 ha), Rajnandgoan (82.4 '000 ha), Raipur (53.39 '000 ha), Kabirdham (27.52 '000 ha), Durg (26.96 '000 ha) and Dhamtari (5.92 '000 ha).
2. After 2012: In descending order, the area coverage of the districts under Urad has been sequentially of Mahasamund (68.92 '000 ha), Rajnandgoan (35.56 '000 ha), Kabirdham (12.78 '000 ha), Gariyaband (12.36 '000 ha), Baloda Bazar (12.14 '000 ha), Balod (9.42 '000 ha), Dhamtari (3.59 '000 ha), Bemetera (2.39 '000 ha), Raipur (1.28 '000 ha) and Durg (0.99 '000 ha). Mehta (2009)
3. Mahasamund and Kabirdham have been showing a decreasing trend in the area under Urad throughout the study period.
4. Rajnandgoan showed a slight decreasing trend in the area under Urad up to 2014-15 but from 2014-15 onwards increasing trend was observed. Mehta (2009)
5. In Raipur, there was a decreasing trend in the pre-partition 2011-12 period, while no trend was observed in the post-partition 2011-12 period. It was observed that its major constituent districts were Gariyaband and Baloda Bazar, whose area under Urad was higher than Raipur itself after the 2011-12 partition period.
6. In Durg, there was a decreasing trend in the pre-partition 2011-12 period, while no trend was observed in the post-partition 2011-12 period. It was observed that its major constituent districts were Balod and Bemetera, whose areas under Urad were higher than Durg itself after the 2011-12 partition period.
7. There is no noticeable trend in the area coverage of Urad in Balod, Baloda Bazar, Gariyaband, and Bemetera in the post-2011-12 partition period, while Dhamtari showed no trend in the area in both pre and post-partition 2011-12 periods.

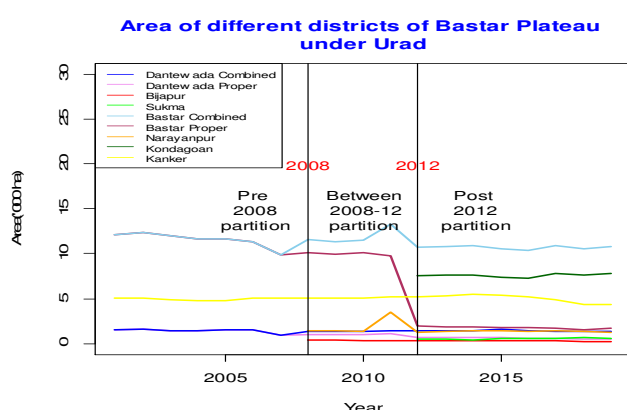


Fig. 20: Calculation of the geographical extent of various districts within the Urad region of the Bastar Plateau.

Subsequently, an examination of the Figure will be conducted. Based on the data of Figure 20, the area coverage of Urad in the Bastar Plateau can be inferred.

1. Before 2008, the districts were organized in descending order based on their area coverage. The districts with the largest area coverage before the partition in 2007-08 were Bastar (81.1 thousand hectares), Kanker (34.64 thousand hectares), and Dantewada (10.2 thousand hectares).
2. From 2008 to 2012, the districts were ranked in descending order based on their area coverage. The districts with the largest area coverage before the division in 2011-12 were Bastar (40.02 thousand hectares), Kanker (20.52 thousand hectares), Narayanpur (7.66 thousand hectares), Dantewada (4.06 thousand hectares), and Bijapur (1.38 thousand hectares). (Jadhav *et al.* (2014).
3. After 2012, the districts were ranked in descending order based on their size in the year 2011-12. The districts, from largest to smallest, were Kondagoan (60.89 thousand hectares), Kanker (40.25 thousand hectares), Bastar (14.03 thousand hectares), Narayanpur (10.77 thousand hectares), Dantewada (4.66 thousand hectares), Sukma (4.27 thousand hectares), and Bijapur (2.34 thousand hectares).
4. Bastar experienced a gradual decline until 2010-11, followed by a sharp dip when Kondagoan was severed from it in 2011-12. After this point, there was no discernible trend in the Urad area. (Jadhav *et al.* (2014). Dantewada had no consistent pattern over the entire study period spanning from 2000-01 to 2018-19. The decline in the Urad cultivation area in Dantewada can be attributed primarily to the districts of Sukma and Bijapur (Jadhav *et al.* (2014). There is no discernible

pattern in the extent of Urad cultivation in Kanker across the whole duration of the study.

5. There is no discernible pattern in the extent of Urad cultivation in Bijapur and Narayanpur after 2007-08, and Sukma and Kondagoan had similar results after 2011-12.

Discussion

In the Northern Hills region, there was an observed upward trend in the cultivation of small millet from 2001 to 2019. However, over the same period, there was a decline in the cultivation of small millets and Urad. Nevertheless, there was no discernible pattern in the regions dedicated to Rice and Soybean cultivation. In the Chhattisgarh Plains, there was an upward tendency in the cultivation of Rice and Soybean between 2001 and 2019. However, the cultivation of Small millet and Urad showed a decline during the same period. The Bastar Plateau experienced an upward trend in the cultivation of urd from 2001 to 2019, while the cultivation of small millet exhibited a decline during the same period. Nevertheless, no discernible pattern was detected in the area dedicated to cultivating rice and soybean crops. Analysis reveals that there were no significant increases in the area of Surguja between 2001 and 2019. However, there was a noticeable decline in the area dedicated to small millets and urad during the same period. Nevertheless, there was no discernible pattern in the region covered by Rice and Soybean. Surajpur- It has been observed that there were no significant increases in the area from 2012 to 2019. However, there was a noticeable decrease in the area dedicated to small millet and urad over the same period. Nevertheless, there was no discernible pattern in the area covered by rice. It has been observed that there were no significant increases in the area of Balrampur between 2012 and 2019. However, there was a noticeable decrease in the area dedicated to growing small millets over the same period. Nevertheless, there was no discernible pattern in the area covered by Rice Soybean and Urd. It has been observed that there were no significant increases in the area of Korea from 2001 to 2019. However, there was a noticeable decrease in the area dedicated to growing small millets during the same period. Nevertheless, there was no discernible pattern in the area covered by Rice, Urd, and Soybean crops. It has been observed that there was a decline in the cultivation area of small millets and urd between 2001 and 2019. Nevertheless, no discernible pattern was detected in the area dedicated to cultivating rice and soybean. In Bilaspur, it has been observed that the cultivation area for Rice and Soybean has been consistently growing from 2001

to 2019. Conversely, there has been a decline in the cultivation area for Small millets over the same period. Nevertheless, there was no discernible pattern in the area covered by Soybean. In Mungeli, it was observed that the cultivation of rice experienced a consistent growth in the region from 2012 to 2019. Conversely, the cultivation of small millets witnessed a decline in the area over the same period. Nevertheless, there was no discernible pattern in the extent of land dedicated to Soybean and Urd crops. Analysis reveals that there were no observable upward trends in the area of Korba between 2001 and 2019. However, there was a noticeable decline in the area dedicated to growing small millets during the same period. Nevertheless, there was no discernible pattern in the extent of land dedicated to Rice, Soybean, and Urd. Jajgir-Champa- There have been no observed decreases in the area from 2001 to 2019. Nevertheless, there was no discernible pattern in the area dedicated to Rice, Small millets, Urd, and soybeans. It has been observed that there has been a decline in the cultivation of small millets and urad in the Raigarh region between 2001 and 2019. Nevertheless, there was no discernible pattern in the area covered by rice. During the period from 2001 to 2019, it was seen that the cultivation of Soybeans experienced consistent growth in terms of land area. On the other hand, the cultivation of Small millets and Urad exhibited a decline in land area during the same period. Nevertheless, there was no discernible pattern in the area covered by rice. No significant trend in the area under cultivation of Rice, Small millets, Soybean, and Urad was noted between 2012 and 2019 in Balod. It has been noticed that the area dedicated to soybeans has consistently decreased from 2012 to 2019. However, no significant trend in the area dedicated to Rice, Sesamum, Urd, and Small millets has been observed during the same period. Upon analysis, it was shown that there were no observable upward trends in the area of Raipur between 2001 and 2019. However, crops such as Arhar, Sesamum, Small millets, and Urd had a decline in their respective areas over the same period. Nevertheless, there was no discernible pattern in the region covered by Rice and Soybean. There were no declining patterns identified in the Baloda Bazar region from 2012 to 2019. Additionally, no trends were observed in the area under Soybean, Rice, Urad, and Small millets. It has been observed that there were no significant increases in the area of Gariyaband between 2012 and 2019. Nevertheless, there was no discernible pattern in the area dedicated to cultivating Rice, Soybean, Urad, and Small millets. In Rajnandgoan, there was an upward tendency in the cultivation of Soybeans between 2001 and 2019, however, the cultivation of Small millets and

Urad declined in the same period. Nevertheless, there was no discernible pattern in the area covered by rice. In Kabirdham, it has been observed that the cultivation area for Soybeans has consistently increased from 2001 to 2019. On the other hand, the cultivation areas for Urd and Small millets have shown a consistent decrease during the same period. Nevertheless, there was no discernible pattern in the area covered by rice. No significant changes were noticed in the cultivation area of Rice, Small millets, Urad, and soybeans from 2001 to 2019 in Dhamtari. Mahasamund- It has been observed that the region of Urd had a declining pattern from 2001 to 2019. Nevertheless, there was no discernible pattern in the region covered by Small millets, Soybeans, and Rice. It has been observed that there were no significant increases in the area of Bastar between 2001 and 2019. However, there was a declining tendency in the area dedicated to Small millets and soybeans during the same period. Nevertheless, there was no discernible pattern in the area covered by rice. Upon analysis, it was determined that there was no discernible trend in the area of Narayanpur between 2008 and 2019. Additionally, no significant changes were noticed in the area dedicated to cultivating Rice, Small millets, Soybeans, and Urad. Upon analysis, it has been determined that there were no discernible patterns or trends in the Kondagoan area between the years 2012 and 2019. Nevertheless, there was no discernible pattern in the extent of land dedicated to Soybean, Rice, Urad, and Small millets. It has been observed that there was a decline in the cultivation of small millets and soybeans in the Dantewada region from 2001 to 2019. Nevertheless, there was no discernible pattern in the extent of land dedicated to Rice and Urd crops. Upon analysis, it was determined that there were no discernible trends in the area dedicated to soybeans, Rice, Urad, and Small millets in Bijapur from 2008 to 2019. It has been observed that there were no discernible trends in the area of Sukma from 2012 to 2019. However, there was a consistent decrease in the area dedicated to growing small millets during the same period. Nevertheless, there was no discernible pattern seen in the case of Rice, Soybean, and Urd. In the period from 2001 to 2019, there was an upward tendency in the cultivation of rice in the area, while the cultivation of small millet exhibited a downward trend. Nevertheless, there was no discernible pattern in the extent of land dedicated to Soybean and Urd crops.

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