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Case Study: First Level Cropping Pattern and Agricultural Diversification Rajsthan'sGanganagar District using Remote Sensing

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Abstract:

The percentages of land covered by various crops at a given moment are referred to as the cropping pattern. This research offers a thorough analysis of agricultural yield and pattern using satellite images and unsupervised classifications. According to the studies that are now available, climate agriculture with improved spatial resolution may be a solution for future predictions. Different statistical methods and additional satellite data were used to quantify and analyses the issue. According to the report, crop specialization is occurring in the majority of ShriGanganagar's districts whereas agricultural diversity is only evident in areas where Desertic predominate and where technology is less advanced. The study found a decline in inequality over the time it was conducted and came to the conclusion that agricultural productivity in ShriGanganagar's districts is converging. The study has identified the key factors influencing agricultural production in Rajasthan has recommended certain policy changes to boost output there. An Unsupervised Classification algorithm is used in the methodology to combine optical remote sensing data from Landsat-7 (August 2021 and February 2022) and with Geostatistical techniques. The most effective times to distinguish agriculture from other types of land cover were found.

Keywords: Cropping Pattern, Remote sensing, Geographical Information System, Level First.

Introduction:

Monocropping, crop rotation, and intercropping are examples of cropping patterns that are used for a variety of factors, including the environment, profitability, adaptability to changing conditions, tolerance and resistance to insect pests and diseases, the need for specific technologies during growing or harvesting, and other components of the production system.
A farmer's choice about crop production is influenced by a variety of physical, social, and economic factors. On their farms, they might plant a range of crops and alternate a particular agricultural mix throughout time. Farmers make decisions on what crops to grow depending

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on a range of factors, including physical, social, and economic factors. On their farms, they might plant a range of crops and alternate a particular agricultural mix throughout time. To maximize productivity and preserve soil fertility, the best agricultural methods always contain certain cropping patterns and cropping systems.

Only cropland information, such as cropland extent, crop type, crop progress, and crop condition are recorded in agricultural statistics; cropping patterns are rarely published. Cropland data is gathered through cadastral ground surveys or household-based surveys. Furthermore, the collecting of such data is primarily location-specific and infrequently thoroughly covers vast areas. These methods of data collecting require a lot of labour, take a long time, are expensive, and are rarely repeated. Additionally, cropland data from farmers' reports, including field size, crop conditions, and yield projections, exhibited systematic bias and significant errors.

Study Area:

The Ganganagar district, which is in Rajasthan's northernmost region, is situated between latitudes 28° 42'30" and 30°12'00" north and 72° 39'15" and 74° 18'30" east, Shown in Figuge-1. The district, which has a total area of about 11154.66 sq km, is bordered to the south, east, north, and west by the districts of Bikaner and Hanumangarh in Rajasthan, Ferozpur in Punjab, and the international border with Pakistan. The district is divided into 10 development blocks, including Anupgarh, Sri Ganganagar, Gharsana, Karanpur, Padampur, Raisinghnagar, RawlaMandi, Sadulshahar, Suratgarh, and Vijaynagar, for administrative convenience. According to the 2011 Census, it has a total population of 1969168. In the district, there are 12 cities and towns and 3014 villages. The district has a 14.34 lakh rural population and a 5.36 lakh urban population, respectively.

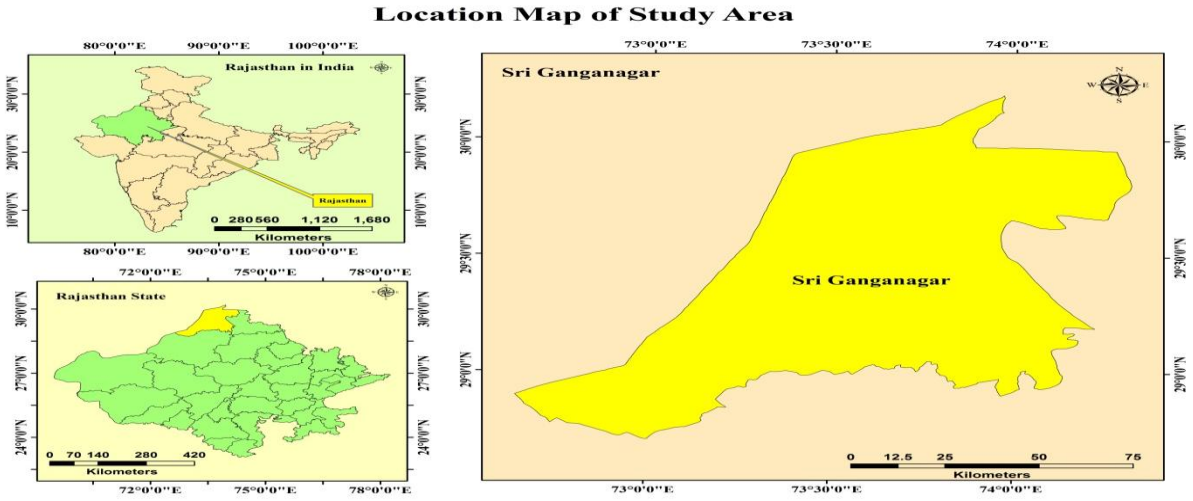

Figure:1 Study area map (Sri Ganganagar)

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Methodology:

This example shows how different remotely sensed variables were retrieved from Landsat-7 imageries to map the cropping patterns in the research area (Figure: 2)

Data Sources:

The Lansat-7 image has a return cycle of 14 days, a spatial resolution of 30 m, and both a vast coverage area and great spatial and temporal resolution. We chose Landsat-7 (Band 3, 4 and 5) wide field view (with a less than 10% cloud cover for the key Coton, Mustrad and wheat growing seasons in 2021 and 2022. (Figure-2).

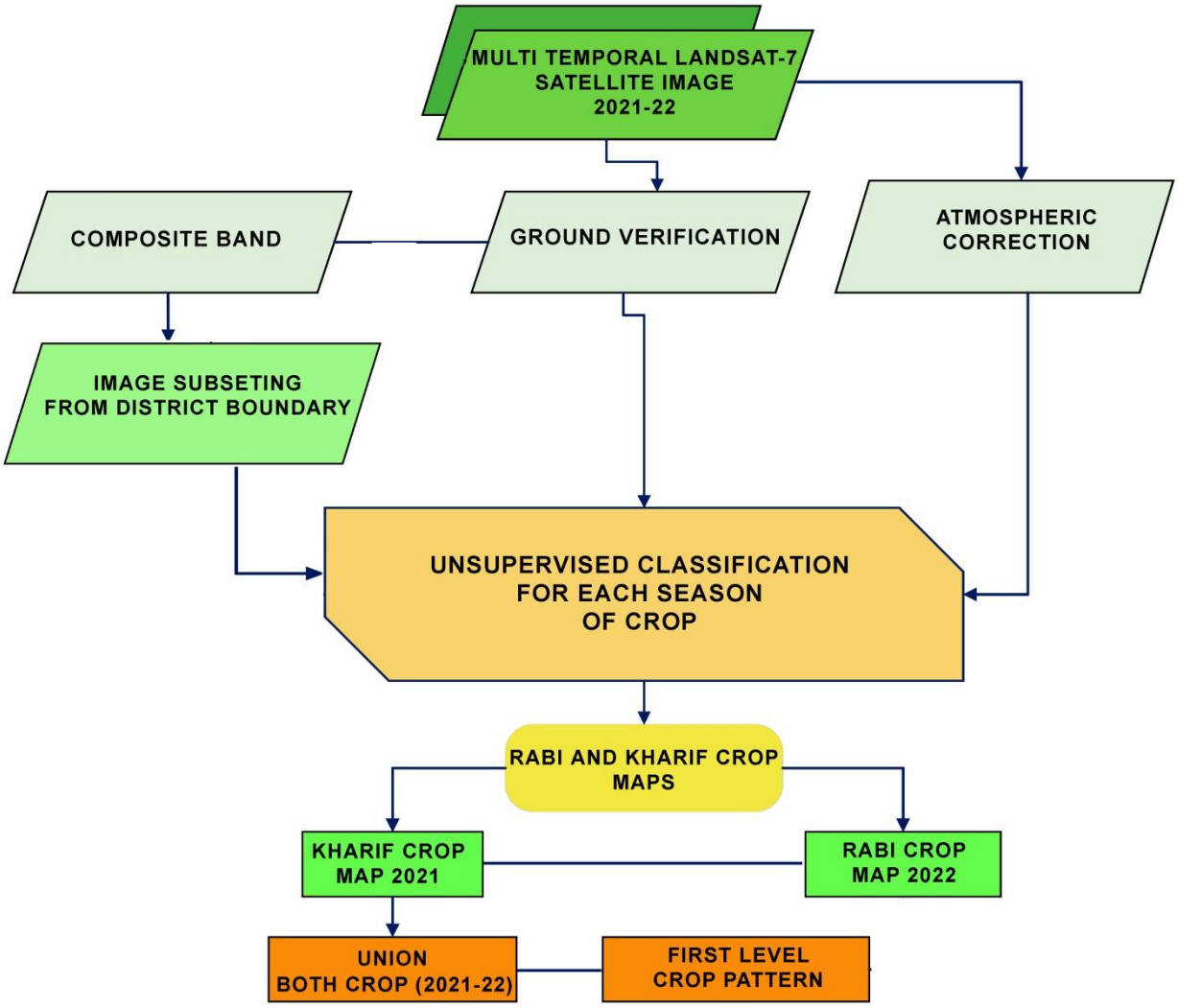

Figure-2: Methodology Chart

Ground Verification (Field Sample of Data):

Field samples were used to confirm that our suggested classification approach was accurate. The sample of land characteristics involved taking pictures, manually identifying Crop type,

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and using a handheld global positioning system (GPS) to capture latitude and longitude information. The same verification samples as supervised classification are needed for unsupervised classification systems to assess classification accuracy.

Unsupervised Classification: We used ERDAS Imagine (Ver. 2014) to cluster feature data into crop kinds using K-means and ISODATA unsupervised learning The most fundamental and widely used unsupervised classification techniques are K-means and ISODATA. They are commonly used in the field of remote sensing since they are straightforward in concept and simple to implement.

Union: In GIS software, union is a geostatistical approach. We utilize this to determine the district of Ganganagar's cropping pattern. Crop data for the years 2021 and 2022 are combined to generate the 2021–2022 crop patterns.

Result and Discussion:

There are more rabi crops in Ganganagar than kharif crops, with 485 thousand hectares of kharif crops and 776 thousand hectares of rabi crops, according to results (table:1). only 390 thousand hectares in the Rabi season and 681 thousand hectares in the Kharif season are left fallow.

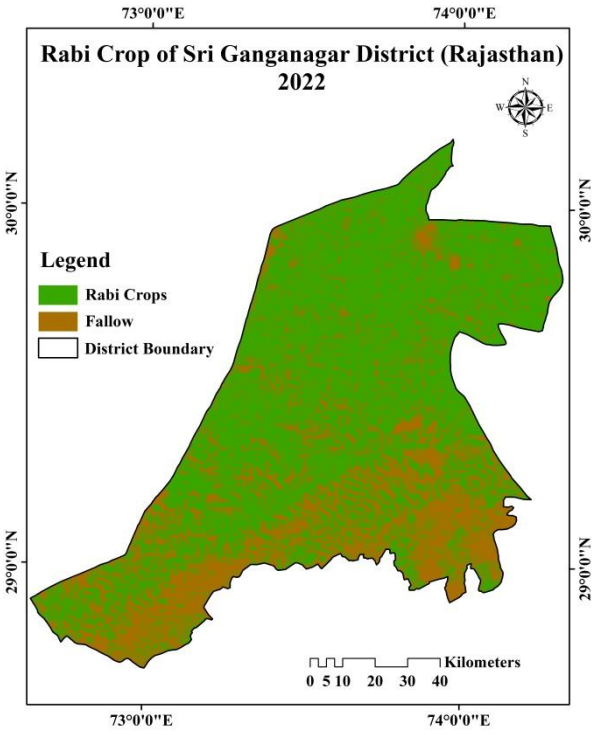

Figure-3: Kharif Crop Map of Sri Ganganagar

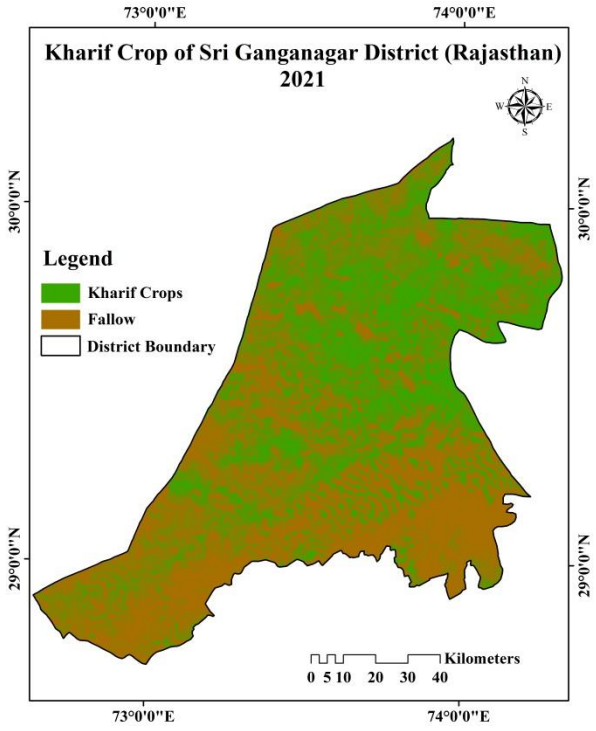

Figure-4: Rabi Crop Map of Sri Ganganagar

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If we look at the kharif crop map for Ganganagar, the southern part is fallow due to the sandy and arid terrain, and the other part is the most cropped area (Figure-3 and Figure-4) and is similar to the rabi crop, however the Kharif crop is shown to have the largest crop area than Rabi crop. Due to the wheat and mustered crop's rabi season, these crops require less water than other crops.

Crop and Non cropped area for Rabi and Kharif Season

Season	**Kharif 2021**	**Rabi 2022**
Class	**Area in (000' Hectare)**	**Area in (000' Hectare)**
Crops	485	776
Fallow	681	390
Total	**1166**	**1166**

Table-1: Rabi and Kharif Crop Area

First Level Crop Pattern area for Rabi and Kharif Season

First Level Crop Pattern	**Area in (000' hactare)**
Kharif-Rabi Crops	442
Kharif-Fallow	43
Rabi-Fallow	334
Fallow-Fallow	347
Total	**1166**

Table-2: Cropping Pattern Area

442 thousand hectares are mostly used for double crops (Rabi and Kharif), whereas only 43 thousand hectares are used for Kharif crops, 334 thousand hectares are used for Rabi crops, and 347 thousand hectares (Table-2) of Ganganagar are left fallow.

Due to the sandy terrain and scarcity of irrigation water, the southern section of Ganganagar is primarily fallow land. The first level of cropping pattern for the ganganagar district is a double-cropped area (Figure-5) in the centre and a single-cropped area with only rabi and kharif crops in the rest of the territory.

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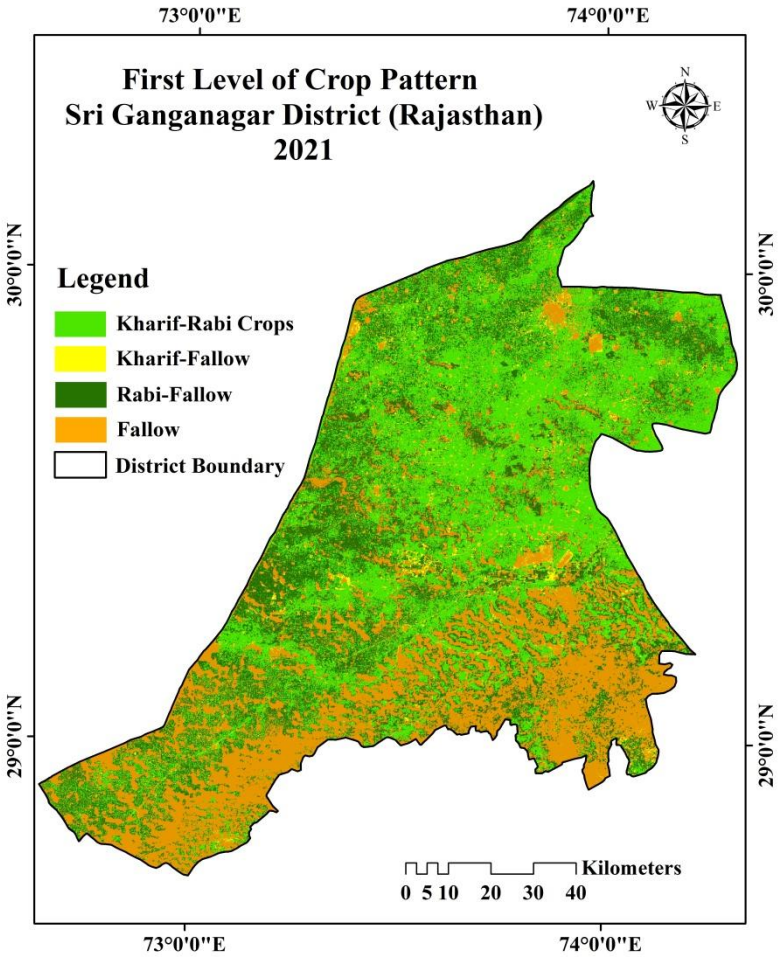

After some time, the Rajasthan economy saw fundamental changes as a result of the anticipated decline in the share of agriculture in the GDP (GDP). Rajasthan State agricultural growth rates are more pleasant than national midpoints, and productivity has increased. The state's crop pattern has improved, only the need of Kharif crop should increase which is advantageous for a state with a heavy agricultural industry. However, there is also expansion for better advancement. By modifying the cropping pattern from these crops to less water-hungry ones, enormous amounts of water could be saved. There is no doubt that the increased agriculture method caused a rise in crop productivity.

Conclusion:

An essential part of a nation's economy is agriculture. Following the various cropping patterns is crucial for a strong economy, and the cultivation is influenced by a number of elements. Thus, we can draw the conclusion that economic variables significantly influence the cropping pattern in Indian agriculture. Despite their extreme poverty, Indian farmers have the urge to alter the farming pattern.

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