Climatic Suitability Areas for the Crops of Charkhi Dadri District in Haryana State

Manju Kumari, Research Scholar, Department of Geography, Jyoti Vidyapeeth Women's University, Jaipur
Dr. Dheer Singh, Research Supervisor, Department of Geography, Jyoti Vidyapeeth Women's University, Jaipur

Abstract

Crop patterns are extremely imperative to understand when decide how to use farming land. As cropping patterns change, arable land can be used to grow a wide range of crops. The degree of competition raises the degree of variety. Understanding how physio-socio-economic elements impact the farming environment is the main advantage of studying crop zones. The study determined the key factors influencing Charkhi Dadri's rural productivity and recommended specific policy changes to boost output. GPS devices are used to gather ground truth data in the research region in order to validate the map and improve its accuracy.

Keyword: Climatic Suitability, Charkhi Dadri District, Cropping pattern, Remote Sensing

1. Introduction:

People's quality of life can only get better and be maintained via development, which is the ultimate goal of this process. It is a notion with a value that is good and reflects change for the improvement of things. It is a method that has been developed with the intention of gradually bettering the social and economic situations of the inhabitants. The term "development" refers to an ongoing process that can be evaluated using a variety of criteria, including but not limited to: economic growth; education; health navy; the degree of upgrading; the position of women; the circulation of goods and services; and entrance to communication. The contexts of space and time are also important to development. Since the beginning of the 20th century, economists, planners, geographers, and other types of regional scientists have been focusing their attention on issues of economic development as well as unfavorable regional imbalances. The world we live in now may be broken down into two distinct halves that are not equal. The first category is made up of a relatively limited number of economically developed nations, whereas the second is made up of a large number of countries that are economically underdeveloped. The socio-economic factor stands out as the most important of the many factors that contribute to the economic disparity between nations. Although mapping agricultural land and crop kinds has historically received most of the attention, cropping patterns have been extensively studied in the remote sensing literature. With the increasing ease of use of satellite statistics and the rapid advancement of remote sensing technology, including machine learning methods, more alternatives for agricultural research become available throughout time. Examining cropping patterns is essential to assessing the sustainability of agriculture. Geographic information systems (GIS) and remote sensing have made it possible to manage dynamic agricultural resources very successfully. Satellite photography has made it possible to map croplands and identify crop kinds on a local, regional, and global scale. Satellite data has shown itself to be a valuable tool for obtaining precise, fast, and economical information in recent years. In India, the green revolution began in the 1967s and enhanced food production through the use of modern unindustrialized techniques and the preamble of high-yield crop assortment. The Green Revolution had a big impact on agriculture in Haryana. The agriculture's association with a few specific crops has led to an increase in the acreage and output of several crops in recent years, especially rice and wheat. Other crops' output and area are also impacted by this. The choice of crop patterns is influenced by a number of factors, including agricultural policies, socio economic and ecological circumstances, water availability, and crop supervision practices. Because of these factors, yield patterns are dynamic and change across time and space. Singh and Kumar (2018) Discusses climatic factors influencing crop patterns in Haryana, including Charkhi Dadri. Sharma and Yadav (2016) Explores GIS-based climatic suitability analysis for crops in Haryana. Department of Agriculture, Haryana (2022) Examines changing climate impacts and adaptation strategies for crops in Haryana. National Institute of Agricultural Economics and Policy Research (2019)

Provides comprehensive climatic zoning and crop suitability assessment for Haryana including Charkhi Dadri.

2. Methodology:

Sources of Data: One can access particular satellite data products from a number of websites that the data source has developed for free. There are numerous websites from data providers, satellite operators, and manufacturers that list the specifications for various remote sensing systems. To choose the optimal data product for a particular project, a user of remote sensing data has got to be knowledgeable about the various foodstuffs and their applications.

Selection of Crops: Identify the major crops grown in Charkhi Dadri (e.g., wheat, mustard, millet, cotton, pulses). Collect crop-specific climatic requirements like temperature range, rainfall, humidity, growing season duration, and soil preferences.

Climatic Data: Collect historical climate data for the district, including:

- Temperature (daily max, min, mean)
- Rainfall (monthly/seasonal totals)
- Relative humidity

Soil and Land Data: Soil type, texture, pH, drainage, and fertility status.

Defining Climatic Suitability Criteria: Establish crop-specific thresholds for climatic parameters based on literature and agronomic research. Define suitability classes for each climatic factor.

GIS-Based Spatial Analysis: Input all relevant data layers (climatic, soil, topography) into a Geographic Information System (GIS). Assign suitability scores to each parameter based on defined classes for each crop. Combine scores using overlay analysis or weighted overlay techniques to generate composite suitability maps.

Validation: Validate the suitability maps using:

- Ground truthing with field surveys.
- Comparing with existing crop yield data and cropping patterns.
- Local farmer knowledge and expert consultation.

Study Area: One of the 22 districts in the northern Indian state of Haryana is Charkhi Dadri district. On December 1, 2016, the Haryana government announced Charkhi Dadri as the 22nd district. District Charkhi Dadri is made up of one sub-tehsil (Boundkalan) and two tehsils (Charkhi Dadri and Badhra), as well as two sub-divisions. District Charkhi Dadri is located between latitude 28.5921$^{o"}$ north and longitude 76.2653$^{o"}$ east. District Charkhi Dadri is located 295 kilometers from Chandigarh, the capital of Haryana, and 112.6 kilometers from New Delhi, the capital of India. A tiny amount of paddy is grown, while the main crops are wheat and mustard in Rabi and cotton in Kharif.

3. Result and Discussion:

A study of data as of the Multi-date Landsat Satellite revealed that the two primary crops during the Kharif season were cotton and a little quantity of rice. Cotton is mostly grown in the district, with the exception of the eastern portion. Wheat and mustard are the two primary crops grown during the Rabi season, go behind by extra crops. In both seasons, there are additional non-agricultural and barren regions. Crop Pattern shows how crops are planted in chronological order. It demonstrates that Charkhi Dadri District is home to the Pattern's greatest Kharif crops. Pedestal on the two seasons Kharif and Rabi, the Rabi season's primary crops are mustrad-wheat and rice-cotton. During the kharif season, we mostly saw rice being grown in the heart of Charki Dadri, with cotton being grown outside. As in 2011, we observe that in 2022, rice is grown in the northern and central parts of Charkhi Dadri, with cotton predominating in the remaining areas. This may be due to the fact that the two primary crops farmed in Charkhi Dadri District during the Kharif and Rabi seasons, cotton and mustard, are progressively shifting from the north to the south. As a result, only a small portion of the agricultural land in the Charkhi Dadri district is utilized for more than two crops. Particularly during the Rabi Season, other crops are progressively going extinct.

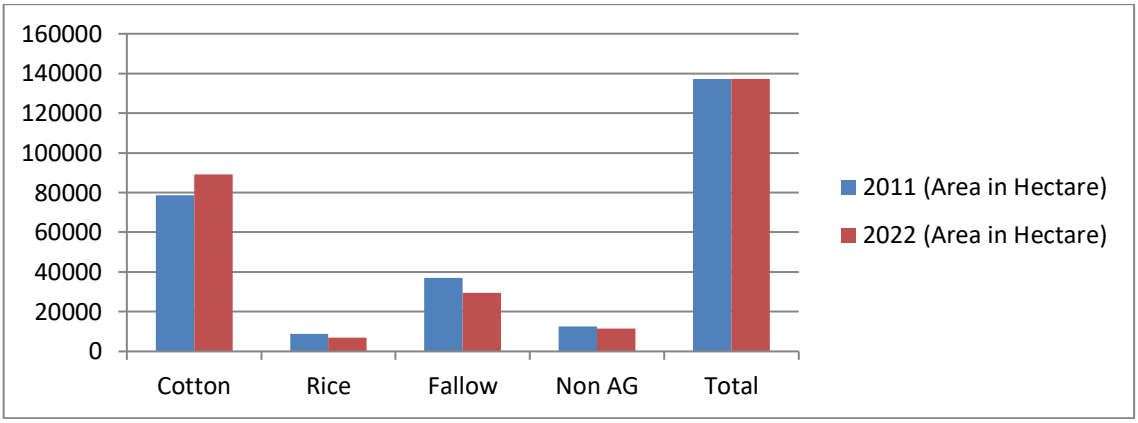

Figure 1: Area graph of Kharif Cropping Patten 2011 and 2022

- **Cotton** area increased by 10,436.2 hectares, representing a significant expansion in cotton cultivation.
- **Rice** area decreased by 1,808.1 hectares.
- **Fallow** land decreased by 7,532.4 hectares, suggesting that some previously uncultivated land was brought into use (potentially for the increased cotton area).
- **Non AG (Non-Agricultural)** land area slightly decreased by 1,095.8 hectares.
- The **Total** area remained constant across both years at 137,321.9 hectares.

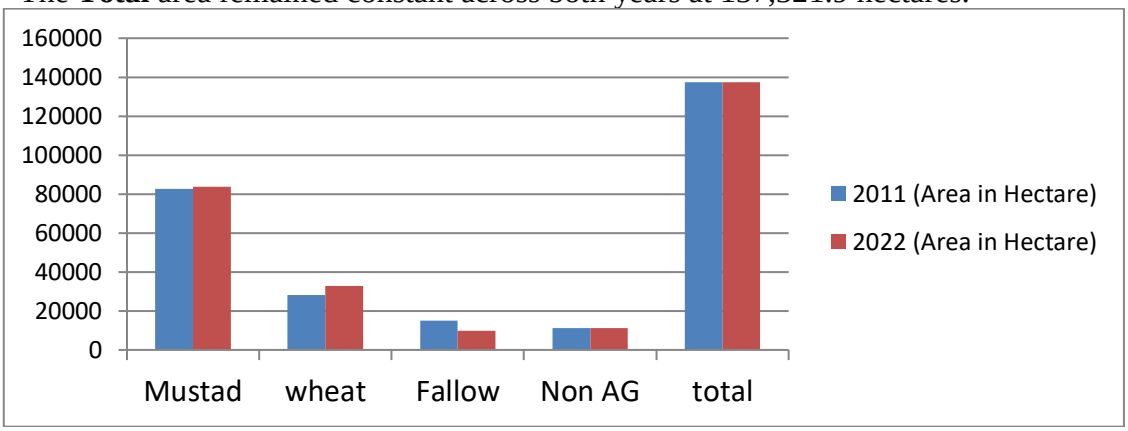

Figure 2: Area graph of Rabi Cropping Patten 2011 and 2022.

The provided table displays changes in the area dedicated to different land uses (Mustard, Wheat, Fallow, and Non-Agricultural) from 2011 to 2022, measured in hectares.

- **Mustard** area increased slightly, from 82,620.2 ha to 83,712.8 ha.
- **Wheat** area also increased significantly, from 28,248.8 ha to 32,735.1 ha.
- **Fallow** land decreased substantially, from 15,146.8 ha to 9,725.4 ha.
- **Non-Agricultural (Non AG)** land remained relatively stable, with a minor decrease from 11,306.1 ha to 11,148.6 ha.
- The **total** reported area remained constant at 137,321.9 ha for both years, indicating a shift in land use allocation rather than an overall change in total area surveyed.

The data suggests that the increase in areas for mustard and wheat cultivation between 2011 and 2022 was primarily achieved by bringing previously fallow land into production.

4. Conclusion:

The current paper outlines a method for analyzing the Charkhi Dadri district's major crop, minor crop, and fallow land cropping trends in 2011 and 2022. One advantage of the proposed method is the potential to display some spatial linkages between crops, which could indicate precise locations of some rotations. For example, the precise location of typical distribution areas and the ten-year change in the Dadri district's charkhi pattern are revealed by the spatial link between cotton and wheat, two seasonal crops grown in the months of Kharif and Rabi, in the study area of Charkhi Dadri district. Another option is to employ a multi-year cropping

pattern map, which includes expert knowledge about the spatial linkages between the crops in the study region and implicit probabilities of change, to predict future spatial crop distribution.

5. References

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