Identification & Mapping of Mustard Cultivation Sites Using a Multi Criteria Evaluation Approach (MCEA) for Kamrup District of Assam, India

Kalyanjit Sarmah[1], C.R. Deka[2]

[1]Project Scientist, Assam Remote Sensing Application Centre (ARSAC)
Guwahati, Assam. INDIA.
sarmah.kalyanjit@gmail.com

[1]Senior Scientific Officer, Assam Remote Sensing Application Centre (ARSAC)
Guwahati, Assam. INDIA.

Abstract: ***Land suitability analysis is a pre requisite to achieve optimum utilization of available land resources for sustainable agricultural management. One of the most important agriculture related issues in the state of Assam is to improve the agricultural output with an efficient use of available land resources. Agriculture is the prime economic activity for most of the people of Assam but the overall production figures for different agricultural crops are still stands at a notably lower level compared to the national average. The aim of the present study is to assess the physical land suitability level for Mustard crop using a Multi-Criteria Evaluation (MCE) method with the help of GIS & Remote sensing tool. The existing pattern of physiographic, meteorological and soil based components were thoroughly considered for the identification & mapping of mustard cultivation sites of Kamrup district with the help of geospatial tool. Present Landuse/Land cover scenario of the study area highlights that although a substantial portion out of the total geographical area falls under agricultural landuse category but it has distinctly been noticed that a major shrunk of future suitable area are till unutilized. The landuse/land cover statistics of the area shows that the Mustard cultivation is confined to only 178.82 sq.km area which shows a huge possibility of further increase in Mustard cultivation sites in coming years. "Overlay analysis" method in GIS based environment was applied to prepare an "Index model" for multi criteria analysis of different natural and soil parameters. Finally, the results show that mustard cultivation sites are mainly concentrated only in the plain areas and in the river adjacent fertile tracts adjacent to river Brahmaputra and its tributaries.***

Keywords: **M**ustard, Kamrup district, **L**anduse/Land cover, **M**ulti-**C**riteria **E**valuation (MCE)**.**

1. Introduction

Agri-based resources are considered to be one of the most vital renewable and dynamic natural resources. Comprehensive, reliable and timely information on agricultural resources are very much necessary at all level. Increasing population pressure and other natural factors like flood, drought, soil erosion and several other climatic disturbances are continuously hampering the growth rate of agricultural production in the North-Eastern part of India. In the present study an attempt has been made to monitor and analyze the pattern of agricultural landuse in the Kamrup district of Assam. Similarly an approach has been taken to analyze the different sets of factors which are responsible for agricultural productivity in the region. Limited agricultural productivity and declining agricultural output has made the researchers and government authority to think about the improvement and implementation of some effective measures to meet the people's need in coming years. In the state of Assam, current landuse pattern is not suitable therefore there is an urgent need to use the existing land in a more rational and possible way. In that case, geospatial technology coupled with GIS & Remote sensing technique offers a dynamic tool for the multidimensional process of landuse/land cover pattern evaluation and analysis. Geospatial technology provides a perfect base to perform a landscape analysis more synoptically, repetitively and precisely. It's a very important source for the evaluation of spatial information such as landuse/land cover, drainage, topography & agri. related components. Similarly, GIS is also a powerful tool for different sets of geo-environmental analysis and appraisal of natural resources. It helps the user to integrate the multisource data base generated from different sources including remote sensing into a single platform.

Sets of multi-criteria parameters like climatic

parameters, soil & topographic parameters, environmental factors and other biophysical parameters usually set a process to identify the suitable agricultural land out of the whole landscape. In such type of situation, many variables are involved and each of these variables needs to be assigned with weightage values according to their relative influences on the optimal growth conditions of crop through Multiple Criteria Evaluation (MCE) method. Geographical information system (GIS) offers a broad and dynamic platform to analyze the hidden agriculture related issues in a more precise way than the conventional method. The overlay analysis operation specially helps a lot in analyzing different sets of parameters based on certain criteria and ultimately brings them into common assured structure. However, the overlay analysis procedures don't enable one to take into account that the underlying variables are not equally important [6]. So, one particular approach that can help to overcome such kind of ambiguity is the Multi Criteria Evaluation method [2]. The objective of using multi criteria evaluation technique is to find out the solution for decision makers characterized by multiple alternatives, which can be evaluated by means of decision making criteria [7]. The primary aim of this research is to find out and delineate the suitable areas for seasonal mustard cropping areas in the Kamrup district using relevant information

2. Study Site

Present study was carried out in Kamrup (R & M) district which is located in the lower Assam belt of Brahmaputra valley. Geographically it is located in between 25040/00// N to 26030/00// N latitude to 9100/00// E to 9200/00// E longitude. It is bordering with Baska, Udalguri and Darrang district in the north, Nalbari and Goalpara district in west, Morigaon district in the east and by the state of Meghalaya in the southern part. The total surface area of the district is approximately 4088.86 sq. km. Kamrup district falls in the fertile agrarian plains of Brahmaputra valley. The topography is almost flat in the middle and northern part of the district whereas presence of a series of scattered hill is visible in the southern part. Average elevation ranges in between 55 m to 70 m in most of the areas but in southern part the elevation raises upto 500 m in hill areas adjacent to Meghalaya plateau. The study area has a sub-tropical with semi-dry summer and a cold winter climatic pattern. Mean annual rainfall ranges in between 1500 mm to 2600 mm, which mostly occurs in the months of June to August. Average annual temperature varies in between a minimum of 70 C in winter months to maximum of 38.50 C during summer season. Taxonomically, the study area has been classified into 19 taxonomic classes. Most of these groups are slightly acidic in nature with pH ranges between 4.5 to 6.0. The hydrological conditions are quite suitable for agricultural drainage. The major surface water sources for the district are rivers, canals, beels (temporary water logging area) and ponds etc. However, there is a significant potential for irrigation from available surface and ground water sources. In the entire study area rainfed and irrigational agricultural activities are practiced throughout the year. Kamrup district has been divided into three agricultural sub-divisions namely (i) Guwahati agricultural sub-division (ii) Rangia agricultural sub-division and (iii) Boko agricultural sub-division.

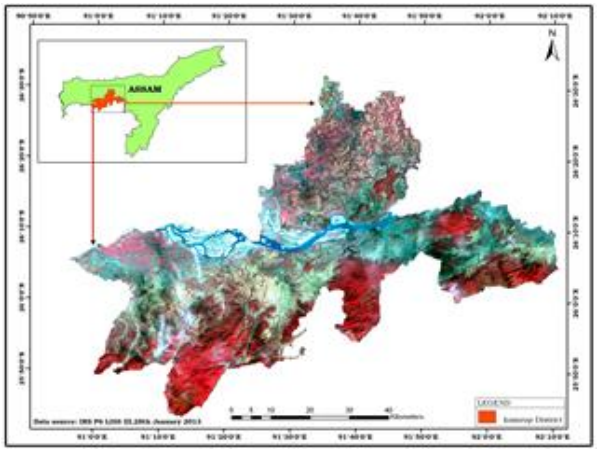

Figure 1: Location map of Kamrup District.

3. Materials And Methodology

A. Landuse/Land cover

The entire landscape of Kamrup district was extensively surveyed from August, 2013 to February, 2014. Field information like location extent, elevation values, types of existing landuse/land cover & cropping pattern were collected through spot verification with handheld GPS device. For the analysis of landuse/land cover pattern an IRS P6 LISS-III satellite data of 28th January 2013 was used during the study. The 1:50000 scale Survey of India topographical sheets No. 83 N 1,5,10,11,12,16 were used for preliminary processing of the satellite data. A False Colour Composite (FCC) was generated using different bands of the satellite data. The satellite imageries were rectified and geometrically corrected using Ground Control Points (GCP)

obtained from topographical sheets and from the fields. Polynomial equation was used for the purpose of registration and orthorectification of the satellite datasets for further analysis. Universal Transverse Mercator (UTM) projection and WGS 84 datum system were considered as a reference system for the Georeferencing of all these datasets. Both the Visual interpretation and Digital Image Processing procedures were adopted for the better demarcation and interpretation of existing landuse/land cover categories in the study area. Sub-pixel level image to mage accuracy was achieved through repeated attempts. Histogram matching operation was performed to eliminate the radiometric errors in the image. GPS based training sites were widely used to generate the signatures for different landuse/land cover classes. later the image was classified based on combination of visual and digital classification system. The output resolution of the classified landuse/land cover map is at 23.5 m.

A. Topographic database

An original ASTER G- DEM dataset was used to analyze the slope, aspect and overall physiographic expression of the study area. "3D analyst" tool of Arc GIS 10.1 software was used to generate a Digital Elevation Model (DEM) from the ASTER dataset. Similarly, for the generation of Slope, Aspect & relief distribution pattern map of the study area the "Topographic Analysis" function of ERDAS Imagine 9.2 software has been applied. Slope analysis function of ERDAS helps in calculating the maximum rate of change between each cell and its neighbors. Every cell in the output raster map has a slope value. Aspect is measured clockwise in degrees from 0, due north to 360 degree, again from due north to coming full circle. Flat areas having smooth surfaces are usually better for rice cultivation as it facilitates even and better circulation of water flows. Both of these parameters were studied to find out the suitable sites for evaluation of mustard cultivation sites in Kamrup district.

B. Soil Parameters

The distribution pattern of different soil parameters in the study area have been prepared through "Natural Neighbour" interpolation followed by reclassification as laid by National Bureau of Soil Survey & Landuse Planning (NBSS & LUP). Soil samples collected from different locations randomly were analyzed in the laboratory for different soil parameters. The sample sites were digitized followed by attachments of soil attributes under GIS environment. The "Natural neighbor" interpolation tool was applied to generate thematic maps of different soil paramaeters. Important soil parameters like Soil texture, soil pH, soil depth, slope were taken into consideration for suitability evaluation. Amongst the major soil determinants, pH is found to be one of the important components for land-crop suitability analysis. Slightly acid soils having pH value between 6 to 7 are generally better for the Mustard crop cultivation.

C. Meteorological database

Temperature, rainfall and humidity are the three most important meteorological components which are generally used to control the growth and distribution of agricultural crops. As mustard is normally grown in dry and cool climate and therefore mustard mostly grown as a rabi season crop. Mustard crop normally requires a temperature between 10 degree Celsius to 25 degree Celsius and an available rainfall condition of 625 mm to 1000 mm. Meteorological information pertaining to different parts of Kamrup district was collected from "India Water Portal" (www.indiawaterportal.com) an online data storage site. Similar to the soil distribution analysis the "Nearest neighbor" interpolation method was applied to prepare the climatic Zonation map of the study area, which later shows the prevailing Agro-Climatic zones of the region and the availability of combination of both moisture content and temperature zones.

D. Crop mapping

For the analysis and monitoring of prevailing cropping system , Green, Red and Near infrared bands of IRS P6 LISS III data with a spatial resolution of 23.5 m were processed in ERDAS Imagine 9.2 software. Initially, an unsupervised classification operation was performed using a spatial statistics (e.g. ISODATA algorithm) to classify the particular image into available number of classes in the area. Later, after the completion of ground truth verification process a supervised classification was performed using Maximum – Likelihood algorithm. Accurate training signature based on ground truth for mustard was used as an input to supervised classification. The accuracy of the cropping area identification and mapping was evaluated by obtaining a post classification Kappa coefficient accuracy assessment tool. In order to assess the accuracy of the classified images, random reference sample points of verification were selected from different landuse classes. Besides, the digital image processing technique for the final identification of cropping areas a visual interpretation technique was followed from a high resolution IRS P6 LISS IV

satellite data with a spatial resolution of 5.6 m.

E. Land and Crop suitability analysis

According to the degree of favorable condition for seasonal mustard crop, a simple statistical weightage technique was used for all the variables leading to multi-criteria decision support approach. Three rating systems, like "1" as Suitable, "2" as moderately suitable and "3" as Unsuitable for all variables were adopted. Suitability rating regarding different factors was assigned after a detail observation of all the necessary factors. All the details regarding the different topographic, climatic and soil parameters are given from Table. I to Table.V.

ERDAS Imagine 9.2 and Arc GIS 10.1 softwares were used to prepare the Topographic (slope & aspect), Climatic (temperature & humidity) and Soil physico-chemical properties (pH, texture & depth) and their relevant layers. During the study period an ideal "Index model" has been developed using "Model maker" function of ERDAS Imagine software.

I. **TABLE 1:** TOPOGRAPHIC SUITABILITY RATING FOR MUSTARD CULTIVATION

Slope (in Degree)	Rating	Aspect Direction	Rating
Less than 15	1	Flat, North, N-East &North-West	1
15 to 30	2	All direction more or less than 15 degree slope	
More than 30	3		3

II. **TABLE II:** SOIL TEXTURE SUITABILITY RATING FOR MUSTARD CULTIVATION

Textural Class	Description	Rating
Clayey	Sand <45%; Silt <40% and clay >40%	3
Coarse Loamy	Sand 40-80%; Silt <50% and Clay < 20%	2
Loamy	Sand 20-50%; Silt 30-50% and Clay < 30%	1
Loamy sand	Sand 70-90%; Silt <30% and Clay<15%	1
Fine	Clay 40-100%	3
Silt Loamy	Sand,50%, Silt 50-85% and Clay <30%	2

III. **TABLE III:** SOIL DEPTH AND AVAILABLE SOIL WATER HOLDING SUITABILITY RATING FOR MUSTARD

Soil Depth	Rating	Water holding capacity	Rating
Extremely stony/rocky	3	Low(<3cm)	3
Partly stony/rocky	2	Moderate (5-10cm)	2
Moderately stony/rocky	2	High (10-15cm)	2
Not stony/rocky	1	Very high (> 15cm	1

IV. **TABLE IV:** SOIL PH AVAILABILITY AND SUITABILITY FOR MUSTARD CULTIVATION

Soil pH	Rating
< 4.5	3
4.5-5.0	3
5.0-5.5	3
5.5-6.0	2
6.0-6.5	2
6.5-7.0	1
> 7.0	2

V. **TABLE V**: CLIMATE SUITABILITY RATING FOR MUSTARD CULTIVATION

Temperature	Rating	Humidity	Rating
> 39 and < 10	3	20 - 30	3
35 – 39	3	38 – 46	3
30 - 35	3	46 - 53	2
15 - 19	1	53 - 59	2

19 - 22	1	59 – 66	2
27 - 29	2	66 - 78	1
22 - 27	2	78 - 89	2

As the present study is purely based on the multi criteria evaluation approach, so after the final consideration of all the natural and soil based parameters, the "index model" was run to find out the suitable areas for mustard cultivation sites in Kamrup district. All those variables in Figure-2 were used as input layers in the index model. In the first phase of the analysis the "Topographic suitability" model was generated using the slope and aspect parameters as base layers. Thereafter, the "Soil suitability" model was formulated by considering the layers like soil pH, soil texture and soil depth. Thirdly, the "Climatic suitability" model was generated by considering the inputs like temperature and humidity dataset. In the next step of the analysis all the mentioned spatial layers were stored in an output file and used them as a memory input file for conducting the entire suitability analysis for Kamrup agricultural district.
Figure. 3, 4 and 5 have shown all the important variables necessary for the suitability analysis namely topography, climatic parameter and soil parameters, which all are used for the formulation of suitability model.

It has already been mentioned that GIS based "Spatial Analyst" tool in Arc GIS software has been used to achieve the output. After the final analysis of all the parameters a reclassification operation was carried out to calculate the area wise extent of different parameters. The statistics of each of the rating classes has been calculated for all the twelve variables as shown in Table. VII.

F. Overlay analysis and suitability map

A Normalize Difference Vegetation Index (NDVI) analysis was performed by using an IRS P6 LISS III satellite image of 28th October 2013. The NDVI analysis showed the overall growth and distribution pattern of green vegetation cover for the entire district, later it helped in evaluating the probable crop growing sites beyond the present cultivation limits. The present NDVI map and the crop-land suitability maps were overlaid to identify the differences between the vegetation pattern and the potential cropping sites in the district. In such way useful information can be gathered concerning the spatial distribution pattern of different suitability classes. This particular analysis helps in getting the proper picture regarding how the mustard crops can be practiced in different suitability levels

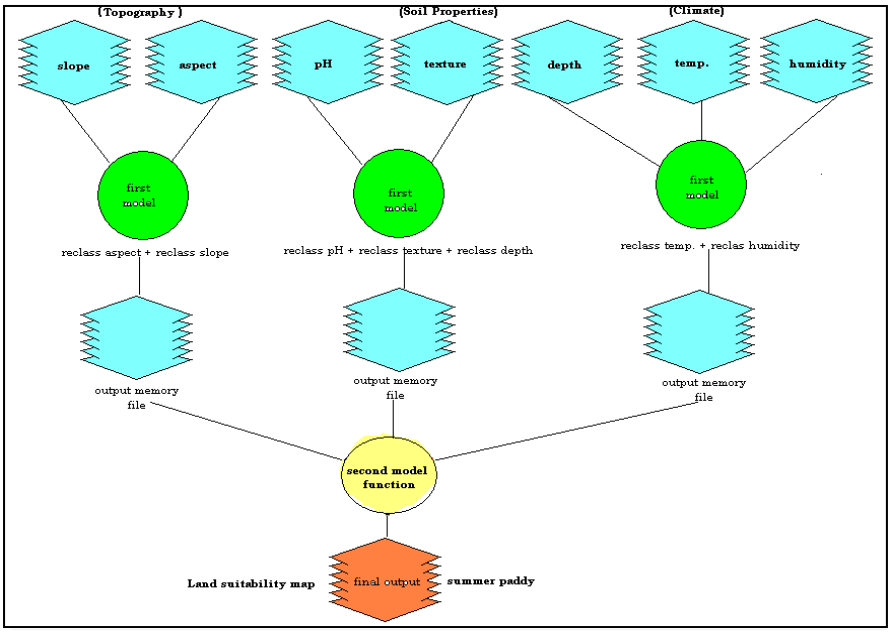

Figure 2: Multi criteria index model for land suitability analysis.

4. Results And Discussion

A. Landuse/Land cover

It has already been mentioned that landuse/land cover analysis is an important component for the formulation of land suitability strata. The landuse/land cover statistics for different agricultural sub-divisions of Kamrup agricultural district has been given in Table. VI and Figure-3.

The LULC analysis shows 9 different classes which were produced from the combination of the multi spectral layers corresponding to green, red and near-infrared bands. The prominent landuse/land cover classes in the study area are- (1) Agricultural land (summer paddy & mustard) (2) Rural habitation (3) Forest land (4) Wasteland (5) Shifting cultivation (6) Grassland (7) River sand (8) Water body and (9) Built-up land. Analysis shows it that few landuse classes like Agricultural land (1279.46 sq.km), Forest land (1127.11 sq.km), Rural habitation (710.08 sq.km) and Sandy area (206.48 sq.km) are occupying a significant portion of the total geographical area. Area wise landuse/land cover statistics in the district which comprises of the Boko, Rangia and Guwahati agricultural sub-division have been presented in Table. VI.

VI. **TABLE VI**: LANDUSE/LANDCOVER PATTERN IN DIFFERENT AGRICULTURAL SUB-DIVISIONS OF KAMRUP AGRICULTURAL SUB-DIVISIONS

Landuse Class	Rangia	Boko	Guwahati	Total landuse
Agril. Land	316.56	292.84	670.06	1279.46
Built-up	32.56	16.83	137.18	186.57
Rural Habitation	129.37	396.9	183.81	710.08
Forest	32.61	412.8	681.7	1127.11
wasteland	51.91	75.91	68.71	196.53
Grassland	32.59	115.85	89.56	238
Water body	16.98	27.98	98.99	143.95
Sandy	11.87	88.73	105.88	206.48
Total	624.45	1427.84	2035.89	4088.18

The overall accuracy of the landuse/land cover classification stands at 92 per cent for each landuse categories. Presently, though most of the plain areas are using as Agricultural land specially in Rangia and Boko sub-divisions but a sizeable portion of plain land area located in the narrow intermontane patches of Boko and Guwahati sub-divisions can also be developed as a probable mustard growing site. The analysis shows that a significant part of agriculture utilizable land area has been left unutilized in many parts of the district. So, the present study can be very much helpful in delineating these stretches of land area as probable agriculture sites in near future.

B. Multi criteria evaluation and suitability

A Multi Criteria Evaluation (MCE) process was adopted to observe the distribution pattern of all the three categories of land suitability classes in the Kamrup district. The observation and integration of all the multi criteria factors in the index model has helped us in tracing the extent of each land suitability classes. Analysis shows that suitable stretches of land can be seen in the presently spreading cropland areas, narrow corridor located in between the hills and the flood effected plain areas located in the upland portion of southern part of Rangia, Boko and Guwahati agricultural sub-division.

"Suitable areas" (1) has been further categorized into two types (a) Very highly suitable area and (b) Highly suitable area; these two areas are mainly characterized by a slope category between 5.60 - 7.80, soil pH ranges in between 5.6 to 7.1, soil texture class varies in between clay to clay loam, topographically these areas are flatland area where elevation is in between 35 to 48 m above msl. In Rangia sub-division though a sizeable portion of agricultural land area is in high land and not that much affected by seasonal flood particularly the places like Hazo, Ramdia and in Bongsar a marginal portion of land left unutilized because of seasonal flood and water logging. Average annual temperature ranges in between 25 Degree Celsius to 30 degree celsius throughout the year.

Secondly, the "Moderately suitable " (2) areas have been classified into three different types- (a) Moderate high suitability area (b) Moderate

suitability area and (c) Moderate low suitability area. Most of these areas are located in between the slope category of 50- 300 slope, humidity is in between 25 – 65 per cent, pH ranges between 4.0 – 5.1, soil texture is in between coarse silty to coarse loamy. Drainage pattern varies from very poorly drained to well drained. Most of the places in Rangia and Boko agricultural sub-division fall under this type suitability class. More precisely certain places like Rangia, Baihata Chariali, Bezera, Changsari, Mirza and Sonapur etc. are mainly comes under this category.

"Marginally suitable" (3) areas are the areas which are completely deprived of any sorts of major agricultural activity. In the existing landuse/land cover pattern parallel lofty hill ranges located in the southern part of the district, numerous numbers of small and medium sizes of wetland areas located in both the sides of river Brahmaputra and other wasteland patches created by seasonal flood are normally fall under this category of suitability class. The soil taxonomic condition of this category of land is also not suitable for cultivation purpose. Presence of more amounts of clay and silt content has made these areas as the least suitable category of land. However, some kind of remedial measures like "Integrated watershed management programme (IWMP)" and "Wasteland development" programme can be very much helpful in making these areas utilizable for agricultural purpose particularly for Mustard crop. Besides, these three categories of suitability classes another category of land has been identified by the already prepared index model, these are the areas which are completely utilizable for agricultural purpose. These kinds of places have been categorized as "Unsuitable" land.

The potential areas which falls under unsuitable land has been identified by using a method developed by Corbett, (1996).This method suggests an approach of "Overlay operation" based on GIS based platform. The two different crop layers of summer paddy and mustard crops were overlaid on the present landuse/land cover layer with the help of "Spatial analyst" tool of Arc GIS software. A clear presentation regarding the location and distribution of different suitability classes has been highlighted in Figure-6. Area wise distribution pattern of different multi criteria factors has been analyzed through three different ranks varies from "Rank-1" to "Rank-3" where Rank-1 stands for the best suitable portion of land Rank-3 for the least suitable areas. Spatial analysis and linkage of all the different parameters in GIS environment has shown it that though a substantial portion of land area falls under the Rank-3 category but most of the land of Kamrup agricultural district still falls under Rank-1 and Rank-2 suitability category.

C. Mustard cultivation

The present landuse/land cover map shows it that the area being used for mustard cultivation in the district is 178.82 sq.km. This category of land includes both the seasonally flood affected areas and comparatively upland agricultural tracts located in the northern & western part of the district. The riverine fertile tracts of mighty Brahmaputra and the areas that engulf the places like Nagarbera, Sontali, Goroimari, Rampur, Ramdia, Hazo, Rangia and Bezera agricultural development circle produces a significant portion of seasonal mustard seeds in the entire district. Similarly, the summer paddy cultivated areas are mostly concentrated in and around Nagarbera and Sontali agricultural blocks. Nagarbera and Sontali blocks of Boko agricultural subdivision can also be termed as the major mustard production centre not only in Kamrup district but in the entire state also. A substantial portion of the area usually falls under the not suitable category. The mustard cultivated areas includes both the out growers block and the scheme areas.

D. Land suitability and NDVI

It has already mentioned in the methodology section that the vegetation cover map and the crop suitability maps were overlaid to analyze the degree of interrelationship between the presence of vegetation cover and extension of suitability zones. After the completion of overlaying process a cross table was obtained in between the areas of suitable land and vegetation cover density stretches. Such a way we obtained the necessary information concerning the spatial distribution and extent of different suitability classes in the Kamrup district. This particular analysis helped us to fine tune our results, because the resultant layer provided the information about how the mustard can be cultivated across the different land suitability zones. The overlay analysis was performed between the mustard crop suitability map and the NDVI map which later helped in better understanding the interrelationship between the mustard cultivation and vegetation cover concentration. But the present "index model" predicts an inverse relationship between the vegetation cover percentage and the suitability map. All the medium, medium-low and low suitable lands are laid under dense vegetation cover where more than 50% canopy cover exist. Whereas, high and medium-high suitable lands are located in the open vegetation cover less

than 50% in the study area. Table.8 highlights the location pattern of mustard cultivation sites and the NDVI vegetation cover in the study area.

VII. **TABLE VII**: AREA WISE DISTRIBUTION OF DIFFERENT LAND SUITABILITY RATING ZONE FOR MUSTARD CULTIVATION IN KAMRUP

Parameters	Categories	AREA PERCENTAGE		
		Rank-1	Rank-2	Rank-3
Topographic Parameters	Slope	72.24	21.55	7.10
	Aspect	70.26	--	30.21
Climatic Parameters	Temperature	18.45	68.10	13.45
	Humidity	20.33	49.89	30.20
Soil Parameters	Soil pH	12.44	61.12	27.11
	Soil texture	21.54	79.27	---
	Soil depth	81.32	20.32	---
	Water holding capacity	89.23	11.21	---

VIII. **TABLE VIII**: RELATIONSHIP BETWEEN THE MUSTARD CULTIVATION AND VEGETATION COVER

Land suitability	Land area (in percentage)	Vegetation cover (in percentage)
High	4.10	0 to <50
Medium-high	19.45	
Medium	47.65	51 to 75
Medium-low	25.32	75 to > 80
Low	4.20	

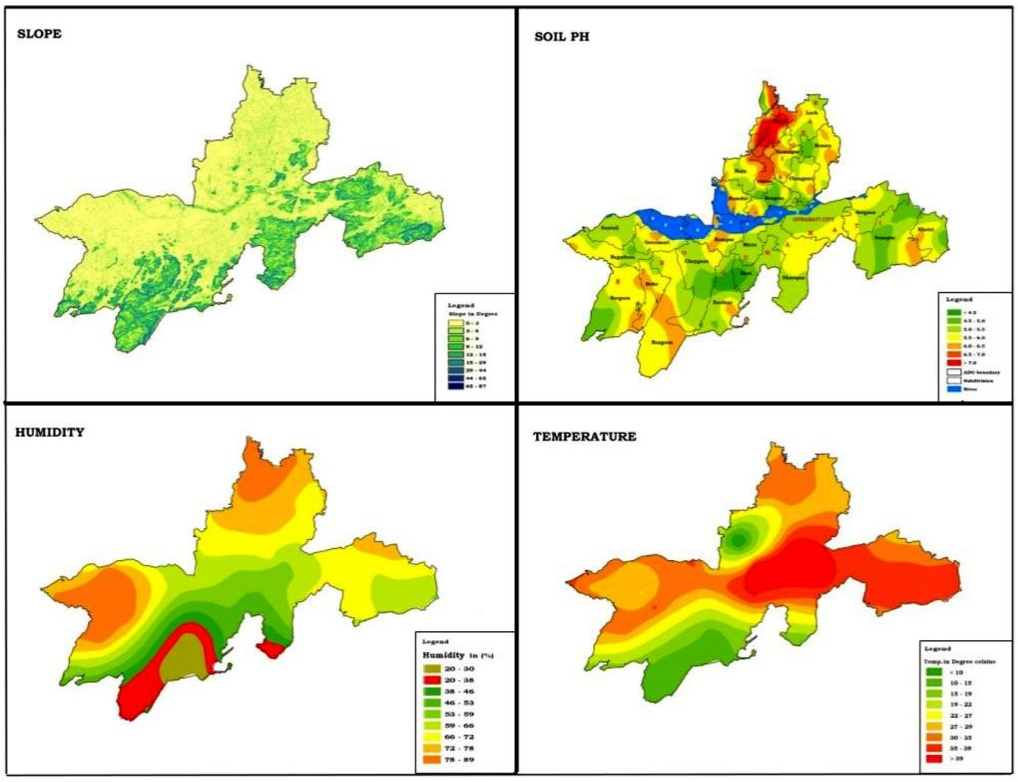

Figure 3: Physiographic and Climatic parameters of Kamrup district.

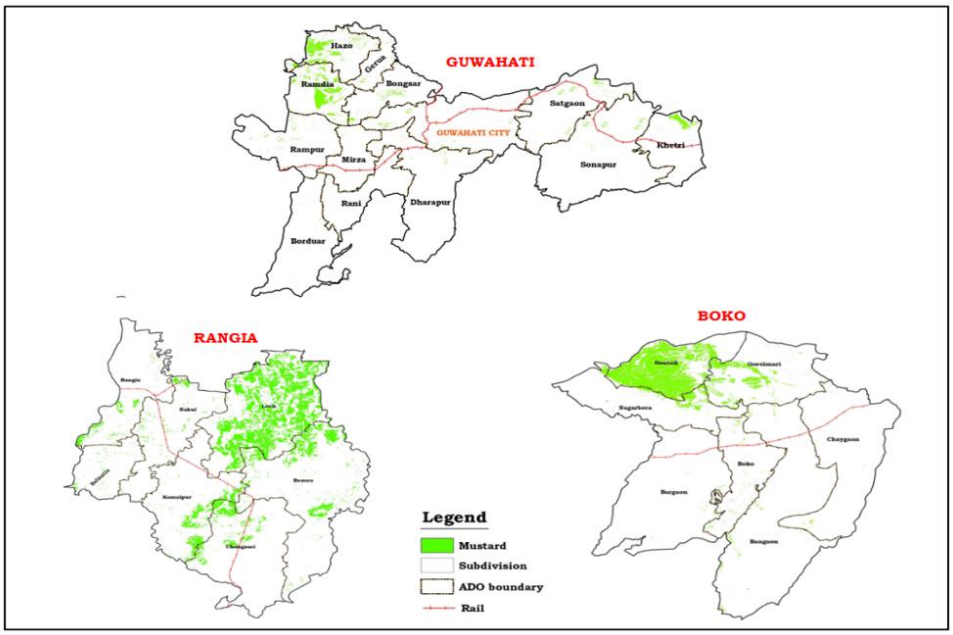

Figure 4: Mustard crop growing areas in different subdivisions in Kamrup district.

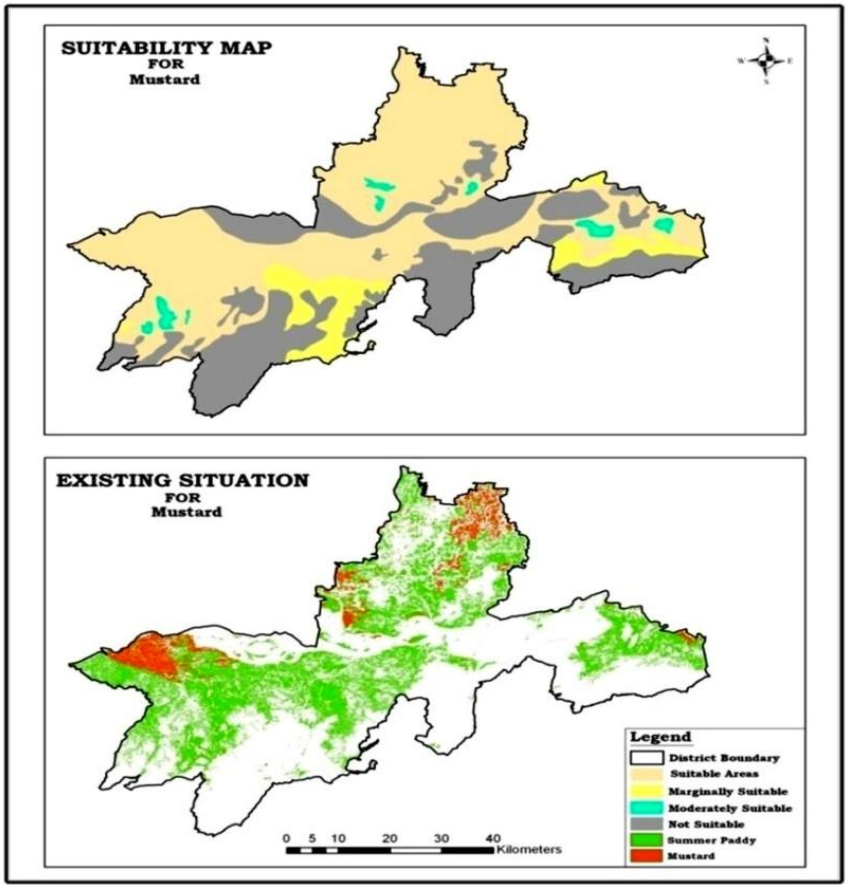

Figure 5: Land suitability map for Mustard cultivation, based on multi criteria decision making approach.

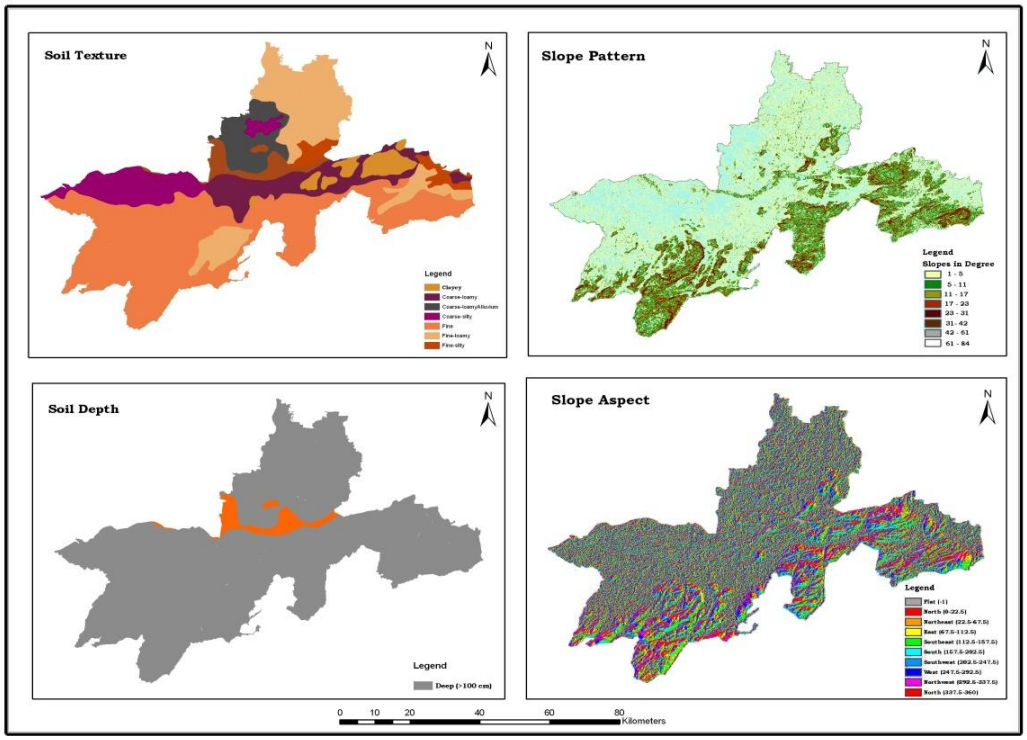

Figure 6: Status of different suitability parameters in Kamrup district.

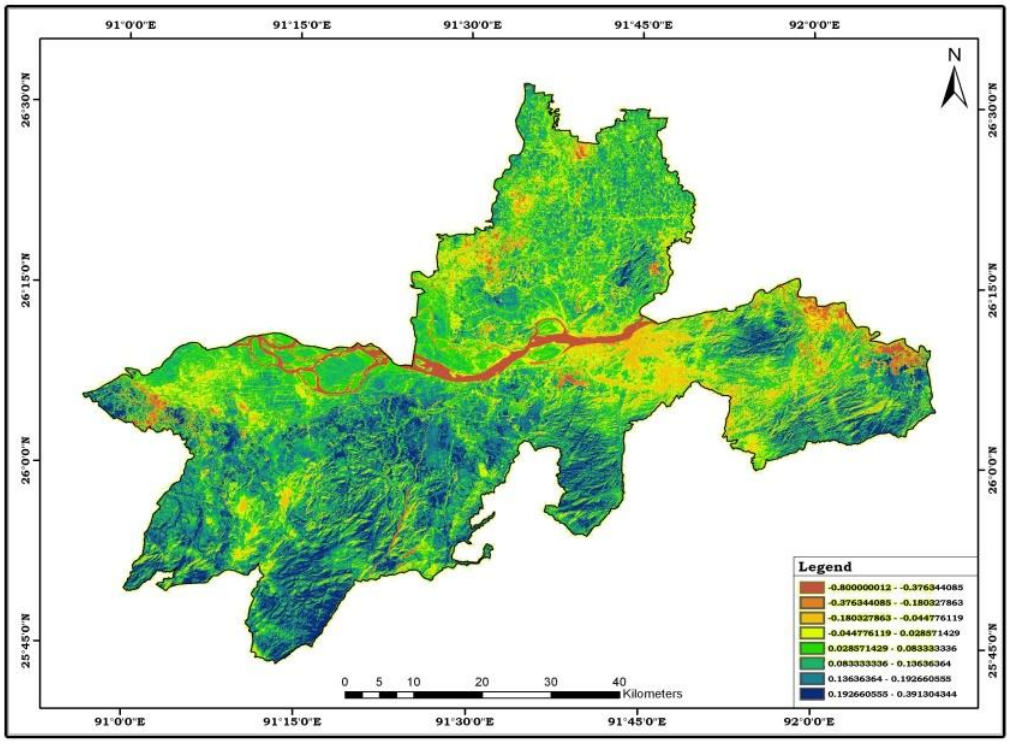

Figure 7: Normalize difference vegetation index (NDVI) map of Kamrup district.

5. Summary And Conclusion

Crop-land suitability analysis is an important component for the overall development of a region. In this particular study, Remote sensing and GIS techniques have been applied to identify the suitable areas for seasonal Mustard cultivation sites. The results obtained from this study indicate that the integration of Remote sensing and GIS and application in multi-criteria evaluation technique could provide a superior database and guide map for decision makers considering crop substitutions in order to achieve better agricultural production. The study clearly brought out the spatial distribution of Mustard cultivation areas derived from remote sensing data in conjunction with evaluation of biophysical variables of soil, topographic and climatic databases in GIS environment which is helpful in crop management option for intensification and diversification of crops. This particular approach has been used in some other countries for the suitability analysis of several other crops. In the entire Indian subcontinent, countries like India, Pakistan, Bangladesh and Sri Lanka have the experience of following this approach for the identification of potential sites for paddy, jute and mustard crops. However, in North East India this kind of study doesn't have a very long historic base.

Present study is a kind of base level research which is mostly based on biophysical database and that could be very much beneficial for a precise cropping management strategy at any level. Additionally, the results of this study could be beneficial for other investigators. This study has been done considering factors like prevailing landuse/land cover types, topographic and soil properties which have put its influence in land suitability classification. However, more numbers of factors like soil, climate, irrigation facilities and socio-economic factors can be incorporated for future study which influences the sustainable use of land resources

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