DETECTION OF THERMAL WATER STRESS IN LALITPUR FOR WHEAT CROP TO SUGGEST OF IRRIGATION

[1]Sangeeta Singh, [2]Anupam Kumar Gautam,
[1]M Tech Environmental engineering student, [2]Assistant Professor Environmental engineering
[1]Civil Engineering,
[1]Maharishi University of Information Technology, Lucknow, India

Abstract *:* **Detection of crop water stress analyse for irrigation scheduling**. Satellite monitoring of vegetation water stress is very important for precision agriculture, which realise on time of irrigation to ensure crops will not suffer from water stress and produce maximum potential yield under limited water condition. Potential of satellite data provide spatial and temporal dynamics of crop growth condition under water stress and analyse for suggestion of irrigation. This study was conducted in Bundhelkhand region of Lalitpur district, tempora

l **Landsat dataOLI+TIRS** was used for detecting water stress using the thermal and optical indices. Land surface temperature, normalized vegetation index and normalized water stress indexwas used for normalized moisture index to find out water stress condition. The main objective of this study was to detect crop water stress using different optical and thermal based indices to suggest irrigation.

The time series NDVI data was used to extract wheat area of Lalitpur District. Extracted wheat area of the district was 125,296 ha. The comparative analysis of normalize moisture index and land surface temperature was used to determine the thermal water stress index for wheat crop in the study area. The output comes in four group of water stress condition as; Normal – Group 1 or class four (NMI > 1) no water with dense vegetation and low temperature, Low stress – Group 2 or class 3 (1> NMI > 0.8) thermal water stress due higher surface temperature and sparser temperature, Moderate stress – Group 3 and class 2 (0.8 > NMI > 0.5) strong water stress due sparser vegetation and Severe stress – Group 4 and class 1 (0.5 NMI > 0) very high or severe thermal water stress due to high temperature and very low vegetation. Whereas the land surface temperature was negatively correlated with NMI. When NMI is higher the LST was lower and vice versa.

The overall study indicates that, Lalitpur district has a water scarcity region. For better agricultural production there is lack of irrigation facility. Due to this crop are in water stress condition and they do not grow properly. The result was used to suggest better irrigation practices for proper growth of wheat crop in Lalitpur district to improve production. On the basis of this research work the better time for irrigation scheduling was suggest as; first irrigation during 8 December to 25 December and second during irrigation 25 January to 15 February. Other than this when severe water stress is shown in the output the irrigation should be must at that time

IndexTerms*:* Thermal water stress, NDVI, NDWI, Land surface temperature, Scheduling irrigation, Wheat area extraction

I. INTRODUCTION

Biosphere's continued exposure to abiotic stress viz, extreme temperature chemical toxicity, salinity, drought etc. has led to imbalance in natural status of environment. Any kind of stress can reduce average yield to more than 50% water stress condition arise due to inability to meet human and ecological demand of water whereas water scarcity refers to lack of available water or lack of water supply . An important point is that water scarcity is one of the many aspects that contribute to water stress thus, an area can be highly water stressed but not necessarily water scarce.

Agriculture is the major sector of all economic sectors which has relevance by water scarcity. Currently agriculture accounts 70% of global freshwater withdrawals. Water is a crucial component for food production. Since the biomass production requires huge amount of water to be transpired it won't be incorrect, if say that agriculture is both cause and victim of water scarcity. Growing demands with population growth has led to large environmental cost. There is an uncertain impact of climate change on water resources and water demand and similarly impact of bio-energy production on agriculture and climate change alter hydrological regimes and the availability of freshwater with impact on rain fed and irrigated agriculture (UN-WATER, 2009, 2012; FAO,2008; FAO,2011a). Increase in precipitation in temperate zones, reduction in precipitation in semi-arid areas extreme variability in rainfall distribution and overall increase in temperature has been seen. All this has a particular impact on tropical and sub-tropical agriculture (IPCC,2008).The availability of water is also affected by change in runoff in rivers and aquifers recharge which will add to human pressure on water resources .

Even after the utilisation of all our water resources for irrigation, about half of the cultivated area will remain rain fed. It is against this background that dry land agriculture gained importance. Problems of dry land agriculture can be broadly grouped in to two;

1. Vagaries of monsoon – Rainfall variability, intensity and distribution, late onset of monsoon, early withdrawal of monsoon and prolonged dry spells during crop season.
2. Soil constraints – Problem relating to crop production in alfisols are soil crusting, low moisture strong capacity, low soil fertility and soil erosion. Physical constraints such as narrow range of soil water content for tillage, tendency to become water logged and poor traffic ability, low n and t content and land degradation from soil erosion and salt accumulation, especially in low lying area, are the major problems with vertisols. Incept sols and entisols haveproblem of low water

holding and land degradation due to soil erosion. Management of these soils for crop production is relatively easy compare to the other two soil groups.

Bundelhkhand region is a dry area where agricultural condition of Lalitpur is very poor. It is under rain fed condition. Agriculture of Lalitpur is not depend upon rain water. Due to lack of water plants irrigation does not scheduling on time. Due to this plants comes under water stress condition and do not grow properly. Which results the low yield per hectare of crop comparatively other than region which has proper irrigation facility. While seeing the irrigation problem in Lalitpur district this research was conducted to find out the water stress in wheat crop to suggest proper irrigation scheduling.

1.1 STUDYAREALOCATION

Lalitpur is one of the districts of Uttar Pradesh state of India. Lalitpur district is a part of Jhansi division and was carved out as a district in the year 1974.Lalitpur is really not only the heartland but also a heart shaped district of Bundelhkand region. It is connected to Jhansi district of Uttar Pradesh by a narrow corridor to the northeast, otherwise almost surrounded Madhya Pradesh state. Lalitpur district lies between latitude24°11' and 25°14'(north) and longitude78°d and 79°0'(east) and is bounded by district Jhansi in the north, districts Sagar and Tikamgarh of Madhya Pradesh state in the east and guan district of Madhya Pradesh separated by river Betwa in the west. The geographical area of the district 5,039sq km with a population of 977,447 as per the census of year 2001.

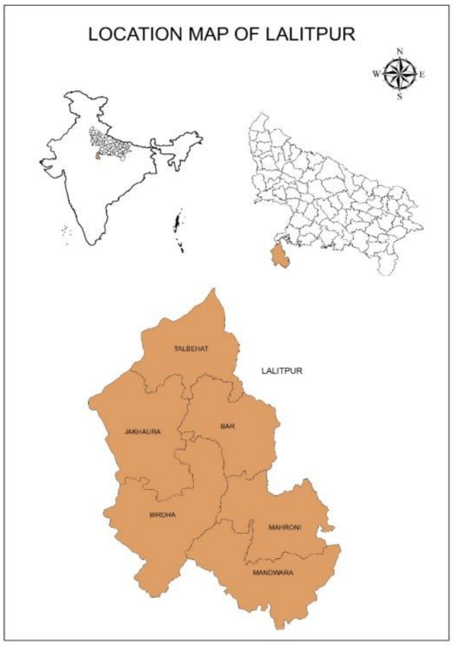


FIGURE NO. 1.1

II. MATERIALS AND METHODOLOGY

Many studies were carried out in India and abroad to demonstrate usefulness of Remote sensing data to quantify different agricultural parameters and agricultural studies. Looking at potential of remote sensing various methods and techniques. Many studies were carried out in India and abroad to demonstrate usefulness are developed in relating remotely sensed signature from satellite sensor to crop parameters, water stress and final analyse to suggestion of irrigationfinal discussed in following sections

2.1 DATA USED

To achieve the objective in present study the following satellite products, and software have been used

2.2 REMOTE SENSING DATA

Satellite dataset used for this study was landsat8 details are giving table in fallow;

Table 2.2 details of satellite data products used in this study

S. NO	DATA TYPE	DATA OF ACQUISITION	PATH/ ROW	RESOLUTION
1	Landsat8	October	146/40	30m
	-	-	-	-
2	Landsat8	November	146/40	30
	Landsat8	November	146/40	30
3	Landsat8	December	146/40	30
	Landsat8	December	146/40	30
4	Landsat8	January	146/40	30

	Landsat8	January	146/40	30
5	Landsat8	February	146/40	30
	Landsat8	February	146/40	30
6	Landsat8	March	146/40	30
	Landsat8	March	146/40	30
7	Landsat8	April	146/40	30

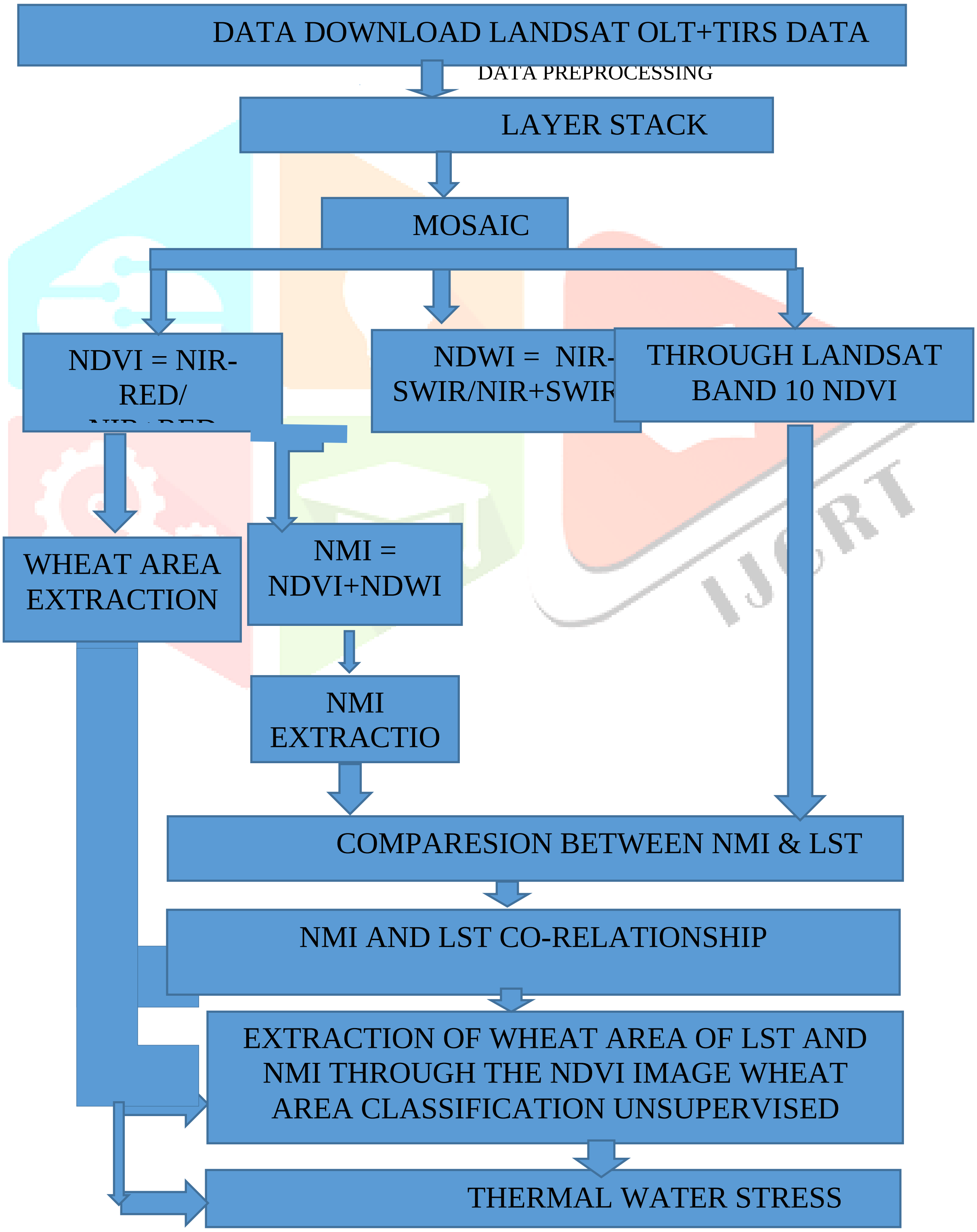
2.3 ANCILLARY DATA

- Shapfile of India, Uttar Pardesh, Lalitpur district and Lalitpur block

2.4 Software used,

- Erdas imagine for image processing.
- Arc GIS for database creation and analysis.
- Microsoft office 2013.

The methodology adopted for this study can be understood by the following flowchart:



LAND SURFACE TEMPERTURE (LST)

The land surface temperature (LST) is the radioactive skin temperature of ground. It depends on the albedo. The vegetation cover and the soil moisture in most cases. LST is mixture of vegetation and bare soil temperature. Because both respond rapidly to changes incoming solar radiation due to cloud cover and aerosol load modifications and dermal variation of illumination. The LST displays quick variation too in turn. The LST influence the partition of energy between ground and vegetation and determines the surface air temperature.

There are various methods to calculate LST. I am going to show you the method from the official USGS webpage (HTT;// Landsat USGS GOV/landsat8 – using – product PHPλ) using band 10 and 11 from the thermal infrared sensor (TIRS) of the landsat8 satellite. It is recommended to use band 10 in quantitative analysis because band 11 is significantly more contaminated by stray light than band 10.

LST ALGORITHM

1 STEP – TOA {Top of atmospheric spectral radiance}

$L\lambda = M_L + Qcal + A_L - Oi$

Where,

$L\lambda$ = Spectral radiance

M_L = Band specific (here band 10) multiplicative rescaling factor = 0.000334

Qcal = Band 10 image

A_L = Band specific additive rescaling factor = 0.100000

Oi = Correction for band 10

1 **STEP** – Conversion of digital number nos. into reflection

3 STEP – Conversion of spectral radiance to brightness temperature(BT).

$$BT = \frac{K2}{\ln[(Ki / L\lambda) + 1]} - 274.15$$

K1, & K2 – band specific thermal conversion constant (from metadata)

K1 = 774.890000, K2 = 1321.080000

To have the ans. in °C, radiance temperature is revised by adding the absolute zero (approx. – 273.15°C)

4 STEP – Calculating NDVI,

NIR (BAND 5) – R (BAND 4)/ NIR (BAND 5) – R (BAND 4)

4 STEP – Cal n proportion of vegetation (Pv).

Pv = (NDVI – NDVIs / NDVIv – NDVIs)2 {here NDVIv = 0.5, NDVIs = o.2}global Condect NDVv to Cal Pv.

5 STEP – Caln Land surface emissivity

$\varepsilon\lambda = \varepsilon v\lambda Pv + \varepsilon s\lambda (1 - Pv) + L\lambda$

Where,

C = Surface roughness (C = 0, for homogeneous φ flat surface), here taken as constant value of 0.005.

$\varepsilon s\lambda$ = 0.999 (Ref.1480307>paf) for NDVI values b/w 0- 0.2 it is considered that the land is covered with soil emissivity value of 0.996 is assigned.

$\varepsilon v\lambda$ = 0.973 {When NDVI values is greater than 0.5, it is considered to be covered with vegetation value of 0.973 is assigned.

6 STEP – LST

$Ts = BT / \{1 + \{\lambda BT/ P)\ln \varepsilon\lambda]\}$

Where,

λ = wavelength of emitted radiance

$\varepsilon\lambda$ = emissivity calculated

$\lambda = ch / \sigma = 1.438\times10^{2}mk$ {σ = Boltzman constant (1.38×10^{23}J/K)

H = Plank's constant, ($6.626\times10_{34}$J/S)

C = Velocity of light (2.998×10^{8}m/s)

NORMALIZED DIFFERENCE VEGETATION INDEX (NDVI)

The normalized difference vegetation index (NDVI) is a simple graphical indicator that can be used analyse remote sensing measurements, typically but not necessarily from a space platform and assess whether the target being observed contains live green vegetation or not.

NDVI= NIR (BAND5) – R (BAND4)/ NIR (BAND5) – R (BAND4)

NORMALIZED DIFFERENCE WATER INDEX (NDWI)

Normalized difference water index (NDWI) may refer to one of at least two remote sensing derived indexes related to liquid water. One is used to monitor changes in water content of levees, using near – infrared (NIR) short wave infrared (SWIR) wavelength proposed by Gao in 19996.

NDWI = NIR (BAND5) – SWIR (BAND6) / NIR (BAND5) + SWIR (BAND6)

NORMALIZED MOISTURE INDEX

Normalized moisture index to fined thermal water stress for dry region NDVI + NDWI = NMI. NMI > 1group 1 and class 4 severe condition. No water with dense vegetation and low temperature. 1 > NMI >0.8 – Group 2 and class 3 low stress condition. Thermal water stress due to higher surface temperature and sparser temperature. 0.8 > NMI > 0.5 –

Group 3 and class 2 moderate stress condition. Strong water stress due sparser vegetation. 0.5 > NMI > 0 Group 4 and class 1 severe condition. Very high or severe thermal water stress due to high temperature and very low vegetation.

15 WHEAT AREA EXTRACTION

Since study was focused on wheat crop identification using remote sensing classes was prepared and performed using temporal NDVI images prepared by Landsat the indicates that in Lalitpur district total wheat area extraction is 125,296ha.

III. RESULTS

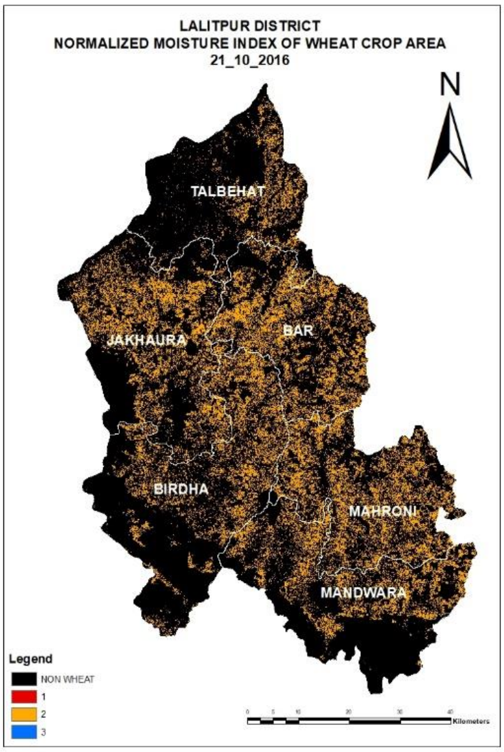
The present study attempts to evaluate performance of different water stress indices for analysis of water stress to suggest irrigation. The inputs from remote sensing has been affectively used and integrated with GIS data bases for water stress and growth for wheat keeping in view the usefulness of remotely sensed signatures to quantify crop water stress. The present study was undertaken in wheat area of Lalitpur district in Bundhelkhand region.

The normalized moisture index (NMI) was used to to find thermal water stress index of wheat crop in Lalitpur district. The output was generated in four groups or classes. Which was defined as; (NDVI + NDWI = NMI) NMI >1 Group 1 and class 4 which represent the normal condition. Where no water stress with dense vegetation and low temperature. Group 2 and class 3 when 1 > NMI > 0.8 that is low water stress condition. Thermal water stress due to slightly higher surface temperature and sparser vegetation. Group 3 and class 2 when 0.8 > NMI > 0.5 – which represent the moderate water stress condition due sparser vegetation and high temperature. 0.5 > 0 – Group 4 and class1 severe condition. Very high or severe thermal water stress due to higher surface temperature and very low vegetation.

3. COMPARITIVE ANALYSIS BETWEEN NMI & LST

Detection of crop water stress analyse for irrigation scheduling. Satellite monitoring of vegetation water stress is very important for precision agriculture, which realise on time of irrigation to ensure crops will not suffer from water stress and produce maximum potential yield under limited water condition. Potential of satellite data provide spatial and temporal dynamics of crop growth condition under water stress and analyse for suggestion of irrigation. This study was conducted in Bundhelkhand region of Lalitpur district, temporal **Landsat dataOLI+TIRS** was used for detecting water stress using the thermal and optical indices. Land surface temperature, normalized vegetation index and normalized water stress indexwas used for normalized moisture index to find out water stress condition. The main objective of this study was to detect crop water stress using different optical and thermal based indices to suggest irrigation.

For- 21 October 2016 image: While seeing the output of NMI and LST for this image, we can recognized that the whole district is under moderate stress with sparser vegetation and the land surface temperature was also higher than the normal temperature which can be found for the proper growth of crop. The month of October is that time period when wheat crop is shown in the field. As it well known that wheat crop is shown in the field after irrigating the field. So it takes time for plant growth. During that time it is normal to come result as sparser vegetation and high temperature which results water stress. So there is no need to irrigate the field. Fig 4.1 and Fig 4.3 have been constructed show the typical compression between two images.



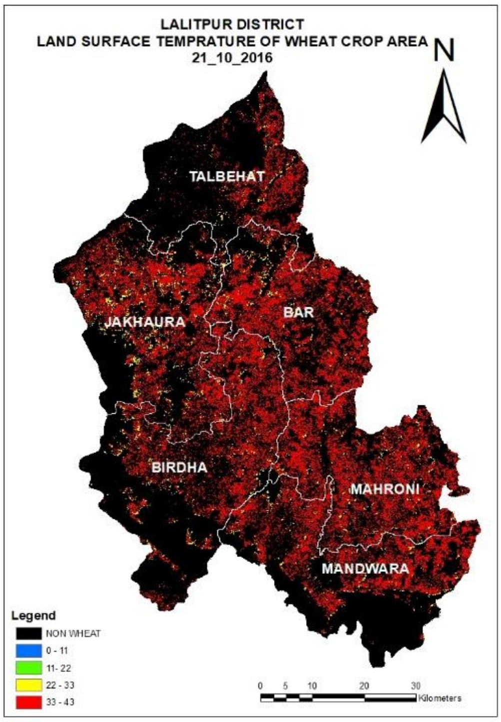
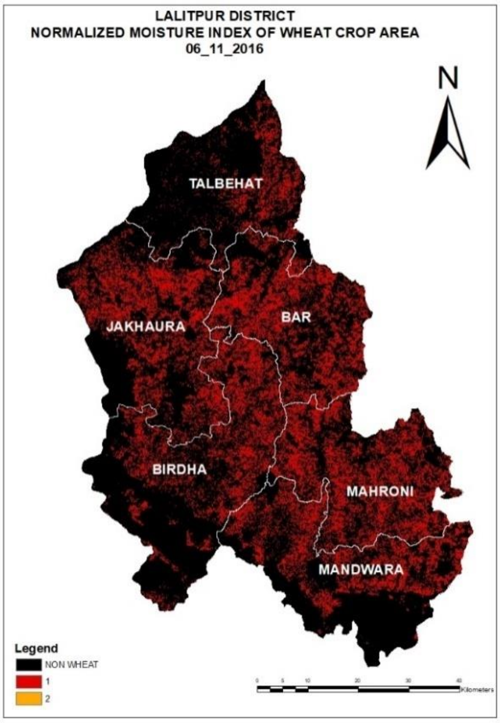


Figure 3.1 21october 2016 NMI imageFigure -3.1 21 October 2016LST image

For- 11 November 2016 image: While seeing the output of NMI and LST for this image, we can recognized that the whole district is under severe stress with low vegetation and the land surface temperature was also higher than the normal temperature which can be found for the proper growth of crop. The month of November is that time period when wheat crop is shown in the field. As it well known that wheat crop is shown in the field after irrigating the field. So it takes time for plant growth. During that time it is normal to come result as sparser vegetation and high temperature which results water stress. So there is no need to irrigate the field.. Fig 4.5 and Fig 4.6 have been constructed show the typical compression between two images.



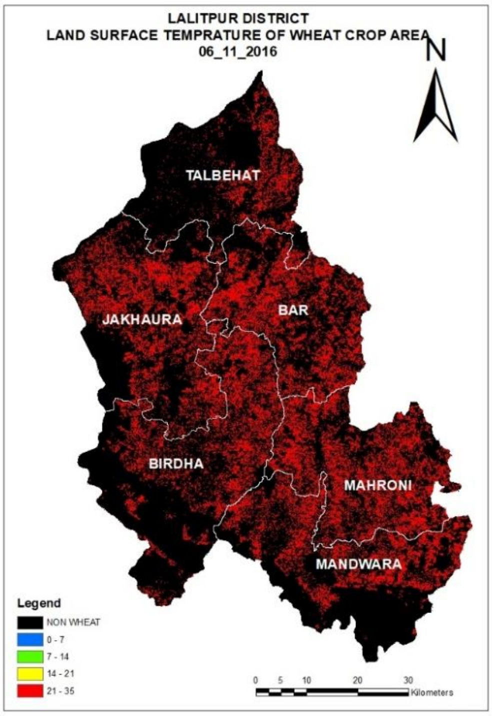
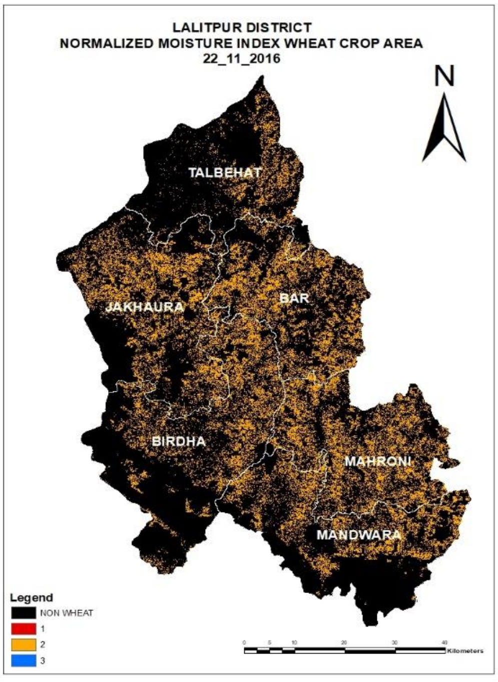


Figure 5.2:6 November 2016, NMI image *Figure -16novmber 2016, LST image*

For- 22 November 2016 image: While seeing the output of NMI and LST for this image, we can recognized that the whole district is under moderate stress with sparser vegetation and the land surface temperature was also higher than the normal temperature which can be found for the proper growth of crop. The month of November is that time period when wheat crop is shown in the field. As it well known that wheat crop is shown in the field after irrigating the field. So it takes time for plant growth. During that time it is normal to come result as sparser vegetation and high temperature which results water stress. So there is no need to irrigate the field.. Figs 5.3 and Figs 5.3 have been constructed show the typical compression between two images.



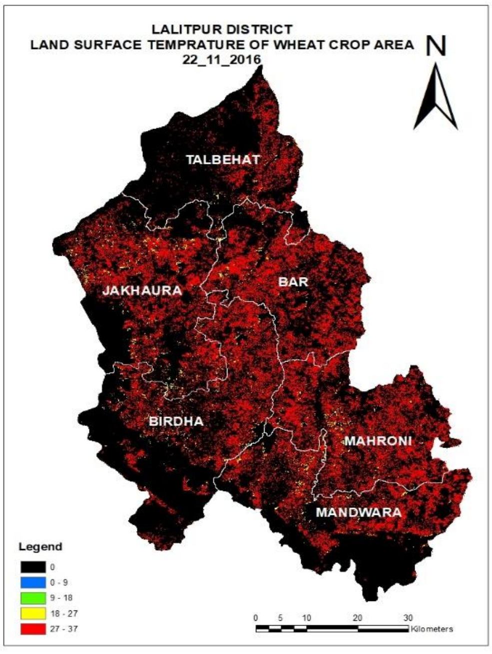
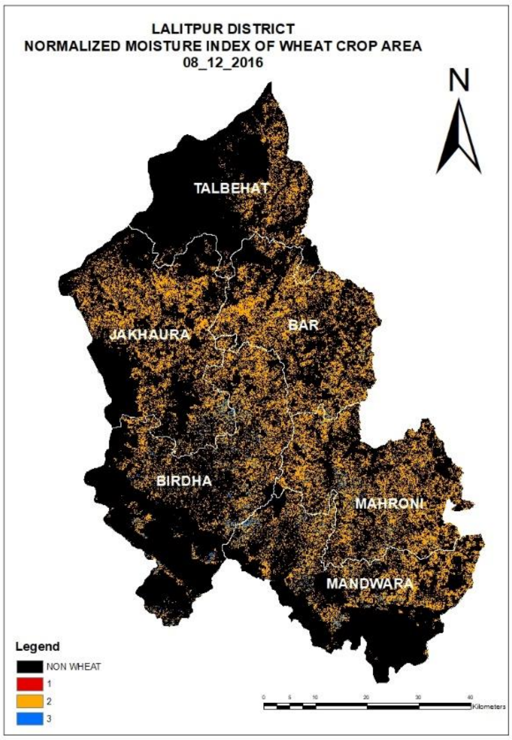


Figure 3.422 November NMI image *Figure -3.422novmber 2016 LST image*

For- 8 December 2016 image: While seeing the output of NMI and LST for this image, we can recognized that the whole district is under moderate stress with sparser vegetation and the land surface temperature was also higher than the normal temperature which can be found for the proper growth of crop. So it takes time for plant growth. During that time it is normal to come result as sparser vegetation and high temperature which results water stress. So there is need to irrigate the field.. On the basis of this research work the better time for irrigation scheduling was suggest as; first irrigation during 8 December.. Figs 5.4 and Figs 5.4 have been constructed show the typical compression between two images.



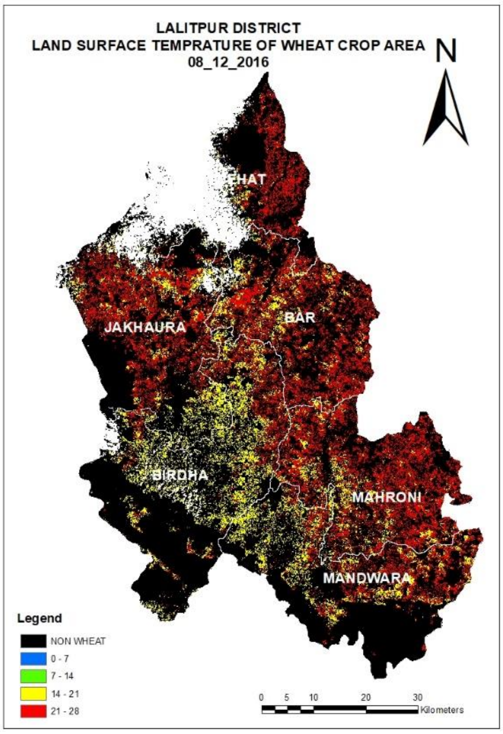
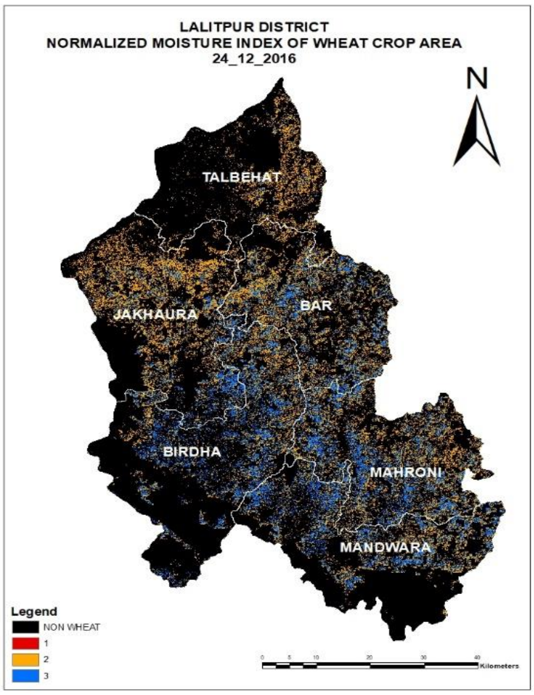


Figure3.5 8 December NMI imageFigure-2.5 8 December 2016 LST image

For- 24 December 2016 image: While seeing the output of NMI and LST for this image, we can recognized that the Talbehat and Jakhaura district is under moderate stress with sparser vegetation and the land surface temperature was also higher and Bar, Birdha, Mahroni and Mandwara low stress water stress higher surface temperature and sparser vegetation. Than the normal temperature which can be found for the proper growth of crop. So it takes time for plant growth. During that time it is normal to come result as sparser vegetation and high temperature which results water stress. So there is need irrigate the field.. On the basis of this research work the better time for irrigation scheduling was suggest as; first irrigation during 25 December.. Figs 5.5 and Figs 5.5 have been constructed show the typical compression between two images.



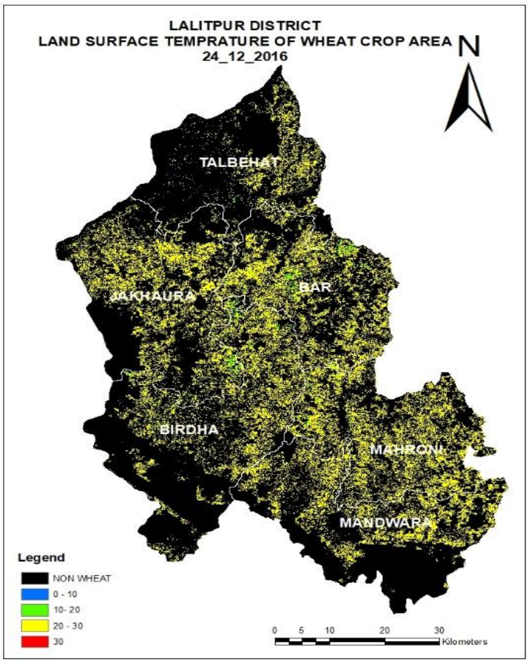
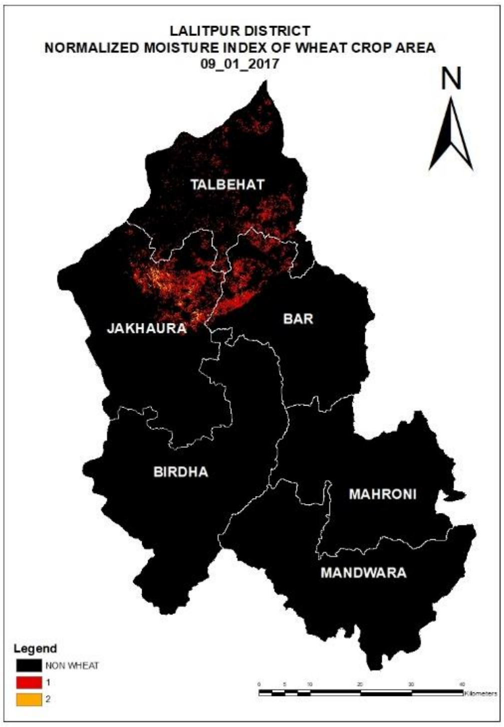


Figure 3.6 24 December NMI image *Figure -3.624 December 2016 LST image*

For- 9 Janauary 2017 image: While seeing the output of NMI and LST for this image, we can recognized that the Takbehat district is under severe stress with low vegetation and the land surface temperature was also higher than the normal temperature which can be found for the proper growth of crop. So it takes time for plant growth. During that time it is normal to come result as low vegetation and high temperature which results water stress. So there is need to irrigate the field. . On the basis of this research work the better time for irrigation scheduling was suggest as; first irrigation during January. . Figs 5.6 and Figs 5.6 have been constructed show the typical compression between two images.



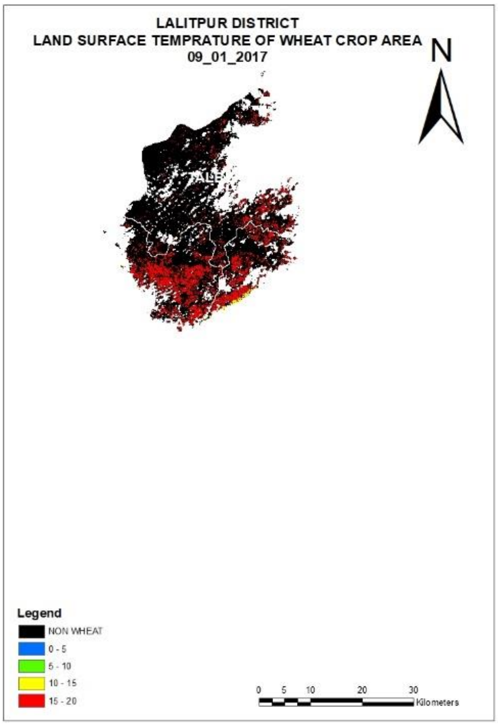
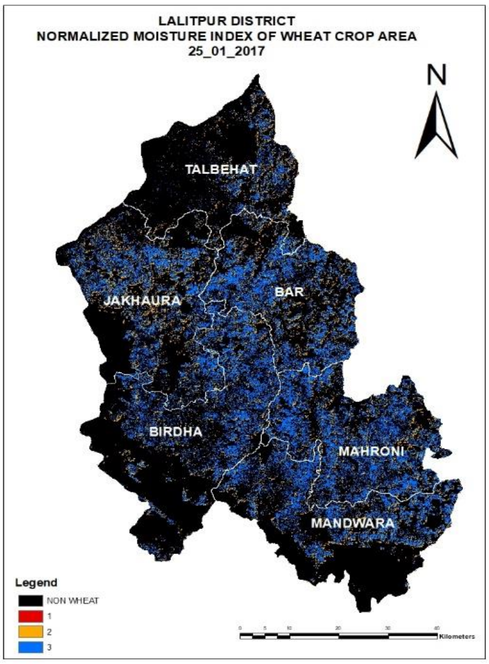


Figure 3.7 9 January NMI image*Figure 3.7 9 January LST image*

For- 25 January 2016 image: While seeing the output of NMI and LST for this image, we can recognized that the whole district is under low stress with sparser vegetation and the land surface temperature was also higher than the normal temperature which can be found for the proper growth of crop. So it takes time for plant growth. During that time it is normal to come result as sparser vegetation and high temperature which results water stress. So there is need to irrigate the field. . On the basis of this research work the better time for irrigation scheduling was suggest as; second irrigation during 25 January. . Figs 5.7 and Figs 5.7 have been constructed show the typical compression between two images.



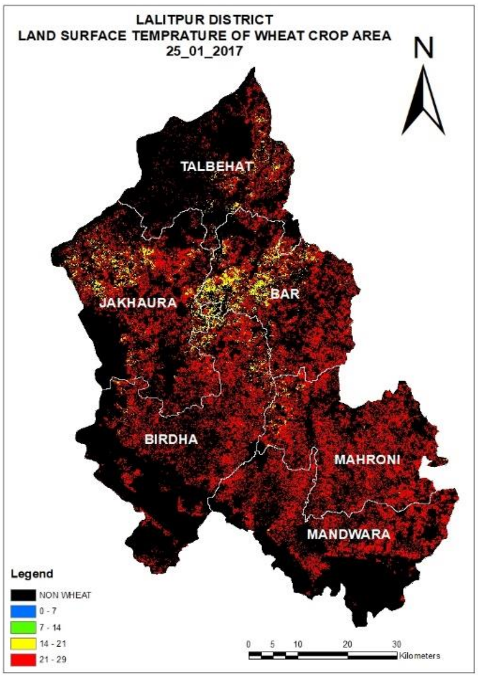
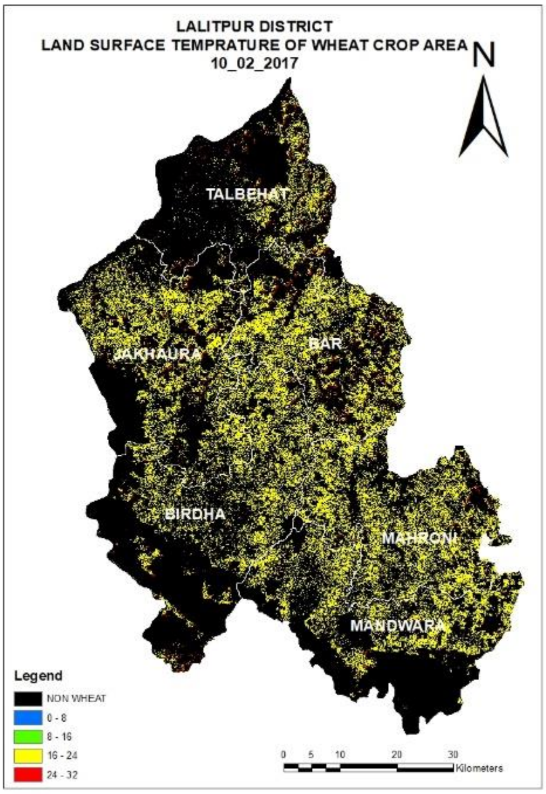


Figure3.8 25 January 2017NMI imageFigure -3.8 25 January 2017 LST images

For- 10 February 2017 image: While seeing the output of NMI and LST for this image, we can recognized that the whole district is under low stress with sparser vegetation and the land surface temperature was also higher than the normal temperature which can be found for the proper growth of crop. During that time it is normal to come result as sparser vegetation and high temperature which results water stress. So there is need to irrigate the field. . On the basis of this research work the better time for irrigation scheduling was suggest as; first irrigation during 15 February. . Figs 5.8 and Figs 5.8 have been constructed show the typical compression between two images.



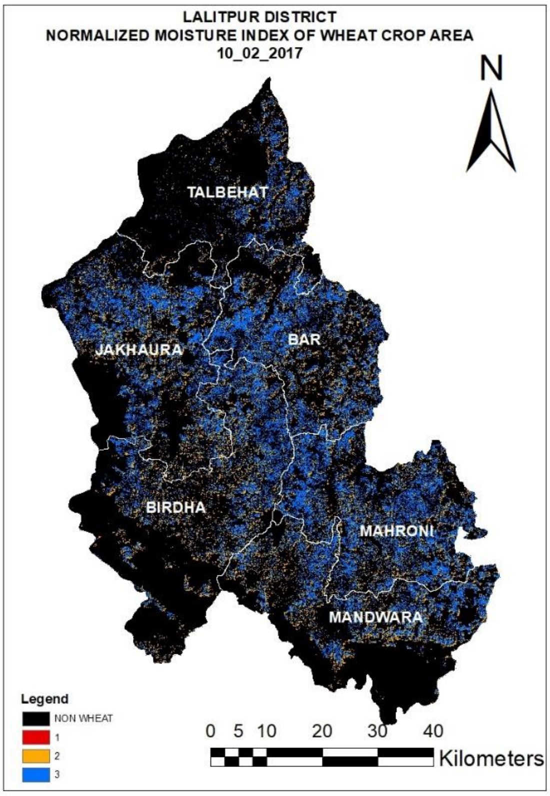
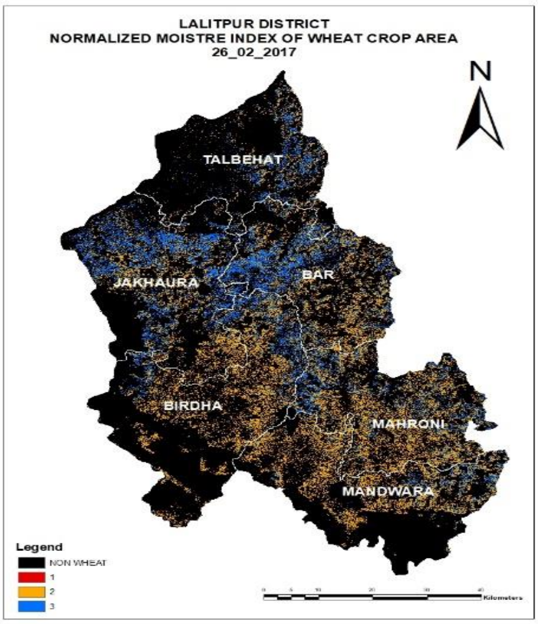


Figure 3.9 10 February 2017 LST imageFigure 3.9 10 February 2017 NMI image

For- 26 February 2017 image: While seeing the output of NMI and LST for this image, we can recognized that the Talbehat, Bar, and Birdha is under low stress with sparser vegetation and the land surface temperature was also higher and Birdha, Mahroni and Mandwara moderate stress strong water stress sparser vegetation and land surface temperature was also higher than the normal temperature which can be found for the proper growth of crop. During that time it is normal to come result as sparser vegetation and high temperature which results water stress. So there is need to irrigate the field. . On the basis of this research work the better time for irrigation scheduling was suggest as; second irrigation during 15 February. Figs 5.9 and Figs 5.0 have been constructed show the typical compression between two images.



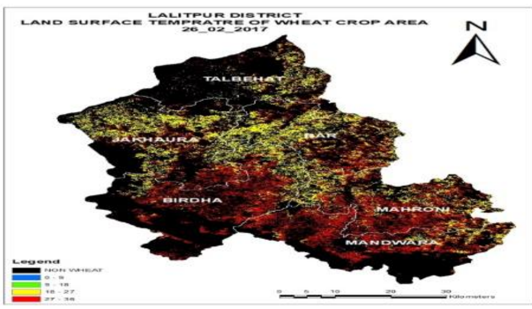


Figure 3.10 26 February 2017 NMI imageFigure -3.10 26 February 2017 LST image

For: 14 march2017 image:
Data is not available because of clouds. . Figs 5.10 and Figs 5.10 have been constructed show the typical compression between two images.

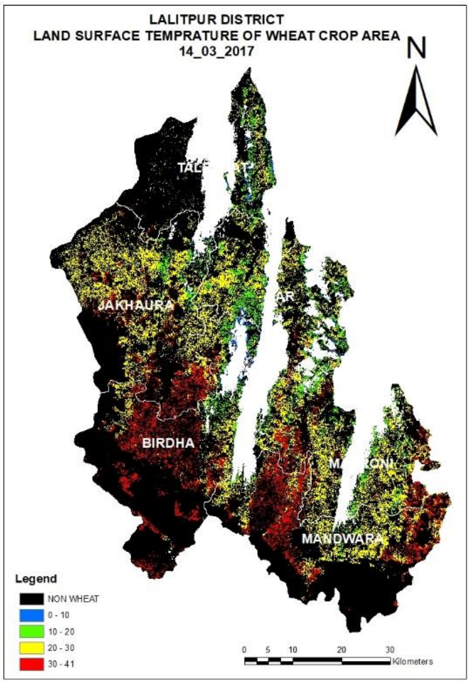
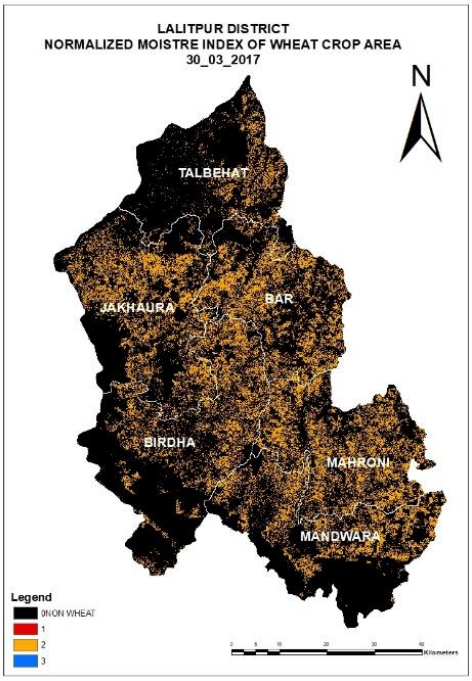


Figure 3.11 14 march 2017 LST imageFigure 3.11 14 march 2017 NMI image

For- 30 March 2017 image: While seeing the output of NMI and LST for this image, we can recognized that the whole district is under moderate stress with sparser vegetation and the land surface temperature was also higher than the normal temperature which can be found for the proper growth of crop. The month of March is that time period when wheat crop is harvest in the field. As it well known that wheat crop is harvest in the field after. During that time it is normal to come result as sparser vegetation and high temperature which results water stress. So there is no need to irrigate the field. . Figs 5.11 and Figs 5.11 have been constructed show the typical compression between two images.



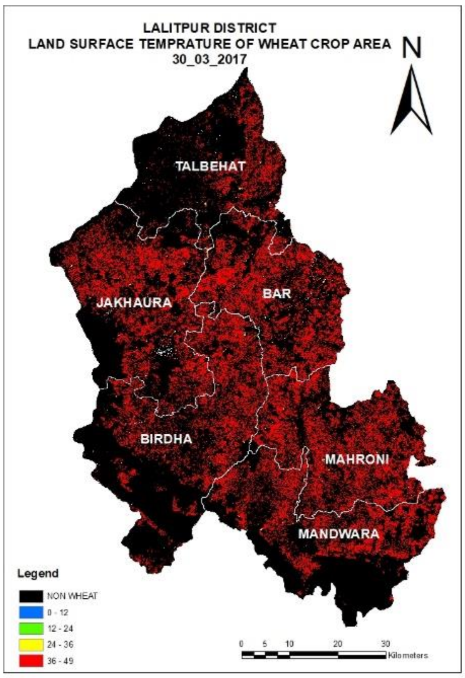
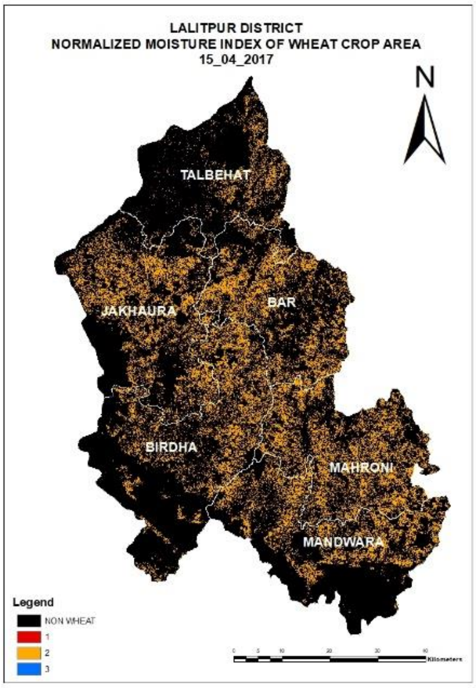


Figure3.12 30 march 2017 NMI imageFigure -3.12 30march 2017 LST image

For- 15 April 2017 image: While seeing the output of NMI and LST for this image, we can recognized that the whole district is under moderate stress with sparser vegetation and the land surface temperature was also higher than the normal temperature which can be found for the proper growth of crop. The month of April is that time period when wheat crop is harvest in the field. As it well known that wheat crop is harvest in the field. During that time it is normal to come result as sparser vegetation and high temperature which results water stress. So there is no need to irrigate the field. . Figs 5.12 and Figs 5.12 have been constructed show the typical compression between two images.



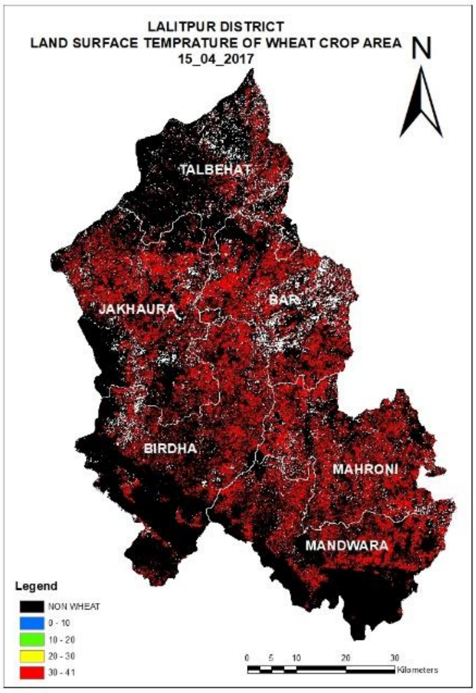


Figure -3.13 15 April 2017 NMI imageFigure-3.13 15 April 2017 LST image

By this research result is conclude that most of plant in stress condition. And moisture low and temperature is high. Very high severe thermal water stress due to high temperature and very low vegetation. Due this plant are not growing properly. According to these condition we suggest two irrigation for growing plant properly.

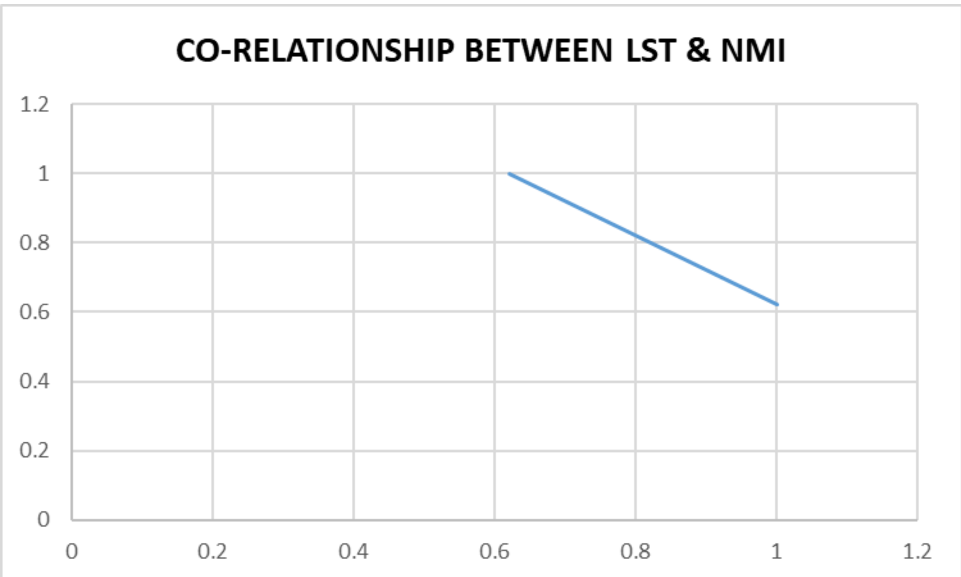
1. We can suggest first irrigation when group 4 and class 1 in severe condition NMI low LST high.
2. We can suggest second irrigation in moderate condition group 3 and class 2. NMI is low and LST high.

TIMMING OF IRRIGATION:

1. 1st irrigation 15 December to 25 December
2. 2nd irrigation 25 January to 15 February.

CO – RELATIONSHIP BETWEEN LST & NMI

The highest negative correlation was found between NMI & LST. The two indices also show a low negative correlation for the moisture pattern. However their correlation between the NMI and LST had an of which could be explained by the negative environmental actions promoted in the agriculture areas. The highest negative correlation was between the NMI and LST of water pattern. Analysis showed that the NMI and LST was the of most negatively correlated index in an agriculture land. . Figs 5.13 have been constructed show the typical relationship between two images.



IV. CONCLUSION

Global water scarcity and unavailability of fresh water including many other biological factors has led to effect crop water stress status influencing its growth. The study focused or detecting crop water stress and observing its analyses to suggest of irrigation. The prime objective of the study was assess performance of different approaches of water stress detection from satellite data and validating with measurements and to analyse the importance of water stress factor in controlling irrigation system. The study was conducted in parts of Lalitpur district latitude 24degri 11' and 25degri 14(north) and longitude 78degri 10' and 79degri 0(east).
Wheat crop practiced in the study area during Rabi season. Landsat OLI data for 2016 – 2017 Rabi season was used in this study. Since study was specified for wheat crop discrimination was done using rule based classification technique. Using rule based classification wheat was properly discriminated from other classes showing individual accuracy of wheat .and overall accuracy of. different satellite based indices were derived individually from optical and thermal dataset NDVI, NDWI model was also use for deriving NMI using temporal Landsat data. Predicted water stress for 2016 – 2017were compared LST.
Since study was focused on wheat crop identification using remote sensing classes was prepared and performed using temporal NDVI images prepared by Landsat. The indicates that in lalitpur district total wheat area extraction is 125,296ha.
Normalized moisture index to find thermal water stress NDVI + NDWI = NMI. NMI > 1 – Group 1 and class 4 severe condition. Very high severe thermal water stress due to high temperature and very low vegetation. 1 >/ NMI > 0.8 – Group 2 and class 2 moderate condition. Thermal water stress due higher surface temperature and sparser temperature. 0.8 >/ NMI >0.5 – Group 3 and class 4 low stress condition. Strong water stress due sparser vegetation. 0.5 >NMI >0 – Group 4 and classs1 normal good condition. Now water with dense vegetation and low temperature. When moisture low then temperature is high water stress condition and when moisture high then temperature is low normal condition. Due to this plant are in water stress condition and plant are not growing properly. In conclusion was found useful in detecting water stress and on the basis of suggestion of irrigation showed better results for – first irrigation 8 December to 25 December and second irrigation 25 January to 15 February.

From this study the following conclusion were made:

Different water stress indices were used for quantifying water stress by satellite data.
Compared between to NMI and LST
Total wheat area extraction 125,296ha
Water stress observed was more over Bundhelkhand region in December and January. Water stress observed for November and March was less due to good wheat growth. Which is suggestion of tow irrigation first irrigation 8 December to 25 December and second irrigation 25 January to 8 February.
Which is irrigation scheduling for NDVI + NDWI = NMI
Extraction of wheat area of LST and NMI through the NDVI images classification wheat area.

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