International Journal of Engineering Sciences Paradigms and Researches (IJESPR)
(Vol. 23, Issue 01) and (Publishing Month: August 2015)
(An Indexed, Referred and Impact Factor Journal)
ISSN (Online): 2319-6564
www.ijesonline.com

Identification of Water Logged Area in Rohtak District using NDWI

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Publishing Date: 20th August 2015

Abstract

Water logging is one or the major environment issue and hurdle in development of the area. The study was carried out to identify the water logged area in Rohtak District, Haryana. Landsat image of the area is used which have Green band and Mid Infra Red band as Band-2 and Band-7 respectively. For the purpose modified version of NDWI (Normalized difference water index) is used. In NDWI there is noise of built-up area and soil in the water traces, to minimize these noise modified version of NDWI (MNDWI) is used in which Mid Infra Red band is used instead of Near Infra Red Band with Green band. The open water features were enhanced and built-up land noise was suppressed, even removed. By analyzing it was found that MNDWI has high value in those areas where there is canal network and few major patches were found where water logging is identified. Patch 'A', 'B' and 'C' were identified as major patch in the study area and those areas were visited for the ground truth and found that there is highly intense water logging.

Keywords: *NDWI, Mid Infra Red, Water logged.*

Introduction

Water logged area spoils the agriculture practice in the area. Poor drainage system in the area and texture of soil are some major cause of water logging in the area. Many different measures were adopted in these types of areas to minimizing the water logging. Pumping out the ground water and drain it in the drainages is one of the measures taken and in other cases plantations are done in waterlogged areas. There are techniques in remote sensing to extract out the waterlogged area so that it can be used for planning for taking such measures. NDVI and NDWI have efficient and important application to identify water-logged areas. NDWI (Normalized difference water index) is an index where water traces can be identified and to make the index more precise towards the water traces, a modification is done in NDWI where Mid Infra Red is used instead of Near Infra Red Band. The single-band method usually involves choosing a band from a multispectral image to extract open water information (Rundquist et al. 1987).

Landsat 5 TM imageries used by Paul et al., (2000) to detect open water bodies and floodplain of the Murrumbidgee River near the city of Wagga, Australia. They found that optical Landsat is very useful for detecting water bodies and floodplain in their study. Integrated GIS and remote sensing in order to detect water-logging areas was used by Sahu (2014) in the part of Purba Medinipur district of Keleghai river basin, India. Water-logged areas and canal density were correlated by him using statistical analysis.

Material and Methods

Data Used: Landsat Image, Adminstrative Boundary

Software Used: Erdas 9.1, Arc GIS 9.3

The main objective of the study is to identify the water logged area in the Rohtak district using Landsat images of year 2000 and to access agriculture damaged area. The study area is located in the central part of Haryana state falling Longitude between 76^0 12' to 76^0 54' and Latitude 28^0 40' to 29^0 06'. The soil texture varies from Sandy to clayey having a heterogeneous composition with frequent calcium carbonate layers at shallower depths. The soil is coarse to fine loam in texture in most of the area. 10% of the total area is affected by salinity and Alkalinity problem due to poor drainage, brackish waters.

Maximum temperature reaches up to 45º C the climate is ideal for agricultural development, particularly for wheat, rice, sugarcane and cotton crops. Annual rainfall of the district is about 58 cm.

Rainy season starts from July to September. About 80% of the total rainfall is received during this period. Rohtak district is a part of Inland drainage basin. The topography of the district is saucer type; therefore, rain water creates flood problems in monsoon season. In order to avoid flood, drains have been dug out. The main source of draining floodwater is drain no. 8, which is contributing a lot of ground water recharge. There is no perennial river in the district. During rains the water, instead of flowing into some rivers, follows a cause directed towards inland depression in eastern and Southern parts of the district and these areas get flooded.

Study Area:

Figure 1: Study Area

NDWI:

NDWI is expressed as below (McFeeters 1996)

NDWI= (Green – NIR) / (Green + NIR)

Where Green is green band and NIR is Near Infrared band.

In the above equation the maximum reflectance of the water features are captured using green band and minimizing the reflectance of water feature which reflect in NIR band. Thus water features are enhanced and soil and vegetation features are suppressed.

In NDWI the built-up features and soil often mixed with the water features. To avoid this mixture, an advanced method is used where build-up and soil signatures are minimized. In this method Mid Infrared is used instead of near infrared with the Green band (Jensen 2004).

The modified NDWI is expressed as follows:

MNDWI= (Green – MIR) / (Green + MIR)

Where Green is green band and MIR id Mid Infrared band

Results

The NDWI model is applied the Landsat image of Rohtak district and as the result high positive values are found near the canal commanding areas. Despite of the commanding area of the canals there are three major patches visually identified having high values of NDWI shown as A,B and C as shown in the figure*.

The MNDWI shown is more suitability than NDWI to find the water area as in MNDWI the built-up and soil traces have very low or zero values and shown in dark tone.

Patch A and B are in the Mehem area and patch is in the Sampla area. These areas have topographic depression and poor drainage system. These are the main factor causing water logging in the area. The field verification of the sites was done and figure * shows the photograph of area in patch 'A'.

The linear features with high values of NDWI are canals in the area. The West part of Rohtak has high values of NDWI other than canal area showing that there is more waterlogged area.

To avoid the negative values and to distinct the values the value of MNDWI is modified as follow.

MNDWI= [(Green – MIR) / (Green + MIR) + 1] * 100

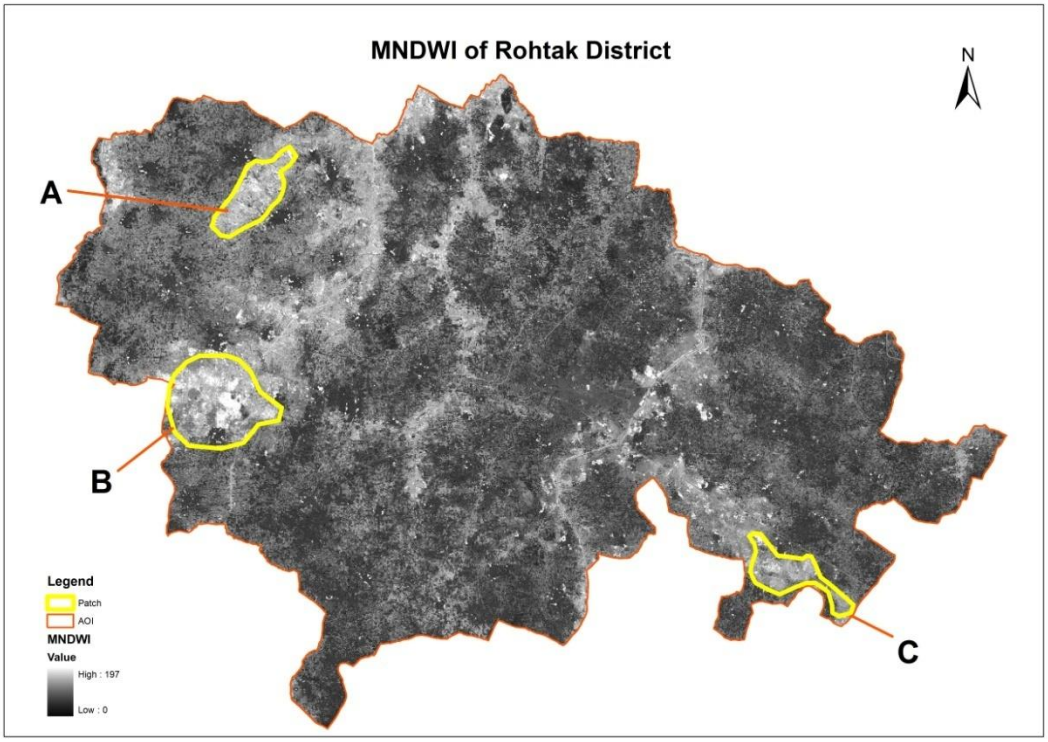

Figure 2: MNDWI of the Study Area

Figure 3: Water Logged Area

Conclusion

In detection of water logged area, the Landsat imageries have shown to be very useful Using medium resolution (30 meter). The information of water was generated by Normalized difference vegetation index (NDVI) and normalized difference water index (NDWI). some other important environmental and socio-economic data have not used In this study. Therefore, such kinds of data may be used for further study on the field in the study area. The topography of the district is saucer type; therefore, rain water creates flood problems in monsoon season. Drains have been dug out to avoid the flood and water logging. The main source of draining floodwater is drain no. 8, which is contributing a lot of ground water recharge. The government and development agencies should take into account as serious issue in waterlogged parts of the study area to avoid the environmental degradation and damage of agriculture crops.

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