Visualizing the affected areas of Nowshera, Pakistan under the transparent flood shapefile using GIS

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Abstract: The flood is the most dangerous and destructive natural disaster in the world. It can cause injuries, loss of lives, damage to: property, roads, railways line and infrastructure. The most difficult phase to identify the affected areas through field observation. In this research we use GIS based approach to identify the affected areas of flood and produce a map to display affected areas. This is used to identify the undation area and make a prediction in future. We apply our approach to heavy flood on the Indus river along the area of Nowshera, Pakistan which was badely affected by flood in August, 2010. In our approach we use GIS tool to apply NDVI algorithm to extract water body from satellite image further produce a shapefiles of flood water from NDVI image and shapefile of river from base map Imagery. Bothe shapefile make transparent and overlap on base map imagery to identify the affected areas [Khan GA, Khan SA. **Visualizing the affected areas of Nowshera, Pakistan under the transparent flood shapefile.** *Life Sci J* 2013;10(1s):198-203] (ISSN:1097-8135). http://www.lifesciencesite.com. 33
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1. Introduction

The flood is the most dangerous and destructive natural disaster in the world. Floods can cause injuries and loss of lives, damage: property, roads, railways tracks and to infrastructure. By early August 2010, the destructive heavy rains had changed the landscape of Pakistan, pushing rivers over their banks. Thousands of villages have been flooded, more than 1,500 people have been killed, and millions have been left homeless. In these situations the land cover mapping is very valuable to identified flood extent and affected land covers. Many organizations require accurate land cover and land use information for a variety of applications. Several researchers point out the importance of land cover information such as [3] presents that the land cover information is required for different purposes e.g. Scientific research (e.g. Climate change modeling, flood prediction) and management (e.g. City planning, disaster mitigation). The approach of remote sensing is the biggest source of acquiring information on land cover and land use [15]. It is too hard to classify the remote sensing data manually [14]. Therefore computer aided techniques are used to extract information from remotely sensed data by means of classification. The land cover and land use classification of satellite images are vital activities for extracting geo spatial data for military and civil purposes like crop disease monitoring, flood disaster analysis and unreachable areas etc. Therefore [14] proposed the soft computing techniques used for image classification because these techniques are based on uncertainty e.g. ANN, fuzzy set theory and rough set theory. Classification of land cover and land use are important to the modeling of global changes and management of ecosystem [13]. The objective of this research is to extract the water body from satellite imageg using NDVI (Normalize diffrence Vegetation Index) and applied ARC GIS to create shape files of flood area and river area. Make both layre transparent on base map to view and analyze the affected areas in District Nowshera Pakistan August 2010

The organization of the paper is as follows. We first discuss the background of the paper in section 2, explain our apprche to identified the extent of flood . Section 3, Finally, we summarize our findings in Section 4.

2. GIS , Shapefile and NDVI.

GIS: A Geographic Information System (GIS) is an organized collection of computer hardware, software, geographic data, and personnel designed to capture, store, update, manipulate, analyze, and display all forms of geographically referenced information. This System allows users to perform very difficult, time consuming, or otherwise impractical spatial analyses. [5].

Shapefile: A shapefile is a homogeneous collection of features that can have either point, multipoint, polyline, or polygon shapes. A shapefile is a vector data storage format for storing the location, shape, and attributes of geographic features. A shapefile is composed of three main files that contain spatial and attribute data. Shapefiles store attributes in an embedded dBASE file. Attributes of other objects can be stored in another dBASE table then joined to the shapefile by an attribute key[6].

NDVI: A Normalized Difference Vegetation Index (NDVI) is an equation that takes into account the amount of infrared reflected by plants. Live green plants absorb solar radiation, which they use as a source of energy in the process of photosynthesis. The reason NDVI is related to vegetation is that healthy vegetation reflects very well in the near-infrared part of the electromagnetic spectrum. Green leaves have a reflectance of 20% or less in the 0.5 to 0.7 micron range (green to red) and about 60% in the 0.7 to 1.3 micron range (near-infrared). These spectral reflectances are themselves ratios of the reflected over the incoming radiation in each spectral band individually; hence, they take on values between 0.0 and 1.0. Thus, the NDVI itself varies between -1.0 and +1.0.
Negative values of NDVI (values approaching -1) correspond to deep water. Values close to zero (-0.1 to 0.1) generally correspond to barren areas of rock, sand, or snow. Low, positive values represent shrub and grassland (approximately 0.2 to 0.4), while high values indicate temperate and tropical rainforests (values approaching 1). The typical range is between about -0.1 (for a not very green area) to 0.6 (for a very green area).Overall, NDVI provides a crude estimate of vegetation health and a means of monitoring changes in vegetation over time, and it remains the most well-known and used index to detect live green plant canopies in multispectral remote sensing data.The NDVI ratio is calculated by dividing the difference in the near-infrared (NIR) and red color bands by the sum of the NIR and red colors bands for each pixel in the image as follows:

$$NDVI = \frac{(\mathrm{NIR} - \mathrm{RED})}{(\mathrm{NIR} + \mathrm{RED})}$$

Where NIR = reflectance in the near infrared band (Band1)
VIS = reflectance in the red (visible) band (Band3)
NDVI =(NIR-VIS)/(NIR + VIS) < 0 represent water
NDVI> 0.3/0.4 represent vegetation
0<NDVI <0.3/0.4 represent dry land
In this particular NDVI image, the shades of greens represent flood water. The negative pixel values in this image for flood water surfaces [7].

Data set description

In this research the data used of the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Terra satellite [9]. The Moderate Resolution Imaging Spectrora diameter (MODIS) launched in December 1999. MODIS provides continuous global coverage every one to two days [10] This image uses a combination of infrared and visible light to increase the contrast between water and land. Water appears in varying shades of blue, and clouds appear in varying shades of blue-green. Vegetation is green, and bare ground is pinkish brown as shown in Figure 1 [1].

Methodology
To produce a transparent map of affected area involved a number processing steps. These include acquiring satellite image of the affected areas, Created NDVI image layer using GIS to extract water body from the mage, create a shapefile of river using base map imagery in GIS, create a shapefile layer of flood water using NDVI image in GIS, make bothe shapefile transparent and all both layer overlap on base map.

1. NDVI image layer. The satellite image import to Arc GIS. The NDVI(Normalize Difference Vegetation Index) algorithm applied to the MODIS image. The purpose of applying NDVI is to create 'new' classify images from the original data that enhance the amount of information that can be visually interpreted from the data. Usually [8] the NDVI is used to monitor the vegetation, but the water bodies always appear in the green on the NDVI band, which can be a very good indicator of the water as shown in the Figure 2.

2.

3. Shapefile layer of river and flood

Shapefile is a popular geospatial vector data format for geographic information systems software. It is developed and regulated by Esri as a (mostly) open specification for data interoperability among Esri and other software products[7].

a. We design polygon shapefile layers of river and flood water using base map (world Imagery) and NDVI layer in Arc GIS tool. These shapefile layer images shown in Figure 3 & 4.

b. Produce map in which show collectively all layers: District Nowshera boundaries, River and Flood as shown as in Figure 5.

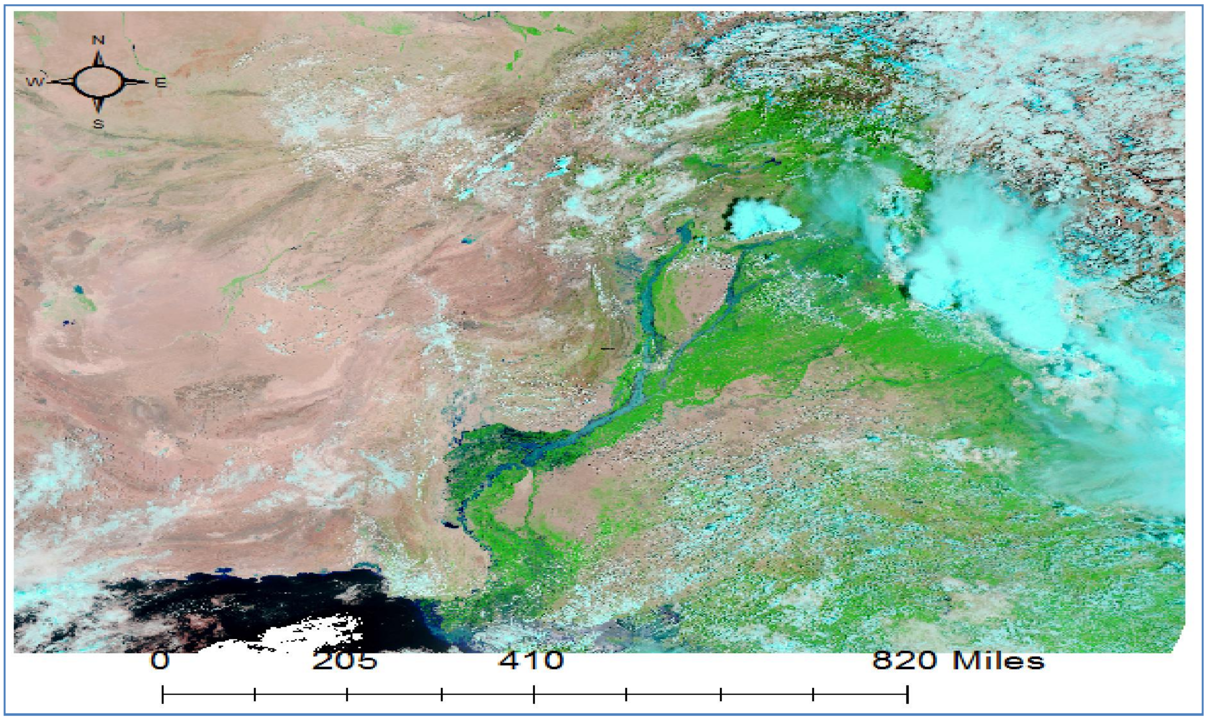

Figure 1. Moderate Resolution Imaging Spectroradiometer(MODIS)on NASA'sTerra satellite image of Pakistan

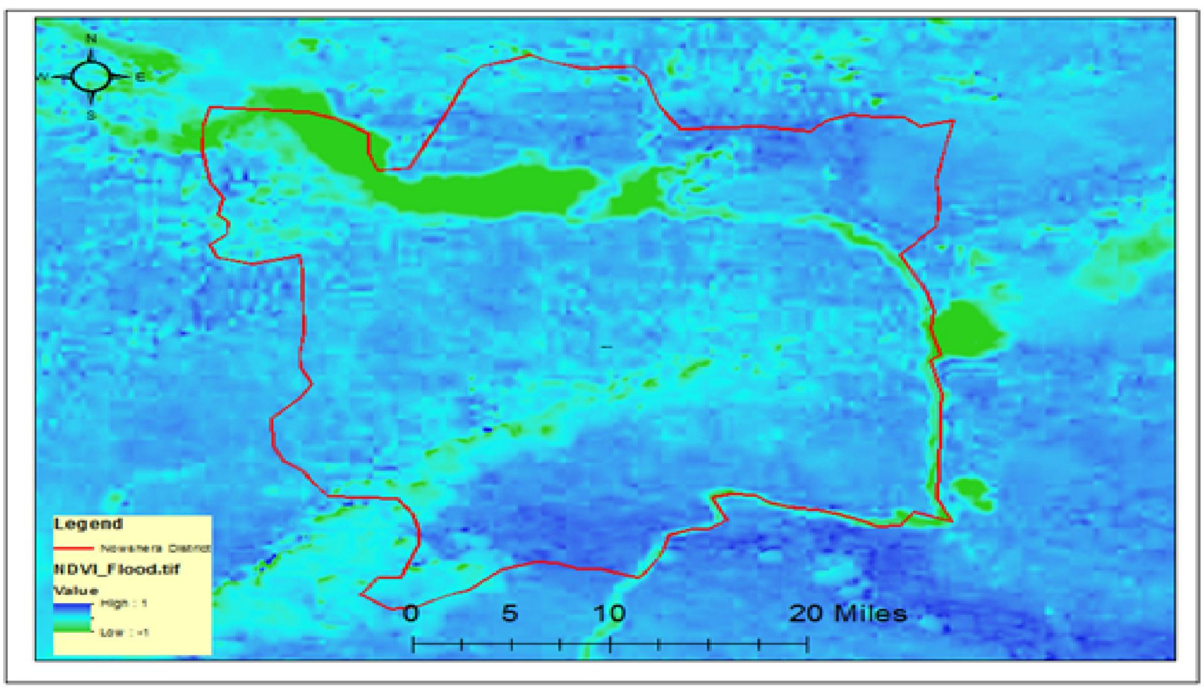

Figure 2.Water body shown in dark green by applying NDVI

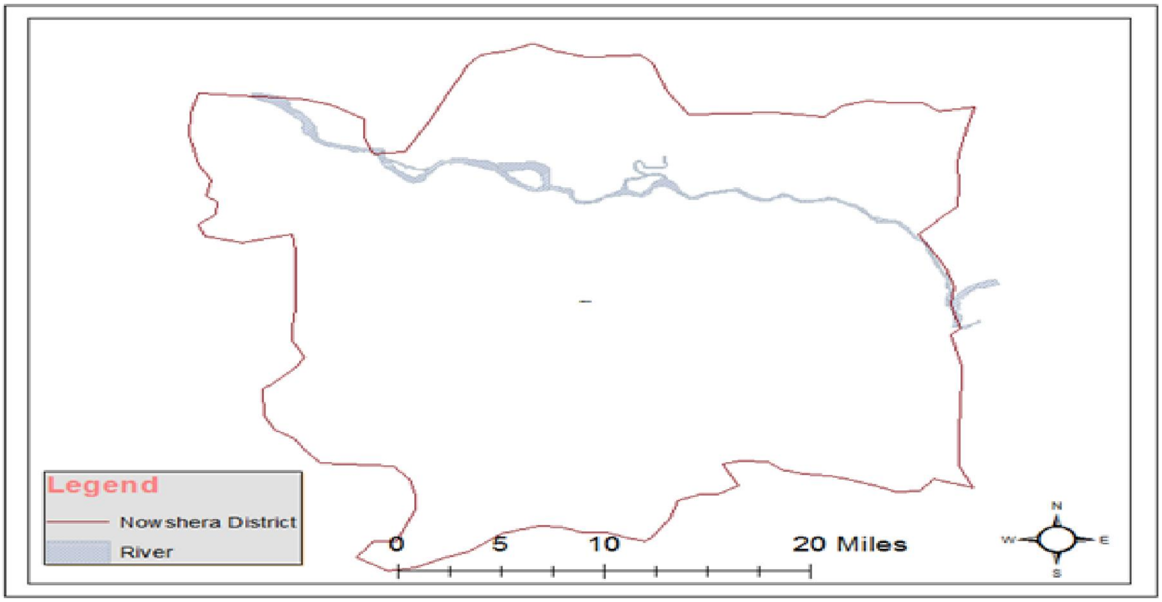

Figure 3. Shapfile of River

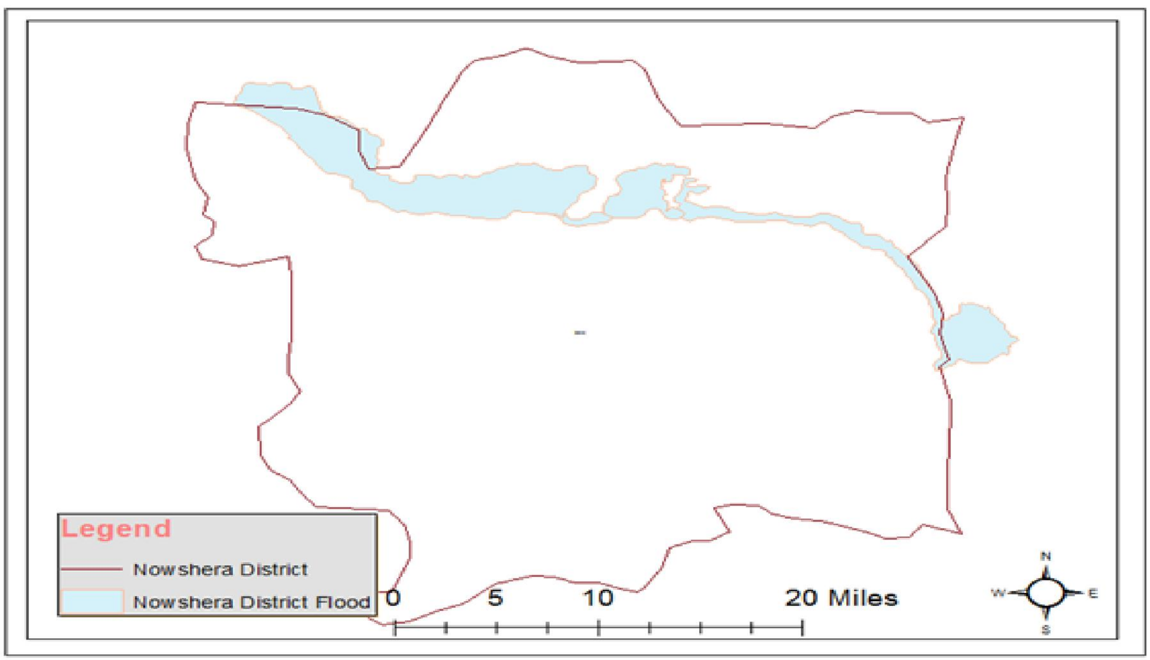

Figure 4. Shapefile of flood water

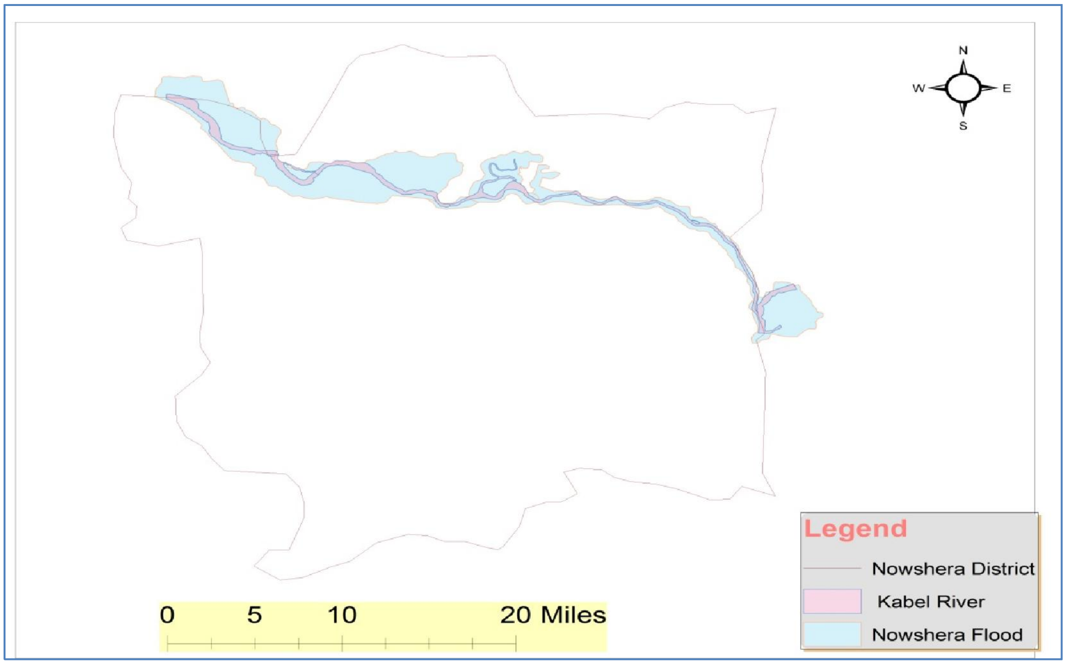

Figure 3. Combine river and flood shapefile.

4. Visualizing the base map Imagery to identify the affected areas

ESRI provides quite a few Basemaps that are available to any ArcMap user. Make both shapfile transparent on basemaps imagery. Transparency of the shapefile make visible spatial features and shown the affected areas as depicted in Figure 6.

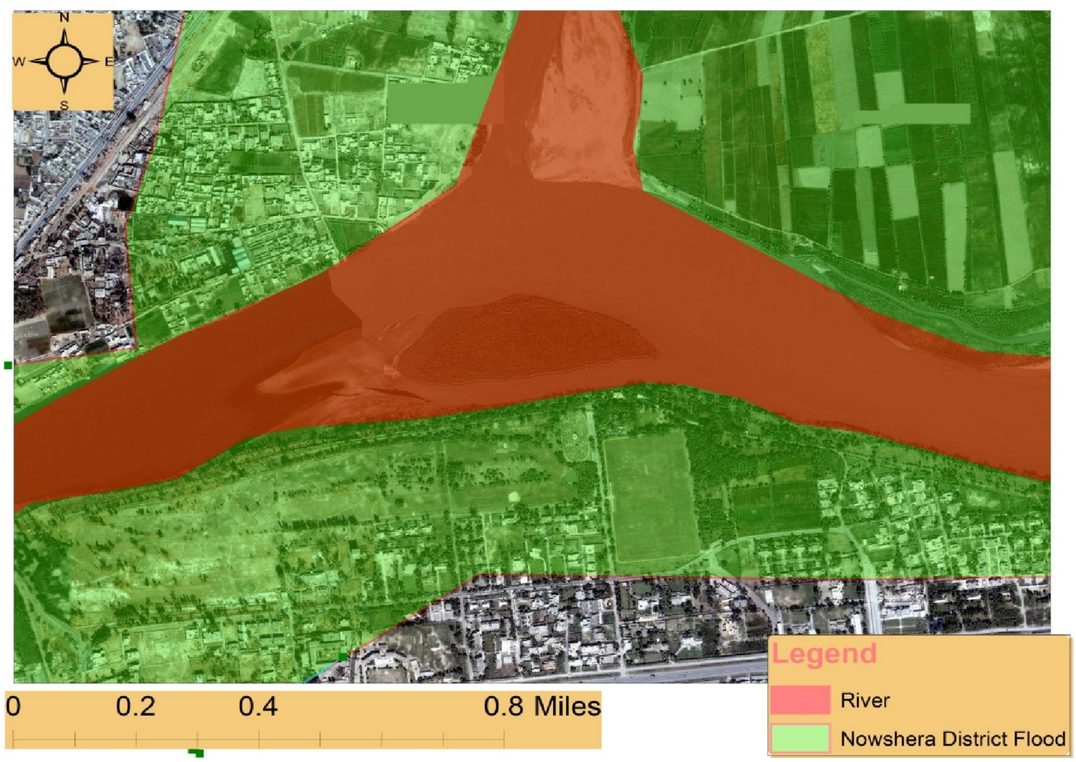

Figure 4. Visualizing the affected areas under the transparent flood shapefile

Conclusion

The flood is the most dangerous and destructive natural disaster in the world. The most difficult phase to identify the affected areas by field observation. Therefore, there must be availability of valid data about the affected areas to provide rescue to the affected peoples. In our approach we use GIS tool to apply NDVI algorithm to extract water body from satellite image further produce a shapefiles of flood water from NDVI image and shapefile of river from base map Imagery. Bothe shapefile make transparent and overlap on base map imagery to identify the affected areas.

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