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Remote Sensing & GIS for the Assessment of Flood Affected Population "A Case Study of September 2014 Floods in Kashmir J&K India"

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Abstract: The frequency and intensity of natural disasters have increased in the recent past. According to Internal Displacement Monitoring Centre (Norwegian Refugee Council) 2014 over 19 million people were forced to flee their homes because of natural disaster like floods, storms and earthquakes. Kashmir valley of India experienced the worst floods in the past sixty years during the first week of September 2014, killing more than 200 people and suffered a massive economic loss of about one trillion. The present study makes use of Geo Spatial technology for the assessment of population affected by September 2014 floods and revealed that 398 villages / wards with a population of 2648092 were affected by September 2014 floods.

Keywords: **Natural Disasters, Floods, Kashmir. Geo Spatial**

I. Introduction

The Kashmir Himalayas which forms the north most part of India, on account of its geological setting, climate and geographic position, is the worst affected area of disasters, making it vulnerable to various natural hazards like floods, earthquakes, landslides and avalanches. Among all these natural disasters flood one of the most devastating hazard affecting lives and economy of the people living in the region. The occurrence and magnitude of floods is mostly influenced by various watershed characteristics like include morphometry, slope, lulc, lithology, soil and geomorphology. Globally flooding is the most destructive natural disaster that attacks humans and their livelihoods around the world (UN 2004). The consequences of flooding are extraordinarily large at the global level (Ahern et al 2005; Hajat et al. 2003; Jonkman 2005). Flooding is accountable for more than one third of the total estimated costs occurred due to disasters (Jonkman and Kelman 2005; Munich re 2007). Flooding is a serious danger to the lives and property of people among all natural disasters. Some of the important reasons for increase flood disasters include: an increase in global temperature due to climate change (Merz et al 2004); over exploitation of natural resources and deforestation; growing urbanization and uncontrolled land use change. India is highly prone to floods and has witnessed highly disastrous floods in the recent times. About $1/8^{th}$ of Indias geographical area that is nearly about 40 million hectares is highly flood prone (Bapalu and Sinha 2005). The Himalayan region of India have miximum relief, torrential rainstorms, frequent cloud bursts and melting glaciers and thus pose a threat to sustainable development (jack Ives 2004). The state of Jammu has had a long history of flooding and floods in the state are linked to the main river Jhelum and have witnessed inundation of the Valley.

The Remote Sensing and GIS Technology play an important role in mitigating the ill effects of natural disasters (Meraj et al 2014). Remote Sensing and GIS is used to generate databases pertaining to evidences left behind by the natural disasters. Satellite images provide a synoptic overview and are excellent tools in mapping spatial distribution of natural disasters and damage assessment can be done by using data of different dates (before and after a natural disaster) . Remote Sensing and GIS technology is very helpful in hazard and risk zones that can be used in better decision making and sustainable development of a region.

Objectives: The main objective of the present was to assess the number of people (population) and number of villages / wards affected by the September 2014 Kashmir floods using Remote Sensing and GIS technology.

II. Study Area

The valley of Kashmir or Jhelum basin constitutes the north part of India, is situated between 33° 55′to 37° 05′ N latitude and 74° 30′ to 75° 35′ E longitude form the study area (fig. No.1) of the present study. The Kashmir valley is an oval shaped basin bounded by lofty mountains on either side. It has a well naturalized drainage system headed by the river Jhelum, the main channel of drainage. The river Jhelum is mainly formed by the junction of three main streams namely the Arapal, the Bringi and the Sandran which rises in the south east region of valley. The Jhelum basin has 24 catchments and 60 sub catchments.

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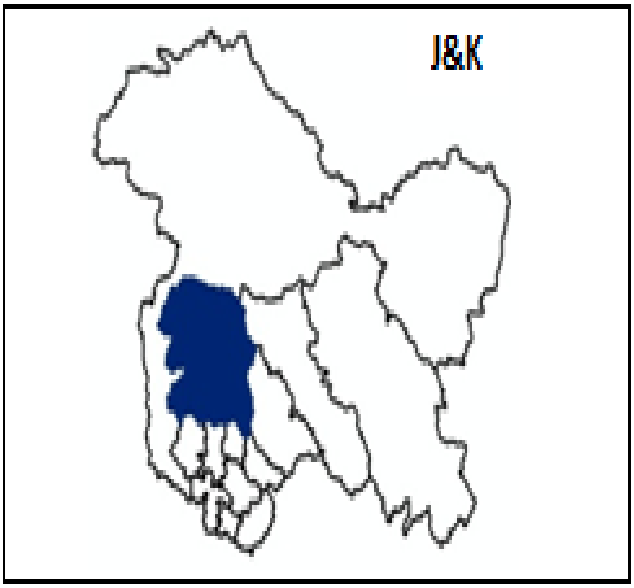

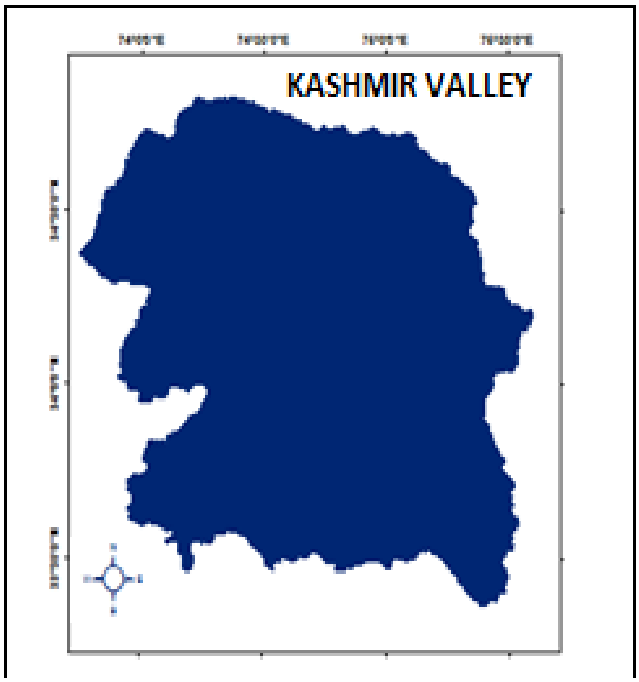

Fig. No. 1: Location of Study Area

III. Material and Methodology

The data sets used in the present study, in order to accomplish the respective objective are

Landsat 8 data (dated 10 September 2014) with spatial resolution 30 m was used to generate flood inundation boundary.

SOI Topographic data with 1:50,000 scale was used to generate settlement layer (settlements within the flood plain of watersheds).

Socio economic data (population data of 2011) from the open government data (OGD) platform from department of census government of India.

In order to achieve the respective objective it is very important to device a proper methodology. Fig. No.2 below shows the flowchart detailing the overall methodology adopted.

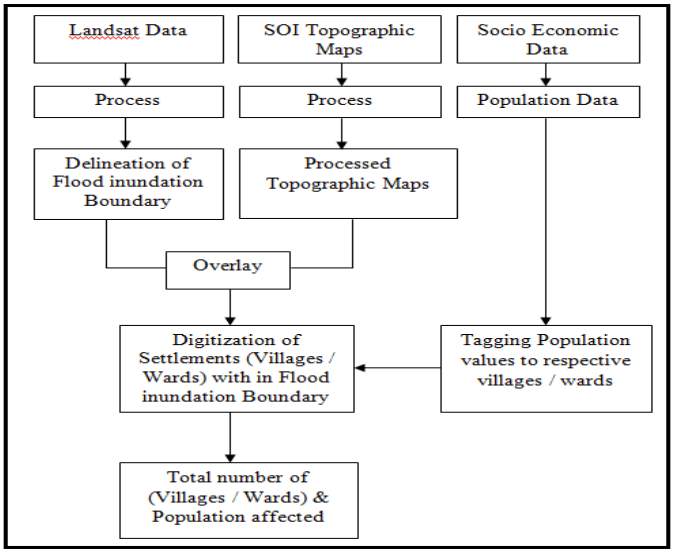

Fig. No. 2: Flowchart of Methodology Adopted

The Landsat data was processed for both geometric and radiometric corrections and from this data flood inundation boundary was delineated using on screen digitisation in GIS environment. Survey of India Topographic maps were geometrically corrected and flood inundation boundary was overlaid on Topographic maps to digitise the settlements with in the inundation boundary with the help of onscreen digitisation. Respective population data (values) were tagged to each village / ward within the settlement layer to achieve the final objective of people affected by the floods.

IV. Results and Tables

It is observed from the present work that 398 villages / wards of Kashmir Valley with a population of 2648092 were inundated (affected) by September 2014 floods. Fig. No.3 below shows the Settlements (villages / wards) inundated during the September 2014 Kashmir flood .

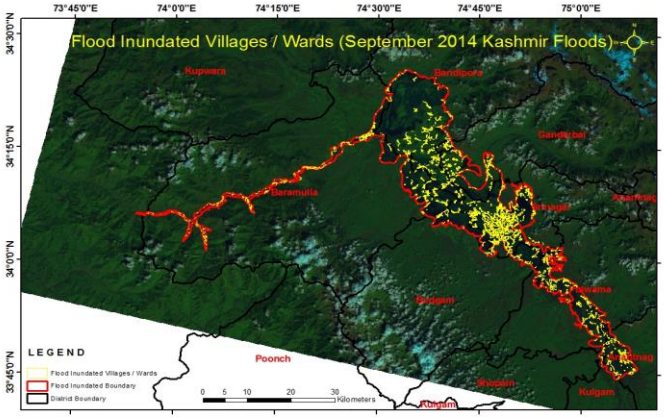

Fig. No. 3: September 2014 Flood inundation map

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The highest numbers of people affected are from district Srinagar (1506228) followed by Baramulla (447970), Bandipur (230444), Pulwama (137228), Ganderbal (109098), Budgam (105672), Anantnag (99693), Kulgam (6950) where as least number of people affected are from district Shopian (4809). In terms of number of villages / wards affected, the highest are from district Baramulla (103), followed by Pulwama (62), Bandipur (62), Srinagar (58) Ganderbal (47), Budgam (32), Anantnag (26), Kulgam (5) and least of villages / wards affected are from Shopian (3) district.

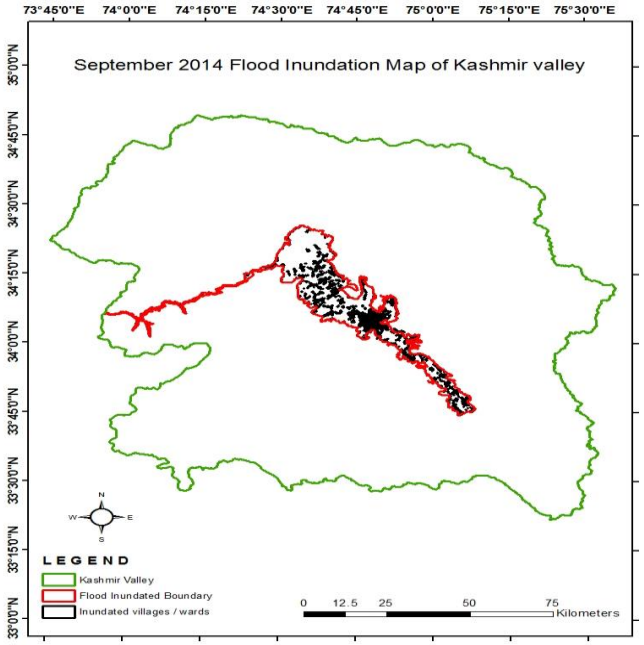

Fig. No. 4: Kashmir valley September Flood inundation map

The fig. No 4 above shows the flood inundation areas within the Kashmir valley during the September 2014 floods.

V. Conclusion

From the present study it is concluded that the Remote sensing and GIS technology is an appropriate tool to address the important issues like flood prediction, flood hazard and risk mapping, flood monitoring, flood inundation mapping and damage assessment of a natural disaster. The present study will be very useful in better prepared for flood disaster in the area and thus will also help in mitigating the ill effects of a flood disaster. This type of study can be extremely useful in the relief distribution activity after a particular event of flood disaster.

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