Assessment of land covers change due to flooding alongside Jhelum and Chenab rivers

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Pakistan is highly vulnerable to weather-related disasters. The country has increasingly been suffering from recurring cycles of intense droughts followed by enormous floods in the last few years. Massive floods of 2010 resulted into a cumulative financial loss of 10 billion US $, life loss of about 2,000 people, 17,553 villages were reportedly damaged and a total area of 160, 000 Km2 was affected. Punjab was severely damaged especially districts of Jhang, D.G. Khan, Rajanpur and Muzaffargarh. This devastating flood in 2010 was unusually intense and much bigger in scope as compared to other extreme events. Floods result in serious economic, social and environmental setback. Floods also change the land by making the farmland unworkable, affecting the vegetation cover, destructing the buildings and roads and thus changing the land use and land cover. Land cover change detection is very important to study or deduce the effects of any natural phenomenon or disaster on ecological system. Satellite Remote Sensing is an evolving technology with a potential to estimate and monitor the effects of any catastrophe. Flooding and flood induced land cover and land use change can be detected by using satellite imageries. This research focuses on the flood impact assessment of Jhang district of Punjab province using multi-temporal satellite images for year 2009 (May and August) and 2010 (July, August, September and December). The motivation of this study is the flood of 2010 in which Jhang was severely affected by flooding in River Chenab and Jhelum. Landsat ETM+ 30 meter multispectral imageries were used for flood assessment by employing maximum likelihood algorithm for supervised classification. Three instances i.e. pre-flood, during flood and post-flood were compared to estimate the change in Land use and Land Cover of district Jhang along Jhelum and Chenab Rivers. Comparison of pre and post flood images shows that there was significant decrease in built up area during flooded instances i.e. from 44% to 13%. Built up area again increased in post-flood month probably due to receding of water and rehabilitation activities. Water content was maximum in the month of August due to flooding while it slowly receded back in post flood month. Vegetation is 41% in August 2009 and 54% in August 2010 as this is a cropping season, and in this month crops like rice, maize etc. start to cultivate, so chlorophyll content is found largely in crops which was identified in NIR band while in May 2009 and December 2010, vegetation is less and bare soil has increased. Water is 2% in August 2009 due to monsoon rains. As flood struck Jhang in August 2010 so water covered about 10% of area. Water class was increased to about 5 times of the pre-flood instance. Post Flood instant clearly depicts that flooded water has almost completely receded and again the land preparation period for new cultivation has been started. The information as a result of this research can be used in further planning for natural resource management, land and water resource management. Climatic modeling and sustainability research can also be facilitated. The data of this research can be used by researchers, policy planners, and other decision makers requiring improved means of projecting land-use/ cover change.

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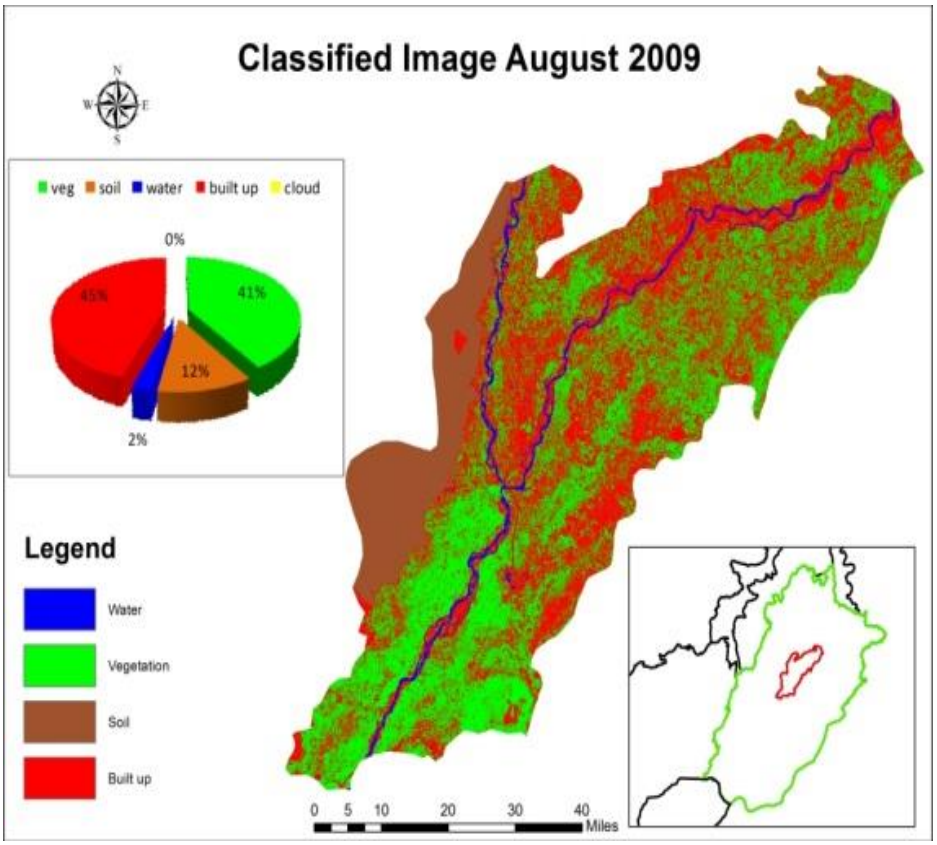

Figure 1. Classified image of August 2009. This is pre-flood classified image. Water has clearly concentrated in the river channels and only 2% area is covered with water.

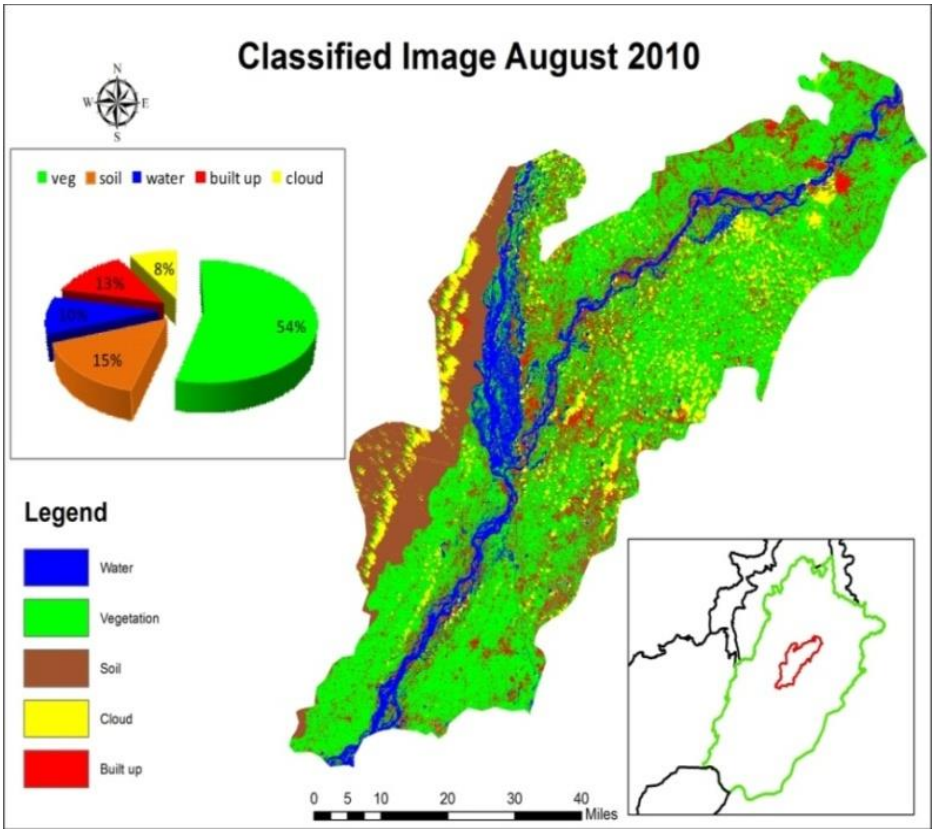

Figure 2. Classified image of August 2010. This figure shows that the area covered with water has significantly increased due to flooding.