

2010 PAKISTAN FLOOD ANALYSIS AND SUSTAINABLE FLOOD

MANAGEMENT

Mehwish Ghulam Zuhra

Key Words: Remote sensing, Pakistan flood 2010, Flood extent map, Damage assessment, Sustainable flood management

1. INTRODUCTION

This study was focused on the Pakistan mega flood 2010 (PMF-2010), which was ranked as the worst humanitarian disaster in the recent history of the United Nation. The PMF-2010 was started in late July, 2010 and continued until early September, 2010. Slow initial response, lack of early flood warning systems, fully and partially damaged communication infrastructure causing little or no accessibility to the affected areas and mismanagement of the flood were few of the reasons, which contributed in this mega disaster. Remote sensing-based data acquisition and analysis can efficiently be used to mitigate natural disasters in such conditions, which was the objective of this research.

2. METHODOLOGY

The flood extent mapping methodology is based on decision tree classification of composite images of pre-flood and during flood PALSAR data. The decision boundaries or the thresholds, first separating the flooded and non-flooded area were derived from the composite image. Later, in the decision tree, the flooded area was further separated into fully flooded and partial flooded area. The partial flood area represents area from which the flood had started receding. The damage assessment methodology depended on the intersection technique; i.e. intersecting the flood extent map with the land use and land classification map. The land use and land classification map was obtained using the maximum likelihood classification of optical sensor's data. The LANDSAT data was used to cover the whole of the Sindh province, which was the worst affected province in the PMF-2010. An ASTER image was also used for a pilot study. The maximum likelihood classification scheme was aided with a textural measure of correlation of the gray level co-occurrence matrix (GLCM), which helped in correct classification of various land uses and land classes in the area of study (i.e. the Sindh province) for the damage assessment.

3. RESULTS

The flood extent map of PMF-2010 and the corresponding damage assessment map of the Sindh province were developed. Based on these maps, it was found that the total flooded area in Pakistan was about 57175 sq. km, out of which fully flooded area was 40640 sq. km, and partial flooded area was 16535 sq. km. In Sindh province, total area affected by the flood was about 23,609 sq. km (about 17,793 sq. km as fully flooded and about 5816 sq. km as partially flooded). The cropland was the most affected land class (with 37% of total flooded area) followed by the uncultivated land with damaged area of 23% and built-up area with damaged area of 16%, respectively, in the Sindh area in the damage assessment.

4. CONCLUSION AND REMARKS FOR SUSTAINABLE FLOOD MANAGEMENT

Results from both methodologies, i.e. the flood extent map and the damage assessment map and areas were validated with available data (images, maps and facts) and it was found that both methodologies' results were satisfactory. An error of only 12% was observed between the damage cropland area calculated in this research and damaged cropland area reported by the provincial disaster management authority (PMDA) of the Sindh province, which is acceptable in remote sensing-based research. Therefore, being simple in nature and with abundant availability of the remote sensing data, the proposed methodology can be used for flood extent mapping and for damage assessment in future unfortunate flood disasters for a rough estimate of damages as well as for better and quick flood relief distribution.