Flood risk assessment and mapping for the Lebanese watersheds

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Of all natural disasters, floods affect the greatest number of people worldwide and have the greatest potential to cause damage. Nowadays, with the emerging global warming phenomenon, this number is expected to increase. The Eastern Mediterranean area, including Lebanon (10452 Km2, 4.5 M habitant), has witnessed in the past few decades an increase frequency of flooding events. This study profoundly assess the flood risk over Lebanon covering all the 17 major watersheds and a number of small sub-catchments. It evaluate the physical direct tangible damages caused by floods. The risk assessment and evaluation process was carried out over three stages; i) Evaluating Assets at Risk, where the areas and assets vulnerable to flooding are identified, ii) Vulnerability Assessment, where the causes of vulnerability are assessed and the value of the assets are provided, iii) Risk Assessment, where damage functions are established and the consequent damages of flooding are estimated. A detailed Land Cover\Use map was prepared at a scale of 1/ 1 000 using 0.4 m resolution satellite images within the flood hazard zones. The detailed field verification enabled to allocate and characterize all elements at risk, identify hotspots, interview local witnesses, and to correlate and calibrate previous flood damages with the utilized models. All filed gathered information was collected through Mobile Application and transformed to be standardized and classified under GIS environment. Consequently; the general damage evaluation and risk maps at different flood recurrence periods (10, 50, 100 years) were established. Major results showed that floods in a winter season (December, January, and February) of 10 year recurrence and of water retention ranging from 1 to 3 days can cause total damages (losses) that reach 1.14 M$ for crop lands and 2.30 M$ for green houses. Whereas, it may cause 0.2 M$ to losses in fruit trees for a flood retention ranging from 3 to 5 days. These numbers differs according to the flooding season, cultivation type and the agro-climatic zone. The flood damage equivalence to constructions summed up to reach 32 M$ for residential structures, 29 M$ for non-residential structures, and 5 M$ for the Syrian refugees tents, while structures' content losses were estimated at 27M$, 54M$, 7 M$ respectively for the same flood frequency. The total length of affected road networks during flooding is 1589km with an estimated cost of 565M$. The total number of affected population reached 82,000 while the number of effected vehicles is 62,000 for a 50year recurrence period