Journal of Water and Soil Science

Evaluating the Feasibility of Direct Flood Damage Estimation Using the HEC-FIA Model in the Semirom Watershed

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Abstract

Floods are among the most frequent and destructive natural disasters worldwide, causing significant damage to human infrastructure and the environment each year. The aim of this study is to assess the direct damages caused by flooding using the HEC-FIA model in the Semirom watershed. In the first step, flood inundation maps were generated using the HEC-RAS model based on digital elevation model (DEM) data, hydrological inputs, and Manning's roughness coefficients under both steady and unsteady flow conditions. These maps were then converted into a format compatible with the HEC-FIA software and integrated with economic, land use, and population data to estimate flood damages. The economic database included updated information on agricultural, horticultural, residential, and industrial land uses, partly obtained through field surveys. The flood event of March 11, 2006, was selected as the base flood, and damage analyses were performed for various return periods. The results indicated that the agricultural sector suffered the most damage. In the base year flood, agricultural damages exceeded 821 billion IRR, while structural damages were estimated at approximately 3 billion IRR. In the 1000-year return period, agricultural damages rose to 1,427 billion IRR, and structural damages increased to 44 billion IRR. Analysis of shorter return periods showed a significant decrease in damages, with no structural damage observed in the 10-year return period or less, although agricultural areas remained vulnerable. The findings suggest that the HEC-FIA model has a high capability in estimating direct flood damages across spatial and temporal scales and can serve as an effective tool for flood risk management and planning.

Keywords: : Flood, HEC-FIA, HEC-RAS, Damage Assessment, RAS Mapper, Flood Inundation Mapping