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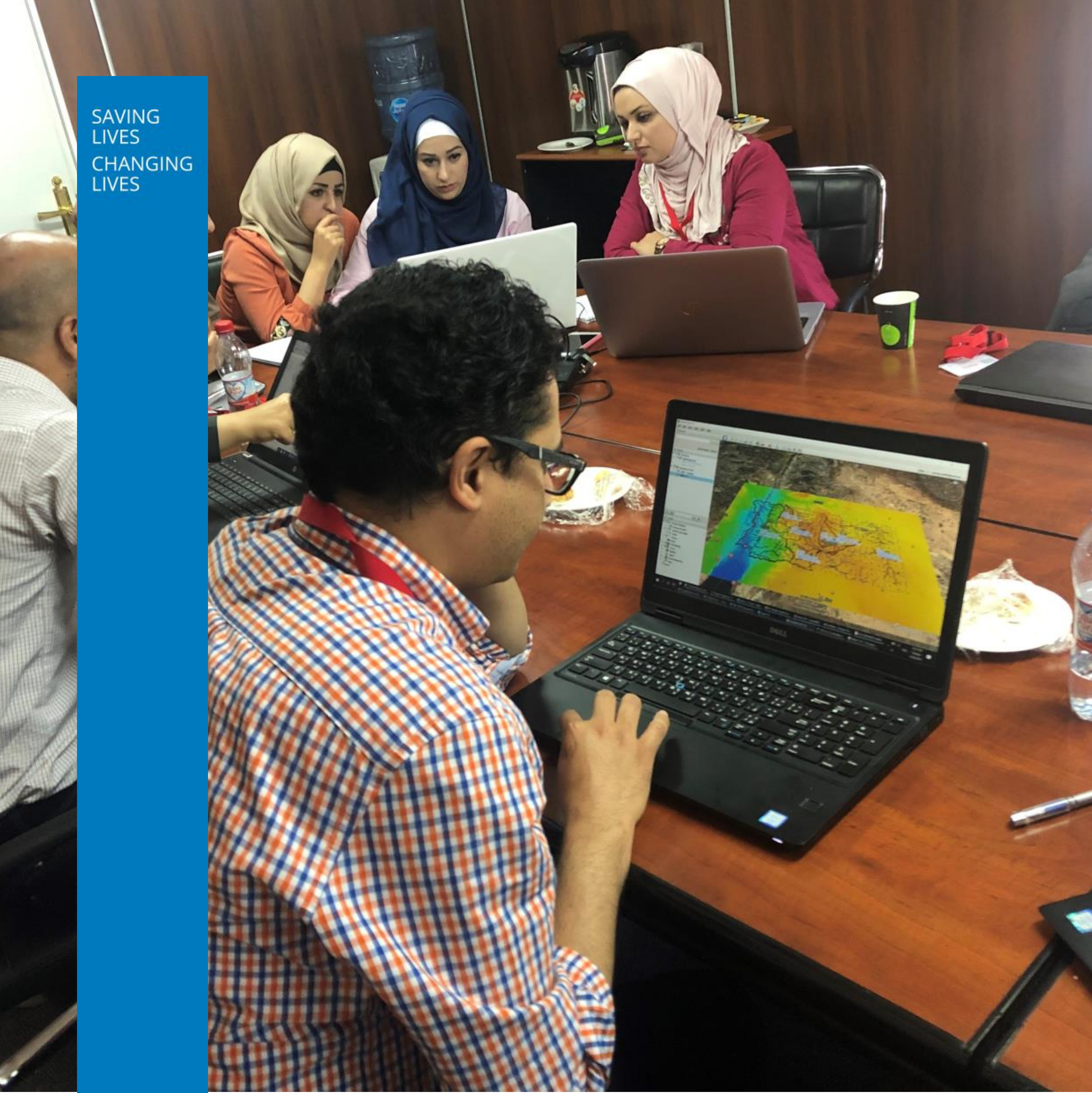

Flood Hazard Map

Integrated Context Analysis
Jordan

WFP
World Food
Programme

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Cover Photo : WFP

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Executive summary

The Integrated Context Analysis (ICA) at the national level is a collaborative and consultative analytical and programming tool that helps highlighting sub-national areas where different programme strategies could be implemented, combining food insecurity trends with exposure to natural hazards or other socio-economic indicators. It is used to inform strategic programmatic decision making by providing evidence to reach consensus on where Safety Nets, DRR (Disaster Risk Reduction), Early Warning, and Preparedness actions – and the various combinations of these four programmatic themes – should be considered in different geographical areas (e.g. provinces, or districts levels, depending on data availability) within a country. This includes the provision of population estimates that are recurrently food insecure or at risk to falling into crisis in the event of a shock, based on historical numbers of food insecure people (where available) to further inform programmatic decision making and planning.

Within the framework of the ICA conducted by WFP to map the natural shocks trend analyses that would affect the livelihoods of vulnerable people, a flood hazard map was produced at district level through integrating the Watershed Modelling System outputs with GIS spatial analysis tools.

During the exercise, national rainfall intensity data of MWI (Ministry of Water and Irrigation) using the IDF Curve, a Digital Elevation Model of 30m and district boundaries (second-level administrative unit) were used.

The results showed that the northern areas of ten districts (Ramtha, Bani Kinana, Al Shuna Al Shmalyah, Kora, Al Mazar Al Shamali, Qasabet Ajloun, Kofranja, Qasabet Al Salt, Ayn Al Basha and Al Jame'ah) are more susceptible to floods and therefore were classified as High level of flood hazard, while the eastern and southern parts of the country showed low susceptibility to flood occurrence.

According to CADRI report, the districts of Amman, Zarqa, Irbid and Mafraq are more vulnerable to flash floods and epidemics due to high concentrations of Syrian refugees, which exercise pressure on social services and infrastructure for water and sanitation, drainage and waste management.

The produced flood hazard map (Figure 1) will help designing resilience short term activities and plans, as well as helping vulnerable people living in these areas adapting during the seasons of the floods.

Background

Jordan’s hazards profile is characterized by exposure to earthquakes, flash floods, drought, snow storms, frost, heat and cold waves, forest fires, landslides, technological/industrial hazards (oil spill, explosions, etc.) and epidemics.

Flood risk, especially for what concerns flash floods, is increasing due to rapid unplanned urbanization and the insufficient capacity of drainage systems. Flood risk is particularly acute for households that are encroaching on natural drainage areas (wadis)”. Capacity Assessment of the Disaster Risk Management System in Jordan, 2017.

Flash floods became a serious problem in Jordan due to climate change ramifications. It accounts for significant damages causing lives losses and properties.

In light of the recent accident, dated October 2018, that saw 21 people lose their lives because of a flash flood, a red flag was raised in order to shed light on the seriousness of this problem.

In 2019, WFP started the ICA exercise to highlight sub-national areas where different programmes strategies make sense.

Climate-related natural hazards maps show where disaster risk management efforts can complement food-security objectives. Upon this core foundation, mapped data on subjects including nutrition, gender, livelihoods and resilience can enrich theme-level strategic planning in which all pieces work together.

It provides evidence to inform broad programmatic strategies, a basis for discussion with partners and a foundation on which to expand through additional analyses and information.

This information can be used by governments and partners to support overall programme strategy design and boost discussions about where their efforts can be targeted and coordinated, to ensure that their plans support and complement each other’s efforts, thus avoiding duplication and gaps.

This report shows the results of flood hazards based on rainfall intensity for 25 years of MWI rain gauge stations (Figure 1). It includes the flood hazard map for Jordan at district level, which represents the first flood hazard map produced in Jordan using both a hydraulic model and spatial GIS analysis, which makes this procedure the most appropriate to represent floods at administrative level.

Methodology

WMS was used as a main hydrological model to delineate floodplain extents and animations of flood waves for a complete flood plain analysis.

It is a comprehensive environment for hydrologic analysis, developed by the Environmental Modelling Research Laboratory of Brigham Young University in cooperation with the U.S. Army Corps of Engineers Waterways Experiment Station and is currently being developed by Aquaveo LLC.

WMS offers state of the art tools to perform automated basin delineation and to compute important basin parameters such as area, slope and runoff distances. It also serves as a graphical user interface for several hydraulic and hydrologic models. With its management of coordinate systems, WMS is capable of displaying and overlaying data in real world coordinates. The program also provides many display tools for viewing terrain surfaces and exporting images for reports and presentations.

The WMS integrates GIS and hydrologic models by using digital terrain data to define watershed and sub basin characteristics and providing interface for hydrologic models widely used in industry.

Data inputs – in GIS format – that are necessary for the design of the hydrological model include:

1. Vector (basin and stream) coverages;
2. Land use and soil type coverages for composite CN generation (when data is available). As a general guideline, the following CN values were assigned:
    a. agricultural areas = 75;
    b. rural and semi-developed areas = 80;
    c. urban areas = 85.

A rainfall design storm for each catchment was developed based on available daily Intensity-Duration-Frequency (IDF) curves for return period of 25-year.

Then, flood hydrograph for a daily storm of 25-year return period was calculated and model input and results were exported into GIS tools to calculate, for each district outlet, the ratio of peak flow divided by the drainage area contributing to the specific outlet. This normalized flood intensity is expressed in cubic meters per second per square kilometre:

$$Q/A = \frac{Q_{peak}\,[\frac{m^3}{s}]}{Area\,[km^2]}$$

The Q/A values were finally imported into GIS software, where a spatial analysis was conducted to get the results at district level. The discharge values were broken down into 3 classes as per below:

High for Q/A greater than 5.60

Medium for Q/A between 0.99-2.70

Low for Q/A less than 0.98

Results and discussions

The flood hazard map was produced using the Zonal Statistics tool, available in the Spatial Analysis toolbox in ArcMap, calculating the maximum value (MAX) of Q/A observed within each district. The historical trend of flood hazard was shown at district level.

The results showed that northern districts are mostly susceptible to floods due to high rainfall intensity.

The results were compared to the number of flash floods events per district occurred between 1982 and 2011. A close and reasonable correlation between the historical flood events occurrence and the flood hazard map was observed.

Flood hazard map