

SAVING  
LIVES  
CHANGING  
LIVES



World Food  
Programme

# Integrated Context Analysis (ICA) Technical Paper Jordan

July 2019

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## 1. Introduction

This report provides the technical analysis of the Integrated Context Analysis (ICA) in Jordan and complements the ICA Programmatic Interpretation and Conclusions by providing an evidentiary basis for discussions on what broad programmatic strategies are appropriate for different parts of the countries. The ICA Programmatic Interpretation and Conclusions is/will be available as a separate document.

The Integrated Context Analysis (ICA) is an analytical process that contributes to the identification of broad national programmatic strategies, including resilience building, disaster risk reduction, and social protection for the most vulnerable and food insecure populations.

The ICA is based on principles of historical trend analyses across a number of technical and sectorial disciplines, the findings of which are overlaid to identify areas of overlap. Trend analyses provide an understanding of what has happened in the past and what may (or may not) be changing to act as a proxy for what may occur in the future, and where short, medium, and longer-term programming efforts may be required. It is based on two core factors: trends of food insecurity and main natural shocks (droughts and floods).

By overlaying these findings on each other, combinations of recurring food insecurity and shock risk can be identified, and in turn the combinations of broad programmatic strategies that may be required to address these in a more holistic manner, drawing on the comparative advantages and technical expertise of governments, partners, communities, and of affected populations themselves.

Beyond the core ICA factors above, additional layers related to subjects that are relevant to programme strategies (e.g. landslide risk, land degradation, nutrition) can be overlaid as lenses to support further strategic adjustments. The ICA can also be used to identify areas where further in-depth studies or food security monitoring and assessment systems are needed. When used as part of WFP's Three-Pronged Approach (3PA) the ICA can guide the identification of priority areas in which to conduct Seasonal Livelihood Programming (SLP) consultations to identify area-specific complementary and multi-sectorial programmes with governments and partners, which in turn set the foundations for targeted joint efforts with communities and partners to plan and implement programmes through Community-Based Participatory Planning (CBPP).

## Partnerships

The following agencies, organisations and government bodies contributed to this report:

- Department of Statistics (DoS);
- iMMAP;
- Ministry of Agriculture (MoA);
- Ministry of Water and Irrigation (MoWI);
- National Centre for Security and Crisis Management (NCSCM);
- National Agriculture Research Center (NARC);
- Royal Scientific Society (RSS);

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## 2. The ICA Data Layers

This page overviews how to think about and use the various ICA data layers to identify programme themes relevant to particular geographic areas. Each layer is included for a specific purpose. The ICA Areas and Categories, explained in more depth on the following page, combine the core layers of food security and natural shocks to visualise the intersection of the main programmatic themes. Lenses and Additional Contextual Information layers are used to refine strategies identified via the Categories.

### ICA Categories and Areas

#### ICA Categories

Assists with broadly identifying where to place the thematic programme building blocks of safety nets, DRR and early warning/preparedness systems.

#### ICA Areas

Adds detail to the process above, by showing the intersection of food insecurity and natural shock risk.

### ICA Core

#### Food insecurity

Helps to identify where food security safety nets (to provide predictable, consistent assistance) are needed by highlighting areas where food insecurity consistently recurs over the defined threshold.

#### Natural shock hazard

Highlights areas where natural climate-related hazard risk are highest and thus DRR efforts are appropriate. These can be built into safety net efforts in areas with consistently high food insecurity. Contributes to defining regions where early warning and preparedness should be

### Lenses

#### Land degradation

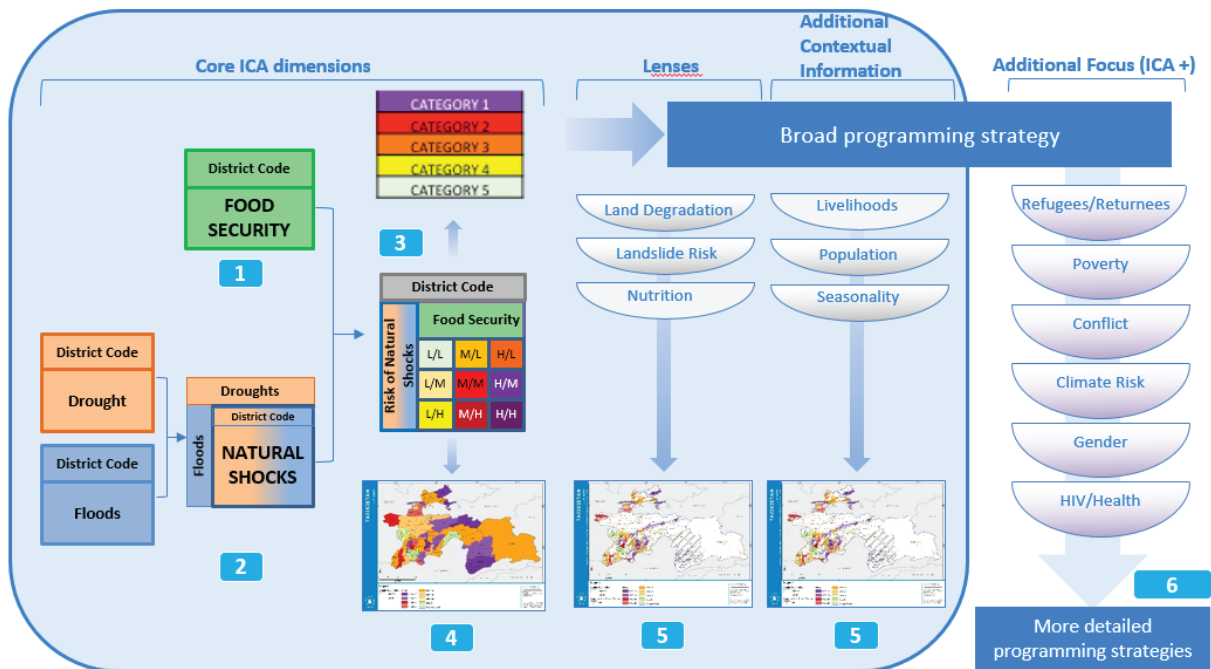
Land degradation can heighten the impact of natural shocks and is a major contributor to food insecurity. This lens shows where efforts to halt and reverse land degradation are required, either as part of safety nets, DRR or stand-alone programmes, and through policy.

#### Population distribution

Shows the geographic concentration of where people live.

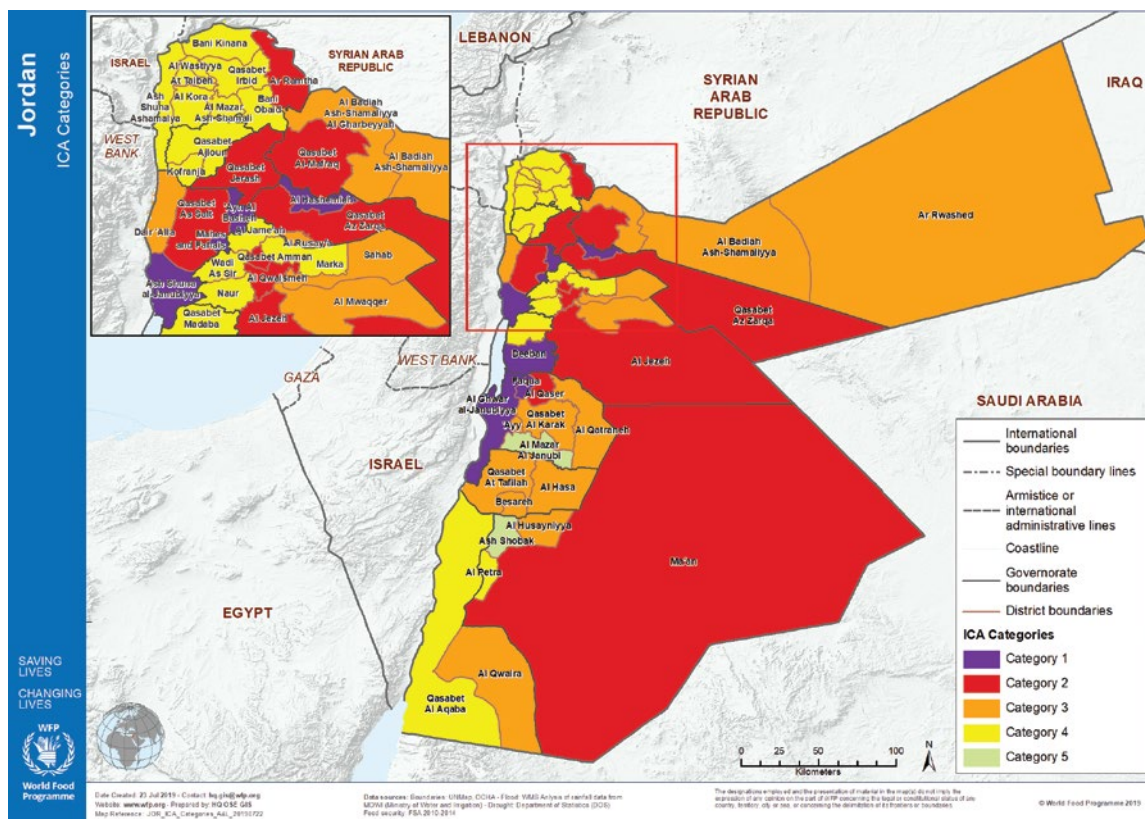
### 3. ICA Technical Construction Process

This diagram outlines how the ICA layers are put together during the analysis process.





## 4. ICA Categories



The ICA categorises the country's districts into Categories 1 to 5 based on their levels of recurring food insecurity and exposure to natural shocks. This is done by combining some of the ICA Areas on the following page, as shown in the table below, such that the nine Areas become five Categories. The ICA Categories and areas provide evidence for broad programmatic strategies and discussion with partners.

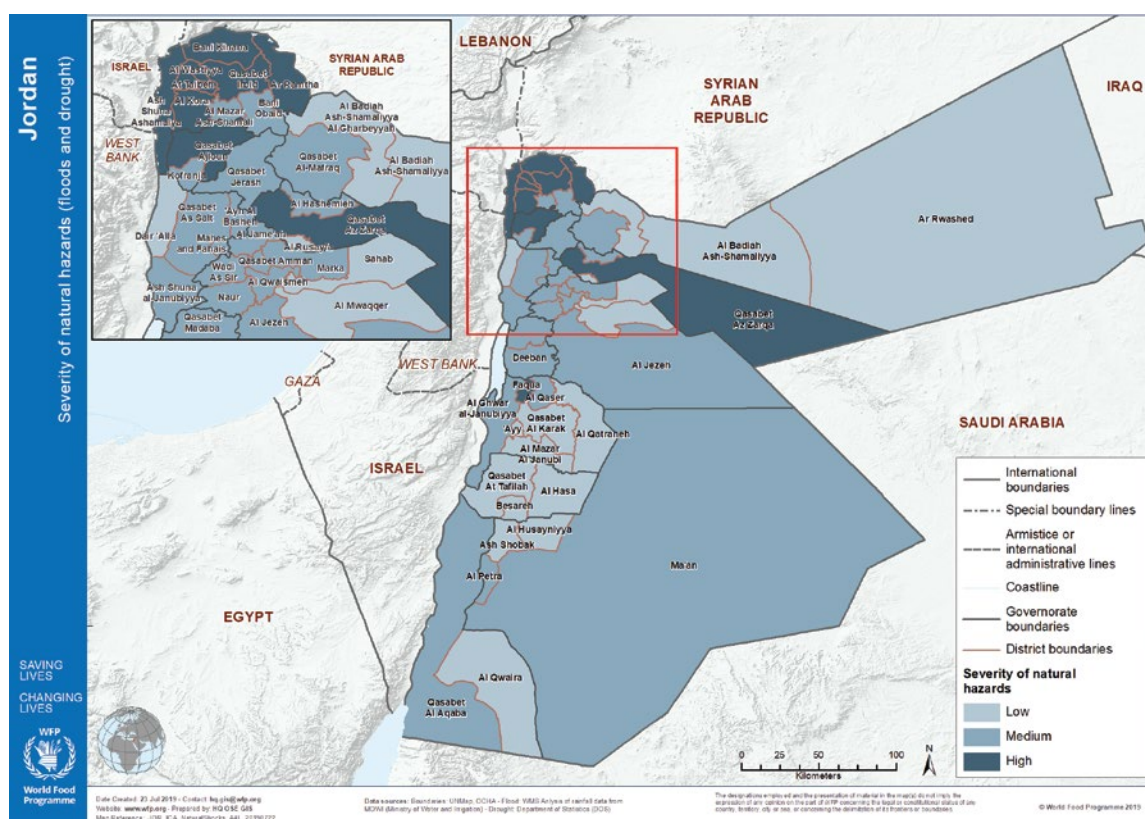
Combined exposure to natural shocks	Recurrence of food insecurity		
	LOW	MEDIUM	HIGH
LOW	<p><b>Area 5</b></p> <p><b>CATEGORY 5</b> Programming that <b>strengthens preparedness</b> to reduce risk and build resilience to natural shocks and other stressors.</p>	<p><b>Area 3 B</b></p> <p><b>CATEGORY 3</b> <u>Longer-term programming</u> to address conditions of long-term (chronic) food insecurity likely due to non-climatic causes (e.g., pervasive poverty, protracted conflict, etc.) aiming to improve food security and build resilience to man-made shocks and stressors.</p>	<p><b>Area 3 A</b></p>
MEDIUM	<p><b>Area 4 B</b></p> <p><b>CATEGORY 4</b> Programming that <u>strengthens early warning and preparedness</u> (considering land degradation trends) to reduce risk and build resilience to natural shocks and other stressors.</p>	<p><b>Area 2 B</b></p> <p><b>CATEGORY 2</b> Programming to address <u>seasonal food insecurity</u> and/or to <u>support post-shock recovery</u>, aiming to reduce risk and build resilience to natural shocks and other stressors.</p>	<p><b>Area 1 B</b></p> <p><b>CATEGORY 1</b> <u>Longer-term programming</u> to address conditions of protracted crises and frequent natural shocks that impede recovery, aiming to improve food security, reduce risk and build resilience to natural shocks and other stressors.</p>
HIGH	<p><b>Area 4 A</b></p>	<p><b>Area 2 A</b></p>	<p><b>Area 1 A</b></p>







## 7. Natural Shock Analysis



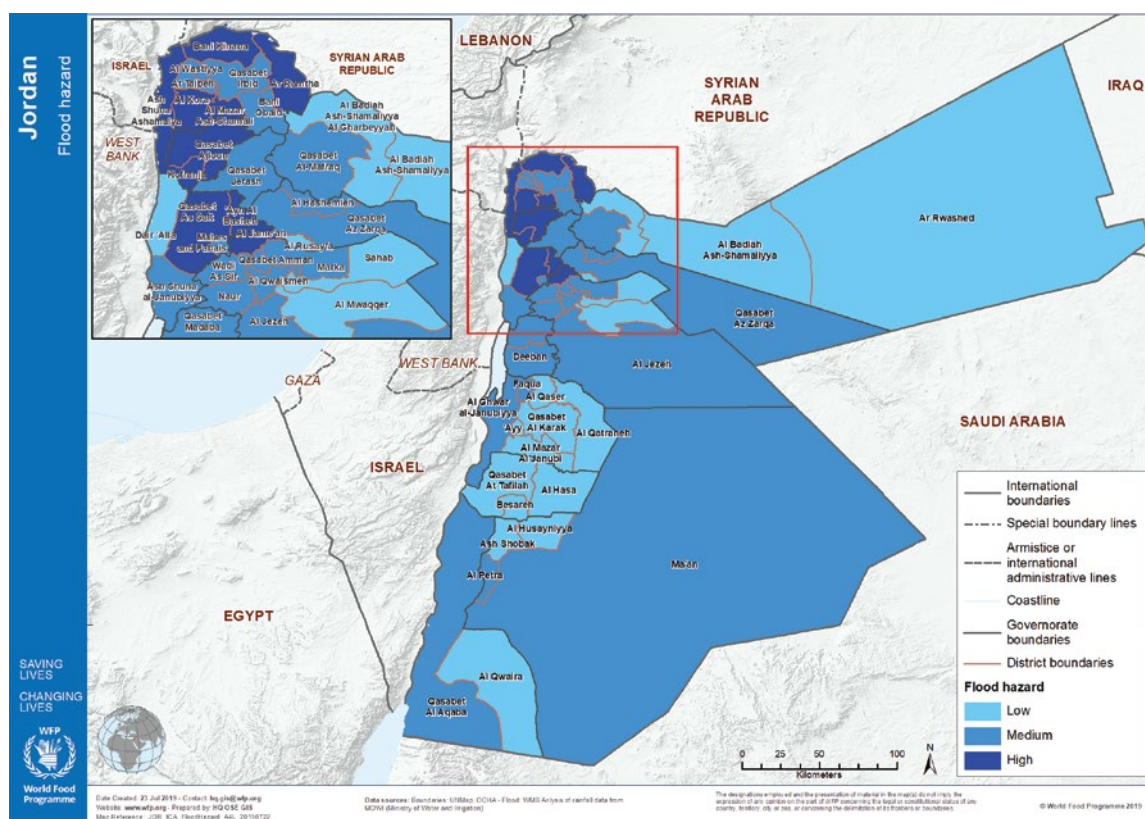
The natural shocks analysis was carried out using data on floods and droughts. Data for each of these shocks was analysed by second-level administrative level (Liwa'a).

	Drought hazard		
Flood hazard	Low	Medium	High
Low	<b>Very Low</b>	<b>Low</b>	<b>Moderate</b>
Medium	<b>Low</b>	<b>Moderate</b>	<b>High</b>
High	<b>Moderate</b>	<b>High</b>	<b>Very High</b>



Combined natural shock hazard by district			
Combined risk of natural shocks	2	3 – 4	5 – 6
ICA Reclassification	Low	Medium	High

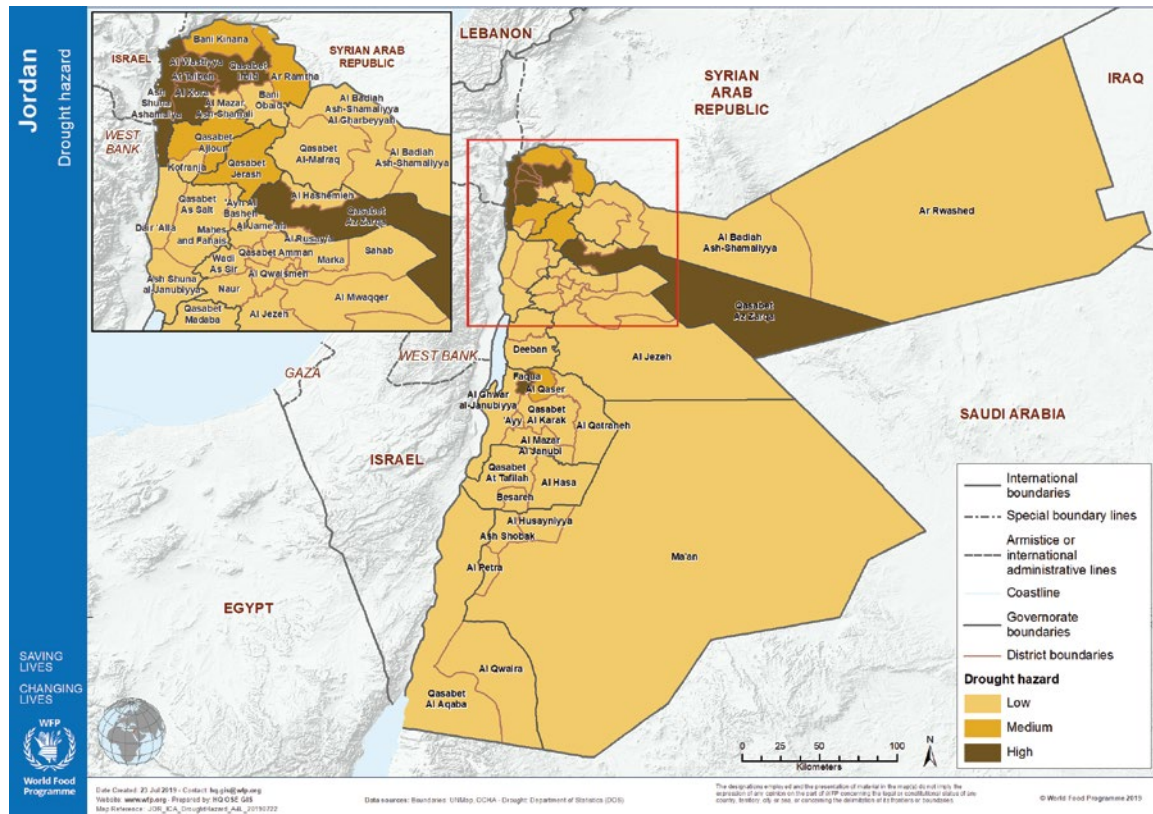
## Floods



Flood data was obtained from the Ministry of Water and Irrigation (MoWI) and was available from 1991 through 2011. The original dataset was aggregated to the second-level administrative level (Liwa'a). The key indicator used was the normalized flood intensity, expressed in terms of ratio between the peak flow and the drainage area, with the range of values classified by the ICA as indicated below.

Flood hazard by district			
Flood hazard (peak flow divided by drainage area)	< 0.98	0.99 – 2.70	> 2.70
ICA Reclassification	Low	Medium	High

## Drought



Drought data was obtained from the “CDI Validation summary report and drought vulnerability maps” report produced by UNDP in 2018 and valid for the period between 1980 and 2016. The original dataset was aggregated to the second-level administrative level (Liwa'a). The key indicators used were natural factors related to exposure and a combination of natural and human-driven factors for the sensitivity. Adaptive capacity, on the other hand, has been based on the availability of resources, socio-economic indicators, legislation and capacity of relevant institutions and society. It should be noted that, for the purposes of the ICA, the original 5-point scale determined by UNDP has been simplified to the standard low-medium-high classification by merging “No vulnerability” with “Low vulnerability” and “High vulnerability” with “Extreme vulnerability”.

Drought hazard by district			
Drought hazard (Drought vulnerability)	< 0.4	0.4 – 0.6	> 0.6
ICA Reclassification	Low	Medium	High

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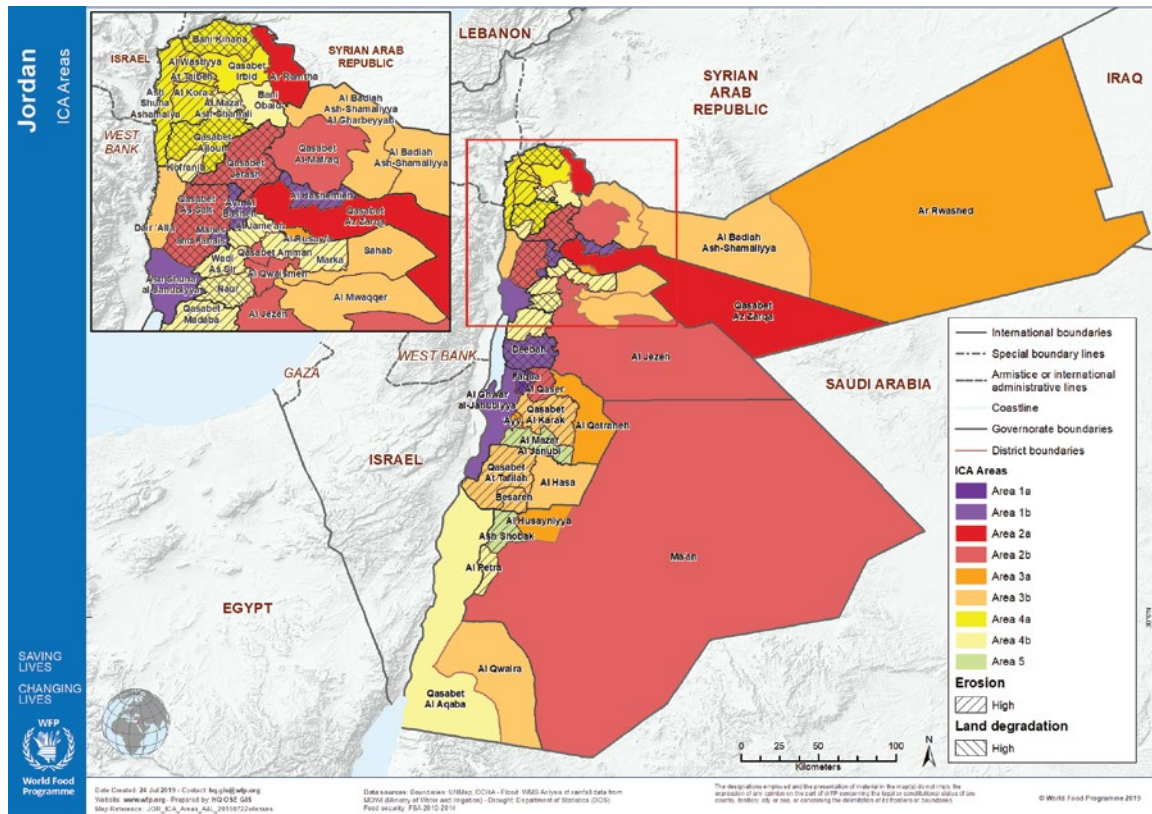
## 8. ICA Lenses

ICA lenses provide information relevant to further refining programme strategies overlaid on top of the ICA Categories. Thus, for example, the land degradation lens can be used to pinpoint areas where landslide risk could be addressed as part of DRR programming. ICA lenses are simple one-indicator overviews of a specific subject.

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## Land Degradation Lens



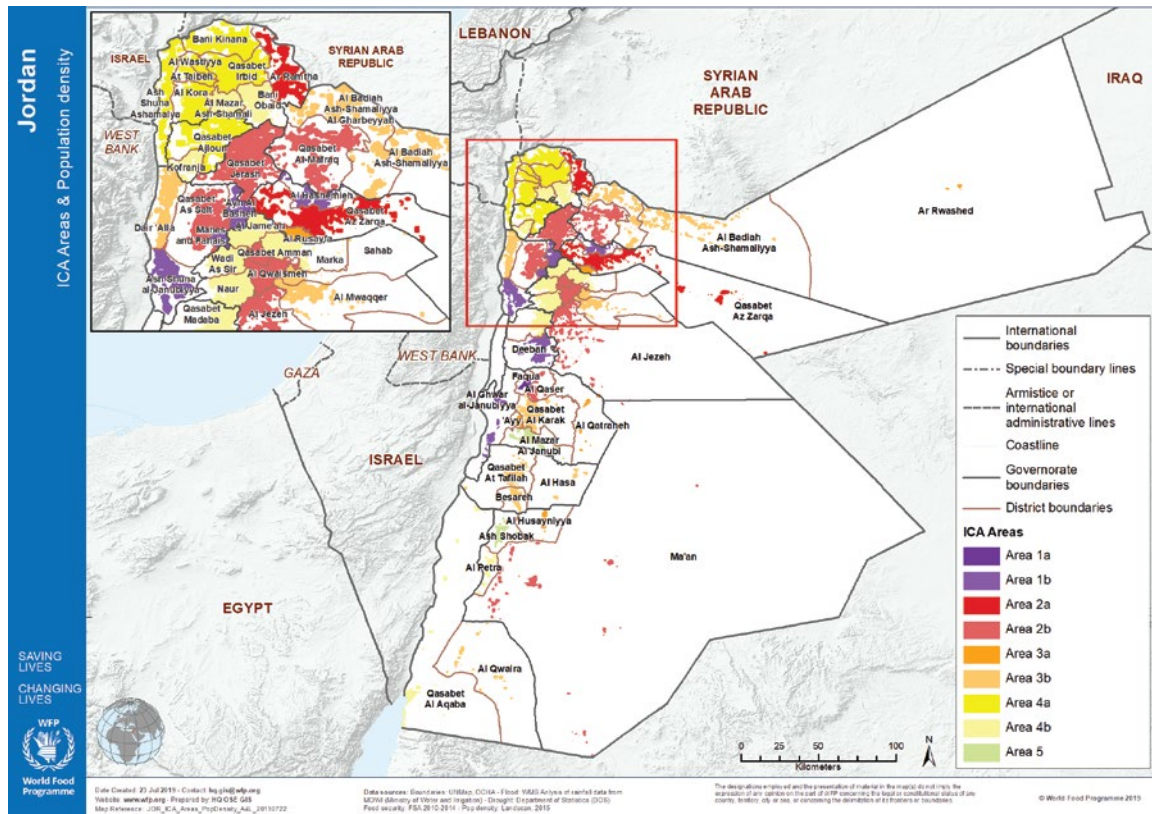
The key indicators used to assess land degradation were the **average land cover change and the percentage of erosion-prone areas**. The original datasets were aggregated to the second-level administrative level (Liwa'a).

Two indicators were used to assess land degradation – the first is a land cover change analysis performed using remotely sensed land cover data for 2001-2006 and 2011-2016 from the National Aeronautics and Space Administration (NASA). It should be noted that this is a proxy analysis that assigns values to certain land cover classes which should be locally verified.

The second is a soil erosion analysis that emerges from a simplified version of the Universal Soil Loss Equation (USLE), considering data on rainfall incidence (FAO GeoNetwork, 2000), soil lithology, land cover extracted from NASA MODIS and slope length, calculated by SAGA-GIS, from NASA SRTM Digital Elevation Model (DEM).

On top of the ICA Areas, districts with high negative land cover changes were mapped, as well as those with significant erosion propensity (> 5 tons/ha per year) affecting more than 50% of the surface area. This map highlights where these different land degradation problems are present, where they coincide and need to be addressed because they can heighten the impact of natural shocks and contribute to worsen the food security conditions.

## Population Density



Population density data mapped and overlaid on the ICA Areas highlights where people are living in the districts that have been categorised according to food insecurity and natural shock risk. Population density comes from the Landscan global dataset, which was available from 2015. It should be noted that this is a global dataset based on land cover, roads, slope, village locations, etc. and is intended to capture the likely spatial distribution of census population figures.

## 9. Technical Analysis Methodology

### Food security

The ICA Food Security analysis aims to assess how the chosen indicator values have fluctuated, versus a benchmark, over the time period for which data are available. It assesses the food security trend of each geographic area against the threshold and reclassifies each area using a simple 3-point scale to indicate its food insecurity status (e.g., “low” as 1, “medium” as 2 and “high” as 3). As previously mentioned, in Syria the threshold for was set at 30%.

To assess the food security trend, the ICA food security analysis considers the recurrence above **threshold, measured as the number of times the area in question has had a food security indicator value** equal to or above the threshold out of the number of available rounds.

### Rapid-onset shocks

WMS (Watershed Modelling System) was used to develop a watershed model starting from a DEM (Digital Elevation Model) and rainfall data.

Land use and soil type coverages for composite Curve Number generation were entered in the WMS platform.

As a general guideline, the following Curve Number values were assigned:

- Agricultural areas = 75;
- Rural and semi-developed areas = 80;
- Urban areas = 85.

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

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

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:

Flood hazard by district			
<b>Flood hazard</b> (peak flow divided by drainage area)	< 0.98	0.99 – 2.70	> 2.70
ICA Reclassification	Low	Medium	High

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## Slow-onset shock

The approach followed for mapping the drought vulnerability was based on the use of data from the Department of Statistics (DoS), in addition to already available maps. A good approach is the one proposed by the German Federal Enterprise for International Cooperation (GIZ, 2014) for climate change vulnerability assessment, based on the following formula:

$$Vulnerability (V) = \frac{potential\ for\ drought}{adaptive\ capacity} = \frac{exposure (E) \ sensitivity (I_s)}{adaptive\ capacity (I_a)}$$

Although there are no specific indicators to include in this approach, it is based on the inclusion of natural factors related to exposure and a combination of natural and human-driven factors for the sensitivity. Adaptive capacity, on the other hand, is based on the availability of resources, socio-economic indicators, legislation and capacity of relevant institution and society. Sensitivity and adaptive capacity were summed for the selected indicators, which were given equal weights. Subsequently, sensitivity was calculated using the following formula:

$$(1) I_s = \sum a_i S_i$$

Where:

- $S_i$ = indicator or data point of the target's sensitivity;
- $a_i$ = weighting factor of the sensitivity indicator  $S_i$

Similarly, adaptive capacity was calculated as follows:

$$(2) I_a = \sum b_i C_i$$

Where:

- $b_i$ = weighting factor of the sensitivity indicator  $C_i$ ;
- $C_i$ = indicator or data point of the target's adaptive capacity.



Each component of equation 1 was calculated by averaging the indicators for sensitivity and adaptive capacity. Therefore, data from DoS were tabulated and arranged for the administration levels in Jordan. The criteria for drought vulnerability are summarized in the table below.

<b>Vulnerability component</b>	<b>Criteria</b>	<b>Data used</b>	<b>Steps</b>	<b>Remarks</b>
Exposure	Drought occurrence between 1980 and 2016.	Rainfall data from MWI and JMD.	1-SPI calculated and GIS maps prepared. 2-Count (Value) for years with SPI < -1 was summed for each admin level. 3-Apply equation 2.	Moderate to extreme droughts count (occurrence) was from 2 to 9 years during the 36-year interval.
Sensitivity	1-Population 2-Agriculture 3-Livestock 4-Forest, reserves	Census data, agricultural census, GIS maps.	Equation 2 applied on the following indicators: 1-Population relative to the total. 2-Agricultural area in relation to the area of the admin unit. 3-Livestock in relation to area of rangelands and agricultural area (rainfed and 0.2 of irrigated). 4-Area of forest or natural reserve.	Area of forest was digitized from satellite images. Maps of RSCN for reserves was used to obtain areas. Rangeland area obtained from satellite images.
Adaptive capacity	1-Poverty 2-Municipal water 3-Irrigation water	DoS data, MWI records, maps of irrigation prepared by Professor Al-Bakri.	1-Poverty as percent for each subdistrict was used for sensitivity by normalizing equation 2. 2-Per capita of municipal water calculated using supply and population. 3-Maps of groundwater wells were used to derive available water per irrigated area.	Municipal water was averaged for districts and subdistricts from governorate level. Groundwater availability was obtained for each subdistrict using spatial analysis tools in GIS.

The approach has the strength of scaling or normalizing the components of vulnerability from zero to one as the general formula for each indicator (data point) is calculated as follows:

$$X_{i,o \text{ to } 1} = \frac{x_i - x_{\min}}{x_{\max} - x_{\min}}$$

Where:

- $x_i$  represent the individual data point to be transformed;
- $x_{\min}$  the lowest value for that indicator;
- $x_{\max}$  the highest value of that indicator;
- $X_{i,o \text{ to } 1}$  the new value to calculate, i.e. the normalised data point within the range of 0 to 1.

Where the individual data point represents each indicator included in exposure, sensitivity and adaptive capacity. Classification of vulnerability classes was relative and was based on equal intervals, using the following classes:

Value	Vulnerability class
< 0.2	No vulnerability
0.2 – 0.4	Low vulnerability
0.4 – 0.6	Moderate vulnerability
0.6 – 0.8	High vulnerability
> 0.8	Extreme vulnerability

Drought hazard by district			
<b>Drought hazard</b> (Drought vulnerability)	< 0.4	0.4 – 0.6	> 0.6
ICA Reclassification	Low	Medium	High

## Land degradation

### Changes in land cover classes

The current method of analysis for land degradation aims to identify and qualitatively classify recent negative change in land cover classes and deforestation, in areas associated with high recurrence of shocks and food insecurity. The analysis compares the status of land cover classes as measured in two time windows (2001-2006 and 2011-2016), considering changes on a yearly basis and with a spatial resolution of 500m. Data is sourced from MODIS (NASA), which offers global coverage. Each of the MODIS standard land cover classes emerging from the two time windows is given a numerical “ecological value” (the higher the number, the higher the ecological value).

MCD12Q1 Class	New Name	Eco Value
Evergreen broadleaf forest	Forest	6
Evergreen needleleaf forest		
Deciduous broadleaf forest		
Deciduous needleleaf forest		
Permanent wetlands	Wetland	6
Closed shrublands	Shrubland	5
Open shrublands		
Woody savannas		
Savannas	Grassland	4
Grasslands		
Croplands	Croplands	3
Cropland/Natural vegetation mosaic		
Urban and built-up	Urban and built-up	2
Barren or sparse vegetated	Barren or sparse vegetated	1
Water	Water	0
Snow and Ice	Snow and Ice	0

Changes over time are expressed as the difference between Time 1 (2001-2006) and Time 2 (2011-2016) land cover class values which can result in a range of values from +36 to -36 where **negative** values indicate a deterioration in the ecological value of the land, **zero** indicates no change in land cover and **positive** values indicate improvement in the ecological value. The average change is calculated for each district (or other administrative area as defined by the analysis), taking into consideration the extent of both positive and negative change. The range of positive values is broken down into three classes using Natural Breaks and the same is done for the **negative** values.

### Erosion propensity

The main indicator utilised for the analysis of soil erosion emerges from a simplified version of the Universal Soil Loss Equation (USLE) which is widely recognized in the sector as a proxy or means of estimating erosion propensity. In its original form it is expressed as:

$$Erosion = R \cdot K \cdot LS \cdot C \cdot P$$

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Where **R** stands for rainfall/runoff factor, **K** stands for soil property in lithological terms, **LS** stands for slope length, **C** stands for predominant land use and **P** indicates a protective factor, such as the presence of infrastructure apt to decrease soil erosion. In general, data on the P factor are hard to find, so a simplified version has been developed which relies on four key elements:

- Rainfall incidence, WorldClim, 1970 - 2000 (~1 km resolution);
- Soil lithology calculated from the FAO Digital Soil Map of the World v3.6, 2003;
- Land cover extracted from NASA MODIS MCD12Q1 product (~250m resolution);
- Slope length calculated from NASA SRTM Digital Elevation Model (500m resolution) using SAGA-GIS.

For more information on the actual elaboration of the raster files and final erosion propensity calculation, please contact OSEP-GIS Unit.

The resulting product provides an estimate of the potential soil loss, in tons/ha per year. All soil loss above 5 tons/ha per year is considered as significant, and the percentage of the territory in each district (or unit of measure) that experiences this level of erosion propensity is calculated.



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## 10. Data Surces

### Administrative boundaries

Unit/level of analysis: Districts (second-level administrative areas)

Format: ☐ Excel ☒ ArcGIS

Comments: Describe any issues relating to administrative boundary data

### Population figures

Source: Landsat

Time span: 2015

Comments: Global dataset based on land cover, roads, slope, village locations, etc. intended to capture the likely spatial distribution of census population figures

### Food security

Indicator: FCS

Source: Department of Statistics (DoS)

Time span: 2010, 2014

Comments: Caveats, limitations, concerns, etc.

### Natural Shocks

#### Floods

Indicator: Normalized flood intensity

Source: MoWI, 1991 – 2011

Time span: N/A

Comments: Caveats, limitations, concerns, etc.

### Drought

Indicator: Drought vulnerability

Source: CDI Validation summary report and drought vulnerability maps , UNDP 2018

Time span: 1980-2016

Comments: Caveats, limitations, concerns, etc.

### Land degradation

Indicator: Land cover change

Source: NASA MODIS

Time span: 2001-2006 vs. 2011-2016

Comments: Proxy analysis

Indicator: Erosion Propensity

Source: HQ OSEP GIS analysis using RUSLE equation, FAO, NASA and WorldClim data inputs

Time span: N/A

Comments: The analysis does not capture the impacts of protective measure in place that reduce erosion.

11. Data tables

Final ICA Collecting Table

ICA Categories	ICA Areas	Governorate	District	Recurrence of food insecurity	Natural shocks hazard	Flood hazard	Drought hazard	Erosion propensity
Category 1	Area 1a	Al Karak	Faqua	High	High	Medium	High	Medium
	Area 1b	Al Balqa	Ash Shuna al-Janubiyya	High	Medium	Medium	Low	Medium
		Al Balqa	'Ayn Al Basheh	High	Medium	High	Low	Medium
		Al Balqa	Mahes and Fahais	High	Medium	Medium	Low	Medium
		Al Karak	Al Ghwar al-Janubiyya	High	Medium	Medium	Low	Medium
		Madaba	Deeban	High	Medium	Medium	Low	Medium
		Zarqa	Al Hashemieh	High	Medium	Medium	Low	Low
Category 2	Area 2a	Irbid	Ar Ramtha	Medium	High	High	Medium	Low
	Area 2b	Zarqa	Qasabet Az Zarqa	Medium	High	Medium	High	Low
		Al Balqa	Qasabet As Salt	Medium	Medium	High	Low	High
		Al Karak	Al Qaser	Medium	Medium	Low	Medium	Medium
		Al Mafraq	Qasabet Al-Mafraq	Medium	Medium	Medium	Low	Low
		Amman	Al Jezeah	Medium	Medium	Medium	Low	Low
		Amman	Al Qwaismeh	Medium	Medium	Medium	Low	Low
		Amman	Qasabet Amman	Medium	Medium	Medium	Low	Low
	Area 3a	Jarash	Qasabet Jerash	Medium	Medium	Medium	Medium	Medium
		Maan	Ma'an	Medium	Medium	Medium	Low	Low
Category 3	Area 3a	Al Karak	Al Qatraneh	High	Low	Low	Low	Low
		Al Karak	'Ayy	High	Low	Low	Low	High
		Al Mafraq	Ar Rwasheed	High	Low	Low	Low	Low
		Maan	Al Husayniyya	High	Low	Low	Low	Low
	Area 3b	Zarqa	Al Rusayfa	High	Low	Low	Low	Medium
		Al Aqaba	Al Qwaira	Medium	Low	Low	Low	Low
		Al Balqa	Dair 'Alla	Medium	Low	Low	Low	Low
		Al Karak	Qasabet Al Karak	Medium	Low	Low	Low	Medium

Category 4	Area 4a	Al Mafrq	Al Badiah Ash-Shamaliyya	Medium	Low	Low	Low	Low	Low
		Al Mafrq	Al Badiah Ash-Shamaliyya Al Gharbeyyah	Medium	Low	Low	Low	Low	Low
		Al Tafilah	Al Hasa	Medium	Low	Low	Low	Low	Medium
		Al Tafilah	Besareh	Medium	Low	Low	Low	Low	High
		Al Tafilah	Qasabet At Tafilah	Medium	Low	Low	Low	Low	High
		Amman	Al Mwaqqer	Medium	Low	Low	Low	Low	Low
		Amman	Sahab	Medium	Low	Low	Low	Low	Low
		Ajloun	Qasabet Ajloun	Low	High	High	High	Medium	High
Category 4	Area 4a	Irbid	Al Kora	Low	High	High	High	High	High
		Irbid	Al Wastiyya	Low	High	High	Medium	High	High
		Irbid	Ash Shuna Ashamalya	Low	High	High	High	High	Medium
		Irbid	At Taibeh	Low	High	High	Medium	High	High
		Irbid	Bani Kinana	Low	High	High	High	Medium	High
		Irbid	Qasabet Irbid	Low	High	High	Medium	High	Low
		Ajloun	Kofranja	Low	Medium	Medium	High	Low	High
		Al Aqaba	Qasabet Al Aqaba	Low	Medium	Medium	Medium	Low	Low
	Area 4b	Amman	Al Jame'ah	Low	Medium	Medium	High	Low	Low
		Amman	Marka	Low	Medium	Medium	Medium	Low	Medium
		Amman	Naur	Low	Medium	Medium	Medium	Low	Medium
		Amman	Wadi As Sir	Low	Medium	Medium	Medium	Low	Medium
		Irbid	Al Mazar Ash-shamali	Low	Medium	Medium	High	Low	High
		Irbid	Bani Obaid	Low	Medium	Medium	Medium	Low	Low
		Maan	Al Petra	Low	Medium	Medium	Medium	Low	High
		Madaba	Qasabet Madaba	Low	Medium	Medium	Medium	Low	Medium
Category 5	Area 5	Al Karak	Al Mazar Al Janubi	Low	Low	Low	Low	Low	Medium
		Maan	Ash Shobak v	Low	Low	Low	Low	Low	High

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## 12. Contacts

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