



## **Mapping the most vulnerable communities for climate change and environment:**

### **Executive Summary:**

Palestine faces many challenges, especially the consequences of the Israeli occupation in many aspects of the Palestinian people life such as the confiscation of agricultural land and the pollution of the Palestinian agricultural lands with the discharged wastewater of the nearby Israeli settlements and the Israeli industrial facilities, in addition to polluting groundwater...etc. Despite the occupation, Palestine faces a lot of problems due to the climate change, limited access to water resources and lands, biodiversity degradation, ecosystems imbalances, weak policies and implemented action plans and poor legal systems which affecting all aspects of life including the deterioration of livelihood. At the moment, the national economy and families' livelihoods have been further strained by the Covid-19 pandemic. Drought and the resulting water scarcity, as well as extreme weather and climate change phenomena such as dry spells, heat waves, frost, flash floods, and winter rain storms, are all hallmarks of climate change. This has had serious consequences for farming families and other actors involved in the value chain of agricultural products.

We Effect in partnership with the Palestinian Agricultural Institutions Coalition (PAIC) is implementing the Environmental and Climate Justice Program (ECJP) for Palestine, which is funded by the Swedish Governed through the Swedish Consulate in Jerusalem. PAIC is a coalition of six Palestinian non-governmental organizations working in the fields of environment, climate change, rural development and agriculture, including the Palestinian Agriculture Relief Committee (PARC), the Union of Agricultural Work Committees (UAWC), and Maan Development Center, Lane Research Center (LARC), Palestinian Hydrology Group (PHG) and the Applied Research Institute –Jerusalem (ARIJ).

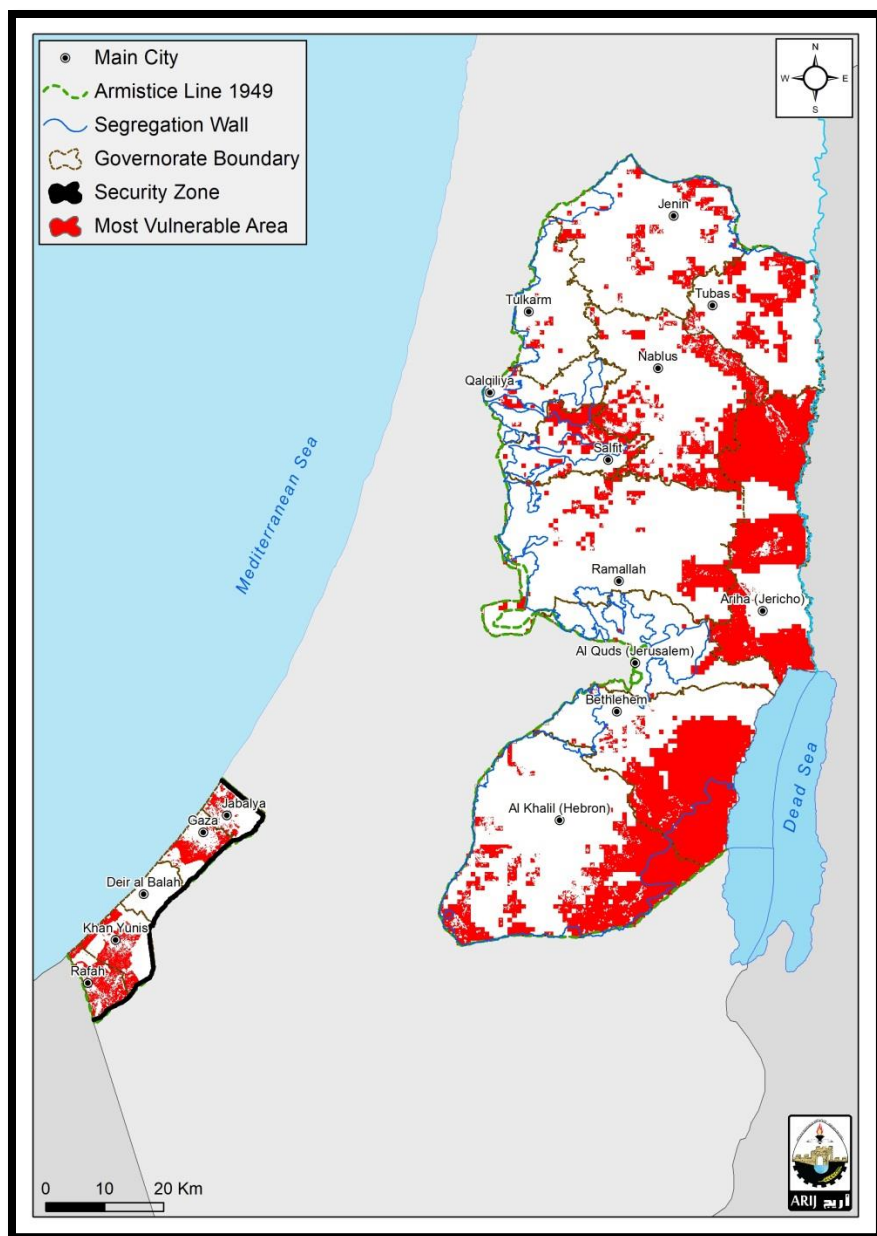
The current report contains Environmental and Climate Justice Vulnerability study in terms of scope, methodology, and output. The Environmental and Climate Justice Program is a 36-month program is being implemented by PAIC and We Effect that will run from 2021 to 2023. The program's overarching goal is to "assist in improving environmental and climate justice in Palestine," "By 2024, civil society organizations and right-holders will have the power to address and challenge systemic barriers to environmental and climate justice in Palestine," says the program's particular goal.

To contribute to the realization of the program goals, the program will use a bottom up approach to environmental governance of strengthening the capabilities of various stakeholders and marginalized communities to influence policy making and strategic sectorial policies. Climate justice recognizes that climate change is as much a political and socioeconomic issues as an environmental issue, therefore the program will use a gender mainstreaming and human rights based approach linking the rights of marginalized community members especially women, youth and smallholder

farmers with the obligations and commitments of duty bearers when it comes to environmental governance and rights, access to information and natural resources.

The role of civil society in strengthening sustainable and long term accountability for environmental governance is crucial thus the program will also contribute to capacity building of civil society organizations (PAIC member organizations and grass root organizations) to participate in the environmental decision making dialogue, improving rights-based environmental mainstreaming, developing risk-management response plans and community resilience plans as well as ensuring financing for innovative green solutions to environmental development and climate justice.

The environment and climate change issues are often of a cross boundary nature, affecting Palestine and other countries in the region in a similar way. Many environmental violations by neighbouring countries (especially the Israeli occupation practices) are affecting the rights of the Palestinians to a clean and healthy environment, while the limited access to resources is another aspect. The geographic area of Palestine is considered a complex area thus the project will try to use smart means and tools to advocate the environmental rights of the Palestinian people.



Map 1: Vulnerability mapping for West banks and Gaza Strip

## **Vulnerability Mapping Objective:**

The program's ultimate purpose is to "assist in enhancing environmental and climate justice in Palestine." "By 2024, civil society organizations and right-holders will have the power to address and fight systemic hurdles to environmental and climatic justice in Palestine," according to the program's goal.

Under vulnerability mapping activity, the project aims at selecting the most vulnerable areas, sectors, social groups, local grass-root organizations, communities and targeted groups for the program by assessing the impact of climate change and environmental vulnerability on the communities at eco-systems, governorate and locality levels. Climatic data, such as climatic trends, drought, and climatic hazards, will be collected and analysed using GIS and remote sensing techniques, overlaid with non-climatic data, such as environmental, agricultural, socio-economic, political, and development data, to understand the scale of climate change's impact on the agricultural, social, and economic sectors, and to inform on community-based adaptation. The consortium (We Effect and PAIC) will focus on five Governorates as directly targeted geographic areas in order to reach out to Palestinian marginalized and vulnerable communities of Gaza Strip and West Bank (including Area C, Hebron District, East Jerusalem and Jordan Valley). The climate vulnerability mapping activity will examine these five geographic areas.

## **Scope of work:**

ARIJ was nominated as lead partner in conducting the vulnerability mapping activity. Therefore, a coordination meeting was conducted for the specialists in the PAIC six organizations as well as We Effect. Accordingly, the specialists in the Climate change Unit and GIS & remote sensing units at ARIJ presented to these experts the methodology and the components of the vulnerability mapping model. Accordingly, during the conducted joint consultation meetings among these experts resulted in approving the proposed methodology for developing the climate vulnerability mapping (CVM) model, including the most relevant and applicable GIS/RS software to run the Climate Vulnerability Mapping model to achieve the assignment's ultimate goal. Also, they agreed on the targeted parameters, mapping scale and resolution, and key performance indicators to be utilized for measuring climate vulnerability in both the West Bank and Gaza Strip. We Effect and PAIC specialised team held several brainstorm meetings through which they discussed the structure and components of the required statistical and spatial data sets that would be included to run the climate vulnerability mapping model effectively. The statistical and special model will end with the selection of most vulnerable and vulnerable communities in the West Bank and Gaza Strip to climate change and prevailing environmental conditions.

Based on the model outputs, the project team will work closely with different stakeholders and private sector to help the selected local marginalized communities and existing related bodies and grassroots in these communities towards improving their awareness and practices regarding climate change adaptation, mitigation, and environmental action, and will look into how to cooperate and support with micro, small, and medium-sized related businesses. The following matrix (Table (1)) presents the selected main components and their indicators to be used in the CVM. The selected 25 indicators are classified under the following main components, which are: climate, topographical, agricultural, socioeconomic, water, environmental, political, and other related components. These valuable indicators will be used in identifying the most and vulnerable communities in the West Bank and Gaza Strip.

#	Component	Indicator	years
1	Climate	Average annual rainfall (interpolation)	2000-2020
		Average annual temperature (interpolation)	2000-2020
		agro-ecological zone	2020
2	Topography	Iso Heights	
3	Agriculture	# of Agriculture Holders	2017
		LU LC	2010
4	Socioeconomic	food insecurity index	2017
		poverty Rate	2017
		unemployment Rate	2017
		population	2019
5	Based on WASH vulnerability index assessment	Main water access for Domestic & Drinking	2019
		# of unconnected households to the current water system	2019
		Monthly Water Supply Quantities (m3) (type: bulk,)	2019
		Average water Consumption (l/c/d)	2019
		Community connected to sewer network	2019
		Available public Solid Waste collection service	2019
		Solid waste management system	2019
		The main coping mechanism? Waste disposal	2019
		Availability of unofficial dumping site	2019
6	Political	Geo-political classification	2019
		Settlement	2019
		Area C - Vulnerability maps - LRC	2017
7	General	Education level per community	2017
		Health services (# and availability)	2017
		Community boundary	2017

**Table 1: CVM indicators**

These indicators have been used to map the climatic vulnerability of West Bank and Gaza Strip communities as part of the input data set and others are used as a shadow map after running the model in order to assure the type of interventions suitable with its characteristics based on gap analysis and the conduction of field assessment for the selected listed communities by the model. Table (2) contains the vulnerability identified criteria of climate Vulnerability Classes and their levels of sensitivity.

Criteria of climate vulnerability Levels	Level of Sensitivity			
	Most Vulnerable	Vulnerable	Less Vulnerable	Least Vulnerable
Average annual rainfall	<250 mm	250-350 mm	350-450 mm	>450 mm
Average annual temperature	18-24 C°	16-18 C°	15-16 C°	<15 C°
# of Agriculture Holders	<150	150-350	350-650	>650
LU LC (Land Use/Land Cover)	Permanent and arable lands	Inland water and forests	Mine, dumps, industrial area	Mine, dumps, industrial area
poverty Rate	>15%	10-15%	5-10%	<5%
unemployment Rate	>20%	10-20%	5-10%	<5%
population	<5000	5000-15000	15000-30000	>30000
# of unconnected households to the current water system	>200	50-200	0-50	0
Monthly Water Supply Quantities (m3) (type: bulk,)	<500 m <sup>3</sup>	500-1500 m <sup>3</sup>	1500-30000 m <sup>3</sup>	>30000 m <sup>3</sup>
Average water Consumption (l/c/d)	<30 l/c/d	30-50 l/c/d	50-75 l/c/d	>75 l/c/d
Community connected to sewer network	No	Yes	Yes	Yes
Available public Solid Waste collection service	No	Yes	Yes	Yes
Waste disposal	Burning	Thrown in the area	burying	Dumping
Availability of unofficial dumping site	Yes	No	No	No
Geo-political classification	Area C	A,B	A,B	A,B
Settlement	Surround -Adjust	Far	Far away	Far away
Education per community # of schools	0-1	2-5	3-8	>8
Health services (availability)	No	Yes	Yes	Yes

**Table 2: Definition and Criteria of Vulnerability Classes**

## Methodology and Assessment Process

### Introduction

This section outlines the approved methodology of the CVM by PAIC team of specialists for selecting the most vulnerable communities in the West Bank and Gaza Strip. It details the proposed data that have been collected, collated and analysed in the course of assessment (See map (1)).

The assessment was divided into two phases. ***The first phase*** is an extensive desk study of the West-Bank and Gaza Strip based on the Local Government Unit (LGU)<sup>1</sup> level, following fast-track ranking approach employed by a designated spatial GIS model. The first phase is a conceptual model designed to map the LGU's affected by climate change in the West-Bank and Gaza Strip under the GIS environment. ***The second phase*** is field work oriented. Where most vulnerable communities resulted from the CVM will be investigated through conducting a baseline assessment and interviews with municipalities, village councils, CBO's in these communities. The resulted LGU's will be interviewed by a detailed questionnaire to have better and in-depth understanding of the priority schemes at their communities. This approach will assist in ensuring that the selected communities by the analytical model are the most vulnerable communities to climate change and environmental challenges. Also, to ensure that the utilized information by the model was accurate and factual. Following the identification of most vulnerable communities (LGUs), the targeted areas of the West Bank and Gaza will be divided among the PAIC member organizations to conduct field assessment. Figure 1 presents the applied conceptual model for identifying the vulnerable communities to climate change and environment.

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<sup>1</sup> **LGU categorization** is important to set its vision because its serves as:

☐ The measure the level of community sensitivity to availability/ scarcity of valuable natural resources, and natural challenges and manmade limitations; ☐ An end toward which all future actions specified in the developmental plan are well directed; ☐ criteria for evaluating alternative strategies, approaches and policies; and ☐ Standard against which success/ challenge of each action is measured.

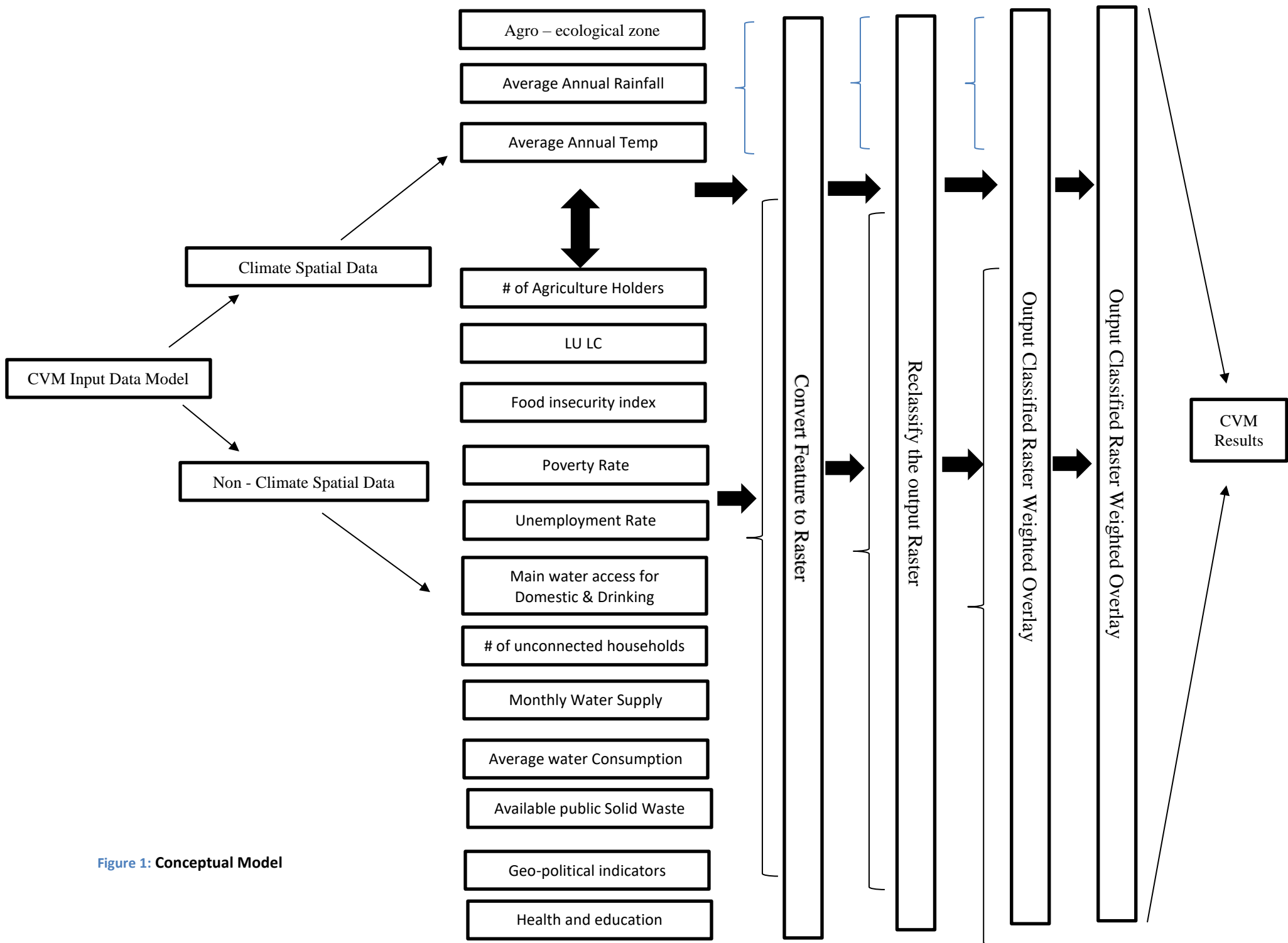


Figure 1: Conceptual Model



## **Assessment Steps**

ARIJ project team agreed with the (We EFFECT and PAIC) team to tackle the mission of mapping the vulnerability of Palestinian communities using a two-phased assessment procedure after reviewing the Terms of Reference (ToR) issued by PAIC. ARIJ was selected to lead this task in direct cooperation with the We Effect and PAIC nominated expert. (See annex 1: The developed ToR for performing the CVM task)

### **First Phase:**

The first phase of the assessment consists of a desk study, using secondary data. During the first phase of the study, the team identified the required main types and sets of data and worked intensively on uploading all collected required data elements and their indicators as outlined in Table 1, into a spatial GIS-based model, with weighing outlined below. The output of the first phase is considered as a fast-track ranking of the Palestinian communities according to their vulnerability as determined by climatic related information such as climatic trends, drought and climatic hazards, and future climatic scenarios, overlaid with non-climatic related information such as environmental, socio-economic, and political and development data.

The used analytical model and mapping study, which based on applying the GIS Model Scheme (Figure 2), has resulted in selecting the most vulnerable communities to climate change and environmental conditions. These communities are distributed between the West Bank and Gaza Strip, as follows: 115 communities are located in the West Bank, and 8 communities are located in Gaza Strip.

The collected data for the first phase was based on 7 general data elements, including around 25 sector-specific sub-elements (Table 1) falling under six main categories: general information (including population densities and administrative classification, etc.); climatic information, economy and food security; poverty and unemployment rate, water and wastewater; and other physical and geopolitical.

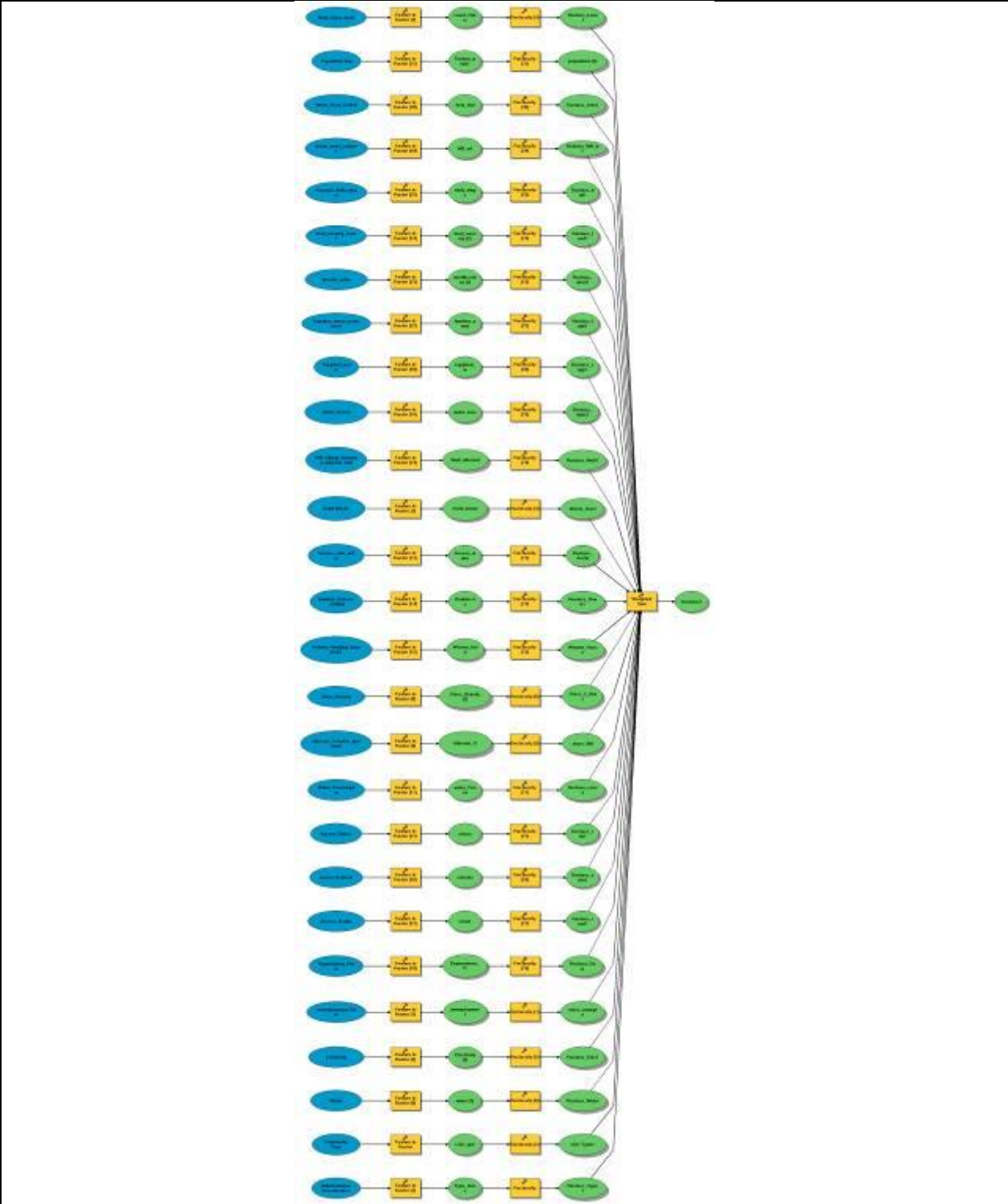


Figure 2:GIS Model Scheme

## **Second Phase:**

The second phase of the assessment process was based on fieldwork/survey orientation. The second phase has commenced after the completion of the first phase and subsequent initial ranking including the selection of the most vulnerable communities to climate change and environmental conditions.

During the second phase, ARIJ and PAIC field research team have conducted field visits to the 68 top ranked most vulnerable communities among the 115 MV ones in the WB and 8 in Gaza strip, to collect data regarding the climate impacts on agricultural, social, economic and other related information to verify the results obtained by the GIS model. Assessments have been conducted using the completion of detailed questionnaire (Annex 2) in close coordination with the targeted communities, through completing 68 questionnaires.

## **GIS as a Methodological Tool**

The Geographic Information System (GIS) was used as a methodological instrument to help fulfil the task's objectives through the above-mentioned research and assessment processes, primarily for the following reasons:

1. GIS was utilized as a dataset to keep all of the acquired and updated data, which would undoubtedly be used as a benchmark for selecting and determining the feasibility and suitability of the proposed initiatives (i.e. GIS mapping will allow the model to demonstrate change visually over time).
2. The outputs of the evaluation exercise were mapped and represented using GIS.
3. GIS was utilized to create a model that ranks community vulnerability in the West Bank and Gaza Strip to climate change and environmental conditions.

More specifically, the proposed model has been developed first by collecting, digitizing, and building a spatial dataset on the Arc/GIS 10.8 software that covers multi-variant data. From this spatial analysis exercise (or the multi-criteria analysis), the LGUs were placed into four categories, namely: Most Vulnerable, Vulnerable, Less Vulnerable, and Least Vulnerable. The four categories were assigned a value of 1-4. Category 4 is the Most Vulnerable, and category 1 is the Least Vulnerable.

## **Data Harmonization**

This part describes the detailed procedure of dealing with the different type of data sets in order to be suitable for the GIS model environment and extension. It should be highlighted that the designed model deal with local government unit (LGU's), since the expected output will explain the climatic vulnerability on this level. As mentioned previously in the conceptual model, all data sets were converted to Raster format<sup>2</sup> in order to easily categorize the communities based on the designed

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<sup>2</sup> The **ra**ster consists of a matrix of cells (or pixels) organized into rows and columns (or a grid) where each cell contains a value representing information, such as temperature.

layer values. Data sets which were used in this study passed through three steps in order to be ready for the model:

1. **Statistical data** (Excel Format): this type of data was prepared and harmonized based on the locality codes (PCBS codes) in order to ease our work in converting this data into GIS vector data (i.e. agricultural statistics, poverty rate, unemployment rate, water resources, PMD datasets, etc.)
2. **Vector data**: this type of data use X and Y coordinates to define the locations of points, lines, and areas (polygons) that correspond to map features, which means storing and analysing the data for any targeted locality inside the GIS system.
3. **Raster data**: this type of data use a matrix of square areas to define where features are located, and also called pixels, cells, and grids, typically are of uniform size, and their size determines the detail that can be maintained in the dataset.

The CVM model consisted of 7 different categories as mentioned in table 1. However, the main spatial data layers were created and used based on the consultation between PAIC and We Effect team are as follow:

- A. Agro-ecological zones (climatic zones),
- B. Climate aridity index for both West Bank and Gaza Strip,
- C. Trends of annual rainfall amount and annual average temperatures,
- D. Land physical features (e.g. Iso heights),
- E. Land Use: the localities boundaries, agro-land use and land cover (looking at agriculture sensitive lands,
- F. Education and health indicators;
- G. Water Resources (available springs, and wells),
- H. Political context: geopolitical Area A, B, C, WB barrier, settlements, military bases, bypass roads, etc.
- I. In addition to the mentioned spatial layers, relevant statistical data was correlated with areas identified as highly vulnerable to climate change such as:
  1. Livelihood types: cultivated area/production
  2. Food insecurity, poverty, economic factors (income, unemployment levels), population densities, rural population, etc.

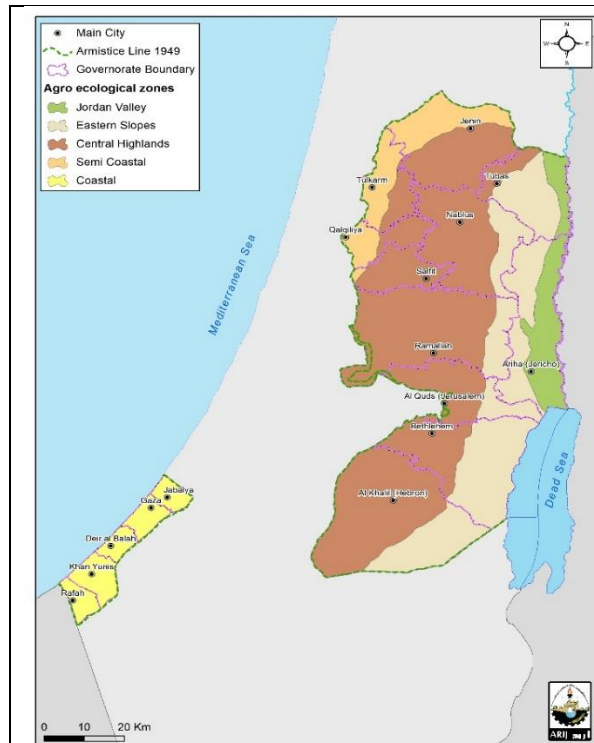


Figure 3: Agro Ecological Zones

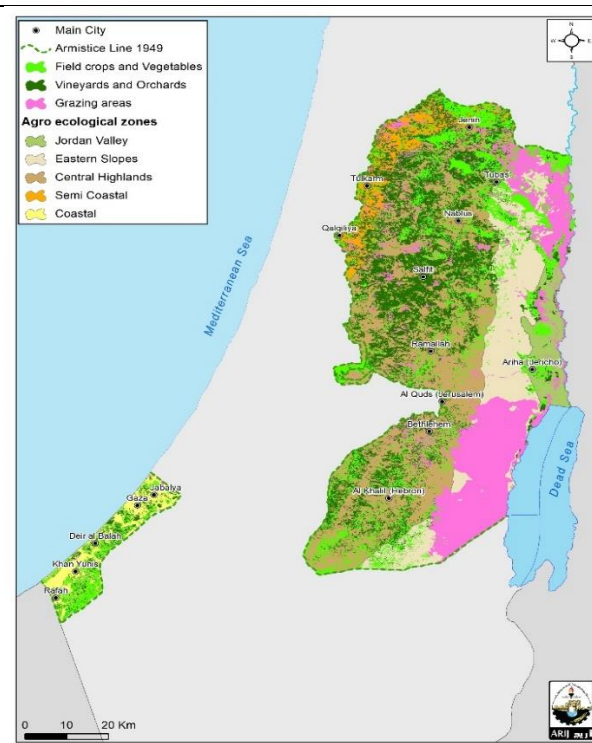


Figure 4: Agricultural areas under LULC

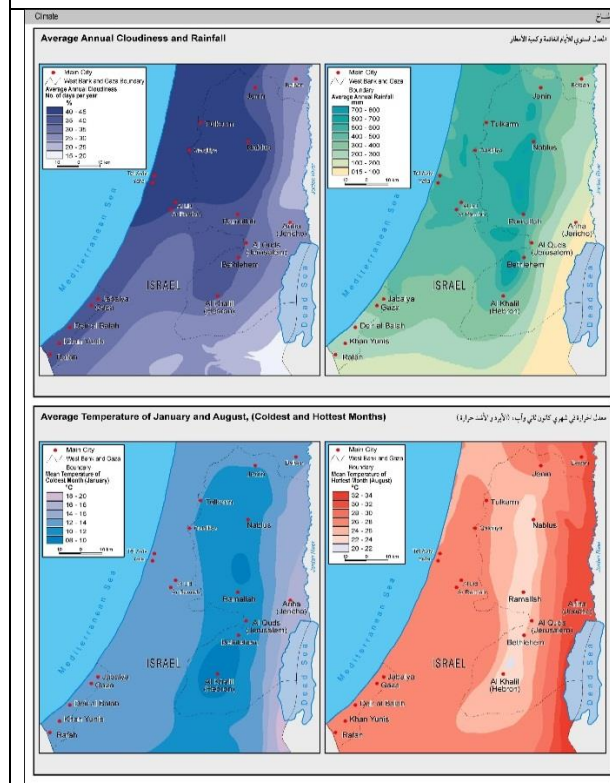


Figure 5: Average Annual Precipitation

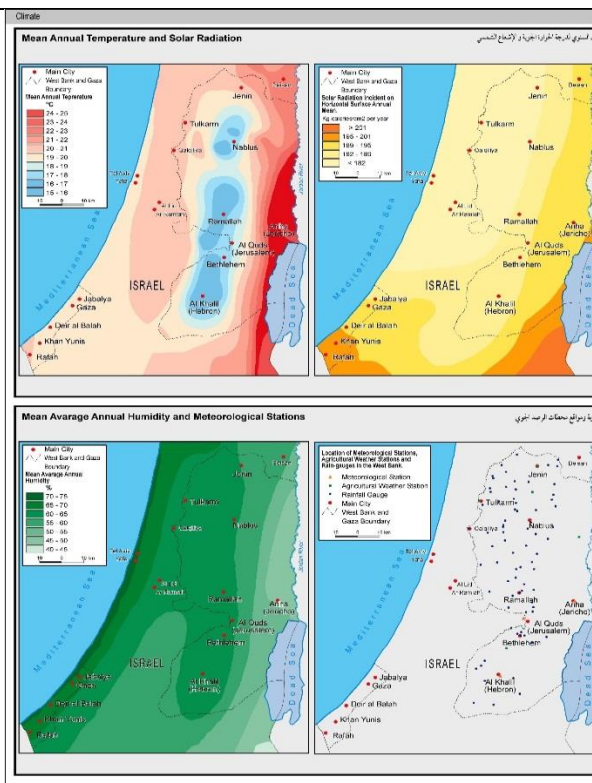


Figure 6: Average Annual Temperature



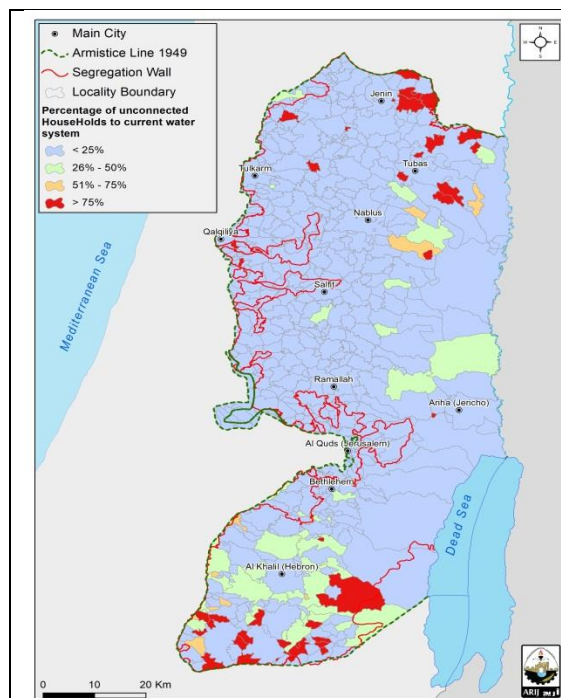


Figure 7: Unconnected HH to water system (%)

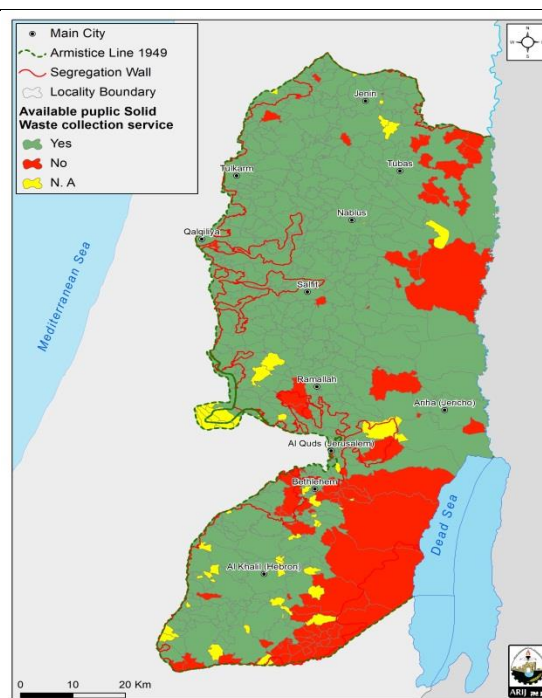


Figure 8: Available Public SW collection services

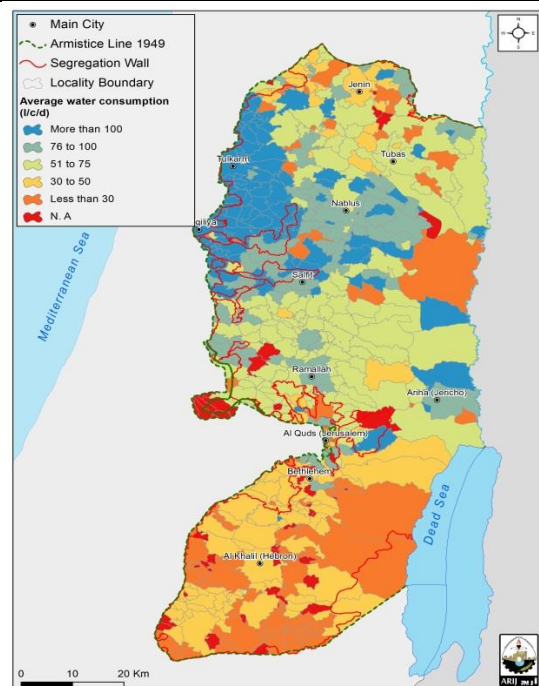


Figure 9: Average Water Consumption

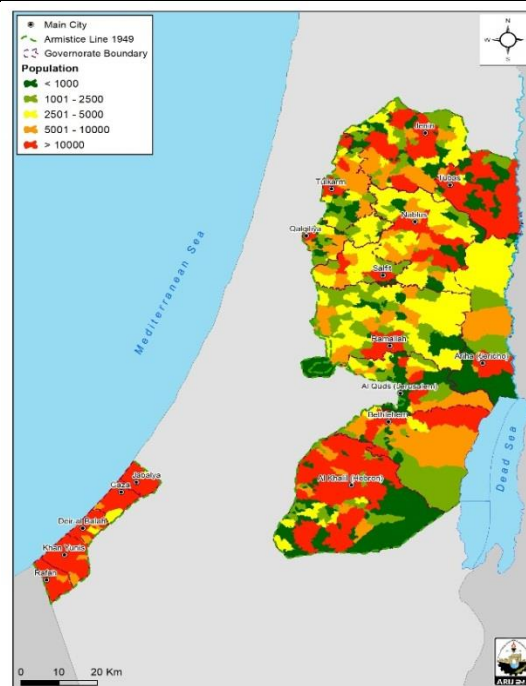


Figure 10: Population scheme

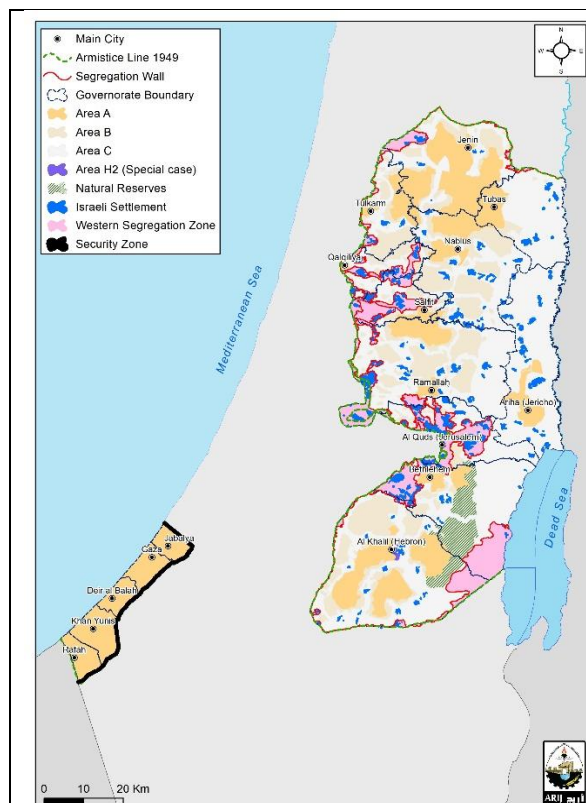


Figure 11: Geopolitical situation

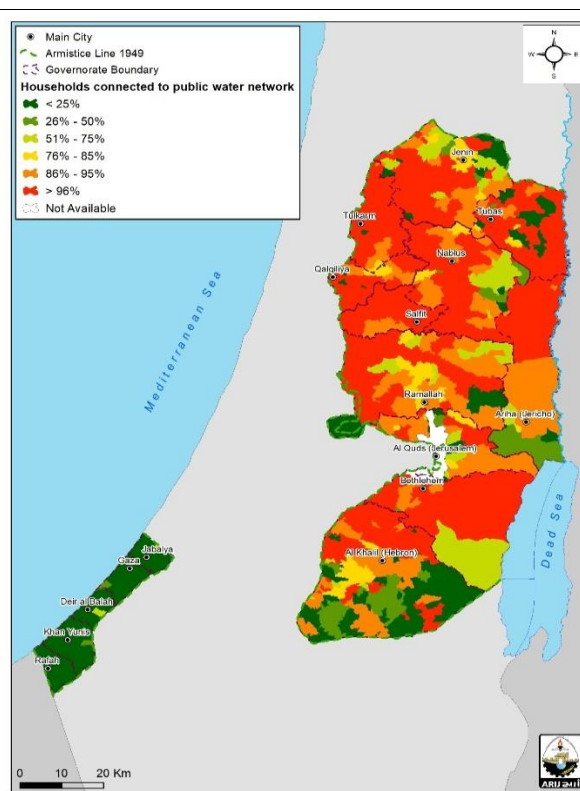


Figure 12: households connected to public water networks

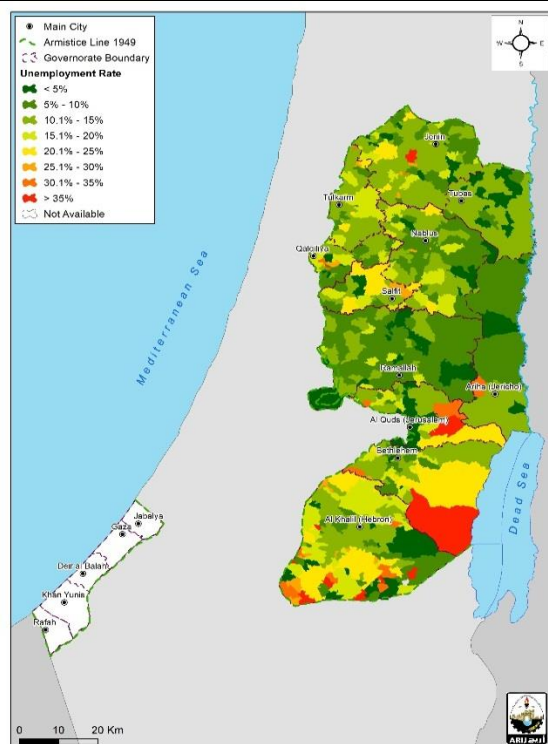


Figure 13: Unemployment Rate

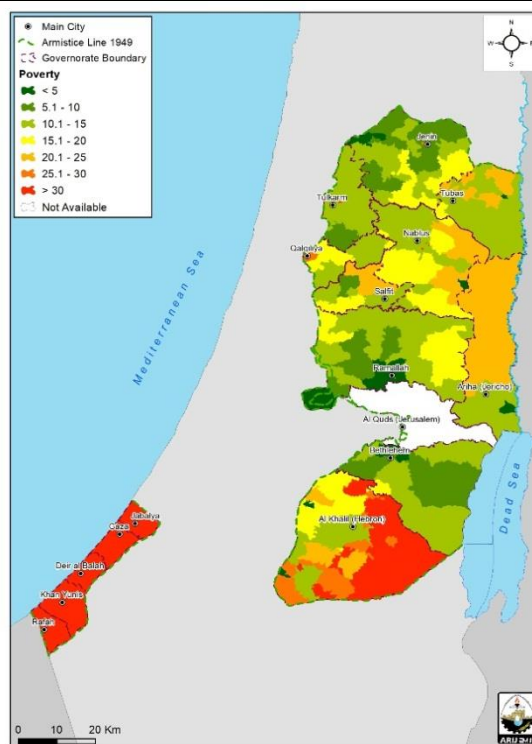


Figure 14: Poverty Rate

## **Result and discussion**

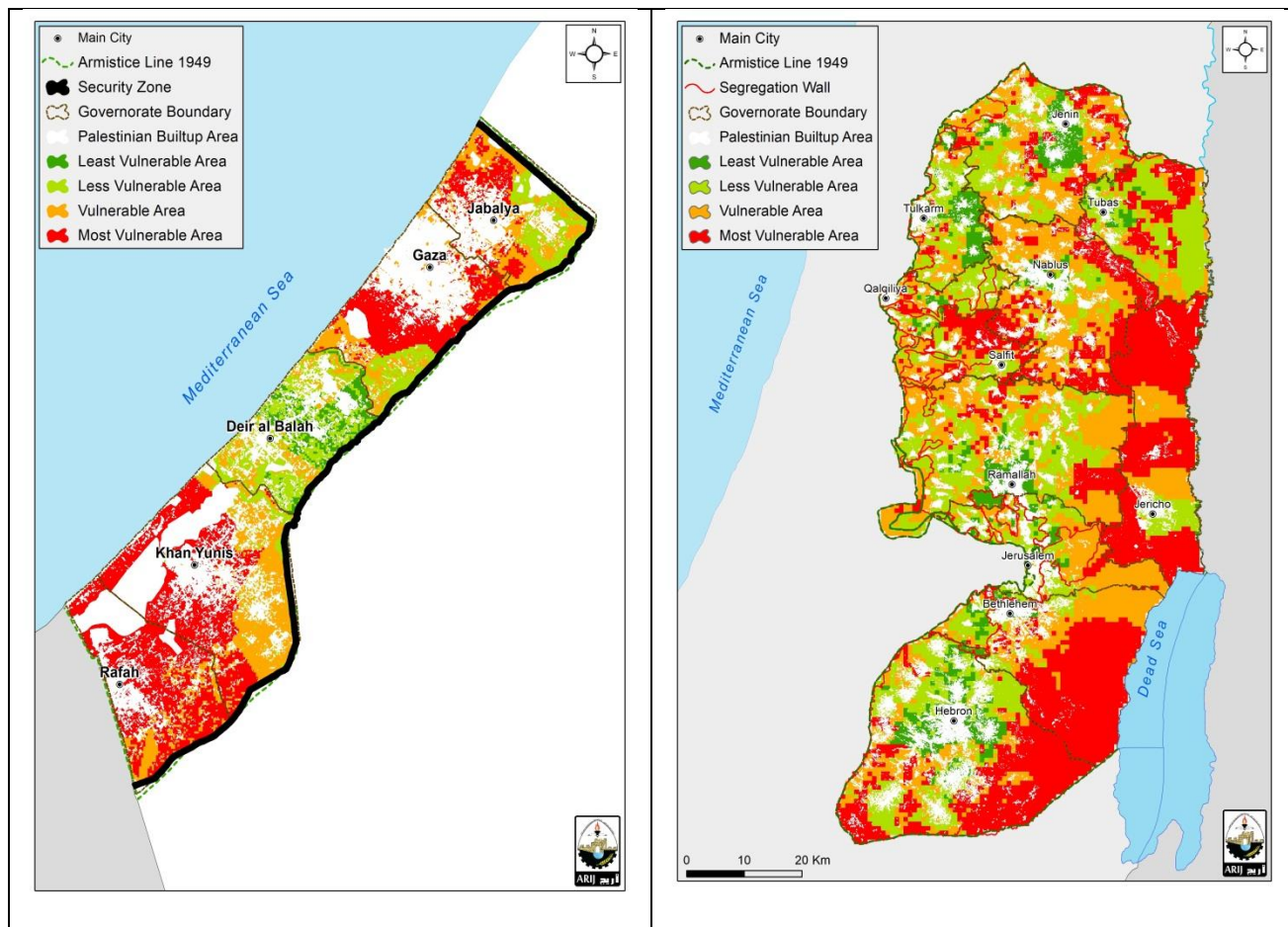
This section provides the results of the desk research on climate sensitivity of the Palestinian communities in the West Bank and Gaza Strip.

During the first phase of this study, communities were ranked and divided into four categories: most vulnerable, vulnerable, less vulnerable, and least vulnerable. This ranking was achieved using a geographical GIS-based methodology based on 25 sector-specific data set pieces that examined various dimensions of vulnerability, as previously stated.

The total identified communities was 556 in the West Bank and 31 communities in Gaza Strip based on the PCBS communities' database and identified community boundaries. Based on the CVM, it resulted with 115 as most vulnerable communities, 110 designated as Vulnerable, 281 as less Vulnerable, and 50 designated as least Vulnerable in the West Bank. And for Gaza strip it resulted with 8 most vulnerable communities, 5 designated as Vulnerable, 7 as less Vulnerable, and 11 designated as least Vulnerable, see Annex 3.

The identified most vulnerable communities were 115 in the West Bank and 8 in Gaza Strip are covering the Palestinian 5 agro-ecological zones. Of the total selected vulnerable communities 61 are located in the Central highlands and 33 in the Eastern slopes and 7 in the Jordan Valley and 14 in the Semi Coastal and 8 in the Coastal zone (See map 2). Based on the Geopolitical classification, all selected Most Vulnerable localities are located in area C, with average unemployment rate equals to 18% and average poverty equals to 22.6%.





Map 2: Vulnerability Scheme in WB and Gaza Strip