

CHAPTER FOUR:
CLIMATE CHANGE AND ENVIRONMENT

INTRODUCTION

Climate change and its consequences on environment could affect all three dimensions of food security: food availability, food accessibility, and food utilization. It could have an impact on human health, livelihood assets, food production and distribution channels, as well as changing purchasing power and market flows¹¹⁰. Its impact could be both short term, resulting from more frequent and more intense extreme weather events, and long term, caused by changing temperatures and precipitation patterns¹¹¹. Climate change is expected to make water resources scarcer. The oPt has already high degree of aridity and pronounced rainfall variability across its territories and is therefore highly vulnerable to drought. It could have an effect not only on the natural environment but on political and socio-economic environment in the oPt¹¹².

ENVIRONMENT AND CLIMATIC CHANGE IMPACTS

To evaluate the environment and the potential impacts of climate changes on food security in oPt, the following sections are highlighted.

Agriculture

The agricultural sector is essential and vital for reaching food security in two ways: it produces the food people eat and it provides the primary source of livelihood. For Palestinian people, agriculture is the traditional way of life, the main mean to food security and main resort to turn to in difficult times. Climate change in the form of drought and frost have reduced crop and pasture productivity over the recent years. This condition has been compounded by drastic food and livestock feed price increases over the last years mainly in the year 2008, and a subsequent decrease in livestock sale prices, as the population does not have sufficient disposable income to pay additional amounts for them (See chapter two). Accordingly, the water scarcity caused by climate change during the winter season 2007/2008 and winter season of 2009, affected 55,000 rain-fed farmers and herder families in the oPt. Farmers are therefore running at a financial loss, and there is little prospect of early relief. Their way of life and their livelihoods thereby imperiled. Climatic change impacts in the oPt come mainly in the form of drought¹¹³, and frost.

Drought

In the last few years, there has been a marked increase in the number of droughts in the oPt, particularly in the southern and eastern slopes of the West Bank. Eighty seven percent of the cultivated land is dedicated to rain fed agriculture and 33% of the entire landmass is used as pastureland for grazing. The total area of hyper arid, arid and climates comprises about 35% of the land area of the West Bank. Consequently, drought increases the vulnerability of rural people (rain-fed farmers and livestock herders) whose coping strategies are already exhausted due to the deterioration of economic situation, high food prices and the closure regime since the second Intifada. Drought is expected to become more frequent, more intense and less predictable as a consequence of climate change. In rural areas that depend on rain-fed agricultural for an important part of their local food supply, changes in the amount and timing of rainfall within the season and an increase in weather variability are likely to aggravate the precariousness of local food systems¹¹⁴.

The most significant environmental effects of climate change for the people of the oPt, over the course of this century, are projected to be a decrease in precipitation (with significant seasonal variation) and significant warming. Climate change forecasts for the eastern Mediterranean from high-resolution regional climate models give clear scientific backing to the Intergovernmental Panel on Climate Change (IPCC) projections for the region. In its Fourth Assessment Report, the IPCC predicts that, for the southern and eastern Mediterranean, warming over the 21st century will be larger than global annual mean warming – between 2.2-5.1°C according to a realistic emissions scenario. Annual precipitation rates are deemed likely to fall in the eastern Mediterranean – decreasing 10% by 2020 and 20% by 2050 – with an increased risk of summer drought.

A prolonged drought could seriously affects crops and livestock in the oPt as it did in a number of neighboring countries. The drought condition in the oPt occur as a result of the low amount and poor distribution of rainfall, which have drastically affected the growing season of crops and grazing plants during the last few years but mainly the last two years. The amounts of rainfall in the West Bank for the last two agricultural season (2007/2008 and 2008/2009) reach 354 mm and 428 mm compared to an average historical yearly rainfall of 537.5 mm. Drought has particularly affected South Hebron and East Bethlehem governorates where precipitation were less than 20% of normal precipitation. The impact of such climate change on

¹¹⁰ The Applied Research Institute – Jerusalem (ARIJ). *Status of Environment in the oPt. Chapter eleven: Climate change. West Bank Palestine. 2007*

¹¹¹ FAO. *Climate change and food security a framework document, Rome, Italy. 2008*

¹¹² *This week in Palestine. Jordan and Palestine threatened by global climate change, Ramallah, Palestine. 2008.*

¹¹³ Ministry of Agriculture. *Impact of drought condition and soaring prices on livelihood of vulnerable farmers, Ramallah, Palestine. 2008*

¹¹⁴ FAO. *Climate change and food security a framework document, Rome, Italy. 2008*

Palestinian Agriculture is especially high owing to already existing water scarcity in the region and dependency of Palestinian agricultural on rainfall. To be noted, the amount of rainfall in the West Bank in the last four seasons was less than the historical average rainfall amount (based on an average of 25 years)^{115,116}.

The same climatic conditions are affecting the Gaza Strip governorates, where the amount of rainfall in the last two seasons is less than the historical average rainfall; it reached 262 mm and 316 mm (2007/2008 and 2008/2009 agricultural season) compared to an average historical yearly rainfall of 358.5 mm.

Drought is equally affecting the farmers, who can not water their crops, and the herders who can not rely anymore on pastures (which are dry and with very limited grazing capacity as a result to drought) for grazing. Pastoralists are unable to pay for extra water (to compensate water deficit) for their animals to drink in the summer. The combined effect of rising fodder and water prices are leading to a situation wherein sheep are becoming a liability, rather than an asset, as herders are trapped in a cycle of debt with water truckers and fodder traders. There are in addition grave risks of overgrazing and degradation of the oPt ecosystem, as the number of livestock exceeds the land carrying capacity, as well as due to the restricted movement and access to grazing areas and pastures. The Jordan Valley and the Eastern slopes show the highest severity of land degradation. The main reason for the degradation is steep slopes, saline soils, overgrazing, over pumping, poor farming techniques.

Frost wave

The frost wave that took place in 2008, has affected over 12,000 farmers, many more laborers and consequently the consumer markets. In January 2008, the frost wave was the most destructive of the last ten years; it caused substantial losses to the already weak grazing period, and rain-fed crops. Such wave has had great impact on agricultural productivity, economy, market, labor and consequently food security.

Accordingly, the agriculture sector and particularly the rainfed sector is mainly affected, where the estimated losses¹¹⁷ of the main rain-fed crops owing to drought and frost in the oPt over the agricultural season 2007/2008 was estimated to reach more than 113.5 million USD \$. Grapes and olives have the highest percent of estimated loss (Table 4.1).

Table (4.1): Estimated losses of the main rainfed crops over the agricultural season 2007/2008 ¹¹⁸

Crop	Area (dunum)	Total Production (ton)	Yield Reduction %	Losses value M US\$
Wheat	207542	38395.27	40	6.9
Fodder crops	66686	22673	35	4.5
Fruits	90207	30743	35	10.7
Olives	866917	134372	40	60.7
Grape	67216	48395	35	14.1

HEALTH, DISEASES, AND PESTS

Climate change could cause new patterns of pests and diseases to emerge, affecting plant, animals and humans, and posing new risks for food security, food safety and human health. This could also affect the nutritional status of people and expose crops, livestock, fish and humans to new risks to which they have not yet adapted, and will challenge health care institutions to respond to new parameters. Many diseases may spread in the oPt, because of the change of the rainfall distribution and rainfall intensity in the oPt, ponds may form the available breeding habitat of mosquitoes and, hence, leads to the population's increase. The effects of this phenomenon are expected to be most severe in the Gaza Strip.

BIODIVERSITY

Palestine's biodiversity comprises about 3% of the global biodiversity. The ongoing crisis presents threats to preserving agro biodiversity. The oPt's biodiversity is considered as one of the 25 recently-defined as global biodiversity hot spots¹¹⁹. Plant species in the oPt are becoming increasingly rare and endangered, due both to the ongoing destruction of their natural habitat by agricultural practices, unregulated urbanization, settlement expansion, industrialization trends combined with high population growth in oPt, as well as over-harvesting of wild species, land degradation, and detrimental climatic and environmental changes.

¹¹⁵ FAO, 2008. *Climate change and food security a framework document*, Rome, Italy.

¹¹⁶ Ministry of Agriculture, 2009: *Rainfall seasonal report, general directorate of soil and irrigation*, Palestine.

¹¹⁷ Abdou Qasem, 2009: *land management in drought planning*. Director General of soil and irrigation. Ministry of agriculture, Palestine

¹¹⁸ Ministry of Agriculture, 2008: *Impact of drought condition and soaring prices on livelihood of vulnerable farmers*, Ramallah, Palestine.

¹¹⁹ Applied Research Institute Jerusalem (ARIJ), 2007. *Status of Environment in the oPt. Chapter Ten: Biodiversity*. West Bank Palestine

It is predicted that in the oPt, a number of species will disappear within the next 10 years. As a result 370 species are expected to become rare or very rare in the West Bank and the Gaza Strip. The central highlands ecosystem in the West Bank is affected by climatic change where it is characterized by high numbers of rocks and thus soil erosion (without terracing the soils can be easily eroded) and where land degradation is one of the main problems during severe climatic conditions. The inability of many farmers to reach their fields means that large areas are falling into disrepair through neglect, and crops are being lost. The Israeli practice of clearing agricultural fields for security purposes is in all probability having an impact on agro biodiversity. Secondly desertification is another challenge facing oPt mainly in Eastern Slopes region and the Gaza Strip, since it is exposed to over-grazing and over urbanization respectively, and where the temperatures are high and rainfall amounts are low making the area susceptible to climatic change. Accordingly, slight climatic change or continuous drought seasons can affect the plant species richness and growth in the region¹²⁰.

FORESTS

Forests cover approximately 3.94% of the total area of the West Bank and 0.55% of the Gaza Strip. The demand on forest in the oPt was mainly represented by fuel wood and grazing of sheep and goats. Since 1971, both types of natural and human-made forests were exposed to destruction perpetrated by both Israelis and Palestinians. Large areas of these forests have been confiscated by Israel and declared as closed military areas and military bases, and/or uprooted for the construction of settlements and the West Bank Barrier. The area of land confiscated was larger than 0.37 million hectares, including almost 93% of the total forest and rangelands of the oPt¹²¹. Palestinians also deplete forested areas through woodcutting used for fuel (either as biomass or for coal production). These activities, combined with natural destructive elements such as wind, snow, soil erosion, ageing, and accidental fires left dramatic scars on forests in the West Bank and the Gaza Strip. They resulted in a vast reduction of the natural and human-made forested areas¹²². The current rate of deforestation will have a destructive effect on the oPt's climate, by disrupting the natural carbon sequestration process, in which carbon dioxide (CO₂) from the atmosphere is absorbed by trees, plants and crops through photosynthesis, and is stored as carbon in biomass (tree trunks, branches, foliage and roots) and soils.

WATER RESOURCES

The presence of the Jordan River, and aquifer systems as physical water resources in the oPt, however, do not automatically translate into access to water for the Palestinians and provide an optimistic estimate of accessible water. The Palestinians have been denied their riparian rights to the Jordan River since the occupation of the West Bank in 1967. Also, a series of military orders issued immediately after the 1967 occupation, declared all water resources to be Israeli state property, granted full control over them, and prevented the Palestinian from developing their utilization of groundwater resources¹²³. Israel is currently exploiting more than 80% of the annual safe yield of the groundwater basins in the West Bank to meet 25% of its water needs. Water consumption by the West Bank Palestinians is almost 73 liters a day per person (L/c/d) compared to about 300 L/c/d for Israeli settlers¹²⁴. In other words, the per capita consumption in Israel is 4 to 5 times higher than the Palestinian per-capita consumption in the oPt. In addition, the Palestinian average consumption is under the World Health Organization (WHO) recommended standard of 150 L/c/d for optimal water supply¹²⁵.

Most of the West Bank governorates suffer from severe shortage in supplied water quantities. In the year 2008, a total of 88.6 MCM water was supplied to the Palestinian communities in the West Bank governorates. The total real deficit in domestic water supply for the same year reached 62.4¹²⁶ MCM for the whole of the West Bank. Thus, on average, domestic water supply covered only 73 % of the demand. Regarding the access to water supply, currently approximately 9% of the population of the West Bank, living in 134 communities, remains unconnected to any form of water networks. Connection to the networks alone, however does not automatically translate into regular and constant water supply. Valve closure, coupled with poor state of infrastructure, un-accounted for water and low pressure of water supplied to the Palestinian communities, causing many Palestinian communities not receiving more than 30 L/c/d.

¹²⁰ Applied Research Institute Jerusalem (ARIJ), 2007. Status of Environment in the oPt. Chapter Ten: Biodiversity. West Bank Palestine

¹²¹ Applied Research Institute-Jerusalem (ARIJ) - Urbanization Monitoring Department. Analysis of Satellite Images, "Monitoring Israeli activities in the oPt" project funded by EU. November 2009 and ARIJ - Geo-Informatics Department. Analysis of Satellite Images and database, 2009/.

¹²² Applied Research Institute Jerusalem (ARIJ), 2007. Status of the Environment in the oPt. Chapter ten: Biodiversity. West Bank Palestine

¹²³ Amnesty International, 2009. Troubled Waters-Palestinians Denied Fair Access to Water.

¹²⁴ The World Bank, 2009, Assessment of Restrictions on Palestinian Water Sector Development

¹²⁵ The World Bank, 2009, Assessment of Restrictions on Palestinian Water Sector Development

¹²⁶ Palestinian Water Authority (PWA), 2008.

Regarding agricultural water supply, the total amount of the water supplies for agricultural uses in the West Bank is estimated approximately at 89 MCM. It should be noted that the agricultural sector is one of the most important economic sectors in the oPt and the main water-using sector. The Palestinian agricultural sector is consuming approximately 75% of the total water consumption¹²⁷. This water comes for the limited available local wells and springs. It is worth mentioning that the availability and access to water remains the greatest obstacle to Palestinian agricultural sector.

In the Gaza Strip, while water supply is theoretically available, the majority of wells (80%) are only working partially and the rest are out of use. In 2006, almost half of Gazan households were buying their water. The per capita daily consumption is only 78 litres per capita per day. Moreover, water quality is poor (around 80% of the water does not meet WHO standards for safety), system losses are at a similarly high level as in the West Bank, and supplies are unreliable. Before the December 2008 Israeli offensive, over half of the population of Gaza city had access to water for a few hours once a week. The blockade has prevented entry of necessary spare parts, materials and equipment for the water and wastewater facilities and has resulted in the construction of new wells with poor water quality and quick aquifer deterioration from untreated sewage and intrusion of sea water¹²⁸.

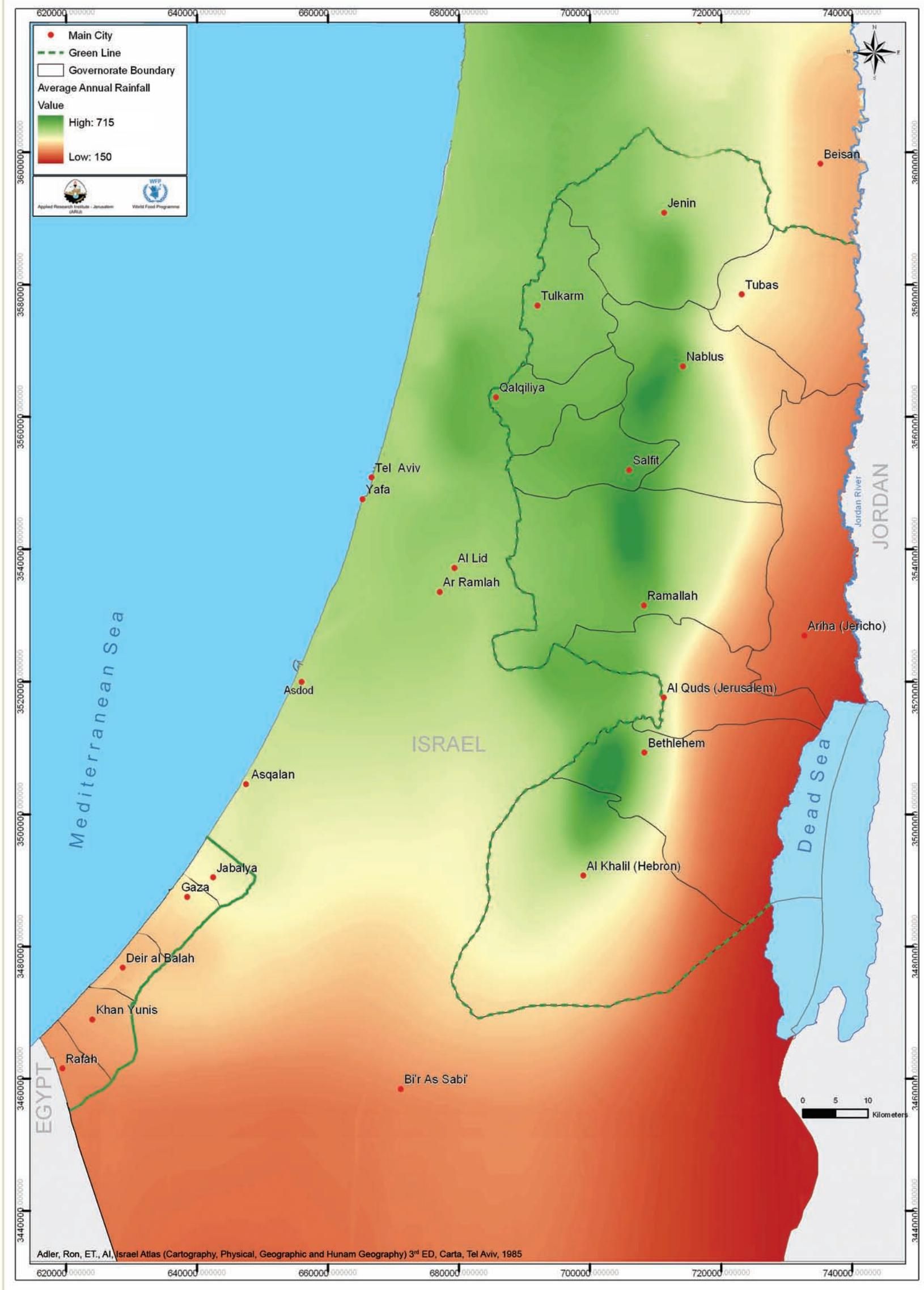
WASTE WATER MANAGEMENT AND SANITATION

In relation to sanitation, the wastewater network connection is much less developed than the water network. Connections are limited to the major urban areas, where indeed the higher concentration of population occurs. In the West Bank, only 56 communities are connected to sewage network, whereas 513 communities use cesspits to dispose their sewage. This revealed that only 32% of the total West Bank population (753,590 people) are served with sewage networks. The areas not served by the water network generally dispose their waste either through cesspits or directly dispose their waste water into open channels into the environment, however this phenomenon also occurs in the areas served by the water network, as in the whole of the West Bank there is only one functioning waste water treatment plant in Al Bireh at Ramallah governorate, which treats only 7% of Palestinian Wastewater generated in the West Bank. As for the Gaza Strip, the sewage network served approximately 61% of Gaza population prior to the Israeli Cast Lead Operation. Part of the wastewater collected by sewage networks is treated in three centralized wastewater treatment plants. However, the treatment plants are functioning at moderate efficiency rates and do not have the capacity to treat the volume of wastewater generated by the ever expanding population. Both the partially treated and untreated wastewater is discharged into open area such as Wadi Gaza or into the Sea and sand dunes.

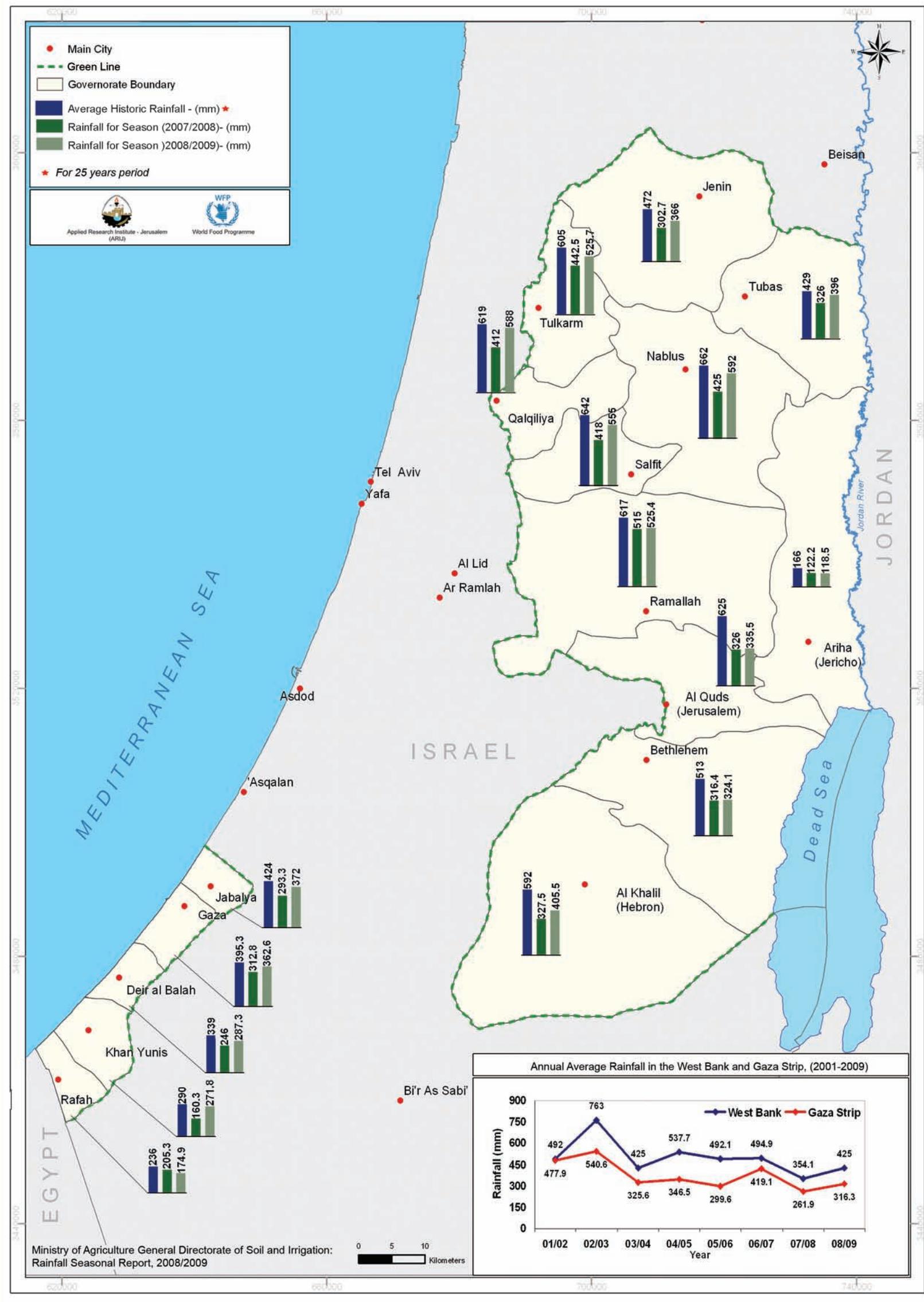
¹²⁷ Palestinian Water Authority (PWA), 2008

¹²⁸ WFP/FAO, Food Security and Vulnerability Analysis Report in the oPt, December 2009.

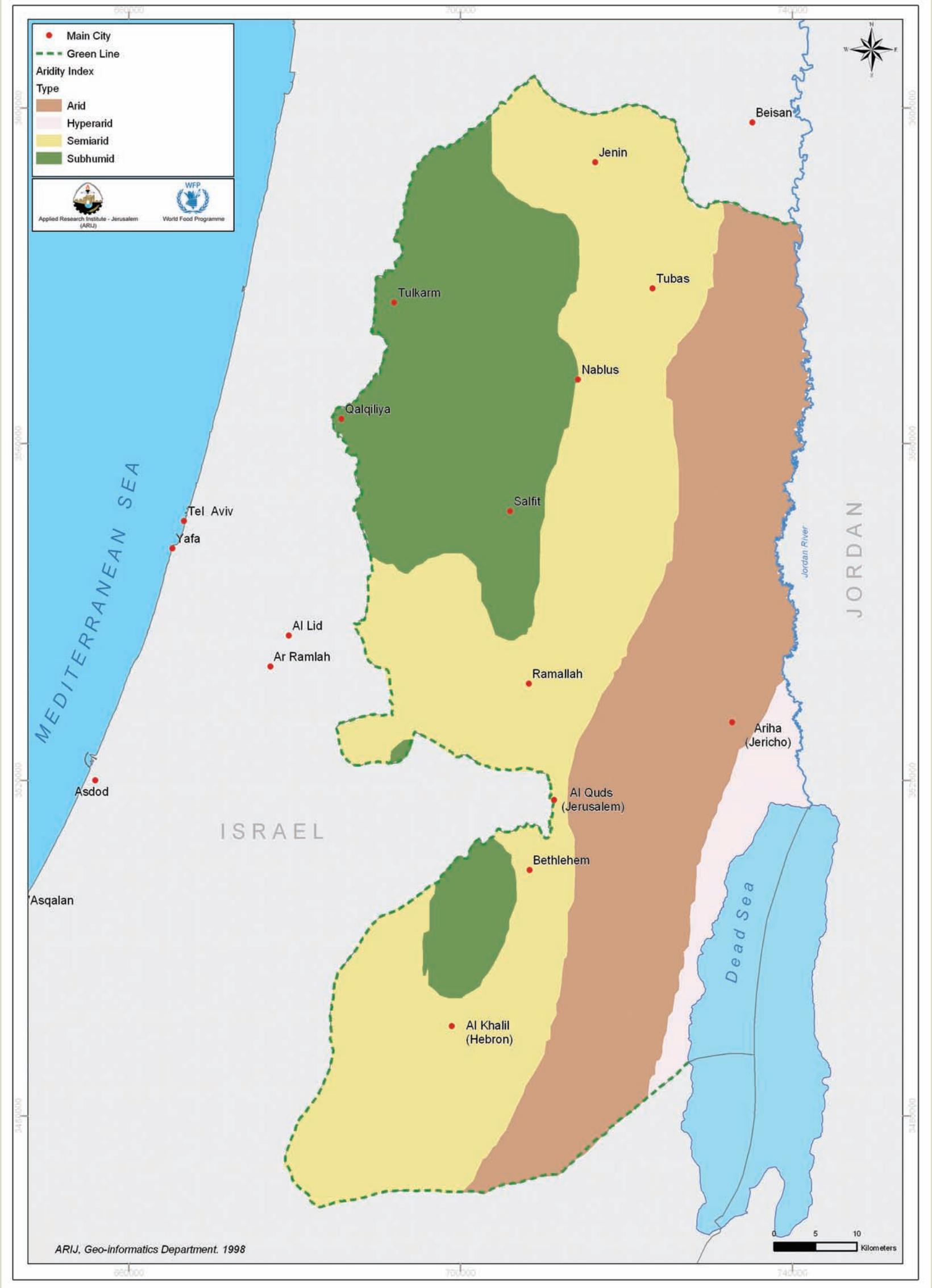
Average Annual Rainfall



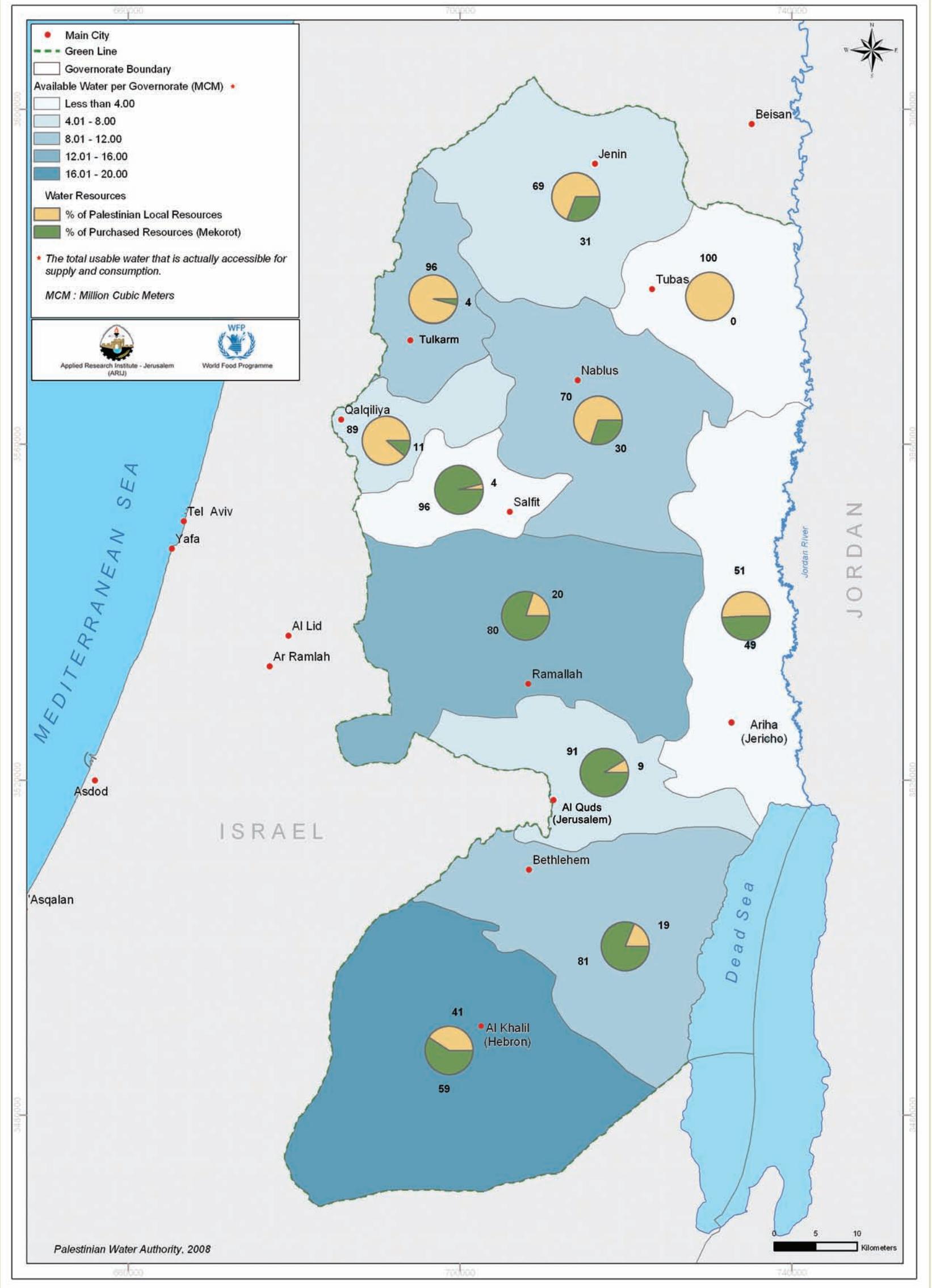
Average Annual Rainfall in the occupied Palestinian territory, 2001 - 2009

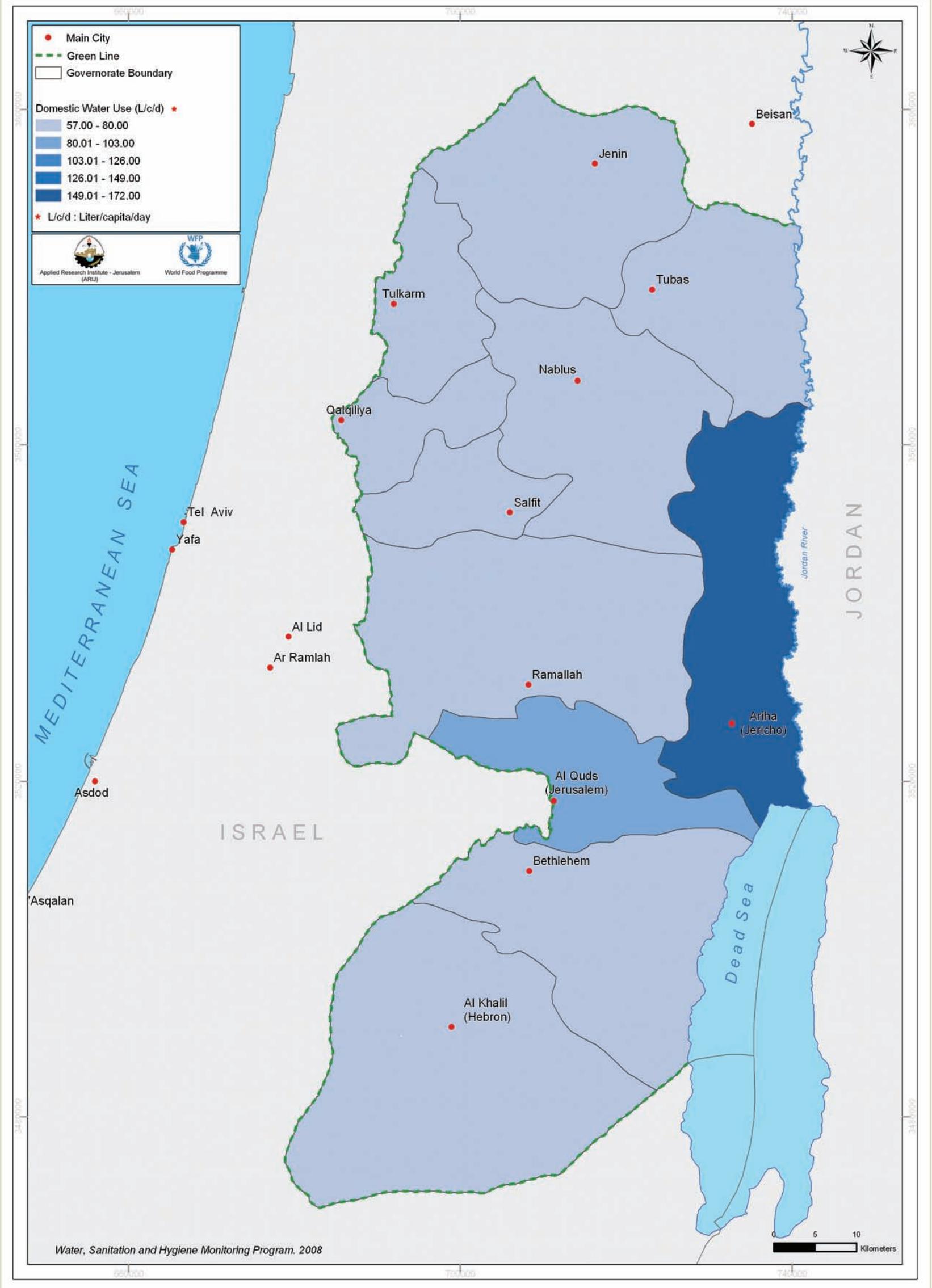


Aridity Index of the West Bank, 1998

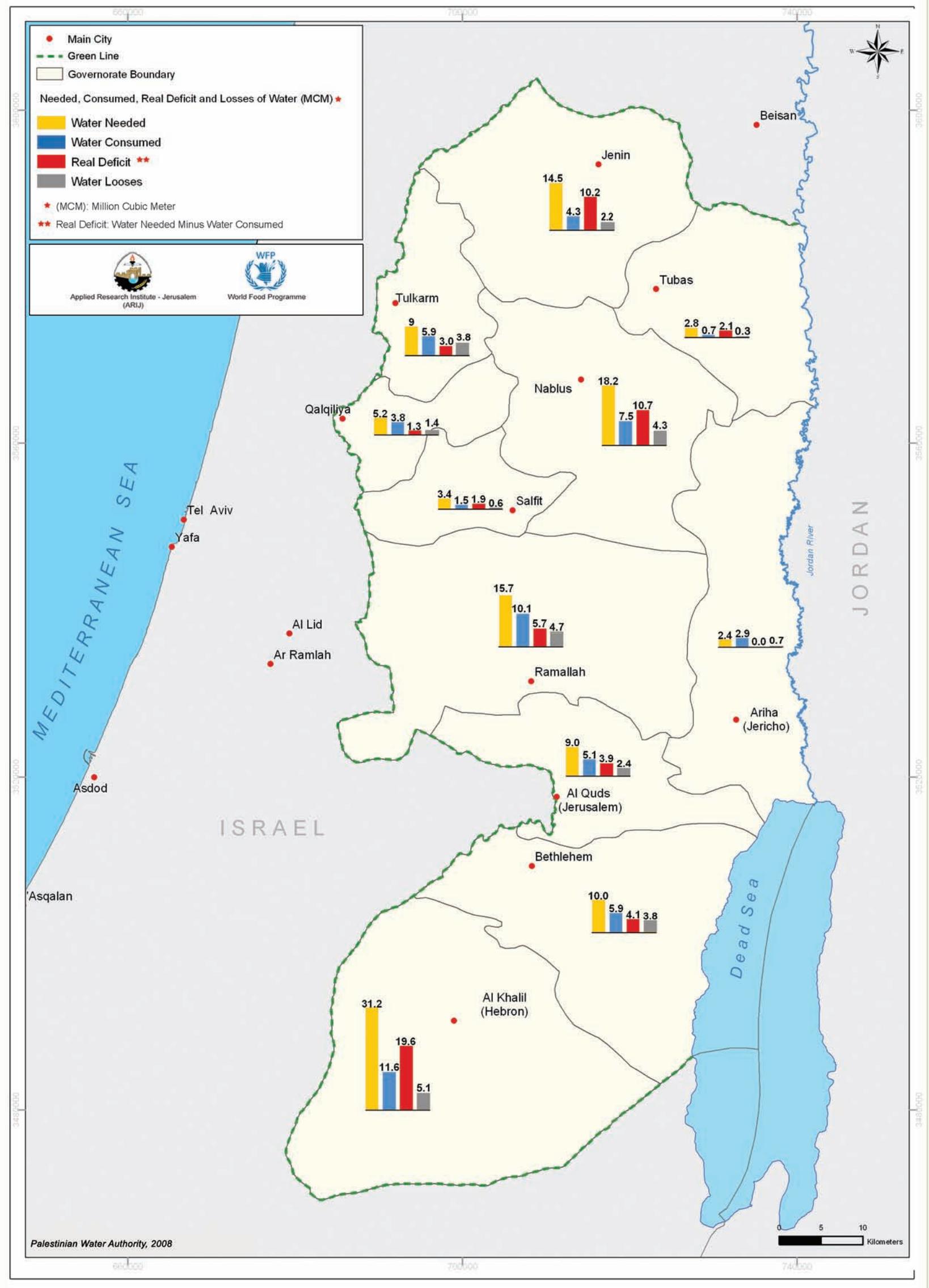


Available Water by Governorate in the West Bank, 2008

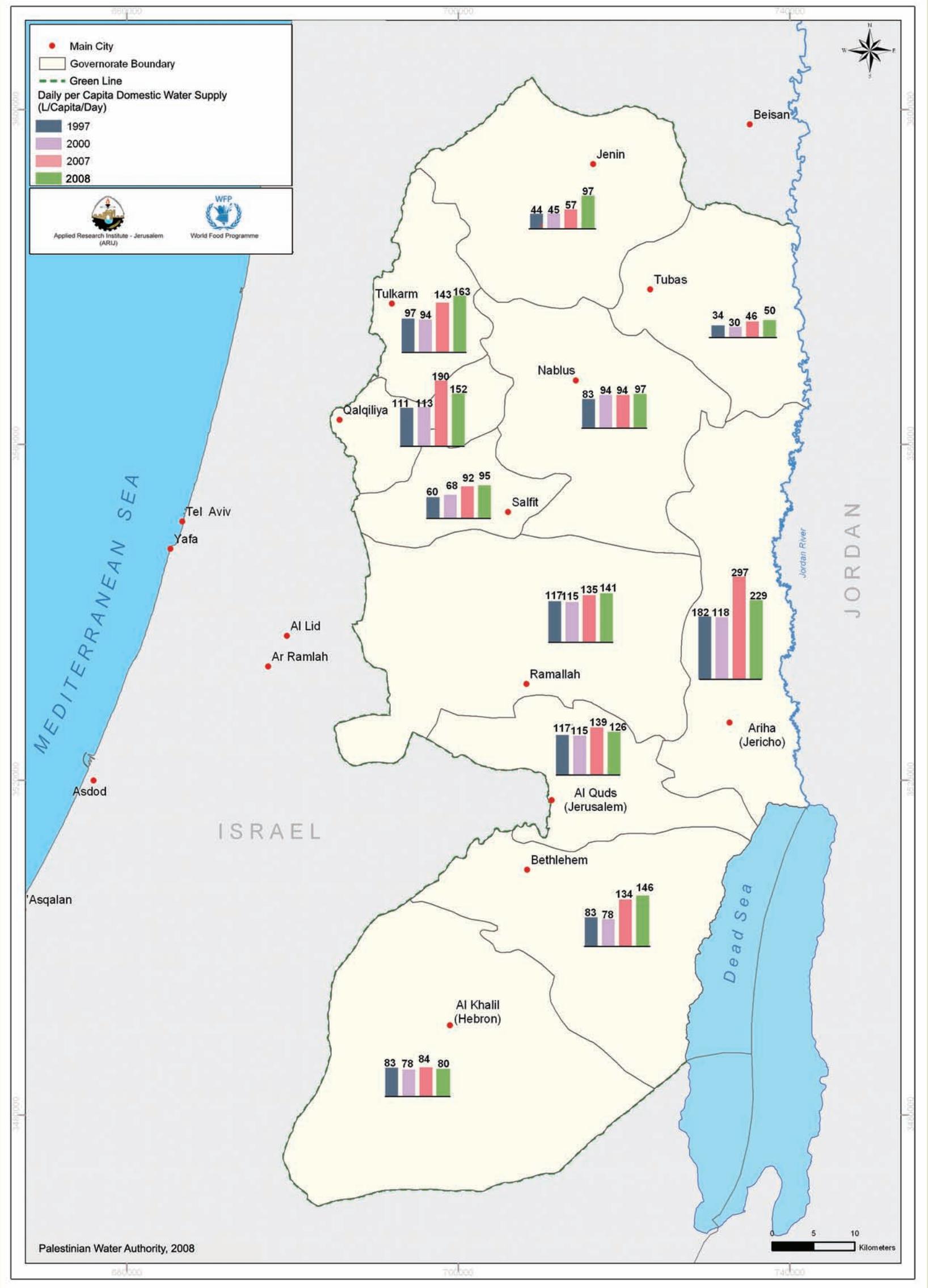


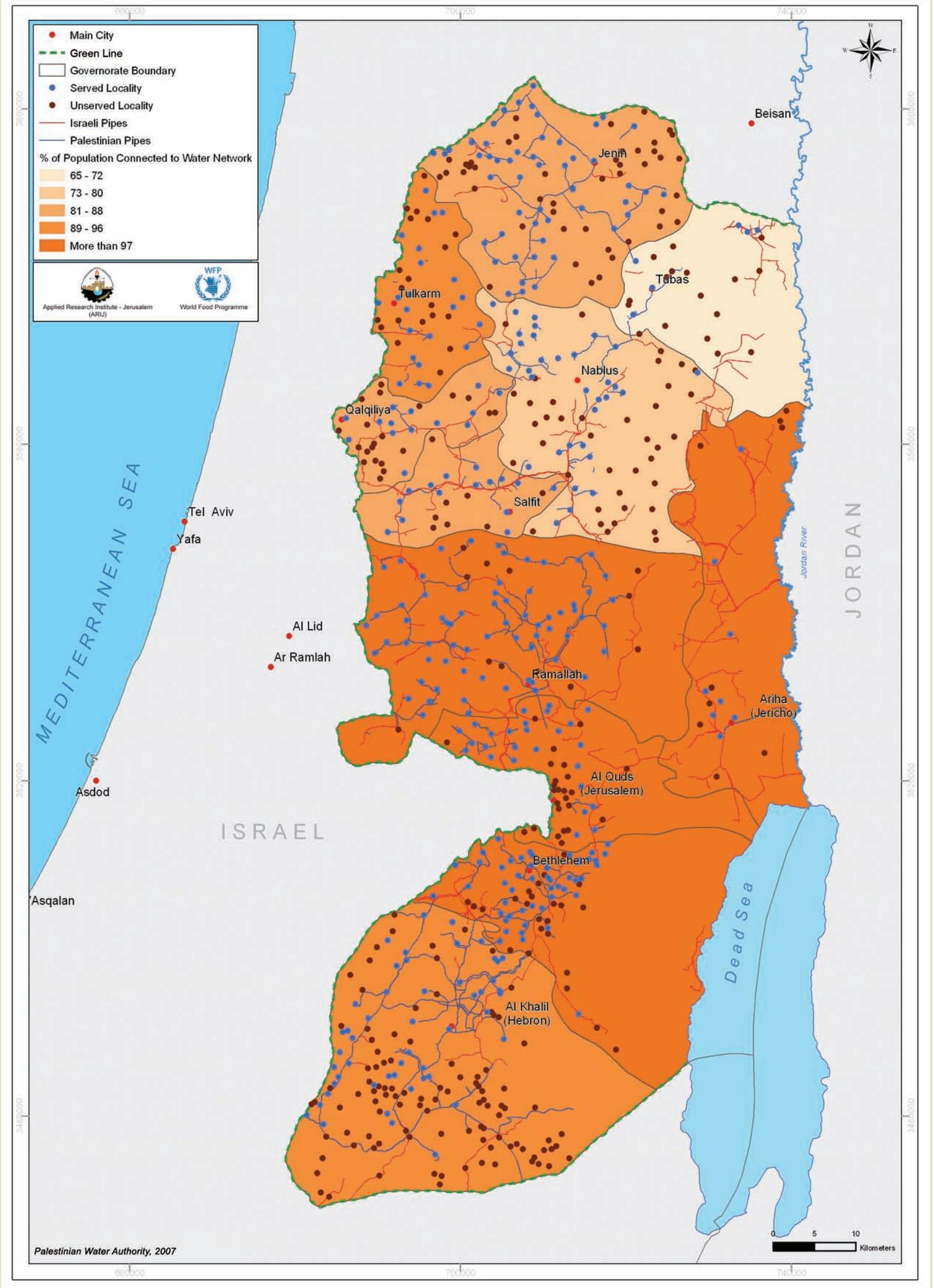


Water Needed, Consumed, Real Deficit and Losses by Governorate in the West Bank, 2008



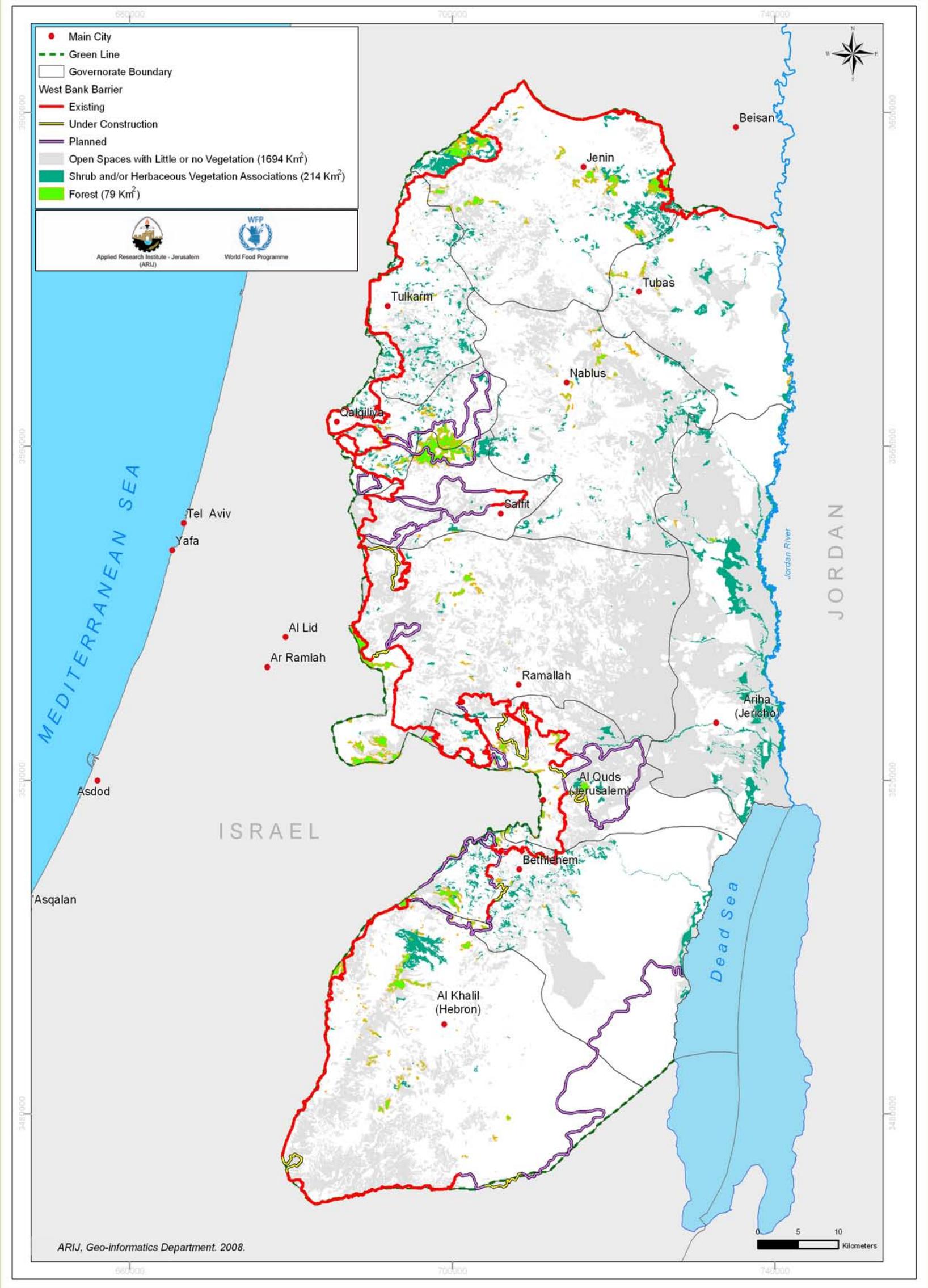
Daily Per Capita Domestic Water Supply by Governorate in the West Bank, 2008





Domestic Water Vulnerability by Governorate, 2007





Forests and Nature Reserves in the West Bank

