

Palestine

Policy fiche: Managing the impact of climate change on agriculture

1. Context of the impact of climate change

Since the Rio Conference in 1992, Palestine has been a dedicated partner in the international negotiations on CC, in the form of “Observer State”. Indeed, as many other countries in the Mediterranean and elsewhere, Palestine also faces rising temperatures, water scarcity, drought and rising sea levels. Committed to joining the international fight against CC, Palestine undertook CC work prior to becoming a Party to the Convention: in 2010, the Palestinian Authority developed a Climate Change Adaptation Strategy aimed to set out a national action plan to address several of the biggest threats posed by CC; it also developed the “Palestinian Climate Change Adaptation Strategy” (2010), and the “National Strategy, Action Programme and Integrated Financing Strategy to Combat Desertification” (2012).

Over the last years, the Palestine has been endeavouring to strengthen institutions and boost its national economy and social welfare from a holistic perspective. To that purpose, a National Development Plan (2014-2016) was issued, along with corresponding policies and strategies. In this sense, a variety of sectoral strategies have been developed for 21 sectors, including water, agriculture, energy and waste, as well as three cross-sectoral strategies targeting environment, gender and youth. Indeed, the country has deployed efforts to reinforce environment-related policies, issuing the “Environment Sector Strategy (2014-2016)” (led by the Palestinian Environmental Quality Authority (EQA) or the “National Strategy for Environmental Awareness and Education”, among others.

After the UN recognition of the Palestinian statehood in 2012, followed by the UNFCCC invitation to join the Convention in July 2014, Palestine submitted in December 2015 the instrument of accession at COP 21 in Paris. Subsequently, On the 17th of March 2016, the State of Palestinein became a Party to the UNFCCC. One month later, the country signed and ratified the Paris Agreement

Figure 1. Main milestones and dates of climate change in Palestine



The country submitted its Initial National Communication Report (INCR) in 2016. The report highlighted the outcomes of the national work on GHG inventories, provided the first analysis of mitigation and adaptation potentials and announced the program of measures aimed to tackle CC. The INCR also reflected the technical and institutional national challenges faced. Having established *adaptation* as the main priority in the national fight efforts to combat climate change, the Palestine also published in 2016 its National Adaptation Plan (NAP), which, such as the INCR, had been reviewed and approved by stakeholders involved in the developing process. Following UNFCCC requests, and in consistence with its INCR and NAP, the country recently submitted its first NDC (2017). The actions highlighted in the NDC have been discussed with stakeholders and agreed at the ministerial and sectorial level.

As seen, Palestine has conducted extensive work and achieved notable progress in contributing to international efforts in the global fight against CC. However, Israeli occupation substantially reduces the State of Palestine’s adaptive capacities in relation to many issues thereby compounding climate vulnerabilities. These limitations on the State of Palestine’s adaptive capacities are most prevalent in Area C, which covers 61% of the West Bank, and in the Gaza Strip but Israeli occupation also increases

vulnerabilities everywhere else. Under such difficult circumstances, the Palestinian Government needs to strengthen its expertise, systems and capacity at the institutional level in order to address all of the issues that are linked to climate change adaptation and mitigation. It currently suffers from limited capacity, expertise, and a general limited ability to respond to these challenges (strategies, plans, actions, etc.) throughout its all territory (WestBank and Gaza Strip). In this respect, while the country endeavours to catch up with the rest of states committed to combat CC risks and damages, technical and financial support is essential. In the national works carried out in responding to the UNFCCC requests, Palestine has been supported by international technical and/or funding organisations, either within bilateral cooperation agreements between states, or within multilateral frameworks (e.g. UN, and in particular the UNDP Programme of Assistance to the Palestinian People (UNDP/PAPP) and the Environment and others).

Table 1. "Evaluation board" of the impact of climate change

High impact (high impact, requiring major action and immediate action)			Negligible impact (the impact is limited but requires follow-up)		
Medium impact (increasing impact, requiring minor action, monitoring and medium-term action)			Uncertain impact (not enough evidence and need for further monitoring and analysis)		
Areas of impact	Currently (2017)		Near future (2020-2030)		Longer term (2030-2050-2100)
Direct effects on costs			Extreme weather events		
Risks and insurance					
Climate variability	<p>Climate change will lead to an intensification of the global hydrological cycle and is likely to have major impacts on regional water resources, affecting both ground and surface water supply for domestic and industrial uses, irrigation, in-stream ecosystems and water-based recreation. Changes in the total amount of precipitation and in its frequency and intensity directly affect the magnitude and timing of runoff and the intensity of floods and droughts. The eastern wind has start to affect both the irrigated and rainfed crops. For the irrigated more irrigation water in needed due to the increase in ET, while for the rainfed it lead to shorten the growth cycle causing to gap in the agricultural production.</p> <p>Temperature changes affect agricultural production through impacts on:</p> <ul style="list-style-type: none"> - Timing and/or duration of physiological processes in plants, which may result in reduced yields; - Nutritional quality of fruit and vegetable crops; - Soil carbon level and salinity; - Negative effects on livestock physiological processes, leading to e.g., reduced milk yields; - Geographical ranges and intensity of pests and diseases <p>Changes in precipitation and reduced water availability lead to:</p> <ul style="list-style-type: none"> - Water stress in plants, affecting plant growth, photosynthesis and respiration; - Land degradation; - Water stress in livestock. 		<ul style="list-style-type: none"> - Reduced rainfall and increased evapotranspiration reducing yields from rain-fed agriculture and pastoralism - Reduced soil fertility and increased land degradation from increased temperatures, evaporation, and drought - Temperature increases from 1.5 - 2.5°C by 2055 - Reduced cold periods and warmer periods - Reduction in rainfall: natural water supplies oscillating between no change up to 15% -20% decrease - Increased possibilities of flooding risks and droughts -increase of rainfall intensity and decrease in rainy days number -Shift in rain season causing a shift in agricultural agenda 		<p>The most optimistic scenario, most likely should emissions be controlled according to the IPCC target of a global average temperature increase not exceeding 2°C.</p> <p>Temperature: Increases by ~1°C by 2025, by ~1.5°C by 2055, by ~2°C by 2090.</p> <p>Temperature related: Reduced cold periods and warmer periods, both becoming more prominent in time.</p> <p>Rainfall: Does not change, or perhaps increases slightly in the period to about 2035.</p> <p>Rainfall-related: A slight possibility of more flooding. A small possibility of increased periods of drought but, in general, limited change overall to rainfall characteristics.</p> <p>Sea levels are forecast, by 2100, to rise at least 18 to 38cm (emissions scenario B1) and as much as 26 to 59cm (emissions scenario A1F1).</p>
Water resources	<p>Palestine's water resources are already under significant pressure from rapid demographic growth, economic development and expected to become scarcer as climate change causes decreases in annual precipitation. Impacts on water resources will have knock-on implications on a range of other sectors, including agriculture, household consumption,</p>		<ul style="list-style-type: none"> - Increase of droughts, due to rainfall decreases and reduced infiltration and recharges rates - Duration of droughts in the 		<p>Lowering per capita internal water resources in Palestine to 67 m³ by 2050 compared to 190 m³ in 2010</p> <ul style="list-style-type: none"> -Increased water shortages from lower rainfall and higher evaporation - Increased to run water flooding

<p>industry, and health.</p> <p>Groundwater represents the main source of water for Palestinians and about half of the water extracted from groundwater wells is used for agriculture. Climate change affects water resources through changes in precipitation and temperature levels, and interactions between the two factors.</p> <p>Drivers, such as rapid population growth, industrial development, urbanisation, and increasing demand for irrigation exert additional pressures on water resources.</p> <p>Palestine's water resources are already under significant pressure from rapid demographic growth, economic development and expected to become scarcer as climate change causes decreases in annual precipitation. Impacts on water resources will have knock-on implications on a range of other sectors, including agriculture, household consumption, industry, and health.</p> <p>Groundwater represents the main source of water for Palestinians and about half of the water extracted from groundwater wells is used for agriculture. Climate change affects water resources through changes in precipitation and temperature levels, and interactions between the two factors.</p> <p>Drivers, such as rapid population growth, industrial development, urbanisation, and increasing demand for irrigation exert additional pressures on water resources.</p> <p>Water resources in Palestine are limited. The groundwater aquifer is the major source of freshwater supply and is shared between Palestine and Israel .Israel has controlled all shared water resources, including surface and groundwater , and has utilized more than 85% of these resources, leaving only 15% for the State of Palestine's use the Israeli occupation strongly influences the State of Palestine's water situation, both in terms of access to available water resources, and by limiting the Palestinian Government's capacities to actively improve the situation (e.g. to construct large scale dams and develop water storage reservoirs For harvesting rainfall).</p> <p>Reduced rainfall results in lower groundwater recharge. The Gaza Strip and the West Bank rely on groundwater for more than 90-95% of their water needs, as the State of Palestine is denied access to the only permanent river, the Jordan River. In the Gaza Strip, scarcity and overuse result in the intrusion of seawater into the Coastal Aquifer and a consequent deterioration in water quality, rainfall due to increased run-off. High temperatures increase demand for water and increase the amount of water discharged from aquifers. Drought conditions lead to ever-decreasing amounts of available groundwater.</p> <p>- The water situation in the Gaza Strip is much worse than in the West Bank. The Coastal Aquifer in the Gaza Strip receives an annual average recharge of 50-60MCM per year, mainly from rainfall, while the annual extraction rate of this aquifer complex is estimated at about</p>	<p>northern (subhumid) and middle (semi-arid) zones is expected to slightly increase. Increase is expected to be higher in the southern (arid) precipitation area</p> <ul style="list-style-type: none"> - The frequency of moderate droughts is expected to decrease vs number of extreme droughts will increase - Increased salinity and pumping costs leading to water deficit. 	<p>from greater rainfall variability</p> <ul style="list-style-type: none"> - Insufficient rain to recharge aquifers. - Reduced surface and groundwater quality. - Increase of droughts, due to rainfall decreases and reduced infiltration and recharges rates - Duration of droughts in the northern (subhumid) and middle (semi-arid) zones is expected to slightly increase. Increase is expected to be higher in the southern (arid) precipitation area - The frequency of moderate droughts is expected to decrease vs number of extreme droughts will increase. - Increased salinity and pumping costs leading to water deficit
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	<p>178.8MCM</p> <ul style="list-style-type: none"> - The gradual intrusion of seawater and upwelling of saline groundwater. Tests have indicated high salinity levels of more than 1,500milligrams per liter (mg/l) of chloride, making significant parts of the aquifer unsuitable for drinking water, domestic applications and for many irrigated crops - The shallow aquifer complex is also very vulnerable to ongoing and serious pollution from agriculture, solid waste and wastewater. - the Coastal Aquifer is projected to be depleted by next year and nitrates and other pollutants have made 95% of the Gaza Strip's water unpotable 				
<p>Agriculture Production</p>	<p>The Palestinian agriculture sector is characterized by its diversity in terms of agricultural production. It benefits from the climatic variations in Palestine, and opportunities for expanding irrigated and export cash crops, as well as its ability to keep abreast of agricultural technological development as a result of favourable agricultural patterns on the one hand, and the presence of many entrepreneurs on the other hand. These characteristics reflect the agricultural sector's ability to rapidly develop and effectively contribute in employment, as well as economic growth and development. This is of particular significant opportunity, especially in the case of declining occupation policies that impede the sector's sustainable development, and include the confiscation and access prevention to land, water resources and irrigation development, as well as hinder import and export of agricultural products and inputs.</p> <p>Palestine has approximately 31% agricultural land cover; of which 91% is in the West Bank and 9% is in the Gaza Strip. The rain-fed area constitutes 86% of cultivated land; 88% in the West Bank and 23% in Gaza. The irrigated area comprises 14% of the total arable land. Between 2004 and 2008, the area of cultivated fruit trees, vegetables and field crops rose by 1.6%, 3.9% and 0.8% respectively. However, while production of vegetables and field crops increased by 18% and 11% respectively, fruit production dropped by 21%.</p> <p>Agriculture is not only of great economic importance, contributing significantly to Palestine's income, exports, food security and job creation, but also of symbolic importance to the Palestinian people and their identity. It is also a sector where climate change is likely to have substantial negative impacts through the effects of rising temperatures, reduced precipitation and extreme events on both the quantity and quality of agricultural output, which may then affect Palestinians' livelihoods and food security.</p> <p>Agriculture's climate sensitivity in the Gaza Strip is often the same or similar to the West Bank, as is the adaptive capacity of systems, institutions, people, and ecosystems to respond. Hence, the two geographic areas share a number of 'highly vulnerable' issues in common for which details above are relevant: livestock production; production of olives and vegetables; irrigation water.</p> <p>As regards the agricultural sector,</p>		<p>The effects of climate change on agricultural production are expected to translate into negative impacts on agricultural incomes and prices, with repercussions on food security. Past periods of rapid food and cereal price increases following climate extremes such as heat waves, drought and intense rainfall indicate a sensitivity of markets to such events</p> <p>Increased trade is expected to play a role in adjusting to the shifts in agricultural and food production patterns resulting from climate change, as long as this potential is not curtailed by trade restrictive measures. At the same time, climate change will compound the effects of other drivers of food insecurity and vulnerability in the Middle East, such as rapid population growth, urbanisation, conflicts and instability.</p>	<ul style="list-style-type: none"> -More frequent droughts and increased desertification. - Changes in economic viability of crops (e.g. shorter growing seasons) -Increased crop water requirements - Decline in grazing ranges and stocks. - Higher food prices. 	

	<p>changes in temperature, precipitation, water availability, atmospheric composition, and extreme climate events are generally expected to negatively affect agricultural production, which may then translate into impacts on agricultural prices, incomes, and food security.</p> <p>Food insecurity is already a cause of concern in Palestine, with 28.6% of Palestinian households (46.7% in Gaza and 16.3% in the West Bank) being considered either severely or marginally food.</p> <p>-insecure in 2014, according to the latest Socio</p> <p>-economic and Food Security Survey in Palestine. In the absence of adaptation, climate change may exacerbate these trends. Quantitative estimates of the effects of climate change on the Palestinian agricultural sector are, however, scarce and generally limited to particular localities.</p> <p>In 2011, the estimated total water used for agriculture does not exceed 150 million cubic meters annually in the West Bank (60 million cubic meters) and 90 million cubic meters in the Gaza Strip) were available for agriculture. Irrigation infrastructure is old and inefficient, under-developed or undeveloped. Irrigation practices are outdated and there is a need to introduce precision agriculture and drip irrigation.</p> <p>Livestock production plays a major role in improving the lives of families in terms of providing a source of income and food (protein) to a large number of households in the Palestinian territories. The number of households depending primarily or secondarily on livestock is 32,200 households. According to the results of the livestock survey conducted in 2013 and that falls within agricultural holdings, livestock population was estimated as follows: 33,980 cows, 730894 sheep, 215335 goats, 2058 camels, 32.5 million broilers (of which 994.6 thousand mothers), 1.8 million laying hens, 546.4 thousand turkeys, 19690 rabbits and 46,226 beehives. There is also a large number of domestic poultry, including 258.9 thousand domestic poultry, 285.6 thousand pigeons, and 5,000 turkeys, 29.1 thousand rabbits, 20 thousand quail birds, and 29.7 thousand of other types.</p> <p>Livestock production's sensitivity to climate is the same as in the West Bank (see above). In May 2015, 15% of chickens in the Gaza Strip died as a result of a heat wave (12°C above the annual average).</p>		
<p>Sea level rise and Coastal erosion</p>	<ul style="list-style-type: none"> - Recorded trend of rising seawater levels totalling >10 cm in the Med Sea over the past 2 decades - Wave storms with wave heights exceeding 3.5 m have increased along with exceptional storms with a wave height above 6 m. - The retreat rate of the top of the cliff eastward, as measured by comparing aerial photographs from 1945 and 2004, is approx. 20 to 30 cm/year). - Increasing levels of carbon dioxide in the atmosphere will also lead to acidification of seawater, which will dissolve the shells of some animals, and reduce the rate of survival and affect the behaviour of fish, with consequences for the fish catch - The water situation in the Gaza Strip is much worse than in the West Bank. The Coastal Aquifer in the Gaza Strip receives 	<ul style="list-style-type: none"> - Rising seawater levels ranging 1-10 cm per decade according to scenarios. - Increased wave storms pose major risks and collapse coastal cliff (retreat and damage) - Sand removal 	<ul style="list-style-type: none"> - Migration of the water line by some 10-30 meters eastward, expected by the year 2100 - Loss of coastal areas due to sea flooding

	<p>an annual average recharge of 50-60MCM per year, mainly from rainfall, while the annual extraction rate of this aquifer complex is estimated at about 178.8MCM</p> <p>The gradual intrusion of seawater and upwelling of saline groundwater. Tests have indicated high salinity levels of more than 1,500milligrams per liter (mg\l) of chloride, making significant parts of the aquifer unsuitable for drinking water, domestic applications and for many irrigated crops</p> <p>The shallow aquifer complex is also very vulnerable to ongoing and serious pollution from agriculture, solid waste and wastewater.</p>			
Vector borne-diseases	<ul style="list-style-type: none"> - Thermal stress: heat stress already harms the elderly, the ill and workers exposed to heat. - Major diseases related to water, sanitation, and food - Changes in temperature, humidity and rainfall directly influence the likelihood of water-borne, foodborne, and vector-borne disease transmission as well as disease. However, the impact of climate on water and food supplies also indirectly affects the occurrence of such diseases - The risk of Waterborne diseases like typhoid, dysentery, cholera, diarrhoea, giardiasis will increase as a result of inadequate water supply either in quantity or quality, and the risk of communicable diseases will increase such as hepatitis. 		<ul style="list-style-type: none"> - Increased incidence of parasitic/ infectious diseases (Malaria, West Nile Fever): rise in extreme weather events + higher temperatures increasing mosquito populations and altering their distribution. - <u>However</u>: low probability risk of renewed outbreak of malaria. 	Same if trends persist
Energy	<p>In 2010, the energy supply in Palestine was based on a single power plant (diesel) in the Gaza Strip, generating 7% of the country's electricity. The rest of the electricity required is currently imported from Israel (89%) and Jordan/Egypt (4%). The price for electricity is high and the country strongly dependant on external supplies. The Energy Sector Strategy for 2011-2013 launched by the Palestinian Energy and Natural Resources Authority, promotes the implementation of the Electricity Law providing support tariffs and promoting the use of renewable sources of energy. The Palestinian Government also continues the implementation of an Energy Efficiency Programme and remains committed to developing the use of renewable energy.</p> <p>A Low Carbon Development Programme concept note was prepared jointly by the Environment Quality Authority and UNDP which needs an estimated budget of 50 Million USD to be implemented.</p> <p>The MOA estimates that the people of the Gaza Strip require around 10,000 metric tonnes of fish annually. However, the annual fish catch from all types of vessel is less than 2,000 metric tonnes.</p> <p>Approximately two-thirds of fish are landed in Gaza Governorate. There are no fish-processing plants, so if the amount of fish caught exceeds demand then fish prices are usually reduced. Fishing and fisheries also suffer from a lack of government subsidies and insurance.</p>		<p>Changes to climate may increase energy demands for heating and/or cooling (e.g. as result of frosts or heatwaves). In order to fulfil domestic demand, 93% of electricity is imported currently; 89% from Israel and 4% from Jordan and Egypt. All required petroleum products are imported through Israel.</p> <p>- Increased energy demands to cope with more temperature extremes</p>	<ul style="list-style-type: none"> -Increased energy demands to cope with more temperature extremes -Rising fuel demands to cope with water shortages. -Domestic/local energy production: Enhancing the equipment and efficiency of the Gaza Power Plant (GPP) -Generation of solar electricity for medium large Scale commercial and Industrial application -Implement energy efficiency measures to reduce consumption, mainly for commercial and industrial application
Biodiversity loss	<ul style="list-style-type: none"> - Spatial movement northward in the distribution of Med species; replacement by desert ecosystems/sp. - Moderate-low vulnerability of some species of plants and butterflies to the 		<ul style="list-style-type: none"> • Changes in the geographical distribution of species and in the ecological services 	No scenario assessed, but under BAU risks will tend to worsen and economic costs will increase

	<p>forecasted reduced precipitation.</p> <ul style="list-style-type: none"> - Prolonged intra-seasonal periods of dryness adversely impacting plants/animals. - Increased risks of forest fires. 		<p>provided by natural ecosystems.</p> <ul style="list-style-type: none"> • Increased water temperature in the Medit. leading to increased penetration and establishment of alien species originating in the Red Sea/Indian Ocean 	
Infrastructural issues	<ul style="list-style-type: none"> • Extreme events (episodic flooding and frost) causing damage to structures 		<ul style="list-style-type: none"> • Frost and increased floods, particularly in the downstream area of the watershed, causing damage to infrastructures 	Frost and increased floods, particularly in the downstream area of the watershed, causing damage to infrastructures
emissions greenhouse gas (GHG) emissions			<ul style="list-style-type: none"> • Rising fuel demands to cope with water shortages 	
Fisheries	<ul style="list-style-type: none"> • However, fishing and fisheries is an additional 'highly vulnerable' issue in the Gaza Strip and there is greater concern than in the West Bank that the cost of agricultural production is highly vulnerable 			
Broader indirect effects	<p>Key pressures affecting natural habitats in the State of Palestine include: unplanned urban expansion, overgrazing, over-exploitation, deforestation and unplanned forestry activities, desertification and drought, soil erosion, hunting, invasive alien species, and pollution.</p> <p>Israel's occupation makes a substantial negative contribution directly to these pressures, including from: the Israeli Illegal Settlement Regime, the Annexation and Expansion Wall, bypass roads and military outposts; the destruction of infrastructure; seizure of agricultural land; and deforestation.</p>		<ul style="list-style-type: none"> • Damage to coastal species and ecosystems • Damage to fishery (in the Gaza Strip), as most of the alien species are of lower nutritional value than the local species. 	
Ecosystems				
Public Health	<ul style="list-style-type: none"> • Increased risk of damages from extreme weather events 		<ul style="list-style-type: none"> • Increased thermal stress: increased heat stress harming the elderly, the ill and workers exposed to heat. 	
Coastal Zone	<ul style="list-style-type: none"> • the Coastal Aquifer is projected to be depleted by next year and nitrates and other pollutants have made 95% of the Gaza Strip's water unpotable 		<ul style="list-style-type: none"> • Seawater intrusion in coastal aquifers • Economic losses and costs of coastal protection 	
Livestock			<p>Food insecurity is already a cause of concern in Palestine, with 28.6% of Palestinian households (46.7% in Gaza and 16.3% in the West Bank) being considered either severely or marginally food.</p>	

2. Policy options to address such impacts

How do the measures identified intend to address each specific impact?

What outputs (documents) and outcomes (actions) are foreseen and by when?

Table 2. "Policy options " of the impact of climate change

Strategic Documents	Year & Agency	Objectives and consistency	How the approved measures will treat the different impacts
National Climate Change Adaptation Strategy	2010 / Environment Quality Authority and UNDP	<ul style="list-style-type: none"> • Summarise the findings of the Vulnerability Assessment and Future Climate Risks Assessment in the UNDP/PAPP Climate Change Adaptation Strategy for the occupied Palestinian territory • Set out the consultation process by which the Palestinian adaptation strategy and programme of action were developed • Identify key adaptation needs • Identify priority adaptation measures • Provide recommendations for the mainstreaming of climate change adaptation in Palestine • The identification of key climate change information and modeling needs for national development planning and environmental policy-making • The identification of priority climate change adaptation policy options and measures • Improvement in the capacity of PA decision-makers effectively to take account of climate change impacts • Improvement in the capacity of PA staff to monitor and evaluate policies with regard to climate change 	<ul style="list-style-type: none"> • Environment Quality Authority (EQA) • Stakeholder engagement approach • Questionnaire survey on climate adaptation needs • Scoping meetings • Regional climate vulnerabilities • Sector vulnerabilities
The National Strategy, Action Programme and Integrated Financing Strategy to Combat Desertification	2011 / Environment Quality Authority	<ul style="list-style-type: none"> • To prevent, halt and where possible reverse the effects and impacts of desertification, land degradation and drought, in order to contribute to poverty alleviation, improve livelihoods of people and achieve sustainable development. 	<p>The following assumptions and enabling environment are required to either be assumed by, or materialize to, ensuring success and sustainability of the measures and results of NAP/IFS:</p> <ul style="list-style-type: none"> • PNA commitment and support to combating desertification • Major improvements in the political situation • Peoples participation and ownership all through the process • Commitment to good governance • Clear definition of tasks, responsibilities and division of labor of different institutions and actors involved • PNA and international community will allocate proper resources to finance and promote the activities and objective of the NAP and IFS
National Adaptation Plan (NAP) to Climate Change	2016 / Environment Quality Authority (EQA)	<ul style="list-style-type: none"> • The objectives of the NAP are to provide: <ul style="list-style-type: none"> ○ An assessment of historic trends in climate in relation to Palestine ○ Identification and prioritization of vulnerabilities: a total of 12 highly vulnerable sectors are identified: agriculture, coastal and marine (Gaza Strip), energy, food, gender, health, industry, terrestrial ecosystems, tourism (only in West Bank), urban and infrastructure, waste and wastewater, and water. ○ Future climate-scenarios ○ Identification and prioritization of adaptation options, including costings: immediate/ short-term adaptation actions in relation to the 12 vulnerable sectors are highlighted; ○ Future developments required 	<ul style="list-style-type: none"> • The adaptation actions detailed concern envisaged (future) or ongoing actions aiming at reducing climate sensitivity and increasing adaptive capacity; • The list of actions provided includes action description, provisions for feasibility (conditional/ unconditional according to international support), timescale for implementation, an estimation of related costs, and the type of support needed; • Adaptation actions also comprise operational strategies, infrastructural changes, policy adjustments and/or capacity building

		<p>for Palestinian institutions to be able to participate in climate-modelling research</p> <ul style="list-style-type: none"> ○ An outline of the process for future monitoring and evaluation; • Future steps 	
Initial National Communication Report (INCR) to the UNFCCC on CC	2016 / Environment Quality Authority (EQA)	<ul style="list-style-type: none"> • Highlighting key outcomes of GHG inventories, analysis of mitigation and adaptation potentials; • Give visibility of the measures taken to tackle CC; • Stress technical and institutional challenges faced. 	<ul style="list-style-type: none"> • Provision of ten prioritised mitigation actions (both 'realistic' mitigation actions and 'all' mitigation actions, according to the international support received).
National Agricultural Sector Strategy (2017-2022) Resilience and Sustainable Development	2016 / Ministry of Agriculture	<ul style="list-style-type: none"> • Provide clear rules and steps for decision-making, as well as a national reference for civil society organizations, the private sector and international partners. The strategic objectives of the adopted policies can be achieved through governmental (service development, drafting of legislation and emphasizing adherence to these), civil society and private sector interventions 	<p>The strategic objectives of the adopted policies can be achieved through governmental (service development, drafting of legislation and emphasizing adherence to these), civil society and private sector interventions.</p> <p>Approved measures will be based on 5 main pillars:</p> <ul style="list-style-type: none"> - Resilience and protection - Natural resources - Production and productivity - Supportive services - Institutionalization and management
State of Palestine Nationally Determined Contributions (NDC) /UNFCCC	EQA 2017	<ul style="list-style-type: none"> • Communicating the Palestinian national commitment towards reducing GHG emissions for the 2016-2030 period • Communicating conditional and unconditional targets, subject to receiving or not international support, as well as to different political scenarios (BAU and independence); • Providing GHG emissions forecast until 2040 under BAU and GHG reduction scenarios; • Communicating the list of mitigation and adaptation options selected to meet the target. 	<ul style="list-style-type: none"> • Provision of immediate/ short-term mitigation and adaptation targets and actions, including action description, provisions for feasibility (conditional/ unconditional according to international support), timescale for implementation, an estimation of related costs, and the type of support needed. • The NDC sets out quantitative mitigation outcomes which are fully conditional on the receipt of international support.

Elaboration of the policies and measures and advancements

The Palestinian Government deploys important efforts to understand and address challenges related to CC. Relevant government institutions, namely the Environment Quality Authority (EQA), the Ministry of Agriculture (MOA), the Palestinian Water Authority (PWA), the Ministry of Transportation (MOT), the Ministry of Finance and Planning (MOFP), the Ministry of National Economy (MONE), the Palestinian Energy and Natural Resources Authority (PENRA), and the Ministry of Health (MOH) are deeply involved in the determination of the near-future actions regarding the envisaged mitigation and adaptation national strategies, although they are recognised as having limited systems, capacity and expertise to address CC challenges efficiently.

What are the main steps followed and what is the stage of the process?

Table 3. " the main steps followed" of the impact of climate change

Strategic Documents	Steering	Process	Associated actors
National Climate Change Adaptation Strategy	Environment Quality Authority (EQA)	Input from stakeholders in the West Bank and the Gaza Strip corroborated the initial premise of the Project Team that the water sector in the Palestine justifies priority focus in terms of climate change impacts, and that agriculture is the Palestinian economic sector most sensitive to climate hazards, both current and future.	All ministries consulted by the Project Team - Environmental Quality Authority (as lead agency), Palestinian Energy Authority, Palestinian Water Authority, Ministry of Agriculture, Ministry of Planning, and Ministry of Transport. Support from leading Palestinian environmental NGOs

The National Strategy, Action Programme and Integrated Financing Strategy to Combat Desertification	Environment Quality Authority	This strategy, NAP and IFS build on and are framed by relevant national and sectoral strategies and plans such as: Environment Sector Strategy, Agriculture Sector Strategy, Social Protection Strategy, Climate Change Adaptation Strategy and Ending Occupation, Establishing the State Programme. While it is aligned and in harmony with the following international conventions, among others: UNCCD and its 10 year strategic plan 2008-2018, UNCBD, UNFCCC, Agenda 21 and MDGs	supported by UNDP/PAPP. Governmental institutions NGOs Academia Civil society UNCCD UNDP
National Adaptation Plan (NAP) to Climate Change	Environment Quality Authority (EQA)	The process used to develop the State of Palestine's first NAP secured input from a wide cross-section of stakeholders and the commitment of all relevant ministries 1. Identification of vulnerable themes/sectors 2. Initial vulnerability assessment 3. Assessment of climate sensitivities and adaptive capacities 4. Agreement of vulnerability ratings 5. Identify potential adaptation options 6. Assess potential adaptation options 7. Implementation of adaptation options as set out in the NAP	<u>NCCC stakeholders:</u> The process used to develop the first NAP secured input from a wide cross-section of stakeholders and the commitment of all relevant ministries;
Initial National Communication Report (INCR) to the UNFCCC on CC	Environment Quality Authority (EQA), Ministry of Agriculture	<ul style="list-style-type: none"> •National process involving all national stakeholders and experts. •2-year process supported by UNDP/PAPP and the Government of Belgium, with a strong component of national capacity building. •Basis: the recommended and applicable guidelines issued in the UNFCCC frame •Support of an international expert to develop the assessment of future-climate scenarios 	<ul style="list-style-type: none"> •NCCC stakeholders: •Private sector and civil society; •Experts, policy-makers, academics, engineers.
National Agricultural Sector Strategy (2017-2022) Resilience and Sustainable Development	Ministry of Agriculture	The strategic planning process for the agricultural sector was based on the Manual for Sectoral Strategy Development (2017-2022), which was issued by the General Directorate of Budgeting in the Ministry of Finance and Planning. The Manual included instructions and comprehensive overview of the methodology. The planning process was initiated at the beginning of April 2016 by reviewing the Steadfastness and Development Strategy of 2014-2016. During this process, key achievements and gaps within the three strategic directions have been identified, along with policies, indicators and programs. The strategic review process provided a general framework and foundation for the strategic planning process of 2017- 2022, through the identification of the right directions for policy interventions.	Ministry of Agriculture, Ministry of Finance and Planning, Ministry of National Economy, Ministry of Labor, Environment Quality Authority, Water Authority, Palestinian Central Bureau of Statistics, Risk Prevention and Agricultural Insurance Fund, Palestinian Agricultural Credit Institution, the Ministry of Local Government, as well as representatives from NGOs, and the Food and Agriculture Organization of the United Nations (FAO) Committee on Natural Resources, Committee on Agricultural Services, Technical Committee of Agricultural Production and the Committee of Institutionalization and Administration) supported the Planning and Budget Management Group and the General Department of Planning and Agricultural Policy.
State of Palestine's NDC/ UNFCCC	EQA	<ul style="list-style-type: none"> - Specifically for the NDC, a strong stakeholder consultation was undertaken through a stakeholder workshop attended by stakeholders from the NCCC (24th October 2016); - Consultation was also carried out with stakeholders outside of the NCCC; - A first draft of the NDC was circulated among stakeholders, and a second draft NDC was prepared taking on board stakeholder feedback. - A final validation workshop with stakeholders to approve the NDC was conducted. - The final NDC was approved by the Palestinian Government. - Overall, the mitigation component of the NDC is consistent with both the INCR and the recently developed draft sectoral strategies. The adaptation component is consistent with the NAP. 	<ul style="list-style-type: none"> • <u>NCCC stakeholders:</u> Environment Quality Authority (EQA); Ministry of Agriculture (MOA); Palestinian Water Authority (PWA); Palestinian Energy and Natural Resources Authority (PENRA); Ministry of Transport (MOT); Ministry of Finance and Planning (MOFP); Ministry of National Economy; Ministry of Health; Palestinian Meteorological Department; Applied Research Institute; House of Water and Environment; Birzeit University • <u>Stakeholders outside the NCCC</u> Ministry of Local Governments and Ministry of Public Works and Housing and Union of Agricultural Work Committees.

		- Start the implementation roadmap of activities and project set out in NDC	
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Which actors were involved, how and at what stage?

Three sectors selected on the basis of their importance to the Palestinian economy and their vulnerability to climate change: agriculture, water and the agri-food sector. The study's objectives are to:

- conduct a qualitative assessment of the economic impacts of climate change in Palestine in three inter-related sectors: agriculture, water and the agri-food sector;
- analyse the state of play in regards to the assessment of costs and benefits of adaptation options, and identify data gaps and research needs
- formulate recommendations for further research on the economic impacts of climate change in the three sectors and the assessment of adaptation costs and benefits.

3. Cross-analysis: policy options and climate impacts

- Environment Quality Authority (EQA)
The EQA is the government body in charge of safeguarding and protecting the environment, controlling and limiting the degradation of natural resources, combating desertification, preventing further pollution, enhancing environmental awareness, and ensuring environmentally sustainable development. Coordination and conduction of work regarding CC and UNFCCC requests (i.e. completion of the INCR and the NDC) is responsibility of the EQA, which has been designed as National Focal Point (NFP) to the UNFCCC.
- Other government agencies in close relationship to CC national works (many of them, involved in the NCCC):
Ministry of Agriculture (MOA); Ministry of Transport (MOT); Palestinian Central Bureau of Statistics (PCBS); Palestinian Energy Authority and Natural Resources Authority (PENRA); Palestinian Water Authority (PWA); Ministry of Local Governments (MOLG); Ministry of Finance and Planning (MOFP); Ministry of National Economy; Ministry of Health; Palestinian Meteorological Department
- National Committee on Climate Change (NCCC)
The NCCC is an expert advisory committee, which supports the Palestinian Government in the implementation and evaluation of its climate policies. It advises on where attention is required with regard to risks and on GHG mitigation and adaptation needs. The NCCC, on behalf of the Palestinian Government, is responsible for preparing climate-related policies (e.g. it was deeply involved in the development of the INCR), and following decisions by the Cabinet, monitoring implementation of these policies.
The NCCC is chaired by EQA, which also acts as the permanent NCCC Secretariat, and comprises appointed representatives from 27 different sector ministries and agencies, academia, NGOs, and the private sector.
NCCC's particular role is to support the Palestinian Government to:
 - Enhance the establishment of a scientific/technical and technological mechanism that addresses developments, impacts and potential challenges associated with CC in the SoP
 - Enhance the organization of scientific and technical research to inform adaptation and mitigation programs and projects
 - Ensure proper execution of the GHGI and preparation of Palestine's NCs for submission to the UNFCCC through EQA, as the National Focal Point (NFP)
 - Develop and monitor the implementation of the National Strategy on CC and the related mitigation and adaptation programs of action, plans and policies
 - Enhance research and solicit and create financing mechanisms that will facilitate and allow the SoP to succeed in its endeavours in relation to climate policy
 - Implement a broad communication strategy, including an awareness-raising, information and education campaign, and develop scientific and technical research and studies on climate change in the SoP
- Academia
Academic centres such as Palestinian universities, i.e. the Birzeit University, the Hebron University and the Islamic University of Gaza, have been actively involved in the preparation of the INCR, specifically as part of the team in charge of the data collection and implementation of the report.
- International/ regional organisations and partnerships and cooperation programs:
 - UNDP PAPP
- Private sector
Also present in all stages of the national process against CC, charged with leading tasks (e.g.

environmental and/or engineering consultancy firms in charge of supporting the EQA in the key national processes such as the INCR)

- Non-governmental organisations

Table 4. Agriculture and climate change "cross analysis sheet"

Fully considered		Weakly considered	
Consider the key components		Do not consider or no specific knowledge	
Areas of impact	National Adaptation Plan (NAP) to Climate Change	National Agricultural Sector Strategy (2017-2022) "Resilience and Sustainable Development".	
risks and insurance		<ul style="list-style-type: none"> • Extreme weather events (i.e. extreme storms) may threaten cultivations. 	
Climate variability	<ul style="list-style-type: none"> • Agricultural production is sensitive to climate and local weather forecasts do not accurately predict heat waves, frosts or flash flood. Low rainfall postpones planting dates, and low temperatures delay maturation and harvesting. • Agricultural extension, awareness-raising and training programs are being implemented by the MOA on farm management and the need to modify practices in order to address the adverse impacts of climate change, including how to cope during drought periods. • Improve the management of the climate changes issues by facilitating the dialogue among relevant stakeholders. Structured to raise awareness and train staff on climate actions with the view to make the best use of partner's supports and successfully envisage medium and long-term strategies to address climate change impacts in the relevant sectors for the country (primarily water & agriculture). • Develop an alternative plan for both irrigated agriculture as well as Rain fed farming. More drought resisting varieties, less water requiring crops, reuse • Climate-smart agriculture: Management of crop production systems including soil and water resources for better environmental sustainability along with improved economic profitability for farmers 	<ul style="list-style-type: none"> • Reduce the negative impacts of climate change and natural disasters • Reduce exposure of farmers to climate change, by developing the capacities of extension officers in this areas, as well as the implementation of hundreds of hours of agricultural training and extension services in fields related to soil moisture in rain-fed areas, the introduction of modern methods of water harvesting, as well as enhancing awareness of farmers regarding the need to shift to the most drought-resistant farming systems. • Enhancing services for farmers, development of legislations and management of the sector, enhancing the production and productivity • Developing resources and policies for the Risk Prevention and Agricultural Insurance Fund • Promoting investment in the agriculture sector, and strengthening public-private partnerships for this purpose. • Promoting innovation and adaptive solutions that mitigate the effects of climate change • Take measures and arrangements to adapt with or avoid the negative impact of climate change and natural disasters, particularly high temperatures and fluctuating precipitation or declining rain water. • Guiding and supporting farmers' initiatives towards intensive and semi-intensive production systems, as well as the application of modern systems of agricultural production in line with the requirements of sustainable development 	
Water Resources	<ul style="list-style-type: none"> • Improve water-use efficiency and using alternatives water resources • Rain-water harvesting small scale- medium scale • The capacity of storm water drainage systems to drain excess water during flood events is limited. • In 2011, 86 million m3 of water was available for agriculture. Groundwater wells are the main source of water for irrigation in the Gaza Strip. Limited use is made of treated wastewater. • There is insufficient freshwater for irrigation during dry periods, and the ability of irrigation engineering to manage irrigation water resources is limited. 	<ul style="list-style-type: none"> • Establish large water facilities in arable irrigated areas through the transfer of water or water collection or wastewater treatment and increase the efficiency of the available water. • Irrigation practices are outdated and there is a need to introduce precision agriculture and drip irrigation • Enforcement of existing regulations strengthened. • Proactive and preventive water adaptation approaches in protecting the limited water resources with emphasis in drinking water resources and upgrading drinking water quality management system and surveillance programs • Take measures and arrangements to adapt with or avoid the negative impact of climate change and natural disasters, particularly high temperatures and fluctuating precipitation or declining rain water. 	
Agriculture Production	<ul style="list-style-type: none"> • Introduction of new saline tolerant crops 	<ul style="list-style-type: none"> • Introduction of new saline tolerant crops 	
Sea level rise and Coastal erosion	<ul style="list-style-type: none"> • the Coastal Aquifer is projected to be depleted by next year and nitrates and other pollutants have made 95% of the Gaza Strip's water unpotable 	<ul style="list-style-type: none"> • Seawater intrusion in coastal aquifers • Economic losses and costs of coastal protection 	
Vector borne-diseases	<ul style="list-style-type: none"> • The need for long-term funding to help prevent or reverse a decline in children's health linked with unsafe water, a contaminated environment, and deteriorating community health services and hospitals 		
Energy	The Gaza Power Plant (GPP) is the primary source of domestic energy production. Current use of renewable energy to meet any increased demand is limited due to the high investment costs,	<ul style="list-style-type: none"> • There is a need to: connect the GPP with fuel pipelines to reduce use of fuel tankers; rehabilitate existing electricity distribution systems; develop fuel-storage facilities; and 	

	<p>although approximately two-thirds of houses use solar water heaters. Many homes have their own electricity generators and households purchase fuel to run them, which is expensive. Lots of households own batteries to store electricity for lighting.</p>	<ul style="list-style-type: none"> import equipment and spare parts required to construct and maintain the infrastructure. The PEA has not been involved so far in any climate change adaptation. However, it has a strong interest in climate change mitigation, e.g. a proposed 100MW Concentrated Solar Power (CSP) plant for Jericho with American private sector involvement (Anova). The PEA is also in discussion with the PWA over a proposed solar-powered desalination plant. Also, there is much use of domestic solar water heaters in Palestine. Mitigation measures need to be reported in the Climate Change Adaptation Strategy for the Palestine. There is a need for regulations and laws that enhance energy efficiency Agriculture and land use, although important to the State of Palestine, represent relatively small proportions of the emissions, and information on land-use change is not available. However, there are a number of measures being used or considered in neighboring countries, such as manure management, which might be appropriate for the State of Palestine.
Biodiversity loss	<p>Consideration of the impacts of potential climate change on biodiversity is outside the remit of this Palestinian Adaptation Programme of Action, which is focused on human well-being in the face of existing and future threats to food and water security. In the realm of human development, it is nevertheless important for the further development of climate change adaptation policy to focus on the linkages between livelihoods and biodiversity conservation. This is particularly relevant for the Palestinian agricultural sector; for example, the impacts of temperature changes on the flowering and fruiting of olive trees, and the role of indigenous species and genetic diversity in the selection of crops and ruminants tolerant to high temperatures and drought. Increasing afforestation with native species can improve water retention and quality, while also providing protected natural and semi natural areas of value for recreation and (eco) tourism. Beyond the realm of livelihoods, protected natural areas have a high cultural value for Palestinian self-identity.</p> <p>Olive trees in the State of Palestine comprise 71.6% of trees and c.15-19% of total agricultural production. About 8,000 hectares is cultivated for grape production and contributes about 12% of total agricultural production. The MOA distributes seeds of field crops (e.g. wheat and barley) that are drought-tolerant. The Palestinian Government is trying to increase the number of jobs through establishing agro-industrial zones, such as Jericho and Jenin. USAID thankfully established several packing and grading houses in the Jordan Valley for high value cash crops (dates, cherry tomatoes, peppers, and herbs).</p>	<ul style="list-style-type: none"> Intensify efforts of research and official institutions, local authorities and centers to protect the forests and natural reserves, as well as organize and develop pastures, protect agricultural biodiversity in all environmental areas in Palestine. Continue the greening of Palestine as a responsibility of all institutions, local authorities, schools and universities. Preservation of rural culture that is based on the cultivation of land with trees and crops, as well as breeding domestic animals as part of the household component.
Infrastructure problems	<ul style="list-style-type: none"> Enhance sustainable community-level irrigation schemes and infrastructure Enhancing agricultural value chain and improving infrastructure for livestock production Current post-harvesting storage techniques are inadequate, e.g. there is a lack of large scale grading and refrigerated cold storage. 	<ul style="list-style-type: none"> Establish large water facilities in arable irrigated areas through the transfer of water or water collection or wastewater treatment and increase the efficiency of the available water. Provide the necessary support for land reclamation and agricultural road construction that link all agricultural land or lands that could be cultivated.
Greenhouse Gas (GHG) Emissions	<ul style="list-style-type: none"> Value of raw materials imported; Infrastructure; Energy supply; Energy demand 	<ul style="list-style-type: none"> Value of industrial products exported; Value of raw materials exported; Employment; Energy supply; Energy demand The Ministry of Agriculture has plans to increase forest area by 200 hectares per year until 2018, and it could be assumed that this would continue, at a lower rate, beyond that. It could save around 9,000 tonnes CO2 eq. per year.
Fisheries	<ul style="list-style-type: none"> Fishing and fisheries is an additional 'highly vulnerable' issue in Palestine 	

Ecosystems			<ul style="list-style-type: none"> • Preservation of rural culture that is based on the cultivation of land with trees and crops, as well as breeding domestic animals as part of the household component.
Public health	<ul style="list-style-type: none"> • Development of water, food and sanitation monitoring and safety systems using high technology. • Training health professionals and increasing the awareness of people, particularly women, in water poor areas about measures they can take to help prevent major diseases related to water, sanitation, and food • The need to strengthen policies, strategies, responses, coordination, sustained community based programming, and donor support in relation to water, sanitation and nutrition, as well as maladapted behavior inevitably result in increasing child mortality, morbidity and impaired intellectual development inevitable. • High levels of poverty in the Gaza Strip result in households making use of unsafe water supplies. • The need for long-term funding to help prevent or reverse a decline in children's health linked with unsafe water, a contaminated environment, and deteriorating community health services and hospitals. • Hygiene practices in the Gaza Strip are not adapted to chronic conditions of unsafe and inadequate water, poor sanitation and a contaminated environment. • Worming treatments administered to school children do not reach young children who are most vulnerable to being affected by parasites • Major investments need to target long-term infrastructure rather than small emergency projects 		<ul style="list-style-type: none"> • Monitoring diseases and establishing procedures for outbreak prevention. • Developing agricultural insurance services and compensation programs • Activation of procedures that ensure public health and phytosanitary.
Coastal Zone			<ul style="list-style-type: none"> • the Coastal Aquifer is projected to be depleted by next year and nitrates and other pollutants have made 95% of the Gaza Strip's water unpotable
Livestock	<ul style="list-style-type: none"> • Increase the availability of animal feed (including plant and organic residues) at an affordable price • Improve livestock-production pens 		<ul style="list-style-type: none"> • Strengthening the role of applied research in official research centers and universities in developing extension services for both plant and livestock agriculture. • Development of agricultural products, for both plant and animal specifications
Decline of landscapes	<ul style="list-style-type: none"> • Land-use planning and management - greening, afforestation, and rangeland development • The Ministry of Environmental Affairs Coastal Protection Plan makes specific recommendations that will help conserve the coastal areas – such as 'set back lines' (beyond which no construction is allowed), improvements in fisheries legislation and techniques and habitat conservation efforts. The very poor regulatory and legal context in the Gaza Strip, however, ensures that even the most basic of such recommendations will likely not be implemented. Expected changes in currents that will follow climate change-induced sea-level rises will impact the coastal area in ways that are difficult to predict, but may safely be expected to exacerbate the situation. 		<ul style="list-style-type: none"> • Incorporation of climate adaptation in land use planning • Protect agricultural lands from urban expansion, especially in plain areas and high value agricultural lands.

Sources

1. Initial National Communication Report to the UNFCCC on CC (2016), State of Palestine Environment Quality Authority
2. National Adaptation Plan (NAP) to Climate Change (2016), State of Palestine Environment Quality Authority
3. National Agricultural Sector Strategy (2017-2022) “Resilience and Sustainable Development” (2016), The State of Palestine Ministry of Agriculture
4. The National Strategy, Action Programme and Integrated Financing Strategy to Combat Desertification in the Occupied Palestinian Territory (2011)
5. Aliewi, A., O’Connell, P.E. and Almasri, M.N. 2013. Implications of climate change in Palestine. In: Shared borders shared waters – Israeli-Palestinian and Colorado River Basin Water Challenges. Eds. Megdal, S.B., Varady, R.G. and Eden, S. Springer, 167-185. Accessed at: https://books.google.co.uk/books?id=ggnP_cgaDkEC&pg=PA174&lpg=PA174&dq=palestine+climate+trends&source=bl&ots=F1o7W0KkTV&sig=doBkglxY_olCvn96yQz2yLk6Up0&hl=en&sa=X&ei=hDv3VMuALM6Q7AaY8IH0DA&ved=0CDEQ6AEwBDgU#v=onepage&q=palestine%20climate%20trends&f=false
6. Almazroui, M., Islam, M. Nazrul, Jones, P.D., Athar, H. and Rahman, M.A. 2012. Recent climate change in the Arabian Peninsula: Seasonal rainfall and temperature climatology of Saudi Arabia for 1979–2009. Atmospheric Research, 111, 29-45. Accessed at: <http://www.sciencedirect.com/science/article/pii/S0169809512000531>
7. Alpert, P., Ben-Gai, T., Benjamini, Y., Baharad, A., Colacino, M., Pierviali, E., Ramis, C., Homar, V., Michalides S., and Manes, A. 2000. Evidence for trends to extremes in observed daily rainfall categories over the Mediterranean. Accessed at: <http://www.bbsr.edu/rpi/ft/May2000/alpert/sld01.htm>
8. Al-Rimmawi, H., Ghanem, M. and Shalash, I. 2010. Rainfall trends in the District of Ramallah and Al-Bireh, Palestine. J. Water Resource and Protection, 2010, 2, 345-352.
9. Asad, E.Y.A. 2014. Climate variability monitoring and assessment in Palestine, presentation at scoping meeting for the establishment of the Arab Climate Outlook Forum (ArabCOF).
10. Becker, A., Finger, P., Meyer-Christoffer, A., Rudolf, K., Schneider, U., and Ziese, M. 2013. A description of the global land-surface precipitation data products of the Global Precipitation Climatology Centre with sample applications including centennial (trend) analysis from 1901–present. Earth Syst.Sci. Data, 5, 71–99.
11. United Nations Conference on Trade and Development (UNCTAD) (2015) The Besieged Palestinian Agricultural Sector.
12. UNDP (2010) Climate Change Adaptation Strategy and Programme of Action for the Palestinian Authority. United Nations Development Programme of Assistance to the Palestinian People, Jerusalem
13. UNFCCC (2014) Assessing the costs and benefits of adaptation options. An overview of approaches
14. Intergovernmental Panel on Climate Change (2007) Climate Change and Water, Technical Paper IV, Geneva: IPCC.

15. JICA (2008) The Feasibility Study on Water Resources Development and Management in the Jordan Rift Valley, (Draft Final Report), Tokyo: Japan International Cooperation Authority.
16. UNRWA (2009) Poverty in the Occupied Palestinian Territory 2007, Gaza City: United Nations Relief and Works Agency for Palestine Refugees. http://www.un.org/unrwa/publications/pubs08/opt_poverty2007_may09.pdf
17. Asad, E.Y.A. 2014. Climate variability monitoring and assessment in Palestine, presentation at scoping meeting for the establishment of the Arab Climate Outlook Forum (ArabCOF).
18. Donat, M.G., Alexander, L. V., Yang, H., Durre, I., Vose, R., Dunn, R. J. H., Willett, K. M., Aguilar, E., Brunet, M., Caesar, J., Hewitson, B., Jack, C., Klein Tank, A. M. G., Kruger, A. C., Marengo, J., Peterson, T. C., Renom, M., Oria Rojas, C., Rusticucci, M., Salinger, J., Elrayah, A. S., Sekele, S. S., Srivastava, K., Trewin, B., Villarreal, C., Vincent, L. A., Zhai, P., Zhang, X., and Kitching, S. 2013: Updated analyses of temperature and precipitation extreme indices since the beginning of the twentieth century: The HadEX2 dataset. *J. Geophys. Res. Atmos.*, 118, 2098-2118.
19. http://unfccc.int/files/national_reports/non-
20. Donat, M.G., Peterson, T. C., Brunet, M., King, A. D., Almazroui, M., Kolli, R. K., Boucherf, D., Al-Mulla, A.Y., Nour, A.Y., Aly, A.A., Nada, T.A.A., Semawi, M.M., Al Dashti, H.A Salhab, T.G., El Fadli, K.I., Muftah, M.K., Eida, S.D., Badi, W., Driouech, F., El Rhaz, K., Abubaker, M.J.Y, Ghulam, A.S., Erayah, A.S., Ben Mansour, M., Alabdouli, W.O., Al Dhanhani, J.S., and Al Shekaili, M.N. 2014: Changes in extreme temperature and precipitation in the Arab region: long-term trends and variability related to ENSO and NAO. *Int. J. of Climat.*, 34, 581-592.
21. http://unfccc.int/files/national_reports/non-annex_i_parties/application/pdf/initial_national_communication_report_state_of_palestine.pdf
22. [annex_i_parties/application/pdf/national_adaptation_plan_state_of_palestine.pdf](#)
23. IPCC. 2013. Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535pp.
24. UNFCCC (2007) Impacts, Vulnerabilities and Adaptation in Developing Countries, Bonn: UNFCCC Secretariat.
25. UNRWA (2009) Poverty in the Occupied Palestinian Territory 2007, Gaza City: United Nations Relief and Works Agency for Palestine Refugees. http://www.un.org/unrwa/publications/pubs08/opt_poverty2007_may09.pdf
26. Abu-Jamous, S. (2009) Potential Impact of Climate Change on Agricultural Water Demand: A Case Study of Jericho District, Palestine. MSc thesis, Birzeit University.
27. MOA. (2016) National Agriculture Sector Strategy, 2014-2016: Resilience and Development, Ministry of Agriculture, State of Palestine. <http://reliefweb.int/sites/reliefweb.int/files/resources/1417423273.pdf>
28. IPCC. 2014. Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of

the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1132pp.

29. http://www.mopad.pna.ps/en/images/PDFs/Palestine%20State_final.pdf
30. The Oslo II Accord, formally entitled the 'Interim Agreement on the West Bank and the Gaza Strip of 1995', created three territorial zones in The West Bank: Area A, where the Palestinian Government has responsibility for public order and internal security; Area B, where the Palestinian Government assumes responsibility for public order for Palestinians, while Israel controls internal security; and Area C, where Israel maintains exclusive control. Area C covers 61% of the West Bank