GUPAP
منتدى غـــزة للـــزراعة الحضرية وشبه الحضرية
Gaza Urban & Peri-urban Agriculture Platform

Impact of Climate Change on Agriculture Sector in the Gaza Strip

A study implemented by GUPAP and in support by the International Committee of the Red Cross (ICRC)

July 2022

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Executive Summary

Executive Summary:

In February to April 2022, the ICRC and GUPAP conducted a study to assess the impacts of climate change on the Gaza farming sector, determine the existing adaptation strategies used by Gaza farmers, identify the enablers for sustainable adaptation action in the field of agriculture, and identify the capacity of the related local authorities, and universities to deal with the climate change challenge.

Methodology: The study team applied mixed methods and a participatory interactive approach using multiple data sources including literature review, 14 interviews, 12 FGDs, and surveys.

Participants: 123 participants from the farmers who participated in the FGDs, 109 out of them filled the survey. 25 farming actors have participated in interview and FGDs.

Main findings:

Finding 1: 95% of surveyed farmers reported that they have been affected by climate change impacts /weather changes during the last year. For example, in 2021, olive and grape production declined significantly, and strong winds blew away almond blossoms and broke some trees. For animal production, the high temperatures caused mortalities in poultry. Little percent (13%) of farmers felt they received support or guidance about this.

Executive Summary:

Finding 2: Over 85% of the farmers reported that rainfall has declined over the last ten years. 93.6% of the farmers reported that there is an increase in temperatures. Most farmers (104 out of 109) indicated that plant and animal diseases increased such as the peacock eyespot that affects olives due to moisture/humidity and newcastle disease that spread in poultry in extreme heat. Furthermore, around 94% of surveyed farmers reported that the production costs have increased over the past ten years.

Finding 3: Around 50% or a little more of surveyed farmers indicated that the climate change has highly affected negatively on the scarcity of water resources, the incidence of crop diseases, amount of production, sale of production, the harvesting time and production

The highest impact on animal production was noted in the spreading of animal diseases and the reduction of grazing areas by 72.6% and 80.2% of farmers respectively.

Finding 4: Most farmers (95%) revealed that they have losses due the climate change / weather impacts last year, and little percent (13%) of them received support or guidance from MoA or other relevant NGOs. Farmers revealed they suffered losses due to climate change last year, and only a small percent of them received assistance from the Ministry of Agriculture or other relevant NGOs.

Executive Summary:

Finding 5: 98% of the farmers follow weather forecasts, and the most commonly used sources to know weather forecasts are media (radio &TV) and social media. Most of them failed to properly define climate and weather, and around 60% of them classify their knowledge about climate changes and its impacts as modest.

Executive Summary:

Recommendation 1: Find new and effective ways to engage with the farmers and raise their awareness about climate change impacts. For example, a website or a mobile phone app could be created to showcase awareness-raising, outreach activities and provide accurate predictions of weather conditions and technical advice to farmers.

Recommendation 2: Support smart agricultural solutions that enable climate adaptation. For example, authorities with support of the international community could look-into schemes to compensate farmers and create climate-friendly adaptation solutions.

Recommendation 3: Create a community of concern among local stakeholders, farmers committees, Environmental Quality Authority, NGOs, municipalities, and Gaza Ministry of Agriculture to identify innovative solutions to adapt to climate change.

Recommendation 4: Improve the capacity of farmers, agencies and academia to utilize the online Israeli metrological services capturing data close geographically to the Palestinian cities (13-15 km distance). A technical working group between the Israeli metrological service and Gaza counterparts could be organized.

Recommendation 5: Carry out an in-depth research on climate change impacts in Gaza, in order to understand the scenarios and set the required adaptation strategies.

2

Background

GUPAP
منتدى غـــزة للـــزراعة الحضرية وشبه الحضرية
Gaza Urban & Peri-urban Agriculture Platform

The Gaza Urban and Peri-Urban Agriculture Platform (GUPAP), launched in 2013, consists of a multi-stakeholder, interactive and participatory space that brings together key actors involved in the development of a resilient Palestinian urban and per-urban agricultural sector in the Gaza Strip. GUPAP working for influencing in the Palestinian agricultural policies that enhance resilience and food sovereignty of the local community.

3

Study Objectives

1

Assessing the impacts of climate change on the Gaza farming sector

2

Determine the existing adaptation strategies used by Gaza farmers

3

Identifying the enablers (Catalysts) for sustainable adaptation action in the field of agriculture

4

Identify the capacity of the related local authorities, weather stations and universities to deal with the climate challenge

4

Limitations of Study

Limitations of Study:

- The duration of study is too short.
- The limited available data about the climate change impacts on agricultural sector.
- The knowledge gap between farmers, which create a debate and questionable findings.
- Lack of cooperation and delay of response from some parties.

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Methodology

Phase1

Inception Phase

- Develop the study implementation (Action) plan
- Determine the study sample
- Conduct a Literature review
- Design the study tools

Phase2

Data Collection Phase

- Conduct interviews, FGDs, and survey

Phase3

Analysis & Reporting Phase

- Data filtration (Screening)
- Data analysis
- Key findings
- Conclusion/Recommendations

Study Tools

2 FGDs with Key Actors (11 participants)

14 Interviews with Key Actors

Survey (109 Farmers)

10 FGDs with Male and Female Farmers (123 participants)

Annex 1 presents the list of interviewed actors

6

Context Analysis & Literature Review

6.1 Introduction

- Agriculture plays an important role in Palestine, and a major source for income and food security. It plays a major role in supporting the community's withstand, welfare and protection of hunger and poverty throughout the continuous crisis in Gaza Strip. Percentage Contribution to GDP by agriculture and fishing sector is 7.1% (Palestine in Figures 2020, PCBS, March 2021).

- The State of Palestine lies within the Mediterranean climate zone. Like many countries around the world, it faces the challenges and consequences of climate change. The State of Palestine also faces many other challenges, such as the Israeli occupation, movement restrictions, and a lack of sovereignty and control over resources.

- The inability to manage natural resources sustainably, or to enforce laws, aggravates the threat of climate change, especially in the face of increasing population, poverty levels, and food insecurity (State of Palestine's Country Programme for the Green Climate Fund Climate Resilient Transformation with the Green Climate Fund,2019).

- In Gaza Strip, there is lack of data due to the destruction of meteorological facilities during the recurrent escalations of conflict after 2006 (Climate Change, Agriculture and Gender in Gaza , Oxfam 2020).

6.1 Introduction

- More than 608 million farms in the world, more than 90% of which are family farms (by our definition), and they occupy around 70–80% of farmland and produce roughly 80% of the world's food in value terms (Lowder et al., 2021).

- In Palestine, 80% of agriculture depends on family work. Specifically in Gaza it reaches more than 95% (GUPAP,2022).

- The predominant nature of agriculture in Palestine is the family farming nature, as nearly 40% of agricultural production and agricultural processes are shouldered by women and aren't officially recognized.

- As a result of the bad economic conditions in the Gaza Strip and the urbanization, the productive costs of the agricultural sector have become high, and the farmer has become dependent on his family members in agricultural work to save the cost of hiring labor.

6.2 About Climate Change

- Climate is generally known as a statistical definition of the mean and variability of the related quantities over a period from months to thousands of millions of years. The human activities that could potentially alter the environment as a result of the release of gases into the atmosphere include industrial activities, the development of large cities, the contamination of rivers and towns, the formation of thousands of dams and lakes and the conversion of grasslands or forests to crops and agricultural activities (McCarthy et al., 2001; Aish et al., 2021).

- The climate change impacts are still challenging to be assessed perfectly because it is caused by a multipart factor. The impact on humans could be well recognized in natural variability, population growth, land use, and governance (Kang et al., 2009; Grasso et al., 2012).

- The Intergovernmental Panel on Climate Change (IPCC) reported that climate change negatively impacts on public health. Furthermore, these effects are predictable to exacerbate over time. Climate change projections include an increase in extreme events (heat waves, wildfires, droughts, and floods) and changes to environmental health elements such as food, air, and water quality (Proust et al., 2012).

6.3 Climate Change Impacts on Agricultural Sector:

- Climate change has been a key topic challenging all aspects of our life recently, a case in point is agricultural sector, in addition to the directly affecting on agricultural production, primarily via the changes and fluctuations in rainfall quantities, and the disintegration of agricultural holdings dropping their productivity, profitability and efficiency. In Gaza, the summer is long, warm, muggy, arid, and clear while the winter is cool and mostly clear (https://weatherspark.com).

- The agricultural activities in Gaza account for more than 50% of fresh water consumption as agriculture considered as one of major sources of income (PWA, 2015).

- Because of pollution and the shortage of groundwater, the reuse of treated wastewater in irrigation as an applicable solution to overcome serious fresh water shortages. Reuse of treated wastewater for irrigation in Palestine represents a confirmed priority in the Palestinian water policy adopted by the Ministry of Agriculture and the Palestinian Water Authority (Zimmo et al., 2005; Al Yaqoubi, 2008).

- Thus, Gaza Strip farmers faces challenges to mitigate their future existence in contradiction of the water shortages, while climate change models predict an increasing water demand as a quantitative factor and groundwater salinization as qualitative factor. Therefore, proper development planning is urgently needed to ensure a sustainable water environment.

- Albaba (2018) reported that the agricultural sector's contribution to gross domestic product (GDP) has been remarkably declining over the years. The analysis of the agricultural sector and its activities illustrates that the sector facing many challenges and obstacles such as climate change. For example, the growing period of wheat in the West Bank governorates was less in almost 12% than the normal situation (230-240 d), and thus reduces the wheat growth season.

- Though it has been reported that in the areas where the crop's growth season encounters limitation, climate change and earth warming could lead to the improvement of crops' yield by increasing the growth season period and the improvement of the plant flowering strength (Challinor et al., 2007).

- The growth and development speed of the crops will increase due to the rise in temperature, though experimental evidence which displays that under this condition, the length of maturity of the seed in the grains and seedy plants will be reduced (Parry et al., 2004; Albaba, 2018; West, 2018).

- The yields of wheat are decreasing due to increased temperatures and decreased precipitation. Thus, it is recommended that any programs that are working to minimize the adverse impact of climate change on wheat production should first consider this crops, which are being most affected by the higher temperatures and are also exposed to higher degrees of vulnerability to climate change (Albaba, 2018).

- Aish et al. (2021) Mentioned that the prediction of irrigation water requirements for the years 2020, 2050 and 2080 show clearly the impacts of climate change on the agricultural sector. Therefore, climate change and the sequencing effects in irrigation water requirements are questions relevant for institutions, decision-makers and stakeholders to address water resources and crop patterns; planning.

- One the most vulnerable areas in Gaza Strip to climate changes are Bedouin communities, notably herders groups since most of them live in poor housing and livelihood conditions and depend on pastoralism as a key source of income. Due to urbanization and climate change, grazing areas have been badly affected and reduced. Additionally, border areas and Al-Mawasi are highly affected by climate change due to the type of soil and low quality of water in these areas. The adjacent areas to the valleys (Wadi Alsalqa valley, Gaza valley, and Beit Hanoun valley) are more at risk of flooding during heavy rain (GUPAP,2022).

6.3 Future Expectations

Future climate scenarios for Palestine project an increase in temperature and a decrease in average annual rainfall, translating into an increase in the risk of drought. The wettest days may also become more frequent, leading to an increased risk of flood. The impact of extreme events and slow-onset changes is estimated to adversely affect soil quality and stability, water quality, biodiversity, and overall ecosystem health, as well as reducing the quality and quantity of crops that can be grown and reducing the area available for agriculture (United Nations Framework Convention on Climate Change Website, 2021). Upon that, the following consequences are expected to happen:

1. A substantial reduction in food production, which would have negative impacts on the income and employment of Palestinians working along the agricultural value chain, leading to vulnerable parts of society suffering significant losses to their livelihoods

2. A reduction in the quality and quantity of food products, which may also lead to food insecurity and adverse health impacts among the population.

3. Negative impacts on all sectors relying on ecosystem services, in particular agriculture, human health and water.

- Key indicators for the local impact of global climate change include an accelerated rise in sea level and changes in regional precipitation patterns. Decreased precipitation is expected to be the most significant effect on Palestine-Israel over the course of this century, accompanied by a significant rise in average temperatures. The combination of decreased rainfall and rising temperatures will result in a higher demand for water (already an overexploited resource) that will be in increasingly short supply and could lead to water insecurity. Agriculture, which is a cornerstone of the OPT's economy, will also suffer as a result. https://al-shabaka.org/briefs/climate-change-the-occupation-and-a-vulnerable-palestine/

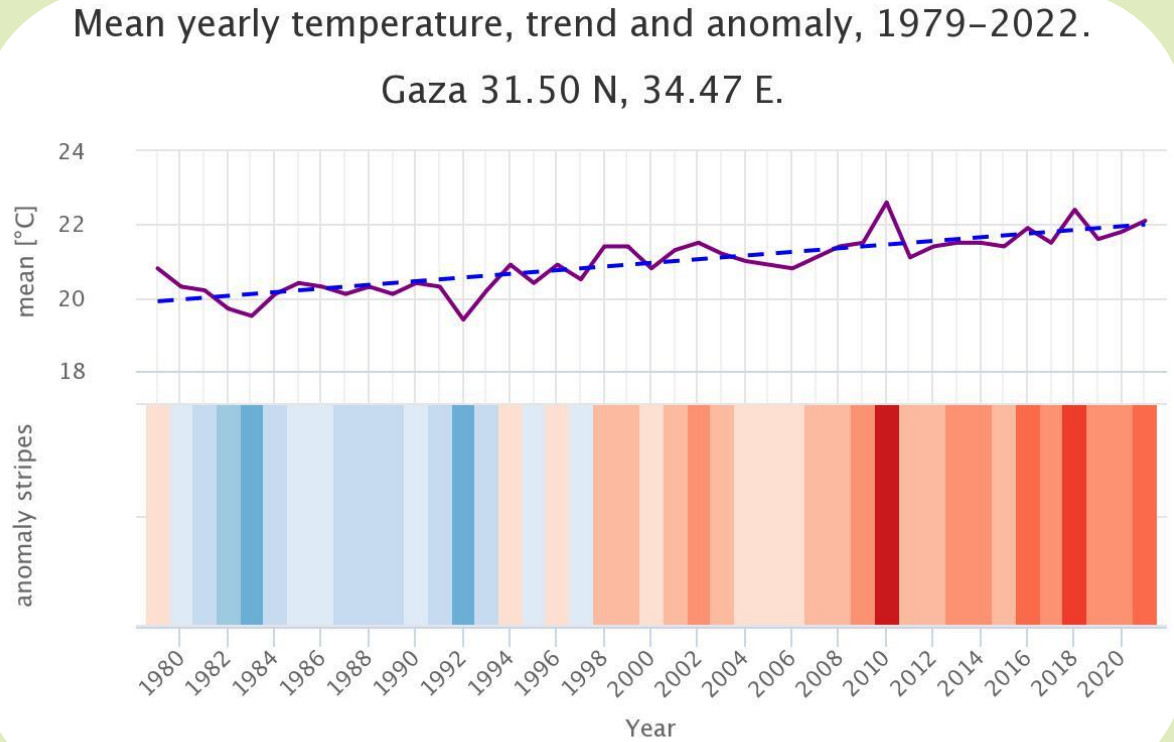
- The key climate-change impacts most likely to affect Palestinians are: 1) Intensification of extreme weather phenomena, such as high wind, hot waves, and frost; 2) Changes in precipitation quantity and patterns; 3) Drought episodes; 4) Stormy rainfall and flooding event; 5) Soil erosion and desertification; and 6) Sea level rise and the intrusion of salty water into the coastal aquifer in Gaza (State of Palestine's Country Programme for the Green Climate Fund Climate Resilient Transformation with the Green Climate Fund,2019).

- The ClimaSouth Project, an organization supporting climate change mitigation and adaptation in several Mediterranean countries, anticipates a reduction of annual precipitation in the eastern Mediterranean region of up to 30% by the end of this century, compared to the period of 1961-1990. Meanwhile, over the past four decades, average temperatures have increased by 0.5°C in the area of the Mediterranean Sea.

- The Intergovernmental Panel on Climate Change predicts that the southern and eastern Mediterranean will warm at a higher rate than the global average over the twenty-first century – between 2.2 and 5.1°C – which will lead to highly disruptive, if not catastrophic, changes to the region's climate, including increased desertification. https://al-shabaka.org/briefs/climate-change-the-occupation-and-a-vulnerable-palestine/

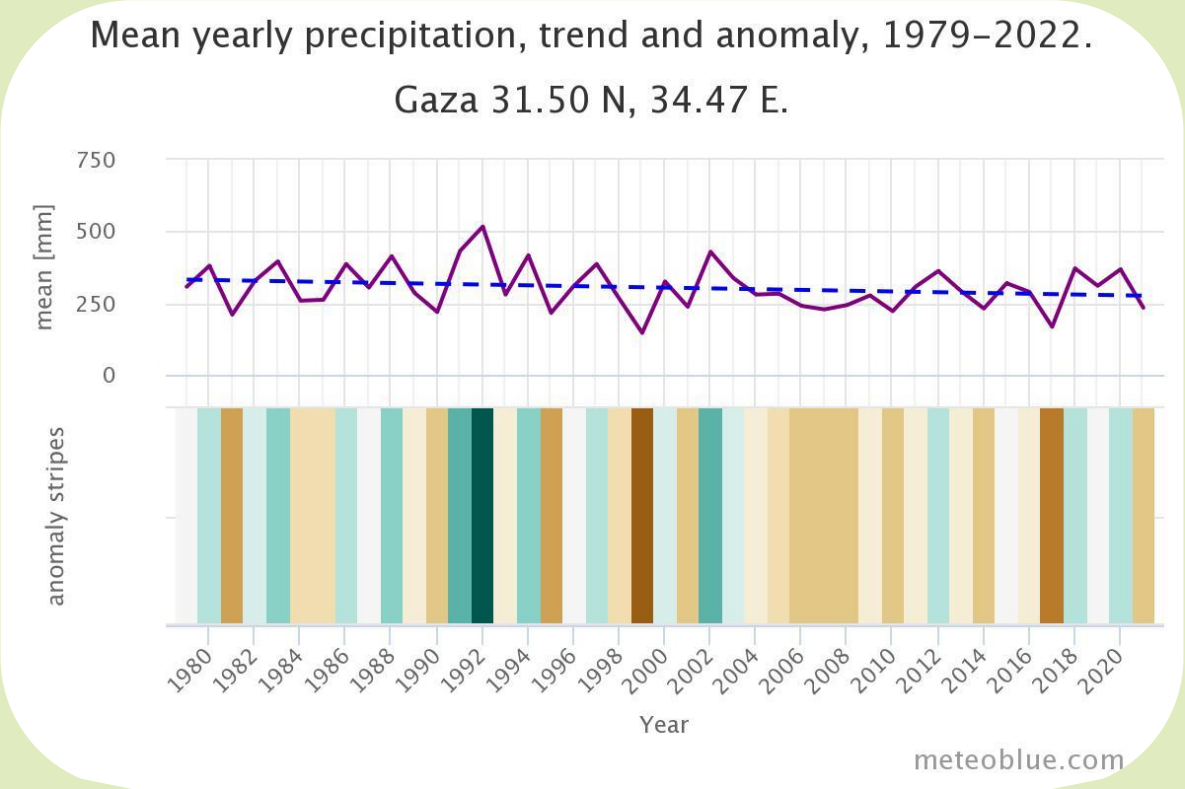
Context Analysis & Literature Review

The following chart presents the mean yearly temperature in Gaza between 1980-2020. The temperature trend is positive and it is getting warmer in Gaza due to climate change



Context Analysis & Literature Review

The following chart presents the mean yearly temperature in Gaza between 1980-2020. In the lower part the graph (Each colored stripe represents the total precipitation of a year - green for wetter and brown for drier years.)



Impact of Climate Change on Agriculture Sector(GUPAP-ICRC 2022-Gaza)

Examples of Crops affected by Climatic changes

- ✓ In 2021, the winter season witnessed surprisingly high temperatures reaching up to 27 °C, followed by abnormally low temperatures during the moderate-temperature months of the year. This has impacted the flowering and production phases of olives. As a result, the production of olives in Gaza has dropped to 9,000 tons, while the usual annual production is 30,000 tons (ICRC, October 2021).

- ✓ Some crops have become much more difficult to be cultivated in Gaza over the years because of climate change, consequently farmers abandon plums, peaches and almonds then replaced them with other fruits and vegetables that are more able to withstand the changing weather conditions (middleeasteye.net,2021).

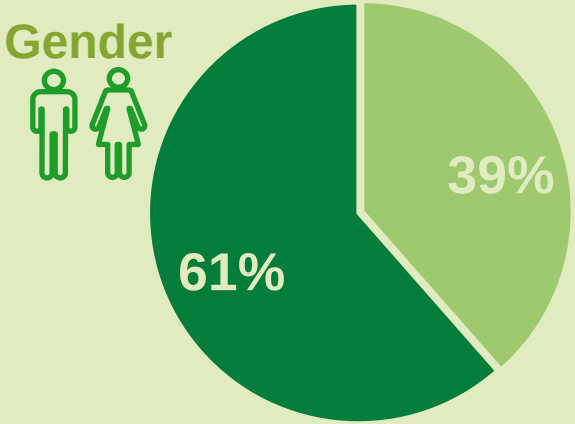
- ✓ In May 2018, the sudden increase in temperatures for 14 days caused a significant loss in production of colored grapes in Rafah, and in 2019 the same issue has appeared in Shaikh Ejlin (Climate Change, Agriculture and Gender in Gaza , Oxfam 2020)..

7

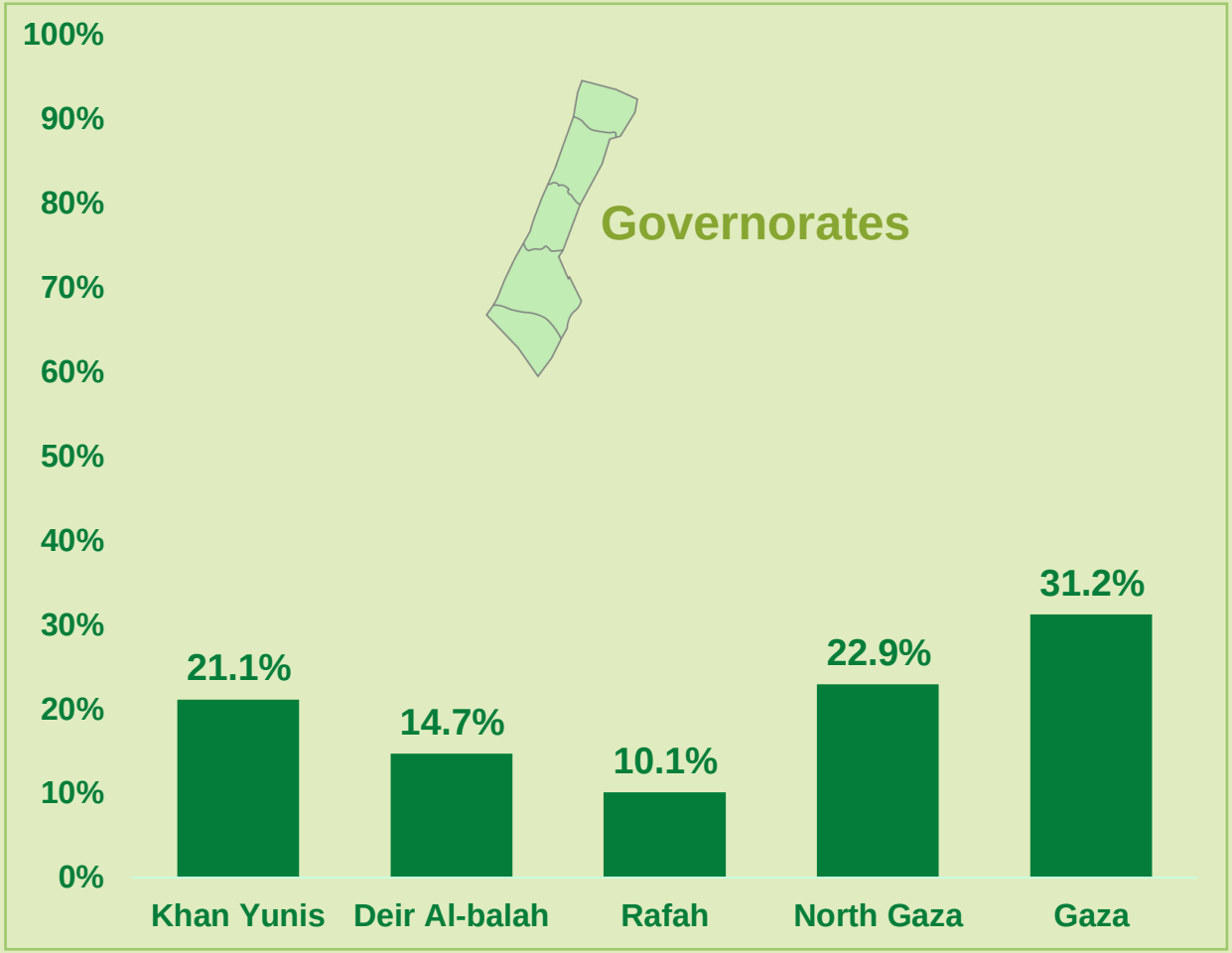
Key Findings

Demographic Data of Surveyed Farmers

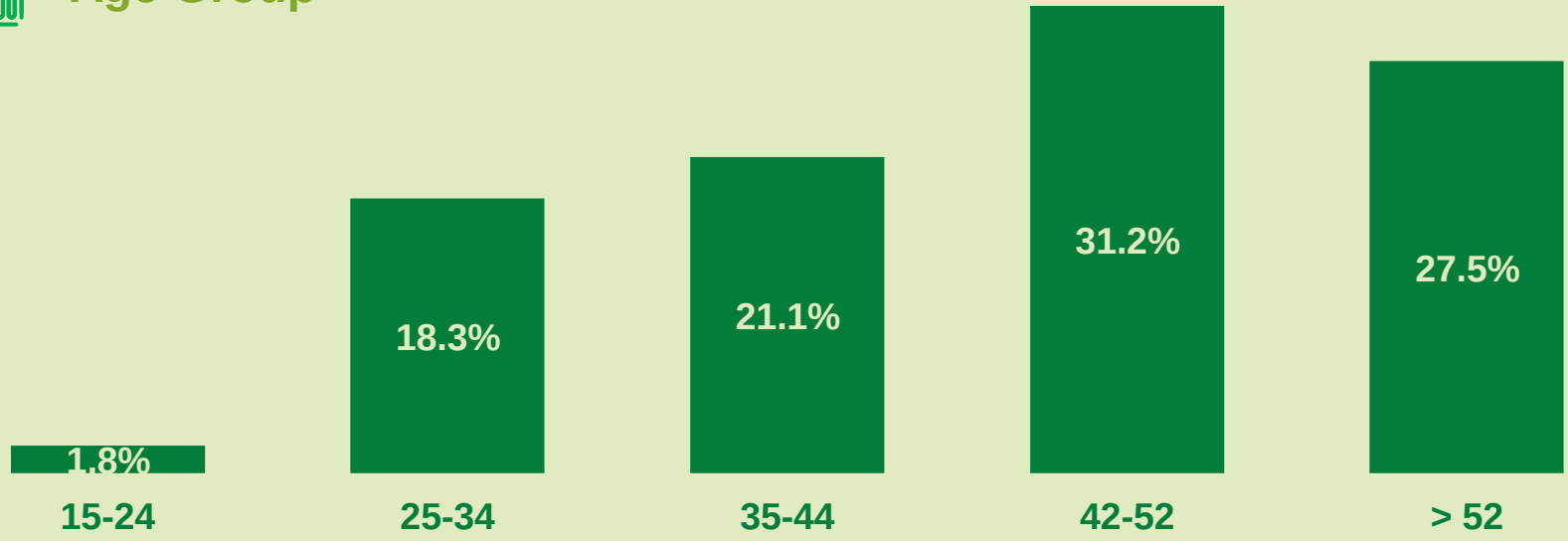
Gender



Governorates

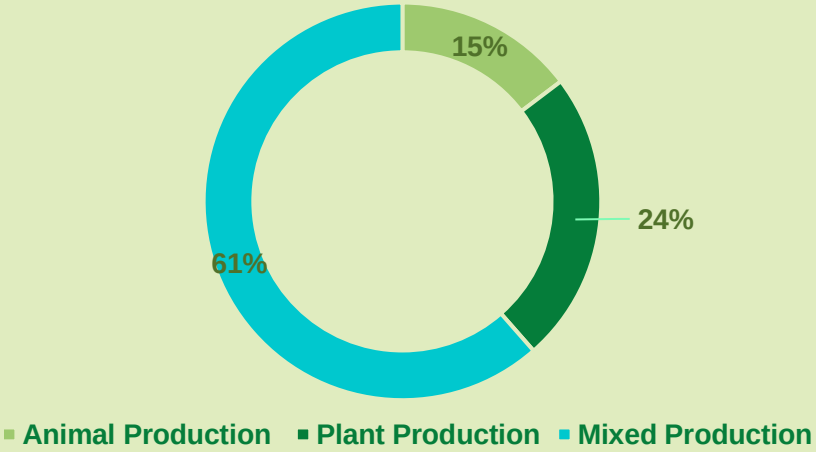


Age Group

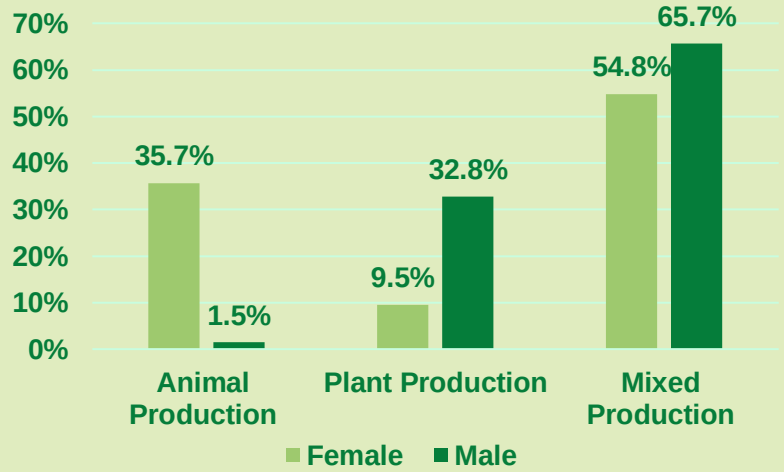


Details about Agricultural Holding

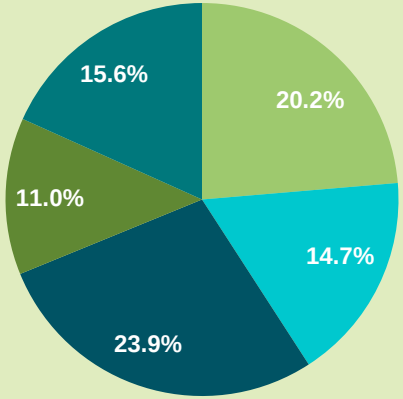
Type of Agricultural Holding



Type of Agricultural Holding Based on Gender



Size of cultivated land (N=93)

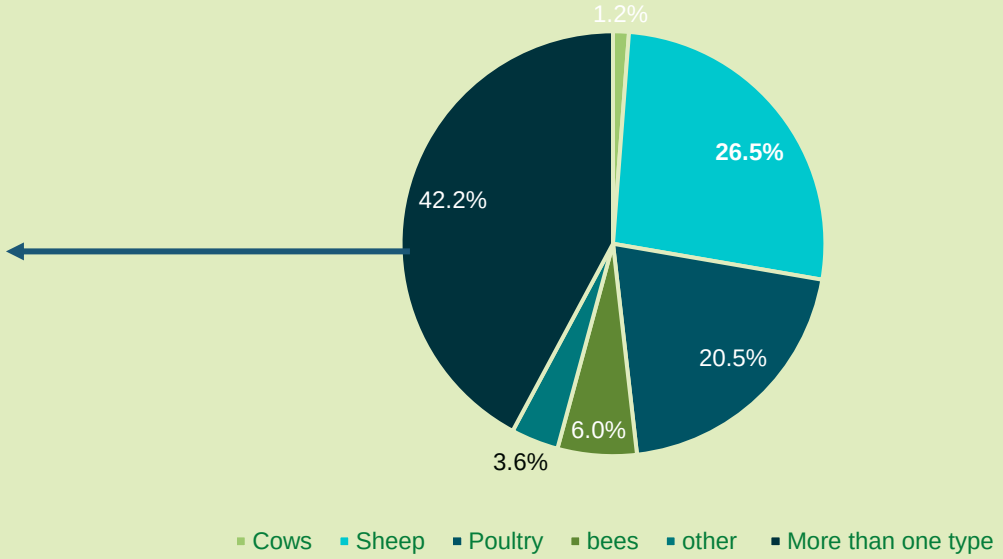


(1 donum or less) 2-3 donum 4-5 donum 6-10 donums > 10 donums

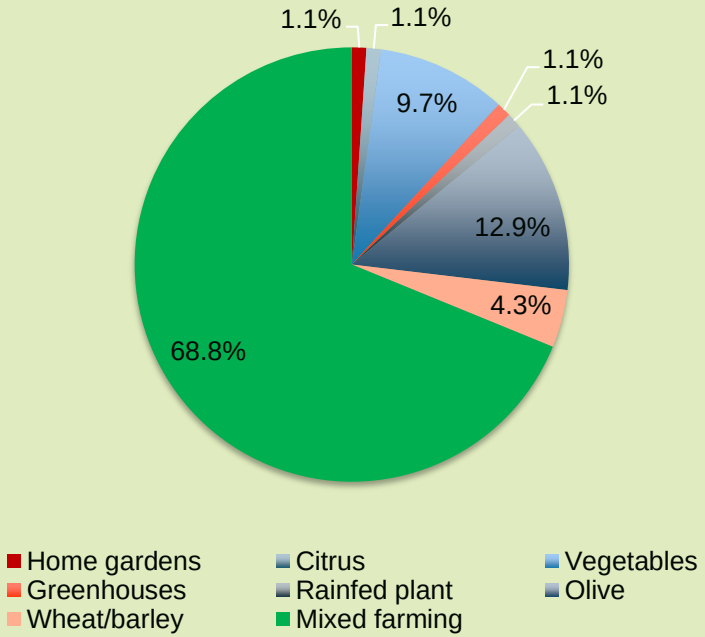
Type of Animal Holding (N=83)

The following chart presents the type of animal holding and the table presents the distribution of animal holding for the farmers who have more than one type of holding.

Type	Frequency
Cows, Sheep	3
Cows, Sheep, poultry	3
Cows, Sheep, poultry, bees	1
Cows, Sheep, bees	3
Sheep, poultry	13
Sheep, poultry, other	2
Sheep, poultry, bees	1
Sheep, other	2
Poultry, other	3
Poultry, bees	4
Total	35



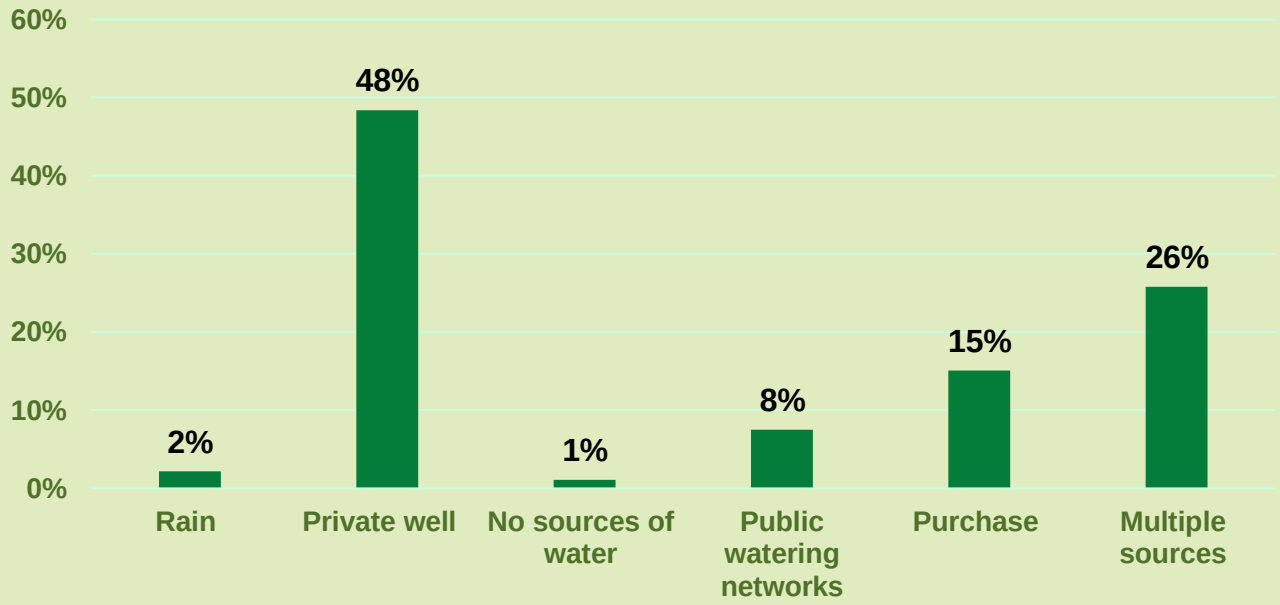
Type of Agro-activities (N=93)



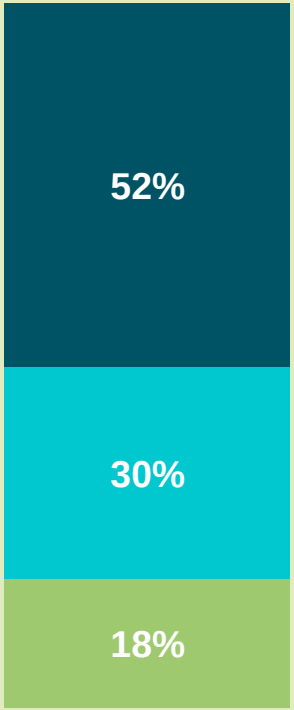
About 69% of farmers cultivate multiple types of crops rather than relying on one. The practice of mixed farming is considered a resilient and positive adaptation strategy.

For more details about mixed plant holding please look at Table 2 in the report word version

Source of watering



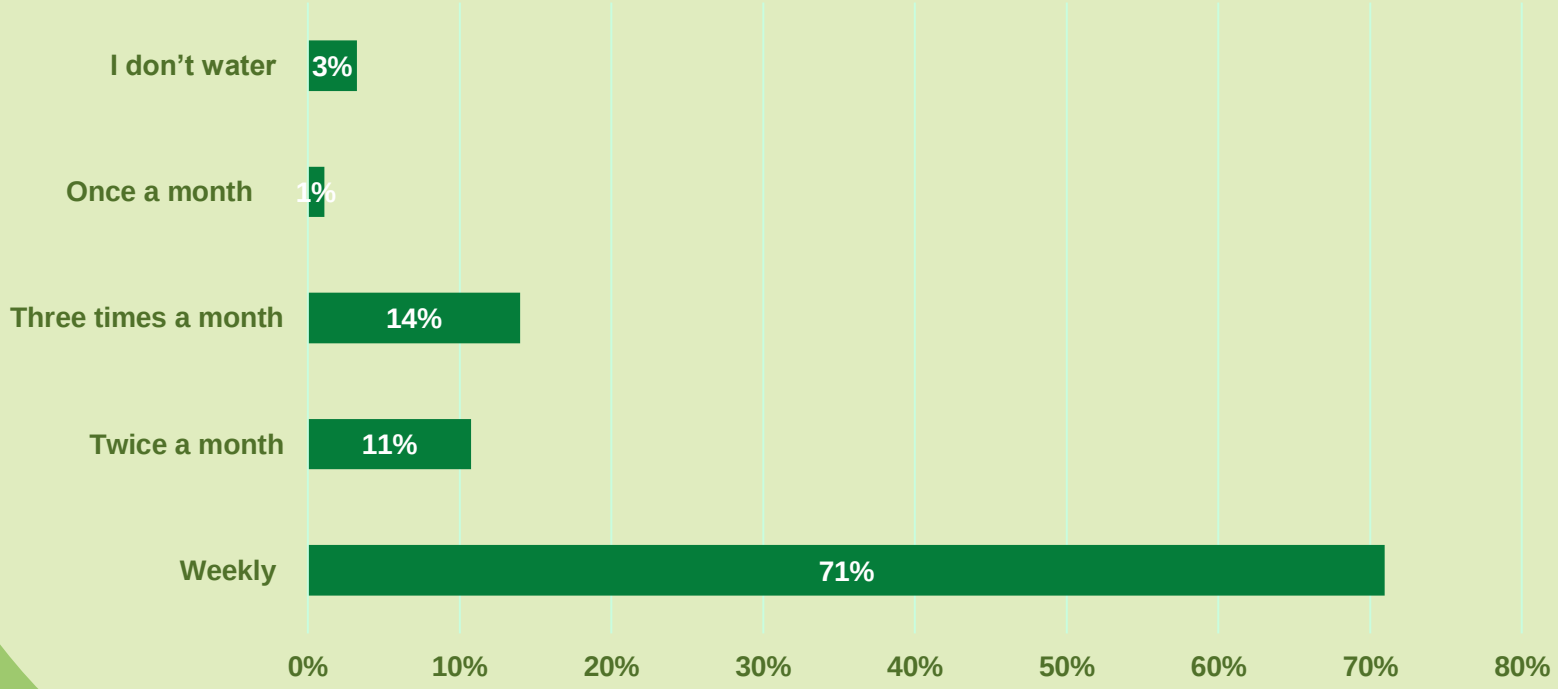
Frequency of plowing the land per year



Once Twice Three times or more

Impact of Climate Change on Agriculture Sector(GUPAP-ICRC 2022-Gaza)

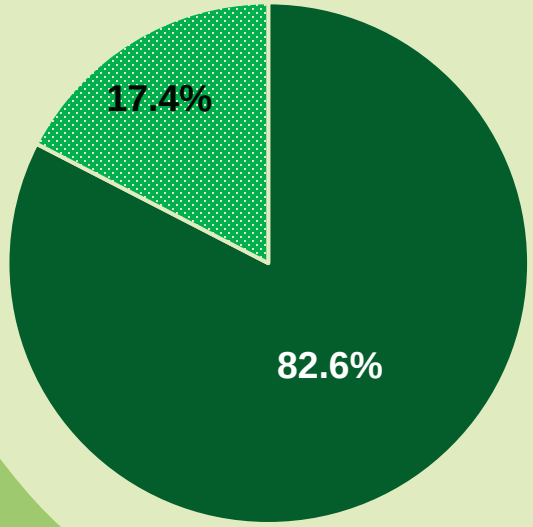
Times of Watering



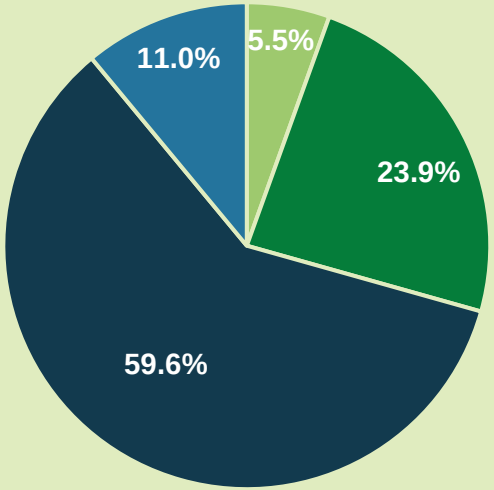
Farmers' Knowledge Level

Most of farmers failed to properly define climate and weather

Do you know the difference between climate and weather?



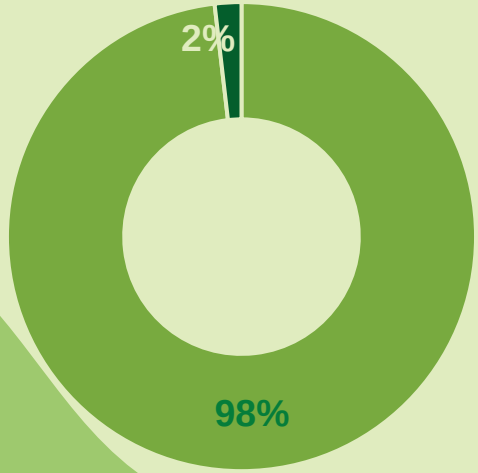
How do you evaluate your knowledge of climate change and its impact?



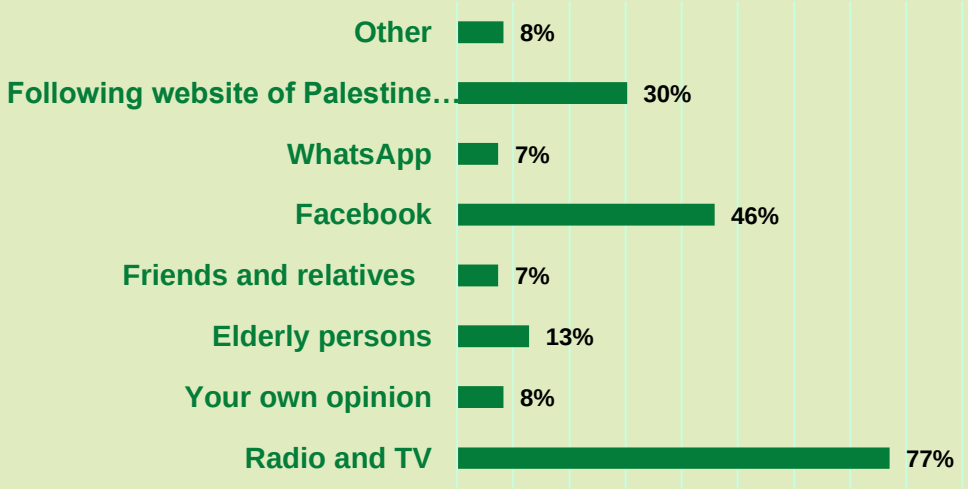
Impact of Climate Change on Agriculture Sector(GUPAP-ICRC 2022-Gaza)

Most of the farmers are interested in following on weather forecasts to make sure they take the best precautionary measures based on their capabilities. The most commonly used sources to know weather forecasts are Radio, TV and Facebook.

Are you interested in knowing and following the weather and climate change?

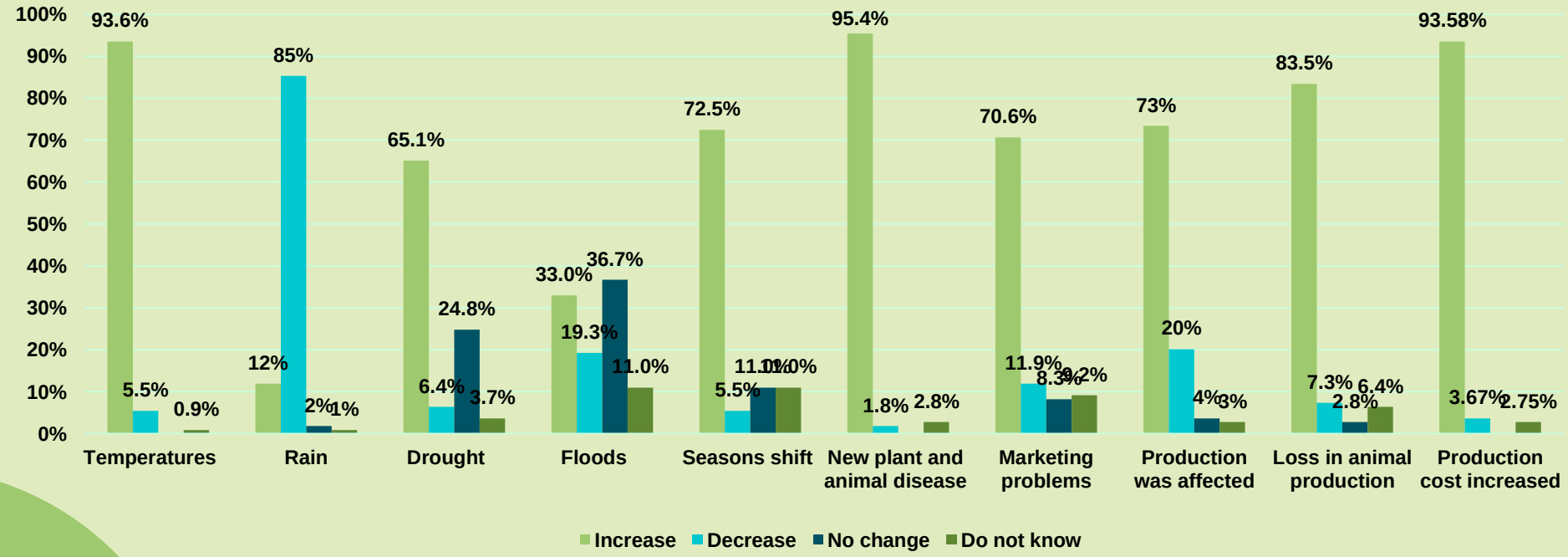


What is your source of information to know about the weather forecast and climate change



Note: Most of farmers depend on more than one source of information

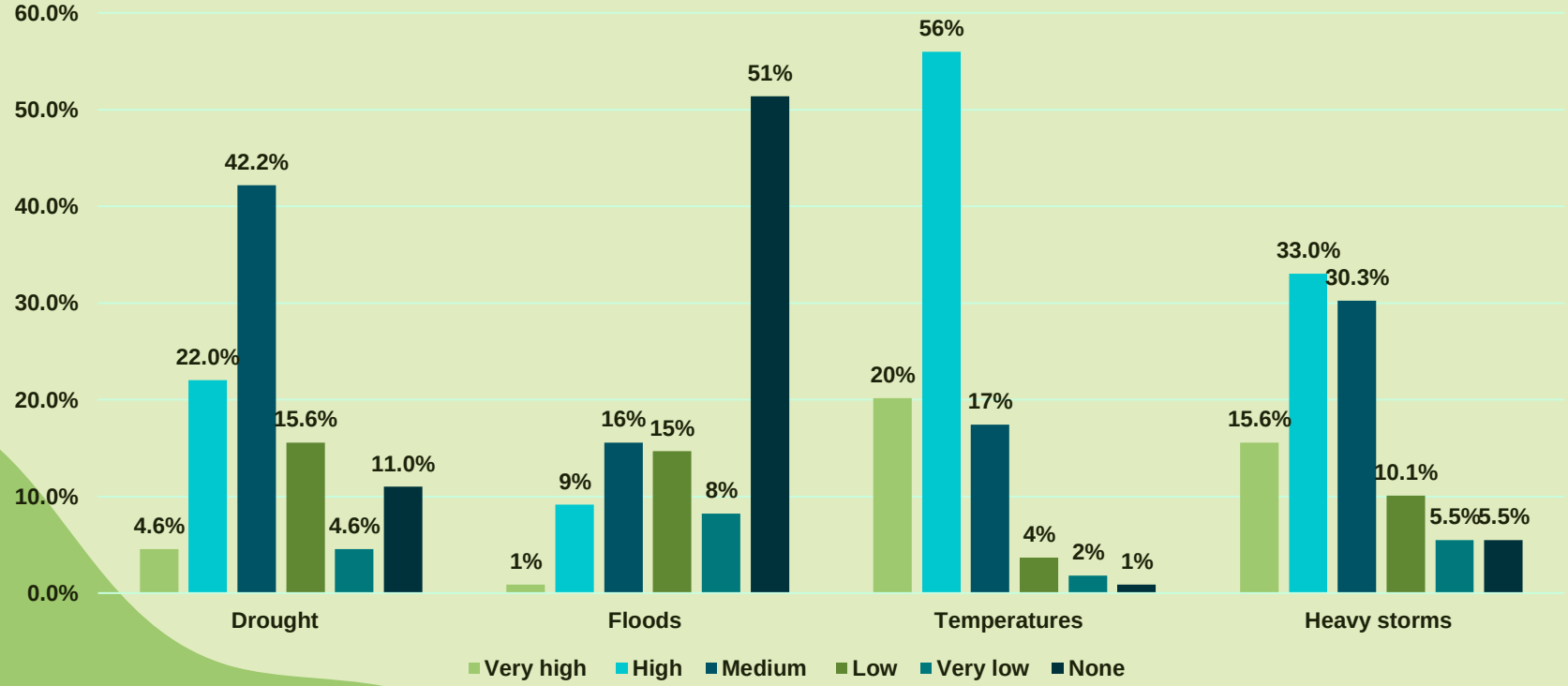
Farmers' perception on climate changes and its impact over the past 10-years



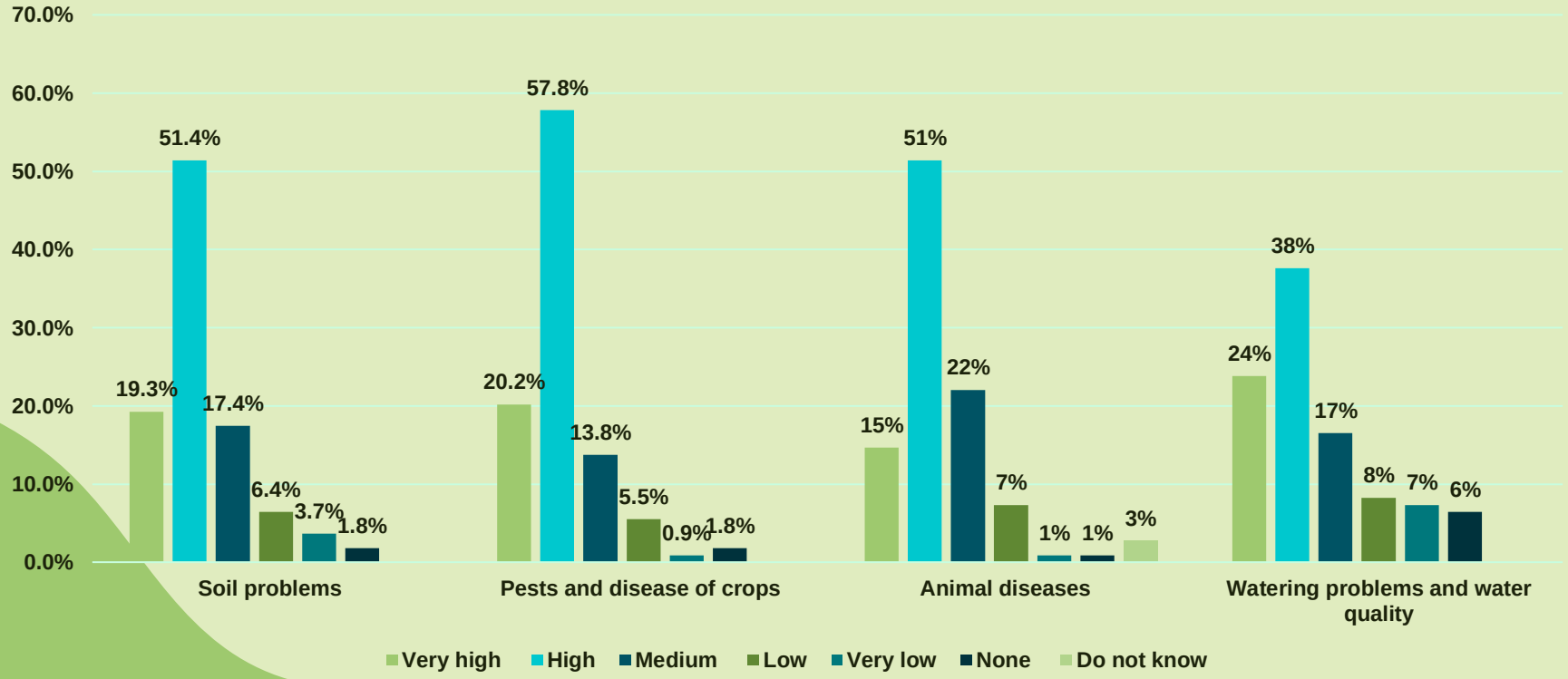
- ✓ The highest negative impacts reported by the farmers due to climate changes are increasing production costs, increasing temperature, and appearance of new plant and animal diseases.
- ✓ More than 85% of the farmers reported that the rainfall is declining, but this season (winter 2021-2022) is much better than the previous seasons.
- ✓ Floods are uncommon in Gaza, but when there is heavy rain, some lands will be affected- especially lower areas and areas near valleys.
- ✓ As reported by 72.5% of the surveyed farmers, season shift is increasing.

Frequency of seasonal risks associated with climate change over the past 10 years

The most frequent risk is temperature since 76% of farmers indicated that this risk is frequent to a high or very high degree, while flooding is the least frequent risk.

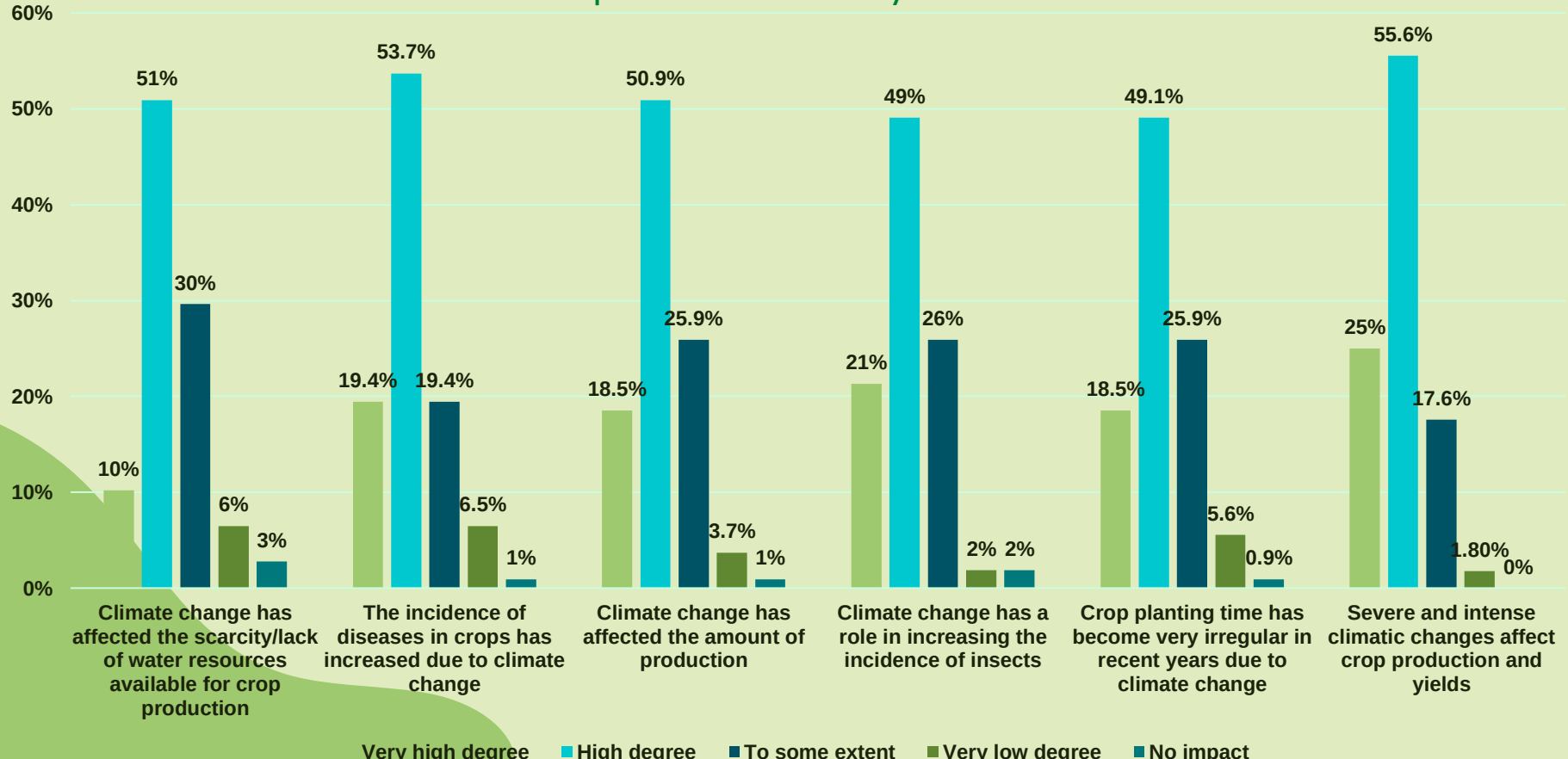


In the chart below, pests and diseases of crops are the most frequent risk since 78% of farmers indicated that it is frequent to a high or very high degree

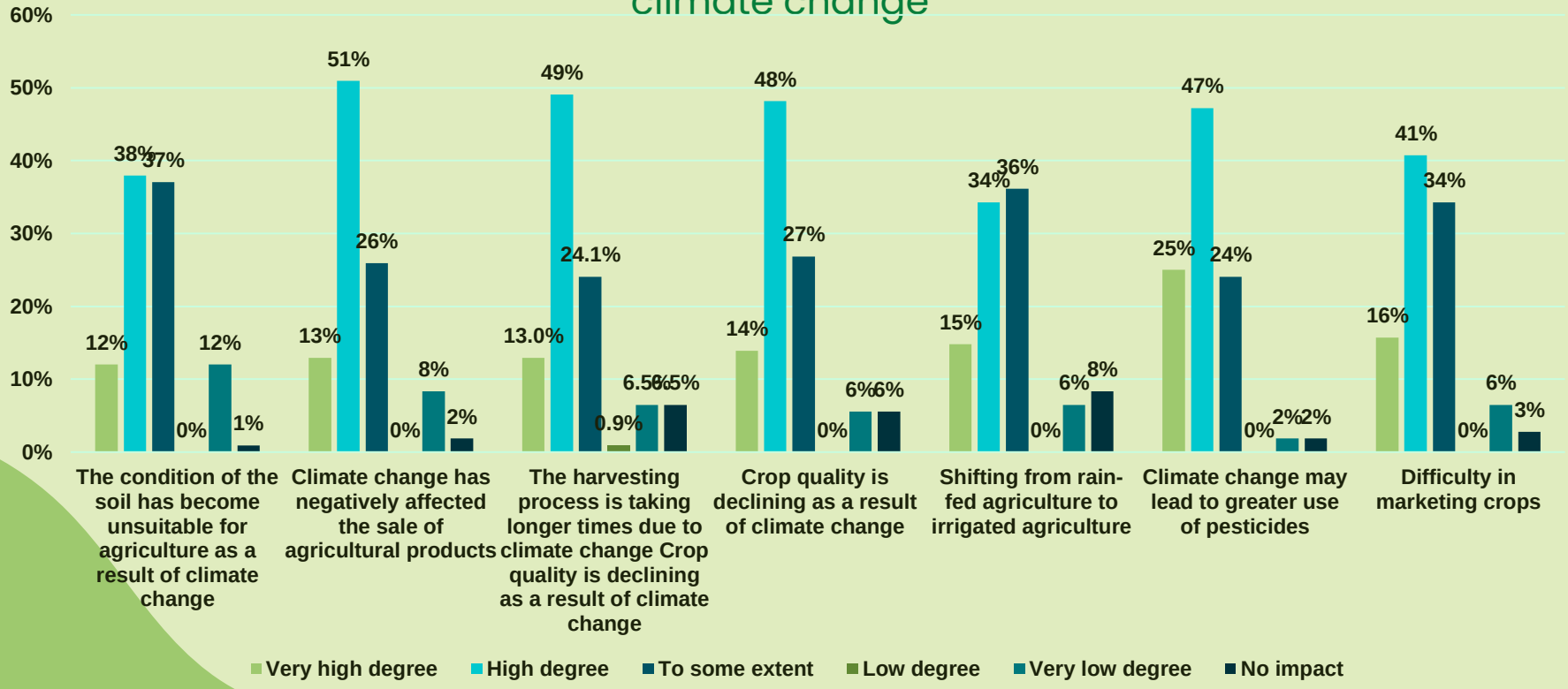


The perceived & expected impact of climate change on crop production (What is the degree of impact of the following items related to climate change?):

In the chart below, about 50% of surveyed farmers indicated that the following items are highly affected by climate change, and the most affected item is crop production and yields

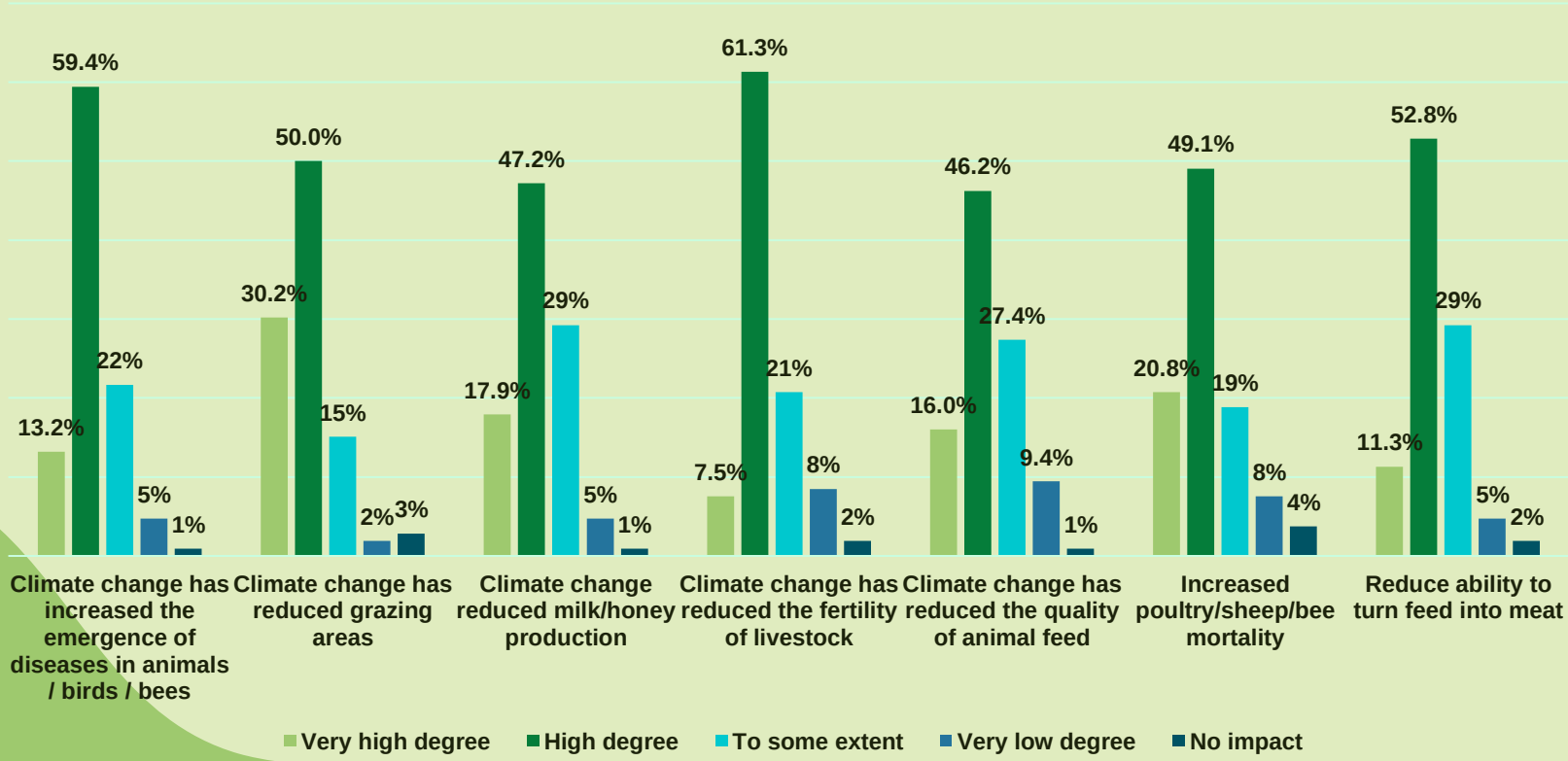


The following items mentioned in the chart below are relatively highly affected by climate change

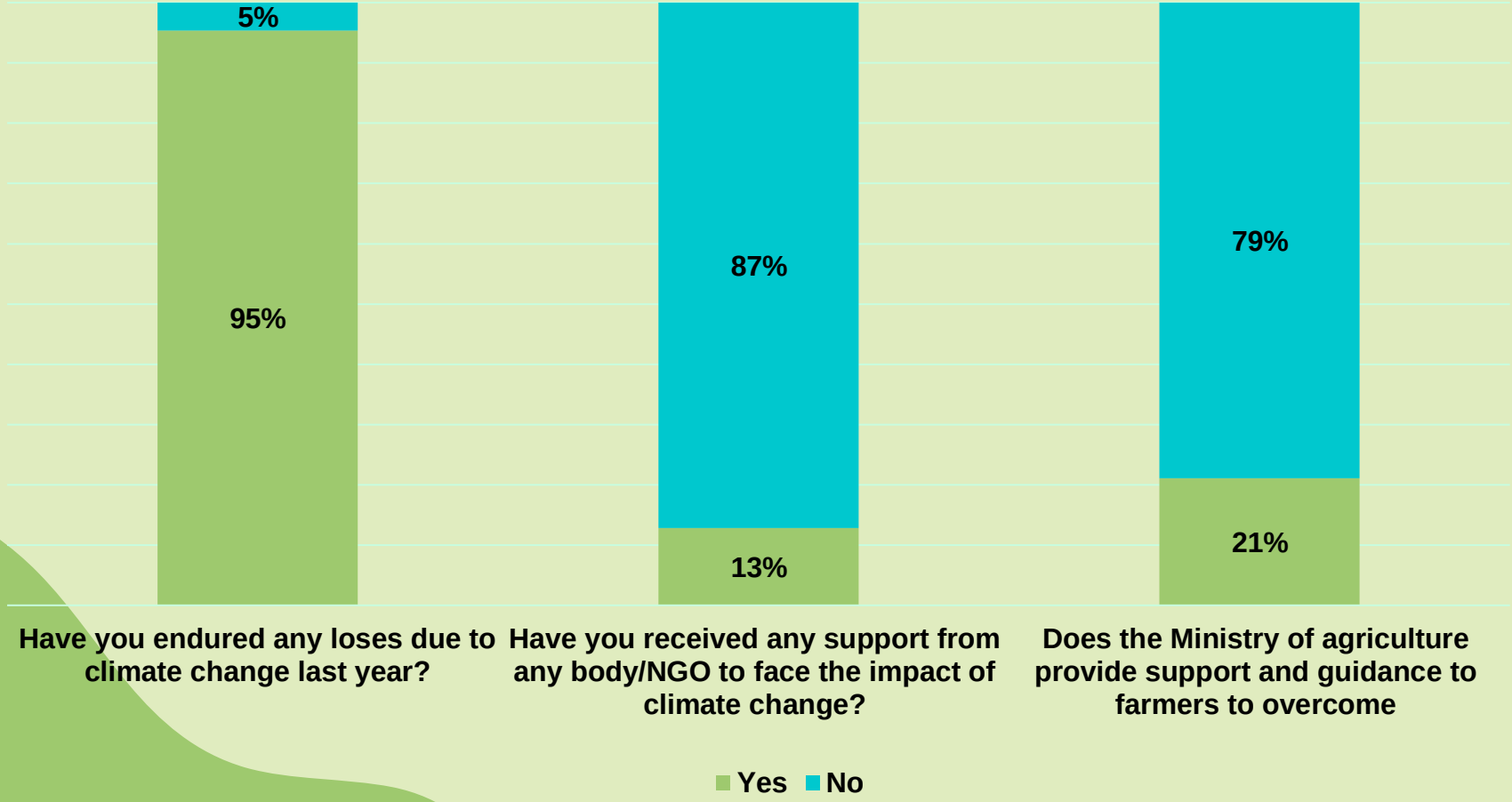


The perceived & expected impact of climate change on animal production (What is the degree of impact of the following items related to climate change?):

The highest impact on animal production was noted on reducing grazing area, and the emergence of animal diseases.



Climate Change Losses & Support


5%
95%
87%
13%
79%
21%
Have you endured any loses due to climate change last year?
Have you received any support from any body/NGO to face the impact of climate change?
Does the Ministry of agriculture provide support and guidance to farmers to overcome
Yes
No

Impacts of Climate Change (Based on FGDs Findings with Farmers)

Impact on Plant Production

- ✓ Strong winds caused the blowing of the almond blossoms and broke some trees.
- ✓ Some farmers used excessive pesticides & insecticides, which affected the soil and plants.
- ✓ In winter 2022, the farmers in North governorate reported that they planted potatoes later than usual due to heavy rain.
- ✓ Due to the very low temperatures, frost can form in greenhouses which kills seedlings and hampers production.
- ✓ The heavy rain has caused the failure of many crops such as potatoes, watermelons, and melons.
- ✓ Because of the lack of rainfall in previous years, the water level in the aquifer has decreased, which caused water salinity in some areas.
- ✓ Heat and strong sunlight caused the product to burn and dry, and power outages made matters worse since irrigation hours were tied to electricity delivery hours.
- ✓ The high temperatures resulted in significant loss of citrus and olive production, where the high temperature affected the blossom and in turn affected the fruits.
- ✓ Shifting of seasons(delayed rain) led to a delay in wheat sowing time.

Impact on Plant Diseases

- ✓ An increase in nematode activity and reproduction in high temperatures and humidity affecting negatively on vegetables, almonds, and guavas
- ✓ Spreading of La Gommose disease in high temperatures and humidity affecting negatively on apricot, almond, and peach trees.
- ✓ Citrus viral yellow and dwarf disease that affects citrus due to soil diseases.
- ✓ Silver disease or spider rust that affects citrus, especially lemon.
- ✓ The spread of blight, a bacterial disease that affects grape trees due to the lack of rain, which leads to a decline in the quality and quantity of the crop.
- ✓ Excessive spread of snails in the eastern areas of the Gaza Strip causes tree erosion and crop destruction because they crawl along with the wind, and the cost of their treatment is high (per liter, $100).
- ✓ The olive cotton bug or olive psylla is one of the insects that infects olive trees in the spring and early summer and causes heavy losses in the crop (become active with temperatures increasing).
- ✓ The peacock eyespot that affects olives due to moisture/humidity.
- ✓ Spreading of olive tuberculosis due to the moisture/humidity.
- ✓ Tomato leaf miner (Tuta absoluta): it is considered a destructive pest for tomatoes. (As mentioned by farmers in Johr Al-Deek and Khanyounis it appeared in frost, but actually, it appeared in Summer and this contradiction is justified by MoAgr that the farmers maybe not manage it once its appearance and it became adapted to the greenhouse atmosphere).
- ✓ Palm weevil, which is an imported pest, becomes active with high temperatures.

Impact on Animal Production

- ✓ The increasing of mortality rate among poultry and sheep.
- ✓ The emergence of foot-and-mouth disease in sheep and Newcastle disease in poultry in extreme heat.
- ✓ Some poultry farms that used traditional raising way (old design farms) has stopped due to their inability to cope with climate change negative impacts.
- ✓ Strong winds facilitate the spread of infection among poultry, especially common cold/flu.
- ✓ The intense heat and humidity resulted in scabies in rabbits and smallpox in sheep.
- ✓ Frequent diarrheas of rabbits as a result of weather fluctuations.
- ✓ The death of many beehives due to weather fluctuations.

Agricultural Experts' comment on farmers' opinions regarding pests, insects, and diseases that appear as a result of climate change:

- Generally, pests are more prevalent at high temperatures, but if they are not treated as soon as possible, they may adapt and remain throughout the year, especially in greenhouses, which provide a suitable temperature for them.

- When the temperature rises, insects become active. Among the insects that become destructive if they spread and are not mentioned by farmers is the whitefly insect. Whiteflies infested the watermelon crop four years ago, resulting in the destruction of 600 donums out of about 3500 donums.

  The snail greatly affects the marketing value of leafy crops in the event of its spread, and it is highly active in the spring and early summer.

Agricultural Experts' comment on farmers' opinions regarding pests, insects, and diseases that appear as a result of climate change:

- Agricultural experts and specialists indicated that some diseases are linked to a specific season and affected by climate change, for example, the peacock eye appears as a result of humidity, the olive psylla appears in the months from March to May and appears as a result of humidity, silver disease or spider rust that affects citrus, especially lemon, which appears in low temperatures.
- The high humidity in winter as high negative impact on wheat, where it facilitate the spread of Loose Smut disease.

  There are other diseases not mentioned by farmers, such as late blight fungus, which affects vegetables, especially cucumbers and potatoes, as a result of persistent frost.

Agricultural Experts' comment on farmers' opinions regarding pests, insects, and diseases that appear as a result of climate change:

- Some farmers may not distinguish between powdery mildew and downy mildew. Therefore, the appropriate pesticide is not selected and this negatively affects the plant. (Note: Downy mildew appears when low temperatures and high humidity coincide, while powdery mildew appears when high temperatures and high humidity coincide).

- There are soil-borne diseases that are affected by climatic changes such as Rhizoctonia & Phytophthora. In the case of low temperatures, the farmer may use excessive organic fertilizers, or in the case of high temperatures, excessive pesticides, and this will negatively affect the soil.

- In terms of diseases related to animal production, in the current year, Newcastle disease appeared among poultry in a large proportion, and the disease spread with high temperatures.
  In poultry, the high temperatures or severe coldness disturb the efficient conversion of the fodders into the meat.

Adaptation Strategies followed by Farmers (Based on FGDs Findings)

Plant production

- ✓ Shifting from growing citrus fruits to growing olives or other fruit trees that do not need large amounts of water and pesticides (In Rafa governorate)
- ✓ A negligible number of farmers shifted from growing grapes to growing orange trees, as they thought it is more profitable (In Gaza governorate).
- ✓ Cover crops with nylon, such as zucchini and eggplant, because they cannot tolerate low temperatures, and heavy rain may cause holes in the crop.
- ✓ Intense irrigation of crops in the event of high temperatures, but this negatively affected some crops (yellowing of the plants) as reported by farmers in Gaza governorate.
- ✓ Shifting from growing Souri (type of olive) to growing K18 olives because peacock eyespots are more prevalent in Souri olives.
- ✓ Cultivation is done from once to twice a year instead of three times in order to reduce soil problems and the spread of pests and diseases.

Plant production

- ✓ Delaying the cultivation time or cultivating earlier.
- ✓ Some farmers installed solar energy systems on their farms as an alternative source of electricity.
- ✓ Pruning palms in winter instead of summer in order to avoid the spreading of palm weevil that became active in high temperatures. Additionally, the palms are also sprayed from 10 to 20 days and anti-insects protection mesh are used.
- ✓ When holes occur in the palms due to palm weevils, a mixture of mud and straw is prepared and placed to fill the holes.
- ✓ To avoid the loss of almonds, cactus trees are planted around them.
- ✓ Spraying of insecticides to control insects spreading.
- ✓ Tightening the greenhouse nylon in the winter season.

Animal production

- ✓ When the soil humidity is high, wood shavings are placed to absorb humidity (mentioned by farmers in Khanyounis and Beit Hanoun)
- ✓ Regular vaccinations for animals, especially if their numbers are large.
- ✓ Primary sterilization to control the transmission of infectious animal diseases, especially water sterilization, which is a major source of disease transmission.
- ✓ Establishing the gestation periods to avoid giving birth in winter, which in turn leads to the death of many newborns due to weather changes.
- ✓ Feeding animals grass instead of fodder, which has become indeed too expensive for farmers to buy.
- ✓ The farms are heated in the winter using heating systems, to avoid the death in young broiler chickens due to low temperatures.

Animal production

- ✓ Some farmers have replaced the grass by alfalfa and corn because they are more beneficial.
- ✓ Some farms and barns use a heating system, where a barrel called "a pylon", is used to ignite firewood, then it is placed on the barn's door to help entering the warm air inside and getting rid of the smoke outside.
- ✓ Placing the broiler chickens in cages instead of the floor, as it is better for poultry in terms of avoiding moisture, is more productive, and the death rate becomes lower.
- ✓ The use of water sprinklers in poultry farms during extreme heat to reduce temperatures

Experts' comment on farmers' feedback regarding adaptation practices with climate change:

- Changes in the climate can be either positive or negative. On the positive side, the amount of rain and the hours of coldness may positively affect the production of olives, grapes, etc., but on the negative side, the increase in the amount of rain may negatively affect some vegetables such as zucchini and may lead to the dump of some agricultural crops such as strawberries in North Governorate.

- Farmers are trying as much as possible to work to adapt with climate changes, but some farmers, especially greenhouse farmers and poultry farms, do not have the financial capacity to work on the preparation in a large way. About 1500 poultry farms lack adequate infrastructure and are subject to fluctuations in temperature, wind strength, and rain. The more severe ones are at risk of drowning.

Experts' comment on farmers' feedback regarding adaptation practices with climate change:

- The interventions of the Ministry of Agriculture focus more on the guidance and counseling aspect. Some farmers receive some materials to resist climate change, such as agricultural-mesh and nylon, and this aspect depends on the interventions implemented by non-governmental organizations.
- Ministry of Agriculture is educating farmers about strategies to adapt climate changes for some crops, for example, the farmers of exposed tomatoes were directed to put protective shading covers to reduce the temperatures. Regarding olive tuberculosis, they were directed and large posters were made and distributed to the olive oil presses during the olive season.
- PARC provided olive growers in the Sudania area with simple equipment such as (ladders, scissors, and disinfectants) and directed them to the pruning mechanism to prevent the spread of the disease.

The obstacles to taking the necessary measures to reduce the risks of climate change

From the Farmers' Point of View

The obstacles

- ✓ The absence of the role of ministries, such as the Ministry of Agriculture, which shoulders the great responsibility for what's going on with farmers, as it sponsors/funds large projects rather than small ones.
- ✓ The absence of policies supporting farmers.
- ✓ No financial compensation had been awarded to farmers who suffered from the damage that caused by the Israeli repetitive aggressions on the Gaza Strip which in turn exacerbate their inability to be well-prepared in order to reduce the potential negative climate changes.

The obstacles

- ✓ The high prices of modern technology devices that limit the impact of climate changes and are beyond the capacity of farmers such as greenhouse climate control system .
- ✓ Pesticides and animal medicines used in agriculture are often of poor quality, as farmers have reported. But as mentioned by experts, this is not a matter of pesticides' quality but is rather resulted from wrong farming practices, where excessive pesticide use makes pesticides less effective.
- ✓ Frequent power cuts affect the watering times for crops or the turning on cooling or heating system in poultry farms.
- ✓ The high price of some types of pesticides, which exceeds the financial capacity of the farmers.

Enablers to ensure sustainable adapting with climate changes

From the Farmers' Point of View

Impact of Climate Change on Agriculture Sector(GUPAP-ICRC 2022-Gaza)

Enablers to ensure sustainable adapting with climate changes

- ✓ Raising the awareness of farmers and implementing capacity building activities on climate change, its effects, and how such effects should be handled.
- ✓ Compensating farmers and providing them with productive inputs, pesticides and fertilizers, especially small farmers.
- ✓ Holding sessions to share experiences and capacities among the farmers on a continuous basis.
- ✓ Activating the national plans developed for the agricultural aspect.
- ✓ Developing clear national strategies that help farmers facing climate changes and adapting to them.
- ✓ The Ministry of Agriculture should play a primary role in providing on-going follow-up and guidance to farmers.
- ✓ Providing seeds, seedlings and new crop varieties that adapt with the climatic changes in the Gaza Strip.

Enablers to ensure sustainable adapting with climate changes

- ✓ Encouraging the local product and activating the import substitution policy.
- ✓ Creating a website for climate changes to constantly publicize awareness-raising and outreach activities and provide accurate predictions of weather conditions and provide technical advice to farmers.
- ✓ Entering the agriculture smart farming techniques and providing projects that aim at raising farmers' capacities to overcome the impact of climate change.
- ✓ Supporting farmers to have a source of renewable energy instead of reliance on electric power supply.

Findings of FGDs and Interviews with Actors

Findings of FGDs and Interviews with Actors

- ✓ The actors emphasized that climate changes began to appear clearly in the last two decades, through the fluctuations in rainfall in terms of time and amount and recurrent heat waves.
- ✓ Decreasing the amount of rainfall led to a decrease in the amount of aquifer water. Therefore, the salinity of the aquifer water has increased.
- ✓ Unprecedented heat waves have reduced crop productivity.
- ✓ The lack of sufficient coldness hours in the previous seasons affected the production of crops, especially olives and almonds
- ✓ High temperature increase the spreading rate of insects.
- ✓ Regarding the challenge of seasons shifting, not all farmers have the ability to deal with it as required, but some farmers deal with it in terms of irrigation times and periods (watering for longer periods), but few of them are starting to deal with the challenge of seasons shifting by delaying cultivation times.

Findings of FGDs and Interviews with Actors

- ✓ In rainfed crops such as wheat, grapes and olives, farmers are forced to use supplemental irrigation instead of relying entirely on rainwater.
- ✓ There are a lack of focused studies/ researches related to climate change impact on agriculture.
- ✓ Some organizations started to implement interventions related to adapting to climate change. For example, FAO support the infrastructure of greenhouses.
- ✓ Currently, there is a plan for a project to be implemented by ICRC as reported by the head of the animal production department in MoA- Khan Younis. The project aimed to convert poultry farms from an open system to a semi-open system (from nylon Zinco), which would improve ventilation and control temperature and, consequently, reduce the need for antibiotics in the poultry farms.
- ✓ The actors confirmed that the farmers realized the climate change risks and start to take steps in taking the protection and adaptation measures within their financial capabilities.

Findings of FGDs and Interviews with Actors

- ✓ Based on the stakeholders' observations, the measures used to mitigate the effects of climate change by farmers are simple adaptation strategies that are commensurate with their financial capacity.
- ✓ Some farmers search on new crops that more adaptive with climate change risks.
- ✓ In order to enhance the production quality, decrease the consumed water quantity, and control the temperature degrees, there is more tendency toward planting in greenhouses rather than in the open fields.
- ✓ As reported by actors, the farmers preferred to cultivate crops that withstand the water salinity such as vegetables (Tomatoes and peppers).
- ✓ Some farmers started raising poultry in cages rather than traditional raising (using old design farms) to avoid moisture/wet land, and decrease the disease.
- ✓ There was a large percentage of deaths in poultry due to the high temperatures, so farmers had to use large-sized fans to reduce the heat in poultry farms.

Findings of FGDs and Interviews with Actors

- ✓ In order to adapt with possible climate changes, MoA introduce some new crop verities that are more capable to adapt with climate changes such as Picual olive and some almonds and grape verities. Additionally, introducing new system as hanging strawberries.

- ✓ Another adaptation strategies, encourage the strawberries farmers in Beit Lahia to build stormwater infiltration boreholes to avoid flooding as happened in season 2021, encourage poultry farmers to direct to the close system farm.

Enablers to ensure sustainable adapting with climate changes

From the Actors Point of View

- ✓ Considering climate changes in agricultural development strategies.
- ✓ Encouraging research centers to find solutions to deal with the risks of climate change and its impact on the agricultural sector.
- ✓ Benefit from the experience of other countries in dealing with climate change.
- ✓ Work on sustainable management of resources, especially water.
- ✓ Activating the role of local authorities in facing some climate changes that may cause disasters such as floods, as happened in Beit Lahia previously.
- ✓ Establishment of the Agricultural Insurance Fund to support the effects of climate change.
- ✓ Raising the awareness level of farmers regarding climate changes impacts and adaptation measures.

The capacity of local authorities, weather stations and universities to deal with the climate challenge

- ✓ The related local authorities and universities are aware of the climate change concept and its impact on different sectors, but their financial and technological capacities are weak. Meanwhile, there are no specialized experts in climate change within the MoA staff.

- ✓ The NGOs don’t pay high attention toward encouraging youth and researchers to suggest innovative solutions to deal with climate change impact.

- ✓ Lack of real efforts towards the environmental challenges on the ground, and universities don’t have a sustainable concentration on climate issues which can be part of the academic curriculum.

The capacity of local authorities, weather stations and universities to deal with the climate challenge

- ✓ In general, Local universities are lacking financial resources and funding for research. However, Al Azhar university and Islamic university recently established a research collaboration in climate change for postgraduate students. The researches topics are related to climate modelling, prediction, climate impacts on soil and water.
- ✓ Lack of resources and funding at local universities for climate change adaptation researches.
- ✓ There is no specialized research centers for investigation the solutions and introducing new technologies to deal with climate change risks.
- ✓ Weak coordination between NGOs, universities, and private sector concerning climate change issues.
- ✓ Lack of resources hinder the full implementation of the national strategy for climate change adaptation.

The capacity of local authorities, weather stations and universities to deal with the climate challenge

- ✓ MoA always tries to support the farmers and raise their awareness as it as possible, but the number of agronomists in MoA is an insufficient. Accordingly, MoA can't reach all farmers.
- ✓ Weak coordination between local organizations and universities concerning climate change issues.
- ✓ Lack of resources hinder the full implementation of the national strategy for climate change adaptation.
- ✓ MoA labs do not have all the necessary instruments, and some lab tests are not available in Gaza, consequently tests being conducted at the local universities or Israeli Lab.

The capacity of weather stations in Gaza

- ✓ The only meteorological station in Gaza, which is located in the University College of Applied Sciences- Khan Yunis Branch provides information on rain forecasts, wind speed, humidity, temperature, and dew.
- ✓ The metrological station is connected with an international system. The system collects readings, analyzes them, and publishes them.
- ✓ The Ministry of Agriculture has rainfall quantity monitoring stations scattered across Gaza's five governorates
- ✓ As mentioned by most of the interviewed actors the metrological readings are accurate, but it provide expectations for only 72 hours, and this case not all farmers are able to take the protection measures due to the financial limitation.
- ✓ The actors agreed on the accuracy of the weather forecast and said that it can be relied upon to a large extent.

8

Conclusion & Recommendations

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Annex1: List of the Interviewed Actors

Name	Position	Agency
Yaseen Al-astal	Head of Urban Planning Department	Municipality of Khanyounis
Omar Matar	Manager of Health and Environment Department	Municipality of Khanyounis
Osama Al-astal	Head of gardens and parks department	Municipality of Khanyounis
Asad Abu Tuaima	Head of Animal Production Department and Lecturer at UCAS	MoAg- Khanyounis
Haya Al-Agha	Head of Development and Invetismnet Department	Municipality of Khanyounis
Bilal Al-laham	Executive Director	Palestinian Farmers Association

List of the Interviewed Actors

Name	Position	Agency
Naser Deeb	Director General of Agricultural Extension	MoA- Gaza
Taher Abu Hamad	Head of Animal Production Department	MoA- Gaza
Ahmed Abu Abdo	Head of Environmental Health Department	Municipality of Gaza
Ghada Al-Khatib	Preventive Health Department	Municipality of Gaza
Shaimaa Abu Amira	Agricultural Engineer	Municipality of Gaza
Mahmoud Al-Ajouz	Lecturer- agriculture college	AL-Azhar University

List of the Interviewed Actors

Name	Position	Agency
Mohammed Abu Haiba	Lecturer & Expert in Renewable Energy	Islamic University
Nabil Abu Shamalah	Expert in Agriculture and Lecturer	Al-esraa University
Ahmed Abu Shabban	Consultant and lecturer	Al-Azhar University
Abdallah Al-Hamed	Responsible for metrological station	UCAS
Saad Ziada	Agricultural Sector Coordinator	UWAC and PINGO
Ferial Taha	Director General of International Relations	MoA

List of the Interviewed Actors

Name	Position	Agency
Wael Thabet	Managing director of plant protection	MoA
Ahmed Qasem	Director of pest-management department	MoA
Moeen Al-Agha	Head of irrigation and soil department	MoA
Ahmed Hilles	Chairman	National Institute for Environment and Development
Azzam Abu Habib	Environmental Expert	UNRWA
Adnan Ayesh	Lecturer- Geology Department	AL-Azhar University

Thank You