Palestinian Hydrology Group

Identifying Vulnerabilities and Climate Risks; Climate Change Adaptation / Implementation in Palestine

Dr. Ayman Rabi

Palestinian National Workshop on
Climate Change
26 - 28 January , 2015
Ramallah- Palestine

EU funded project

ClimaSouth

Palestinian Environment Quality Authority

PALAST
Promoting Science & Technology

What is Vulnerability?

Vulnerability is defined as “the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity”. (IPCC 2007)

EU funded project
ClimaSouth
Palestinian Environment Quality Authority
PALAST
Promoting Science & Technology

Parameters of Vulnerability

- **Exposure**: The nature and degree to which a system is exposed to significant climatic variations.
- **Sensitivity**: The degree to which a system is directly or indirectly affected, either adversely or beneficially, by climate variability or change.
- **Adaptive capacity**: The ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.

EU funded project
ClimaSouth
Palestinian Environment Quality Authority
PALAST
Promoting Science & Technology

Climate Risks

- Spatial and Temporal Climate Variability (Temperature, Rain, etc)
- Extreme Climate Events (Floods, Droughts, Winds, frosts, etc)
- Season Shift – Variability
- Rainfall intensity, duration, timing, number of rainy days

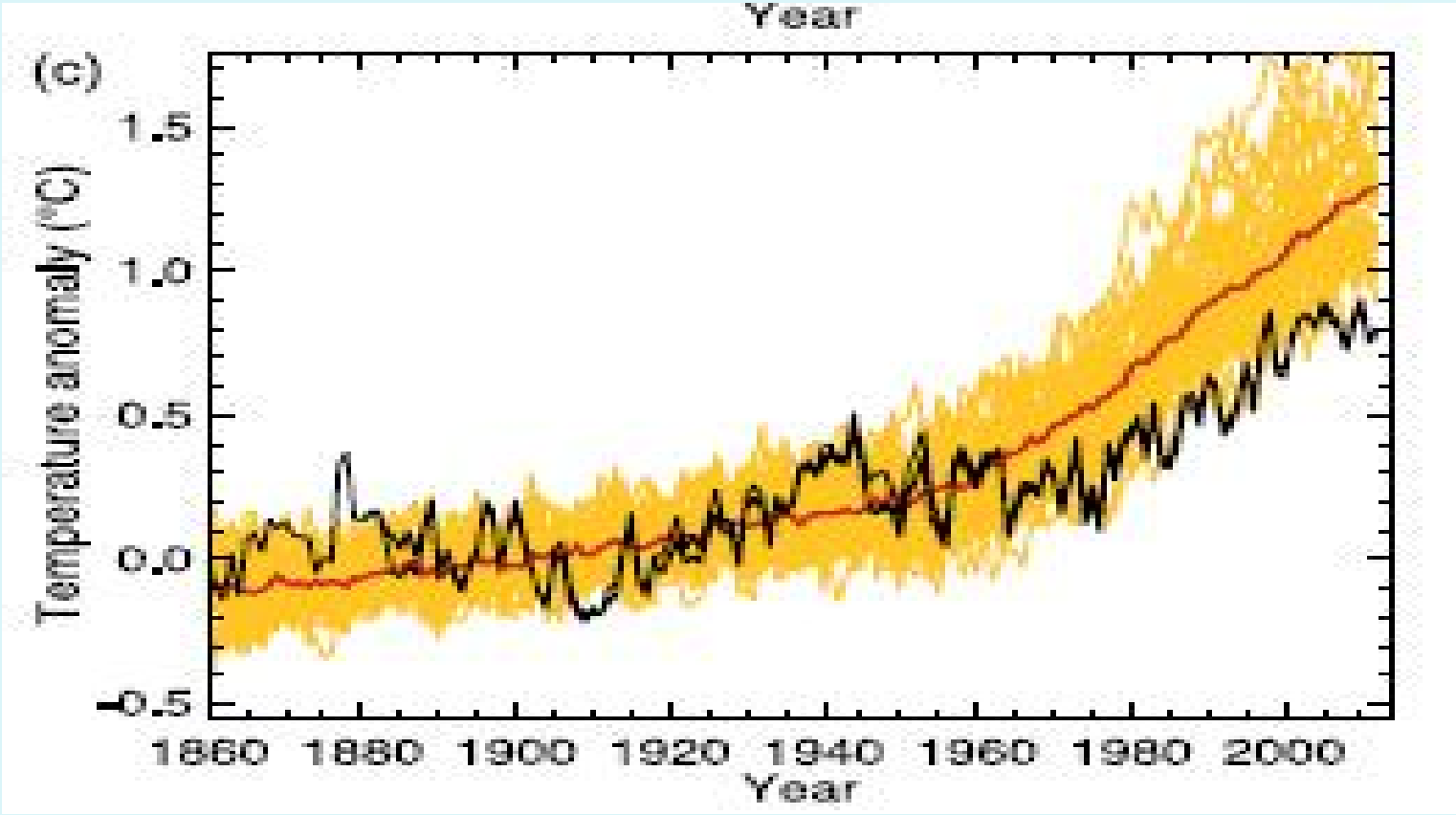
So What is the situation in Palestine????

EU funded project

Palestinian Environment Quality Authority

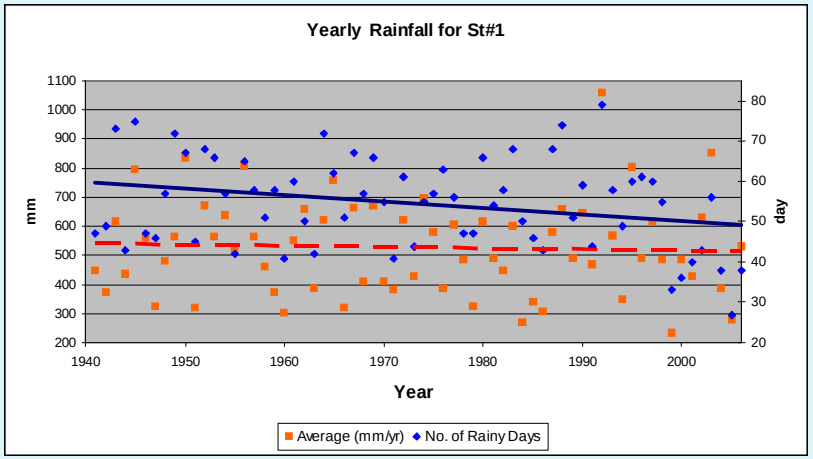
Promoting Science & Technology

Global Temperature

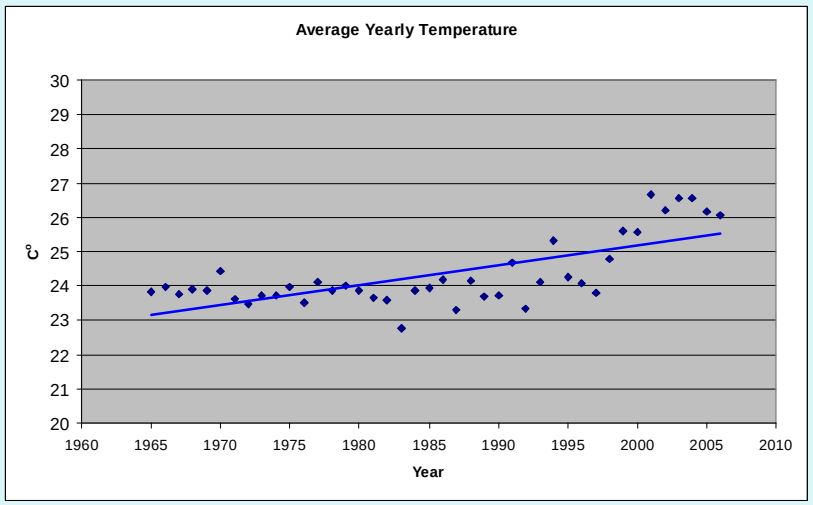


Source: IPCC, 2014

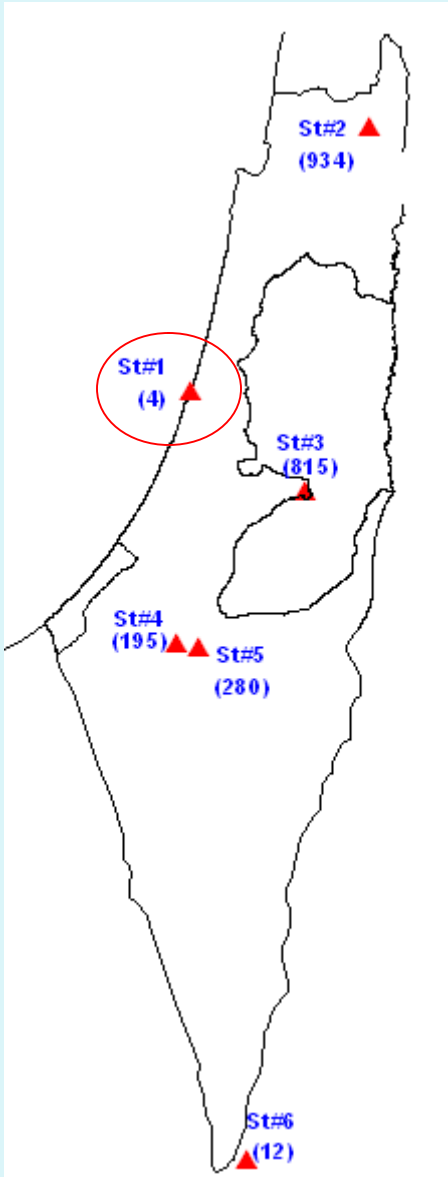
St#1



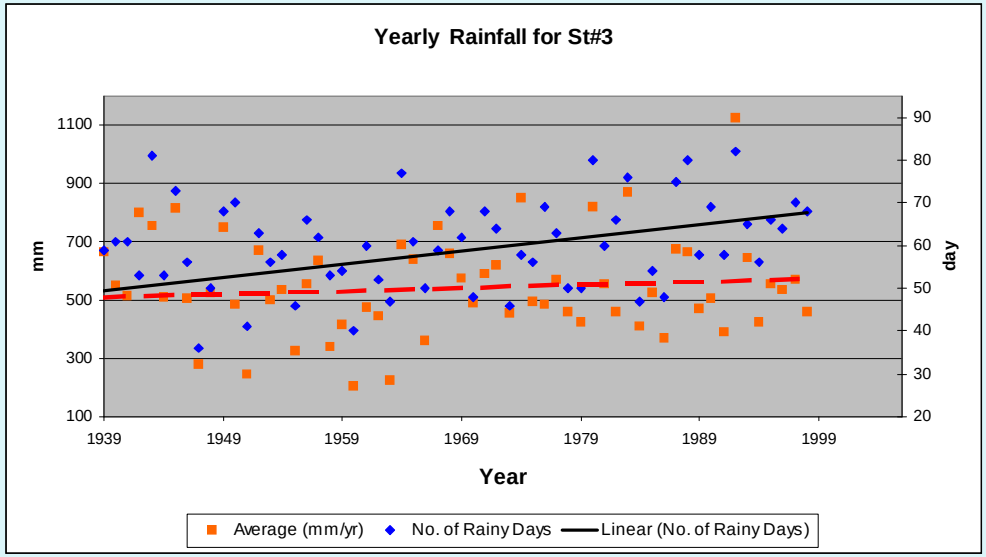
- Period: 65 years
- Mean annual average rainfall= 526 mm/yr
- Mean annual average rainy days= 60 days
- Change in rainfall trend= -22.4 mm (decrease)
- Change in rainy days trend= -10 days (decrease)



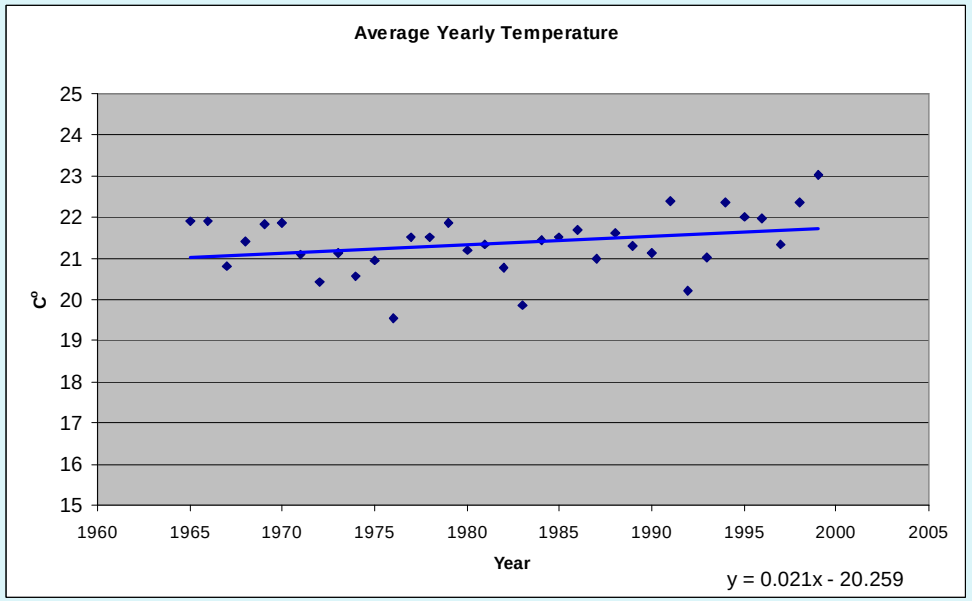
- Period: 41 years
- Mean annual average temperature= 24.3 C°
- Change in temperature trend= 2.3 C° (increase)



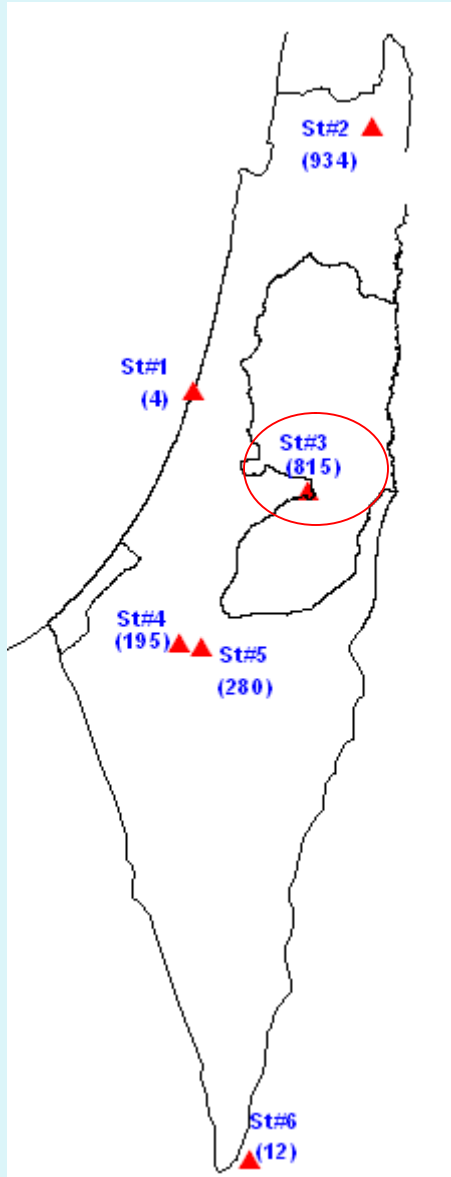
St#3

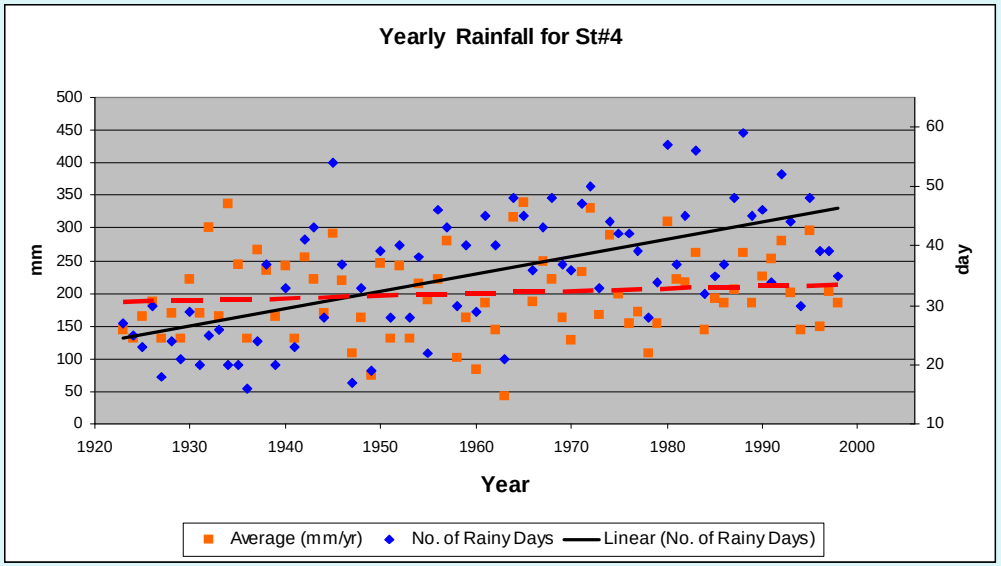


- Period: 97 years
- Mean annual average rainfall= 522.7 mm/yr
- Mean annual average rainy days= 54 days
- Change in rainfall trend= 106 mm (increase)
- Change in rainy days trend= 30 days (increase)

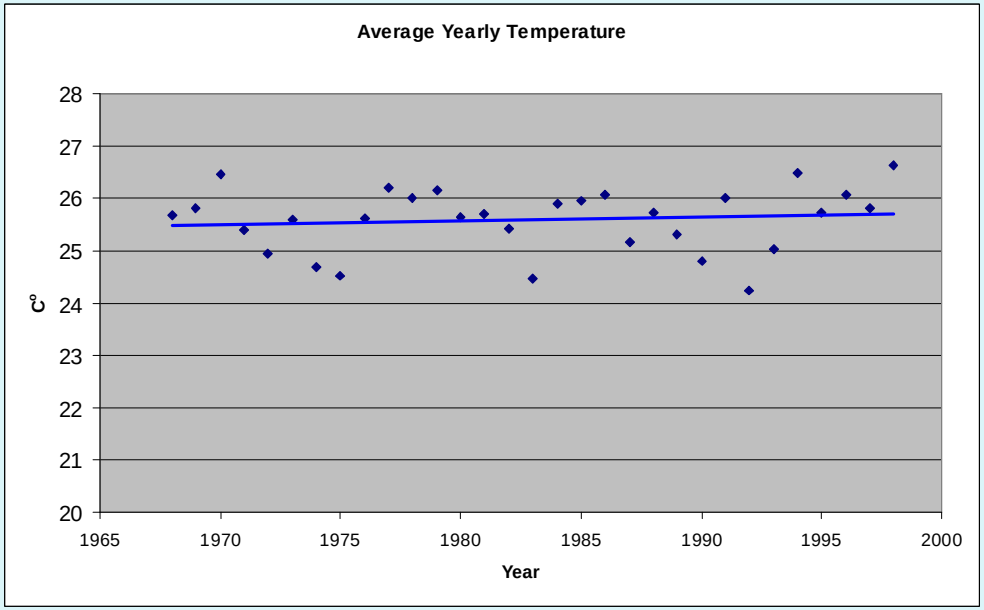


- Period: 34 years
- Mean annual average temperature= 21.4 C°
- Change in temperature trend= 0.7 C° (increase)

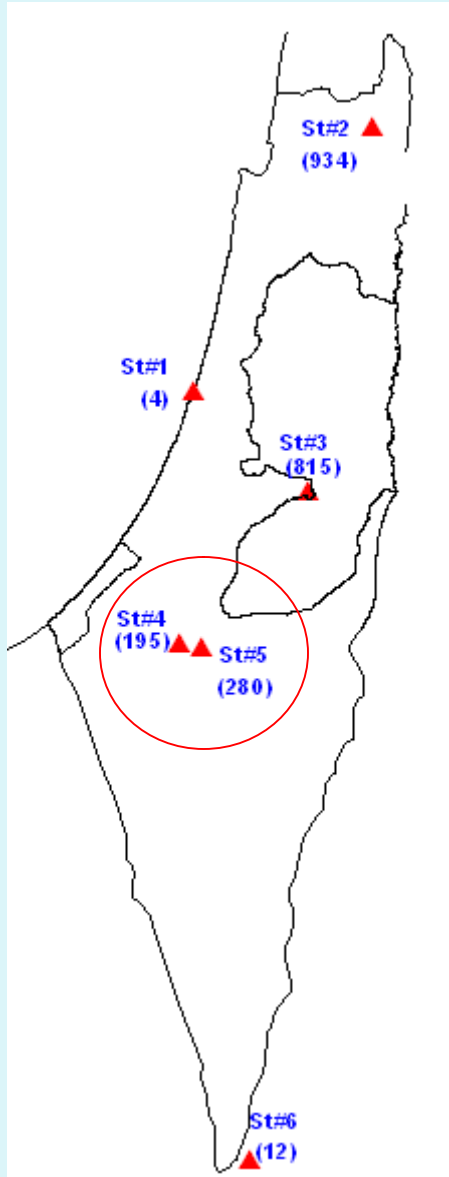




- Period: 75 years
- Mean annual average rainfall= 198.5 mm/yr
- Mean annual average rainy days= 35 days
- Change in rainfall trend= 28 mm (increase)
- Change in rainy days trend= 22 days (increase)



- Period: 30 years
- Mean annual average temperature= 25.6 C°
- Change in temperature trend= 0.2 C° (increase)

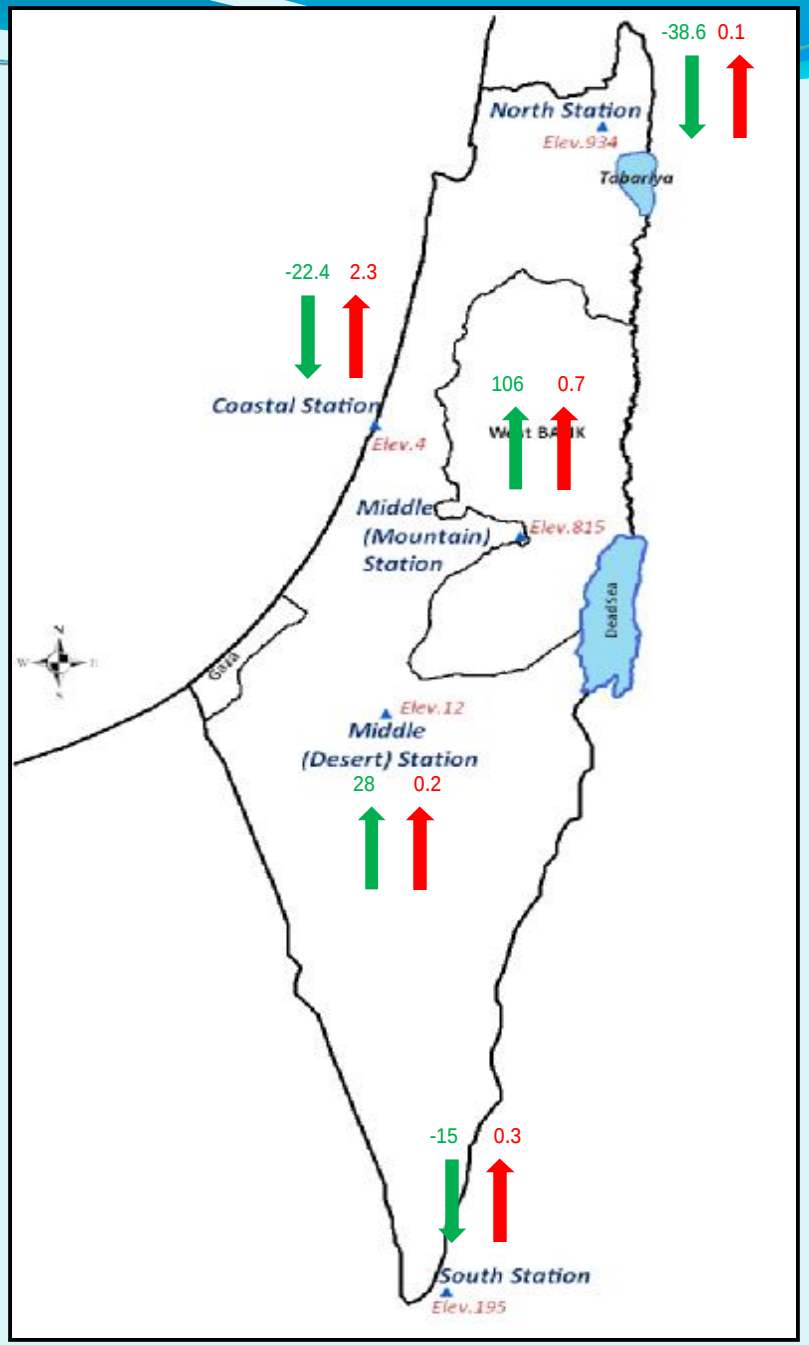


Temperature & Precipitation Trend Analysis for the late 20th century

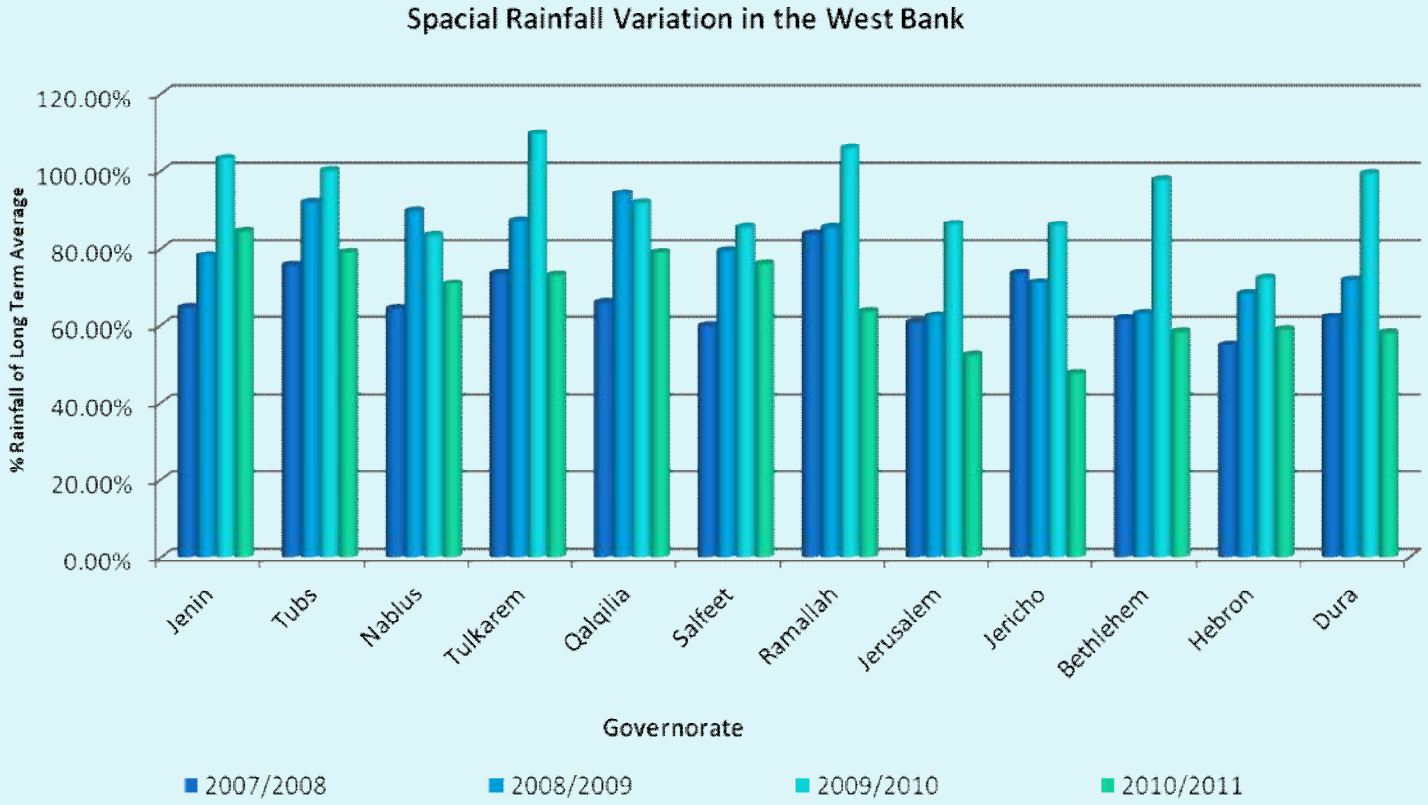
Where;

Refers to Temperature change in °C

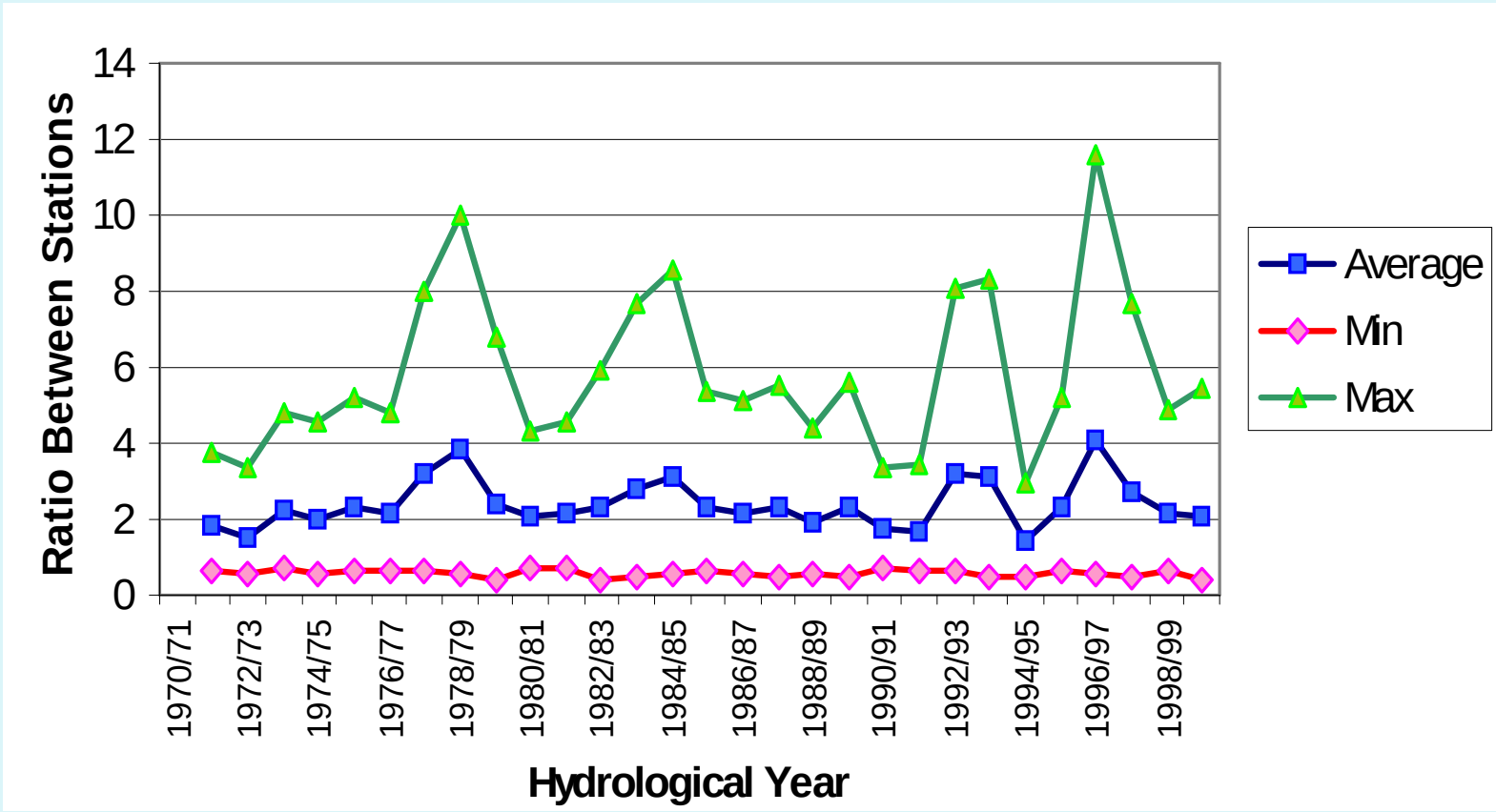
Refers to Precipitation change in mm



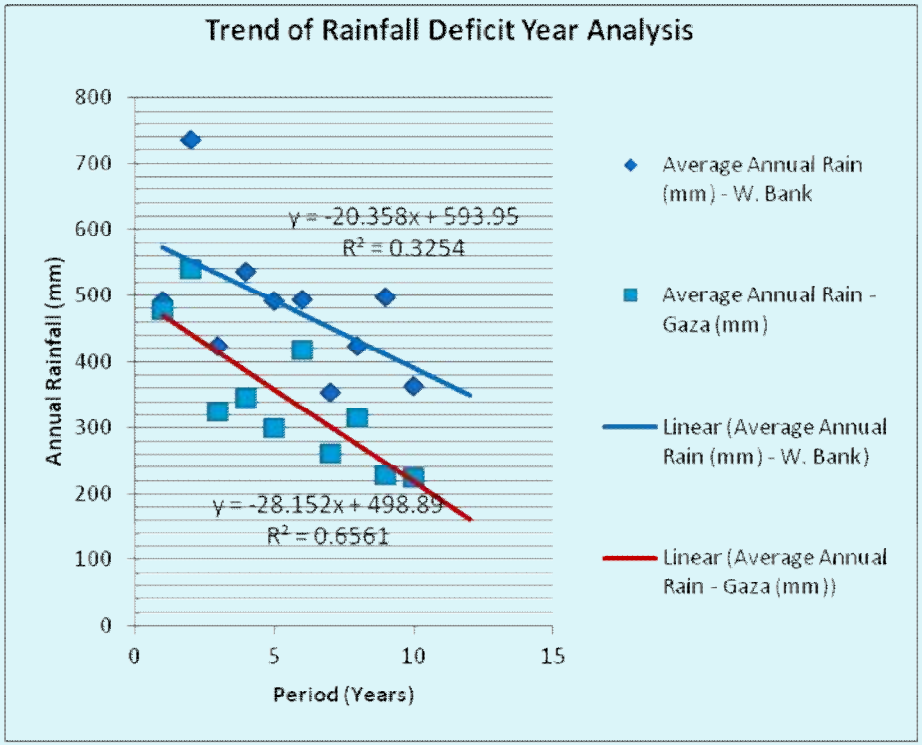
Source: Abu Sa'da, 2007

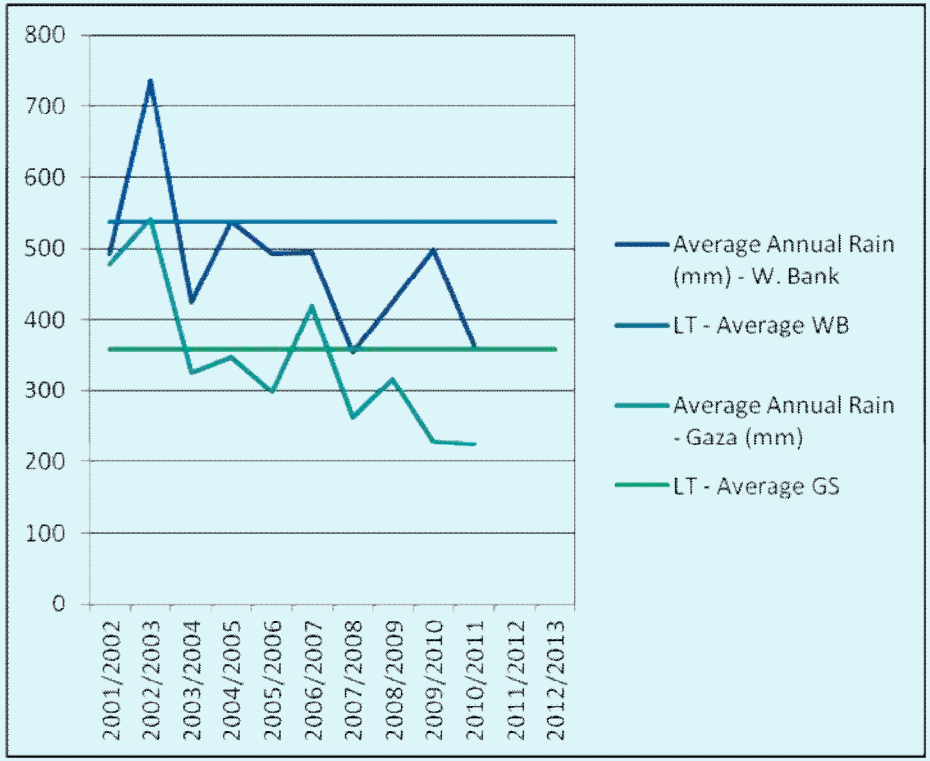

Spacial Rainfall Variation in the West Bank
% Rainfall of Long Term Average
120.00%
100.00%
80.00%
60.00%
40.00%
20.00%
0.00%
Jenin
Tubs
Nablus
Tulkarem
Qalqilia
Salfeet
Ramallah
Jerusalem
Jericho
Bethlehem
Hebron
Dura
Governorate
2007/2008
2008/2009
2009/2010
2010/2011

Temporal Variation of Rainfall

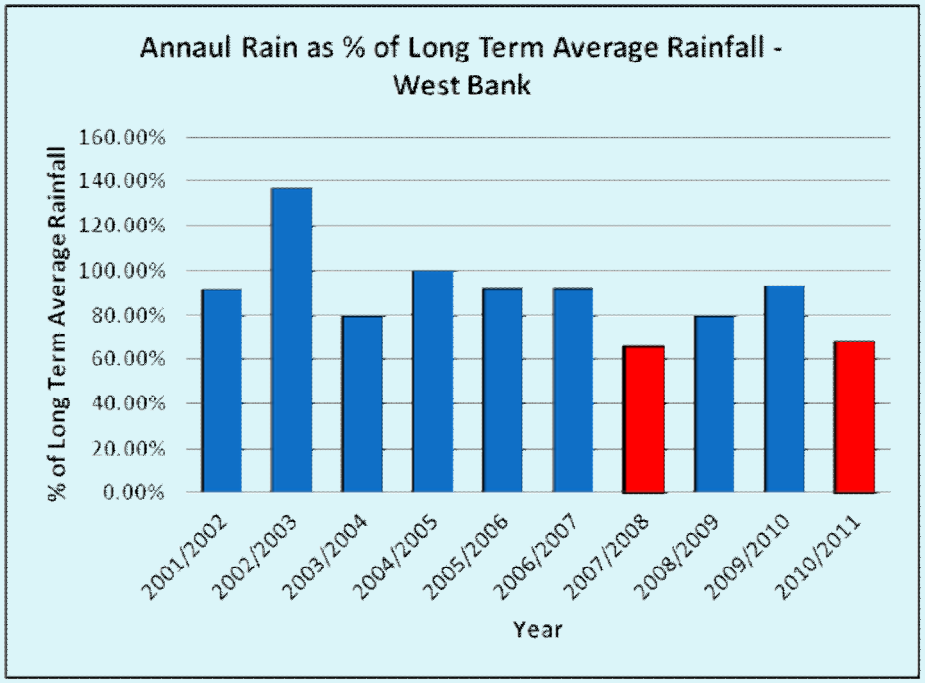


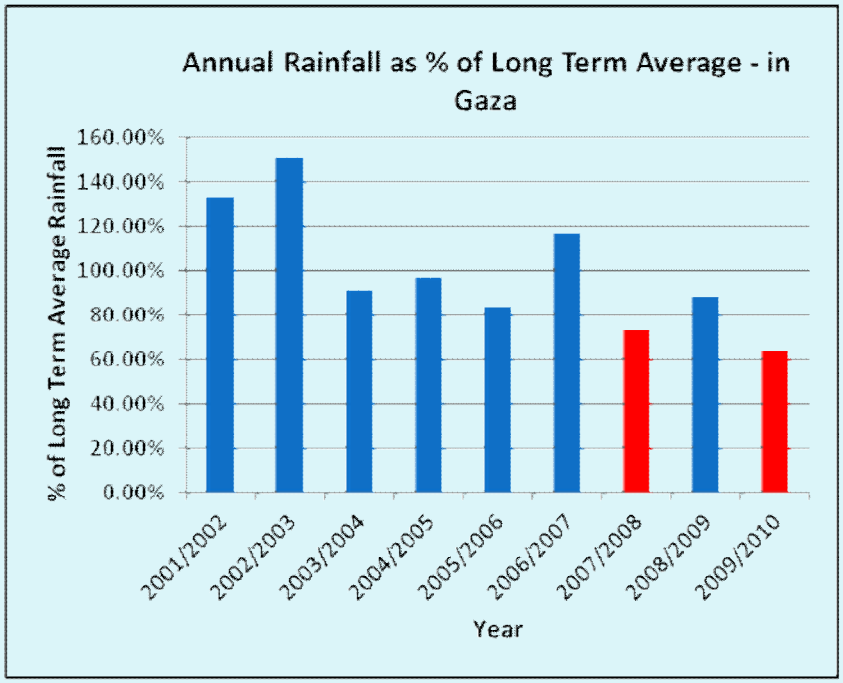
Rainfall Trend





Rainfall Deficit

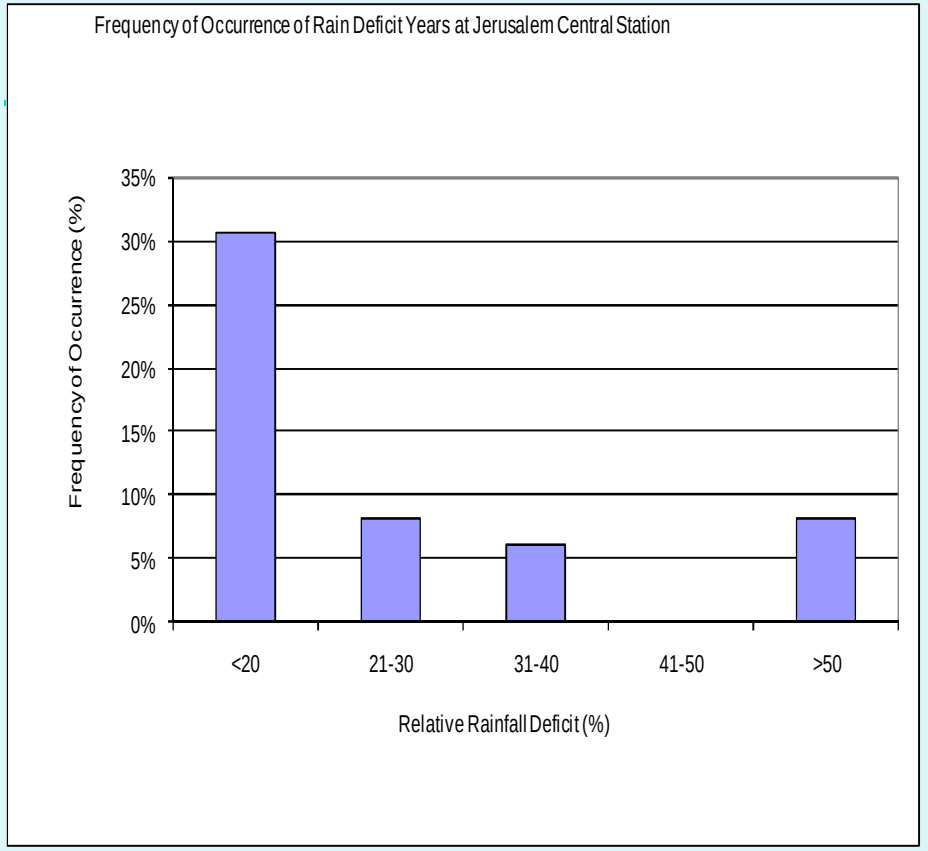




Meteorological drought ranging from extreme (<60% average rain) to mild droughts

Drought Phenomena

- The frequency and duration of drought in the region is not fixed over time.
- The time between two occurrences of drought can be described as random variable.
- Drought has non-uniform return periods.



Floods

- Generally Speaking Flood events are less frequent than drought events in Palestine. However, it is caused by high rainfall intensity and short periods where nearly 30 – 40% of rainfall long term average equivalent falls in 1 -2 days.
- The most recent floods recorded in February 28 – 2 march2012, 3 – 10 January 2013 and 23 – 25 November 2014.
- The total damage form 2013 flood was estimated at 15 MUS$ and also unfortunately loss of lives

Institutional, Policy and Legal Setup Related to Extreme Events

- No specific laws or regulations
- No Specific institution charged for monitoring and management
- No sufficient budget for planning and mitigation
- Reactive rather than proactive measures

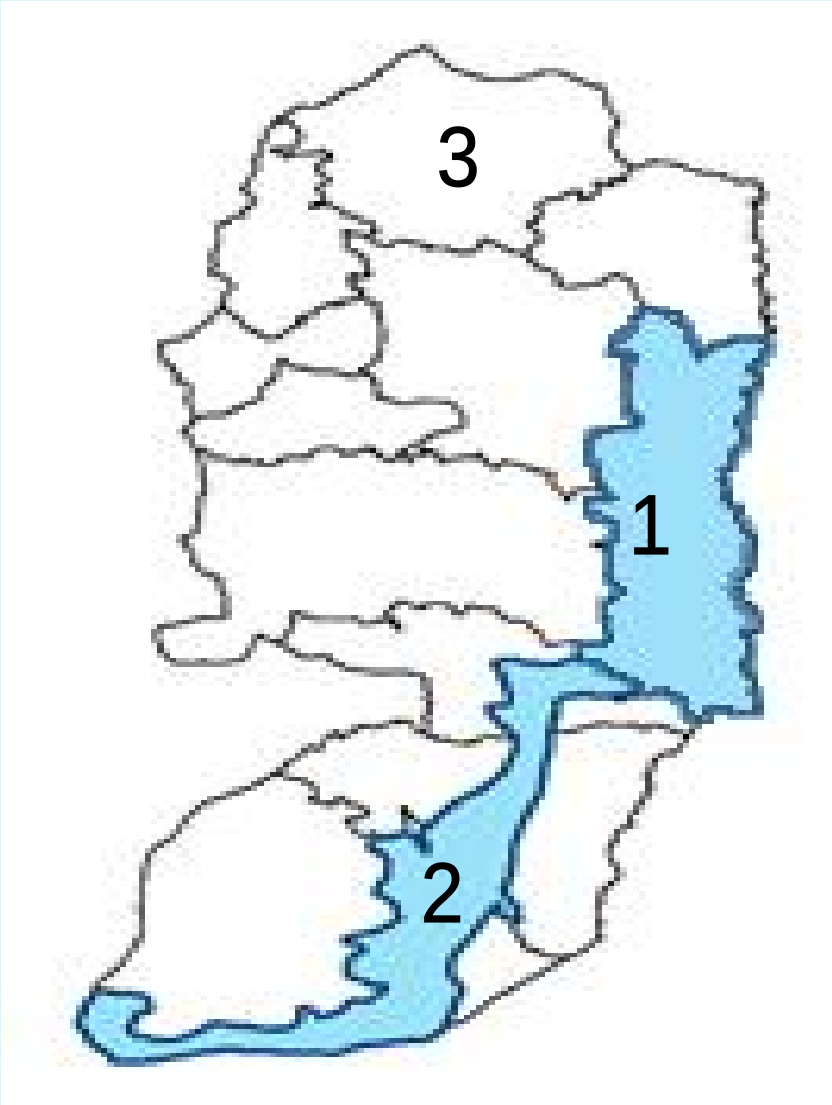
Impact of the Drought

- Livelihood
- Public Health
- Social and Economic
- Nature and Environment

EU funded project
ClimaSouth
Palestinian Environment Quality Authority
PALAST
Promoting Science & Technology

Arid Areas are the most Vulnerable to Drought: Two Examples

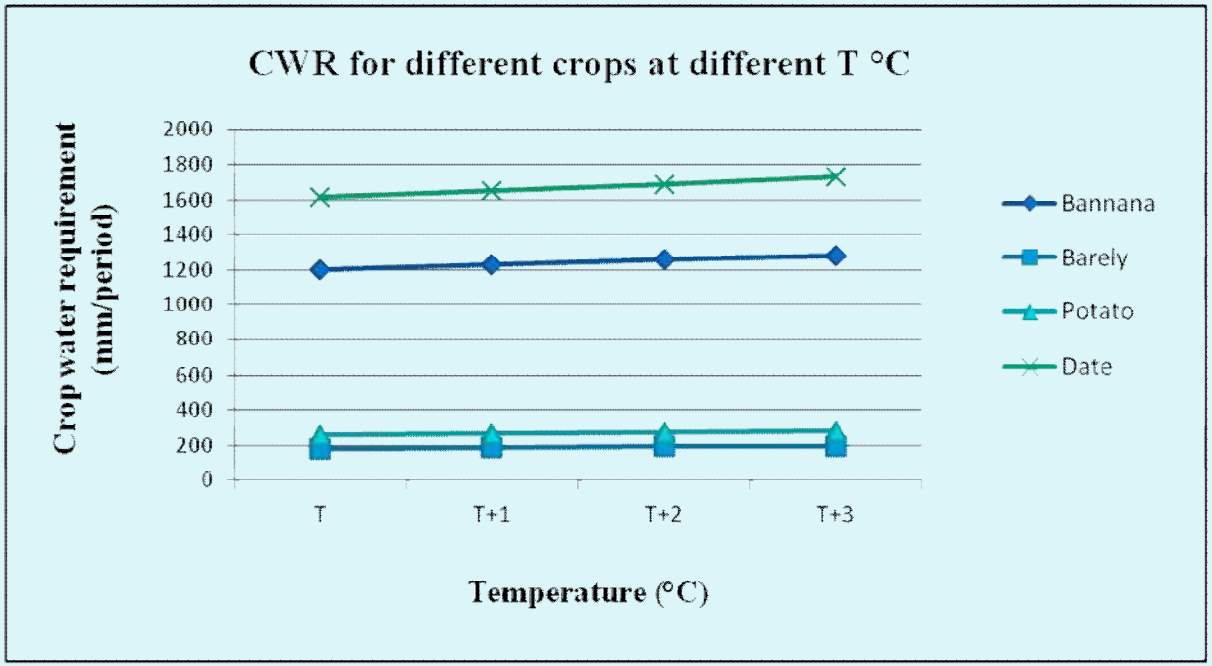
- Both areas are characterized by an arid and semi arid nature.
- Area 1 is the main irrigated agriculture (citrus, dates and vegetables) and is a plain area at 200 m below sea level
- Area 2 is hilly with steep slopes and elevations may go up to 800 m ASL. Most of the area is considered as range land used mainly for grazing.



Aea#1: Impact on Crop Water Requirement (CWR)

Average change rate (%) of CWR with temperature increase;

CWR = Et_o *K_c



	T+1°C	T+2°C	T+3°C
CWR change rate	2.7%	5.4%	8%

Impact on Irrigation Water Requirement (IWR)

Annual IWR for the total area under consideration;

∑ IWR for each crop x corresponding area

IWR= CWR – effective rain

	P-20%	P-10%	P	P+10%	P+ 20%
IWR (MCM/year)	21.05	20.24	19.95	19.66	19.38
Change rate %	5.53	1.47	0.00	-1.44	-2.84.

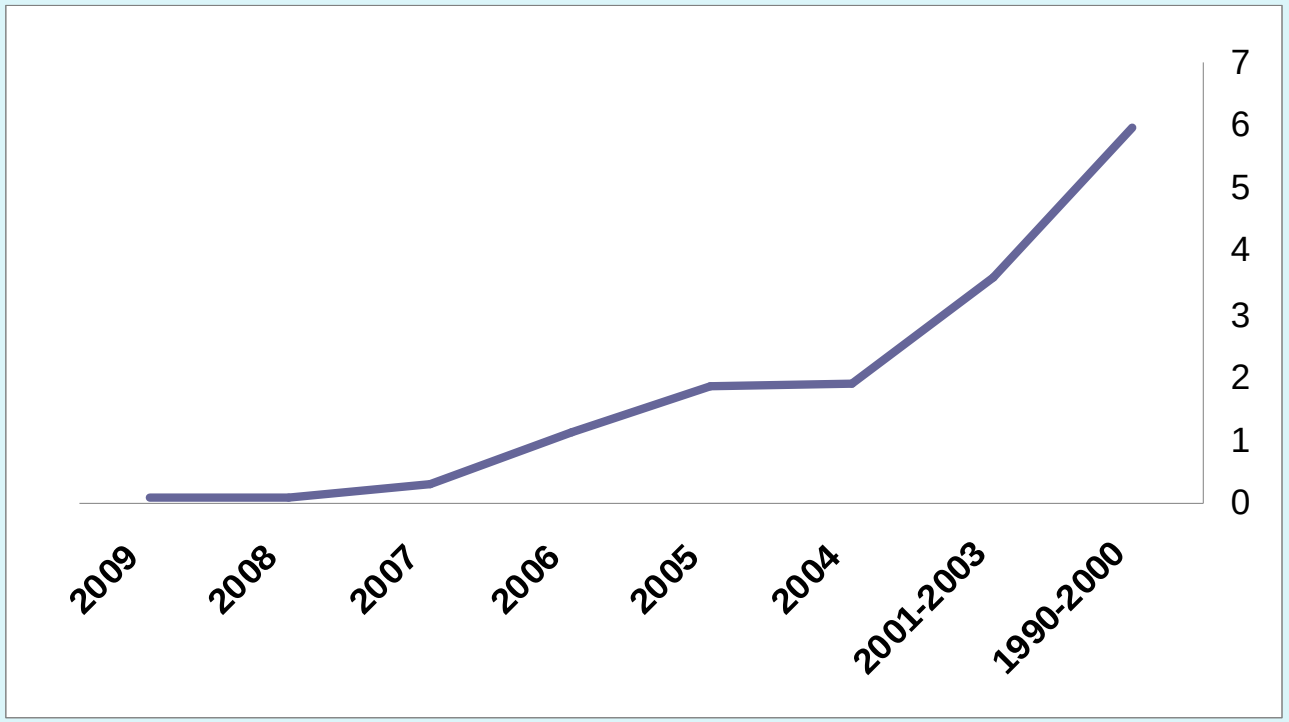
Irrigation Water Deficit/Surplus Under Hypothetical Climate Change Scenarios

	T	T+1	T+2	T+3
P-20%	1.104	1.685	2.285	2.881
P-10%	0.294	0.877	1.469	2.065
P	0.00	0.581	1.172	1.763
P+10%	-0.286	0.291	0.880	1.470
P+20%	-0.566	0.010	0.596	1.181

•Values are expressed in MCM/Year

Area2: Impact on Rangeland and livelihood

- Deterioration and retrogression of rangeland productivity



Range Land Deterioration

- The range land deterioration enhances the unpalatable shrubs domination
- Lack of field crops seeds
- Extinction of some grass species
- Overgrazing
- More purchase of animal feed

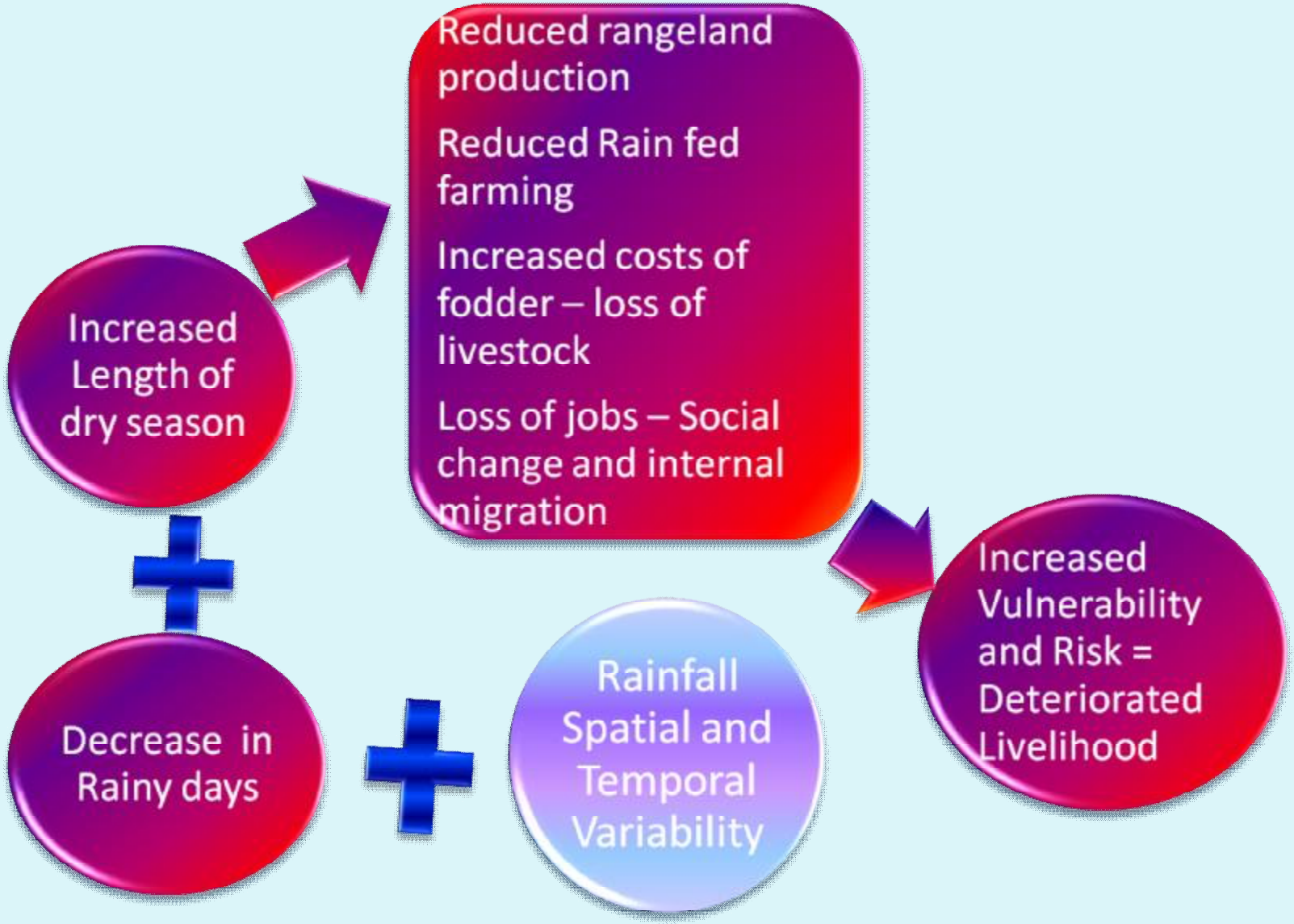
Impact on livestock- main source of income

- Increases livestock mortality rate with 10% at least
- Decrease the quantities of the produced milk with 48%
- Delaying the breeding season for one month at least
- Increase animal water demand as a result of reliance on grain feeding
- Reduction in the flock sizes – livestock sold to afford buying water tankers and other life subsistence

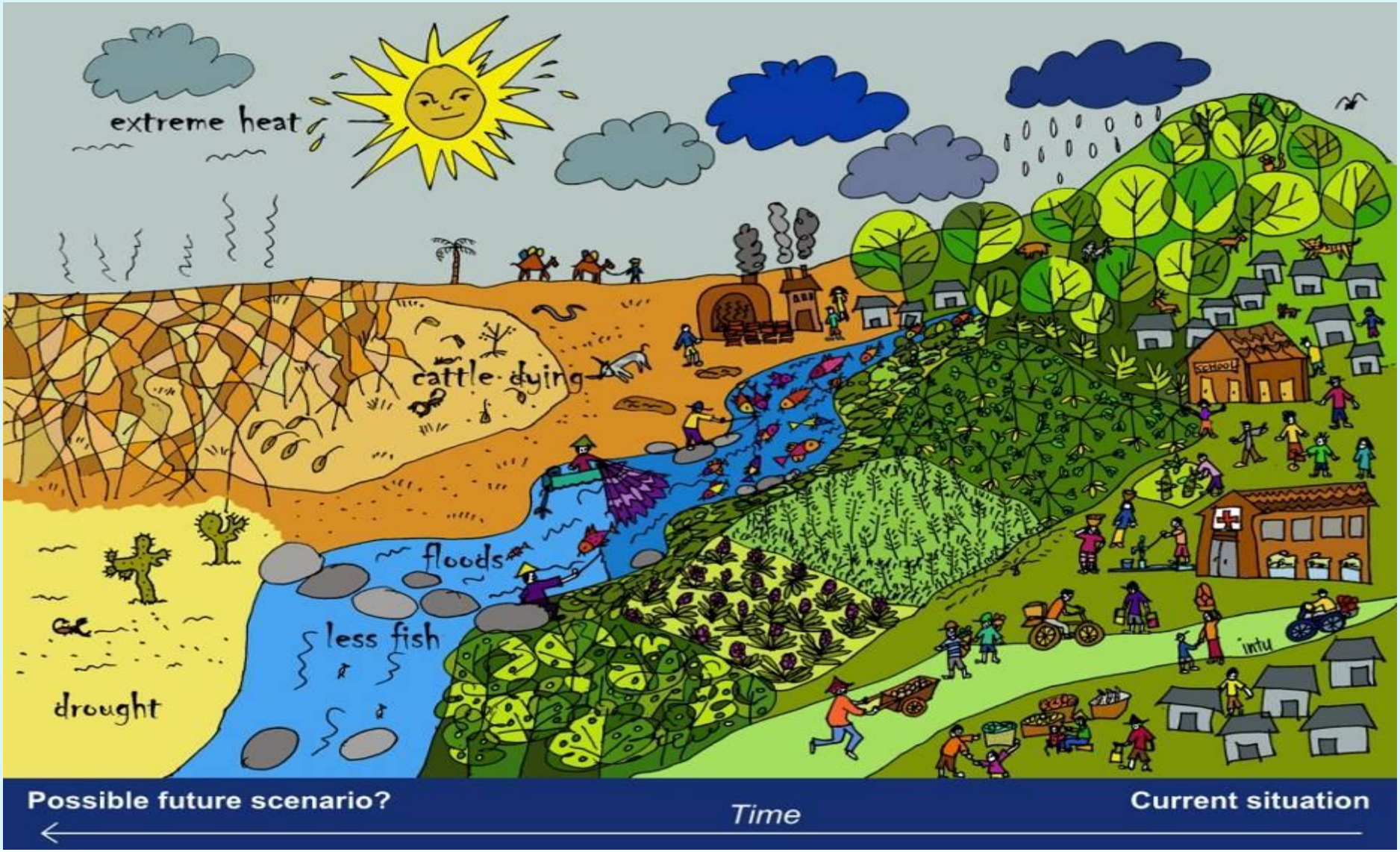
Socio-economic impacts

- Less water collected and Increased water costs
- Internal Migration reaches 40% in some communities
- Social instability
- Reduction in percentage of population relying on raising livestock
- Change in profession-shift from farming
- Less expenditure on basics affecting household nutritional levels.

Impact on Livelihood



In Summary


extreme heat
cattle dying
floods
less fish
drought
School
Possible future scenario?
Time
Current situation

Vulnerability Assessment

- Why?

• In order to plan properly for mitigating impact and improving adaptive capacity

- How?

• Many useful tools and methodologies for assessment, planning and strategy development

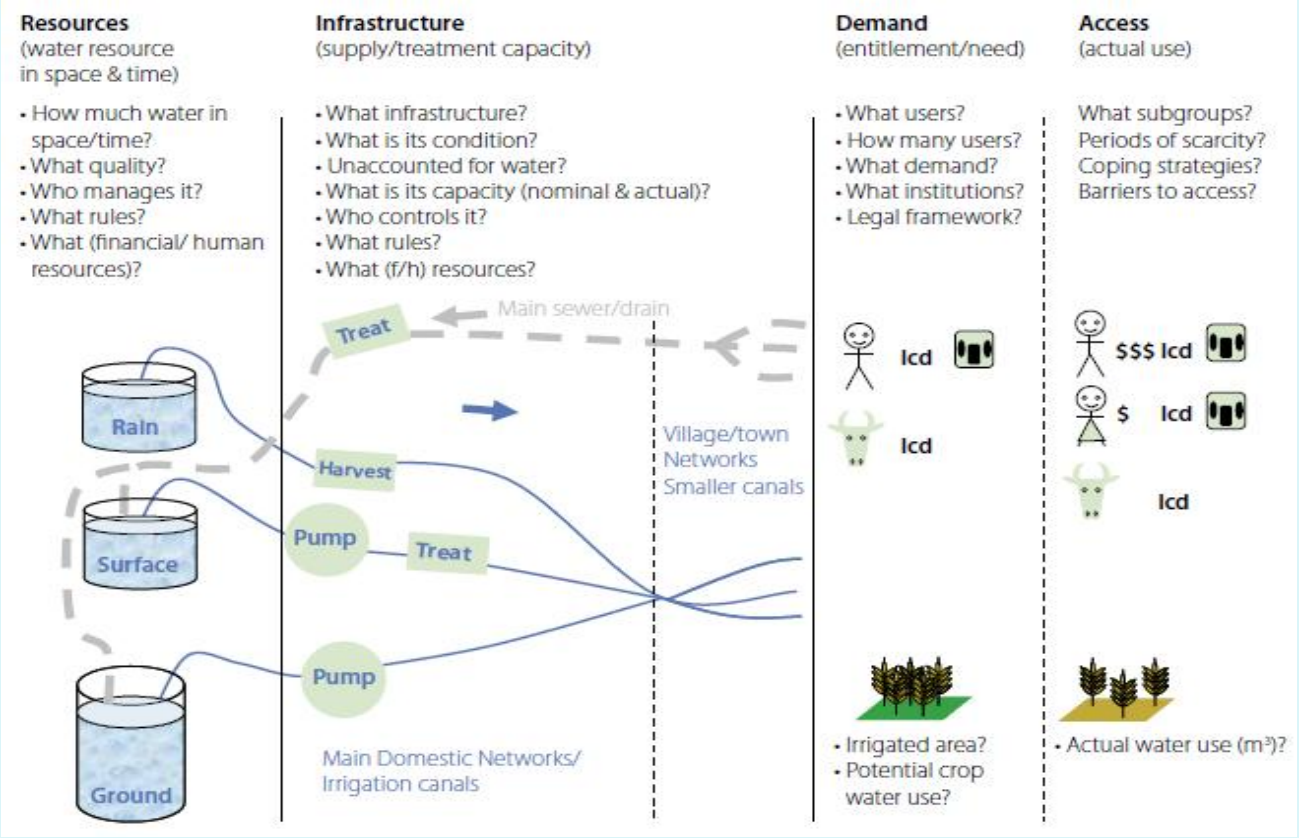
EU funded project
ClimaSouth
Palestinian Environment Quality Authority
PALAST
Promoting Science & Technology

Adaptation

Adaptive capacity: potential or capability of a system to adjust to climate change, including climate variability and extremes, so as to moderate potential damages, to take advantage of opportunities, or to cope with consequences (IPCC, 2007).

Useful Tools

Resource and Capacity Assessment Tool - RIDA



EU funded project

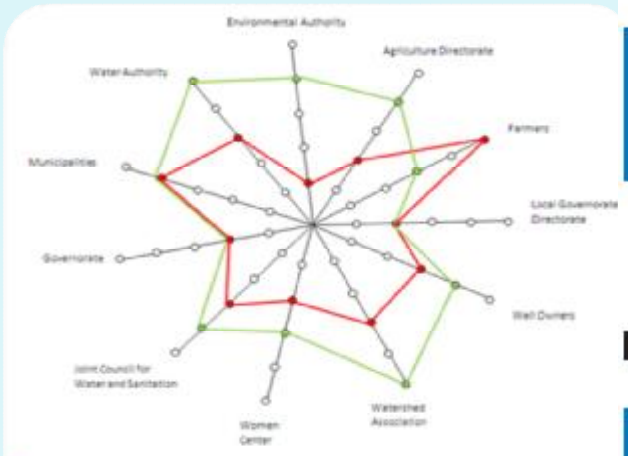
ClimaSouth

Palestinian Environment Quality Authority

PALAST

Promoting Science & Technology

Stakeholder Analysis Tools - PRA & RAAKS



	Stakeholder	11	10	9	8	7	6	5	4	3	2
1	Farmers	1-	2+	2+	1+	2-	+ -	2+	2+	2-	2+
2	Agriculture Directorate	2+	2-	2+	1+	2-	2+	2+	2+	+ 2	...
3	Environmental Directorate	2+	2-	2-	1-	2+	2+	2+	2+	...	...
4	Water Authority	2+	2+	2+	1-	2+	2+	2+	...	...	...
5	Municipalities	2+	1+	2+	2+	2+	2+	...	...	...	...
6	Governorate	2+	1+	+ -	2+	2-	...	...	...	...	...
7	Joint Council for Water & Sanitation	2+	1-	+ -	2+	...	...	...	...	...	...
8	Women Centre	1+	1-	2+	...	...	...	...	...	...	...
9	Watershed Association	1+	2+	...	...	...	...	...	...	...	...
10	Well Owners	1-	...	...	...	...	...	...	...	...	...
11	Local Governorate Directorate	...	...	...	...	...	...	...	...	...	...

- Defining Actors
- Linkage and Relation Analysis

WINDOW A

Problem definition exercise	Window: A1
Actor identification exercise	Window: A2
Actor objective sheet	Window: A3
Environmental limits checklist	Window: A4
Prime mover septagram	Windows: A5/B6
Approximation exercise I	Windows: A5/B8
Approximation exercise II	Window: A5

WINDOW B

Impact analysis sheet	Window: B1
Actor analysis checklist	Window: B2
Info–source–use exercise	Window: B3/a
Communication network sheet	Window: B3/b
Source–intermediary–user sheet	Window: B3/c
Linkage matrix	Window: B4/a
Linkage mechanism checklist	Window: B4/b
Task analysis sheet	Window: B5
Basic configurations	Window: B6
Communication analysis exercise	Window: B7
Window reporting sheet	Window: B8/a
Understanding the social organization of innovation	Window: B8/b

WINDOW C

Knowledge management analysis exercise	Window: C1
Actor potential checklist	Window: C2
Defining possible actions	Window: C3/a
Strategic commitments	Window: C3/b

Community-based Risk Screening – Adaptation and Livelihoods (CRiSTAL) Tool

Affected area/ sector	Event(hazards)	Vulnerability Assessment of the watershed			
		Exposure	Degree of Sensitivity of the System	Degree of the adaptive capacity	Vulnerability of the area
Downstream area	Flood	High-As a closed watershed, runoff water from hilly areas drains to and accumulates in the downstream area.	High-The downstream area is very sensitive to flood.	Low-Suggested adaptation measures can only upgrade the system partially, and these options are costly.	High
Water sources	Drought	High-Groundwater that forms the main water source is directly affected by the amount of precipitation.	High-Summer water needs already greater than production, and groundwater abstraction faced by many regulatory problems.	Medium-There is an ability to regulate groundwater exploitation. Some upgrade measures adopted by now but are not enough.	High
Plantation area and infrastructure	Frost wave	Medium-The area suffers repeatedly from frost wave in winter months causing severe impacts on the area.	Medium-Impacts magnitude and affected areas change from year to year.	Low- Some upgrades already adopted, but need modifications. Negative impacts mostly limited to some crops.	Medium
	Wind storm	Medium-Unpredicted windstorms mostly cause damage of crops, and infrastructure.	Medium-There is an ability to upgrade the system by improving the system itself, but it is considered costly for some people.	Medium-Some modifications can be implemented to reduce the impacts.	Medium

ClimaSouth
EU funded project
Palestinian Environment Quality Authority
PALAST
Promoting Science & Technology

Ecological Vulnerability assessment

KARMCHBAT	Climatic factors		Anthropogenic factors				Other		
Stress factor	Decreased precipitation	Increased temperature	Grazing	Logging	Hunting	Agriculture and urban expansion	Soil erosion	Forest fire	Phytopathology
Exposure	M	M	H	M	M	L	L	L	M
Sensitivity	L	M	H	H	M	M	H	L	H
Impact	M	M	**H**	M	M	M	L	L	M
Adaptive capacity	M	M	L	M	L	L	M	H	M
Vulnerability	M	M	**H**	M	M	M	M	L	M
Resilience	M	M	**L**	M	M	M	M	H	M

EU funded project

ClimaSouth

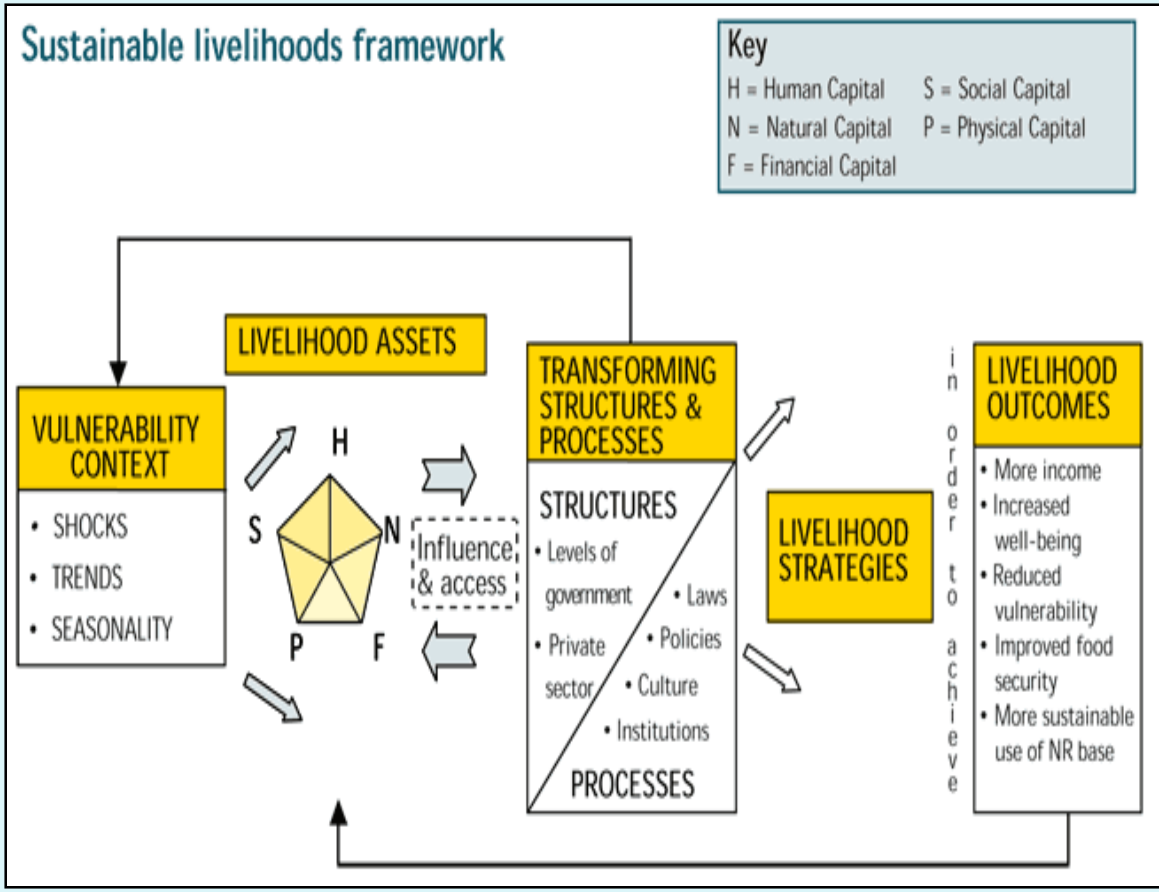
Palestinian Environment Quality Authority

PALAST

Promoting Science & Technology

Sustainable Livelihood Assessment

	High temperature and low precipitation		
Livelihood Assets	Andaket	Aydamoun/ Karmchbaat	Qoubyat
Human Capital			
Education Level	High	Medium	High
Poverty Level	Low	High	Low
Income	Medium	Low	Medium
Access to Health Services	Medium	Medium	High
Awareness Level	Medium	Low	Medium
Natural Capital			
Dependency on Agriculture	Low	High	Low
Dependency on Water Resources	High	High	High
Dependency on Livestock	Low	High	Low
Dependency on the Forest	High	High	Medium
Physical Capital			
Ownership of House	Yes	Yes	Yes
Ownership of Land	Yes	Yes	Yes
Presence on Vehicles	Yes	Yes	Yes
Presence of House Electronics	Yes	Yes	Yes
Social Capital			
Participation in the House	High	High	High
Membership in Local Societies	High	Medium	High
Financial Capital			
Dependency on Retirement	High	Medium	High
Dependency on Employment Salary	High	Medium	High
Trade	High	High	High



EU funded project

ClimaSouth

Palestinian Environment Quality Authority

PALAST
Promoting Science & Technology

Conclusion

- The impact of political restrictions imposed by Israeli Occupation coupled with the change in climate conditions is certainly increases the vulnerability of Palestinian People and reduces their resilience to coup with the already very limited and insufficient water available for their use.

Recommendations

- No Business as usual can continue
- It is important to re-assess the available potential water resources (ground and surface) in the light of this change and work hard to acquire the Palestinian Water Rights in these resources.
- Develop appropriate means to increase the water availability (Demand and Supply Management) and accessibility to all Palestinian People.

Recommendations

- Develop an alternative plan for both irrigated agriculture as well as Rain fed farming. More drought resisting varieties, less water requiring crops, reuse, etc.
- Develop plans to improve rangeland production - regenerate the grazing areas and to maintain the current pattern of land use in those areas.
- Adopt more appropriate plans to eliminate internal migration from the vulnerable areas, invest in infrastructure, health and education services as well as WATSAN services.

THANK YOU