Palestinian Hydrology Group

Identifying Vulnerabilities and Climate Risks; Climate Change Adaptation / Implementation Case Study: Marj Sanour - Palestine

Dr. Ayman Rabi

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

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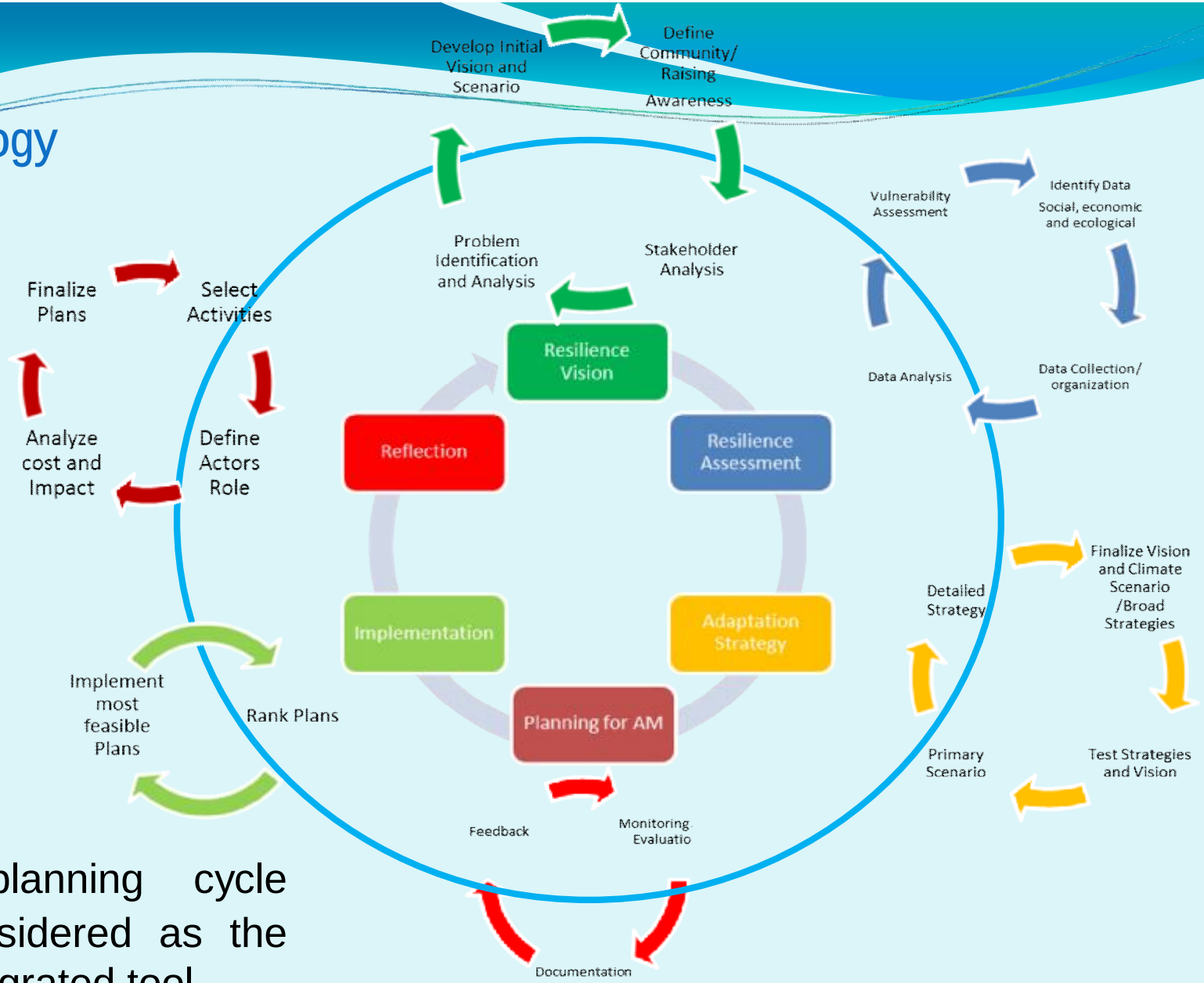
Objectives

•The major objective was to assess the vulnerability of social, agricultural and environmental systems to climate change in the watershed.

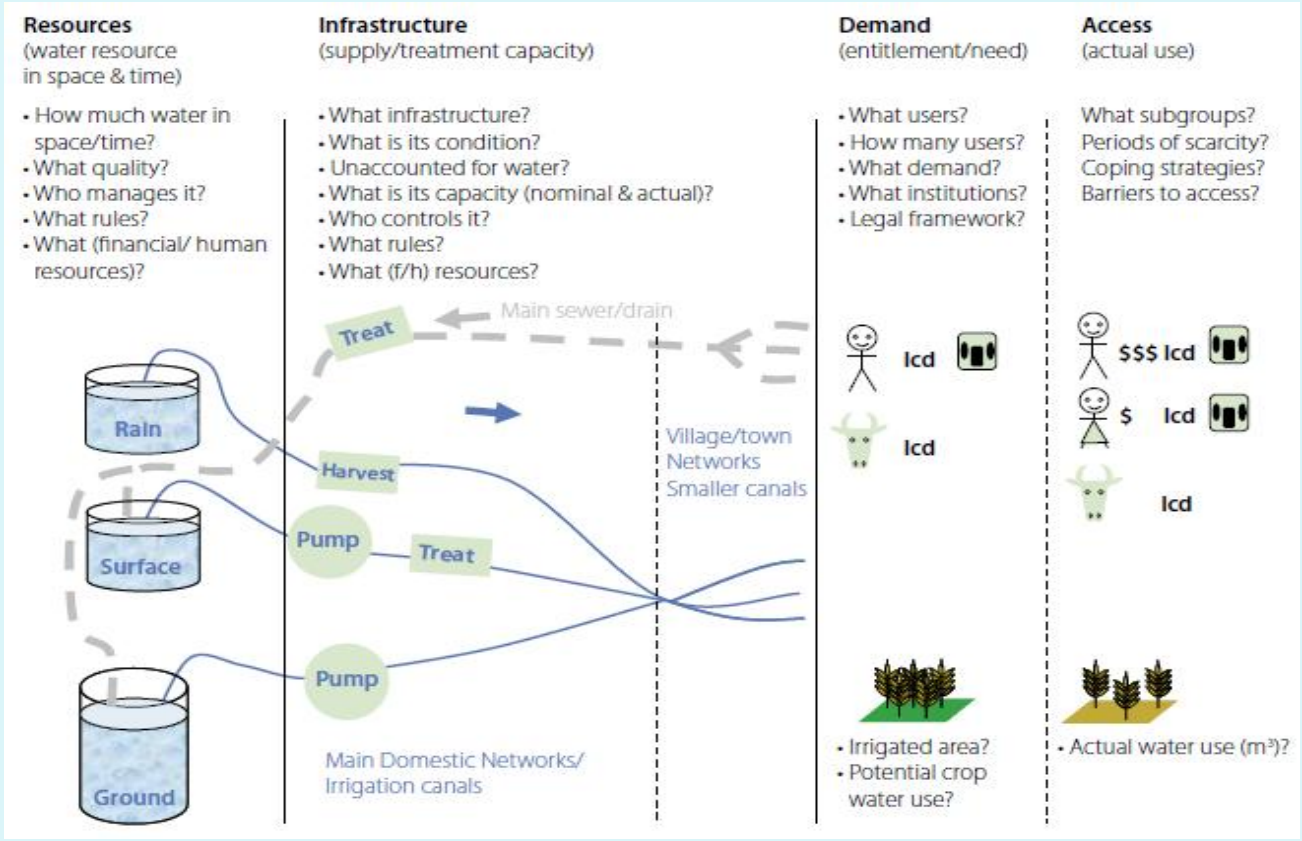
Methodology



- The planning cycle was considered as the main integrated tool

Assessing Resources and Capacities

Resource and Capacity Assessment Tool - RIDA



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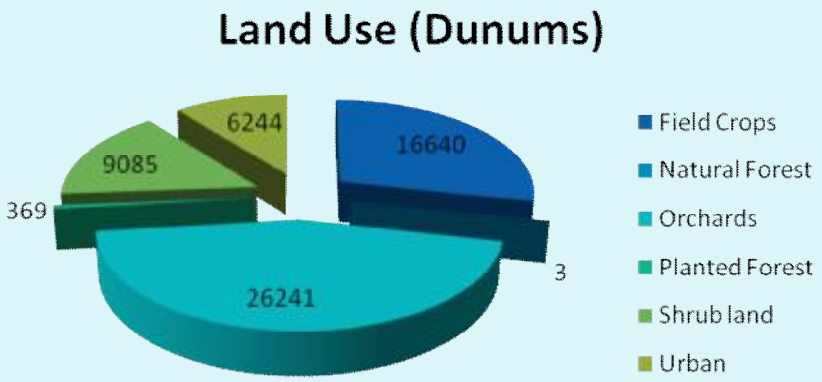
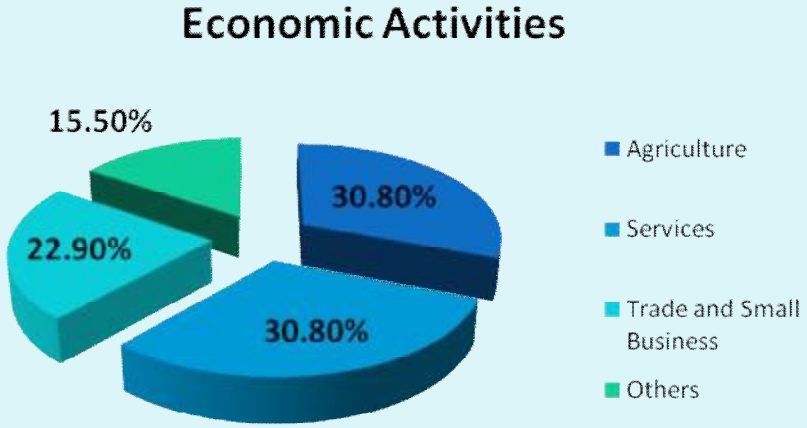
Marj Sanour RIDA

- Total Population is 27,538 (51% Male,49% Female)
- Unemployment is nearly 15.5 %
- Main Income Sources:





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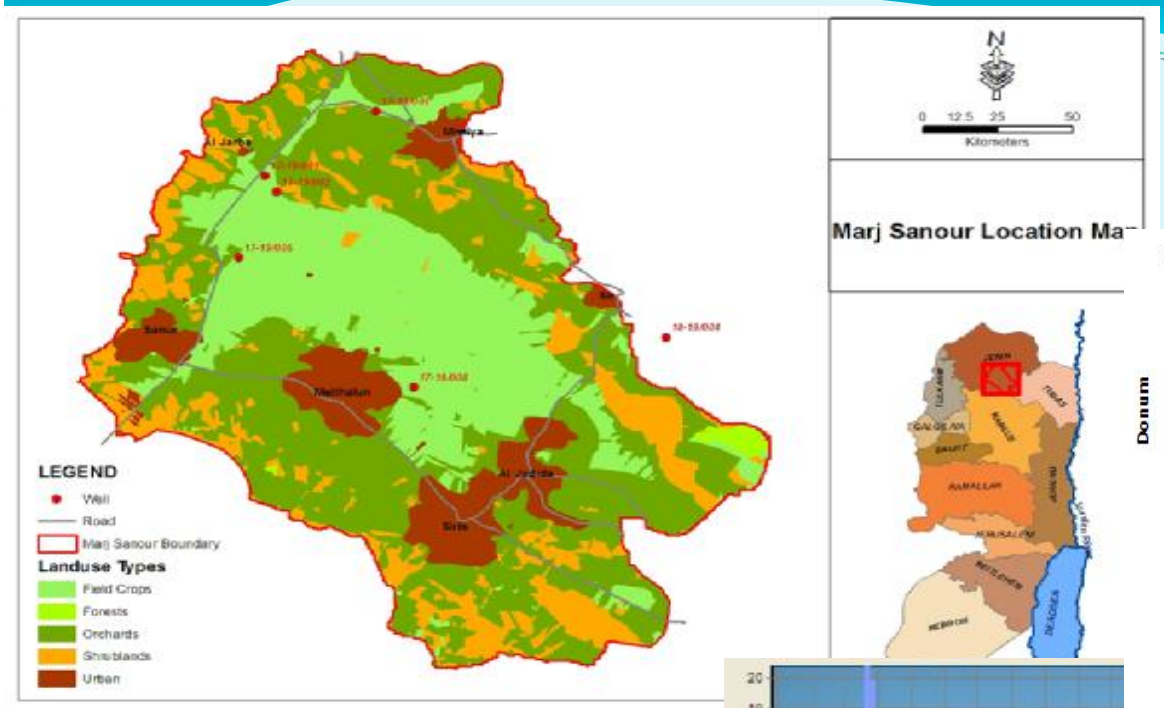
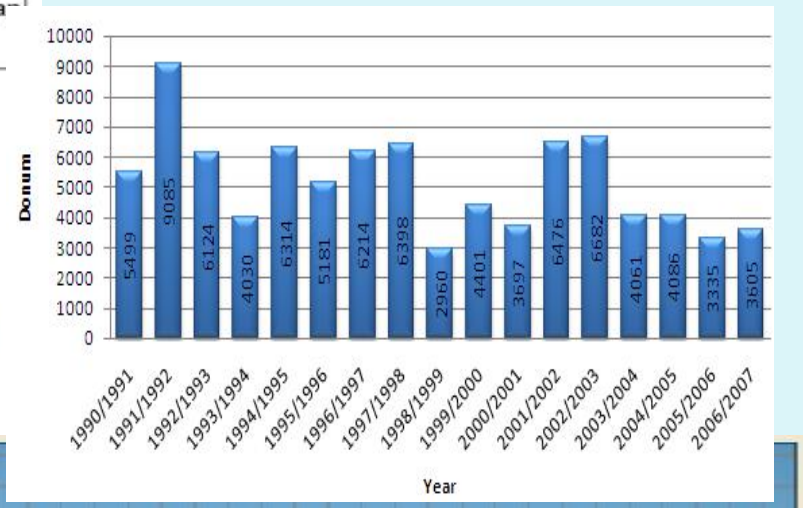
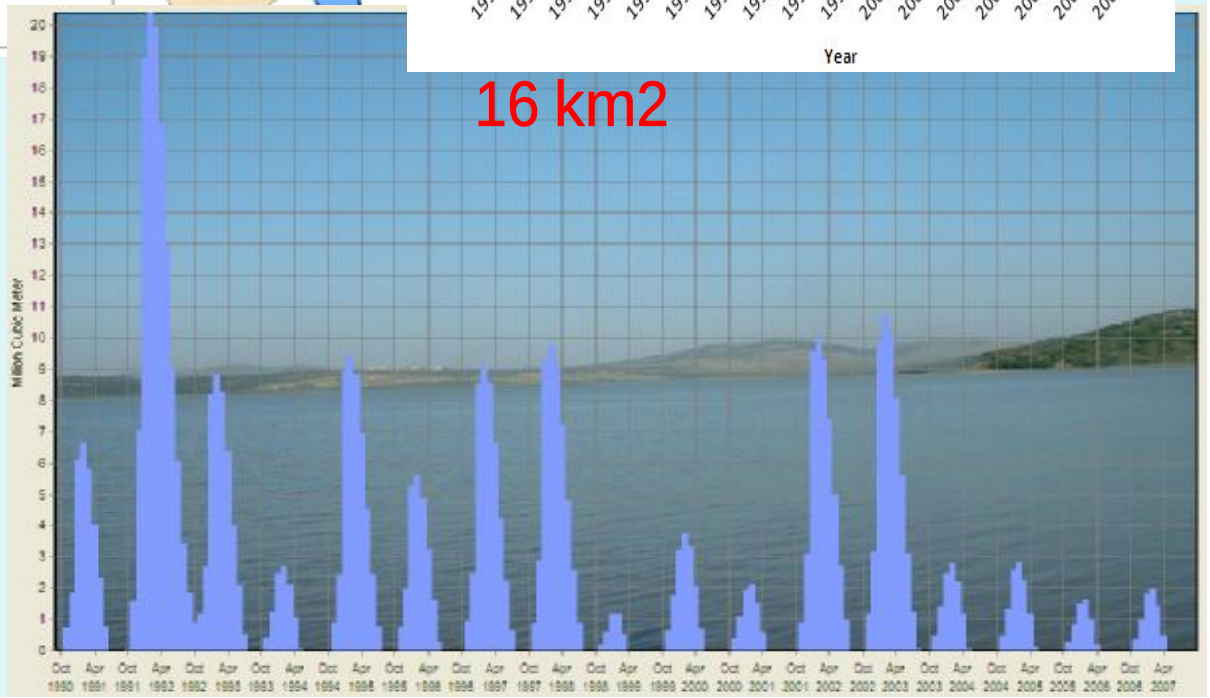
Marj Sanour



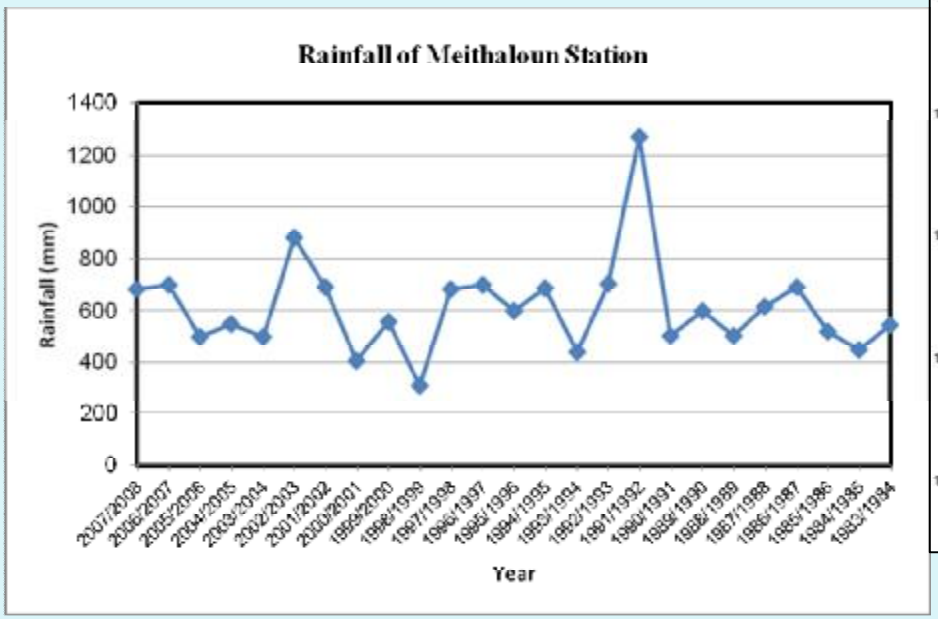


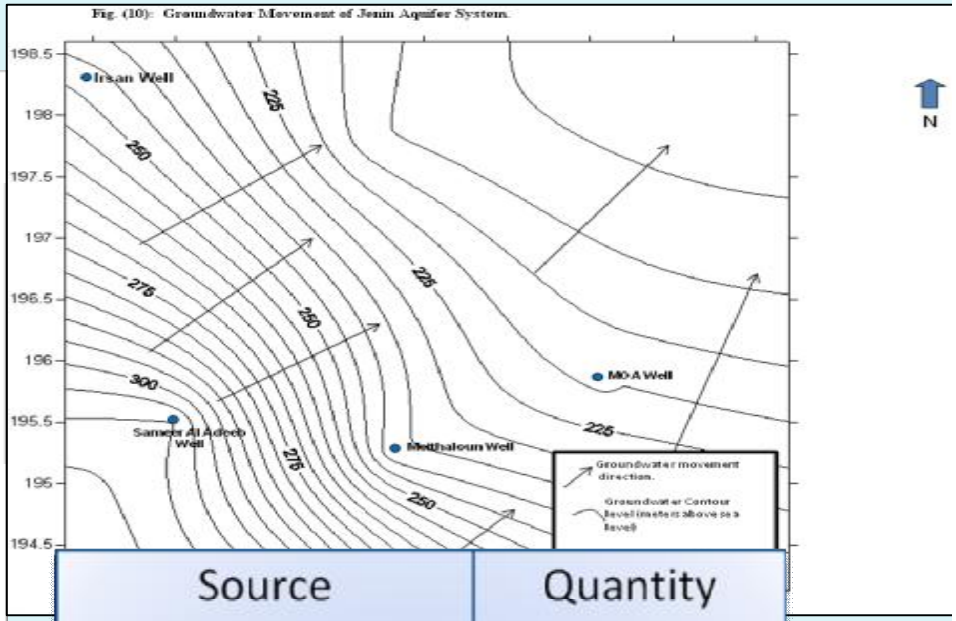
16 km2

- Total Volume stored vary from 1 to 20 Mcm per year depending on Rainfall
- Total Surface Catchment Area is 58km2



Resources





- Groundwater

Source	Quantity (MCM)
Private Agricultural Wells	2,27
Meithaloun Well	0.625
Sanour Well	0.09
Cisterns	0.11
Total	0.825

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Infrastructure

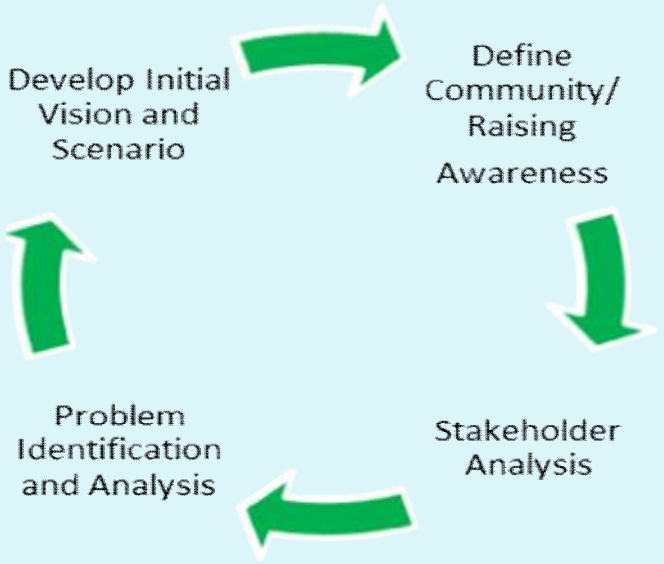
Community	Current water source	Average monthly consumption of the family (m^3)	Cost of $1m^3$ from the network (NIS)	Storage capacity of the family (m^3)	Dependence on other sources
Meithaloun	85% from Meithaloun well - new network	20	5	60	5% cisterns+ water tanks
Judeida	70% from Meithaloun well - new network	15	5	60	30% cisterns+ water tanks
Siris	75% from Meithaloun well - new network	20	5	60	25% cisterns+ water tanks
Jarba	100% from Meithaloun well - new network+cisterns+watertanks	*30	5	10	cisterns+ water tanks
Sir	60 %from Meithaloun well - new network + cisterns	15	5	70	40% cisterns+ water tanks
Misilya	100% from Meithaloun well - new network	20	5	70	_
Sanour	95% from water network -PWA	15	4	3	5% cisterns+ water tanks

Demand and Availability

- Availability of Resources are not sufficient to meet demand
- Flood water is not utilized properly
- Groundwater is not sufficient

Visionning

- Visioning – Stakeholder Identifications - Problem Analysis – Initial Visio



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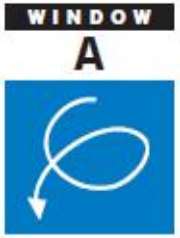
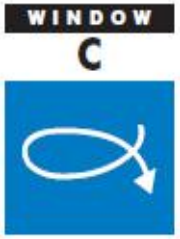
Stakeholder Analysis Tools - PRA & RAAKS

- Defining Actors
- Linkage and Relation Analysis



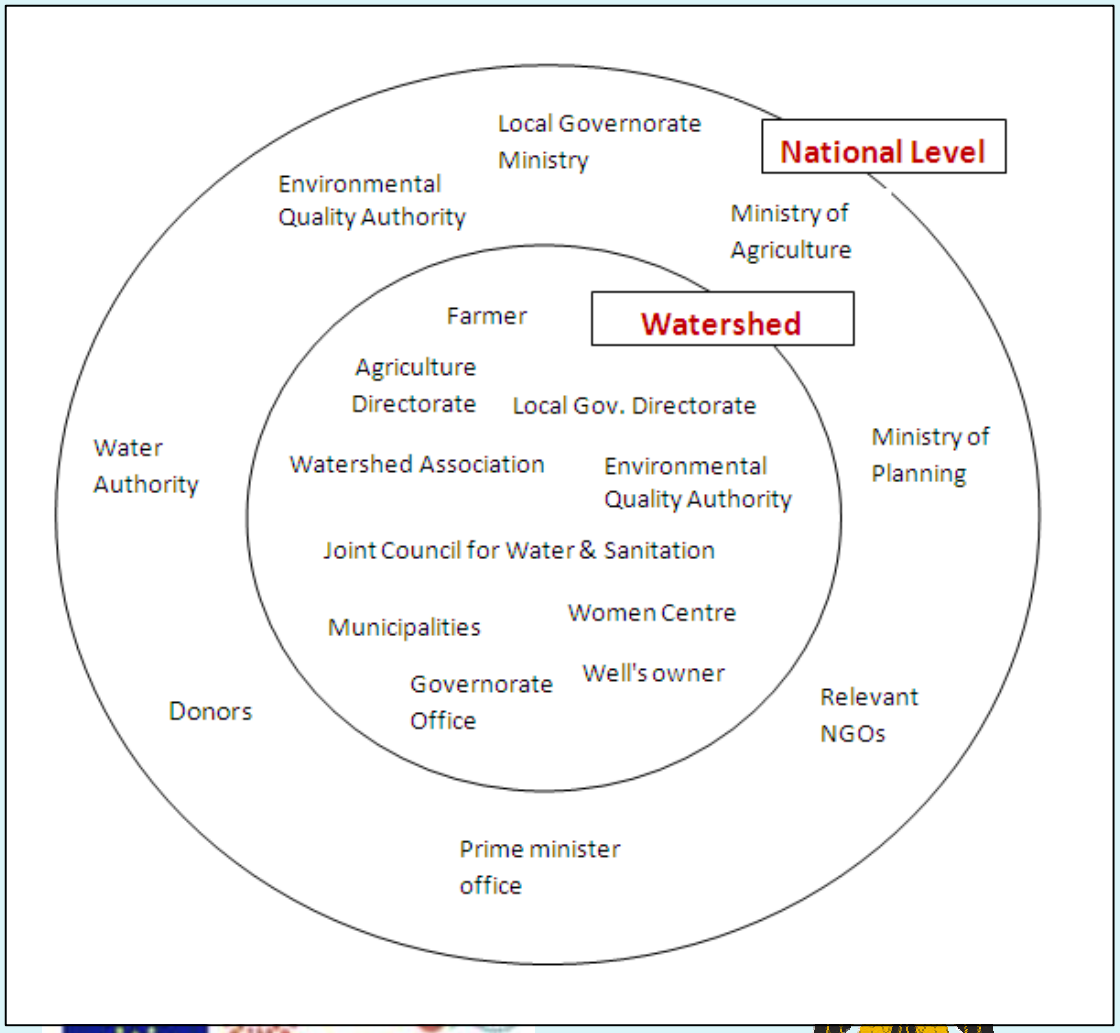
Problem definition exercise	Window: A1
Actor identification exercise	Window: A2
Actor objective sheet	Window: A3
Environmental limits checklist	Window: A4
Prime mover septagram	Windows: A5/B6
Approximation exercise I	Windows: A5/B8
Approximation exercise II	Window: A5

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



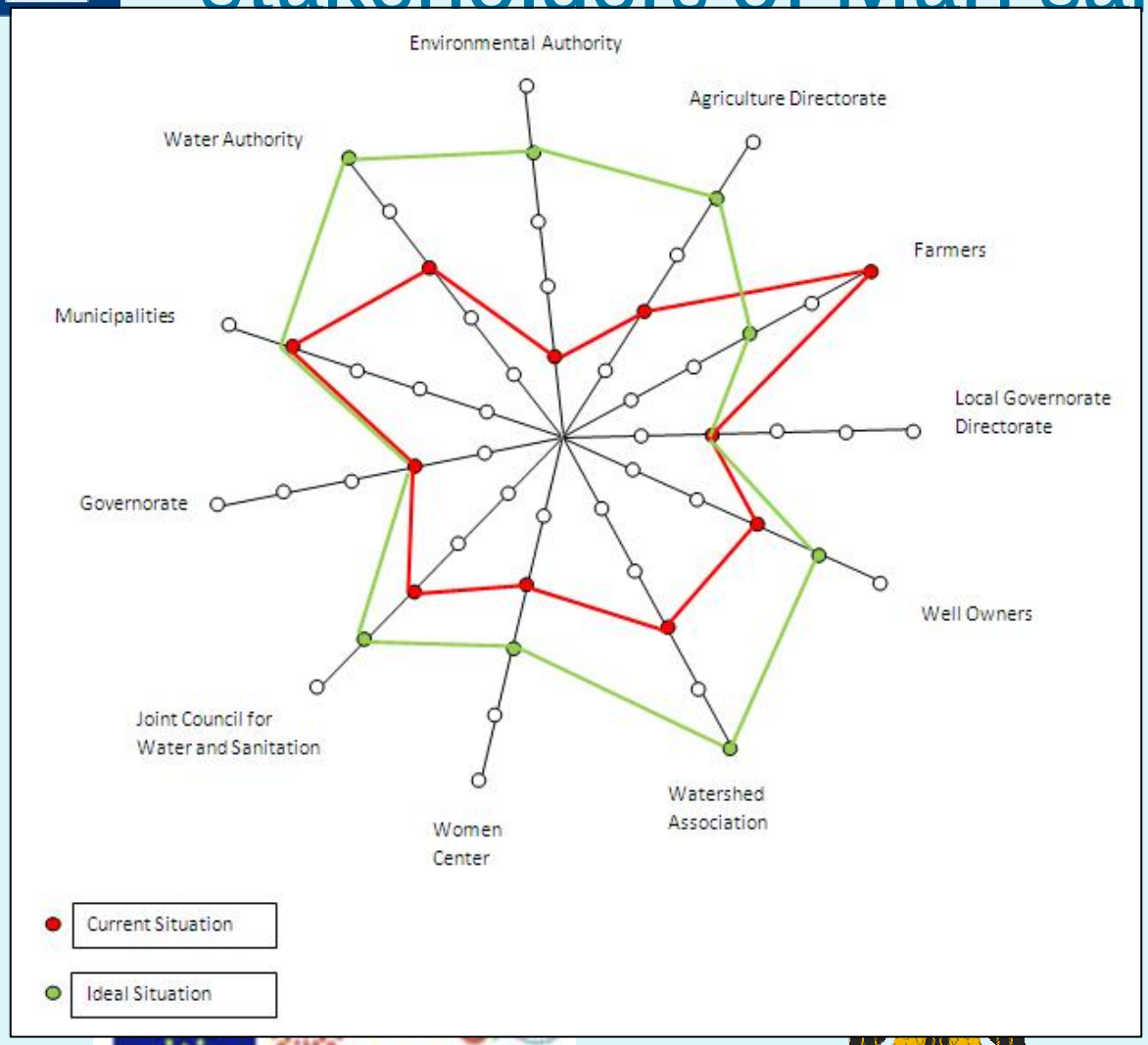
Knowledge management analysis exercise	Window: C1
Actor potential checklist	Window: C2
Defining possible actions	Window: C3/a
Strategic commitments	Window: C3/b

Stakeholders of Marj Sanour



- Stakeholder Categorization in relation to their interest as Primary and Secondary

Stakeholders of Mari Sanour



- Stakeholder Role (Existing and Expected)

Stakeholders of Marj Sanour

	Stakeholder	11	10	9	8	7	6	5	4	3	2	1
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		....	....	....	....	....	....	....	....	....	....

- Stakeholder Linkages

+ refers to having a relation, - refers to absence of a relation, +- refers to having an unofficial relation, 1 refers to unimportant relation and the symbol 2 refers to having an important relation.

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Participatory Problem Analysis

- Low and irregularity of rainfall
- Increase in temperature and humidity

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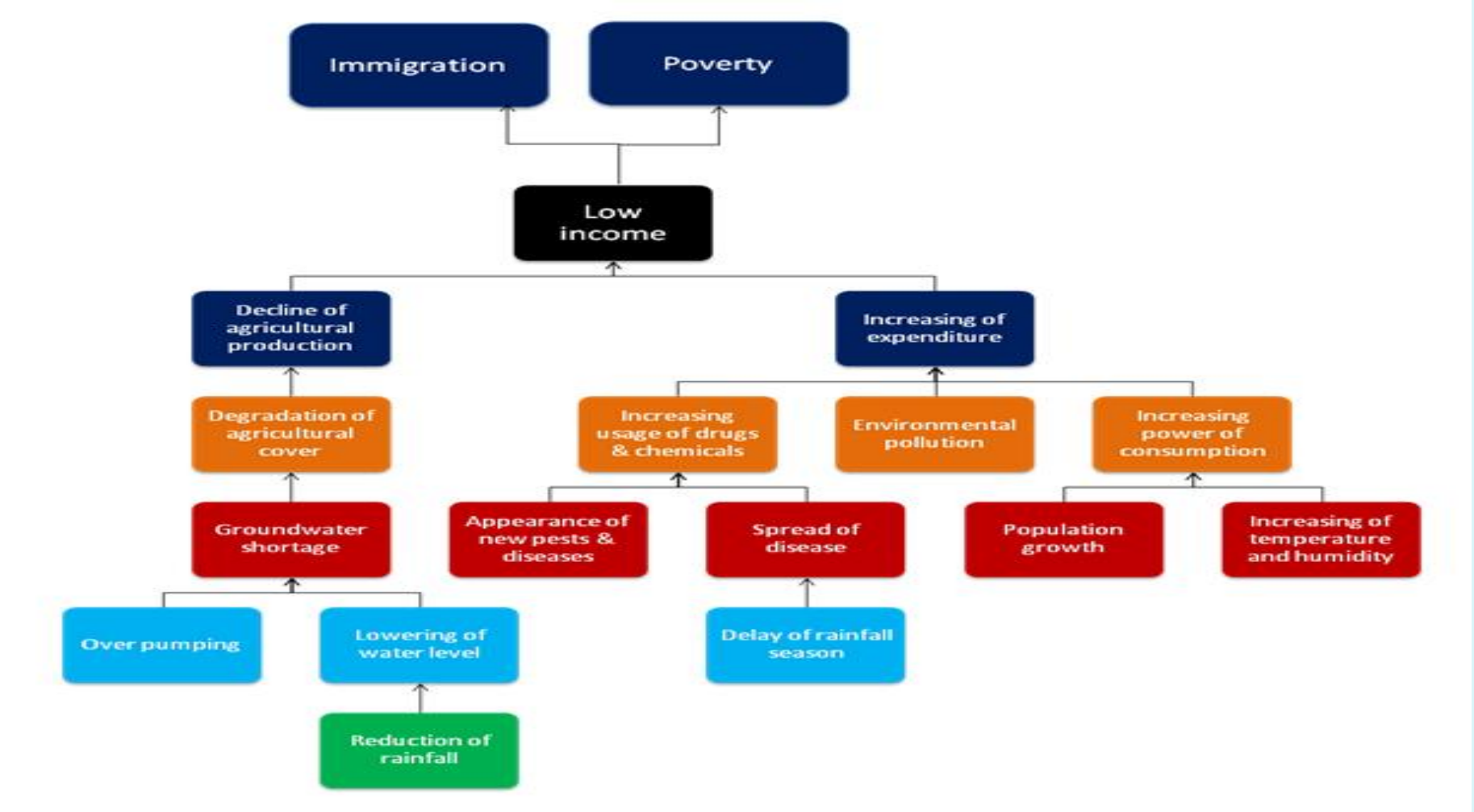
Problem Tree



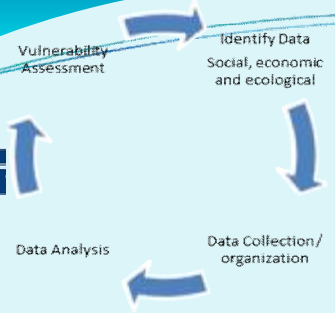
Preliminary Vision

Marj Sanour most important implications of climate change were expressed as follows:

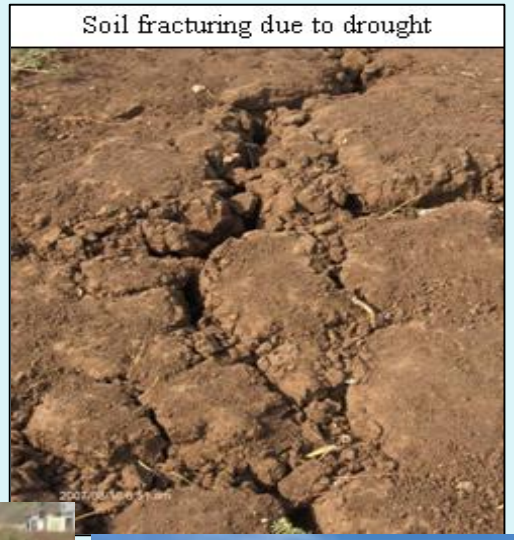
- Damage of winter crops before they reach the production stage
- Delay the ripeness of olive, where the flood in October was very low
- Low rates of crop production in general
- Delay in summer agriculture season in cases of flood
- Increase costs on livestock breeders due to limited pastoral areas in the cases of low rainfall
- Low profit returns from agriculture activities
- Spread of agricultural diseases

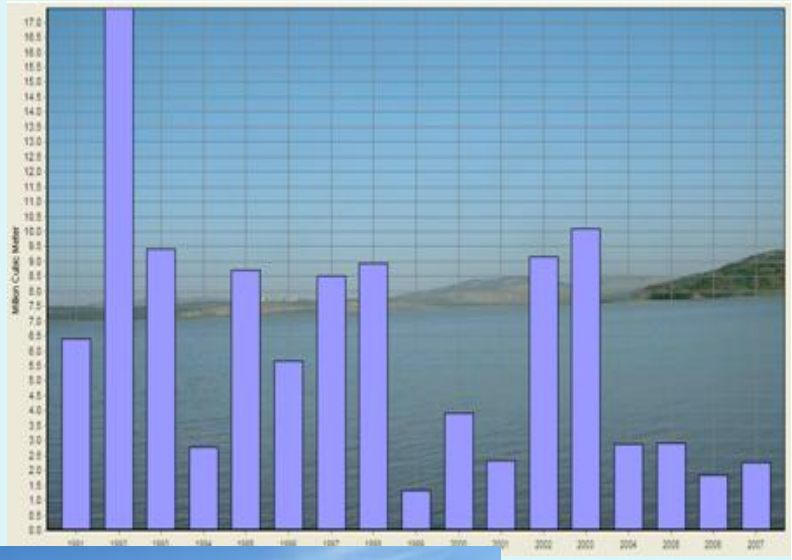
"Rural livelihoods in Marj Sanour watershed area will demonstrate effective ecosystem/watershed management and improve the conjunctive use of both ground and surface water in order to improve agricultural practices"

Vulnerability Assessment



Exposure
Sensitivity
Adaptive Capacity





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Causes	Vulnerability sources		Event	Impacts	Sector	Other causes of the same impact	Affected category	Affected area	Degree of watershed Sensitivity to Climate variability
	Human	Natural							
Intensive rain		✔	Flooding	Soil erosion in hilly areas	Agriculture	Lack of techniques	Farmers and local people	Valley areas, downstream areas, and adjacent residential areas	High
Natural closed watershed bounded by mountains		✔		Flooding of downstream area	Agriculture, and water	Low permeability of bed soil			
Low permeable bed soil		✔		Destruction of crops and trees	Agriculture, and economic	Agricultural pests, frost, wind, and drought			
Un reclaimed hilly areas, and lack of water harvesting techniques	✔			Destruction of infrastructure	Economic	Weak awareness in protecting public infrastructure			
Lack of infrastructure against runoff in hilly areas	✔			Transfer of weed seeds and spreading of human and agricultural diseases	Health, and social	Plowing and wind			
				Water accumulation in downstream area	Agriculture	Lack of water harvesting techniques			
				Inability to use the land	Agriculture	Drought			
				Lack of land use strategy	Agriculture	Drought			

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

Reduction of rainfall		✔	Drought	Lowering of groundwater level	Agriculture	Over pumping	Farmers and local people	Agricultural land	High
				Reduction of abstracted water	Agriculture	Over pumping			
Increasing of Temperature		✔		Limited quantity of harvested rainwater	Social	Over exploitation, and unsuitable storage facilities			
				Degradation of agricultural production	Agriculture	Agricultural diseases			
				Limiting of used agricultural land	Agriculture	Flooding			
				Increasing groundwater salinity	Environment	Over pumping			
Shifting of winter season		✔		Increasing of power consumption	Social	Industrial facilities			
				Increasing of diseases	Health	Weak awareness on healthy and environmental issues			
				Environmental pollution	Environment	Industrial facilities and the use of chemicals			
				Water resources conflict	Social	Ownership conflict			

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

Watershed nature		✔	Frost wave	Destruction of infrastructure (pipes and water meters)	Social, and agriculture	Human abuses and occupation military forces	Agriculture	Watershed area	Medium
Sudden change of temperature		✔							
Clear sky		✔							
Watershed nature		✔	Wind storms	Destruction of simple facilities	Social	Human abuses	Agriculture	Open areas	Medium
				Destruction of green houses	Agriculture	Careless			

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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

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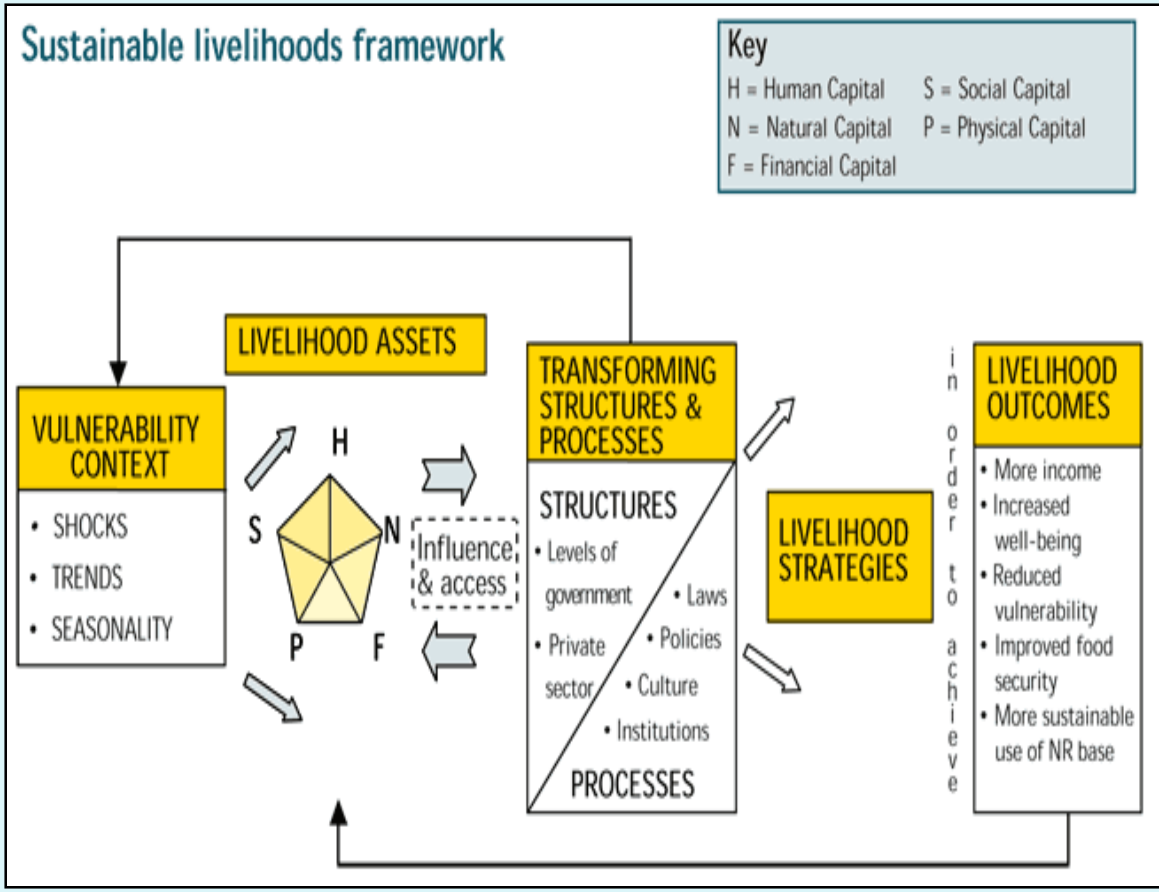
Sustainable Livelihood Assessment

	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



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Adaptive Capacity Assessment

- What are the measures locals of Marj Sanour are currently practicing to cope with climate change impacts?
- Are they enough and effective?
- What other suggestions locals of Marj Sanour have to adapt to climate change impacts?
- What are the obstacles in applying these adaptation measures?

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Adaptive Capacity Assessment

Risk	Impacts	Coping measure	Effectiveness	Degree of the adaptive capacity	Suggested adaptation measure
Flood	Soil erosion	– Planting trees – Building stone retaining walls – Avoid plowing steep lands – Reverse plowing	Effective but not enough	Low	Land reclamation and building new retaining walls
	Flooding of agricultural lands and inability to cultivate	Pump the water to adjacent lands and cultivate it	Not enough		– Recharge wells – Cultivate fodder crops – Deep plowing – Make the flooded lands a natural reserve
	Crop damage	Re-cultivate the lands with summer crops	Not enough		Cultivate types of crops that are tolerant to flood water like Alfalfa

Adaptive Capacity Assessment

Drought	– Decline of groundwater level – Increase salinity of ground water – Increases pumping rates	– Decrease areas of irrigated lands – Cultivate crops with low water requirement – Increase depth of present wells and drill more wells	Not convenient	Medium	Groundwater recharge to increase available water and pumping quantities for domestic and agricultural use
	Decrease in water harvesting quantities	Purchase water from tankers	Not convenient and not enough		----------
	Decrease in Cultivated lands and agriculture production	– Purchase water from tankers – Off-farm jobs	Not convenient and not enough		----------
	Increase consumption of electricity and fuels	----------	----------		----------
	Conflict on water resources	----------	----------		Identify the pumping rates

Adaptive Capacity Assessment

Frost	Damage of infrastructure and crops	– Use of smoke – Water spraying – Covering of crops	Not enough	Low	----------
Wind	Damage of facilities and greenhouses	Rehabilitation of damaged facilities	Not enough	Medium	– Frequent maintenance of facilities – Build of windbreaks

Local and national obstacles against applying adaptation measures, from stakeholders' perceptions, were identified as follows:

•Lack of required fund

•Administrative regime

•Current political situation; occupation and its consequences

•Land fragmentation; Marj Sanour lands are owned by different families from different communities

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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

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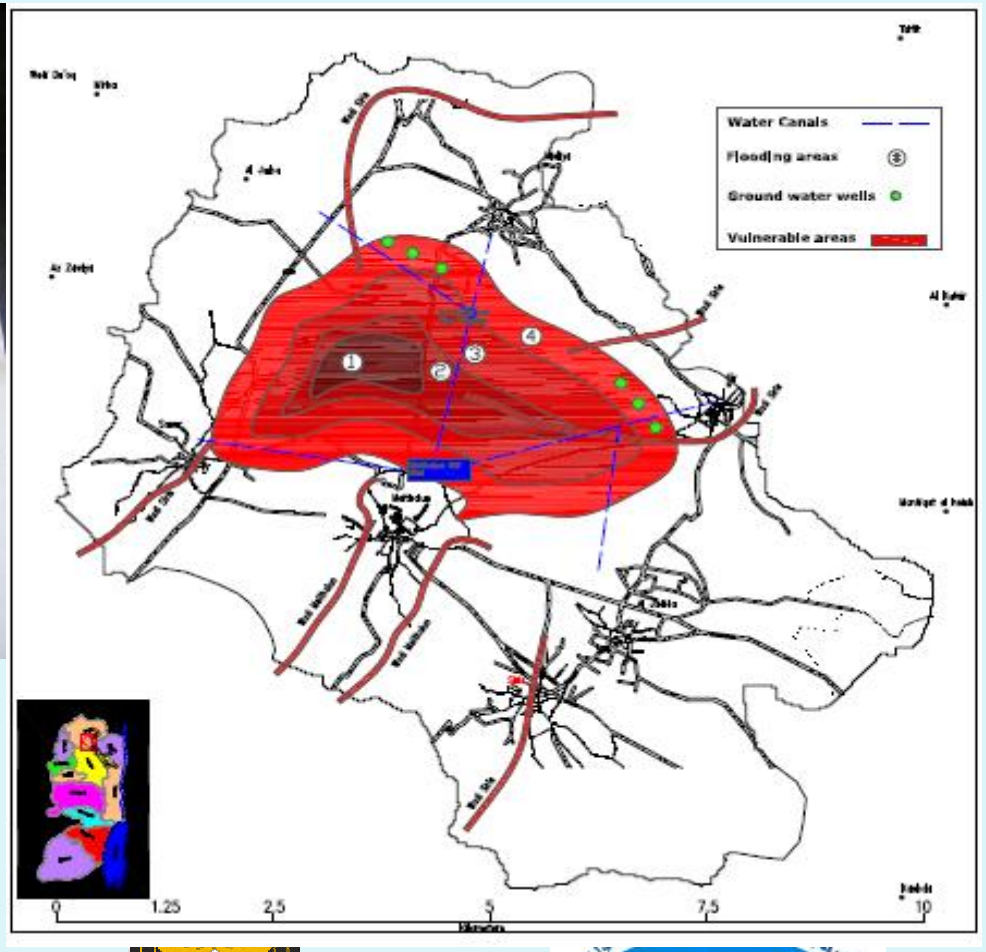
Defining Vulnerable Areas



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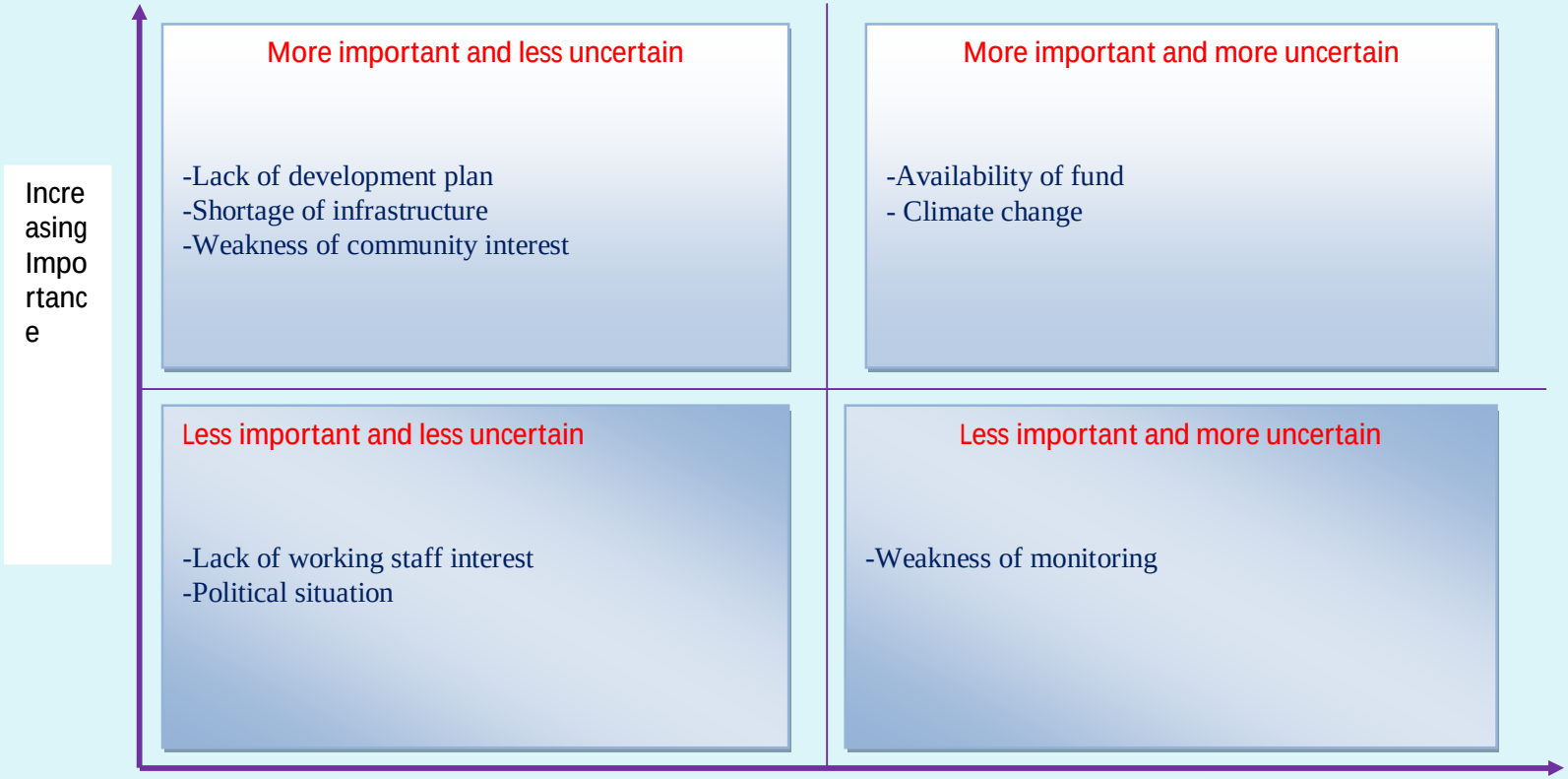
Scenarios and Strategies



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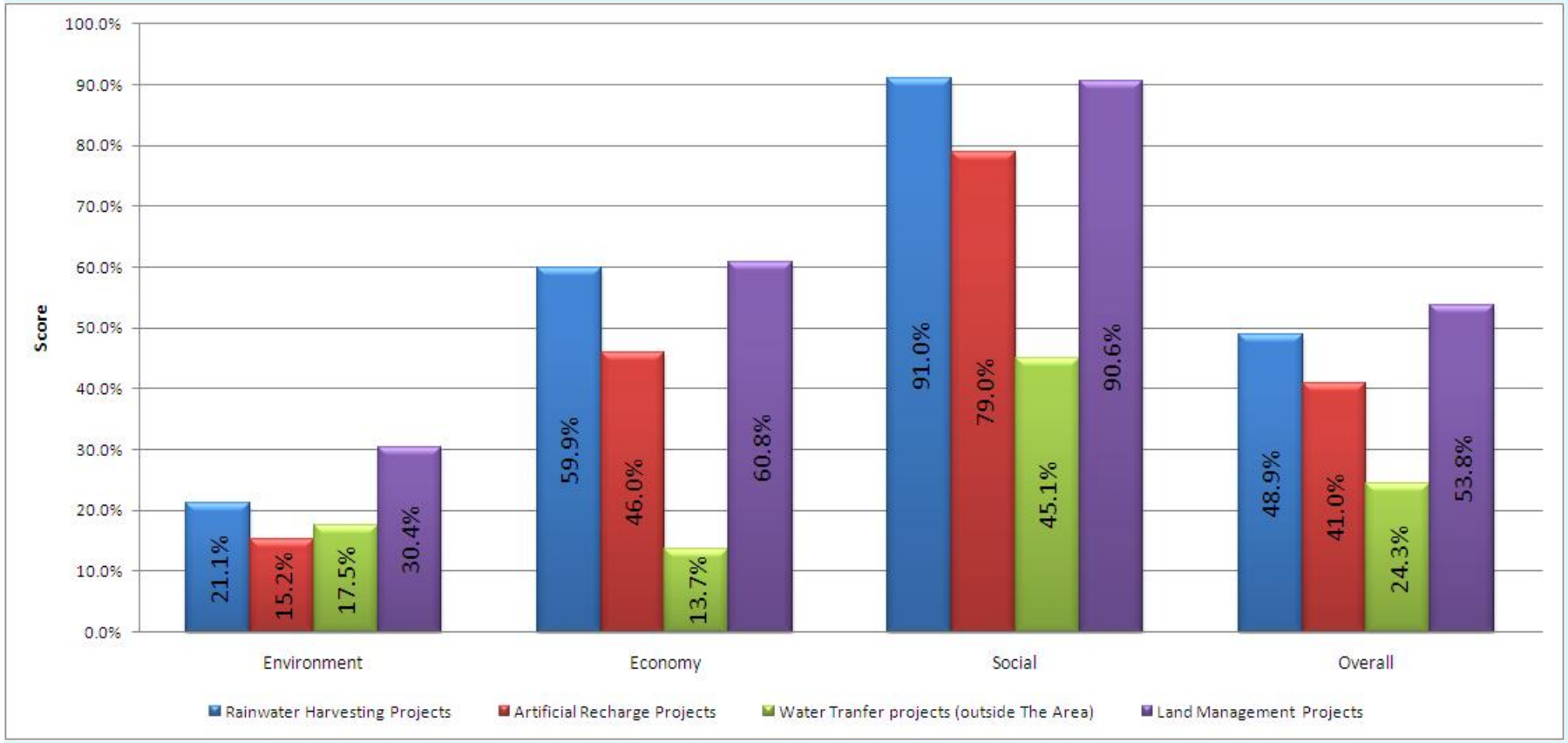
Proposed Actions

Activity	Scenarios			
	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Constructing domestic and agricultural cisterns, and reservoirs	X	X	X	X
Constructing large pools	X		X	
Constructing dams	X		X	
Reclamation and rehabilitation of land	X	X	X	X
Providing modern agricultural equipments	X		X	
Training of farmers	X	X	X	X
Introducing new crops (organic crops)	X	X	X	X
Constructing artificial groundwater recharge structures	X		X	
Building stone retaining walls and terraces	X	X	X	X
Activating farmers associations	X	X	X	X
Encouraging home gardens and animal husbandry	X	X	X	X
Improving olive trees, and olive oil	X	X	X	X
Tourist attraction	X		X	
Constructing and rehabilitating agricultural roads	X		X	

Ranking and Prioritization



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