



Lebanese Republic
The Litani River Authority

CLIMATE CHANGE EFFECT ON IRRIGATION

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Outline

- Introduction : Litani River Authority (LRA)
 - Litani River basin
 - Irrigation schemes for LRA
- Problems facing the Litani River
- Climate Change Projection in Lebanon
- Effect of climate change on agricultural sector in Lebanon
- Adaptation Techniques
- Conclusion

Litani River Authority (LRA)

- Created by a Law dated on 14 August 1954 and rectified later on 30 December 1955

- Mission:

- Execute the Litani River Master Plan for irrigation, drainage and domestic water.

- **Irrigation Schemes** in South Bekaa and South Lebanon

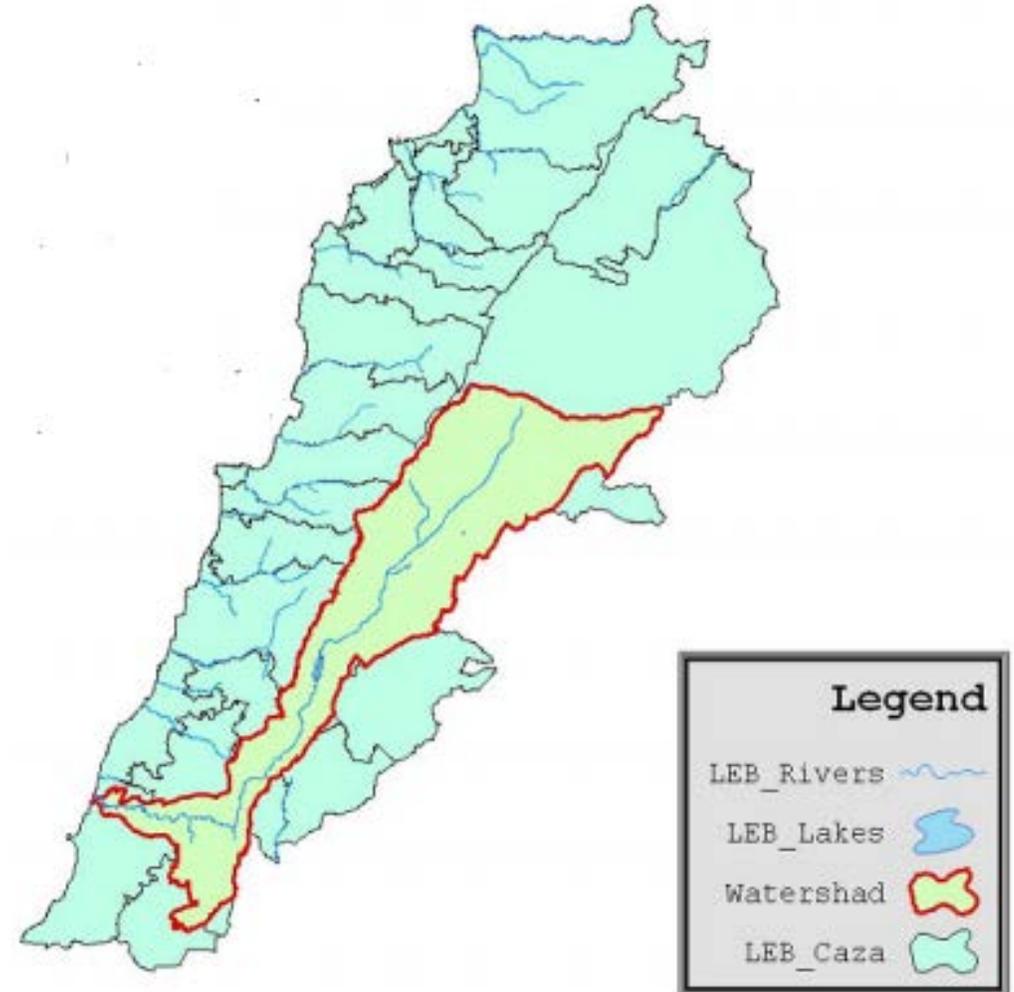
- Representing 42% of Lebanese Area (264 Villages and Towns) (total 76,000ha)

- **Water governance** at Litani Basin Basin



Litani River & Watershed

- The Largest in Lebanon with 2170 Square Kilometres (20% of Lebanon Total Area)
- 30% From the total Flow of all Lebanese Rivers.
- Totally running in Lebanon along 170 Km and 60 Km of tributaries
- **The Litani river is a major source of irrigation and drinking water**
- The UPER litany basin is the main river basin in Lebanon and hosts **half of the agricultural lands** in Lebanon



Irrigation Schemes for LRA

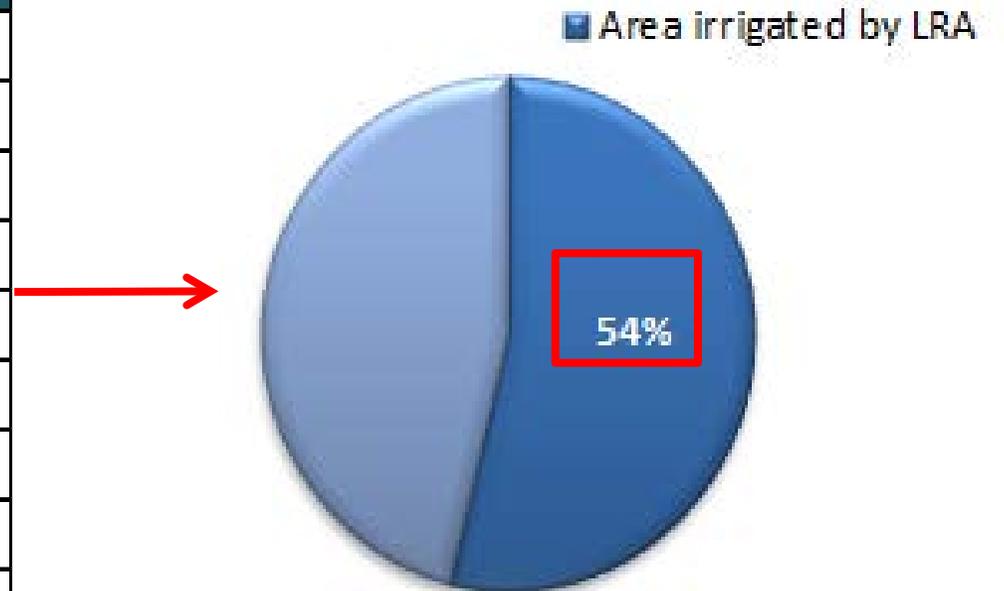
- **Qaraoun Lake** : largest artificial lake in Lebanon (area 12km² and capacity 220Mm³)
- **Canal 900** : 13000 Mm³/year
- **Conveyor 800** : 12 Concrete & 8 embankment reservoirs of total capacity 110MCM for irrigation 13,000 ha of land and water supply for 70 villages
- **Quasmieh & Ras el Ein Project**: 4000ha of open channel systems



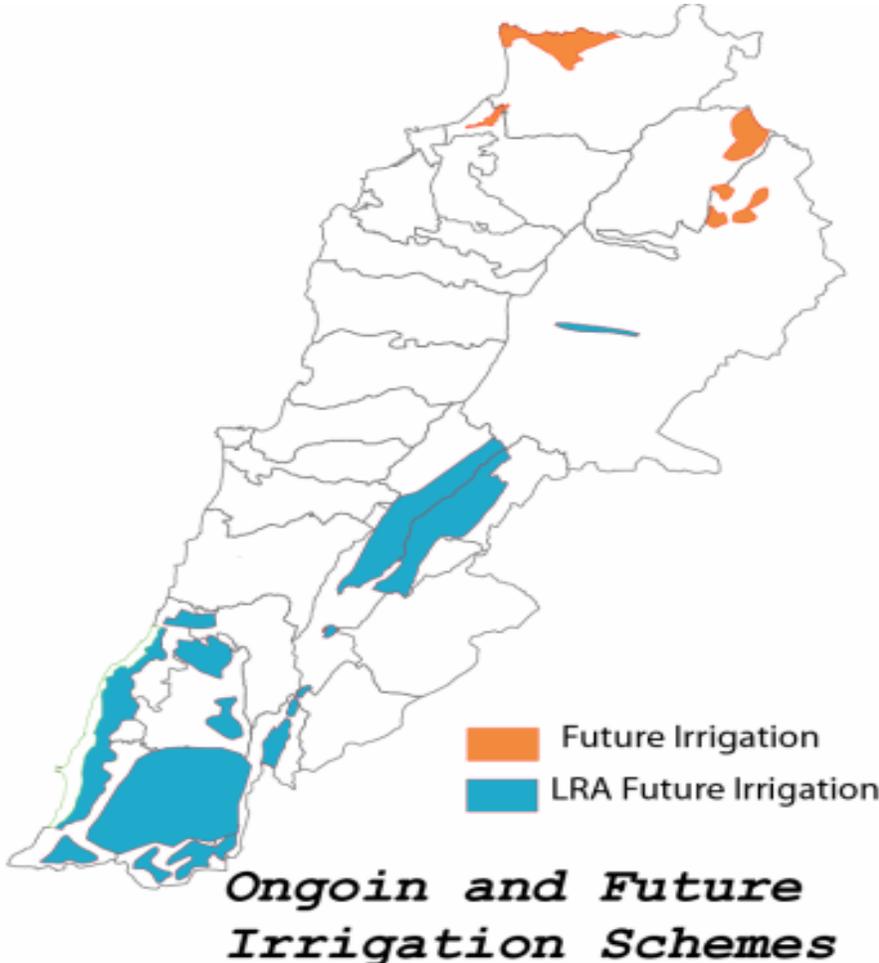
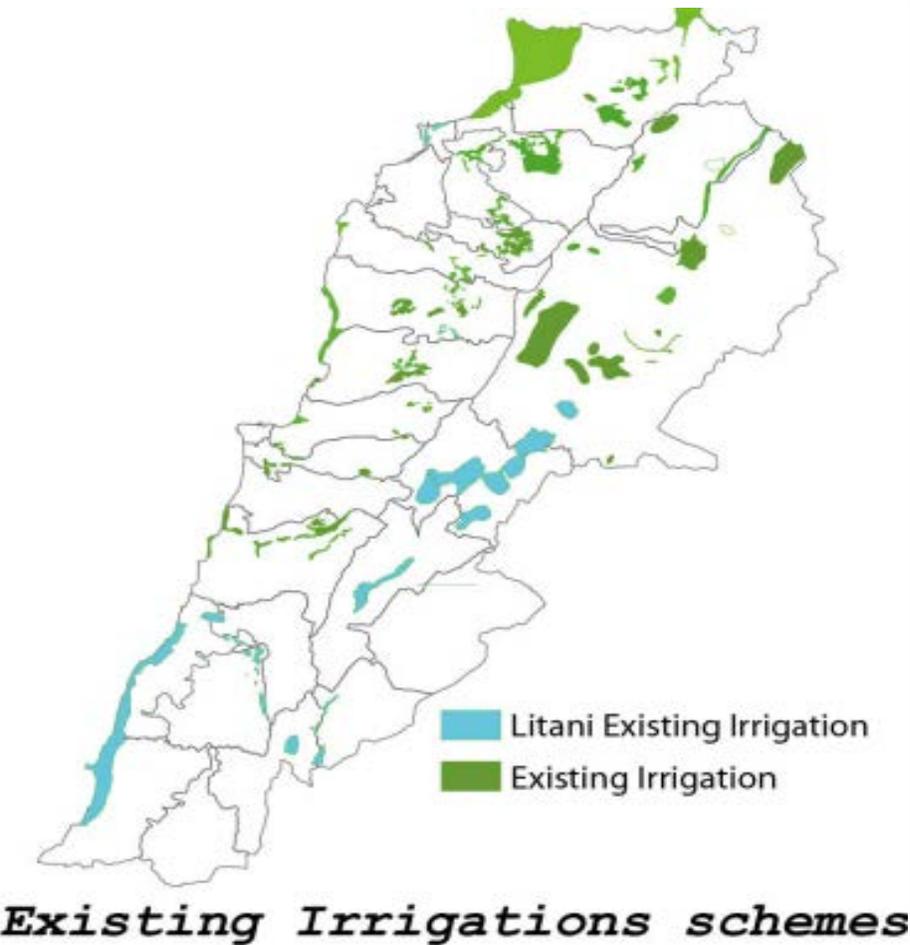
Litani River Authority Irrigation Schemes

Lebanon Vs LRA	Area (Ha)		
	Irrigated	Ongoing/Proposed	Total
Total Lebanon Schemes	60 900	82 000	142 900
LRA Schemes	16 530	60 330	76 860

Region	Project	Area (Ha)			
		Irrigated	Ongoing	Proposed	Total
South Bekaa	South Bekaa	2000	6700	14800	23500
	South Qaraoun Dam		980		980
	Small and medium Schemes	8090			8090
	Total	10090	7680	14800	32570
South Lebanon	South Lebanon		15000	20000	35000
	Qasmieh	4000		2000	6000
	Pilot Sector	350	850		1200
	Small and medium Schemes	2090			2090
	Total	6440	15850	22000	44290
Total		16530	23530	36800	76860

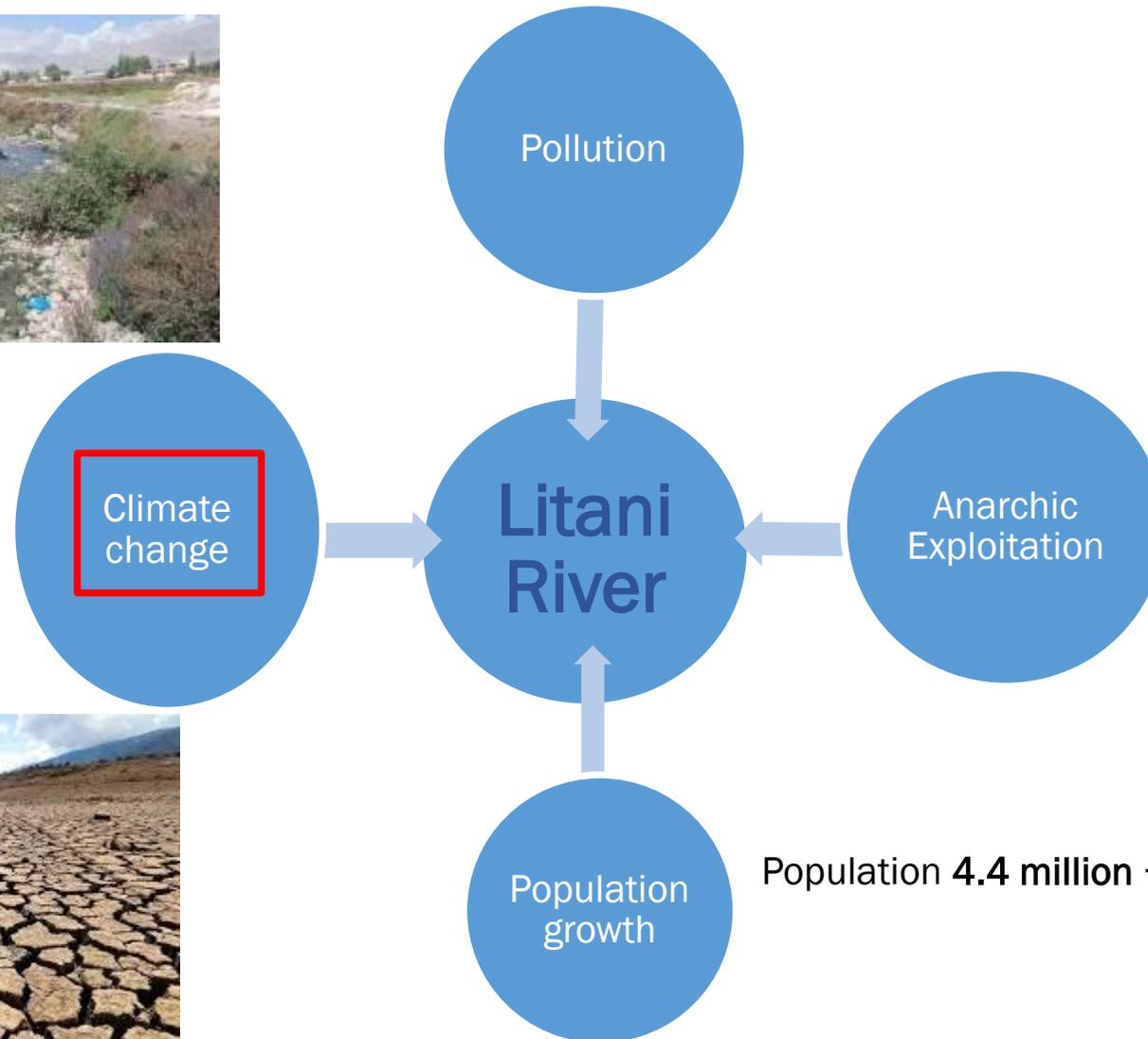


Irrigation Schemes (Lebanon Vs LRA)



Risk of incomplete schemes in the future !

Main Problems and Risks Threatening the Litani River Water



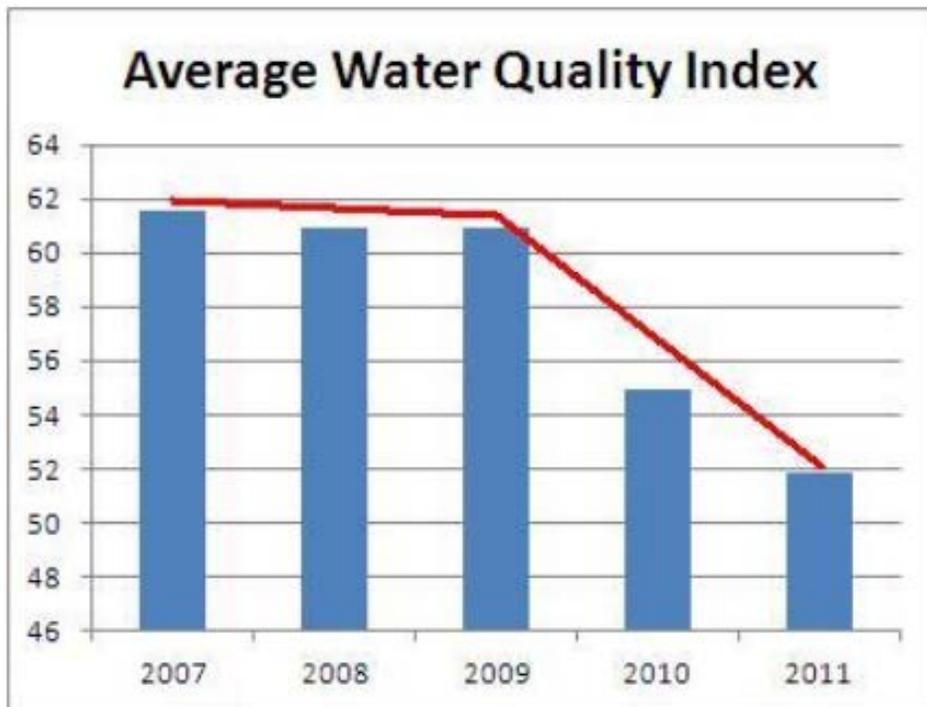
Population **4.4 million** + Refugees **1.7 million**

Water Quantity Issue

- **Human pressure on water resources has increased drastically since the 1970s, as confirmed by:**
 - **Significant decrease in river flows**, due to increased water withdrawals, through tapping of springs and direct pumping or diversion from the river for irrigation (personal purposes)
 - **Substantial groundwater depletion**, due to extensive pumping both for domestic and irrigation needs.

Water Quality Issue

- The quality of surface waters in the Litani River Basin varies seasonally and partially, but is generally bad
- Untreated wastewater discharges, both domestic and industrial, are one of the primary sources of pollution



Water diseases in the Bekaa

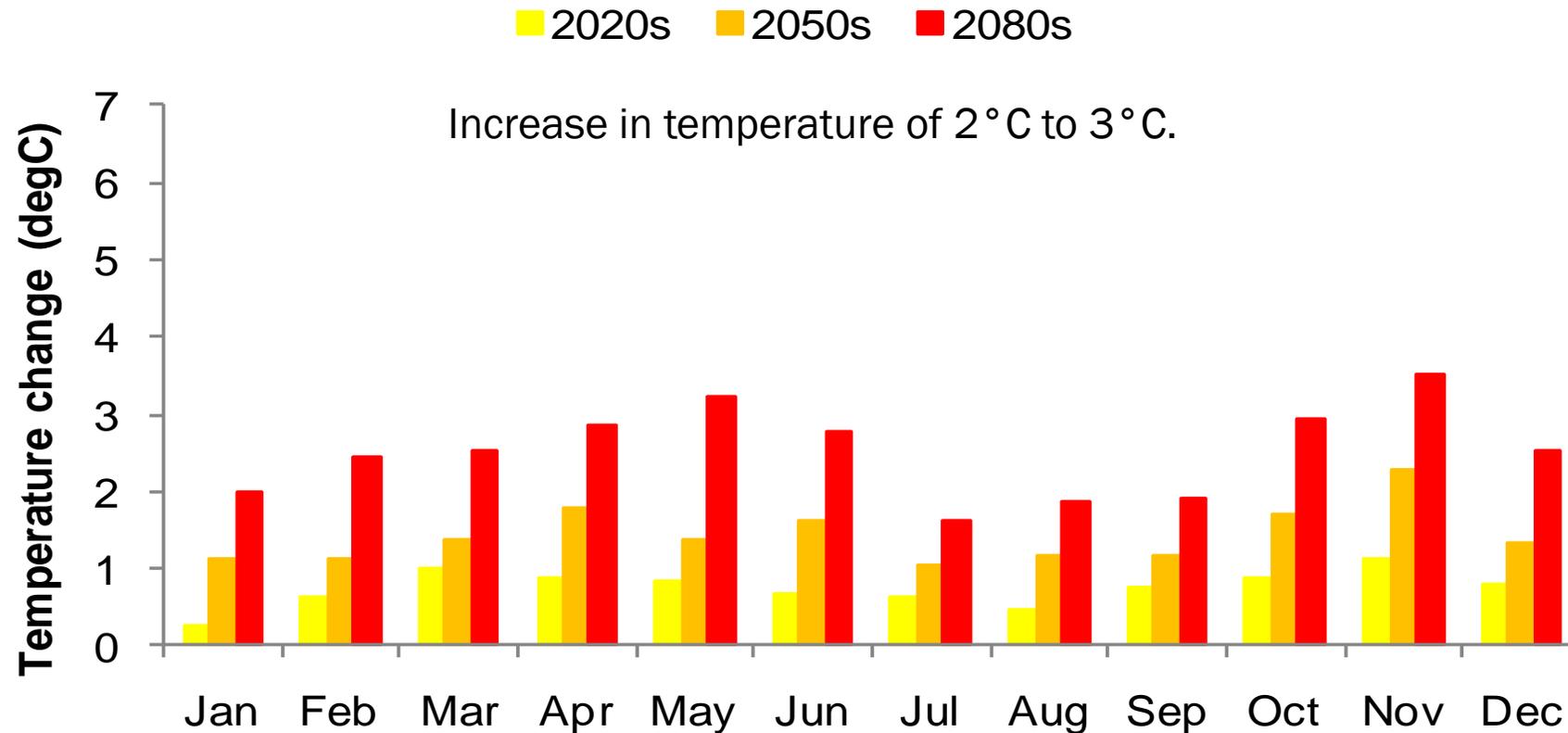
Poor water quality is a serious public health issue. Water-borne diseases are worldwide one of the leading causes of mortality. The occurrence of dysentery, typhoid fever and hepatitis A in the Bekaa is 7.5 annual cases per 10,000, that is twice the national average (2009 statistics from Ministry of Public Health). These are reported cases only, actual cases could be 5-10 times higher.

Litani River Pollution

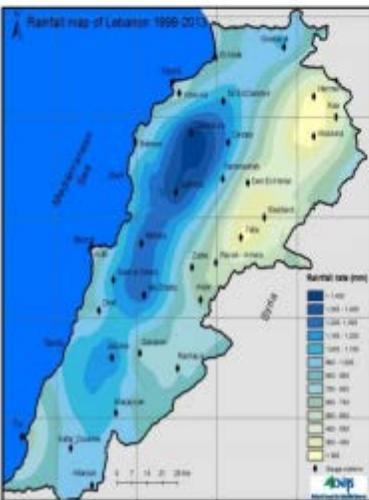
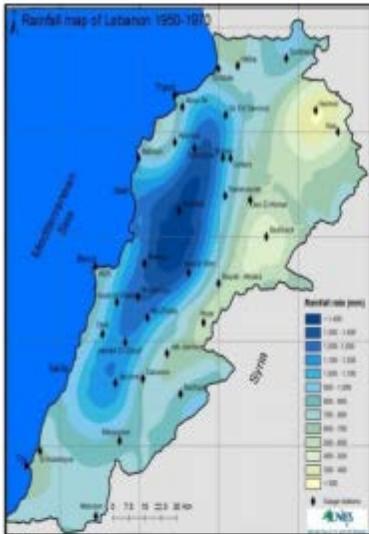


Climate projections: Temperature Change

Beirut A2

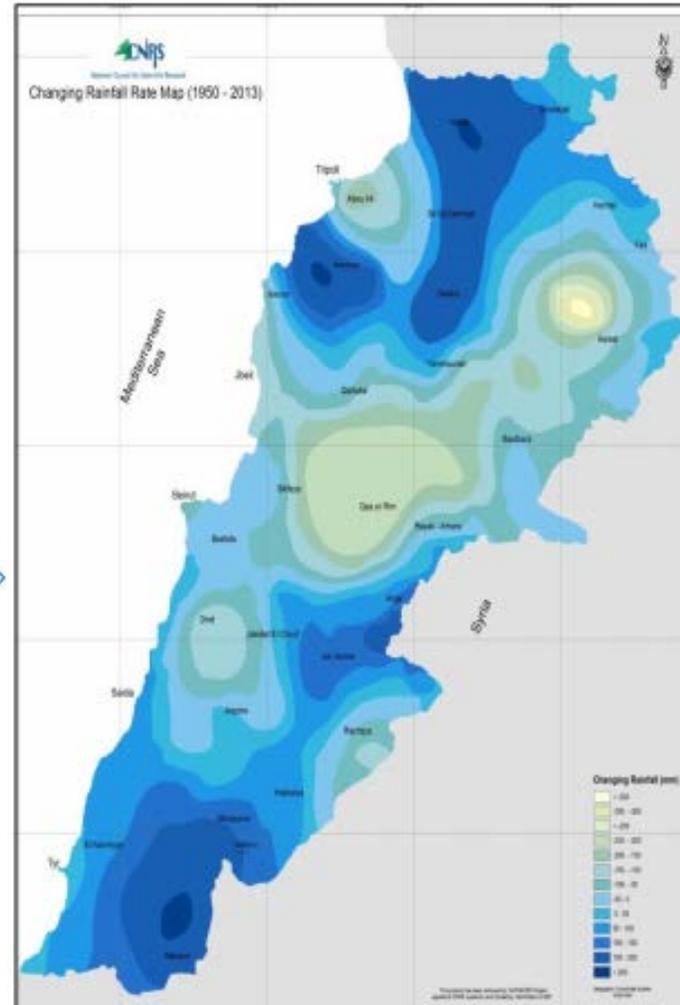


Climate projections: Rainfall quantities

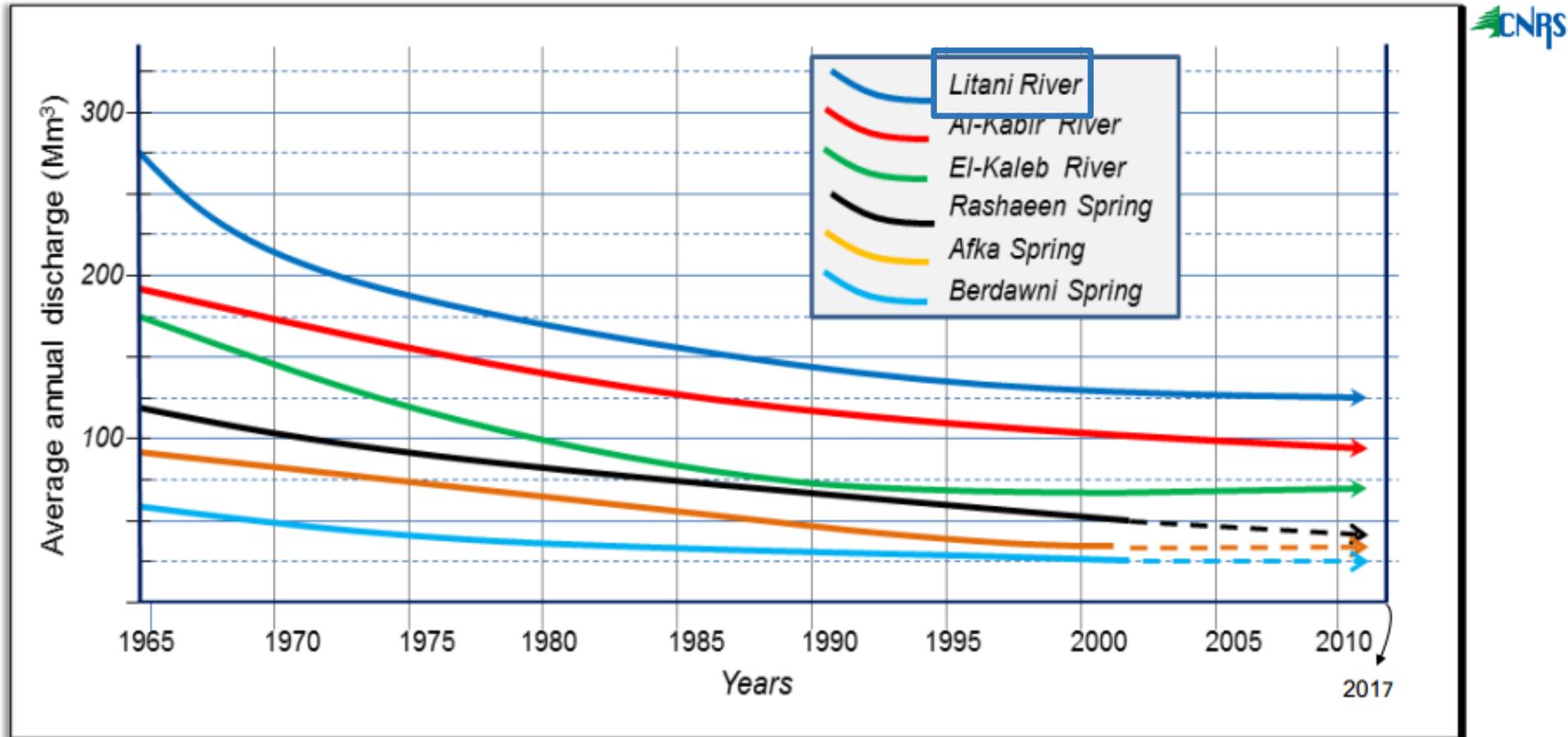


RAINFALL MAP
(1950-1970)

RAINFALL MAP
(1998-2013)

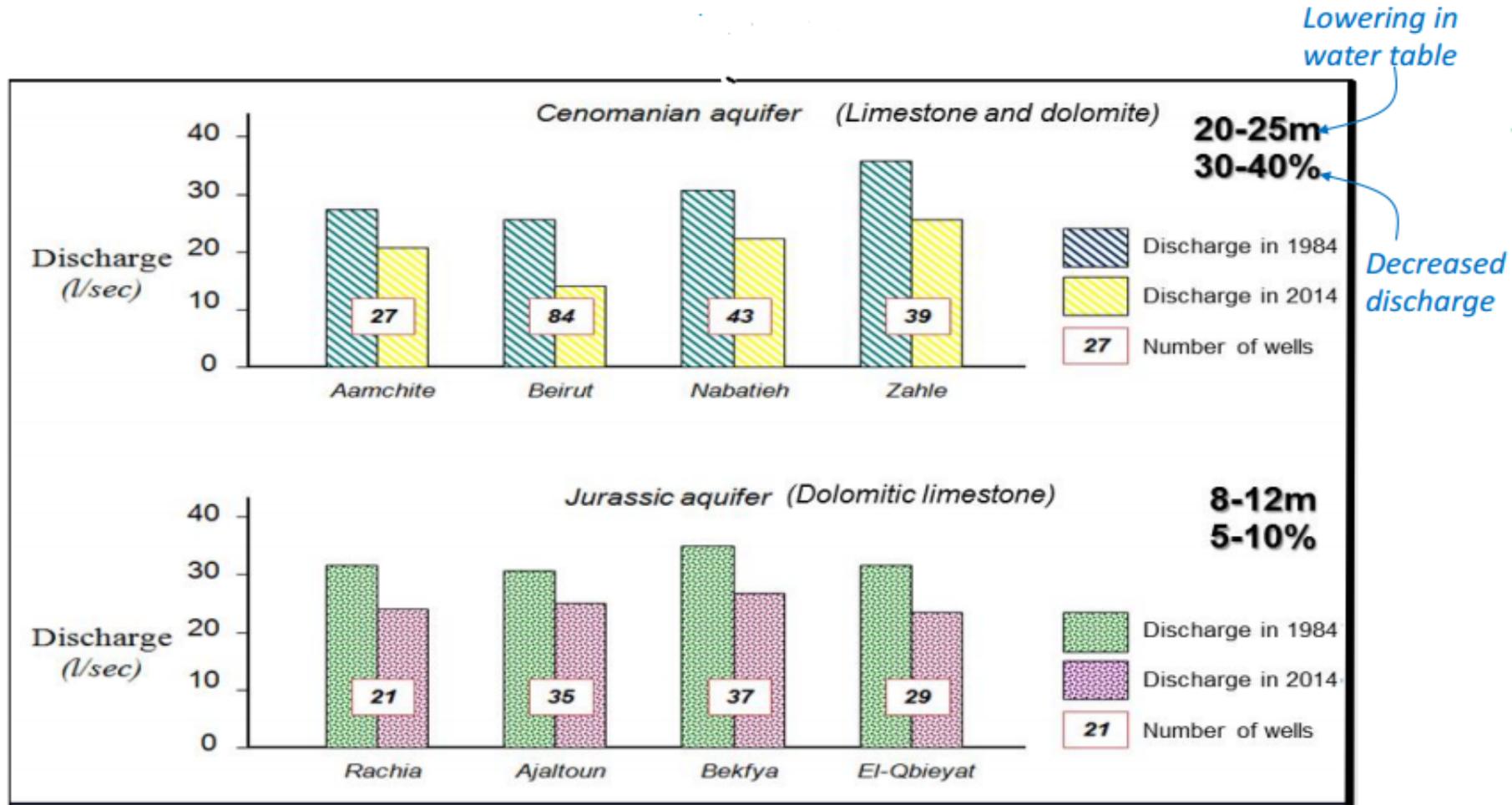


River Discharge in Lebanon



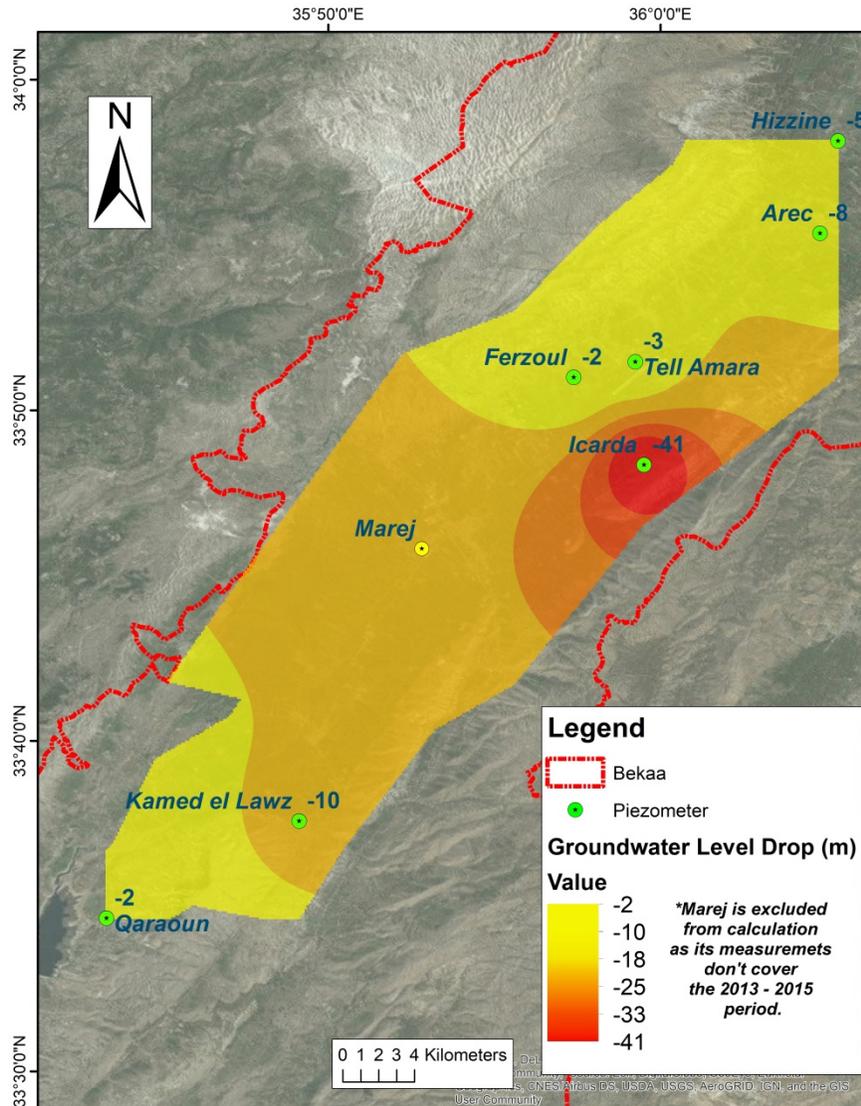
Decreased discharge in rivers and springs: reaches up to 55% (over 5 decades)

Ground water



Groundwater depletion in the major aquifers
 (245 boreholes)

Groundwater Level in the Upper LITANI Bassin



8 monitoring wells in the ULB Neogene-Quaternary (2013-2015)

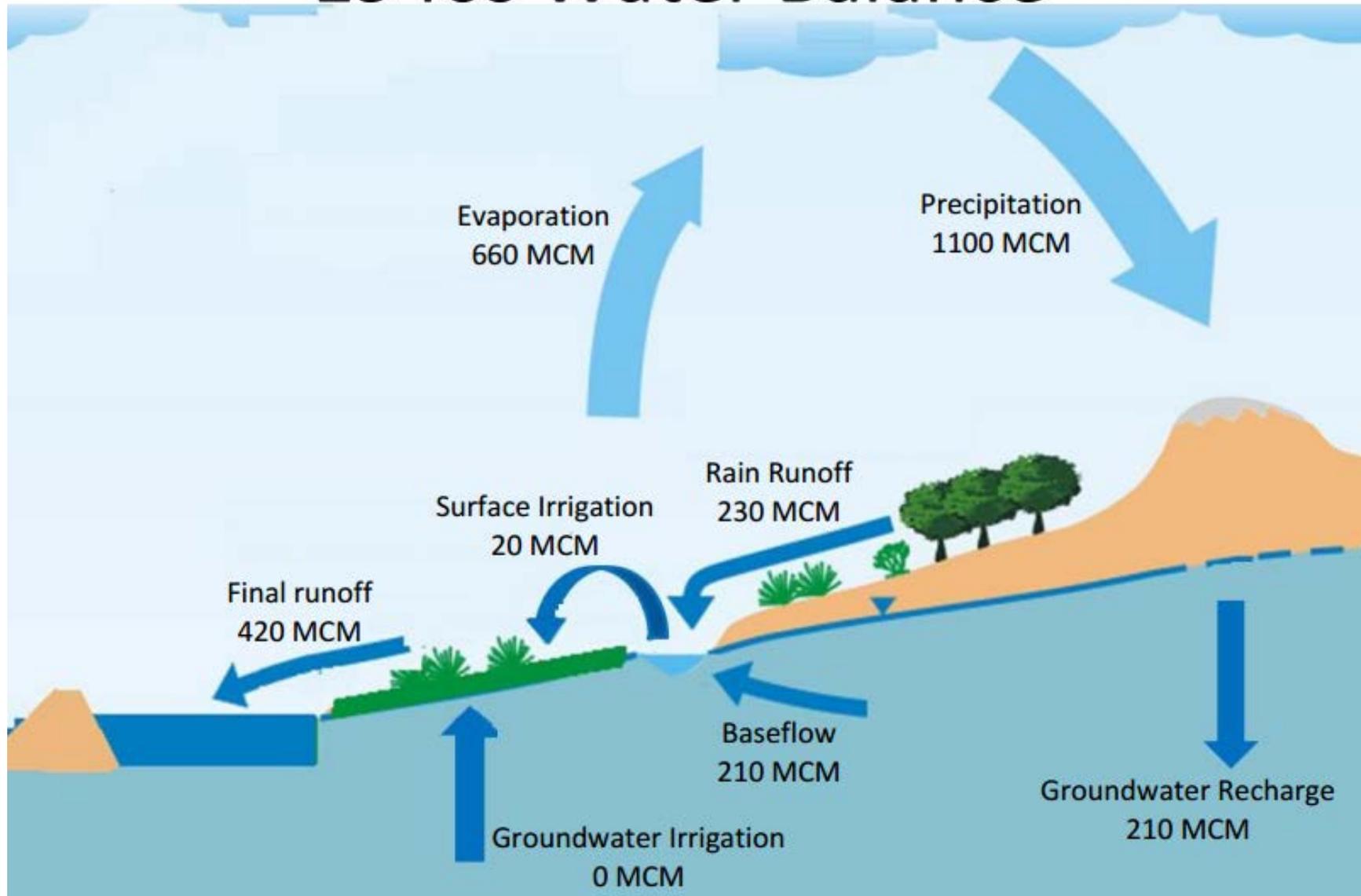
- Increasing pressures on groundwater resources

Dropping water level in all evaluated wells

- Drop ranging from **2-41 m**
- ICARDA 41 m; Kamed el Lawz **10 m**
- Results consistent with USAID-LRBMS (2013) & UNDP and MoEW (2014)

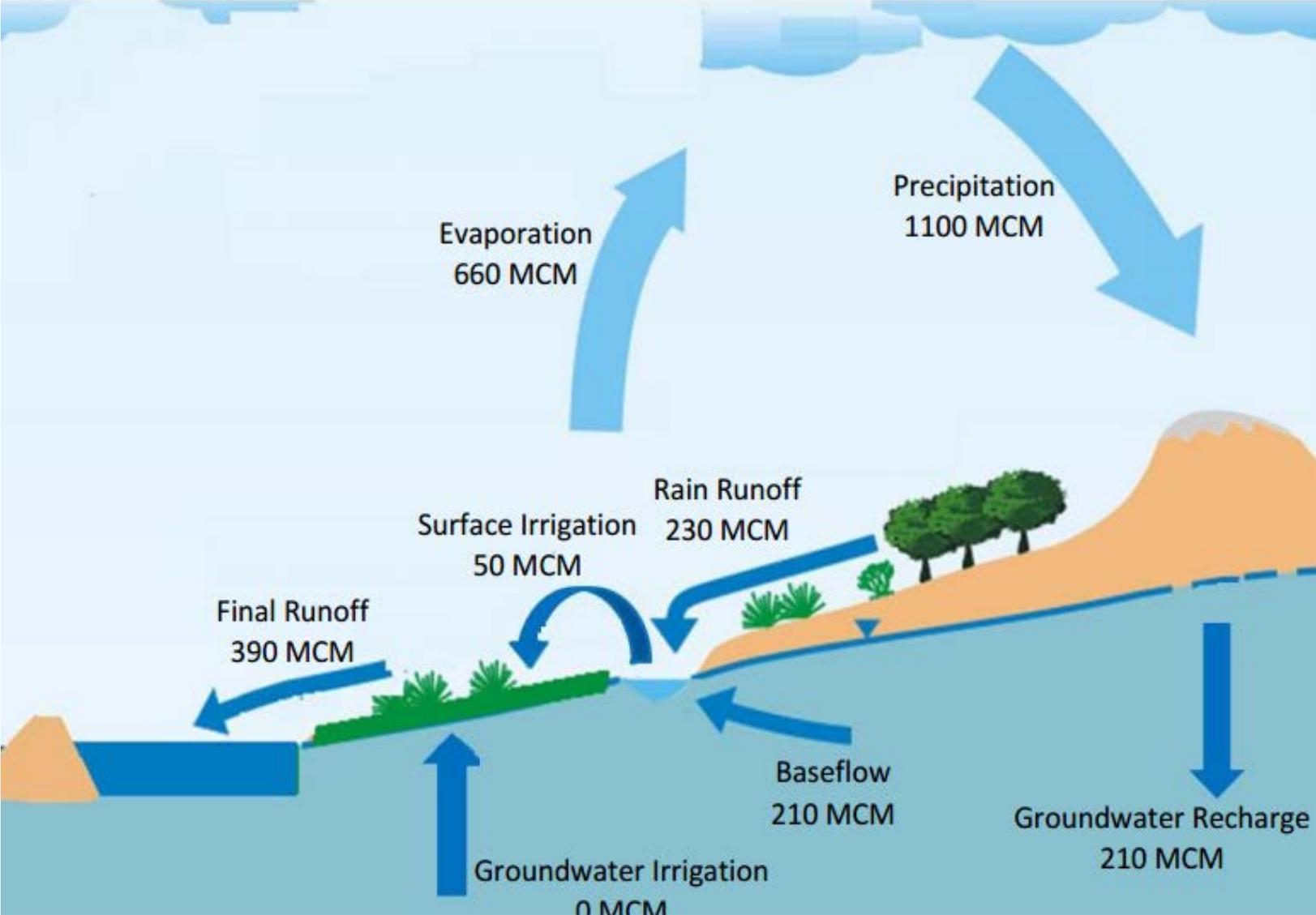
Water Balance of the Upper Litani River

1940s Water Balance

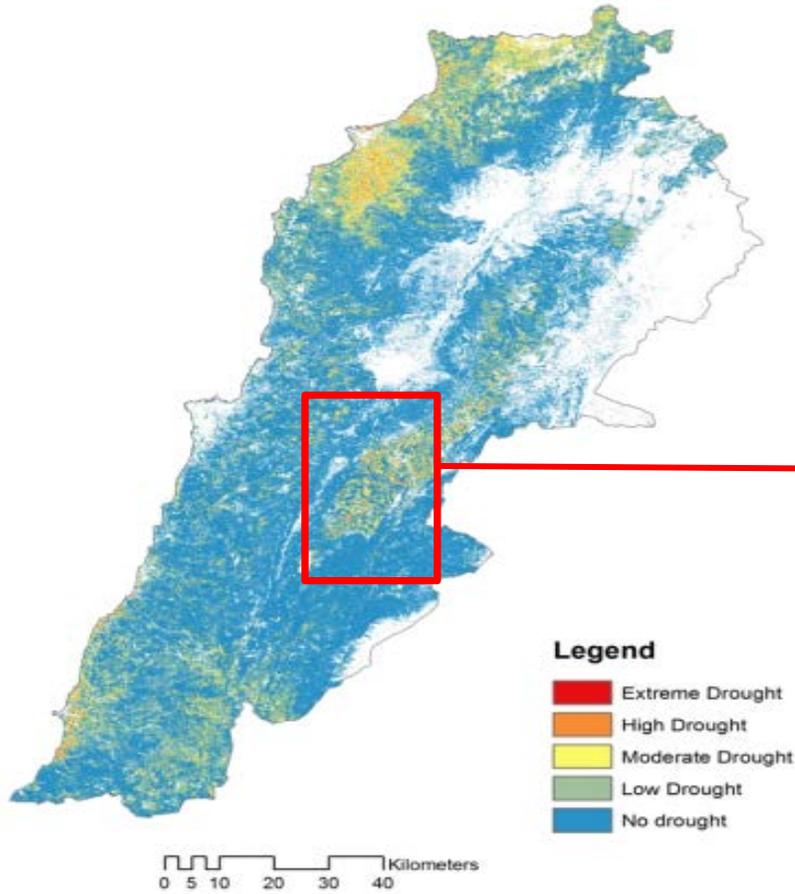


As climate change advances, springs and rivers will dry out earlier in the year if not forever !

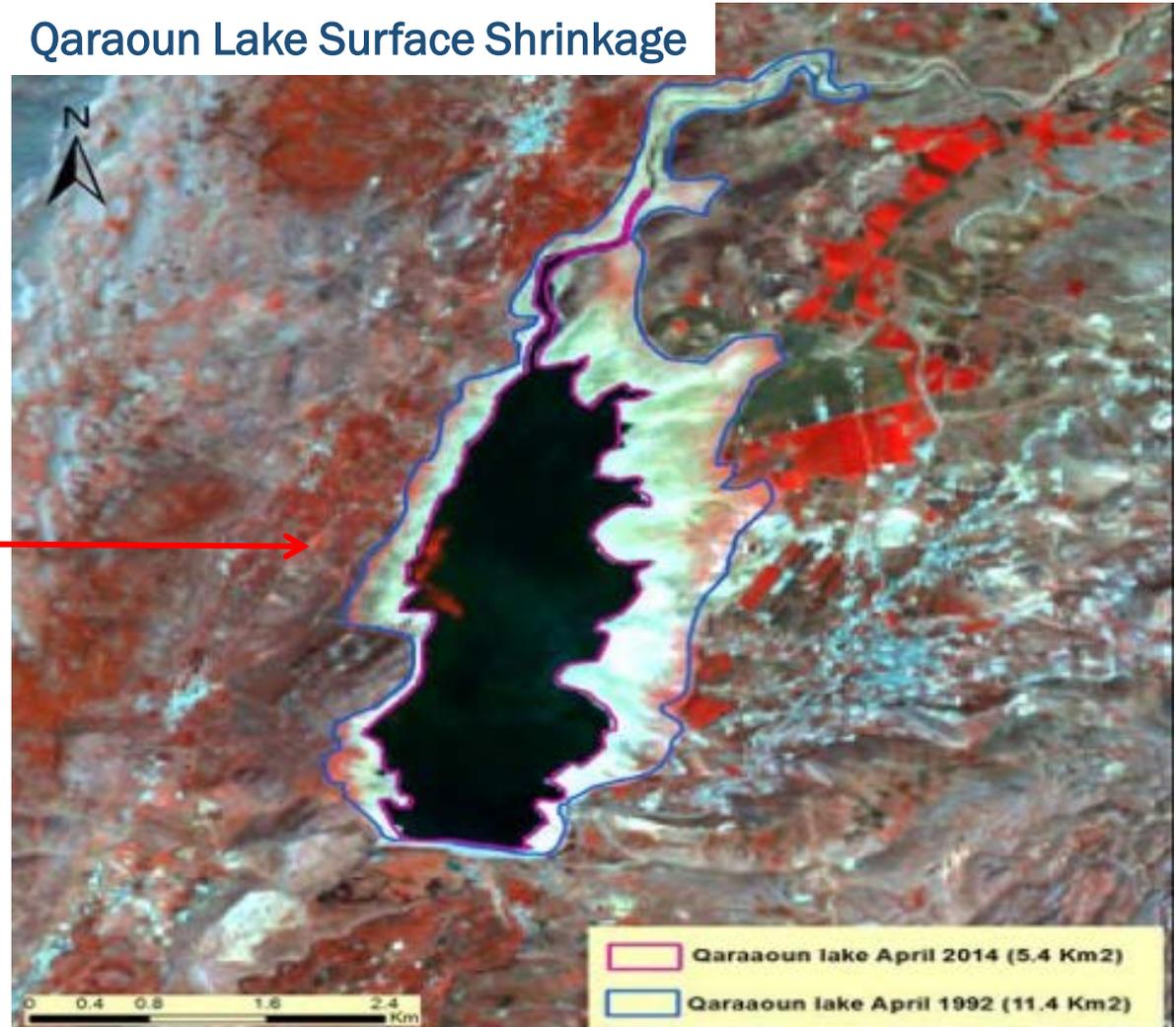
1970s Water Balance



Drought in the Litani Upper Bassin



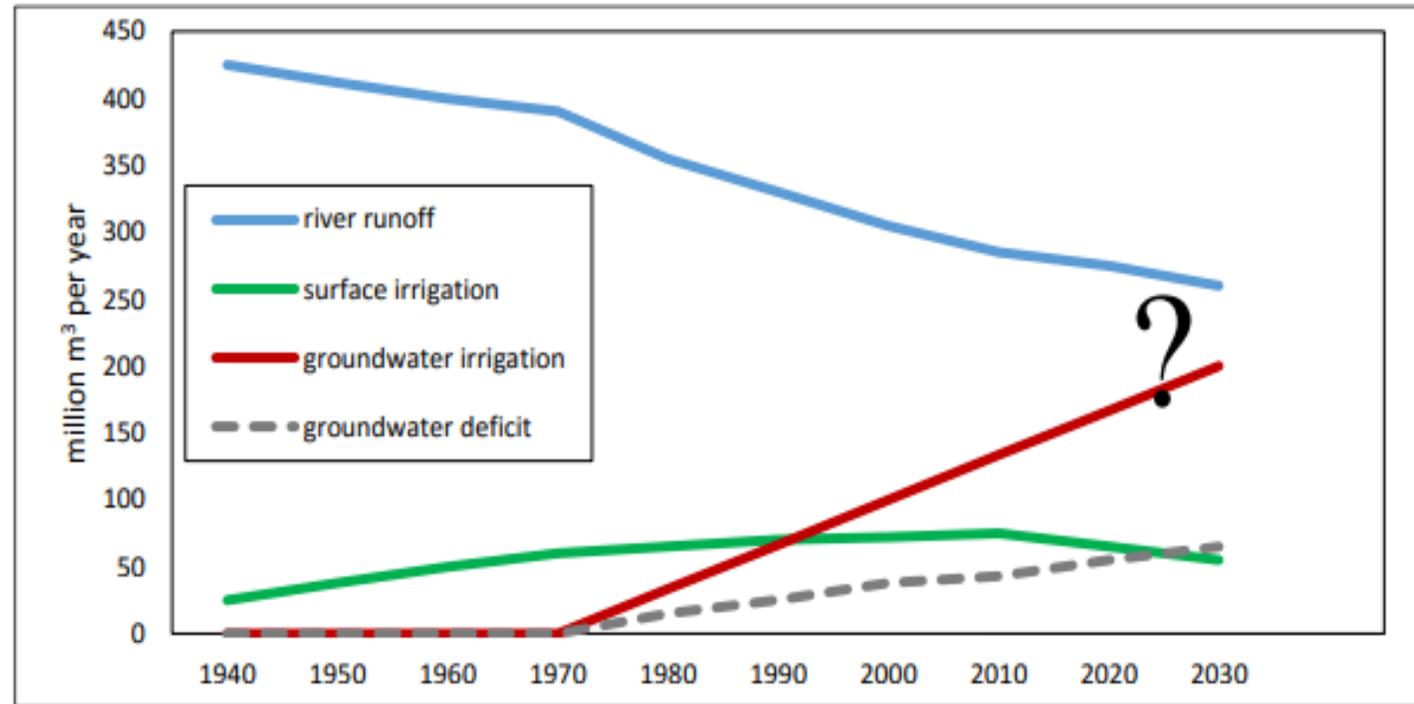
Qaraoun Lake Surface Shrinkage



Qaraoun Lake levels are dropping and pollution is Threatening



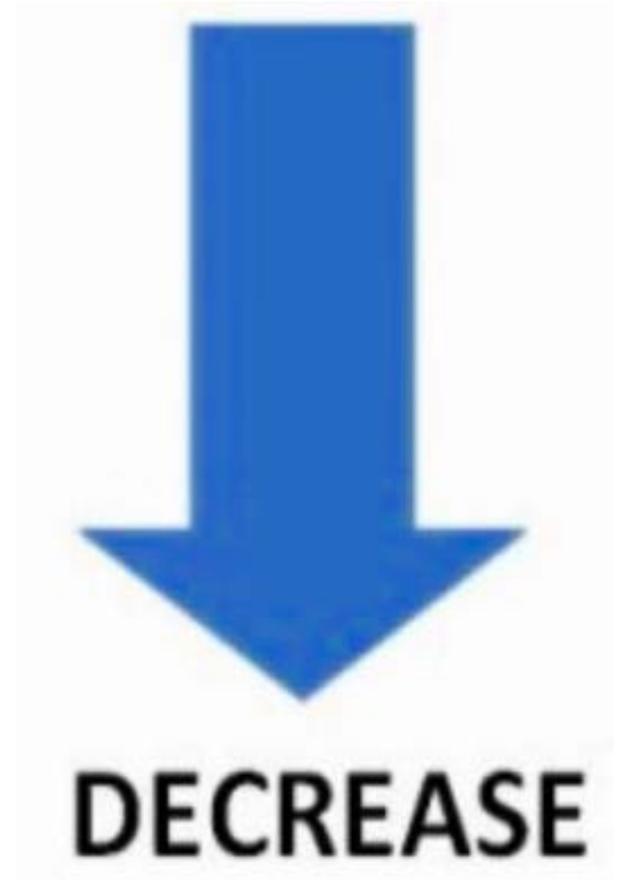
Evolution of water flows (MCM/y) in Upper LRB



(by United Nations (2009) and the USAID (2014))

Agricultural Sector in Lebanon

- FAO described the region of the **Upper Litani Basin**, the Bekaa Valley, as the major agricultural area, consisting 42% of Lebanon's farm lands and 50% of the irrigated land.
- Agriculture in Lebanon is the most vulnerable sector to climate change and experience a **decrease in productivity** for most of the crops and fruit trees



Agricultural Sector in Lebanon

Figure 10. Accumulated productivity changes in the agriculture sector due to climate change, Lebanese governorates, 2010–2030 (in percentage change)

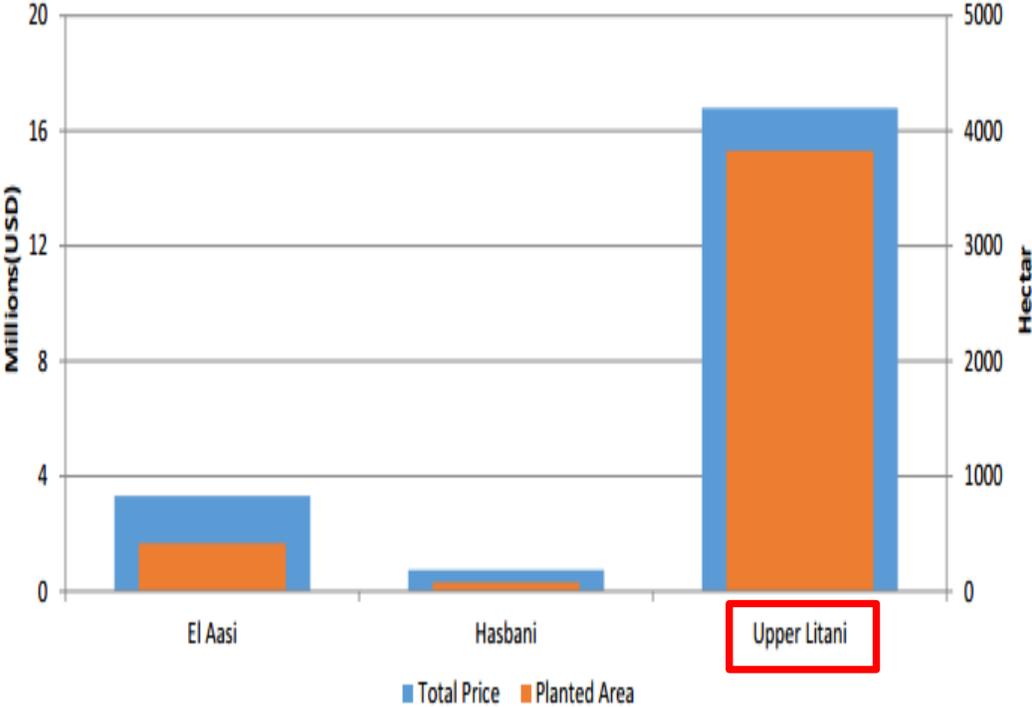
	<i>2010–2030</i>
	<i>Accumulated (%)</i>
Mount Lebanon	-5.72
Northern Lebanon	-8.44
Bekaa	-3.10
Southern Lebanon	-9.66
Nabatieh	-9.98

Agricultural Sector in Lebanon

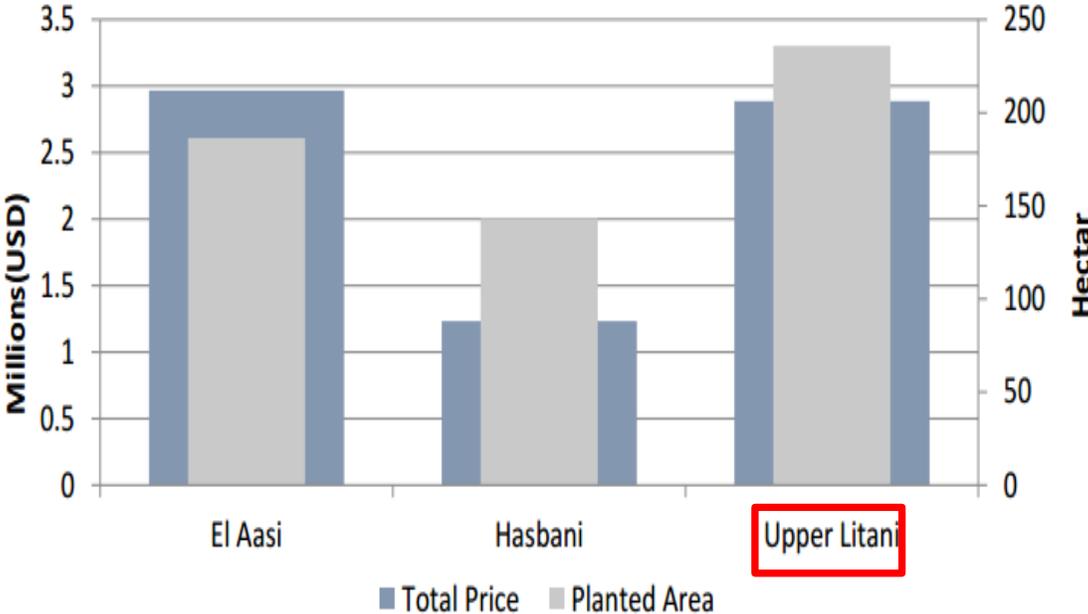


Flood Risk Assessment (by CNRS)

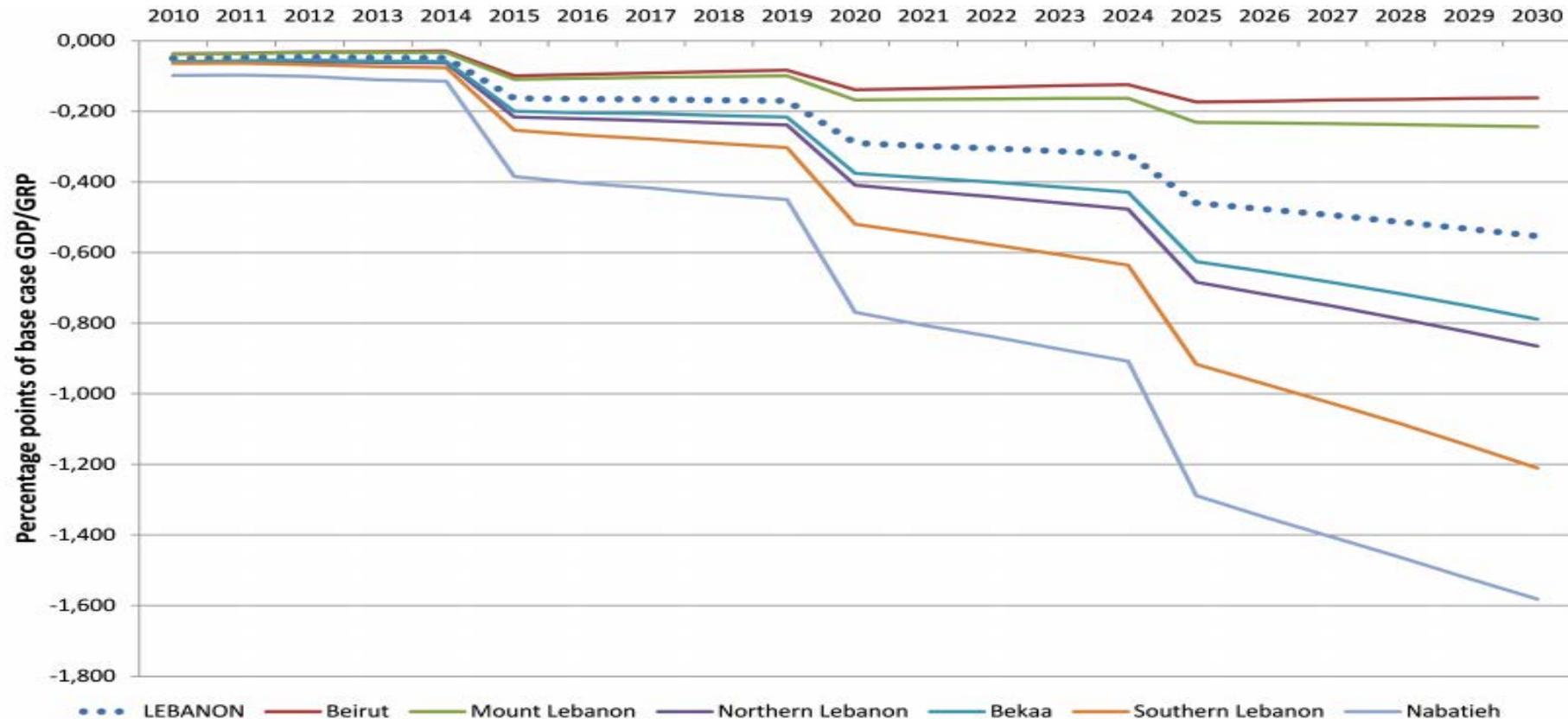
■ Agricultural damage (crops)



■ Agricultural damage (fruit trees)



Regional impacts of productivity changes in agriculture due to climate change on GRP



	<i>Discount rate</i>		
	<i>0.5</i>	<i>1.0</i>	<i>3.0</i>
GDP (LBP billion 2010)	-4,442.2	-4,139.8	-3,150.5
GDP (% of 2010 value)	-7.75%	-7.22%	-5.50%
Per capita HH consumption (LBP 2010)	-538,873	-504,412	-391,022
Per capita HH consumption (% of 2010 value)	-4.28%	-4.00%	-3.10%

Adaptation Measures and Technologies: Water

- Protection of groundwater from salinization in coastal areas
- Implementation of water demand side management strategies to reduce water consumption in the domestic, industrial and agriculture sectors
- Control use of groundwater
- Development of watershed management plans
- Collecting rainwater from greenhouse tops (currently being implemented by the Ministry of Environment in cooperation with UNDP)

*Such activities can **increase agricultural revenues by USD 4 million USD** per year and secure water availability through drought periods*

Conclusion

