5h Beirut Water week
Water, energy, food and ecosystems nexus in the Mediterranean Region: Current Challenges and Future Insights

Impact of Syrian refugees on Water Resources Management in Lebanon

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Syrian refugees impact on water stress and water resources of Lebanon

Global changes in the MENA Region

- The region is experiencing a progressive climatic change from Mediterranean climate to semi arid climate.
- An increase of 2 to 4°C in the next years along with demography increase due to refugees movements.
- The Arab Spring Political and Religious conflicts have increased population mass movement such as of the Syrian refugees with impacts on the social and economical life in Lebanon

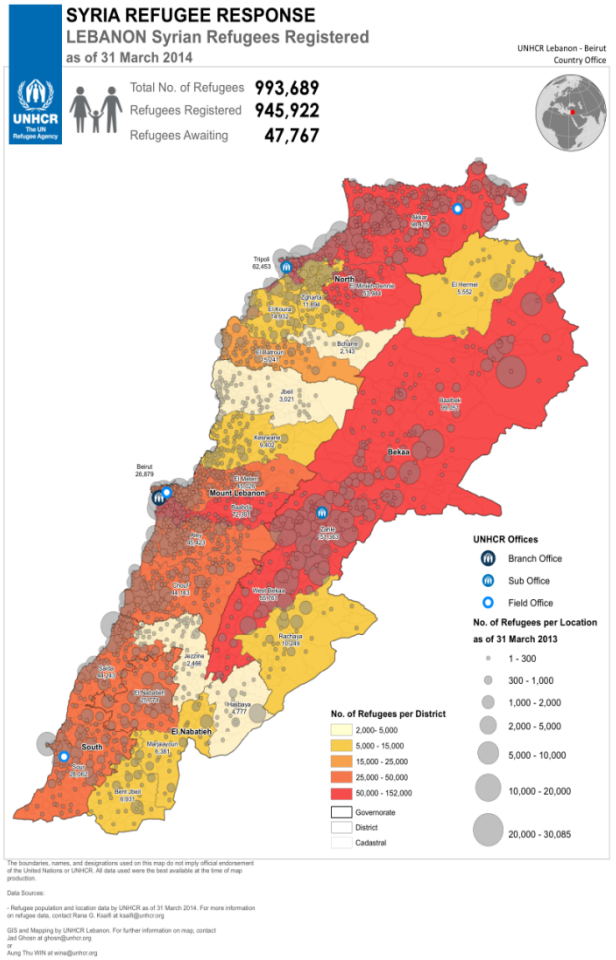
- **Lebanon** is affected this year by a heavy water shortage
- Water storage is much smaller and the snow in the mountain doesn't have the time to infiltrate the stored resources.
- Moreover the country has usually a volume of 2.7 billion m3/y as renewable water resources, and this year this quantity will be around 1.6 billion m3/y.

- **Syria** : The country is very affected by the civil war since March 2011 and from climatic change which makes the country dryer. This situation has an impact on increasing the number of refugees and displaced to the neighboring countries.

Syrian refugees impact on water stress and water resources of Lebanon

Syrian refugees impact

- **The Syrian conflict** started in 2011 and no end is foreseen until now.
- **1.5 million of refugees in Lebanon (30% of the Lebanese population)** and this number **is expected to increase up to about 7 million** until the end of 2015.
- Lebanon, which hosts others foreign refugees, is already under "pressure" and this situation is beyond its capacity to be managed equitably.
- **The Syrian** refugees are **dispersed in different communities and regions**.
- **The communities** have a lot of problems to integrate the Syrian refugees because of political and religions identity.
- *ex: Tripoli which is already under pressure with local tensions hosts today 42000 Syrian refugees.*



- Lebanon **can't close its border**: **lack of political will and weak institutions (clandestine refugees).**
- Many refugees have settled next to the borders.

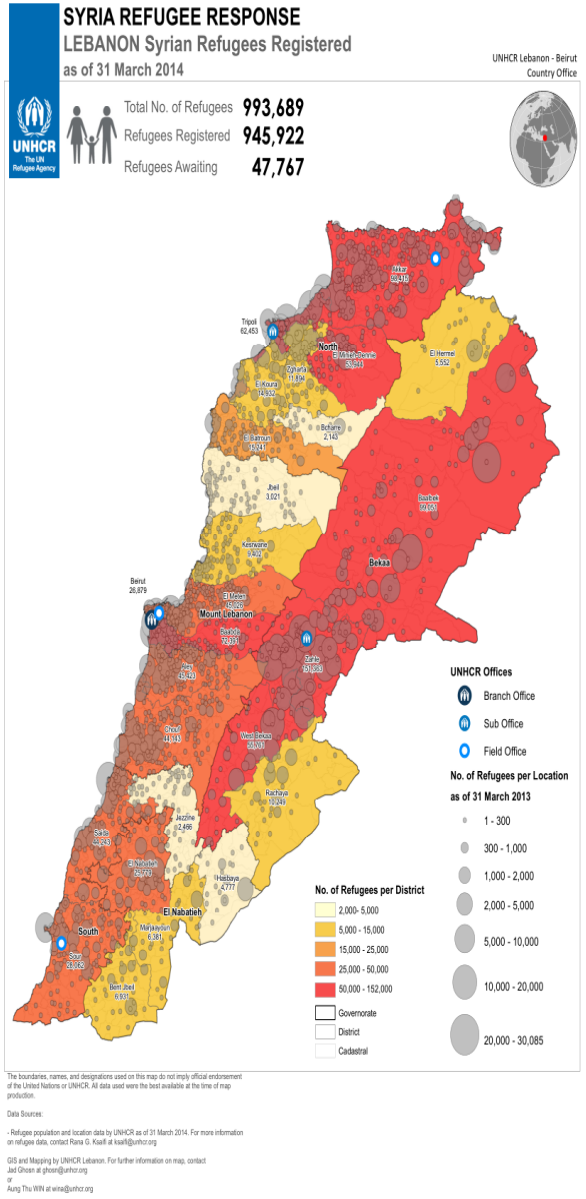
Syrian refugees impact on water stress and water resources of Lebanon

Syrian refugees impact

- Since many years an **anti Syrian ideology is present**.
- Syrians live in conditions of **very high poverty**: 1/3 have no **jobs**, most have lows wages and are not highly qualified for labor work.
- **Impact on Lebanese labor because they are** cheaper.
- Syrian have **difficulties to afford daily life and housing**: they often live in home/garage or tents (**80 000)**.
- Syrians refugees have **few access to safe water and** they don't have the means to buy bottled water.

- Some regions, like *the Bekaa and Akkar,* will experience a very **hard water stress during the summer**.
- Syrian live in this regions in very hard poverty conditions.
- The lack of water along with this year's hottest temperatures could be a **source of tensions and conflicts**.

- **The impact on Lebanon is huge**: serious **economic shocks** due to the conflict in Syria, including a **decline in trade, tourism and investment and an increase in public spending**.
- If the situation will be reestablished in Syria it will take in Lebanon more than ten years to manage and rehabilitate the impacts due to the refugees.



Syrian refugees impact on water stress and water resources of Lebanon

Water stress in Lebanon

- **Water pollution** caused by industrial waste.
- **Damaged infrastructures** due to civil war (1975-1990).
- Lebanese government (1992- 2006) **prefers to invest in the tertiary sector** instead of the water infrastructures.
- **Lack of water** due to the **global changes,** decrease of precipitation and stockade infrastructure.
- Old irrigation technology **Waste of water:** 40 % (damaged infrastructures, 1.2 billion m^3 of water flowing to the sea, no optimization of water management and daily life use).
- **Sea water intrusion** in the coastal areas.
- **Illegal pumping** from private wells for private use.
- **Dams and hill lakes constructions projects slow down** because of internal conflicts / tensions and public debts.
- **Impact on the population and agriculture** : lack of water mostly in arid regions, problems of quality and quantity : sanitation problem, difficulties to distribute and to have access to water.

Syrian refugees impact on water stress and water resources of Lebanon

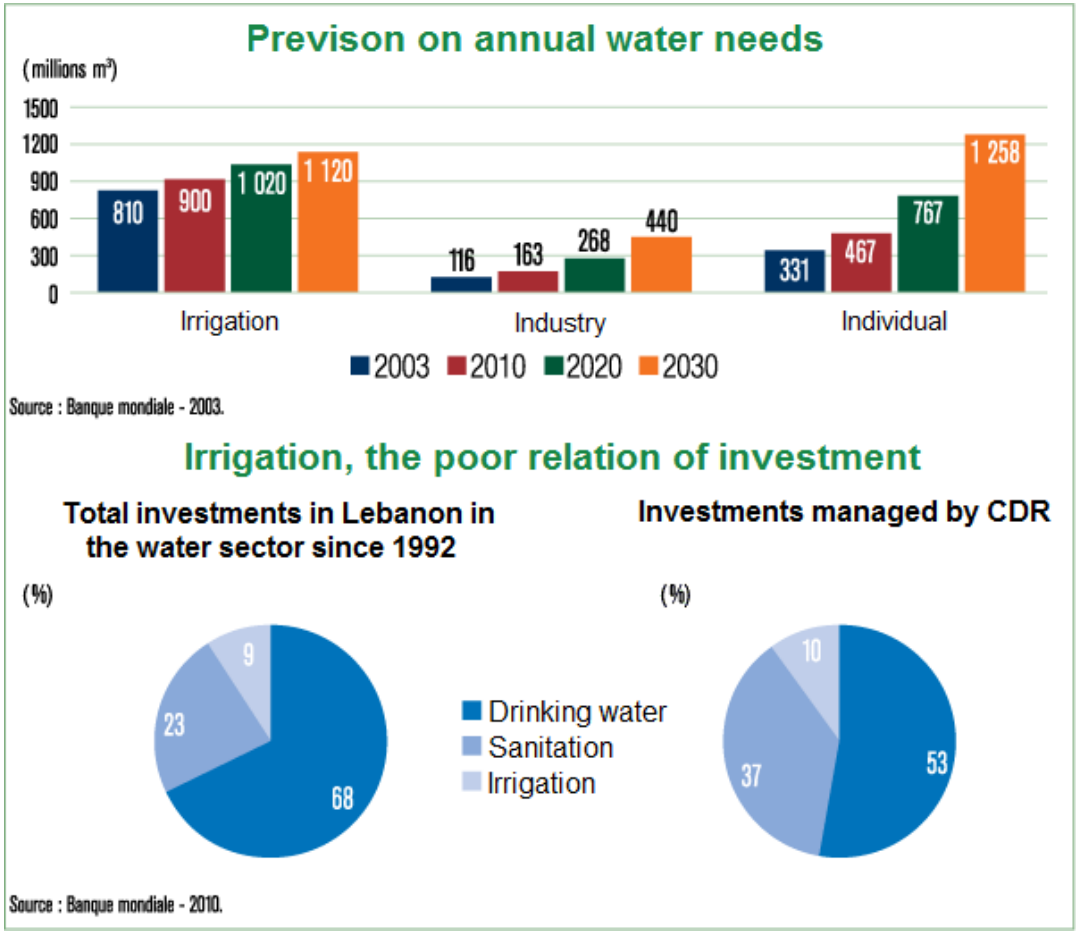
Water stress in Lebanon

A tourist uses 500 liters of water/day, a local user 50 liters/day.

Lack of snow for skiing economy.

300 million today in the deficit of the hydraulic balance.

The country could reach **1.7 billion cubic meters per year by 2040.**



Syrian refugees impact on water stress and water resources of Lebanon

Water resources in Lebanon : Constraints in brief

Country "blessed" with abundant water resources , but…:

- 90% of rainfall occurs within a period of 3 months
- Lebanon's soil geological nature (Karstic)
- Groundwater is the major source used for water supply (overpumping, seawater intrusion, drop in water table level …)
- Deficiency/low number of wastewater treatment plants
- Absence of surface water storage facilities
- Objectives of the 10-year IWRM strategic plan were not met
- Political and financial constraints
- Etc…

Water demand in Lebanon : IWRM

Two scenarios

~~**Water Stress**~~

Sustainable management - IWRM

850 Mm^3

+

565 Mm^3

+

~ 400 Mm^3

Storage
Dams and hill lakes

Non Conventional

Network efficiency
Potable water 50% → 80% 2040
Irrigation: - new techniques
Water establishment-
Ministry of Agriculture-

Hydraulic Balance

Lebanon Strategic Plan 2000-2010-2018

General Principles

- Ensure additional water storage installations (dams, lakes, recharge of aquifers…)
- Establish drinking water projects (Distribution **network and efficiency**, **Public Private Partnership** involvements,...)
- Consider various irrigation projects (Ensuring **food security**, network efficiency…)
- Ensure wastewater collecting projects and treatment plants (**water reuse** for irrigation, municipal use and artificial recharge of aquifers…).
- Consider infrastructures for flood mitigation, rectification and alignment of rivers beds.
- New Water Mass : Conventional and Non-conventional water

Syrian refugees impact on water stress and water resources of Lebanon

Actions in place

- **NGO like CICR, CARE...** local interventions with refugees. *(ex: Zahle)*
- **International cooperation** (70% of the funds provided from others countries) **World Bank / cooperation with France.**
- **- UN - HRC intervention**

Annual Growth Rate : 2.7 %
Domestic and Industrial use per person / day : 300 Liters

Scenario 1 : Unsustainable Management of Irrigation (10000m3/ha)										
Id.	Designation			2012		2013		2014	2015	2020
A.1	population LB (millions)			5	5.2	5.14	5.84	5.27 6.77	5.42 6.96	5.56 7.14
	population SYR (millions)			0.2		0.7		1.5	1.54	1.58
A.2	Water Demands	Domestic & industrial Use	m3/person/year	109.5		111.33		113.15	114.98	116.8
			Total (Mm3/y)	569.4		649.58		766.44	799.83	833.95
		Agriculture	Surface (x10exp3 Ha)	145		150		160	190	200
			Total (Mm3/y)	1450		1500		1600	1900	2000
	General Total Mm3/y			2019.4		2149.58		2366.44	2699.83	2833.95
B	water Resources Mm3/y	Surface Water		1200		1500		1600	1750	1750
		Ground Water		500		500		500	500	500
		Total		1700		2000		2100	2250	2250
C	Balance Mm3/y with Population SYR			-319.4		-149.58		-266.44	-449.83	-583.95
D	Balance Mm3/y without Population SYR			-297.50		-71.65		-96.71	-272.71	-399.41

Annual Growth Rate : 2.7 %
Domestic and Industrial use per person / day : 300 Liters

Scenario 1 : Unsustainable Management of Irrigation (10000m3/ha)												
Id.	Designation			2020		2025		2030		2035		2040
A.1	population LB (millions)			5.56	7.14	5.71	7.33	5.86	7.53	6.02	7.73	6.19 7.94
	population SYR (millions)			1.58		1.62		1.67		1.71		1.76
A.2	Water Demands	Domestic & industrial Use	m3/person/year	116.8		118.63		120.45		122.28		124.1
			Total (Mm3/y)	833.95		869.85		907.08		945.69		985.72
		Agriculture	Surface (x10exp3 Ha)	200		220		240		260		280
			Total (Mm3/y)	2000		2200		2400		2600		2800
	General Total Mm3/y			2833.95		3069.85		3307.08		3545.69		3785.72
B	water Resources Mm3/y	Surface Water		1750		1850		1960		2080		2200
		Ground Water		500		500		500		500		500
		Total		2250		2350		2460		2580		2700
C	Balance Mm3/y with Population SYR			-583.95		-719.85		-847.08		-965.69		-1085.72
D	Balance Mm3/y without Population SYR			-399.41		-527.36		-646.35		-756.42		-867.59

Annual Growth Rate : 2.7 % Domestic and Industrial use per person / day : 300 Liters												
Scenario 2 : Sustainable Management of Irrigation (7000m3/ha)												
Id.	Designation			2020		2025		2030		2035		2040
A.1	population LB (millions)			5.56	7.14	5.71	7.33	5.86	7.53	6.02	7.73	6.19 7.94
	population SYR (millions)			1.58		1.62		1.67		1.71		1.76
A.2	Water Demands	Domestic & industrial Use	m3/person/year	116.8		118.63		120.45		122.28		124.1
			Total (Mm3/y)	833.95		869.85		907.08		945.69		985.72
		Agriculture	Surface (x10exp3 Ha)	200		220		240		260		280
			Total (Mm3/y)	1400		1540		1680		1820		1960
	General Total Mm3/y			2233.95		2409.85		2587.08		2765.69		2945.72
B	water Resources Mm3/y	Surface Water		1750		1850		1960		2080		2200
		Ground Water		500		500		500		500		500
		Total		2250		2350		2460		2580		2700
C	Balance Mm3/y with Population SYR			16.05		-59.85		-127.08		-185.69		-245.72
D	Balance Mm3/y without Population SYR			200.59		132.64		73.65		23.58		-27.59

Annual Growth Rate : 2.7 %
Domestic and Industrial use per person / day : 300 Liters

Scenario 3 : Unsustainable Management of Irrigation (10000m3/ha) + Climate Change Effect 2 degrees

Id.	Designation			2012		2013		2014		2015		2020	
A.1	population LB (millions)			5	5.2	5.14	5.84	5.27	6.77	5.42	6.96	5.56	7.14
	population SYR (millions)			0.2		0.7		1.5		1.54		1.58	
A.2	Water Demands	Domestic & industrial Use	m3/person/year	109.5		111.33		113.15		114.98		116.8	
			Total (Mm3/y)	569.4		649.58		766.44		799.83		833.95	
		Agriculture	Surface (x10exp3 Ha)	145		150		160		190		200	
			Total (Mm3/y)	1450		1500		1600		1900		2000	
	General Total Mm3/y			2019.4		2149.58		2366.44		2699.83		2833.95	
B	water Resources Mm3/y	Surface Water		700		1000		1100		1250		1250	
		Ground Water		500		500		500		500		500	
		Total		1200		1500		1600		1750		1750	
C	Balance Mm3/y with Population SYR			-819.4		-649.58		-766.44		-949.83		-1083.95	
D	Balance Mm3/y without Population SYR			-797.50		-571.65		-596.71		-772.71		-899.41	

Annual Growth Rate : 2.7 %
Domestic and Industrial use per person / day : 300 Liters

Scenario 3 : Unsustainable Management of Irrigation (10000m3/ha) + Climate Change Effect 2 degrees

Id.	Designation			2020		2025		2030		2035		2040	
A.1	population LB (millions)			5.56	7.14	5.71	7.33	5.86	7.53	6.02	7.73	6.19	7.94
	population SYR (millions)			1.58		1.62		1.67		1.71		1.76	
A.2	Water Demands	Domestic & industrial Use	m3/person/year	116.8		118.63		120.45		122.28		124.1	
			Total (Mm3/y)	833.95		869.85		907.08		945.69		985.72	
		Agriculture	Surface (x10exp3 Ha)	200		220		240		260		280	
			Total (Mm3/y)	2000		2200		2400		2600		2800	
	General Total Mm3/y			2833.95		3069.85		3307.08		3545.69		3785.72	
B	water Resources Mm3/y	Surface Water		1250		1350		1460		1580		1700	
		Ground Water		500		500		500		500		500	
		Total		1750		1850		1960		2080		2200	
C	Balance Mm3/y with Population SYR			-1083.95		-1219.85		-1347.08		-1465.69		-1585.72	
D	Balance Mm3/y without Population SYR			-899.41		-1027.36		-1146.35		-1256.42		-1367.59	

Annual Growth Rate : 2.7 %
Domestic and Industrial use per person / day : 300 Liters

Scenario 4 : Sustainable Management of Irrigation (7000m3/ha) + Climate Change Effect 2 degrees

Id.	Designation			2020		2025		2030		2035		2040	
A.1	population LB (millions)			5.56	7.14	5.71	7.33	5.86	7.53	6.02	7.73	6.19	7.94
	population SYR (millions)			1.58		1.62		1.67		1.71		1.76	
A.2	Water Demands	Domestic & industrial Use	m3/person/year	116.8		118.63		120.45		122.28		124.1	
			Total (Mm3/y)	833.95		869.85		907.08		945.69		985.72	
		Agriculture	Surface (x10exp3 Ha)	200		220		240		260		280	
			Total (Mm3/y)	1400		1540		1680		1820		1960	
	General Total Mm3/y			2233.95		2409.85		2587.08		2765.69		2945.72	
B	water Resources Mm3/y	Surface Water		1250		1350		1460		1580		1700	
		Ground Water		500		500		500		500		500	
		Total		1750		1850		1960		2080		2200	
C	Balance Mm3/y with Population SYR			-483.95		-559.85		-627.08		-685.69		-745.72	
D	Balance Mm3/y without Population SYR			-299.41		-367.36		-426.35		-476.42		-527.59	

Annual Growth Rate : 2.7 % Domestic and Industrial use per person / day : 300 Liters												
Scenario 5 : Unsustainable Management of Irrigation (10000m3/ha) + Climate Change Effect 4 degrees												
Id.	Designation			2012		2013		2014		2015		2020
A.1	population LB (millions)			5	5.2	5.14	5.84	5.27	6.77	5.42	6.96	5.56 7.14
	population SYR (millions)			0.2		0.7		1.5		1.54		1.58
A.2	Water Demands	Domestic & industrial Use	m3/person/year	109.5		111.33		113.15		114.98		116.8
			Total (Mm3/y)	569.4		649.58		766.44		799.83		833.95
		Agriculture	Surface (x10exp3 Ha)	145		150		160		190		200
			Total (Mm3/y)	1450		1500		1600		1900		2000
	General Total Mm3/y			2019.4		2149.58		2366.44		2699.83		2833.95
B	water Resources Mm3/y	Surface Water		350		650		750		900		900
		Ground Water		500		500		500		500		500
		Total		850		1150		1250		1400		1400
C	Balance Mm3/y with Population SYR			-1169.4		-999.58		-1116.44		-1299.83		-1433.95
D	Balance Mm3/y without Population SYR			-1147.50		-921.65		-946.71		-1122.71		-1249.41

Annual Growth Rate : 2.7 %
Domestic and Industrial use per person / day : 300 Liters

Scenario 5 : Unsustainable Management of Irrigation (10000m3/ha) + Climate Change Effect 4 degrees

Id.	Designation			2020		2025		2030		2035		2040	
A.1	population LB (millions)			5.56	7.14	5.71	7.33	5.86	7.53	6.02	7.73	6.19	7.94
	population SYR (millions)			1.58		1.62		1.67		1.71		1.76	
A.2	Water Demands	Domestic & industrial Use	m3/person/year	116.8		118.63		120.45		122.28		124.1	
			Total (Mm3/y)	833.95		869.85		907.08		945.69		985.72	
		Agriculture	Surface (x10exp3 Ha)	200		220		240		260		280	
			Total (Mm3/y)	2000		2200		2400		2600		2800	
	General Total Mm3/y			2833.95		3069.85		3307.08		3545.69		3785.72	
B	water Resources Mm3/y	Surface Water		900		1000		1110		1230		1350	
		Ground Water		500		500		500		500		500	
		Total		1400		1500		1610		1730		1850	
C	Balance Mm3/y with Population SYR			-1433.95		-1569.85		-1697.08		-1815.69		-1935.72	
D	Balance Mm3/y without Population SYR			-1249.41		-1377.36		-1496.35		-1606.42		-1717.59	

Annual Growth Rate : 2.7 %
Domestic and Industrial use per person / day : 300 Liters

Scenario 6 : Sustainable Management of Irrigation (7000m3/ha) + Climate Change Effect 4 degrees

Id.	Designation			2020		2025		2030		2035		2040	
A.1	population LB (millions)			5.56	7.14	5.71	7.33	5.86	7.53	6.02	7.73	6.19	7.94
	population SYR (millions)			1.58		1.62		1.67		1.71		1.76	
A.2	Water Demands	Domestic & industrial Use	m3/person/year	116.8		118.63		120.45		122.28		124.1	
			Total (Mm3/y)	833.95		869.85		907.08		945.69		985.72	
		Agriculture	Surface (x10exp3 Ha)	200		220		240		260		280	
			Total (Mm3/y)	1400		1540		1680		1820		1960	
	General Total Mm3/y			2233.95		2409.85		2587.08		2765.69		2945.72	
B	water Resources Mm3/y	Surface Water		900		1000		1110		1230		1350	
		Ground Water		500		500		500		500		500	
		Total		1400		1500		1610		1730		1850	
C	Balance Mm3/y with Population SYR			-833.95		-909.85		-977.08		-1035.69		-1095.72	
D	Balance Mm3/y without Population SYR			-649.41		-717.36		-776.35		-826.42		-877.59	

General Table										
		2012	2013	2014	2015	2020	2025	2030	2035	2040
Scenario 1 Unsus.	with Population SYR	-319.4	-149.58	-266.44	-449.83	-583.95	-719.85	-847.08	-965.687	-1085.72
	without Population SYR	-297.50	-71.65	-96.71	-272.71	-399.41	-527.36	-646.35	-756.417	-867.588
Scenario 2 Sus.	with Population SYR					16.048	-59.851	-127.081	-185.687	-245.716
	without Population SYR					200.592	132.637	73.64588	23.58302	-27.5883
Scenario 3 Unsus.	with Population SYR	-819.4	-649.581	-766.438	-949.827	-1083.95	-1219.85	-1347.08	-1465.69	-1585.72
	without Population SYR	-797.5	-571.654	-596.713	-772.708	-899.408	-1027.36	-1146.35	-1256.42	-1367.59
Scenario 4 Sus.	with Population SYR					-483.952	-559.851	-627.081	-685.687	-745.716
	without Population SYR					-299.408	-367.363	-426.354	-476.417	-527.588
Scenario 5 Unsus.	with Population SYR	-1169.4	-999.581	-1116.44	-1299.83	-1433.95	-1569.85	-1697.08	-1815.69	-1935.72
	without Population SYR	-1147.5	-921.654	-946.713	-1122.71	-1249.41	-1377.36	-1496.35	-1606.42	-1717.59
Scenario 6 Sus.	with Population SYR					-833.952	-909.851	-977.081	-1035.69	-1095.72
	without Population SYR					-649.408	-717.363	-776.354	-826.417	-877.588

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Conclusion

Lebanon **is under pressure** with the **increasing number of Syrian refugees** hosted and with **climate-related impacts** which affects the water resources. It is possible that **several conflicts and tensions** break out across the country in different places for different reasons: policy, lack of resources, communities tensions. Theses tensions and conflicts can be triggered by the **lack of water provided** to the population and to the refugees. That can occur as **soon as the temperatures rise** during the hottest season. Here we have a **warning threshold problems** that can lead to a **civil and community war.** The construction of dams was one of the solutions to cope with climate change and people water needs, but local tensions have slowed it down. How can we construct dams if there are again tensions? Moreover these dams need the population contribution and higher prices to fund the project. How can people give more if labor price is down and if Lebanon is affected by conflicts ? **We have to quickly react** to find a solution to give access to safe water to the local population and refugees in the hot season. The plans settled by the Lebanese authorities and NGO cannot be realized over several years. **Therefore the government has to cooperate with the international institutions and emergency NGO to avoid a conflict and distribute water** to the increasing populations which lives in Lebanon.