International Water Management Institute

Analyzing the FAO proposed water reuse standards for Lebanon in 2010 as compared to international guidelines, MENA countries national standards and possibility of enforcement in the Lebanese context

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Context

- ReWater MENA project is a 4-year regional project (Lebanon, Jordan, Egypt) implemented by the International Water Management Institute and funded by SIDA. It ends in September 2022.

- Objective: expanding safe reuse of water in the MENA region through research, project design and stakeholders' engagement, as well as exchanging knowledge between countries.

- Activities are designed according to countries' needs and context, presented to National Steering Committees in each country

- In Lebanon

1. *Analysis of Water Reuse Potential in Lebanon* (reviewed by Lebanese stakeholders)
2. *Two local reuse systems* (Ablah and Zahleh WWTPs) designed with local and national stakeholders, *with implementation plans.*
3. Support to LIBNOR committee for the *formulation of official standard for irrigation water reuse* in Lebanon.
4. *Scientific field experiments* led by LARI to evaluate the risks of irrigating crops from Ablah WWTP treated effluents as compared to groundwater and Litani water

Objective of the presentation

Present and discuss the results of the research conducted to support the formulation of water reuse standards for Lebanon

Policy analysis of the proposed standards by FAO (2010)

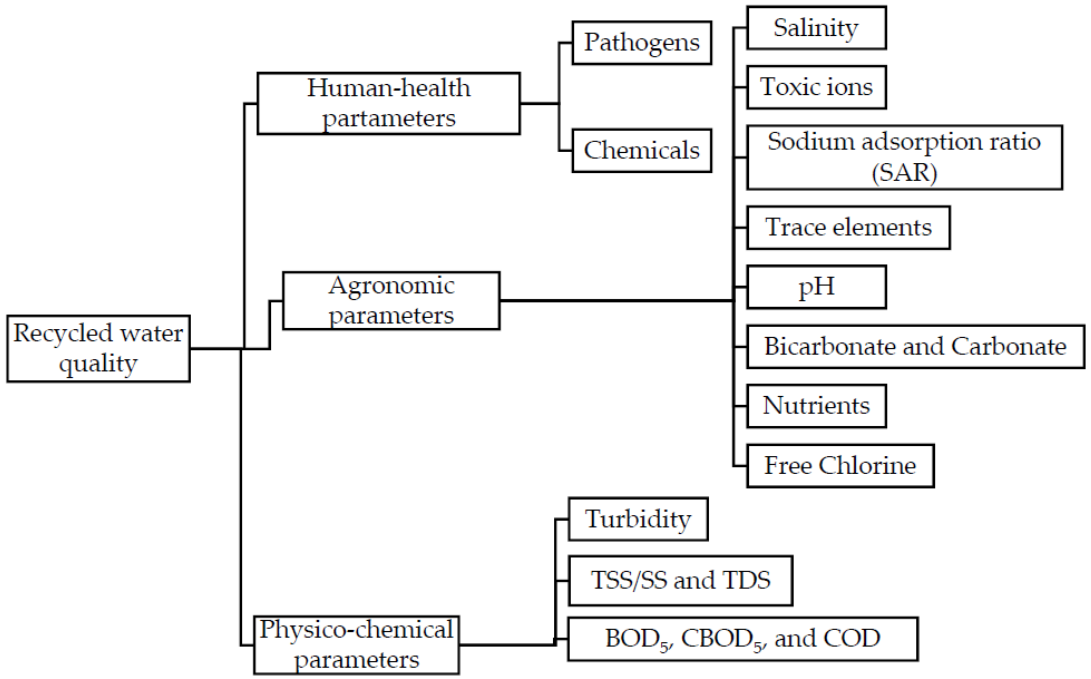
Scientific Field experiments

History of water quality regulations in Lebanon:

- 2001: Environmental Limit Values: discharge of effluents in the environment
- 2010: FAO project proposes reuse standards
- 2015: MEW and MoE legislation text prepared but not officially approved and needs revision
- 2019: LIBNOR committee on water reuse standards formed and all stakeholders agree to revise FAO 2010 through the committee
- 2019-2021: ISO adopted as guidelines (not mandatory)
- Future steps: revise FAO guidelines and adopt as mandatory official regulations

Core elements of Regulation/Standard for water reuse in agriculture

Different parameters to control in treated water



Shoustarian et al. 2020

1- List of parameters and threshold values

- Different categories of water with different target applications (categories of edible or non-edible plants (1-5 categories depending on countries) with recommendations of treatment technologies
- Complete restrictions on crops and use of irrigation systems

2- Monitoring protocol

- Frequency and performance of testing

3- Recommended best practices for safety

- On-farm management (safety measures for carrying irrigation agronomic practices to reduce risks and improve productivity)
- Handling of treatment technologies and reuse systems to increase safety

4- Governance framework

- Distribution of roles and responsibilities of each administration/stakeholder (if not stated in other regulations)

The main regulatory approaches and recent policy recommendations and trends

Standards need to be adapted to local contexts and take into consideration financial, technological and institutional capacities of the country

Californian Model

- **Zero risk, Best quality water (pathogens close to zero)**
- **Advanced, high-cost treatment technologies**
- **High number of parameters, lower limit values**

WHO (1989) and FAO (1992)

- **Level of stringency should be proportional to capacity of enforcement**
- **Higher thresholds for pathogens**
- **Less sophisticated and costly treatment technologies**

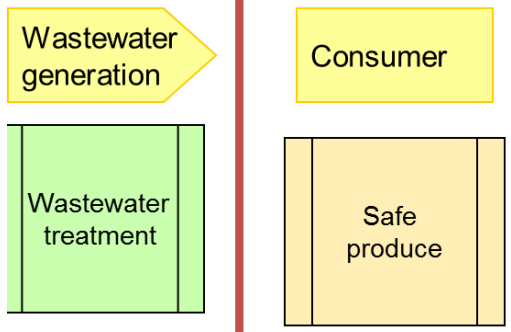
WHO 2006 Risk-management approach

- **Paradigm shift from fixed standards related to water quality to health-based standards achievable throughout the reuse chain**

WHO 2006 paradigm shift

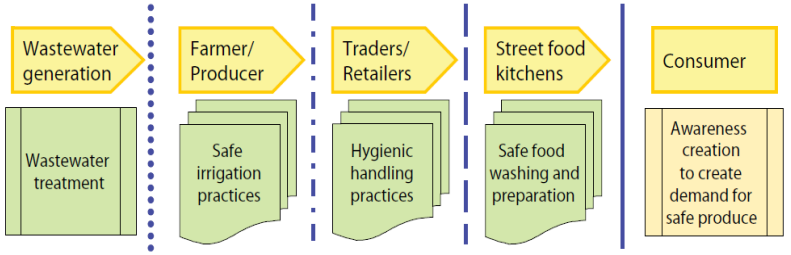
OPTION 1: Eliminate hazards from water

One barrier:
Water Reclamation

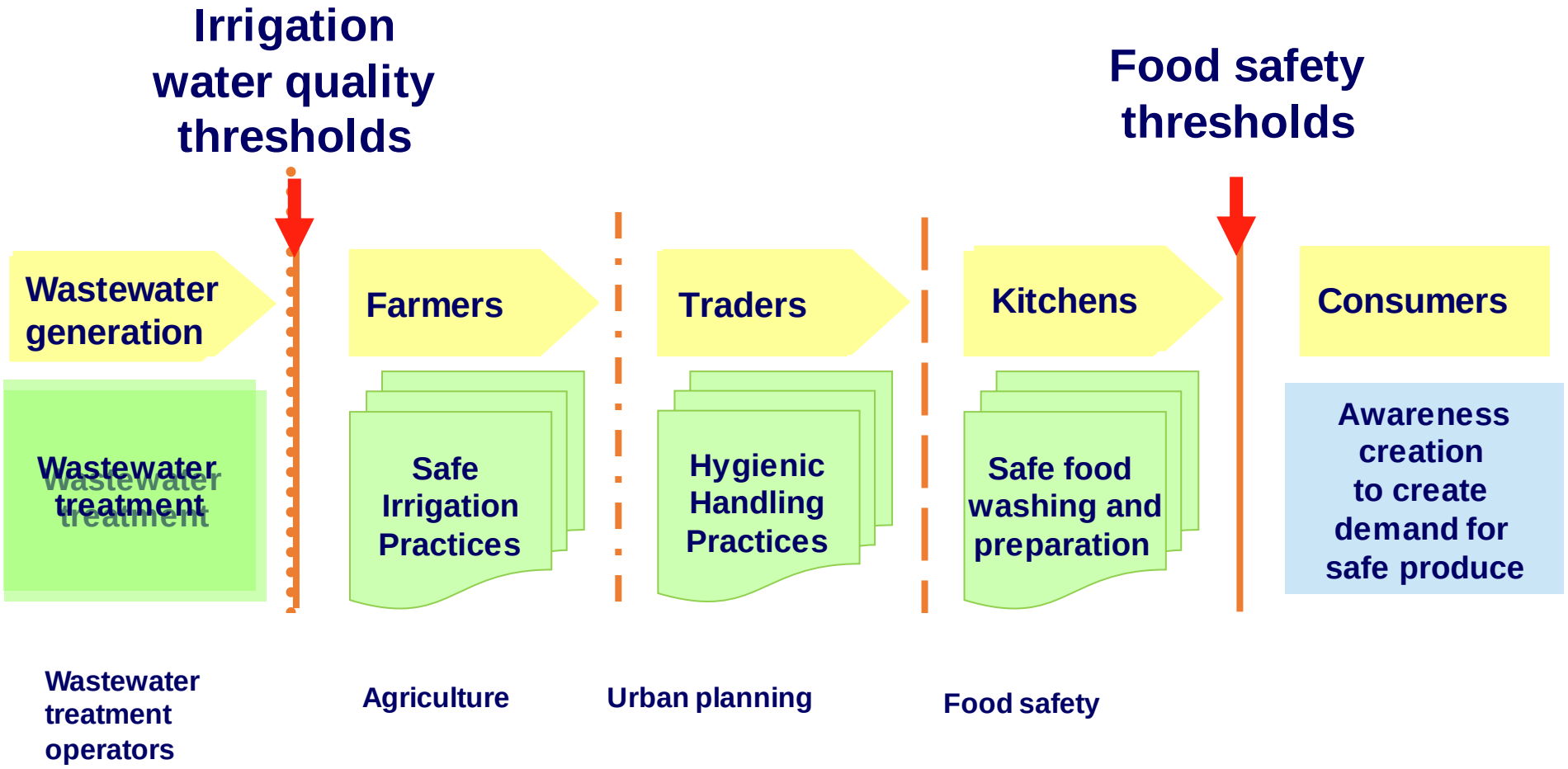


OPTION 2: Lower the hazards

Multiple barrier:
Risk management along the sanitation-food chain



2006 WHO Guidelines



INSTITUTIONS INVOLVED IN ENSURING SAFETY

Material and methods

Policy analysis of the proposed standards by FAO (2010)

1- Systematic comparison with international regulations

- Crop categories, parameters, threshold values and restrictions in main international guidelines USEPA (2012), WHO (1989, 2006), FAO (1992) and 14 MENA countries for all parameters, with a focus on pathogen control
- Governance framework in Jordan, Egypt, Morocco and Tunisia (detailed regulations)

2- Evaluation of the possibility of enforcement in Lebanon based on the national and local studies conducted

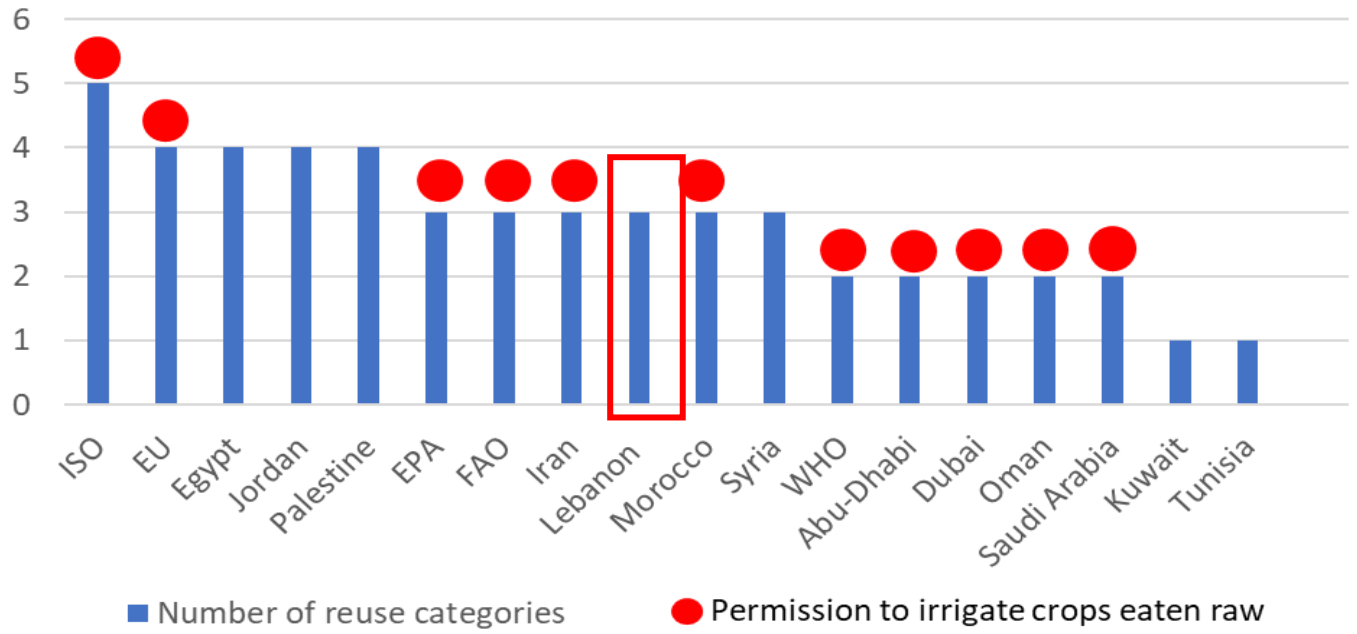
- Water quality tests
- Existing crops and irrigation practices in the areas identified as potentially irrigable by WWTPs;
- and where informal reuse in practiced (Bekaa, Chouf, North Lebanon)
- Governance and performance of the wastewater sector

3- Recent recommendations on standards design in developing countries (WHO 2006)

Main results

1- Regulatory approach for pathogen control: close to WHO (1989) and FAO (1972)

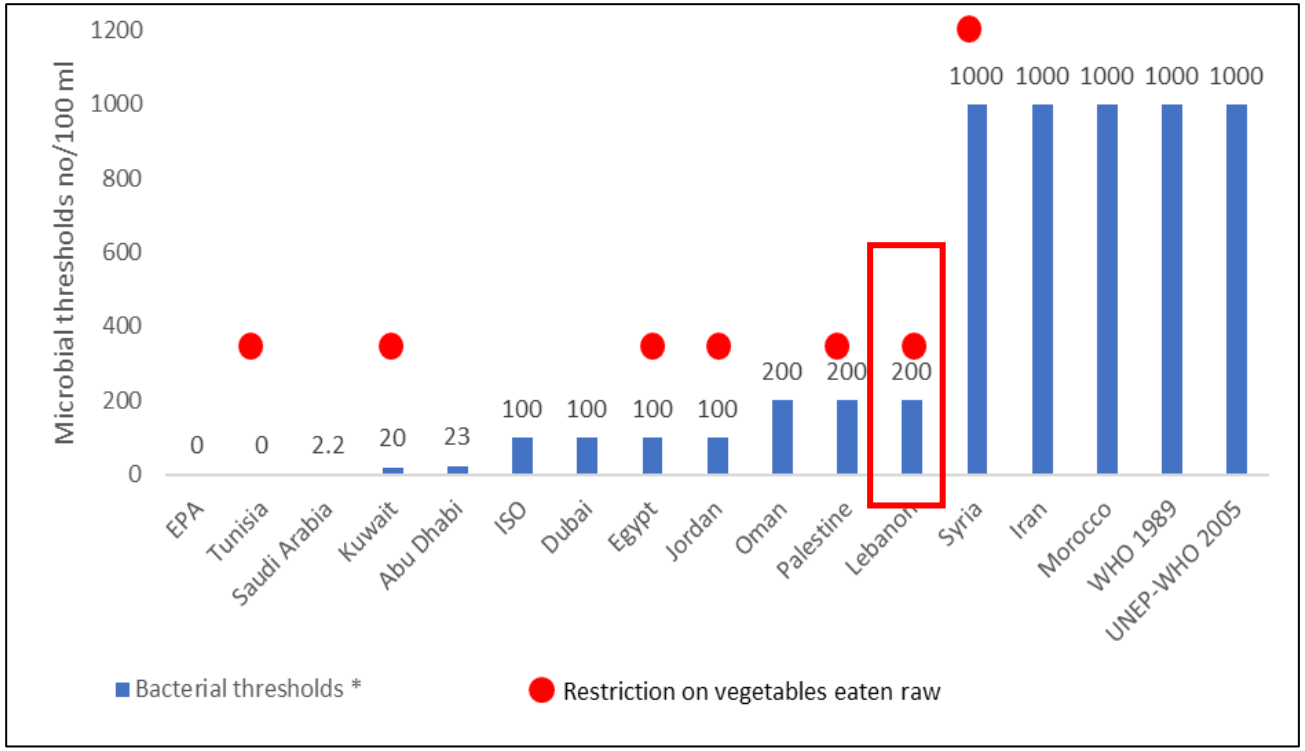
- Lebanon adopts three categories like WHO-FAO, Syria, Morocco, Jordan
- Fixed standards approach as per WHO 1989 (as opposed to risk management as per WHO 2006)



Main results

2- Pathogen threshold and restrictions on crops and irrigation systems

- *Bacterial thresholds for food crop irrigation lower than WHO 1989*
- *Lebanon does not allow crops to be eaten raw while most international guidelines do so*. MENA countries are divided
- *Lebanon completely forbids the use of sprinkler on food crops* (except fruit trees) while WHO (1989) allows it.
- *Restrictions on crops and irrigation systems will be hard to be enforced* as all potential areas are planted with a mixture of crops including vegetables to be eaten raw, and use of sprinkler is widespread



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Main results

3. General number of parameters and threshold values

- Lebanon considers the main parameters usually regulated in countries' standards
- **Number of parameters** close to other regulations (some can be added such as Dissolved oxygen and Turbidity)
- **Limit values: stricter than some, less strict than others**

	BOD_5 (mg. L^{-1})	COD (mg. L^{-1})	DO (Dissolved oxygen)	TSS (mg. L^{-1})	Turbidity (NTU)	Bacteria (no./100 mL)	Intestinal nematodes (eggs. L^{-1})	N-NO3	Ph
Lebanon	25	125	✗	60	✗	≤ 200 (Fecal coliforms)	<1	<5	6.5_8
FAO								<5	6.5_8
ISO	10	✗	✗	10	5	100 (95%ile ≤ 10) (Thermo-tolerant coliforms)	None	✗	✗
WHO						1000 (E. coli root crops); 10000 (leaf crops); 1000 (low growing drip irrigated crops); 100000 (high growing drip irrigated crops)			
Egypt	15	✗		≥ 15	≥ 5	20 (E. coli)	≤1	Not available	Not available?
Jordan	30	100	More then 2	50	10	100 (E.coli)	≤1	<5	6_9
Morrocco	✗	✗	✗	100 (sprinkler irrigation); 200 (gravity irrigation)	✗	< 1000 (Fecal coliforms)	0	30	6.5_8.4
Syria	30	75	✗	50	✗	<1000 (fecal)	<1	20	6_9

Main results

4. Governance framework

- The responsibilities of each administration are not stated in the standard
- More largely, a governance framework on reuse systems is missing in Lebanon: who does the operation of water reuse system? Who decides where water should be distributed?
- In the existing regulations, responsibilities overlap or conflict: no monitoring agency Jordan distinguishes between testing by operator and testing by monitoring agency

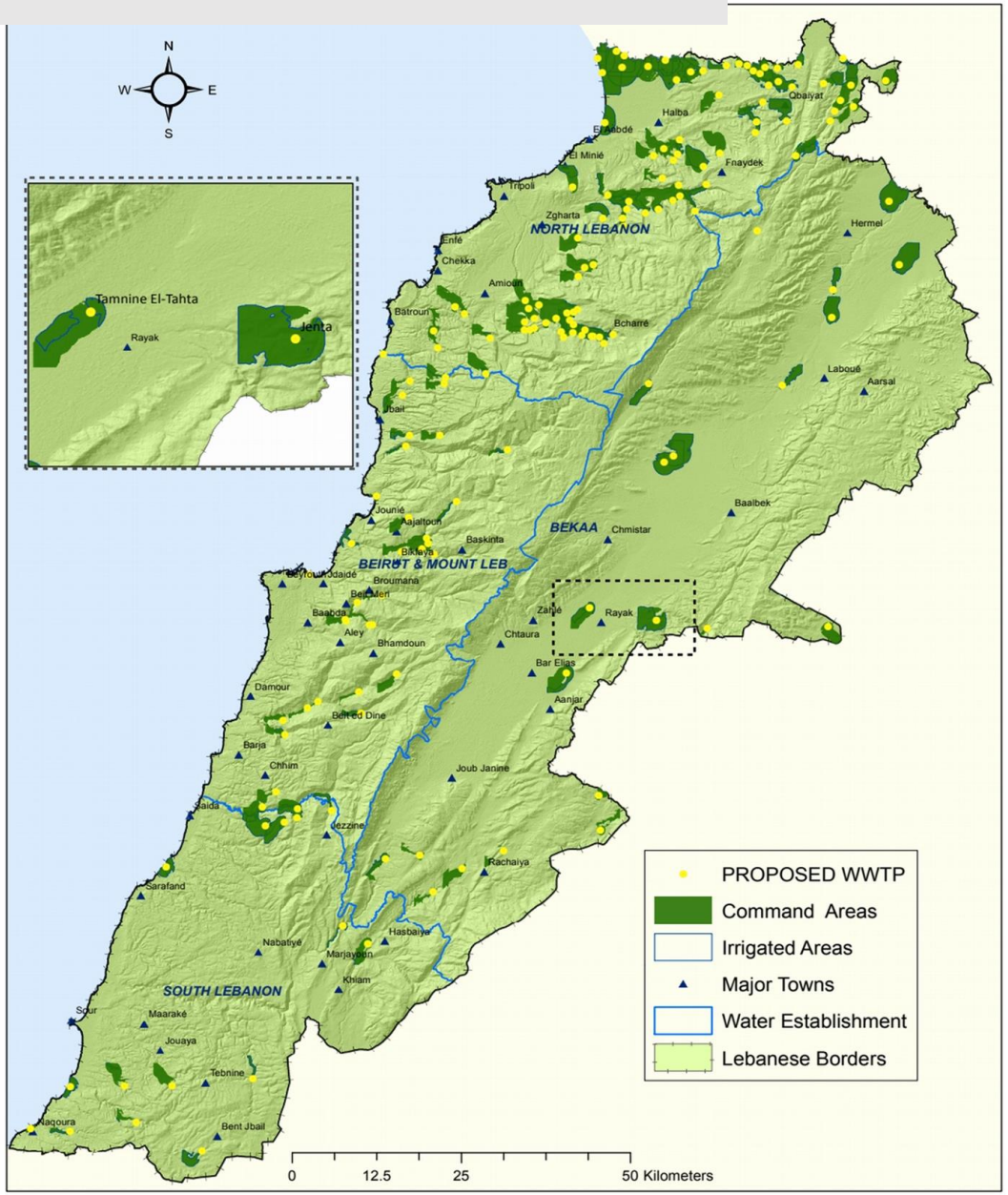
Role	CDR	MoEW	MoF	MoE	MoA (irrigation)	MoPH (drinking water)	Municipalities	WE	WB	Donors	NGOs	Research	Media	Water Users
Funding	X		X					Cost recovery?	X	X				
Policy & Strategy	X Master Plan	X National		X	X	X		X Regional	X	X		X		
Planning	X	X			X			X	X	X		X		
Contracting/ Constructing	X	X			X		X	X	X	X	X			
Development & Implementation	X	X					X	X		X	X			
Operation & Maintenance	X						X	X		X				
Tariff/ Tax Collection			X				X	X Propose tariffs						X
Legislation, rules and regulation		X		X	X	X					X Lobby	X		
Services & interactions with water users		X		X	X		X			X	X		X	X
Monitoring & Evaluation		X		X	X	X		X		X	X	X		

Main results

5. Lack of mention of direct/indirect Reuse

- Some regulations allow for indirect water reuse, i.e., mixing the treated effluents with freshwater in rivers to supply existing irrigation infrastructure (Egypt Nile drainage system; Jordan dams and reservoirs).

- In Lebanon, regulating indirect needs to be considered because water is needed in existing reuse schemes (Zahleh, Aitanit, Chouf at many locations)



Conclusions and recommendations

1. The FAO proposed guidelines for Lebanon in 2010 are generally strict relatively to other international guidelines and MENA countries, especially with regards to pathogen threshold and crop restrictiveness

2. Crop and irrigation systems restriction are expected to be hard to be enforced in practice

3. Enforcing the standards require establishing a clear governance framework for management and monitoring of reuse systems. This could be added to the Standards under revision or be designed an independent regulation

4. The approach for pathogen control follows the ‘ fixed standards’ approach. We recommend adopting aspects of the WHO risk management approach which can decrease the cost of investment on treatment technologies and address the informal reuse (outside of WWTPs), but this require strong institutional coordination and should be accompanied by an integrated plan for the wastewater management

Thank you

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