ONLINE CONFERENCE IWRA 2021

A Nexus trade-offs analysis of water, energy, food, nutrition and feedback to the environment in Lebanon

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Introduction & Background

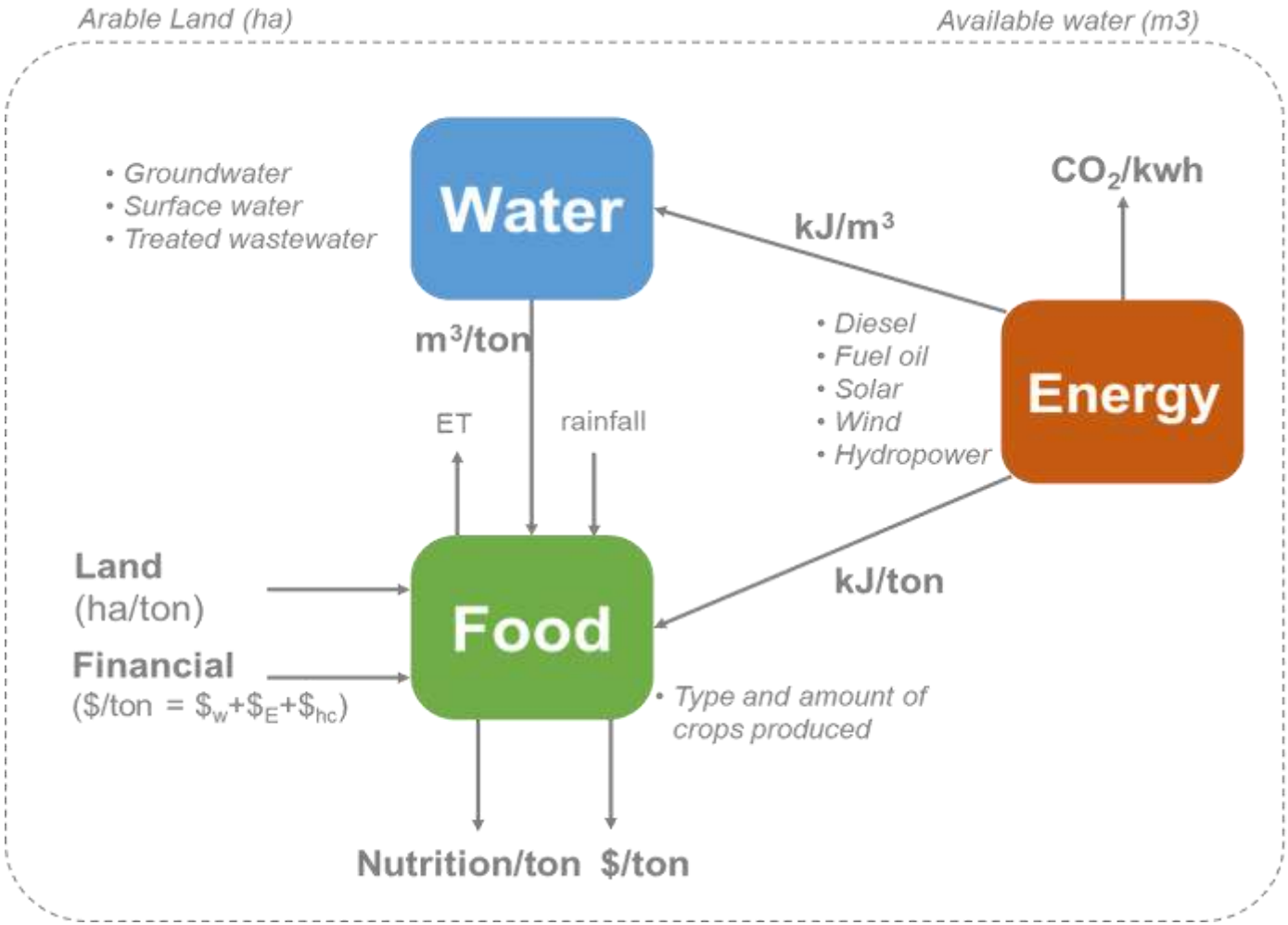
- Food security in Lebanon is a pressing matter especially under the latest economic, financial, political, and health challenges.
- Agriculture is one of the few sectors in the country that can contribute to the economy
  - Improvement of local production of nutritious food
  - Reduction of reliance on import of food which is very high cost
- Challenges:
  - population increase
  - freshwater scarcity and degradation of water quality
  - high energy cost
  - limited land resources

Introduction & Background

- Realizing that unilateral disciplinary approaches to water scarcity issues do not account for the interconnectivity between water and energy for food production ….
- Nexus approach to quantify the interconnections between water, energy, nutrition, and food systems in Lebanon
- Explore scenarios that increase local food production vs. import and impact on resources
- Focusing on the Lebanese-Mediterranean plant-based diet which has been shown to be healthy with a smaller environmental footprint
- <u>Public Health impact:</u>
  - *Assess the environmental impact of these scenarios (GHG)*
  - *Improvement of nutritious level in Lebanese food basket*

Methodology

1. Defining the interconnectivity of W-E-F
2. Scenarios and tradeoff analysis



Methodology

- Assessment based on the baseline year of 2017
- Sources considered and % use of each in 2017:
  - **Water sources:**
    - Surface water → 80%
    - Groundwater → 20%
    - Treated wastewater → 0%
  - **Energy sources** (for food and for water)
    - Diesel → 70-100%
    - Gasoline → 0-30%
    - Solar → 0%
    - Wind → 0%
- Defining Self-Sufficiency ratio as:

$$\%\ \textbf{Self-Sufficiency Ratio}_i = (Production_i * 100) / (Production_i + Import_i - Export_i)$$

- Calculating amounts of water and land needed for current production

Crops selected: non-exhaustive selection but most crops that can be produced locally

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>100% self-sufficiency

Apple	230
Grapes	146
Banana	145
Oranges	136
Grapefruit	131
Peach	123
Cherries	116
Tangerines	110
Lettuce	110
Potato	109
Apricot	107
Lemons	103
Almond	101

> 90% self-sufficiency

Olives	100
Tomato	100
Cucumber	98
Melon	98
Watermelon	96
Zucchini	92

Cereals

Wheat	17
Corn	1

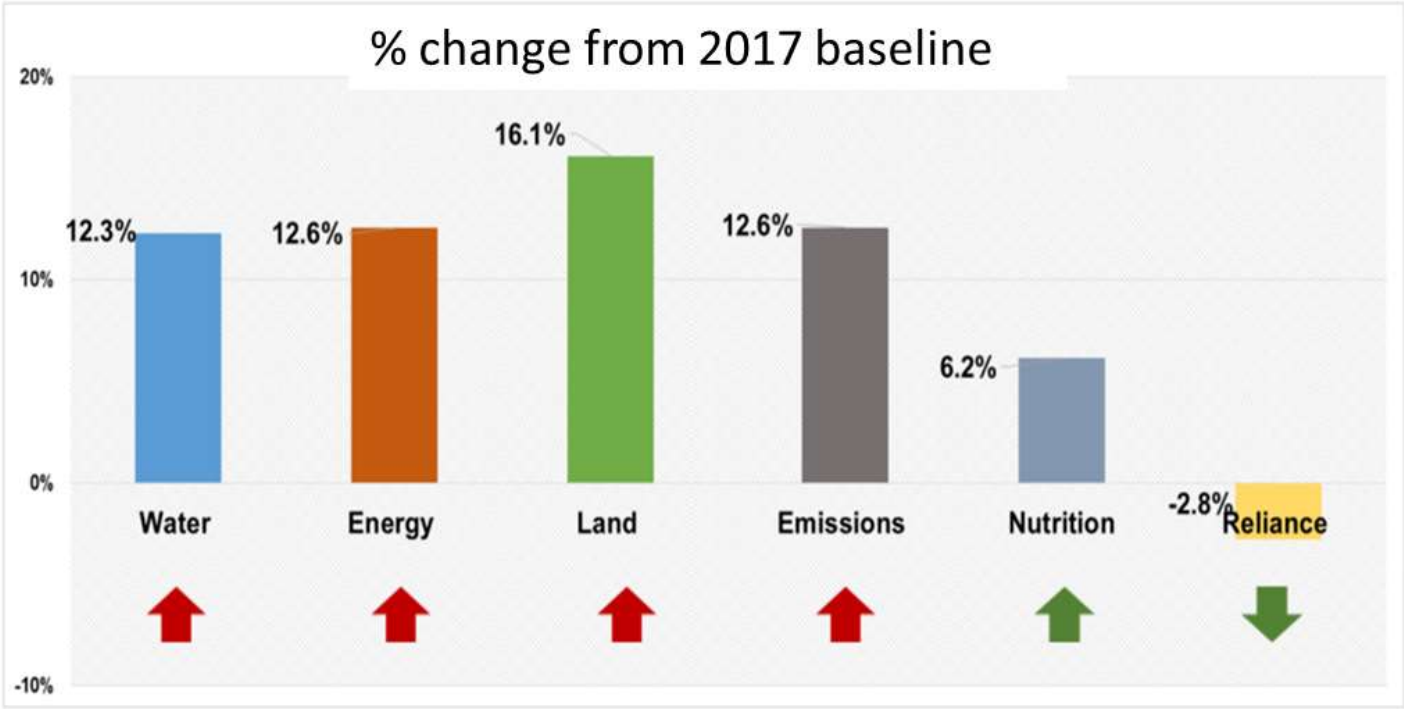
Medium and low self-sufficiency

Peas (dry)	90
Beans (green)	89
Onion (dry)	89
Pepper (green)	80
Strawberry	73
Peas (green)	70
Walnut (with shell)	49
Beans (dry)	48
Garlic	25
Chickpeas	19
Lentil	7
Broad Beans	3

2017		
Water	(m^3)	464,793,307
Energy	(GJ)	1,547
Land	(ha)	198,179
Cost	(Billion LBP)	1,539
Emissions	(ton CO_2)	105,744
Nutrition	(kcal)	1.4 E+14
Reliance	ratio (I/C)	0.45

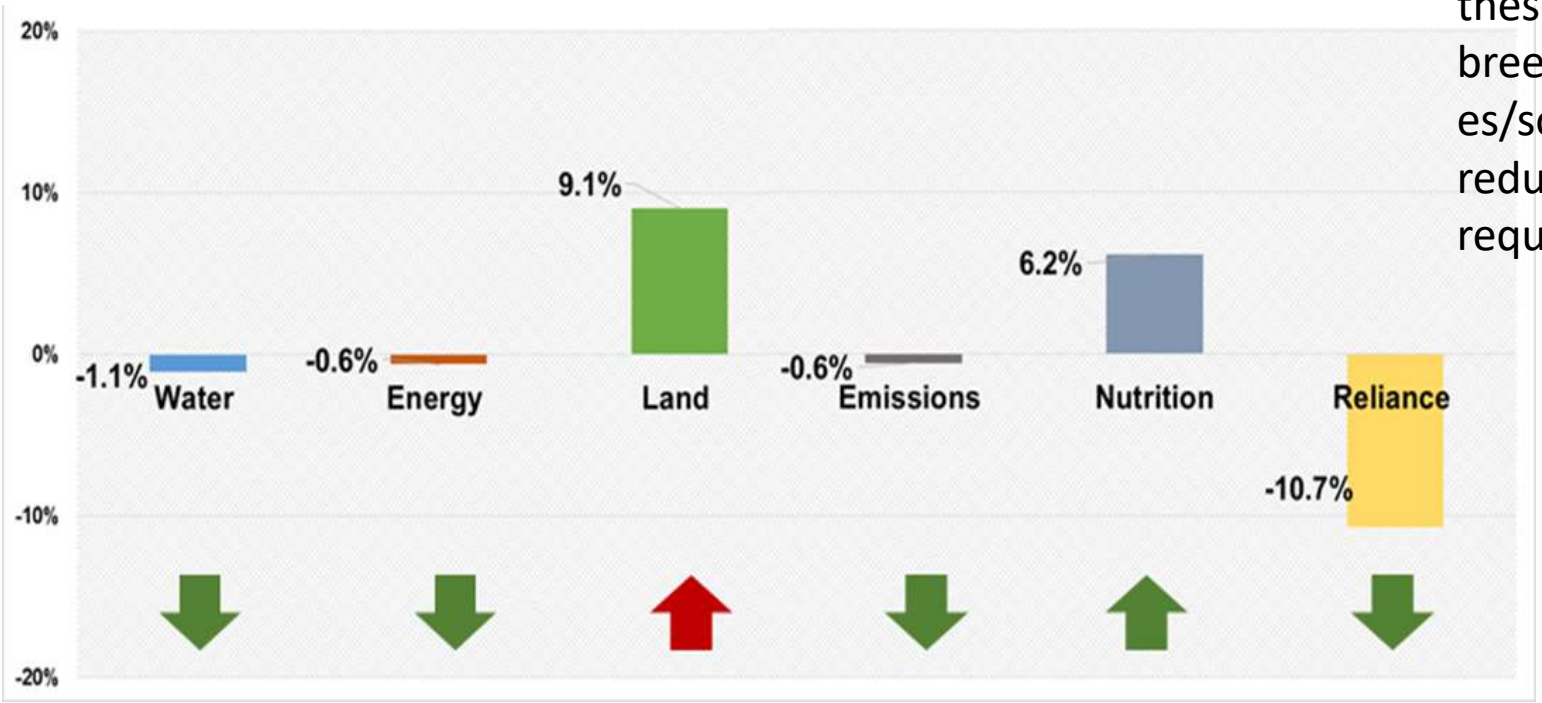
Scenario A:

- Increase self-sufficiency to enrich the Lebanese food basket with nutritious food produced locally
  - **Increase** beans (green, broad, dry), lentils, chickpeas and peas (dry, green) to **100% SS**
  - **Water:** 80% groundwater, 20% surface water (same as 2017)
  - **Energy-Water:** 100% Diesel (same as 2017)
  - **Energy-Food:** 70% Diesel, 30% Gasoline (same as 2017)



Options:

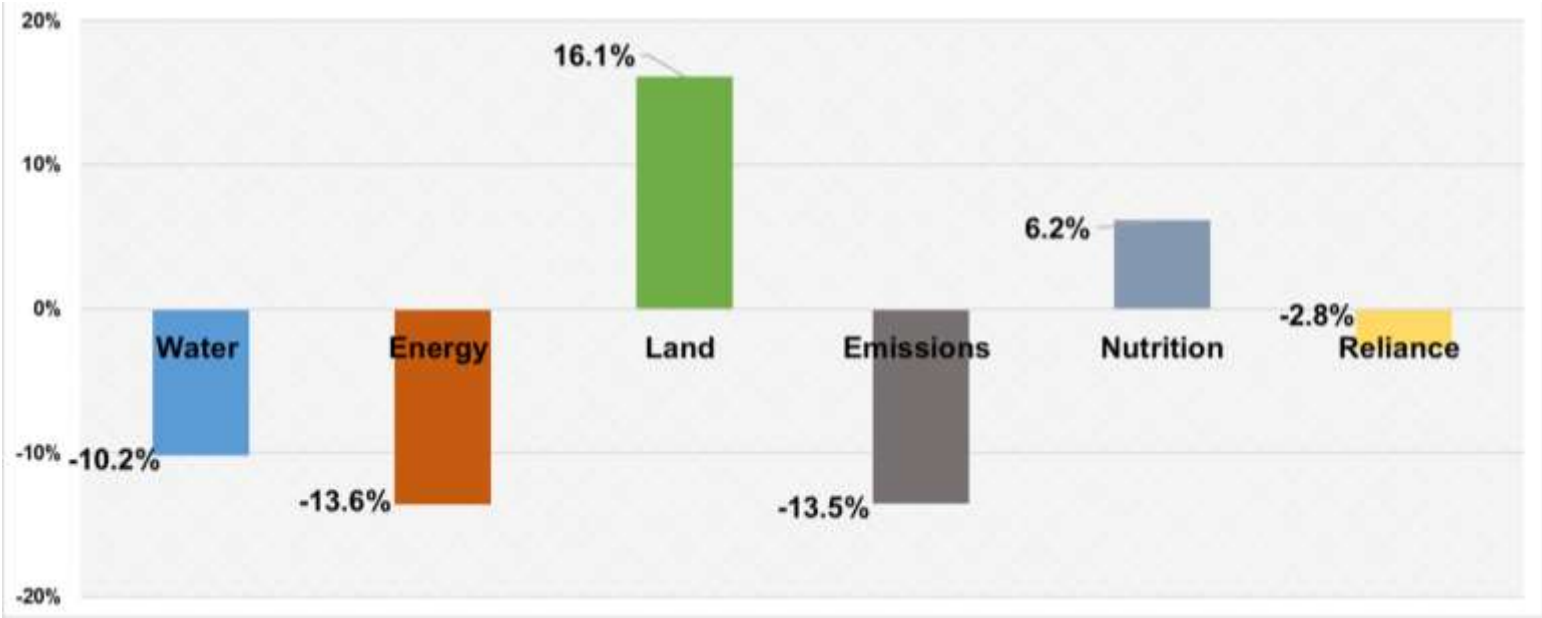
- Increase self-sufficiency to enrich the Lebanese food basket with nutritious food produced locally
  - **Increase** beans (green, broad, dry), lentils, chickpeas and peas (dry, green) to **100% SS**
  - **Decrease** production of crops with SS>100% to SS=100% i.e. stop export of these crops
  - **Same everything else**



Improved yield of these crops (crop breeding/technologies/soil nutrition) to reduce land requirements

Another Option:

- Increase self-sufficiency to enrich the Lebanese food basket with nutritious food produced locally
  - **Increase** beans (green, broad, dry), lentils, chickpeas and peas (dry, green) to **100% SS**
  - **Water:** 60% groundwater (**Reduced**), 20% surface water, 20% treated wastewater (**Alternative Resource**)
- Results in reuse of 105 million m^3 of wastewater and relieving the dumping of raw contaminants into rivers
- Saving freshwater for other pressing uses



Conclusion

- Investing in locally produced needs of pulses (***broad beans, lentils, chickpeas, and peas)*** results in **increased nutritional value** in the locally produced basket, and **reduced reliance** on foreign markets.
- With proper resource allocation, this results in reducing pressure on fresh water and reducing contamination of surface and groundwater
- Results in reducing GHG emissions
- Positive implications on public health
- For achieving this, the WEF Nexus Tradeoff is a helpful tool and the requirements include:
    - Improved technologies
    - Better policies/incentives
    - Public awareness and change in behavior of producers and consumers