

# LEBANON'S AGRICULTURAL SECTOR POLICIES: CONSIDERING INTER-REGIONAL APPROACHES TO ADAPTATION TO CLIMATE CHANGE

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## Summary

This policy brief is based on the “Climate Change in Lebanon: Higher-order Regional Impacts from Agriculture” study, by Eduardo A. Haddad, Nadim Farajalla, Marina Camargo, Ricardo Lopes, Flavio Vieira

A research study by Haddad et al. conducted through a Memorandum of Partnership between NEREUS Lab at the University of Sao Paulo, Brazil and the Issam Fares Institute at the American University of Beirut (AUB) looked at how projected changes in climate variables - specifically temperature and precipitation - could impact growth and welfare in Lebanese regions through changes in productivity in the agriculture sector for the period 2010-2030.

## MAIN FINDINGS

- ▶ The costs from climate change in Lebanon by 2030 brought to today: in terms of the GDP would be LBP 4,140 billion, which would account for 7.22% of the 2010 GDP.
- ▶ Agriculture would be mostly affected with a permanent decline in production of LBP 105.9 billion by 2030.
- ▶ The effects of climate change on crop yields will exacerbate regional inequalities in Lebanon, as there are potentially high costs and risks associated with a burden to the poorer and more vulnerable regions of the country.
- ▶ The regional view pushes policy-makers to consider an integrated approach of production value chains, and stresses on the importance of inter-regional analysis when considering new policies.

## MAIN RECOMMENDATIONS

- ▶ A National Climate Change Strategy is of utmost necessity to mainstream climate change into sectoral planning.
- ▶ Reconsideration of the Strategy of the Ministry of Agriculture to take into consideration the various climate change impacts on the sector with specific regional considerations.

## Problem Statement

Climate change poses additional uncertainty to the future of Lebanese territories; where the economic impacts due to the changing climate would be experienced in different ways across the sectors and regions. The Lebanese Ministry of Agriculture (MoA), in its 2010 strategy and action plan, rarely mentions the effects of climate change, restricting it to considerations related to increased risks of desertification due to climate change. The strategy does however generally address food security and balanced development by stating it will “provide food securities, fight poverty, provide balanced development between regions, decrease cost of food, improve production to meet national demand” as one of its aims. The development of the agricultural sector has not been uniform across regions, even though in its structure the MoA does have regional services that extend to the different governorates.

In order to have a more detailed agricultural strategy that takes climate change effects on the different regions into consideration, more data and assessments are needed on a national level. In particular those related to climate change modeling.

The Second National Communications to the United Nations Convention on Climate Change (UNFCCC) of Lebanon showed efforts in climate modeling where a specifically developed regional model was used. However, in the case of the agriculture sector, the direct impact of climate change on yields and crop product quality were only identified based on the parameters described in the literature. Accordingly, to

fill this gap in data availability and further enhance the assessments, the study by Haddad et al. (2014) analyzed the susceptibility of agricultural outputs to future climate change in Lebanon, and the extent to which it propagates to the economic system as a whole. The study quantifies the broader economic impacts considering not only the temporal dimension but also the regional disaggregation of the results.

## **“Land dedicated to agriculture has been declining over the past twenty years, to below 11% in 2011”**

### **Background**

Lebanon’s location, topography, and natural endowments, enabled the existence of a diversified agriculture sector (CDR, 2005). Areas under cultivation are mainly concentrated in the Bekaa and Northern Lebanon (42.1% and 27.2% respectively), with Southern Lebanon accounting for 12.6% and Nabatieh and Mount Lebanon around 9% each, rounding off the list (Ministry of Agriculture, 2013). Approximately half of the 270,000 hectares that are cultivated in Lebanon are irrigated (MoA, 2013). Land dedicated to agriculture has been declining over the past twenty years, to below 11% in 2011 (World Bank, 2013). Overall, the agriculture sector (including livestock) is responsible for almost 5% of Lebanon’s GDP.

Lebanon’s climate is typical of the Mediterranean region with four distinct seasons that encompass a rainy period followed by a dry period. According to the PRECIS model, temperatures by 2040 will increase from around 1°C on the coast to 2°C in the mainland, and by 2090 they will be 3.5°C to 5°C higher, respectively. Rainfall is also projected to decrease by 10-20% by 2040 and by 25-45% by the year 2090, compared to the present. This combination of significantly less wet and substantially warmer conditions will result in an extended hot and dry climate (MoE, 2011).

Agriculture is one of the most vulnerable economic sectors to climate change as it is directly affected by changes in temperature and rainfall. Limited availability of water and land resources in Lebanon, together with increasing urbanization, puts additional challenges for its future development. In general, the direct effects of climate on agriculture are mainly related to lower crop yields or failure owing to drought, frost, hail, severe storms, and floods; loss of livestock in harsh winter conditions and frosts; and other losses owing to short-term extreme weather events.

### **Research Methodology**

A methodological framework was applied, in which the results were produced in two stages.

The initial stage studied the effect of climate variables on the average yield of the five main identified types of crops in Lebanon, which include cereals, fruits, olives, industrial crops, and vegetables. The Lebanese area was divided upon governorates, and accordingly, crop shares were weighed for each governorate<sup>1</sup>. Then the accumulated effect of the five crops was calculated for every governorate, and was used as productivity shocks to the economy in the second stage.

The second stage involved the calculation of the higher-order impacts which are the ripple effects that a shock to productivity would have on the economy as a whole, based on:

- ▶ The sequential dimensions
- ▶ The regional disaggregation

Accordingly, the process adopted was to estimate econometrically the initial correlation between climate variables and agriculture productivity, and then to feed the results into an interregional computable general equilibrium model to capture the system-wide impacts of the projected climate scenarios for Lebanese regions.

Two sets of simulations were conducted; the first set of simulations produced a baseline forecast for the Lebanese economy for the period 2010 to 2030. The second simulation was done under the assumption that the productivity in agriculture would grow slower over the period reaching 2030. This involved an additional set of shocks that incorporated the direct effects of the slower productivity growth. Thus the results show the effects on the economy of a scenario in which the productivity of the agriculture sector grows at a slower rate than under a “business as usual” scenario.

### **Results**

The results for the different simulations were categorized as direct impacts of climate change on the economy, regional perspectives, and regional welfare due to migrations.

Regarding the impacts of climate change on the economy through changes in crops yields, the simulations revealed a permanent loss for Lebanon’s GDP by 2030 of approximately 0.55% when the scenarios with and without climate change are compared. Present values of losses range between 5.50% and 7.75% of the GDP for 2010. In terms of welfare, the average Lebanese citizen would lose around LBP 504,000 (\$336 USD) in terms of the present value of the reductions in household consumption accumulated to 2030, representing 4% of current per capita annual consumption.

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**1 The agriculture data sets were unified to all of Lebanon, but the shares of the regions per type of crop were identified and were weighted accordingly.**

Table 1

*Change in GDP values discounted to present values at different rates, 2010-2030*

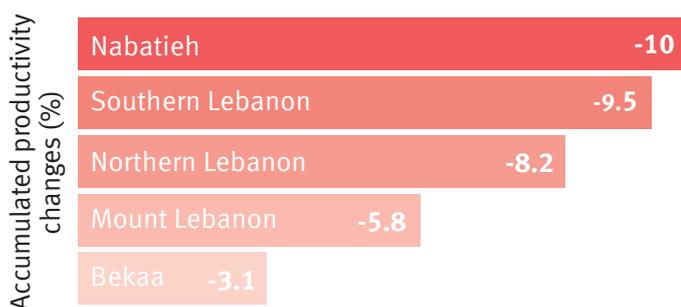
|   | DISCOUNT RATE (%) |          |          |
|---|-------------------|----------|----------|
|   | 0.5               | 1.0      | 3.0      |
| GDP (LBP billion 2010)                      | -4,442.2          | -4,139.8 | -3,150.5 |
| GDP (% of 2010 value)                       | -7,75%            | -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 %  |

Moreover, the economic impacts would be experienced in different ways across the sectors and regions. For example, agriculture would be the sector with the highest sensitivity to climate, with a permanent decline in production of LBP 105.9 billion by 2030, which is equivalent to 1.9% of the baseline sectoral value added at that year.

In terms of regional impacts, the agriculture sector would be mostly affected in the southern governorates which include Southern Lebanon and Nabatieh at a loss of 9.66% and 9.98% respectively due to the high vulnerability of their crop mix containing a high share of industrial crops – the most vulnerable crop type.

Figure 1

*Accumulated productivity changes (in percentage change) in the agriculture sector due to climate change in the Lebanese governorates, 2010-2030*



From the inter-regional perspective, the poorest regions in the country have the highest threat. It is fair to conclude from Gross Regional Product results that the effects of climate change on crop yields will potentially exacerbate regional inequalities in Lebanon. The most significant discrepancy can be found by comparing the systemic effects of climate change in Nabatieh and Southern Lebanon (accumulated losses in relation to the 2010 baseline's values of 22.64% and 16.26% by 2030, respectively) to the effects in Beirut and Mount Lebanon (losses of 3.24% and 4.32%, respectively). Moreover, regional inequality is potentially magnified over time.

A final point refers to regional welfare as suggested by the results on net migration, which take into account endogenous population changes in order to maintain the baseline utility levels in the regions. The higher percentage changes in the population in Beirut and Mount Lebanon, required to keep residents as well off as in the baseline (no climate change), reveal important impacts on relative changes in the cost of living in the central areas of the country. This negative effect, common to all governorates, would be mostly due to the reduction in real income caused by the general increase in prices led by the increase in the prices of agricultural products.

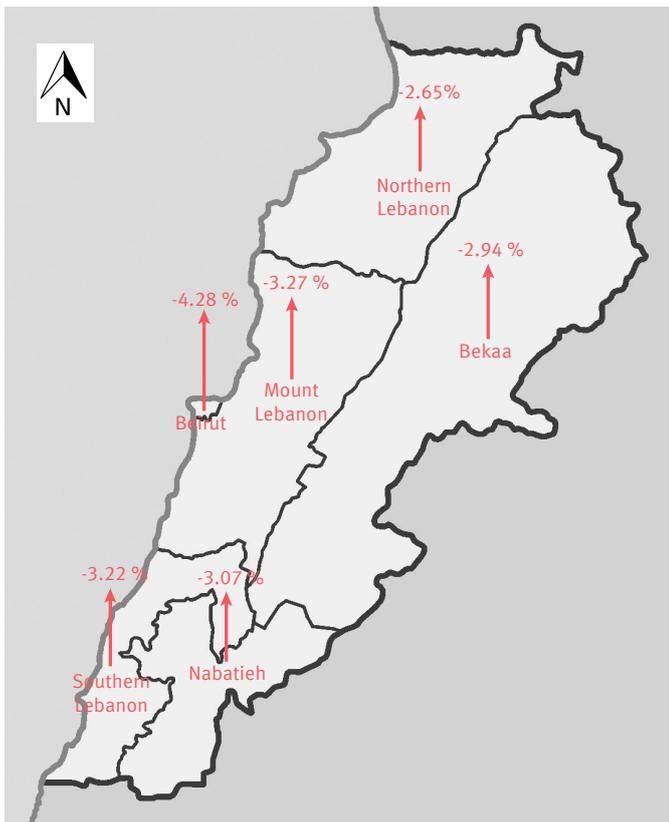
**“...Agriculture would be the sector ... with a permanent decline in productivity of LBP105.9 billion by 2030”**

Table 2

*Systemic impacts of productivity changes in agriculture due to climate change on regional population (net migrants)*

|                  | REGIONAL POPULATIONS<br>2010 - 2030 |
|------------------|-------------------------------------|
|                  | % OF 2010 VALUES                    |
| Lebanon          | -3,19 %                             |
| Beirut           | -4,28 %                             |
| Mount Lebanon    | -3,27 %                             |
| Northern Lebanon | -2,65 %                             |
| Bekaa            | -2,94 %                             |
| Southern Lebanon | -3,22 %                             |
| Nabatieh         | -3,07 %                             |

## Net migrants per region as % of 2010 values



### Recommendations:

- ▶ A National Climate Change Strategy is of utmost necessity to:
  - ▶ Help in guiding all sector strategies by mainstreaming climate change into sectoral planning.
  - ▶ Ensure an integrated approach to management of resources to optimize efficiency.

A starting point for developing such a strategy includes:

- ▶ Assigning a responsible body that is either an inter-ministerial committee or a focal unit.
  - ▶ Setting a baseline for all concerned ministries.
- ▶ Reconsideration of the Strategy of the Ministry of Agriculture to:
    - ▶ Include detailed objectives and plans under its aim to “provide food securities, fight poverty, provide balanced development between regions, decrease food costs, improve production to meet national demand”.
    - ▶ Take into consideration the various climate change impacts on the agriculture sectors, including

the supply chain and the social and economic repercussions based on existing studies and projections.

- ▶ Re-develop the strategy with specific regional considerations, objectives, proposed actions, and measures in order to ensure proper adaptation practices are being implemented, accompanied by proper extension and support to farmers for better adoption, making use of the different regional services of the ministry.
- ▶ Propose a mechanism for improving collaboration with the Ministry of Economy and Trade on issues related to Lebanon’s trade policies in order to ensure food security in the wake of climate change impacts and the competition and scarcity in resources due to population growth.

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