

RANIA LACHHAB

PhD Candidate, Agricultural, Food and Resource Economics, Michigan State University
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EDUCATION

Michigan State University

Ph.D. Agricultural, Food, and Resource Economics
Major in Environmental and Resource Economics

Expected May 2024

Institut Agronomique et Veterinaire Hassan II

M.S. Agricultural Economics (with Distinction)
B.S. Agricultural Engineering (Validectorian)

October 2018

RESEARCH INTERESTS

Resource economics; water economics; agricultural economics; applied microeconomics; applied econometrics; climate change; policy design; impact evaluation; development economics

PAPERS IN PROGRESS

- **Make it Rain: Cloud seeding and water resources in California**

. *R. Lachhab*

Management of water resources is a complex decision-making process, especially in drought-susceptible regions where water scarcity poses a serious constraint to energy production, agriculture, and urban water distribution. Weather modification, such as cloud seeding, has been used in many contexts, including the Middle East, southern Europe, North Africa, China, and the US to ease water shortages and stabilize natural fresh water supplies, by increasing precipitation and streamflow. Cloud seeding has become a contentious issue, leading to both international conflict and concerns about the effectiveness of implemented programs. In this paper, I use a two-way fixed effects model to estimate the effects of California's long-running cloud seeding programs on precipitation to help understand the role of precipitation enhancement projects as a tool in water resources management. I find that the precipitation enhancement program covering the Upper Santa Ynez and the Huasna-Alamo watersheds increases precipitation by 26% in the target areas at an average cost of \$5.6/acre-foot. I also find that the effectiveness of cloud seeding differs even between adjacent target areas, which suggests that results of a program in a specific area might not be extrapolated to justify the investment in a new precipitation enhancement program in a different area. These results provide guidance on the contexts in which cloud seeding programs may be economically viable, along with estimating potential deleterious impacts to neighboring communities.

- Irrigation Adoption and Crop Choice Adaptation to Water Policy in Ethiopia

. *R. Lachhab, M. Gammans*

This paper investigates how farmers alter their production practices in response changes in public irrigation infrastructure. We consider the construction of the Koga dam in northwest Ethiopia in 2011. We combine data on crop choice, irrigation, and farm characteristics from the World Banks Living Standards Measurement Study with climate and topographical data to estimate the short-run and long-run effect of the Koga dam on farm-level irrigation access and crop choice. We use a differences-in-differences approach to estimate the effect on irrigation and a multinomial logit discrete choice model to characterize crop choice. We find little effect on irrigation two years post-construction but observe an increase of 6.4% in probability of irrigation in areas with dam access four years post-construction. For crop choice, our estimates imply dam access leads to an initial 3.5% increase in the likelihood of planting cereals, growing to an effect of 6.9% after four years. Results suggest that the large-scale irrigation scheme increases the likelihood of irrigation adoption. The policy intervention also increases the likelihood of choosing cereals, oilseeds, and spices, whereas participation in extension programs increases the likelihood of increasing cereals production.

- Appraising the role of mismeasurement past climate in climate change impact analysis

. *M. Gammans, R. Lachhab*

Economists often use regression-based approaches to measure the relationship between climate and economic activity. This requires the empiricist to construct a climate variable, which is typically defined as some average of shorter-term weather variables. Since weather is variable and random, the climate average contains measurement error. The average of past weather may be a noisy proxy for agents' future weather expectations. We evaluate the extent that this measurement error biases estimates and affects inference for three climate impact approaches: the cross-sectional Ricardian (Mendelson, Nordhaus, and Shaw, 1994), long-differences (Burke and Emerick, 2016), and climate-weather interaction approaches (Dell et al, 2010; Merel and Gammans, 2021; Carleton et al., 2022).

- Economic Impacts of Climate Change on Agriculture and Water Resources in Morocco (RR in *Climate Change Economics*)

. *R. Lachhab*

Climate change presents a major challenge with adverse impacts on sustainable economic development, especially in developing regions such as North Africa. Projected reduced rainfall with increased spatiotemporal irregularity will aggravate water scarcity in this region. Water resources shortages will particularly affect agriculture, the most climate-sensitive economic sector, in terms of agricultural production and incomes. This paper examines the impacts of climate change on water resources and on the agricultural value-added at a regional level in Morocco. Using a dynamic integrated hydro-agro-economic optimization model, I represent the relationship between conjunctive water use and agricultural production in the upstream part of the Oum-Rbia water basin, with a spatial water distribution network of water flows, balances and constraints. The model maximizes the total profit of water use by agricultural producers within the study region, which are primarily constrained by water availability. Simulations are conducted regarding projected changes in climatic and hydrologic variables. Results indicate a total gross margin reduction of 7%. In irrigated areas, production is roughly maintained at the same level as in the "business as usual" scenario but irrigation water quantities increase significantly, by up to 20%. Groundwater use buffers the increase in surface water shortages in agricultural perimeters that use surface water and groundwater conjunctively. Therefore, the groundwater head is reduced in all aquifers as a consequence of climate change. Finally, the economic value of water is greater under climate change scenario compared to "business as usual", especially in irrigated areas that only use springs (+18%).

- **The Economic Impacts of Climate Change on African Agriculture**

. *R. Lachhab* The increased warming and shifts in rainfall patterns associated with climate change are predicted to adversely affect African agriculture. This paper examines the impacts of climate patterns on farmland values in Africa, employing a cross-sectional Ricardian approach. Using aggregate national-level data for 54 countries, land value is regressed on precipitation, temperature, and other non-climatic variables. The results indicate that the current climate conditions have significant impacts on land values across Africa. The valuation of marginal impacts of climate variables on land values shows an increase by 13.6 US\$/mm and a decrease of 933.7 US\$/C.

PRESENTATIONS

- The Economics of Weather Modification and Water Resources (*accepted*)

. *2023 Agricultural and Applied Economics Association Annual Meeting*

- Cloud Seeding for Precipitation Enhancement in California (*accepted*)

. *2023 Western Economic Association International*

- Economic Impacts of Weather Modification on Water Resources and Drought

. *2023 Midwest Economics Association Annual Conference*

- Irrigation Adoption and Crop Choice Adaptation to Water Policy in Ethiopia

. *2022 Agricultural and Applied Economics Association Annual Meeting*

- Economic Impacts of Climate Change on Moroccan Agriculture: a hydro-economic river basin modelling approach

. *2019 International Consortium on Applied Bioeconomy Research*

- Water Resource Management in North Africa and the Middle East.

. *The Water-Energy-Food Nexus in the Levant: Challenges and Opportunities. Beirut, Lebanon 2018.*

- Economic Impacts of Climate Change on Agriculture and Water Management in the Oum-Rbia basin.

. *International Conference on Managing Water Scarcity in River Basins: Innovation and Sustainable Development. Agadir, Morocco 2018.*

RESEARCH EXPERIENCE

Michigan State University

Research Assistant

2022-ongoing

Africa Institute for Research in Economics and Social Sciences

Research Engineer

2018-2019

Policy Center for the New South - Think Tank

Research Assistant, intern

2018

NOVEC Consulting -Groupe CDG

Intern in consulting/engineering for the Department of Water Resources and Rural Development.

2017

TECHNICAL STRENGTHS

Modeling and Analysis

Microeconometrics, Dynamic optimization, Microeconomic theory

Software & Tools

Stata, R, GAMS, Mathematica, Eviews, SPSS, MATLAB, ArcGIS

Languages

English, French, Arabic, Darija

Engineering background

Hydrology, Soil Science, Agronomy, Climatology, Zoology, Chemistry

ACADEMIC ACHIEVEMENTS

- Fellowship to pursue a PhD degree in the US, awarded by OCP Foundation.
- Scientific Committee Appreciation Prize for Best Research at the international conference "Managing Water Scarcity in River Basins: Innovation and Sustainable Development", Agadir, Morocco, 2018.
- Erasmus+ Scholarship to pursue a Masters degree in France (2017).
- Major de promotion, M.S. class of 2018, Institut Agronomique et Veterinaire Hassan II.
- Excellence Scholarship for higher education (2013).

TEACHING AND EXTENSION EXPERIENCE

Instructor of Record Summer 2023

Michigan State University

- AFRE 206: World Food, Population and Poverty

Grader Spring 2022

Michigan State University

- AFRE 445: Strategic Management for Food and Agribusiness Firms
- AFRE 465: Corporate Environmental Management

Teaching Assistant Spring 2019

Universite Mohammed VI Polytechnique

- Economic Analysis and Modeling of Agricultural Production Chains
- Irrigation and Water Economics
- Microeconomics for Public Policy

Guest Lecturer Fall 2017

Institut Agronomique et Veterinaire Hassan II

- Modelisation economique appliquee a l'agriculture
- Evaluation economique des projets de developpement

Extension 2016-2018

Michigan State University

- Conservation practices adoption and advice: examining perceived barriers and uptake across growers and their technical advisers in the Central Valley, California

Institut Agronomique et Veterinaire Hassan II

- Policy Makers: Agence Hydraulique du Bassin Oum-Rbia. Policy recommendation on water pricing and optimization of water management for agriculture in the basin.
- Dairy farmers: Enhancing dairy cows production and business expansion by integrating the value chain of milk in Morocco.

COMMUNITY SERVICE

- Reviewer for the Association of Environmental and Resource Economists 2023 Summer Conference
- Webmaster for the Graduate Student Organisation at AFRE, MSU (2021-2023).
- Board member of the Moroccan Association of Student Agricultural Engineers (2016-2018).
- Project manager at Enactus IAV (2015-2017).