RANIA LACHHAB

PhD, Agricultural, Food and Resource Economics
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CURRENT APPOINTMENT

University of California, Berkeley *2024-Present*
Postdoctoral Scholar, Department of Agricultural and Resource Economics

EDUCATION

Michigan State University *2019-2024*
Ph.D. Agricultural, Food, and Resource Economics
Major in Environmental and Resource Economics

Institut Agronomique et Veterinaire Hassan II *2013-2018*
M.S. Agricultural Economics (with Distinction)
B.S. Agricultural Engineering (Valedictorian)

Mediterranean Agronomic Institute of Montpellier *2018*
M.S. Agricultural Management and Territories (Erasmus+)

RESEARCH INTERESTS

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

PAPERS IN PROGRESS

- **Silver Bullets: Cloud Seeding and Water Resources in California**
. *R. Lachhab and M. Sears*
Management of water resources presents complex challenges, especially in drought-prone regions where water scarcity affects energy production, agriculture, and urban water supplies. Weather modification, such as cloud seeding, has been used globallyacross the Middle East, Europe, North Africa, China, and the USto alleviate water shortages and stabilize natural freshwater supplies by increasing precipitation and streamflow. Despite its applications, cloud seeding remains controversial, with debates surrounding its effectiveness and the potential for international conflicts. This paper examines the efficacy of precipitation enhancement as a water management tool, using a nonlinear difference-in-differences framework with a Poisson Quasi Maximum Likelihood Estimator (QMLE) to analyze Californias extensive cloud seeding programs. Our findings indicate that these programs increase precipitation by 57% in targeted areas, with an average cost of $8.65 per acre-foot. However, the effectiveness of cloud seeding varies even among adjacent areas, suggesting that results from one location may not be applicable to another. Furthermore, we identify significant negative impacts on downwind watersheds, with estimated losses amounting to $49 million. This research provide guidance on the contexts in which cloud seeding programs may be viable, along with estimating potential deleterious impacts to neighboring communities.

- Joint Estimation of Irrigation Adoption and Crop Choice in Ethiopia

. R. Lachhab

This paper examines the joint decision-making process of irrigation adoption and crop choice among smallholder farmers in Ethiopia. Given the critical role of agriculture in Ethiopia's food security and economic growth, understanding these decisions is essential for formulating effective agricultural policies. I use data from Ethiopia's Living Standards and Measurement Study-Integrated Survey on Agriculture (LSMS-ISA) to estimate a nested logit choice model to analyze the determinants of these decisions, focusing on the role of agricultural extension services. The results indicate that access to extension services significantly influences both the adoption of irrigation technology and the selection of crops, underscoring the joint nature of these choices. By integrating the effects of extension services and irrigation availability, this study provides insights into how farmers in resource-constrained environments adapt to water scarcity and climate variability. The findings contribute to the existing literature by addressing the joint decision-making process in technology adoption and crop selection, offering valuable implications for policymakers seeking to enhance agricultural productivity and resilience in Ethiopia.

- 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

- Silver Bullets: Cloud Seeding and Water Resources in California
. 2024 Agricultural and Applied Economics Association Annual Meeting

- Optimize your Teaching Experience in Grad School
. MSU AFRE Brown Bag Seminar

- Silver Bullets: Cloud Seeding and Water Resources in Californiats
. The University of Arizona, Department of Agricultural and Resource Economics

- The Economics of Weather Modification and Water Resources
. 2023 Agricultural and Applied Economics Association Annual Meeting

- Cloud Seeding for Precipitation Enhancement in California
. 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. Ravello, Italy.

- Water Resource Management in North Africa and the Middle East.
. The Water-Energy-Food Nexus in the Levant: Challenges and Opportunities. The American University of 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 *2022-2024*
Graduate Research Assistant

Africa Institute for Research in Economics and Social Sciences *2018-2019*
Research Engineer

Policy Center for the New South - Think Tank *2018*
Research Assistant

NOVEC Consulting - Groupe CDG *2017*
Intern in consulting/engineering for the Department of Water Resources and Rural Development.

TECHNICAL STRENGTHS

Modeling and Analysis	Microeconometrics, Dynamic optimization, Microeconomic theory
Software & Tools	Stata, R, GAMS, LateX, Eviews, SPSS, MATLAB, ArcGIS
Languages	English, French, Arabic, Darija
Engineering background	Hydrology, Soil Science, Agronomy, Climatology, Zoology, Chemistry

ACADEMIC ACHIEVEMENTS

- Merit-based fellowship to pursue a PhD degree in the US, awarded by OCP Foundation (1 of 3).

- 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

Teaching Assistant/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

- Job Market Symposium Lead at EconNect Africa (2024-2025)
- Referee for *Journal of Environmental Studies and Sciences*
- Referee for *Water Resources Research* (2023)
- 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).

ASSOCIATION MEMBERSHIPS

Agricultural and Applied Economics Association, American Economic Association, Association of Environmental and Resource Economists, Western Economic Association International, Midwest Economics Association,