BOLDLY
THE CAMPAIGN TO LEAD, INNOVATE & SERVE

1866 AUB American University of Beirut الجامعة الأميركية في بيروت

Faculty of Agricultural and Food Sciences
Department of Agriculture

Healthy Earth, Healthy Food, Healthy People

Town Hall Meeting with Qatar Foundation, Texas A&M University (TAMU) and TAMU Qatar

Research at the Department of Agriculture

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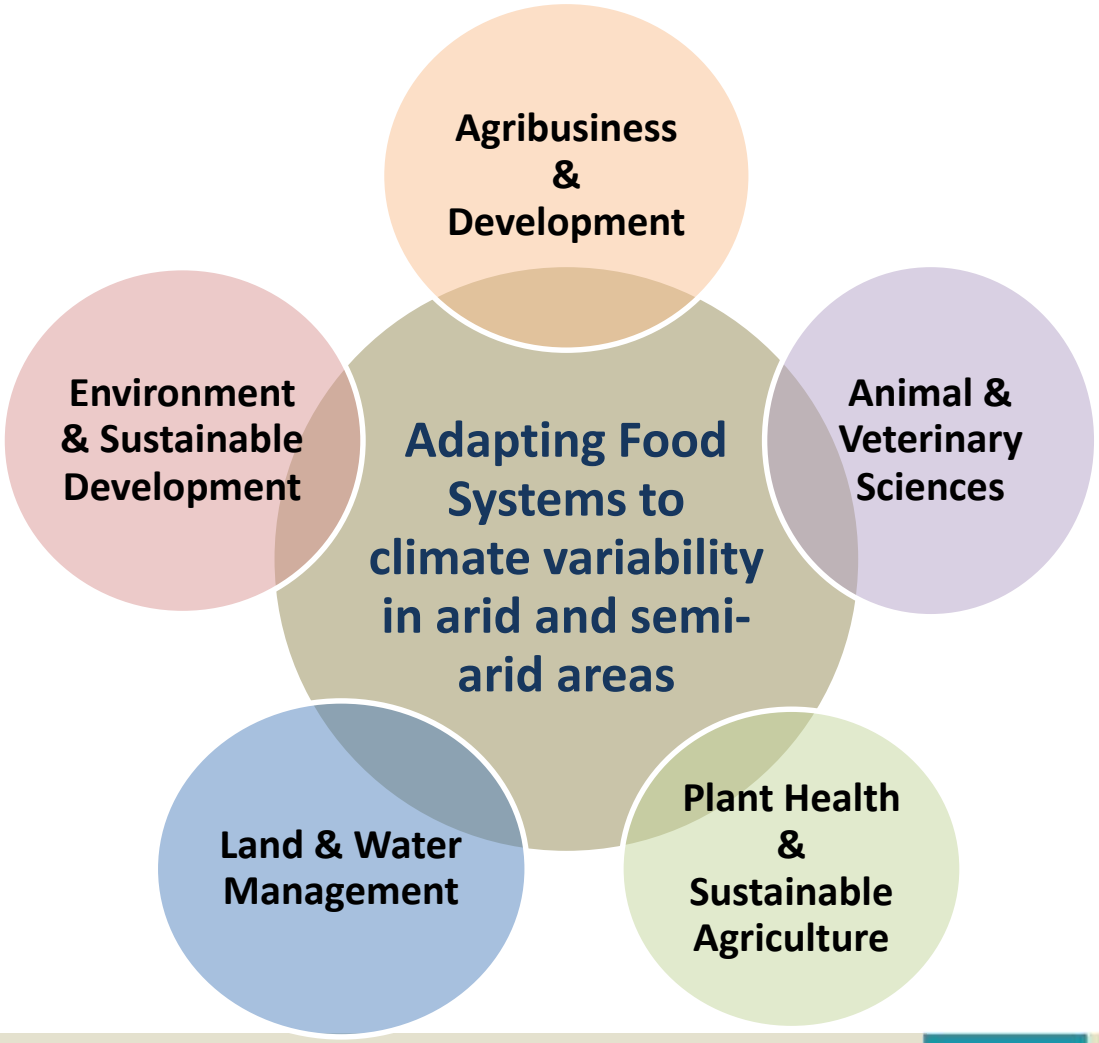
Wednesday February 7, 2018

AGRI and ESDU research strategy

- The research strategy is set inline with the FAFS strategy to lead the way in food security and food systems research.
- The proposed research strategy aims to build on research strengths and experience of the faculty and to consolidate the research activities into a structured effort under the guiding theme of **"Adapting Food Systems to Climate Variability in Arid and Semi-Arid Areas"**
- The proposed strategy is set for the AGRI Department and the ESDU within the same framework; they have been subdivided into research clusters.

Research Clusters



Goals of the research strategy

- Three goals were set for the proposed research strategy. They were selected to provide an integrated framework through which academic research is placed in context to be synchronized with graduate teaching, community and the private sector, stakeholders and funding agencies, and faculty resources.
- **Goal I :** Leading the way in food systems research in dry areas
- **Goal II:** Competitive edge in fundraising and incentives for research
- **Goal III :** Graduate programs for the 21st century

Goal I: Leading the way in food systems research in dry areas

A. The Agribusiness and Development Cluster

Objective	Initiatives
I.1. Investigate the impact of climate variability on Agriculture production in the region.	**I.1.a.** Collection and compilation of climatic and production data. **I.1.b.** Data analysis and modeling
I.2. Analyze the determinants of Adoption of Conservation Agriculture /Organic in MENA	**I.2.a.** Survey of farmers **I.2.b.** Modeling the determinants of CA/organic adoption
I.3. Assess the economics of green house gas emissions mitigation	**I.3.a.** Sectorial contribution to green house emissions **I.3.b.** Link with relevant AUB initiatives and centers such as the Energy group in Engineering and the Isam Fares institute

Objective	Initiatives
I.4. Evaluate the effect of food prices on household food security	I.4.a. Economic impact of Food price shocks on household nutrition status I.4.b. Develop economic indicators for nutrition security in partnership with Nutrition and Food Science
I.5. Study the efficiency and effectiveness of agri-food supply chains in response to recent trends for food safety and quality	I.5.a. Survey of food manufactures in Lebanon to explore the potential effect of food safety management adoption on the organization of food supply chains I.5.b. Evaluate determinants of food safety management adoption I.5.c. Document perceived benefits and costs of food safety management systems (ISO 22000, GAP, etc.)
I.6. Study food retail expansion patterns, its drivers and implications for food security	I.6.a. Survey of consumers and retailers to assess determinants of retail outlet choices in Lebanon I.6.b. Analyze modern food retail expansion patterns in MENA using data from various databases I.6.c. Identify drivers of observed food retail patterns in MENA

B. The Plant Health and Sustainable Agriculture Cluster

Objective	Initiatives
I.7. Develop new strategies for environmentally sound integrated pest management (IPM) and partnership with National and regional initiatives for the development and promotion of sustainable production systems	**I.7.a.** Investigating the potential use of plant extracts or locally isolated organisms/microorganisms (arthropod predators and parasites, entomopathogens, microalgae) for integrated plant health management or for organic agriculture **I.7.b.** Grafting as an alternative approach for pest control on major horticultural crops **I.7.c.** Identification of pheromones of introduced or major pests and their use in monitoring or management of insect pests

Objective	Initiatives
I.8. Plant breeding for pest resistance and environmental stress to cope with climate variability and for sustainable production systems	**I.8.a.** Molecular and other biotechnological tools such as marker assisted selection to develop improved resistance to pests and tolerance to heat, drought and salt stress **I.8.b.** Identification of major genes conferring resistance to pests or tolerance to abiotic factors
I.9. Improve early disease detection for exclusion and eradication	**I.9.a.** Develop serological and molecular detection methods for detection of introduced or major diseases.
I.10. Study the physiological and photomorphological ecology and foraging behavior of parasitic weeds and their management	**I.10.a.** Develop and evaluate novel integrated parasitic weed strategies in various crops, including potato Orobanche **I.10.b.** Remote sensing-introduce GIS applications in mapping weeds of Lebanon.

Objective	Initiatives
I.11. Gene mining of major disease causal agent (almond witches' broom) to develop adapted detection methods and potential disease management based on induced resistance or gene silencing	**I.11.a.** Full genome sequencing of AlmWB phytoplasma, explore virulence genes and potential for resistance through gene silencing **I.11.b.** Multilocus genome studies to evaluate pathogen diversity **I.11.c.** Recombinant DNA technology to produce pure antigens for the production of antibodies **I.11.d.** Develop specific detection methods
I.12. Investigate plant pathogen outbreaks due to climate variability	**I.12.a.** Surveys on emerging plant pathogens and other pests **I.12.b.** Research on expected emerging plant pathogens related to climate variability **I.12.c.** Epidemiology and adaptability of expected plant pathogens **I.10.d.** Disease management plans

Objective	Initiatives
I.13. Address solutions to problems expected in crop production and protection due to climate change	**I.13.a.** Establish an agriculture biotechnology lab **I.13.b.** Initiate a new MS in agriculture biotechnology **I.13.c**. Initiate research on the topics cited above to cope with problems in agriculture production that may arise from climate change in the ME or MENA region
I.14. Become a hub or reference lab for disease and pest diagnosis	**I.14.a.** Contacts to be re-initiated with the University of Florida, to promote FAFS as a hub for early detection and diagnosis of diseases/pests of quarantine importance in the ME region… Coordination with USDA APHIS ' Plant Protection and Quarantine (PPQ) program will be sought.

C. The Land and water Management Cluster

Objective	Initiatives
I.15. Assess relationships between soil and human health	**I.15.a.** Selenium contents in crops related to soil content, development of nutrient rich crops **I.15.b.** Manure content of antibiotics relating to content in crops **I.15.c.** NH3 gas as alternative methyl bromide for soil disease control **I.15.d.** Mapping of nutrient and antibiotics in soil and plants in relation to human health in the MENA region in partnership with Health Sciences
I.16. Evaluate conservation agriculture strategies	**I.16.a.** Expand No-till practices to different field and horticultural crops
I.17. Water Energy Food Nexus modeling and tradeoffs	Details
I.18. Soil Characterization and modeling	

Objective	Initiatives
I.19. Develop more sustainable and climate-resilient agroecosystems in a water scarce region	**I.19.a.** Study interlinkages between conflicts, migration, and food security (WFP) **I.19.b.** Quantify impacts of crisis on water, agriculture, and food security (IIED, CIDOB)
I.20. Better understand the variability embedded in landscapes under current conditions in terms of crop development, water use and productivity and sensitivity to climate drivers as it relates to different land and crop management strategies	**I.20.a.** Predict and map yield and water productivity in the region (NASA, USDA, ICARDA) **I.20.b.** Develop and apply climate-smart agricultural techniques (FEA, CNRS, URB) **I.20.c.** Map daily water use and stress using remote sensing (URB, USDA)

D. The Animal and Veterinary Science Cluster

Objective	Initiatives
I.21. Assess the significance of food Safety and Zoonoses	**I.21.a.** Disease investigation, diagnosis and pathophysiology
I.22. Evaluate alternative feed ingredients and animal nutrition strategies in hot climates	**I.22.a.** Identify and test novel feed ingredients produced in arid regions **I.22.b.** Identify and test nutritional approaches to alleviate heat stress effects
I.23. Assess animal adaptation to water stress	**I.23.a.** Research on the adaptation of economically important domestic breeds to water stress **I.23.b.** Identify the physiological and molecular mechanisms involved in response to water stress **I.23.c.** Novel approaches for reducing water stress

Objective	Initiatives
I.24. Investigate the use of technology in Animal Science and Agriculture	**I.24.a.** Vaccine production and evaluation, **I.24.b.** Genomics applied to animal diseases and production
I.25. Assess Animal Welfare	**I.25.a.** Farm Animal Welfare
I.26. Assess livestock contribution to Food Security	**I.26.a.** Role of livestock in Food Security in MENA

E. The Environment and Sustainable Development Unit

Objective	Initiatives
I.27. Assess the importance of Urban Agriculture for Food Security in the MENA region	**I.27.a.** Investigate Urban Agriculture in relation to Food Security in the MENA region **I.27.b.** Mainstreaming Urban Agriculture in the MENA region through a multi-stakeholder approach **I.27.c.** Investigate Urban Agriculture in relation to community based Food Sovereignty in the MENA region under the RUAF umbrella
I.28. Resilient Food Systems in Semi-Arid Areas	**I.28.a.** Sustainability indicators of local agro-pastoral systems in MENA **I.28.b.** Sustainability and quality assessment of small scale dairy sector: a case study in Mount Lebanon **I.28.c** Value chain analysis of local products in relation to agro biodiversity **I.28.d.** Assess the socio-economic contribution of traditional farmers markets **I.28.e.** Align the regional Karianet network with the local food system paradigm through community based pilot activities, in partnership with IFAD and IDRC

Rabi H. Mohtar
Professor and Dean

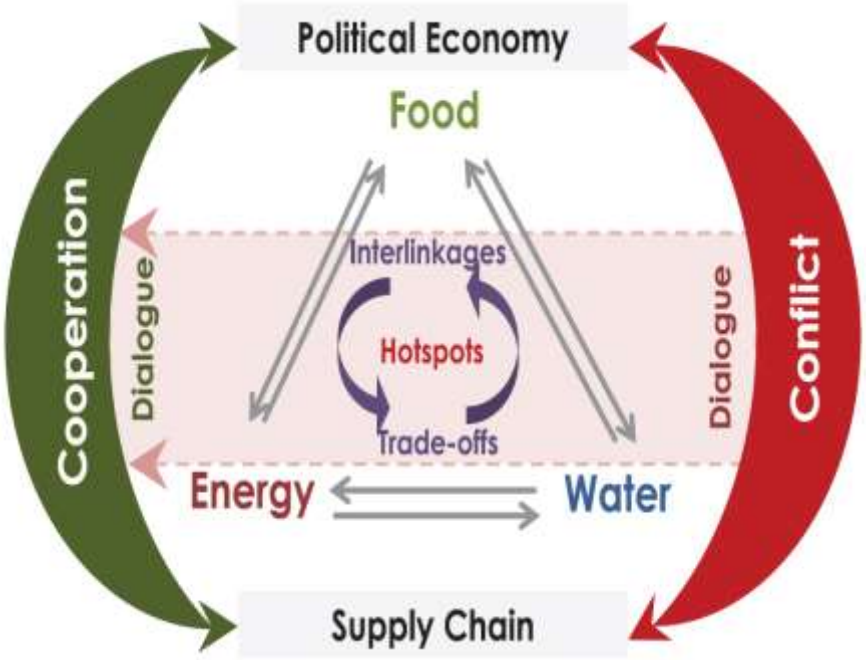
Pedostructure Characterization Lab - concept and impact:
development of hydrostructural pedology theory; improved thermodynamic modeling for more effective accounting of green water resources.

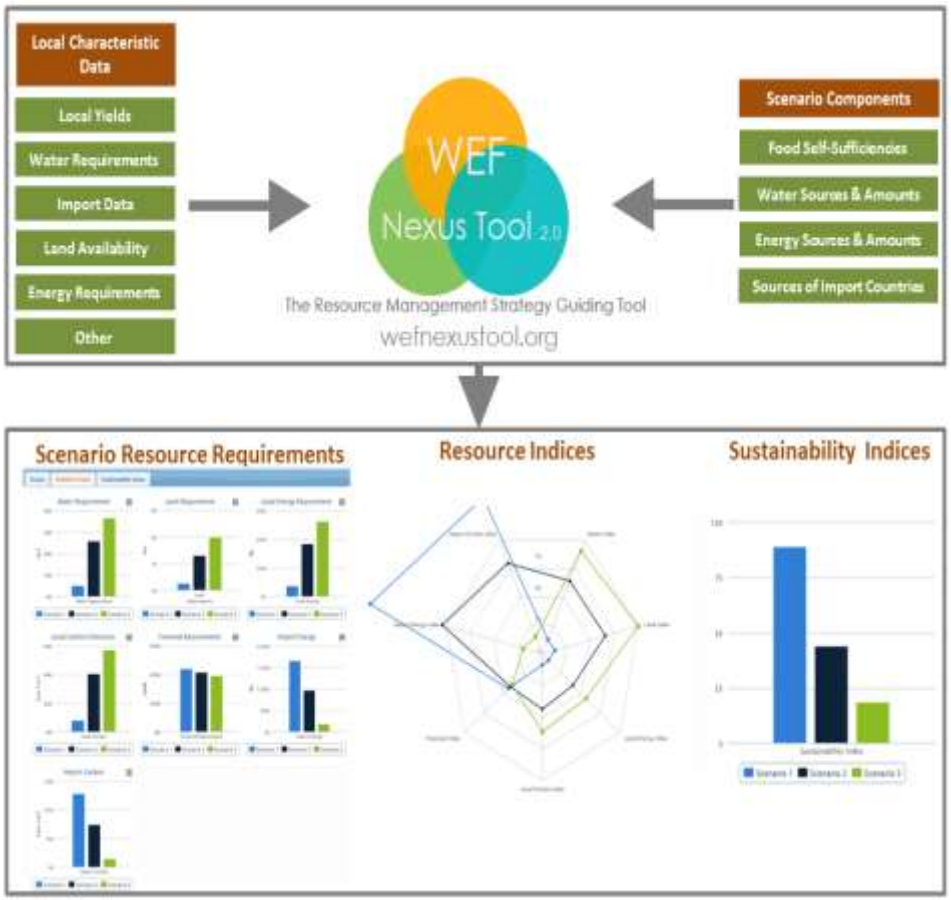
Assessing Feasibility of Non-traditional Water:
improved understanding of soil property changes resulting from repeated wastewater applications; the implications for soil health, for reduced reliance on fresh water, and for global water and food securities.

Development of the Nexus concept: scenario based analytical tool for implementation of framework, quantification of interlinkages between resource systems, assessment analytics for trade-offs in resource allocation, *integration of science and policy inputs for scenario assessment* [WEF Nexus Tool 2.0] http://www.wefnexustool.org/login.php].

Sustainable Development: energy-water-infrastructure **Nexus tradeoffs dialogue** *about options for ensuring* ***sustainable development****.*

WEF Nexus Framework





Rabi H. Mohtar and Bassel Daher (2016). **Water-Energy-Food Nexus Framework for Facilitating Multi-stakeholder Dialogue**, *Water International,* DOI: 10.1080/02508060.2016.1149759.

Bassel T. Daher & Rabi H. Mohtar (2015). **Water–energy–food (WEF) Nexus Tool 2.0: guiding integrative resource planning and decision-making**, Water International, DOI:10.1080/02508060.2015.1074148

Case Studies

- **Food Security** (Qatar)
- **Water Gap in** Texas
- **Fracking-Water-Transportation** (Texas)
- **Renewable Energy Deployment**
- **WEF Nexus in** Mekong Basin
- **WEF Nexus in Gediz Basin** (Turkey)
- **Phosphate Industry** (Morocco)
- **Hydropower & Food Security in** Nigeria
- **WEF and SDGs** (Morocco)
- **WEF Nexus in** Lebanon
- **WEF Nexus in San Antonio**
- **WEF Nexus in Matagorda** (Texas)

Global Design Teams

Sustainable Water Management Solutions

Sewage & Sanitation Jonestown, TX

Air Quality TX: College Station, Houston Vellore (Chennai, Tamil Nadu)

Cacao Pod Cracker Design (Hilo, Hawaii)

Food waste / Processing Tanzania

Meat Processing Method Nigeria

Aquaponics California

Park Development San Antonio, Texas

Mower attachments, Farm Equipment Texas

Chicken Manure Texas

Cotton Ginning and Contamination Texas

HUVR Texas

Cardamom Value Chain Guatemala

Water Purification India

Pedostructure Characterization Laboratory

- First lab of its kind in USA.
- State-of-art apparatus (Typosoil™).
- A new paradigm in soil physics: hydrostructural Pedology.
- Main research activities:

1. Long term impact of non-conventional water reuse on soil health and productivity.
2. Long term impact of soil additives (ex. Biochar) on soil health and productivity.
3. Quantifying and accounting for green water and soil-water holding properties.

Water Management

1. **Efficient Water Management [Green Water Management].**
2. **Impact of Soil Health and Productivity.**

Biochar Additives

Greywater for Irrigation

Treated Wastewater for Irrigation

Erik Braudeau, Amjad T. Assi, Rabi H. Mohtar. (2016). **Hydrostructural Pedology**. Wiley-ISTE. 186 pages. ISBN: 978-1-84821-994-6 Link to English Version. Link to the lab: https://wefnexus.tamu.edu/pedostructure-characterization-lab-2/