Economic and Social Commission for Western Asia

Modelling Climate Change Impacts on Agricultural Productivity using AquaCrop tools and RICCAR datasets

Climate Change & Natural Resources Sustainability Cluster
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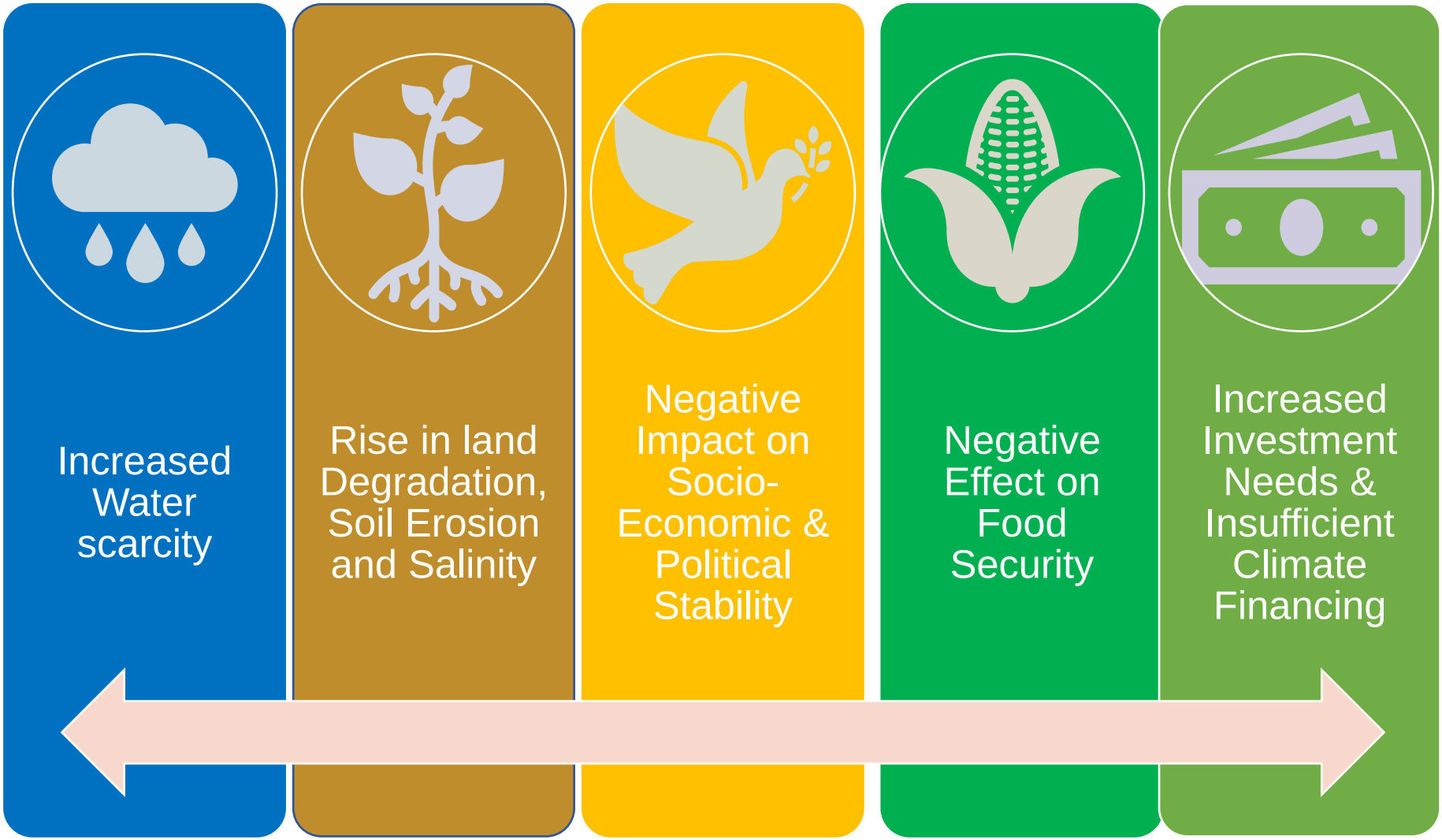
Shared Prosperity Dignified Life

Climate Change Impact on Agriculture in the Arab Region



Projecting Agricultural Productivity within Climate Change….. AquaCrop tools & RICCAR Datasets

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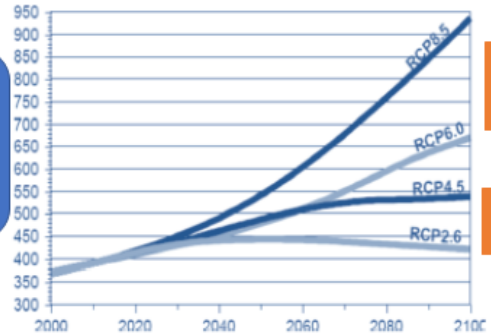
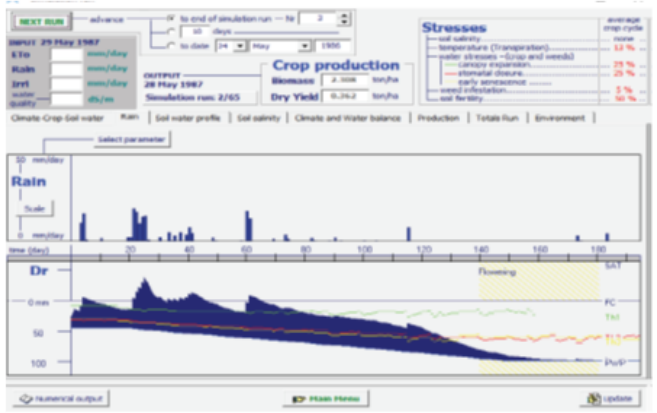
United Nations

RICCAR Climate Change Scenarios*



RCP 4.5

RCP 8.5

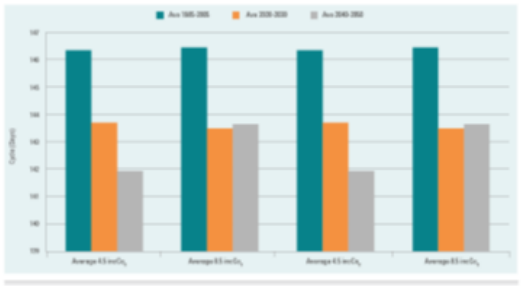


Historical Yield Data

Soil Data

Crop Data

AquaCrop Simulations



- Seasonal precipitation, temperature changes and evapotranspiration
- Changes in crop yield, crop water productivity, length of growth cycle
- Irrigation scheduling and deficit irrigation

*EC-Earth, CNRM-CM5, and GFDL-ESM2M

AquaCrop Tool for projecting Agricultural Productivity

Key Results 20 Workshops, 9 Case Study Reports in 9 Countries, and advisory services

Mashreq Country	Irrigated Crop	Rainfed Crop	Province
Iraq	Tomato		Suwaira
	Wheat		Suwaira
Jordan	Tomato		Almafraq
		Wheat	Maadaba
Lebanon	Wheat		Beqaa
Palestine	Potato	Wheat	Jenin

https://www.unescwa.org/publications/national-assessment-reports

Case Study of AquaCrop Simulation for Jordan

Methodology

- **2 localities selected** (Mafraq & Madaba)
- **Crop types identified** (rainfed wheat, irrigated tomatoes)
- **2 scenarios**: RCP 4.5 & 8.5 consider the periods 2020-2030, 2040-2050
- **17% deficit irrigation** simulation for tomatoes

Projections & Results

- **Crop growth cycle** will decrease 2-4 days for tomatoes, 3-5 days for Wheat
- **Productivity of tomato** decreases by 1 and 3.1 % for 2025 and 2045 periods, in case of fixed CO2. In case of changing CO2, productivity increases significantly by 12.8 and 17.6%, for the 2025 and 2045 periods.
- **Productivity of wheat** increases by about 33.8 and 48.3% for 2025, 2045 periods. In changing CO2, productivity increases by 53.5 and 81.6%, for both periods
- **Deficit irrigation** resulted in significant reduction in tomato (7.5 and 8.7%, for both periods, under RCP 4.5 scenarios, and around 6% for both periods under RCP 8.5)

Case Study of AquaCrop Simulation for Iraq

Methodology

- **1 localities selected** (Al Suwaira region)
- **Crop types identified** (Irrigated wheat; and tomatoes)
- **2 scenarios**: RCP 4.5 & 8.5 consider the periods 2020-2030, 2040-2050
- **Deficit irrigation** simulation by 20% for 2025 period and 40% for 2045 period

Projections & Results

- **Crop growth cycle** decrease 1-2 days for tomatoes, 4-9 days for Wheat
- **Productivity of tomato** decrease for both period and scenarios under stable CO2 conditions, while it increases by 12.8% for 2045 period and RCP 4.5 if changed CO2
- **Crop Water productivity of wheat** decreases for both period and scenarios under stable CO conditions, 2while it increases by 15.08% for 2045 period and RCP 8.5 if changed CO2
- **Deficit irrigation in tomatoes resulted in** reduction in yield in all cases reaching -34% in case of 40% deficit irrigation under both scenarios
- **Deficit irrigation in wheat resulted in** reduction in yield in fixed CO2 conditions and reached 10 and 9.4 % changed CO2 conditions

Case Study of AquaCrop Simulation for Lebanon

Methodology

- **1 localities selected** (central Bekaa Valley)
- **Crop types identified** (Irrigated wheat)
- **2 scenarios**: RCP 4.5 & 8.5 consider the periods 2020-2030, 2040-2050

Projections & Results

- **Crop growth cycle** will decrease 3-7 days
- **Productivity of wheat** would rise for all scenarios in case of fixed and changing CO2 concentration.
- For most pessimistic scenario RCP8.5, wheat yields are projected to increase by 26 and 42% for the periods 2025 and 2045
- Increase in yield is the result of the changes in precipitation patterns during the growing season, with rainfall delayed until the end of mid-season

Case Study of AquaCrop Simulation for Palestine

Methodology

- **1 localities selected** (Marj Ibn Amer, Jenin Governorate)
- **Crop types identified** ((Rainfed wheat and Irrigated potato)
- **2 scenarios**: RCP 4.5 & 8.5 consider the periods 2020-2030, 2040-2050
- **Deficit irrigation** simulation for potato by 20 and 25% for 2025- 2045 period

Projections & Results

- **Crop growth cycle** will decrease 1-2 days for wheat, 2-3 days for Potatoes
- **Crop Water productivity of wheat** in fixed CO2 increases by 17.8 and 30 % for the 2025 and 2045 periods, whereas in case of changing CO2 an increase of 33 and 56 % in the two periods
- **Crop Water productivity of Potato** is expected to decrease for both periods and scenarios with fixed $CO_{2,}$concentration and marked increase in case of changing CO2 by 11.6 and of 23.8 % for both periods
- **Deficit irrigation resulted in** significant reduction in potato yield up to 28% under 25% deficit irrigation for period 2025, and in case of fixed CO2 under RCP 4.5

CLIMATE RESILIENT AGRICULTURE:
TRANSLATING DATA TO POLICY ACTIONS

Institutional & Financial Arrangements

- Adopt and scale up conservation-agriculture practices in rainfed agriculture
- Promote investments to modernize irrigation systems
- Water accounting systems to monitor water availability and water allocations
- Promote research and assessments on use of crop varieties suited to new climate conditions

Technical Arrangements

- Adjusting sowing dates according to temperature and rainfall patterns
- Modify irrigation depth & application time
- Applying conservation agriculture such as (minimum tillage, applying crop rotation)
- Promote rainwater harvesting, application of supplementary irrigation

Evidence Generation

- Research to compare yields, soil properties development and plant growth phases
- Produce interactive map using geographic information systems to see impacts of climate change on agriculture areas
- Unified & reliable database between institutions (Agriculture – Water-Meteo – Statistics authority)

Towards a Resilient Agriculture Sector…

Recommendations for Agriculture Strategies & Policies

Cross sectoral coordination (ministerial & technical levels), ensuring stakeholders engagement, & building solid partnerships

Formulation of adaptation measures with identified priority areas within the impact of Covid-19 pandemic (short and long terms ones)

Use of innovative and improved agricultural technologies: affordable, adaptable to the region & improve crop & water productivity

Investing in nature-based solutions: use of drought-resistant varieties, efficient water storage methods & practice crop rotation

Adoption of innovative digital solutions

Mobilizing resources for investment in agriculture value chains

Improving data collection, reporting, and sharing

Performing periodic risk assessments to evaluate short, medium &long-term decision-making

Economic and Social Commission for Western Asia

Thank you

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