Digital Augmentation for Accelerated Climate Smartness of Dryland Agriculture

Ajit Govind

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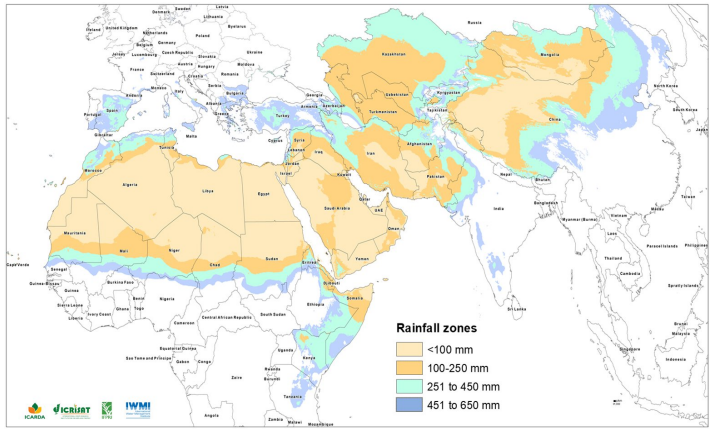
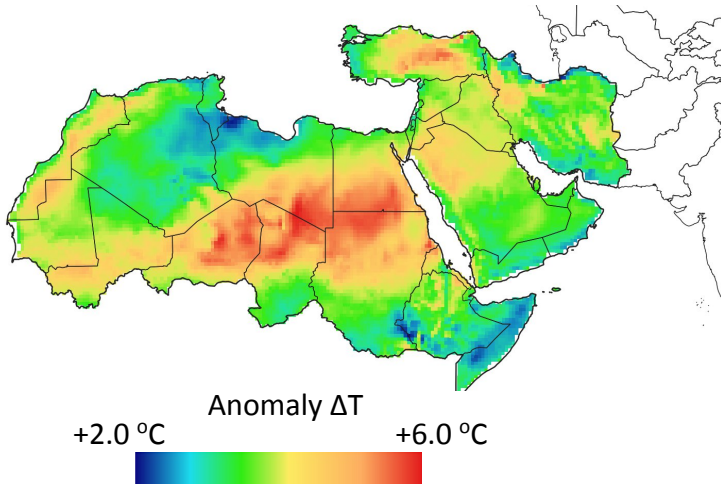
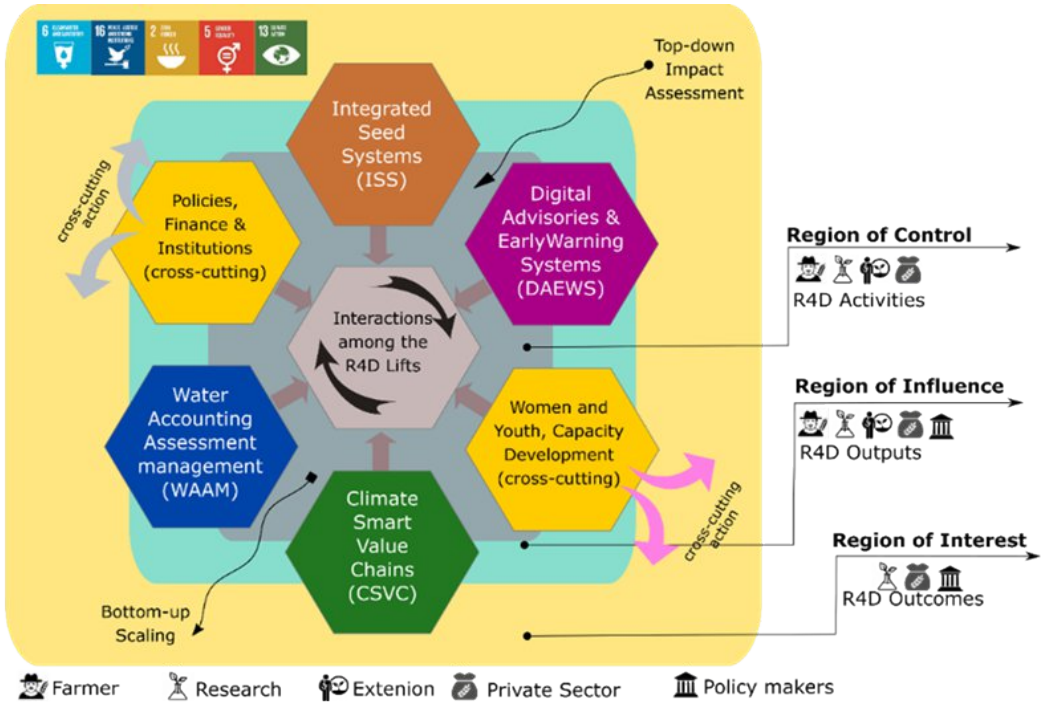
FSD7
Morocco

A Systemic Crisis in Global Drylands

- Urbanization
- Climate Change
- Land Degradation
- Conflicts
- Climate Hazards





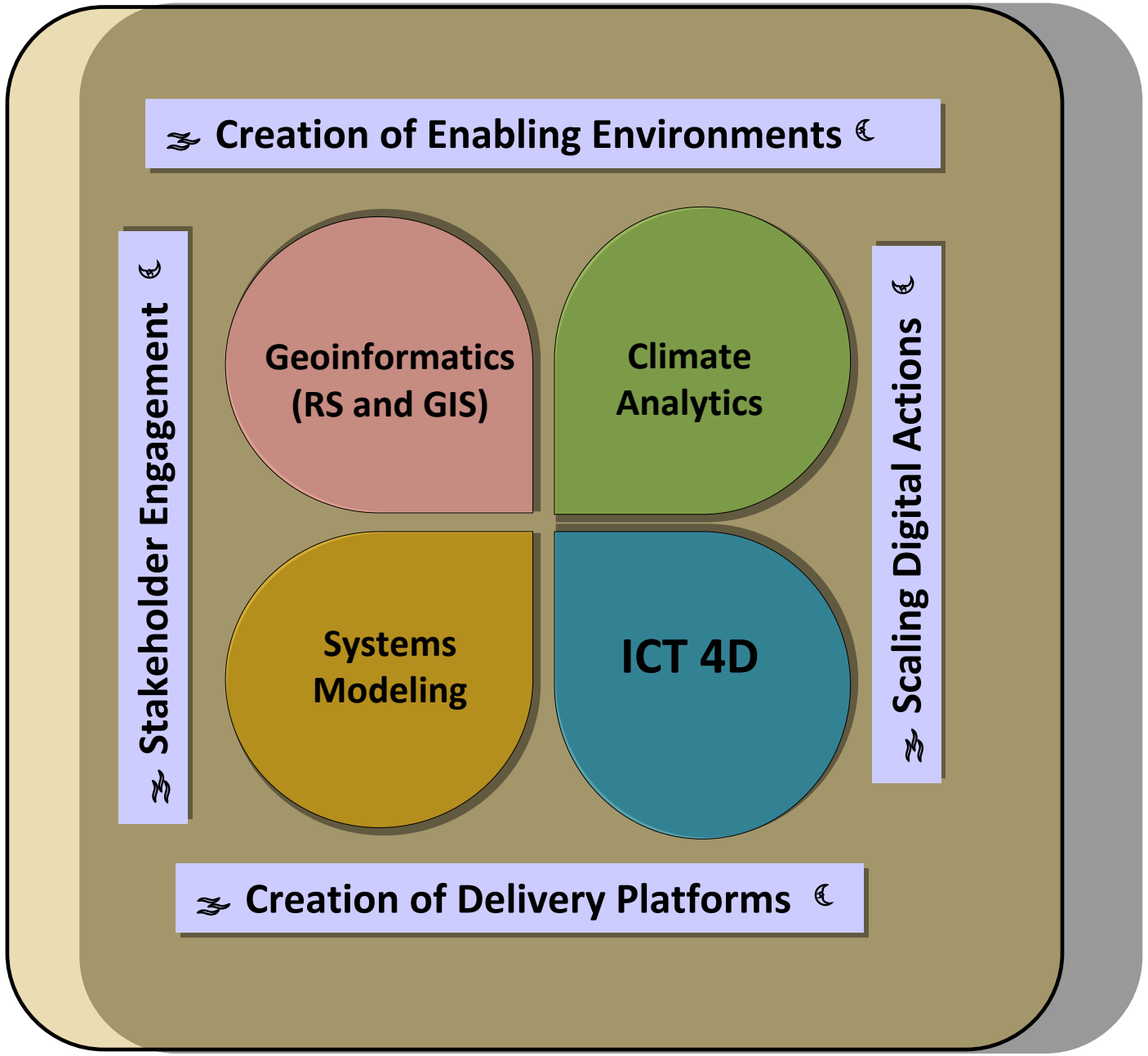


ICARDA · WORLD RESOURCES INSTITUTE · GLOBAL COMMISSION ON ADAPTATION · NL هولندا · CCAFS

WorldFish · IWMI International Water Management Institute · IFPRI INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE · WAGENINGEN UNIVERSITY & RESEARCH

icarda.org

The Main Forms of Digital Actions at ICARDA



Examples of CGIAR Initiatives and Projects on Digital Actions in MENA	Countries
Excellence in Agronomy	Egypt Morocco
CWANA-Regional Initiative (WP5)	Egypt Morocco
ClimBER: Building Systemic Resilience against Climate Variabilities and Extremes	Morocco Senegal
Regional Water harvesting Potential Mapping	Entire MENA
NENA-ET Net: Regional ET Network	Entire MENA
AFESD: Plant Breeding Centre of Excellence	Morocco Sudan
Iraq Climate Smart Agriculture Investment Plan : WorldBank	Iraq

Geoinformatics-based Digital Actions

CGIAR Excellence in Agronomy

Egypt Use Case

Yield and Yield gap distribution in the Irrigated Systems of Egypt

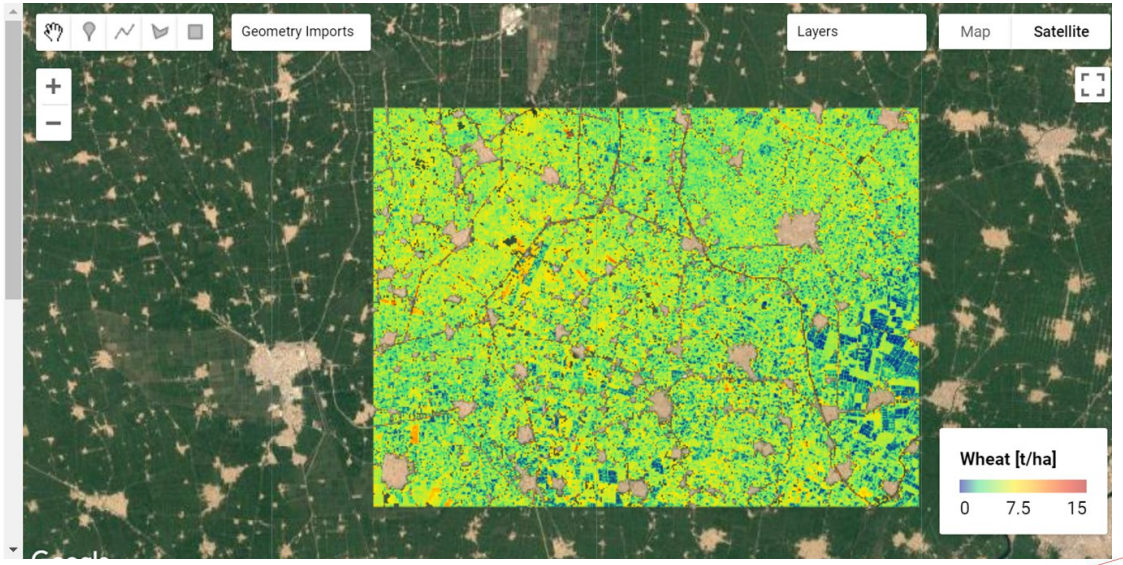
Select the harvesting Year

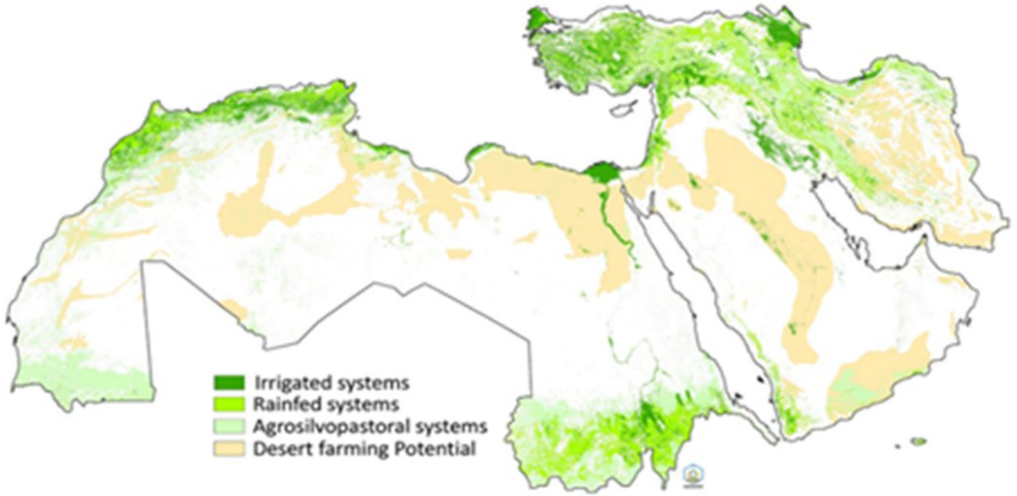
2018

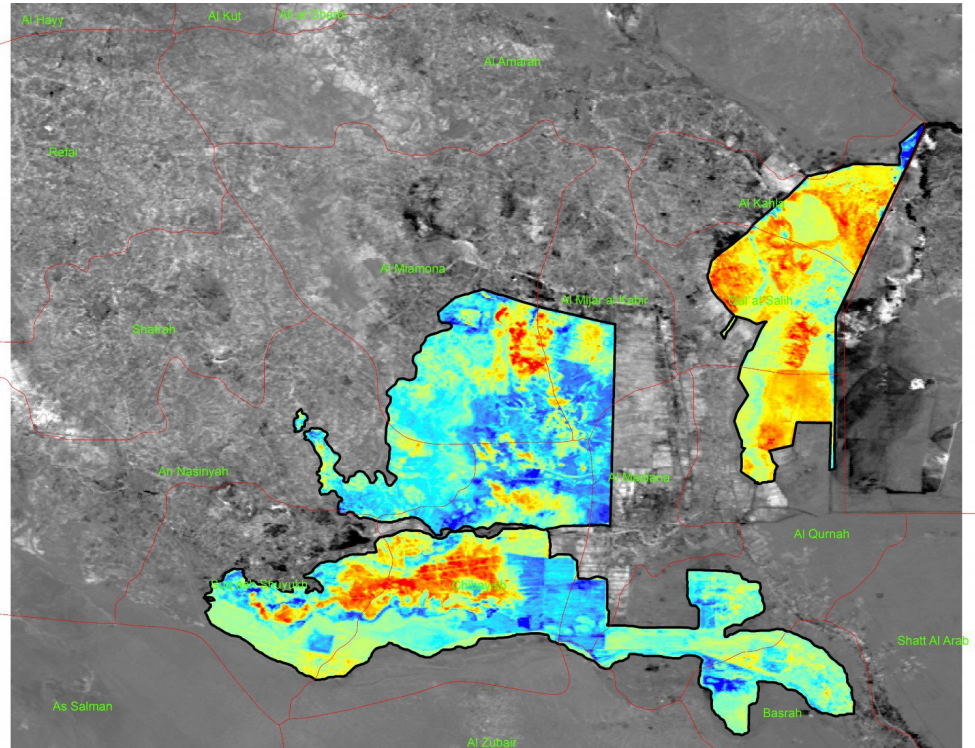
Select the Crop & Create an AOI

Wheat

Polygon | Rectangle

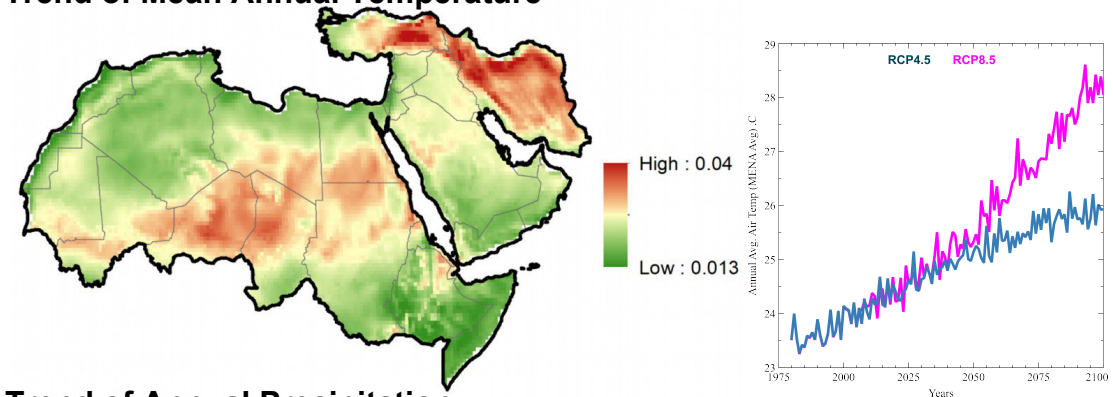




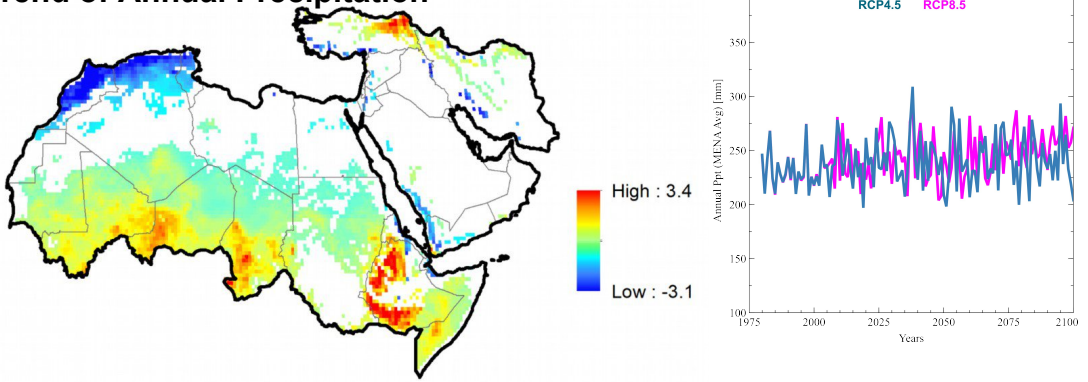


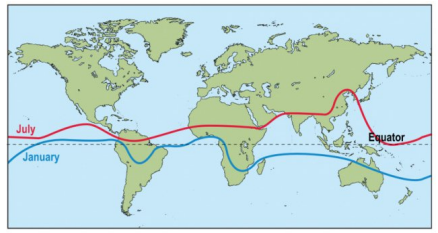
Climate Analytics as a Digital Action

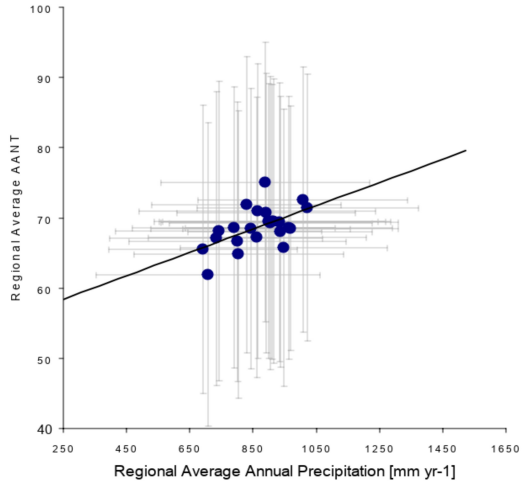
Trend of Mean Annual Temperature



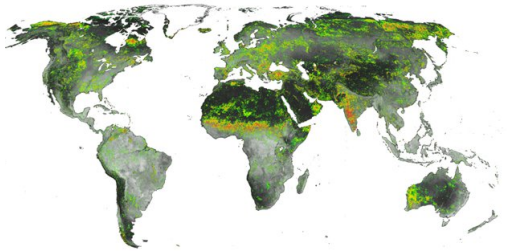
Trend of Annual Precipitation

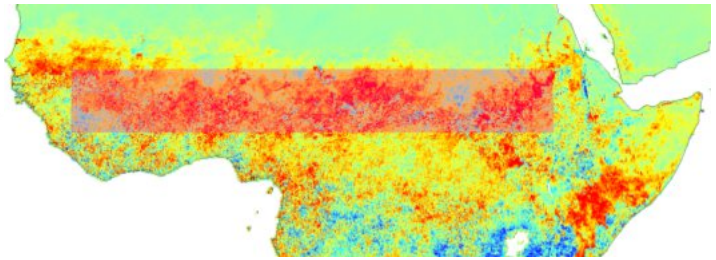






Trend of Vegetation Dynamics

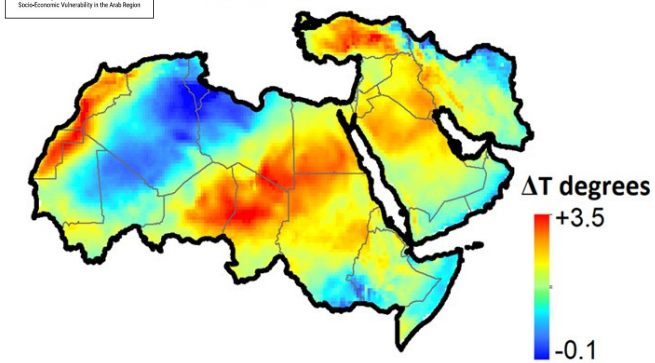




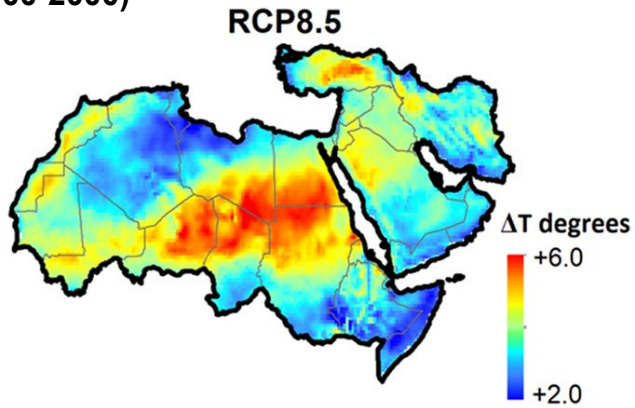
RICCAR
Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region

MAT change (2100-2000)

RCP4.5



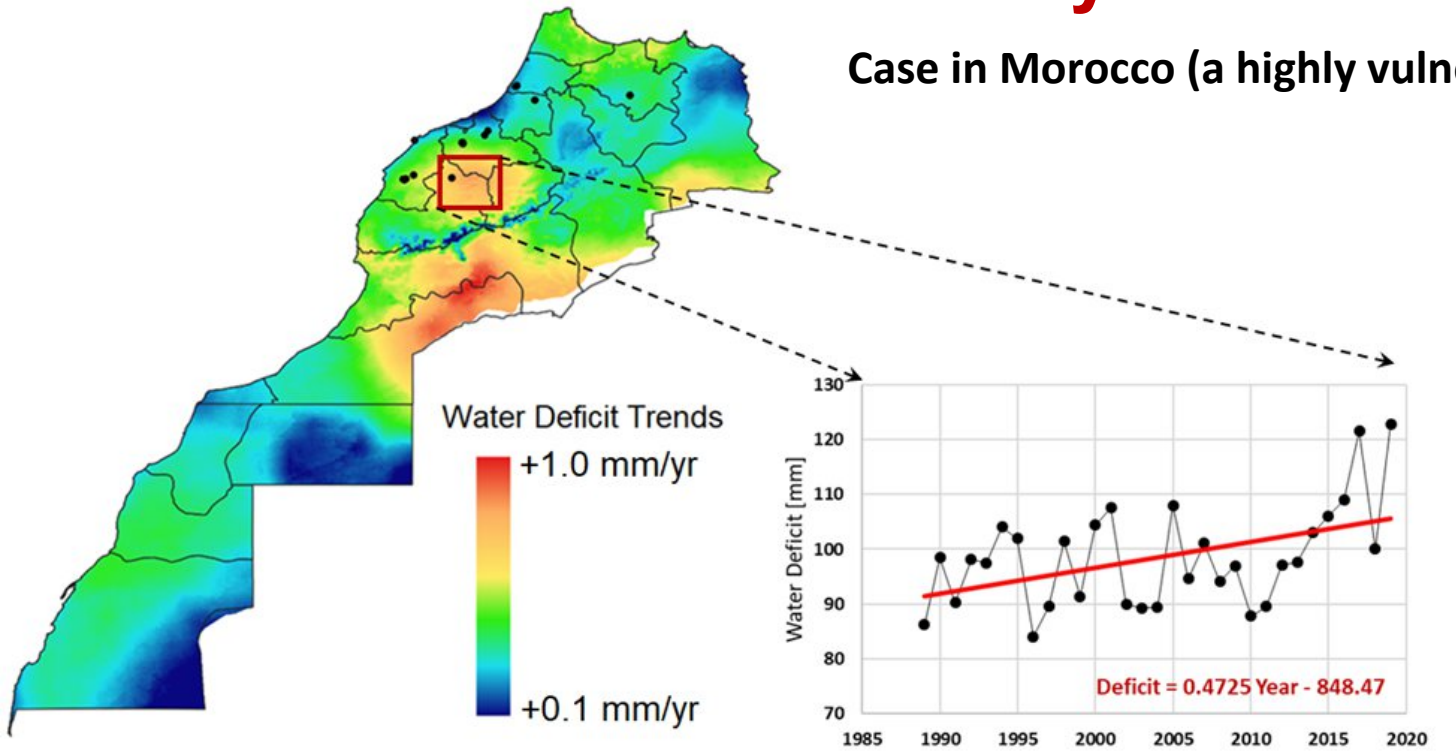
RCP8.5



- Temperature is more dynamic than Precipitation under Climate Change.
- Hot Spots of Temperature Increase: Turkish and Iranian highlands, Niger, Chad, South Egypt
- Hot Spots of Ppt Decline: Highlands of Maghreb region (NW Africa)..Morocco, Algeria, Tunisia

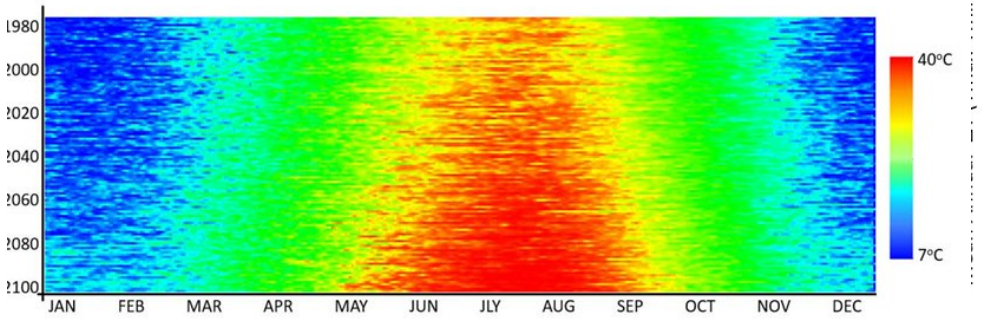
Climate Analytics as a Digital Action

Case in Morocco (a highly vulnerable site)

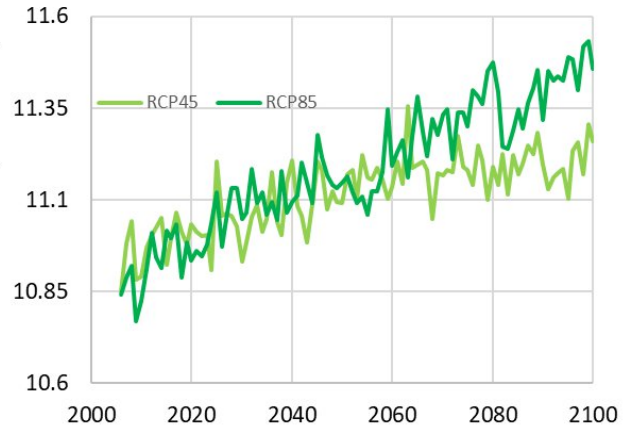


NASA-NEX-GDDP (21 GCMs)

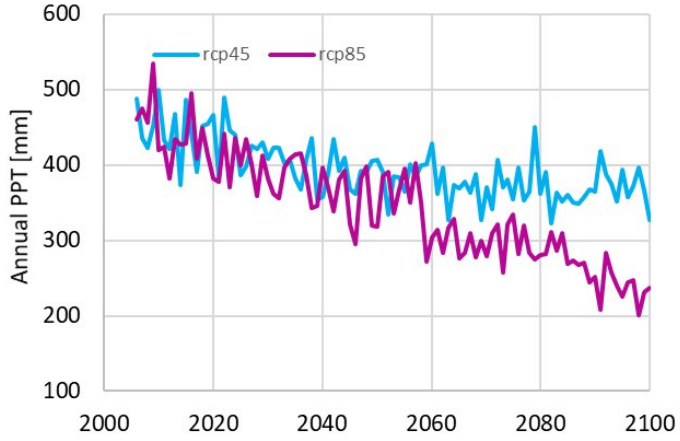
Change of Seasons with CC



ΔT=Tmax-Tmin

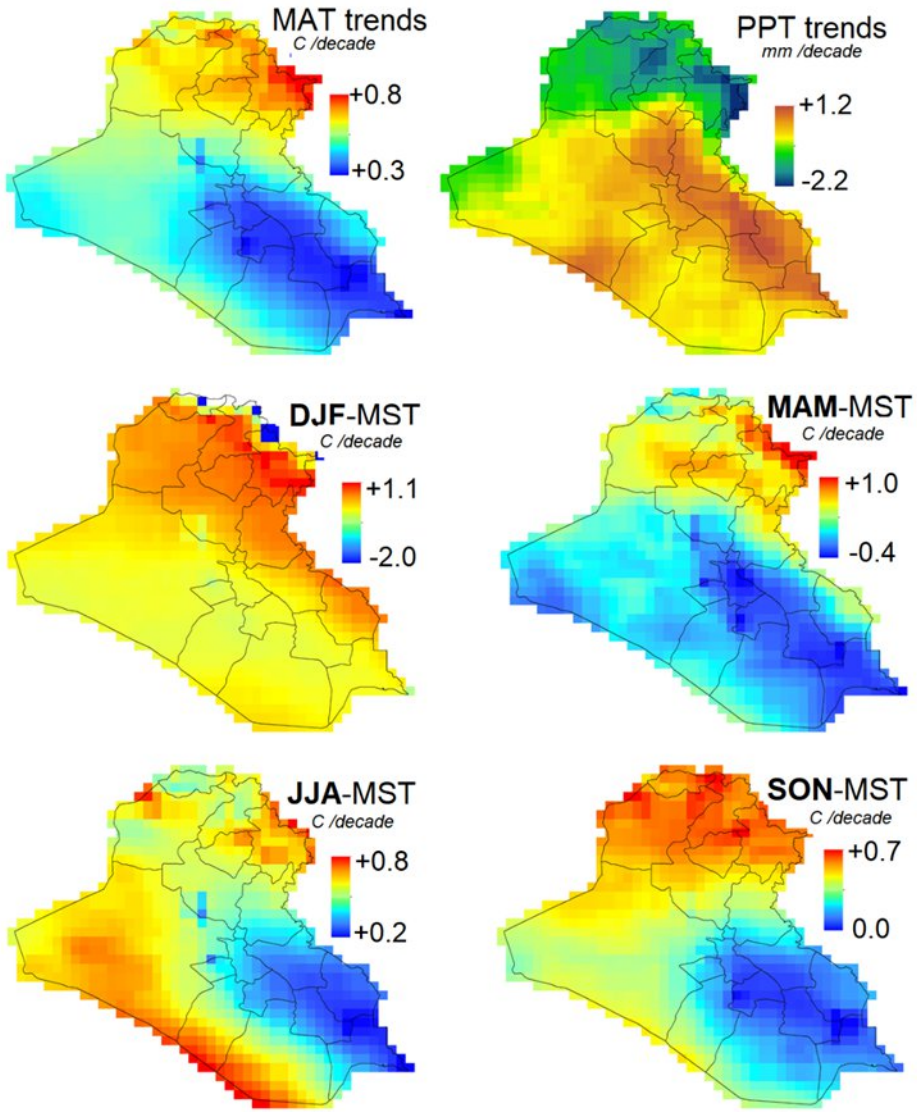


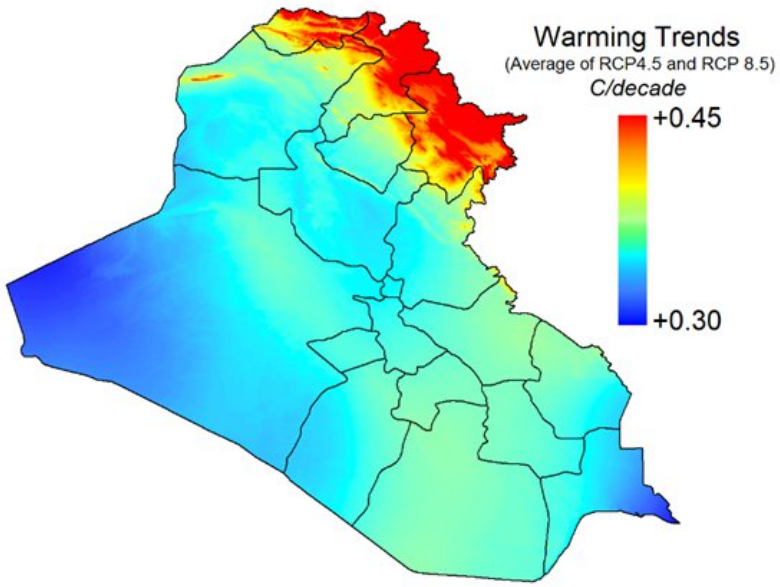
Annual Precipitation

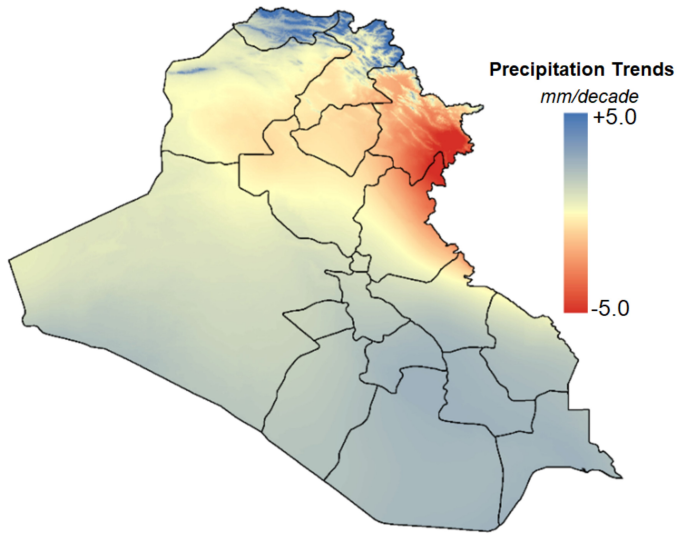


Govind et al. [2021], BREEDMOD Project, AFESD

Climate Analytics as a Digital Action





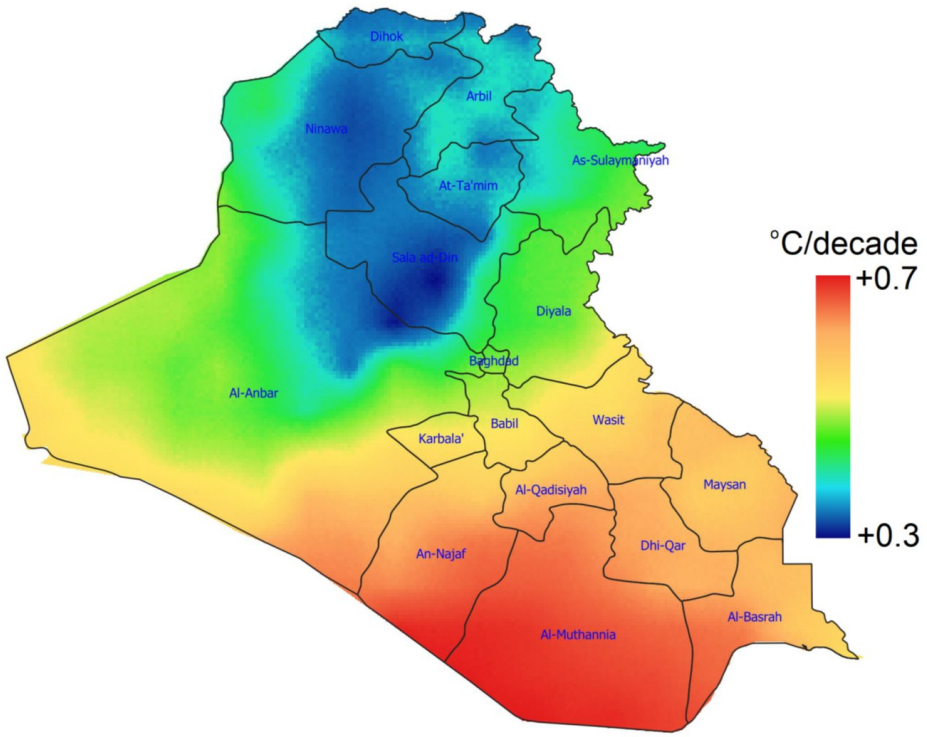


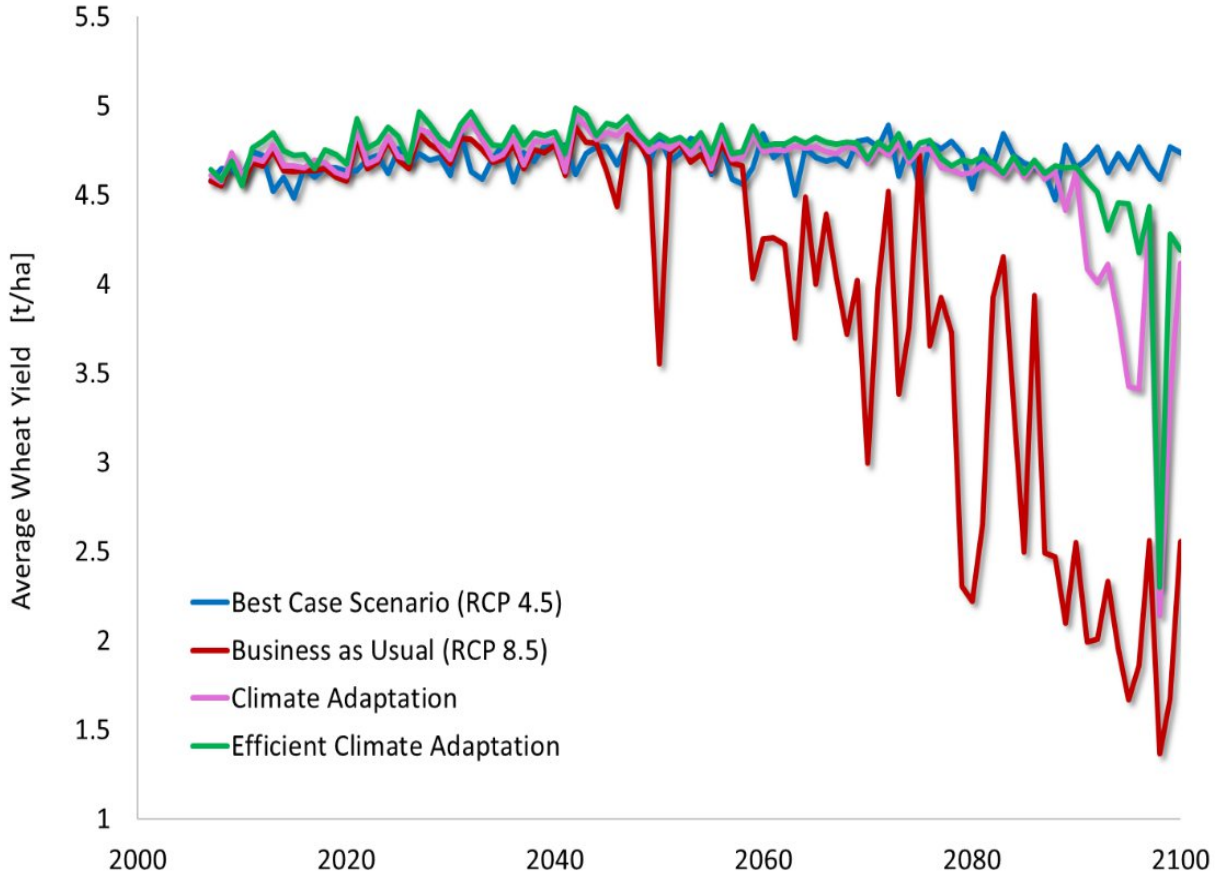
Govind et al. [2020], Iraq BUR to IPCC

UNEP

Systems Modeling as a Digital Action

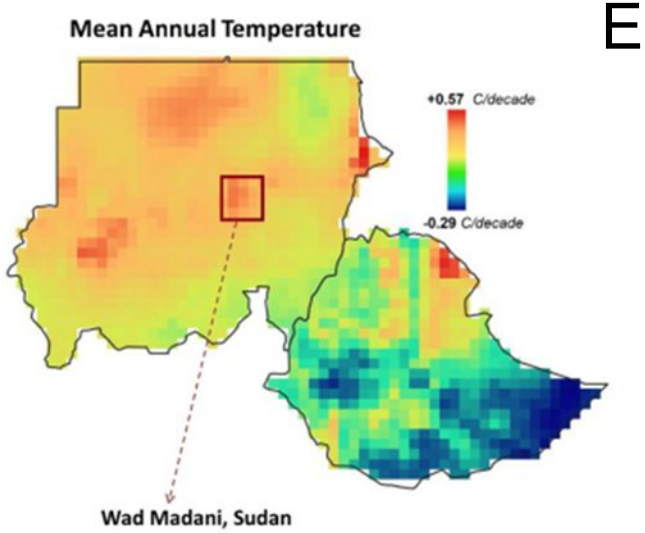
Enhancing Water Productivity as a Climate Adaptation in the Mesopotamian Plains (Irrigated Context)

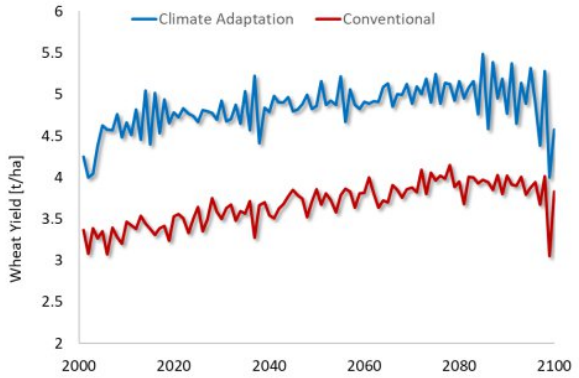


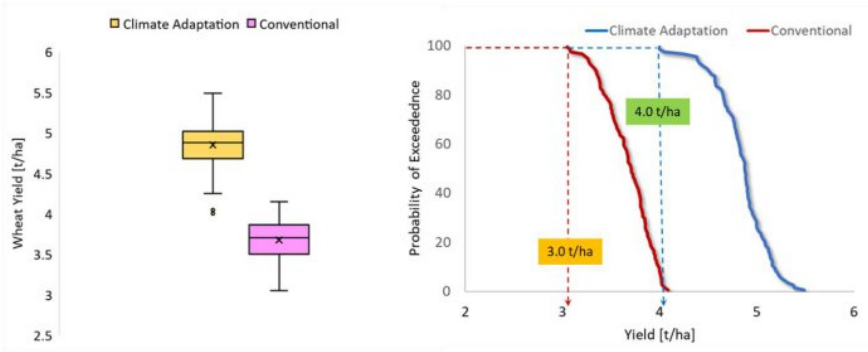


Govind et al. [2021 Iraq BUR

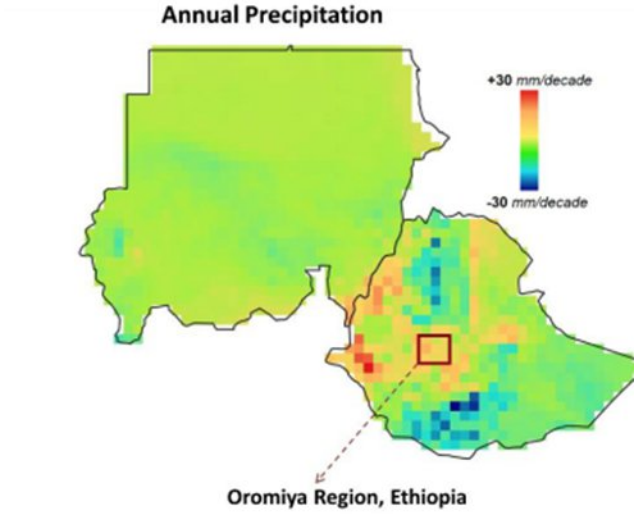
Enhancing Wheat Water Productivity in Sudan

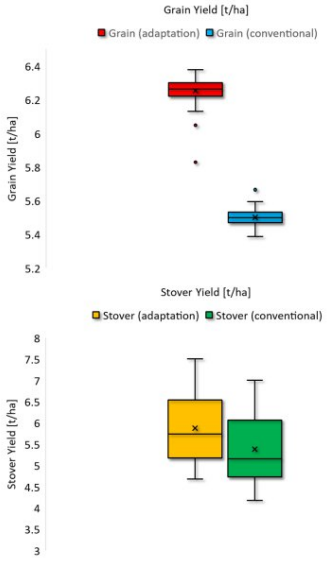


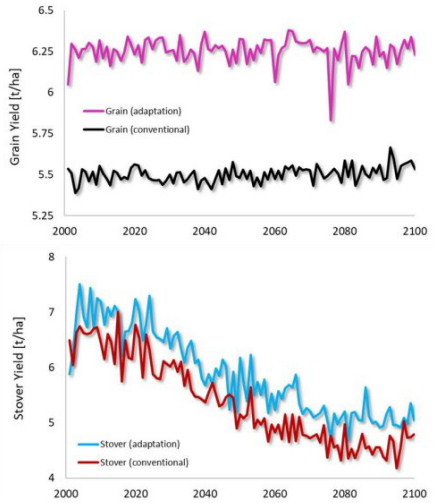




Improving Maize Agronomy in Ethiopia

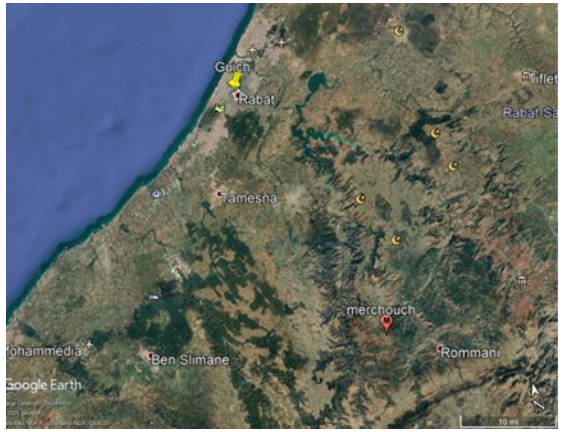


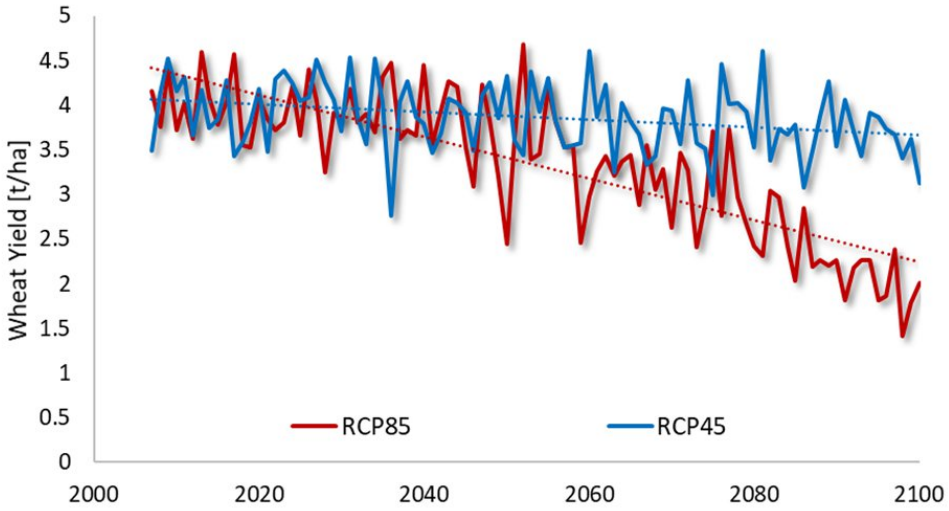


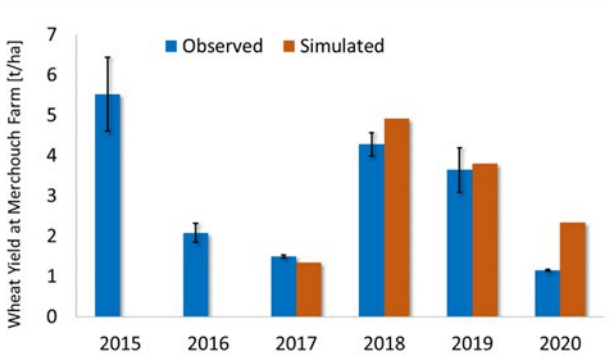


Govind and Kumari [2021] ENEBEL-Sahel Project

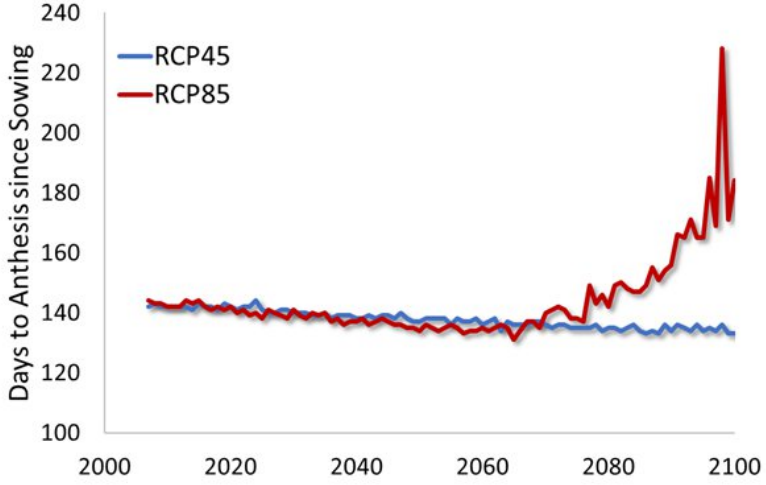
Foresight Yield Gap Analysis under Climate Change
(Using Currently Promising Varieties)



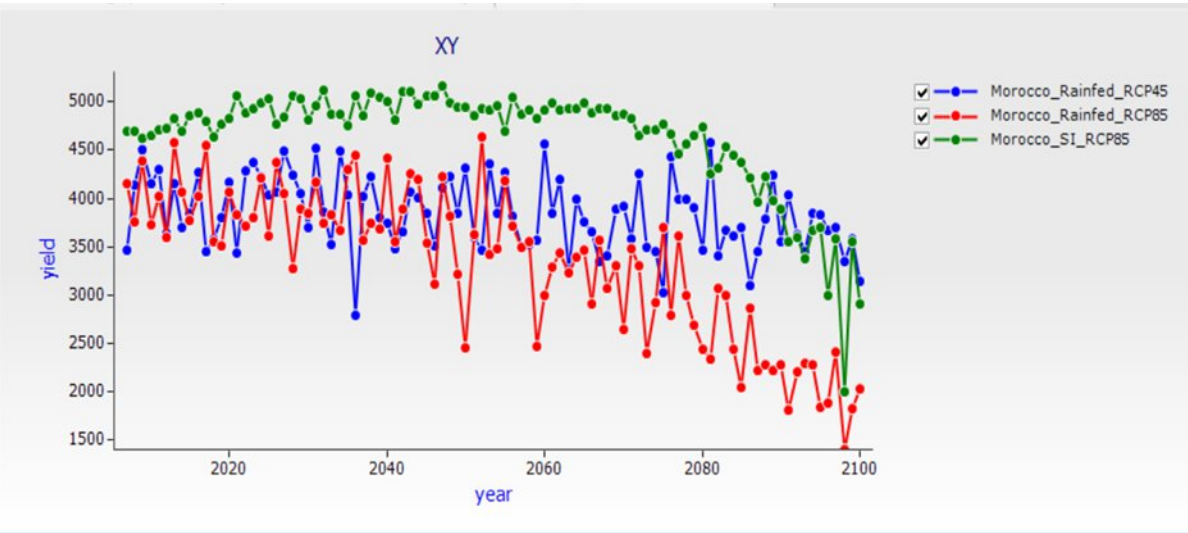


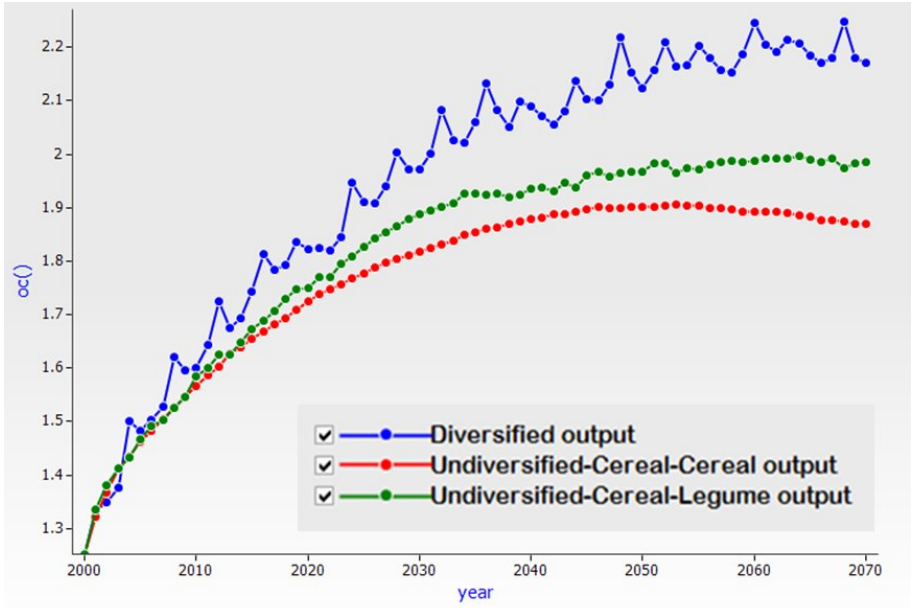


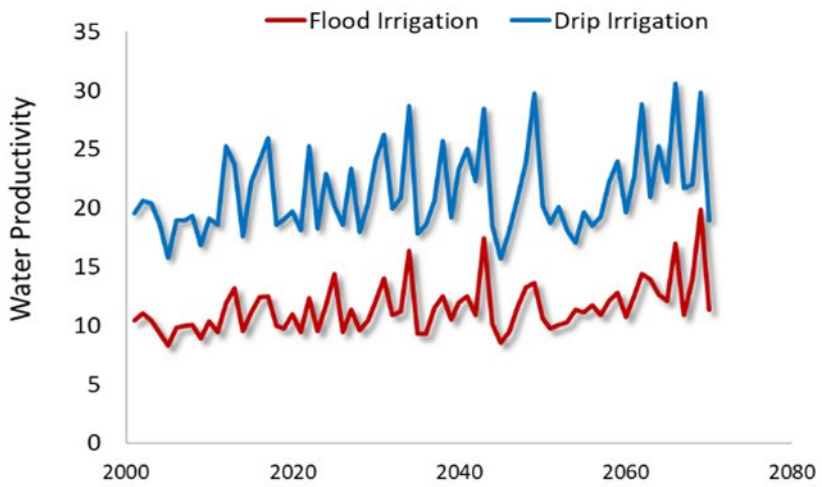
Years	Observed Yields for Std. Cultivars [t/ha] (Advanced Yield Trials)			
	Miki3	Omrabi5	Waha	Mean
2014-15	6.75	5.26	4.544	5.51
2015-16	2.32	1.82	2.07	2.07
2016-17	1.50	1.49	1.49	1.49
2017-18	4.56	4.37	3.88	4.27
2018-19	4.13	3.98	2.84	3.64
2019-20	1.13	1.12	1.17	1.14



Modeling Based Identification of Climate Adaptation







Crop Diversification with a crop rotation pattern that repeats only every 4 years from 2000-2100

Year-1		Year-2		Year-3		Year-4	
Wheat	Soybean	Chickpea	Maize	Fababean	Maize	Barley	Soybean

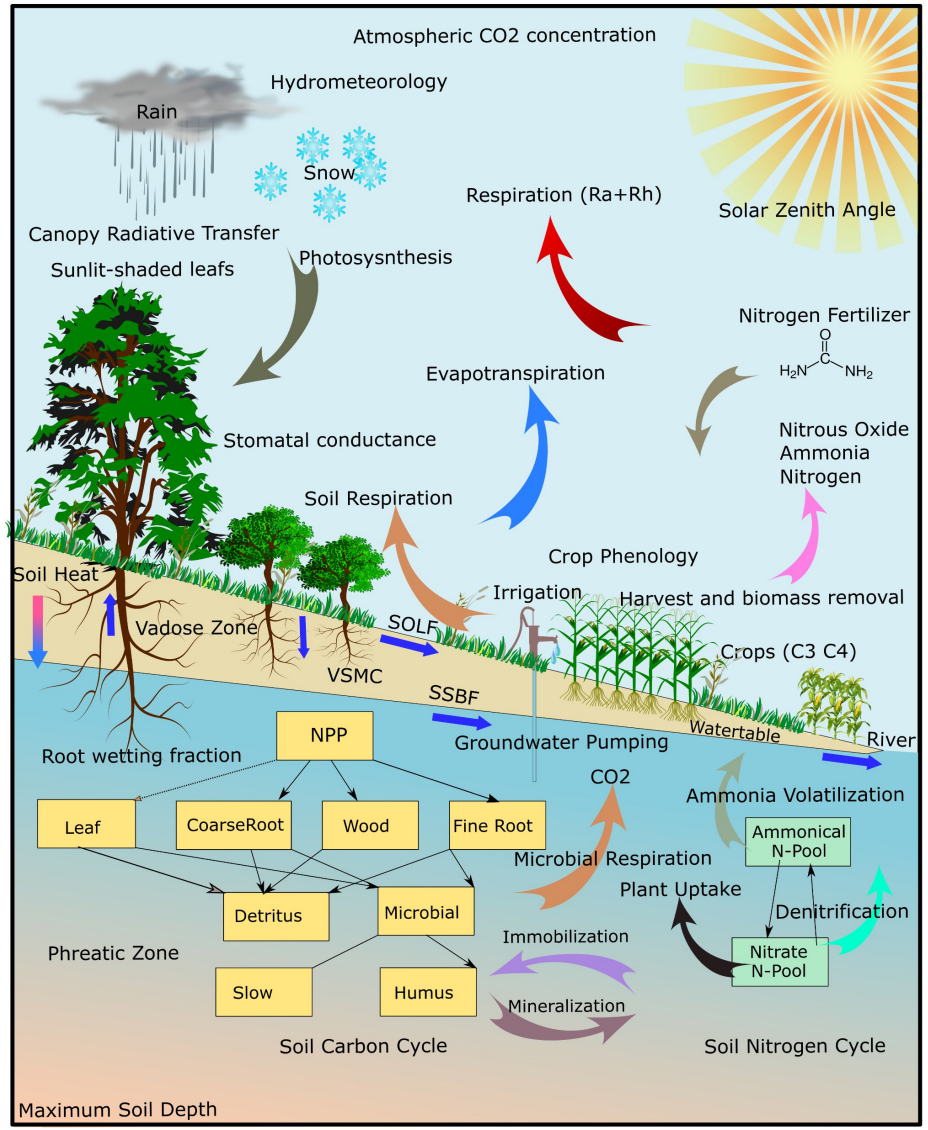
Simple- Cereal-Cereal sequence done continuously from 2000-2100

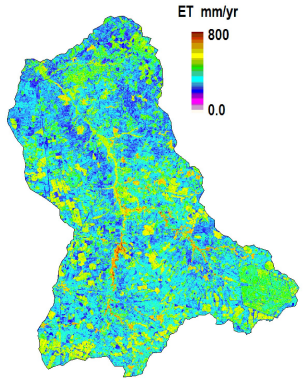
Year-1		Year-2		Year-3		Year-4	
Wheat	Maize	Wheat	Maize	Wheat	Maize	Wheat	Maize

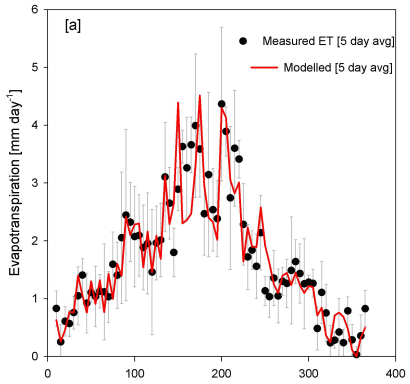
Simple Cereal-Legume Sequence done continuously from 2000-2100

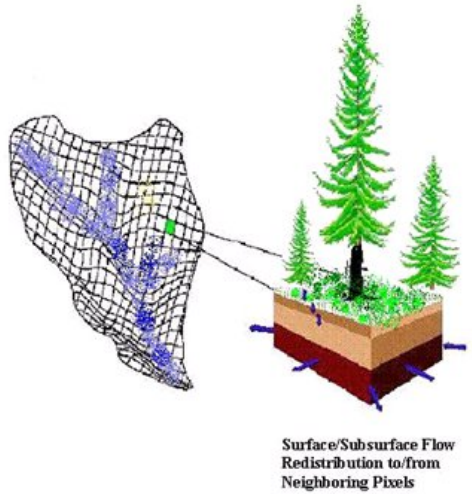
Year-1		Year-2		Year-3		Year-4	
Wheat	Soybean	Wheat	Soybean	Wheat	Soybean	Wheat	Soybean

Spatially Distributed SVAT Modeling









STEPS

Simulator of Terrestrial Ecohydrological Processes and Systems

- Spatially- Explicit
- Spatial resolution is flexible
- Daily model
- Process-based
- Feed-back mechanisms addressed
- BGCs (C,W,N cycles) are tightly coupled
- Agroecosystems (C3 and C4 plants)
- Fate of N Fertilizer transformations
- Forest / Agroecosystem Management

ICARDA

INRA SCIENCE & IMPACT

TEXAS A&M UNIVERSITY

UNIVERSITY OF TORONTO

Govind et al. [2009a], J of Hydrology

Govind et al. [2009b], J of Geophysical Res.

Govind et al. [2015], Ecological Modeling

Egypt | Digital Augmentation for Smallholder Farmers In Egypt

Egypt Use Case

Problem

One of the main reasons for Egypt's lower wheat production is poor agronomic practices by the farmers who do not have access to information about the best context-specific agronomic practices. The agricultural extension system is also not fully developed.

EiA Solution

EiA will develop and validate digital advisory tools that will offer farmers crucial agronomic information. This digital augmentation will also serve the extension system and will also increasingly engage women and youth

Engagement With The Government of Egypt

- Series of interaction with demand partners
- Providing active support in technical guidance
- Assisting in field data collection
- Extension support

With Heads of Extension, Economic reforms, and ICT Advisor to Ministry of Agriculture and Land Reclamation

The MVP for Egypt- GeoAgro Web App

CGIAR EXCELLENCE IN AGRONOMY

EGYPT USE CASE

Yield and Yield gap distribution in the Irrigated Systems of Egypt

Select the harvesting Year

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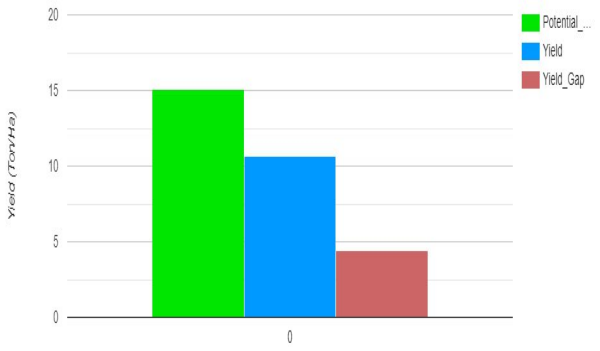
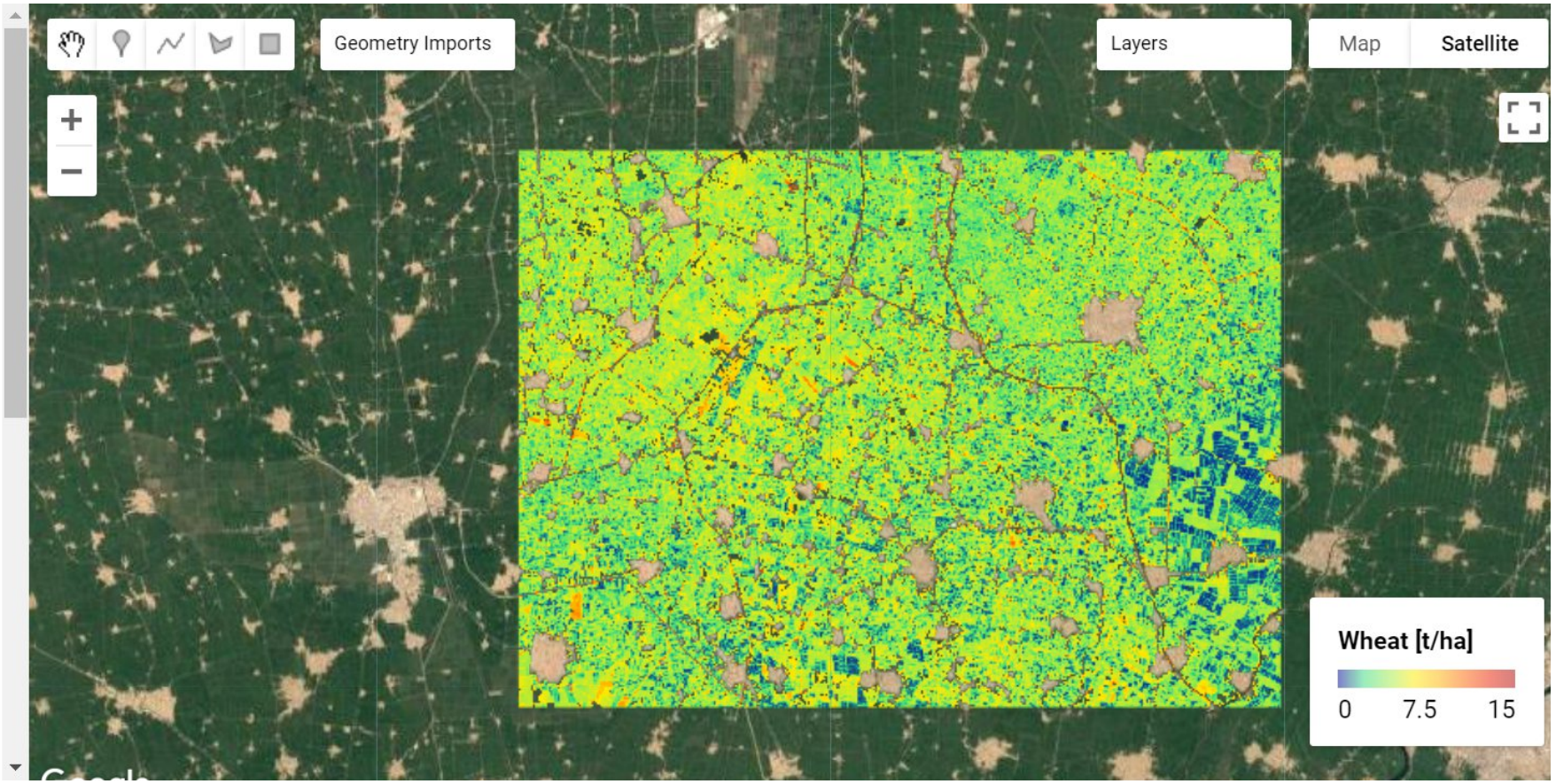
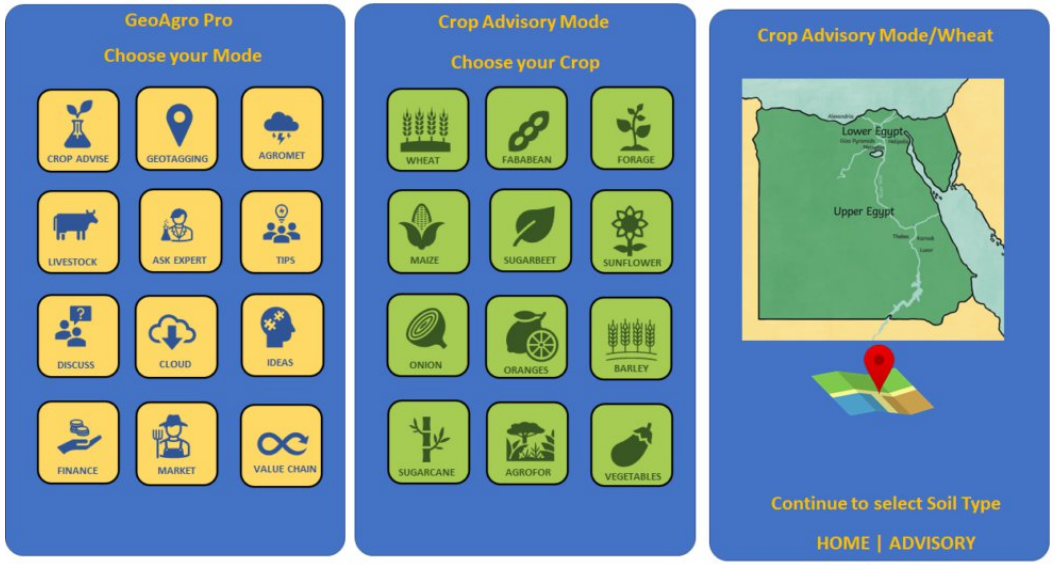
Wheat

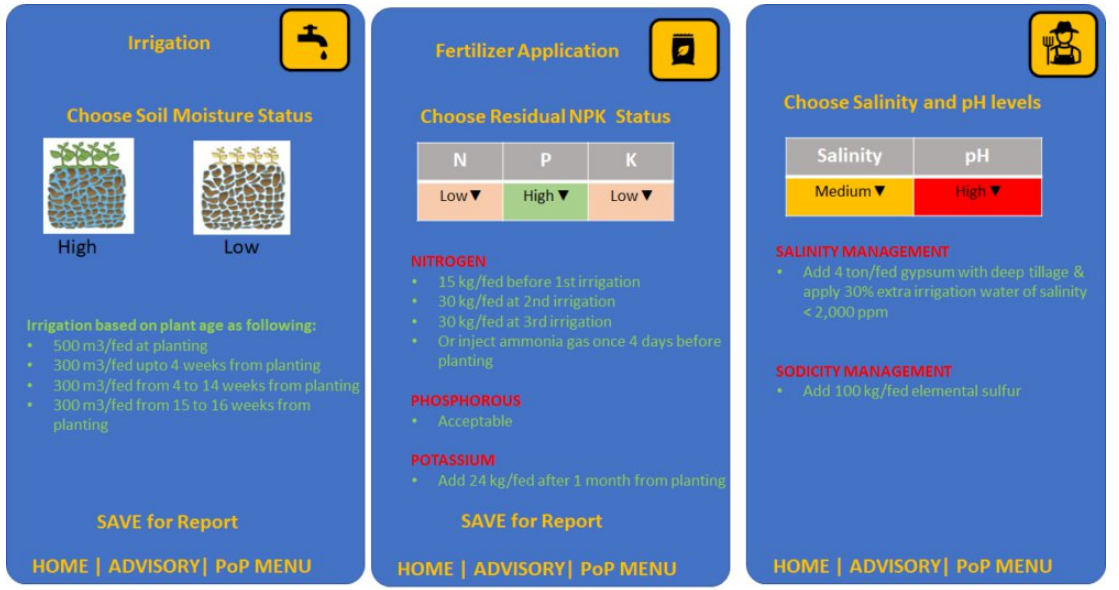
Polygon Rectangle

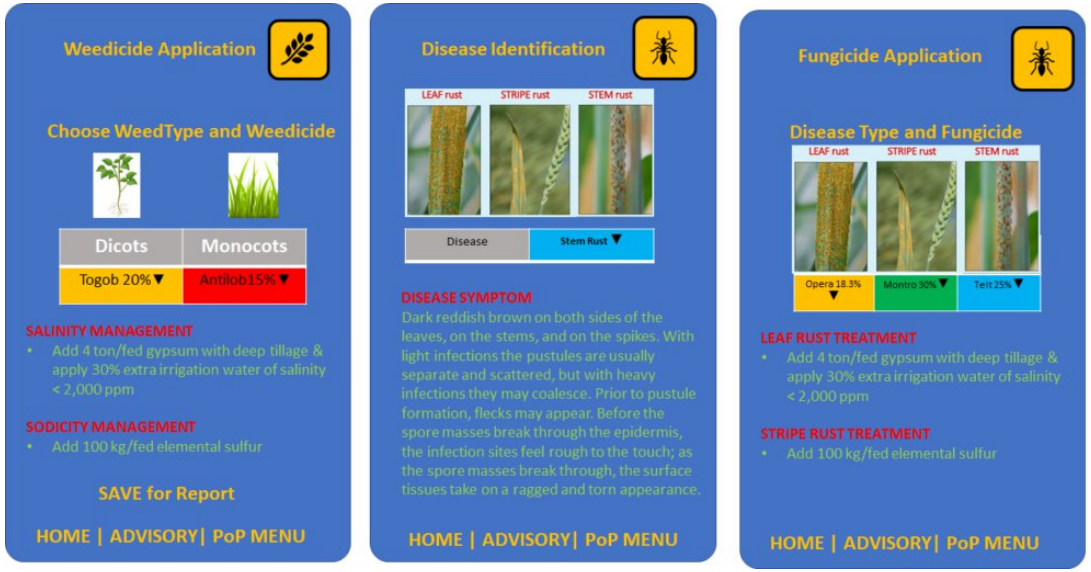




The MVP for Egypt- GeoAgro-MiSR Smartphone App







2020-2022
Incubation Phase

- The demand was validated
- Major partnerships were identified
- The MVP was developed
- Baseline field data was accumulated
- Preliminary field testing done

2022-2024
EiA Active Phase

- The MVP will be perfected and enhanced
- Partnerships will be diversified
- The MVP will be scaled
- Field data will be collected and monitored
- Activities towards impact at scale

2024-2025
EiA Impact Phase

- The MVP will be scaled up
- Partnerships will be diversified and strengthened
- Solid impact achieved
- Contribute to Egypt’s digital policy
- PPP strengthened
- Agronomy will be transformed

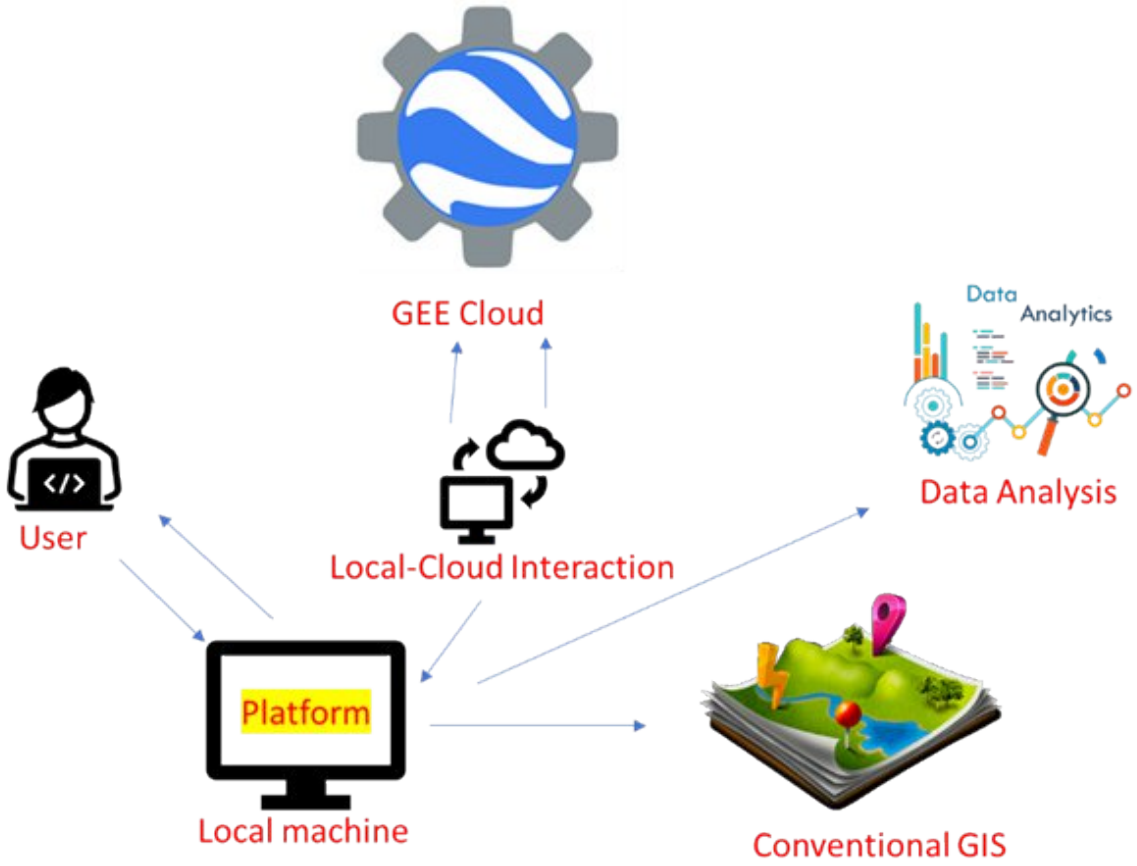
CGIAR

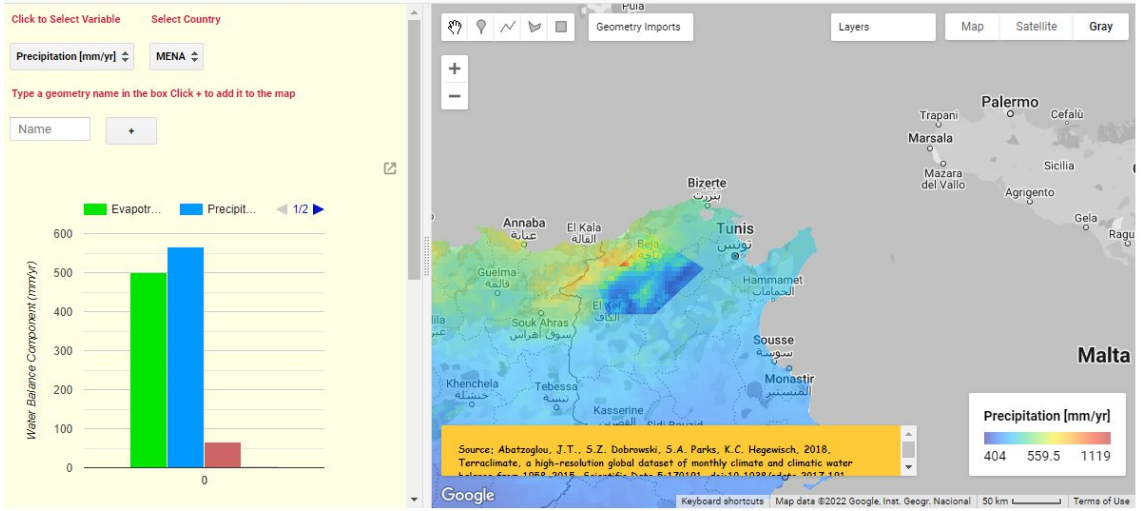
EXCELLENCE IN AGRONOMY 2030

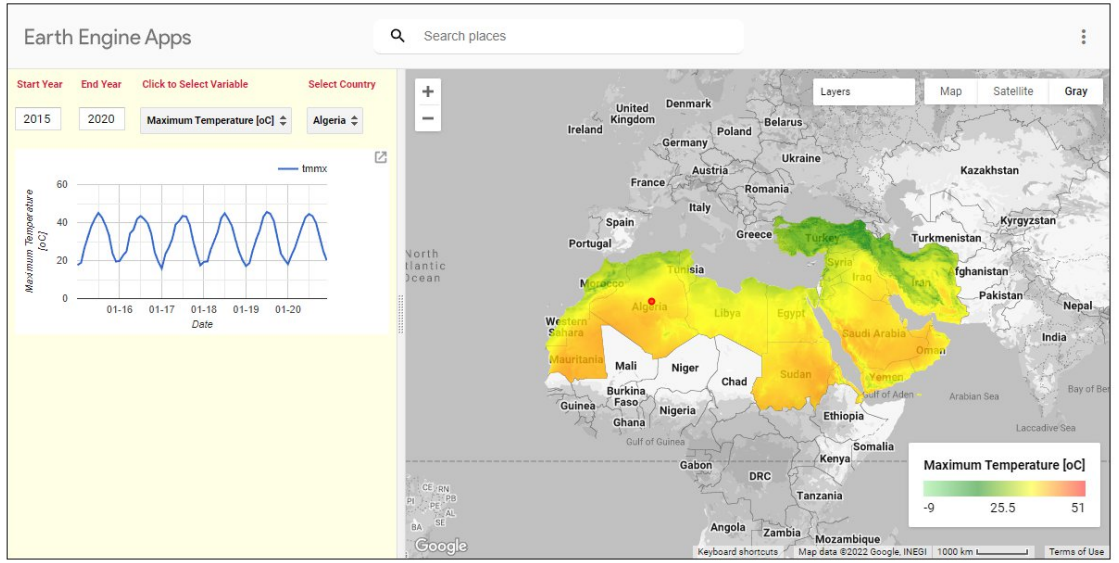
Egypt Use Case

The Web-based Platform for RWH Potential Mapping

Cloud Computing Enabled Dynamic Platform







Concluding Statements…..

1. Climate Adaptation in MENA's agricultural sector should have Water as the fulcrum.

2. Digital augmentation is probably the only solution to accelerate and scale climate adaptation. This can be used to supplement extension activities, capacity development activities, and policy framing, all transforming the agrifood system rapidly.

3. Digital augmentation should have broad thematic diversities, different delivery platforms and different modes of action. It can range from smartphone advisory apps, web-based platforms, ex ante assessments and geomatics based estimates. Bundling of services based approaches are better.

4. It is important to think about scaling the digital augmentation with the right enabling environments, policies and incubation and acceleration of developers with a PPP spirit for sustainable digital augmentation.

5. Engagement with stakeholders is critical (it can be in the form of stakeholder consultations, or context-specific surveys to understand the challenges and prospects).

Thanks!

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