In Situ Rainwater Harvesting Feasibility In The NENA Region, With Country Examples

Ajit Govind
Senior Climatologist and Systems Modeller, Acting Head GeoAgro ICARDA, EGYPT

Mira Haddad
Research Associate - Spatio-temporal assessment.
Restoration Initiative on Dryland Ecosystems (RIDE), Resilient Agrosilvopastoral Systems (RASP). ICARDA, JORDAN

Cairo Water Week
16th Oct 2022

ICARDA

CGIAR

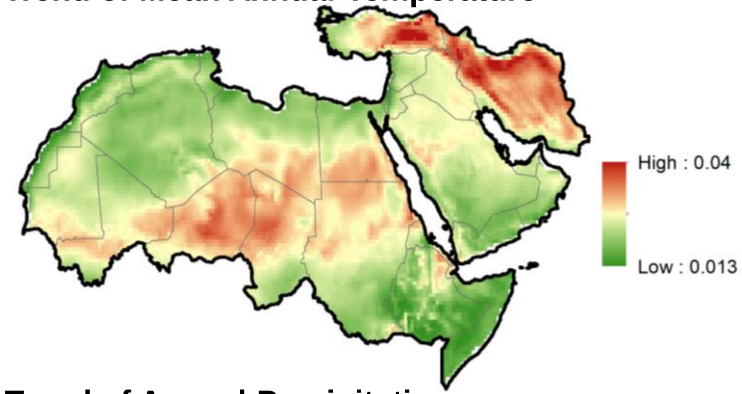
Aknowledgements

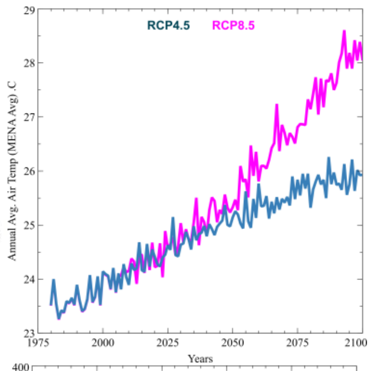
This activity is implemented under the project WEPS-NENA “implementing the 2030 agenda for efficiency, productivity and sustainability of Water in the NENA region” under the Water Scarcity Initiative.

Implemented by FAO and funded by SIDA

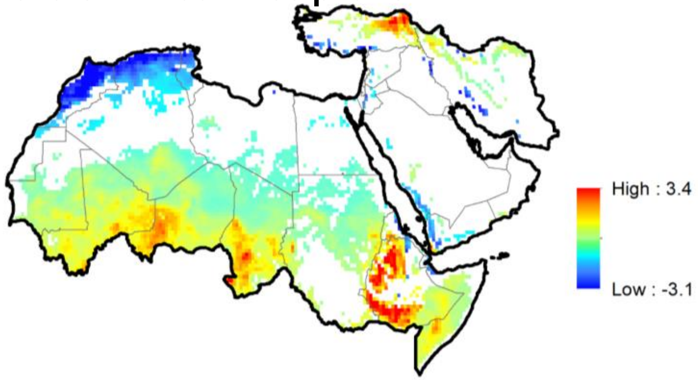
Nature of Changing Climate in the NENA

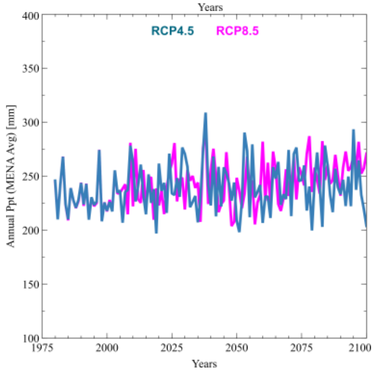
Trend of Mean Annual Temperature

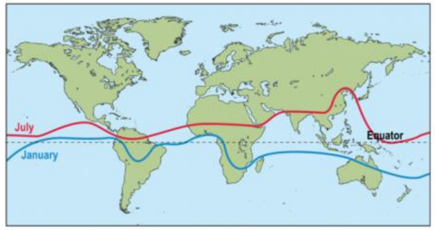


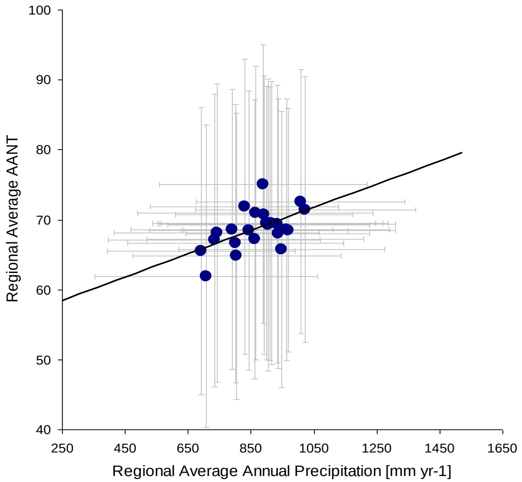


Trend of Annual Precipitation

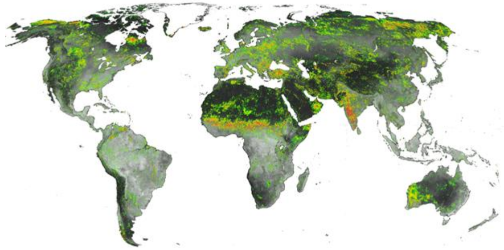


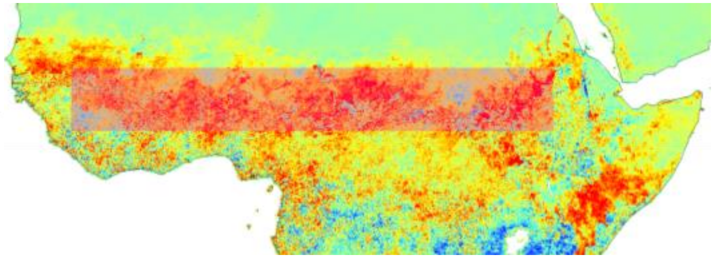






Trend of Vegetation Dynamics

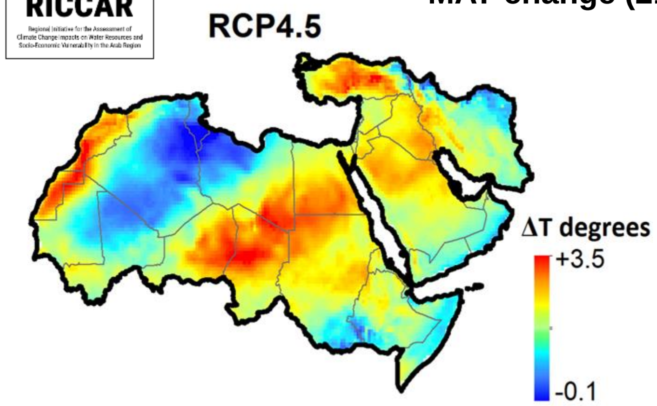


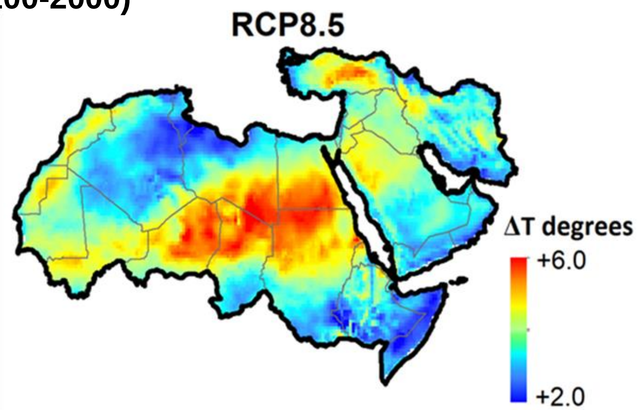


RICCAR

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

MAT change (2100-2000)



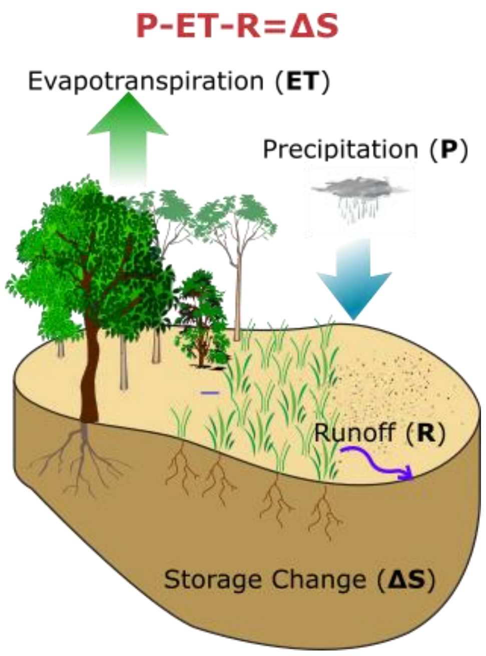


- Temperature is more dynamic than Precipitation under Climate Change.
- Hot Spots of Temperature Increase: Turkish and Iranian highlands, Niger, Chad, South Egypt
- Hot Spots of Ppt Decline: Maghreb region Morocco, Algeria, Tunisia

Rain Water Harvesting

- A method of water conservation in arid and semi-arid regions, where rainfall is either not sufficient to sustain a good crop and pasture growth, or where, due to the erratic nature of precipitation, the risk of crop failure is very high

- Water harvesting can be accomplished through in situ harvesting, soil conservation methods, and increasing infiltration for the recharge of groundwater



Meteorology and Climate

Soil Characteristics

Geomorphology Characteristics

Hydrogeological characteristics

Vegetation Characteristics

How the Landscape Hydrological Cycle Needs To Be Adjusted to Enhance RWH?

$$[Input] - [Output] = \Delta S$$

$$[Precipitation] - [Runoff + ET] = \Delta S$$

$$[Rain+Snow] - [Runoff + ET] = [\Delta Ssat + \Delta Sunsat]$$

$$[Rain+Snow] - [Rbase + Rsurf + ETunder + ETover] = [\Delta Ssat + \Delta Sunsat]$$

To enhance RWH, the question to be asked to a reliable model is : What process I need to manipulate to enhance the ΔS

Optimum Adjustment of the following

- Reduce the ET losses (landuse change, agronomical changes, reforestation, etc)
- Reduce the Runoff losses (increase soil infiltration, increase surface roughness)
- Reduce both ET and Runoff
- Increase Soil Storage (increase Capacity, increase infiltration, increase OM)

The Web-based Platform for RWH Potential Mapping

www.mena-rainwater.org

REGIONAL WATER HARVESTING POTENTIAL MAPPING PROJECT

Hydroclimatology

This module gives the user the possibility to spatially and temporally analyze various meteorological variables . It will be possible for the user to visualize the spatial distribution of the meteorological variable for the region or for a given country for s given time. Also it is possible to draw time series for any given point during a specified time frame and save the file. The underlying data source is TerraClimate

Biophysical Factors

This module gives the user the possibility to spatially and temporally analyze various biophysical variables . It will be possible for the user to visualize the spatial distribution of the variable for the region The various categories of biophysical variables are shown below. Each category has several variables under it.

- Geomorphological
- Hydrometeorological
- Vegetation
- Edaphic
- Hydrogeological
- Surface Hydrology

Water Balance

This module gives the user the possibility to spatially and temporally analyze various components of the water balance for a given Area of Interest. Further, the average water balance of that region will be graphically analyzed such that the user understands the general mechanism of Water Balance and decide the ideal Water Harvesting intervention at that location.

RWH Pot. Zonation

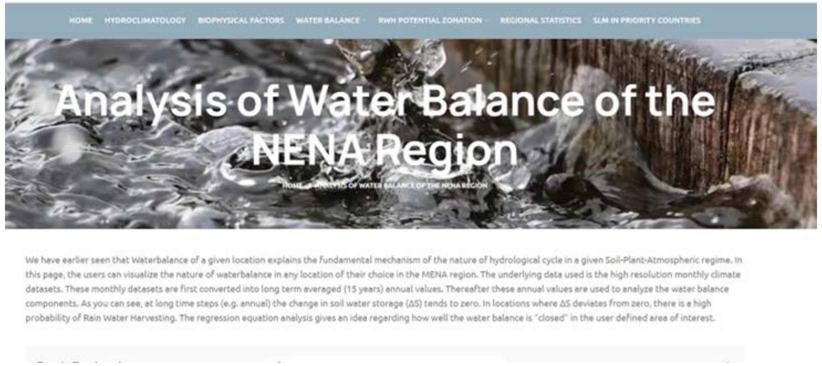
This module gives the user the possibility to map and visualize the RWH potential zonation mapping based on a multicriteria approach. The maps can be visualized regionally or nationally

RWH Sensitivity

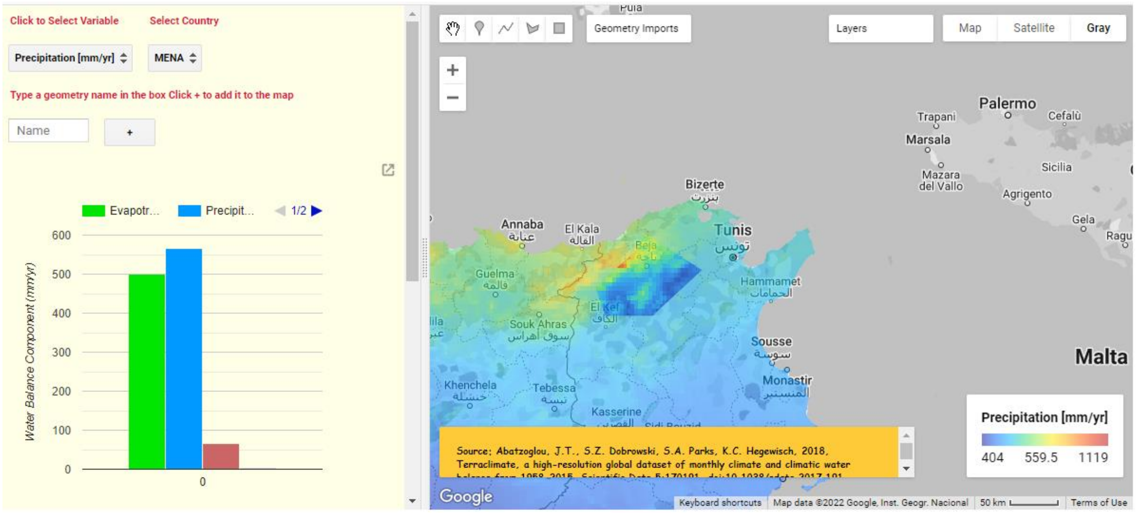
This module gives the user the possibility to map and visualize the changes in RWH potential zonation mapping by changing crucial variables such as Precipitation, ET and Soil characteristics such that it helps policy makers to do "what if" scenarios.

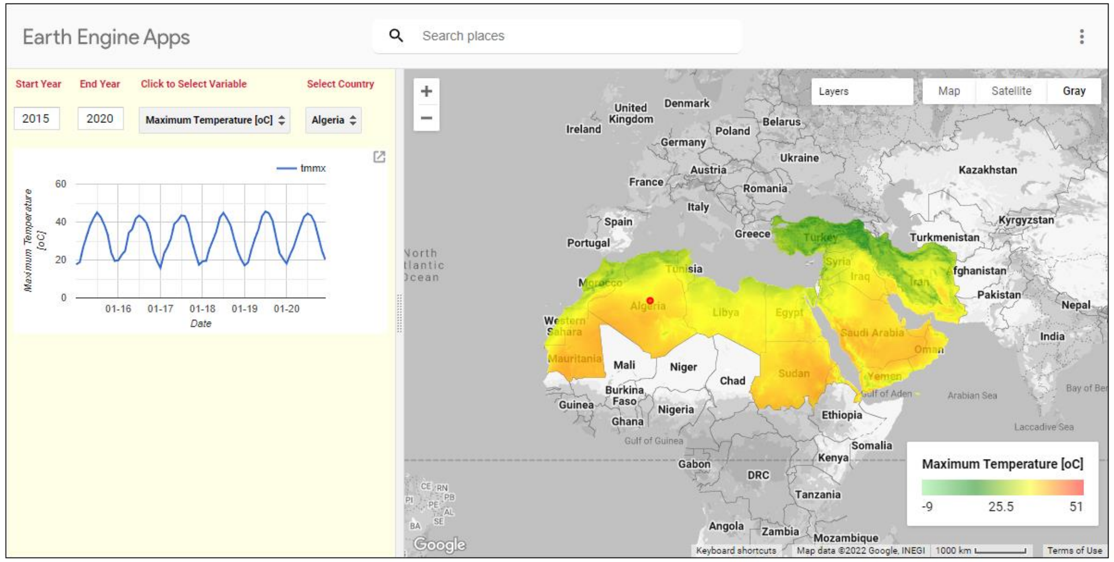
SLM in Priority Countries

This module gives the user the possibility to explore the different SLM practices with their details. Only the SLM practices documented in the WOCAT database is visible through this module. The search can be made for different MENA countries and the different SLM will be listed.

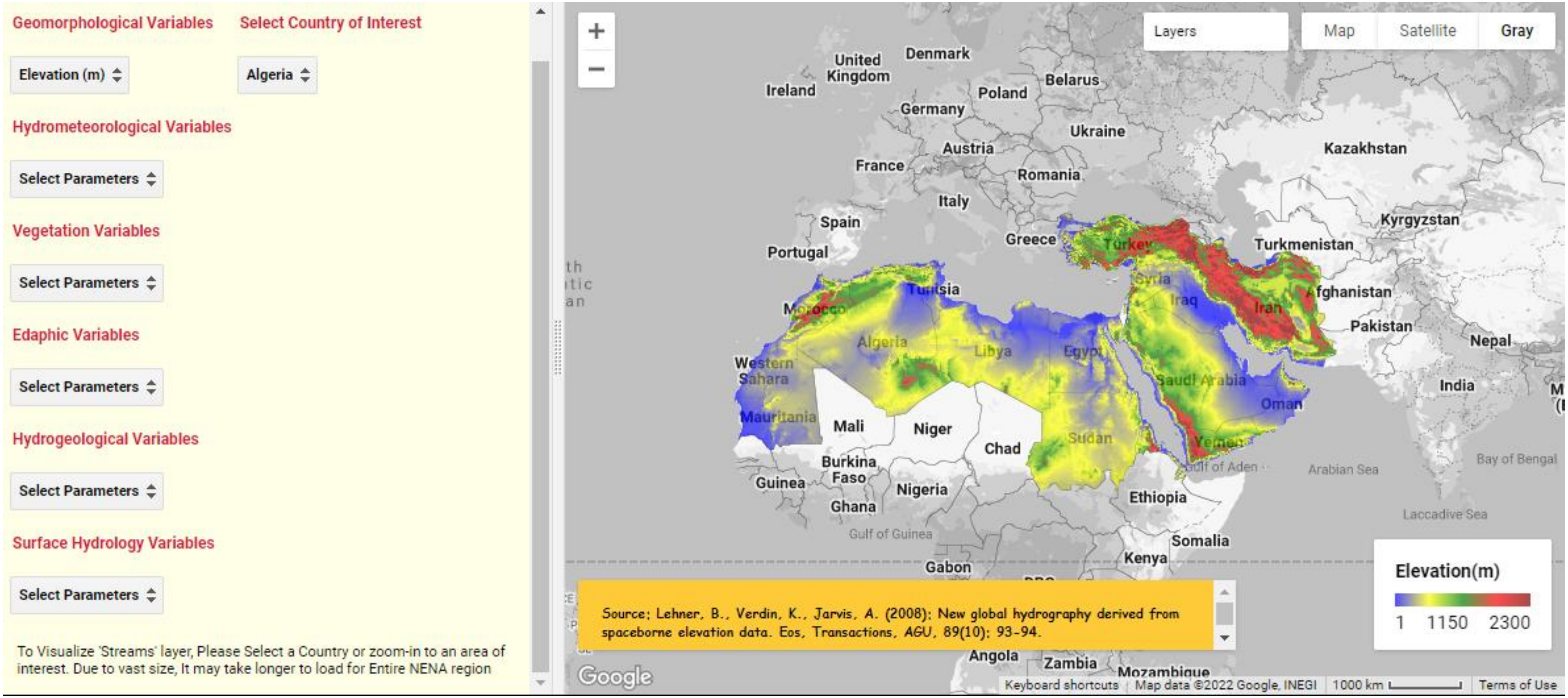


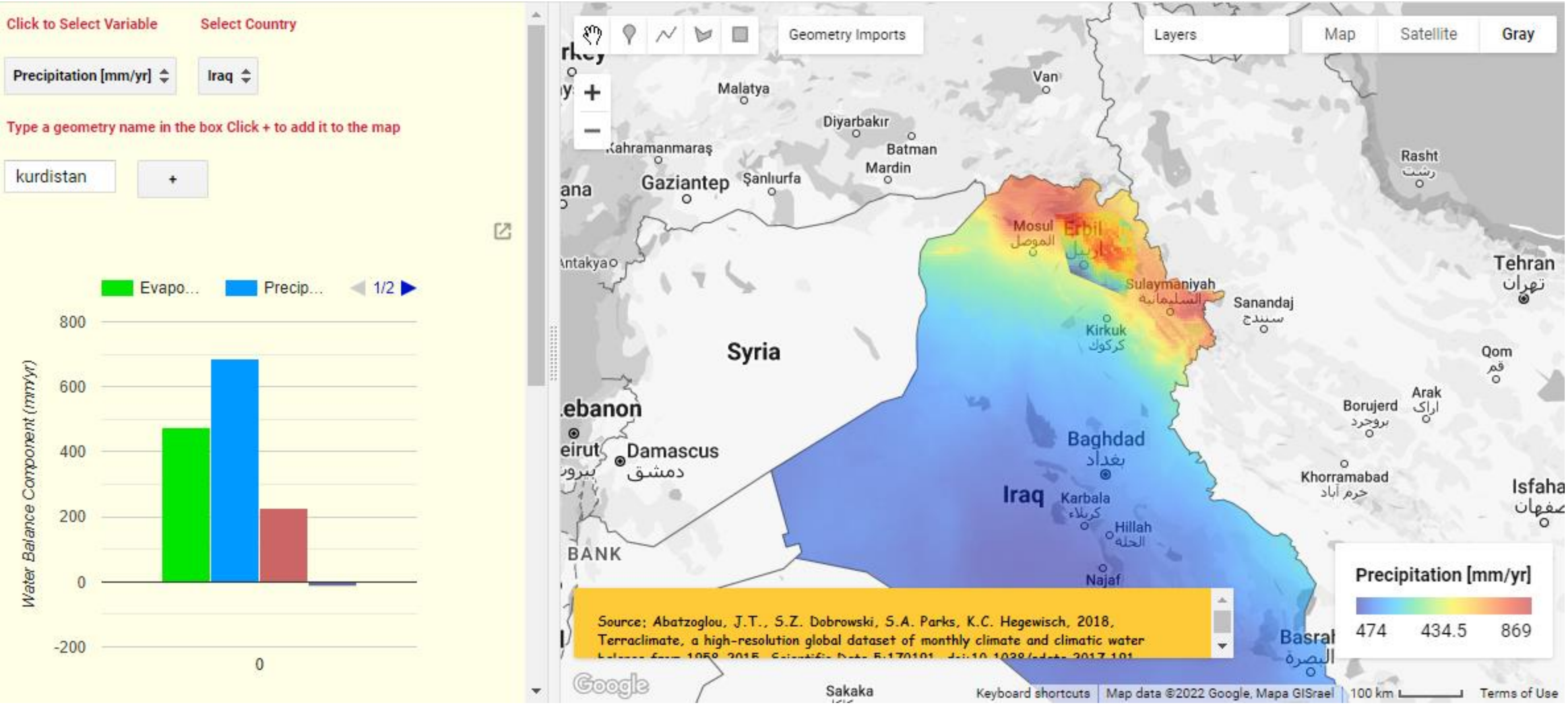
Cloud Computing Enabled Dynamic Platform





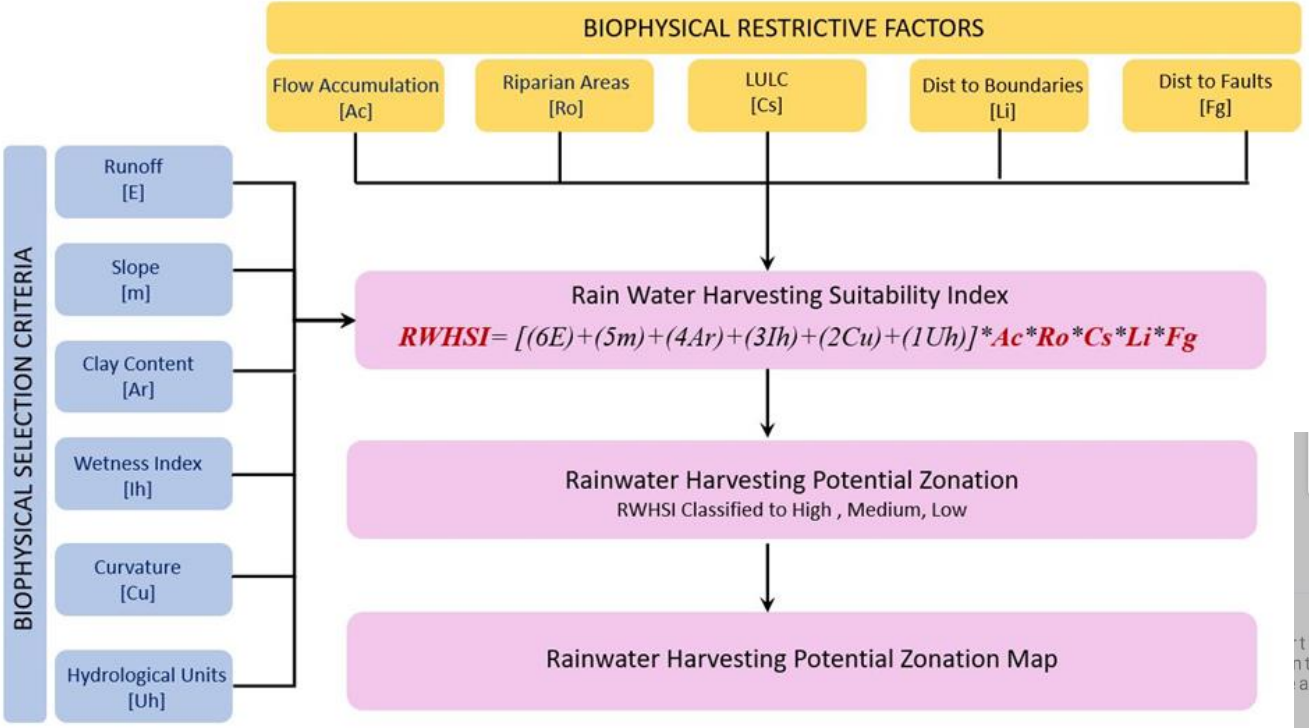
Cloud Computing Enabled Dynamic Platform





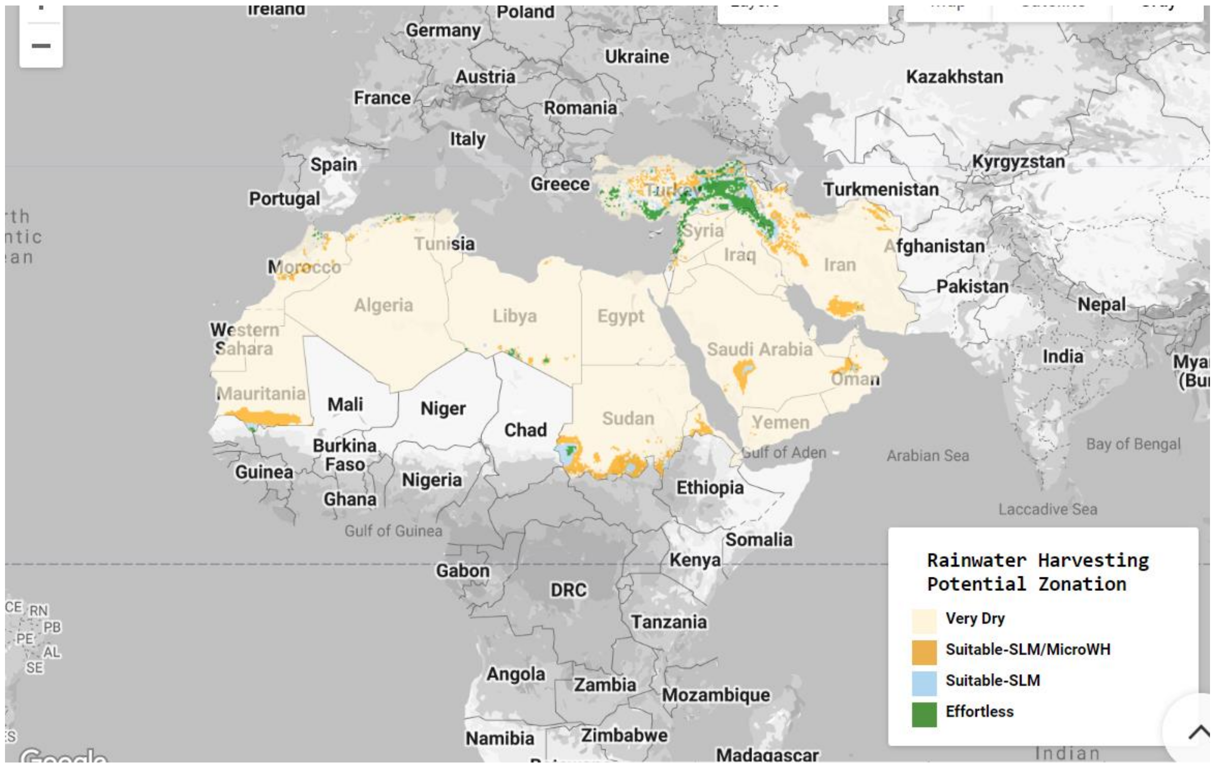
Click to Select Variable
Select Country
Precipitation [mm/yr]
Iraq
Type a geometry name in the box Click + to add it to the map
kurdistan
+
Evapo...
Precip...
1/2
800
600
400
200
0
-200
0
Water Balance Component (mm/yr)
Geometry Imports
Layers
Map
Satellite
Gray
Van
Malatya
Diyarbakır
Batman
Kahramanmaraş
Mardin
Gaziantep
Şanlıurfa
Rasht
Mosul
Erbil
Sulaymaniyah
Sanandaj
Tehran
Kirkuk
Syria
Qom
Arak
Borujerd
Lebanon
Damascus
Baghdad
Khorramabad
Iraq
Karbala
Hillah
Najaf
BANK
Source: Abatzoglou, J.T., S.Z. Dobrowski, S.A. Parks, K.C. Hegewisch, 2018,
Terraclimate, a high-resolution global dataset of monthly climate and climatic water
Precipitation [mm/yr]
474
434.5
869
Sakaka
Keyboard shortcuts
Map data ©2022 Google, Mapa GISrael
100 km
Terms of Use

Multicriteria-based RWH Potential Zonation



CIAT – with support from the U.S. Agency for International Development - USAID/Honduras and the technical collaboration of FAO

Impact: RWH has been included as an intervention in the World Bank CSA investment blue print for Iraq, which was lead by ICARDA



Concluding Statements…..

1. All Climate Adaptation in MENA should have Water as the fulcrum.

2. Rain Water Harvesting as a Climate Adaptation is still in the nascent stage and needs attention. It is quite relevant for the MENA region.

3. Identifying context specific RWH interventions need integrated analysis at the landscape/ watershed scale with a systems approach

4. A web-based platform has been developed to map the RWH potential zonation and other spatiotemporal analysis focusing on the MENA region. This may help the countries develop RWH as a policy in climate adaptation endeavours.

5. RWH (or RW Conservation or SW conservation) can be manifested by ↓ET losses, ↓ Runoff losses or ↑ Storage Capacity and hence ΔS. But it has to be optimized.

$[P] - [R + ET] = \Delta S$

Upstream SLM

Optimal ↓**ET**

Optimal ↓**R**

Optimal ↑**ΔS**

Optimum actions at the <u>local scale</u> is the one that has lowest ET and R losses at the <u>watershed</u> Scale

Ecological Needs

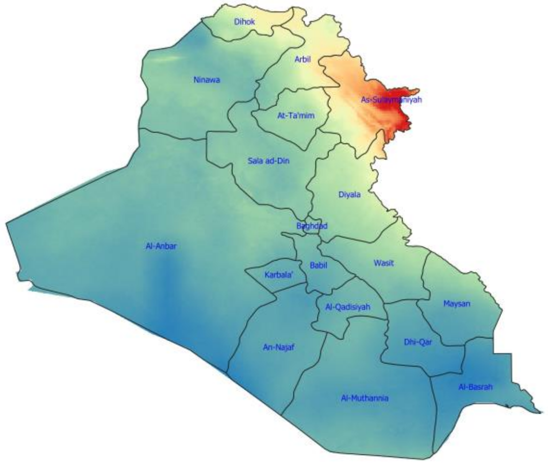
Stakeholder Needs

Downstream SLM

Optimal ↓**ET**

Optimal ↓**R**

Optimal ↑**ΔS**



Advice using Models

ICARDA