Copernicus user needs:

The Water-Energy-Food Nexus

Copernicus for water management workshop
Brussels | 29 May 2018

Livia Peiser
FAO Land and Water Division

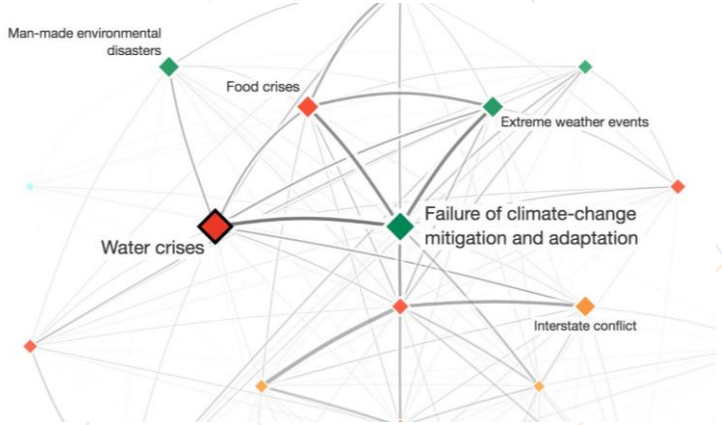
Outline

- The nexus concept
- Examples of interpretations at FAO
- Role of Earth Observation
- Relevant on-going activities: WaPOR
- Future needs of products and services

The nexus concept and its added value

- Not entirely new, but it is a critical frame for times of heightened competition
- Convening power across and within sectors by clearly recognizing interdependencies, conditions and constraints
- Flexible concept, it provides a platform for building a common language and, thus, dialogue

Economic Forum 2008, Global Risks



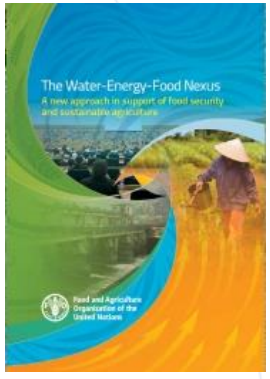
Bonn Nexus Conference 2011

Bonn2011 Conference
The Water, Energy and Food Security Nexus
Solutions for the Green Economy
16–18 November 2011

> "The Water-Energy-Food Nexus describes the complex and inter-related nature of our global resources systems"

> "It is about balancing different resource user goals and interests – while maintaining the integrity of ecosystems"

FAO publication: nexus for food security and sustainable agriculture



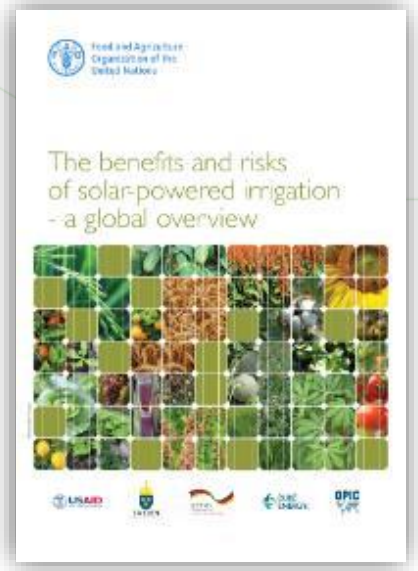
Some practical interpretations – relevant to EOs

- Solar Powered Irrigation
- Bio-energy crops
- Hydro-power

Examples: SPIs' impacts on water resources

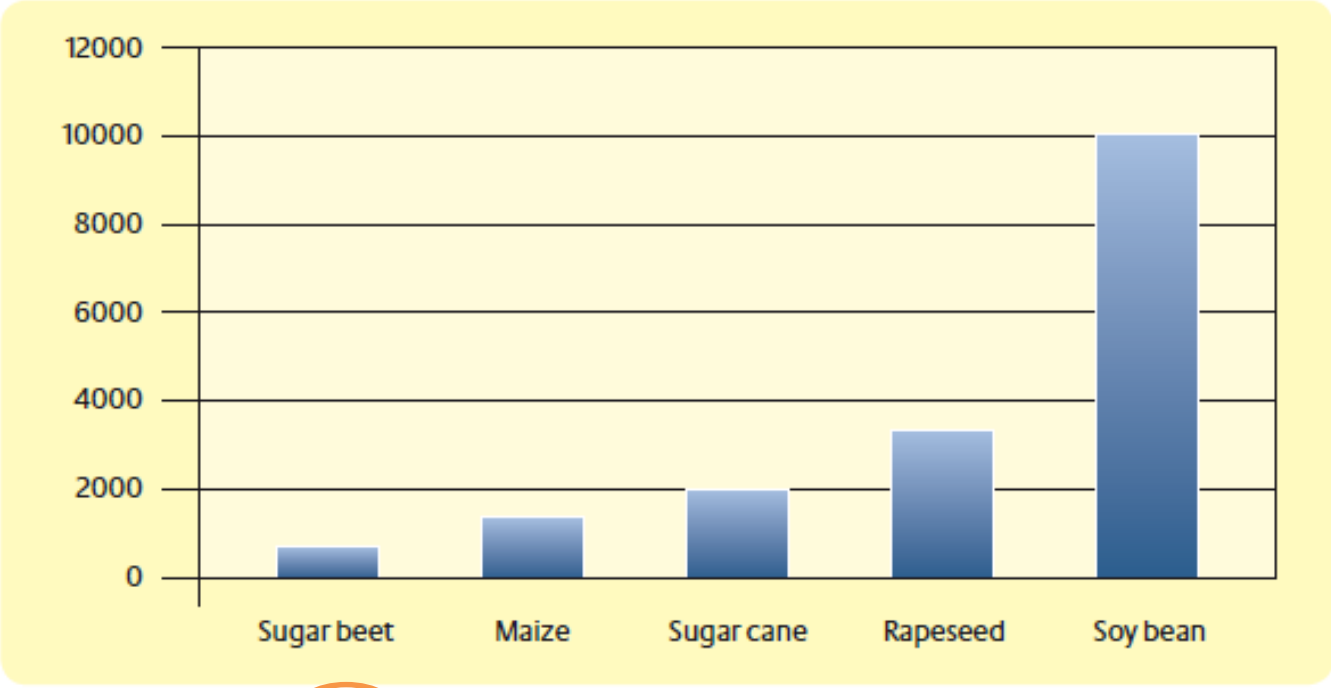
- Price of energy (electricity, fuel) have had regulating effects on water withdrawals: with SPIs, high risk of overexploitation of groundwater

- With SPIs, water accounting and irrigation monitoring becomes increasingly critical



Examples: biofuels' impacts on water resources

Figure 3: Water use intensity of some major biofuels (litres of water evaporated per litre of biofuel produced)



Source: Hoogeveen et al. (2009)

Role of Earth Observation

- Irrigation and actual ET (ETa) monitoring
- Land use (crops)
- Land productivity (biomass, yield)
- Water productivity (yield/ETa)…

in complex and diverse landscapes

Relevant initiatives: WaPOR

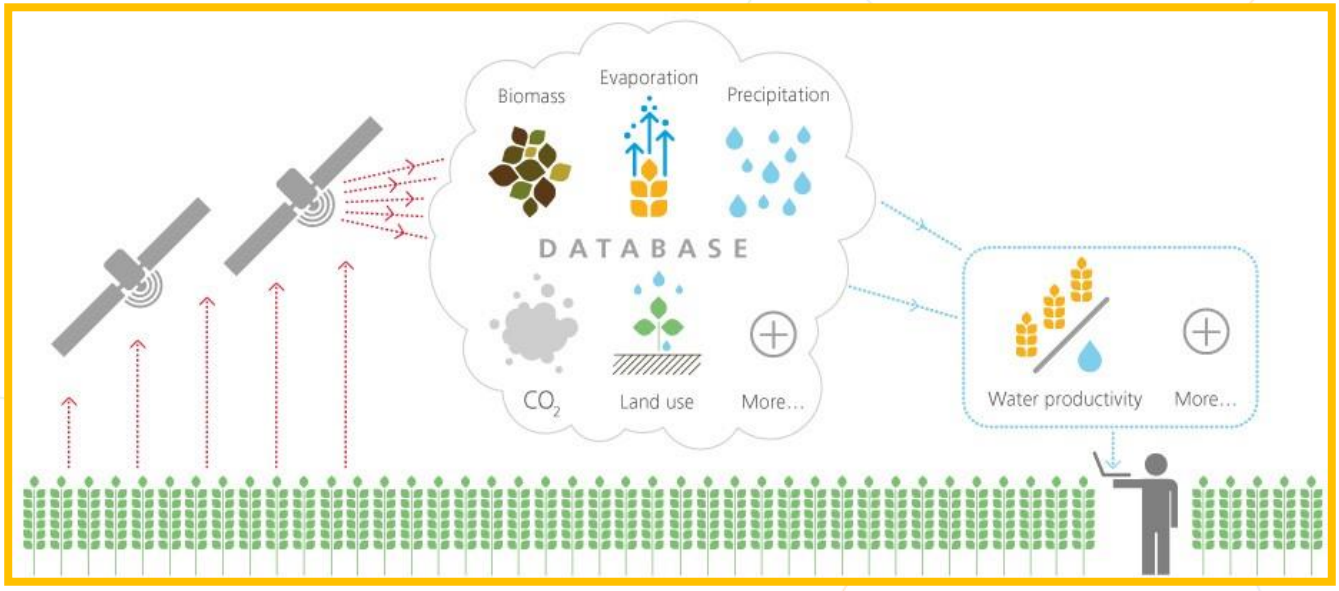
Remote sensing for water productivity

Donor: The Netherlands

Duration: 2015-2019

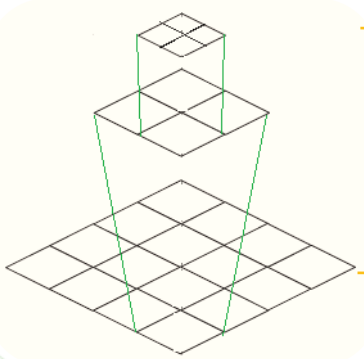
Coverage: Africa and Near East

Countries: Morocco, Tunisia, Egypt, Lebanon, Syrian Arab Republic, Jordan, Ghana, Kenya, South Sudan, Mali, Benin, Ethiopia, Rwanda, Burundi, Mozambique, Uganda, West Bank & Gaza Strip, and Yemen.



Ministry of Foreign Affairs of the Netherlands
Food and Agriculture Organization of the United Nations
UNESCO-IHE Institute for Water Education
IWMI International Water Management Institute

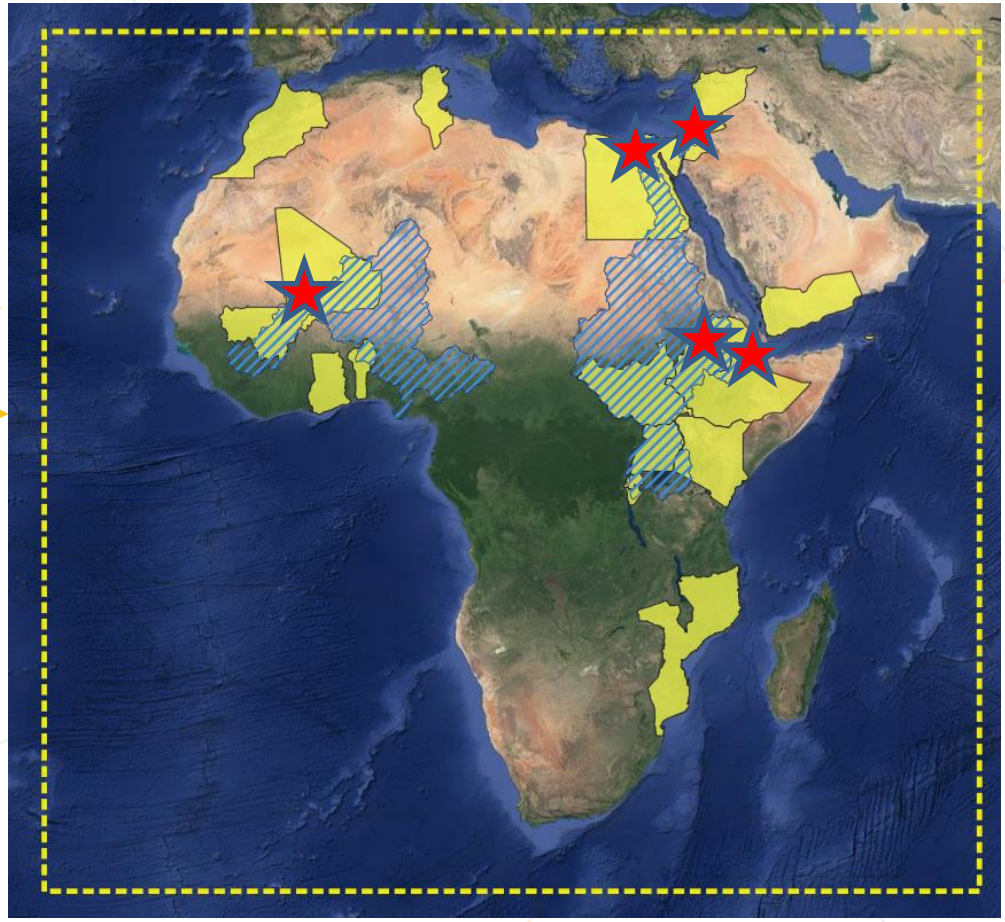
Remote sensing for water productivity



Level 3 – 30 m

Level 2 – 100 m

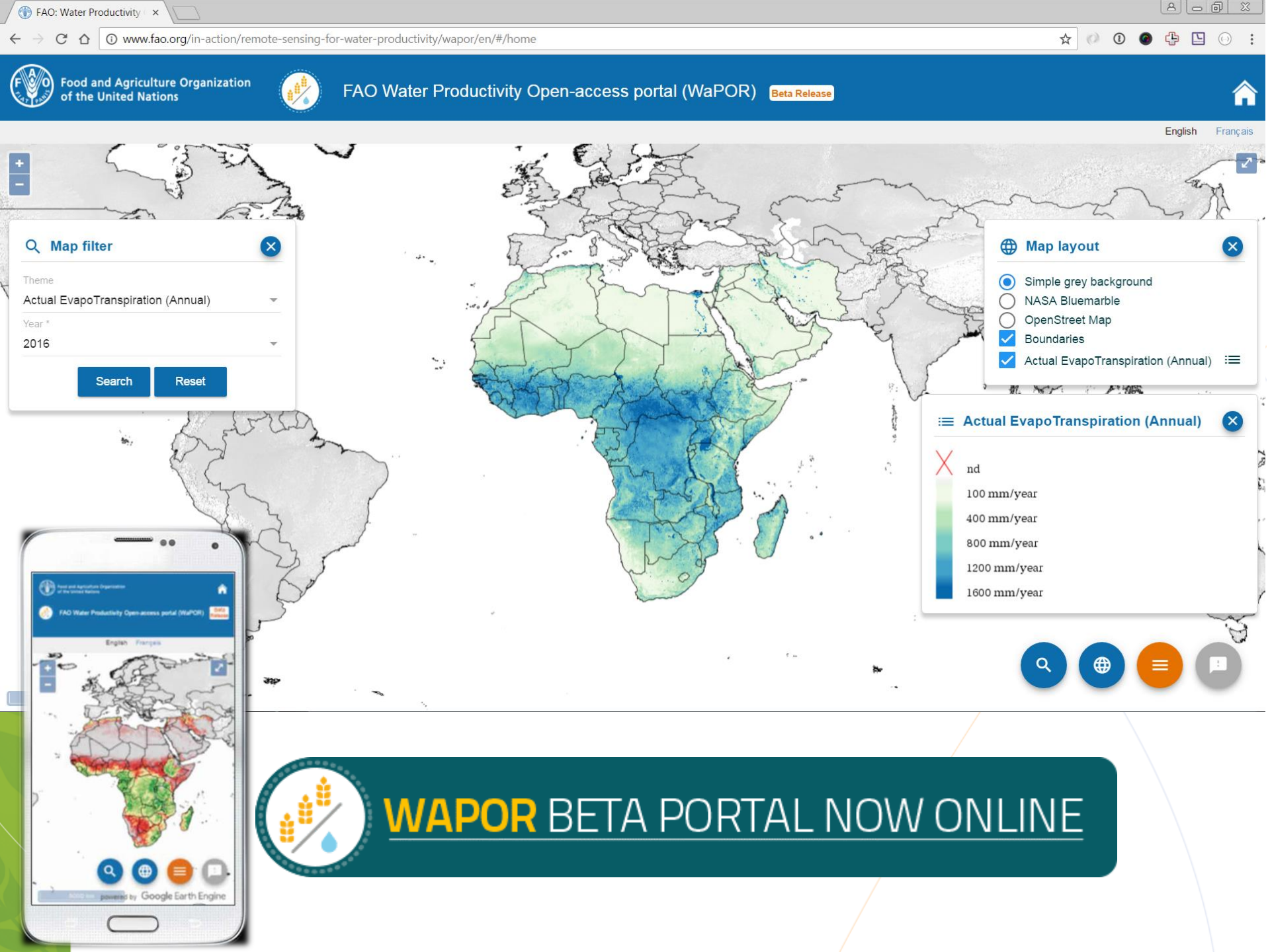
Level 1 – 250 m



Consortium:

eleaf · vito · ITC UNIVERSITY OF TWENTE. · WATERWATCH FOUNDATION

Ten years: 2009 - 2019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www.fao.org/in-action/remote-sensing-for-water-productivity/wapor/en/#/home
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FAO Water Productivity Open-access portal (WaPOR)
Beta Release
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400 mm/year
800 mm/year
1200 mm/year
1600 mm/year
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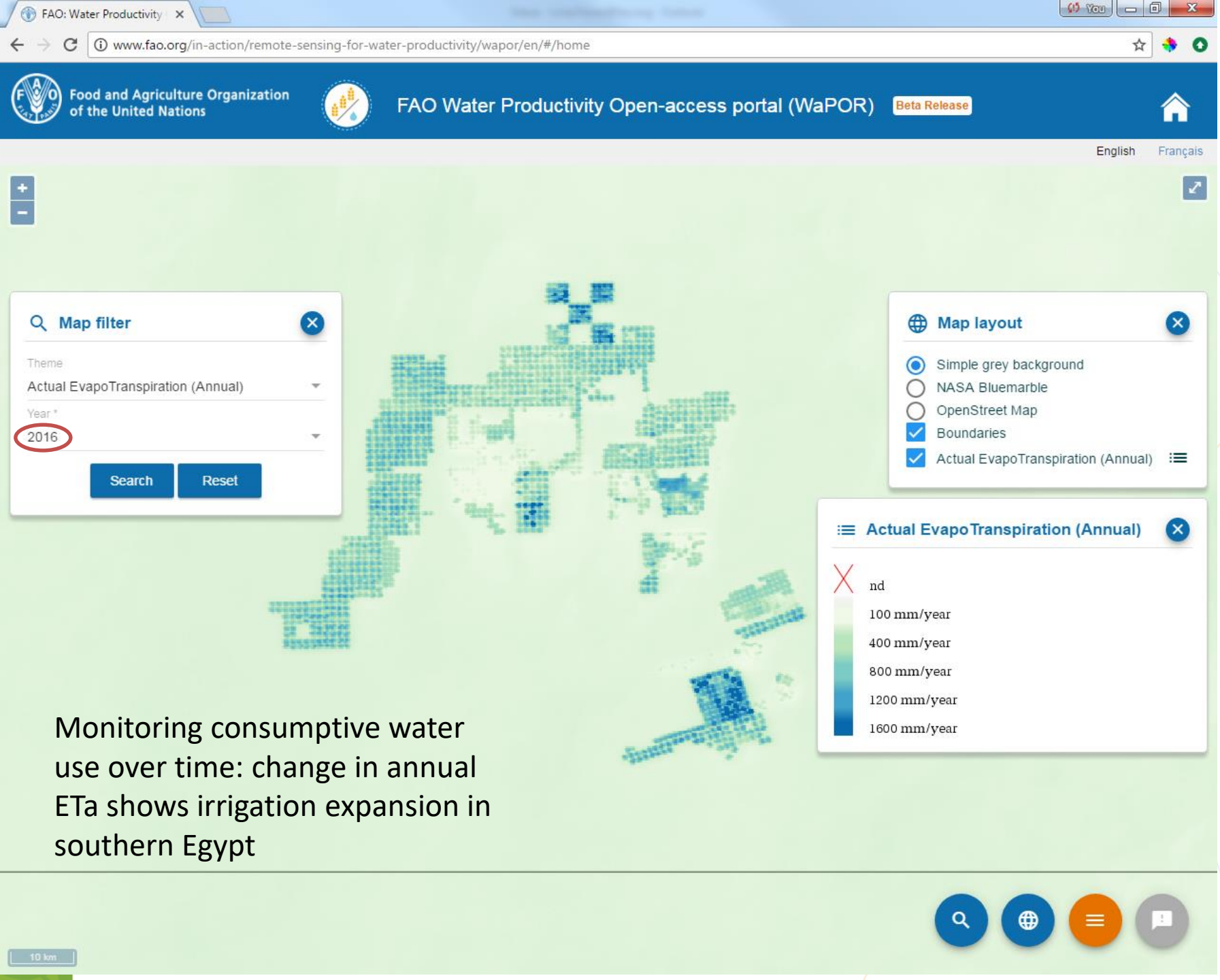
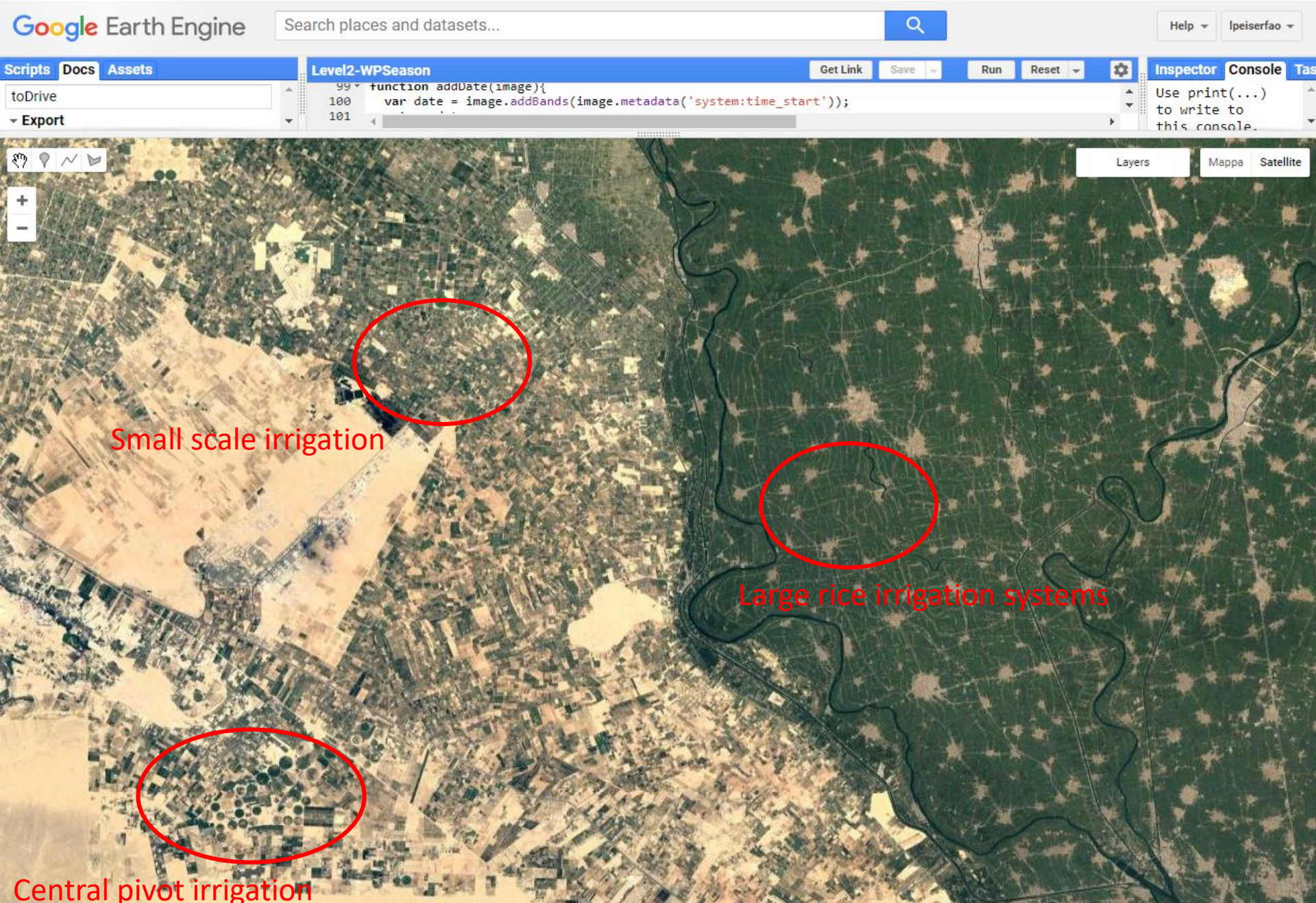
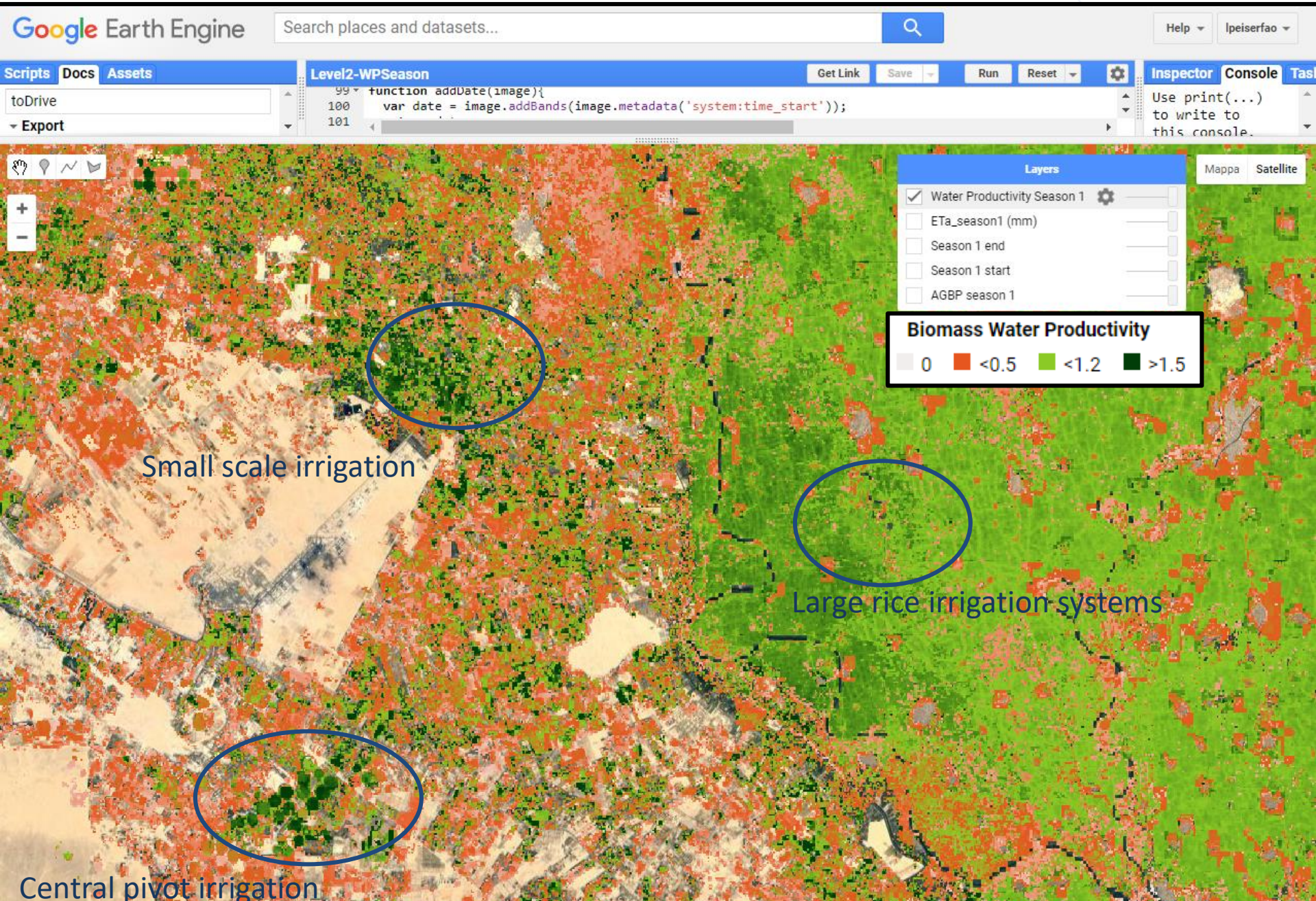


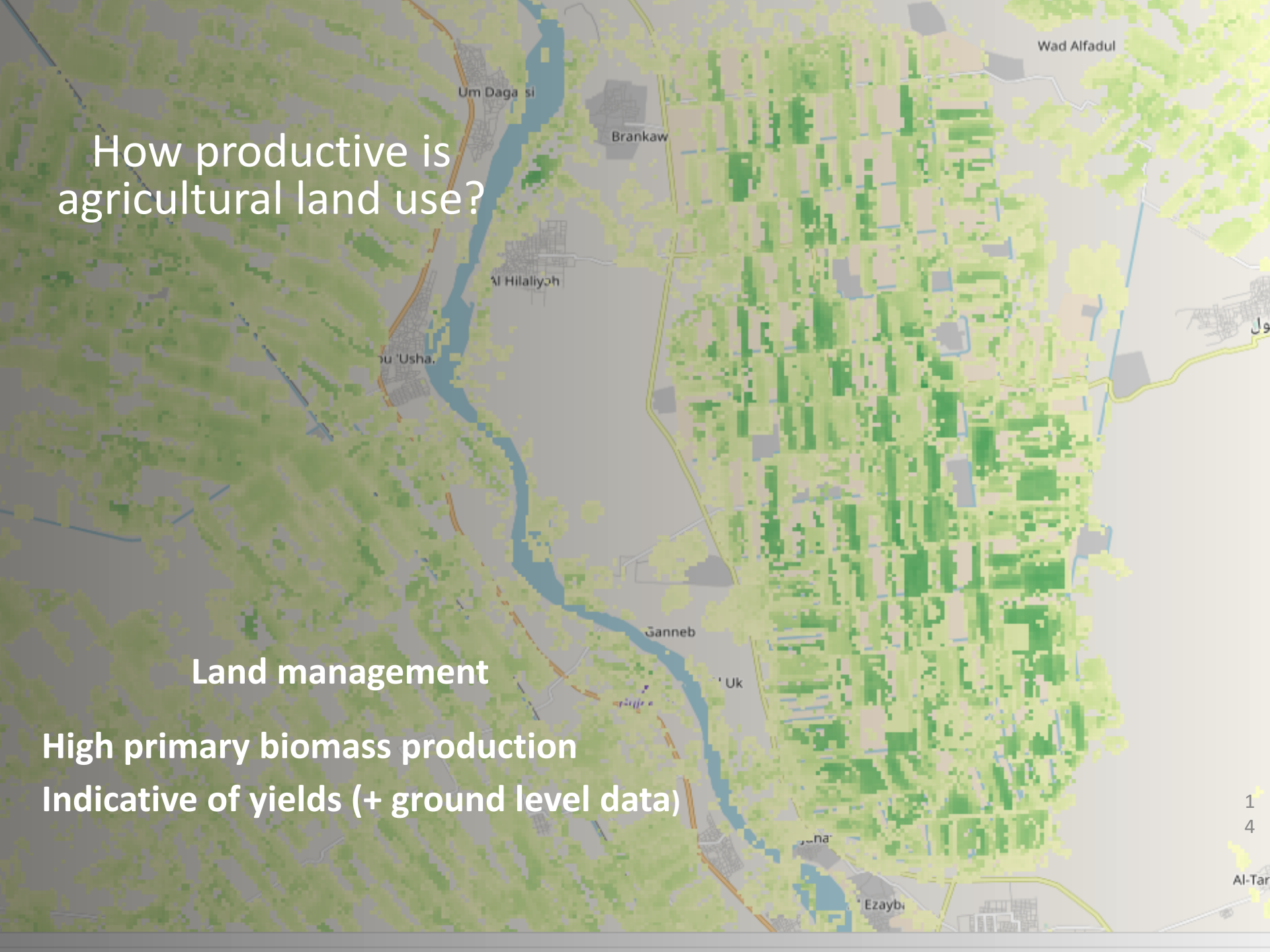
Monitoring consumptive water use over time: change in annual ETa shows irrigation expansion in southern Egypt

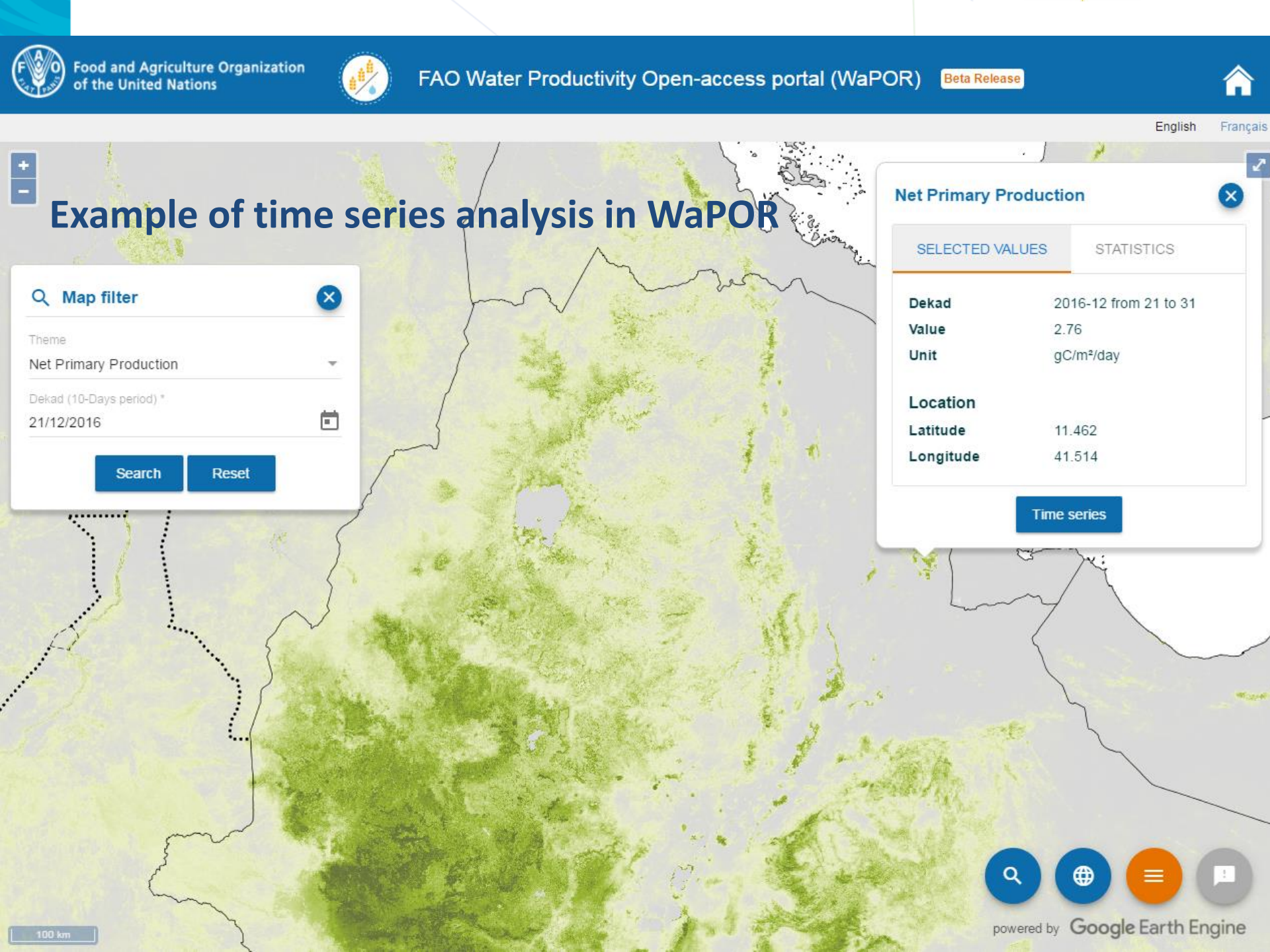
Water productivity in the Nile Delta, Season 1, 2015



Water productivity in the Nile Delta, Season 1, 2015




How productive is agricultural land use?
Land management
High primary biomass production
Indicative of yields (+ ground level data)
Wad Alfadul
Um Daga si
Brankaw
Al Hilaliyah
Ganneb
Uk
Ezayba
Al-Tar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English
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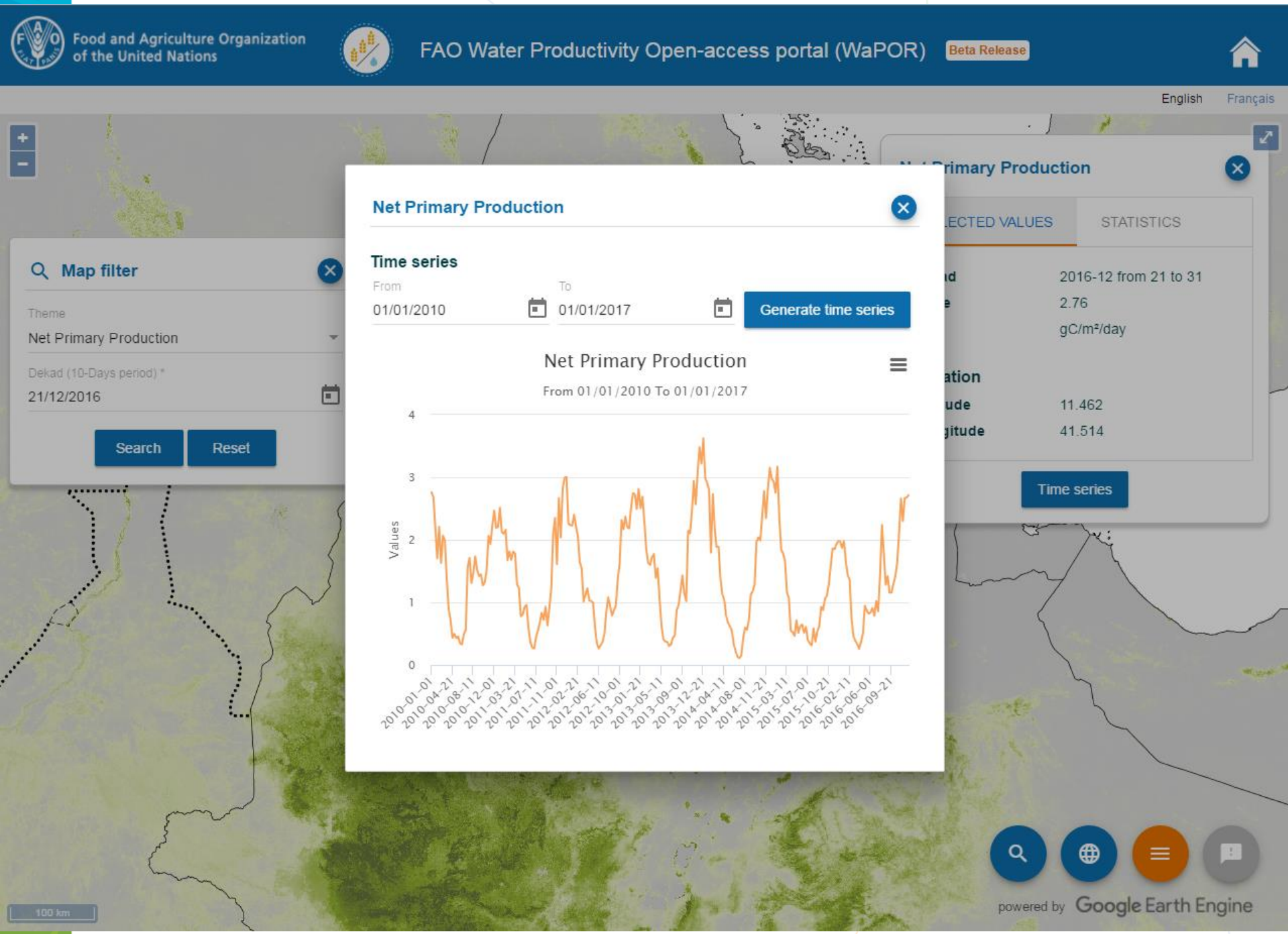
Example of time series analysis in WaPOR
Map filter
Theme
Net Primary Production
Dekad (10-Days period) *
21/12/2016
Search
Reset
Net Primary Production
SELECTED VALUES
STATISTICS
Dekad
2016-12 from 21 to 31
Value
2.76
Unit
gC/m²/day
Location
Latitude
11.462
Longitude
41.514
Time series
100 km
powered by Google Earth Engine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01/01/2017
Generate time series
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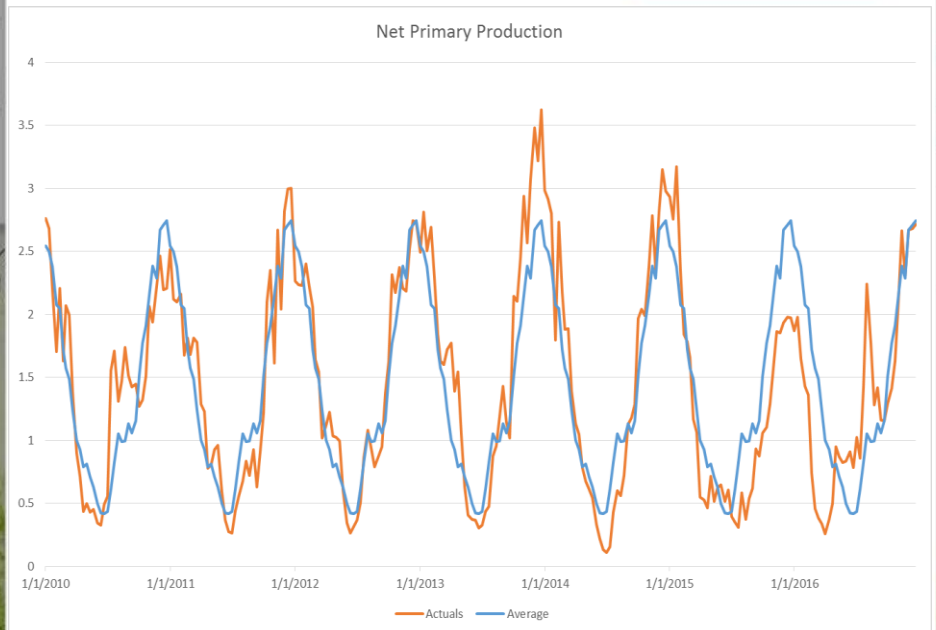
Net Primary Production

Time series

From 01/01/2010

To 01/01/2017

Generate time series



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Time series

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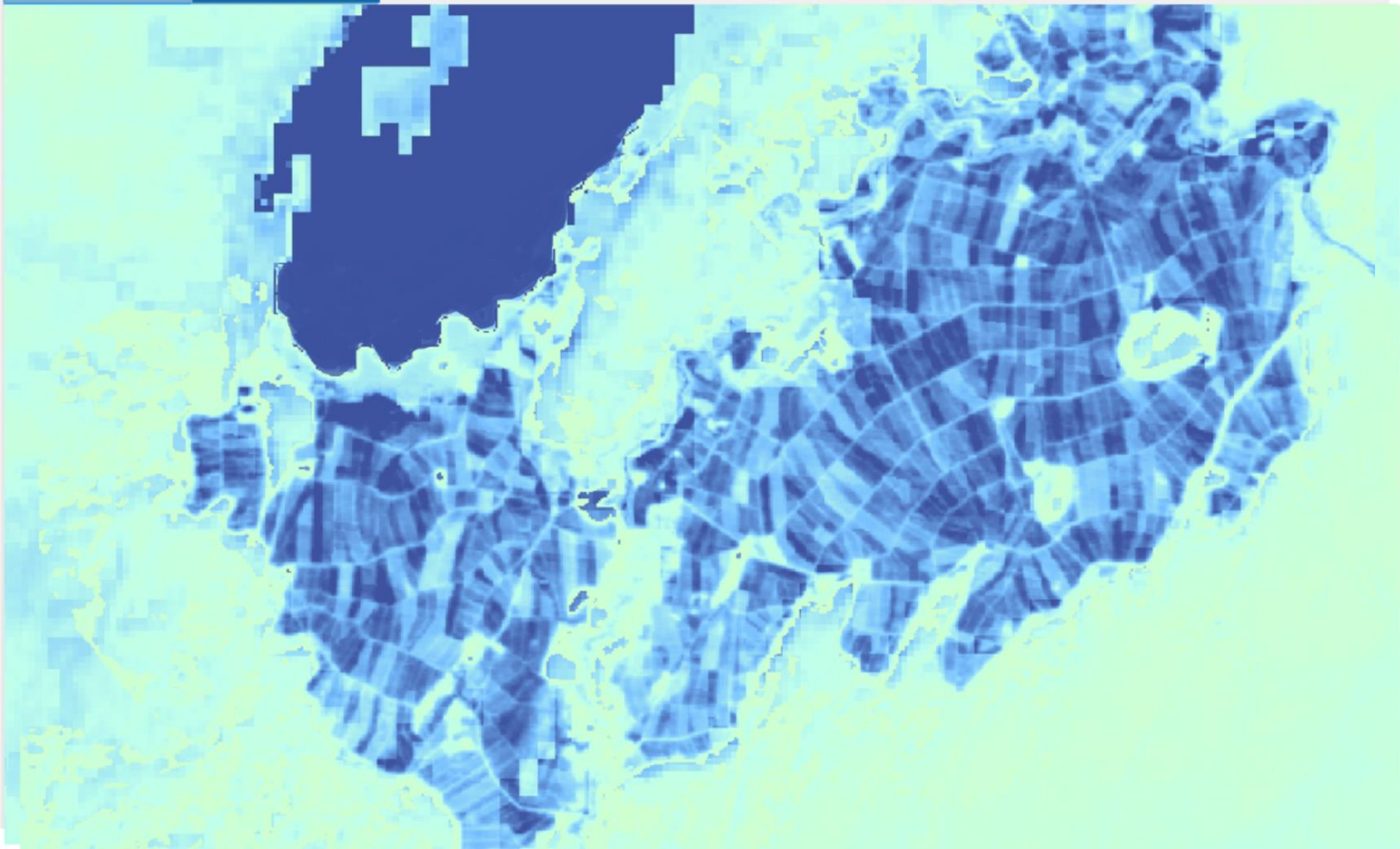
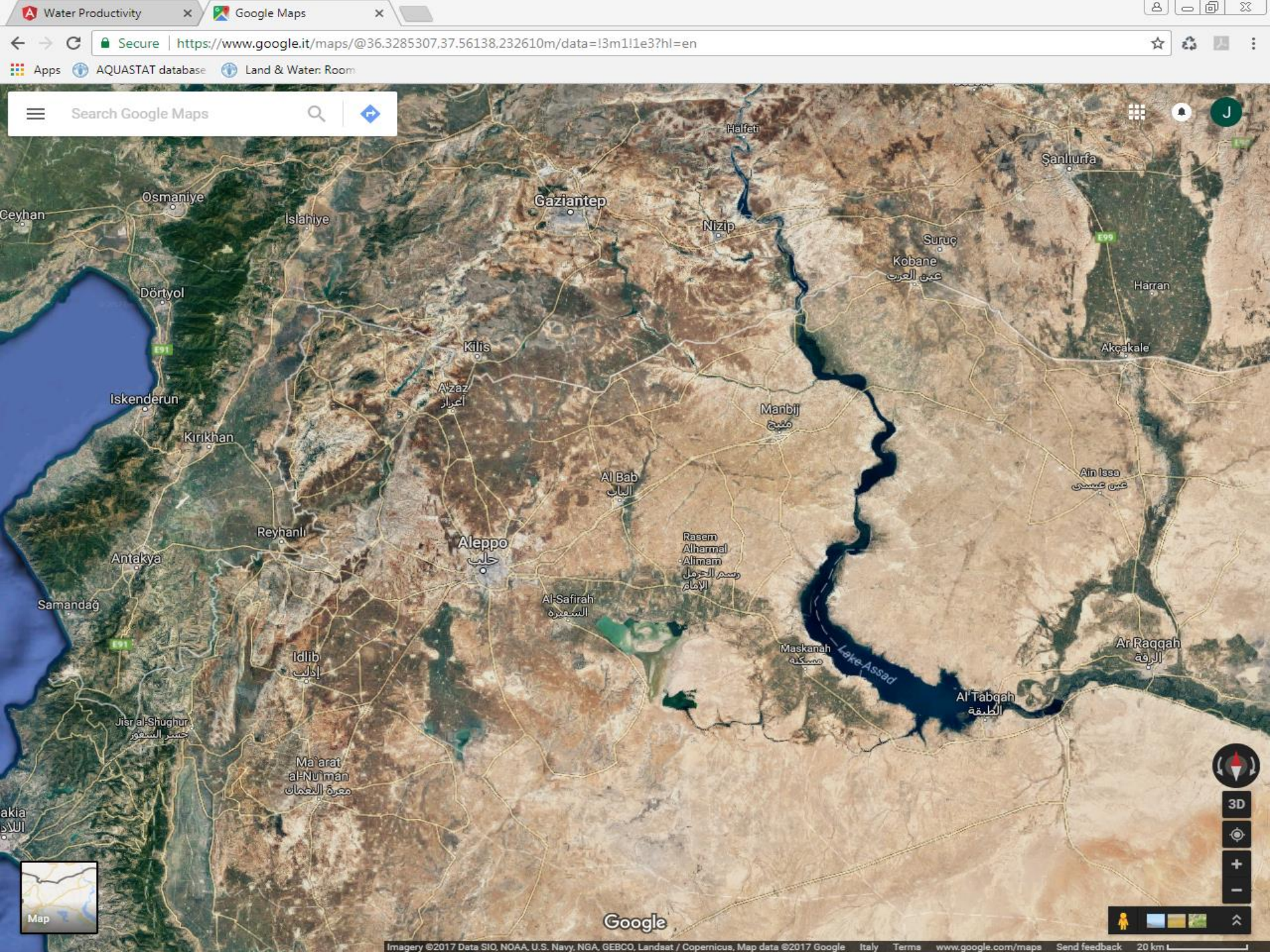
LEVEL 1 (250 m) LEVEL 2 (100 m)

Close up on Metahara sugarcane

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عين عيسى
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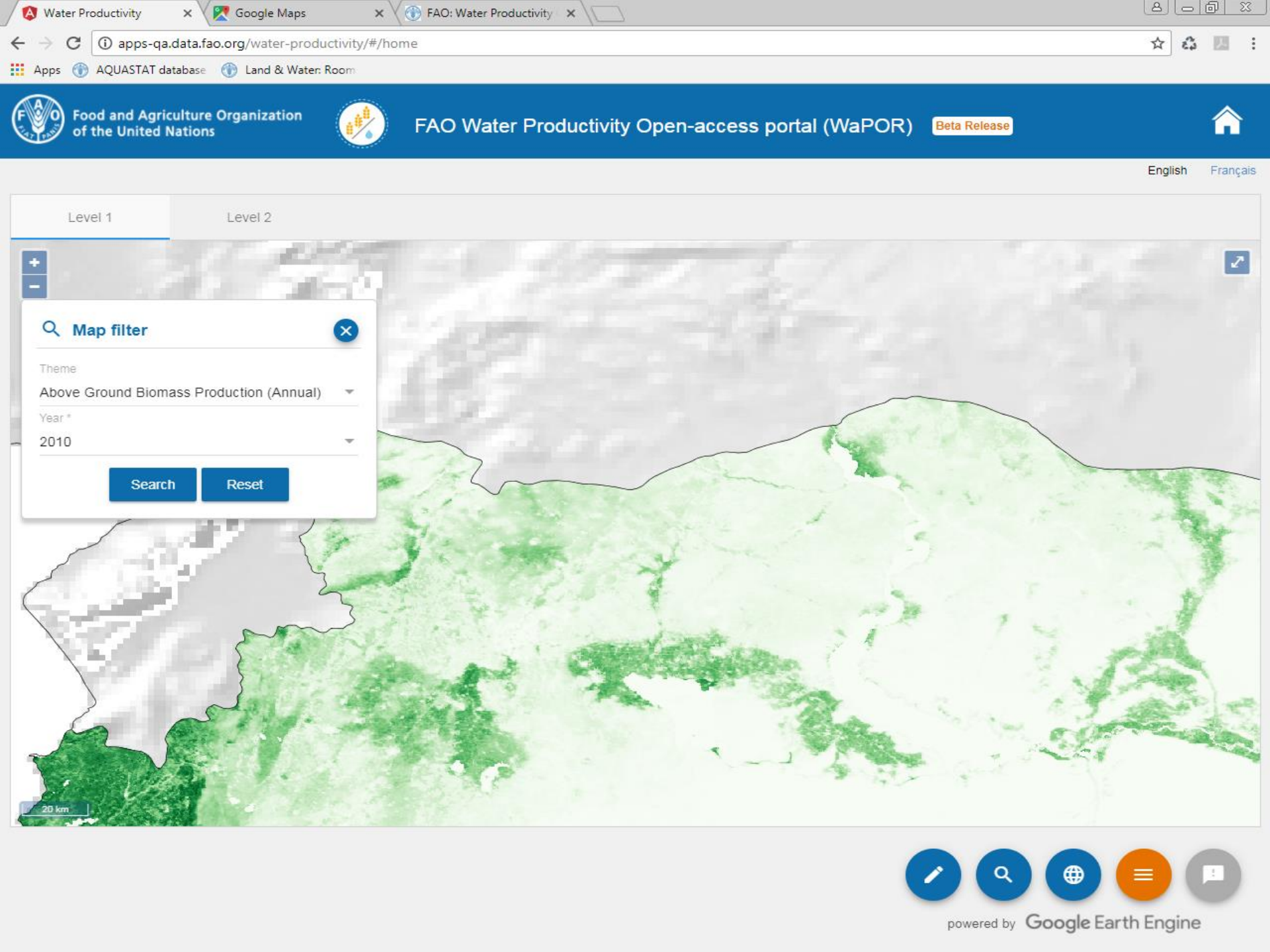
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Map filter
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Above Ground Biomass Production (Annual)
Year *
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Reset
20 km
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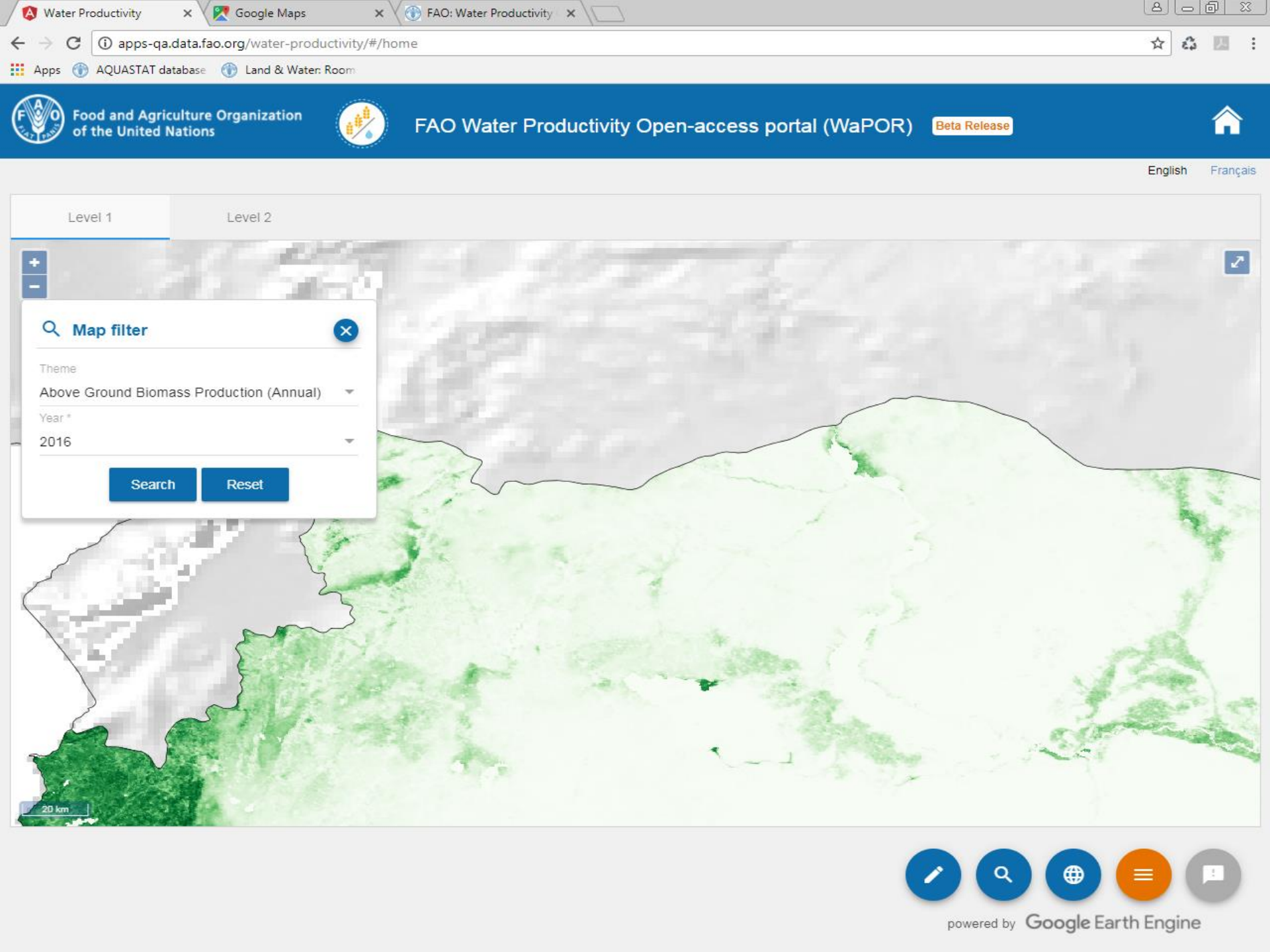
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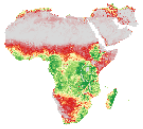
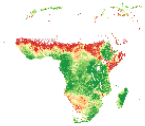
Browse data

Gross Biomass Water Productivity



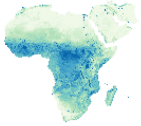
The annual Gross Biomass Water Productivity expresses the quantity of output (above ground biomass production) in relation to the total volume of water consumed in the year (actual evapotranspiration). By ...

Net Biomass Water Productivity



The annual Net Biomass Water Productivity expresses the quantity of output (above ground biomass production) in relation to the volume of water beneficially consumed (by canopy transpiration) in the year, ...

Actual EvapoTranspiration (Annual)

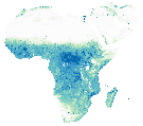


The EvapoTranspiration (ET) is the sum of the soil evaporation (E) and canopy transpiration (T). The value of each pixel represents the annual actual evapotranspiration in a given year.

Above Ground Biomass Production (Annual)

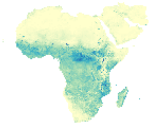
The annual Above Ground Biomass Production expresses the total amount of dry matter produced over the year. It is calculated by dekad and summarized as annual total. Each pixel represents the amount of ...

Transpiration (Annual)



The annual Transpiration is the portion of annual ETa due to canopy transpiration only (net of soil evaporation). The value of each pixel represents the total annual transpiration for that specific year.

Actual EvapoTranspiration (Dekadal)

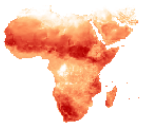


The Evapotranspiration (ET) is the sum of the soil evaporation (E) and canopy transpiration (T). The value of each pixel represents the average daily actual evapotranspiration for that specific dekad.

Transpiration Fraction

Transpiration Fraction is an additional, complementary data layer that is provided with the AET data component. Each pixel of this data layer indicates which % of AET is made up of transpiration for that ...

Reference EvapoTranspiration



Reference evapotranspiration (RET) is defined as the evapotranspiration from a hypothetical reference crop and it simulates the behaviour of a well-watered grass surface. Each pixel represents the daily reference ...

Net Primary Production

Net Primary Production (NPP) is a fundamental characteristic of an ecosystem, expressing the conversion of carbon dioxide into biomass driven by photosynthesis. The pixel value represents the mean ...

Precipitation

Precipitation data is delivered on a daily basis. The source of this dataset is CHIRPS (Climate Hazards Group InfraRed Precipitation with Station) quasi-global rainfall dataset, starting from 1981 up to near ...

http://www.fao.org/in-action/remote-sensing-for-water-productivity/wapor/en/#/home

Future needs of products and services

- Irrigation and actual ET (ETa) monitoring
- Land use (crops)
- Land productivity (biomass, yield)
- Water productivity (yield/ETa)…

in complex and diverse landscapes

- Land Surface Temperature, at appropriate temporal and spatial resolution (HRLST mission)
- Meteorological forcing(air T, humidity, pressure, wind speed…)
- Scaling up reference data collection and ground truthing
- Computing power, exploitation platforms / data cubes, capacity development
- Being aware of unreliability of bandwidth in many non-industrialised countries

Thank you

http://www.fao.org/in-action/remote-sensing-for-water-productivity

www.fao.org/land-water