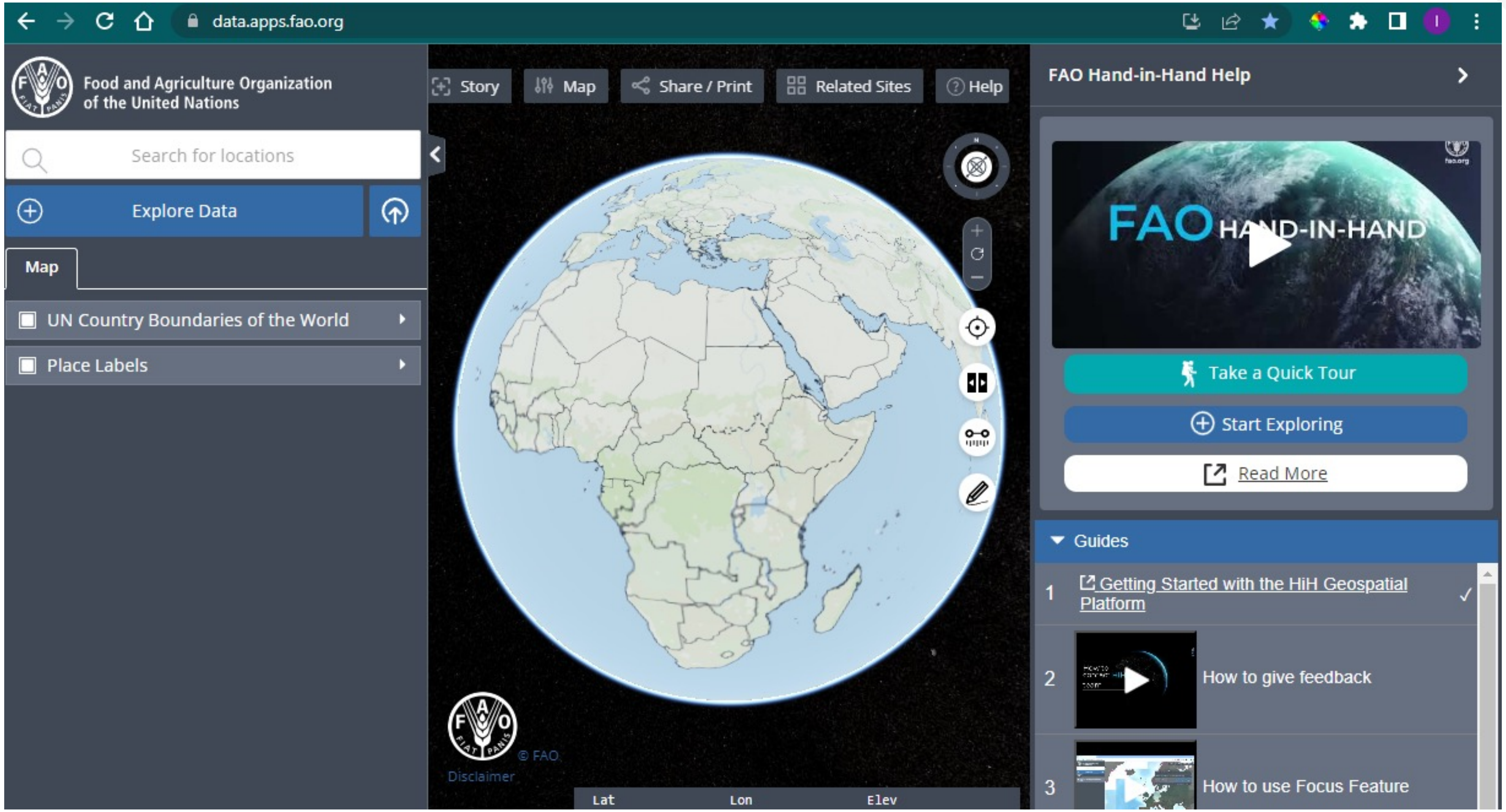
Knowledge driven land and water management to accelerate SDG progress

(or why HR thermal EO matters)

Livia Peiser, FAO Land and Water Division
International workshop on high-resolution thermal EO | ESA-ESRIN, 10 May 2023

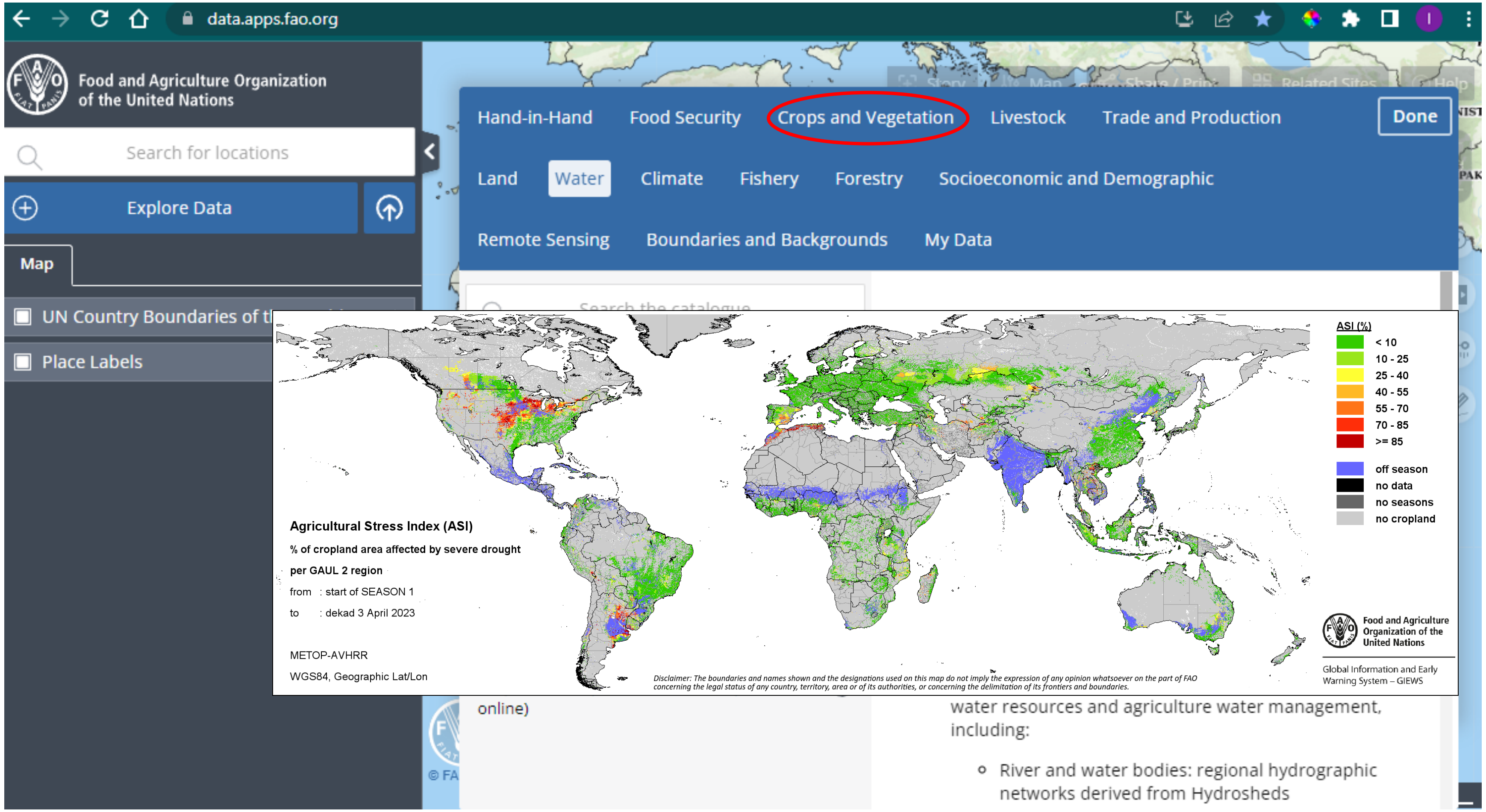
Thermal data for Food and Agriculture



The geospatial platform of FAO Hand in Hand initiative is the entry point to our geospatial work, and thermal data supports several thematic areas.

Food and Agriculture Organization of the United Nations

Thermal data for Food and Agriculture



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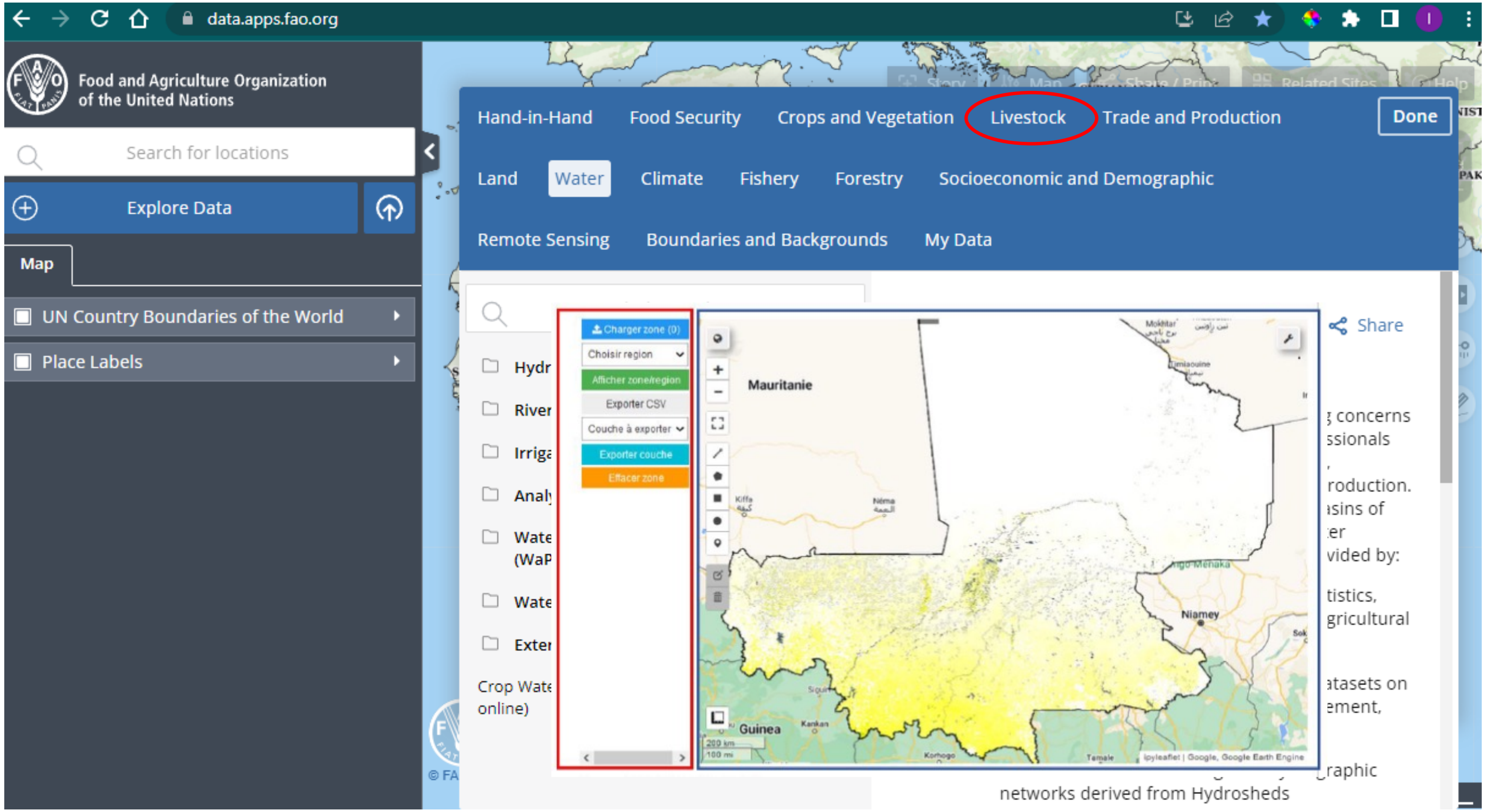
Crops and vegetation: Agriculture Stress Index uses LST data for early warning

Thermal data for Food and Agriculture



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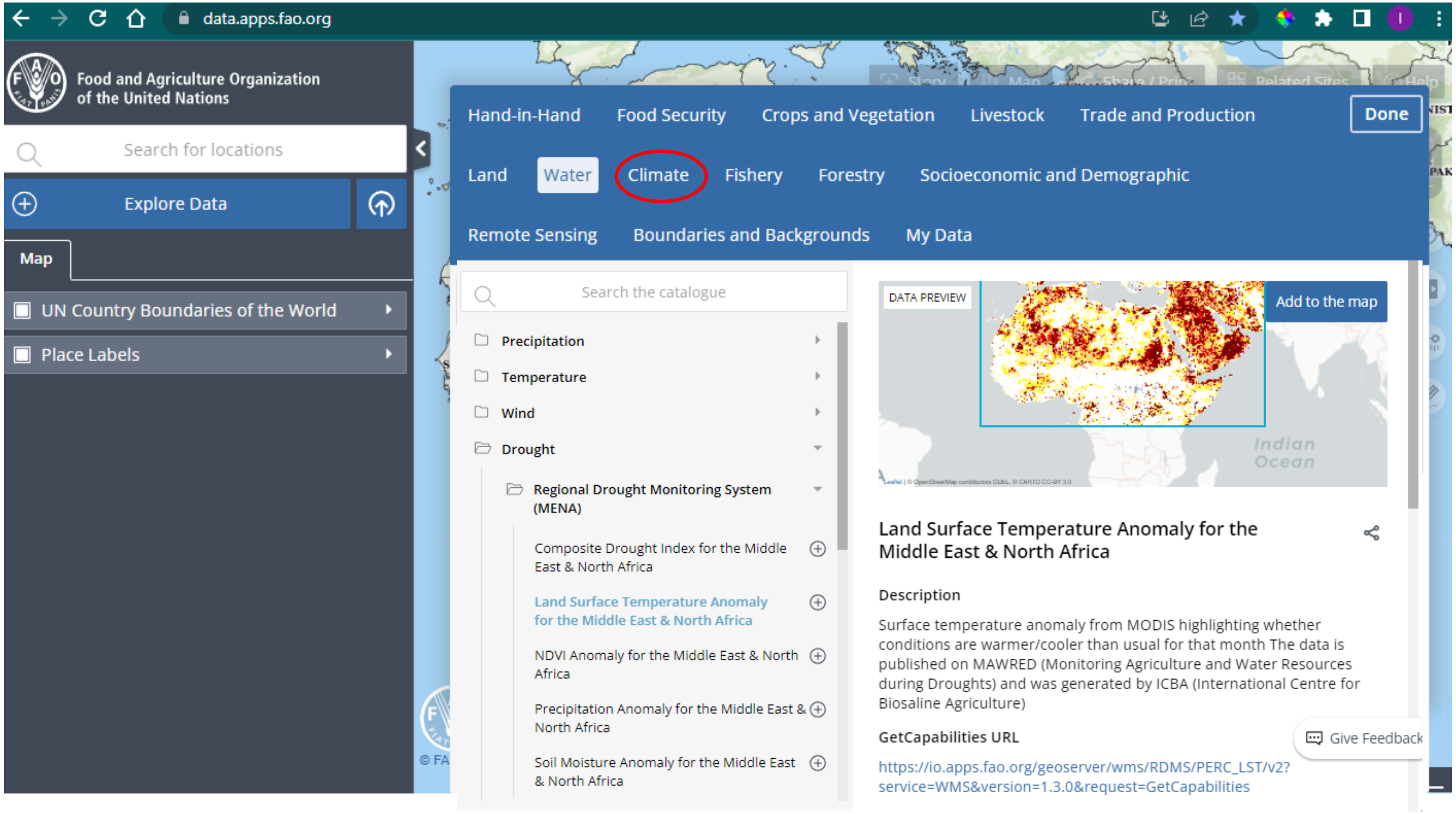
Livestock: wildfires data to monitor availability of biomass for pastoralists

Thermal data for Food and Agriculture



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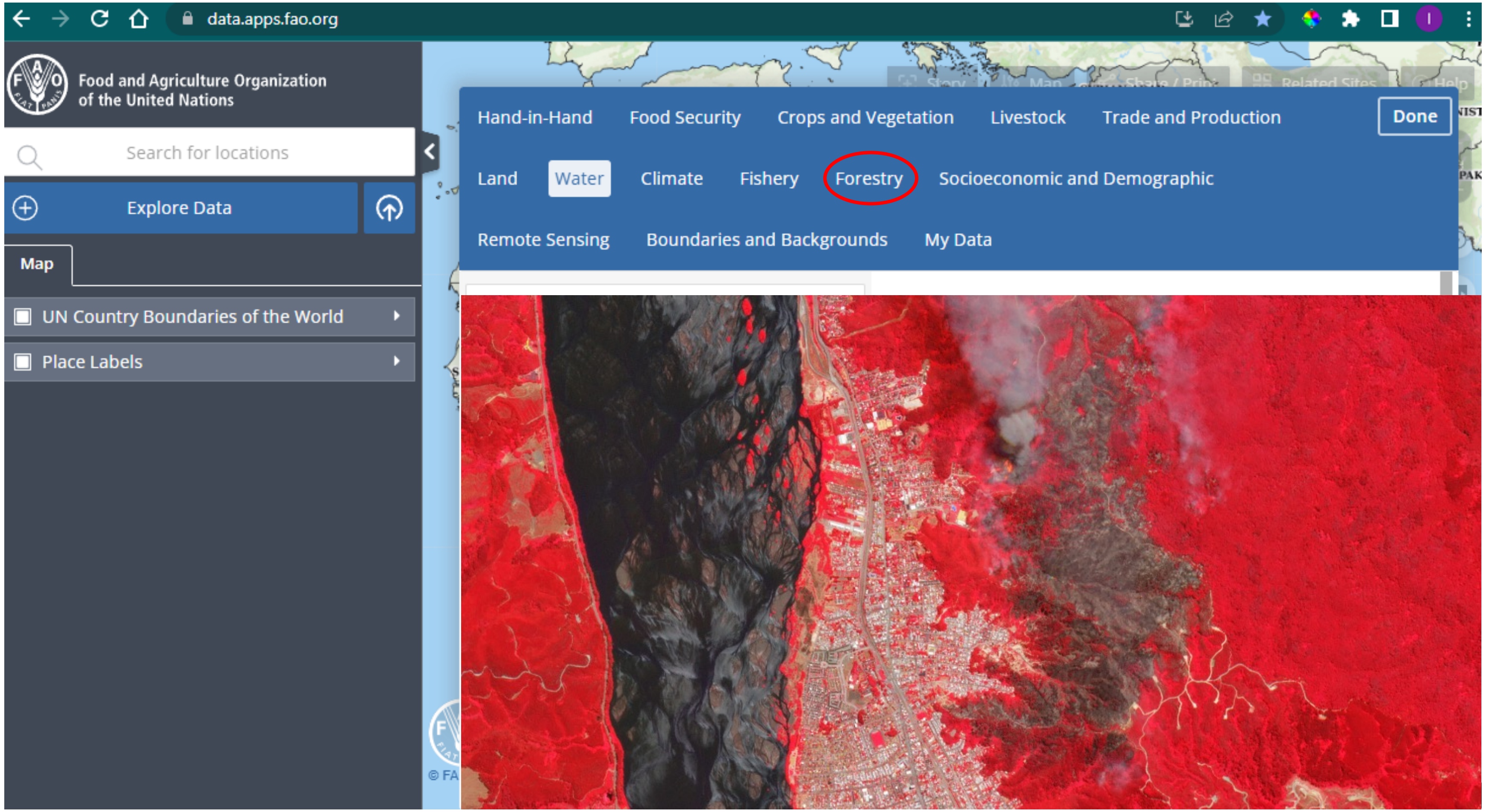
Climate: temperature anomalies

Thermal data for Food and Agriculture



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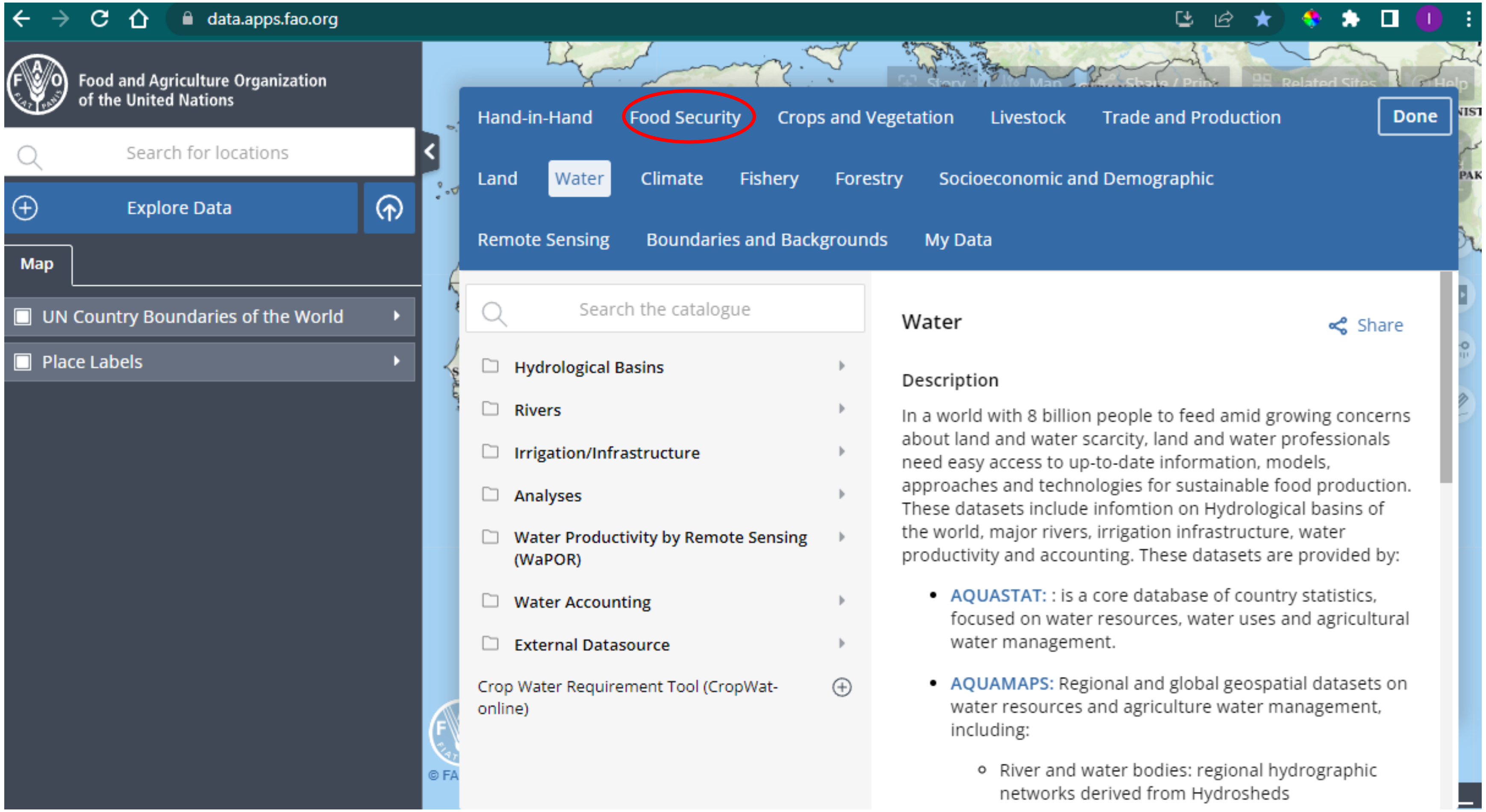
Forestry: forest fires

Thermal data for Food and Agriculture



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Food security and emergency operations (heat waves, volcano, wildfires)

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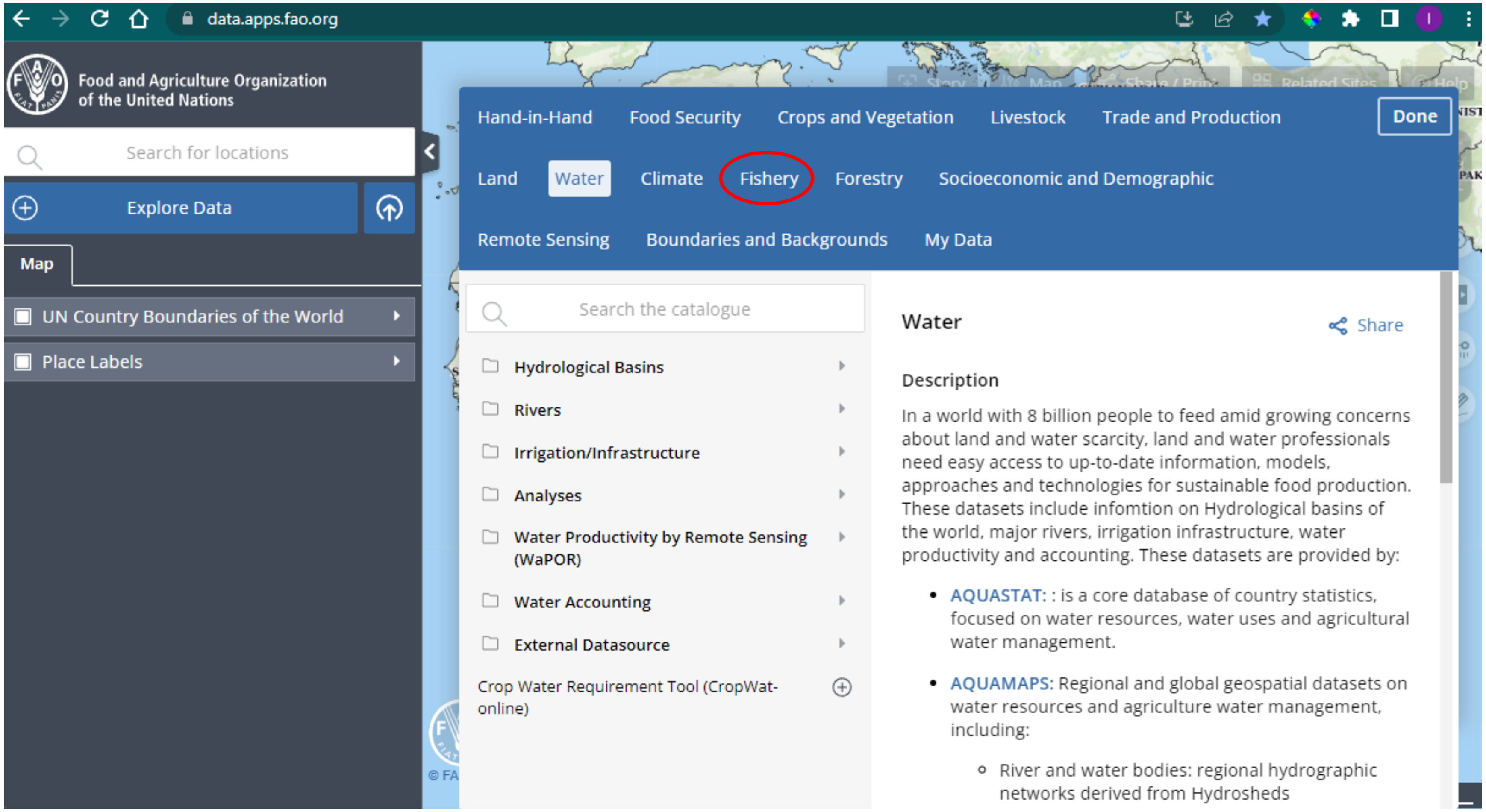
Thermal data for Food and Agriculture



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Fishery: water bodies and fishing areas health status

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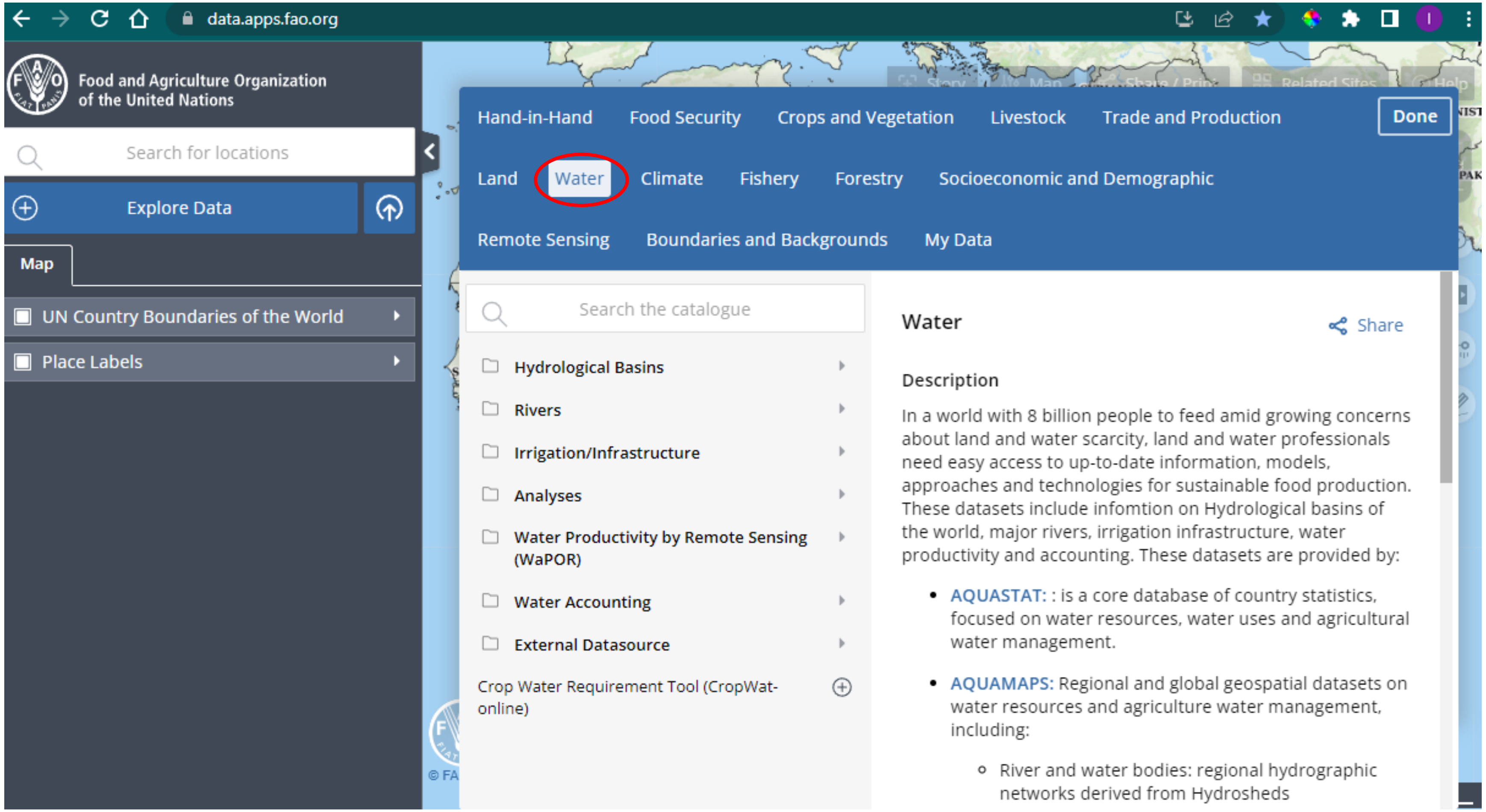
Thermal data for Food and Agriculture



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Water: evapotranspiration, soil moisture, water productivity

Water and agriculture in a changing climate

Over 828 million people suffer from hunger
(SOFI 2022)

Around 3.2 billion people live in agricultural areas with high to very high water shortages or scarcity
(SOFA 2020)

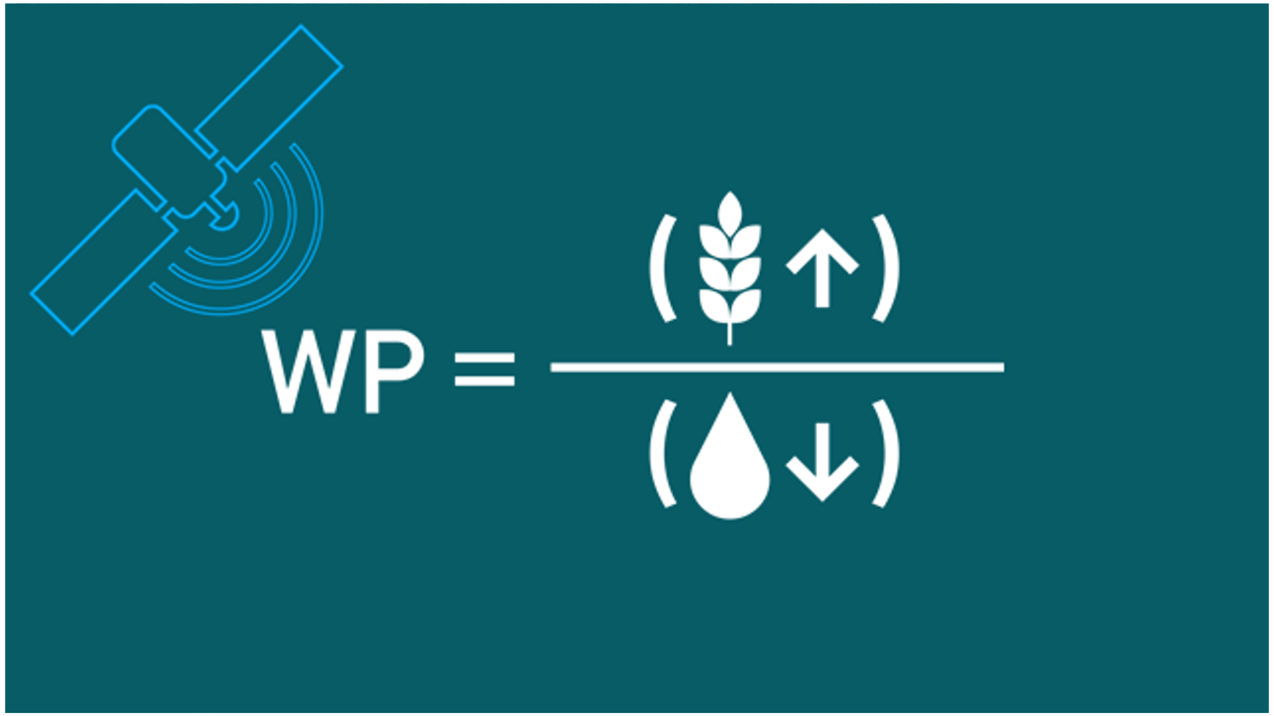
Agricultural production needs to grow globally by 50% by 2050
(SOLAW 2022)

Current patterns of intensification are not proving sustainable
(SOLAW 2022)

From 2000 – 2019 total cropland increased with 63 M ha, almost 85% of this increase is irrigated
(SOLAW 2022)

Water-related risks are projected to increase with every degree of global warming (IPCC 2022)

We need to produce more food with less water



Water productivity in agriculture measures the output (kg/ha) per unit of water consumed (m³/ha).

Measuring these two variables is not easy at appropriate scales for decision making

Satellites can help monitor these dimensions of water use and resources in cost-effective ways.

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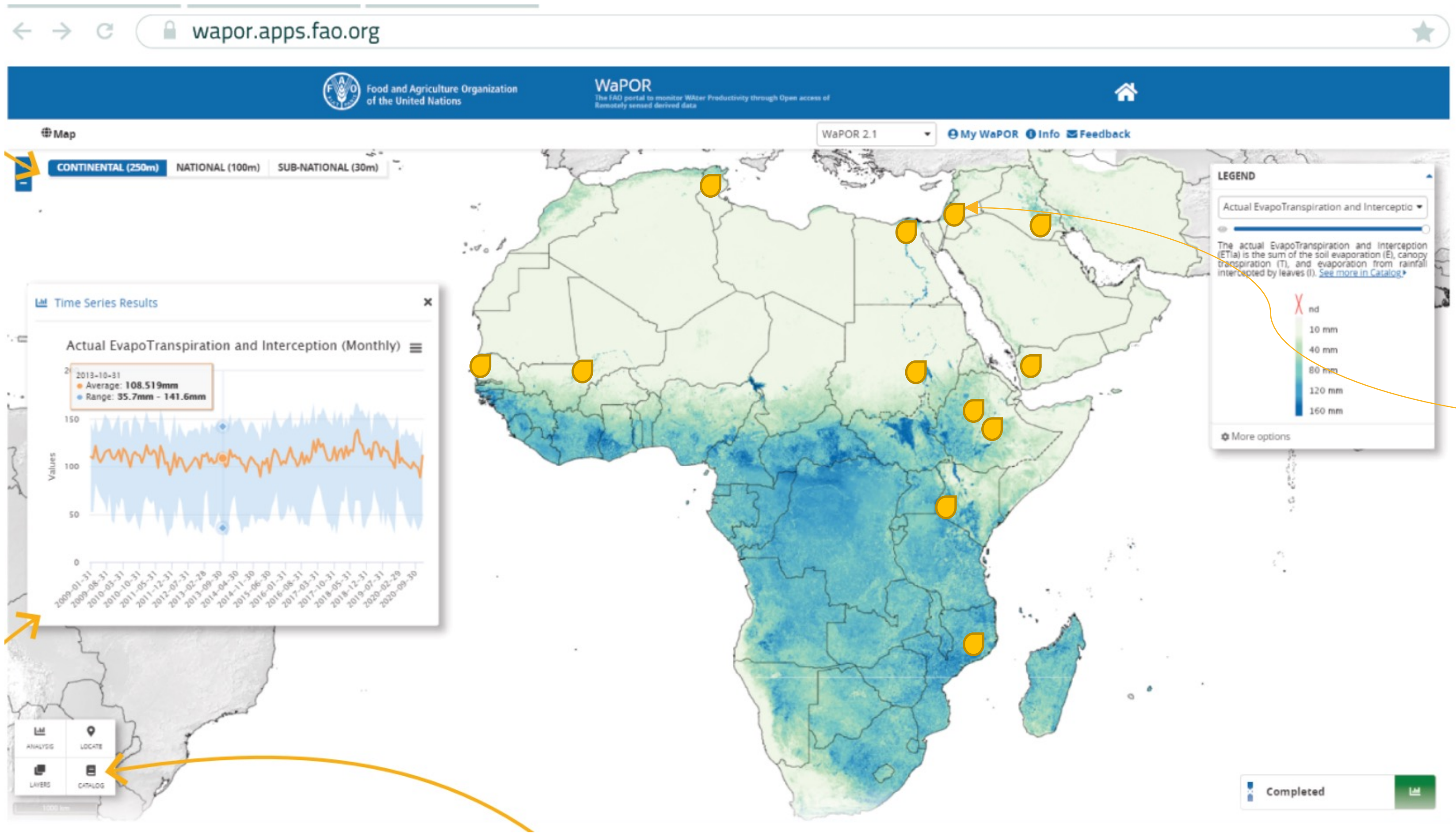
WaPOR provides actionable information ...



Ministry of Foreign Affairs of the Netherlands

IHE DELFT

IWMI International Water Management Institute

eleaf SPACE FOR GROWTH

…for different users

scale

Farmers and other end-users (app developers, agricultural entrepreneurs): advisory services

Irrigation scheme managers, WUAs, river basin authorities: monitoring water use and irrigation performance

Policy makers: water allocation strategies, water productivity targets, SDGs

- FAO Custodian Agency of 2 indicators: 6.4.1 and 6.4.2;
- **Only 86 countries** regularly report water use data since 2006, which allows for analysis of «decoupling» economic growth from water use.

SUSTAINABLE DEVELOPMENT GOAL 6

Clean water and sanitation

Ensure availability and sustainable management of water and sanitation for all.

SUMMARY TABLE

INDICATORS

6.4.1 6.4.2

6.4.1 Change in water-use efficiency over time	FAO
6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resources	FAO

“ **The main challenge for this indicator is therefore obtaining enough information to demonstrate increases in value added per unit of water withdrawn, especially in the poorest regions.** ”

Inter-agency and Expert Group on SDG Indicators (IAEG-SDG) will review indicator formulation

ICT applications

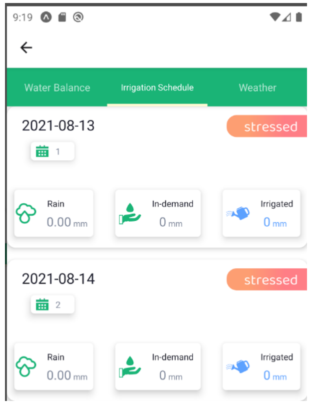
LARI-LEB

PlantVillage Nuru

IRWI

FAMEWS

FAO DSP



irey

INGC

There is a wide range of applications of WaPOR data that go beyond water productivity, facilitated by its availability through open geospatial formats and APIs.

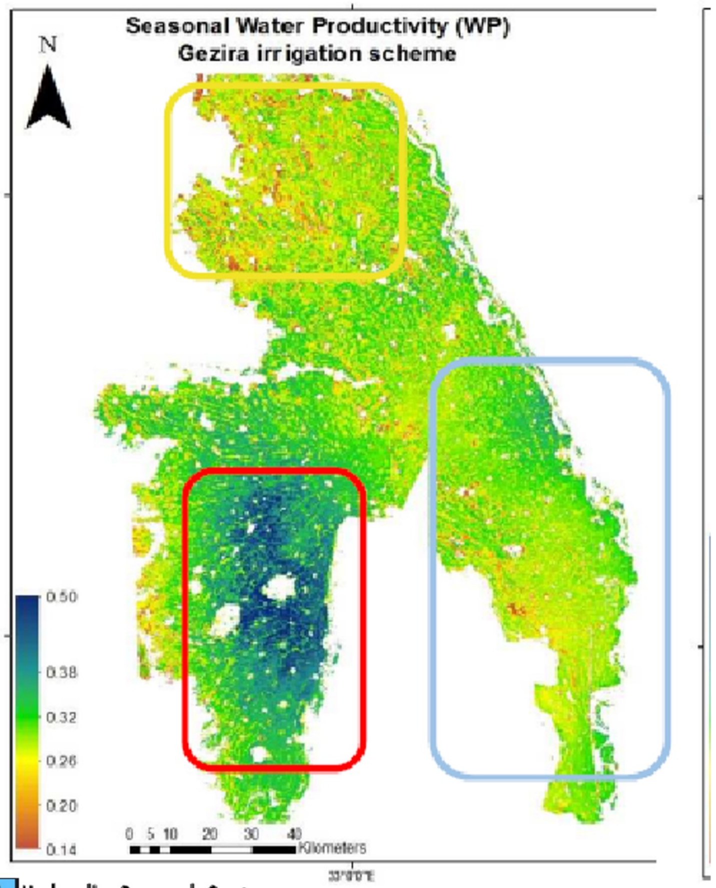
ICT-based solution (app) for irrigation scheduling advice

These app helps farmers know:

- how much water is required so that they can decide when and how much to irrigate and
- how healthy is the crop and predicted yield during the season.

Apps can use WaPOR data in combination with user's inputs and other data sources

Discussing irrigation performance



Hydraulics Research Center
مركز البحــــوث الهيدروليكية

In the Gezira irrigation scheme (Sudan) WaPOR data helps monitor how different zones are performing -> but spatial resolution is still a limitation with fields of 15 m width

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Knowledge based water management is high on the agenda

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THE WORLD BANK
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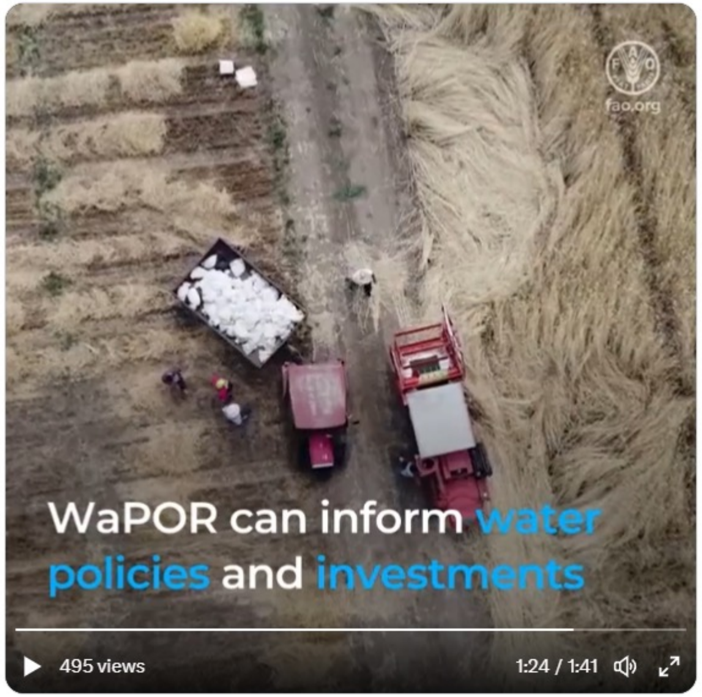
IRRIGATING FROM SPACE
USING REMOTE SENSING FOR AGRICULTURAL WATER MANAGEMENT

FAO INVESTMENT CENTRE

INVESTMENT BRIEF

With water becoming increasingly scarce and irrigated agriculture already accounting for 70 percent of global water withdrawals, governments around the world are supporting efforts to improve the performance of water use in agriculture. Improving water productivity is often the most important route for coping with increased water demand in agriculture (FAO, 2020). While the use of remote sensing to assess and monitor agricultural water productivity is not new, the time is ripe to scale up such technologies and use them for effective policy making, especially in irrigated areas where water is scarce. Remote sensing technologies use high spatial and temporal resolutions to estimate several agrohydrological variables across nested scales – from field to irrigation schemes to watershed. The Food and Agriculture Organization of the United Nations (FAO) and its partners have invested in developing databases and tools that apply remote sensing in agricultural water management, with a focus on low-income and data-scarce contexts.

This brief proposes concrete applications of the FAO-developed tool: WaPOR – Water Productivity through Open access of Remotely sensed derived data portal. It establishes the methodological framework used to estimate key variables that can assist decision-making on improving irrigation water management, such as irrigation water application and economic irrigation water productivity (EIWP). The results from a case study of the Bekaa Valley, Lebanon's most important farming region, show that the correct application of WaPOR combined with economic data can lead to better policy and investment decision-making, and more sustainable agricultural water management in water-scarce regions.



9:00 AM · Mar 22, 2023 · 3,443 Views

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WaPOR Version 3

bitbucket.org/cioapps/wapor-et-look/wiki/Home

Bitbucket

wapor-et-look

- Source
- Commits
- Branches
- Pull requests
- Pipelines
- Deployments
- Jira issues
- Security
- Wiki
- Downloads

FAO-SDLC / WaPOR ET Look / wapor-et-look

Wiki

wapor-et-look / **Home**

Welcome to the wiki of the WaPOR version 3 methodology.

WaPOR methodology

Version 3.0
10 May 2022

Achieving Food Security in the future while using water resources in a sustainable manner will be a major challenge for curr
available resources. Agriculture is a key water user and careful monitoring of water productivity in agriculture and exploring
with increased water demand in agriculture. Systematic monitoring of water productivity through the use of Remote Sensin

The FAO portal to monitor Water Productivity through Open access of Remotely sensed derived data (WaPOR) provides acc
data layers related to land and water use for agricultural production and allows for direct data queries, time series analyses,
agriculture.

The beta release of WaPOR was launched on 20 April 2017 covering the whole of Africa and the Near East region. WaPOR V
be released in January 2022. Each version of the data was improved based on extensive internal and external validation and

This document provides a detailed description of the processing chain applied for the production of the **WaPOR version 3**
at 100m (level 2) and 30m (level 3) resolution. References are included throughout the document so that additional informa

Wiki content

Getting started for Abbreviations and Definitions

Understanding the WaPOR pipeline for a general overview of the produced WaPOR database components, the Technical
processing applied, and the Code Repository with links to all relevant documentation.

Intermediate data components for detailed documentation on Albedo, fAPAR, Land Surface Temperature, Light Use Efficie

Data Sources for an overview of all input data (both model and sensor data) used to produce the (intermediate) data comp

WaPOR data components and methodology described in more detail and also includes the underlying methodology as v
(PCP), Phenology (PHE) Quality layers (QUAL), Relative Evapotranspiration (RET), Soil moisture (RSM), Total Biomass Product

References provides all literature references

What's new in Version 3

New inputs:

- (Ag)ERA5 meteo
- VIIRS
- Sentinel-2
- Copernicus DEM
- WorldCover land cover

Preparation of intermediates:

- VIIRS atmospheric correction
- Cloud masking
- Coefficients for albedo and fAPAR
- Updated statics
- Gapfilling and smoothening
- Thermal sharpening

Modelling:

- Soil moisture parameterization
- Tenacity factor

Data components:

- Extent
- Spatial resolution
- Delivery projection
- Relative Soil Moisture (RSM) added as beta product

Data production:

- Cloud processing
- Tile based processing

But more HR LST is needed

Fragmented landscapes are home to smallholder farmers who need better information and advices to cope with climate crisis.

Spatial resolution and frequency of observations of LST will help improve land and water productivity data where it is needed the most.

Building on a long-term collaboration

- MoU ESA-FAO
- ET4FAO (poster)
- Thermal sharpening (pyDMS) now integrated in WaPOR V3 and pyWaPOR (presentation tomorrow and poster)
- Ecostress used for validation
- Champion users and field data for WorldCover and WorldCereal
- Looking forward for the Copernicus Global ET product of CGLS
- Willing to integrate additional precursor LST products before Sentinel

THANK YOU!

wapor.apps.fao.org

wapor@fao.org

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