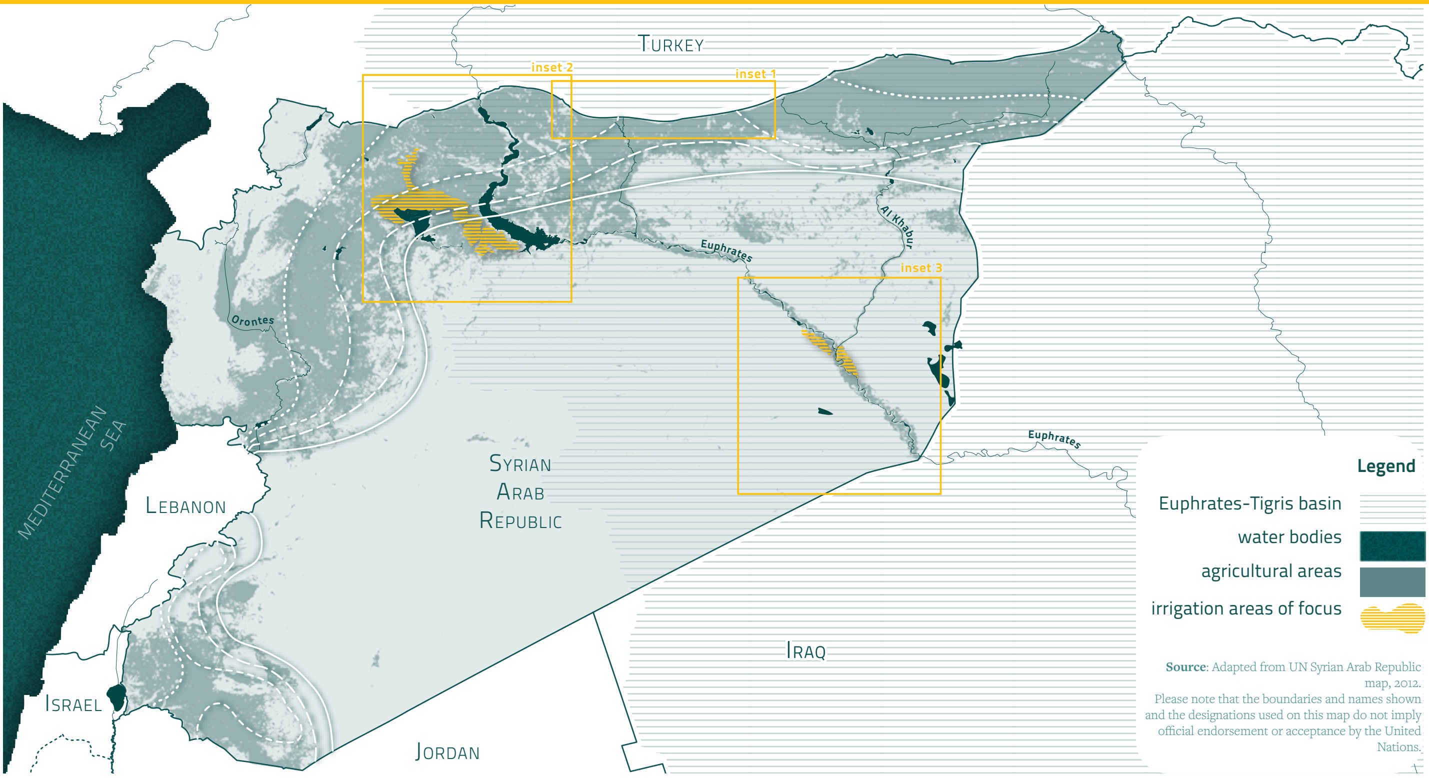
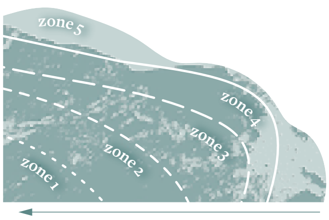
Food and Agriculture Organization of the United Nations

WaPOR for monitoring agriculture in conflict areas



Agro-ecological zones
(mainly defined by rainfall)



increasingly drier towards the center of the country

zone 1: steppes and desert, < 200 mm
zone 2: 200 mm - 250mm
zone 3: 250 mm (with 50% chance of less)
zone 4: 250 mm - 350 mm
zone 5: more than 350 mm of rainfall annually

An increasingly larger share of the Syrian agriculture had become irrigated into the first decade of the new millenium, supporting a growing population and a resolve to become more food secure. With the bulk of the land area being in semi-arid to arid climates, irrigation is vital practice in this sector, with as much as 23.4 percent of cultivated area in the Syrian Arab Republic being equipped for irrigation in 2010 (AQUASTAT, 2019).

Since 2011 up to today, the country has been affected by a crisis that has had a negative impact on all sectors of the economy, including agriculture. The Food and Agriculture Organisation (FAO) had estimated at USD 16 billion the financial cost of damage and loss in the agriculture sector between 2011 and 2016 (FAO, 2017), with irrigation infrastructure being heavily affected. 2016 marked a record low in agricultural production with 40 percent less food than was produced before the conflict (WFP, 2016).

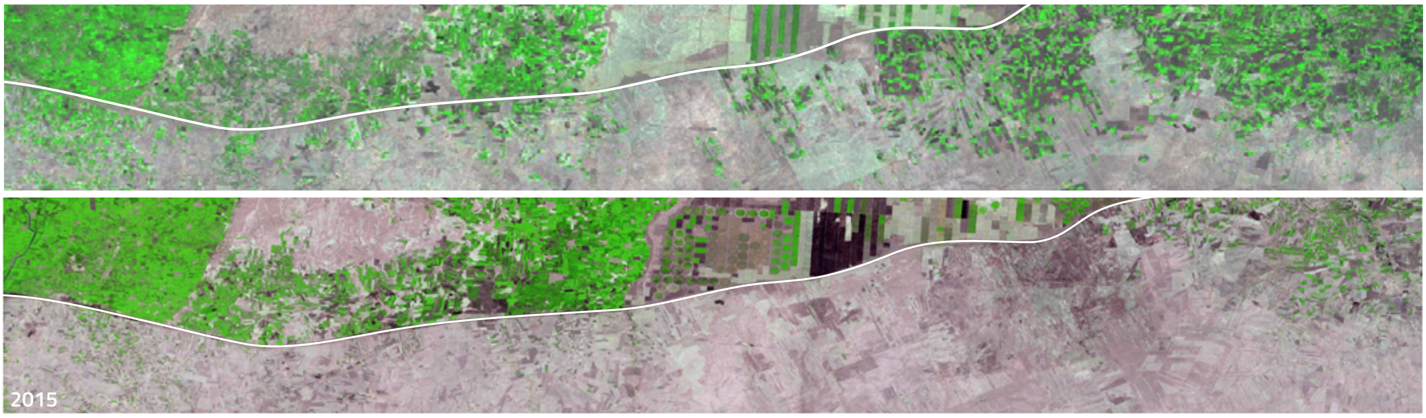
During a conflict, it might not be feasible or safe to carry in-situ monitoring of agricultural activity or damage assessment. Even outside of a context of conflict, it can be a resource-intensive process, that can perhaps only take place every few years. That is one of the reasons why earth observation products can provide a viable alternative or complement to already existing efforts to monitor different aspects of agriculture. This case study will demonstrate the role that near real time freely available WaPOR data can play in helping understand the impact that conflict has on agricultural production.

Deir Ez-zor is a governorate that, given its arid climate, relies heavily on the water from the Euphrates river for most of its needs, including agriculture. Though its economy centers mainly on oil production, agriculture has always been a prominent sector with the production of wheat, cotton, sesame and vegetables. Aleppo is a more traditionally agricultural governorate, with high reliance on water from the Euphrates as well. This case study seeks to focus on the two largest irrigation sectors in Deir Ez-zor centre and on irrigation schemes near Maskanah, in Aleppo governorate, to understand, using WaPOR data, how they have been affected over the conflict years. It fits in the context of and parallels an assessment of the damages in the irrigation

Inset 1 (on next page): stark contrast in agricultural activity at the Northern border of the Syrian Arab Republic and Turkey in August 2015 (top); a border area that is usually much greener and more lush on the Syrian side of the border as can be seen from satellite imagery from August 2010 (bottom). (source: Sentinel and Landsat)

systems in Syrian Arab Republic during the conflict carried by the office of FAO Syria with a national team of experts from the Ministry of Water Resources (MoWR) and General Organization of Remote Sensing (GORS).

Inset 1

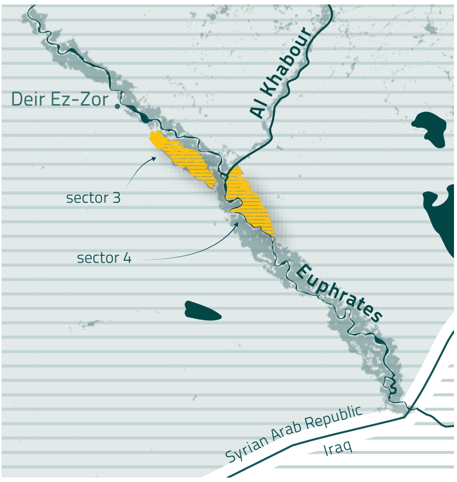


Changes in Actual Evapotranspiration

The AETI layer is available at 250 m, 100m and for certain areas at 30 m resolution for each year, month and dekad since 2009. The resolution used in this particular case study is 100 m.
The **E**, **T** and **I** components are available separately.

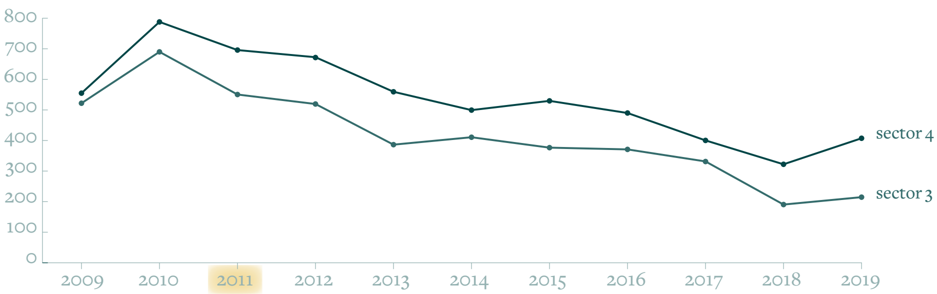
The Actual Evapotranspiration (AETI) layer on WaPOR quantifies the amount of water that is "lost" into the atmosphere from evaporation (from the soil for example), transpiration (as a result of plant metabolic activity) and interception (water that accumulates on the surface of leaves and subsequently evaporates). This layer allows us to identify where agricultural activity might be occurring, that is, in this case, the areas that are actively being irrigated.

Inset 3



: year of start of the conflict

Average yearly AETI in the sectors near Deir Ez-Zor(in mm/ha):



That is especially the case in Deir Ez-Zor, where it barely rains and all agriculture is irrigated. In this case, AETI is an excellent indicator of irrigation activity.
In the two irrigation sectors near Deir Ez-Zor, the yearly AETI has been decreasing steadily since it peaked in 2010, with only a slight increase in 2019, which is in agreement with reports that the conflict affected the productive capacity of the sectors and their farmers. Yet, those trends hide spatial dynamics that are worthwhile highlighting :

Percentage change in yearly actual evapotranspiration

-100 0 +100

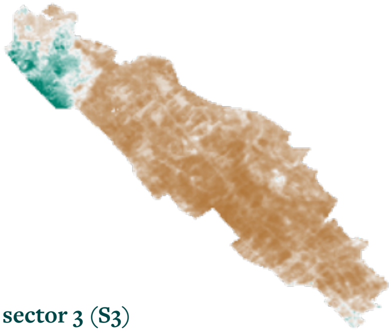
› **between 2011 and 2014**
(halfway point of the conflict)

In **S4,** some areas remote from the river but close to the waterway that borders the East side of the sector have seen an increase in AETI, in well defined clusters.
In **S3,** we notice a sharp overall decrease in the AETI in the northern part of the sector.

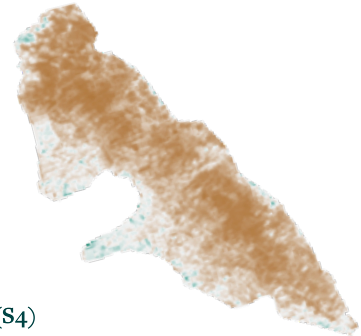
sector 3 (S3) **sector 4** (S4)

› between 2014 and 2018
(end of the conflict)

In **S4**, while AETI remained somewhat stable near the river, with some slight increases near a waterway in the northernmost part of the river, the rest of the sector saw a reduction in AETI, denoting a reduction in irrigation. For **S3,** improvements can be seen in some areas the northern part of the sector where the steepest AETI decline was noted halfway into the conflict compared to before.



sector 3 (S3)

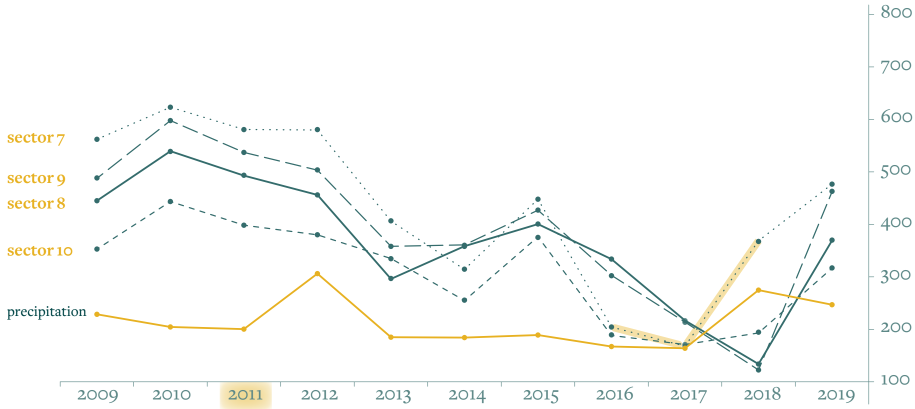


sector 4 (S4)

While the schemes in the Deir Ez-Zor display an overall downward tendency with some localised improvements, in Aleppo, the picture is much more variable when it comes to recovery from the conflict.

Inset 2

Average yearly AETI and precipitation in irrigation sectors in Aleppo (in mm/ha):

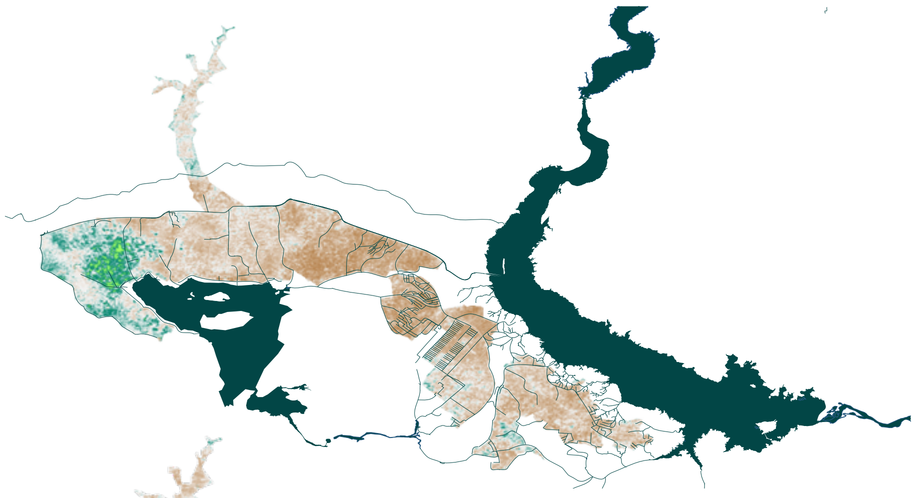


Percentage change in yearly actual evapotranspiration

-100 0 -100 + 100

› between 2016 and 2017

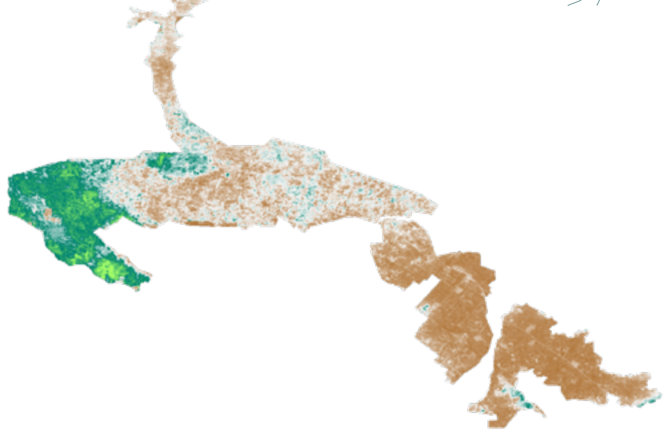
Despite the overall decline in AETI displayed by the time series between 2016 and 2017, the Easternmost part of sector 7 actually displayed an increase in evaporative activity which signals to us that agriculture was carried out there more intensely than in 2016.



+500

› between 2017 and 2018

The time series displays a significant increase in AETI over sector 7, while all other sectors were either in strong decline or only slight increase (sector 10, North of sector 7). Even within sector 7, the increase was not homogenous: evapotranspiration increased in many parts of the sector, especially in the Easternmost part closer to Lake Al Jabbul. Sector 7 showed the most drastic augmentation in measured AETI.



Remarks on changes in AETI

The precipitation layer, at 5 km resolution, is available at the continental level for each year, month, dekad and day since 2009.

It matters to note that the Aleppo irrigation sectors are situated in an area of the Syrian Arab Republic where it rains slightly more than in Deir Ez-Zor (consult the main map on page 1 to see the different agro-ecological zones, mainly based on rainfall), and that needs to be taken into consideration when attempting to understand what is happening on the ground. Looking at AETI (water loss from fields) at a finer temporal resolution (monthly or finer) in conjunction with the precipitation (water input aside from irrigation) data always contributes insights into the levels of evapotranspiration, or plant activity. Using evapotranspiration to track agricultural activity and quantify it is ideal for semi-desertic areas where agriculture is mostly irrigated. Yet, we are able to parse out important dynamics regarding the evolution of these agricultural areas during the conflict.

Despite some slight improvements in some areas of the irrigation schemes in Deir Ez-Zor, the irrigation infrastructure has not yet been rehabilitated. Those improvements can be attributed to a host of possible reasons, including, that some farmers might have tried to dig wells in an attempt to resume production on their own, without relying on the irrigation infrastructure that is largescale. That is unfortunately not a viable solution in the medium to long terms as the groundawater in the area is saline. In Aleppo, however, FAO participated in the rehabilitation of four pumping stations in the sector 7 (refer to inset 2). Uncoincidentally, that is the sector of the irrigation scheme that showed the most improvements in AETI levels after 2016.

In sum, earth observation data products can provide us with invaluable and frequent information about areas of difficult access, but there is still a level of knowledge of the place and information about its dynamics that is required to extract from them the right insights and interpretations.
WaPOR AETI data, as well as other layers, is available at a wide range of temporal and spatial scales that constitute a cost-effective asset to understanding present and past dynamics of places in which normal agricultural data collection is compromised or of questionable accuracy.

Find out more about WaPOR data at https://wapor.apps.fao.org/catalog/WAPOR_2/1

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