



Climate change its causes & consequences

A general report showing the situation of climate change phenomena and its impacts on vital development sectors in north and east Syria.

This report clarifies the impact of increase greenhouse gases emission & temperatures on precipitations and river flooding, also illuminate drought zones and its effects on partial ecosystems by showing its indicators and statistics from AANES authorities and other international and regional open source.

CRISES OVERVIWE:

The overall factors of climate change have affected the various aspects of economic and social life, as well as caused the deterioration of partial ecosystems, and resulted in many negative and abnormal phenomena that burden local communities and their administration with an extra burden that is difficult to bear or deal with.

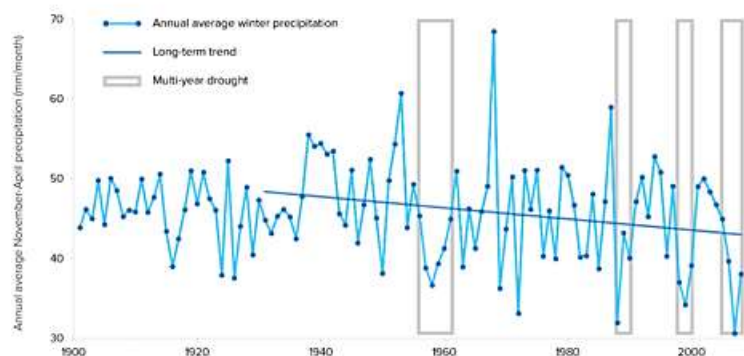
Indicators of the intensification of climate change phenomena are summed up in the succession of droughts. The increase in temperatures and the decrease in rainfall, and thus the decrease in the moisture of agricultural soils, causes an increase in the risk of erosion, which has led to a decline in vegetation cover, a decrease in the flow of rivers and water courses, and a decrease in groundwater levels.

In addition to natural phenomena, human interventions on the environment often cause its deterioration. Especially if the possibilities of these societies are limited and their options are restricted.

A decade of war in Syria has produced many activities that help deepen the climate crisis. The increase in the emission of greenhouse gases caused local warming and the entrapment of rain in the clouds. As for the destroyed and dilapidated infrastructures, they were not able to distribute benefits and provide services in the required manner, which prompted people to adopt old methods that pollute the environment in order to meet their daily needs of electricity, heating, water, sewage and others.

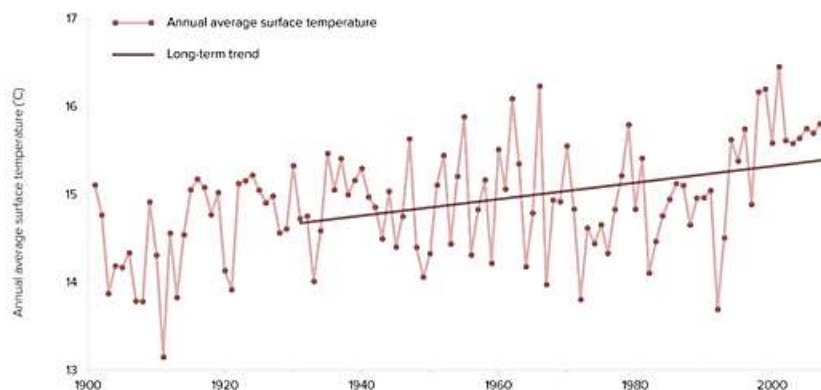
Rainfall (1901 - 2008)

Precipitation patterns are changing in the Fertile Crescent. Rainfall from November through April, when most of it occurs, has decreased 13% since 1931. The gray boxes represent multi-year droughts, which are defined as three or more consecutive years when precipitation is below the century-long average.



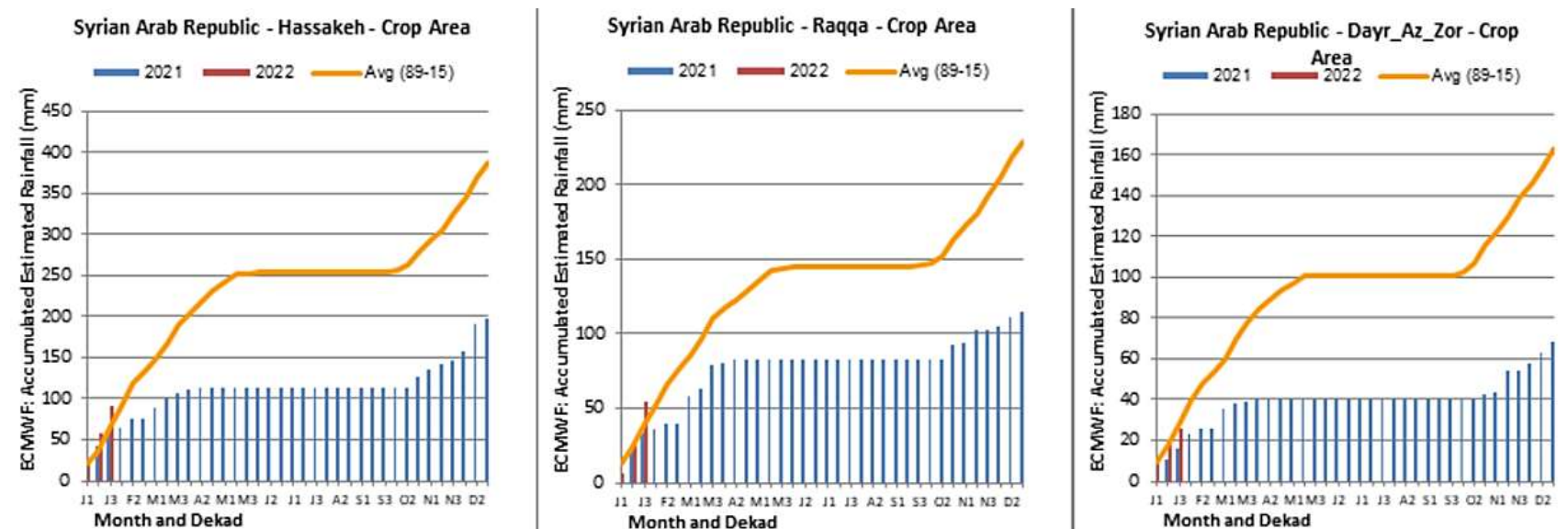
Temperature (1901 - 2009)

Temperature has shown a long-term increasing trend in the Fertile Crescent. Every year from 1994 through 2009 was warmer than the century-long average for the region.



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The areas of NES are part of the Fertile Crescent, which was previously studied and it was found that the observation of precipitation and temperatures for the period of time from 1900 to 2009 showed that the precipitation decreased in the basins forming the crescent, especially the Euphrates basin, which constitutes 98.8% of the areas of NES (53,300 km²). It also showed that temperatures are constantly increasing, which increases the rates of warming and increases the population's consumption of energy for irrigation and cooling purposes, as well as its impact on the availability of water suitable for the agricultural balance.



And no region of NES was able to reach the precipitation in 2021 or 2022 to the average levels calculated for it, and on the basis of which it was classified into the areas of agricultural stability. It is noted above that during the year 2021, none of the monthly precipitation in the three regions (Al-Hasakah, Raqqa, Deir ez-Zor) did not reach the observed average rate.

CLIMATE CHANGE CAUSES:

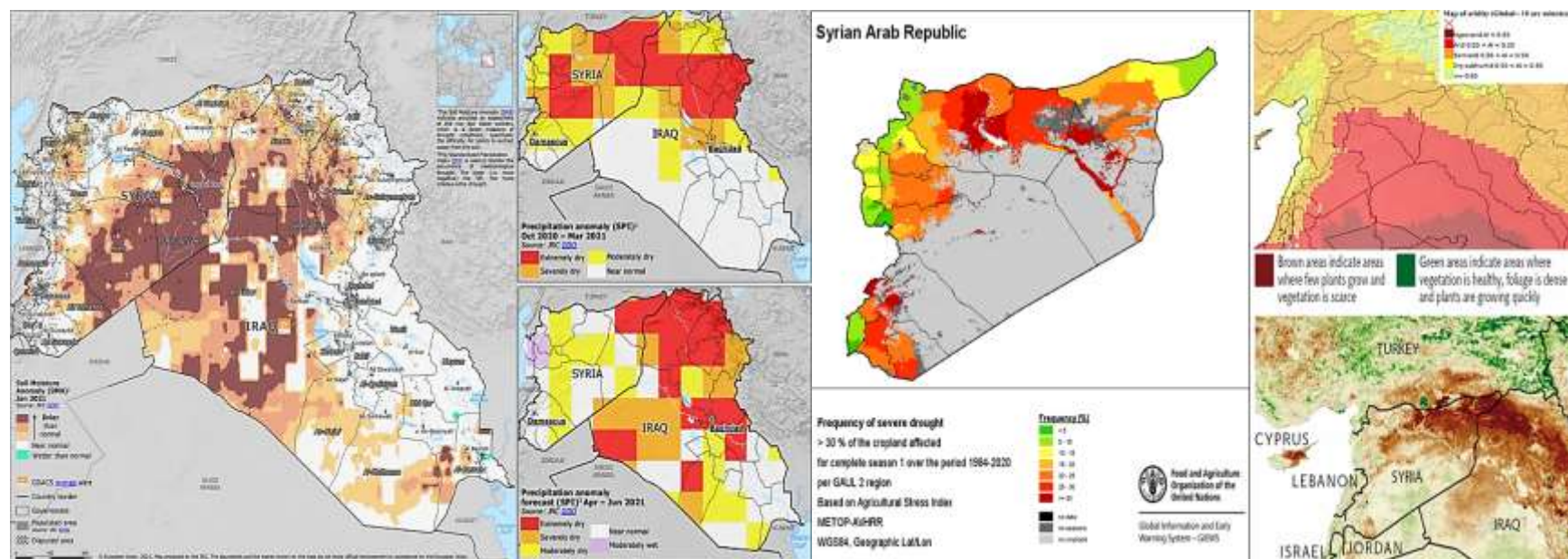
One of the most important reasons behind climate change is the decrease in precipitation, which is evident in the attached map prepared according to the Standardized Precipitation Index (SPI). This in turn reduces the relative moisture of the soil and exposes it to erosion that causes sandstorms in the presence of strong winds. It shows below that the soils of the NES region suffer from severe to semi-severe drought. According to the Soil Moisture Anomaly index (SMA).



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As dry lands maps prepared by AQUASTAT-FAO are divided according to the Aridity Index (AI) into hyper arid, arid, semi-arid, dry subhumid, and humid, we noticed that most of the land area of NES regions is located in the arid and semi-arid region, in which the aridity index is between 0.5-0.2. or between 0.2-0.05.

And according to the Frequency of Severe Drought standard, which studies a period of time ranging from 1984 to 2020. It is noted that the frequent periods of drought in the regions of NES have increased greatly during the four studied decades, and this is strong evidence that the region is under the influence of climate change phenomena.

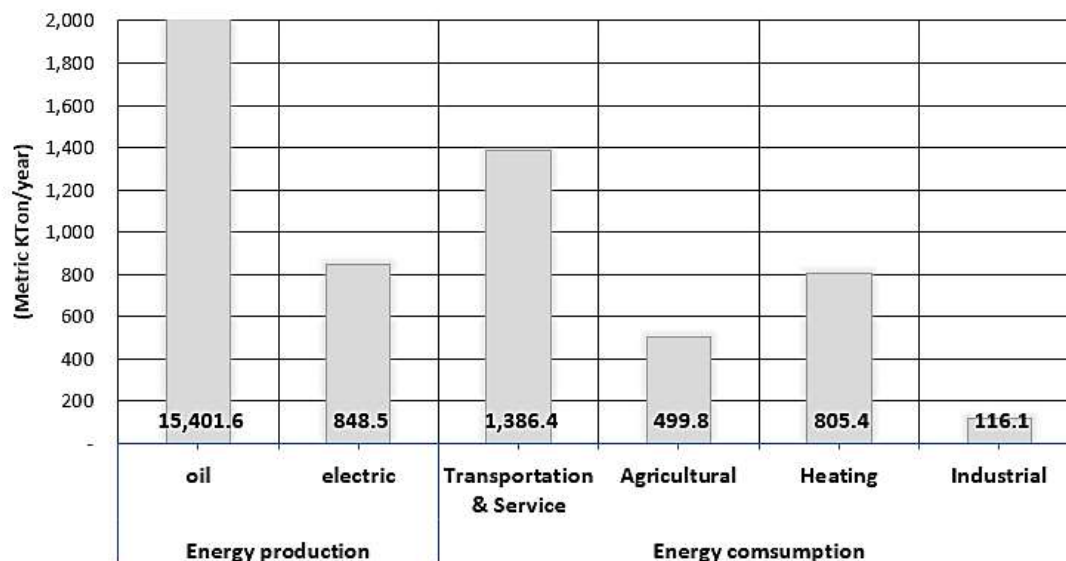


The increase in greenhouse gas (GHG) emissions can be considered one of the most influential factors in exacerbating the phenomena of climate change. This has increased dramatically in areas of NES, as a result of the ongoing conflict, the destruction of infrastructure, and the poor supply of residential communities with basic materials necessary for living. The total GHG emissions in 2021 amounted to an approximate value of 19,057.9 metric kilotons of carbon dioxide equivalent (CO₂eq) for the various energy-producing and consuming activities, and with an estimated population of 4,214,022 people that calculated by **comparative statistical analysis methods** depending on many population statistical studies, HDC



Organisation found that the per capita greenhouse gas emissions are estimated at 4.52 metric tons/capita per year, that exceed the world average value 4.2 metric tons/capita.

GHG's emission as Co2eq from Energy of NES area in 2021



As a result, the equivalent carbon footprint of NES areas reached approximately 19,057.9 kiloTons in the year 2021. With an estimated population of 4,214,022 people, the per capita greenhouse gas emissions are estimated at 4.52 tons/capita*year.

CLIMATE CHANGE CONSEQUENCES:

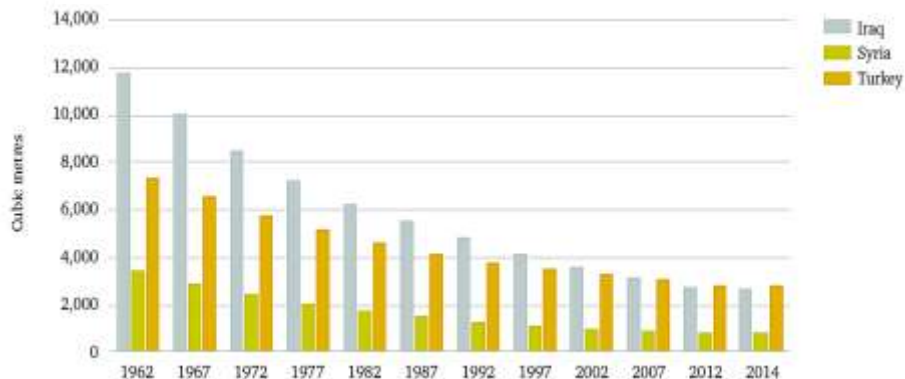
IMPACTS ON WATER AVAILABILITY:

According to UN the per capita share of water is estimated at 1,000 cubic meters annually and below it, is considered below the water poverty line. During the past two decades, because of climatic change factors and regional interventions on water courses, the gap between water resources and the demand for it has increased, and with the increase in demand and the mismanagement of resources and the impact on that of political conflicts in the region that led to a decrease in The per capita share is significantly as happened in Syria.

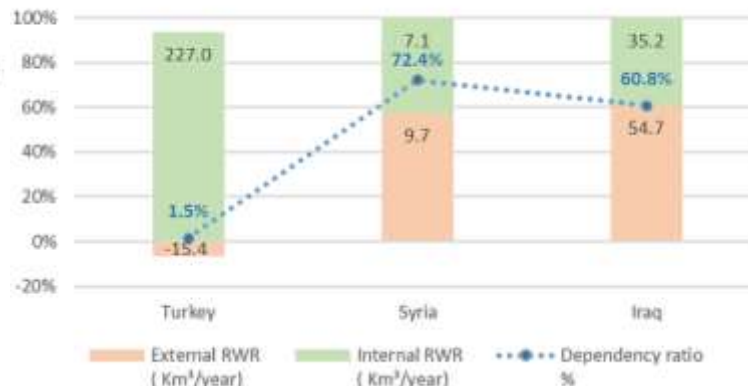


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Per capita share of water of the three-riparian country of Euphrates & Tigris

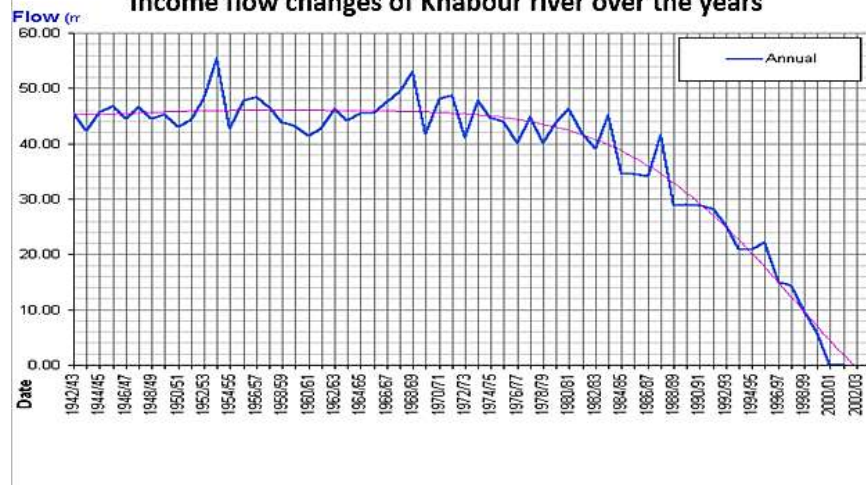


Water dependency of the three-riparian country of Euphrates & Tigris

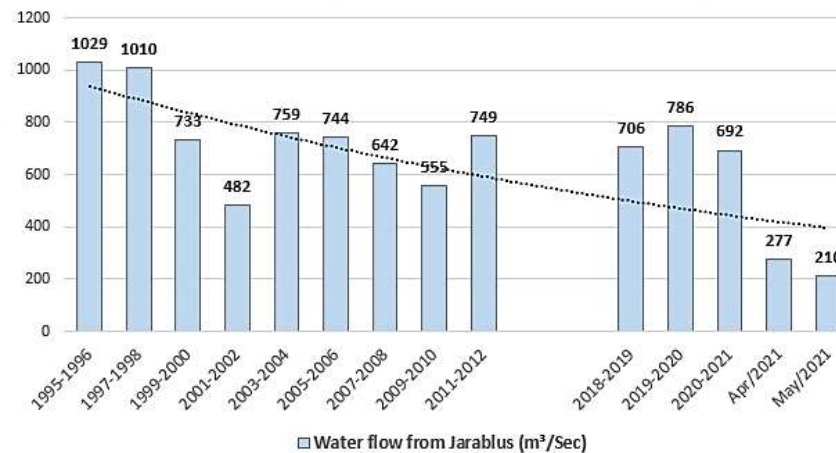


The amount of surface flow entering Syria from abroad is estimated at 28.52 km³/year, of which the Euphrates River constitutes 15,768 km³/year when Turkey commits to pass an annual average flow of 500 m³/sec (55.28% of the surface flow coming from outside the country of which up to 58%, or 290 m³ /s), must be passed to Iraq, according to the 1990 agreement between Syria and Iraq.

Income flow changes of Khabour river over the years

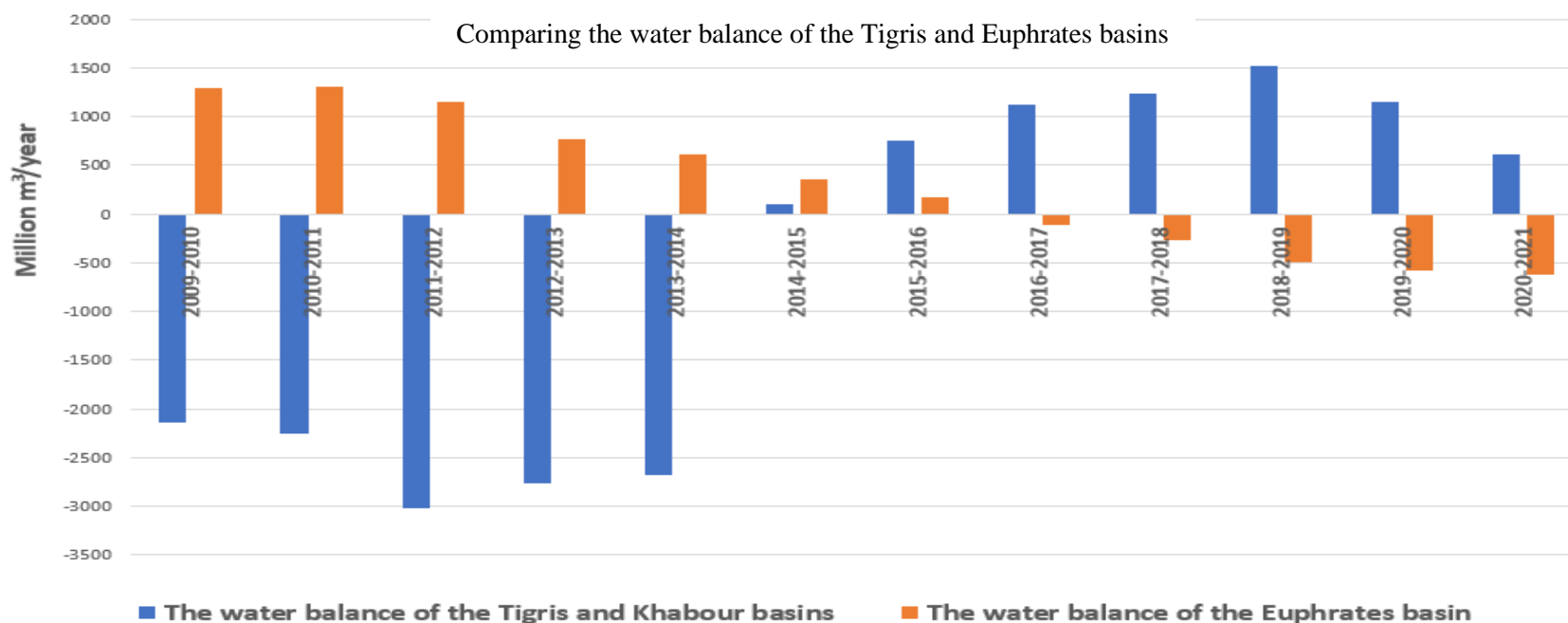


Income flow changes of Euphrates river over the years



But nowadays the incoming flow of the Euphrates River from Turkey decreased. Where it was with an annual average value of 692 m³/s for the year 2020 and decreased to reach a value of 377 m³/s as an annual average for the year 2021.

Also, it was expected to take advantage of the natural resources of the Khabour River to irrigate 150,000 hectares from Ras Al-Ain to Al-Sour within the Khabour River project, but all projects stopped investing due to drought. That can define by the average flow income, which was in 1998/99 (9.82 m³/sec) and become (5.93 m³/sec) in 1999/2000 then drought totally at 13/4/2001 converting to seasonal river flow not exceed 3 m³/sec.

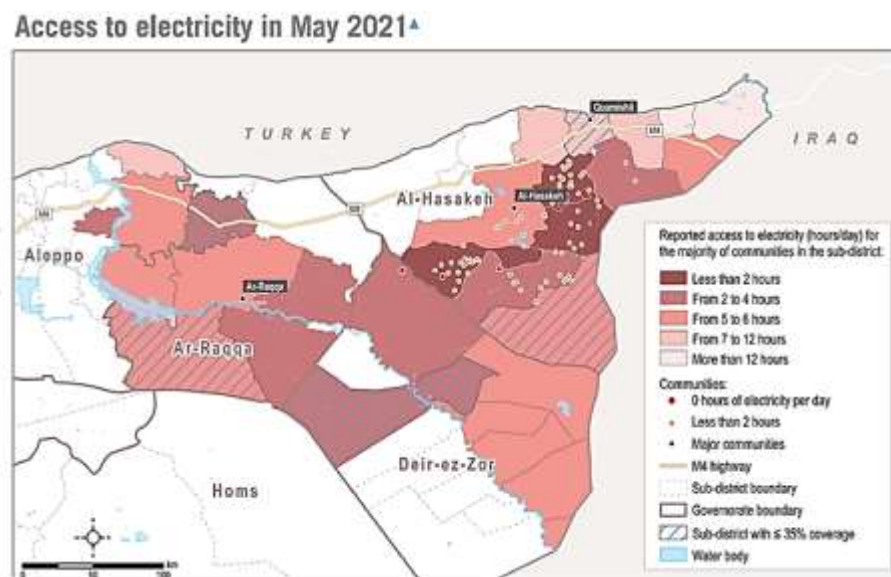
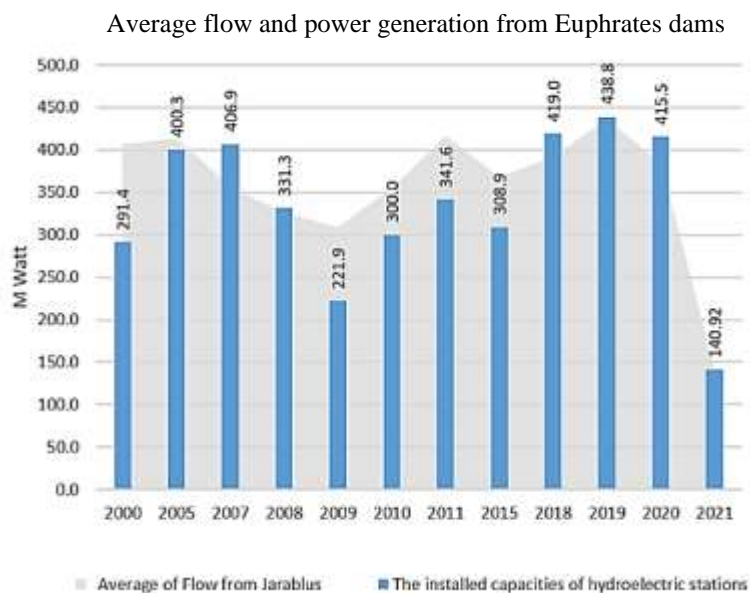


Finally, and by comparing the water balance of the Tigris and Euphrates basins, we note that **the Tigris Basin** was suffering from a deep deficit in the availability of water resources necessary to cover the total needs of its economic and social activities, but, this deficit began to disappear with the beginning of 2015 and the reason behind this is the significant decline in the areas of irrigated agricultural lands as a results of drought of Khabour river and non-implementing of the Tigris river project, As for **the Euphrates basin**, it was abundant with water until the same year, but its resources deteriorated after that due to a group of factors, the most important of which is the emergence of the results of the acceleration in the implementation of the GAP projects, in addition to the military actions and the destruction of the infrastructure witnessed by them.



IMPACT ON ELECTRICITY SUPPLEMENT:

Low-income flow of Euphrates River to Syria makes its three dams enable to produce electricity due to inappropriate water flow & head. This, in turn, increased the use of diesel generators to secure access to electricity within the NES human settlements, which depend more than 81% on hydroelectric stations in the current energy mix. Many water pumping stations were also out of service, whether for irrigation or drinking purposes. This in turn led to the decline in agricultural and livestock production and the deterioration of the economic value chain. This led to an increase in the emission of greenhouse gases and the deterioration of more ecosystems.

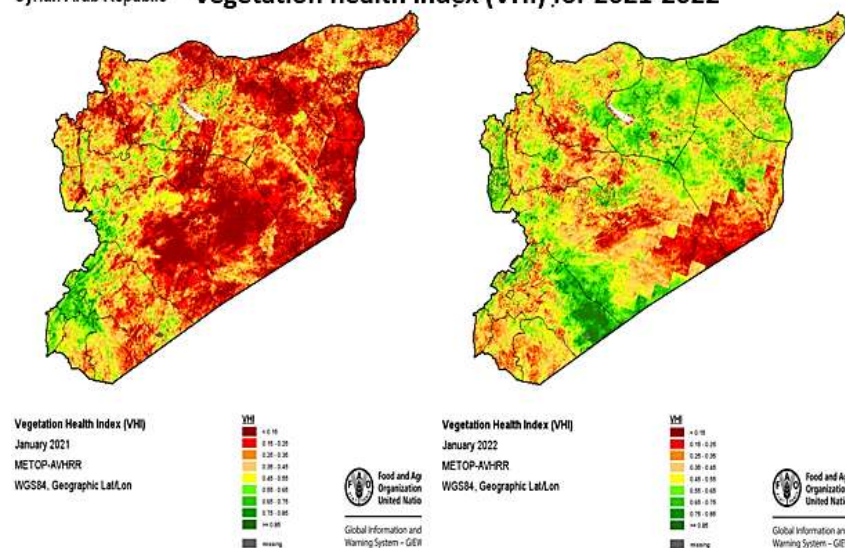


IMPACT ON VEGETATION:

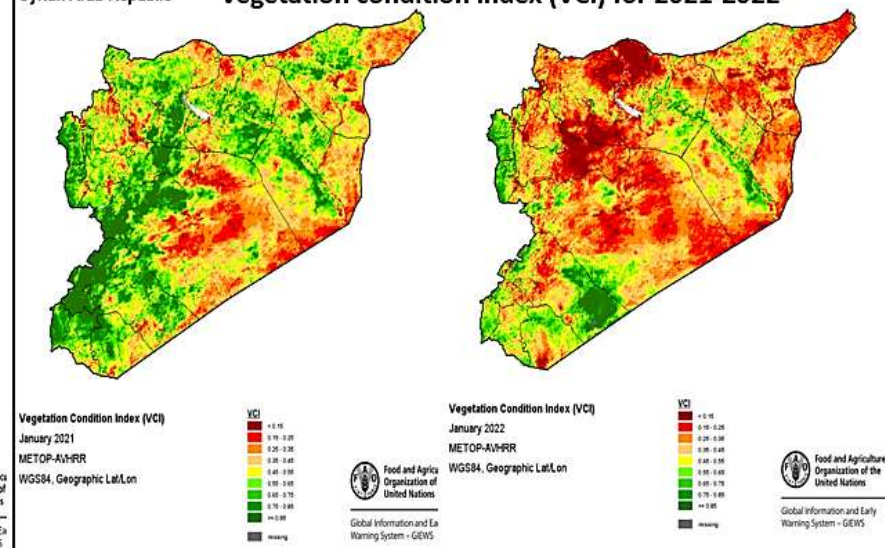
These factors combined eventually led to the decline of vegetation cover. Which is one of the most important factors for the stability and balance of ecosystems, as it maintains the presence of low and permissible percentages of greenhouse gases emitted from various activities and directly affecting the increasing severity of climate change phenomena, especially local warming.

So as shown below, you can see the Vegetation health index (VHI) for 2021-2022, and the Vegetation condition index (VCI) for 2021-2022 in a very low percentages in all Syria, especially in NES.

Syrian Arab Republic **Vegetation health index (VHI) for 2021-2022**



Syrian Arab Republic **Vegetation condition index (VCI) for 2021-2022**



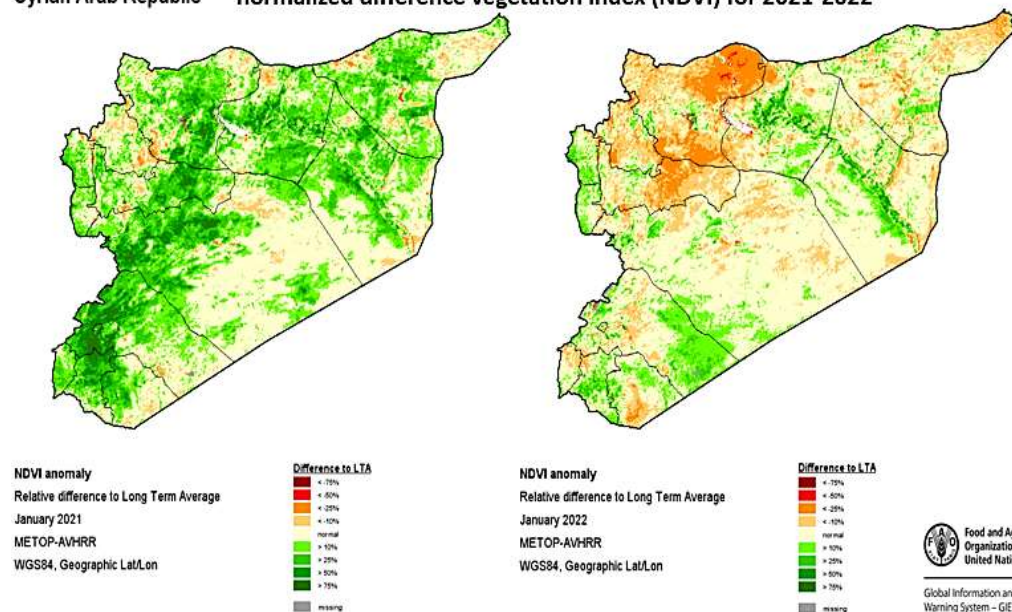
As inclusion the farmers and its farms faced a hard situation imposed on them and harshly affected its economic activities, not only socio-economic sector has damaged, all ecological component has been deteriorated from this water crises, air, soil, human, livestock, and vegetations, as we see blow the NDVI (Normalized Difference Vegetation Index) was below -10% value in 2021, but become worse in 2022 reaching to -25% value and in some areas was under -50%.



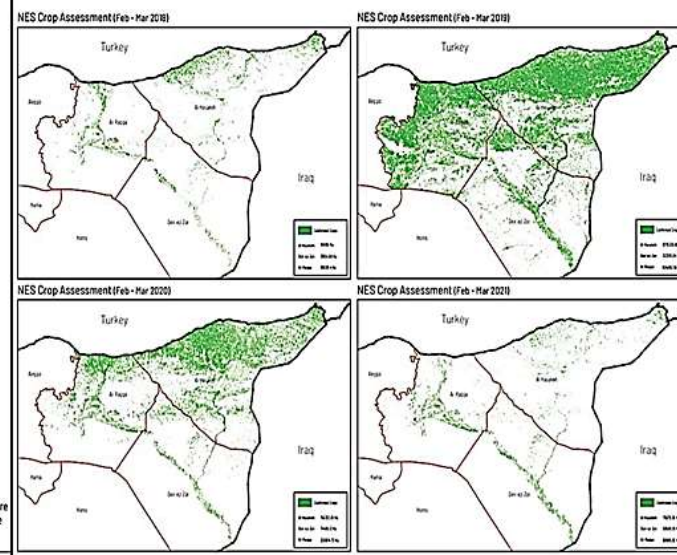
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As shown in the attached below maps, the growth of vegetation cover for crops for the past four years (NES crop assessments from 2018 to 2021), showing the distribution of cover and its difference depending on rainfall, which has become difficult to predict and severe drought years have become more abnormal than before.

Syrian Arab Republic normalized difference vegetation index (NDVI) for 2021-2022



NES crop assessments from 2018 to 2021



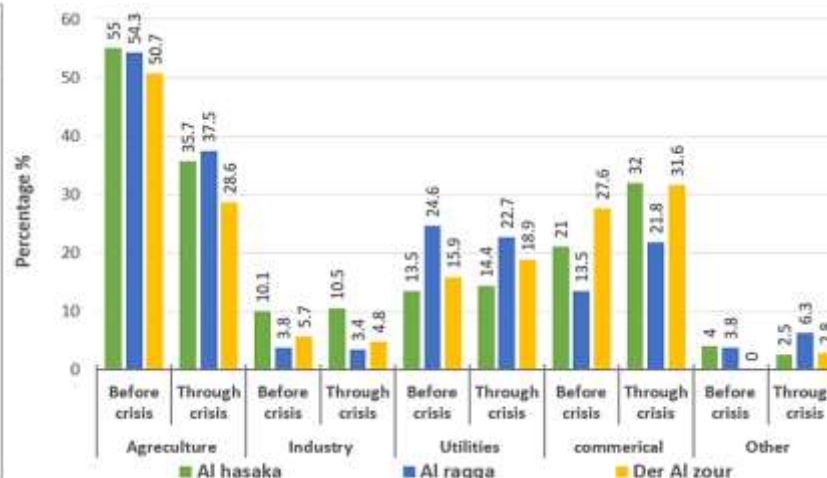
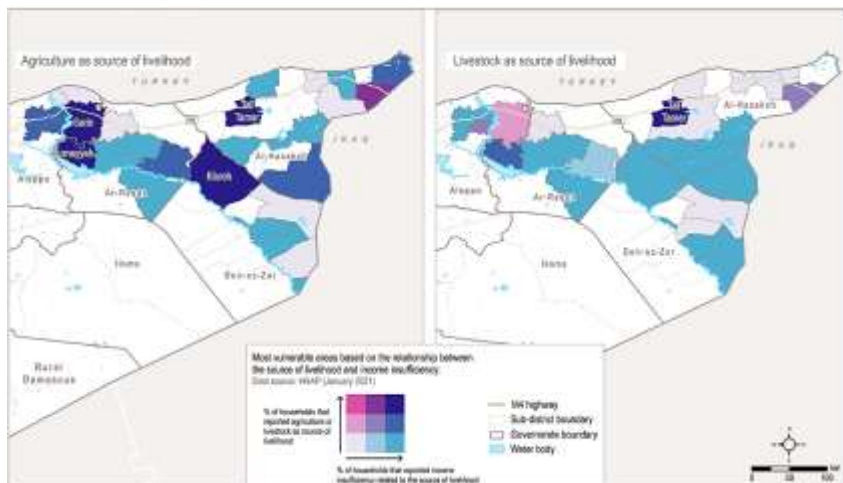
Food and Agriculture Organization of the United Nations
Global Information and Early Warning System - GIEWS

It's important to note that the NDVI map above calculated as relative difference to Long Term Average (LTE) of NDVIs anomaly from many year ago.

IMPACT ON AGRICULTURE AND LIVESTOCKS:

Agriculture is one of the most influential sources of local income in the internal economy of NES. The percentage of dependence on agriculture has continued to exceed all dependence rates in other economic sectors before and after the crisis, as it decreased in Al-Hasakah region by 35% and still declining due to drought.

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Drought conditions destroyed large areas of rainfed crops resulting in significant loss of income for farmers in addition to the impact of barley crops on the availability of animal feed which led to high livestock mortality rates already in 37% of the (Al-hassakah, Raqqa, Dair ezzor) communities assessed in 2021.

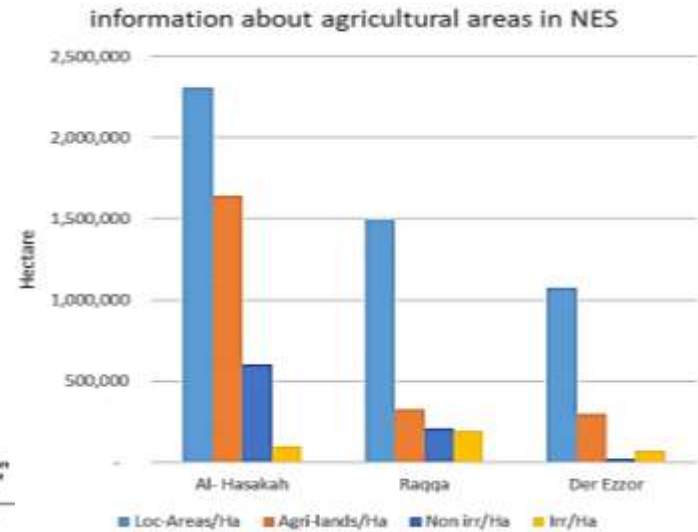
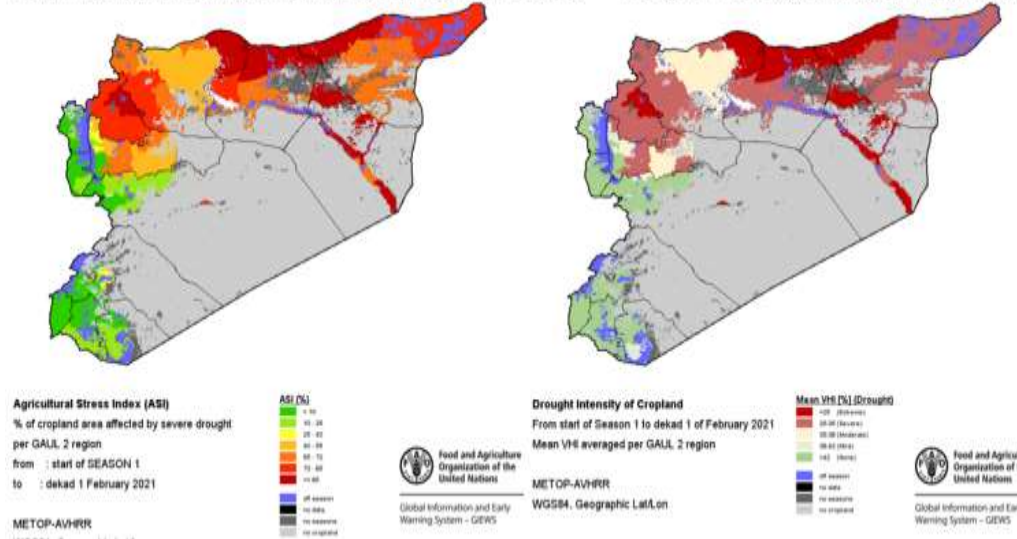
| Some information about livestock in 2021 | | | | | | | | |
|--|---------|-----------------|------------------|-----------------|-----------|-----------------|-----------------|---------------------|
| location | cattles | Reduction ratio | sheeps and coats | Reduction ratio | chickens | Reduction ratio | Total livestock | Avg Reduction ratio |
| Al Hasakah | 38,662 | 61% | 1,545,994 | 44% | 2,412,000 | 32% | 3,996,656 | 46% |
| Raqqa | 9,300 | 48% | 699,200 | 28% | 1,920,000 | 26% | 2,628,500 | 34% |
| Der Ezzor | 77,200 | 57% | 875,220 | 31% | 316,000 | 40% | 1,268,420 | 43% |
| Manbij/Kobani | 23,050 | 36% | 232,556 | 23% | 1,850,000 | 23% | 2,105,606 | 27% |
| Total North East Syria | | | | | | | 9,999,182 | 37% |

According to FAO datasets and maps below, you can see **Agricultural stress index (ASI) for 2021** is so high in NES areas. Where all of its regions recorded values above 55% and many of them record the value above 85%, and this shapes a realistic danger on food security and economic activities those following agricultural activities, Which portends large displacement movements from the countryside towards the cities, causing greater pressure on their infrastructure, and will also create a lot of unemployment among young people and reduce the purchasing power of families who depend on the returns of agricultural lands.



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Syrian Arab Republ Agricultural stress index (ASI) for 2021 Drought intensity of cropland for 2021



| Some information about agricultural areas and crops in NES | | | | | | | | | |
|--|------------------|------------------|-------------|------------------|-------------|----------------|----------------|----------------|----------------|
| Location | Loc-Areas/Ha | Agri-lands/Ha | % from Area | Planted lands/Ha | % from Agri | Irr/Ha | % from planted | Non irr/Ha | % from planted |
| Al- Hasakah | 2,309,900 | 1,640,713 | 71% | 702,125 | 43% | 100,235 | 14% | 601,890 | 86% |
| Raqqqa | 1,493,900 | 328,491 | 22% | 400,235 | 122% | 190,325 | 48% | 209,910 | 52% |
| Der Ezzor | 1,077,700 | 300,961 | 28% | 90,325 | 30% | 70,213 | 78% | 20,112 | 22% |
| Manbij/Kobani | 448,500 | N/C | N/C | N/C | N/C | N/C | N/C | N/C | N/C |
| Total NES areas | 5,330,000 | 2,270,165 | 43% | 1,192,685 | 53% | 360,773 | 47% | 831,912 | 53% |

The table shows in 2021, agricultural lands was formed 43% of total NES areas, and from them only 53% was planted land, this percentages illuminate that the farmers couldn't plant their land duo to varies reasons related to water availability, suit Fertilizer providing, also seeds quality and others factors such as instability situation.

In April 2021 the Global Drought Observatory (GDO) issued a drought warning for eastern Syria as the latest FAO report on rainfall analysis in Syria predicted that the lack of rainfall associated with the climate crisis will have severe consequences, setting the country on a path to becoming a security hotspot. climatic. Future droughts will increase and intensify, creating more problems for agriculture and communities as water levels dropped down, both in rivers and groundwater sources.

