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Original
Drought in Piemonte (NOAA-STAR data) / Sparavigna, A. C.. - ELETTRONICO. - (2021). [10.5281/zenodo.5515204]

Availability:
This version is available at: 11583/2924832 since: 2021-09-18T10:40:39Z

Publisher:
Zenodo

Published
DOI:10.5281/zenodo.5515204

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12 October 2024

Drought in Piemonte (NOAA-STAR data)

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Here we show and discuss data from NOAA STAR, the Center for Satellite Applications and Research of the National Oceanic and Atmospheric Administration, USA, about the drought in Piemonte, Italy. Data are evidencing that year 2017 was characterized by prolonged drought and that it was similar to years 2003 and 2006, as previously discussed in literature. Drought warning for 2021 is also considered.

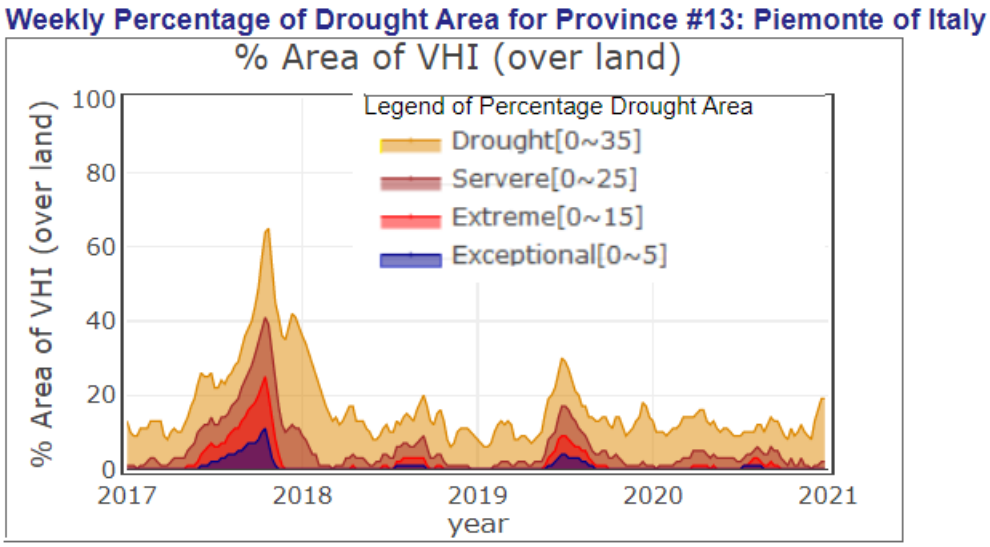
Keywords: Vegetation Health Indices, Drought, NOAA-STAR, NOAA-NIDIS, Climate change, Forest fires, Wildfires, Piemonte, Torino.

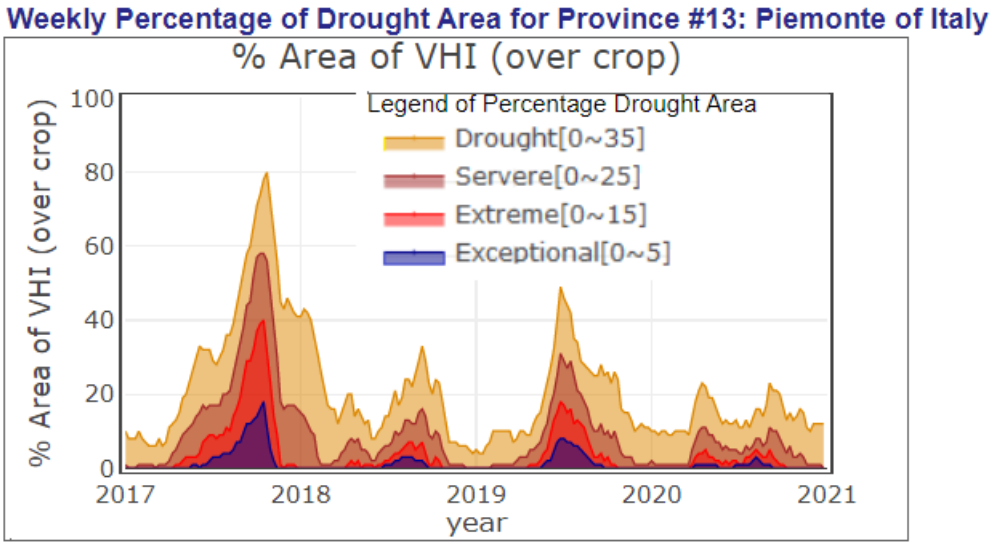
Torino, 18 September 2021.

The National Oceanic and Atmospheric Administration, NOAA, is a scientific and regulatory agency of the United States Department of Commerce, having several tasks. Among them, NOAA is monitoring the vegetation health of the planet. In particular, it is the NOAA STAR, the Center for Satellite Applications and Research, which is providing data on vegetation coming from satellites.
As explained by NOAA Center for Satellite Applications and Research, “the satellite-based global VH [Vegetation Health] System is designed to monitor, diagnose and predict long- and short-term land environmental conditions and climate-dependent socioeconomic activities”. The System is based on satellite observations and models for the vegetation response to the environmental conditions. In this framework, the NOAA STAR System is providing several vegetation health indices, among them the Vegetation Condition index (VCI), the Temperature Condition index (TCI), and the Vegetation Health index (VHI). In [1],[2], we have used the NOAA STAR VHI data for analyses made by means of recurrence plots, for some locations in Italy. It was evident, comparing the plots of different areas, the role of local environments on the behavior of VH Index.
On VCI, TCI and VHI indices, it is based a NOAA STAR product concerning drought. The NOAA STAR Drought (D) parameter is assessing drought in different conditions, “Exceptional”, "Extreme", "Severe", Moderate", according to the values of indices. NOAA-STAR data for analyses on drought have been mentioned in several publication, such as Refs. [3]-[20]. Here we consider Drought D index for Piemonte, Italy, in particular for year 2017. Drought warning for 2021 will be also considered.

NOAA-STAR DATA

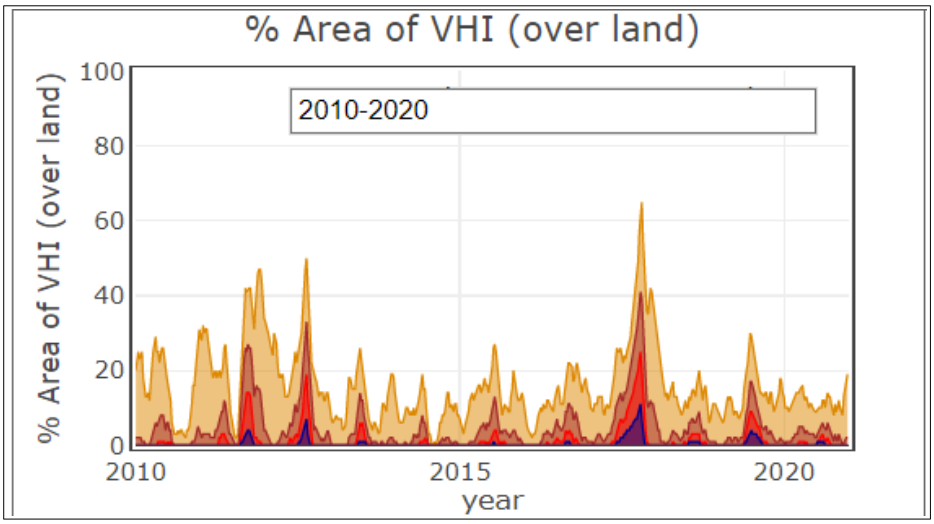
The following images are adapted from screen-shots of data proposed by NOAA-STAR, at the following link www.star.nesdis.noaa.gov/smcd/emb/vci/VH/vh_adminMean.php?type=Province_Weekly_PAreaPlot





Plots are evidencing a peak of drought in 2017. Credit for the images is given to the NOAA / NESDIS Center for Satellite Applications and Research.

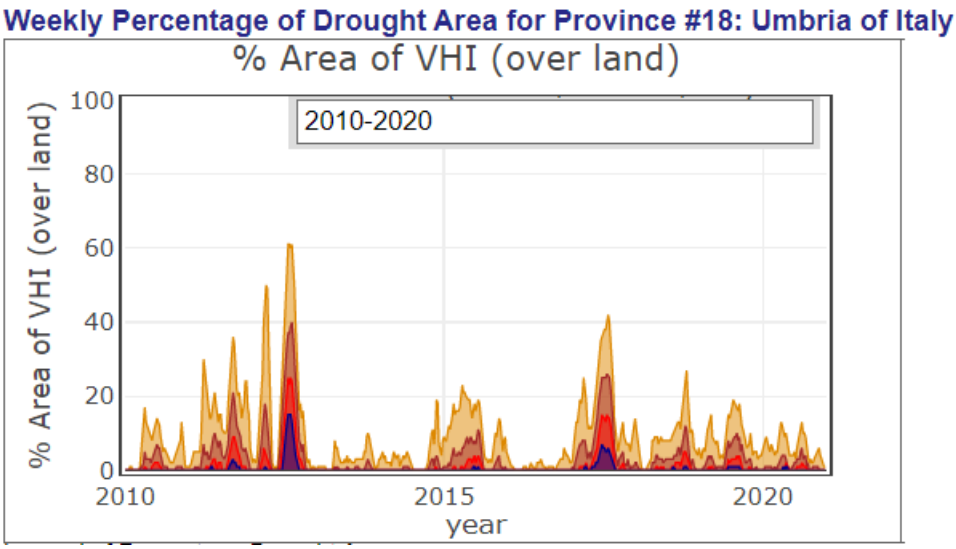
From the previous images we can see that year 2017 was characterized by a larger percentage area of drought. We can also analyze larger time periods. For instance, in the following images, we can see the time range from 2010 to 2020. Data are concerning Piemonte.



Piemonte

Credit for the image is given to the NOAA / NESDIS Center for Satellite Applications and Research.

Since NOAA-STAR is providing data for all the Italian regions, we can compare them to those of Piemonte. For instance, the following panel is giving data concerning Umbria. From NOAA-STAR data, we can see that 2017 is characterized by drought for almost all of Italy.



Credit for the image is given to the NOAA / NESDIS Center for Satellite Applications and Research.

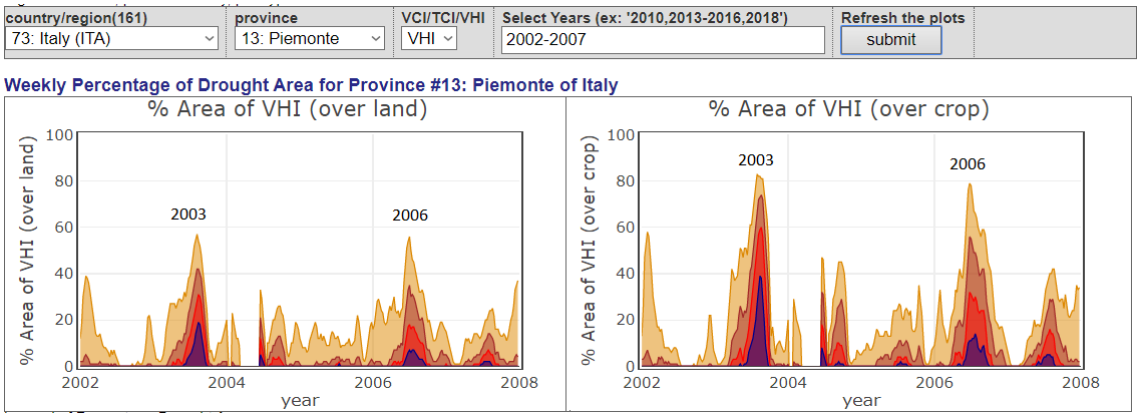
Year 2017

At the web site http://www.arpa.piemonte.it/news/la-situazione-idrica-in-piemonte-nel-2017 , the Regional Environmental Protection Agency, Agenzia Regionale per la Protezione Ambientale, ARPA, tells the following about year 2017.

"Nel 2017 sono caduti circa 680 mm di precipitazione in Piemonte, con un deficit pluviometrico pari al 33% nei confronti della norma 1971-2000: l'anno è risultato così il 4° più secco degli ultimi 60 anni. Sui bacini a sud del Po (Tanaro, Bormida, Scrivia-Curone e Agogna-Terdoppio) si sono registrati deficit del 40 % o poco superiori; deficit inferiori al 25 % su Orco, Stura di Lanzo, Dora Baltea, Sesia e Toce e tra il 25 e il 40 % altrove. La siccità meteorologica nel 2017 è stata importante e caratterizzante sia come intensità che come durata ed estensione. Sull'intera regione la fenomenologia si è protratta fino a fine anno ed ha raggiunto il culmine tra il mese di ottobre e novembre. Se negli anni tra il 2013 e il 2016, in generale, il fenomeno della siccità non era mai stato prolungato, né diffuso né intenso e non era riuscito ad influenzare l'anno intero, il 2017 è parso in controtendenza, e certamente assimilabile alle annate 2006 e 2003, in termini di deficit idrico."

In 2017, we had about 680 mm of rainfall in Piedmont, with a pluviometric deficit equal to 33%, compared to the period 1971-2000. Therefore, 2017 was the 4th driest year in the last 60 years. For the fluvial basins which are south of Po river (Tanaro, Bormida, Scrivia-Curone and Agogna-Terdoppio) deficits of 40% or slightly higher have been observed; deficits of less than 25% for Orco, Stura di Lanzo, Dora Baltea, Sesia and Toce, and between 25 and 40% elsewhere. The meteorological drought of year 2017 was important for intensity and duration. In Piemonte, the phenomenon lasted until the end of the year and reached its peak between October and November. Between years 2013 and 2016, the phenomenon of drought was not so prolonged or intense. It had not influenced the whole year. Year 2017 seemed to go against the trend, and certainly it was similar to years 2003 and 2006, in terms of water deficit.

Here in the following the data from NOAA – STAR, showing the same as ARPA.



Credit for the images is given to the NOAA / NESDIS Center for Satellite Applications and Research.

2017 wildfires

In [21], we can find discussed some consequences of 2017 extremely drought: the spread of fire in the forests of Italian Alps and the air pollution in Torino. In the [21], we can find a clear impact of fires on both local and regional air quality.

"In October 2017 the drought which characterised the summer over most of the peninsula endured in the North-West of Italy. Led by positive surface pressure anomalies due to anticyclone persistence in the South-West of Europe, almost the entire extension of Piemonte (i.e. Piedmont) did not receive any rainfall. This event represented an exceptionally rare condition for one of the rainiest months in Northern Italy. Indeed, Torino's precipitations data series – started in 1802 – found its lowest October value in 2017, comparable only with the extreme drought 1921". This is told in [21], mentioning Ref. [22]. "The significant soil dryness favoured the spread of several forest fires in the Alps mountain range in the second half of October 2017. Wildfires occurred into many Piemonte valleys" [21]. As a consequence, the fires added further pollution to environmental conditions of Torino.

Wildfires and VHI index

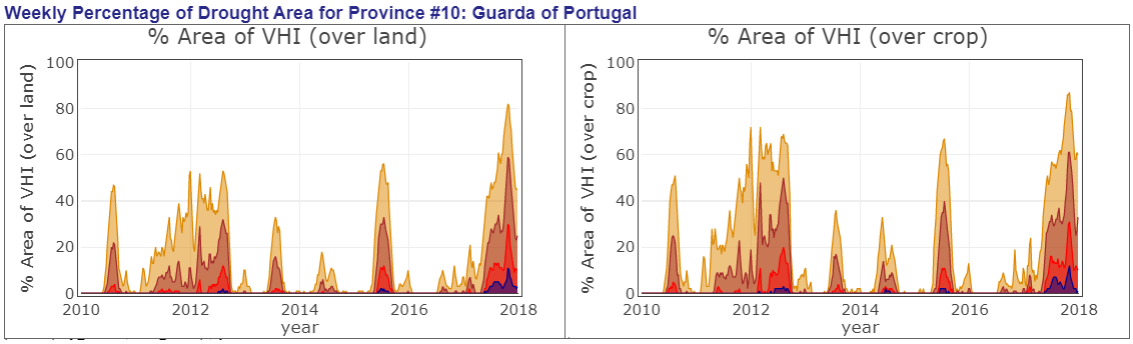
As we have seen before, year 2017 was evidenced by the NOAA VHI index as a year during which large areas of Piemonte experimented an exceptional drought. The year was also characterized by wildfires [21].

The link between VHI and wildfires is discussed in [23]. This reference is a study of the environmental conditions for Portugal, in relation with the NOAA/NESDIS satellite data, based on vegetation health [NESDIS, National Environmental Satellite data and Information Service]. The article concludes that "the dynamics of VHI-indices, show good relation both to the burned areas and to the number of events of forest fires". The study in [23] is focused on data over the period 2001-2017.

After the analysis of statistical results, the authors have shown that for 13 of the 18 districts of Portugal, where large wildfires happened, the "88% of big fires have relation with at least one of next conditions, detected with VHI-method". The conditions given in [24] are: 1) vegetation stress because of lack of soil water (VCI < 40.0), 2) vegetation stress because of the leaves overheating (TCI < 40.0), and 3) percentage of drought by district exceeded 20%. "It means that preferably the large forest fires occur if the district has a percentage of drought are equal to or greater than 20% " [23].

Moreover, article [24] tells that "The analyses of VHI indices evolution and their relationship with forest fires showed the possibility in determining the VHI patterns that could be used as indicators of probability of large fires in Portugal. One of the typical cases was observed frequently in the spring in the years with large forest fires. In this pattern the TCI shows low value, indicating thermal stress, and VCI has high value, indicating good vegetation growth in spring. Usually these conditions lead to large production of fine fuel that dries in summer favoring large fires".

The following images are showing NOAA-STAR data for Guarda, Portugal, years 2010-2017.



Credit for the images is given to the NOAA / NESDIS Center for Satellite Applications and Research.

Drought warning 2021

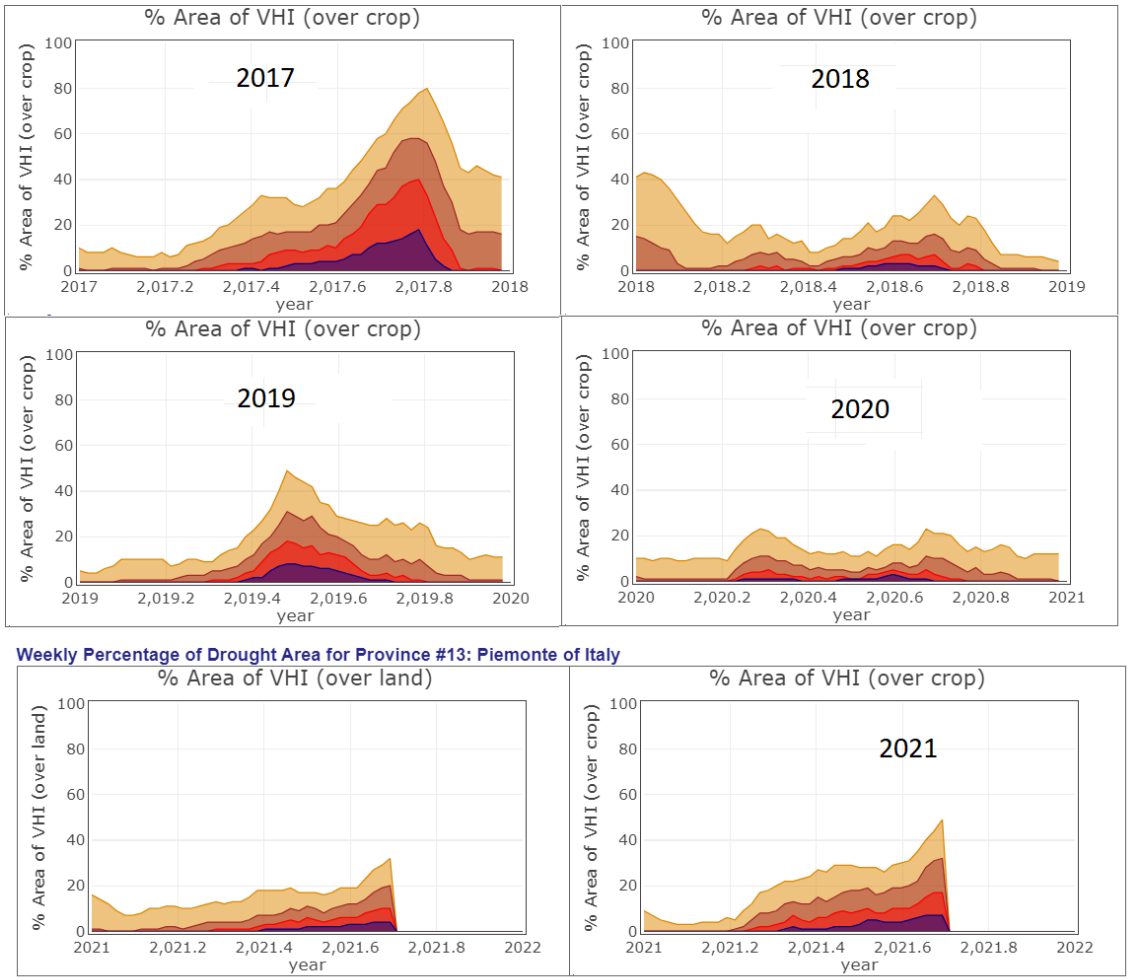
NOAA NIDIS, the National Integrated Drought Information System, poses the following question - "Why Drought Early Warning?" - at its web site, link https://www.drought.gov/about/drought-early-warning . NOAA answers stressing that "Drought is a recurring natural phenomenon that is often called "the creeping disaster." Unlike other natural hazards, such as hurricanes, floods, and tornadoes, droughts develop gradually over a long period of time. The gradual nature of drought can prevent us from recognizing drought's true impacts, often diminishing the urgency that would otherwise trigger a timely and comprehensive response". To recognize the drought risk - the site continues - it is necessary to monitor and forecast physical indicators of climatological drought. At the same time, it is necessary to consider economic, social, and environmental impacts.

Then, let us consider a drought warning for 2021 in Piemonte.

On August 25, 2021, Ansa, that is Agenzia Nazionale Stampa Associata, told the following. "Caldo e la prolungata siccità stanno impoverendo l'agricoltura, anche in Piemonte. Lo conferma il monitoraggio condotto dalla Coldiretti sugli effetti dell'estate rovente che ha causato danni di oltre un miliardo nelle campagne favorendo anche il diffondersi degli insetti dannosi per le coltivazioni, come la cimice asiatica. In Piemonte i fiumi ed i torrenti hanno una portata ridotta tra il 35% ed il 65% rispetto alle medie storiche degli anni precedenti e negli ultimi giorni è calata di un ulteriore 20% per mancanza di piogge. A patirne, soprattutto, il comparto cerealicolo ed in futuro potrà esserci quello zootecnico, in difficoltà per mancanza di foraggi."
In the news, it is reported that a prolonged drought is damaging crops in Piemonte too. This fact is stressed by the monitoring made by Coldiretti (an association for representation and assistance of Italian agriculture), on the effects of a hot summer, also favoring the spread of insects, which are harmful to growing crops. In Piemonte, rivers and streams have their flow with a reduced rate between 35% and 65%, compared to

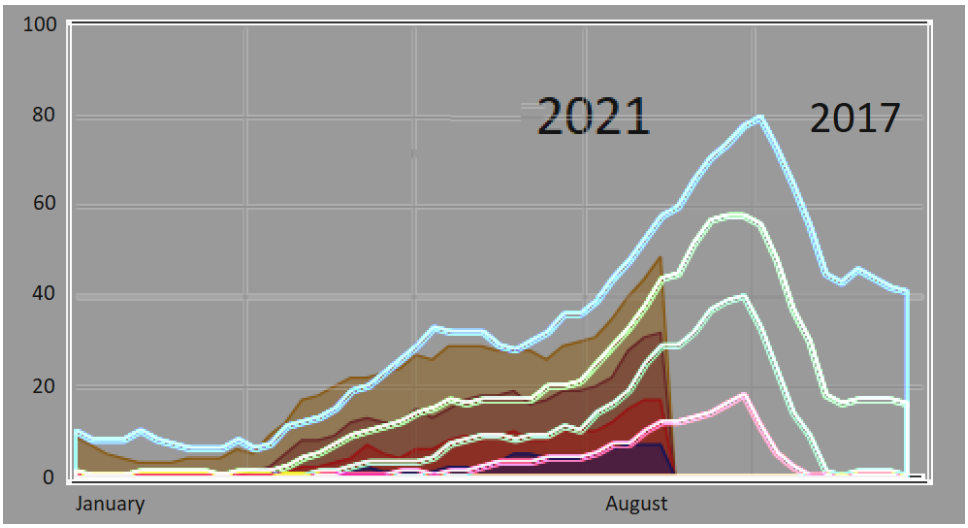
historical averages of previous years. In recent days, it has dropped by a further 20% due to lack of rain. Cereal crops will suffer and, in the future, also the breeding of livestock will suffer too, for a difficulty due to lack of fodder.

Here some data from NOAA STAR for Piemonte. In the upper panels, we can see the percentage of drought area, for years 2017-2020 (over crop). In the lower panel, we can find available data for 2021 (over land and crop).



Credit for the images is given to the NOAA / NESDIS Center for Satellite Applications and Research.

Let us compare years 2017 and 2021 (over crop). In the following figure, the data concerning 2017 are represented by contour lines to be compared to area percentages of 2021 (colored pixels).



Credit for the images here used is given to the NOAA / NESDIS Center for Satellite Applications and Research.

The contours of the weekly percentage of drought area in 2017 seem close to those of 2021. The trend for 2021 could be like that of 2017, if the shortage of rainfall continues.

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