



# Future wildfire conditions in Ukraine under the RCP 8.5 climate scenario

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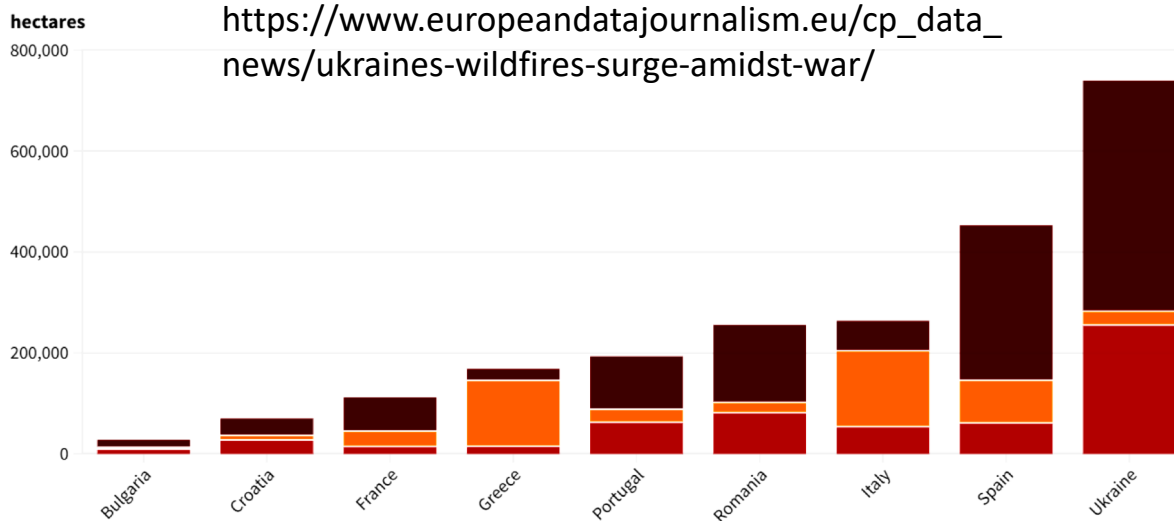
# Introduction

- 18.5 % of Ukraine's territory is covered by forests.
- During 1990–2017 in the forest areas of the country about 106.8 thousand fires with a total area of 139.2 thousand hectares arose.
- In 2020, under severe drought, 209 forest fires occurred in Ukraine, most significant were in the Chernobyl zone in April.

## Most burned area in Ukraine

Overall area (in hectares) burned between 2020 and 2022 in the most burned EU countries and Ukraine

■ 2020 ■ 2021 ■ 2022

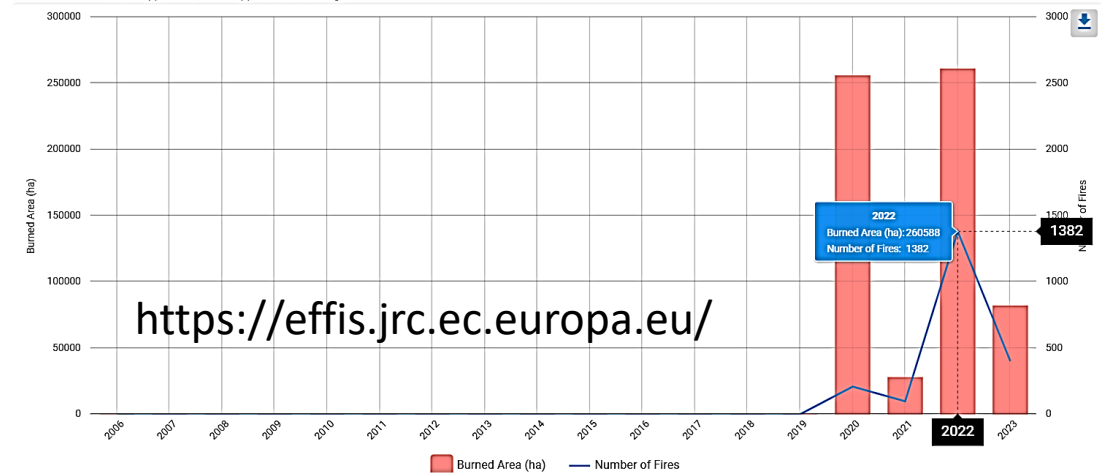


[https://www.europeandatajournalism.eu/cp\\_data\\_news/ukraines-wildfires-surge-amidst-war/](https://www.europeandatajournalism.eu/cp_data_news/ukraines-wildfires-surge-amidst-war/)

## EFFIS Annual Statistics for Ukraine

Statistics in the charts up 2022 show full year statistics. 2023 is updated up to current date. Fires mapped in EFFIS of approx. 30 ha or larger.

Country Profile Copy URL



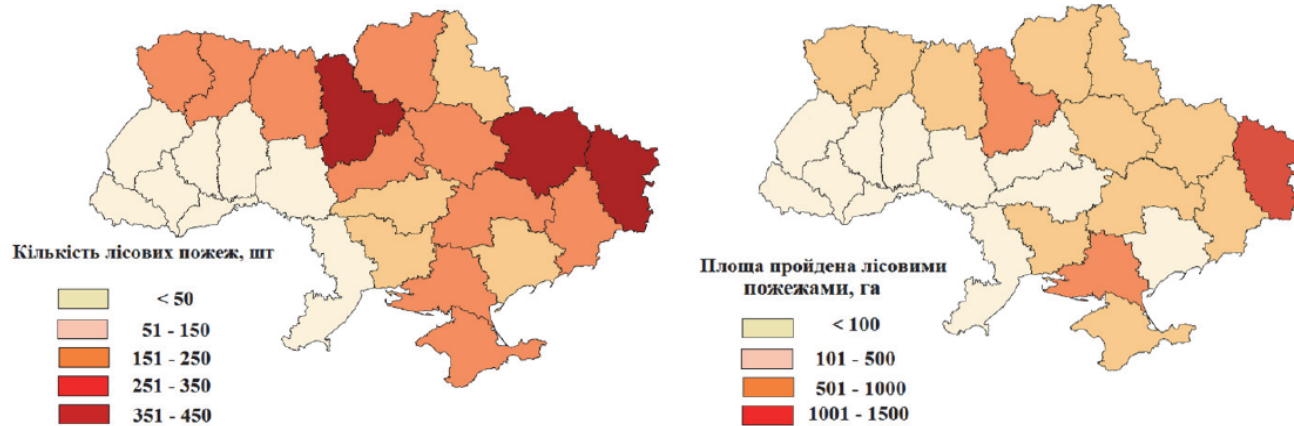
<https://effis.jrc.ec.europa.eu/>

In 2022, most of the forest fires occurred in the military combat zone.



# Current wildfire`s statistics

1990-2017



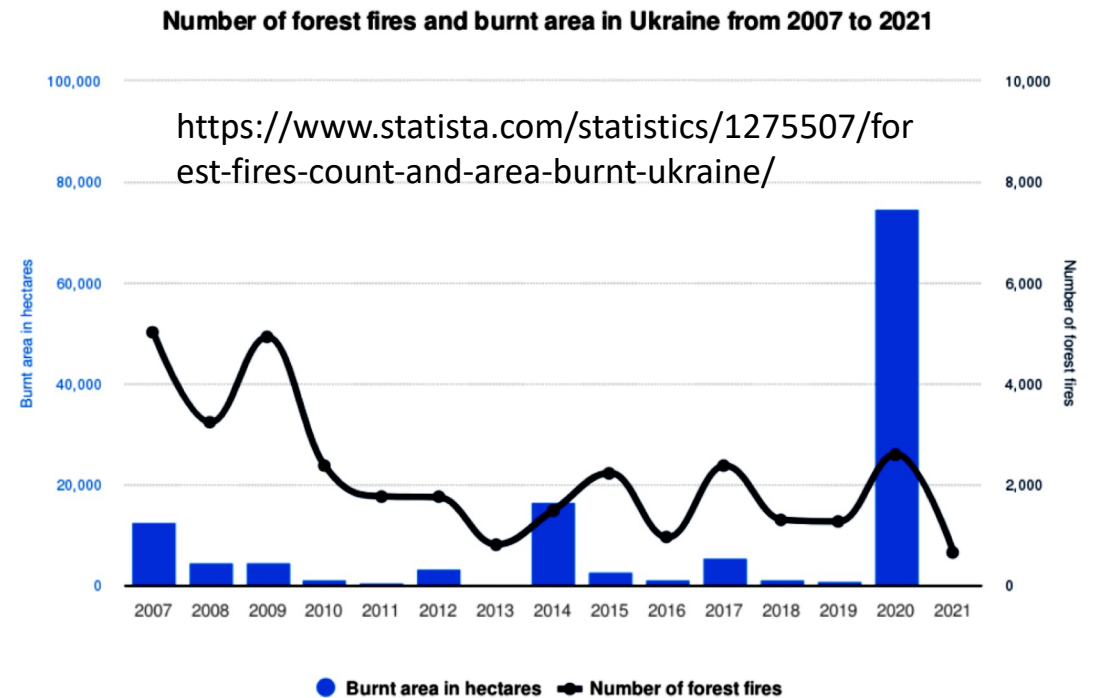
Number of wildfires

Burnt areas, ha

Zibtsev et al. (2019). DOI: [10.31548/forest2019.03.027](https://doi.org/10.31548/forest2019.03.027)

- The average annual number of wildfires ranges from 8-10 cases in the west regions (Vinnytsia, Ternopil', Chernivtsi) to more than 400 cases in the northern Steppe (Kyiv region > 700 cases).
- In most cases, fires are caused by forest visitors, as well as uncontrolled agricultural burnings.

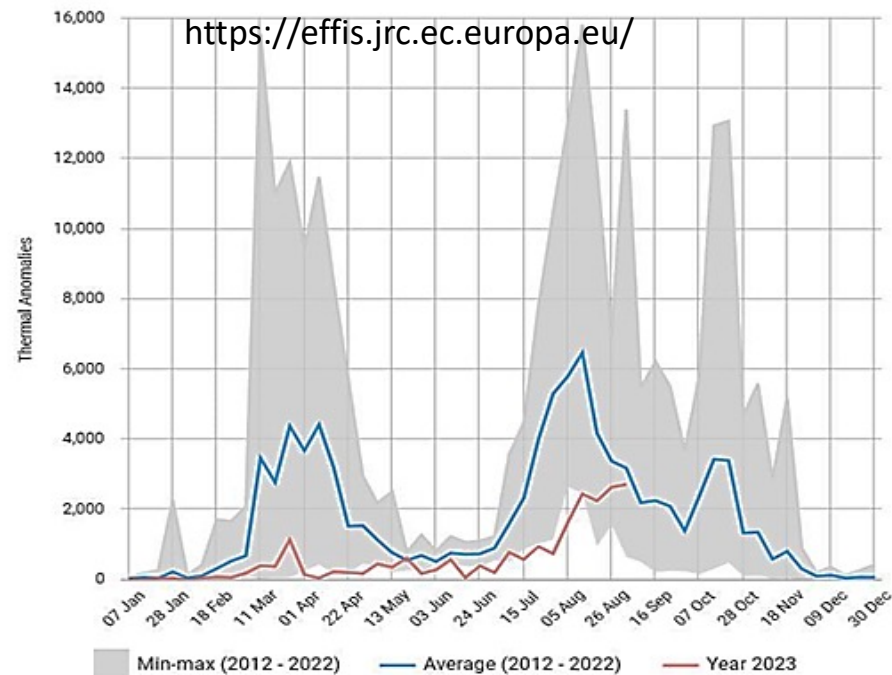
- An analysis of the long-term dynamics of fires shows that forest fires in Ukraine are a sustainable phenomenon.



Source  
Joint Research Centre  
© Statista 2022

Additional Information:  
Ukraine; Joint Research Centre; 2007 to 2021

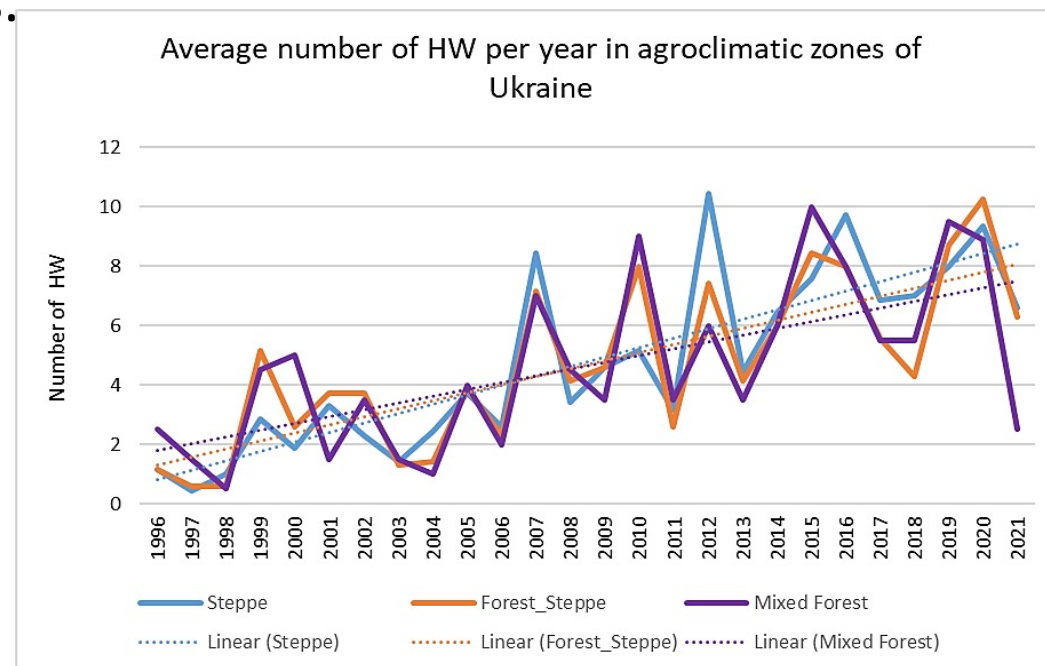
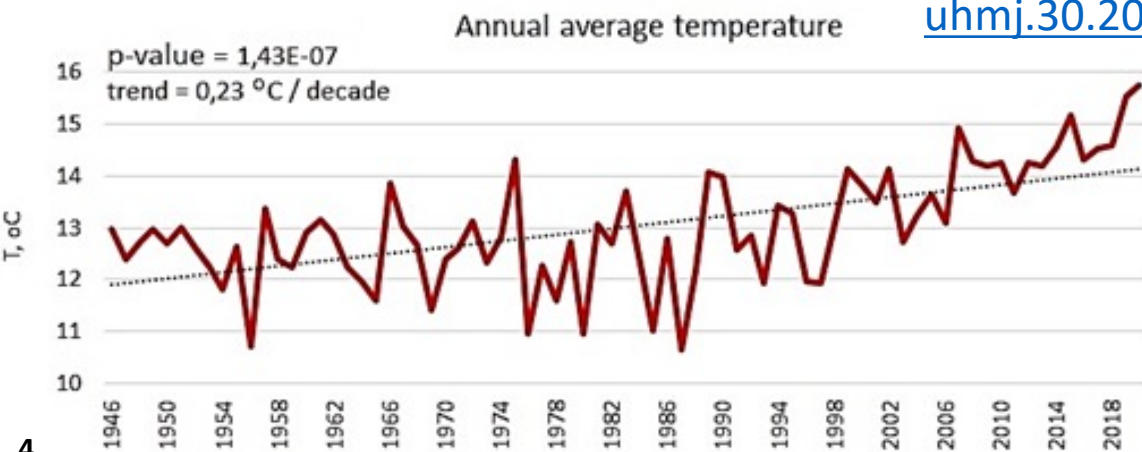
# Weather condition and wildfires



- Frequency, intensity of wildfires and amount of burned areas depend on the current weather and climate conditions.
- In the seasonal distribution in Ukraine are three periods of maximum fire activity: spring (March-April) and summer (August) and autumn (October).
- The annual average temperature in Ukraine (as well as precipitation) has a positive long-term trend.
- The number of heat waves (HW) significantly increased during last 20 years.

Semenova I. (2022).

<https://doi.org/10.31481/uhmj.30.2022.03>





# Methods and data

To analyse future fire weather conditions the Angström index ( $AI$ ) was used:

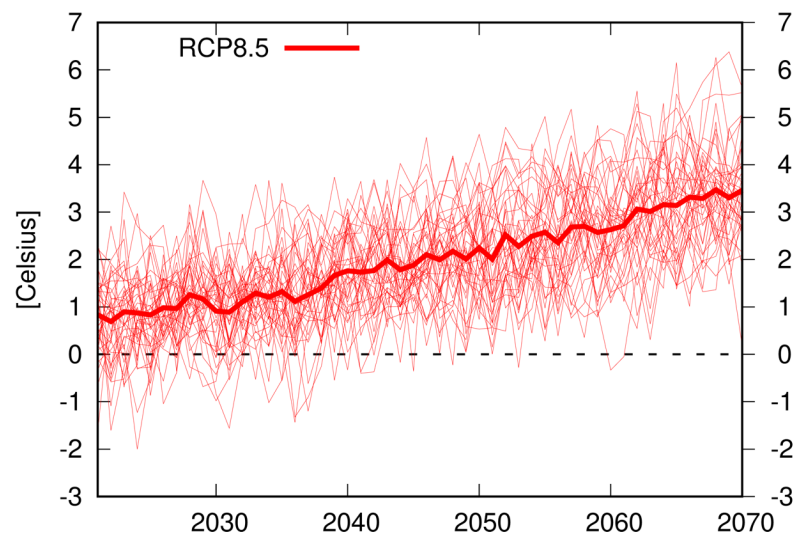
$$AI = \left( \frac{H_{13}}{20} \right) + \left( \frac{27 - T_{13}}{10} \right)$$

Index values	Interpretation
$AI > 4.0$	Fire occurrence unlikely
$4.0 < AI < 2.5$	Fire conditions unfavorable
$2.5 < AI < 2.0$	Fire conditions favorable
$AI < 2.0$	Fire occurrence very likely

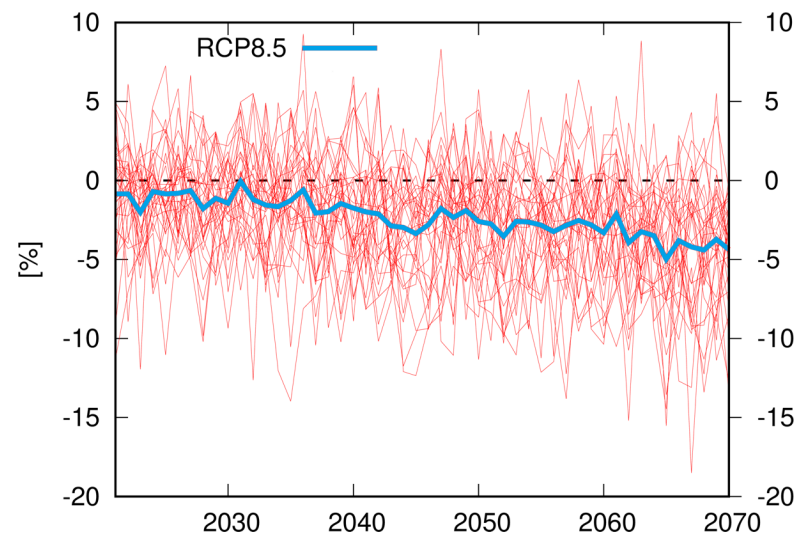
where  $H_{13}$  is relative air humidity [%] and  $T_{13}$  is air temperature [°C] at 13:00.

For the calculation  $AI$  the high-resolution regional climate model's data from the framework of the CORDEX (RCM is MPI-CSC-REMO2009) was used.

Temperature change Ukraine Jan-Dec wrt 1991-2020 AR5 CMIP5 subset



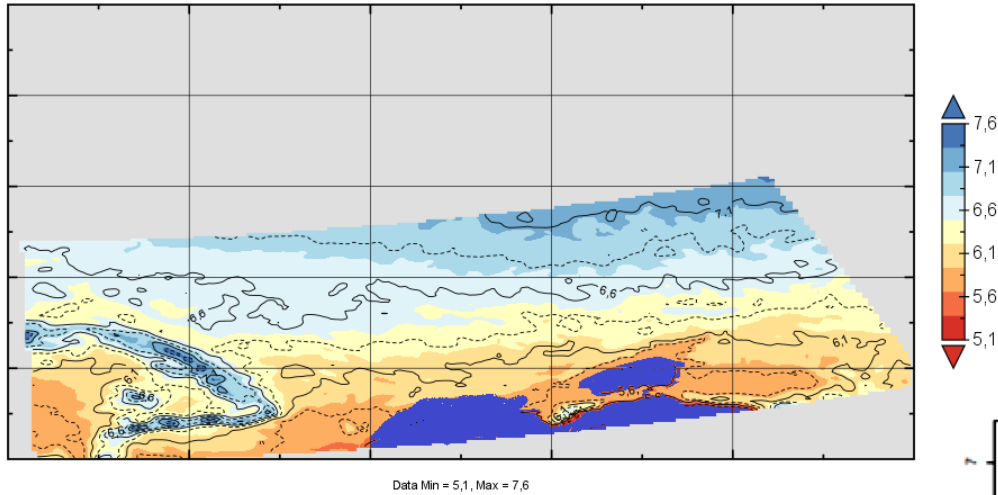
Relative Relative humidity change Ukraine Jan-Dec wrt 1991-2020 AR5 CMIP5



KNMI Climate Change Atlas  
[https://climexp.knmi.nl/plot\\_atlas\\_form.py](https://climexp.knmi.nl/plot_atlas_form.py)

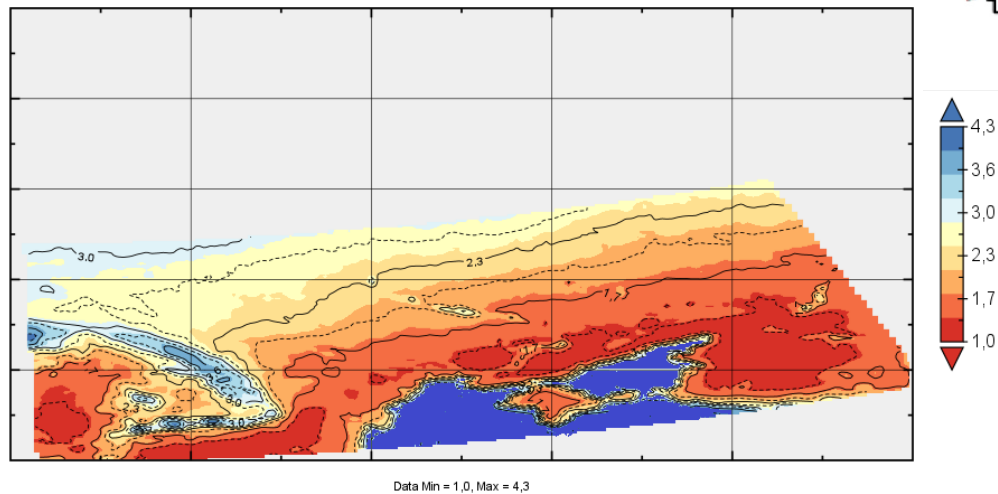
# AI seasonal distribution in 2021-2070

Mean AI in winter 2021-2070

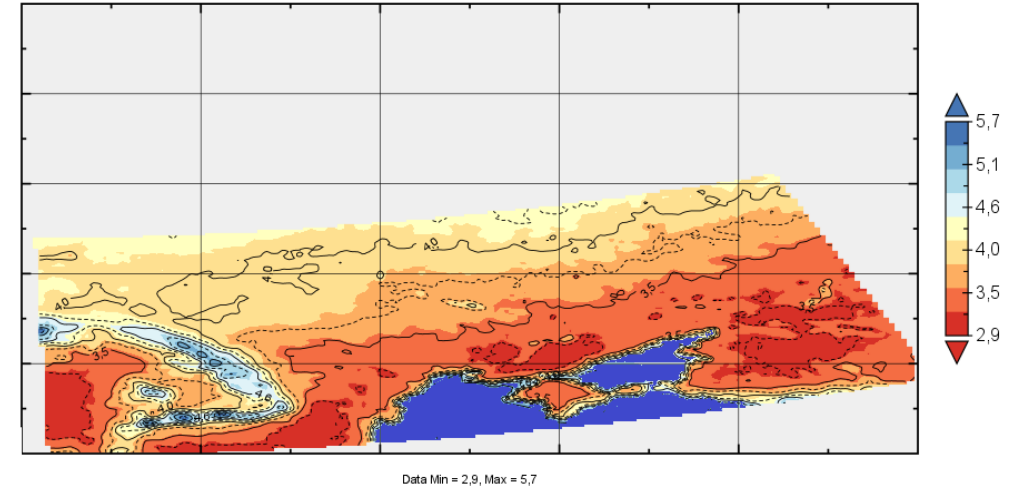


A clearly defined seasonal course: max AI in winter and autumn, min AI in summer and spring.

Mean AI in summer 2021-2070

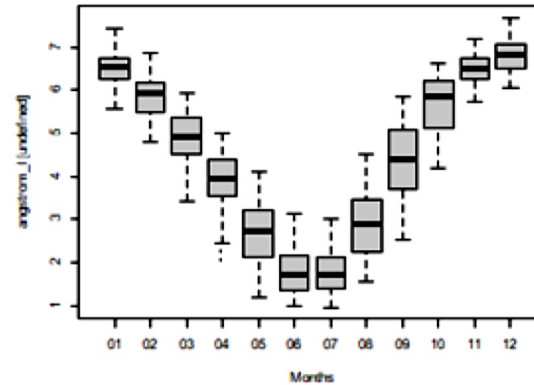
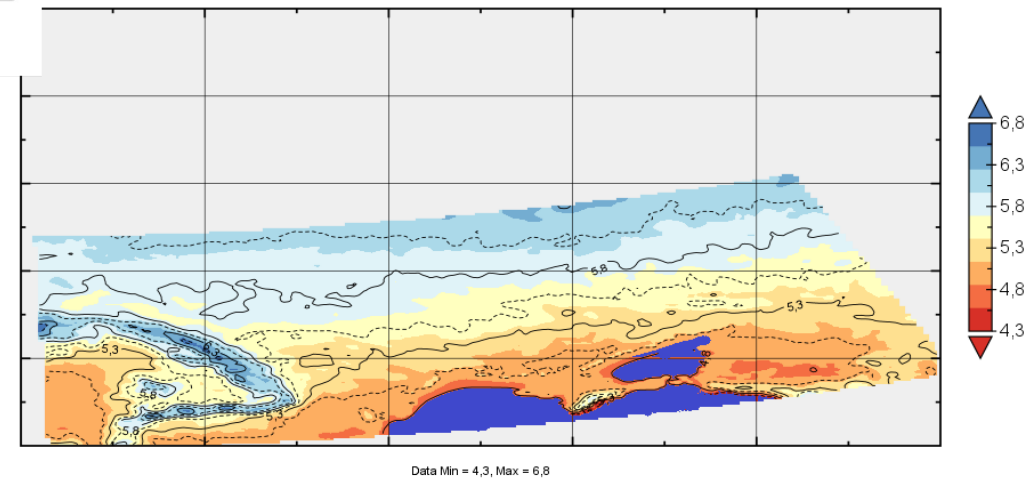


Mean AI in spring 2021-2070



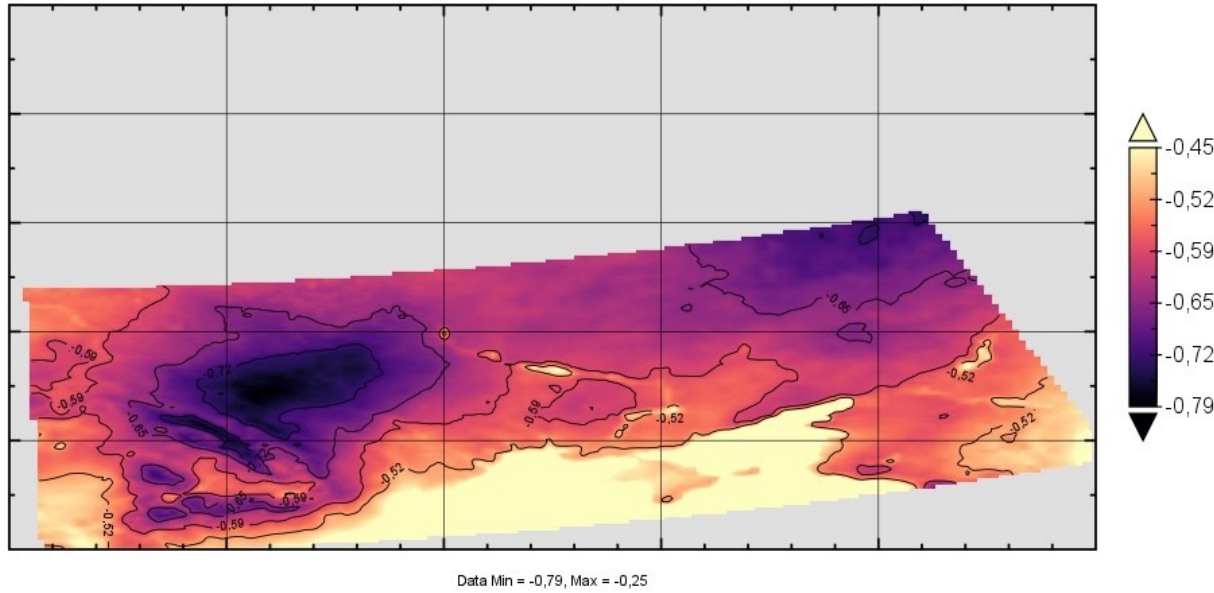
AI has a quasi-zonal distribution with the minimum in the southern steppe, and the maximum the north of the forest-steppe and mixed forests.

Mean AI in autumn 2021-2070

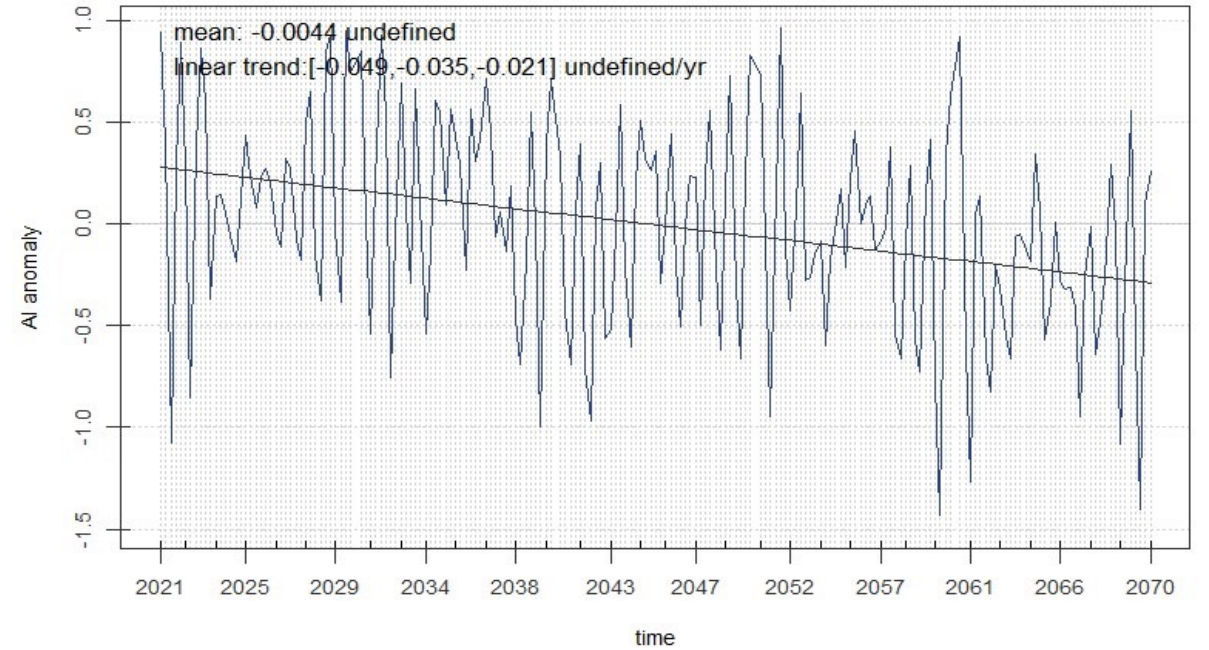


# AI anomalies and trends

All-time AI linear trend, 2021-2070

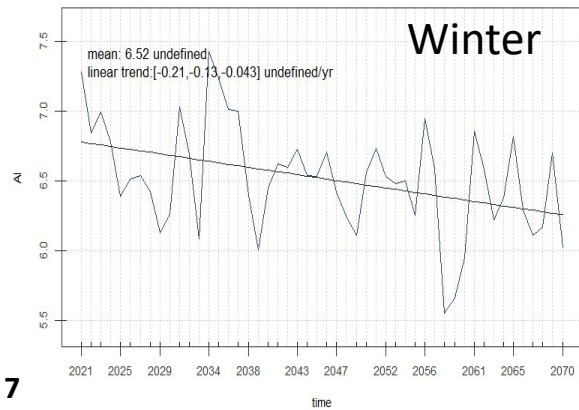


AI seasonal anomalies

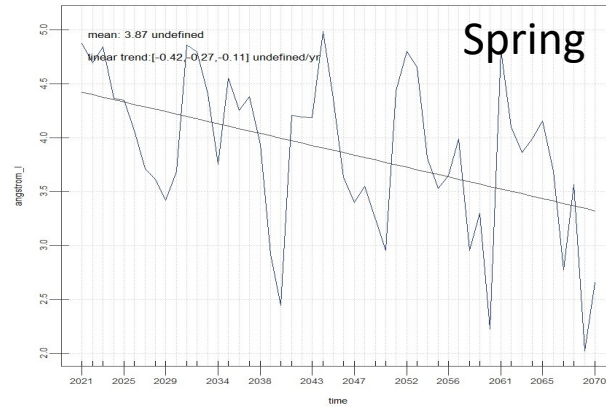


The AI time series shows the expected decrease in AI values in all seasons except autumn.

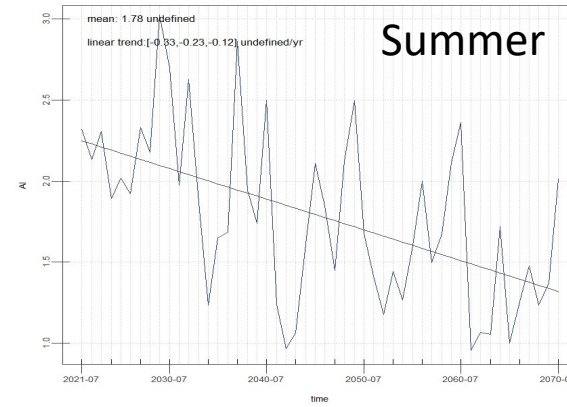
Area-averaged AI time series in January 2021-2070



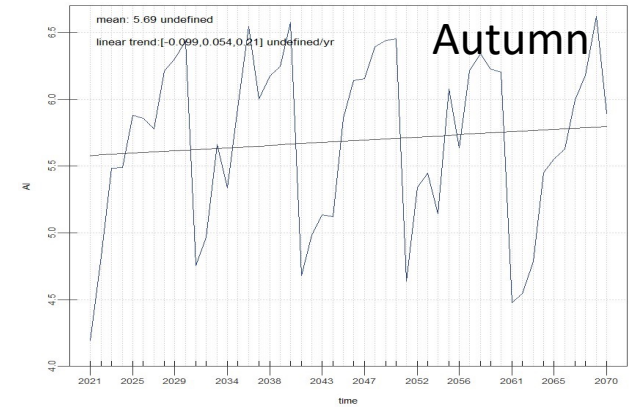
Area-average AI time series in April 2021-2027



Area-averaged AI time series in July 2021-2070



Area-averaged AI time-series in October 2021-2070

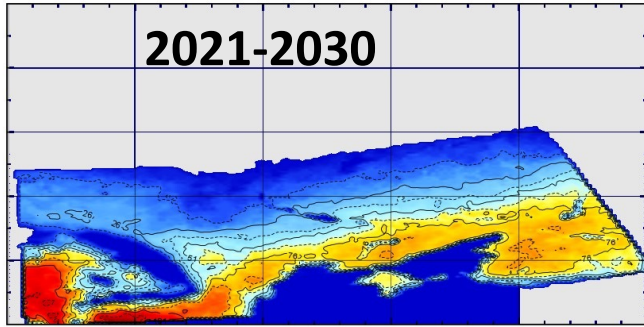




# Frequency of days with high fire danger level $AI < 2$ (days per year)

Frequency  $AI < 2$  (cases per year) in 2021-2030

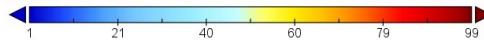
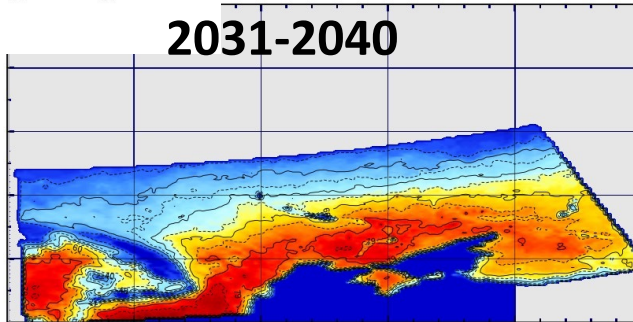
**2021-2030**



Data Min = 0, Max = 126

Frequency  $AI < 2$  (cases per year) in 2031-2040

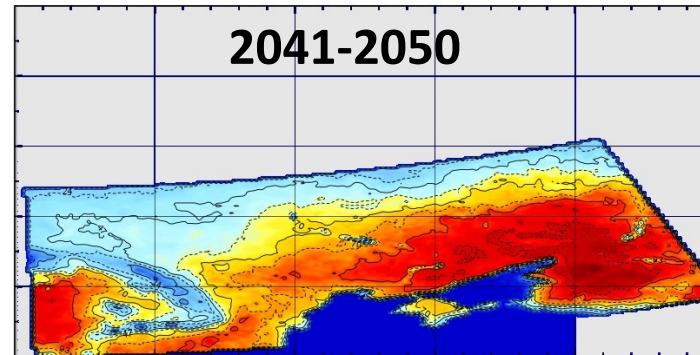
**2031-2040**



Data Min = 0, Max = 99

Frequency  $AI < 2$  (cases per year) in 2041-2050

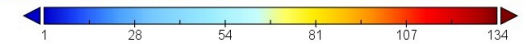
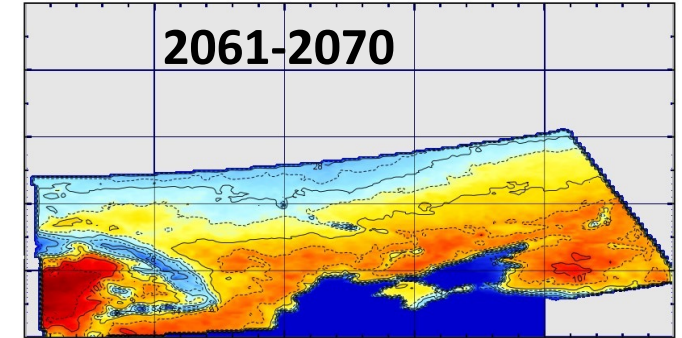
**2041-2050**



Data Min = 0, Max = 116

Frequency  $AI < 2$  (cases per year) in 2061-2070

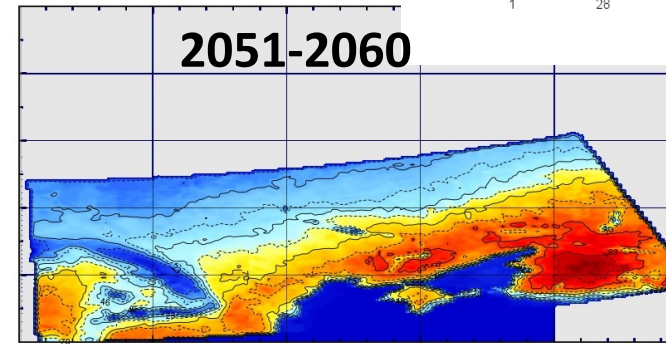
**2061-2070**



Data Min = 0, Max = 134

Frequency  $AI < 2$  (cases per year) in 2051-2060

**2051-2060**



Data Min = 0, Max = 116

← Maximum frequency from **70-85** days/year to **110-115** days/year →

Maximum number of days with  $AI < 2$  is expected in the southern steppe all times.

In 2041-2050 the maximum affected area with  $AI < 2$  is expected throughout Ukraine).



# Summary and conclusion

- According to projections, climate change to make wildfires more frequent and intense both in global and regional level.
- A simple Angström index based on air temperature and relative humidity is suitable for determining the impact of climate change on fire weather conditions.
- The projected temperature and humidity conditions in Ukraine under the most severe scenario of RCP8.5 will contribute to significant increase in the annual number of days with high level fire danger, especially in spring a

