



Slovenian Case Study—Wind Impact on 2022 Goriški Kras Wildfire Progression[†]

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Abstract

In July 2022, Slovenia was affected by the largest wildfire in its recorded history. The Goriški Kras wildfire lasted from 15 July to 1 August 2022 and continuously covered an area of 4249 ha on Slovenian and Italian sides of the border. Using satellite and incident commanders' data, we were able to reconstruct the wildfire's progression for up to three situations per day. The main driving factors of wildfire spread were south and west winds, while the most common (NE) bora wind played only a minor role.

Keywords: wildfire; rate of spread; bora wind; Slovenia

1. Introduction

In July 2022, Slovenia experienced the largest wildfire in its modern recorded history. It was the largest in terms of affected area, damage caused, and the number of national and international response units involved [1]. The Goriški Kras wildfire lasted from 15 July to 1 August 2022, covering an area of 3679 ha on the Slovenian side and 570 ha on the Italian side of the border [1,2].

The main goal of the study was to provide a detailed analysis of wildfire progression during this severe wildfire in Slovenia—which has not been done before. Using satellite imagery, incident commander report and wind data, we were able to reconstruct the wildfire's progression for up to three situations per day [2–5]. We formulated one research question: how big was the impact of the bora wind on the total extent of the wildfire?

This study presents efforts towards strengthening national fire behaviour research capacities.

2. Methods

Wildfire reconstruction was conducted using a multi-sensor and multi-temporal remote sensing approach to capture the evolution of the Goriški Kras 2022 wildfire. Satellite imagery from Sentinel-2 and Landsat 8 [3,4] were complemented with: Copernicus Emergency Management Service (EMS) Rapid Mapping products, which were activated specifically in response to the Goriški Kras wildfire; intermediate fire perimeters from the intervention report; along with the approximate locations and ignition times of the three initial fire starts [5]; and official final burned area polygons produced by public forest services from both sides of the border [6,7]. The combination of these datasets enabled frequent observations while maintaining consistent spatial coverage, allowing the detection of changes in burned area throughout the active fire period.



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Additionally wind data from the two nearest Slovenian Environmental Agency meteorological stations (Bilje and Godnje) were used for wind change assessment [8]. For both stations wind history between first fire ignition (16:00 on 15 July) and end of major progression (13:00 on 24 July) was examined. Two main wind directions were detected at both stations: east winds, that includes also bora winds; and south to west winds.

3. Results and Discussion

The Goriški Kras 2022 wildfire consisted of three initially completely separate wildfires that began on 15, 17, and 19 July 2022, each starting more than 5 km apart. The macro location of wildfire is presented in Figure 1. The highest rate of spread, exceeding 2000 m/h, was recorded on 20 July, two days before the wildfires united together. The final burned area of 4249 ha was reached on 24 July, when light rain stopped the progression. The firefighting operation concluded on 1 August. Fire progress in first days is presented in Figure 2.



Figure 1. Location of Goriški Kras 2022 wildfire at Slovenia–Italy border.

In the observed time window, during the wildfire event between 15 and 24 July, on both meteorological stations, bora and other east winds were blowing more than 70% of time. During the wildfire event, 7 days with a wildfire progression above 500 m were detected. Among them only one day (July 17) was mainly driven by the bora wind, or other east winds blowing from 60° to 140° azimuth. All 6 other days were mainly driven by south and west winds (blowing from 180° to 290° azimuth) that were blowing only about 20% of all observed time.

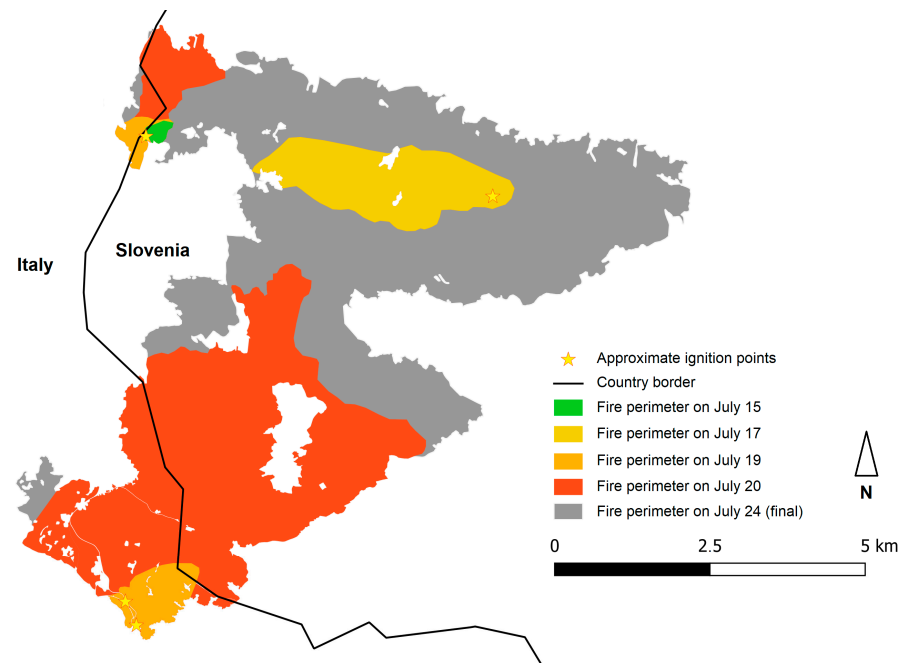


Figure 2. Three ignition points from 15, 17 and 19 July, with evening perimeters on 15, 17, 19, 20 and 24 July.

4. Conclusions

This sub-Mediterranean part of Slovenia is known for its strong northeast bora wind. For this reason, we aimed to determine the impact of the bora wind on the total extent of the wildfire.

Only on 17 July was the strong bora wind the main driver of wildfire spread all day long, while on other days, the bora wind alternated with south and west winds during the daytime. Since the south and west winds were slightly stronger and blew during the hottest part of the day, when FWI values were extremely high, they had a much greater impact on wildfire spread.

The majority of wildfire progression took place on the flat Karst plateau; therefore, orography was mainly not considered as an important driver.

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Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

FWI Canadian fire weather index

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