Wildfires And Commercial Space-based Solutions

Increasing Wildfires and its Costs

With increasing natural disasters worldwide, wildfires and its devastating impact on humans and biodiversity have been drawing attention. The heatwave in summer 2022 has particularly shown the dangers and economic impact of wildfires.

Alone in Spain more than 300k hectares of land had been burned causing costs of almost EUR 3bn according to the European Forest Fire Information System (EFFIS). Spain, Romania and Portugal were impacted the most in Europe. Indeed, 80% of burnt areas are in the countries of the Mediterranean. This number has more than doubled since the 1990s, according to the National Interagency Fire Center. Munich RE estimates worldwide damages through wildfires at USD 24 bn between 2019 and 2021, insurance companies covered around **USD 17 bn**[3].

In the United States, since 2000, an annual average of 70,072 wildfires has burned an annual average of **2.8 million hectares**[2]. Similar trends had been seen in Australia, India, or Russia. The recent wildfires in California and Australia caused economic losses over EUR 10 billion each.

Research shows that over 90% of wildfires originate from human activity (e.g. harvesting, land conversation, agriculture, energy lines, conflicts). However, changing weather conditions and extended droughts have led to a considerable increase in wildfire size, frequency and associated impacts.

Country	Hectares burned 2022	CO2 Emitted as a result (tonnes)	Financial Cost
Spain	293k	2m	€3bn
Romania	149k	896k	€2bn
Portugal	103k	620k	€1bn
France	62k	371k	€639m
Italy	51k	304k	€523m
Croatia	33k	197k	€340m
Greece	22k	133k	€229m
Bulgaria	13k	76k	€131m
Hungary	7k	44k	€75m
Slovenia	4k	26k	€45m
Germany	4k	26k	€44m
Ireland	3k	17k	€29m

*Hectares burnt as per 6 September 2022. Financial cost is calculated using average cost per hectare. **Illustration citymonitor.ai.***[1]

1. The cost of Europe's summer of wildfires
2. Wildfires Statistics
3. Waldbrände und Buschfeuer

Multiple Stakeholder Involved in Fighting Wildfires

Firefighting is mainly financed by public money and national as well as regional governments are increasing their budgets as per increasing threats. According to a recent WWF report, the annual budget for forest fires in six Mediterranean countries (Turkey, Spain, Italy, Portugal, France, and Greece) is around **EUR 2 billion**[4]. France, for example, had earmarked 850 million euros to upgrade its fleet **of aircrafts**[5]. Greece allocated 75 million euros for measures like clearing forests and roads. Approximately 80% of available funds are spent on suppression and just 20% on prevention. The average cost of suppressing a forest fire in Greece may reach EUR 150,000, while in Canada and the USA it costs EUR 81,000 and EUR 17,000 correspondingly.

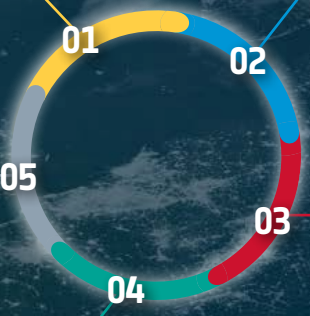
Next to state fire departments, forest owners, reforestation companies, but also insurance companies, real estate developers and energy providers have an interest in decreasing damages by wildfires.

Today, various sources of detecting fires are being used: watchtowers are the most classic option and can be used for forest fire detection locally. Also airplanes may start on a daily basis to watch for devastating fires. Regional volunteering platforms exists to complement these actions. Yet, digital solutions are increasingly supporting the sector: camera networks with AI enabled cloud systems or drones are being used for fire management services, but applications are geographically limited, and more data integration and strategic insights are needed.

Space Added Value by Public Initiatives

Thanks to its ability to see through clouds and wide geographic coverage, space-based solutions, especially Earth observation, are supporting the battle against wildfires. The European public sector, in particular Copernicus, is supporting actors through the European Forest Fire Information System (EFFIS) at European level and the Global Wildfire Information System (GWIS) on **global level**[6].

*The EFFIS is a web-based information tool with near -real-time and historic data, providing information on the pre-fire conditions and assessing post-fire damages, hence the full **fire cycle**[7]:*



Fire Danger Assessment

Fire danger is related to soil and vegetation dryness which can be analysed, for example by Copernicus Sentinel-1 and Sentinel-2.

Rapid Damage Assessment

Fire severity assessment and Land cover damage assessment Sentinel-2 imagery and EFFIS can identify areas of land affected by wildfire scarring.

Vegetation Regeneration

Using Sentinel-2 data vegetation regrowth can be monitored (e.g. Rheticus Wildfires by Planetek Italia)

Emissions Assessment and Smoke Dispersion

Solutions exploit cloud computing, big data and artificial intelligence, combing Copernicus and Earth Observation/remote sensing automatization for air quality monitoring. Using in particular Sentinel 4 and 5.

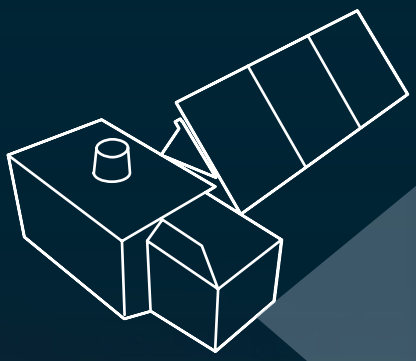
Potential Soil Loss Assessment

Using Sentinel-2 and 2B an operational semi-automated burned area mapping service was developed in Greece (NOFFi)

4. Transparency Against Wildfires
5. Wildfires: Europe's latest economic headache
6. EUSPA EO and GNSS
7. European forest fire information sytem

The CAMS Global Fire Assimilation System (GFAS) has estimated that wildfire emission between June and August 2022 has stood at 6.4 megatonnes of carbon, the highest level since 2007. GFAS can estimate the quantity of biomass burned or the emissions of smoke pollutants through satellite observations of active fires and fire **radiation power**[8]. Further use of Sentinel-2 data focussing on the development and demonstration of burned area mapping services had been supported in the frame of the Artificial Intelligence for Earth Observation (AI4EO) Wildfires project by **ESA**[9].

Various use cases by public administrations using Copernicus data, can be found on the website of NEREUS **(Network of European Regions Using Space Technologies)**[10].

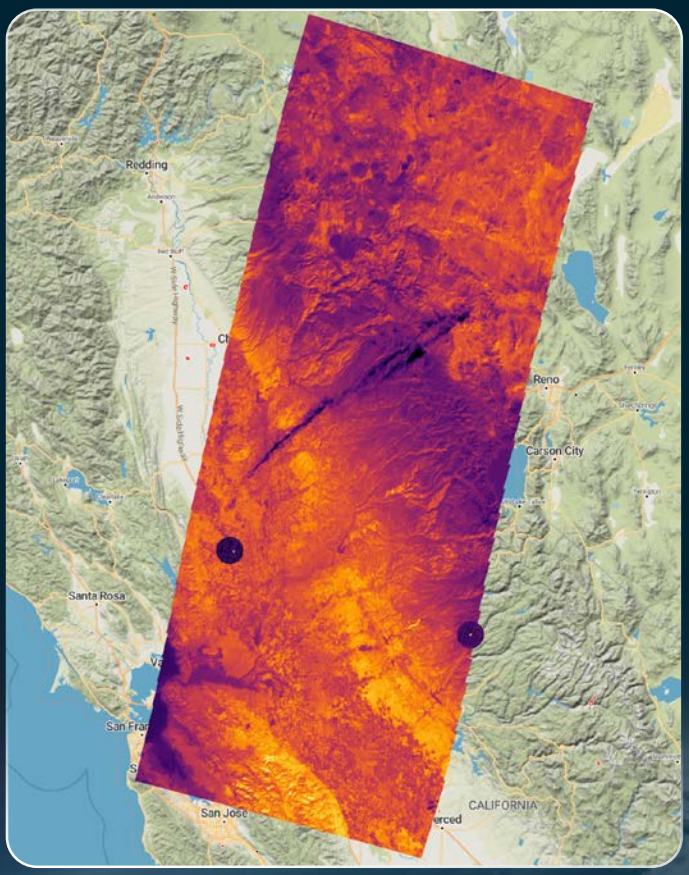


The pictures shows a Sentinel-2 image: The satellite's shortwave infrared channel was used to highlight heat from a wildfire in western Spain. The Copernicus Emergency Mapping Service was activated and helps civil protection authorities respond to ***emergencies***[11].

8. Europe's summer wildfire emissions highest in 15 years
9. Advanced AI4O for wildfire monitoring
10. User stories sheets
11. Wildfire near Salamanca: before-and-after

Commercial Initiatives Are Gaining Traction Worldwide

Dealing with wildfires as a business case is gaining traction: complementing available services with new payloads, higher resolutions or higher monitoring frequencies, commercial players have started developing new solutions and focusing their attention, among others, on forecasting and rapid-fire identification. Google, for example, has announced an expansion of its wildfire services and AI powered detection system in the US, Canada, Mexico and parts of Australia.



*The image shows fire detection of **FOREST-1** from space over California. The company intends to have a constellation of eight satellites deployed in 2024 with the intention to provide worldwide coverage of high-resolution thermal-infrared imagery.*

After that, OroraTech plans to deploy 100 CubeSats to report any fire bigger than 10 meters across the world within half an hour. The expansion of use cases to urban heat, island monitoring and the **energy sector is also planned**[16]*. The company seems to gain confidence by investors as it has extended its Series A round with EUR 15M from private investors and public sector co-funding in November 2022.*

Other actors integrate high-resolution satellite images into their platforms: the collaboration of Maxar and CAPE analytics and its Wildfire Intelligence product suits is an **example**[12].

CAPE focuses on supporting the insurance industry as it identifies specific risk factors like vegetation clearance, roof construction and material, and proximity to surrounding structures. Hitachi Energy builds on Maxar's satellite imageries to monitor vegetation near power lines, one of the major **sources of wildfires**[13]. BlackSky and Satlogic offer likewise wildfire services such as damage and change assessments of forests, buildings, and **infrastructure**[14].

Vertically integrated solutions are also emerging. OroraTech, founded in 2018 and ESA BIC Bavaria alumnus, succeeded its mission FOREST-1: a satellite equipped with RGB, long-wave-infrared (LWIR) and medium-wave-infrared (MWIR) cameras, launched onboard a **Spire nanosatellite in January 2022**[15].
OroraTech's offering in the market, the Wildfire Intelligence Solution, is leveraging satellite data for wildfire detection & monitoring and precise damage assessment. It is used by clients worldwide, detecting over 1000 fires daily and protecting more than 160 million hectares of forest. With customers from forestry, governments and NGO sectors, OroraTech's solution is used in six continents.
Through the ESA InCubed Programme, ESA is supporting OroraTech with its **FOREST-3 implementation phase**[17].

Interest in thermal infrared imagery is indeed increasing worldwide: British based SatelliteVu is working on a thermal imaging constellation as well as Germany-based Constellr, yet respectively focusing mainly on cities and energy efficiency as well as agriculture respectively, rather than wildfires. Washington-based Hydrosat has raised USD 15 million for its thermal infrared imagery constellation to **monitor surface temperatures globally**[18].
With increasing capabilities of upcoming private constellations, decreasing launch costs and ever better data science potential, private space actors are likely to support the development and implementation of Wildfires detection and mitigation use caseson a commercially sustainable basis and ESA is supporting this development.

12. CAPE Analytics Expands Wildfire Analytics Coverage to the...
13. Connecting the Dots | Wildfires are advancing, but so is satellite...
14. Monitor wildfire lifecycle and mitigate risk exposure
15. FOREST-1 Mission success: a gigant leap for ororatech
16. OroraTech launches commercial wildfire detection system
17. OroraTech Accelerates Deployment of Its Multipurpose...
18. Hydrosat raises $10 million for thermal infrared imagery...