Battling wildfires from behind the scenes

28 October 2021, by Jennifer Wills

Firefighters battle a wildfire on the Greek island of Evia on 13 August 2019. Credit: © Georgios Kostomitsopoulos, Shutterstock

Catastrophic wildfires in Europe have become a far too common headline and this year has been no exception as the world once again bore witness to parts of the continent burning. While southern Europe is no stranger to the devastation and loss they leave in their wake, countries in central and northern Europe—areas that were previously not prone to wildfires—are now also experiencing them. Harnessing science and technology, researchers are proving that there is more than one way to fight and respond to fire.

Between 2000 and 2017, 611 firefighters and civilians lost their lives, according to the 'Sparking fire smart polices in the EU' report. In this 7-year period, 8.5 million hectares burned, costing over EUR 54 billion to the economy and irreparable damage to the environment. Since then, wildfires have continued to wreak havoc across Europe and in countries around the world. What we are now seeing is a new breed of wildfire: large-scale, unpredictable and intense, often fuelled by climatic conditions due to, amongst other things, climate change.

As wildfire behavior changes, so too is the European Union (EU) policy landscape changing. The European Green Deal and the EU Forest Strategy for 2021 that comes under it, the EU Biodiversity Strategy for 2030 and the new EU Strategy on Adaptation to Climate Change are forward new priorities for better wildfire protection, prevention and recovery.

Responding to the new priorities, researchers are pushing boundaries to save lives, livelihoods and the environment. For example, a science-based strategy in wildfire management is being developed by the FirEUrisk project that will shift conventional thinking in the field. FirEUrisk is a precursor to four large-scale demonstrator projects funded under the H2020 European Green Deal: DRYADS, FIRE-RES, FIREOOGUE and SILVANUS, which aim to accelerate the adaptation process to extreme wildfire events.

"The fires in Portugal in 2017 and in Greece in 2018, and in Greece 2021 again, and in Turkey and Algeria, with the loss of many lives, reminded us once more about the need to have a different and more science-oriented approach to the problem," explained Domingos Xavier Viegas, project coordinator and a professor at the University of Coimbra, Portugal. "This need is further driven by changes in socio-economic conditions, land use, geopolitical situation and, in particular climate. We have no excuse to continue managing the problem of wildfires as if nothing has changed."

Key to their success will be the close collaboration between researchers, stakeholders and citizens. "Our goal is to benefit from all the science and knowledge that exists dispersed across so many people and agencies or accumulated in so many research institutions and put it into the service of our communities to make our forest areas free of major fires, and nicer places to visit and live safely," noted Viegas.

Focusing on large, high-impact fires where wild landscapes border urban areas scientists will

consider fire management as a holistic and integrated approach that links prevention, response and restoration in a common policy framework. It will place particular emphasis on risk assessment, risk reduction and risk adaptation. "To improve fire prevention, a risk assessment will be developed which incorporates several factors that are frequently not considered," said Viegas.

This includes the socio-economic, economic and ecological impact of fires such as the value of properties and natural capital like air, water, soil and ecosystem services. Risk reduction will incorporate knowledge on fire occurrence and evolution to better protect communities and minimize the effects of fire on the environment. Risk adaptation will integrate knowledge and models on climate, land use and socio-economic changes to promote more resilient landscapes and communities, enabling them to adapt to the changing fire risk over the next decades.

"We intend to extend the solutions developed by science and good practices to the pan-European level," Viegas added.

Help from above

Researchers from the S2IGI project are also breaking new ground in wildfire management by developing a software decision support system (DSS) that uses satellite data to predict and manage fires. "Firefighter operators face several problems: a lack of reliable early-time fire detection tools, the unpredictability of fires and the behavior of extreme events," said Raffaele Bua, project coordinator and software architect at Nurjana Technologies. The DSS is set to change this.

Provided as software as a service, or SaaS, the DSS is available via a web platform offered by the NEWMOS framework and supports the three phases of wildfires: strategic, tactical, and post-event. In the strategic phase, which is forest prevention and mitigation, the system provides users with simulation models and risk probability maps that are useful for preparing for a wildfire event. The tactical phase is when there is an actual wildfire. The system supports the user with weather maps and a flame behavior model. "In the post-

event phase, which is recovery, the system provides statistics and information on the burned areas, with tools and a map to estimate the economic damage," highlighted Bua.

With a 5-minute lag, users are given hotspot early detection information and weather data as well as the ability to run a wildfire simulation showing how the fire would develop over the following hours.

Initially set up to manage wildfires in Sardinia, Italy, the system can be used in other countries. "We have tested the technology on an area in Australia by exploiting another satellite, Himawari, for wildfire behavior simulation and detection," confirmed Bua. The system has also reached new heights, managing to accurately as well as automatically monitor and detect wildfire hazards from space.

As for its performance and accuracy, the results are more than promising. The online model has achieved a detection performance of 99.904% with a false positive probability of 0.018%. "We are confident that the performance will be better with a machine learning model," added Bua. The system will be able to compute the best routes for emergency vehicles, track emergency vehicles via GPS sensors and produce daily fire probability maps in the future.

On the ground

The VALKYRIES project is also pushing limits in research to ensure that first responders can reach those caught in disasters such as wildfires. To do this, researchers will standardize and harmonize technologies and procedures for first aid response in disaster management at the European level. This will include procedures for cross-sector and cross-border cooperation.

The team will design and develop a modular, interoperable, scalable and secure platform to aid deployment of emergency services during disasters like wildfires. "The main platform to be developed is SIGRUN: Cognitive communications and resource federation for command and control of first aid responses in mass casualty incidents," said Juan-Román Martínez Arranz, project coordinator and project manager at Indra Digital Labs. "The

combination and interconnection of the harmonized solutions within the project will make up the platform, providing advanced communications, information sharing, and tactical command and control services for first aid responders."

When a [wildfire](#) starts, there is no time to lose. Coordination between different stakeholders is crucial to minimize human and material damages. What role will the platform play? "Based on one of the use cases of the project, located between Spain and Portugal, the 112 emergency coordinator center (CCU) in Badajoz, Spain, receives multiple calls about fires in areas near the border between Spain and Portugal," explained Martínez. "The platform will support the systematic and homogeneous gathering of relevant information to improve every stage of the intervention. In other words, it will generate truthful and real-time information for the first responders' teams to make informed decisions." Thanks to this information, those on the frontline will have a greater understanding of the geolocation of victims, emergency services will be positioned tactically, and further resources and hospitals will be on standby.

While the platform will not be immediately useable in countries outside the EU, its expansion is on the horizon. "This is of great interest and would allow for a very desirable intercontinental interoperability when it comes to health emergencies," outlined Martínez. In the future, the VALKYRIES solution could be used in other areas such as transport, defense and telecommunications.

Disasters like wildfires are inevitable, but our response to them is not. Researchers are working across borders to prepare and respond, as best we can, to these increasingly severe fire events, ultimately saving lives and minimizing the losses from them.

Provided by Horizon: The EU Research & Innovation Magazine