Report on the outcomes of a Short-Term Scientific Mission[1]

Action number: CA22164

Applicant name: Valentina Bacciu

Details of the STSM

Title: **Understanding real-time fire suppression decision-making**

Start and end date: 19/07/2024 to 28/07/2024

Description of the work carried out during the STSM

The STSM of Valentina Bacciu was hosted by the School of Agriculture at the University of Lisbon and was integrated into the National Wildfire Decision Support Cell (NAD-AIR) of the National Authority of Emergency and Civil Protection (ANEPC), supported by a formal ongoing collaboration between the two institutions on wildfire analysis.

During the STSM, the grantee engaged in a series of comprehensive and enlightening activities that significantly enhanced her understanding and knowledge of the practical and analytical aspects of fire suppression decision-making.

On the first day, the grantee attended an **orientation session** where she was introduced to the organizational structure and the key functions of the ANEPC, with a specific focus on NAD-AIR. She also received an overview of the technological infrastructure and resources available for wildfire management in Portugal, which set the foundation for rest of the STSM.

In the subsequent days, the grantee familiarized herself with the routine activities in the NAD-AIR, including:

- monitoring of weather conditions and interpreting a wide range of weather data and fire indices from the Instituto Português do Mar e da Atmosfera (IPMA, *Portuguese Weather Service*);
- developing operative strategic analyses (*análise estratégica operacional*) with a forecast window of three days;
- applying technology and environmental data to predict fire evolution and behaviour.

This allowed the grantee to focus, as planned, on the two main areas of interest, namely "*understanding of the decision-making process in supporting fire suppression operations*" and "*sharing and acquiring knowledge on the use of various fire and environmental data to support operational decisions*".

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As regards the first topic, the grantee explored the Portuguese framework and procedures related to real-time fire management decision-making, assisting each morning the wildfire analyst experts engaged in the issuing of the operative strategic analysis and its retrospective evaluation and (mainly during the afternoons) in the real-time fire monitoring and fire suppression decision-making.

Regarding the second topic, the grantee gained insight into the data used in the NAD-AIR through the daily use of the information collection platform (*FEB Monitorização*), which was made fully available. This enabled Valentina Bacciu to explore the type of data collected during fire occurrences within the Portuguese system, gain insights and confidence into the data used, and collaborating in the near real-time fire monitoring and behaviour prediction.

The STSM period coincided with relatively moderate weather conditions conducive to a low number of fires, compared with statistics, resulting in 143 hectares burned compared to the 2006-2023 average of approximately 5000 hectares (EFFIS data). One significant event, the Alcabideche-Cascais wildfire on July 21st (about 85 ha), was selected for in-depth study. For this event, the grantee:

- outlined and analyzed the data collected (wildfire-related data, weather conditions, vegetation and topography maps);
- examined and built the fire progressions and calculated the main fire metrics;
- analysed fire behaviour and interpreted strategic fire suppression decision-making processes

The STSM work culminated in the preparation of a detailed report intended to support decision-making and strategic planning, identifying best practices, and highlighting areas for improvement.

Moreover, the grantee participated in collaborative meetings with various ANEPC experts, gaining a multidisciplinary perspective on civil protection and wildfire management. For example, she earned new knowledge on the Copernicus Emergency Management Service (CEMS) activation procedure and type of available product to support decision making in the case of forest fires. She also attended weekly briefings at both national and European levels.

Description of the STSM main achievements and planned follow-up activities

Valentina Bacciu STSM achieved all its planned goals and expected outcomes. Overall, this STSM enhanced the grantee's understanding of fire suppression decision-making processes and the use of fire and environmental data to support operational decisions.

In particular, the grantee:

- gained new knowledge through the comprehensive analysis of the cognitive and procedural steps and decision chain involved in real-time fire management decision-making;
- better understand the impact of real-time information systems, fire monitoring sources (cameras, field data, etc), and decision support tools on operational outcomes and how this information can help in designing more robust and responsive fire management strategies;
- enhanced her interpretation skills to support rapid and effective operational decisions;
- identified best practices and potential for transferability between Portugal and Italy;
- gained additional insights into broader operational frameworks and strategic coordination efforts;
- learned how fire analysis is performed *a posteriori* and prepared an in-depth study for the main fire event occurred during the STSM period.

Furthermore, the STSM provided a strategic opportunity to bridge academic knowledge with practical field applications, fostering a deeper integration of scientific research into operational wildfire management.

This STSM significantly contributes to the broader objectives of the NERO COST Action. Specifically, the reconstruction of the Alcabideche-Cascais wildfire progressions will contribute to WG1 (focused on collecting fire data) both in terms of substance and method. Indeed, the reconstructed fire progressions will be proposed to be added to the open-access European fire database (D1.1) that will feed the analysis of extreme fire behaviour in WG2. In addition, the learned and tested approach will be applied to other Italian fires and disseminated to local stakeholders and to other NERO researchers who would potentially carry out their STSM at CNR (thus contributing to Task 3.3 "Experience and expertise interchange").

The comparison between the Portuguese and the Italian approaches in fire management decision-making and data collection allowed to identify current gaps as well as best practices and potential for transferability, thus contributing to D1.4 regarding the synthesis of future directions and recommendations.

The STSM also offered a unique chance to learn how other countries integrate scientific knowledge into operational procedures, aligning with WG3 objectives. Finally, this STSM actively contributes to WG4 since it will be presented in a common and dedicated webinar in October 2024, with the specific aim to maximize NERO's impact through effective communication and outreach and promoting the widespread adoption of best practices in fire management.

The planned follow-up activities connected to this STSM are:

- application of the learned approach on fire reconstruction to other 5 (minimum) Italian fires;
- disseminating the acquired knowledge to local stakeholders and to other researchers;
- contribution in WG1 to the storytelling template (D1.2) to enable comparisons between different events;
- contribution in WG2 to the identification to the presence of tipping points (thresholds) through statistical analysis, with the aim to describe the occurrence and the drivers of extreme fire behaviour in the fires collected in the open-access European fire database.